

REAR AXLE DATA AND SPECIFICATIONS

Rear Axle	C-67	C-68	C-69	C-70	C-300	
Type	Semi-Floating	Semi-Floating	Semi-Floating	Semi-Floating	Semi-Floating	
Gear Type	Hypoid	Hypoid	Hypoid	Hypoid	Hypoid	
*Ring Gear Diameter.....	8.25"	8.75"	8.75"	9.62"	8.75"	
Pinion Bearings	2	2	2	2	2	
Type	Tapered Roller	Tapered Roller	Tapered Roller	Tapered Roller	Tapered Roller	
Adjustment	Shim Pack	Solid Washer	Solid Washer	Solid Washer	Solid Washer	
Differential Bearings	2	2	2	2	2	
Type	Tapered Roller	Tapered Roller	Tapered Roller	Tapered Roller	Tapered Roller	
Adjustment	Threaded Adjuster	Threaded Adjuster	Threaded Adjuster	Threaded Adjuster	Threaded Adjuster	
Drive Gear Pinion.....	Matched Sets	Matched Sets	Matched Sets	Matched Sets	Matched Sets	
Drive Gear Run-Out.....	.005" Maximum	.005" Maximum	.005" Maximum	.005" Maximum	.005" Maximum	
Drive Gear and Pinion Backlash	.006" to .008"	.006" to .008"	.006" to .008"	.006" to .008"	.006" to .008"	
Differential Side Gear Clearance	.004" to .012"	.004" to .012"	.004" to .012"	.004" to .012"	.004" to .012"	
Axle Ratio	Std. T&C	Std. T&C	Standard	Standard	Standard	
	Wgn.	Wgn.				
With Standard 3-Speed Trans.	3.73 3.91	— —	—	—	—	
No. Drive Gear Teeth....	41 43	— —	—	—	—	
No. Drive Pinion Teeth...	11 11	— —	—	—	—	
With PowerFlite	3.54 3.73	3.36 3.54	3.54	3.54	3.54	
No. Drive Gear Teeth....	39 41	37 39	39	39	39	
No. Drive Pinion Teeth...	11 11	11 11	11	11	11	
Type Recommended	Ex. Press. Hypoid	Extreme Pressure Hypoid		Ex. Press. Hypoid	Ex. Press. Hypoid	
Lubrication	Summer	90	90		90	90
	Winter	90	90		90	90
	Extreme Cold	80	80		80	80
	Capacity	3¼ Pints (Including T&C Wagon)	3½ Pints (T&C Wagon)		5 Pints (Limousine)	3½ Pints
Wheel Bearings						
Type	Tapered Roller	Tapered Roller		Tapered Roller	Tapered Roller	
Adjustment	Select Shims	Select Shims		Select Shims	Select Shims	
Axle End Play.....	.003" to .008"	.003" to .008"		.003" to .008"	.003" to .008"	
Road Clearance (full load)....	8.4"	8.4"	8.6"	9¾"	NA	
T&C Wagon	8.4"	8.4"	—	9¾"		
Sedan	—	—	—	9¾"		
Tread (Rear)	59.62"	59.62"	60.35"	60.75"	NA	
T&C Wagon	59.62"	59.62"	—	—		
Sedan	—	—	—	60.75"		

*Windsor Town and Country Wagon Models use an 8.75 diameter ring gear.

ADDITIONAL SPECIAL TOOLS REQUIRED FOR SERVICING THE REAR AXLE

Tool Number	Tool Name
C-406A	Wrench—Differential Bearing Adjusting
C-430	Dial Indicator Set
C-452	Puller—Companion Flange or Yoke
C-757	Sleeve—Axle Shaft Oil Seal Installing
C-758-D2	Pinion Bearing Pre-load and Cone Angle Setting Gauge
C-784	Companion Flange on Yoke Holding—Wrench
C-839	Driver—Axle Shaft Inner Oil Seal
DD-807	Driver—Pinion Oil Seal Installing
DD-914-8	Ring—Medium Reducer (use with DD-914-89)
DD-914-89	Plate Set—Pinion Bearing Puller Adaptor
DD-921	Wrench—Differential Case Cap Remover and Installer
DD-993	Puller—Pinion Oil Seal
DD-999	Tool—Companion Flange or Yoke Installing

TIGHTENING REFERENCE

	Foot-Pounds
AXLE SHAFT NUTS	145 (minimum)
BRAKE SUPPORT PLATE TO HOUSING MOUNTING BOLT NUTS	35
DIFFERENTIAL CARRIER TO AXLE HOUSING BOLT NUTS	45
REAR AXLE DRIVE GEAR BOLT NUTS	40
DIFFERENTIAL BEARING CAP BOLTS	90
PINION SHAFT COMPANION FLANGE NUT	
C-67	240 (minimum)
C-68, C-69, C-70, C-300	250 (minimum)

55x749

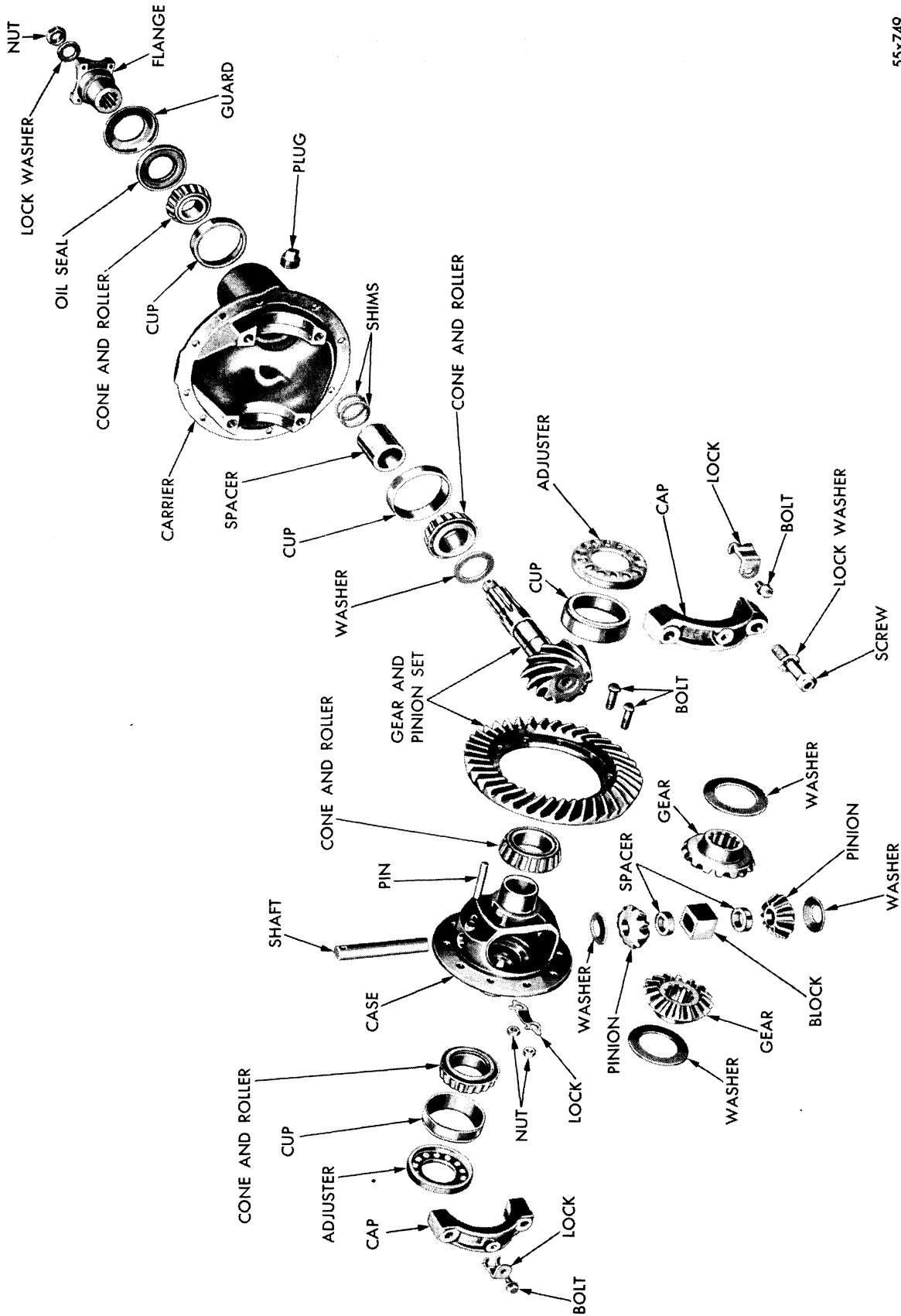
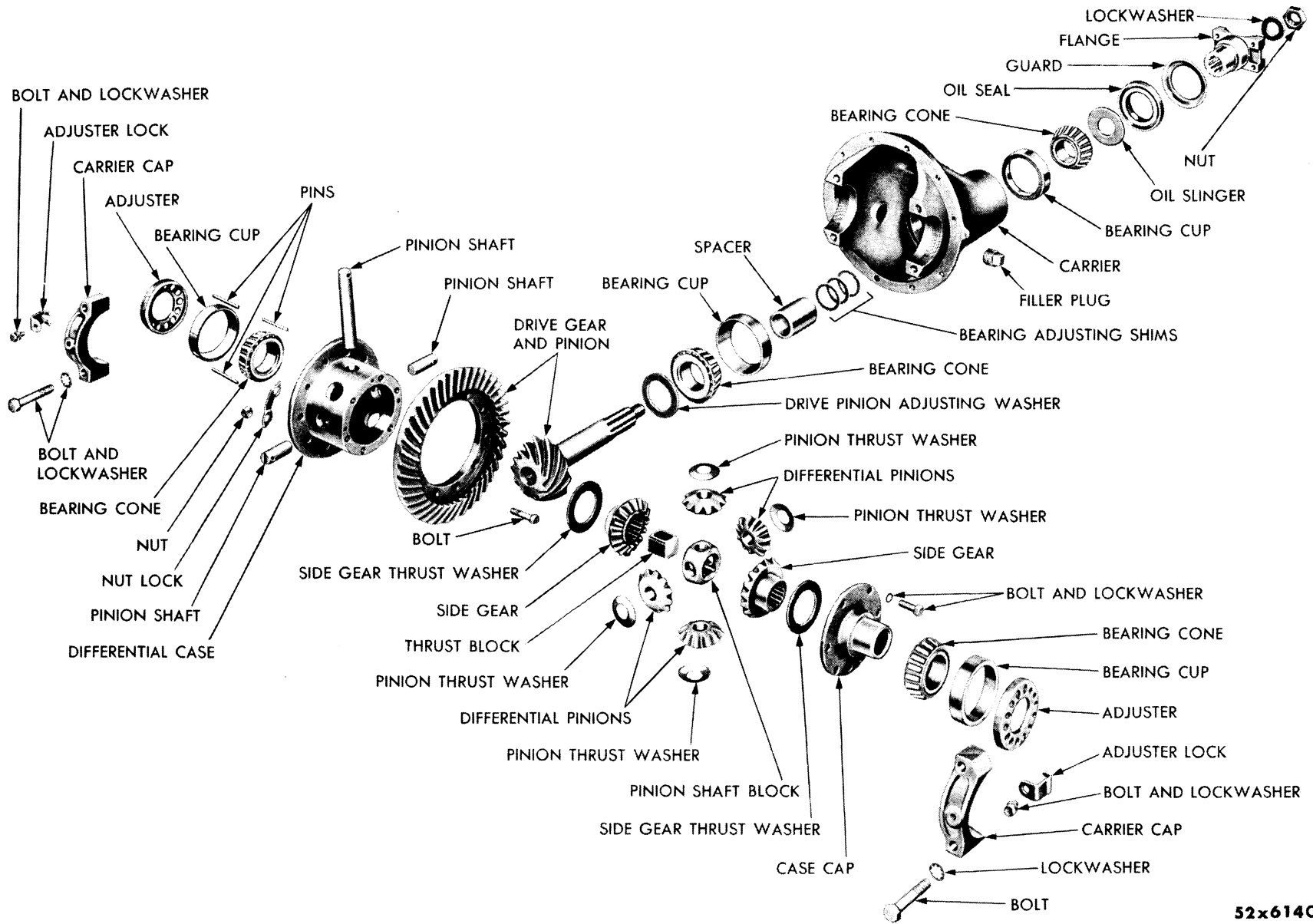
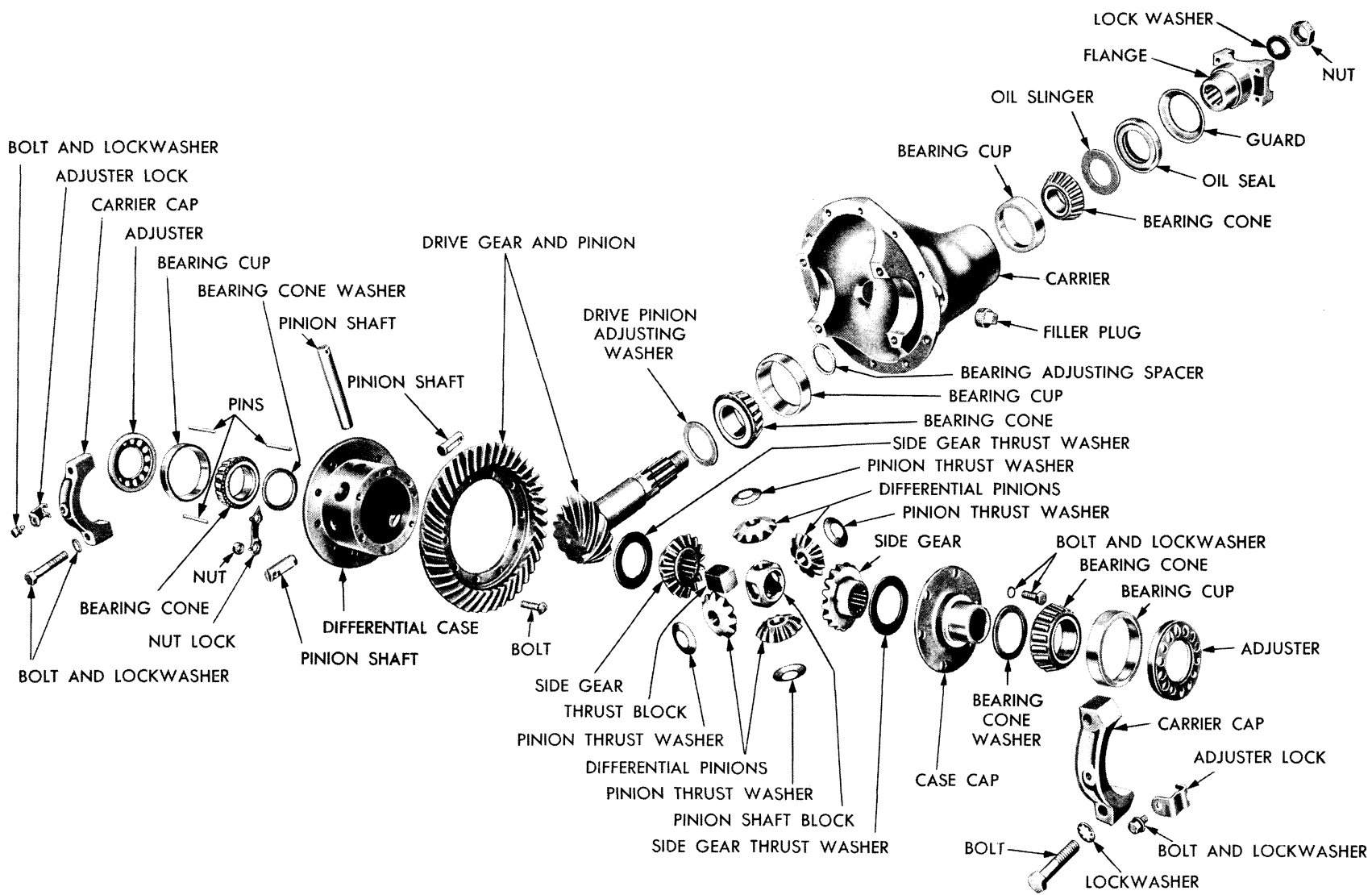


Fig. 1—Rear Axle, With 3 Speed Transmission C-67 (Except Town and Country Wagon)



52x614C

Fig. 2—Rear Axle (Exploded View) C-67 PowerLite Equipped Cars (Except Town and Country Wagon)



52x600A

Fig. 3—Rear Axle (Exploded View) C-68, C-69 including C-67-C-68 Town and Country Wagon

Section II

REAR AXLE

1. DESCRIPTION

A modification has been made on the differential carrier assembly on the New Yorker eliminating the axle drive gear thrust screw and thrust pad. This change has also been made on Crown Imperial cars produced later in the model year. A Belleville lockwasher is now being used in conjunction with the drive pinion flange nut on all Chrysler axles replacing the slotted nut and cotter pin formerly used, permitting a more accurate torque setting of the drive pinion flange nut and allowing more accurate pre-loading of the drive pinion bearings.

These washers have a .024 to .031 inch "dish" and are marked with white paint on the "convex" side of the washer. When installing the Belleville washer the "convex" or painted side of washer should face towards the nut.

A Belleville washer can also be used with a slotted type nut providing the tightening specification for the Belleville washer is used.

The tightening specifications for use with the Belleville type washer are 240 minimum foot-pounds torque for the Windsor DeLuxe Models and 250 minimum foot-pounds torque for the New Yorker and Imperial Models.

NOTE

The thread form on the differential bearing adjusters on the 1955 New Yorker and Custom Imperial Models (except for the Crown Imperials) are changed and are not interchangeable with the 1954 adjusters.

The axles, as shown in Figures 1, 2, 3 and 4, though different in design, are of the semi-floating type with a hypoid ring gear and pinion. The differential, drive pinion and axle shafts are carried on adjustable taper roller bearings. The rear cover is welded to the axle housing, necessitating the removal of the differential assembly in order to adjust the differential bearings. To insure quiet, smooth operation, the ring gear and pinion are serviced only in matched sets.

2. CLEANLINESS

Cleaning parts after disassembly is a very im-

portant procedure. Parts must be kept clean all through assembly. Tiny metal chips, bits of dirt, or foreign particles mixing with the lubricant are liable to cause excessive wear or axle failure if not cleaned from parts and housing.

Whenever the rear axle carrier assembly is removed from car for overhauling, the assembly and parts (except bearings) should be cleaned in a suitable cleaning solvent to remove dirt and hardened lubricant from the assembly before inspection. Bearings should be soaked in clean kerosene or any other good quality bearing cleaning fluid.

NOTE

Gasoline should never be used for cleaning parts since parts cleaned with gasoline have a tendency to rust.

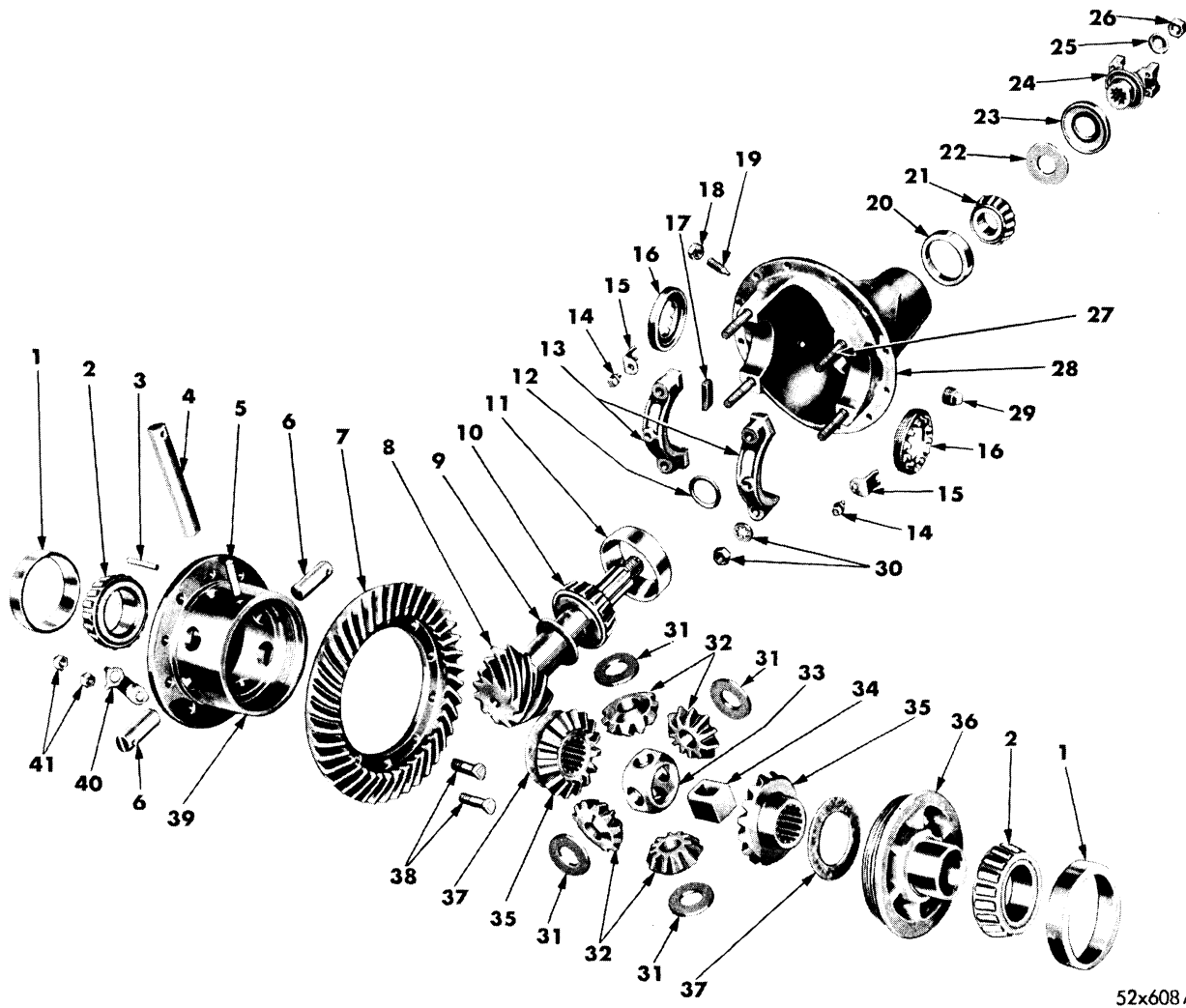
The bearings should be immersed in clean solvent and rotated by hand until clean. After cleaning, blow dry with controlled compressed air.

3. INSPECTION

The inspection of rear axles consists of visual inspection for damaged or excessive parts wear. Parts that are worn, pitted or scored must be replaced. Scratches or rough spots on mating surfaces should be stoned-out if possible. If spots or scratches cannot be stoned-out without damaging part, part should be replaced. Bearings and bearing cup should be examined for cracks, chips and discoloring due to overheating or excessive wear. Bearings should be lubricated and assembled in bearing cup, rotated by hand to check for roughness, and then wrapped in cloth and stored until ready for use.

Axle housing should be inspected for broken welds, missing or loose housing to carrier attaching bolts, damaged threads, bent or cracked housing. Inspect spring seat welds to make sure they are not broken or loose. Repair or replace as required.

Drive gear and pinion should be inspected



52x608 A

Fig. 4 — Rear Axle (Exploded View) C-70

- | | |
|---|---|
| 1—Differential bearing cup | 22—Axle drive pinion bearing oil slinger |
| 2—Differential bearing cone | 23—Axle drive pinion bearing oil seal |
| 3—Differential pinion shaft lock pin | 24—Companion flange and oil seal guard |
| 4—Differential pinion shaft—long | 25—Companion flange nut washer |
| 5—Differential case cap lock pin | 26—Companion flange nut |
| 6—Differential pinion shaft—short | 27—Carrier cap stud |
| 7—Axle drive gear | 28—Carrier |
| 8—Axle drive pinion | 29—Filler plug |
| 9—Axle drive pinion inner bearing washer | 30—Differential bearing cap stud nut and lockwasher |
| 10—Axle drive pinion bearing cone—rear | 31—Differential pinion thrust washer |
| 11—Axle drive pinion bearing cup—rear | 32—Differential pinions |
| 12—Axle drive pinion bearing spacer | 33—Differential pinion shaft block |
| 13—Carrier caps | 34—Rear axle drive shaft thrust block |
| 14—Differential bearing adjuster lock screw | 35—Differential side gear |
| 15—Differential bearing adjuster lock | 36—Differential case cap |
| 16—Differential bearing adjuster | 37—Differential gear thrust washer |
| 17—Axle drive gear thrust screw pad | 38—Axle drive gear bolts |
| 18—Axle drive gear thrust screw check-nut | 39—Differential case |
| 19—Axle drive gear thrust screw | 40—Axle drive gear bolt nut lock |
| 20—Axle drive pinion bearing cup—front | 41—Axle drive gear bolt nuts |
| 21—Axle drive pinion bearing cone—front | |

for chipped, cracked or worn teeth. Thrust washers and mating surfaces should be inspected for excessive wear.

Inspect the axle shaft splines for evidence of twisting or cracking. Check axle shaft keyway and threaded section for wear. Replace any shaft showing signs of torsional or spline damage.

Inspect inner and outer axle shaft seals for

wear. Inspect seal surface of axle shaft for excessive wear, nicks, or scratches that may possibly cause seal leaks. Wheel hub boss and seal surface of axle shaft should be free of nicks and burrs. Replace all damaged or worn parts.

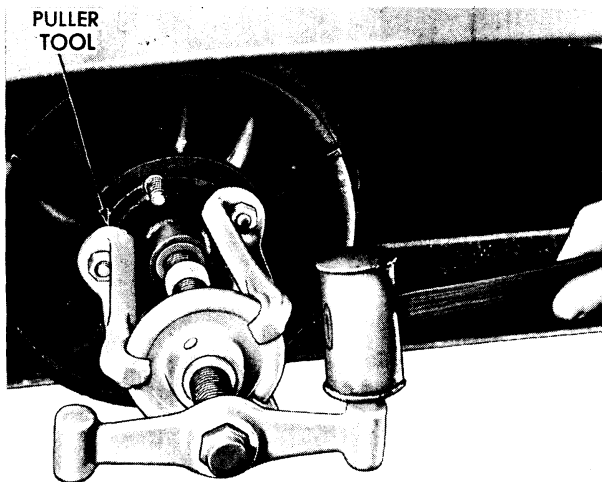
NOTE

Replacing seals regardless of their appearance is good insurance against leakage.

REMOVAL AND INSTALLATION

4. REMOVAL AND INSTALLATION OF AXLE DRIVE SHAFT AND AXLE SHAFT OIL SEAL

Should it become necessary to overhaul the rear axle, drain the housing and proceed as follows:



54x660

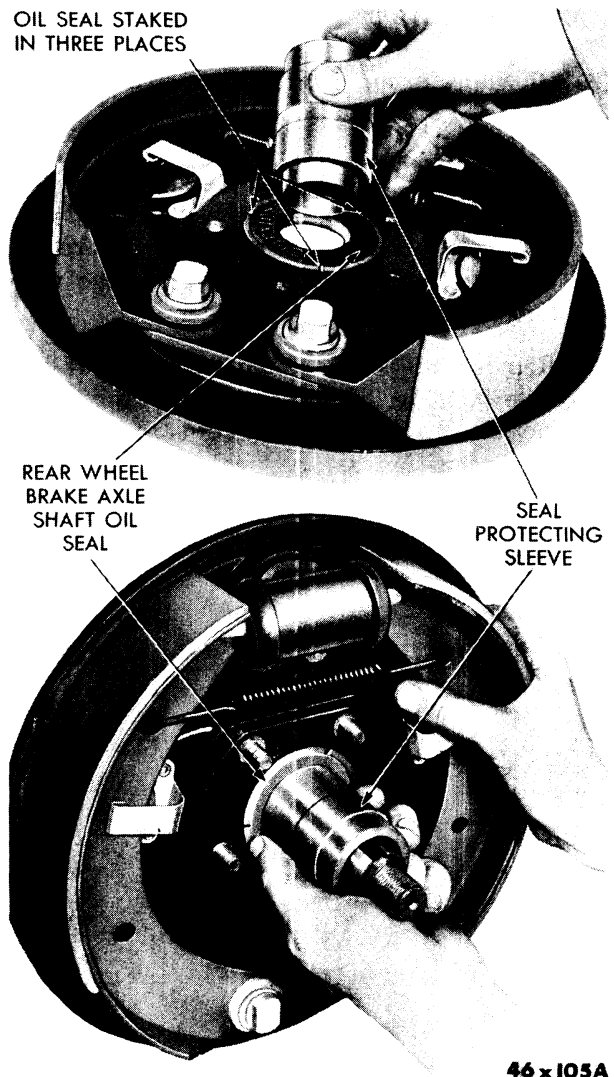
Fig. 5—Removing Rear Hub

a. Removal

- (1) Jack up car and remove wheel, hub and drum assembly, using wheel puller set Tool C-675, as shown in Figure 5.

CAUTION

Do not strike end of axle shaft to loosen hub because of possible damage to axle shaft and roller bearings.



46x105A

Fig. 6—Removing or Installing Brake Support, Using Tool C-757

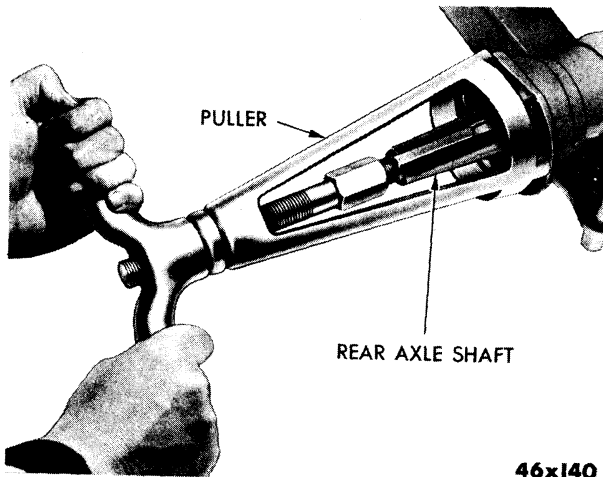


Fig. 7—Removing Axle Drive Shaft and Bearing,
Using Tool C-499

- (2) Block brake pedal so it cannot be depressed.
- (3) Disconnect brake line at wheel cylinder.
- (4) Remove the rear axle drive shaft key and install the special sleeve Tool (C-757) in the axle bearing outer oil seal before removing the brake support from the axle housing, as shown in Figure 6.
- (5) Remove the shims from each end of the axle housing. Shims should be kept separate so that they can be reinstalled in the same position as they came off the axle housing, so as to keep the axle shaft thrust block centralized in the differential assembly.

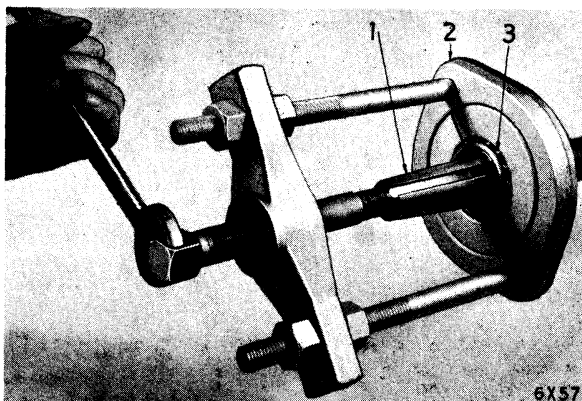


Fig. 8—Removing Bearing from Axle Drive Shaft

1—Axle drive shaft 2—Tool C-293-C 3—Bearing

- (6) Remove the axle shafts and bearings from the housing, using Tool C-499, as shown in Figure 7.

CAUTION

Do not allow the axle shaft to drag on the inner oil seal when removing axle from housing. The inner diameter of the oil seal is designed with a feather edge to hug the shaft snugly to prevent oil leak. If this edge is enlarged or damaged in any way, the efficiency of the seal will be impaired.

If axle shaft bearings are to be replaced, perform operation in Step (7).

- (7) Remove bearings from the axle shafts, using bearing puller Tool C-293-C, as shown in Figure 8.

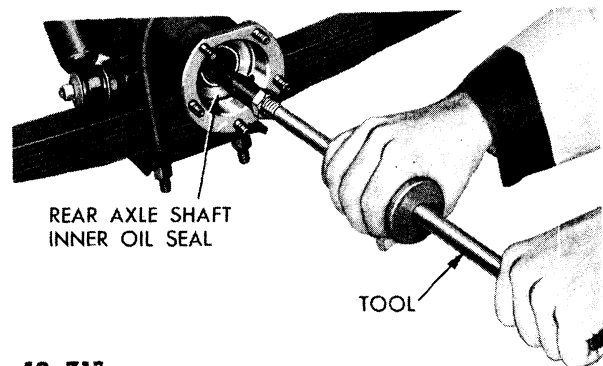


Fig. 9—Removing Axle Shaft Inner Oil Seal
(Tool C-637)

- (8) Remove the axle shaft inner oil seal from housing, using Tool C-637, as shown in Figure 9.
- (9) Remove outer oil seal from support plate by driving the seal out of plate with driver, Tool C-839.

Cleanliness and inspection are vital factors to be remembered when overhauling or repairing a rear axle assembly.

Clean all parts after disassembly and keep them clean throughout assembly. Metal chips, or particles of grit or dirt that may drop into the lubricant, will cause excessive wear and eventually cause failure of the axle.

NOTE

New oil seals should be installed whenever seals are removed from axle housing and brake support plate.

b. Installation

Always inspect all parts before assembly and replace those that are worn or scored. Check for and remove any burrs, nicks, scratches, or rough spots on mating surfaces of replacement parts that may have been caused by rough handling.

- (1) Install the rear axle drive shaft inner oil seal in housing, using special drift Tool C-241 for Model C-70.

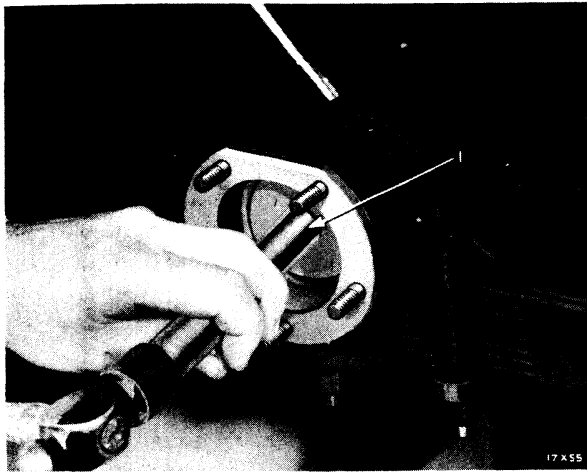


Fig. 10—Installing Axle Shaft Oil Seal (Tool C-241)

- (2) Install outer oil seal in brake support plate. Secure seal in place by staking in three places, as shown in Figure 6.
- (3) Leather seals should be prepared for installation by soaking them in light engine oil for 30 minutes.

Before installing the axle shaft in housing, examine the bearing surface of the bearing cups for wear and pits, also the surface of the axle shaft on which the oil seal wipes to make sure that it is smooth and free from tool marks and burrs. If necessary, dress down the surface of the shaft with a stone or fine emery cloth to make a smooth bearing surface for the oil seal.

NOTE

Stone or emery polish lines should run around and not along shaft.

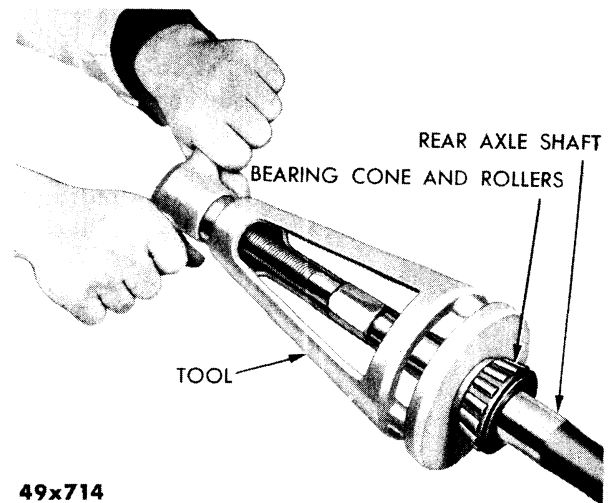


Fig. 11—Installing Axle Shaft Bearing (Tool C-158)

- (4) To install the axle shaft, first replace the bearing on axle shaft with special Tool C-158 (Fig. 11) and moderately lubricate axle bearings with hypoid lubricant. Carefully insert the axle shaft in the housing, making sure the shaft and differential side gear splines align.
- (5) Install the axle drive shaft outer bearing cup with special driver Tool C-413 (Fig. 12).
- (6) Install shims in same manner as removed to maintain the central position of axle shaft thrust block.
- (7) Install special sleeve Tool C-757 in the axle bearing outer oil seal, before mounting brake support to the axle housing (Fig. 6), to protect seal from being damaged by axle shaft keyway during installation.
- (8) Clean mating surfaces of axle housing flange and brake support.

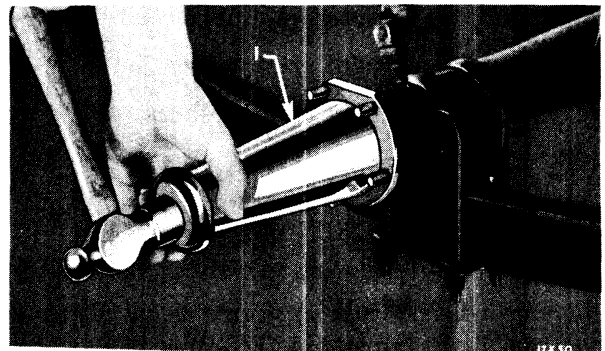


Fig. 12—Installing Axle Drive Shaft Bearing Cup (Tool C-413)

- (9) Install new gaskets.
- (10) Install brake support plates and tighten attaching nuts to 35 foot-pounds torque.
- (11) Install axle shaft keys.
- (12) Connect brake lines to brake cylinder, unblock brake pedal and bleed brake lines.
- (13) Check the axle shaft end play with dial indicator to make sure it comes within .003 to .008 inch limits, as outlined in Paragraph 6.
- (14) Install wheel hub and drum assembly. Tighten axle shaft nuts to a minimum of 145 foot-pounds torque. Install new cotter keys and hub caps.

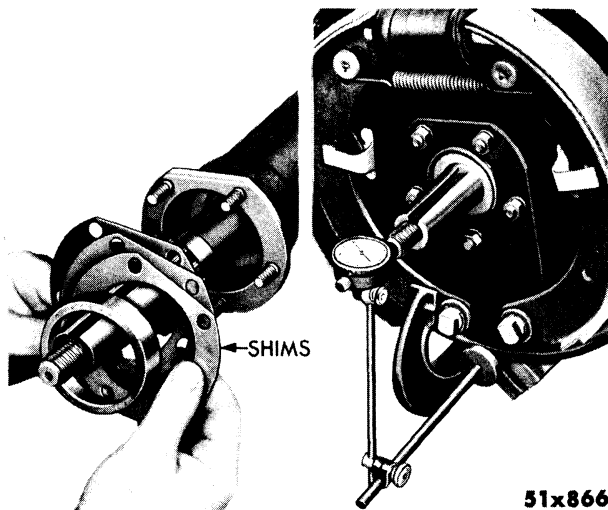


Fig. 13—Axle Shaft Bearing Adjusting Shims

Checking Axle Shaft End Play

- (15) Refill the axle housing and carrier assembly with Extreme Pressure Hypoid Lubricant, as outlined in Lubrication Section.
- (16) Check and refill master cylinder.
- (17) Check and adjust brake shoes.
- (18) Remove jack from car.

5. REMOVING BROKEN END OF AXLE DRIVE SHAFT

Remove wheel, drum and axle drive shaft, as outlined in Paragraph 4. If break is less than about 8 inches from splined end of shaft, it will be necessary to remove differential and carrier

assembly. If break is more than 8 inches from splined end of shaft, it will be necessary to remove inner oil seal and snare inner end of axle drive shaft out through housing with a loop.

CAUTION

To avoid damage to rear axle carrier assembly, the oil must be drained from the differential housing and the housing cleaned to remove chips and grit before installing the new axle shaft.

- (1) Replace axle shaft and check rear axle end play, as outlined in Paragraph 6.
- (2) Replace wheel hub and drum assembly and tighten axle shaft nuts to a minimum of 145 foot-pounds torque.

6. SETTING AXLE SHAFT END PLAY

Rear axle shaft end play is adjusted by the use of adjusting shims (Fig. 13) that are bolted between the axle housing ends and the brake support plates. The shims are available in thicknesses of .005, .010, .0125, .015 and .030 inch. The correct axle end play is .003 to .008 inch. One or more shims may be required to obtain correct end play.

- (1) Preparation for setting axle shaft end play consists of removal of axle drive shafts. It is not necessary to remove the bearing cones from the axle drive shafts unless they are to be replaced. Clean parts after disassembly, and inspect bearing cups, cones, and rollers for signs of surface failure.
- (2) The axle drive shaft thrust block has an elongated hole to allow the block approximately $\frac{1}{4}$ inch total lateral motion in the assembly. The thrust block must be located so that the elongated hole is approximately centered on the long differential pinion shaft.

To adjust the axle end play, the operation can be started from either side of the axle housing. These instructions will be confined to the case of starting at the left side.

Install the left axle drive shaft and bearing cone assembly (without lubricant). Drive in the bearing cup as far as it will go, using Tool C-413, in order to prevent damage to the axle housing. This will thrust the block as far to the right as it can go, as shown in "A," Figure 14.

- (3) If the left bearing cup is now withdrawn about $\frac{1}{8}$ inch, the thrust block will be approximately centered on the differential pinion shaft. Axle operation is not affected by mislocation of the thrust block unless the block bears against the differential pinion shaft, in which case the end play of the left and right axle shafts may be different, and wheel thrust will be imposed upon the differential bearings, a condition that should be avoided.

With the left bearing cup remaining at its innermost position, as shown in Figure 14, lay a straightedge across the end of the axle housing. Measure the distance from the straightedge to the bearing cup face, to the nearest $\frac{1}{4}$ inch. The example shown in "B," Figure 14, shows a measurement of $\frac{3}{32}$ inch.

One eighth inch minus the above measurement gives the thickness of shims required at the left end of the housing to center the thrust block. For the above example, a shim $\frac{1}{32}$ inch thick would center the thrust block. A .030 inch shim is close to this thickness, but a good practice is to use about a .020 inch shim which is less shim than the thickness required for centering the thrust block.

- (4) Remove the left axle shaft, grease the bearing, reinstall the shaft and bearing. Using the correct thickness of shims or shim as determined in Step (3), install the left brake support plate. The bearing cup should not be driven all the way in during this operation. As the brake support plate is drawn up tight, it will push the bearing cup in to the correct position. This completes the work on the left axle.

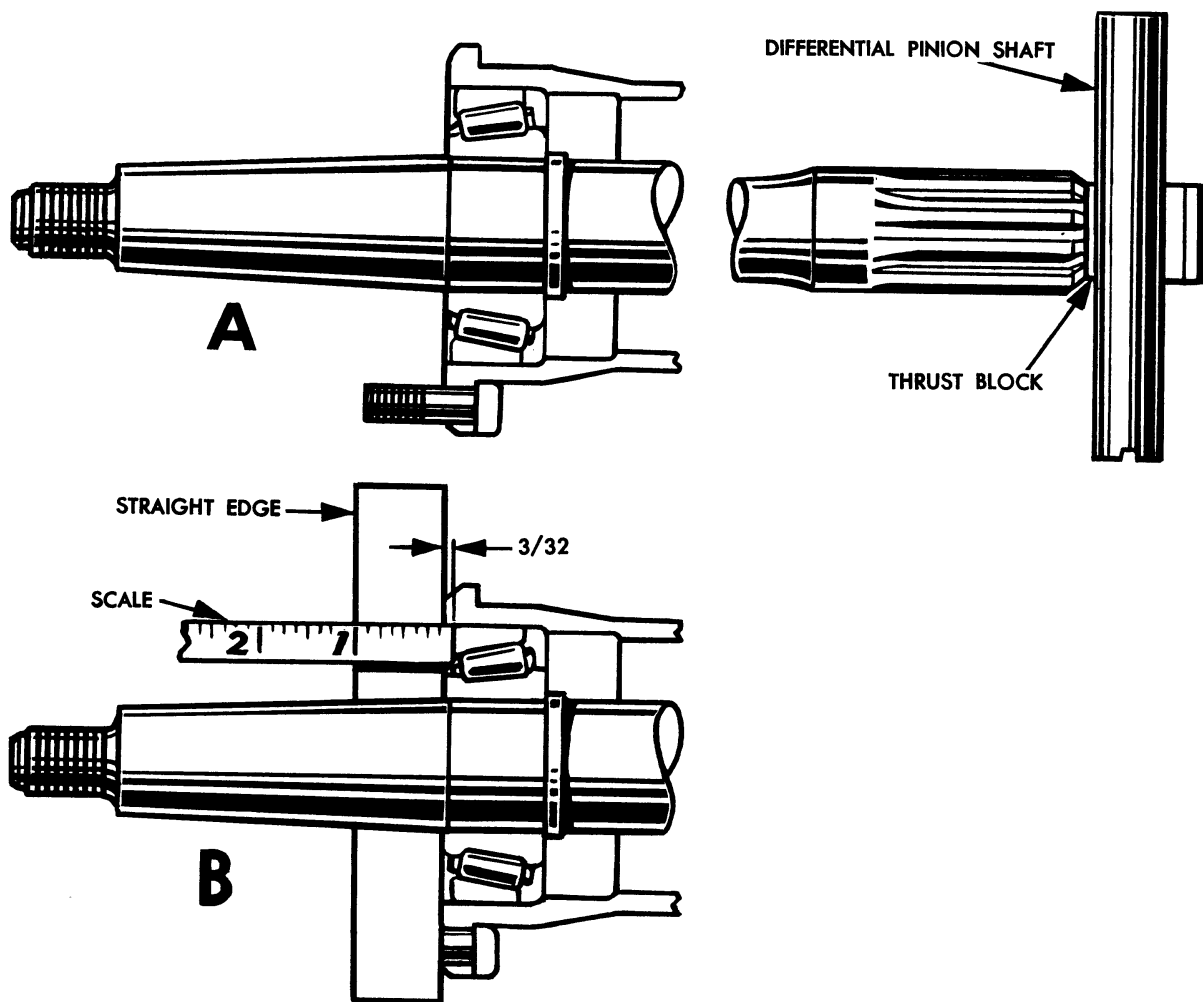


Fig. 14—Adjusting Axle Shaft End Play

CAUTION

Use clean shims. Clean mating surfaces. Presence of rust or grit will result in incorrect measurement.

- (5) Install the right axle drive shaft and bearing without lubricant. Bearing should be clean and dry. Using Tool C-413, drive the bearing cup in as far as it will go, while rotating the axle shafts to seat both bearings properly. If the proper procedure has been followed, as outlined in Step (4), the left bearing cup will be up firmly against the left brake support plate, and the right bearing cup, bearing cone, right axle shaft, thrust block, left axle shaft and left bearing cone, will move as a unit, until the left bearing is seated. It is important that the axle shafts be rotated during this operation. Now the end play in the bearings will be zero, and the rotation of the axle shafts will require more effort. The right bearing cup should then protrude beyond the housing end.

Leaving .010 inch out of the left shim, as described in Step (3), will help to assure that the right bearing cup will protrude beyond the housing end face.

- (6) Hold a straightedge firmly against the outer face of the right bearing cup. Using a set of feeler gauges, measure accurately the distance between the housing face and the straightedge. This measurement gives the thickness of the shim that would give zero end play if it were used in the assembly. The shim thickness to be used is obtained by adding .003 inch to the above measurement. If this gives a thickness that cannot be built up from existing shims, use the next larger shim combination. This insures that the end play will be greater than .003 inch.

For an example of end play setting, assume the right bearing cup face protrudes .038 inch beyond the end face of the housing. Shim thickness required for .003 inch end play is .038 inch + .003 inch = .041 inch. This cannot be obtained with existing shims, so .0425 inch is used, which is obtained with one .030 inch and one .0125 inch shim. The end play is then .0425 inch minus .038 inch, equals .0045 inch.

- (7) Remove the right axle shaft and lubricate

the bearing. Install axle shaft, bearing and shim pack as determined in Step (6), and complete the assembly.

- (8) If the dial indicator shows less than .003 inch, or more than .008 inch end play, remove the brake support plate and oil seal, and add or remove shims, as required, to obtain the desired axle shaft end play.

CAUTION

When adjusting axle shaft end play, equal thicknesses of shims should be removed or installed on both sides of the axle housing to maintain the centralized position of the axle shaft thrust block.

After the axle shaft end play has been checked or corrected, install the brake drum and wheel assembly. Tighten axle shaft nuts to a minimum of 145 foot-pounds torque. Install cotter keys and remove jack from car.

7. REMOVAL AND INSPECTION OF DIFFERENTIAL AND CARRIER ASSEMBLY

a. Removal

- (1) Remove wheel hub and drum assembly and rear axle shafts, as outlined in Paragraph 4, and proceed as follows:
- (2) Disconnect rear universal joint and drop propeller shaft.

NOTE

All accumulation of grit, dirt and other foreign matter, deposited on the differential and carrier assembly around the attaching bolt nuts, should be cleaned off before the assembly is removed from the housing to prevent them falling into the housing, gears, or bearings, when the assembly is removed.

b. Inspection

- (1) Make sure the companion flange or yoke nut is tight and has not moved from its original position.
- (2) Check the backlash between the drive gear and pinion gear. See Figure 15. (Backlash should not be less than .006 inch or more than .008 inch.)
- (3) Inspect the surfaces of the drive gear and

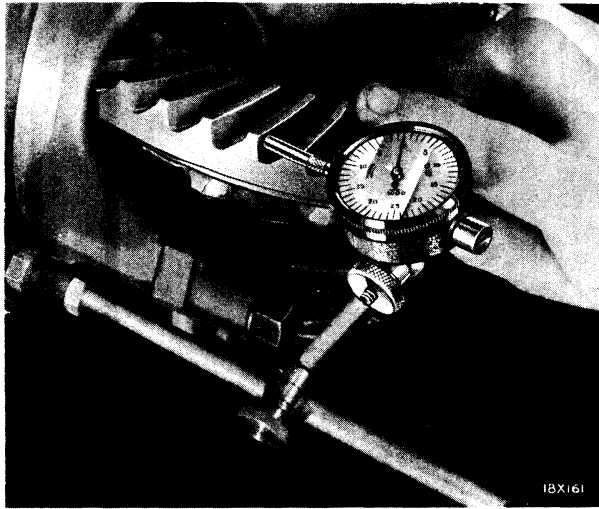


Fig. 15—Checking Backlash Between Drive Gear and Pinion (Tool C-430)

pinion teeth for nicks, burrs, scoring or other damage (Drive gear and pinion are replaceable in sets only.)

- (4) Check tightness of drive gear to differential case bolts. Tighten if necessary.
- (5) Check drive gear runout with gauge C-430. Runout should not be more than .005 inch.
- (6) Check differential bearing pre-load and backlash, as outlined in Paragraph 22.

NOTE

Careful inspection of pinion bearing pre-load will assist in determining cause of noisy axle. Improper drive pinion position will cause a noisy axle.

8. REMOVING DIFFERENTIAL CASE AND DRIVE GEAR ASSEMBLY FROM CARRIER (All Models)

Refer to Figures 2, 3 and 4. Disassemble the differential case assembly as follows:

- (1) Mount the carrier assembly in stand. Mark both differential bearing adjusters and caps, so they may be reinstalled in approximately the same position at assembly (Fig. 16).

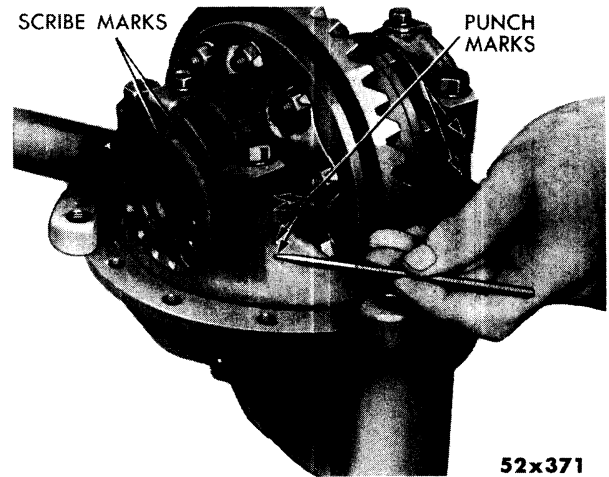


Fig. 16—Marking Bearing Caps and Adjusting Nuts

NOTE

Bearing caps must NOT be interchanged. They are lined-bored with the carrier housing when manufactured.

- (2) Remove the bearing cap bolts, caps, adjusting nuts and bearing cups and lift the differential case and drive gear assembly out of carrier.

NOTE

Clean drive gear, bearings, bearing cap, drive pinion and inside of carrier assembly, as outlined in "Cleanliness," Paragraph 2.

9. DISASSEMBLY AND INSPECTION OF CAGE-TYPE DIFFERENTIAL

a. Removal

- (1) Place differential case and drive gear assembly on bench, bend down locking tabs and remove drive gear to case attaching nuts and bolts.
- (2) Using a fiber hammer, tap drive gear off differential case.
- (3) To check differential case for runout, mount the differential case, bearings and cup assembly in carrier. Install bearing caps and adjusters and adjust excessive

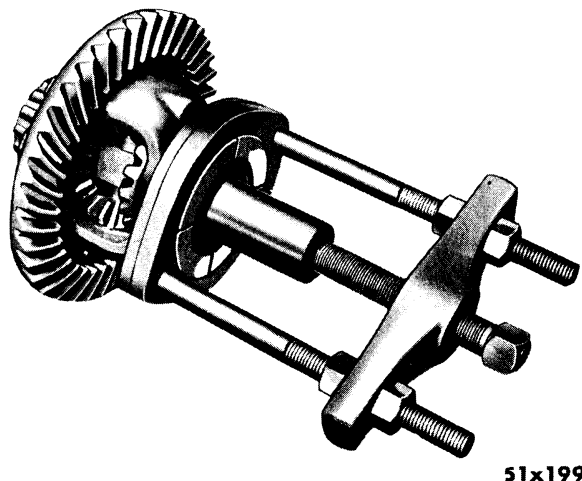


Fig. 17—Removing Differential Side Carrier Bearings
(Tool C-293-C)

play from bearings with adjusters. Mount dial indicator on carrier mounting surface and check drive gear mounting flange runout. Runout should not exceed .005 inch. If there is more than .005 inch runout the differential case should be replaced.

- (4) Inspect bolt holes for wear or out-of-round; if worn or out-of-round, replace case.
- (5) Mount differential case assembly in a heavy vise, using copper jaws.
- (6) Install Tool C-293-C on bearings, as shown in Figure 17, and remove bearings from differential case.

b. Inspection

- (1) Check the clearances between the side gears and thrust washers. Clearance should be .004 to .012 inch. To do this, use two feeler gauge blades. Slide the blades between side gear and thrust washer—one blade on each side of gear hub, as shown in Figure 18. Try two .004 inch blades—they should go in. Then, try two .013 inch blades—these should not go in. Now, check the opposite side gear the same way.
- (2) Remove differential pinion shaft lock pin from differential case, push out pinion shaft and remove differential side gears. When reassembling the ground surfaces

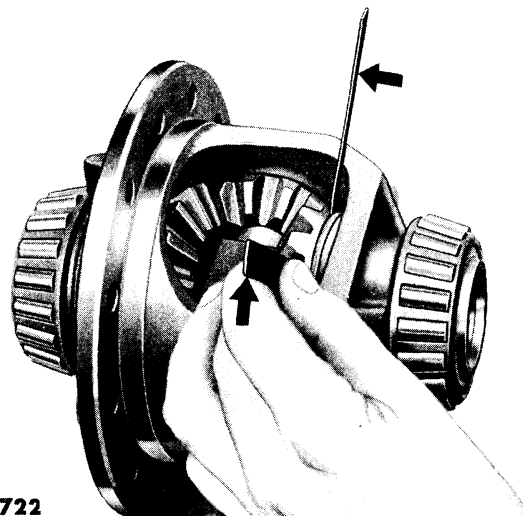


Fig. 18—Checking Differential Side Gear Clearance

of the thrust block should be turned toward the axle shaft. Clean all parts thoroughly in a suitable solvent and dry with compressed air. The bearings should also be immersed in clean solvent and rotated until clean.

- (3) Check differential side gear and pinion teeth, bores and spherical back of pinions, pinion (cross) shaft, thrust washers and thrust surfaces inside the differential case for wear or damage. If any of the above mentioned parts are worn so that they will affect the operation of the differential, they should be replaced.
- (4) Inspect the fit of the differential side gears in the hub of the differential case. If they are excessively loose, the gears or case should be replaced.
- (5) Examine the surfaces of differential case cone and roller bearings, and the bearing cups, for pitting and wear. Assemble cups in bearings and rotate. If the bearings are rough or drag on rotation, the bearing rollers may have a flat spot. If so, the bearing should be replaced.
- (6) Make sure the oil passages in the differential carrier are clear, clean and unobstructed.

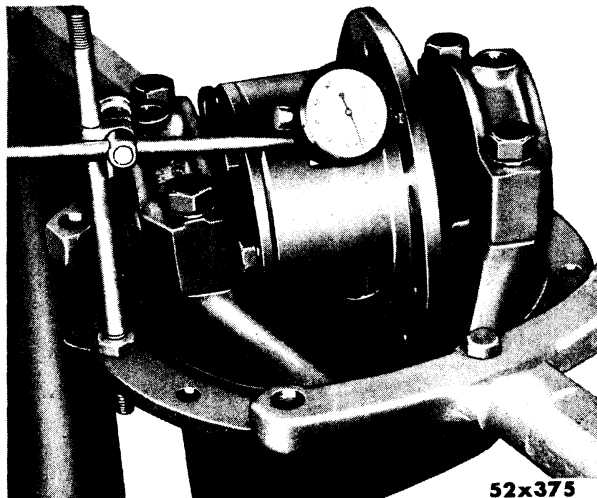


Fig. 19—Checking Ring Gear Mounting Flange Runout

NOTE

Whenever a differential carrier assembly is removed for rebuilding, due to bearing or other failure, care must be taken to see that all foreign matter, such as grit, dirt, metal particles, etc., are removed from the carrier.

10. DISASSEMBLY AND INSPECTION OF BARREL-TYPE DIFFERENTIAL WITH BOLTED-ON CASE CAP

a. Disassembly

- (1) Place differential case and drive gear assembly on bench, bend down locking tabs and remove drive gear to case attaching nuts and bolts.
- (2) Use a fiber hammer to tap drive gear off differential case.
- (3) Clean around differential case flange to allow for checking face runout.
- (4) Mount the differential case in the carrier. Assemble bearings, the adjusting nuts and bearing caps on carrier. Adjust and remove excessive play from the bearings. Mount a dial indicator on the carrier mounting face and check the ring gear mounting flange for runout, as shown in Figure 19.

NOTE

If there is more than .005 inch runout during the above check, the differential case must be replaced.

Inspect the bolt holes in the ring gear mounting flange for wear or out-of-round. If the bolt

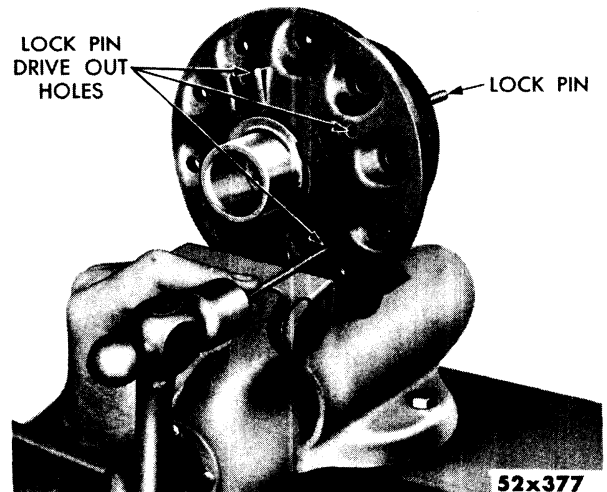


Fig. 20—Removing the Differential Pinion Shaft Lock Pins

holes are out-of-round, the ring gear will creep on the case.

- (5) Remove the differential case from the carrier.
- (6) Fit Number 18 plates behind bearings and pull off the differential bearings, using Tool C-293, as shown in Figure 17. Remove the differential bearing spacers.
- (7) Remove the differential cap to case bolts, and tap the cap lightly with a soft hammer to remove.
- (8) Remove the three differential pinion shaft lock pins by driving them out of the case with a hammer and punch, as shown in Figure 20.
- (9) Drive the long pinion shaft out of the differential case, using a brass drift and hammer. **NOTE: This shaft can be identified as having only 1 retaining pin.**
- (10) Lift out the rear axle drive shaft thrust block.
- (11) Drive the short pinion shafts out of the case, and lift out the pinion shaft block. **NOTE: The short pinion shaft sides of the block are punch marked for identification.**
- (12) Lift out the differential pinion gears, slide gears and thrust washers.

b. Cleaning and Inspection

- (1) Clean all parts thoroughly in a suitable solvent and blow dry with compressed air. Remove any chips or foreign material from

the carrier housing. Inspect all machined surfaces for nicks, burrs or scratches. Inspect the thrust shoulders in the carrier housing (bearing cups) to make sure there are no burrs on them. The thrust shoulder must be flat so that the bearing cups will seat properly. Check the differential case for cracks, fractures, distortion or damage. Install a new case if necessary.

- (2) The bearings should be immersed in clean solvent and rotated by hand until clean. After cleaning, blow dry with compressed air.

CAUTION

Do not spin the bearings with air pressure when blowing them dry, as damage to the bearings may result from this practice.

- (3) Check the bearings for roughness, or brinelling. The bearings must run free and show no indication of roughness or wear.
- (4) Examine the bearing cups for pitting, scoring or wear. Inspect all gears for chipped or worn gear teeth. Check the fit of the differential side gears on the axle shaft splines and the differential gears on the pinion shafts. Check the thrust washers for wear and replace if necessary.

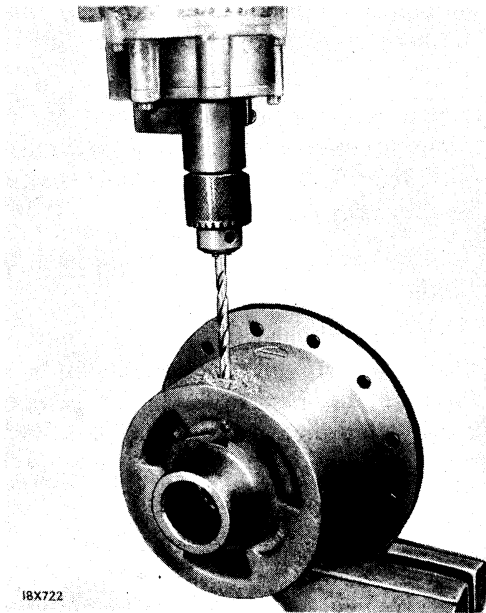


Fig. 21—Removing Differential Case Cap Lock Pin

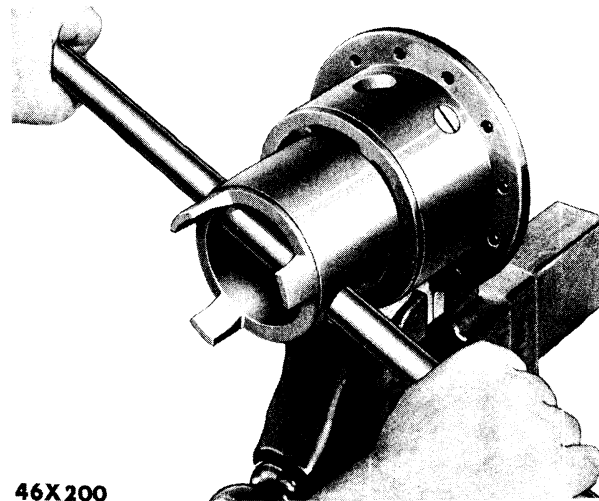


Fig. 22—Removing Differential Case Cap, Using Tool DD-921

NOTE

Whenever a differential carrier assembly is removed for rebuilding due to bearing or other failure, care must be taken to see that all foreign matter, such as grit, dirt, metal particles, etc., are removed from the carrier.

11. DISASSEMBLY AND INSPECTION OF BARREL-TYPE DIFFERENTIAL WITH SCREWED-ON CASE CAP

Remove drive gear from differential case as outlined in Paragraph 10 and proceed as follows:

- (1) Mount the flange of the differential case in a vise equipped with copper jaws.
- (2) Remove differential bearings with puller. On Model C-70 use Number 83 adapter and Number 41 plug, puller set Tool DD-914.
- (3) Remove the differential case cap locking pins by center punching and drilling, as shown in Figure 21. Remove shell of pin left in hole with a punch. The differential case cap is .001 to .002 inch larger than the differential case body in which it fits. The case must be expanded by heating for easy removal of case cap. The case will be damaged, if any attempt is made to remove cap without heating.

Heat the outside of the case (not cap) with a torch. Keep the flame moving around the case to assure even heating. Try a piece of ordinary soft solder on the case, from time to time. When the solder starts to melt at approximately 360 to 400 degrees F., the case will be as hot as it can get without damaging the thrust washers.

When the case is just hot enough to melt soft solder loosen cap with a blunt drift and a heavy hammer and quickly unscrew the cap from the case, with Tool DD-921, as shown in Figure 22. The parts can now be immersed in oil to cool for subsequent handling.

- (4) Remove the three different pinion shaft lock pins by driving them out of the case with a hammer and punch, as shown in Figure 23.
- (5) With a drift and hammer, drive the long pinion shaft out of the case. Then, remove the thrust block. Now, drive the short pinion shafts out of the case and lift out the pinion shaft block.
- (6) Remove the differential pinions, side gears and thrust washers from the case.

12. ASSEMBLY OF CAGE TYPE DIFFERENTIAL

When installing drive gear to differential case, be sure the holes in drive gear are properly lined up with the holes in the differential case before pressing the gear on the case.



Fig. 23—Removing Differential Pinion Shaft Lock Pins

- (1) Press gear on case. Install attaching bolts and tighten to 40 foot-pounds torque.
- (2) Install the differential side gears with their thrust washers, the differential pinions and their thrust washers, and the differential pinion shaft. Check the differential side gear clearance (Fig. 18).

If clearance cannot be obtained with the old thrust washers and gears, install necessary new parts to obtain the correct clearance.

- (3) After clearance has been obtained, remove pinion shaft gears and thrust washers. Coat the shaft and other parts moderately with Extreme Pressure Hypoid oil and re-assemble parts in differential case.
- (4) Line up the locking pin hole in the pinion shaft. Enter the shaft in pinion shaft hole in case. Assemble side gears and thrust washers in hub of case and pinion gears, thrust block spacers and thrust block on shaft. Press shaft into case.
- (5) Install pinion shaft locking pin in case and press pin in place, peening the metal of the case over the ends of pin to retain pin in place.
- (6) Install differential bearings on differential case, using Tool DD-1004.
- (7) Install bearing cups on bearings and mount the differential gear assembly in carrier.
- (8) Assemble bearing caps and bearing adjusting nuts in carrier and check the differential case runout. After bearing caps have been brought up against bearing cups, mount a dial indicator, with the pointer resting against the back face of the ring gear. As the drive gear and case is rotated, the runout should not exceed .003 inch. If runout exceeds .005 inch, the differential case should be replaced.

13. ASSEMBLY OF BARREL TYPE DIFFERENTIAL WITH BOLTED-ON CASE CAP

- (1) If new differential side gears are to be installed, place a new thrust washer over hub of differential side gear and lay in position in the differential case.

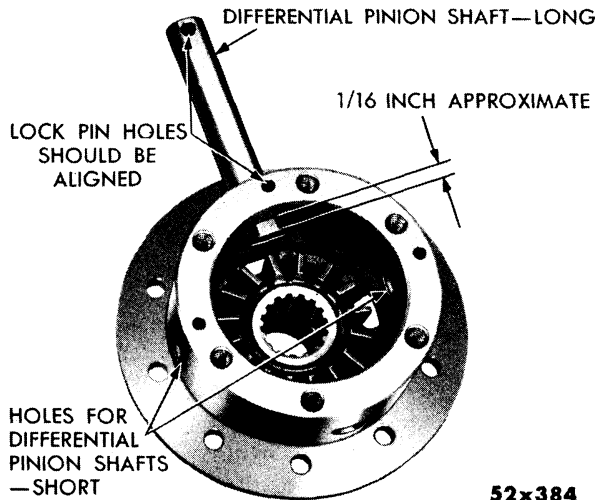


Fig. 24—Positioning the Long Pinion Shaft in Case

- (2) Line up the locking pin hole in the long pinion shaft with the hole in the differential case pinion boss (opposite boss has no pin hole). Drive the pinion shaft in case until it protrudes about $\frac{1}{16}$ inch on the inside of case, as shown in Figure 24.
- (3) Place a pinion thrust washer on the pinion so that the concave side faces the pinion. Install the pinion and thrust washer on the end of the shaft that protrudes through case. Tap shaft in case, while holding pinion up against case, until end of shaft is even with edge of pinion.
- (4) Insert the pinion shaft block with punch marked sides facing the short shaft holes. Install the axle drive shaft thrust block and continue to drive the shaft through the pinion shaft block and rear axle drive shaft thrust block.
- (5) Install the opposite pinion and thrust washer. Drive the shaft into final position in case, making sure locking pin holes are lined up.
- (6) Drive one of the short pinion shafts into either of the remaining holes until the shaft protrudes about $\frac{1}{16}$ inch on the inside of case. (Be sure the lock pin holes line up.) Install pinion and thrust washer and continue to drive shaft until shaft enters hole in the pinion shaft block. Install the other short shaft, washer and gear in the same manner.

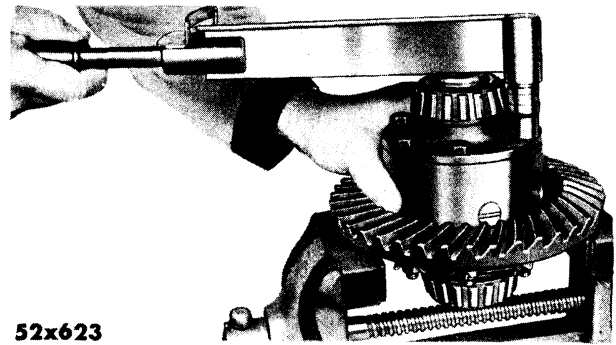
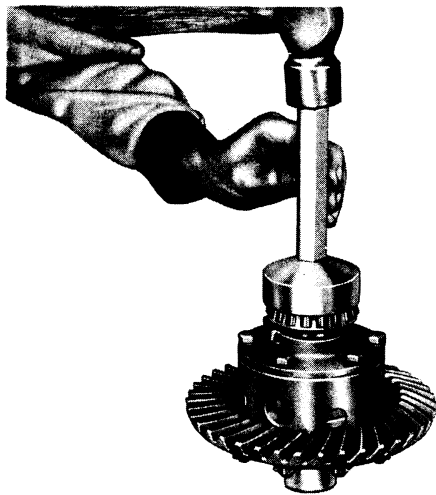


Fig. 25—Tightening Differential Case Cap Screws

- (7) Lock the three pinion shafts into the case by installing three new locking pins in the holes, driving the pin ends approximately $\frac{1}{16}$ inch below machined surface of case.
- (8) Assemble the thrust washer and differential side gear in the cap. Using the attaching cap screws as guides, position cap on differential case, and tap into position with fiber hammer.
- (9) Tighten cap screws to 35 foot-pounds torque as shown in Figure 25.
- (10) Install ring gear and tighten mounting bolt nuts to 40 foot-pounds torque. Lock the nuts by bending locking tabs.
- (11) Slide the differential bearing spacers over the hubs (if so equipped). Install the bearings on the case, using Tool DD-1005, as shown in Figure 26.
- (12) Place the differential bearing cups over the bearings. Install complete assembly in the carrier housing.
- (13) Seat the adjusting nuts in the pedestals of the carrier housing and install the caps and bolts. **NOTE: Be sure the caps are on the same side from which they were removed.**
- (14) Mount a dial indicator, with the pointer resting against the back face of the ring gear and check the runout. Runout should be true within .005 inch, as shown in Figure 19.



52x385

Fig. 26 — Installing Differential Bearings

14. ASSEMBLY OF BARREL TYPE DIFFERENTIAL WITH SCREWED-ON CASE CAP

- (1) If new differential side gears are to be installed, place a new thrust washer over hub of gear and lay in position in the differential case.
- (2) Line up the locking pin hole in the long pinion shaft with the hole in the differential case pinion boss (opposite boss has no locking pin hole). Drive the pinion shaft in until it protrudes about $\frac{1}{16}$ inch on the inside of case.
- (3) Place a pinion gear thrust washer on pinion so that the concave side faces the pinion. Install the pinion gear and washer on the end of shaft that protrudes. Tap shaft and hold pinion, until end of shaft is even with edge of pinion.
- (4) Insert the pinion shaft block (with punch marked sides facing the short shaft holes and the side marked 1 facing up). Install the thrust block and continue to drive the shaft through the pinion shaft thrust block and pinion shaft block.
- (5) Install the opposite pinion gear and thrust washer. Drive the shaft into final position.
- (6) Drive one of the short pinion shafts into either of the remaining holes, until the

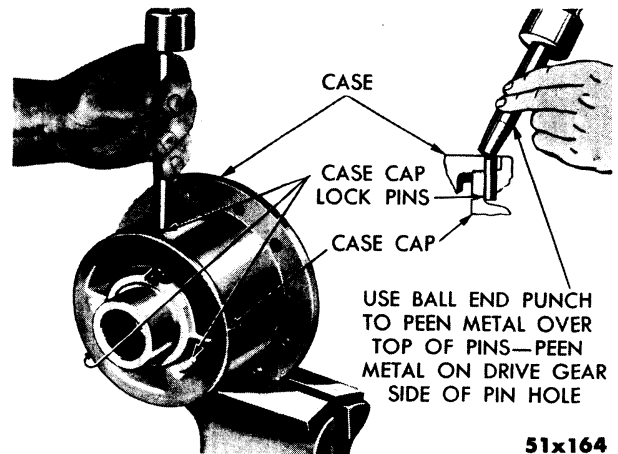
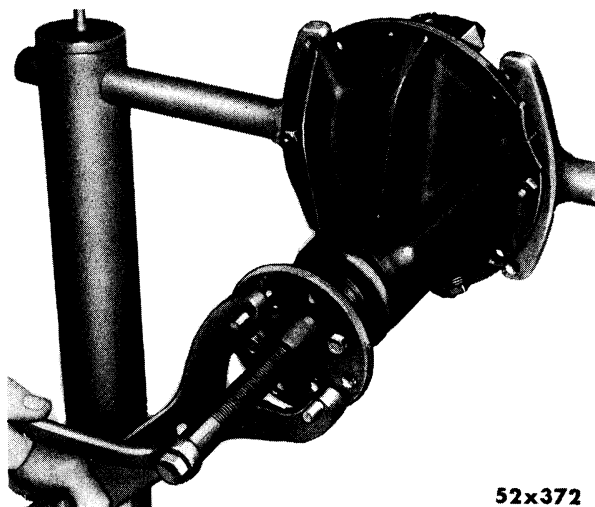


Fig. 27 — Staking Differential Case Cap Lock Pins

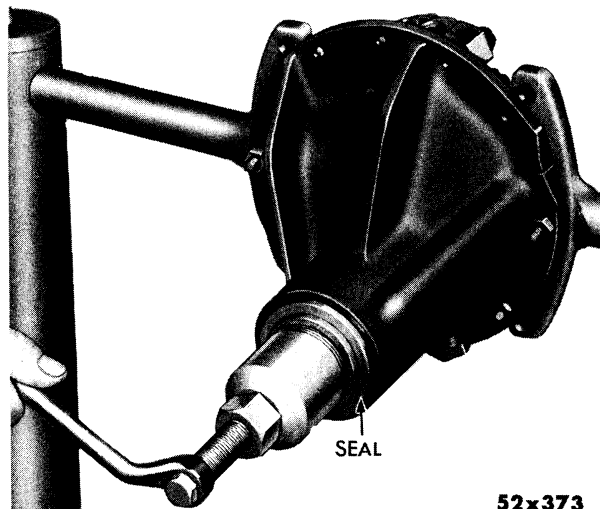
shaft protrudes about $\frac{1}{16}$ inch on the inside of case. Be sure the lock pin holes line up. Install pinion gear and thrust washer and continue to drive until shaft enters hole in the pinion shaft block. Install the other short shaft, washer and gear in the same manner.

- (7) Lock the three pinion shafts in the case (by installing three new locking pins in the holes) and peen over.
- (8) Clamp the completed assembly in vise and heat the outside surface of the threaded portion of the case with a torch flame, as in the disassembly procedure.
- (9) Dip the threaded portion of the cap in gear oil. Assemble the thrust washer and the differential side gear in the cap, and screw into the differential case with wrench Tool DD-921, as shown in Figure 22. Tighten securely in position with a blunt drift and hammer.
- (10) Drive three new differential case cap lock pins $\frac{1}{16}$ inch below the surface of case. Peen the metal of the case over the pins with a ball end punch, as shown in Figure 27.
- (11) Install the differential bearing cones on the case, using Tool DD-1004. Check the case runout, as shown in Figure 19.



52x372

Fig. 28 — Removing the Companion Flange



52x373

Fig. 29 — Removing Drive Pinion Bearing Oil Seal

15. REMOVAL OF AXLE DRIVE PINION FROM CARRIER (ALL MODELS)

a. Removal

- (1) With the carrier assembly mounted in stand, remove the companion flange retaining cotter pin nut and washer.
- (2) On all models, remove drive pinion flange with utility puller Tool C-549.
- (3) Remove the pinion shaft oil seal. Use Tool DD-993 to remove drive pinion oil seal from differential carrier assembly. Refer to Figure 29.
- (4) Remove the oil slinger, bearing cone, spacer and shims (if so equipped), pinion adjusting washer, bearing cone and pinion from carrier housing.
- (5) To remove or install the rear bearing from (or on) drive pinion, use special Tool DD-914 (for Model C-70) and Tool C-293-C for all other models (Fig. 30).

NOTE

When using Tool C-293-C, use Number 36 plates also.

- (6) Remove both bearing cups from carrier assembly with a suitable drift. Be sure to drive both cups out evenly.

b. Cleaning and Inspection

- (1) Clean all parts thoroughly in a suitable solvent and blow dry with compressed air.

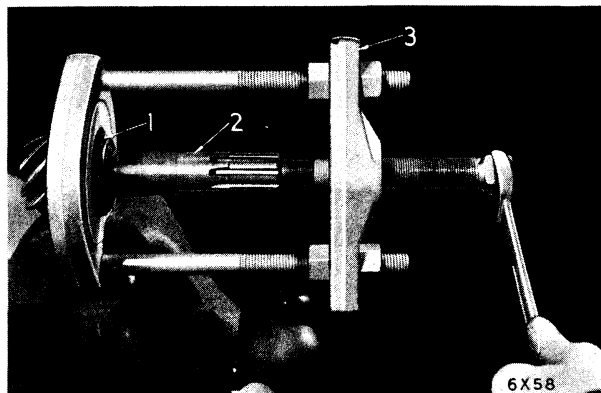


Fig. 30—Removing Bearing from Axle Drive Pinion

1—Bearing

2—Pinion

3—Tool C-293-C

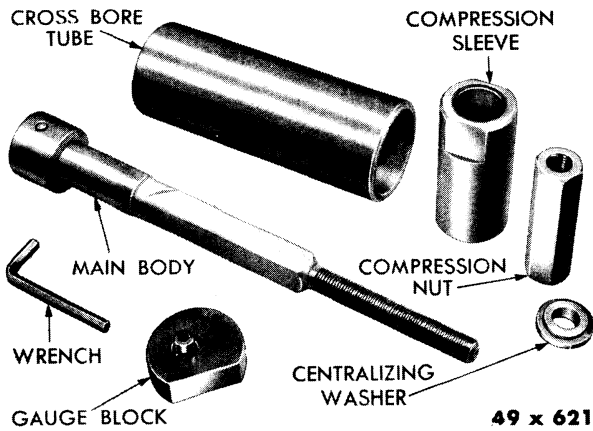


Fig. 31—Special Tool Set C-758-D2

Remove any chips or foreign material from the carrier housing. Inspect all machined surfaces for nicks, burrs or scratches. Inspect the thrust shoulders in the carrier housing (bearing cups) to make sure there are no burrs on them. The thrust shoulder must be flat so that the bearing cups will seat properly.

CAUTION

Do not rotate the bearings with air pressure when blowing them dry, as damage to the bearings may result from this practice.

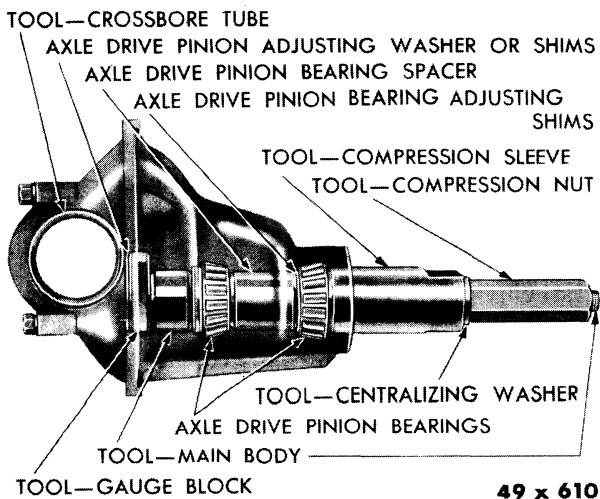


Fig. 32—Main Body, Bearings, Spacer and Shims Installed (Tool C-758-D2)

- (2) Check the bearings for roughness, or brinelling. The bearings must run free and show no indication of roughness or wear.
- (3) Clean carrier housing thoroughly, inspect oil passages and inside of housing for burrs, grit or dirt.

16. INSTALLATION OF DRIVE PINION BEARING CUPS

Place the bearing cups in position in the carrier. Then, refer to Figures 31 and 32 and proceed as follows:

- (1) With the bearing cups squarely in position in the carrier, assemble Tool C-758-D2 by

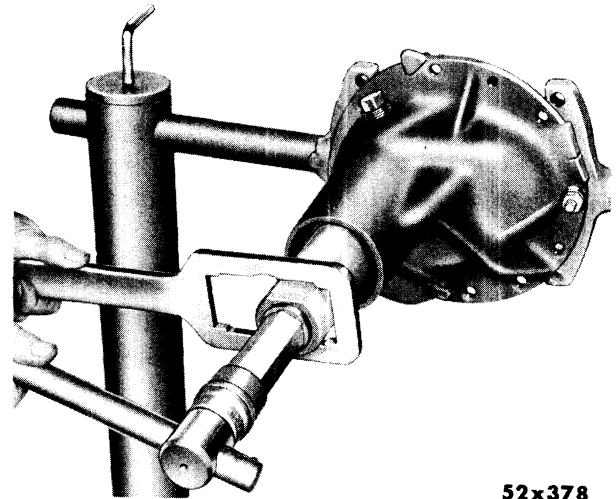


Fig. 33—Seating Bearing Cups in Carrier Housing

placing the rear pinion bearing over the main screw of tool and inserting into carrier from the gear side.

- (2) Place the front pinion bearing over the main screw, followed by adaptor SP-535, washer SP-534 and nut SP-533. Press the bearing cups into place by tightening the tool nut, as shown in Figure 33.

NOTE

Allow the tool to rotate slightly in order to avoid damaging the bearings or cups during this operation.

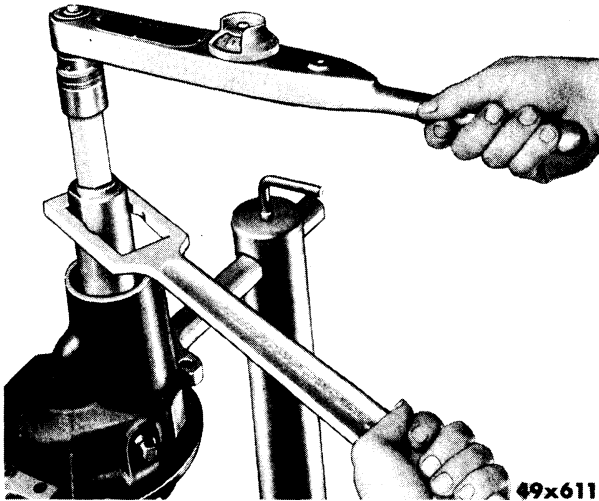


Fig. 34—Tightening Compression Nut with Foot-Pound Torque Wrench

CAUTION

Do not install the pinion oil seal during the pre-load and pinion setting operations. Otherwise, there will be an added drag on the pinion shaft which would give a false bearing pre-load on the torque wrench.

17. REAR AXLE ADJUSTMENT

To set the drive gear and pinion for quiet operation and long life, the following adjustments must be made in the order indicated.

- (1) Pinion bearing pre-load.
- (2) Pinion setting.

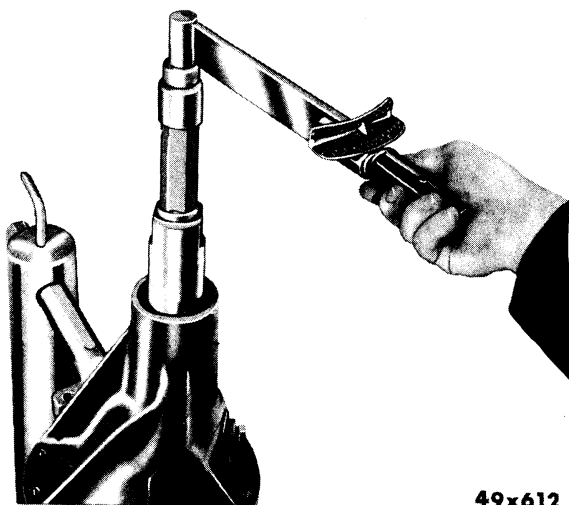


Fig. 35—Checking Torque Required to Turn Main Body

- (3) Differential bearing pre-load.
- (4) Backlash between drive gear and pinion.

Each adjustment is important because each one has a significant effect on the final goal—good tooth contact.

Pinion Bearing Pre-load

The importance of correct pinion bearing pre-load cannot be over-emphasized. The selection of washers to give the desired pre-load should be carefully made.

- (1) Where pinion bearings are installed without pre-loading, the cones are not drawn far enough into their cups to bring the rollers in full contact with the thrust ribs on the cones. Bearings installed in this manner would allow the pinion to “walk” backward and forward under operating loads. This causes a variation in tooth contact pattern, resulting in excessive wear and scoring of gears which usually is accompanied by noise.
- (2) On the other hand, where the pinion bearing cones are drawn too far into their cups, the bearings are overloaded before they have to withstand operating loads imposed upon them by the gears. They are apt to “burn up” under a driving load—the rollers might score the cups, causing bearings to spall or flake, resulting in premature axle failure.

18. SETTING DRIVE PINION PRE-LOAD, C-67 (EXCEPT TOWN AND COUNTRY WAGON)

With the use of special Tool C-758-D2 (Fig. 31), items 1 and 2, pinion bearing pre-load and pinion setting can be pre-determined, thus saving considerable time and labor incurred in the old trial and error method. Also, the pinion bearing cups can be installed with this tool.

Install cups in housing. Assemble the bearing cones and tool in carrier without the bearing spacer. Tighten the main nut, drawing cups into their proper position.

NOTE

Turn the tool and bearings at intervals to help line up bearing cups and avoid possible damage to the bearings.

- (1) With bearing cups in carrier, slide rear bearing cone and spacer over **main body** of tool and insert in carrier.
- (2) Slide adjusting shims and front bearing cone over **main body**, as shown in Figure 33.
- (3) Place **compression sleeve**, **centralizing washer** and **compression nut** over **main body**, and tighten to 240 minimum foot-pounds torque, as shown in Figure 34.
- (4) Remove torque wrench and, with a speed wrench, rotate **main body** of tool to seat bearings properly.
- (5) Use an inch-pound wrench to read the torque required to turn **main body**, as shown in Figure 35. Desired torque should be from 20 to 30 inch-pounds. It may be necessary to add or remove shims to obtain desired torque. In this case, loosen up the assembly and add or remove shims as required.

19. SETTING DRIVE PINION, C-67 (EXCEPT TOWN AND COUNTRY WAGON)

- (1) Place **gauge block** on top of **body** and tighten in place, as shown in Figure 36 (gauge block takes place of drive pinion).
- (2) Assemble **cross bore gauge bar** to carrier bearing supports, as shown in Figure 37. Tighten cap screws to hold bar in place.
- (3) The distance between **gauge block** and **cross bore gauge bar** determines thickness of spacer washer to be used, as shown in Figure 38. The pinion washer to be used is obtained by finding the thickness of the washer that slides between the cross bore gauge bar and the gauge block with a slight drag. This washer will be the correct size for assembly, provided the pinion has no correction indicated on the small end of the pinion head. In manufacture, after the pinion is lapped in with the gear, the position of the pinion for best tooth contact is etched on the small end of the pinion head as a + or - number. This number is the number of thousandths of an inch between the "best bearing" position and the standard position. A +2 would indicate that the pinion should be located .002 inch farther

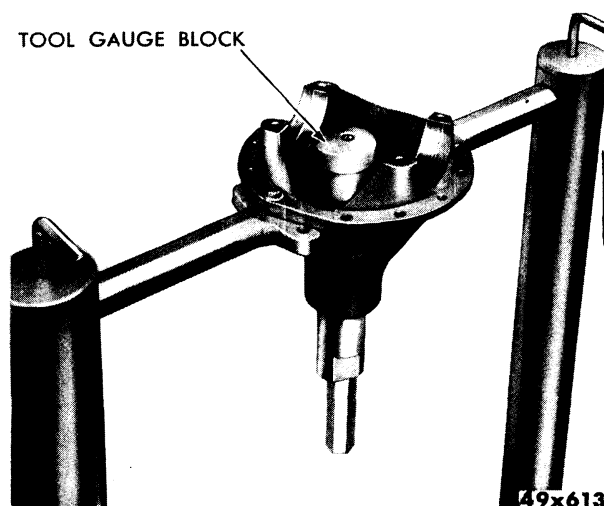


Fig. 36—Installing Gauge Block on Main Body

than the standard setting away from the drive gear. This amount (.002 inch) should be subtracted from the washer thickness of the washer that slides between the cross bore and gauge block. For example, if the gauge indicated that a carrier and rear pinion bearing combination required a pinion washer .090 inch thick, the washer to be used in the assembly is not known until the pinion is inspected for its position mark. If it is marked 0, the spacer to be used in this example is .090 inch. If the pinion is marked +2, the spacer should be .088 inch thick. If the pinion is marked -2, the spacer to be used is .092 inch thick.

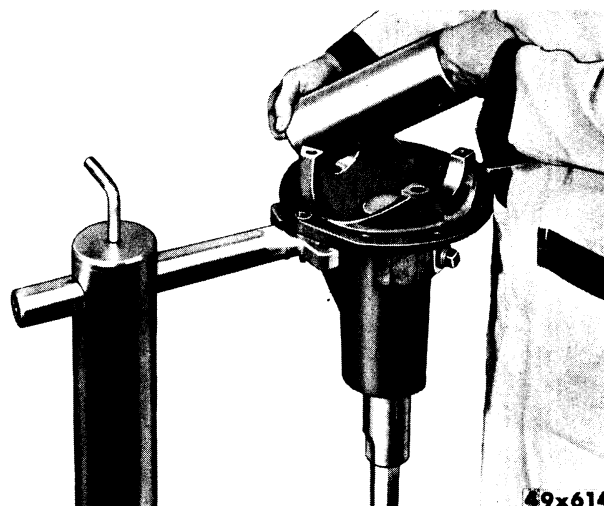


Fig. 37—Installing Cross Bore Gauge Bar

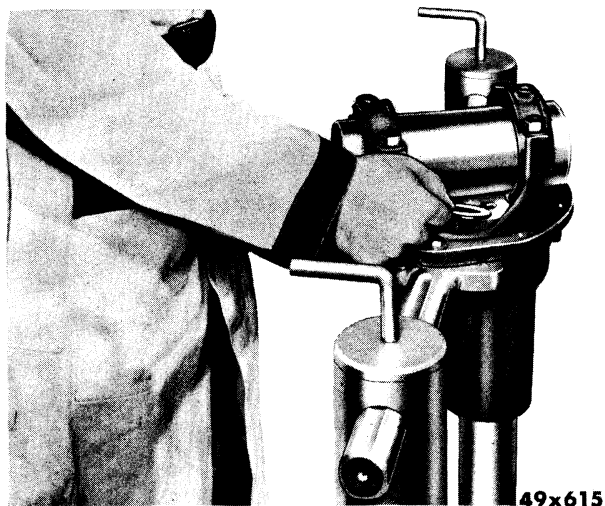


Fig. 38—Checking Spacer Washer Thickness

- (4) Slide the pinion washer over the pinion shaft with the chamfered side against the

pinion. Install the rear pinion bearing, using Tool C-3095 and a suitable arbor press.

- (5) Install the pinion in the differential carrier. Slide the bearing spacer, bearing pre-load shim pack, bearing cone and oil slinger over shaft and down into position.
- (6) Install a new oil seal, using driver Tool DD-807, as shown in Figure 40. Install the companion flange, washer and nut. Tighten to 240 minimum foot-pounds torque.

20. PINION PRE-LOAD AND PINION SETTING (C-68, C-69, C-70 AND C-67, TOWN AND COUNTRY WAGON)

The above models use a large bearing at the rear of the drive pinion. The shoulder is close to the front bearing, so the enlarged section of the pinion shaft performs the function of spacing the pinion bearings.

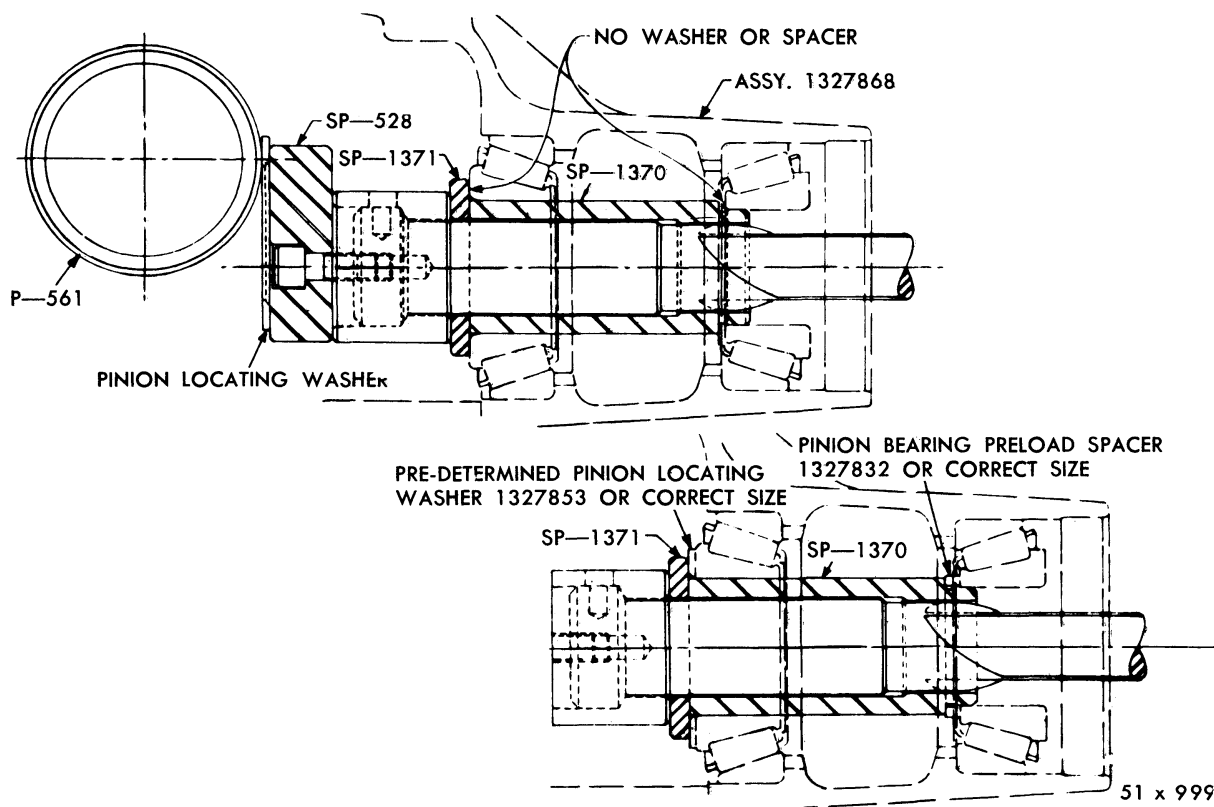


Fig. 39—Setting Pinion Bearing Pre-load with Tool C-758-D2

P—Plug SP—Spacer

Adjustment of bearing pre-load is left to a thick spacer (approximately $\frac{3}{16}$ inch), available in various thicknesses, and selected to give pre-load within the limits specified.

Pinion bearing spacers are available in fifteen different sizes as follows:

Spacer Thickness

.175 in.	.191 in.
.177 in.	.193 in.
.179 in.	.195 in.
.181 in.	.197 in.
.183 in.	.199 in.
.185 in.	.201 in.
.187 in.	.203 in.
.189 in.	

To check and adjust the pinion bearing pre-load, refer to Figure 39, and proceed as follows:

- (1) Assemble spacer SP-1371 to the main section of the tool and install spacer SP-1370.

Correct pinion bearing pre-load should have a drag torque of not more than 25 to 35 inch-pounds with the pinion seal removed.

- (2) Slide the pinion rear bearing over spacer SP-1370 and up against spacer SP-1371.
- (3) Insert the tool, as assembled, into the carrier housing. Slide front bearing over the tool shaft and into its proper position in the bearing cup.
- (4) Tighten the tool compression nut so that the torque required to rotate the tool assembly on the bearings is 25 to 35 inch-pounds, with the bearings lubricated with hypoid gear oil.
- (5) Assemble the gauge block SP-528 to the main screw. Place SP-561 bearing arbor in the differential carrier bearing supports, as shown in Figure 39.

NOTE

Remove any burrs or upsets in the bearing sup-

ports before installing the bearing arbor, as the arbor must be securely seated in the bottom of bearing bores. Carefully tighten the retaining bolts to 10 foot-pounds torque.

- (6) Select a pinion washer of sufficient thickness so that it will just pass between the gauge block end of the setting tool and the machined surface of the arbor, as shown in Figure 38.

For example, if a .090 inch washer can be inserted, but a .092 washer cannot be forced between the two surfaces by hand, the .090 inch washer should be used even though it might feel loose.

Check the end of the drive pinion, as it should indicate the amount that should be added or subtracted from the washer that was selected in the above check.

As example, if the mark on the pinion shaft indicated +2, a .002 inch **thinner** washer should be used for the final assembly. If a spacer selected by the use of the tool is .090 inch, it is necessary to deduct .002 inch. Therefore, the correct washer for final assembly would be .088 inch.

When the correct washer has been selected for the drive pinion, disassemble the tool from the differential carrier housing.

- (7) Add the washer selected to the tool, between the spacer SP-1371 and the pinion rear bearing. Add the spacer SP-1370 and the **pinion bearing adjusting spacer** (that was removed from the axle at disassembly). Insert the tool assembly in the carrier housing.
- (8) Slide the front bearing on the shaft and into position in its cup. Install the tool spacer, nut and washer.
- (9) Tighten tool to 250 minimum foot-pounds torque as shown in Figure 34.

Turn the tool with a speed wrench to permit the bearings to seat. When the bearings have

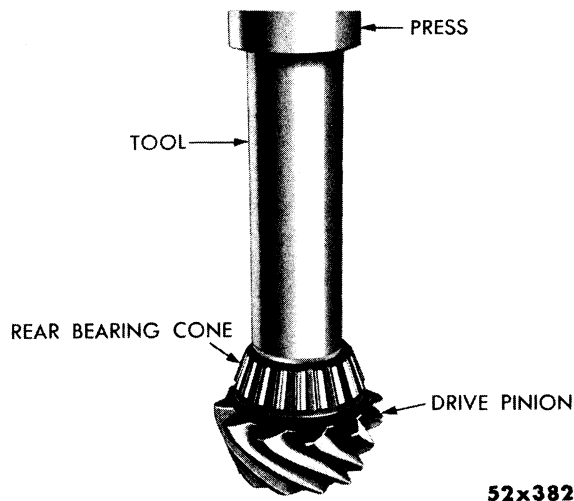


Fig. 40—Installing Bearing on Pinion Shaft

been seated, check the bearing pre-load by revolving the tool, using an inch-pound torque wrench, as shown in Figure 35.

The correct bearing pre-load should be 25-35 inch-pounds torque.

If the bearing adjustment does not conform to the above specifications, it will be necessary to change the adjustment by using a thicker or thinner bearing spacer. A **thicker** spacer should be used if the pre-load is too great or a **thinner** spacer if the pre-load is not sufficient.

When the correct spacer has been selected for the drive pinion bearings, disassemble the tool from the differential carrier housing.

- (10) Slide the pinion washer over the pinion shaft with the chamfered side against the pinion. Install the rear pinion bearing, using Tool C-3095 and a suitable arbor press (See Fig. 40).
- (11) Install the pinion in the differential carrier. Slide the bearing adjusting spacer, bearing and oil slinger over shaft and down into position.
- (12) Install a new oil seal, using driver Tool DD-807, as shown in Figure 41. Install the companion flange, washer and nut. Tighten to 250 minimum foot-pounds torque.

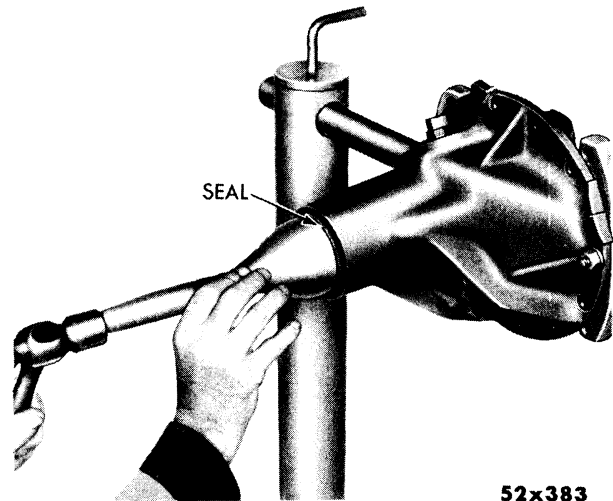


Fig. 41—Installing the Drive Pinion Oil Seal

21. SETTING DIFFERENTIAL BEARING PRE-LOAD AND BACKLASH (ALL MODELS)

Differential bearing pre-load and backlash between the drive gear and pinion are obtained after pinion bearing pre-load and pinion settings, as described in Paragraph 20.

- (1) Place the differential bearing cups over the bearings and install complete assembly in the carrier housing.
- (2) Seat the adjusters in the pedestals of the carrier housing and install the caps and bolts.

NOTE

Be sure the caps are on the same side from which they were removed.

- (3) Mount a dial indicator with the pointer resting against the back face of the ring gear and check the runout. Runout should be true within .005 inch, as shown in Figure 42.

In order to make certain that the differential bearings and cups are properly seated, proceed as follows:

- (4) Using spanner wrench Tool C-406, as shown in Figure 44, turn the right-hand bearing adjuster clockwise until considerable backlash exists between the ring gear and the pinion. Back off the adjuster several turns.

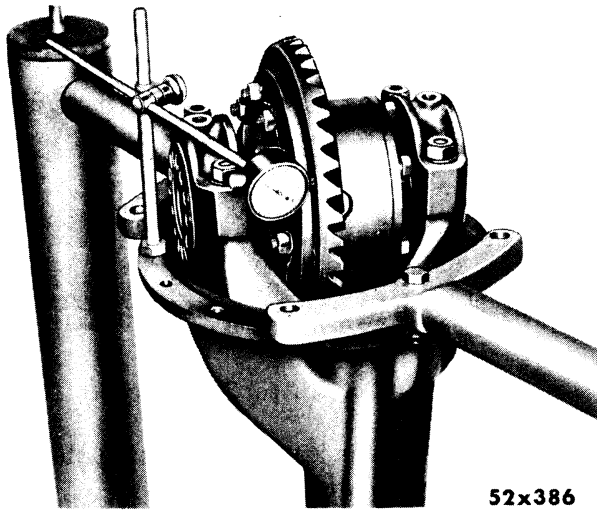


Fig. 42—Checking Ring Gear Runout

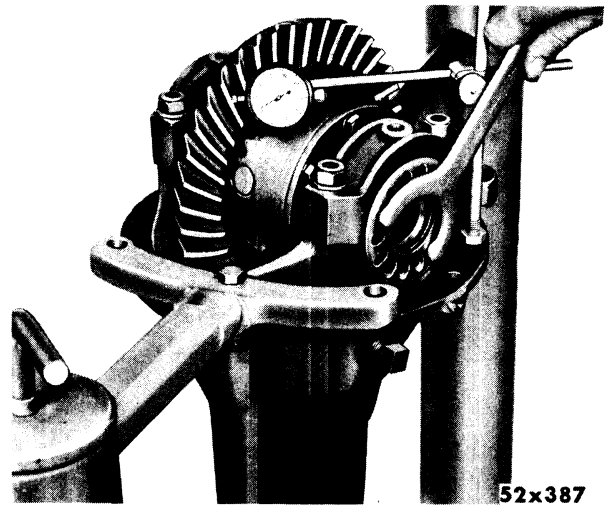


Fig. 43—Checking Backlash between Ring Gear and Pinion

- (5) Tighten the lower pedestal bolts to 90 foot-pounds, leaving the top bolts slightly loose. This holds the bearing cups in line while moving the ring gear.
- (6) Mount the dial indicator on the carrier so that the plunger rests against one of the ring gear teeth, as shown in Figure 43. (Make certain that the indicator is properly positioned so that the plunger will accurately indicate the exact amount of backlash.)
- (7) Check the backlash between the ring gear and the pinion at 90 degree intervals as the ring gear is rotated. Stop at the point of last backlash.
- (8) Turn the left-hand bearing adjuster clockwise until only .001 inch backlash exists between the ring gear and the pinion. Be sure that the right-hand adjuster is kept screwed out so that the bearing cup can move without interference.
- (9) Make certain that the left-hand bearing adjuster is in position where the nut lock and attaching bolt can be installed. Tighten the upper left-hand bearing cap bolt to 90 foot-pounds torque.

NOTE

In order to properly pre-load the bearings, the entire procedure must be very carefully performed. Therefore, it is important to complete the operation with .001 inch clearance between

the ring gear and the pinion before the upper bolt is tightened.

- (10) Turn the right-hand adjuster clockwise until the dial indicator shows a backlash of .006 inch between the ring gear and the pinion, as shown in Figure 43.

Considerable effort will be required to turn the adjusting nut to the last notch or two. However, this is necessary to insure adequate pre-load. The adjustment should be performed so that the adjuster lock and attaching bolt can be installed.

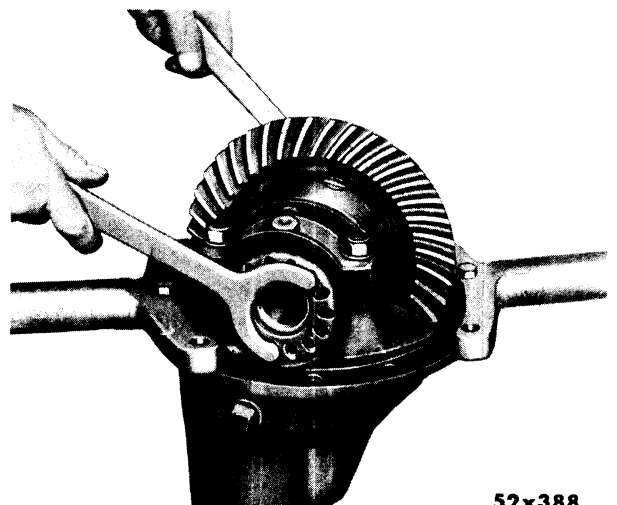


Fig. 44—Adjusting Differential Bearings

52x388

52x386

52x387

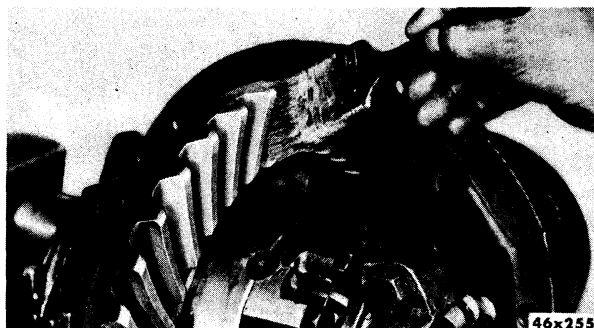


Fig. 45—Applying Gear Marking Compound to Gear Teeth

- (11) Tighten the right-hand bearing cap attaching bolt to 90 foot-pounds torque, and recheck the other three. After final tightening of all pedestal bolts, recheck the backlash.

As a result of this method of adjustment, the carrier pedestals have been spread, the differential bearings have been pre-loaded, and the backlash between the ring gear and pinion has been correctly set.

CAUTION

Whenever the adjustment of the differential assembly is changed to obtain correct tooth contact, re-adjust the differential bearing pre-load and the backlash between the ring gear and pinion.

Checking Tooth Contact

If all the adjustments have been correctly made, the gears will be properly meshed and quiet in operation. Proper tooth contact is essential for quiet gear operation and long life. Therefore, it is necessary that the tooth contact be checked with gear marking compound before the differential carrier assembly is installed in the axle housing.

22. GEAR ADJUSTMENT FOR CORRECT TOOTH CONTACT

- (1) If improper tooth contact is evident, as indicated by Figures 47 and 48, the pinion should be adjusted either forward or backward, maintaining the backlash within specified limits until correct tooth contact, as shown in Figure 46, is obtained.
- (2) Check tooth contact by means of the gear marking compound applied to the drive gear teeth, as shown in Figure 45. Apply load against the back face of the drive gear with a round bar as the drive pinion



Fig. 46—Correct Gear Tooth Contact

is rotated. This leaves a bare area the size, shape and location of contact.

- (3) With adjustments properly made, correct tooth contact, as shown in Figure 46, will result. Notice that the contact pattern is well centered on the drive and coast sides about $\frac{1}{16}$ inch from the edges of the teeth. When tooth marks are obtained by hand, they are apt to be rather small. However, under an actual operating load, the contact area will spread out—the higher the load, the greater becomes the contact area.
- (4) Figures 47 and 48 show improper or incorrect tooth contact. To correct such conditions, readjust the drive gear and pinion as follows:

a. Heavy Face Contact

If the tooth marking is across the length of the tooth, narrow and high on the tooth face, as shown in Figure 47, the teeth will roll over or gall. This type of contact causes excessive wear and noise.



Fig. 47—Heavy Face Contact

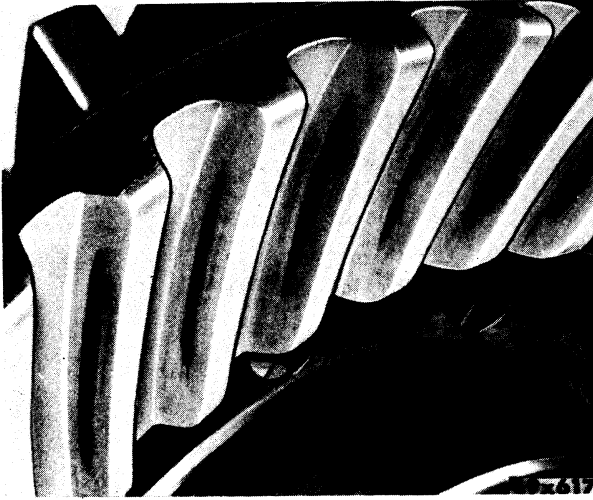


Fig. 48—Heavy Flank Contact

To correct heavy face contact—move the pinion in toward the center of the drive gear by installing a thicker washer behind the pinion. Re-adjust backlash.

b. Heavy Flank Contact

If the tooth marking is across the length of the tooth, but narrow and low on the flank, as shown in Figure 48, the teeth will gall or score. This type of contact causes excessive wear and noise.

To correct heavy flank contact—move the pinion away from the center of the drive gear by using a thinner washer behind the pinion. Re-adjust backlash.

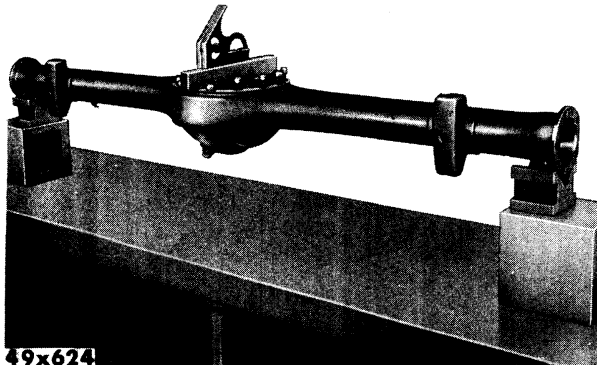


Fig. 49—Leveling Housing for Checking Alignment

23. INSTALLATION OF AXLE ASSEMBLY

Check carrier housing flange and flange face on differential housing for nicks and burrs.

- (1) Mount the differential carrier to the axle housing, using a new gasket. Tighten the mounting nuts to 45 foot-pounds torque.
- (2) Reinstall rear axle shafts, brake supports and check axle end play, as outlined in Paragraph 4. Connect brake tubes, bleed brakes, install rear wheels, and tighten rear axle shaft nuts to a minimum of 145 foot-pounds torque. Install new cotter key.
- (3) Reinstall propeller shaft and fill the rear axle differential with the correct viscosity Hypoid oil. Refer to the Lubrication Section.

24. REAR AXLE HOUSING ALIGNMENT

Rear axle housings may become bent, bowed or warped. If not corrected, such conditions will cause premature axle failure. Disassemble axle assembly and check housing for horizontal and vertical alignment, as described below.

a. Checking Axle Housing for Horizontal Alignment

- (1) Place axle housing in "V" blocks—on surface plate.
- (2) Turn housing until machined surface for carrier mounting is facing UP and is perfectly level, as shown in Figure 49.
- (3) Place square against machined surface of housing end flange and surface plate, as shown in Figure 50. Amount of housing

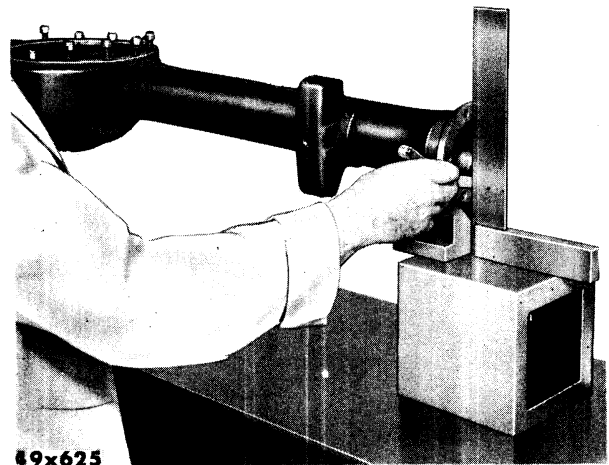


Fig. 50—Checking Horizontal Alignment

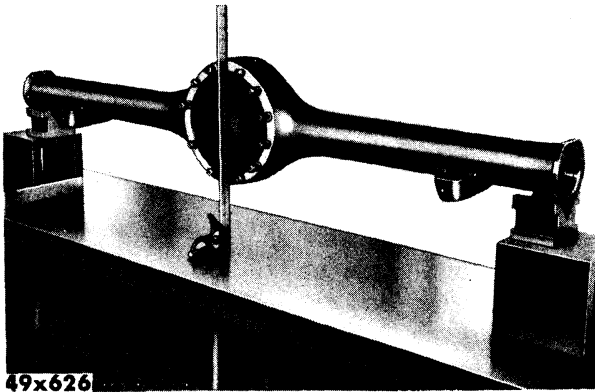


Fig. 51—Squaring Axle for Vertical Alignment

misalignment will be indicated by the thickness of feeler gauge between square and end flange at top or bottom. A housing that checks more than .007 inch should be replaced.

b. Checking Axle Housing for Vertical Alignment

- (1) With housing in "V" blocks, turn housing until machined surface for carrier mounting is in a squared, vertical position, as shown in Figure 51.
- (2) Place square against machined surface of housing end flange and surface plate, as shown in Figure 52. Amount of housing misalignment will be indicated by the thickness of feeler gauge between square and end flange at top or bottom. A housing that checks more than .007 should be replaced.
- (3) To determine the amount that axle is misaligned, multiply the thickness of feeler stock used by the ration of 4.7 to 1.

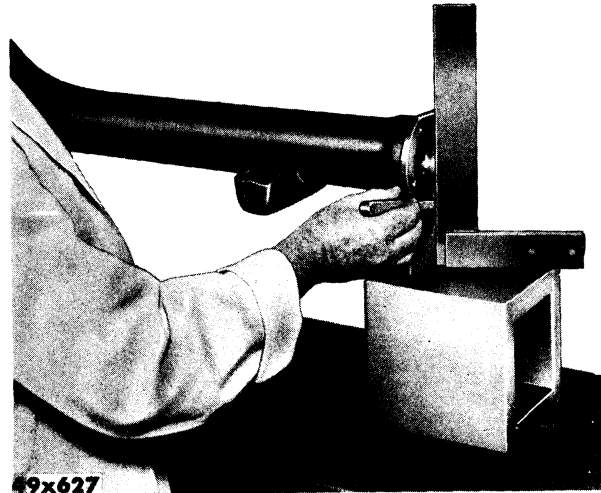


Fig. 52—Checking Vertical Alignment

25. WELDING REAR AXLE HOUSING

Arc welding of complete rear axle assemblies to repair leaking housings, covers, loose or broken spring seats and brake line clips, has been common shop practice for some time. However, recent investigations have proven that arc welding should definitely **not** be used for repairing the rear axle housing, unless axle is completely disassembled.

It is possible for arcing electric current to jump the gap and damage roller bearings when there is end play. The damage is similar to brinelled bearing marks. It is further possible for damage to be done to the faces of the drive gear and pinion, as well as to the differential side gears and pinions, if conditions are just right for the existence of sufficient backlash gap on these parts to cause arcing.

Grounding of arc welding equipment is not effective in preventing damage. Instead of arc welding equipment, gas welding equipment should always be used on rear axle housing, unless the unit is completely disassembled.

SERVICE DIAGNOSIS

26. REAR WHEEL NOISE

Possible Causes:

- a. Wheel loose on axle shaft.
- b. Worn drum or axle shaft keyways.
- c. Wheel hub bolts loose.
- d. Insufficient bearing lubrication.
- e. Scored wheel bearing cup or cone.
- f. Defective, brinelled wheel bearing.
- g. Excessive axle shaft end play.

Remedies:

- a. Check keyways for possible damage. Re-set drum and tighten nut to 145 foot-pounds minimum torque.
- b. If keyways in hub and axle shaft show excessive wear, replace hub and axle shaft to correct this condition.
- c. Tighten loose wheel hub bolts.
- d. Check bearings for possible damage and replace if necessary. Refer to Lubrication Section for proper lubrication.
- e. Check rear wheel bearings. If scored or show signs of wear, they should be replaced.
- f. Defective or brinelled bearings must be replaced. Check rear axle shaft end play.
- g. Readjust axle shaft end play to bring desired clearance of .003 to .008 inch.

27. NOISE IN REAR AXLE ASSEMBLY

Possible Causes:

- a. Misaligned axle housing.
- b. Bent or sprung axle shaft.
- c. End play in drive pinion bearings.
- d. Excessive gear lash between drive gear and pinion.
- e. Improper adjustment of drive pinion bearings.
- f. Loose drive pinion companion flange nut.

- g. Improper wheel bearing adjustment.
- h. Scuffed gear tooth contact surfaces.

Remedies:

- a. Refer to Rear Axle Housing Alignment, Paragraph 24, in this Section.
- b. Replace bent or sprung axle shaft.
- c. Refer to Pinion Bearing Pre-load, Paragraph 20, in this Section.
- d. Refer to Backlash Adjustment, Paragraph 21, in this Section.
- e. Adjust pinion bearings, as outlined in Rear Axle Adjustment, Paragraph 17, in this Section.
- f. Tighten drive pinion flange nut.
- g. Check axle shaft end play. Readjust to bring desired end play clearance of .003 to .008 inch.
- h. Check lubricant. Replace scuffed gears. For correct tooth contact, refer to Paragraph 22, in this Section.

28. REAR AXLE DRIVE SHAFT BREAKAGE

Possible Causes:

- a. Improperly adjusted wheel bearings.
- b. Misaligned axle housing.
- c. Vehicle overloaded.
- d. Abnormal clutch operation.
- e. Grabbing clutch.

Remedies:

- a. Replace broken shaft and readjust end play to desired clearance of .003 to .008 inch.
- b. Replace broken shaft, after correcting Rear Axle Housing Alignment, as outlined in Paragraph 24, in this Section.
- c. Replace broken shaft. Avoid excessive weight in or on car.

d. Replace broken shaft after checking for other possible causes. Avoid erratic use of clutch.

e. Replace broken shaft. Refer to Clutch, Section IV, to correct this condition.

29. DIFFERENTIAL CASE BREAKAGE

Possible Causes:

- a. Improper adjustment of differential bearings.
- b. Excessive drive gear clearance.
- c. Vehicle overloaded.
- d. Erratic clutch operation.

Remedies:

a. Replace broken case and examine gears and bearings for possible damage. At reassembly, adjust differential bearings, as outlined in Rear Axle Adjustment, Paragraph 17, in this Section.

b. Replace broken case and examine gears and bearings for possible damage. At reassembly, adjust drive gear and pinion backlash to required specification of .006 to .008 inch, as outlined in Rear Axle Adjustment, Paragraph 17, in this Section.

c. Replace broken case and examine gears and bearings for possible damage. Avoid excessive weight in or on car.

d. Replace broken case. After checking for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.

30. DIFFERENTIAL SIDE GEAR BROKEN AT HUB

Possible Causes:

- a. Excessive axle housing deflection.
- b. Misaligned or bent axle shaft.
- c. Worn thrust washers.

Remedies:

a. Replace damaged gears. Examine other gears and bearings for possible damage. Check Rear Axle Housing Alignment, as outlined in Paragraph 24, in this Section.

b. Replace damaged gears. Check axle shafts for alignment, and examine other gears and bearings for possible damage.

c. Replace damaged gears. Examine other gears and bearings for possible damage. Replace thrust washers that are badly worn. Side gear to thrust washer clearance should be from .004 to .012 inch.

31. SCORING OF DIFFERENTIAL GEARS

Possible Causes:

- a. Insufficient lubrication.
- b. Improper grade of lubricant.
- c. Excessive spinning of one wheel.
- d. Excessive loads.

Remedies:

a. Replace scored gears. Scoring marks on the pressure face of gear teeth, or in the bore are caused by instantaneous fusing of the mating surfaces. **Scored gears should be replaced.** Fill rear axle to required capacity with Extreme Pressure Hypoid Lubricant SAE 90 (winter and summer), or with SAE 80 below —10 degrees F.

b. Replace scored gears. Inspect all gears and bearings for possible damage. Clean out and re-fill axle with Extreme Pressure Hypoid Lubricant SAE 90 (winter and summer), or with SAE 80 below —10 degrees F.

c. Replace scored gears. Inspect all gears, pinion bores and shaft for scoring or bearings for possible damage.

d. Replace scored gears. Inspect all gears, bearings, pinion bores and shaft for scoring or possible damage. Avoid excessive weight in or on car.

32. TOOTH BREAKAGE (DRIVE GEAR AND PINION)

Possible Causes:

- a. Overloading.
- b. Erratic clutch operation.
- c. Ice-spotted pavements.
- d. Improper adjustment.

Remedies:

a. Replace gears. Examine other gears and bearings for possible damage. Replace parts as needed. Avoid excessive weight in car.

b. Replace gears, being careful to examine remaining parts for possible damage. Avoid erratic clutch operation.

c. Replace gears. Examine remaining parts for possible damage. Replace parts as required.

d. Replace gears. Examine other parts for possible damage. Drive gear and pinion backlash should be .006 to .008 inch. Refer to Gear Adjustment for Correct Tooth Contact, Paragraph 22, in this Section.

33. REAR AXLE NOISE

Rear axle noises are generally divided into three groups:

- (1) **Gear Noise on Pull** — If the noise is of a heavy pitch and increases as the car speed is increased, it is an indication of scored teeth due to loss of lubricant, incorrect mesh of teeth or wrong type of lubricant.
- (2) **Gear Noise on Coast** — If noise is heavy and irregular, it is an indication of scored teeth as a result of excessive end play in pinion bearings or by incorrect adjustments.
- (3) **Bearing Noise on Pull or Coast** — This indicates bearings are chipped, cracked, scored, badly worn or loose, or the pinion is improperly positioned. Bearings, that are badly worn or broken, will make a gravelly, rough, grating sound that may change slightly in volume as speed changes.

Possible Causes:

- a. Insufficient lubricant.
- b. Improper drive gear and pinion adjustment.
- c. Unmatched drive gear and pinion.
- d. Worn teeth on drive gear or pinion.
- e. Loose drive pinion bearings.
- f. Loose differential gear bearings.

g. Misaligned or sprung drive gear.

h. Loose carrier housing bolts.

Remedies:

a. If an axle is noisy because of insufficient lubricant, it is too late to obtain any benefit by adding lubricant. The gears or bearings, or both, are likely to be damaged. Inspect all parts, replace damaged parts, and check axle and housing assembly for leaks.

b. Check drive gear and pinion tooth contact, as outlined in Gear Adjustment for Correct Tooth Contact, Paragraph 22, in this Section.

c. Remove unmatched drive gear and pinion. Replace with a new matched gear and pinion set. Refer to Removal and Inspection of Differential Carrier Assembly, Paragraph 7, in this Section.

d. Check teeth on drive gear and pinion for contact, as outlined in Gear Adjustment for Correct Tooth Contact, Paragraph 22, in this Section. If necessary, replace with new matched set.

e. Adjust drive pinion bearings, as outlined in Rear Axle Adjustment, Paragraph 17, in this Section.

f. Adjust differential gear bearings, as outlined in Rear Axle Adjustment, Paragraph 17, in this Section.

g. Check drive gear for runout.

h. Tighten carrier housing nuts to required torque. Check for oil leaks.

34. LOSS OF LUBRICANT**Possible Causes:**

- a. Lubricant level too high.
- b. Worn axle shaft oil seals.
- c. Cracked rear axle housing.
- d. Worn drive pinion oil seal.
- e. Scored and worn companion flange.

Remedies:

a. Drain excess lubricant by removing filler plug, allowing lubricant to level at lower edge of filler plug hole.

b. Replace worn oil seals. Prepare new seals before installation. See Paragraph 4.

c. Refer to Welding Rear Axle Housing, Paragraph 25, in this Section.

d. Replace worn drive pinion oil seal. Prepare new oil seal before installation. See Paragraph 21.

e. Replace worn or scored companion flange and oil seal. Prepare new oil seal before installation.

35. OVER-HEATING OF UNIT

Possible Causes:

- a. Lubricant level too low.
- b. Incorrect grade of lubricant.
- c. Bearings adjusted too tightly.
- d. Excessive wear in gears.
- e. Insufficient drive gear to pinion clearance.

Remedies:

a. Refill rear axle, allowing lubricant to level at lower edge of filler plug hole.

b. Drain, flush and refill rear axle with Extreme Pressure Hypoid Lubricant SAE 90 (winter and summer), or with SAE 80 below —10 degrees F.

c. Readjust differential bearings to required pre-load.

d. Check gears for excessive wear or scoring. Replace as necessary.

e. Readjust drive gear and pinion backlash from .006 to .008 inch. Check gears for possible scoring.

NOTE

Oil seals may be destroyed by excessive heat. Replace cracked or hardened seals.