Group 3
REAR AXLE
CONTENTS

CONTENTS (Cont'd)

Sure Grip Differential

REAR AXLE

DATA AND SPECIFICATIONS

MODELS	PS-1, PS-3, PC-1, PC-2, PC-3, PY-1
Type	Semi-Floating
Gear Type	Hypoid
Ring Gear Diameter	8.75 inch
Pinion Bearing	Tapered Roller (2)
Drive Pinion Bearing Pre-load	20-30 in. lbs. without seal
Adjustment	Shim Pack
Differential Bearings	Tapered Roller (2)
Differential Bearing Adjustment	Threaded Adjuster
Drive Gear and Pinion	Serviced in Matched Sets Only
Drive Gear Runout	.005 inch (Maximum)
Drive Gear and Pinion Adjustment	Select Washer
Drive Gear and Pinion Backlash	.006 to .008 inch
Differential Side Gear Clearance	
Models PC-1, PC-2, PC-3, PY-1	.001 to .012 inch
Models PS-1, PS-3	.004 to .012 inch
Differential Lubricant Capacity	3½ pints
Axle Ratio	
Models PS-1, PC-1, PC-2, PC-3, PY-1	2.93 to 1
Model PS-3	3.31 to 1
Wheel Bearing Type	Tapered Rollers
Wheel Bearing Adjustment	Select Shims
Wheel Bearing Axle Shaft End Play	.013 to .018 inch

TIGHTENING REFERENCE

	Foot-Pounds
Axle Shaft Nuts	145 (Min.)
Brake Support Plate to Housing Mounting Bolt Nuts	30 - 35
Differential Carrier to Axle Housing Bolt Nuts	45
Rear Axle Drive Gear to Case Bolts	45
Differential Bearing Cap Bolts	90
Rear Axle Drive Pinion Companion Flange Nut	240 (Min.)

SPECIAL TOOLS

C-293-E2 or F2	Puller Sets — Roller Bearing
C-406-A	Differential Bearing Adjusting Wrench
C-413	Rear Axle Shaft Outer Bearing Cup Driver
C-452	Universal Joint Flange Puller
C-485	Torque Wrench (Foot-Pounds)
C-496	Pinion and Transmission Companion Flange or Yoke Puller
C-499	Axle Shaft Puller
C-637	Axle Shaft and Inner Oil Seal Puller
C-685	Torque Wrench (Inch-Pounds)
C-745	Rear Axle Shaft Oil Seal Installing Sleeve
C-748	Pinion Oil Seal Puller
C-758-D3	Pinion Setting Gauge Set
C-839	Rear Axle Shaft Inner Oil Seal Driver
C-845	Universal Wheel and Hub Puller
C-3281	Companion Flange Holding Wrench
C-3339	Dial Indicator
C-3565	Axle Shaft Outer Seal Driver
C-3571	Adapter Kit
C-3656	Pinion Oil Seal Driver
DD-996	Pinion Bearing Installer
DD-999	Flange or Yoke Installer
DD-1005	Differential Case Side and Cross Shaft Roller Bearing Driver
DD-1014	Repair Stand — Differential Carrier
SP-2919	Pinion Setting Adapter — Part of Tool C-758-D3 and C-3571
SP-2920	Pinion Spacer Sleeve — Part of Tool C-758-D3 and C-3571
SP-2921	Setting Adapter — Part of Tool C-758-D3 and C-3571

SERVICE DIAGNOSIS

1. REAR WHEEL NOISE

a. Wheel loose on axle shaft.

b. Wheel hub bolts loose.

c. Improper shimming at axle bearing.

d. Insufficient lubrication.

e. Brinnelled or scored wheel bearings.

f. Worn drum or worn axle shaft keyways.

g. Bent or sprung axle shaft.

2. REAR AXLE NOISE

a. Lubricant level too low.

b. End play in drive pinion bearings. Also see Paragraph 3b—gear noise on coast.

c. Excessive gear lash between ring gear and pinion. Also see Paragraph 3a and c. Gear noise on pull.

d. Loose drive pinion companion flange nut.

e. Scuffed gear tooth contact surfaces.

3. REAR AXLE GEAR NOISE

a. Gear noise on pull—a heavy pitch noise and increases as car speed increases, indicates scored gear teeth due to loss of lubricant, excessive gear lash or wrong type of lubricant.

b. Gear noise on pull or coast—noise is heavy and (irregular) indicating excessive end play in pinion bearings.

c. Bearing noise on pull or coast—a rough grating sound may change slightly in volume as speed changes; indicates that the rear axle pinion bearings are chipped, cracked, scored, badly worn and loose, or no gear lash.

4. CLICKING NOISE IN DRIVE LINE

a. Noise in drive line when vehicle is backed up or moved forward — Clean axle shaft taper, keys and drums. Apply a heavy coating of chalk around entire circumference and length of the tapered section of rear axle shaft. Install drums and tighten axle shaft nuts 145 foot-pounds torque, minimum. Check universal joints, and flange splines. Tighten companion flange nut to 240 foot-pounds torque, minimum.

5. REAR AXLE DRIVE SHAFT BREAKAGE

a. Improperly adjusted wheel bearings.

b. Abnormal clutch operation.

c. Misaligned axle housing.

d. Vehicle overloaded.

6. DIFFERENTIAL CASE BREAKAGE

a. Improper differential bearing adjustment.

b. Abnormal clutch operation.

c. Excessive drive gear clearance.

d. Vehicle overloaded.

7. DIFFRENTIAL SIDE GEAR BROKEN

a. Worn thrust washers.

b. Misaligned or bent axle shaft.

c. Overloading vehicle.

8. TOOTH BREAKAGE (Drive Gear and Pinion)

a. Overloading and abnormal clutch operation.

b. Improper gear adjustment.

9. OVERHEATING OF AXLE UNIT

a. Lubricant level too low.

b. Bearings adjusted too light.

c. Bearings adjusted too tight.

d. Excessive wear in gears.

e. Insufficient drive gear to pinion clearance.

10. LOSS OF LUBRICANT

a. Lubricant level too high.

b. Clogged breather.

c. Scored or worn parts.

d. Oil seals worn.

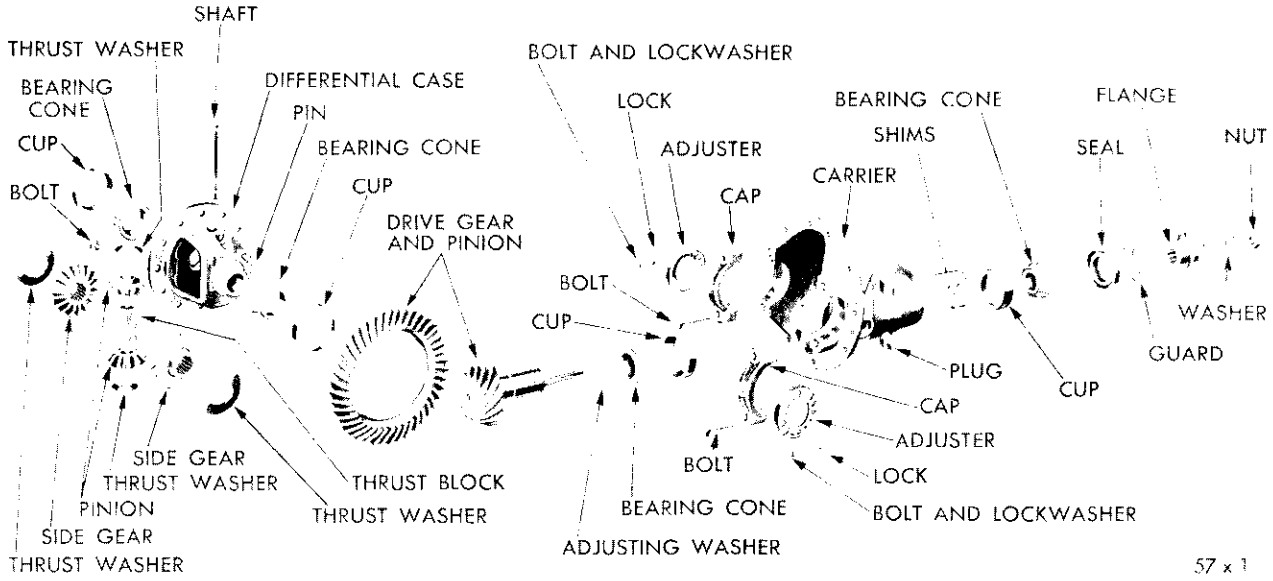

Fig. 1—Rear Axle (Disassembled View)
(Pinion Without Spacer)

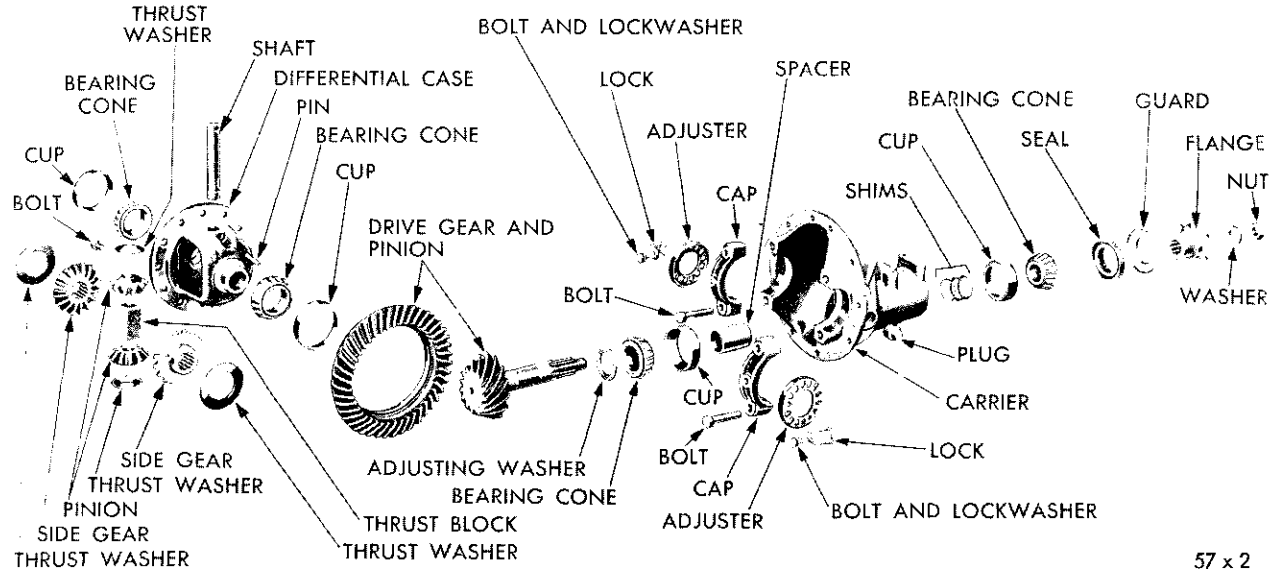

Fig. 2—Rear Axle (Disassembled View)
(Pinion with Spacer)

Group 3
REAR AXLE

The rear axle assembly (Figs. 1 and 2) consists of four sub-assemblies; axle drive shafts with related parts, differential with ring gear, drive pinion with carrier, and axle housing. It is not necessary to remove the entire axle assembly to service any of the above components with the exception of the axle housing itself.

11. AXLE DRIVE SHAFTS

a. Removal

(1) Raise the car and remove the rear wheels, hub and drum assembly, using puller Tool C-845.

CAUTION

Do not use a knock-off type wheel puller. Use of a knock-off type puller may cause damage to bearings and thrust block.

(2) Block the brake pedal to prevent its being depressed and disconnect the brake lines at the wheel cylinders.

(3) Remove the axle drive shaft key and remove the brake support and dust shield using Tool C-757 to protect the outer seal (Fig. 2).

(4) Carefully remove the shim pack from each end of the axle housing. Identify each shim pack as to location to aid in reassembly.

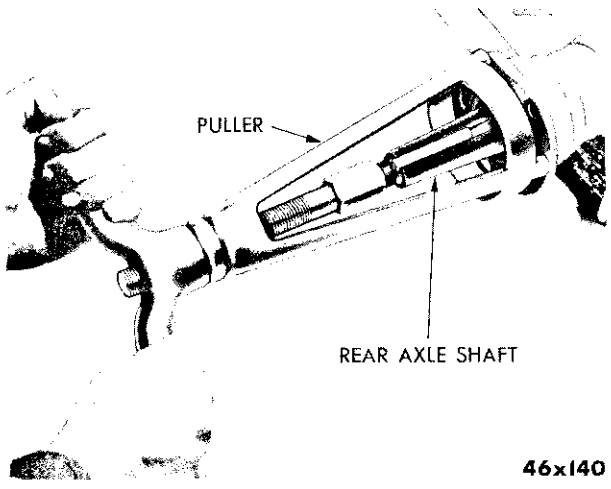

Fig. 3—Removing Axle Drive Shaft and Bearing

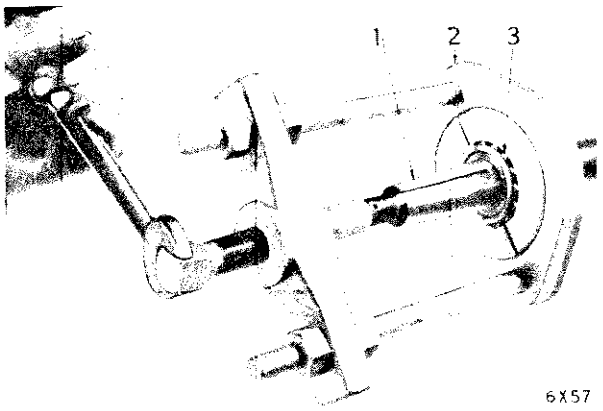

Fig. 4—Removing Bearing from Axle Drive Shaft

1. Axle Drive Shaft 2. Tool 3. Bearing

(5) Remove the axle shafts and bearing assembly using Tool C-499 (Fig. 3). If necessary, the bearings may be removed from the axle shafts using bearing puller, Tool C-293-13 (Fig. 4).

(6) Remove the axle shaft inner oil seals with puller Tool C-637 (Fig. 5). Remove the brake dust shield outer seal using Tool C-3565.

b. Cleaning and Inspection

(1) With mineral spirits or dry cleaning solvent, clean the axle shafts, bearings, cups, shims and shim contacting surfaces as well as the counterbores of the axle housing. With the exception of the bearings, dry all parts with compressed air.

(2) Inspect the bearing cones and cups for spalling, brinnelling or other visible damage. If either the bearing cone or cup is not up to inspection

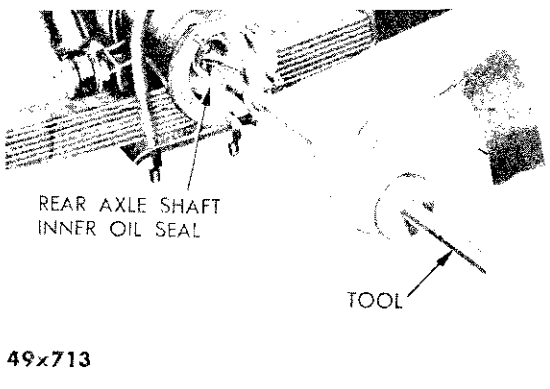

Fig. 5—Removing Axle Drive Shaft Inner Oil Seal

standards, replace both the cone and cup.

(3) Inspect each axle shaft for signs of fatigue, worn or scored oil seal contacting surfaces, wear or accumulated metal deposits on the thrust block end of the shaft, damaged threads, or excessively worn splines. Machined surfaces can usually be satisfactorily dressed. If abnormal conditions are noted, the shafts should be replaced.

(4) Inspect the shims for distortion or other visible damage. Install new shims if necessary.

(5) Inspect the shim contacting surfaces of both the brake support and axle housing for burrs. Remove burrs with crocus cloth if possible.

(6) If inspection reveals that replacement of either the axle shaft or bearing is necessary, press bearing on the axle shaft using an arbor press, or Tool DD-996.

(7) Make certain that the bearing and axle shaft contacting surfaces are thoroughly cleaned so the bearing bottoms against the shoulder of the axle shaft. (Tapered portion of the bearing must face the axle shaft threads.)

c. Axle Drive Shaft End Play

Where original axle shafts and bearings are used, start measurement of end play with original shim packs, after recording thickness of each. When either or both the axle shaft and bearing is replaced, use shim packs totaling .040 inch per side. Shims are available in thicknesses of .005, .0125, .015 and .030 inch.

d. Axle Drive Shaft Assembly

(1) Install inner oil seals with Tool C-839 (Fig. 6).

(2) Starting at one end of the axle housing, install a .040 inch shim pack on the flange studs.

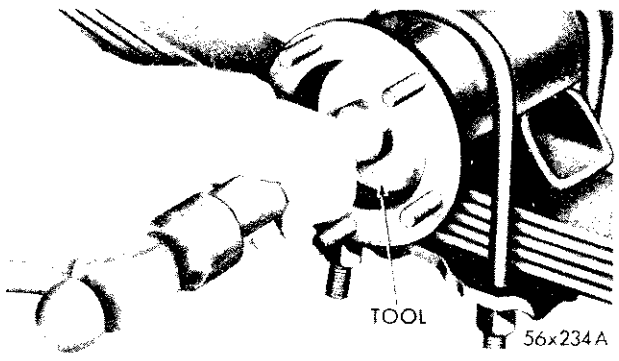

Fig. 6—Installing Axle Shaft Inner Oil Seal

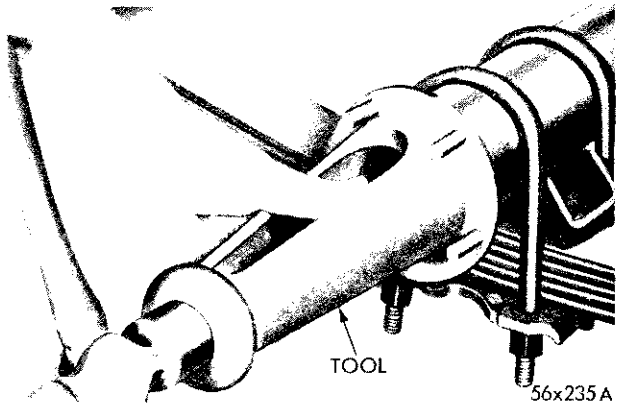

Fig. 7—Installing Axle Drive Shaft Bearing Cup

(3) Working from the same side of the axle housing, lubricate the axle shaft bearing with multi-purpose gear lube and install the axle shaft.

(4) Install the bearing cup with the installing Tool C-413 (Fig. 7). Make certain the bearing cup is driven into the axle housing until the face of the installing tool bottoms against the shims, **not the housing flange.** Remove tool and install the brake support, lockwashers, and nuts. Tighten nuts 30 to 35 foot-pounds torque.

(5) Working from the opposite side of the axle housing, lubricate the bearing and install the other axle shaft until it contacts the axle shaft thrust block.

(6) With a fiber mallet, lightly tap the end of the axle shaft against the thrust block. This will force the opposite axle shaft bearing to seat in its cup.

(7) Install the bearing cup with Tool C-413 (Fig. 7). The bearing cup must be gently driven into position until the axle shaft end play just disappears without pre-loading the bearing. The bearing cup will protrude slightly beyond the face of the axle housing flange.

(8) While the Tool C-413 is held firmly against the bearing cup, insert a feeler gauge between the axle housing flange and the face of the tool to measure the clearance.

(9) To determine the thickness of the shim pack required to obtain .013 to .018 inch axle shaft end play, add a minimum of .013 inch to the feeler gauge reading. Compare the thickness of this shim pack with the thickness of the opposite pack. If the difference in the thickness of the shim packs exceeds .020 inch, divide the

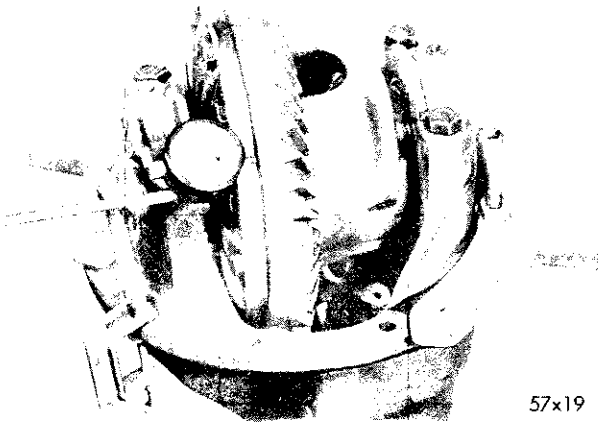

Fig. 8—Checking Drive Gear Runout

difference between both axle shaft bearings to center the axle shafts and the thrust block. Equal thickness of shims on both axle shafts is necessary to maintain the centralized position of axle shaft thrust block.

(10) Position shim packs on flange studs and drive the cups in until tool bottoms on the shim packs.

(11) Install new outer oil seals on brake support plates with Tool C-3565 with lip of seal toward the center of vehicle.

(12) Insert sleeve Tool C-745 in outer seal to protect seal when the brake support is installed.

(13) Install the dust shield and brake support. Tighten attaching nuts 30 to 35 foot-pounds torque. Install wheels, hub and drum.

12. DIFFERENTIAL CARRIER REMOVAL

(1) Remove the axle drive shafts (See Paragraph 11A).

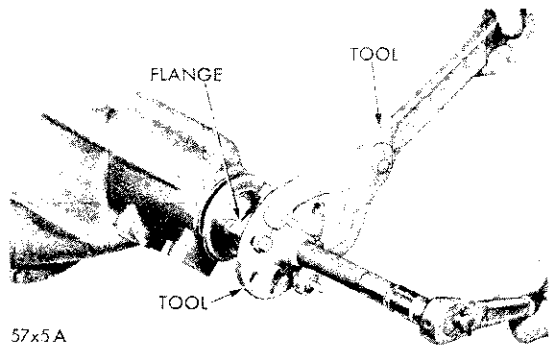

Fig. 9—Removing or Installing Companion Flange

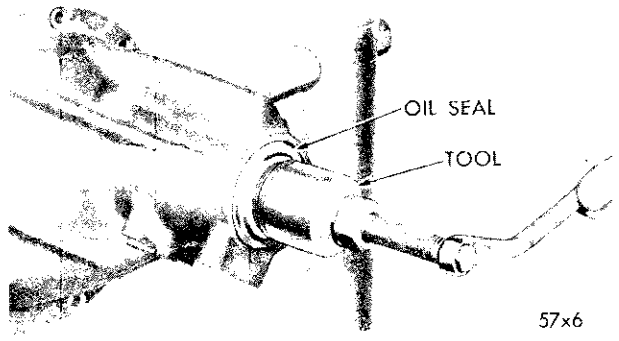

Fig. 10—Removing Pinion Bearing Oil Seal

(2) Disconnect the rear universal joint and drop the propeller shaft.

(3) Remove the drain plug and drain the lubricant into a container.

(4) Remove the attaching nuts and lift rear axle carrier assembly from under vehicle.

a. Differential and Drive Pinion

(1) Mount differential in stand Tool DD-1014 and attach the dial indicator Tool C-3339 to the differential carrier flange so the pointer of indicator squarely contacts the back face of ring gear (Fig. 8). Make certain there is no end play in the differential side bearings. If end play is evident, remove the adjustor lock and slightly loosen the bearing cap on the gear tooth side. Tighten the adjuster sufficiently to eliminate end play.

(2) Rotate ring gear several complete revolutions while noting the total indicator reading. This reading must not exceed .005 inch runout. If indicator reading exceeds the .005 inch runout, it will be necessary to check runout of differential case mounting flange (see Paragraph 12B [3]).

(3) With companion flange up, hold the flange with holding Tool C-3281 and remove the pinion shaft nut and convex washer.

(4) Install the companion flange puller Tool C-452 and remove the flange (Fig. 9).

(5) Install oil seal puller Tool C-748 by screwing it securely into the pinion oil seal (Fig. 10) and tighten puller screw to remove the seal.

(6) While holding one hand over the companion flange end of carrier, invert the carrier in the stand. The oil slinger, front bearing cone

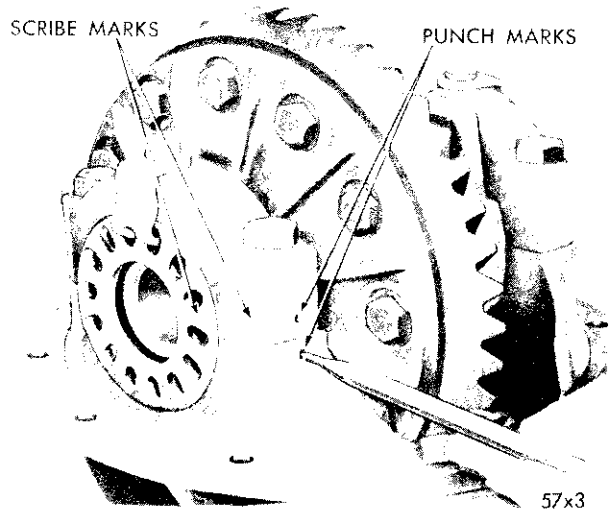

Fig. 11—Marking Bearing Caps and Adjusting Nuts

shim pack and bearing spacer (when so equipped) will drop from the carrier.

(7) Apply identifying punch marks on the bearing supports of the differential carrier, differential bearing caps, and bearing adjusters for reassembly identification (Fig. 11).

(8) Remove each of the differential bearing adjuster lock screws and locks.

(9) Loosen bearing cap bolt (one each side) and back off bearing adjusters slightly with a spanner wrench Tool C-406, to remove differential case bearing pre-load. Remove the bearing cap bolts, caps and bearing adjusters.

(10) Remove the differential assembly with bearing cups. Make certain that each bearing cup remains with its respective bearing.

(11) Remove the drive pinion and rear bearing cone from the carrier.

(12) Using puller Tool C-293 and four No. 36 adaptor plates, remove the rear bearing cone from the pinion shaft (Fig. 12). Remove the pinion locating washer.

(13) The bearing cups can be removed from the carrier with a blunt brass drift and a hammer.

b. Differential Case Disassembly

(1) Grip the ring gear in an upright position using brass jaws in a vise. Remove the (12) ring gear to differential attaching cap screws.

NOTE: The ring gear attaching screws have left hand threads; turn clockwise to loosen.

(2) Remove the assembly from the vise and with a fiber mallet, tap the ring gear off the case.

(3) If ring gear runout was found to be more than .005 inch (Paragraph 12A [2]) test the case as follows: Install the differential with bearing cups in the carrier.

(4) Install the bearing caps, attaching bolts and bearing adjusters. Snug the bearing cap bolts down lightly and screw in both adjusters with a spanner wrench Tool C-406A.

(5) Tighten support cap bolts and adjusters sufficiently to prevent any end play in the bearings.

(6) Attach the dial indicator Tool C-3339 to the differential carrier flange so the pointer of indicator squarely contacts the ring gear surface of the differential case flange between the

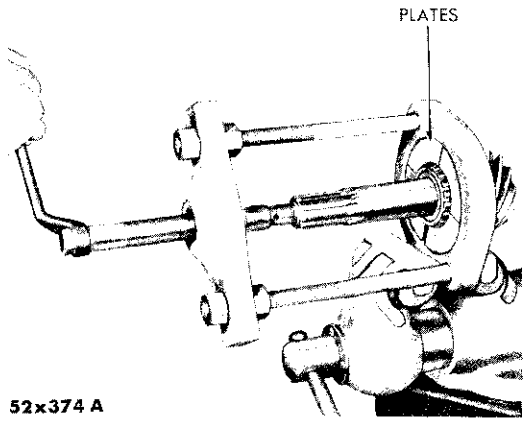

Fig. 12—Removing Bearing from Pinion Shaft

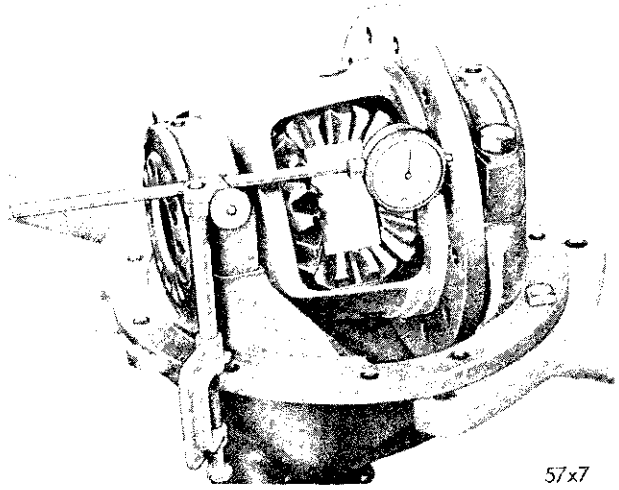

Fig. 13—Checking Drive Gear Mounting Flange Runout

outer edge of the flange and the ring gear bolt holes (Fig. 13).

(7) Rotate differential several complete revolutions while noting the total indicator reading. This reading must not exceed .003 inch runout. If runout is in excess of .003 inch, the differential case must be replaced.

(8) Remove the case from carrier. If ring gear runout exceeded .005 inch when checked as outlined in Paragraph 12A (2), and the differential case mounting flange runout does not exceed .003 inch, replace the ring gear and pinion.

(9) Measure the side gear clearances between gear and case (Fig. 14). Clearances should be .004 to .012 inch. .001 to .012 inch on models PS-1 and PS-3. If clearance exceeds .012 inch, install new thrust washers and/or differential case or gear.

(10) From the back side of the ring gear flange drive the differential pinion shaft lock pin out of the case with a 7/32 x 3½ inch flat nose drift and a hammer. (The hole is reamed only part way through, making it necessary to remove the lock pin from one direction.) The lock pin is a roll-pin type.

(11) Drive the pinion shaft out with a brass drift and a hammer. Remove the axle drive shaft thrust block.

(12) Rotate one differential side gear until each pinion appears at the large opening of the case. Remove each pinion and thrust washer at that time.

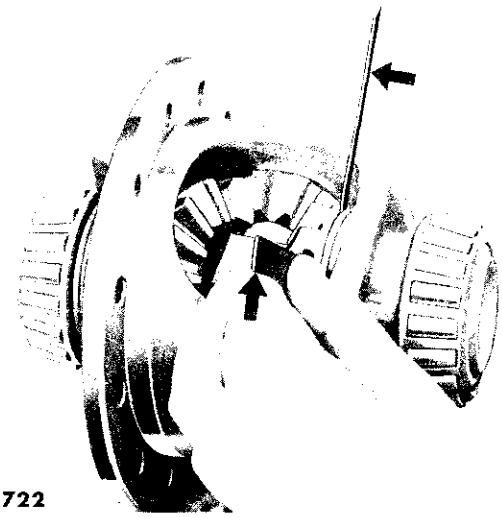

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Fig. 14—Checking Differential Gear Clearance

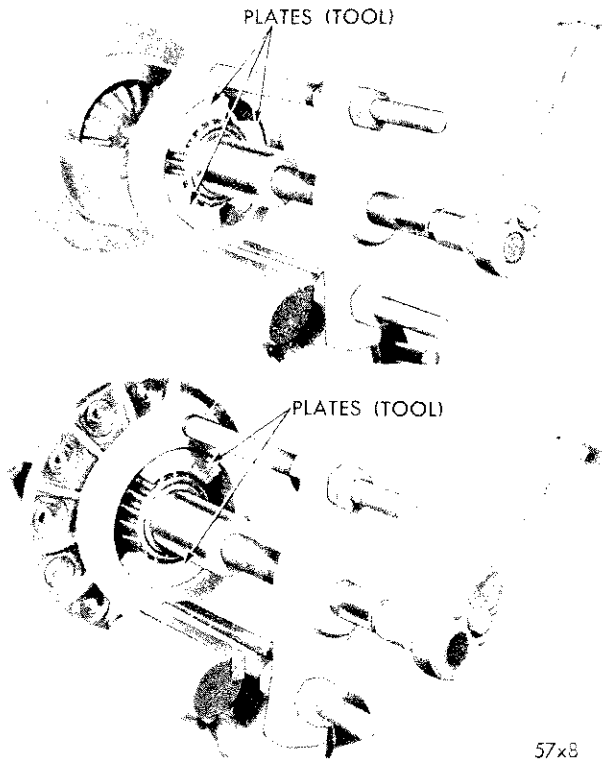


Fig. 15—Removing Differential Bearings

(13) Remove the two differential side gears and thrust washers.

c. Cleaning and Inspection

(1) Clean all parts in mineral spirits or a dry cleaning solvent and **with the exception of the bearings,** dry with compressed air.

(2) Inspect the differential bearing cones and cups for wear, pits, scores, spalling, brinnelling or other visible damage. If replacement is necessary, remove the bearings from the differential case with puller Tool C-293-E2 for PS-1 and PS-3 and Puller C-293-F2 for PC-1, PC-2, PC-3 and PY-1 using three adaptor plates No. 18 (Fig. 15).

(3) Inspect the differential case (if the differential case flange runout exceeded the .003 inch, replace the case), for cracks, elongated or enlarged pinion shaft holes and the side gear counterbores. Inspect the four thrust washer contacting surfaces for galling, metal deposits or raised portions of metal. If any of the above conditions exist, satisfactory correction must be made or the case must be replaced. Inspect the case for cracks or other visible damage which might render it unfit for further service.

(4) Inspect the differential pinion shaft for excessive wear. Check pinion gears and differential side gears for excessive wear, cracks, chipped teeth or other visible damage. Replace as necessary.

(5) Inspect axle shaft thrust block for excessive wear or other visible damage. The thrust block can be damaged by using a "knock off" type wheel puller. The wear surfaces on the opposite side of the block must be smooth. If the thrust block is replaced, axle shaft end must be reset.

(6) Inspect differential pinion shaft lock pin for damage or looseness in the case. Replace the pin or case as necessary.

(7) Inspect ring gear and pinion for scored, worn or chipped teeth. Check for damaged splines and attaching bolt threads. If replacement of ring gear or pinion is necessary, replace both the ring gear and drive pinion as they are furnished only in matched sets.

(8) Inspect the drive pinion bearing cups for pits, spalling, brinnelling, excessive wear, or other visible damage. If inspection reveals that either cup is unfit for further service, replace both the cup and the mated cone.

(9) Inspect the differential carrier for cracks or other visible damage which would render it unfit for further service. Raised metal on shoulders incurred in removing the pinion cups should be flattened by use of a flat nose punch.

(10) Inspect the drive pinion for scored, pitted, damaged or excessively worn teeth, damaged bearing journals or splines. If replacement of the pinion is necessary, a new ring gear must also be used as they are furnished only in matched sets. Inspect the pinion bearing spacer for distortion and damage also.

(11) Inspect companion flange for cracks, worn splines, pitted, rough or corroded oil seal contacting surface. Replace the companion flange as necessary.

(12) Inspect pinion bearing shim pack for damaged or distorted shims. Replace shims with correct ones during establishment of pinion bearing pre-load.

d. Differential Case Assembly

(1) Install the thrust washer on each of the differential side gears and position the gears in case.

(2) Through the large side opening of the case, insert each of the two pinion and thrust washers exactly 180 degrees opposite each other so the pinion shaft holes of the two gears and thrust washers are properly aligned.

(3) Rotate the gears 90 degrees so the pinion shaft holes of the case are in exact alignment with the holes in the two thrust washers and pinions.

(4) From the pinion shaft lock pin hole side of the case, insert the slotted portion of the pinion shaft through the case, the conical thrust washer and through one pinion gear only.

(5) Install the thrust block between the two pinion gears. The thrust block must be installed so the hole in the block is aligned with the pinion shaft and with the smoothly ground sides facing the two side gears.

(6) While keeping all of these parts in proper alignment, push the pinion shaft on through until the locking pin hole in the pinion shaft is in exact alignment with its respective hole in the case. Install pinion shaft lock pin through hole in the case from the pinion shaft side of the ring gear flange (Fig. 16).

(7) Make certain the contacting surfaces of the ring gear and the case flange are clean and free from any burrs. Position the ring gear on the case; aligning the threaded holes of the ring gear with those in the case flange.

(8) Install the ring gear cap screws through the case flange and into the ring gear. After all cap screws are properly started, tap the gear onto the flange.

(9) Position the unit between the brass jaws of vise and alternately tighten each cap screw

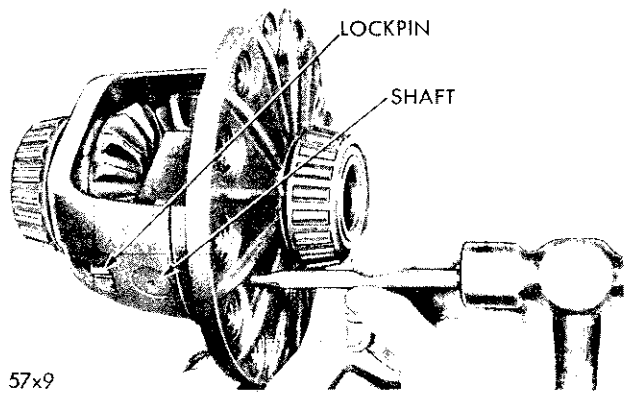


Fig. 16—Installing Pinion Shaft Lock Pin

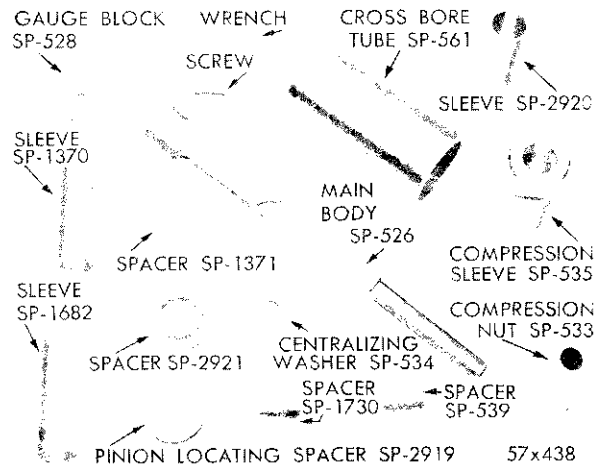


Fig. 17—Tool Set C-758-D3

40 foot-pounds torque.

(10) Position each differential bearing cone on the hub of the case (taper away from ring gear) and with installing Tool DD-1005, install bearing cones with an arbor press used in conjunction with the installing tool.

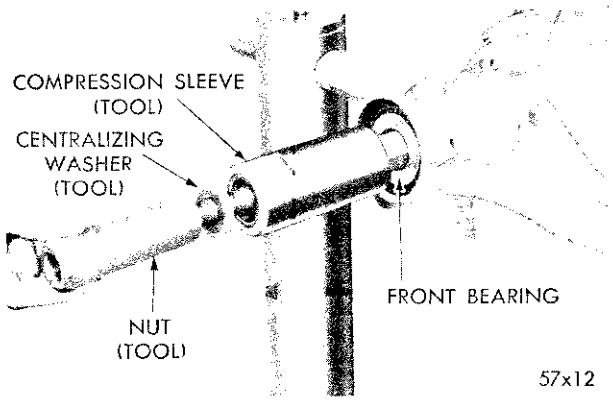


Fig. 18—Compression Sleeve and Centralizing Washer in Position with Tool C-758-D3

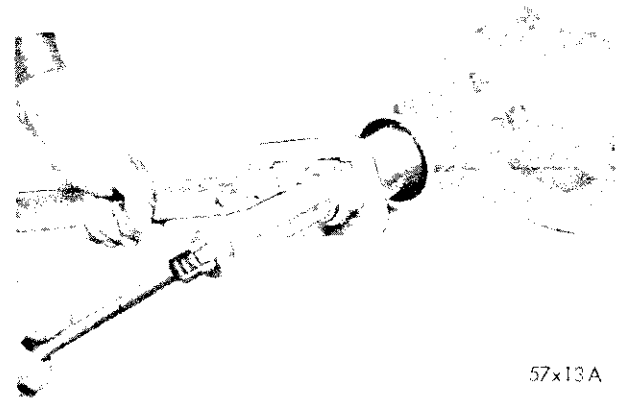


Fig. 19—Seating Bearing Cups in Carrier with Tool C-758-D3

e. Pinion Bearing Cup Installation

(1) Place the bearing cups squarely in position. Assemble Tool C-758-D3 (Fig. 17) by placing the spacer (SP-2919) followed by the rear pinion bearing cone over the main screw of the tool and inserting it into the carrier from the gear side (Fig. 18).

(2) Place the front pinion bearing over the main screw followed by the compression sleeve SP-535, centralizing washer SP-534, and main screw nut SP-533. Hold the compression sleeve with the companion flange holding Tool C-3281 and tighten the nut (Fig. 19), allowing the tool to rotate as the nut is being tightened in order not to damage the bearings or cups. **Do not remove tool after installing the cups (Fig. 20).**

Two types of drive pinions are used. The method of determining pinion depth of mesh and bearing

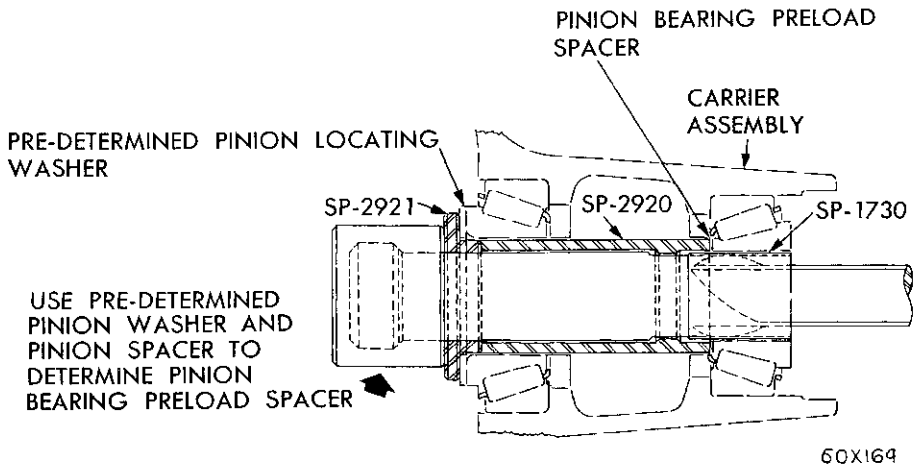


Fig. 20—Pinion Pre-Load (Sectional View) Tool Installed

pre-load are the same for both pinions however, the sequence of making the two adjustments changes. Pinions without a bearing spacer require the depth of mesh adjustment first, while drive pinions with a separate bearing spacer require bearing pre-load adjustment first.

13. PINION WITH BEARING SPACER INSTALLATION USING TOOL C-758-D3

a. Bearing Pre-Load

(1) With Tool installed in carrier, remove the main screw nut, centralizing the washer, compression sleeve and the front pinion bearing.

(2) Install the pinion bearing spacer, the larger bore of spacer next to the rear bearing.

(3) Position sleeve (SP-1730) in the front bearing, making sure the sleeve is flush with the rear of the bearing.

(4) Position the original shims, previously removed from the drive pinion shaft, over the sleeve and slide the sleeve bearing and shims over the tool main screw until the shims rest against the spacer.

(5) Install the tool compression sleeve (SP-535) (square end out), centralizing washer (SP-534) and main screw nut (SP-533). Turn the carrier in the stand to bring the nut on top.

(6) Tighten tool nut to 240 foot-pounds with torque wrench C-485, using holding Tool C-3281 on the compression sleeve to hold the assembly in several positions to make a complete revolution while tightening. Remove holding tool and rotate the assembly several turns in both directions to align the bearing rollers. Recheck torque to 240 foot-pounds (torque may have diminished as bearing rollers were aligned by rotating).

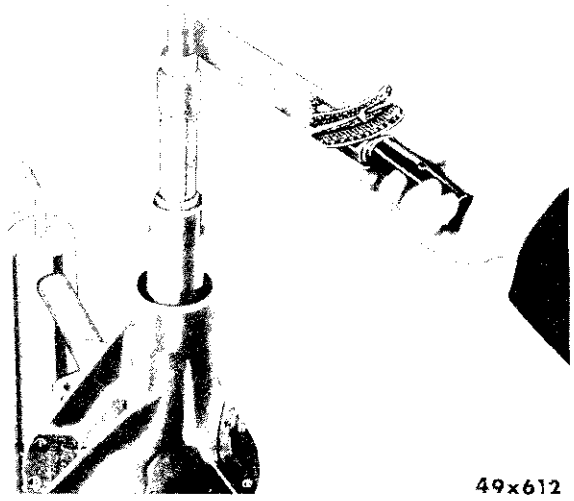


Fig. 21—Checking Pre-Load Torque (Inch Pounds)

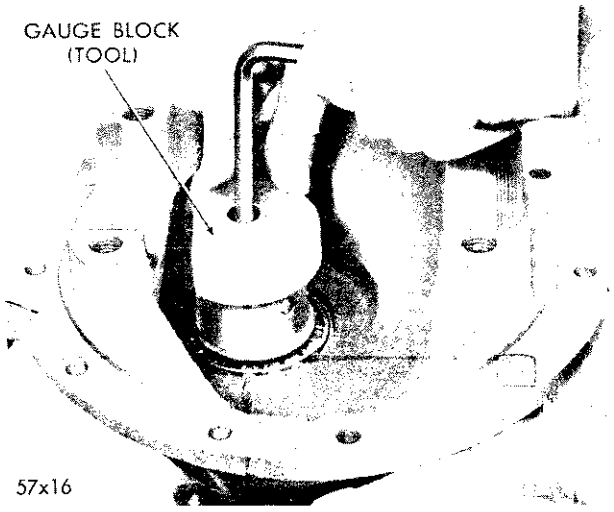


Fig. 22—Installing Gauge Block

(7) Correct bearing pre-load readings can only be obtained with the nose of the carrier up. Use inch pound torque wrench C-685. With the handle of the wrench floating, read torque when the wrench is moving through at least one full rotation. Correct reading is 20 to 30 inch pounds and should be uniform during the full rotations (Fig. 21). If bearing pre-load is more than 30 inch pounds, a thicker shim should be used under front bearing. If bearing pre-load is less than 20 inch pounds, a thinner shim should be used. Shims are available in thicknesses of .010, .012, .014, .016, and .018 inch. After proper bearing pre-load is established, do not remove the tool.

b. Depth of Mesh

The position of the drive pinion with respect to the ring gear (depth of mesh) is determined by the location of the bearing cup shoulders in the carrier and by the portion of the pinion back of the rear bearing. The thickness of a pinion spacer washer suitable for the carrier can be determined by using Tool C-758-D3.

(1) Reverse the carrier in the stand and install gauge block SP-528 on the end of the tool (Fig. 22), attaching it to the tool with the allen screw. The flat portion of the spacer should be facing the differential bearing pedestals and the offset of the spacer (or the large portion) toward the center of the carrier. Tighten screw with an allen wrench.

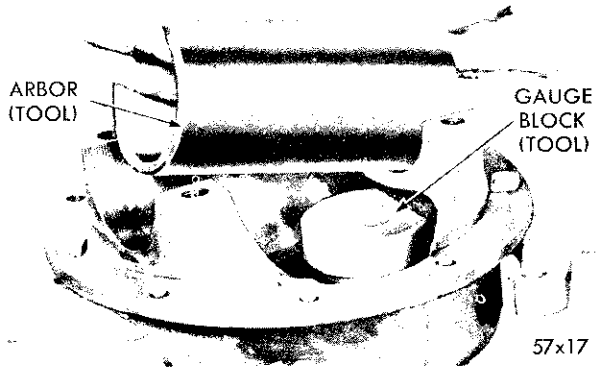


Fig. 23—Installing Arbor in Differential Bearing

(2) Position the arbor SP-561 (part of Tool C-758-D3) in the differential bearing pedestals of carrier (Fig. 23). Center the arbor so than an approximate equal distance is maintained at both ends. Position the differential bearing caps and attaching bolts on the carrier pedestals. Between the arbor and each cap, insert a piece of .002 inch feeler stock and tighten the cap bolts securely.

(3) Select a washer that will fit between the tool gauge block and arbor (Fig. 24). This fit must be snug but not too tight (similar to the pull of a feeler gauge). This washer is suitable for measurement, not for installation.

(4) To select a washer for installation, read the marking on the end of the pinion (—0, —1, —2, +1, +2, etc.). When the marking is —, add that amount to the thickness of the washer selected in (3). When the marking is +, subtract that amount. Example: With a washer .086 inch thick and a pinion marked —2, install a washer .088 inch thick (.086 + .002=.088). Example: With a washer .086 inch thick and a pinion marked +2, install a washer .084 inch thick (.086 — .002=.084), or when a washer .086 inch thick is too loose and .088 inch too tight, use .088 and the pinion marking.

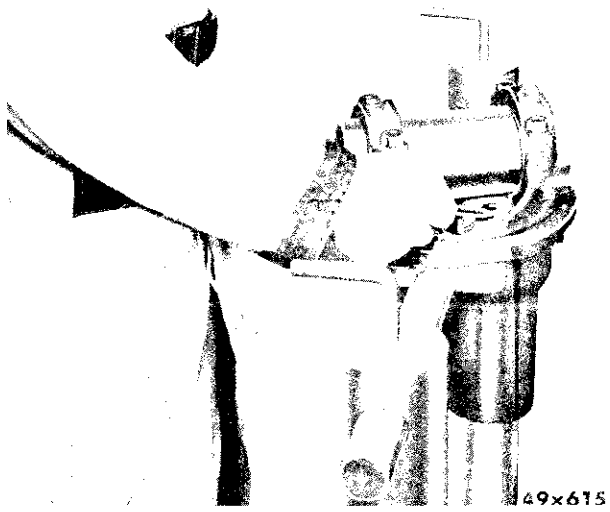


Fig. 24—Determining Spacer Washer Thickness

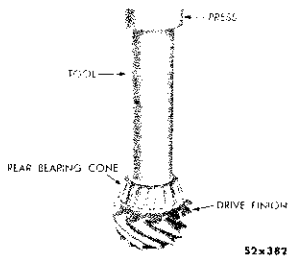


Fig. 25—Installing Bearing on Pinion Stem

(5) Remove tool arbor from the carrier.

(6) Remove the tool and bearings out of the carrier.

(7) Remove the shims, spacer, tool sleeve, and rear bearing cone from the tool main screw.

(8) With the shaft end of the pinion facing up, install the correct pinion spacer washer on the pinion gear shaft. These washers have a chamfer on one side. **The chamfer must face the pinion gear thrust surface.**

(9) Position the rear bearing cone on the pinion shaft (small end away from pinion gear). Make certain that the contacting surfaces of the correct washer, pinion gear and rear bearing cone are perfectly clean and free of any foreign particles.

(10) Install the rear bearing cone onto the pinion shaft with Tool DD-996. An arbor press may be used in conjunction with the tool (Fig. 25).

(11) Install the bearing tubular spacer on the pinion shaft (large bore facing the rear bearing).

(12) Install the selected shim pack.

(13) Lubricate the front and rear pinion shaft bearing cones with a heavy oil.

(14) Install the front bearing in its cup in the carrier.

(15) Install the oil seal in the carrier with driver, Tool C-3656. Lip of seal must face the front bearing. The seal must be driven into the carrier until it bottoms against the shoulder

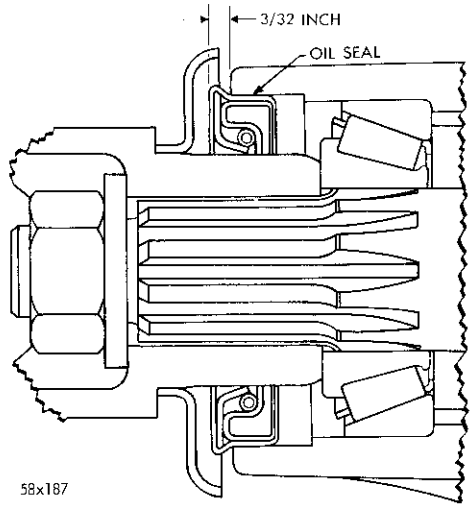


Fig. 26—Pinion Oil Seal Installation

of the carrier counterbore (Fig. 26).

(16) Insert the pinion shaft up through the carrier. While supporting the pinion in the carrier, install the companion flange with installing Tool C-496 or DD-999.

(17) Remove tool and install the plain washer (convex side of the washer up) and nut.

(18) Hold the companion flange with holding Tool C-3281. Tighten the companion flange nut to 240 foot-pounds. Rotate the assembly several turns in both directions to align the bearing rollers. Recheck torque to 240 foot-pounds (torque may have diminished as bearing rollers were aligned by rotating).

14. PINION WITHOUT BEARING SPACER INSTALLATION USING TOOL C-758-D3 (Fig. 27)

a. Depth of Mesh

The position of the drive pinion with respect to the ring gear (depth of mesh) is determined by the location of the bearing cup shoulders in the carrier and by the thrust portion of the pinion in back of the rear bearing. The thickness of a pinion spacer washer suitable for the carrier can be determined by using Tool C-758-D3.

(1) Install the pinion locating spacer SP-2921 on the main body of Tool C-758. Place large end of rear bearing over shoulder of spacer and insert tool in the carrier.

(2) Place front bearing (small end down), compression sleeve SP-535, centralizing washer SP-534 and compression nut SP-533 on the main body.

(3) With the nose of the carrier up, place flange holding Tool C-3281 on the compression sleeve. Allow the assembly to rotate while tightening the nut 25 to 35 inch pounds torque.

(4) Rotate the tool several times in each direction to align the bearing rollers and recheck the torque.

(5) With the proper pre-load on the bearings, invert the carrier in the stand. Install gauge block SP-528 in the end of the tool with the allen screw.

(6) Position arbor SP-561 (part of Tool C-758) in the differential bearing pedestals of the carrier. Center the arbor so that an approximate equal distance is maintained at both ends.

(7) Position the differential bearing caps and at-

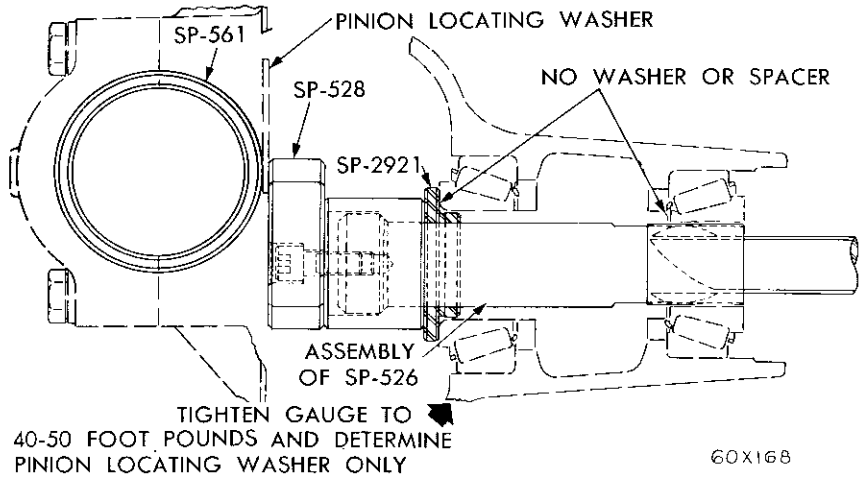


Fig. 27—Pinion Pre-Load — Tool Installed Sectional View

taching bolts on the carrier pedestals.

(8) Between the arbor and each cap, insert a piece of .002 inch feeler stock. Tighten the cap attaching bolts securely.

(9) Select a washer that will fit between the tool gauge block and arbor. This fit must be snug but not too tight, similar to the pull of a feeler gauge. This washer is suitable for measurement, not for installation.

(10) To select a washer for installation, read the marking on the end of the pinion (—0, —1, —2, +1, +2, etc.) when the marking is —, **add** that amount to the thickness of the washer selected in step (9). When the marking is +, **subtract** that amount. Example: With a washer .086 inch thick and a pinion marked —2, install a washer .088 inch thick (.086 + .002=.088). Example: With a washer .086 inch thick and a pinion marked +2, install a washer .084 inch thick (.086 — .002=.084) or when a washer .086 inch thick is too loose and .088 inch too tight, use .088 and the pinion marking.

(11) Remove the differential bearing caps and arbor from the carrier.

(12) Reverse the carrier in the stand so the nut of the tool is up and leave tool in carrier, ready for bearing pre-loading.

(13) While supporting the lower portion of the tool in the carrier with one hand, remove the tool nut, tool centering washer and compression sleeve. Lower the tool down and out of the carrier.

(14) Remove the pinion front bearing cone from the carrier.

b. Pinion Bearing Pre-Load

(1) Place spacer SP-2921 on main body of Tool C-758 with the shoulder up. Place the selected pinion spacer, spacer sleeve SP-2920 and the rear bearing on the tool.

(2) Insert the tool in carrier, install the original shim pile and the front bearing. Install the compression sleeve SP-535 (square hole down), centralizing washer SP-534 and tool nut SP-535.

(3) Tighten tool nut to 240 foot-pounds using holding Tool C-3281 on the compression sleeve to hold the assembly in several positions to make a complete revolution while tightening. Remove holding tool and rotate assembly several turns in both directions to align the bearings rollers. Recheck torque to 240 foot-pounds (torque may have diminished as bearing rollers were aligned by rotating).

(4) Correct bearing pre-load readings can only be obtained with the nose of the carrier up. Use inch pound torque wrench C-685. With the handle of the wrench floating, read the torque when the wrench is moving through at least one full rotation. Correct reading is 20 to 30 inch pounds and should be uniform during the full rotations. If bearing pre-load is more than 30 inch pounds, a thicker shim should be used under front bearing. If the bearing pre-load is less than 20 inch pounds, a thinner shim should be used. Shims are available in thicknesses of .010, .012, .014, .016 and .018 inch.

(5) Remove the tool with shim pack, bearing cone, pinion locating washer, and spacer from the carrier and the tool.

(6) Install the correct washer on the pinion shaft. The washer has a chamfer on one side. **This chamfer must face the pinion gear thrust surface.**

(7) Position the rear bearing cone on the pinion shaft (small side away from the pinion gear). Make certain the contacting surfaces of the correct washer, pinion gear, and contacting surface of rear bearing cone are perfectly clean and free of any foreign particles. Install the rear bearing cone onto pinion shaft with Tool DD-996. (Refer to Fig. 25.)

(8) Install the selected shim pack.

(9) Lubricate front and rear pinion bearings with heavy oil.

(10) Insert the pinion shaft up through the carrier and install the front bearing.

(11) Install the oil seal in carrier with driver C-3656 with lip of seal toward the bearing.

(12) Start the companion flange on the pinion shaft, completing the installation of the companion flange with installing Tool C-496 or DD-999. Remove the tool.

(13) Install the plain washer (concave side of washer down) and nut. Hold companion flange with holding Tool C-3281 and tighten nut to 240 foot-pounds torque. Rotate the assembly several times in both directions to align the bearing rollers. Recheck torque to 240 foot-pounds (torque may have diminished as bearing rollers were aligned by rotating).

15. PINION DEPTH OF MESH AND BEARING PRE-LOAD WITHOUT USING TOOL C-758-D3

a. Depth of Mesh

(1) If the old and new pinions have the same markings, use the spacing washer of the same thickness as that of the old washer.

(2) If, for instance, the pinion being replaced is marked zero (0), and the new pinion is marked plus two (+2), try a .002 inch thinner washer, and if marked minus two (—2), try a .002 inch thicker washer. Due to the fact that these washers are selected more or less by guess, it may be necessary to change the washer several times in order to obtain the correct tooth contact pattern (see Paragraph 17).

b. Pinion Bearing Pre-Load (Without Using Tool C-758-D3)

(1) With the spacer and rear bearing installed on pinion, place the tubular spacer and shims on pinion and hold the assembly in the carrier.

(2) Install front bearing and companion flange (without oil seal), using Tool C-496 or DD-999.

(3) Install the washer and nut and tighten to 240 foot-pounds while permitting the assembly to rotate and prevent damaging the bearings.

(4) Test the pre-load (see Paragraph 13A [7]).

16. DIFFERENTIAL CASE ASSEMBLY — INSTALLATION

a. Installation in Carrier

(1) Install the differential bearing cup on its respective bearing, and position the assembly in the carrier.

(2) Install the differential bearing caps, making certain that the identification marks on the cap correspond with those on the carrier. Install attaching bolts and tighten bolts of each cap by hand.

(3) Note the identification marks on the differential bearing adjusters and reinstall each in its respective side.

(4) Screw in adjuster by hand. Each bearing adjuster can be screwed into the carrier support with little or no effort due to the fact that the support cap bolts are only hand tight. No attempt should be made at this time to apply any excessive pressure. To square the bearing cups with the bearing, turn the adjusters "in" with a spanner wrench Tool C-406A (Fig. 28) until cups are properly squared with the bearings and end play is eliminated, with some backlash existing between the drive gear and pinion.

(5) While facing each bearing support cap, tighten the left hand bolt 85 to 90 foot-pounds torque on each side.

(6) Attach the dial indicator Tool C-3339 to the carrier flange so the pointer or indicator is squarely contacting one of the ring gear teeth (drive side) (Fig. 29).

b. Differential Bearing Pre-Load and Gear Backlash Adjustment

NOTE: The differential bearing pre-load and backlash between drive gear and pinion are obtained after the pinion bearing pre-load and pinion are established.

Place differential and drive gear assembly on the bearing support and snug down the caps. Check drive gear for runout on the back face (Fig. 8). Drive gear runout should be true within .005 inch maximum. Make adjustments as follows:

Using two spanner wrenches Tool C-406 (Fig. 28), screw out bearing adjuster at back face of drive gear and screw in the opposite adjuster until considerable backlash is obtained. This helps align bearing cups.

Tighten bearing cap lower bolts 110 foot-pounds

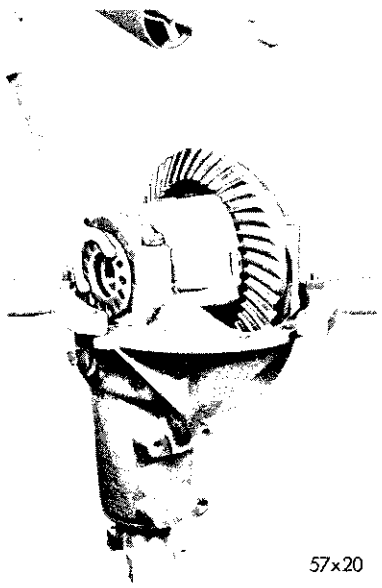


Fig. 28—Adjusting Differential Bearings

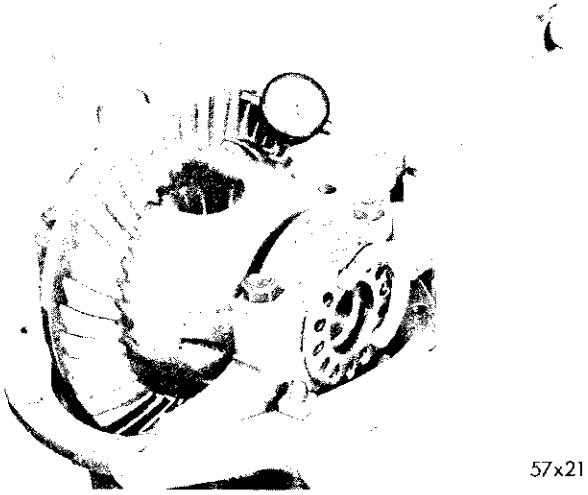
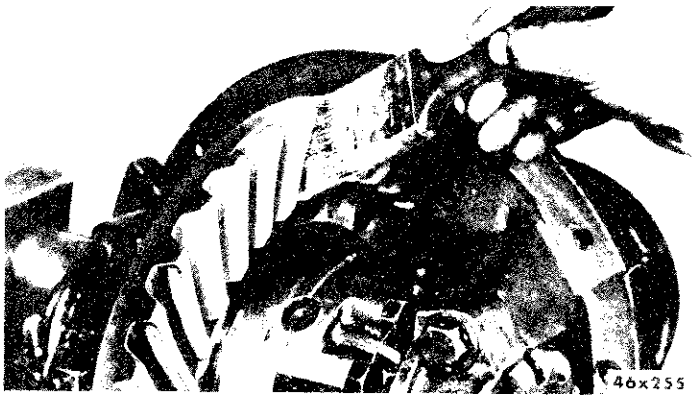


Fig. 29—Checking Backlash Between Drive Gear and Pinion

torque, leaving top bolts fairly loose. This holds bearing cups in line while moving drive gear. Screw out adjuster on tooth side of gear until it clears bearing cup. Screw in opposite adjuster until only a little backlash remains. This will insure bearing cup alignment for final adjustment.



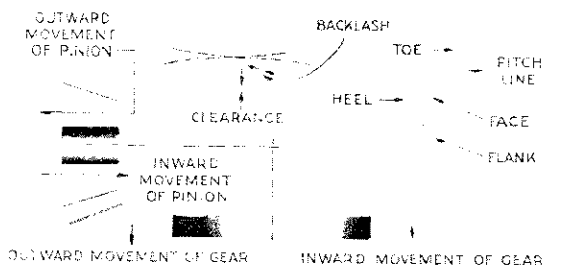


Fig. 30—Gear Tooth Nomenclature

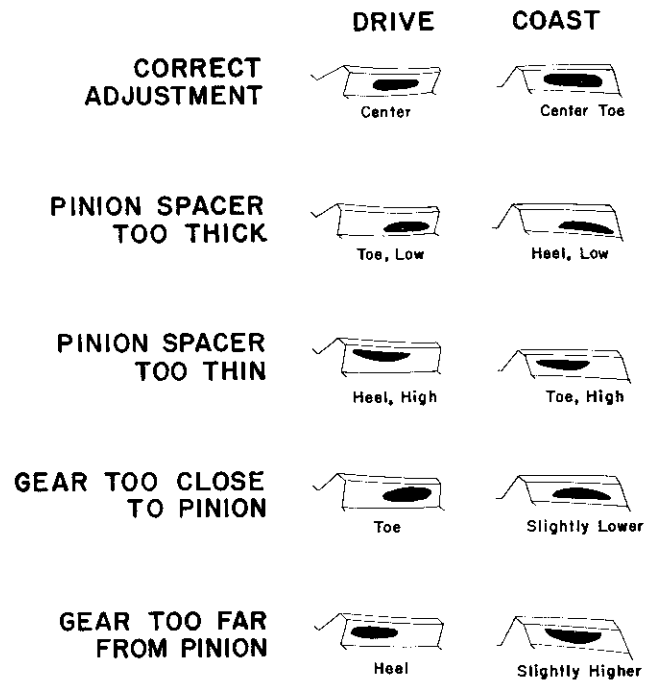


Fig. 31—Gear Tooth Contact

Turn drive gear a few times by hand to seat bearings. With a dial indicator, find point of least backlash on drive gear at 90 degree intervals. At least point of backlash, screw in adjuster at back face of drive gear until .001 inch appears on indicator.

Screw in adjuster on tooth side until indicator shows .006 to .008 inch backlash. Lock adjusting nuts in place and tighten both top bolts 110 foot-pounds torque.

Secure the dial indicator to the carrier flange so pointer of indicator is squarely contacting one of the drive gear teeth (thrust side) (Fig. 29). After the first reading is taken, move the dial indicator away from the gear tooth and rotate and check drive gear at 90 degree intervals for specified backlash between drive gear and pinion. If adjustment is followed, the bearing supports will be spread, differential bearings pre-loaded, and backlash between drive gear and pinion established.

CAUTION

Whenever adjustment of differential assembly is changed to obtain correct tooth contact, readjust

differential bearing pre-load and backlash between drive gear and pinion.

If all adjustments have been correctly made, the gears will be properly meshed and quiet operation will result.

17. GEAR TOOTH CONTACT PATTERN

The gear tooth contact pattern (Fig. 30) will disclose whether the correct washer has been installed behind the pinion rear bearing and the ring gear has been positioned properly. Various gear tooth contact patterns are shown in Figure 31.

18. CHECKING TOOTH CONTACT PATTERN

Apply a red lead to the ring gear teeth and apply a load against the back of the ring gear with a round bar. As this pressure is being applied to the ring gear, rotate the pinion. This action will leave a distinct contact pattern on the gear teeth. The series of illustrations show the correct pattern as well as a series of incorrect patterns.

19. HEAVY FACE CONTACT

If the tooth pattern is across the length of the tooth face, narrow and near the top, the teeth will wear thin and roll over or score, resulting in excessive gear lash and noise. Condition is corrected by installing a thicker washer behind pinion rear bearing.

20. HEAVY FLANK CONTACT

If the tooth pattern is across the length of the tooth, narrow and low on the flank, the pinion teeth will score and also result in noise. Condition is corrected by installing a thinner washer behind pinion rear bearing.

21. HEAVY TOE CONTACT

If the tooth pattern is heavy on the toe of the tooth, the edges of the teeth may chip resulting in excessive damage to the entire assemly. Condition is corrected by moving the ring gear away from the pinion. This will increase the backlash making it again necessary to insert a thicker washer behind the pinion rear bearing.

22. HEAVY HEEL CONTACT

If the tooth pattern is heavy on the heel of the teeth, the edges of the teeth may chip resulting in excessive damage to the entire assembly. Condition is corrected by moving the ring gear toward the pinion. This would result in decreasing the backlash making it again necessary to insert a thinner washer behind the pinion rear bearing.

23. WELDING REAR AXLE HOUSING

The axle housing should be completely disassembled if it is to be welded with arc welding equipment. It is also possible to weld the assembled housing with gas welding equipment, if precaution is taken to protect gaskets and heat-treated parts.

24. REAR AXLE HOUSING ALIGNMENT

a. Horizontal Alignment (Rear Wheel Toe)

Position Tool C-3479 (Wheel Toe Gauge and Scriber) in front of the rear wheels and scribe a line in center of tread of each tire. After scribing tire from the front, move gauge to the rear of the rear tires and check toe by placing the stationary scriber on one of the scribe marks and the adjusting gauge scriber on the other. Toe should be $\pm 1/10$ inch.

b. Vertical Alignment (Rear Wheel Camber)

Rear wheel camber should not exceed $\pm \frac{1}{4}$ degree and should be held as close to 0 degree as possible.

25. CARRIER ASSEMBLY INSTALLATION

(1) Use a new gasket and install carrier assembly to axle housing. Tighten mounting nuts 45 foot-pounds torque.

(2) Press bearing on axle shaft. Pack bearing rollers with the proper lubricant, align axle spline, and install axle shaft in housing. Install axle drive shaft outer bearing cup using Tool C-413.

(3) Install shims in the same manner in which they were removed to maintain central position of the axle shaft thrust block. Install a new seal in brake support plate using Tool C-3565 with the lip of seal facing toward the center of the vehicle.

(4) Install brake support plate and tighten nuts 30 to 35 foot-pounds torque.

(5) Check axle shaft end play, as outlined in Paragraph 11C.

(6) Install hub and drum assembly.

(7) Tighten axle shaft nuts 145 foot-pounds torque minimum, and install new cotter pins.

(8) Connect rear universal joint.

(9) Remove block from brake pedal and bleed the brake lines.

(10) Refill axle housing and carrier assembly with specified lubricant. Refer to the Lubrication Group for axles equipped with Sure-Grip differentials.

SURE-GRIP DIFFERENTIAL

26. DESCRIPTION (Fig. 32, 33, 34 and 35)

The sure-grip differential is similar to the conventional differential except for the addition of friction plates for transmitting torque from the differential case to the differential gears and a means for engaging these plates. It has four pinion gears, positioned in the case by two pinion shafts which are at right angles to each other and free fitting at their intersection. Both ends of each shaft have two flat surfaces, or ramps, which mate with identical ramps in the differential case. There is additional clearance in the case to permit a slight peripheral movement of the ends of the pinion shafts within the case.

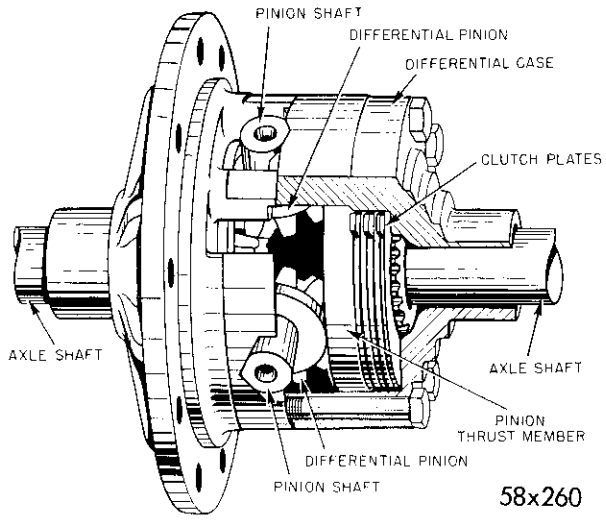


Fig. 32—Sure-Grip Differential (Schematic)

27. SURE-GRIP DIFFERENTIAL IDENTIFICATON

NOTE: Identification of the Sure-Grip type differential assembly can be made by the letter "S" stamped on the identification pad on the right side of the carrier housing, or by a metal tag reading, 'Use Sure-Grip Lube" attached by means of the rear axle housing-to-carrier bolt, below the carrier filler plug. If the letter "S" or tag is not apparent, remove filler plug and use a flashlight to look up through the filler plug hole to identify the type of differential case. The sure-grip type differential case (two-piece

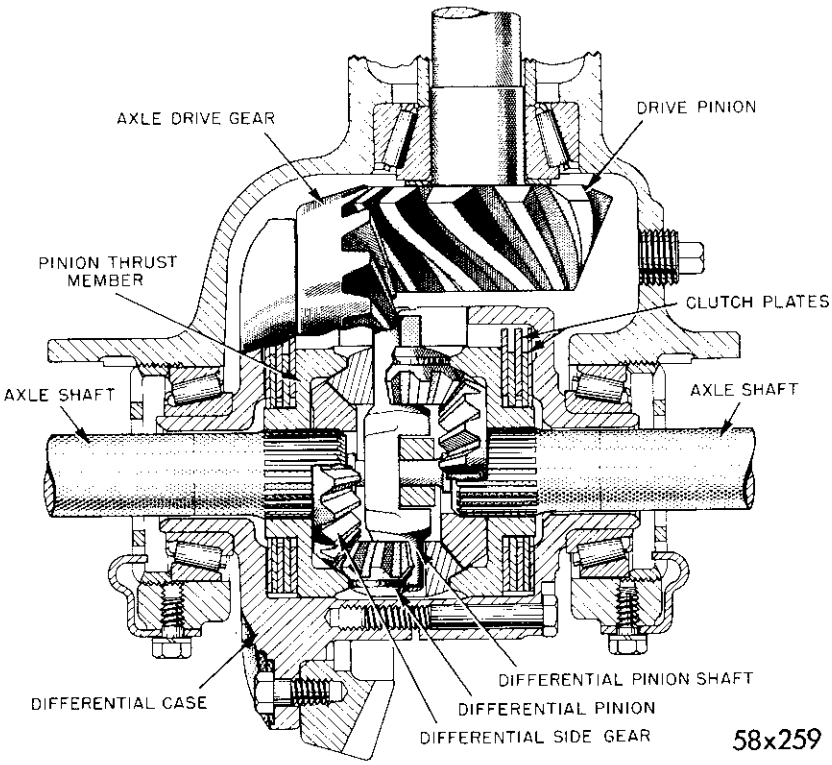


Fig. 33—Sure-Grip Differential Cross Section

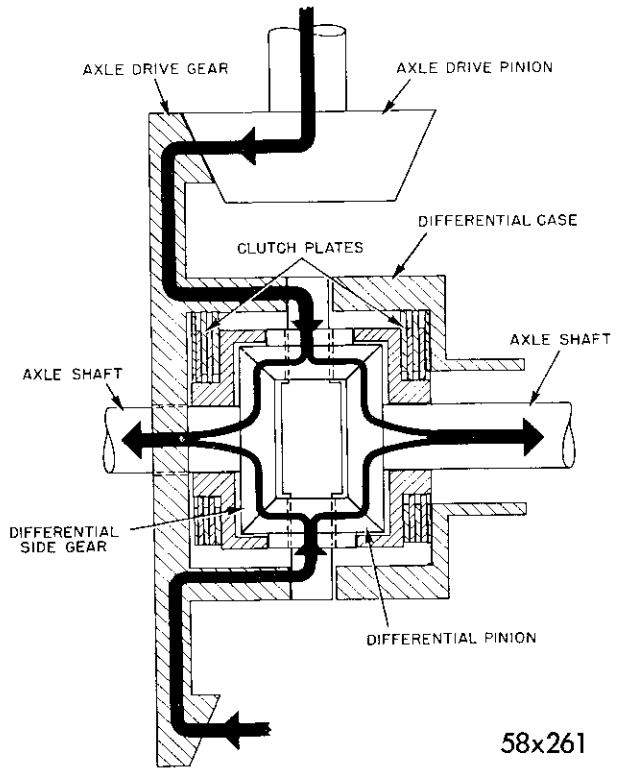


Fig. 34—Power Flow Axle Turning at Same Speed

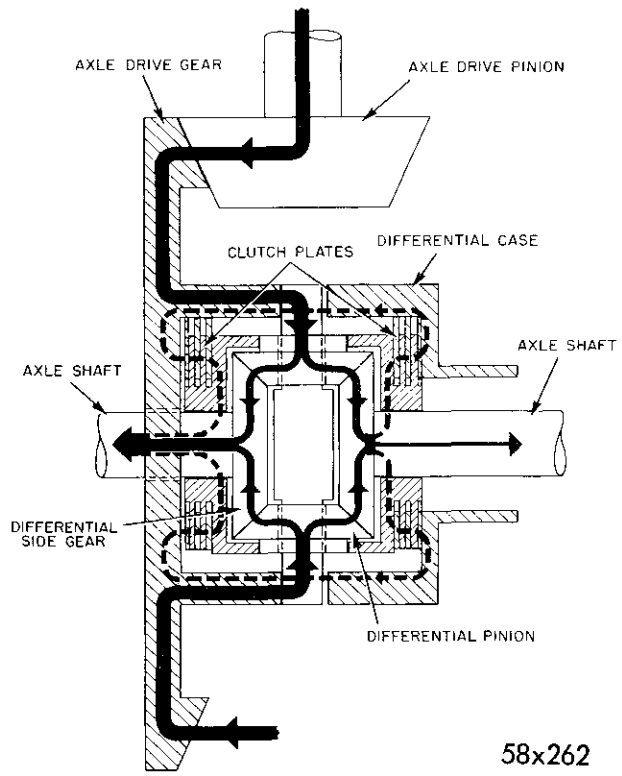


Fig. 35—Power Flow Axle Shafts Turning at Differential Speeds

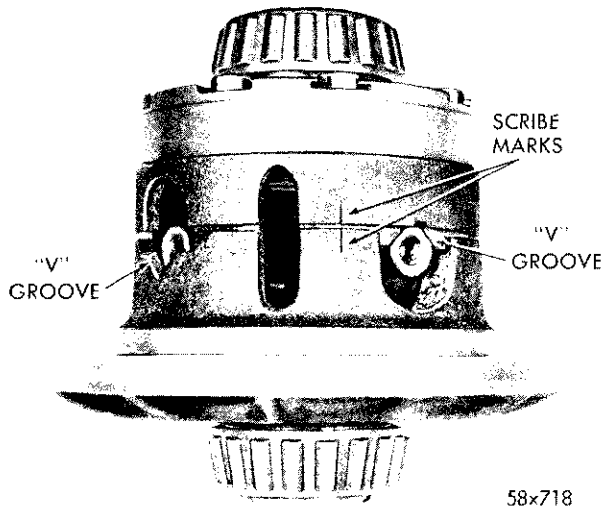


Fig. 36—Case Halves Scribed for Reassembly

construction) has attaching bolts. The conventional type differential case (one-piece construction) has a dome-like shape with no case cap attaching bolts.

28. LUBRICATION

Use special differential gear lubricant Part No. 1879414 or a gear lubricant designated GL-4 in axles equipped with the Sure-Grip differential. The lubricant should be changed every 20,000 miles.

29. REMOVAL AND INSTALLATION (SURE-GRIP DIFFERENTIAL)

WARNING

Before raising a rear wheel off the ground, shut off engine, set the parking brake tightly, carefully block front wheel diagonally opposite the one to be removed, against both forward and rearward movement.

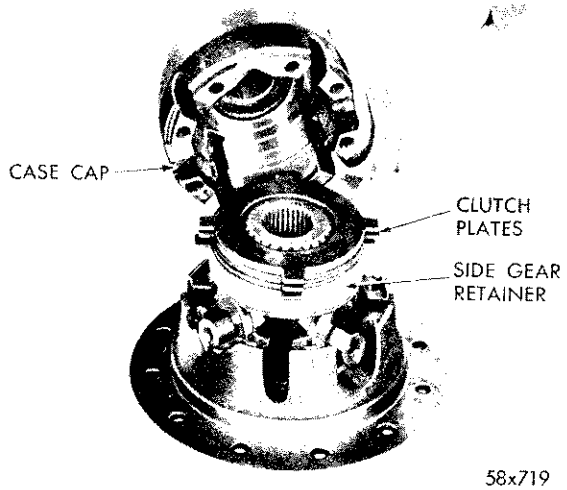


Fig. 37—Removing or Installing Differential Case Cap

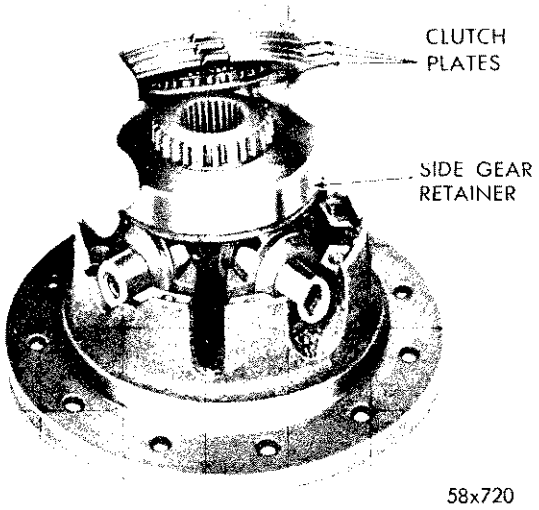


Fig. 38—Removing or Installing Clutch Plates (Cap Side)

Follow the same procedure outlined under removal and installation of the conventional rear axle differential.

a. Disassembly

(1) Remove axle drive ring gear. Check runout of the drive gear mounting flange. Replace both case halves if runout exceeds .003 inch.

NOTE: Before disassembling the case halves, place scribe marks on each half to aid in aligning case when reassembling (Fig. 36).

(2) Remove case cap attaching bolts and remove case cap (Fig. 37). Remove the clutch plates (Fig. 38).

(3) Remove the side gear retainer (Fig. 39) and side gear (Fig. 40).

(4) Remove pinion shafts with pinion gears (Fig. (41).

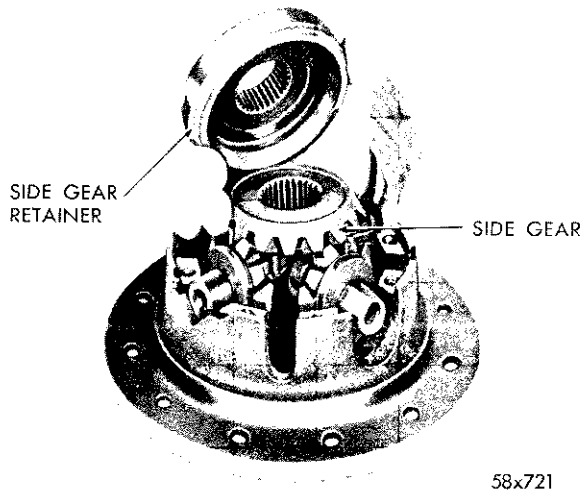


Fig. 39—Removing or Installing Side Gear Retainer (Cap Side)

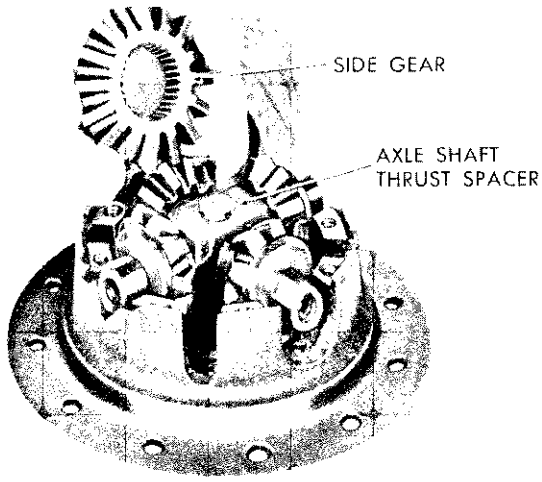


Fig. 40—Removing or Installing Side Gear (Cap Side)

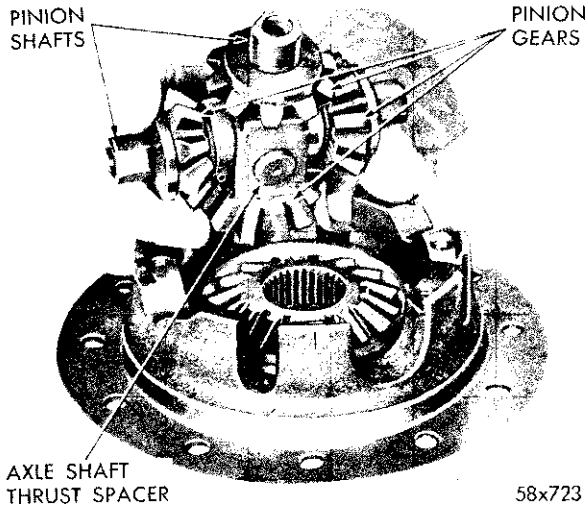


Fig. 41—Removing or Installing Pinion Shafts and Pinion Gears

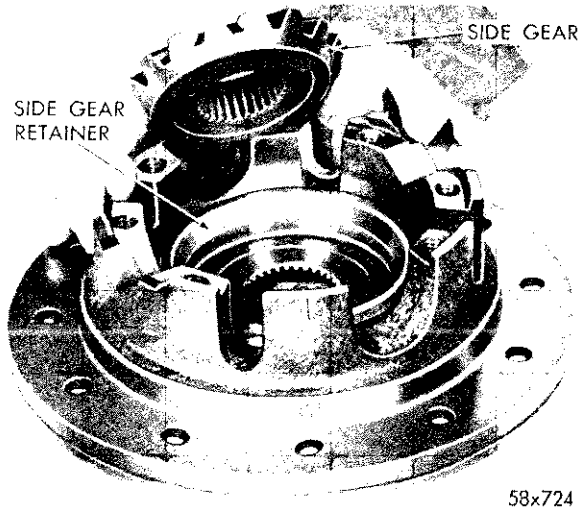


Fig. 42—Removing or Installing Side Gear from Differential Case

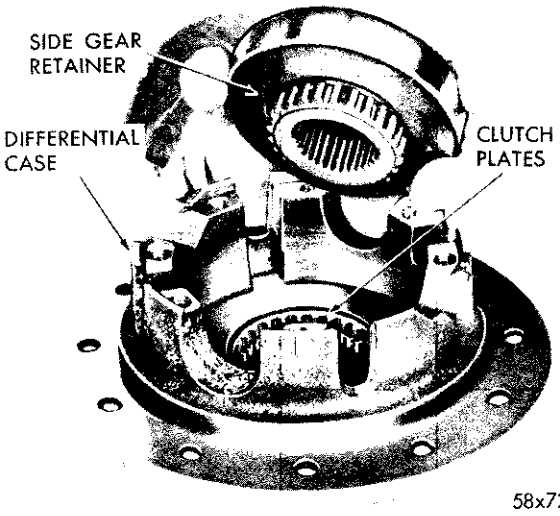


Fig. 43—Removing or Installing Side Gear Retainer

(5) Remove remaining side gear (Fig. 42), side gear retainer (Fig. 43) and clutch plates (Fig. 44).

(6) Remove axle shaft thrust spacer by pressing out lock pin.

b. Cleaning and Inspection

Clean all parts thoroughly. Inspect all parts for wear, nicks and burrs. Replace worn or distorted clutch plates. If the case is worn, it will be necessary to replace both halves.

c. Assembly

(1) Install a **thin** plate in each half of the case, then a disc, plate, disc and plate.

(2) Place the side gears in their retainers. Insert splines of the retainers through splines of clutch discs.

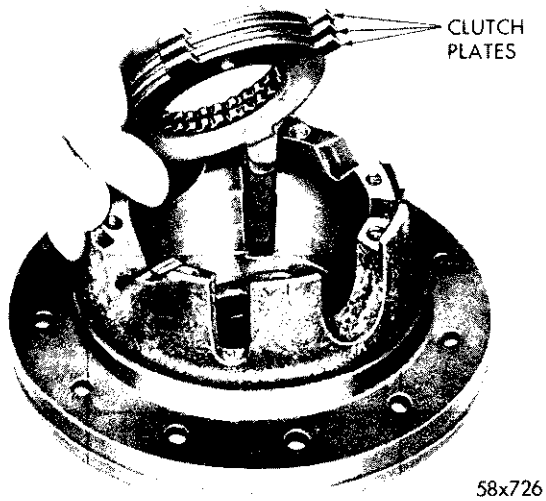


Fig. 44—Removing or Installing Clutch Plates

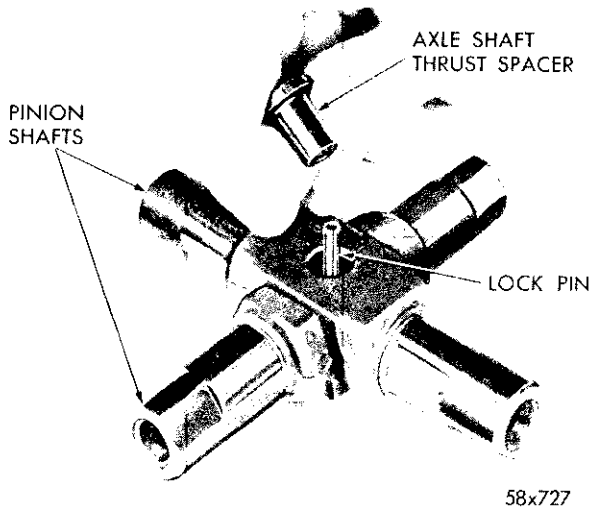


Fig. 45—Installing Axle Shaft Thrust Spacers

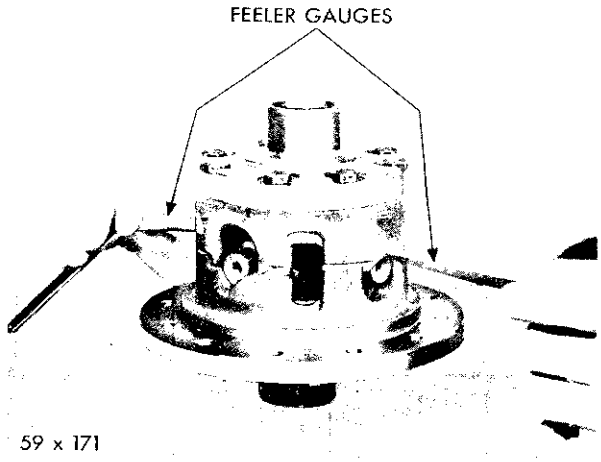


Fig. 46—Checking Clearance Between Pinion Shafts and Case

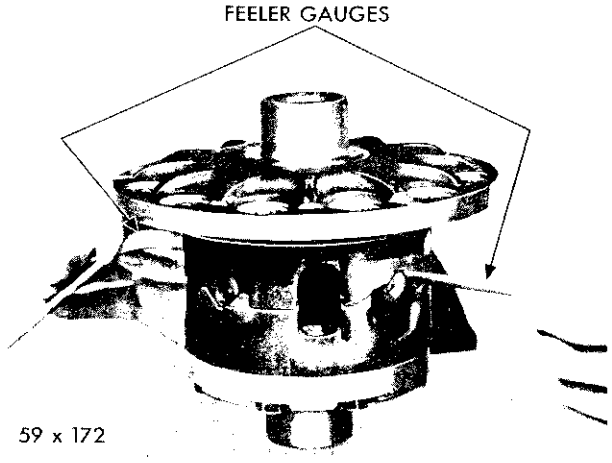


Fig. 47—Checking Clearance of Pinion Shaft and Cap

(3) Place aligning pin through one axle shaft thrust spacer. Assemble pinion shafts on aligning pin.

(4) Place the pinion gears on shafts and install the assembly on drive gear half of case. Insert thrust spacer in the pinion shaft (Fig. 45).

(5) Slide cap half of case over edge of bench far enough to insert one finger up through the assembly to hold it together. Place assembly on drive gear half, matching the scribe marks.

(6) Install cap attaching bolts. Tighten lightly, to seat cap on case. Check the assembly for free turning of differential gears and both side gears. If tight, the side gear retainers may not be meshed through all clutch discs. When both the side gears turn freely, tighten bolts to 55 foot-pounds for left hand thread.

(7) With differential resting on one hub, insert two feeler blades, one over each end of the pinion shaft having ramps above it (Fig. 46). Clearance should not exceed .020 inch at each end of shaft.

(8) Invert differential to rest on opposite hub. Check opposite pinion shaft in like manner to same specification (Fig. 47).

Measurements over .020 inch indicate that the clutch discs are worn and should be replaced. New discs and plates may produce a clearance of as little as .002 inch. With either new or used discs, the measurement of the two shafts should be within .005 inch of each other.

Use C-3565 driver when installing rear axle shaft outer oil seal and C-745 seal protector when installing the brake shield over the rear axle shaft.