Section II

REAR AXLE

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DATA AND SPECIFICATIONS

Rear Axle	C-75	C-76	IM-1-2-4
Type	Semi-Floating	Semi-Floating	Semi-Floating
Gear Type	Hypoid	Hypoid	Hypoid
Ring Gear Diameter	8.75″	8.75″	8.75″
Pinion Bearing	2	2	2
Type	Tapered Roller	Tapered Roller	Tapered Roller
Adjustment	Shim Pack	Shim Pack	Shim Pack
Differential Bearings	2	2	2
Type	Tapered Roller	Tapered Roller	Tapered Roller
Adjustment	Threaded Adjuster	Threaded Adjuster	Threaded Adjuster

REAR AXLE

DATA AND SPECIFICATIONS (Continued)

Rear Axle	C-75		C-76		IM-1, 2, and 4
Drive Gear Pinion	Matched Sets		Matched Sets		Matched Sets
Drive Gear Run-Out	.005″ Maximum		.005″ Maximum		.005″ Maximum
Drive Gear and Pinion Backlash	.006″ to .008″		.006″ to .008″		.006″ to .008″
Differential Side Gear Clearance	.0 to .008″		.0 to .008″		.0 to .008″
Axle Ratio	Std. Model	T & C Wgn.	Std.	T & C Wgn.	Standard
With Standard 3-Speed Trans.	3.73	3.91	—	—	—
No. Drive Gear	41	43	—	—	—
No. Drive Pinion Teeth	11	11	—	—	—
With Torque Flite	3.18	3.36	3.18	3.36	3.18
No. Drive Gear Teeth	35	37	35	37	35
No. Drive Pinion Teeth	11	11	11	11	11
Type Recommended	**Ex. Press. Hypoid**				**Ex. Press. Hypoid**
Summer	90				90
Winter	90				90
Extreme Cold	80				80
Capacity	3½ Pints				3½ Pints
Wheel Bearings					
Type	Tapered Roller				Tapered Roller
Adjustment	Select Shims				Select Shims
Axle End Play	.003″ to .008″				.003″ to .008″
Road Clearance (Full Load)	7.4″		7.4″		7.6″
T & C Wagon	7.4″		7.4″		—
Sedan	—		—		—
Tread (Rear)	59.62″		59.62″		60.35″
T & C Wagon	59.62″		59.62″		—
Sedan	—		—		—

SPECIAL TOOLS

Tool Number	Tool Name
C-637	Puller—Rear Axle Shaft and Inner Oil Seal
C-293	Puller Sets—Roller Bearing
C-406A	Wrench—Differential Bearing Adjusting
C-413	Driver—Axle Shaft Outer Bearing Cup
C-3339 or 430	Dial—Indicator Set
C-452	Puller—Companion Flange or Yoke
C-499	Puller—Axle Shaft
C-549	Puller—Utility
C-745	Sleeve—Rear Axle Oil Seal Outer
C-757	Installing Sleeve—Axle Shaft Oil Seal
C-758-D3	Gauge—Pinion Bearing Pre-Load and Cone Angle Setting
C-3281	Wrench—Companion Flange on Yoke Holding
C-839	Driver—Axle Shaft Inner Oil Seal
C-845 or C-319	Puller—Universal Wheel and Hub
C-3565	Driver—Axle Shaft Outer Seal
C-3566	Driver—Axle Shaft Outer Seal—End Brake Support
DD-996 or DD-955	Installing Sleeve—Pinion Bearing
DD-914-8	Ring—Medium Reducer (use with DD-914-89)
DD-921	Wrench—Differential Case Cap Remover and Installer
DD-993	Puller—Pinion Oil Seal
DD-999	Installing Tool—Companion Flange or Yoke
DD-1005	Driver—Differential Case Side and Cross Shaft Roller Bearing

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	240 (minimum)

Section II
REAR AXLE

1. DRIVE GEAR ASSEMBLIES

The rear axles (Figs. 1 and 2) are semi-floating type with two pinion differentials and hypoid drive gear and pinion. The drive gear and pinion on all models are serviced only in matched sets to insure smooth quiet operation.

Cleaning and inspection of parts after disassembly is very important. Metal chips not cleaned from housing after a failure may cause excessive part wear and future failures.

Bearing cones and cups should be carefullly checked for discoloration due to overheating,

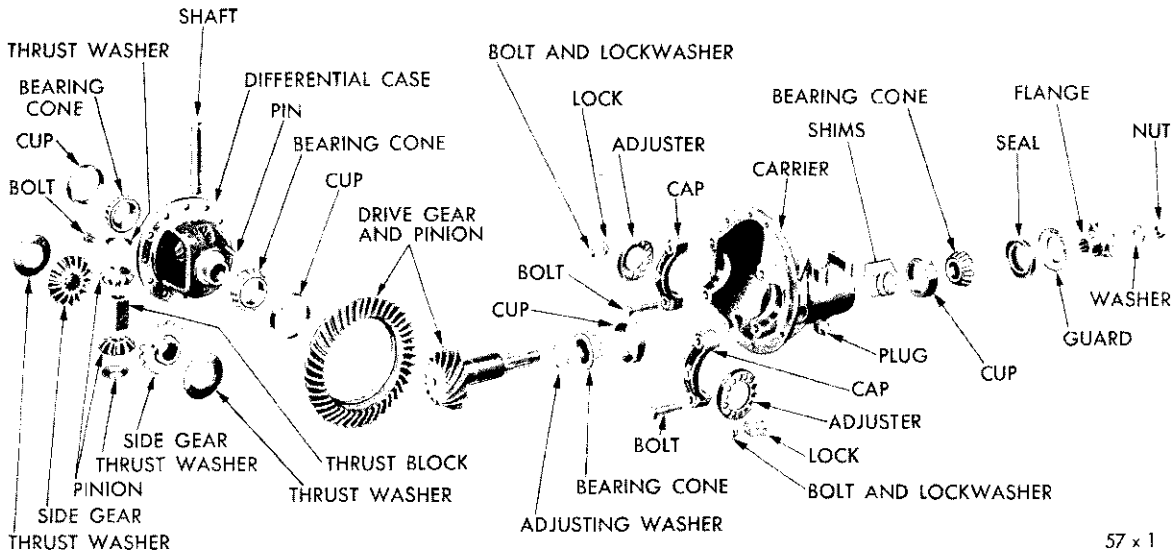


Fig. 1—Rear Axle Exploded View

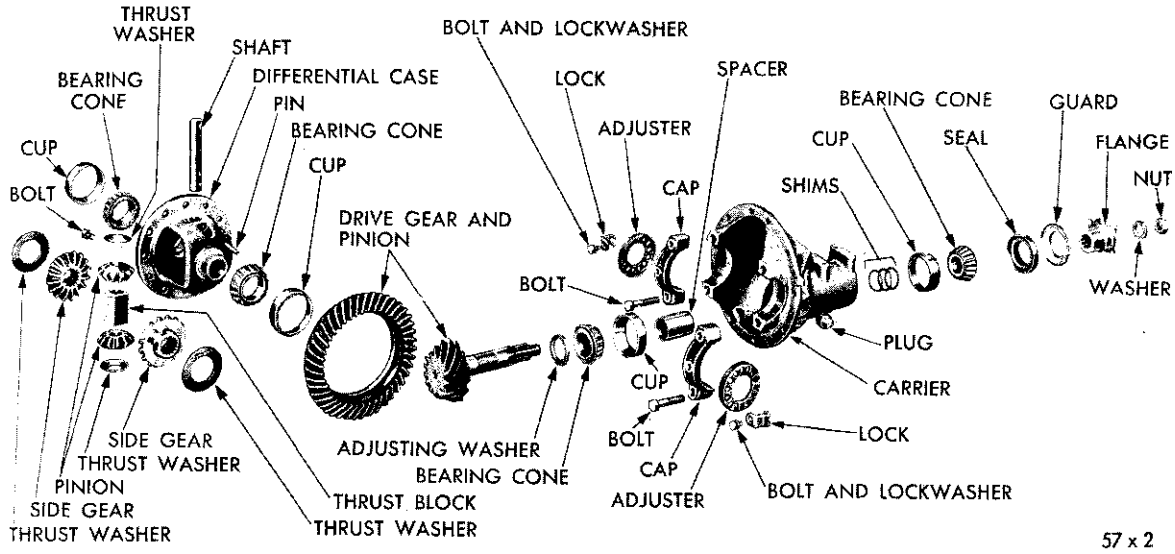


Fig. 2—Rear Axle Exploded View

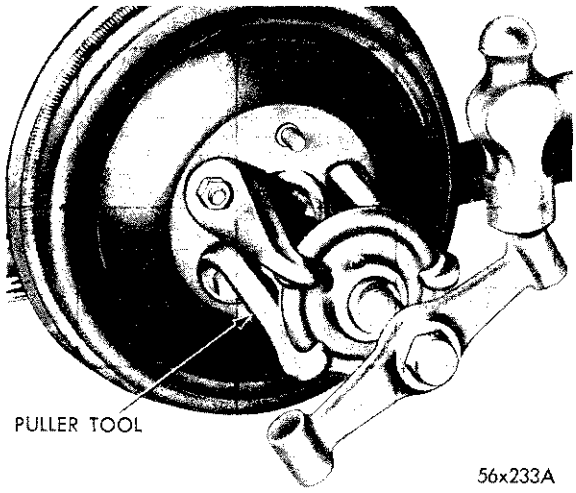


Fig. 3—Removing Hub and Drum Assemblies

and for surface wear. Axle housing should also be checked for broken welds or bent sections.

Rear spring seats should be inspected to make sure they are not broken or loose. Axle shafts should be inspected and replaced if there is evidence of damage. The axle shaft should be free of nicks and burrs before assembly.

NOTE: Gaskets and other seals should be replaced whenever they are removed as an insurance against leakage. Bearings, thrust washers and differential pinion shaft should be thoroughly lubricated before final assembly.

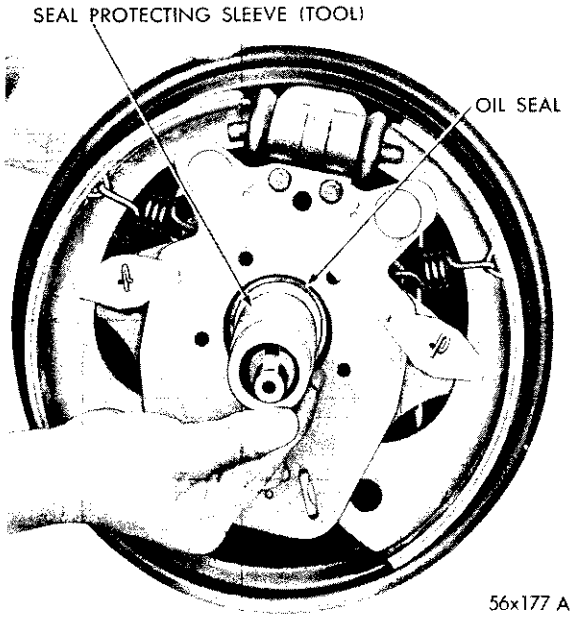


Fig. 4—Removing or Installing Protective Sleeve

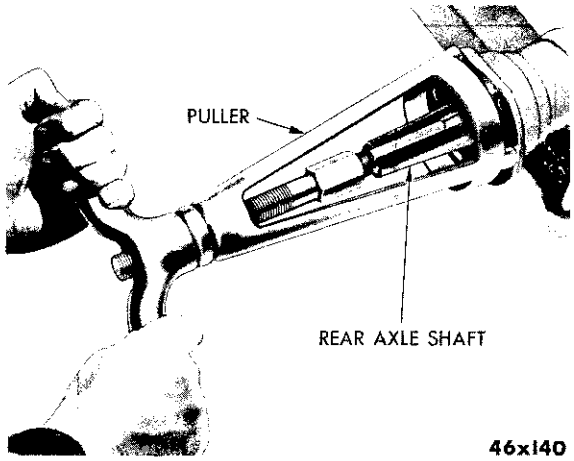


Fig. 5—Removing Axle Shaft and Bearing

2. REMOVAL OF DIFFERENTIAL CARRIER ASSEMBLY (All models)

Raise car off floor and block the brake pedal so pedal cannot be depressed. Drain lubricant from differential housing. Back off brake shoes, with Tool C-845. Remove rear wheels, hub and drum assemblies, as shown in Figure 3. Disconnect the brake line at wheel cylinders. Remove rear axle drive shaft keys, install special sleeve Tool C-757 in axle outer oil seal (Fig. 4) and remove the brake backing plate. Remove the shims from each end of axle housing. Each set should be kept separate so that at reassembly, the central location of the axle, shafts, and thrust block will be maintained. Remove axle shafts and bearings from housing, using puller Tool C-499. (Fig. 5). If necessary, remove bearings from the axle shafts, using bearing puller Tool C-293 with adapter plate No. 13, as shown in Figure 6.

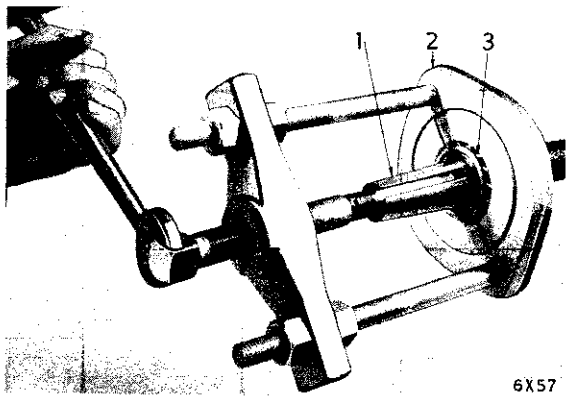


Fig. 6—Removing Bearing from Axle Shaft

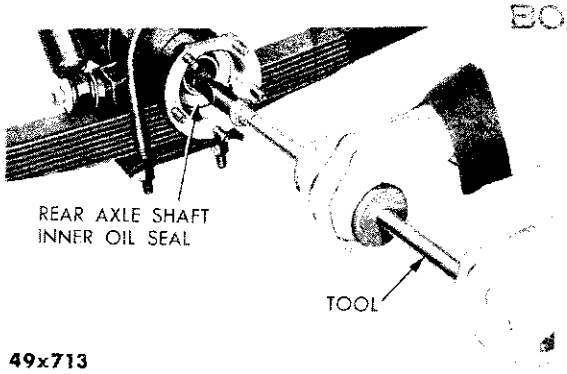


Fig. 7—Removing Inner Oil Seal Using Tool C-637

Remove the rear axle shaft inner oil seals, using puller Tool C-637 (Fig. 7) to remove the inner seal and Tool C-839 for the outer, as shown in Figure 8. Disconnect the rear universal joint and drop the prop shaft. Remove bolts attaching the carrier assembly to axle housing, and remove carrier assembly. Clean carrier assembly in suitable solvent.

3. CHECKING DRIVE GEAR AND CAGE ASSEMBLY

Check gear tooth pattern on drive gear, and pinion backlash before disassembly (Fig. 9). With carrier assembly mounted in stand, mark both differential bearing caps and adjusters, before removing caps, adjusters and drive gear assembly from carrier, as shown in Figure 10.

NOTE: The caps must NOT be interchanged as they are line bored with the carrier housing at manufacture.

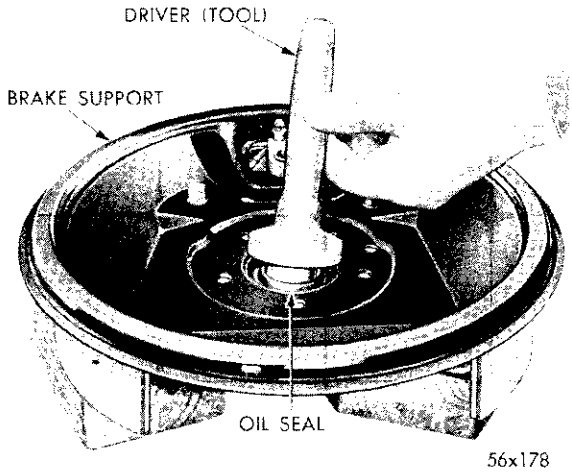


Fig. 8—Removing Outer Axle Shaft Oil Seal with Tool C-839

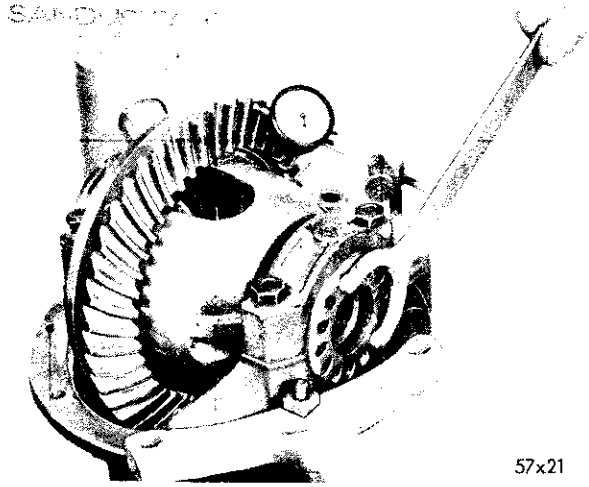


Fig. 9—Checking Drive Gear and Pinion Backlash

4. DISASSEMBLY AND INSPECTION OF DIFFERENTIAL DRIVE GEAR AND CAGE ASSEMBLY

Place differential case and drive gear assembly in a suitable fixture and remove the drive gear to case attaching cap screws and remove drive gear. **Drive gear to case bolts are left-hand threads, turn clockwise to loosen.** Tap ring gear off case, using a fibre hammer. To check differential case runout after removal of drive gear, mount differential case and bearings without drive gear in carrier and adjust. Remove excessive play from the bearings with adjusters. Mount a dial indicator on carrier mounting face and check the drive gear mounting flange

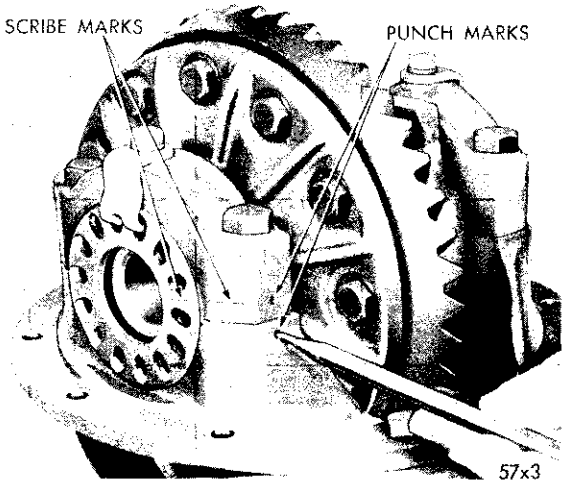


Fig. 10—Marking Caps and Adjusters

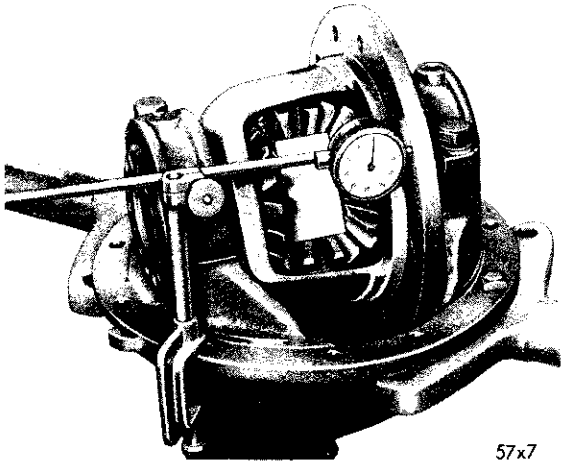


Fig. 11—Checking Drive Gear Mounting Flange

runout, as shown in Figure 11. Runout should not exceed .003 inch.

Inspect bolt holes in drive gear mounting flange for wear or out of round. If bolt holes are out of round, the drive gear will creep on the case.

After checking the runout of the assembly, remove the differential case assembly from carrier. Use Tool C-293 in combination with 3

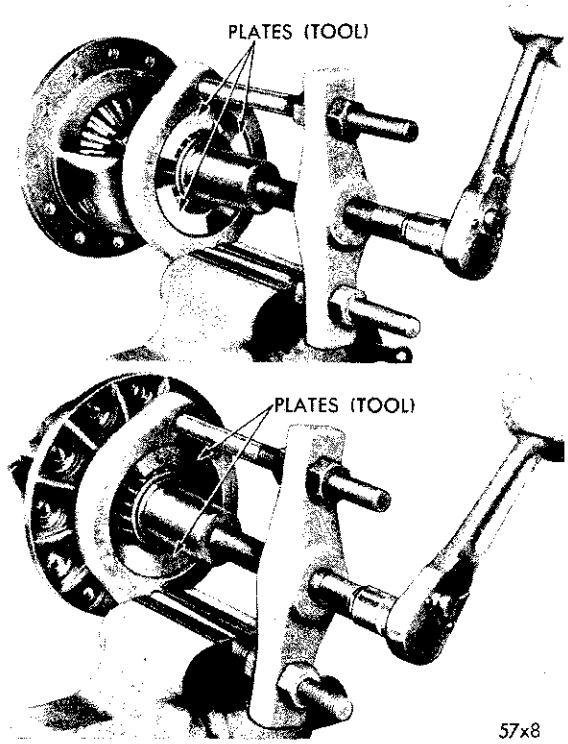


Fig 12—Removing Differential Case Bearings

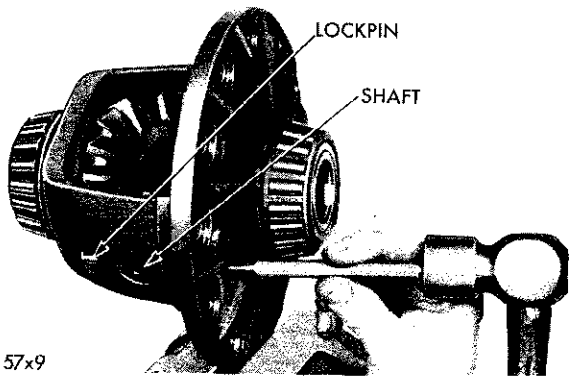


Fig. 13—Removing Differential Pinion Shaft Lock Pins

Number 18 adapter plates behind bearings to pull off the differential bearings from case, as shown in Figure 12.

Remove differential pinion shaft lock pins by driving pin from case with a hammer and punch, as shown in Figure 13. Drive the long differential pinion shaft out of differential case, using a brass drift and hammer. This shaft can be identified as having only one retaining pin. Rotate one differential side gear until each pinion appears at the large opening of case. Remove each pinion and thrust washer one at a time, as shown in Figure 14. Lift out rear axle drive shaft thrust block.

5. DISASSEMBLY OF DRIVE PINION SHAFT AND BEARING ASSEMBLY

Remove the companion flange retaining nut and Belleville washer (Fig. 15) and with puller Tool C-452, and flange holding Tool C-784, re-

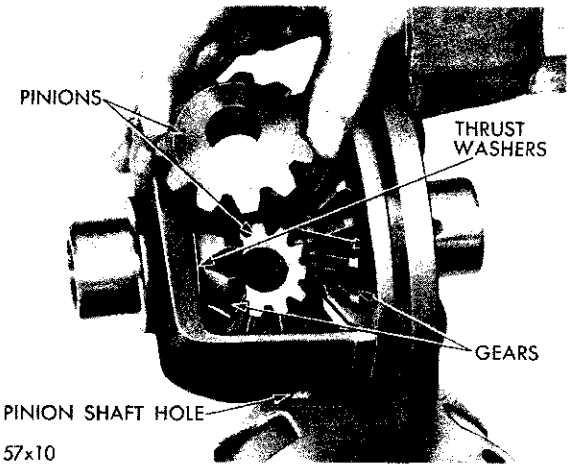


Fig. 14—Removing or Installing Pinion Gear

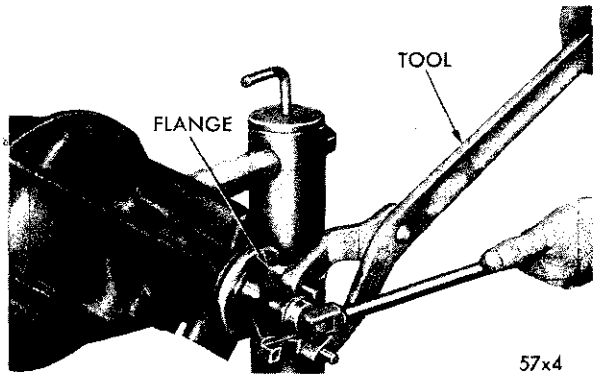


Fig. 15—Removing Companion Flange Nut

move the companion flange, as shown in Figure 16. Insert pinion oil seal puller Tool C-748 into seal and remove seal from housing, as shown in Figure 17. Remove pinion bearing washer, bearing cone, and pre-load shims, or spacer (if so equipped). Remove differential carrier. If necessary, remove the rear bearing from pinion shaft, with puller Tool C-293, and four adapter plates, as shown in Figure 18. Slide the pinion adjusting washer off shaft. If necessary, remove both bearing cups from carrier housing, using a suitable drift. Place drift alternately in the two machined slots, in order to drive cups out evenly. Clean carrier, pinion shaft and related parts in suitable solvent, inspect and replace parts as necessary.

6. CLEANING AND INSPECTION

Clean all parts thoroughly in a suitable solvent and blow dry with compressed air. Remove any chips or foreign material from carrier housing. Inspect all machined surfaces for nicks, burrs or scratches including inner and outer thrust shoulders of differential case. The thrust shoulder on adjusters must be free from burrs so that bearing cups will seat properly. Check differential case for cracks, fractures, distortion or damage. Install a new case if necessary. The bearings should be immersed in clean solvent and rotated by hand until clean. After cleaning, blow dry with compressed air. **Do not spin the bearings with air pressure when blowing them dry, as they are likely to score due to absence of any lubrication.** Check bearings for roughness, or brinelling. The bearings must run free and show no indication of roughness or wear. Examine bearing cups for pitting, scoring or wear. Inspect all gears for chipped or worn gear teeth. Check the fit of differential side gears on axle shaft splines and differential gears on pinion shaft. Check thrust washers for wear, and replace if necessary. Inspect axle shafts splines for wear, cracks or distortion. Replace necessary parts.

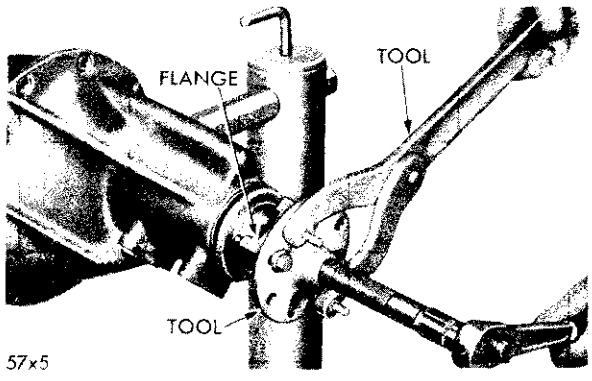


Fig. 16—Removing Companion Flange

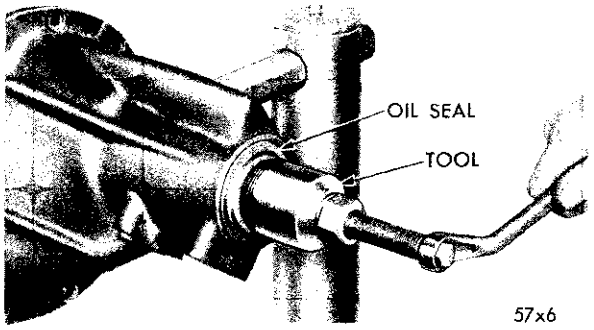


Fig. 17—Removing Drive Pinion Bearing Oil Seal

7. ASSEMBLING THE DIFFERENTIAL CASE AND PINION GEARS

If new differential side gears are to be installed, coat parts with Hypoid Gear oil. Install a new

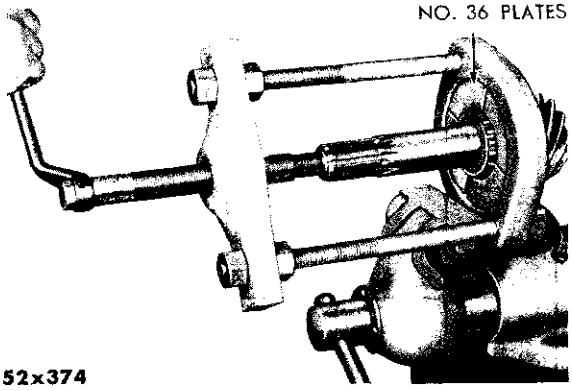


Fig. 18—Removing Pinion Bearing From Shaft (Puller C-293-F2)

thrust washer over hub of each gear and install in position in differential case.

Insert each of two pinions through the large side opening of case (Fig. 18) so that pinion shaft holes of two gears and thrust washers are properly aligned. Rotate gears 90 degrees so that pinion shaft holes of case are in exact alignment with holes in the two thrust washers and pinions. From the pinion shaft lock pin hole side of case, insert the slotted portion of pinion shaft through case; the conical thrust washer just through one pinion gear. Install the thrust block between two pinion gears.

IMPORTANT

The thrust block must be installed so that hole in block is aligned with pinion shaft and with the ground sides facing the two side gears.

While keeping all of these parts in proper alignment, push the pinion shaft on through until locking pin hole in pinion shaft is in exact alignment with its respective hole in case.

NOTE: Before installing pinion shaft lock pin, rotate the differential gears. They must turn freely throughout the 360 degree revolution. The clearance between each gear and case ranges from .001 to .008 inch. This clearance has been established to ascertain free rotation.

Install pinion shaft lock pin through hole in case from the pinion shaft side of the drive gear flange. Position each differential bearing

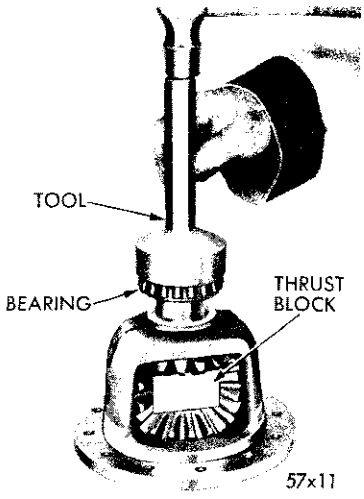


Fig. 19—Installing Differential Bearings

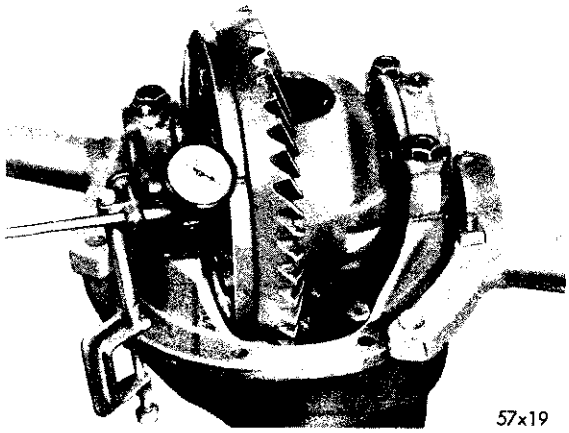


Fig. 20—Checking Drive Gear Runout

cone on hub of case (Fig. 19) (taper away from drive gear) and with installing Tool DD-1005, install bearing cones. Make certain that contacting surfaces of drive gear and flange are clean and free from burrs. Position drive gear on case aligning the threaded holes of drive gear with those in the case flange. Insert drive gear cap screws through case flange and into drive gear. After it has been ascertained that all cap screws are properly started into their respective threads, tap gear onto case with a fiber mallet until it seats properly on case flange. Position drive gear between brass jaws of vise and alternately tighten each cap screw to 55 foot-pounds torque.

Place differential bearing cups over bearings, and install complete assembly in carrier housing. Seat the adjusting nuts in the cap pedestals of carrier housing, and install caps and bolts. **Be sure caps are on the same side from which**

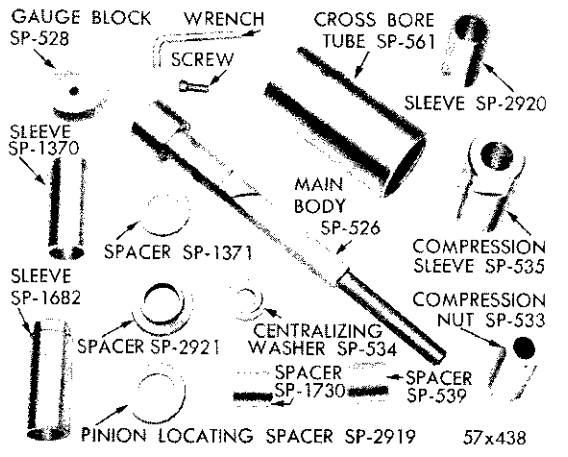


Fig. 21—Special Tool Set C-758-D-3

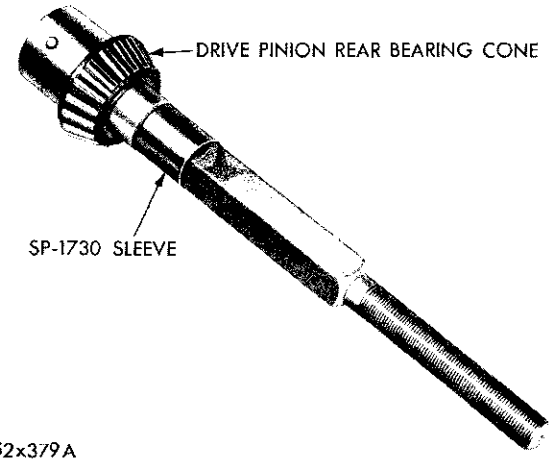


Fig. 22—Bearing Installed on Main Body of Tool C-758-D-3

they were removed. Adjust and remove excessive play from bearings. Check drive gear for runout, as shown in Figure 20.

NOTE: If there is more .005 inch runout the differential case should be replaced.

8. INSTALLATION OF DRIVE PINION SHAFT, BEARING CONES AND CUPS

Place bearing cups in position in carrier, refer to Tool-set C-758-D-3 (Fig. 21) and proceed as follows: With bearing cups squarely in position in carrier, assemble Tool C-758-D-3 by placing rear pinion bearing over main screw of tool (Fig. 22) and insert tool into carrier from gear side. Place the front pinion bearing over main screw, followed by adaptor SP-535, washer SP-534 and nut SP-533 (Fig. 23). Press bearing cups into place by tightening tool nut, as shown in Figure 24. **Allow tool to rotate slightly in order not to damage bearings or cups during this operation.**

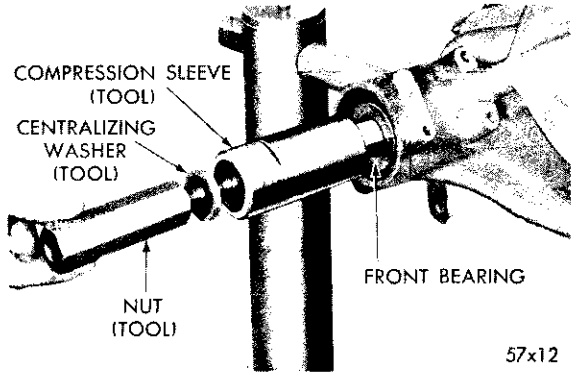


Fig. 23—Compression Sleeve and Centralizing Washer Positioned in Carrier

CAUTION

Do not install pinion oil seal during preload and pinion setting operations; otherwise, there will be added drag on pinion shaft giving a false bearing preload on torque wrench.

Pinion Bearing Pre-load Adjustment

The importance of correct pinion bearing preload cannot be over-emphasized. The selection of adjusting washers to give the desired preload should be carefully made. When 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 thrust ribs on cones. Bearings installed in this manner would allow 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, and usually is accompanied by noise. On the other hand, where the pinion bearing cones are drawn too far into their cups, the bearings are over-loaded even before they have to withstand operating loads imposed upon them by gears. They are apt to "burn up" under a driving load—the rollers might score the cups, causing bearings to gall or flake, resulting in premature axle failure.

Correct cone distance is obtained by use of a spacer and washer combination. **Do not install pinion oil seal during pre-load and pinion**

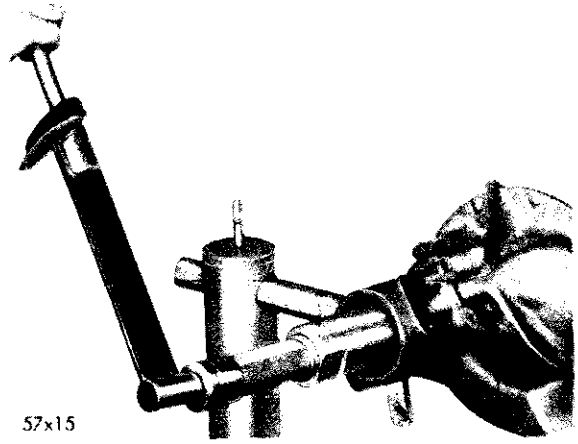


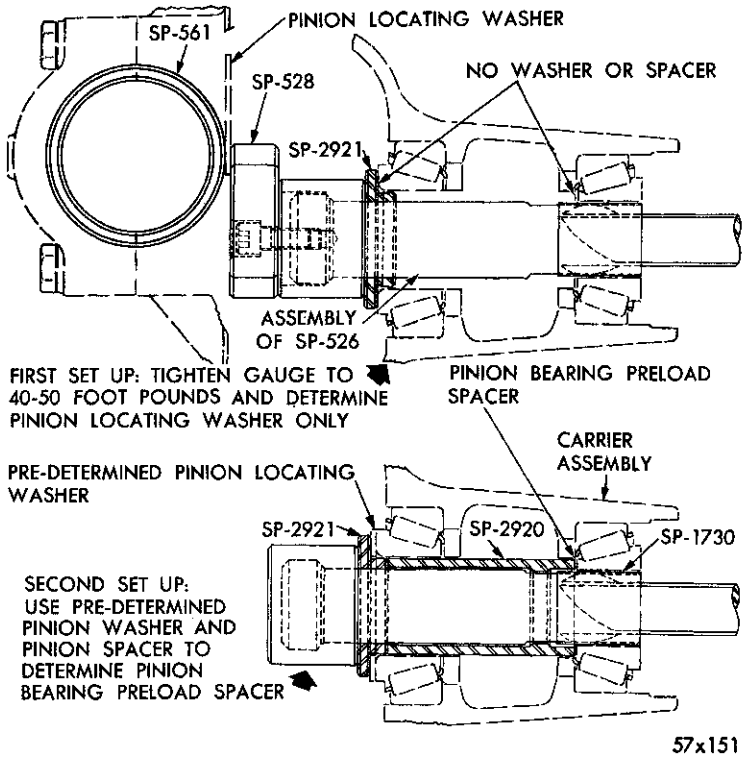
Fig. 24—Seating Bearing Cups and Checking Torque

setting operations, otherwise, there will be an added drag on pinion shaft which would give a false bearing pre-load on the torque wrench.

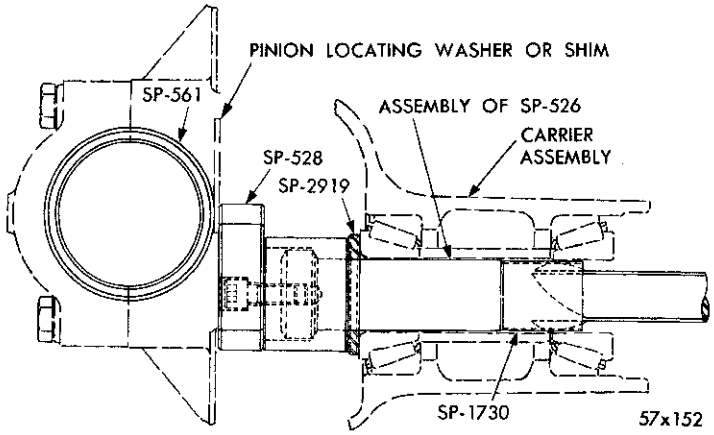
9. PINION BEARING PRE-LOAD AND PINION SETTING (Without using special Tool C-758-D-3)

Correct drive gear and pinion adjustment consists of following: Pinion Bearing Pre-load, Pinion Setting, Differential Bearing Pre-load, and Backlash between Drive Gear and Pinion. The final inspection of these adjustments is performed by checking the tooth contact patterns, as described in Paragraph 13.

Pre-loading the pinion and differential bearing is important because it holds the drive pinion and differential in place and prevents back and forth movement which would create incorrect gear and pinion tooth contact.



Used on New Yorker-Imperial



Used on Windsor

Fig. 25—Tool C-758-D-3 Installed in Housing

NOTE: If the differential assembly was satisfactory from the standpoint of noise before being disassembled, the drive pinion may be assembled with the original adjusting washers and shims. If replacement parts are installed, or differential adjustment is necessary, the proper thickness washer must be installed between the pinion and rear bearing. The drive gear and pinion are manufactured and lapped in pairs.

With use of special Tool C-758-D-3 (Fig. 25), pinion bearing pre-load and pinion setting can be predetermined, thus saving considerable time and labor in performing this operation. Selecting of correct pinion spacer washer and adjustment of bearing pre-load is accomplished by adjusting washers available in various thicknesses, and selected to give pre-load within specified limits. Pinion bearing adjusting washers 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 obtain proper pinion setting in relation to drive gear, the correct thickness thrust washer must be selected before drive pinion is installed in carrier. To select proper thickness thrust washer, proceed as follows: It will be noted that face of drive pinion is etched with plus (+), or minus (—) sign, followed by a number ranging from 1 to 4, or zero, (0) marking.

NOTE: When replacing a ring gear and pinion, remember that they are matched and lapped in pairs. The position in which the best tooth contact is obtained is etched on end of pinion shaft.

If old and new pinion have the same marking and if old bearing is being used, use a thrust washer of same thickness. But if old pinion is marked zero (0) and new pinion is marked + 2, try a .002 **thinner** washer. If new pinion is marked — 2, try a .002 inch **thicker** washer. A **thinner** or **thicker** thrust washer may be required covering the range from .084 to .100 inch when making final adjustment.

If bearing cups are to be replaced, place the bearing cups in position in carrier assembly drive cups in place with suitable drift. After properly positioning bearing cups in carrier, assemble drive pinion thrust washer (chamfered side down toward gear) on drive pinion shaft. Install rear bearing, spacer (if so equipped) and shims on pinion shaft. Insert shaft into carrier housing. Install front pinion bearing and universal joint flange washer and nut. **Do not install oil seal.** Tighten rear axle drive pinion flange nut to 240 foot-pounds torque. Rotate drive pinion shaft after tightening flange nut with wrench to properly seat the bearing rollers in bearing cups. Pre-load torque required to rotate pinion shaft with bearings oiled should be 25 to 35 inch-pounds torque. Add shims to **decrease** torque or remove shims to **increase** torque. After correct pinion setting and bearing preload has been obtained, remove drive pinion flange, install oil seal and tighten drive pinion flange washer and nut to proper torque. Install drive gear with grease marking compound and adjust for correct tooth contact and backlash.

10. PINION BEARING PRE-LOAD AND PINION SETTING (C-75 and Town and Country Wagon)

Lubricate pinion bearing cones. Install locating washer SP-2919 on tool mainshaft. Position rear pinion bearing cone on main screw of Tool C-758-D-3 followed by pinion bearing spacer.

NOTE: Spacer has a larger bore at one end, install large bore end of spacer next to rear bearing.

Install sleeve Tool SP-1730 on tool main screw with sleeve bottoming against the tool main screw shoulder. Install original shims removed from drive pinion shaft over the tool main screw and sleeve and against spacer. Position the carrier in stand so companion flange is facing upwards. Insert tool in carrier. Install pinion shaft front bearing and compression sleeve Tool SP-535. Install tool centralizing washer SP-534 followed by the main screw nut, Tool SP-533. Hold compression sleeve Tool SP-535 with holding Tool C-784 or C-3281, tighten nut to 240 foot-pounds torque. (Fig. 26).

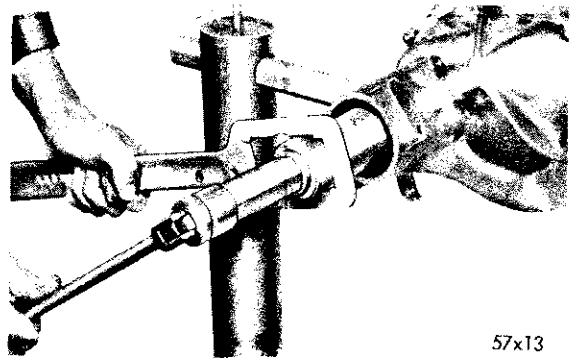


Fig. 26—Tightening Compression Nut

With an inch-pound torque wrench on the nut of tool, rotate wrench several revolutions to seat bearings, (Fig. 24). The correct reading should be 20 to 30 inch-pounds. If bearing pre-load is more than 30 inch-pounds, a thicker shim should be used under front bearings. Shims are available in thickness of .010, .012, .014, .016 and .018 inch. If bearing pre-load is less than 20 inch pounds, a thinner shim should be used.

NOTE: Correct pre-load readings can only be obtained with pinion shaft tool in a vertical position.

Assemble gauge block SP-528 (Fig. 27) to main screw. Place SP-561 bearing arbor in differential carrier bearing supports, as shown in Figure 28.

NOTE: Remove any burrs or upsets in bearing supports before installing bearing arbor, as arbor must be securely seated in bottom of bearing bores.

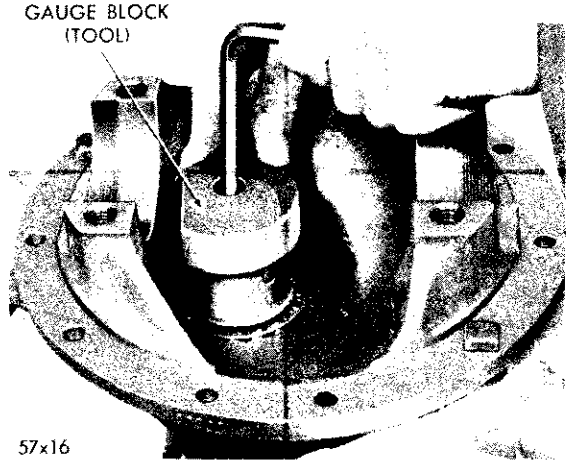


Fig. 27—Installing Gauge Block on Main Body

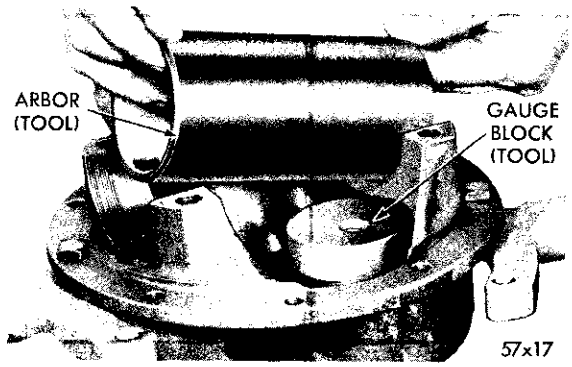


Fig. 28—Installing Arbor

Center arbor in differential bearing pedestals of carrier. Insert a piece of .002 inch shim stock between arbor and each cap and tighten caps to 10 foot-pounds torque. Select a pinion washer of sufficient thickness so that it will just pass between gauge block end of setting tool and machined surface of arbor, as shown in Figure 29.

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

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

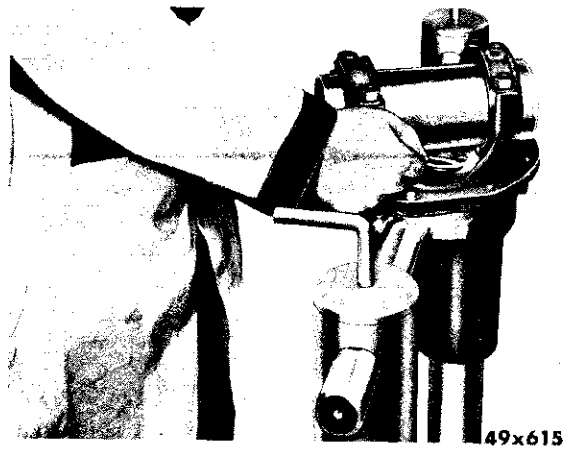


Fig. 29—Determining Spacer Washer Thickness

When correct washer has been selected for drive pinion, disassemble tool from differential carrier housing. Add washer selected to tool, between spacer SP-2921 and pinion rear bearing. Add spacer SP-2920 and the **pinion bearing adjusting spacer** (that was removed from the axle at disassembly). Insert tool assembly in carrier housing. Slide front bearing on shaft and into position in its cup. Install tool spacer, nut and washer. Tighten tool 240 minimum foot-pounds torque, as shown in Figure 24. Turn the tool with a speed wrench to permit bearings to seat. When bearings are seated, check bearing pre-load by revolving tool, using an inch-pound torque wrench, as shown in Figure 27. The correct bearing pre-load should be 25 to 35 inch-pounds torque.

If the bearing adjustment does not conform to 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 pre-load is too great or a **thinner** spacer if pre-load is not sufficient. When correct spacer has been selected for drive pinion bearings, remove the differential bearing cap, shim stock and arbor from carrier housing. Disassemble tool from differential carrier housing. Install pinion setting washer over pinion shaft with chamfered side against the pinion. Make certain the contacting surfaces of rear bearing cone are perfectly clean. Install cone and shaft and press bearing on shaft with Tool DD-955. (Fig. 30).

Install the selected shim pack. Lubricate front and rear pinion bearing cone with heavy

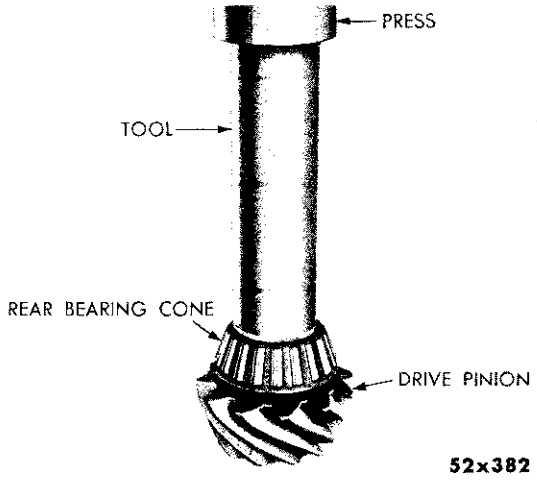


Fig. 30—Installing Pinion Bearing Cone on Pinion Shaft

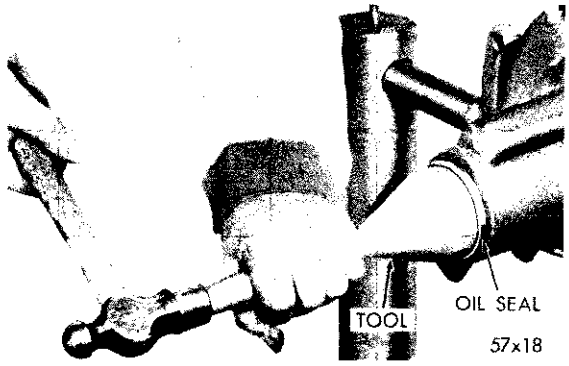


Fig. 31—Installing Drive Pinion Oil Seal

oil. Insert new oil seal with driver Tool C-359 making sure it is seated all the way in carrier (Fig. 31). Install companion flange on pinion shaft with Tool C-496. Holding companion flange with Tool C-784, tighten nut to 240 foot-pounds torque.

11. PINION BEARING PRE-LOAD AND PINION SETTING (C-76 and Imperial Models)

Check the bearing cups and carrier for grit and dirt. Assemble washer SP-2921 followed by correct pinion locating washer and spacer SP-2920 along with rear bearing on main shaft of Tool C-758-D-3. Insert tool, bearing and washer assembly in carrier along with original shims previously removed from drive pinion shaft. Install front bearing, compression sleeve SP-535, centralizing washer SP-534 and main nut SP-533. Hold compression sleeve nut with holding Tool C-784 or C-3281 and torque nut to 240 foot-pounds.

With an inch-pound torque wrench, rotate wrench in a clockwise direction several revolutions to seat bearings. The correct torque reading should be from 25 to 35 inch-pounds. If bearing preload is more than 35 inch-pounds, a thicker shim should be used under front bearing cone. Shims are available in thicknesses of .010, .0125, .015, .016, and .018 inch. If bearing preload is less than 25 inch-pounds, a thinner shim should be used.

NOTE: Correct pre-load can only be obtained with tool in a vertical position.

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

Assembly of Pinion in Carrier

With shaft end of pinion facing up, install se-

lected washer on pinion shaft. Chamfered side of washer facing the drive pinion gear. Position rear bearing cone on pinion shaft. Make sure contacting surfaces of washer, pinion head and rear bearing cone are perfectly clean and free of dirt or foreign particles. Install rear bearing cone onto pinion shaft with Tool DD-955. Install selected shim pack. Lubricate front and rear pinion bearings. Insert pinion shaft and bearing assembly on carrier. Install front bearing and oil seal in carrier (lip of seal facing front bearing). Drive seal into carrier until seal is seated against shoulder of the carrier. Support pinion gear in carrier and start companion flange with installing Tool C-496 or DD-999. Install plain washer (concave side of washer down) and nut. Torque flange nut 240 foot-pounds and remove tool.

12. SETTING DIFFERENTIAL BEARING PRE-LOAD AND BACKLASH

Differential bearing pre-load and backlash between drive gear and pinion are obtained after pinion bearing pre-load and pinion settings, as described in Paragraph 10. Place differential bearing cups over bearings and install complete assembly in carrier housing. Seat adjusters in pedestals of carrier housing and install caps and bolts.

NOTE: Make sure caps are assembled to carrier in same position from which they were removed.

Make certain that differential bearings and

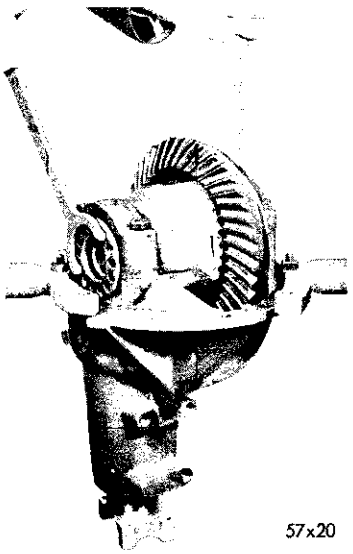


Fig. 32—Adjusting Differential Bearings Adjusters

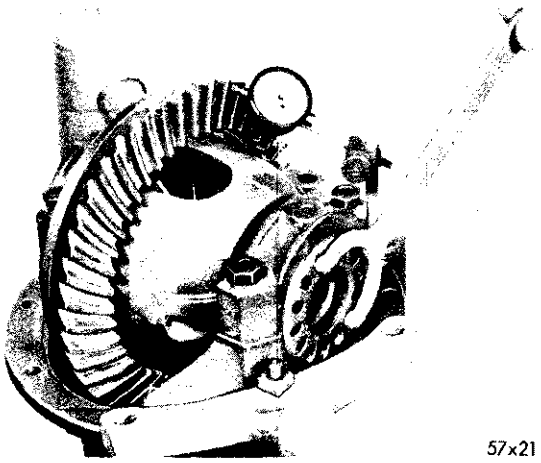


Fig. 33—Checking Backlash Between Drive Gear and Pinion

cups are properly seated, as follows: Using spanner wrench Tool C-406, as shown in Figure 32, turn right hand bearing adjusting nut in clockwise rotation until considerable backlash exists between ring gear and pinion. Back off adjusting nut several turns. Tighten lower pedestal bolts 85 to 90 foot-pounds torque, leaving top bolts slightly loose as this holds bearing cups in line while moving ring gear. Mount dial indicator on differential housing so that plunger rests against one of the ring gear teeth, as shown in Figure 33. (Make certain that indicator is properly positioned so that plunger will accurately indicate that exact amount of backlash.) Check backlash between ring gear and pinion at 90 degrees intervals as the ring gear is rotated, then stop at point of least backlash. Turn left hand (tooth side) bearing adjusting nut in a clockwise rotation until only .001 inch backlash exists between ring gear and pinion. Be sure right hand adjusting nut is kept screwed out so that bearing cup can move without interference. Make certain that right hand (back face of ring gear) bearing adjusting nut is in position where nut lock and attaching bolt can be installed. Tighten the upper **right hand** bearing cap bolt 85 to 90 foot-pounds torque. **In order to properly pre-load bearings, the entire procedure must be very carefully performed. It is important therefore, to end up with .001 inch clearance between ring gear and pinion before upper bolt is tightened.**

Turn left hand adjusting nut in a clockwise direction until dial indicator shows a backlash

Fig. 34—Applying Red Lead to Indicate Tooth Contact

of .006 inch between ring gear and pinion, as shown in Figure 33. Considerable effort will be required to turn adjusting nut to last notch or two. This is necessary, however, to insure adequate pre-load. The adjustment should be performed so that adjuster lock and attaching bolt can be installed. Tighten right hand bearing cap attaching bolt 90 foot-pounds torque, and recheck the other three. After final tightening of all pedestals, bolts, recheck backlash. As a result of this method of adjustment, the carrier pedestals have been spread, the differential bearings have been pre-loaded, and backlash between ring gear and pinion has been correctly set.

CAUTION

Whenever adjustment of differenial assembly is changed to obtain correct tooth contact, readjust differential bearing pre-load and backlash between ring and pinion.

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

Fig. 35—Heavy Face Contact

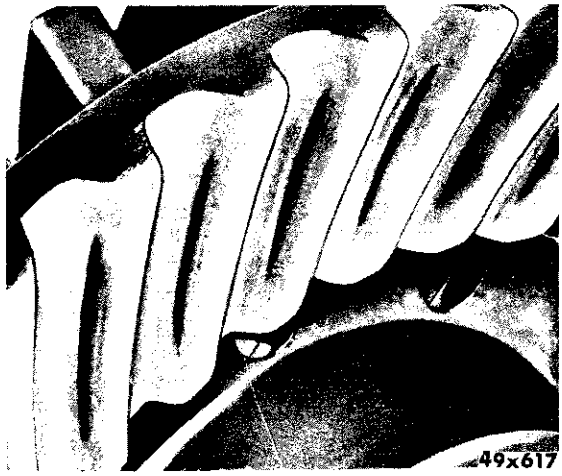


Fig. 36—Heavy Flank Contact

13. GEAR ADJUSTMENT FOR CORRECT TOOTH CONTACT

Check tooth contact by means of gear marking compound applied to drive gear teeth, as shown in Figure 34. Apply load against back face of drive gear with a round bar as drive pinion is rotated. This leaves a bare area the size, shape and location of contact. If improper tooth contact is evident, as indicated by Fig. 35 and 36, the pinion should be adjusted either forward or backward, maintaining the backlash within specified limits until correct tooth contact, as shown in Figure 37, is obtained. With adjustments properly made, correct tooth contact, as shown in Figure 37, will result. Notice that contact pattern is well centered on the drive and coast sides about $\frac{1}{16}$ inch from edges of teeth. When tooth marks are obtained by hand, they are apt to be rather small. Under an actual operating load, however, the contact area increases. Figures 35 and 36 show improper or incorrect tooth contact. To correct such conditions, readjust drive gear and pinion as follows:

Fig. 37—Correct Gear Tooth Contact

a. Heavy Face Contact

If tooth marking is across the length of tooth, narrow and high on the tooth face, as shown in Figure 36, the teeth will roll over or gall. This type of contact causes excessive wear and noise.

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

b. Heavy Flank Contact

If tooth marking is across the length of tooth, but narrow and low on the flank, as shown in Figure 36, 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 pinion. Readjust backlash.

14. INSTALLATION OF AXLE ASSEMBLY

Check carrier housing flange and flange face on differential housing for nicks and burrs. Mount differential carrier to axle housing using a new gasket. Tighten mounting nuts 35 foot-pounds torque. Reinstall rear axle shaft, brake supports and check axle end play, as outlined in Paragraph 16. 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 pin. Reinstall propeller shaft and fill rear axle differential with correct viscosity Hypoid Oil. Refer to Lubrication, Section XV of this manual.

15. INSTALLATION OF AXLE SHAFTS

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

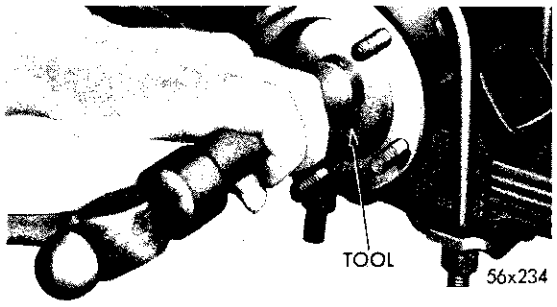


Fig. 38—Installation of Axle Shaft Inner Oil Seal with Tool C-839

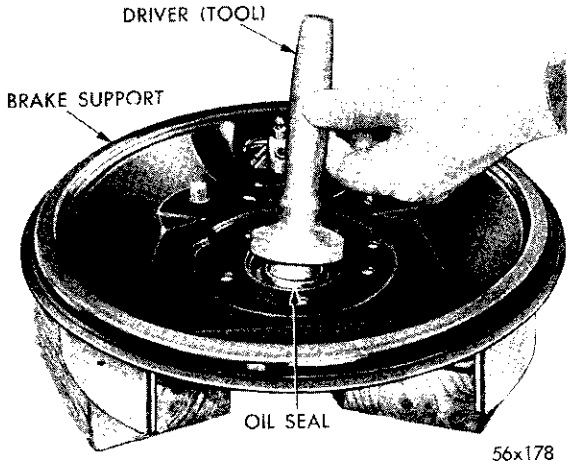


Fig. 39—Removing or Installing Outer Oil Seal with Tool C-839

Install rear axle drive shaft inner oil seal in housing, using special drift Tool C-839, as shown in Figure 38. Install outer oil seal in brake support plate, as shown in Figure 39. Leather seals should be prepared for installation by soaking them in light engine oil for 30 minutes. Before installing axle shaft in housing, examine bearing surface of bearing cups for wear and pits, also surface of axle shaft on which the oil seal wiped to make sure the machined surface is smooth and free from tool marks and burrs. If necessary, dress down surface of shaft with a stone or fine emery cloth to make sure a smooth bearing surface is maintained for oil seal.

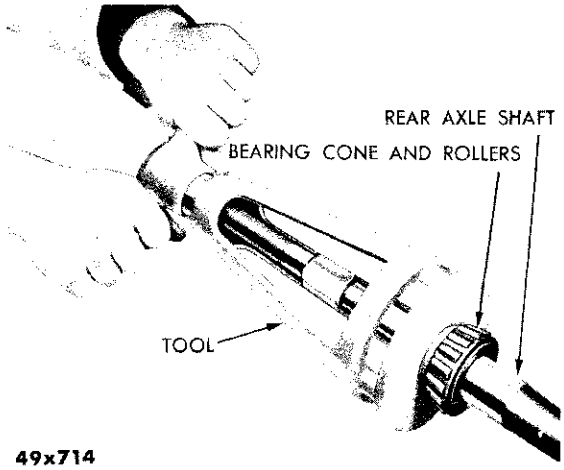


Fig. 40—Installing Axle Shaft Bearing

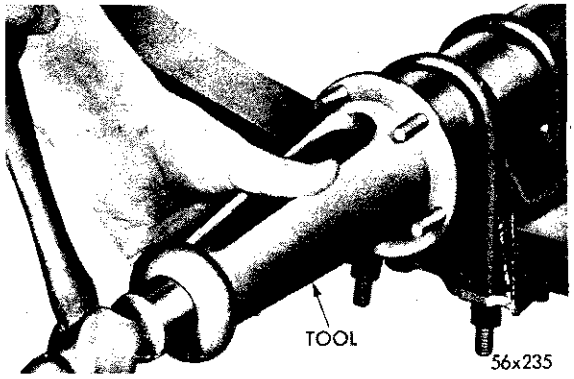


Fig. 41—Installing Axle Drive Shaft Bearing Cup with Tool C-413

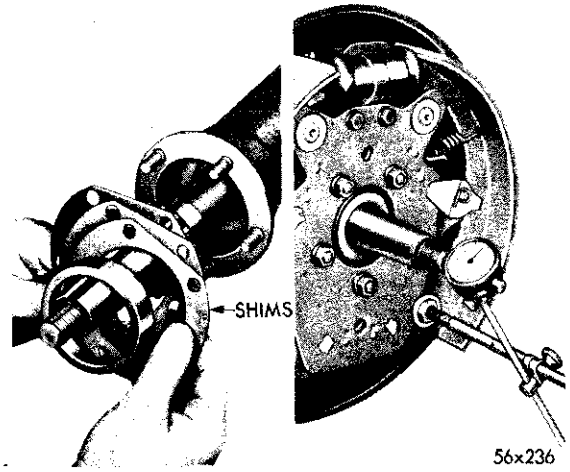


Fig. 42—Checking Axle Shaft End Play

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

To install axle shaft, replace bearing on axle shaft with special Tool C-158 (Fig. 40) and moderately lubricate axle bearings with multi purpose grease. Carefully insert axle shaft in housing, making sure shaft and differential side gear splines align. Install axle drive shaft outer bearing cup wth special driver Tool C-413, as shown in Figure 41. Install axle shaft shims in same manner as removed to maintain central position of axle shaft thrust block. Install special sleeve Tool C-757 in axle bearing outer oil seal, before mounting brake support to axle housing (Fig. 4), to protect seal from being damaged by axle housing flange and brake support. Install brake support plates and tighten

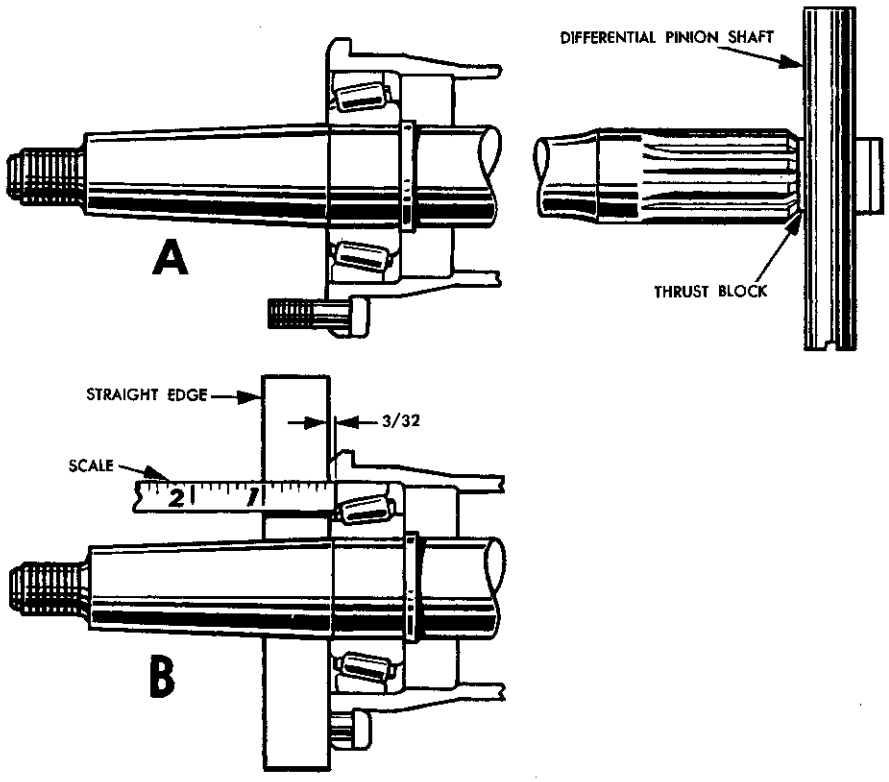


Fig. 43—Adjusting Axle Shaft End Play

attaching nuts to 35 foot-pounds torque. Install axle shaft keys. Connect brake lines to brake cylinder, unblock brake pedal and bleed brake lines. Check axle shaft end play with dial indicator to make sure it comes within .003 to .008 inch limits, as outlined in Paragraph 16, (Fig. 43).

Install wheel hub and drum assembly. Tighten axle shaft nuts to a minimum of 145 foot-pounds torque. Install new cotter pins. Refill axle housing and carrier assembly with Extreme Pressures Hypoid Lubricant, as outlined in "Lubrication", Section XV. Check and refill master cylinder. Check and adjust brake shoes. Lower car and remove brake pedal block.

16. SETTING AXLE SHAFT END PLAY

Rear axle shaft end play is adjusted by use of adjusting shims that are bolted between the axle housing ends and brake support plates. The shims are available in thicknesses of .005, .010, .0125, .015, and .030 inch. The correct axle end play is .013 to .018 inch. One or more shims may be required to obtain correct end play.

Preparation for setting axle shaft end play consists of removal of axle drive shafts. It is not necessary to remove bearing cones from 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.

The hole in the axle drive shaft thrust block is longer than the differential pinion shaft by approximately $\frac{3}{16}$ inch of the diameter. This difference is provided to accommodate normal tolerances on axle shaft and housing lengths, so that the block will clear the differential pinion shaft after the end play adjustment is made.

To adjust axle end play, the operation can be started from either side of axle housing. These instructions will be confined to the case of starting at the left side. Install left axle drive shaft and bearing cone assembly (without lubricant). Drive bearing cup as far as it will go, using Tool C-413, in order to prevent damage to axle housing. This will thrust the block as far to the right as it can go, as shown in Figure 43 "A". If the left bearing cup is now withdrawn about $\frac{3}{32}$ 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 end play of the left and right axle shafts may be different, and wheel thrust will be imposed upon differential bearings, a condition that should be avoided.

With left bearing cup in its innermost position, as shown in Figure 43 "A", lay a straightedge across end of axle housing. Measure distance from straightedge to bearing cup face, to nearest $\frac{1}{64}$ inch. The example shown in Figure 43 "B" shows a measurement of $\frac{1}{16}$ inch.

The $\frac{3}{32}$ inch minus the above measurement gives thickness of shims at left end of 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 the thickness required for the example, however, it is good practice to use about .010 less, shim thickness for the centering adjustment than the exact amount required for centering. For this example, .020 inch shim would be used.

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

CAUTION

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

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

The use of .010 less centering shim at the left end helps assure that the right bearing cup

will protrude beyond the housing end face. Hold a straightedge firmly against the outer face of right bearing cup. Using set of feeler gauges, measure accurately distance between housing face and straightedge. This measurement gives thickness of shim that would give zero end play if it were used in assembly. The shim thickness to be used is obtained by adding .013 inch to above measurement. If this gives a thickness that cannot be built up from existing shims, use the next larger shim combination. This insures that end play will be greater than .013 inch.

For example of end play setting, assume right bearing cup face protrudes .028 inch beyond end face of housing. Shim thickness required for .013 inch end play is .028 + .013 inch equals .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 .028 inch, equals .0145 inch.

Remove right axle shaft and lubricate bearing. Install axle shaft, bearing and shim and complete the assembly.

CAUTION

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

After axle shaft end play has been checked or corrected, install 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.

17. REMOVING BROKEN AXLE DRIVE SHAFT

Raise car, back off brake shoes, remove wheel, drum and axle drive shaft as outlined in Paragraph 3. If break is less than eight inches from splined end of shaft, it will be necessary to remove differential and carrier assembly. If break is more than eight 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 hoop.

CAUTION

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

Replace axle shaft and check rear axle end play, as outlined in Paragraph 15. Replace wheel hub and drum assembly and tighten axle shaft nuts to a minimum of 145 foot-pounds torque. Refill differential, and adjust brake shoes.

18. 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. Recent investigations, however, 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 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 to prevent damage. Instead of arc welding equipment, gas welding equipment should always be used on rear axle housing, unless the unit is completely disassembled.

19. 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 follows:

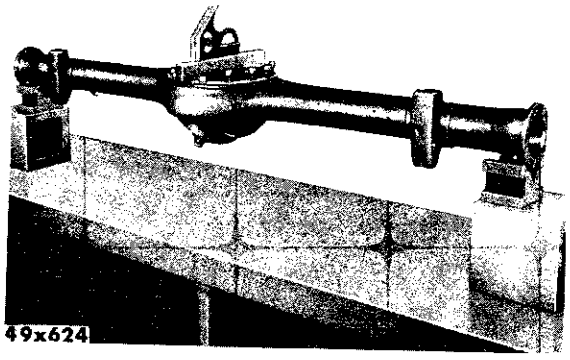


Fig. 44—Leveling Housing for Checking Alignment

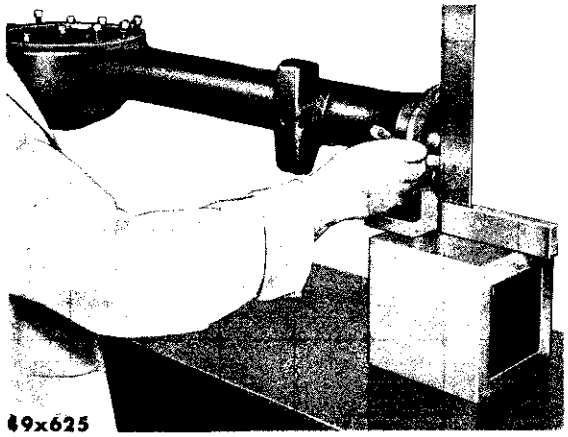


Fig. 45—Checking Horizontal Alignment

a. Checking Axle Housing for Horizontal Alignment

Place axle housing in "V" blocks—on surface plate. Turn housing until machined surface for carrier mounting is facing UP and perfectly level, as shown in Figure 44. Place square against machined surface of housing end flange and surface plate, as shown in Figure 45. Amount of housing misalignment will be indicated by 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

With housing in "V" blocks, turn housing until machined surface for carrier mounting is in a squared, vertical position, as shown in Figure 46. Place a square against machined surface of housing end flange and surface plate, as shown in Figure 47. Amount of housing misalignment will be indicated by thickness of feeler gauge between square and end flange at top or bottom. A housing that checks more than .007 inch should be replaced. To determine amount that axle is misaligned, multiply thickness of feeler stock used by the ratio of 4.7 to 1.

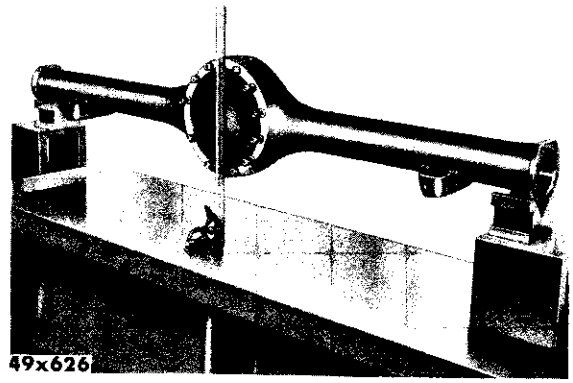


Fig. 46—Squaring Axle for Vertical Alignment

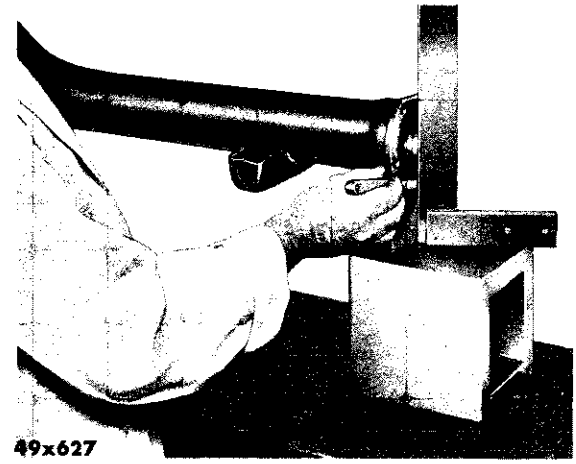


Fig. 47—Checking Vertical Alignment

SERVICE DIAGNOSIS

20. REAR AXLE NOISE

a. Check keyways for possible damage. Reset 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, XV 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.

21. NOISE IN REAR AXLE ASSEMBLY

a. Refer to Rear Axle Housing Alignment, Paragraph 19, in this section.

b. Replace bent or sprung axle shaft.

c. Refer to Pinion Bearing Pre-Load, Paragraph 9, in this section.

d. Refer to Backlash Adjustment, Paragraph 12, in this section.

e. Adjust pinion bearings, as outlined in Paragraph 8, a, 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 12, in this section.

22. REAR AXLE DRIVE SHAFT BREAKAGE

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 19, 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.

23. DIFFERENTIAL CASE BREAKAGE

a. Replace broken case and examine gears and bearings for possible damage. At reassembly, adjust differential bearings, as outlined in Paragraph 12, 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 inch, as outlined in Paragraph 12, in this section.

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

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

24. DIFFERENTIAL SIDE GEAR BROKEN AT HUB

a. Replace damaged gears. Examine other gears and bearings for possible damage. Check Rear Axle Housing Alignment, as outlined in Paragraph 19, in this section.

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

25. SCORING OF DIFFERENT GEARS

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 refill 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.

26. TOOTH BREAKAGE (DRIVE GEAR AND PINION)

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 inch. Refer to Gear Adjustment for Correct Tooth Contact, Paragraph 13, in this section.

27. 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 the 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.

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 13, 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 2, in this section.

d. Check teeth on drive gear and pinion for contact, as outlined in Gear Adjustment for Correct Tooth Contact, Paragraph 13, in this section. If necessary, replace with new matched set.

e. Adjust drive pinion bearings, as outlined in Paragraph 12, in this section.

f. Adjust differential bearings, as outlined in Paragraph 12, in this section.

g. Check drive gear for runout.

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

28. LOSS OF LUBRICANT

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.

c. Refer to Welding Rear Axle Housing, Paragraph 18, in this section.

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

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

29. OVER-HEATING OF UNIT

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 or 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 gear for possible scoring.

NOTE

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