

SECTION 4B

REAR AXLE DIFFERENTIAL CARRIER

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GENERAL INFORMATION

AXLE IDENTIFICATION

It is important to know which axle is being serviced, in order to use the correct overhaul procedure. The manufacturing code number on Passenger Car axles may be found on the axle tube close to the carrier. It is the third letter of the axle code. For example, if an axle had this axle number: HKP 218 DW, the manufacturer could be determined from the third letter, P. Truck axles are identified in this section by ring gear size.

The following chart lists pertinent information needed on Passenger Car and Series 10-30 Truck axles.

ALTERNATE PINION DEPTH SETTING PROCEDURE

A new pinion depth coding system facilitates the use of Pinion Setting Gauge J-21777-01, as outlined in later portions of this section. The coding system is used on passenger car differentials with 8-1/2 inch and 8-7/8 ring gears, on Corvette, and on truck models with 8-7/8 inch ring gears.

However, if J-21777-01 is **not** used in determining pinion depth shim requirements, the following tools and procedures are recommended. Only the steps of the procedures that differ from the J-21777-01 method are mentioned.

VEHICLE SERIES	RING GEAR SIZE			
	8-1/2	8-3/4	7-1/2	8-3/8
CHEVROLET	X	X	X	
CHEVELLE	X			
MONTE CARLO	X			
CAMARO	X			
NOVA			X	
CORVETTE				X

Fig. 4B-1A--Axle Usage Passenger Car

8-1/2" Ring Gear - Passenger Car

1. Set up the tools as shown in figure 4B-3A.
2. Preload the dial indicator one half revolution, with the plunger off the gauge plate, and tighten in this position.
3. Rest the plunger on the low gauging surface, marked Y.

MODEL	SOURCE	TYPE/CAPACITY	RING GEAR SIZE
C10	Chevrolet	Salisbury/3750#	8-7/8"
K10	Chevrolet	Salisbury/3750#	8-7/8"
K10	Chevrolet	Salisbury/4000#	8-7/8"
P10	Chevrolet	Salisbury/3500#	8-7/8"
G10	Chevrolet	Salisbury/3100#	8-7/8"
G10	Chevrolet	Salisbury/3100#	8-1/2"

C20 (Except Crew Cab)	Chevrolet	Salisbury/5700#	10-1/2"
C20 (Crew Cab)	Chevrolet	Salisbury/7500#	10-1/2"
K20	Chevrolet	Salisbury/5700#	10-1/2"
P20	Chevrolet	Salisbury/5700#	10-1/2"
G20	Chevrolet	Salisbury/3500#	8-7/8"

C30 (Except Dual Wheel Camper)	Chevrolet	Salisbury/7500#	10-1/2"
C30 (Dual Wheel Camper)	Dana	Salisbury/7500#	10-1/2"
P30	Chevrolet	Salisbury/7900#	10-1/2"
P30 (With H22/H23)	Chevrolet	Banjo/11,000#	12-1/4"
G30	Chevrolet	Salisbury/5700#	10-1/2"
G30 (Dual Wheel)	Dana	Salisbury/6200#	9-3/4"
G30 (Dual Wheel)	Dana	Salisbury/7500#	10-1/2"

Fig. 4B-2A--Axle Usage Truck

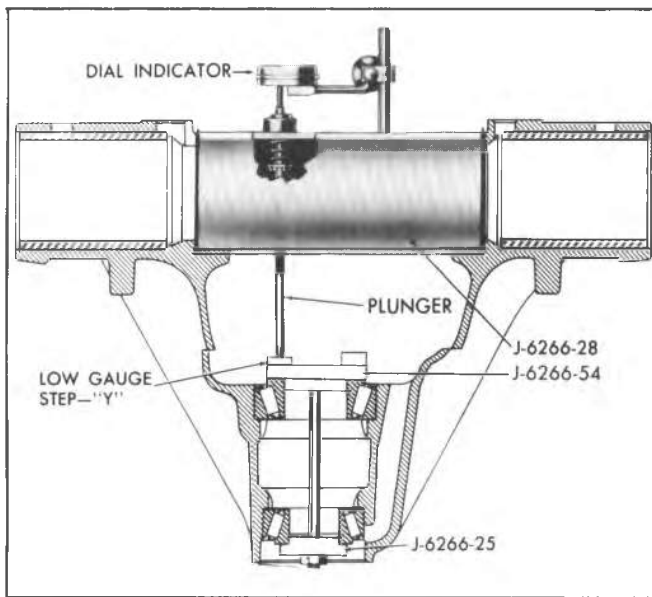


Fig. 4B-3A--Pinion Gauging Tools - 8 1/2" Ring Gear

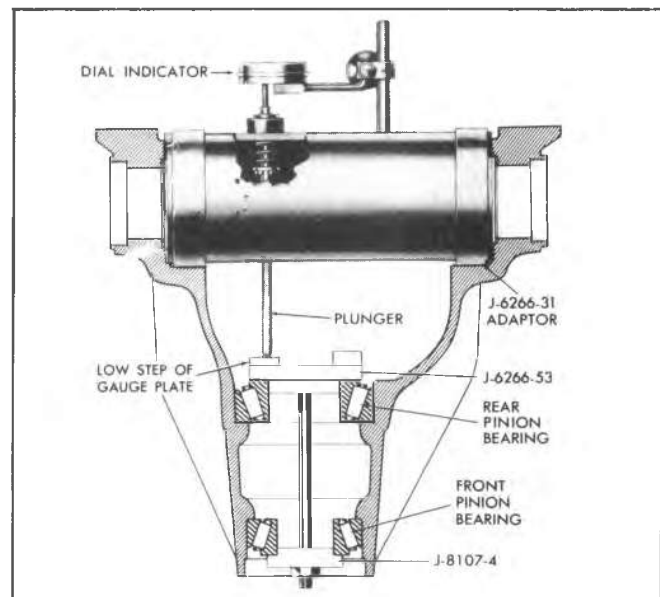


Fig. 4B-4A--Pinion Gauging Tools - Corvette

4. "Zero" the indicator on the highest spot of the gauging surface.

5. Swing the plunger off the plate and read the dial indicator. This reading is the required shim thickness for a nominal pinion.

6. If a pinion is coded +2, +1, -1, or -2, alter the shim thickness that many thousandths of an inch.

For example, if the indicator reading was .028, and the pinion code is -1, the required shim would be $.028 - .001 = .027$ inch.

Corvette and 8-7/8" Ring Gear - Truck

1. Set up the tools as shown in figures 4B-4A, and 4B-5A.

2. "Zero" the dial indicator **off** the gauge plate.

3. Swing the plunger across the plate until the highest reading is obtained. Record the result.

4. Combine the pinion code number with "45", which represents a nominal pinion. From that number, subtract the dial indicator reading. The result is the required shim thickness.

For example, if the reading was .016, and the pinion code was +2, the correct shim could be determined as follows: $45 + 2 = 47$; $.047 - .016 = .031$ inch.

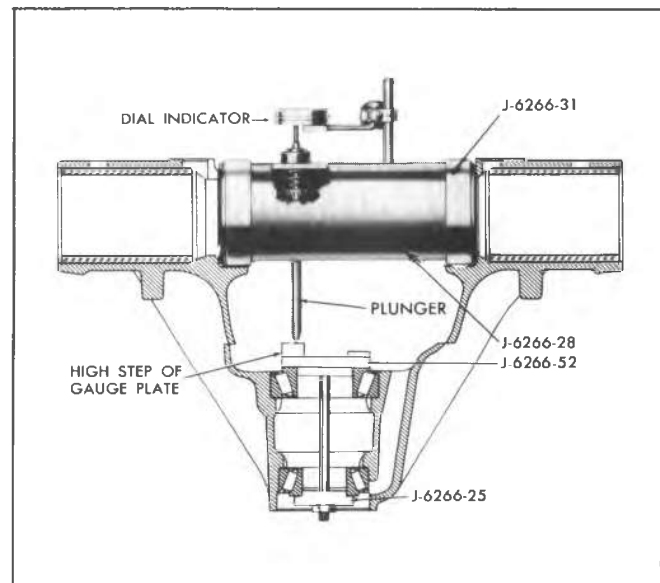


Fig. 4B-5A--Pinion Gauging Tools - 8-7/8" Truck

7-1/2", 8-1/2" and 8-3/4" RING GEAR

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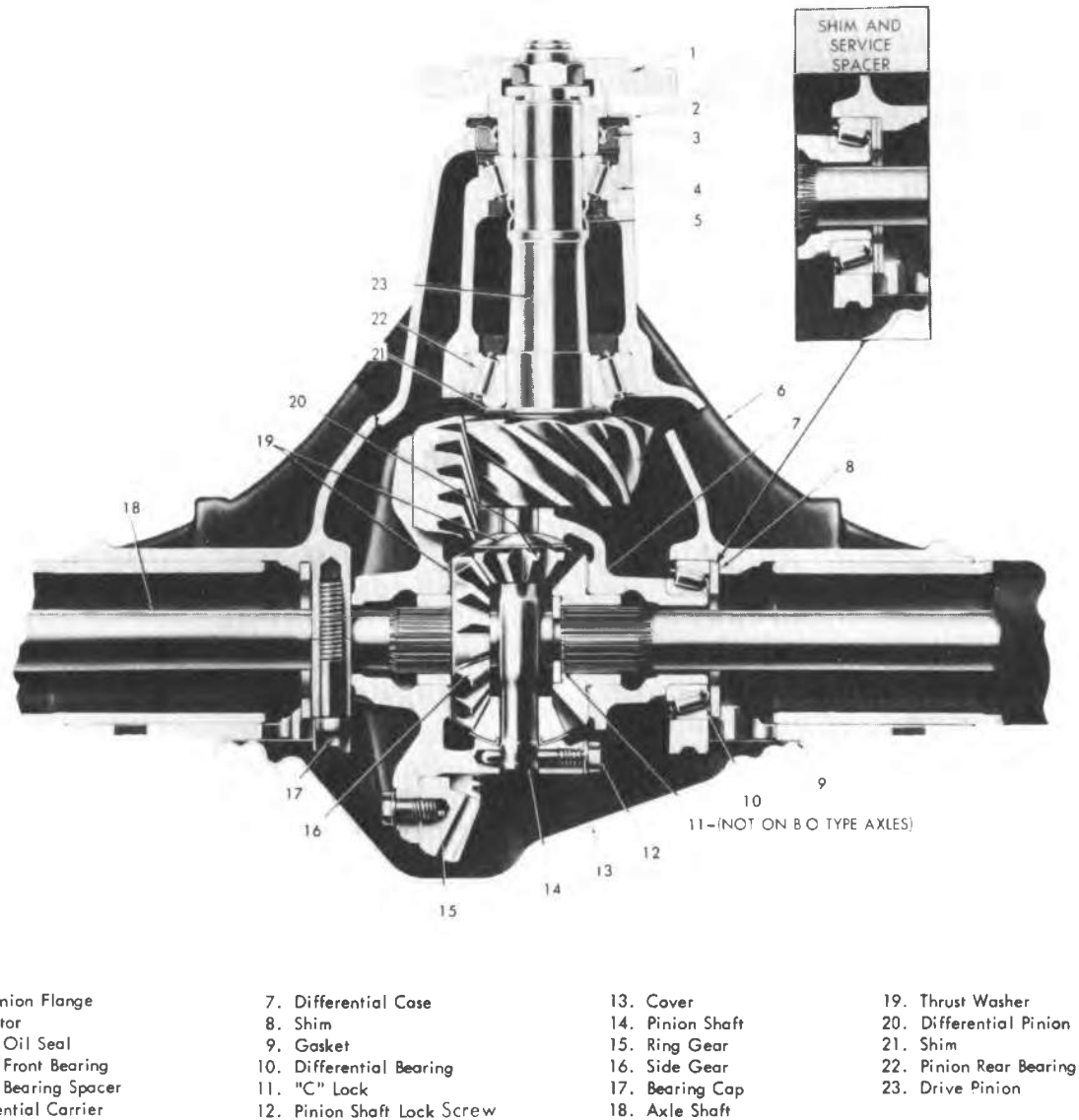


Fig. 4B-1--Cross Section of Typical Differential

DIFFERENTIAL CASE

Removal and Disassembly

NOTE: Before proceeding with following steps, it is advisable to check the existing ring gear to pinion backlash as described under "Checks and Adjustments". This will indicate gear or bearing wear or an error in backlash or pinion depth setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, they may be reinstalled at original lash to avoid changing gear tooth contact.

1. Remove screw that retains differential pinion shaft and remove pinion shaft.
2. Remove rear axle shaft.
3. Roll out the differential pinions and thrust washers; then remove side gears and thrust washers. Mark the pinions and side gears so they can be reassembled in their original

positions.

4. Mark side bearing caps for installation in same position during reassembly. Loosen bolts holding differential side bearing caps to housing.

CAUTION: Do not attempt to pry caps off as this may damage machined face of caps.

5. Using a pry bar as shown in figure 4B-2, pry differential case out of carrier. Exercise caution in prying on carrier so that gasket sealing surface is not damaged. If the bearings are preloaded, the case will suddenly fall free when it is pried past a certain point; therefore, make sure case is properly supported to prevent damage. The bearing cups may be loosely installed, as shown in figure 4B-2, to prevent case from falling.

6. Place right and left bearing outer races and shims in sets with marked bearing caps so that they can be reinstalled in their original positions.

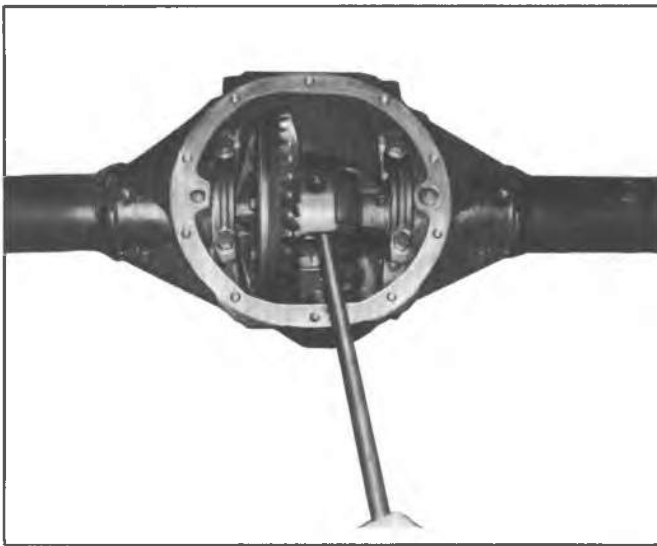


Fig. 4B-2--Differential Case Removal

Inspection

1. Clean all parts in cleaning solvent; inspect all bearing cups, races and rollers for scoring, chipping or evidence of excessive wear.
2. Inspect axle shaft and side gear for evidence of excessive wear.
3. Inspect hypoid ring gear and pinion teeth for possible scoring, cracking or chipping.
4. Inspect differential case, pinions, side gears, thrust washers and pinion shaft for cracks scoring, spalling or excessive wear.
5. Check fit of differential side gears in case.

Differential Bearing Replacement

1. Install side bearing remover and proper adapter plug tool J-22888-02 shown in figure 4B-3. Make sure that the puller legs are fitted securely in case notches, against inner race.
2. Tighten puller screw to remove bearing.
3. Place new bearing onto hub, with the thick side of the inner race toward the case. Drive the bearing into place, using J-22761 for 8-1/2" ring gear J-22175 for the 8-3/4" ring

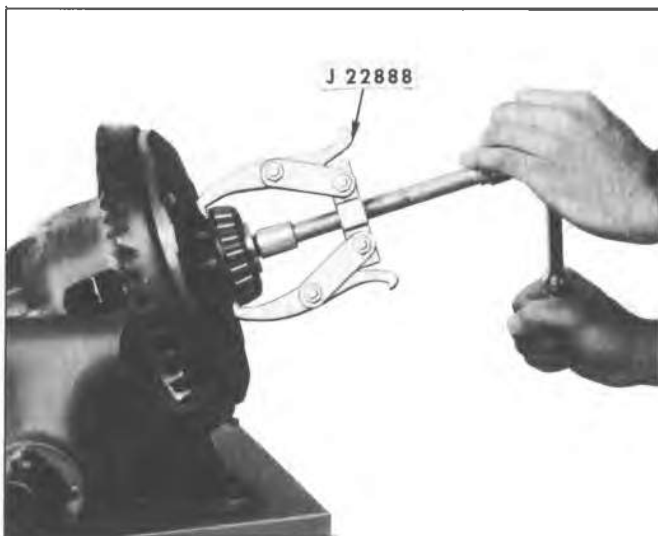


Fig. 4B-3--Differential Side Bearing Removal

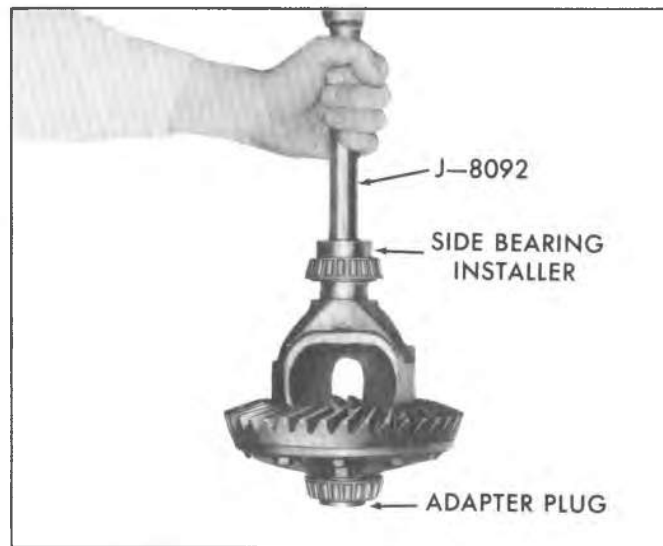


Fig. 4B-4--Differential Bearing Installation

gear, or J-25299 for 7-1/2" ring gear, as shown in figure 4B-4.

4. Before bearing installation on opposite hub, support differential case on proper adapter plug. This allows differential case to rest on adapter plug instead of bearing cage. Install other bearing as done in Step 3.

Ring Gear or Differential Case Replacement

1. Remove the ring gear screws (L.H. thread) and, using a soft drift and a hammer, tap ring gear off the case.

NOTE: Do not attempt to pry ring gear from case. To do so may damage machined surfaces.

2. Remove any nicks or imbedded dirt from case flange surface which mates with ring gear. Clean all surfaces.
3. Liberally coat the differential case pilot with hypoid lubricant. Pre-align ring gear and differential case bolt holes and press against proper adapter plug to initially start ring gear on case pilot, as shown in figure 4B-5.
4. Start all ring gear bolts during initial assembly to maintain bolt hole alignment. Draw up all bolts evenly, using a criss-cross pattern to avoid cocking the gear on the case.

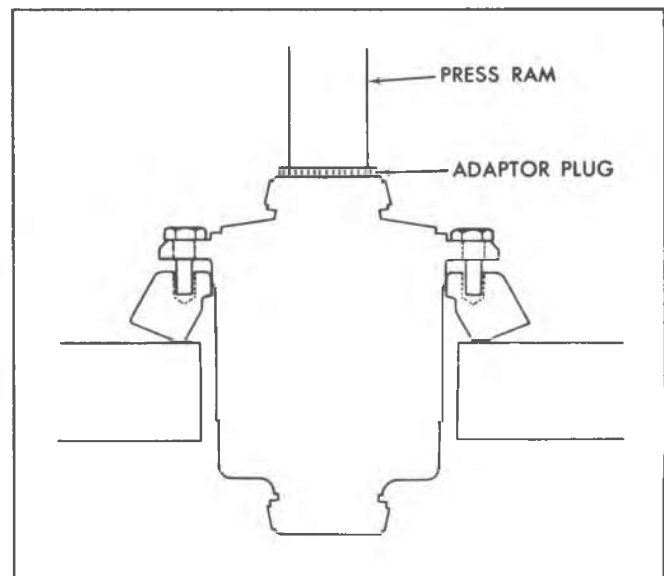


Fig. 4B-5--Ring Gear to Case Installation

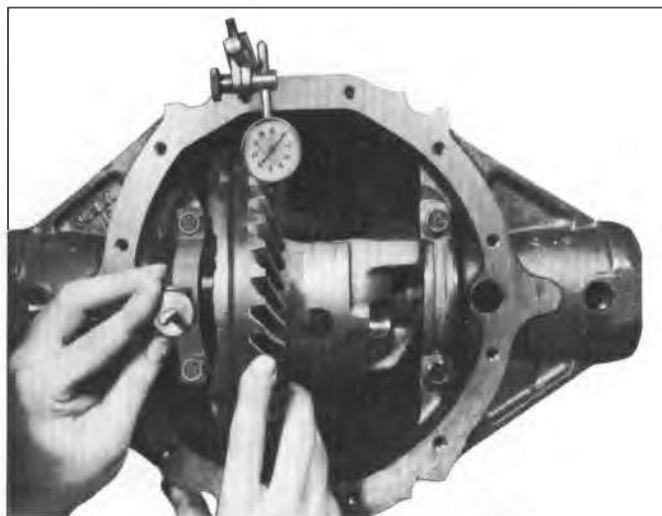


Fig. 4B-6--Installing Gauging Tool

5. Insure that gear is seated firmly against the case, then torque all bolts to 50 lb. ft.

Reassembly

1. Install thrust washers and side gears into case. If original parts are being reused, replace in original positions.
2. Position pinions and thrust washers through loading hole in case 180° apart so that they engage side gears.
3. Rotate gears until the differential pinion bores and the case shaft holes are aligned.
4. Install pinion shaft and lock screw. It is not necessary to torque lock screw until axle shafts are installed.
5. Differential may be installed in carrier now, or after service is performed on the drive pinion.

Installation and Adjustment

1. Check condition of bearing, bearing cups, cup seat in carrier and carrier caps to make sure that they are free from nicks, burrs and foreign material.
2. Lubricate bearings with axle lubricant; position cups on proper bearing, then install differential assembly in carrier and support the assembly to prevent it from falling.
3. For 8-1/2" and 8-3/4" ring gear:
 - a. Install strap J-22779-6 on left bearing by tightening bearing bolts alternately and evenly to snug fit.

With the ring gear tight against the pinion gear (.000" to .001" backlash), insert gauging Tool J-22779 between the left bearing cup and carrier housing. See Figure 4B-6.

While oscillating tool, turn adjusting nut clockwise until a noticeable drag is produced.

Tighten lock bolt on side of tool.

- b. For 7-1/2" ring gear:

Position the ring gear tightly against the drive pinion (zero backlash). Being sure that the bearings are properly seated, install a Service Spacer A (.160 inch), Service Shim B and Feeler Gauge C, as shown in the ring gear side of Figure 4B-7. The thickness of the Feeler Gauge must be sufficient to produce a slight "drag" when moved between the carrier and the Service Shim.

4. Between the right bearing and carrier, install Service Spacer A (.170 for the 8-1/2" and 8-3/4" ring gear, .160 for the 7-1/2" ring gear, Service Shim B, and Feeler Gauge C. Thickness of Feeler Gauge must be sufficient to produce a slight "drag" when moved between carrier and Service Shim.

Now measure the above dimensions as shown in Figure 4B-8, for 8-1/2" and 8-3/4" ring gear, figure 4B-7 for the 7-1/2" ring gear.

5. For the 8-1/2" and 8-3/4" ring gear: Using a micrometer as in Figure 4B-9, measure the thickness of J-22779 in a minimum of three places and average these readings. Record the result.

Add together the dimensions of the Service Shim, Service Spacer and Feeler Gauge. Record the result.

For the 7-1/2" ring gear: Add together the dimensions of the Service Shim, Service Spacer and Feeler Gauge. Record the result for each side.

6. Use the sample procedure in Figure 4B-8 for the 8-1/2" and 8-3/4" ring gear, Figure 4B-7 for the 7-1/2" ring gear to determine the proper thickness for each shim pack.

NOTE: Production preloading of the differential bearings is accomplished by the use of cast iron preload shims. These shims cannot be used when rebuilding the carrier as they may break when tapped into place.

For proper bearing preload, the shims must not be installed loosely, nor should they require undue force for installation.

7. Install left shim first, then wedge right shim between bearing cup and spacer (position shim so that chamfered side is outward or next to spacer). If shim does not have sufficient chamfer or lead around O.D. to allow easy installation without scraping spacer, file or grind chamfer before installing.

8. If difficulty is encountered in installing shim, partially remove case slide case and shim into position. Tap shim into position, using soft faced hammer, while rotating differential case with free hand. See Figure 4B-10.

9. Install bearing caps in original position and torque to 60 ft. lbs. for the 8-1/2" and 8-3/4" ring gear, 55 ft. lbs. for the 7-1/2" ring gear.

NOTE: At this point, the differential side bearings are properly preloaded. If any adjustments are required in later procedures, make sure that preload remains established. If backlash is changed, be sure that total thickness of two shim packs does not change.

10. Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, as shown in Figure 4B-11. The backlash should be within the range of 0.005"-0.008". Check gear lash at four different equally spaced positions around the gear. Variation in readings should not exceed .002".

NOTE: Position the dial indicator so that indicator button is perpendicular to tooth angle and in line with gear rotation.

11. If variation in backlash readings exceeds .002", measure ring gear and case runout as shown in Figure 4B-12. Gear runout should not exceed .003", should runout exceed this limit check ring gear and case for deformation and/or foreign matter between case and gear.

12. If gear lash is not within limits, correct by decreasing shim thickness on one side and increasing thickness of other shim the same amount. Total shim thickness must be maintained at all times to maintain proper preload.

13. Backlash changes approximately .002" for each .003" change in shim dimensions. If backlash exceeds .008", increase the shim thickness on ring gear side, while decreasing shim thickness on opposite side an equal amount. If backlash is less than .005", decrease the shim thickness on ring gear side, while increasing shim thickness on opposite

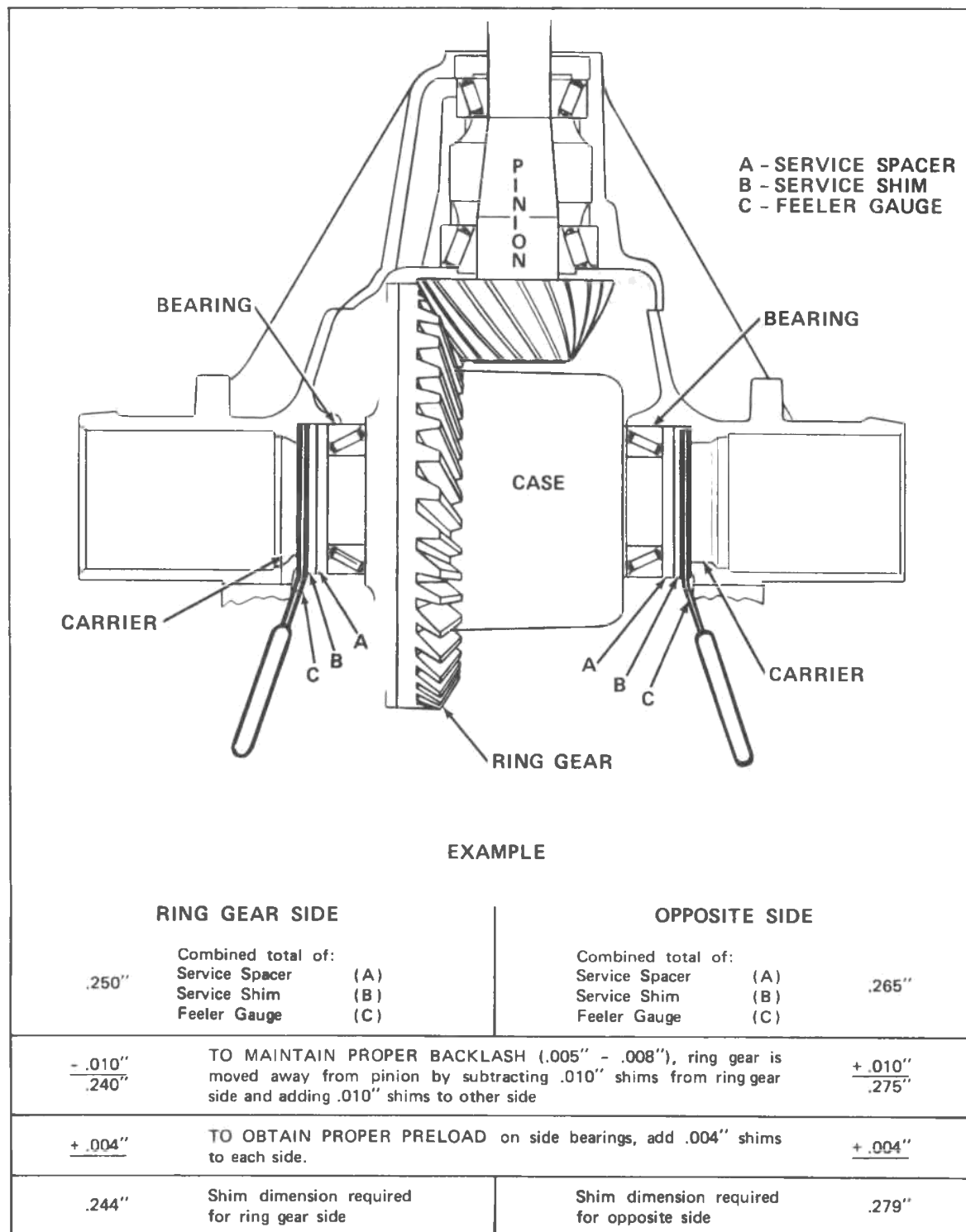


Fig. 4B-7--Determining Side Bearing Shim Requirements 7-1/2"

side an equal amount.

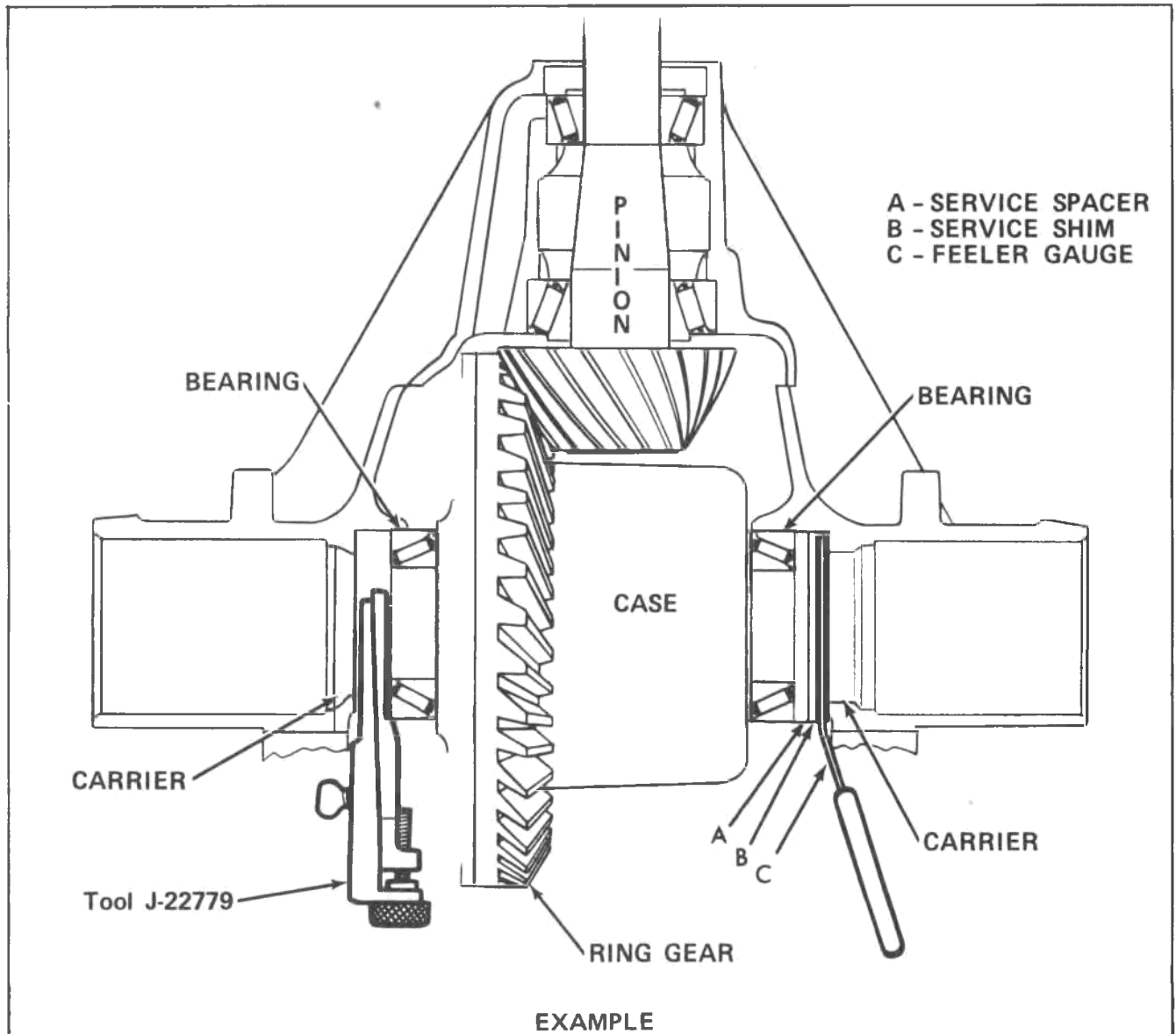
DRIVE PINION

Removal

1. Remove differential as previously outlined.
2. Check torque required to rotate drive pinion as described under "Drive Pinion - Installation and Adjustment". If there is no torque reading, check for looseness of pinion assembly by shaking (push-pull) the

companion flange. Looseness indicates the need for bearing replacement.

3. Install Holder J-8614-11 on flange by using two bolts with flat washers, as shown in figure 4B-13. Position J-8614-11 on flange so that the four notches are toward the flange.
4. Remove pinion nut and washer.
5. Thread end of J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-11 installed as in step 3, insert J-8614-2 into J-8614-11 and turn it 1/8 of a turn to locked position.



RING GEAR SIDE		OPPOSITE SIDE	
.250"	Thickness of Tool J-22779 required to force ring gear into contact with pinion	Combined total of: Service Spacer (A) Service Shim (B) Feeler Gauge (C)	.265"
$-.010"$ <u>.240"</u>	TO MAINTAIN PROPER BACKLASH (.005" - .008"), ring gear is moved away from pinion by subtracting .010" shims from ring gear side and adding .010" shims to other side		$+.010"$ <u>.275"</u>
$+.004"$ <u></u>	TO OBTAIN PROPER PRELOAD on side bearings, add .004" shims to each side.		$+.004"$ <u></u>
.244"	Shim dimension required for ring gear side	Shim dimension required for opposite side	.279"

Fig. 4B-8--Side Bearing Shim Requirements 8-1/2" and 8-3/4"



Fig. 4B-9--Measuring Gauge Thickness

Remove flange by turning J-8614-3 while holding J-8614-11 as shown in figure 4B-14.

6. To remove the drive pinion, first thread the original pinion nut half-way on the pinion, for thread protection.

7. Place the differential cover temporarily back onto the housing, using two screws. This will prevent the pinion from falling to the floor during removal.

8. Tap the end of the pinion nut with a large hammer and a soft drift, as shown in figure 4B-15.

NOTE: Care must be taken not to damage pinion bearings while removing pinion from carrier. Inspect bearings and cups for damage and replace if needed.

9. Remove the pinion oil seal and the front pinion bearing. Remove the cover and retrieve the drive pinion from the housing. Discard the pinion oil seal, nut and collapsible spacer. Use a new seal, nut and spacer on reassembly.



Fig. 4B-10--Installing Differential Shim

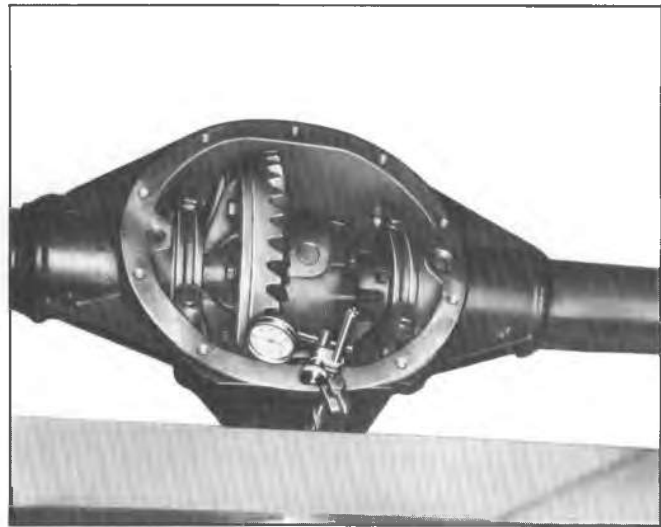


Fig. 4B-11--Checking Ring Gear Backlash

Bearing Removal and Cup Replacement

1. If front pinion bearing is to be replaced, drive outer race from carrier using drift in slots provided for this purpose. Tap alternately on opposite sides of bearing cup to avoid cocking.

2. If rear pinion bearing is to be replaced, drive outer race from carrier using a drift in slots provided for this purpose.

3. Remove rear pinion bearing from pinion shaft using rear pinion bearing remover J-8612 for the 8-1/2" ring gear, and the 8-3/4" ring gear, and J-25320 for the 7-1/2" ring gear. See figure 4B-16.

Tighten nuts on tool until plates are under the bearing inner race. Then, set tool on press. Make sure the plates straddle opening on press. Do not position bolts across opening. To do so may bend the bolts when pressure is applied. Press bearing from pinion. Record thickness of shim removed from between bearing and pinion head.

4. Inspect carrier pinion bearing bores and shoulders for nicks. Remove as necessary. Clean the bores and the installation tools.

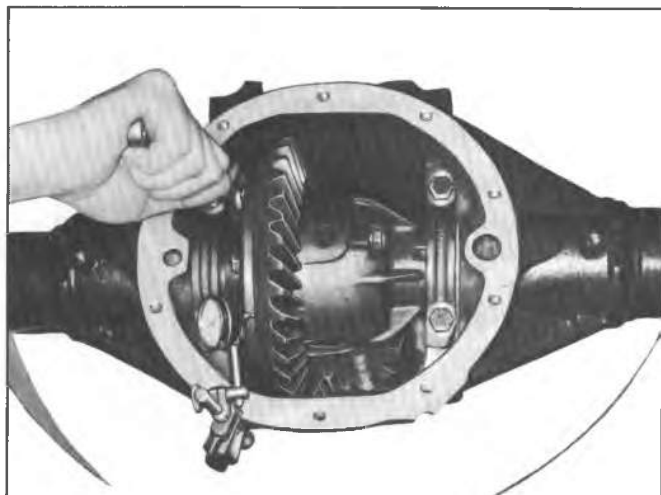


Fig. 4B-12--Checking Ring Gear Runout

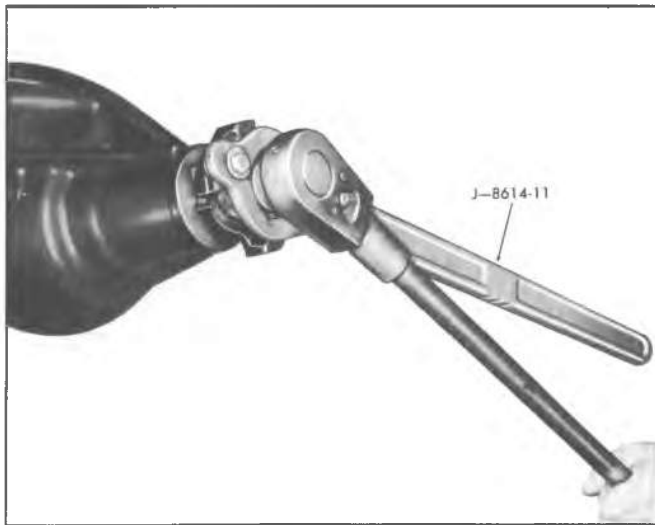


Fig. 4B-13--Drive Pinion Nut Removal

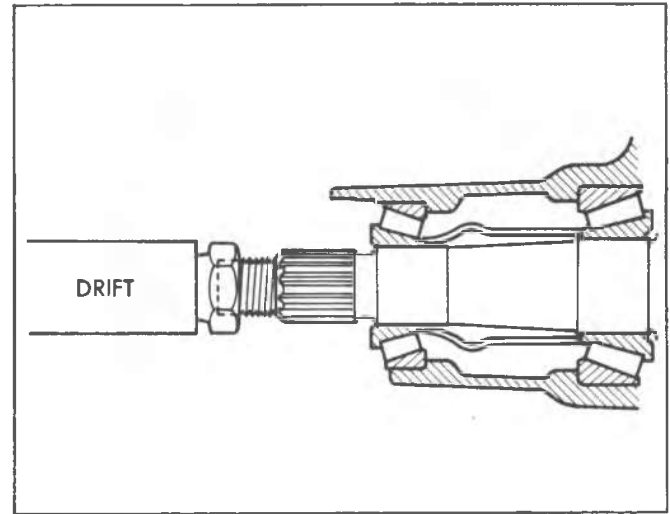


Fig. 4B-15--Removing Drive Pinion

5. Lubricate both outer cups with liberal amounts of hypoid lubricant.

6. Install the rear cup, with the large end against the bore shoulder, using Rear Pinion Bearing Cup Installer J-8608 for the 8-1/2" ring gear and the 8-3/4" ring gear, J-7818 for the 7-1/2" ring gear, as shown in figure 4B-17.

7. Install the front cup, with the large end against the bore shoulder, using Installer J-7137 as shown in figure 4B-18.

8. Check both bores to make sure cups are fully seated.

Setting Pinion Depth and Installing Pinion Bearings

NOTE: If the original ring gear and pinion and the pinion rear bearing assembly are to be reinstalled, the original shim thickness may be used.

Ring and pinion gear sets are matched in a special test machine which permits adjustment of pinion depth in ring gear until a point is reached where best operation and proper tooth contact under load is obtained. At this point, the setting of the pinion with reference to the centerline of the ring gear is indicated by the machine. This setting may vary slightly

from the design or "nominal" setting due to allowable variation in machining the parts. When a pinion is found having a plus or minus reading recorded in thousandths on the rear face of the pinion, this indicates that the pinion during testing was found to have best tooth contact at a position varying from design or nominal depth.

In order to compensate for all of the allowable machining variables, a procedure of gauging the carrier and shimming the pinion has been developed. After gauging a carrier, the assembler must install the appropriate shim between the drive pinion shoulder and rear bearing so that pinion depth can be adjusted to the required position for best tooth contact in each axle assembly.

Proper pinion depth is determined with Pinion Setting Gauge J-21777-01 for the 8-1/2" and 8-3/4" ring gear, gauge J-23597-01 for the 7-1/2" ring gear.

1. Clean the housing assembly and all gauge parts to insure accurate measurements.

2. Lubricate front and rear pinion bearings which will be used in final assembly and position them in their respective races in the carrier.

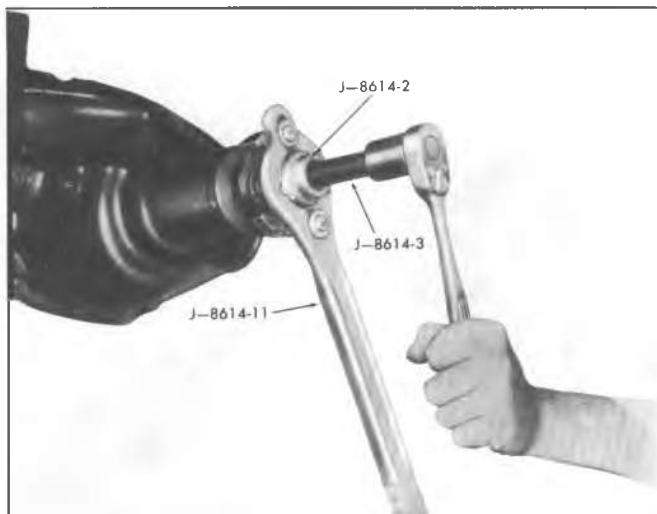


Fig. 4B-14--Drive Pinion Flange Removal



Fig. 4B-16--Removing Drive Pinion Rear Bearing Typical

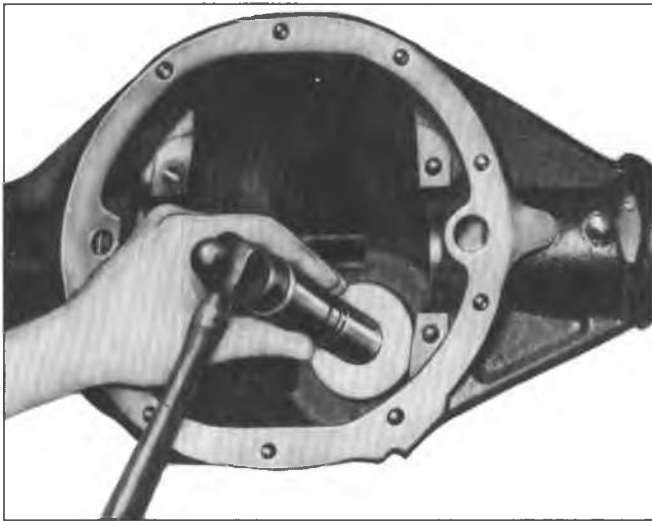


Fig. 4B-17—Installing Pinion Rear Bearing Cup

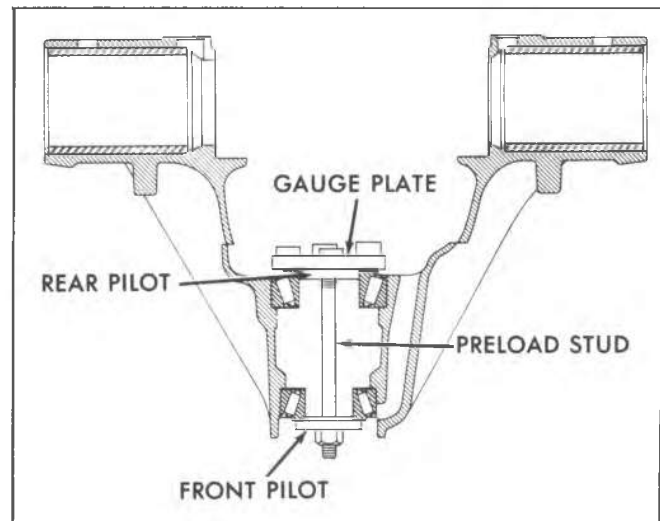


Fig. 4B-19—Gauge Plate Installed

3. Position gauge plate J-21777-29 on preload stud J-21777-43 (8-1/2" and 8-3/4" ring gear) J-23597-11 on preload stud J-21777-43 (7-1/2" ring gear), insert stud through rear bearing and pilot J-21777-35 (8-1/2" and 8-3/4" ring gear) J-23597-12 (7-1/2" ring gear) and through front bearing and pilot J-21777-42. Insert the hex nut until snug and rotate the bearings to make sure they are properly seated. See figure 4B-19 for illustration of proper positioning.

4. Hold the preload stud stationary with a wrench on the flats and tighten hex nut until 20 in. lbs. of torque are required to rotate the bearings as shown in figure 4B-20.

5. Mount the side bearing discs J-21777-45 on the ends of arbor J-21777-1 (8-1/2" and 8-3/4" ring gear). Side bearing discs J-21777-45 on the ends of arbor J-23597-1 (7-1/2" ring gear), using the step of the disc that corresponds to the base of the carrier.

6. Place the arbor and plunger assembly into the carrier, being sure the side bearing discs are seated properly.

7. Install the bearing caps finger tight to prevent the discs from moving.

8. Position dial indicator J-8001 on the mounting post

of the arbor with the contact button resting on the top surface of the plunger.

9. Preload the dial indicator one half revolution and tighten in this position.

10. Place the plunger onto the gauge plate. For 8-1/2" and 8-3/4" ring gear select the button on the gauge plate that corresponds to the ring gear size and rotate the plate until the plunger rests directly upon that button.

11. Rock the plunger rod slowly back and forth across the button until the dial indicator reads the greatest deflection. At this point, set the dial indicator to zero. Tools will now be positioned as shown in figure 4B-21.

NOTE: Select the gauging button that corresponds to the ring gear size for the 8-1/2" and 8-3/4" ring gear.

It is important to use a dial indicator correctly when determining pinion depth requirements. Be sure to record the number indicated by the indicator needle; do not record the amount of travel of the needle.

After "zeroing" the dial indicator on the highest point of deflection on the gauge plate, the indicator probe is swung off the gauge plate, allowing the needle

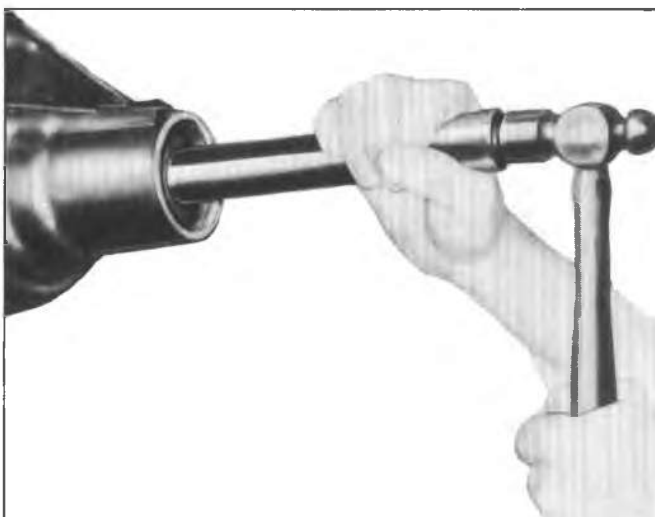


Fig. 4B-18—Installing Pinion Front Bearing Cup

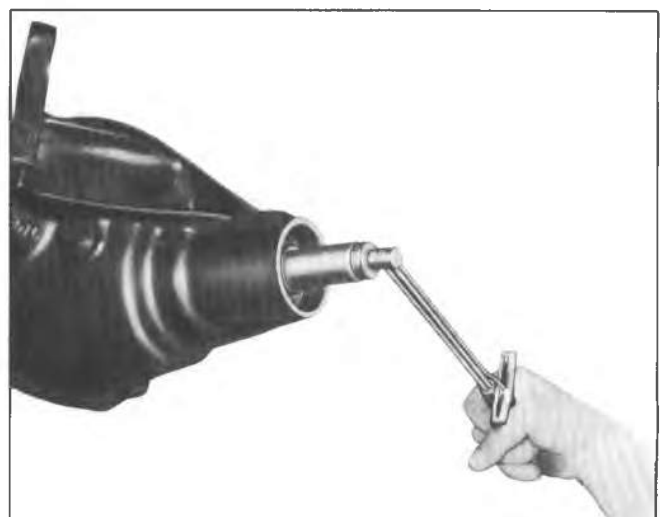


Fig. 4B-20—Measuring Rotating Torque

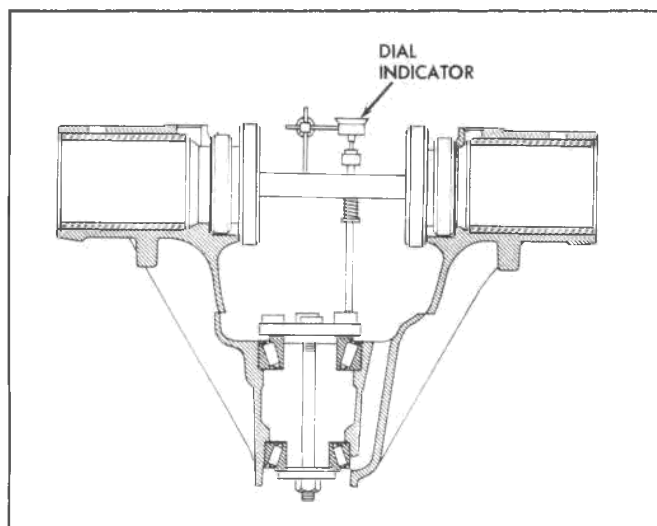


Fig. 4B-21--Depth Gauge Installed in Position Typical

to move. The number which the needle points toward is the correct shim thickness required for a nominal pinion. See figure 4B-22.

12. Repeat the rocking action of the plunger several times to verify the setting.

13. Once the zero reading is obtained, swing the plunger until it is removed from the gauging plate button.

The dial indicator will now read the required pinion shim thickness for a "nominal" pinion. Record this size.

14. Check the rear face of the drive pinion being installed for a pinion code number. This number indicates the necessary alteration of the pinion shim thickness as determined in step 13.

a. If the pinion is stamped with a plus + number, add that many thousandths to the indicator reading. For example, if indicator reading is .019, and pinion is marked +2, the correct depth shim for installation will be $.019 + .002 = .021$ inch.

b. If the pinion has no plus + or minus - number, use the indicator reading as the correct shim thickness.

c. If the pinion is stamped with a minus (-) number, subtract that many thousandths from the indicator reading. For example, if the indicator reading is .031, and pinion is marked (-3), the correct depth shim for installation will be $.031 - .003 = .028$ inch.

15. Remove bearing caps and depth gauging tools from carrier.

16. Position the shim selected in step 14 on the pinion shaft against pinion head.

17. Lubricate the rear pinion bearing with liberal amounts of hypoid lubricant and install rear bearing onto pinion using J-8609-01 (8-1/2" and 8-3/4" ring gear) J-5590 (7-1/2" ring gear) as shown in figure 4B-23.

Installation and Adjustment

1. Lubricate the front bearing with liberal amounts of hypoid lubricant, and place into outer cup.

2. Place a new pinion oil seal into position in carrier bore. Tap lightly with a protective plate and a hammer until seal flange seats against carrier, as shown in figure 4B-24.

3. Coat lips of pinion oil seal and seal surface of pinion flange with gear lube.

4. Install a new pinion bearing spacer onto the drive

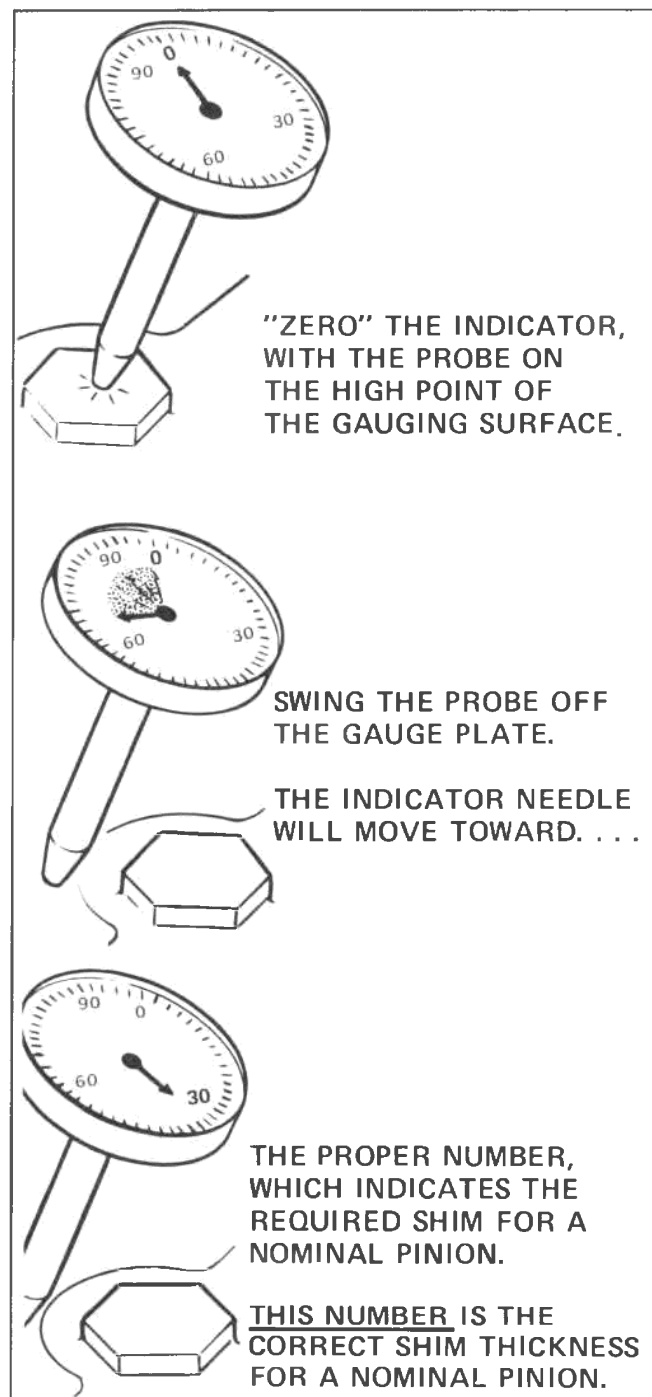


Fig. 4B-22--Use of Dial Indicator

pinion.

5. Remove nut and sleeve from Companion Flange Installer J-9458. Screw J-9458 onto drive pinion and insert assembly into housing.

6. Position companion flange onto drive pinion. Install sleeve and nut onto J-9458.

7. Install Companion Flange Holding Tool J-8614-11. See Figure 4B-25.

8. Tighten nut on Tool J-9458 which draws drive pinion through front bearing and companion flange. Tighten only until end play is removed from drive pinion then remove Tool J-9458.

NOTE: When no further end play is detectable, and

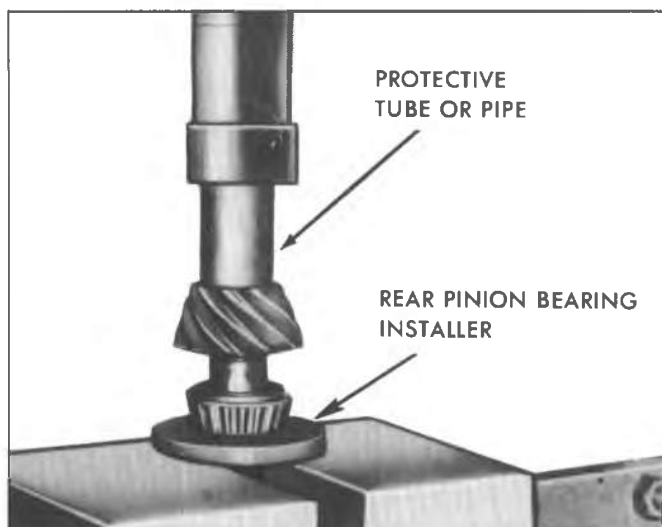


Fig. 4B-23--Drive Pinion Rear Bearing Installation

when Holder J-8614-11 will no longer pivot freely as pinion is rotated, bearing preload specifications are being neared. Further tightening should be done only after nut and washer installation and preload has been checked with a torque wrench.

9. Lubricate cavity between end of pinion splines and pinion flange with a non-hardening sealer (such as Permatex Type A or equivalent) and install washer. Lubricate new nut threads with a liberal amount of hypoid lubricant, and install on pinion snugly.

10. Check preload by using an inch pound torque wrench such as J-5853 as shown in Figure 4B-26.

NOTE: After torque has been checked, final tightening should be done very cautiously. For example, if when checking, torque was found to be 5 inch pounds, additional tightening of the pinion nut as little as 1/8 turn can add 5 additional inch pounds drag. Therefore, the pinion nut should be further tightened only a little at a time and torque should be checked after each slight

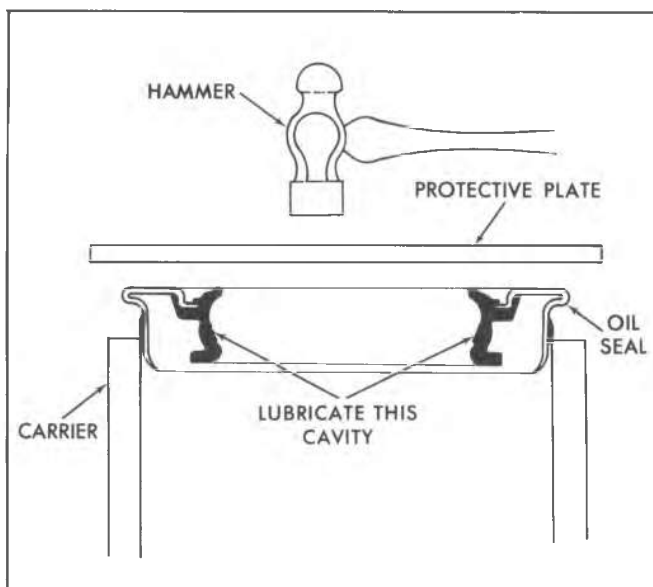


Fig. 4B-24--Installing Pinion Oil Seal

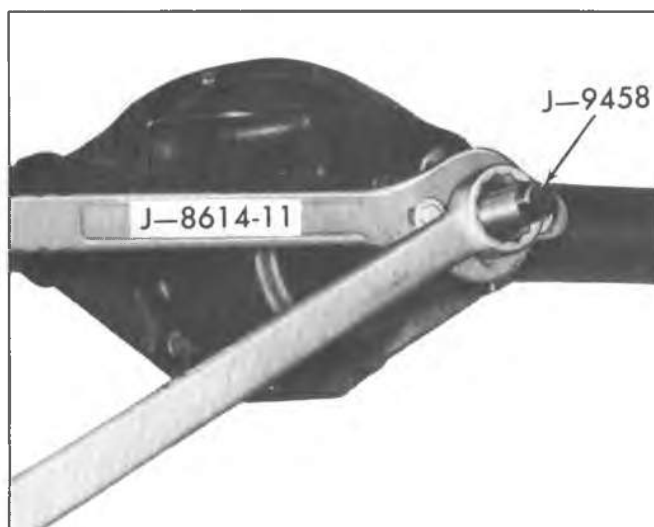


Fig. 4B-25--Drive Pinion Flange Installation

amount of tightening. Exceeding torque specifications may compress the collapsible spacer too far and require its replacement.

11. While observing the preceding caution, carefully set preload drag at 20-25 in lb. on new bearings or 10-15 in. lb. on reused bearings.

12. Rotate pinion several times to assure that bearings have been seated. Check preload again. If drag has been reduced by rotating pinion, re-set preload to specification.

CHECKS AND ADJUSTMENTS

Four adjustments are essential for proper operation of the differential and its related parts. These adjustments are a) Pinion Bearing Preload, b) Side Bearing Preload c) Pinion Depth and d) Ring Gear-to-Pinion Backlash.

Pinion Bearing Preload is set to specifications in step 11 of "Drive Pinion- Installation and Adjustment".

Side Bearing Preload is set to specifications in step 6 of "Differential Case-Installation and Adjustment".

Following service to the Differential Case or to the Drive Pinion and Ring Gear, a Gear Tooth Contact Pattern Check must be made to verify the accuracy of the work in setting

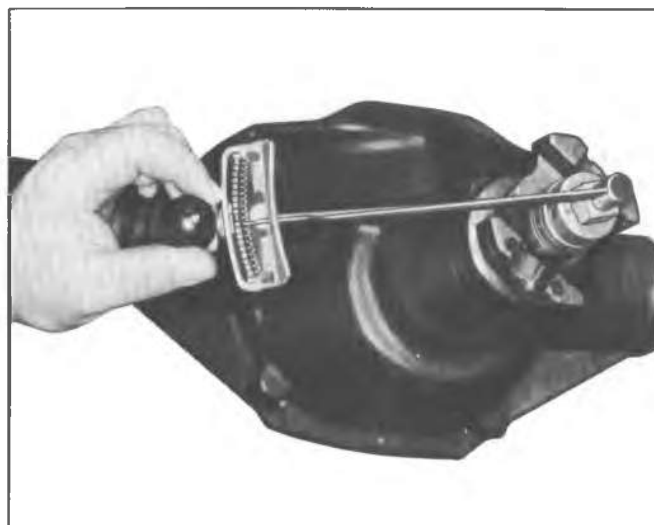


Fig. 4B-26--Measuring Rotating Torque

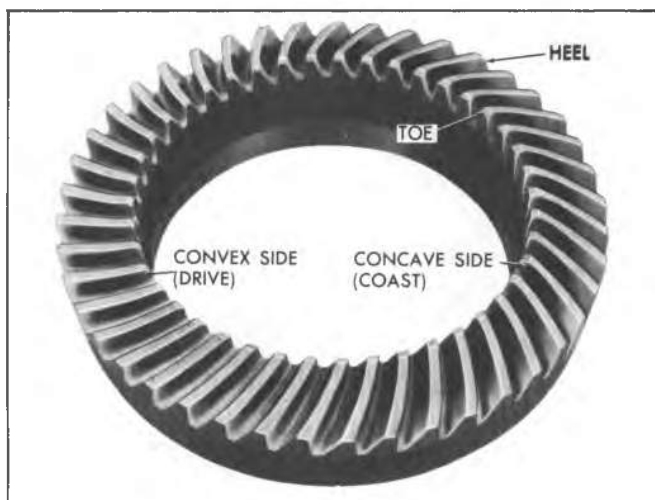


Fig. 4B-27--Gear Tooth Nomenclature

the pinion depth and ring gear-to-pinion backlash.

Gear Tooth Contact Pattern Check

Prior to final assembly of the differential, a Gear Tooth Contact Pattern Check is necessary to verify the correct relationship between ring gear and drive pinion. Gear sets which are not positioned properly may be noisy, or have short life, or both. With a pattern check, the most desirable contact between ring gear and drive pinion for low noise level and long life can be assured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end. The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. See Figure 4B-27.

Test

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.

2. Use gear marking compound and apply this mixture sparingly to all ring-gear teeth using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.

3. Tighten bearing cap bolts to 55 lb. ft.

4. Expand brake shoes until a torque of 20-30 lb. ft. is required to turn the pinion.

NOTE: A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with wrench so that ring gear rotates one full revolution then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear is not recommended.

5. Observe pattern on ring gear teeth and compare with Figure 4B-28.

Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern. These are backlash and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on hand loaded teeth pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

NOTE: It may be necessary to adjust both pinion depth and backlash to obtain the correct pattern.

The position of the drive pinion is adjusted by increasing or decreasing the shim thickness between the pinion head and inner race of rear bearing. The shim is used in the differential to compensate for manufacturing tolerances. Increasing shim thickness will move the pinion closer to centerline of the ring gear. Decreasing shim thickness will move pinion farther away from centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims which moves the entire case and ring gear assembly closer to, or farther from the drive pinion. (The adjusting shims are also used to set side bearing preload). To increase backlash, increase right shim and decrease left shim an equal amount. To decrease backlash, decrease right shim and increase left shim an equal amount.

The important thing to note is that the contact pattern is centrally located up and down on the face of the ring gear teeth.

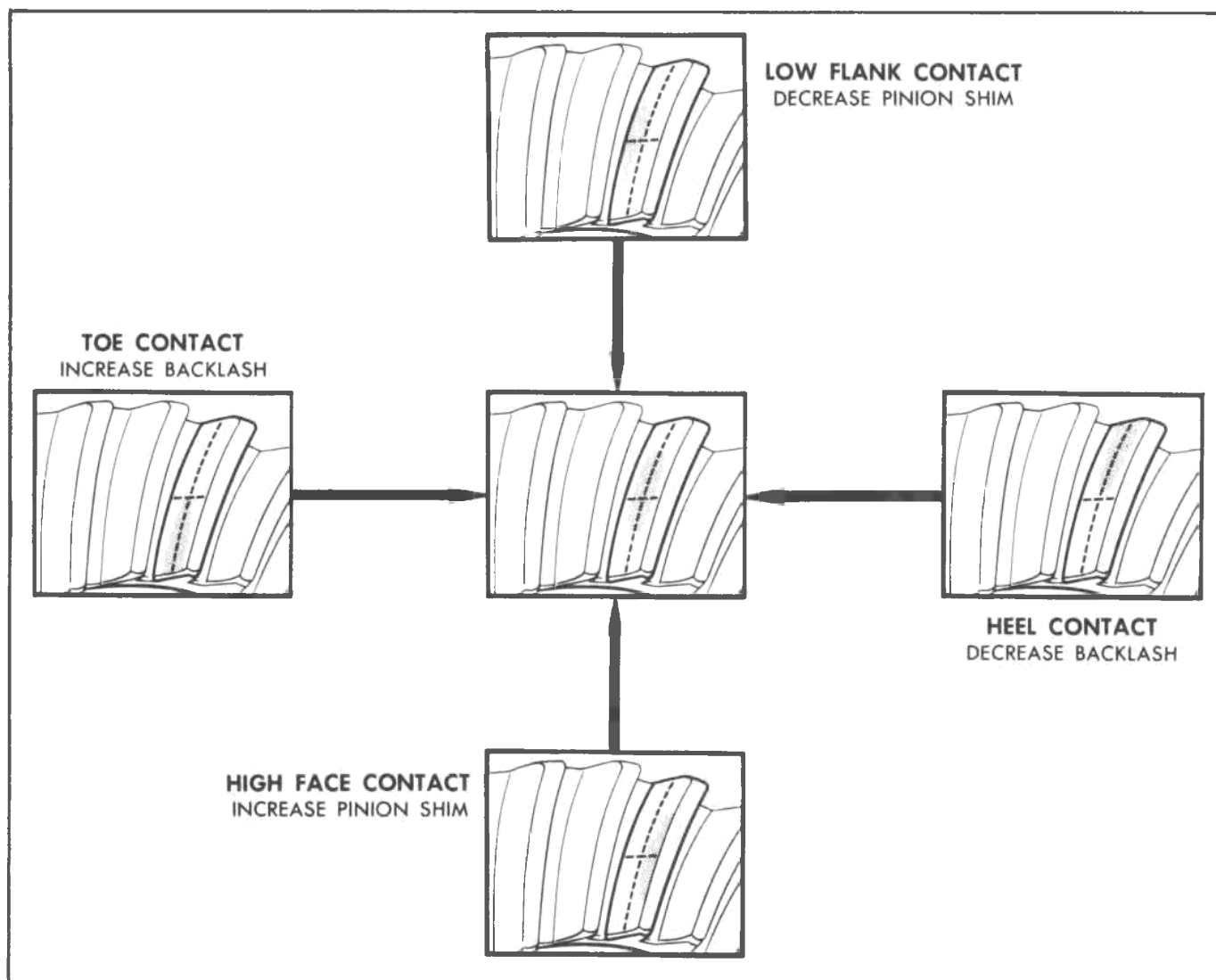


Fig. 4B-28--Gear Teeth Contact Pattern Check

SERIES 10 TRUCK DIFFERENTIAL

8-7/8" RING GEAR

INDEX

Differential Case		Drive Pinion		Checks and Adjustments	
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Side Bearing Repl.	4B-16	Setting Pinion Depth	4B-21	Pinion Depth and Backlash	4B-25
Ring Gear Repl.	4B-16	Installation and Adjustments	4B-23	Gear Tooth Contact Pattern	
Installation and Adjustment	4B-17			Check	4B-25

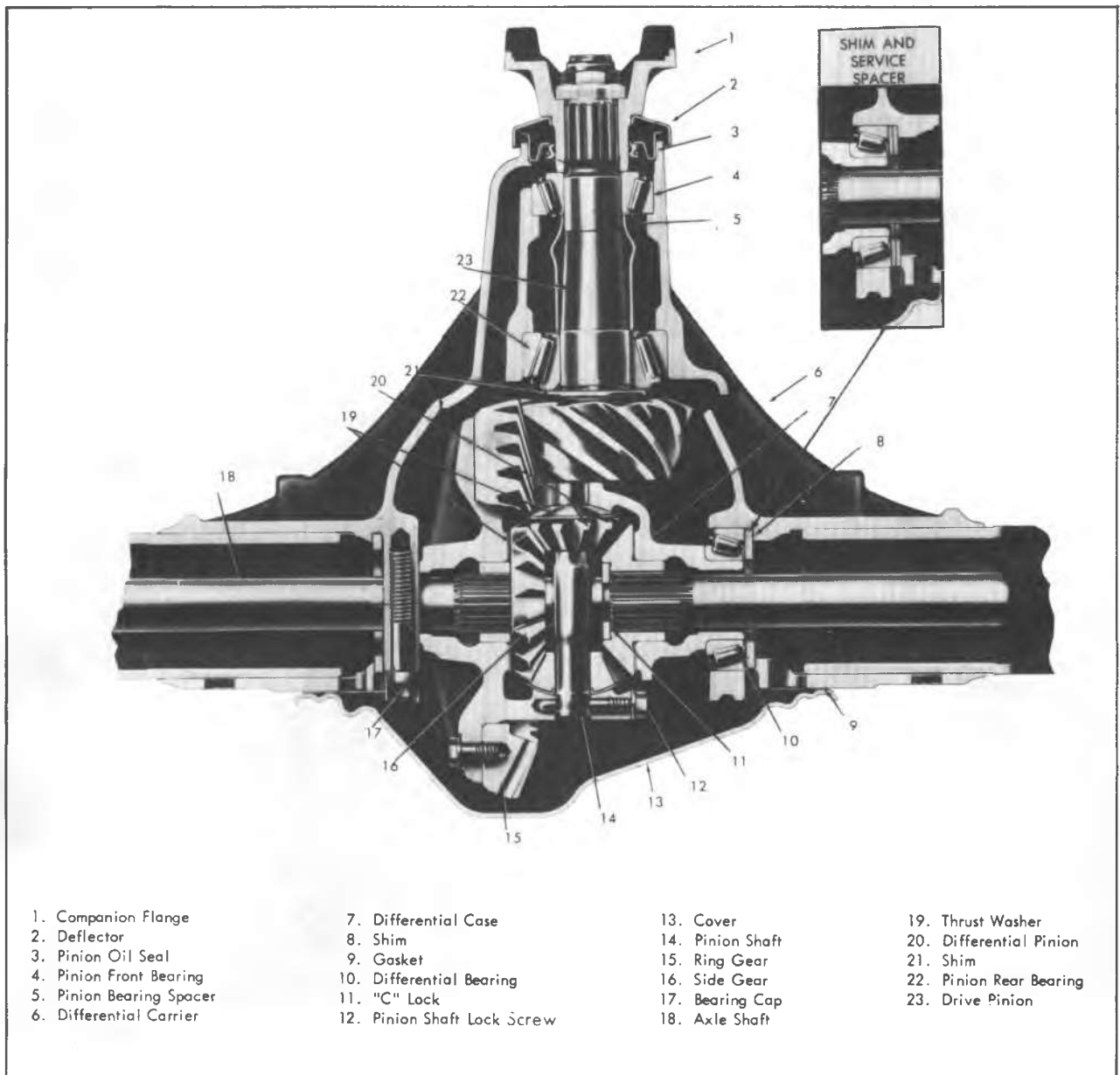


Fig. 1B—Cross Section of Differential with 8 7/8" Ring Gear

DIFFERENTIAL CASE

Removal and Disassembly

NOTE: Before proceeding with following steps, it is advisable to check the existing ring gear to pinion backlash as described under "Checks and Adjustments". This will indicate gear or bearing wear or an error in backlash or pinion depth setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, they may be reinstalled at original lash to avoid changing gear tooth contact.

1. Remove screw that retains differential pinion shaft, and remove pinion shaft.
2. Remove rear axle shafts as outlined in the Service Manual.
3. Roll out the differential pinions and thrust washers, then remove side gears and thrust washers. Mark pinions and side gears so that they can be reassembled in original position.
4. Mark the bearing caps and housing for reassembly in same position. Loosen bearing cap bolts. Tap surface of bearing caps to loosen.

CAUTION: Do not attempt to pry caps off as this may damage machined face of caps.

5. Using a pry bar as shown in Figure 2B, pry differential case out of carrier. Exercise caution in prying on carrier so that gasket sealing surface is not damaged. If the bearings are preloaded, the case will suddenly fall free when it is pried past a certain point; therefore, make sure case is properly supported to prevent damage. The bearing caps may be loosely installed, as shown in Figure 2B, to prevent case from falling.
6. Place left and right bearing cups with bearing caps so that they may be reinstalled in original positions. Place shims with appropriate cups.

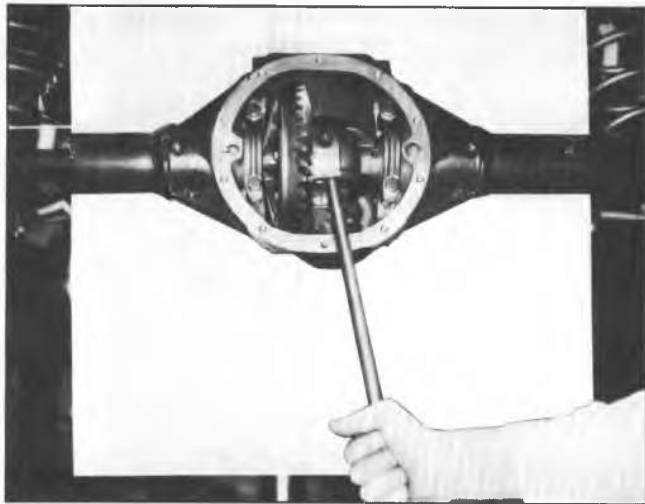


Fig. 2B—Differential Case Removal

Inspection

1. Clean all parts in cleaning solvent; inspect all bearing cups, races and rollers for scoring, chipping or evidence of excessive wear.
2. Inspect axle shaft and side gear splines for evidence of excessive wear.
3. Inspect hypoid ring gear and pinion teeth for possible scoring, cracking or chipping.
4. Inspect differential case, pinions, side gears, thrust washers and pinion shaft for cracks, scoring, spalling or excessive wear.
5. Check fit of differential side gears in case.

Differential Bearing Replacement

1. Install Tool J-22888 and Adapter Plug J-8107-4, assuring puller legs are fitted securely in notches in case and against bearing cone, as shown in figure 3B.
2. Tighten puller screw to remove bearing.
3. Place new bearing on hub with thick side of inner race toward case and drive into place, using J-22175 and Driver Handle J-8092, as shown in figure 4B.
4. Before bearing installation on opposite hub, support differential case on Adapter Plug J-8107-4. This allows differential case to rest on adapter instead of bearing cage. See Figure 4B. Install remaining bearing as instructed in Step 3.

Ring Gear or Differential Case Replacement

1. Remove the ring gear bolts (L.H. thread on passenger car applications) and, using a soft drift and a hammer, tap ring gear off the case.

NOTE: Do not attempt to pry ring gear from case. To do so may damage machined surfaces.

2. Remove any nicks or imbedded dirt from case

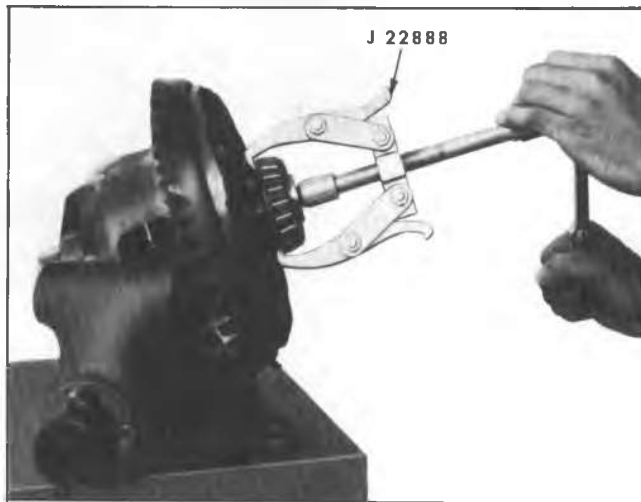


Fig. 3B—Differential Bearing Removal

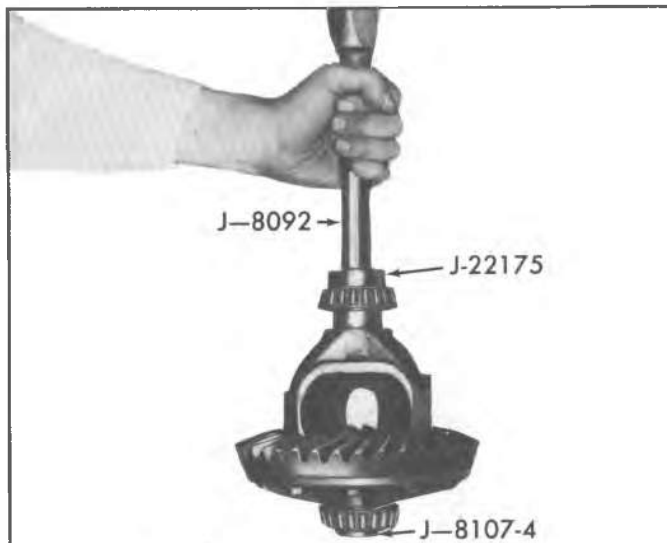


Fig. 4B—Differential Bearing Installation

flange surface which mates with ring gear. Clean all surfaces.

3. Liberally coat the differential case pilot with hypoid lubricant. Pre-align ring gear and differential case bolt holes, and press on adaptor plug J-8107-4 to initially start ring gear on case pilot, as shown in figure 5B.
4. Start all ring gear bolts during initial assembly to maintain bolt hole alignment. Draw up all bolts evenly, using a criss-cross pattern to avoid cocking the gear on the case.
5. Insure that the gear is seated firmly against the case, then torque the bolts to 90 ft. lbs. for passenger cars, and 60 ft. lbs. for truck models.

Reassembly

1. Install thrust washers and side gears into case. If original parts are being reused, replace in original positions.

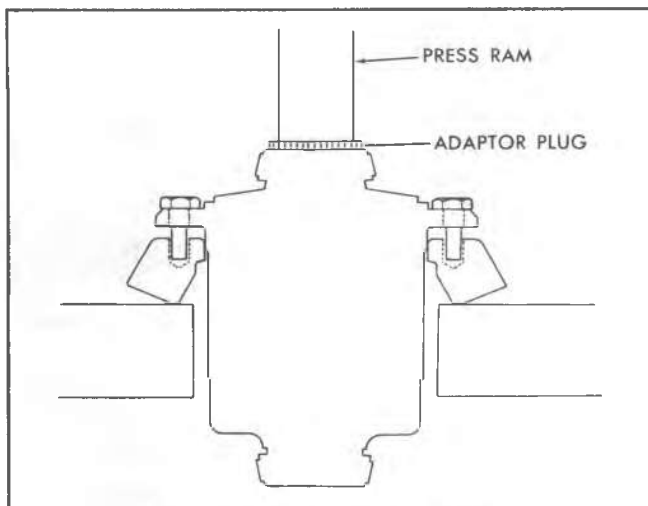


Fig. 5B—Ring Gear-to-Case Installation

2. Position pinions and thrust washers through loading hole in case 180° apart so they engage side gears.
3. Rotate gears until the differential pinion bores and the case shaft holes are aligned.
4. Install pinion shaft and lock screw. It is not necessary to torque lock screw until axle shafts are installed.
5. Differential may be installed in carrier now, or after service is performed on the drive pinion.

Installation and Adjustment

1. Check condition of bearing, bearing cups, cup seat in carrier and carrier caps to make sure that they are free from nicks, burrs and foreign material.
2. Lubricate bearings with axle lubricant; position cups on proper bearing, then install differential assembly in carrier and support the assembly to prevent it from falling.
3. Install strap J-22779-6 on left bearing by tightening bearing bolts alternately and evenly to snug fit.
4. With the ring gear tight against the pinion gear (.000" to .001" backlash) insert gauging Tool J-22779 between the left bearing cup and carrier housing as shown in Figure 6B.
5. While oscillating tool, turn adjusting nut clockwise until a noticeable drag is produced.
6. Tighten lock bolt on side of tool.
7. Between the right bearing and carrier, install Service Spacer A (.170"), Service Shim B and Feeler Gauge C. Thickness of Feeler Gauge must be sufficient to produce a slight "drag" when moved between carrier and Service Shim.
8. Now measure the above dimensions as shown in Fig. 7B.
 - a. Using a micrometer as in Figure 8B measure the thickness of J-22779 in a minimum of three

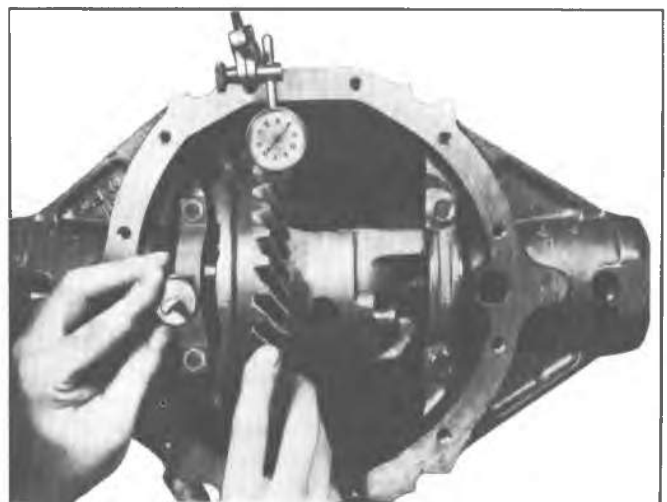
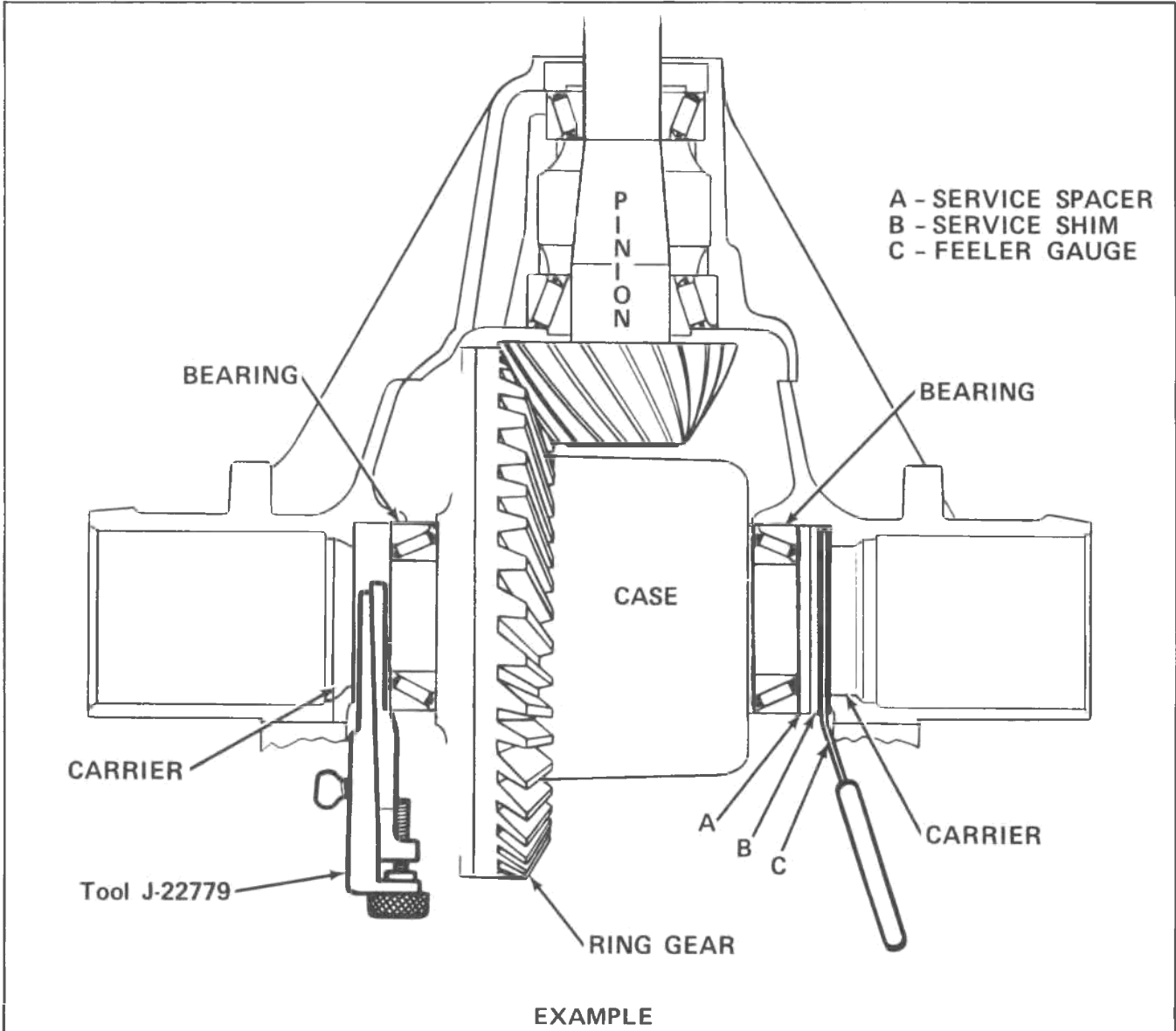


Fig. 6B—Installing Gauging Tool



RING GEAR SIDE		OPPOSITE SIDE	
.250"	Thickness of Tool J-22779 required to force ring gear into contact with pinion	Combined total of: Service Spacer (A) Service Shim (B) Feeler Gauge (C)	.265"
$\frac{-.010"}{.240"}$	TO MAINTAIN PROPER BACKLASH (.005" - .008"), ring gear is moved away from pinion by subtracting .010" shims from ring gear side and adding .010" shims to other side		$\frac{+.010"}{.275"}$
$\frac{+.004"}{}$	TO OBTAIN PROPER PRELOAD on side bearings, add .004" shims to each side.		$\frac{+.004"}{}$
.244"	Shim dimension required for ring gear side	Shim dimension required for opposite side	.279"

Fig. 7B--Determining Side Bearing Shim Requirements

places and average these readings. Record the result.

- b. Add together the dimensions of the Service Shim, Service Spacer and Feeler Gauge. Record the result.

9. Use the sample procedure in Figure 7B to determine the proper thickness for each shim pack.

NOTE: Production preloading of the differential bearings is accomplished by the use of cast iron preload shim. These shims cannot be used when rebuilding the carrier as they may break when tapped into place.

10. Install left shim first, then wedge right shim between bearing cup and spacer. Position shim so that chamfered side is outward or next to spacer. If shim does not have sufficient chamfer or lead around O.D. to allow easy installation without scraping spacer, file or grind chamfer before installing.
11. If difficulty is encountered in installing shim, partially remove case and slide case and shim into position. Tap shim into position, using a soft faced hammer, while rotating differential case with free hand as shown in Figure 9B.
12. Install bearing caps in original position and torque to 60 ft. lbs.

NOTE: At this point, the differential side bearings are properly preloaded. If any adjustments are required in later procedures, make sure the preload remains as established in step 9. If backlash is changed in later steps, be sure the **total** thickness of the two shim packs does not change.

13. Mount a dial indicator on the carrier and check the backlash between the ring gear and pinion, as shown in Figure 10B. The backlash should be within the range of 0.005"-0.008". Check gear lash



Fig. 9B—Installing Differential Shim

at four different equally spaced positions around the gear. Variation in readings should not exceed .002".

NOTE: Position the dial indicator so that indicator button is perpendicular to tooth angle and in line with gear rotation.

14. If variation in backlash readings exceeds .002"; measure ring gear and case runout as shown in Figure 11B. Gear runout should not exceed .003"; should runout exceed this limit, check ring gear and case for deformation and/or foreign matter between case and gear.
15. If gear lash is not within limits, correct by decreasing shim thickness on one side and increasing thickness of other shim **the same amount**. Total shim thickness must be maintained at all times to maintain proper preload.
16. Backlash changes approximately .002" for each .003" change in shim dimensions.



Fig. 8B—Measuring Gauge Plate Thickness

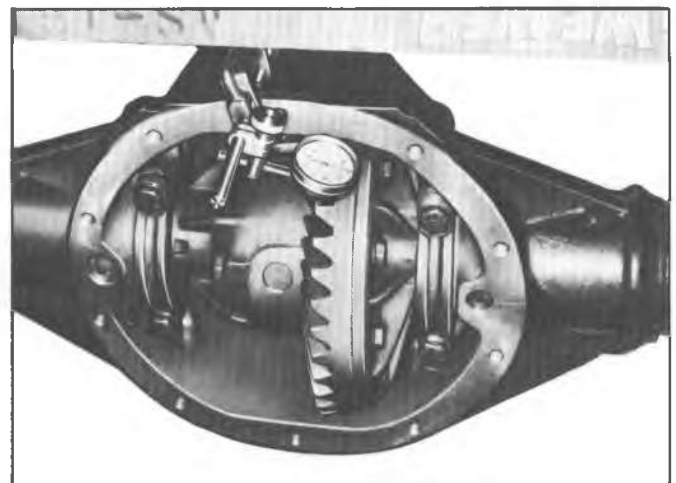


Fig. 10B—Checking Ring Gear Backlash

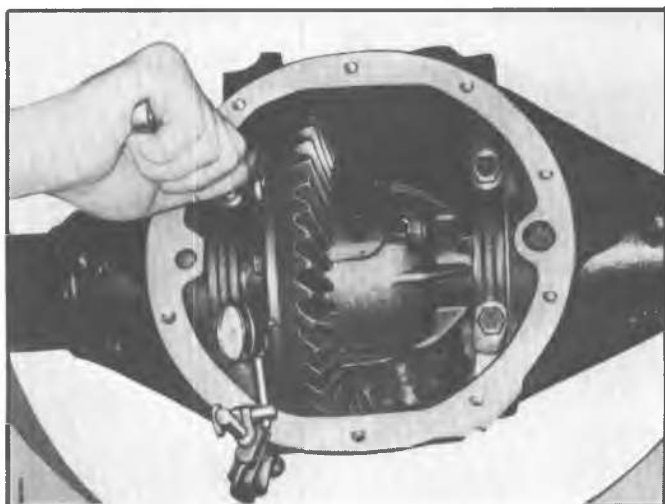


Fig. 11B—Checking Ring Gear Runout

If backlash exceeds .008", increase the shim thickness on the ring gear side, while decreasing the shim thickness on the opposite side **an equal amount**. If backlash is less than .005", decrease the shim thickness on the ring gear side, while increasing the shim thickness on the opposite side **an equal amount**.

DRIVE PINION

Removal

1. Remove differential as previously outlined.
2. Check torque required to rotate drive pinion, as described under "Drive Pinion - Installation and Adjustment". If there is no preload reading, check for looseness of pinion assembly by shaking (push-pull) the companion flange. Looseness indicates the need for bearing replacement.
3. Install Holder J-8614-11 on flange by using two bolts with flat washers, as shown in figure 12B. Position J-8614-11 on flange so that the four notches are toward the flange.
4. Remove pinion nut and washer.
5. Thread end of J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-11 installed as in step 3, insert J-8614-2 into J-8614-11 and turn it 1/8 of a turn to locked position. Remove flange by turning J-8614-3 while holding J-8614-11 as shown in figure 13B.
6. To remove the drive pinion, first thread the original pinion nut half way on the pinion, for thread protection.
7. Place the differential cover temporarily back onto the housing, using two screws. This will prevent the pinion from falling to the floor during removal.
8. Tap the end of the pinion nut with a large hammer and a soft drift, as shown in figure 14B.

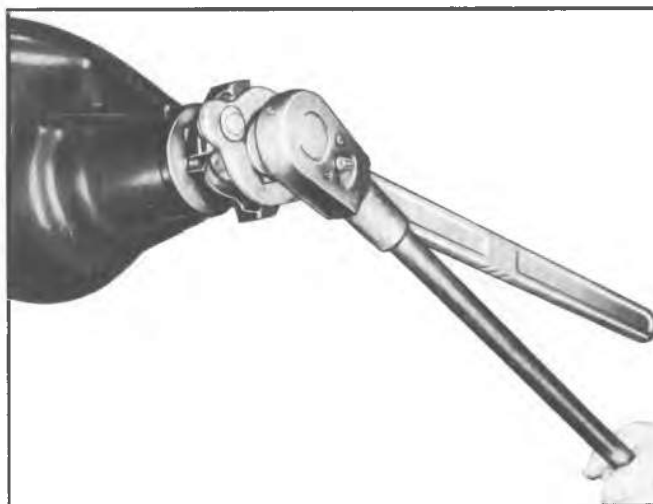


Fig. 12B—Drive Pinion Nut Removal

NOTE: Care must be taken not to damage pinion bearings while removing pinion from carrier. Inspect bearings and cups for damage and replace if needed.

9. Remove the pinion oil seal and the front pinion bearing. Remove the cover and retrieve the drive pinion from the housing. Discard the pinion oil seal, nut, and collapsible spacer. Use a new oil seal, nut and spacer on reassembly.

Bearing Removal and Cup Replacement

1. If front pinion bearing is to be replaced, drive outer race from carrier using a drift in slots provided for this purpose. Tap alternately on opposite sides of the bearing cup to avoid cocking.
2. If rear pinion bearing is to be replaced, drive outer race from carrier using a drift in slots provided for this purpose.



Fig. 13B—Drive Pinion Flange Removal

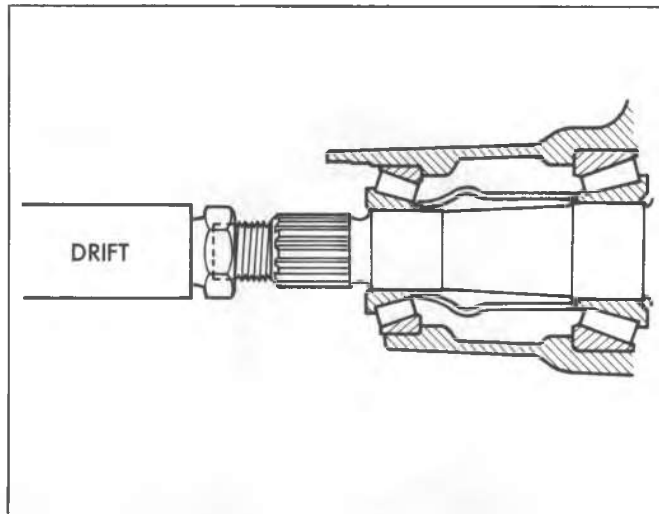


Fig. 14B—Removing Drive Pinion

3. Remove rear pinion bearing from pinion shaft using Press Plate J-22912, as shown in figure 15B.

Tighten nuts on tool until plates are under the bearing inner race. Then set the tool on a press. Make sure the plates straddle the opening on the press. Do not position bolts across the opening. To do so may bend the bolts when pressure is applied. Press bearing from pinion. Record the thickness of shim removed from between bearing and pinion head.

4. Inspect carrier pinion bearing bores and shoulders for nicks. Remove as necessary. Clean the bores and the installation tools.
5. Lubricate both bearing cups with liberal amounts of hypoid lubricant.
6. Install the rear cup, with the large end against the bore shoulder, using Installer J-0270-14 for Truck models, and J-9745 for Passenger Car, as shown in figure 16B.



Fig. 15B—Removing Drive Pinion Rear Bearing

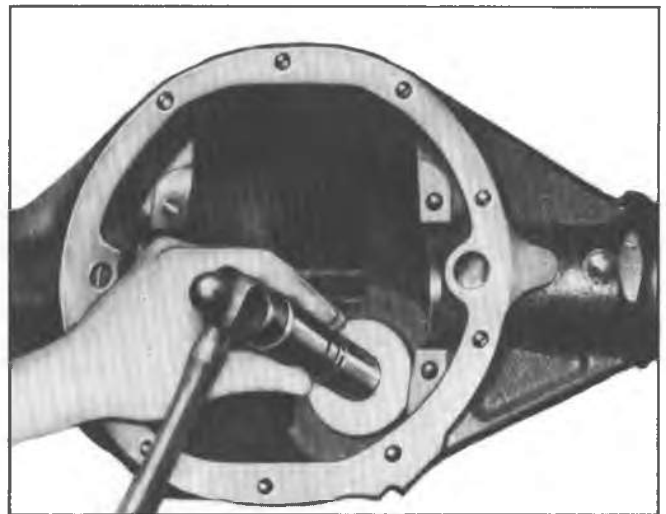


Fig. 16B—Installing Pinion Rear Bearing Cup

7. Install the front cup, with the large end against the bore shoulder, using Installer J-7137 as shown in figure 17B.
8. Check both bores to make sure cups are fully seated.

Setting Pinion Depth and Installing Pinion Bearings

NOTE: If the original ring gear and pinion and the pinion rear bearing assembly are to be reinstalled, the original shim thickness may be used.

Ring and pinion gear sets are matched in a special test machine which permits adjustment of pinion depth in ring gear until a point is reached where best operation and proper tooth contact under load is obtained. At this point, the setting of the pinion with reference to the centerline of the ring gear is indicated by the machine. This setting may vary slightly from the design or

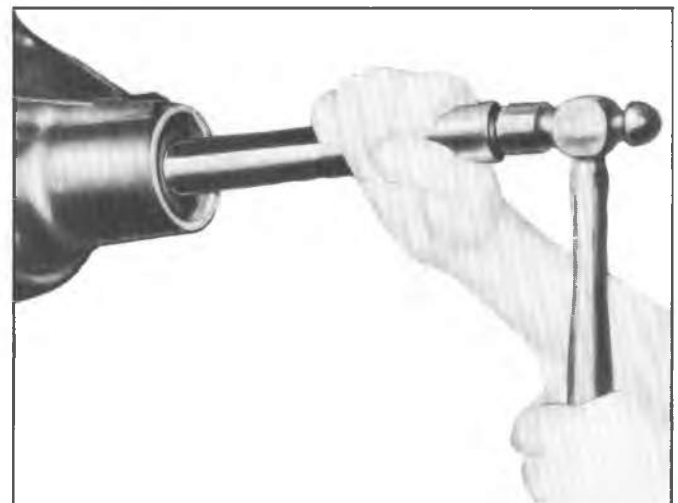


Fig. 17B—Installing Pinion Front Bearing Cup

"nominal" setting due to allowable variation in machining the parts. When a pinion is found having a plus or minus reading recorded in thousandths on the rear face of the pinion, this indicates that the pinion during testing was found to have best tooth contact at a position varying from design or nominal depth.

In order to compensate for all of the allowable machining variables, a procedure of gaging the carrier and shimming the pinion has been developed. After gaging a carrier, the assembler must install the appropriate shim between the drive pinion shoulder and rear bearing so that pinion depth can be adjusted to the required position for best tooth contact in each axle assembly.

Proper pinion depth is determined with Pinion Setting Gauge J-21777-01.

1. Clean the housing assembly and all gauge parts to insure accurate measurements.
2. Lubricate front and rear pinion bearings which will be used in final assembly and position them in their respective races in the carrier.
3.
 - a. **For Passenger Car** use cloverleaf gauge plate J-21779-29 mounted on preload stud J-21777-43.
 - b. **For Truck Models** use cloverleaf gauge plate J-21779-36 mounted on preload stud J-21777-43.
 - c. For all models, insert stud through rear bearing and pilot J-21777-35, and through front bearing and pilot J-21777-42. Install the hex nut until snug and rotate the bearings to make sure they are properly seated. See figures 18B and 19B for illustration of proper positioning.
4. Hold the preload stud stationary with a wrench on the flats and tighten hex nut. Tighten until 20 in. lbs. of torque are required to rotate the bearings, as shown in figure 20B.
5. Mount the side bearing discs J-21777-45 on the

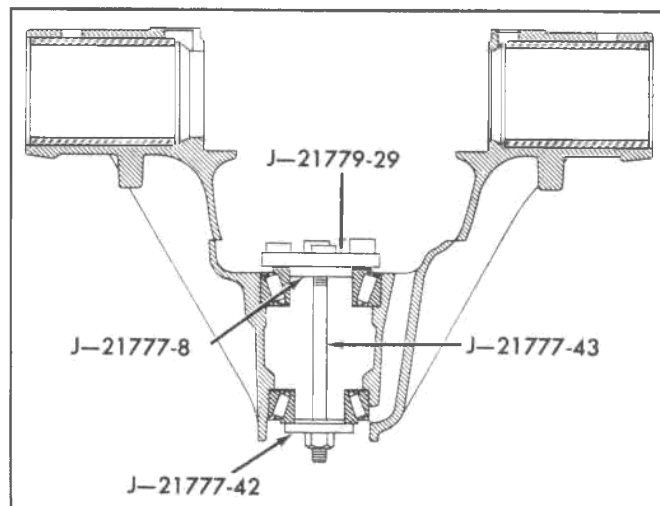


Fig. 18B—Gauge Plate Installed—Passenger Car

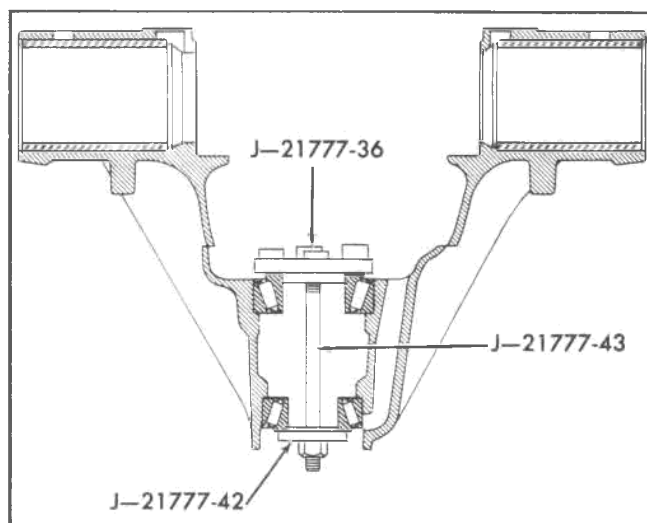


Fig. 19B—Gauge Plate Installed—Truck

ends of arbor J-21777-1, using the step of the disc that corresponds to the bore of the carrier.

6. Place the arbor and plunger assembly into the carrier, being sure the side bearing discs are seated properly.
7. Install the bearing caps finger tight to hold the discs from movement.
8. Position dial indicator J-8001 on the mounting post of the arbor with the contact button resting on the top surface of the plunger.
9. Preload the dial indicator one-half revolution, and tighten in this position.
10. Select the button on the gauge plate that corresponds to the ring gear size and rotate the plate until the plunger rests directly upon that button.
11. Rock the plunger rod slowly back and forth across the button until the dial indicator reads the greatest

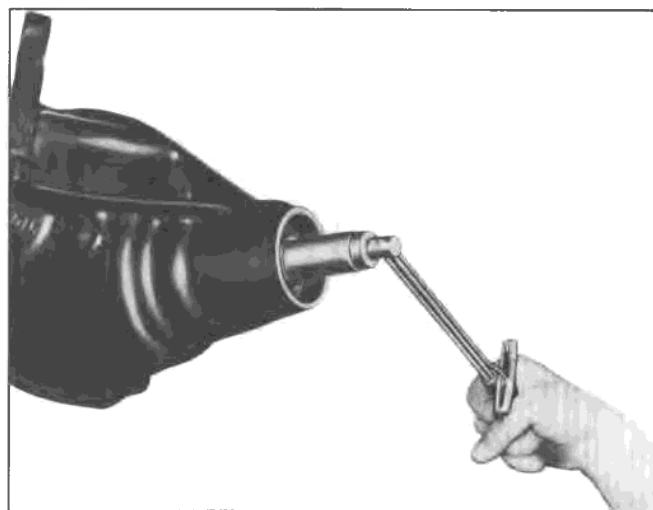


Fig. 20B—Measuring Rotating Torque

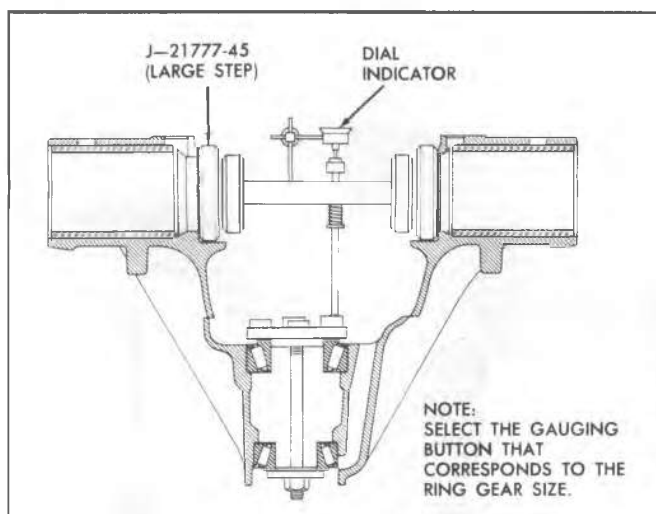


Fig. 21B—Gauging Tools Installed in Carrier—Passenger Car

deflection. At this point, set the dial indicator to zero. Tools will now be positioned as shown in figures 21B and 22B.

12. Repeat the rocking action of the plunger several times to verify the setting.
13. Once the zero reading is obtained, swing the plunger until it is removed from the gauging plate button.

The dial indicator will now read the required pinion shim thickness for a "nominal" pinion. Record this figure.

14. Check the rear face of the drive pinion being installed for a pinion code number. This number indicates the necessary alteration of the pinion shim thickness as determined in step 13.

- a. If the pinion is stamped with a plus (+) number, **add** that many thousandths to the

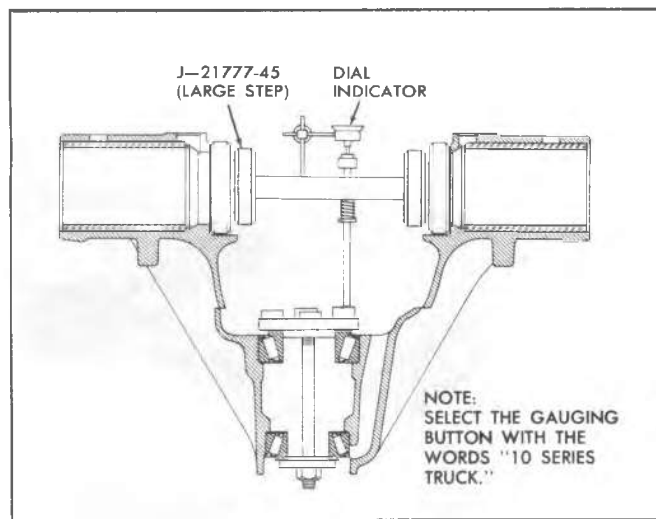


Fig. 22B—Gauging Tools Installed in Carrier—Truck

indicator reading. For example, if indicator reading is .019, and pinion is marked (+2), the correct depth shim for installation will be $.019 + .002 = .021$ inch.

- b. If the pinion has no plus (+) or minus(−) number, use the indicator reading as the correct shim thickness.
- c. If the pinion is stamped with a minus (−) number, **subtract** that many thousandths from the indicator reading. For example, if the indicator reading is .031, and pinion is marked (−3), the correct depth shim for installation will be $.031 - .003 = .028$ inch.
15. Remove bearing caps and depth gauging tools from carrier.
16. Position the shim selected in step 14 on the pinion shaft against pinion head.
17. Lubricate the rear pinion bearing with liberal amounts of hypoid lubricant and install rear bearing. Use J-6547 as shown in figure 23B for passenger car models. Use J-5590 for truck models, as shown in figure 24B.

Installation and Adjustment

1. Lubricate the front bearing with liberal amounts of hypoid lubricant, and place into outer cup.
2. **For Passenger Car** place a new pinion oil seal into position in carrier bore. Tap lightly with a protective plate and a hammer until seal flange seats against carrier, as shown in figure 25B.
3. **For Truck Models** position seal in bore and place gauge plate J-22804-2 over seal and against flange. Gauge plate insures proper seating of seal in carrier bore. See figure 26B. Use J-23911 to press seal into bore until gauge plate is flush with the

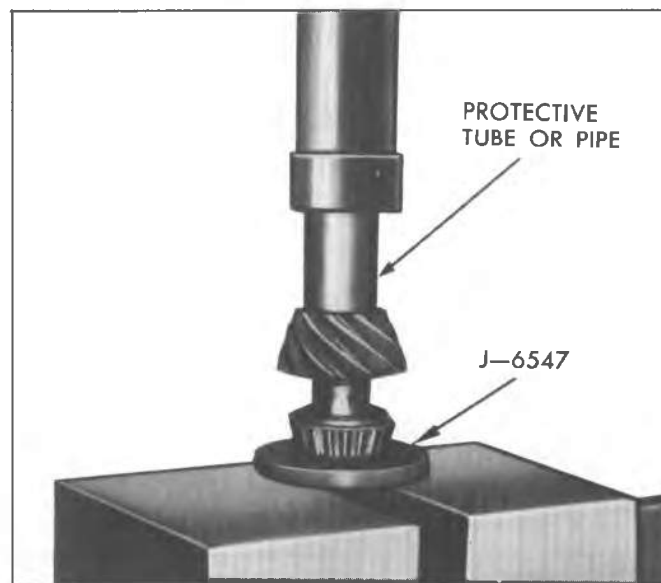


Fig. 23B—Installing Rear Bearing—Passenger Car



Fig. 24B—Installing Rear Bearing—Truck

carrier shoulder and seal flange. Turn gauge plate 180°; seal must be square in carrier to seal properly.

4. Coat lips of pinion oil seal and seal surface of pinion flange with hypoid lubricant.
5. Install a new pinion bearing spacer onto drive pinion.
6. **For Passenger Car**, position companion flange onto drive pinion, using J-9458 and companion flange Holding Tool J-8614-11, as shown in figure 26B. Tool J-9458-1 is threaded onto pinion shaft, and nut tightened against J-9458-2 to pull flange onto shaft. Remove J-9458 after flange is seated.
7. **For Truck models**, place drive pinion into position, and mount a suitable thick washer or sheet metal plate over the pinion stem. Install the original

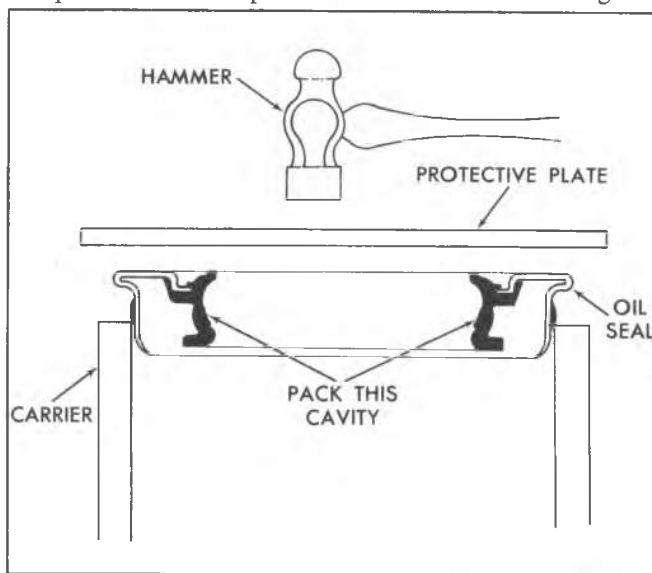


Fig. 25B—Installing Pinion Oil Seal—Passenger Car

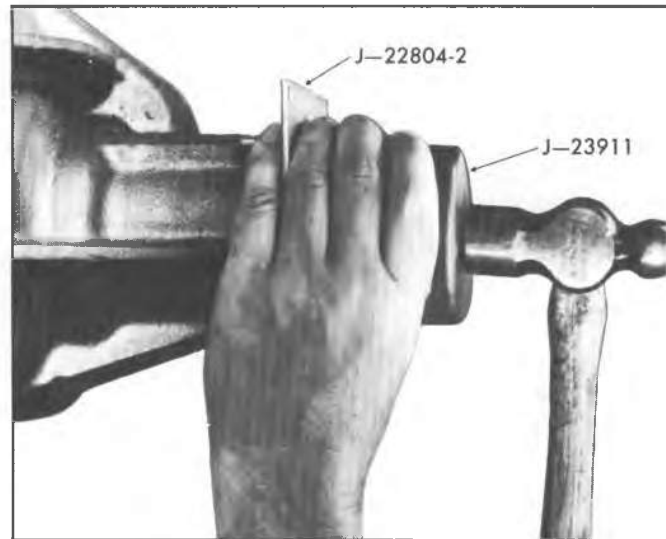


Fig. 26B—Installing Pinion Oil Seal—Truck

pinion nut and tighten sufficiently to draw pinion through the front bearing far enough to leave threads exposed when the companion flange is placed into position. Remove the washer and install the companion flange, using J-8614-11.

For all models, tighten nut until all end play is removed from drive pinion.

NOTE: When no further end play is detectable, and when Holder J-8614-11 will no longer pivot freely as pinion is rotated, preload specifications are being neared. Further tightening should be done only after nut and washer installation and preload has been checked.

9. While observing the preceding caution, carefully set preload drag at 20-25 inch pounds on new bearings,

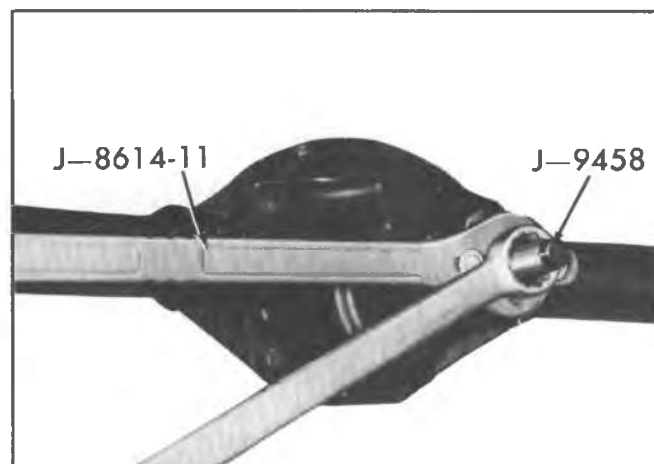


Fig. 27B—Installing Companion Flange—Passenger Car

or 10-15 inch pounds on reused bearings. Use an inch-pound torque wrench such as J-5853, as shown in figure 28B, to measure the rotating torque.

NOTE: After torque has been checked, final tightening should be done very cautiously. For example, if when checking, torque was found to be 5 inch-pounds, additional tightening of the pinion nut as little as 1/8 turn can add 5 additional inch pounds drag. Therefore, the pinion nut should be further tightened only a little at a time and torque should be checked after each slight amount of tightening. Exceeding torque specifications may compress the collapsible spacer too far and require its replacement.

10. Rotate the pinion several times to assure that bearings have been seated. Check preload again. If drag has been reduced, re-set preload to specifications.

CHECKS AND ADJUSTMENTS

Four adjustments are essential for proper operation of the differential and its related parts. These adjustments are a) Pinion Bearing Preload, b) Side Bearing Preload, c) Pinion Depth and d) Ring Gear-to-Pinion Backlash.

Pinion Bearing Preload is set to specifications in step 8 of "Drive Pinion-Installation and Adjustment".

Side Bearing Preload is set to specifications in step 9 of "Differential Case-Installation and Adjustment".

Following service to the Differential Case or to the Drive Pinion and Ring Gear, a Gear Tooth Contact Pattern Check **must** be made to verify the accuracy of the work in setting the pinion depth and the ring gear-to-pinion backlash.

Gear Tooth Contact Pattern Check

Prior to final assembly of the differential, a Gear Tooth

Contact Pattern Check is necessary to verify the correct relationship between ring gear and drive pinion. Gear sets which are not positioned properly may be noisy, or have short life, or both. With a pattern check, the most desirable contact between ring gear and drive pinion for low noise level and long life can be assured.

GEAR TOOTH NOMENCLATURE

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end. The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. See Figure 29B.

Test

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.
2. Use gear marking compound and apply this mixture sparingly to all ring gear teeth using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten bearing cap bolts to 55 lb. ft.
4. Expand brake shoes until a torque of 20-30 lb. ft. is required to turn the pinion.

NOTE: A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with wrench so that ring gear rotates one full revolution then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear is not recommended.

5. Observe pattern on ring gear teeth and compare with Figure 30B.



Fig. 28B—Measuring Rotating Torque

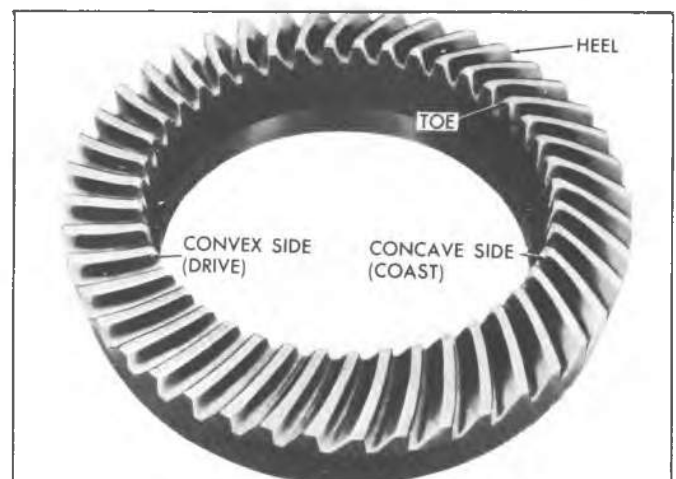


Fig. 29B—Gear Tooth Nomenclature

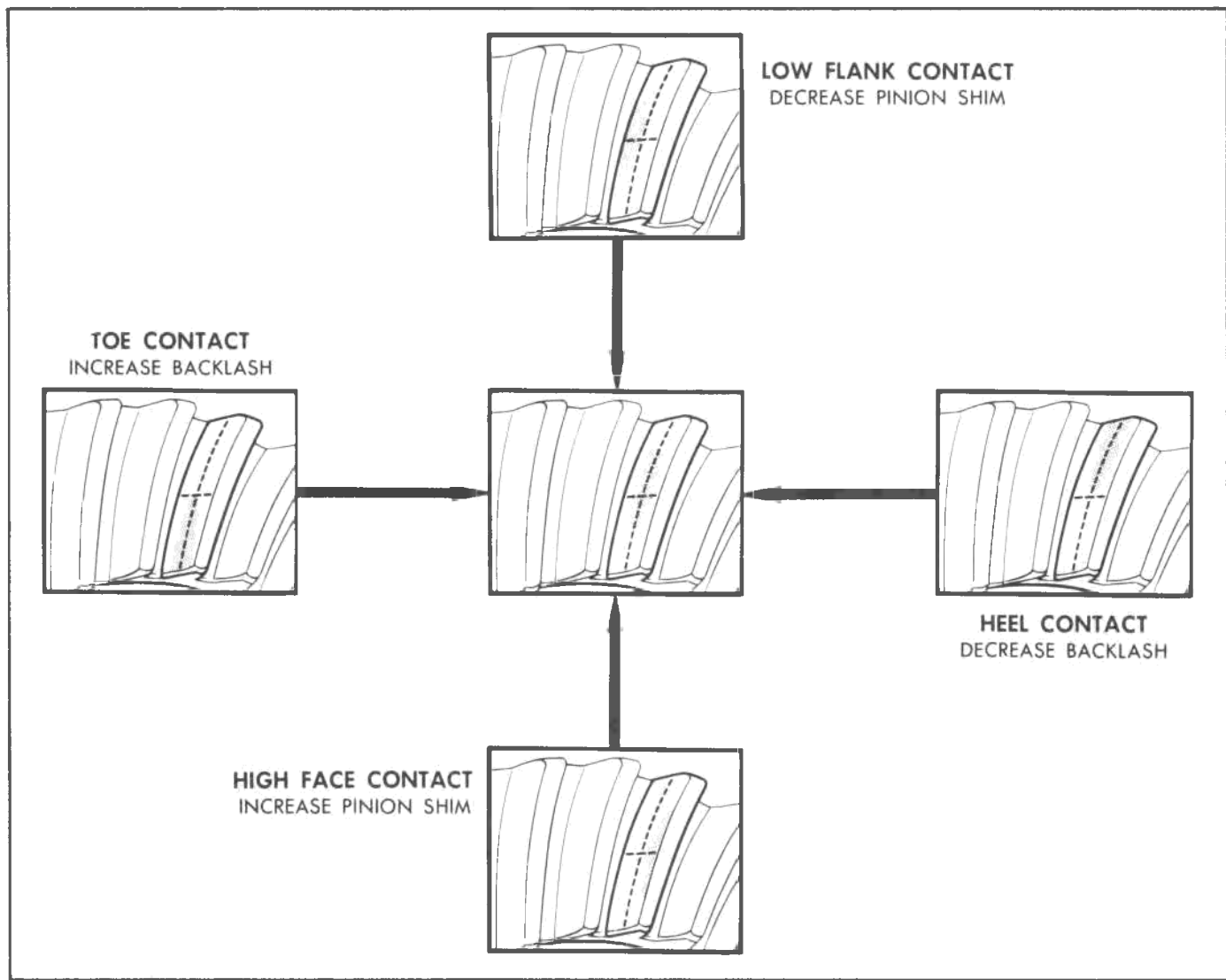


Fig. 30B—Gear Tooth Contact Pattern Check

Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern. These are backlash and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on hand loaded teeth pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

NOTE: It may be necessary to adjust both pinion depth and backlash to obtain the correct pattern.

The position of the drive pinion is adjusted by increasing or decreasing the shim thickness between the pinion head and inner race of rear bearing. The shim is used in the differential to compensate for manufacturing

tolerances. Increasing shim thickness will move the pinion closer to centerline of the ring gear. Decreasing shim thickness will move pinion farther away from centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims which moves the entire case and ring gear assembly closer to, or farther from the drive pinion. (The adjusting shims are also used to set side bearing preload). To increase backlash, increase right shim and decrease left shim an equal amount. To decrease backlash, decrease right shim and increase left shim an equal amount.

The important thing to note is that the contact pattern is centrally located up and down on the face of the ring gear teeth.

CORVETTE DIFFERENTIAL

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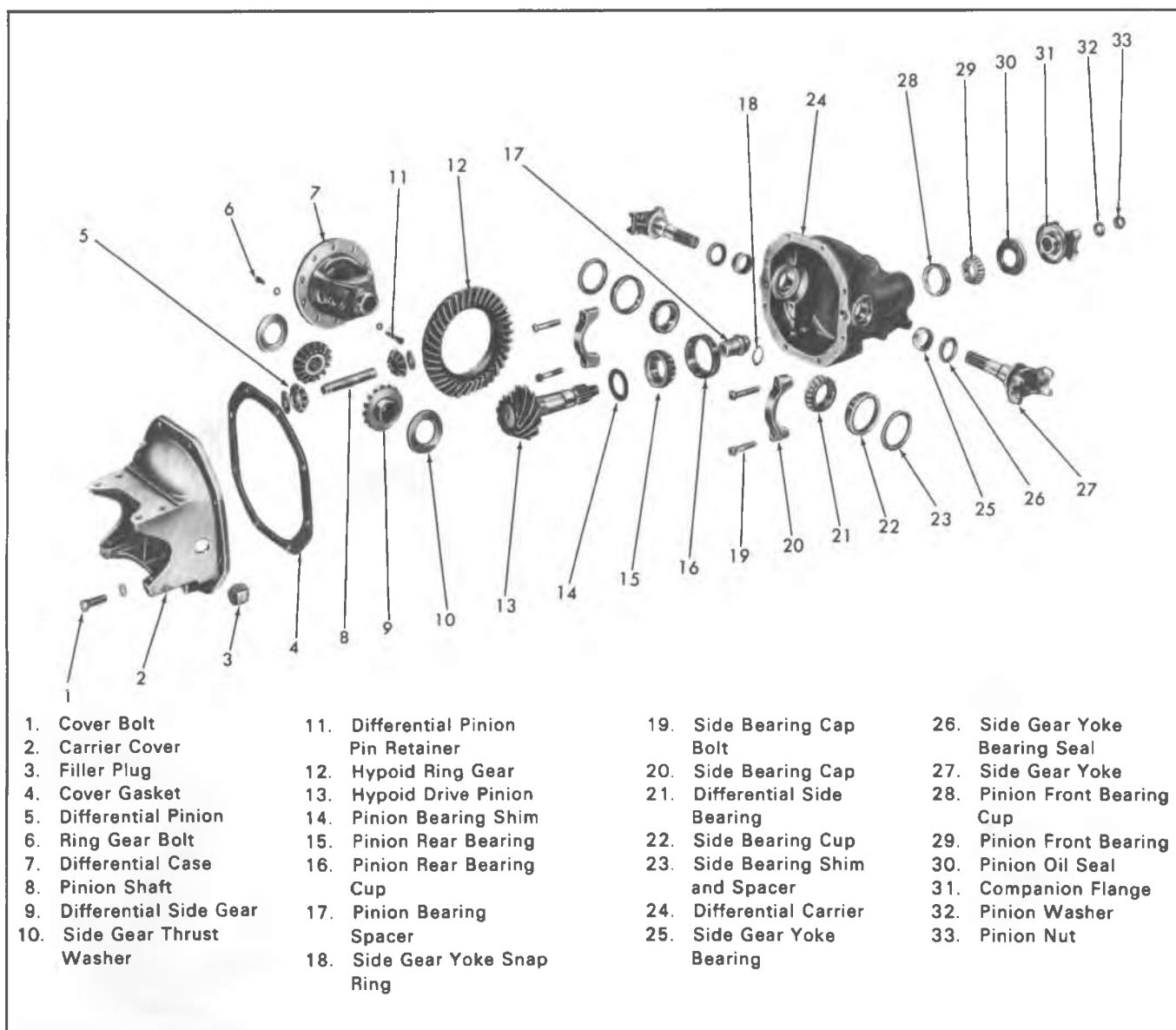


Fig. 1C—Carrier Assembly—Exploded View

DIFFERENTIAL CASE

Removal and Disassembly

1. Clamp carrier in Holding Fixture J-3289.
2. Remove snap rings securing side gear yokes and pull yokes out of carrier. See Figure 1C.
3. Mark differential bearing caps for reassembly in same relative location and remove caps.
4. Pull differential assembly out of carrier, taking care not to damage machined mounting surface on carrier. See Figure 2C. Remove differential bearing shims and mark for future reference.
5. To disassemble, and reassemble, follow procedures outlined in "Positraction Differential Unit" section.

Inspection

1. Clean all gears and bearings in cleaning solvent and blow dry.
2. Inspect gears for scoring, pitting or cracks.
3. Inspect bearings for spalling, pitting or scoring. Discard all parts that show excessive wear or failure.
4. Inspect side gear driveshaft yokes closely for spline wear or yoke cracking. If equipment is available, use magnetic penetrant method to check for minute fractures in yokes or gears.

Differential Bearing Replacement

1. Place Puller J-22888 over differential bearing using Adapter Plug J-8107-4 in side gear bore. Tighten puller screw to remove bearing as in Figure 3C.
2. Install new bearing on hub using Installer J-22175. See Figure 4C.
3. Before bearing installation on opposite hub, support differential case on Adapter Plug J-8107-4. This allows differential case to rest on plug instead

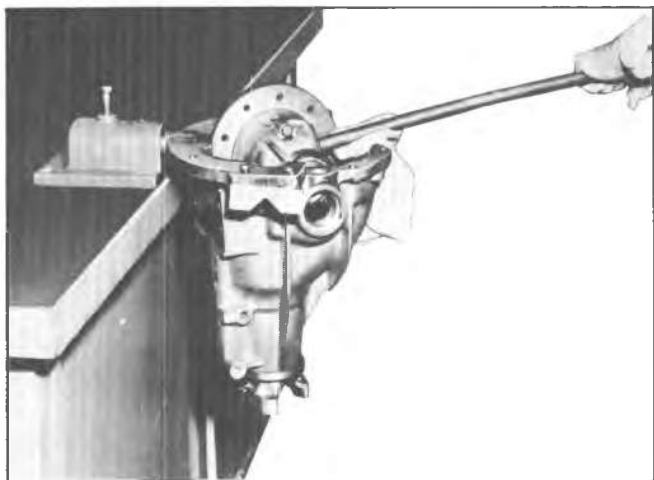


Fig. 2C—Removing Differential Case

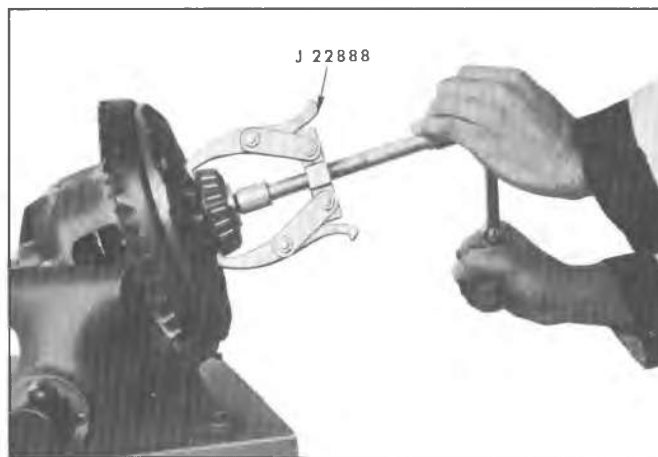


Fig. 3C—Removing Differential Bearing

of bearing cage. See Figure 4C. Install remaining bearing.

Ring Gear or Differential Case Replacement

1. Remove ring gear bolts and tap ring gear off differential case.
2. Install guide pins fabricated from 3/8-24 x 1 1/2" bolts with heads removed and ends slotted as shown in Figure 5C.
3. Clean ring gear mounting surface and mounting flange on case. Place ring gear on pilot case diameter.

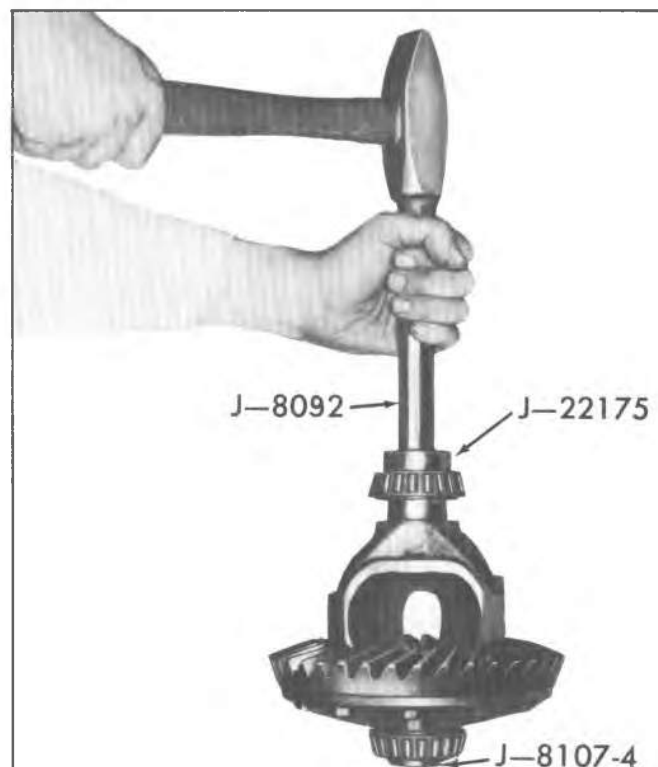


Fig. 4C—Differential Bearing Installation

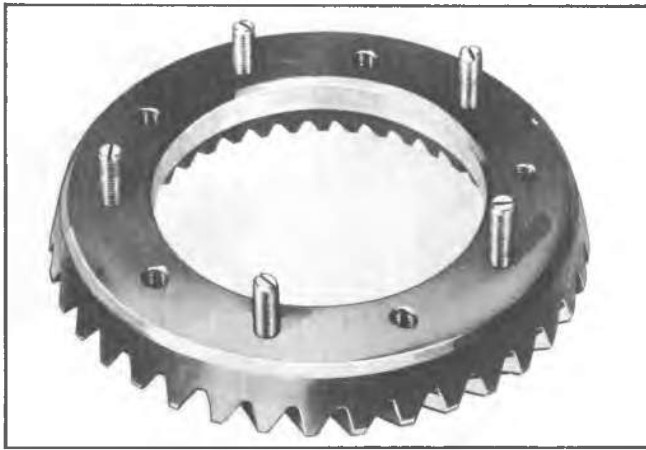


Fig. 5C—Ring Gear Guide Pins Installed

4. Install every other ring gear bolt and draw ring gear up evenly until gear is seated against flange.
5. Remove guide pins and install remaining ring gear bolts. Torque bolts to specifications.

Side Gear Yoke Bearing and/or Seal Replacement

1. Place new yoke bearings on Installer J-9773 and install bearing into carrier bore using Handle J-7079-2. See Figure 6C. Drive bearing until it is fully seated.
2. Place a new seal on Installer J-9774 and install into seal bore outboard of bearing as in Figure 7C.

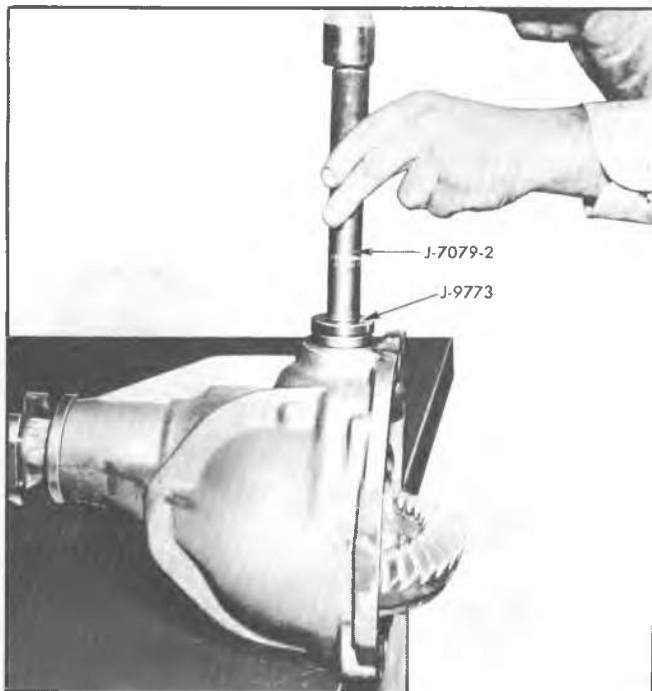


Fig. 6C—Installing Side Gear Yoke Bearings

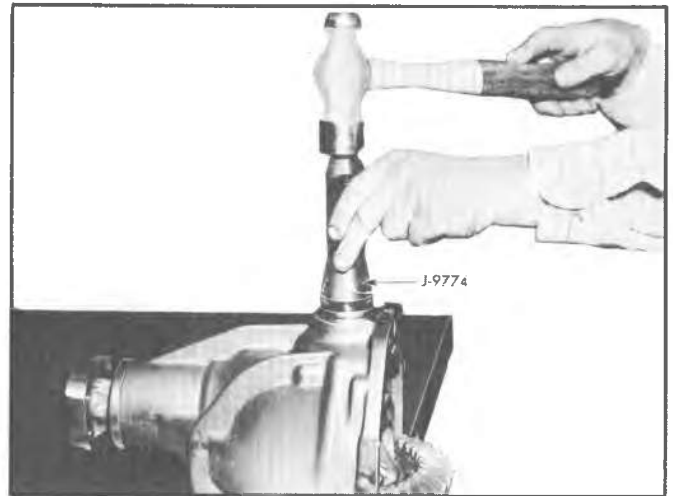


Fig. 7C—Installing Side Gear Yoke Seal

Installation and Adjustment

1. Check condition of bearing cups, cup seat in carrier and carrier caps to make sure they are free from nicks, burrs and foreign material.
2. Lubricate bearings with axle lubricant. Position cups on proper bearings then install differential assembly in carrier as shown in Figure 8C. Install right bearing cap, tightening the bolts to a snug fit.
3. Service spacers are available in one thickness only—.170" plus or minus .001". Steel service shims are used with the service spacer. See following Shim Chart for shim availability and identification.

NOTE: Production preloading of the differential bearings is accomplished by the use of cast iron shims. These shims cannot be used when rebuilding the carrier as they may break when tapped into place.

4. Install strap J-22779-6 on left bearing by tightening bearing bolts alternately and evenly to a snug fit.



Fig. 8C—Installing Differential Assembly

Shim Thickness	Shim Identification	
	Notches	
	I.D.	O.D.
.040	0	0
.042	4	1
.044	4	2
.046	4	3
.048	4	4
.050	5	0
.052	5	1
.054	5	2
.056	5	3
.058	5	4
.060	6	0
.062	6	1
.064	0	2
.066	0	3
.068	0	4
.070	1	0
.072	1	1
.074	1	2
.076	1	3
.078	1	4
.080	2	0
.082	2	1
.084	2	2
.086	2	3
.088	2	4
.090	3	0
.092	3	1
.094	3	2
.096	3	3
.098	3	4
.100	4	0

5. With the ring gear tight against the pinion gear (.000" to .001" backlash), insert gauging Tool J-22779 between the left bearing cup and carrier housing. See Figure 9C. Turn adjusting nut clockwise while oscillating the tool until a noticeable drag is produced.
6. Tighten lock bolt on side of the tool, then remove tool.
7. Using a micrometer, measure the thickness of the gauging plates in a minimum of three places as shown in Figure 10C. Average these readings and record the result.
8. Turn the ring gear 90 degrees and repeat Steps 5, 6 and 7.
9. The required thickness of the service shim is determined by subtracting the thickness of the service spacer from the **higher** of the two averaged readings obtained in Steps 7 and 8.

EXAMPLE:

Gauge thickness (higher reading) 254"
 Service spacer..... minus .170"
 Service shim size (left side).....084"

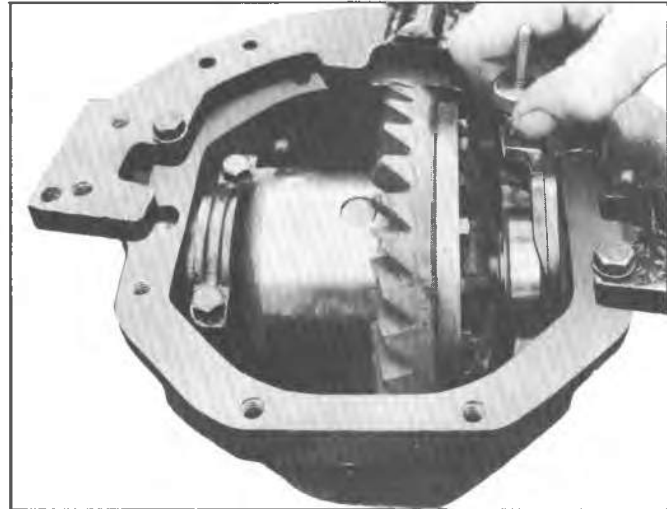


Fig. 9C—Measuring Differential Shim Requirement

10. Install the selected shim between the service spacer and bearing. Remove strap J-22779-6 and install left bearing cap. Torque bearing cap bolts to specifications.
11. Remove right-hand bearing cap and install Tool J-22779 between right bearing cup and carrier housing.
12. Turn adjusting nut clockwise while oscillating tool until a noticeable drag is produced (bearing outer race rotates with tool). Remove tool and measure the thickness of the gauging plate in a minimum of three places. Average these readings and record the results.
13. Turn the ring gear 90 degrees and repeat Steps 11 and 12.
14. The required thickness of the service shim is determined as in Step 9; however, an additional .008" must be added to obtain proper side bearing preload.



Fig. 10C—Measuring Gauge Plate Thickness



Fig. 11C—Installing Differential Shim

EXAMPLE:

Gauge thickness (higher reading)	.226"
Service spacer used..... minus	.170"
Difference	.056"
For preload	add .008"
Service shim size	.064"

NOTE: Service shims are available in increments of .002 in.—if the shim measurement falls between the available shims, select a shim thinner by .001 inch.

15. Install the selected shim between the service spacer and bearing, using a soft face hammer. See Figure 11C.
16. Install the right bearing cap and torque both bearing caps to specifications.
17. Mount a dial indicator on the carrier and check backlash between the ring gear and pinion, as shown in Figure 12C. Backlash should be within the range of .003" to .010" with a reading of .005" to

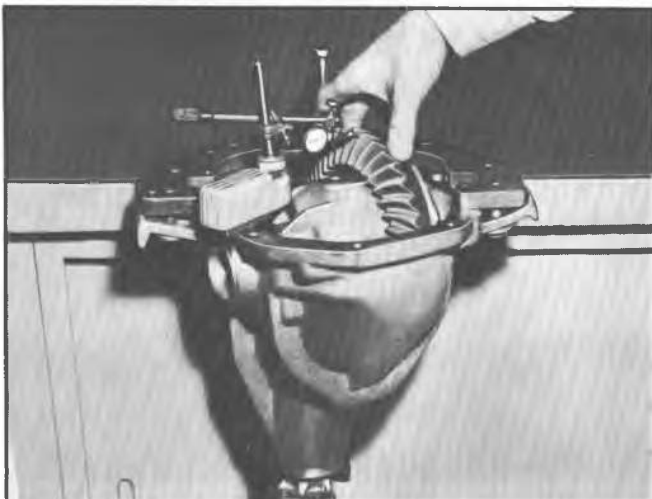


Fig. 12C—Checking Backlash

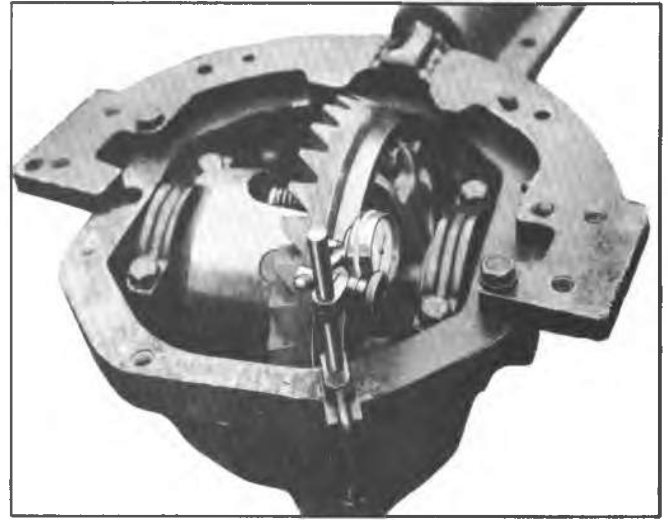


Fig. 13C—Checking Ring Gear Runout

.008" preferred. Check reading at four equally spaced positions around the ring gear. Variation in reading should not exceed .003".

NOTE: Position the dial indicator so that indicator button is perpendicular to tooth angle and in line with gear rotation.

18. If variation in backlash exceeds .003", measure ring gear and case runout as shown in Figure 13C. Gear runout should not exceed .003"; should runout exceed this limit, check ring gear and case for deformation and/or foreign matter between case and gear.
19. If gear lash is not within limits, correct by decreasing shim thickness on one side and increasing thickness of the other shim the same amount. Total shim thickness must be maintained to maintain proper preload.

EXAMPLE: By decreasing shim on the right side .003" and increasing shim thickness on the left side by .003", backlash will decrease by .002".

DRIVE PINION

Removal

1. Remove differential case as previously outlined.
2. Check pinion bearing preload as described under "Drive Pinion - Installation and Adjustment". If there is no preload reading, check for looseness of pinion assembly by shaking the companion flange. Looseness indicates the need for bearing replacement.
3. Turn holding fixture over and install Holder J-8614-11 on flange by using two bolts with flat washers, as shown in figure 14C. Position J-8614-11 on flange so that the four notches are toward the flange.

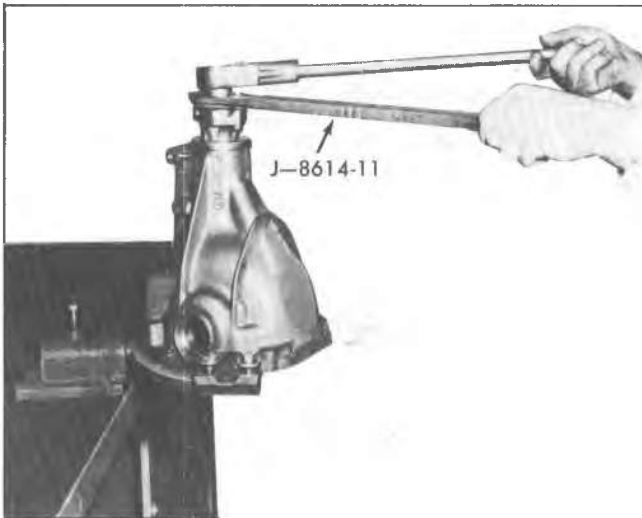


Fig. 14C—Removing Companion Flange Nut

4. Remove pinion nut and washer. Discard pinion nut and use a new one upon reassembly.
5. Thread end of J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-11 installed as in step 3, insert J-8614-2 into J-8614-11 and turn it 1/8 of a turn to locked position. Remove flange by turning J-8614-3 while holding J-8614-11 as shown in figure 15C.
6. With companion flange removed, drive pinion and rear bearing assembly can be removed from carrier.
7. Pry companion flange seal out of carrier using screw driver and discard seal. Remove pinion front bearing assembly.
8. Pry differential side gear yoke seals out of carrier and discard seals. Using a piece of 1 3/4" O.D. pipe of suitable length, tap yoke bearings out of bore.

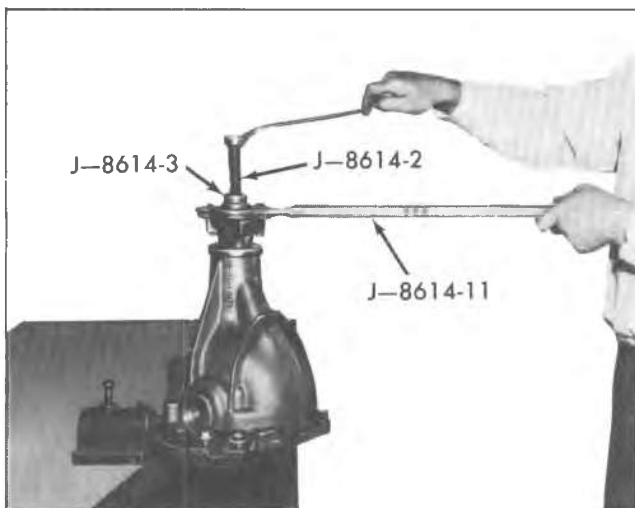


Fig. 15C—Removing Companion Flange

Inspection

1. Clean all gears and bearings in cleaning solvent and blow dry.

NOTE: Do not spin bearings during drying process. The extremely fast spinning and lack of lubrication may quickly result in the failure of an otherwise reusable bearing.

2. Inspect gears for scoring, pitting or cracks.
3. Inspect bearings for spalling, pitting or scoring. Discard all parts that show excessive wear or failure.

Pinion and/or Bearing Replacement

1. If necessary to replace pinion bearings, tap old cups out of carrier using a brass drift. See Figure 16C. Tap alternately on opposite sides of cup to prevent cups from cocking in carrier. Inspect cup seats and bore for any nicks or burrs and remove as necessary before installing new bearing cups.
2. Select front and rear pinion bearings and drive cups into carrier using Drive Handle J-8092 and Cup Installers J-8608 for the rear cup and J-7137 for front cup. See Figures 17C and 18C. Seat cups securely and squarely against shoulders in carrier.
3. Remove pinion rear bearing using Press Plates J-9771 in Holder J-0358-1 as shown in Figure 19C. Remove and discard shim between bearing and gear head.

Setting Pinion Depth

NOTE: If the original ring gear and pinion and the pinion rear bearing assembly are to be reinstalled, the original shim thickness may be used.

Ring and pinion gear sets are matched in a special test machine which permits adjustment of pinion depth in ring gear until a point is reached where best operation and proper tooth contact under load is obtained. At this point, the setting of the pinion with reference to the

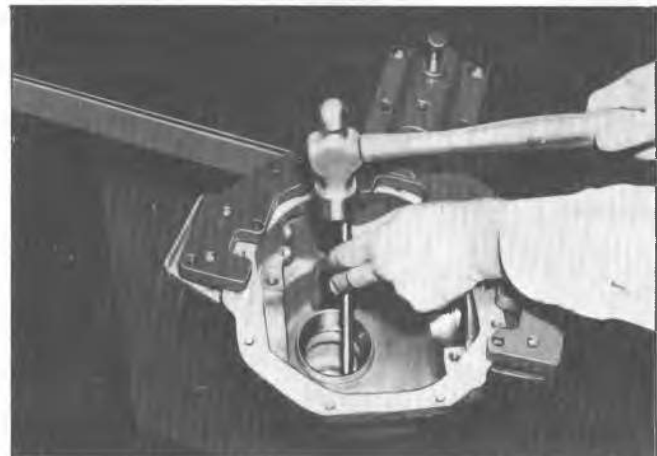


Fig. 16C—Removing Pinion Bearing Cup

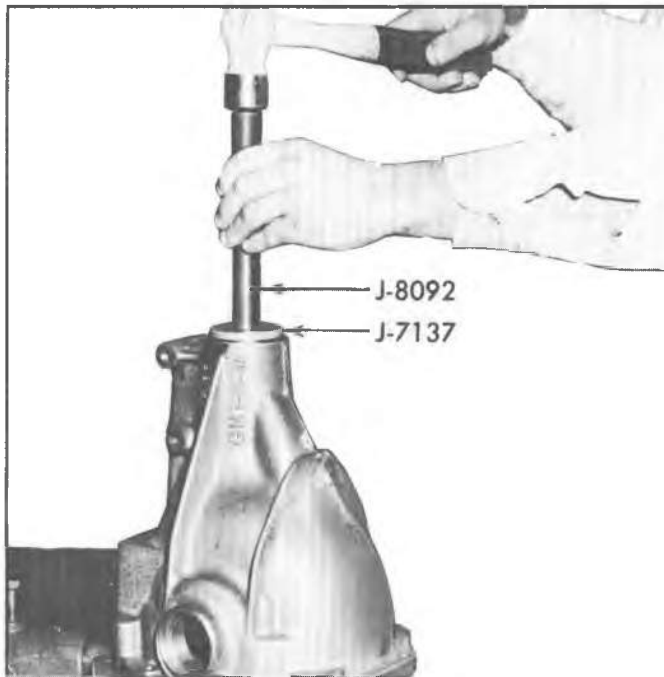


Fig. 17C—Installing Pinion Front Bearing Cup

centerline of the ring gear is indicated by the machine. This setting may vary slightly from the design or "nominal" setting due to allowable variation in machining the parts. When a pinion is found having a plus or minus reading recorded in thousandths on the rear face of the pinion, this indicates that the pinion during testing was found to have best tooth contact at a position varying from design or nominal depth.

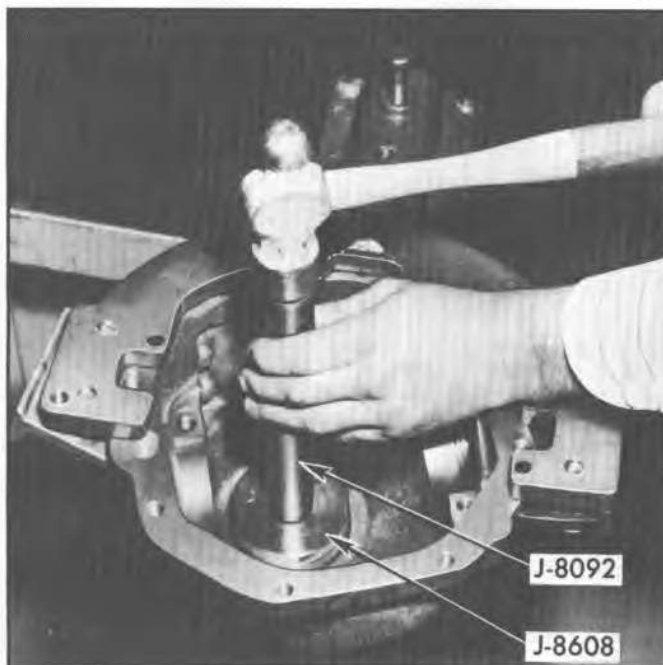


Fig. 18C—Installing Pinion Rear Bearing Cup

In order to compensate for all of the allowable machining variables, a procedure of gaging the carrier and shimming the pinion has been developed. After gaging a carrier, the assembler must install the appropriate shim between the drive pinion shoulder and the rear bearing so that pinion depth can be adjusted to the required position for best tooth contact in each axle assembly.

Proper pinion depth is determined with pinion setting Gauge J-21777-01.

1. Clean the housing assembly and all gauge parts to insure accuracy of measurements.
2. Lubricate the front and rear pinion bearings which will be used in final assembly and position them in their respective races in the carrier.
3. With cloverleaf gauge plate J-21777-36 mounted on preload stud J-21777-43, insert stud through rear bearing and pilot J-21777-35, and through front bearing and pilot J-21777-42. Install the hex nut until snug and rotate the bearings to make sure they are properly seated. See figure 20C for illustration of proper positioning.
4. Hold the preload stud stationary with a wrench on the flats and tighten hex nut until 20 in. lbs. of torque are required to rotate the bearings, as shown in figure 21C.
5. Mount the side bearing discs J-21777-45 on the ends of arbor J-21777-1, using the step of the disc that corresponds to the bore of the carrier.
6. Place the arbor and plunger assembly into the carrier, being sure the side bearing discs are seated properly.
7. Install the bearing caps finger tight to hold the discs from movement.
8. Position dial indicator J-8001 on the mounting post of the arbor with the contact button resting on the top surface of the plunger.

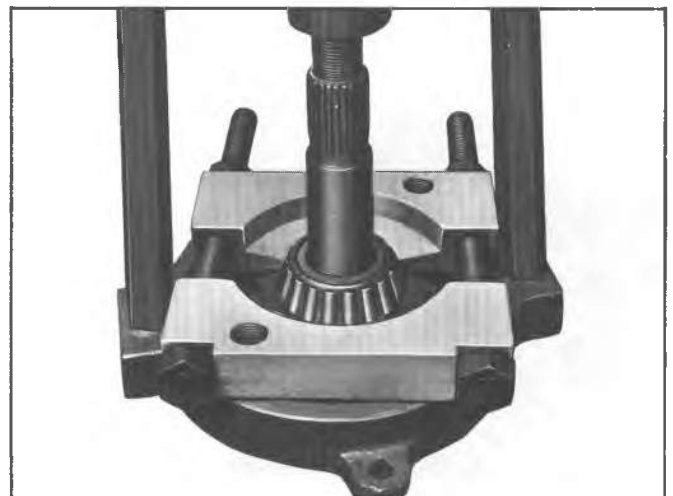


Fig. 19C—Removing Pinion Rear Bearing

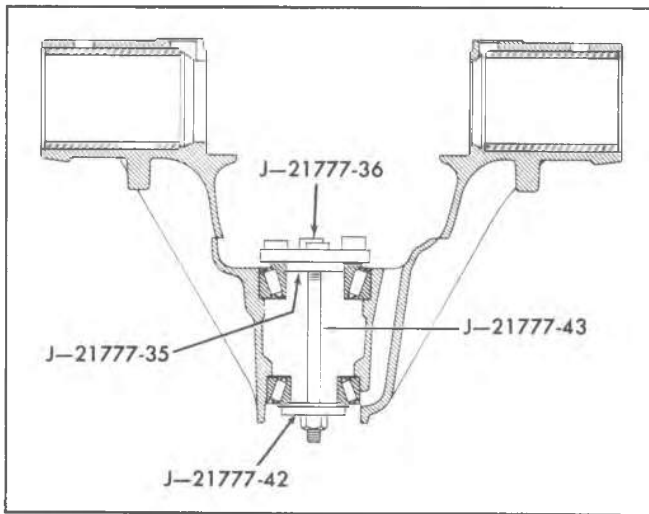


Fig. 20C—Gauge Plate Installed

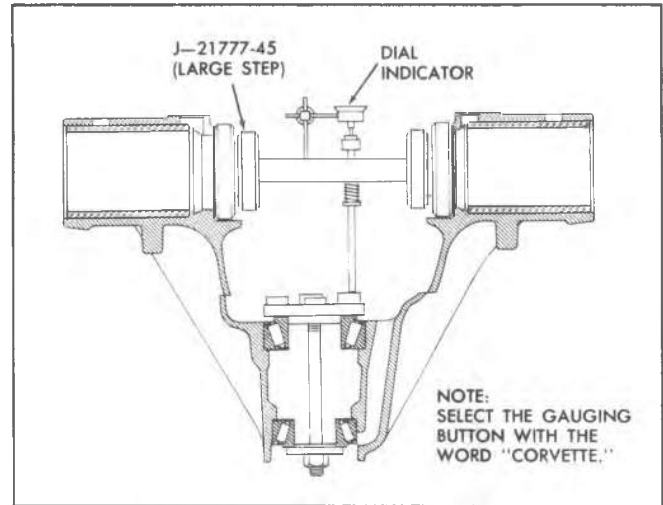


Fig. 22C—Pinion Depth Gauging Tools Installed

9. Preload the dial indicator one half revolution, and tighten in this position.
10. Select the button on the gauge plate that corresponds to the ring gear size and rotate the plate until the plunger rests directly upon that button.
11. Rock the plunger rod slowly back and forth across the button until the dial indicator reads the greatest deflection. At this point, set the dial indicator to zero. Tools will now be positioned as shown in figure 22C.
12. Repeat the rocking action of the plunger several times to verify the setting.
13. Once the zero reading is obtained, swing the plunger until it is removed from the gauging plate button.

The dial indicator will now read the required pinion shim thickness for a "nominal" pinion.

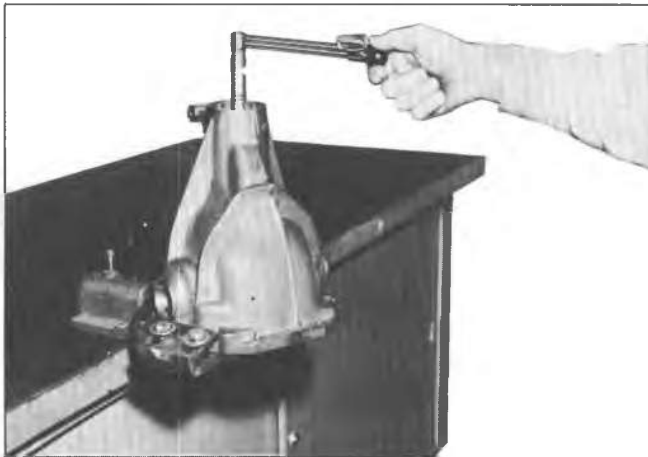


Fig. 21C—Measuring Rotating Torque

14. Check the rear face of the pinion being installed for a pinion code number. This number indicates the necessary alteration of the pinion shim thickness as determined in step 13.
 - a. If the pinion is stamped with a plus (+) number, **add** that many thousandths to the indicator reading. For example, if indicator reading is .019, and pinion is marked (+2), the correct depth shim for installation will be $.019 + .002 = .021$ inch.
 - b. If the pinion has no plus (+) or minus (−) number, use the indicator reading as the correct shim thickness.
 - c. If the pinion is stamped with a minus (−) number, **subtract** that many thousandths from the indicator reading. For example, if the indicator reading is .031, and pinion is marked (−3), the correct depth shim for installation will be $.031 - .003 = .028$ inch.
15. Remove bearing caps and depth gauging tools from carrier.
16. Position the shim selected in step 14 on the pinion shaft against the pinion head.
17. Install the rear bearing on drive pinion, using J-8609 as shown in figure 23C.

Installation and Adjustment

1. Lubricate pinion bearings and outer races and place drive pinion in carrier.
2. Place a new pinion bearing spacer over pinion so it seats on inner race of rear bearing.
3. Slide pinion front bearing cone and roller assembly over pinion shaft so it seats against spacer.
4. Pack the cavity between the seal lips of the pinion flange oil seal with a lithium-base extreme pressure lubricant.
5. Place oil seal in carrier bore and tap into position.

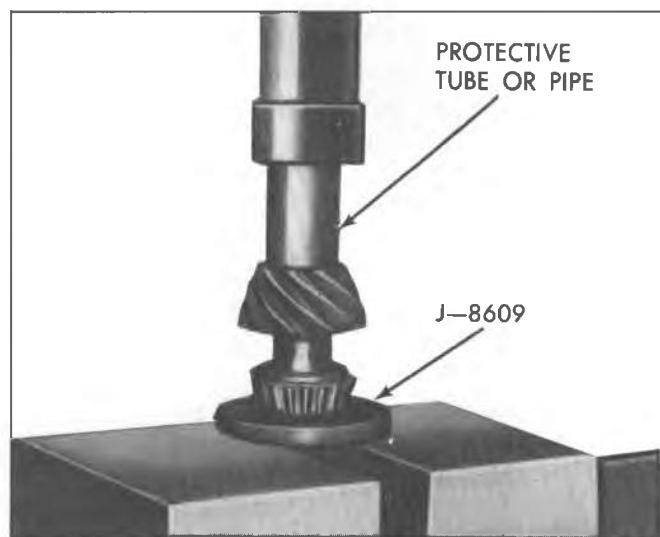


Fig. 23C—Installing Pinion Rear Bearing

with a hammer and drift, until oil seal flange seats against the carrier.

6. Install companion flange using Holder J-8614-11 and Installer J-5780. See Figure 24C.
7. Pack the cavity between end of pinion splines and pinion flange with a nonhardening sealer (such as Permatex Type A or equivalent) prior to installing washer and nut on pinion.
8. Install a new nut on pinion shaft. Tighten nut to remove end play—continue alternately tightening in small increments, and checking preload with torque wrench J-5853 and adapter J-5810 until torque required to rotate pinion is 20-30 in. lbs. for new bearings and seal, or 5-15 in. lbs. when used parts are reinstalled. See Figure 25C.

CHECKS AND ADJUSTMENTS

Four adjustments are essential for proper operation of the differential and its related parts. These adjustments

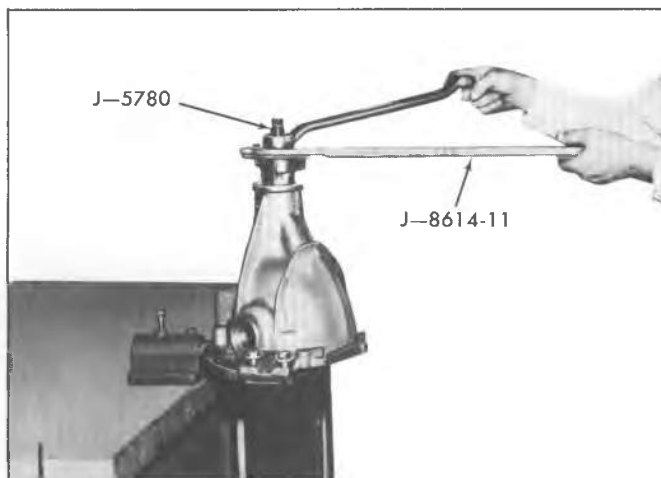


Fig. 24C—Installing Companion Flange

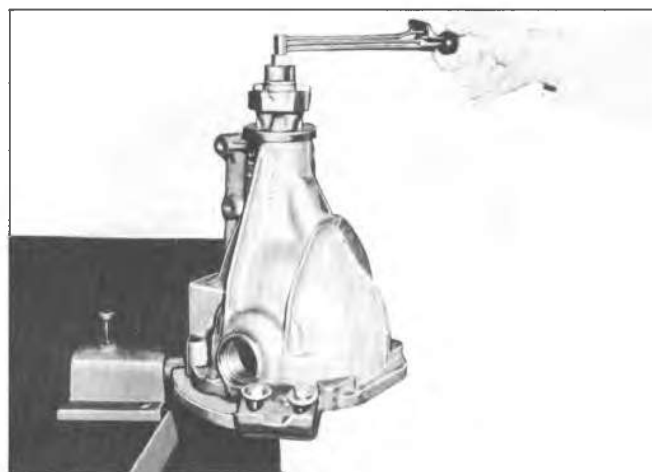


Fig. 25C—Measuring Rotating Torque

are a) Pinion Bearing Preload, b) Side Bearing Preload, c) Pinion Depth and d) Ring gear-to-Pinion Backlash.

Pinion Bearing Preload is set to specifications in step 8 of "Drive Pinion—Installation and Adjustment."

Side Bearing Preload is set to specifications in step 14 of "Differential Case—Installation and Adjustment."

Following service to the Differential Case or to the Drive Pinion and Ring Gear, a Gear Tooth Contact Pattern Check **must** be made to verify the accuracy of the work in setting the pinion depth and the Ring Gear-to-Pinion backlash.

Gear Tooth Contact Pattern Check

Prior to final assembly of the differential, a Gear Tooth Contact Pattern Check is necessary to verify the correct relationship between ring gear and drive pinion. Gear sets which are not positioned properly may be noisy, or have short life, or both. With a pattern check, the most desirable contact between ring gear and drive pinion for low noise level and long life can be assured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end. The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. See Figure 26C.

Test

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.
2. Use gear marking compound and apply this mixture sparingly to all ring gear teeth using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten bearing cap bolts to 55 lb. ft.

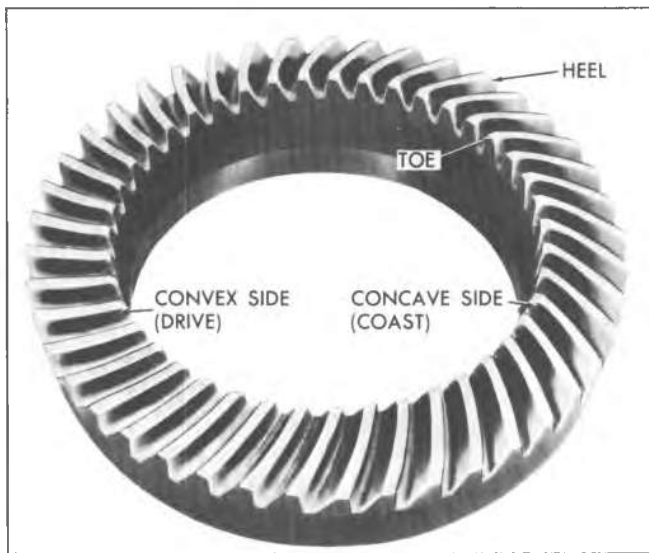


Fig. 26C—Gear Tooth Nomenclature

4. Expand brake shoes until a torque of 20-30 lb. ft. is required to turn the pinion.

NOTE: A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with wrench so that ring gear rotates one full revolution then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear is not recommended.

5. Observe pattern on ring gear teeth and compare with Figure 27C.

Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern. These are backlash and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on hand loaded teeth pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

NOTE: It may be necessary to adjust both pinion depth and backlash to obtain the correct pattern.

The position of the drive pinion is adjusted by increasing or decreasing the shim thickness between the pinion head and inner race of rear bearing. The shim is used in the differential to compensate for manufacturing tolerances. Increasing shim thickness will move the pinion closer to centerline of the ring gear. Decreasing shim thickness will move pinion farther away from centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims which moves the entire case and ring gear assembly closer to, or farther from the drive pinion. (The adjusting shims are also used to set side bearing preload). To increase backlash, increase right shim and decrease left shim an equal amount. To decrease backlash, decrease right shim and increase left shim an equal amount.

The important thing to note is that the contact pattern is centrally located up and down on the face of the ring gear teeth.

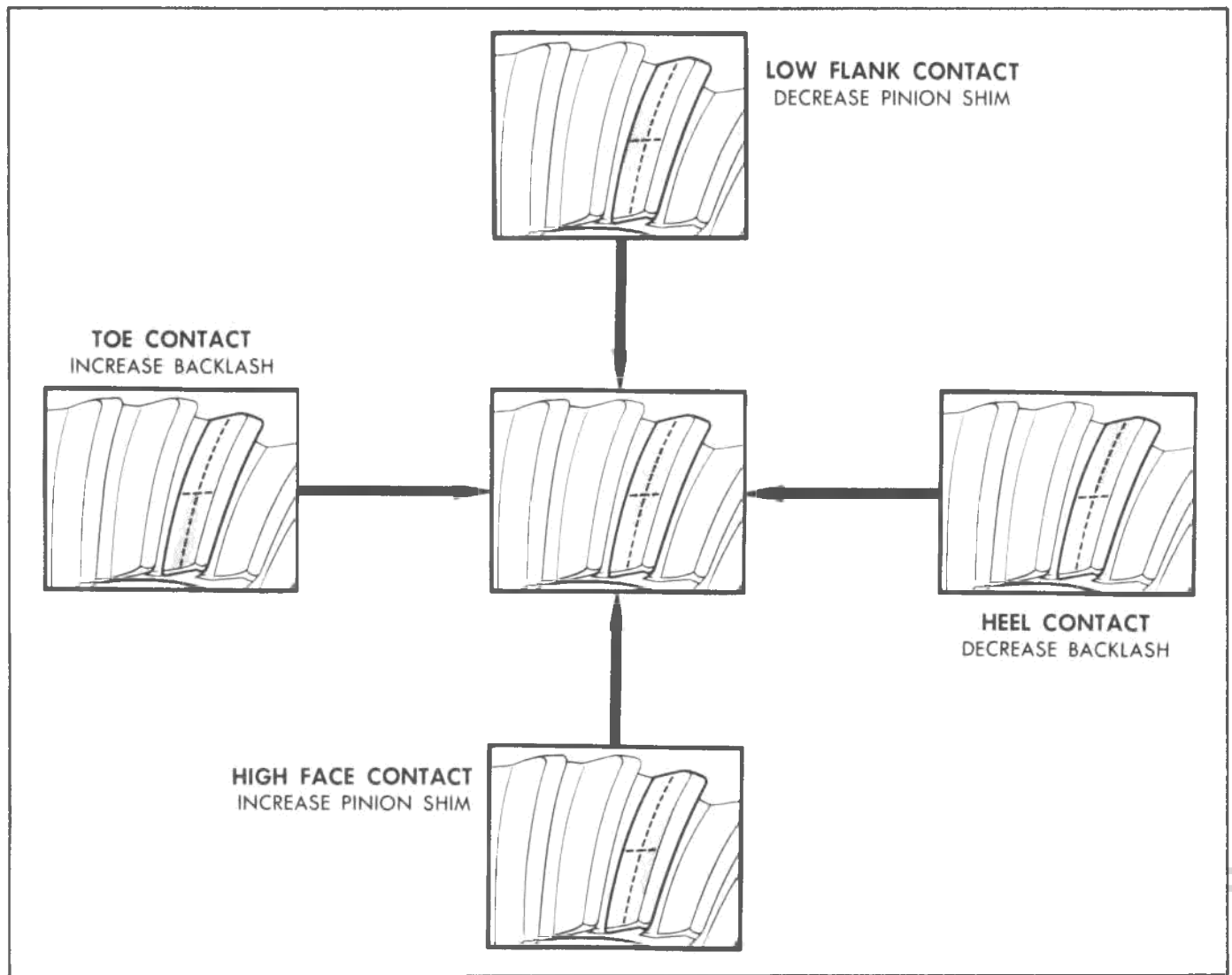


Fig. 27C—Gear Tooth Contact Pattern

LIMITED SLIP DIFFERENTIAL UNITS

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GENERAL DESCRIPTION

Vehicles with 8 1/2" ring gear or 8 7/8" ring gear axles use three optional limited slip differentials, namely Chevrolet, Eaton and Borg Warner. Corvette uses only the Eaton unit.

The Borg Warner unit is not repairable except for differential side bearings and must be replaced with either a Chevrolet or an Eaton Positraction differential unit, if service is necessary. See figure 1D.

All truck 10 1/2" ring gear axles produced by Chevrolet use an optional Eaton Positive Locking differential that is serviced as an assembly only. Truck 10 1/2" ring gear axles produced by Dana use only the optional Dana Power-Lok, shown in figure 17D.

Overhaul procedures for limited slip axles are the same as for standard axles, except for the following operations.

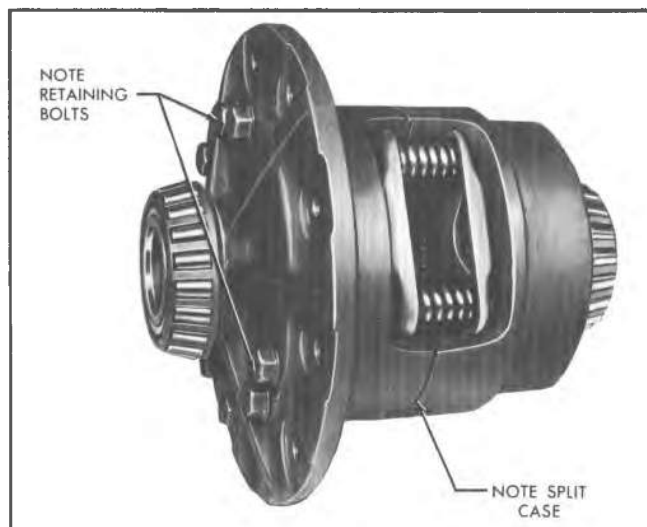


Fig. 1D—Borg Warner Positraction Identification

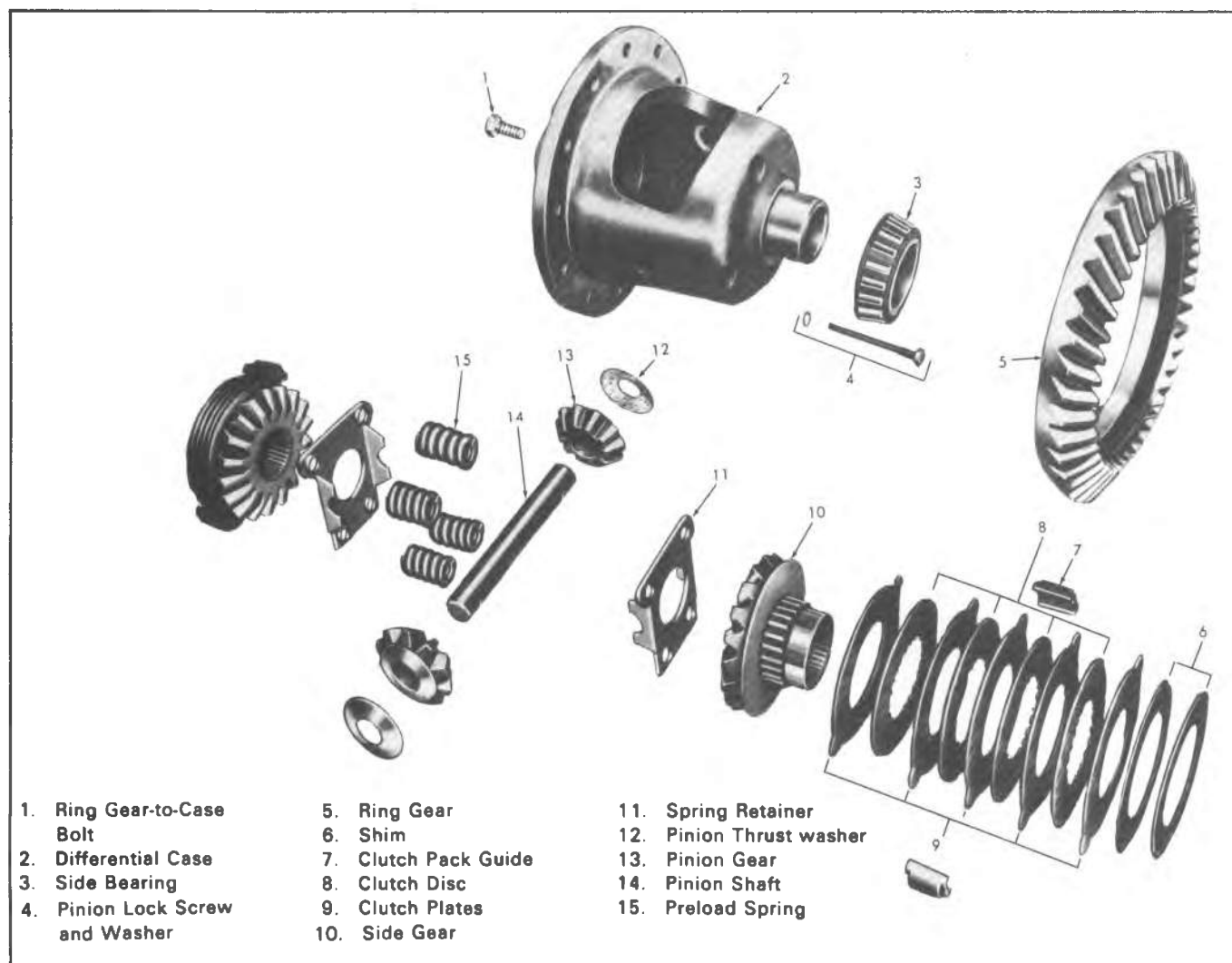


Fig. 2D—Eaton Positraction Exploded View

EATON POSITRACTION—FIGURE 2D

Disassembly

1. Remove ring gear and side bearings following the procedures established for the conventional differential unit.
2. **For all models except Corvette**, remove the preload spring retainer and springs by tapping on the spring retainer through the observation hole in the case. See Figure 3D. Drive the spring retainer from the case sufficiently to allow insertion of a 1/4 inch bolt in each of the two front springs. Secure each bolt with a nut as in Figure 4D.

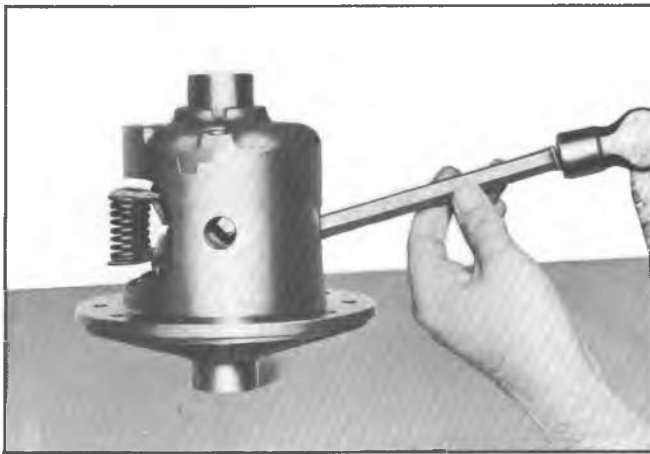


Fig. 3D—Removing Preload Spring Pack (Typical)

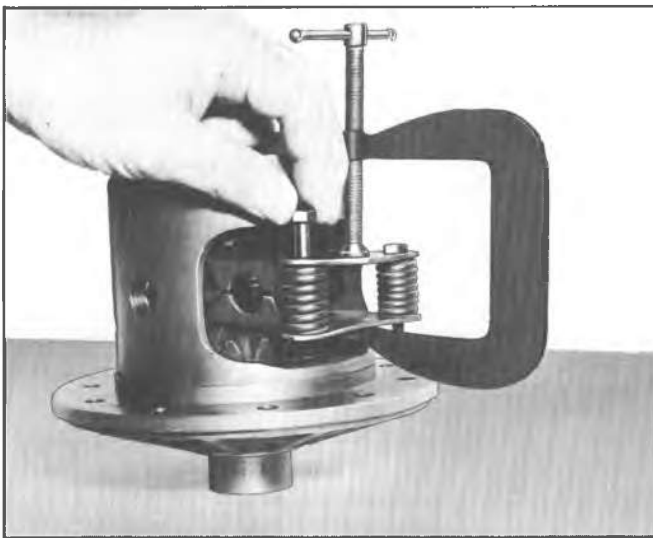


Fig. 4D—Installing Bolts to Retain Springs

3. **On Corvette** it will be necessary to raise the spring retainers slightly to clear the shoulder on the side gears. Install Tool J-22311 to clutch pack so that slotted ends are equally engaged at front and rear of spring retainer. See Figure 5D.



Fig. 5D—Removing Preload Spring Pack (Corvette)

4. After installing the retaining bolts continue to drive spring retainer from the case until enough of the retainer is exposed to permit installation of bar stock and "C" clamp as shown in Figure 6D. Center the bar stock over the axle shaft hole in the spring retainer, then compress "C" clamp sufficiently to permit withdrawal of spring pack.

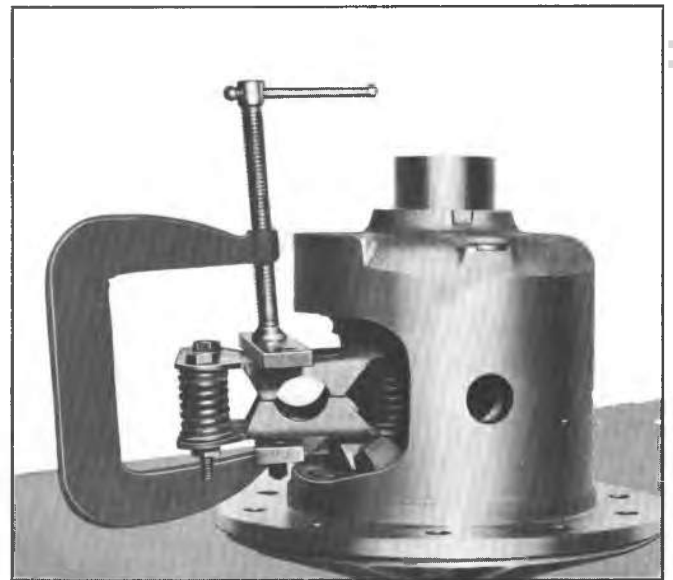


Fig. 6D— C-Clamp and Bar Stock Installed for Spring Removal

5. Position spring pack in vise and remove 1/4 inch bolts. Alternately relieve "C" clamp pressure and vise pressure until spring compression is relieved. See Figure 7D.

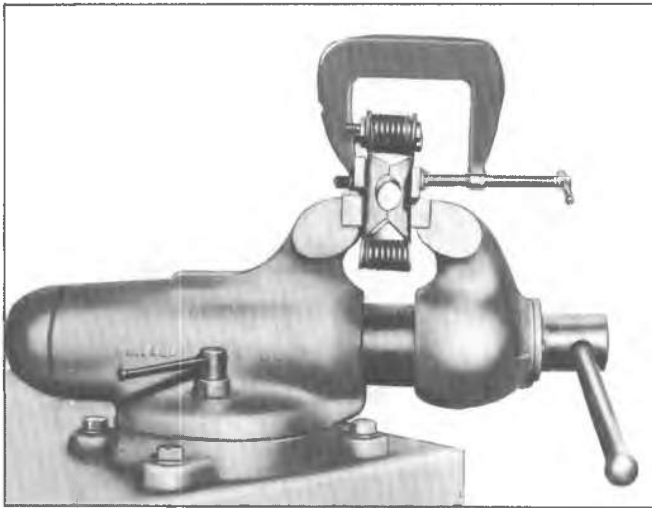


Fig. 7D—Removing Preload Springs from Pack

6. **For Truck Models**, roll out the differential pinions and thrust washers.

For Passenger models, pinion gears can be removed by rotating them in one direction only. Using Figure 8D as a reference, rotate differential case clockwise to remove the first gear, then rotate case counter-clockwise to remove the second gear. To remove second gear, it may be necessary to assist pinion gear upon its seat by prying on gear through observation holes on case. Mark pinions and side gears for reassembly in original position.

7. Remove side gear, clutch pack, shims and guides from case. Tap the assembly from the case, using a brass drift as shown in Figure 9D. Repeat removal on opposite gear.



Fig. 9D—Removing Side Gear

8. Separate clutch pack assembly from side gear. Retain clutch pack assembly with original side gear.

Inspection

1. Check clutch plates and discs for excessive wear and signs of overheating.
NOTE: Clutch plates and discs are not serviced separately. If replacement is required, clutch pack must be replaced as an assembly.
2. Inspect preload springs for distortion and other defects.
3. Compress springs and determine if they are capable of properly preloading the clutch pack, replace springs that are weak or questionable.
4. Examine spring retainer for alignment between the retainer halves and for excessive wear at spring seats.

Reassembly

1. Lubricate clutch plates and discs with special positraction lubricant.
2. Alternately position clutch plate and clutch disc on side gear, beginning and ending with clutch plate, until assembly of clutch pack is complete. See Figure 10D.
3. Install clutch pack guides on the clutch plate lugs. Make sure that the clutch disc lugs engage with side gear teeth.
4. Select shims of equal thickness as those removed from the case, or if old shims are suitable, reinstall them over the side gear hub.
5. Lubricate and assemble opposite side gear as above.
6. Install one side gear, clutch pack assembly and shim(s) in the differential case.

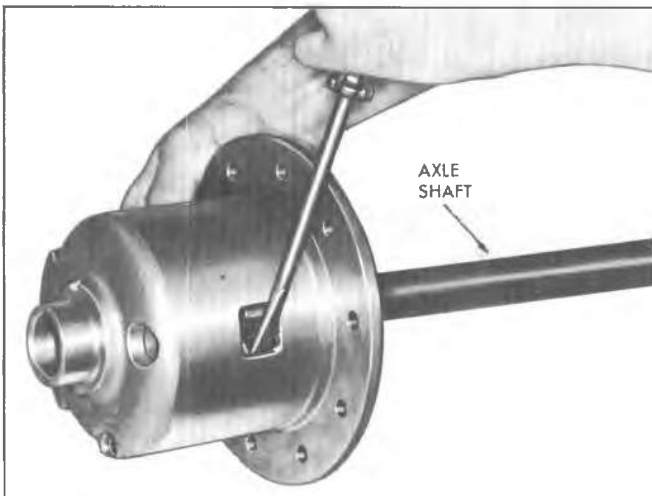


Fig. 8D—Removing Differential Pinion Gears



Fig. 10D—Assembling Clutch Pack

7. Position pinion gears and thrust washers on side gears. Install pinion shaft through case and gears.
8. Install dial indicator in case so that contact button rests against pinion gear as shown in Figure 11D.
9. Compress clutch pack, using a screwdriver as shown in Figure 11D. Move the pinion gear to obtain tooth clearance.
10. Tooth clearance should be .001" to .008". If required, change shims to obtain proper tooth clearance.
11. Remove side gear assembly and repeat tooth clearance procedure for other side gear on opposite side of case.
12. Remove pinion shaft, gears and thrust washers.
13. Install remaining side gear, clutch pack assembly and shims in case.
14. Install pinion gears and thrust washers. Installation of pinion gears can be performed by reversing the pinion gear removal procedure.

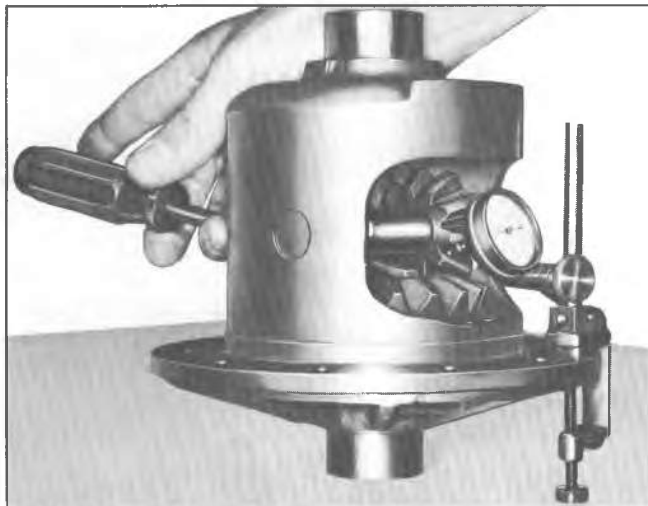


Fig. 11D—Measuring Pinion Gear Tooth Clearance

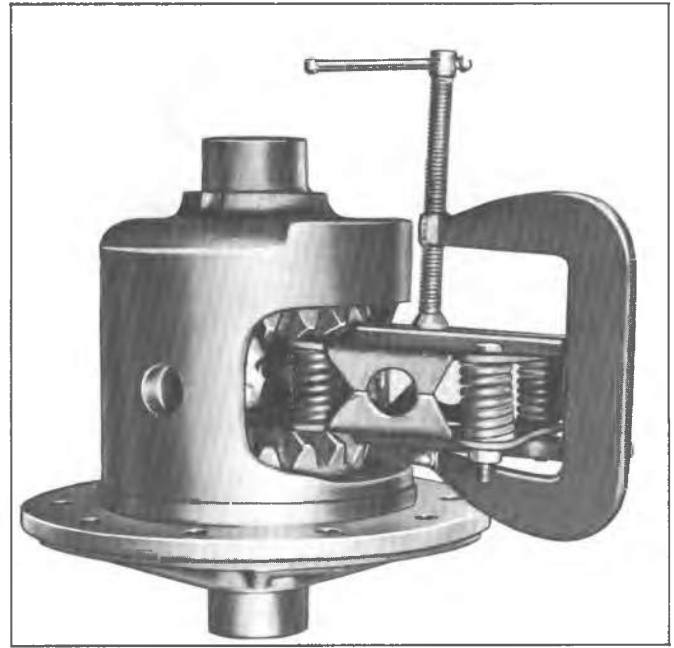


Fig. 12D—Spring Pack Compressed for Installation

15. **For all except Corvette** assemble springs in spring retainer and clamp assembly in vise. Install "C" clamp and bar stock on spring retainer then install a 1/4 inch bolt and nut in each front spring. See Figure 12D.
16. Position spring pack between side gears and remove bar stock and "C" clamp.
17. **On Corvette** install Tool J-22311 to compress clutch pack, secure pack with 1/4" bolts as shown in Figure 13D. Partially install pack then remove bolts and complete pack installation. Remove tool.
18. Drive spring pack into side gears sufficiently to retain front springs, then remove 1/4 inch bolts from springs. Drive spring pack into position. See Figure 14D.
19. Install the pinion shaft and lock screw to retain side gears until axle shafts are installed.

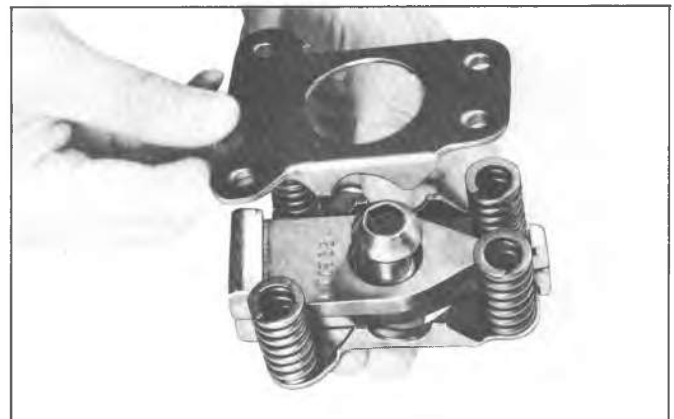


Fig. 13D—Installing Spring Pack Compression Tool (Corvette)

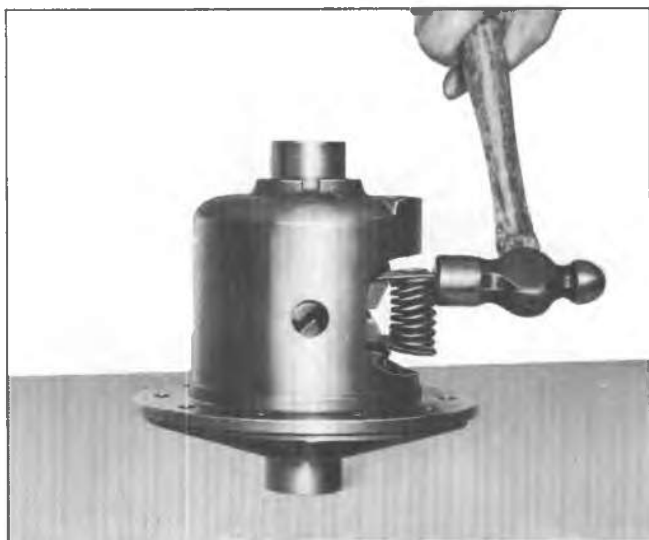


Fig. 14D—Installing Spring Pack

20. Check alignment of spring retainer with side gears. Slight movement of the spring pack can be made if necessary.
21. Install side bearings and ring gear to case using procedure outlined for the conventional differential.
22. Place differential in carrier and adjust bearings and backlash as outlined for the conventional differential.
23. Check operation of unit as follows:
 - a. Raise rear of vehicle until rear wheels are off the ground, and remove one wheel and tire assembly.
 - b. Attach Adapter J-5748 to axle shaft flange and install a 1/2-13 bolt into adapter, shown in Figure 15D.
 - c. With wheel and tire assembly still on vehicle held firmly to prevent turning, measure torque required to rotate opposite axle shaft with a 0-150 lb. torque wrench attached to J-5748. Torque required to rotate axle shaft should be no less than 40 ft-lbs.

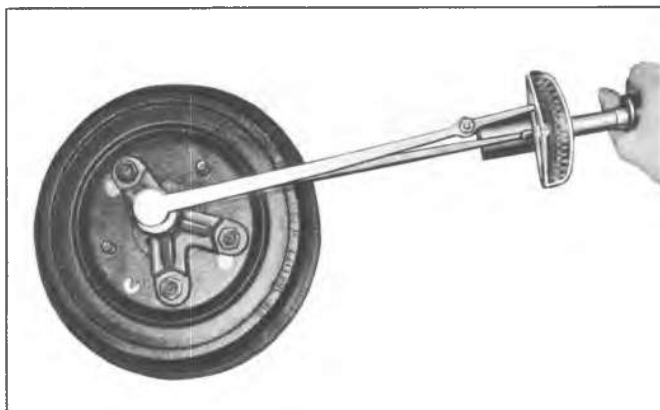


Fig. 15D—Measuring Positraction Rotating Torque

CHEVROLET POSITRACTION—FIGURE 16D

A Chevrolet produced Positraction differential unit is used optionally in 8 1/2 inch ring gear axles. Individual components of this positraction unit are not interchangeable with other design units.

Disassembly

1. Remove ring gear and side bearings following the procedures established for the conventional differential unit. Remove pinion shaft.
 2. Using a wide, blunt instrument such as a drift or block of wood, drive the preload spring from the case.
 3. Support an axle shaft in a vise, and slide the case into the shaft; then turn the case to remove both pinions and thrust washers.
- NOTE: The pinion shaft may be partially installed to aid in rotating the case.
4. Remove the case from the axle shaft and remove both side gears, clutch packs and shims. Mark the gears, clutch packs and shims for reinstallation in same positions.

Inspection

Check the clutch plates and discs for wear and signs of overheating. Check the condition of the preload spring. Check the gear teeth for signs of wear. Replace parts as needed. Clean all parts to be used for assembly.

NOTE: The force required to compress the preload spring to 1-5/16 inches should be 300 lbs. $\pm$ 30 lbs.

Reassembly

1. Lubricate the clutch discs and plates with positraction lubricant.
2. Alternately position clutch plates and discs on a side gear, beginning and ending with a clutch plate.
3. Position the side gear, clutch pack and original shim into the case.
4. Install both pinion gears and thrust washers into the case, and install pinion shaft.
5. Place the case onto an axle shaft supported in a vise.
6. Insert a screwdriver between the pinion shaft and the face of the side gear. Force the screwdriver in until the clutch pack is compressed.
7. Check the backlash between side gear and pinion gears. If backlash does not fall into the range of .005" to .008", adjust the shim dimension as required. Increasing shim thickness will decrease backlash; to increase backlash, decrease the thickness of the shim.

NOTE: Service shims are available from .070" to .122" in increments of .004".

8. Remove the pinion shaft, pinion gears, side gear, clutch pack and shim from the case.
 9. Install the opposite gear, clutch pack and original shim into the opposite side of the case. Place both pinion gears, and thrust washers into position, and install the pinion shaft.
 10. Follow the procedure in steps 5, 6 and 7 to determine the proper shim dimension.
 11. When the proper shims have been determined to achieve .005" to .008" backlash between both pinion gears and both side gears, install shims, clutch packs and side gears into case.
 12. Mount the case onto the axle shaft locked in a vise. Place both pinions and thrust washers into position—180° apart—and carefully "roll in" by turning the case on the shaft.
- NOTE: A large "C" clamp may be used to apply slight compression against pinion gears to aid the "rolling in" procedure.
13. Tap the preload spring into place with a hammer.
 14. Install the pinion shaft and lock screw.
 15. Install the side bearings and ring gear using the procedure outlined for conventional units.
 16. Place the differential unit in the carrier and adjust ring gear and pinion backlash, and gear tooth pattern.

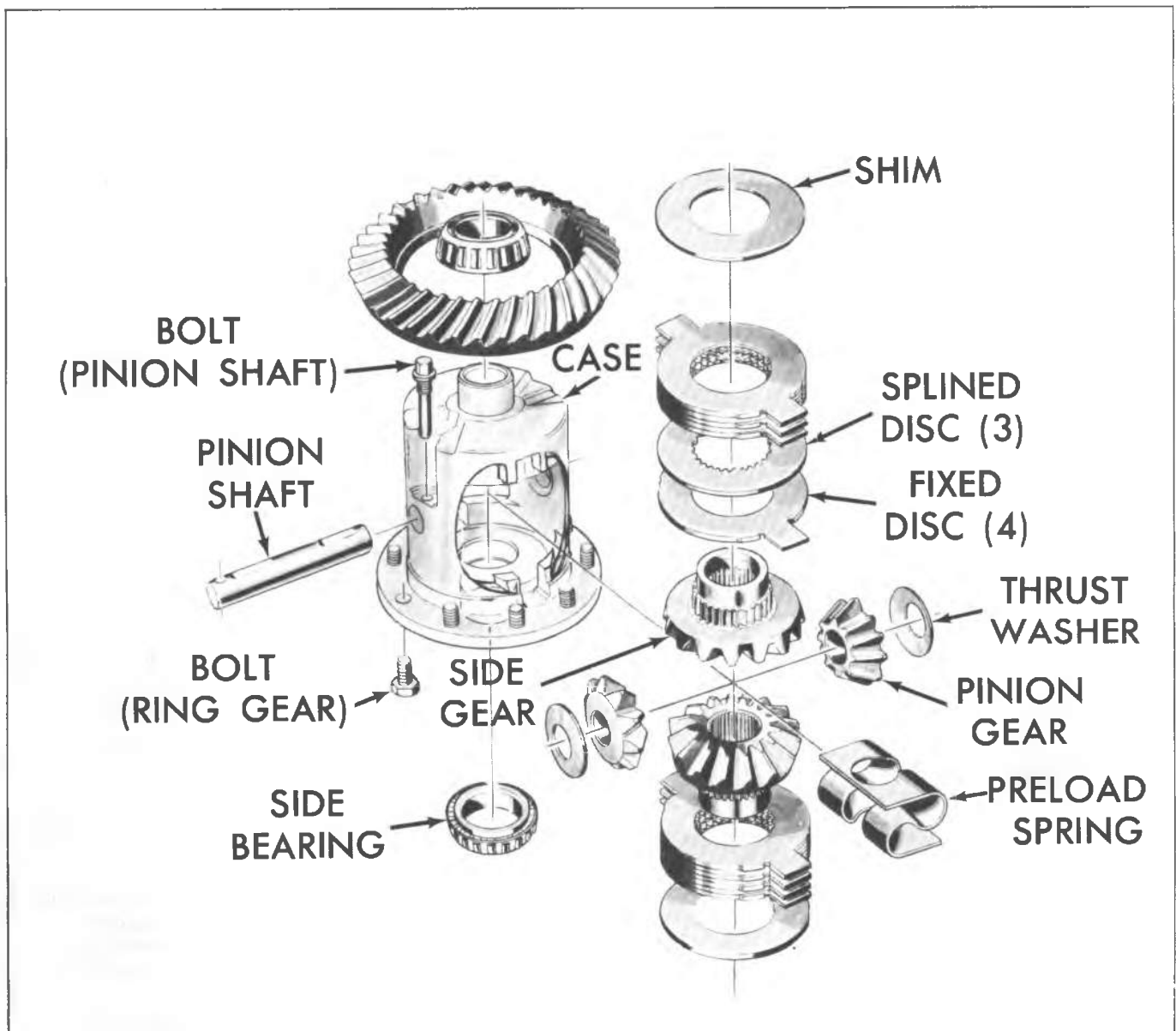


Fig. 16D—Chevrolet Positraction—Exploded

POWER-LOK DIFFERENTIAL

The Power-Lok differential shown in Figure 17D is a unit which is installed as optional equipment in place of the standard differential. The locking differential permits the major driving force to be transmitted to the wheel with better traction. This means that the vehicle can be operated on ice, snow, sand or under other adverse conditions with a minimum amount of slippage through one wheel.

Disassembly

1. Remove differential bearing cups and tag for reassembly reference.
2. Remove differential bearing cones, using Puller Tool J-22888.
3. Tag each bearing cone and shim for reassembly reference, as they should be replaced in their original locations.
4. Scribe mark on both halves of differential so they can be reassembled in their original locations.
5. Remove eight bolts attaching two halves of case together.
6. Separate plain half of differential case from flanged half.
7. Remove five plates and discs from side gear ring.

NOTE: A series of clutch plates and dished (Belleville) friction plates on each side of differential side gears transmits drive from differential case to axle shafts. Carefully observe the order in which the plates are used, since they must be replaced in the same order. Refer to Figure 17D.

8. Remove side gear ring and side gear.
9. Remove two cross shafts and pinion gears.
10. Remove side gear, side gear ring, and five plates and discs from the opposite side. Observe the order in which the plates are used.

Inspection

1. Inspect cross shafts and pinions for scoring, wear, pitting, etc. If the center lands of either cross shaft show signs of wear, examine ends of axle shafts to determine if the axle shaft is rubbing against cross shaft. This rubbing condition may cause a whine or howl that is similar to a pinion bearing noise, at 40 to 50 MPH. This condition can be corrected by grinding 1/32" off the end of the axle shaft.

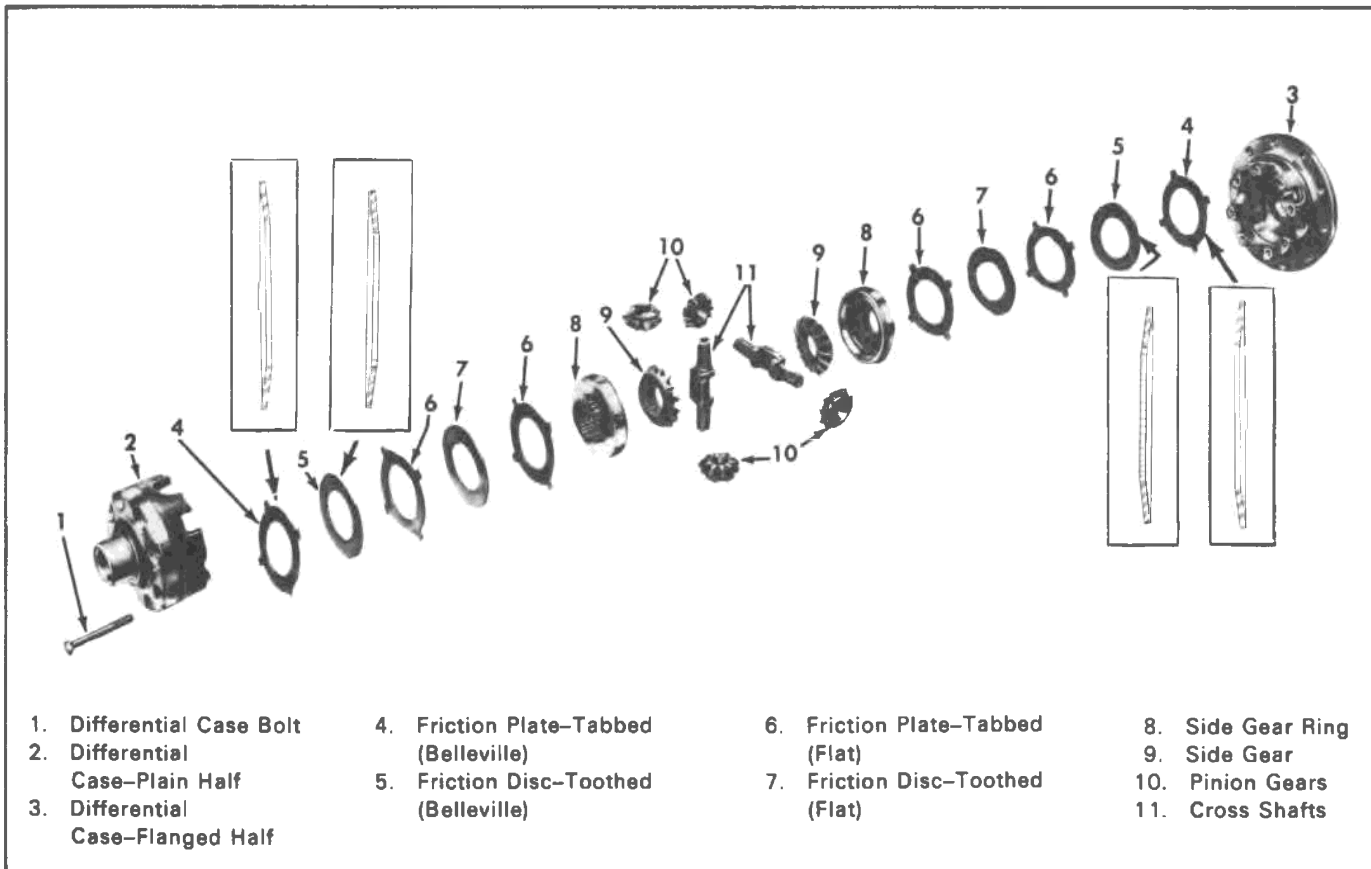


Fig. 17D—Power-Lok Differential

2. Inspect clutch discs and plates for wear, cracked, or distorted condition. Refer to "Specifications" section.
3. Inspect side gear rings, side gears, and differential cases for worn, cracked, or distorted condition that would render these parts unfit for further services.

Assembly

During assembly operations, all parts should be kept clean and free of dirt or other foreign material. As each part is assembled in its proper position, it is necessary that it be lightly coated with the correct lubricant.

1. Place tabbed Belleville friction plate (4) in flanged differential case, being extremely careful that convex (bulged) side is toward the side gear. See Figure 17D.
2. Assemble remaining plates and discs to splines of side gear ring, being sure they are assembled in the same order of removal. The convex (bulged) side of the Belleville friction disc (5) should be toward the side gear and it should nest into the Belleville friction plate (4).
3. Place assembled side gear ring with plates and discs in flanged half of differential case.
4. Install side gear and cross shafts with pinions.
5. In the order listed install the following: (1) side gear, (2) side gear ring, (3) flat plate with tabs, (4) flat disc with teeth, (5) flat plate with tabs, (6) Belleville disc with convex (bulged) side up, or toward side gear, (7) Belleville plate, with convex (bulged) side up, or side toward gear.
6. Position plain half of differential case over previously assembled parts with scribe markings on both halves of case in alignment.
7. Install differential case bolts, but do not tighten at this time.

8. Before tightening bolts, use axle shafts and align splines of the side gear and side gear ring, on each side. Tighten bolts evenly and alternately. Remove axle shafts.
9. Observe if Power-Lok components have been assembled properly. Each pinion cross shaft can be tight on its ramp or if there is clearance it should be only a few thousandths, and it should be equal at all four cross shaft ends.

Testing Procedure

The Power-Lok can be effectively tested for correct operation by placing one rear wheel on good dry pavement and the other on ice, snow, mud, gravel, grease, etc.

It can easily be determined whether or not the non-slipping wheel is providing pulling power. The procedure should then be repeated with the opposite wheels on the dry and slippery surfaces.

The above testing procedure is a rough test that can be made by the owner of the vehicle. However, if it is suspected that the unit is not operating properly, it can be checked by the following procedure.

Be sure the transmission is in neutral. Raise one wheel off the floor and place a block in the front and rear of the opposite wheel. Remove the hub cap and install a special tool across two wheel studs. Apply a torque wrench to special tool. Disregard breakaway torque and observe only the torque required to continuously turn the wheel smoothly.

If the torque reading is less than 40 foot-pounds or more than 200 ft. lb., the unit should be disassembled and the necessary repairs made.

CHEVROLET SERIES 20-30 TRUCK DIFFERENTIAL 10-1/2" RING GEAR

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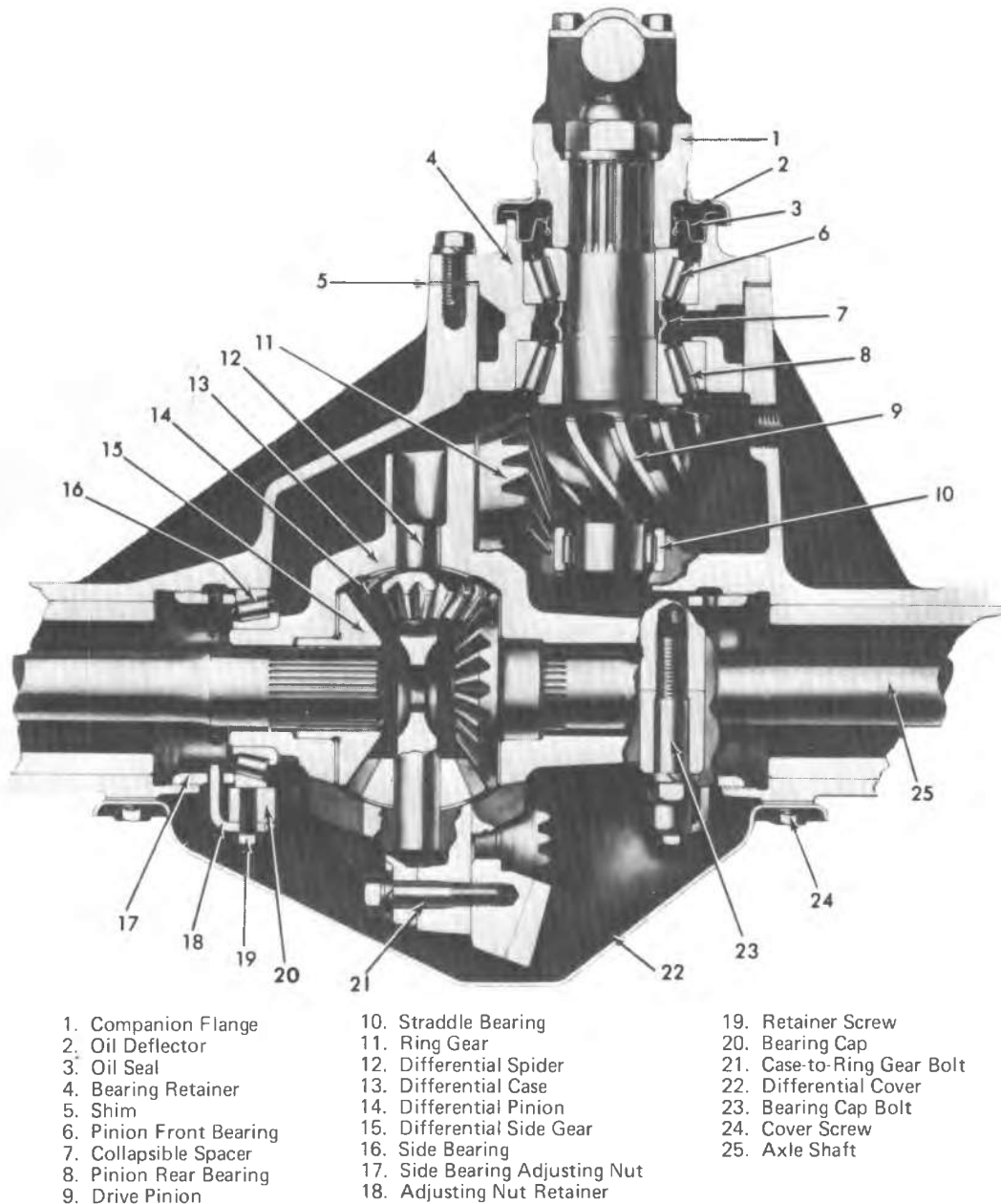


Fig. 1E—Cross Section of Chevrolet Truck Differential with 10 1/2" Ring Gear

DIFFERENTIAL CASE

Removal

1. Mount axle assembly in a bench vise or holding fixture.
2. Remove cover bolts and cover, as seen in figure 2E, and allow lubricant to drain into pan.
3. Remove axle shafts as outlined in Truck Service Manual.

NOTE: Before proceeding with following steps, it is advisable to check the existing ring gear to pinion backlash as described in Step 9 of "Differential Case—Installation." This will indicate gear or bearing wear or an error in backlash or pinion depth setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, then may be reinstalled at original lash to avoid changing gear tooth contact.

4. Remove adjusting nut lock retainers from bearing caps.
5. Mark bearing caps for reinstallation in the same position, and remove caps.
6. Loosen side bearing adjusting nuts, using J-24429 as shown in figure 3E.
7. Remove differential from carrier.

Side Bearing Replacement

1. Install bearing puller J-8107 onto one side bearing, with puller screw centered on pilot plug as shown in figure 4E. Be sure to install puller fingers into notches of case, in order to pull on inner race only.
2. Tighten puller screw, while rotating bearing to insure that bearing cage is not being distorted.
3. Remove the other bearing in the same manner.

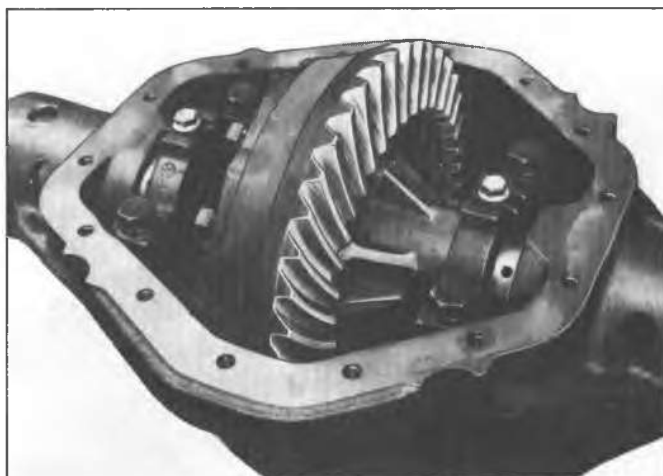


Fig. 2E—Cover Removed from Carrier

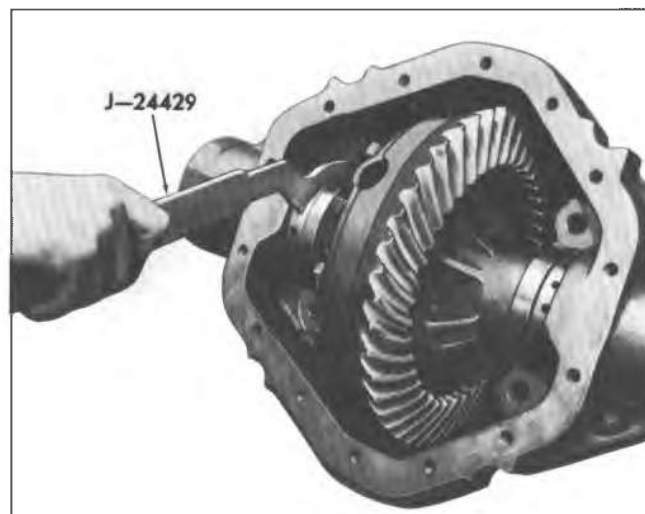


Fig. 3E—Loosening Adjusting Nuts



Fig. 4E—Differential Bearing Removal

4. Inspect bearings and hub for nicks, burrs or evidence of abnormal wear.
5. To install bearings, place bearing onto hub, and use driver handle J-8092 and bearing installer J-24430 to drive bearing onto hub until it seats against the shoulder.
6. When installing the second bearing, support case on pilot plug as shown in figure 5E to prevent damage to first bearing installed.

Ring Gear Replacement

1. Remove the ring gear bolts and lock washers, and use a soft faced hammer to tap the ring gear from the case.
2. Place new ring gear into position on case and install lock washers and bolts.
3. Torque bolts alternately to specifications.



Fig. 5E—Differential Bearing Installation

Disassembly of Case

1. Mark the case and cover halves with a scribe line for reassembly in the same position.
2. With ring gear removed, separate case and cover.
3. Remove the internal parts and keep separated so they may be installed in the same relative positions.

Inspection

1. Inspect the differential gears, pinions, thrust washers, spider and all mating surfaces for evidence of abnormal wear.
2. Clean all parts thoroughly in suitable solvent.
3. Replace parts as necessary.

Reassembly of Differential

1. Lubricate internal parts with hypoid gear lubricant.
2. Place differential pinions and thrust washers onto spider.
3. Assemble differential gears and washers to case and cover.
4. Assemble differential case and cover making sure scribe marks align.
5. Install ring gear and attaching bolts and lockwashers, and torque alternately to specifications.
6. The differential may be installed into the carrier at this point, or may be installed after servicing the drive pinion.

Installation and Adjustment

1. Place bearing cups over side bearings and lift the differential assembly into the carrier. Install bearing caps, making sure marked caps are installed in original positions. Secure the cap bolts snugly.

2. Loosen the right side adjusting nut and tighten the left side nut, using J-24429 as shown in figure 3E, until the ring gear contacts the drive pinion. Do not force the gears into contact so as to bind them. At this point, zero lash is obtained.
3. Back off the left adjusting nut approximately two slots. Install locking fingers into holes and fasten fingers to bearing cap.
4. Tighten right adjusting nut firmly to force the case into solid contact with the left adjusting nut.
5. Loosen right adjusting nut until it is free from its bearing, then retighten until it contacts the bearing.
6. Tighten right adjusting nut approximately two slots if used bearings are being installed, or three slots if new bearings are being installed.
7. Install locking retainer into holes and attach fingers to bearing cap.
8. Torque bearing cap bolts to specification.

NOTE: At this point the differential bearings are properly preloaded. If any additional adjustments are required in the following procedures make sure that the preload remains as established. If one adjusting nut is loosened the other nut must be tightened **an equal amount** to maintain this preload.

9. Mount a dial indicator on the housing and measure the backlash between the ring gear and pinion. Backlash should be from .003" to .012" with .005" to .008" preferred. Refer to figure 6E.

NOTE: If backlash is more than .012" loosen the right adjusting nut one slot and tighten left adjusting nut one slot. If backlash is less than .003" loosen the left adjusting nut one slot and tighten the right adjusting nut one slot.

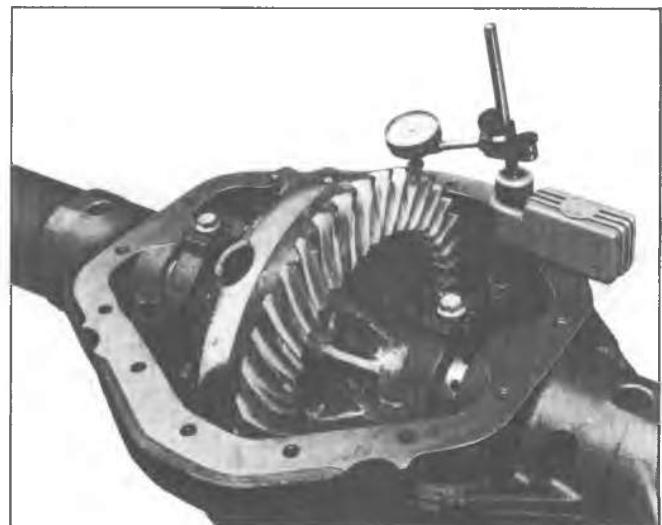


Fig. 6E—Measuring Backlash

DRIVE PINION ASSEMBLY

Removal

1. Remove differential as previously outlined.
2. Check pinion bearing preload as described under "Drive Pinion - Reassembly". Record the result. If there is no preload reading, check for looseness of pinion assembly by shaking the companion flange. Looseness indicates the need for bearing replacement.
3. Remove the pinion bearing retainer bolts from the housing as shown in figure 7E.
4. Remove the pinion and bearing retainer assembly. It may be necessary to rap on the pilot end of the pinion to assist the assembly from the carrier.
5. Record the thickness of the shims removed from between the bearing retainer flange and the carrier housing.

Disassembly

1. Clamp the pinion assembly in vise.
2. Install Holder J-8614-11 on flange by using two bolts with flat washers, as shown in figure 8E. Position J-8614-11 on flange so that the four notches are toward the flange.
3. Use a suitable sized socket to remove the pinion nut and washer. Discard the pinion nut and use a new one upon reassembly.
4. Thread end of J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-11 installed as in step 2, insert J-8614-2 into J-8614-11 and turn it 1/8 of a turn to locked position. Remove flange by turning J-8614-3 while holding J-8614-11 as shown in figure 9E.
5. Support the bearing retainer as shown in figure 10E and press out the drive pinion. Do not allow drive pinion to fall onto the floor.



Fig. 7E—Removing Retainer Bolts

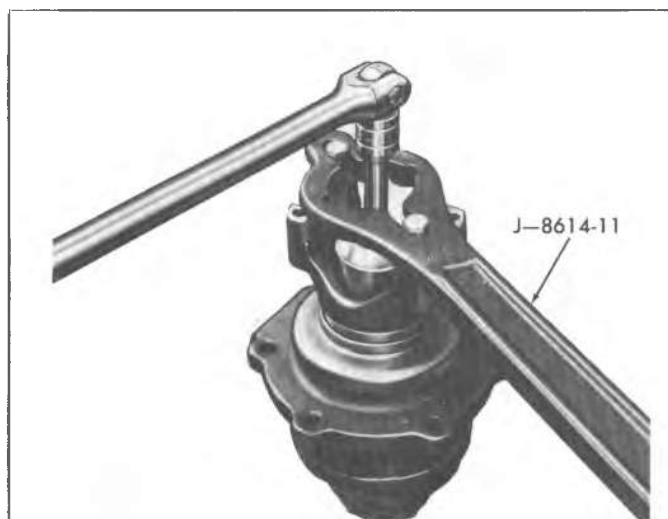


Fig. 8E—Removing Pinion Nut

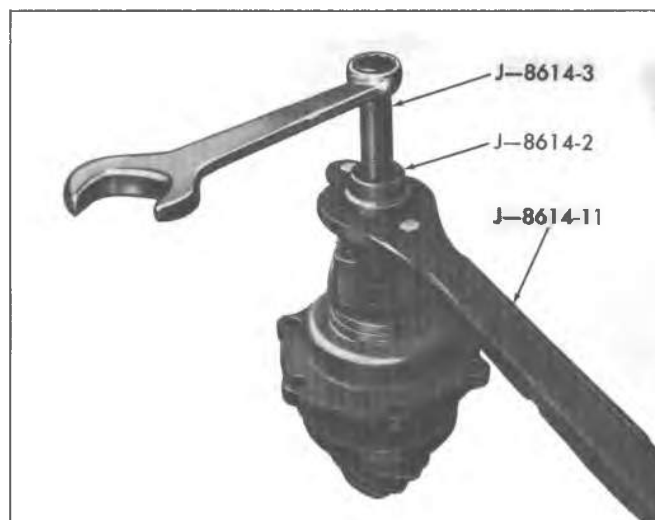


Fig. 9E—Removing Flange

6. Separate the pinion flange, the oil seal, the front bearing and the bearing retainer. The oil seal may have to be driven from the bearing retainer if it is being replaced.
7. Drive the pinion front and rear bearing cups from the bearing retainer, using a drift.
8. To remove the rear bearing, use J-22912 as shown in figure 11E.
9. Drive the pinion straddle bearing from the carrier housing, using a drift as shown in figure 12E.

Inspection

1. Clean all parts in a suitable solvent and dry with air.
2. Inspect the drive pinion for chipped, cracked or excessively worn teeth and inspect the splines for wear.
3. Inspect the bearings for worn or pitted rollers or races. Inspect the pinion flange splines for wear.

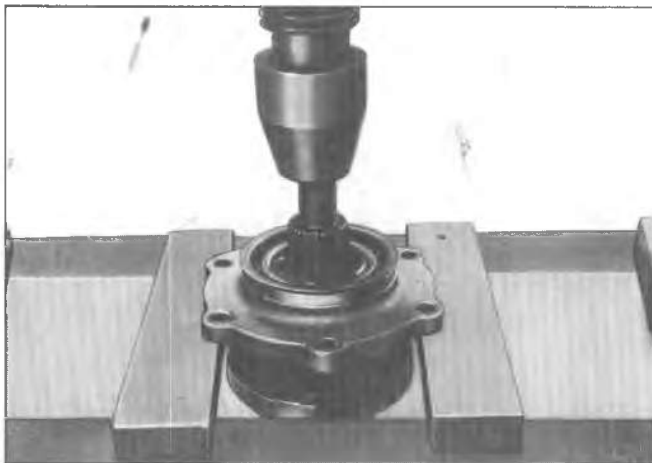


Fig. 10E—Pressing Drive Pinion from Bearing Retainer

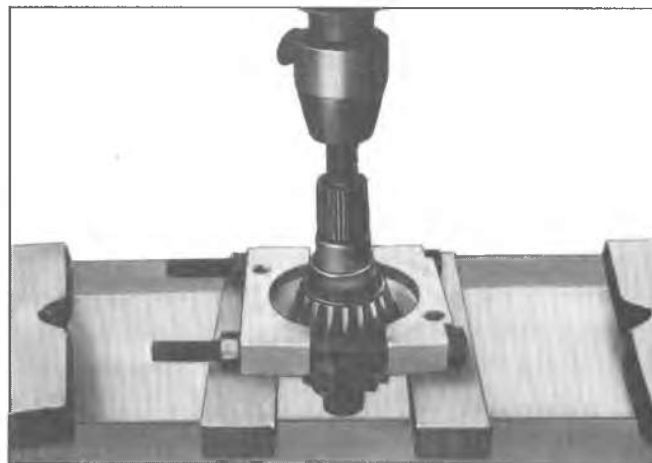


Fig. 11E—Removing Pinion Rear Bearing

4. Inspect the bearing retainer for cracks, imperfections, corrosion, pits and grooves.
5. Replace parts as required.

Reassembly

1. Lubricate all parts with hypoid lubricant.
2. Press pinion rear bearing onto drive pinion as shown in figure 13E, using J-24433.
3. Install the front and rear pinion bearing cups into the bearing retainer, using driver handle J-8092 on J-8608 for the front cup, and on J-24432 for the rear cup.
4. Install the pinion straddle bearing into the carrier housing, using driver handle J-8092 and installer J-23322, as shown in figure 14E.
5. Place bearing retainer, with cups in position, onto

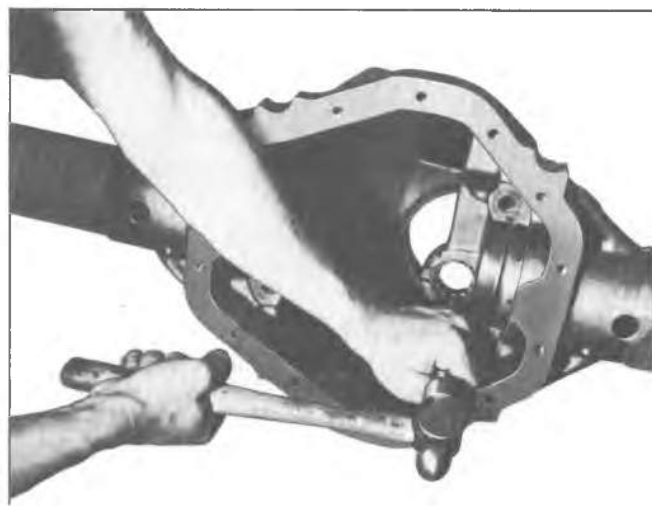


Fig. 12E—Removing Straddle Bearing

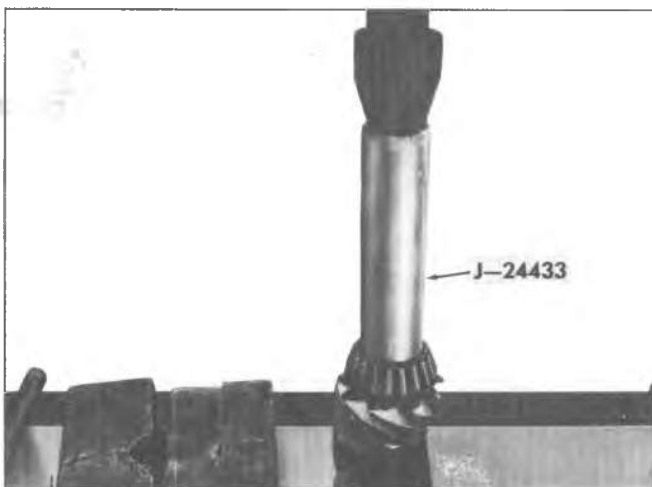


Fig. 13E—Installing Pinion Rear Bearing

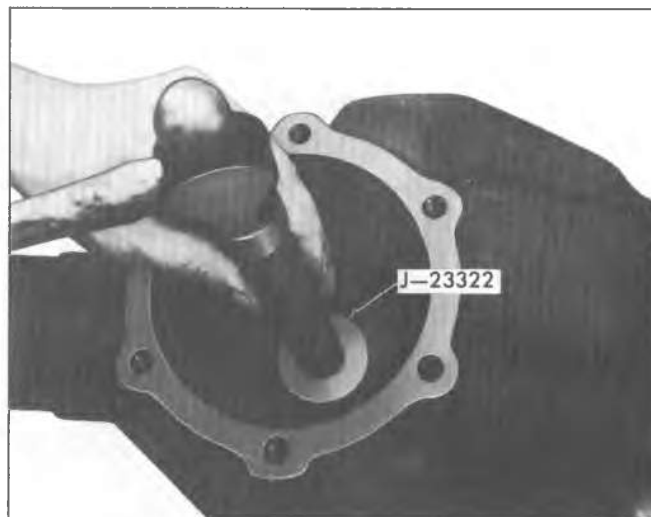


Fig. 14E—Installing Straddle Bearing

the drive pinion. Install a new collapsible spacer into position.

6. Press front bearing onto drive pinion.
7. Lubricate the oil seal lips with a lithium-base extreme pressure lubricant, and install the seal in the retainer bore. Use J-24434 with driver handle J-8092. Press the seal into the bore until it seats against internal shoulder.
8. Install pinion flange and oil deflector onto the splines, then install lock washer and new pinion nut.
9. Clamp the pinion flange into a vise. Install J-8614-11 as in figure 8E. Tighten the nut to achieve proper bearing preload.
 - a. Proper preload is attained when rotational torque required to rotate the pinion is 25-35 in. lbs. for new bearings, or 5-15 in. lbs. for used bearings.
 - b. Tighten pinion nut to approximately 350 ft. lbs., then take a torque reading as shown in figure 15E, using J-5853.
 - c. Continue tightening pinion nut in small increments until proper preload is attained.

CAUTION: *Over-tightening of pinion nut may collapse spacer too much, requiring its replacement.*

Installation and Adjustment

1. Examine the head of the drive pinion for a pinion depth code number.
2. Compare the depth code number with the number on the original pinion. Use the following chart to select the proper shim for preliminary setting of pinion depth.
3. Refer to the thickness of the shim recorded earlier in Pinion Removal procedures. Increase or decrease

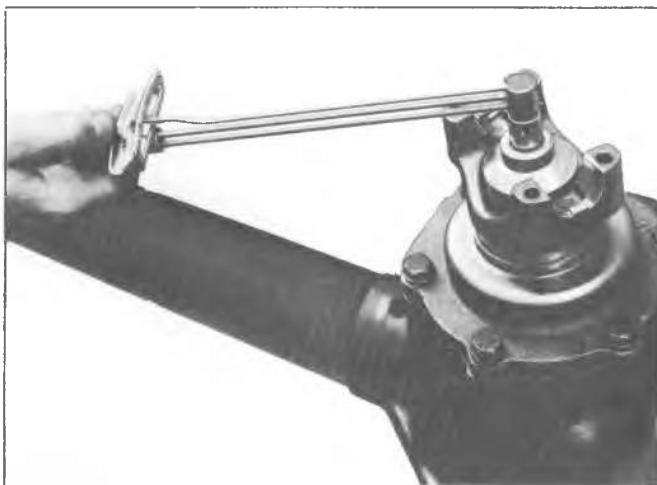


Fig. 15E—Measuring Rotating Torque

		CODE NUMBER ON ORIGINAL PINION				
		+2	+1	0	-1	-2
CODE NUMBER ON SERVICE PINION	+2	—	ADD .001	ADD .002	ADD .003	ADD .004
	+1	SUBT. .001	—	ADD .001	ADD .002	ADD .003
	0	SUBT. .002	SUBT. .001	—	ADD .001	ADD .002
	-1	SUBT. .003	SUBT. .002	SUBT. .001	—	ADD .001
	-2	SUBT. .004	SUBT. .003	SUBT. .002	SUBT. .001	—

Fig. 16E—Pinion Depth Codes

the shim dimension as indicated by the chart in figure 16E.

- a. For example, if original shim measured .014 inch, original code was -1 and new code is +2, the correct shim would be .014 inch plus .003 = .017 inch.
 - b. If original shim was .012 inch, original code +2, and new code is -2, the correct shim would be .012 minus .004 = .008 inch.
4. Place the pinion shim as determined in step 3 onto the carrier housing, making sure the bolt holes align with those of carrier, and that the mating surfaces are clean and free from foreign material.
 5. Place the pinion retainer assembly into position, and align bolt holes to carrier. Install retaining bolts and tighten in a crosswise manner. Torque to specifications.
 6. Following drive pinion service, a Contact Pattern Check must be made.

CHECKS AND ADJUSTMENTS

Four adjustments are essential for proper operation of the differential and its related parts. These adjustments are a) Pinion Bearing Preload, b) Side Bearing Preload, c) Pinion Depth and d) Ring Gear-to-Pinion Backlash.

Pinion Bearing Preload is set to specifications in step 9 of "Drive Pinion Reassembly".

Side Bearing Preload is set to specifications in step 6 of "Differential Case—Installation and Adjustment".

Following service to the Differential assembly or to the Drive Pinion, the Pinion Depth and the Ring-Gear-to-Pinion Backlash **must** be checked, using a Gear Tooth Contact Pattern Check as outlined below.

Gear Tooth Contact Pattern Check

Prior to final assembly of the differential, a Gear Tooth

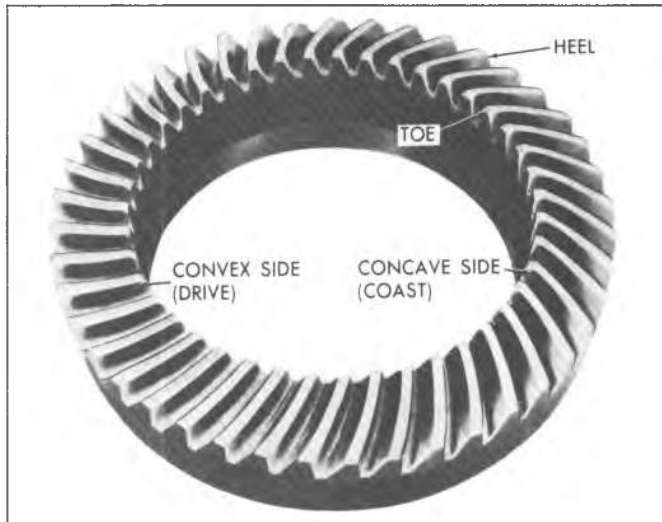


Fig. 17E—Gear Tooth Nomenclature

Contact Pattern Check is necessary to verify the correct relationship between ring gear and drive pinion. Gear sets which are not positioned properly may be noisy, or have short life, or both. With a pattern check, the most desirable contact between ring gear and drive pinion for low noise level and long life can be assured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end. The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. See Figure 17E.

Pattern Check

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.
2. Use gear marking compound (yellow lead chromate or equivalent) and apply this mixture to ring gear

teeth. When properly applied, the area of tooth contact will be clearly visible after load is applied.

3. Tighten bearing cap bolts to specifications.
4. Apply load to gears by expanding brake shoes or by wrapping a heavy rag around the companion flange to resist rotation.

NOTE: A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with wrench so that ring gear rotates one full revolution then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear is not recommended.

5. Observe pattern on ring gear teeth and compare with figure 18E. Make adjustments as outlined below.
6. The important thing to achieve in the pattern check and subsequent adjustments is to locate the contact pattern centrally on the face of the ring gear teeth.

Pinion Depth Adjustment

1. The pinion depth shim may be replaced as necessary to place the drive pinion at the correct depth. See figure 18E.
2. Depth shims are available from .006 inch to .024 inch, in increments of .001 inch.

Backlash Adjustment

1. Remove locking retainers from side bearing adjusting nuts.
2. Move adjusting nuts **an equal amount** in or out to achieve proper backlash.
 - a. To increase backlash, loosen the left adjusting nut and tighten the right adjusting nut **an equal amount**.
 - b. To decrease backlash, loosen the right adjusting nut and tighten the left adjusting nut **an equal amount**.

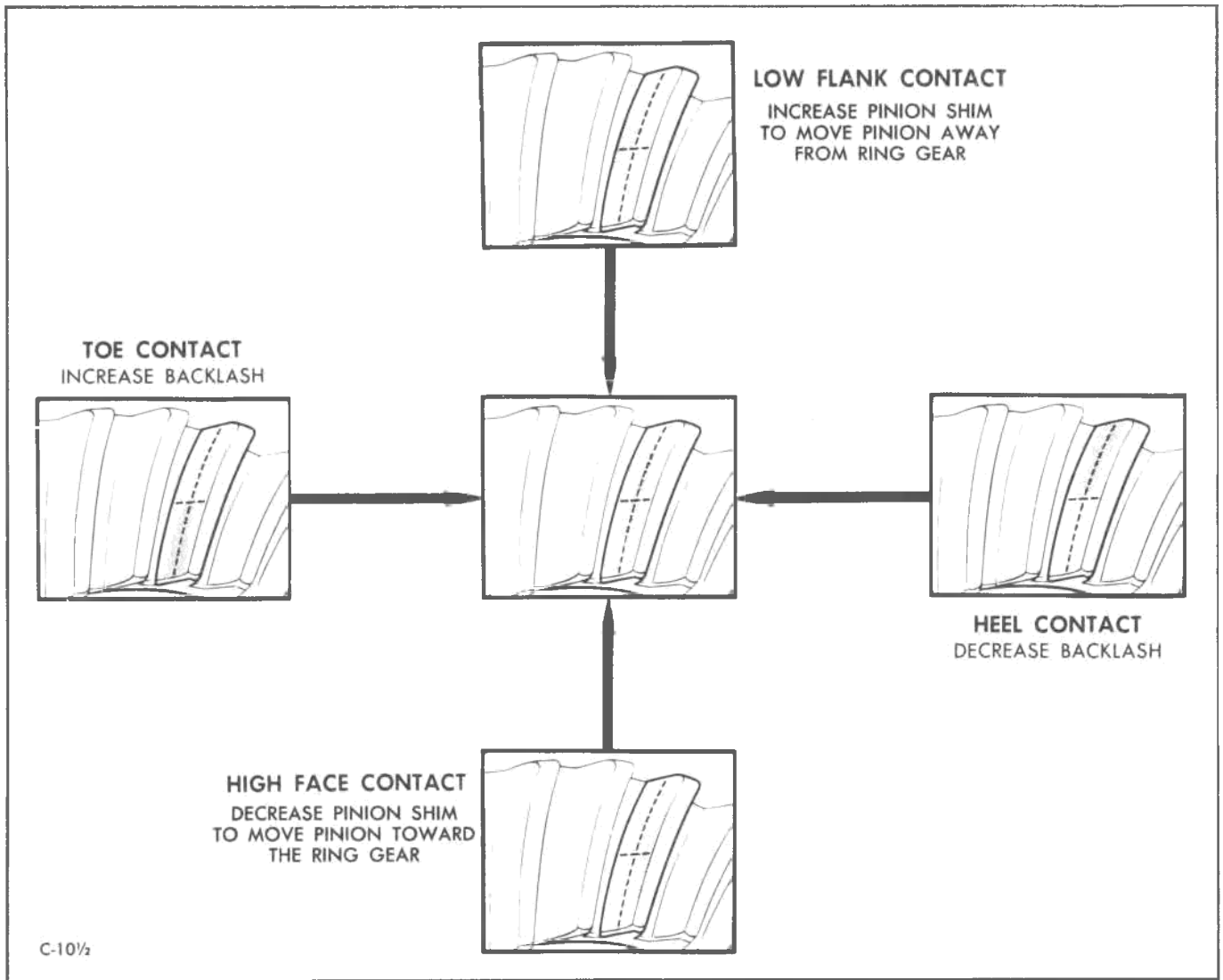


Fig. 18E—Gear Teeth Contact Pattern Check

DANA DIFFERENTIALS **10-1/2" RING GEAR** **INDEX**

Differential Case—Removal and Disassembly	4B-55
Drive Pinion—Removal and Disassembly	4B-56
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GENERAL DESCRIPTION

This Dana Spicer axle is similar in design to other Salisbury type axles with the following exceptions:

1. In order to remove the differential case, the carrier must be spread.

2. The drive pinion assembly incorporates an inner and outer bearing shim pack. The inner shim is used to maintain proper pinion depth. The outer shim is used to maintain proper preload on the pinion bearings.

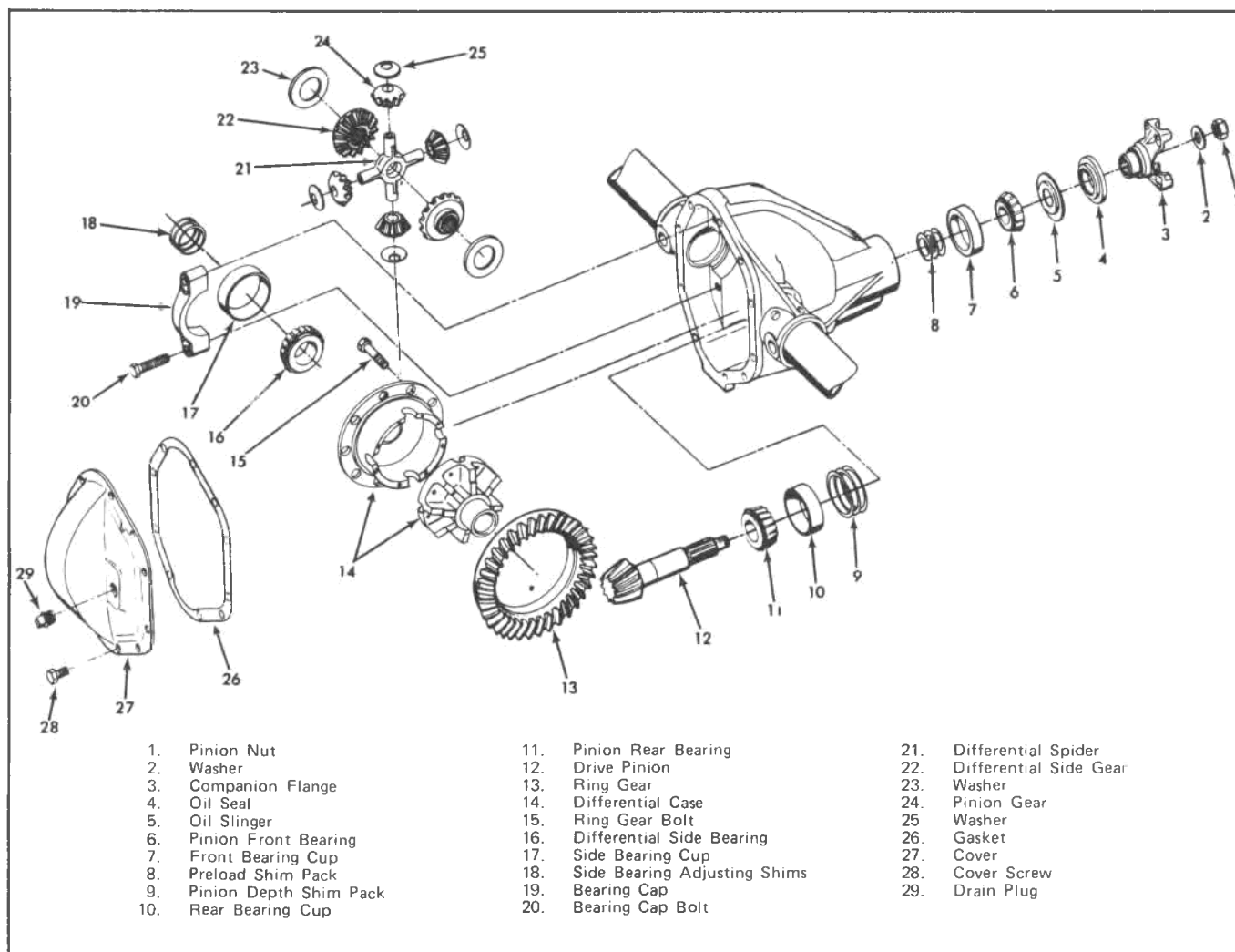


Fig. 1F — Dana Differential with 10 1/2" Ring Gear

DIFFERENTIAL CASE

Removal

1. Place vehicle on hoist with rear axle hanging free.
2. Remove wheel and tire assemblies.
3. The axle shafts are full-floating type with flanged outer end of shaft attached to wheel hub by studs and nuts. Wheel is supported by tapered roller bearings at outer end of axle housing.
 - a. Remove axle shaft to hub attaching nuts.
 - b. Rap on axle shaft to loosen shaft from hub and remove shafts.
4. Remove plug in carrier and drain lubricant.
5. Remove cap screws and lock washers attaching cover to carrier. Remove cover and gasket.
6. Mark one side of carrier and matching cap for reassembly in the same position. Remove bearing caps.
7. Using spreader tool J-24385, and a dial indicator as shown in figure 2F, spread carrier a maximum of .015 inch.

CAUTION: Do not exceed this dimension, as carrier may be permanently damaged.
8. Remove the dial indicator and use a prybar to remove the differential case from the carrier. Record the dimensions and location of the side bearing shims. Remove the spreader tool.

Disassembly

1. Remove differential side bearings by placing J-22912 under bearings and supporting plates on a press bed. Apply force to pilot plug J-8107-3 to drive the case from the bearing.

NOTE: Use care not to damage case hubs with tool J-22912.
2. Remove the ring gear bolts and the ring gear. Tap

the ring gear with a soft-faced hammer to free it from the case.

3. Scribe both case halves for reassembly in same position.
4. Remove bolts holding case halves together, as shown in figure 3F.
5. Tap lightly on top half of case to free it from the bottom half. Remove top half of case.
6. Lift out all internal parts.

Inspection

1. Clean all gears and bearings in solvent. Inspect cups, races and rollers for scoring, chipping or evidence of excessive wear.
2. Inspect ring gear teeth and machined surfaces. Examine fit of internal gears.
3. Inspect pinion cross-shaft.
4. Replace parts as required.



Fig. 3F—Separating Case Halves

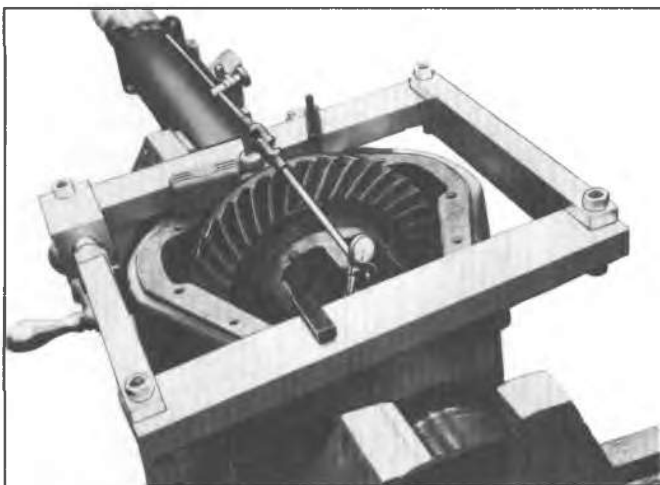


Fig. 2F—Spreading the Carrier

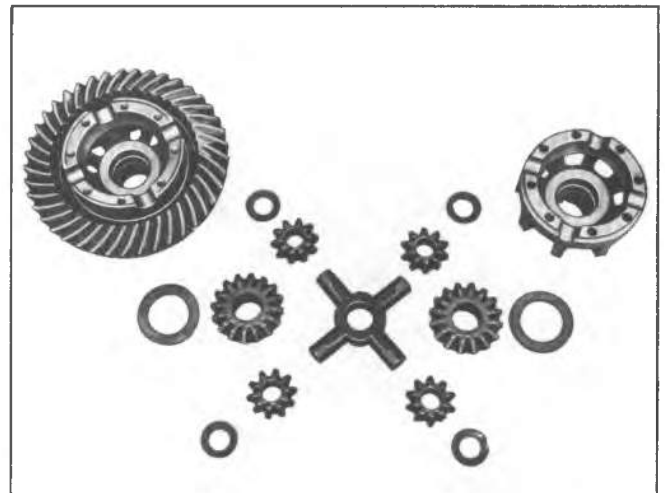


Fig. 4F—Internal Parts Inspection

DRIVE PINION

Removal and Disassembly

1. Remove differential as previously outlined.
2. Check pinion bearing preload as described under "Drive Pinion - Installation and Adjustment." If there is no preload reading, check for looseness of pinion assembly by shaking the companion flange. Looseness indicates the need for bearing replacement.
3. Install Holder J-8614-11 on flange by using two bolts with flat washers, as shown in figure 5F. Position J-8614-11 on flange so that the four notches are toward the flange.
4. Remove pinion nut and washer. Discard pinion nut and use a new one upon reassembly.
5. Thread end of J-8614-3 into small O.D. end of J-8614-2. Then with J-8614-11 installed as in step 3, insert J-8614-2 into J-8614-11 and turn it 1/8 of a turn to locked position. Remove flange by turning J-8614-3 while holding J-8614-11 as shown in figure 6F.
6. Remove drive pinion from carrier. It may be necessary to tap on the pinion with a soft faced hammer.
7. With a long drift, tap on inner race of outer pinion bearing to remove pinion oil seal, slinger, gasket, outer pinion cone and roller and shim pack. Tag shim pack for reassembly.
8. Should inspection indicate necessity, pinion bearing cups can be removed from carrier using a long drift and hammer. Remove shims and oil slinger which are located behind the inner bearing cup. Tag shims for reassembly.
9. Remove rear pinion bearing using J-22912, and an arbor press.



Fig. 5F—Removing Pinion Nut

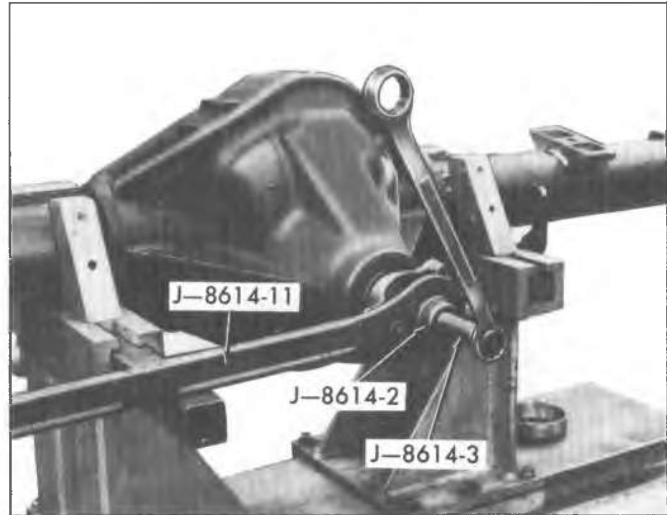


Fig. 6F—Removing Companion Flange

Inspection

1. Clean all gears and bearings in cleaning solvent and inspect all bearing cups, races and rollers for scoring, chipping or evidence of excessive wear. On pinion bearing rollers, inspect large end of rollers for wear. This is where wear is most evident on tapered roller bearings.
2. Inspect pinion splines and flange splines for evidence of excessive wear.
3. Inspect ring gear and pinion teeth for possible scoring, cracking or chipping.
4. Inspect differential case for cracks or scores or side gears, thrust washers, and pinion thrust faces.
5. Check fit of differential side gears in case.
6. Check fit of side gears and axle shaft splines.
7. Inspect differential pinion shaft and spacer for scoring or evidence of excessive wear.

DIFFERENTIAL CASE

Reassembly

1. Assemble new washers to side gears. Apply a small amount of hypoid lubricant on the side gear hubs.
2. Assemble pinion gears and new washers onto cross shaft.
3. Place side gears, pinion gears, cross shaft and washers into flanged half of case.
4. Assemble top half of case to bottom half, making sure scribe marks are aligned.
5. Assemble body bolts finger tight. Then tighten bolts alternately to specifications.
6. Install ring gear to differential case.
7. Install ring gear-to-case bolts finger tight, then tighten alternately to specifications.
8. Place side bearing into position and install, using

tools J-8092 and bearing installer J-24383 as shown in figure 7F.

9. Install bearing on opposite side in the same manner. Be sure to support differential case on pilot plug J-8107-3.

SHIM REQUIREMENTS—GAUGING PROCEDURES

Side Bearing Shims

1. With the pinion removed from the carrier, place the bearing cups over the side bearings, and install the differential case into the carrier.
2. Place the shim which was originally installed on the ring gear side into its original position.
3. Install the bearing caps lightly in their marked positions. Tighten the caps just enough to keep the bearings in place.
4. Mount a dial indicator on the carrier with the tip of the indicator on the back face of the ring gear.
5. Position two screwdrivers between the bearing shim and carrier on the ring gear side of the case. Pull on the screwdrivers and force the differential case as far as possible away from the dial indicator.
6. With force still applied, set the indicator dial to "zero", being sure the probe is still in contact with the ring gear.
7. Reposition the screwdrivers to the opposite side of the differential case as shown in figure 8F.
8. Pull on the screwdrivers and force the differential case back toward the dial indicator. Repeat several times until the same indicator reading is obtained.
9. To the dial indicator reading, add the thickness of the shim. Record the result, as this figure will be used during determination of side bearing shim requirements.



Fig. 7F—Installing Side Bearing

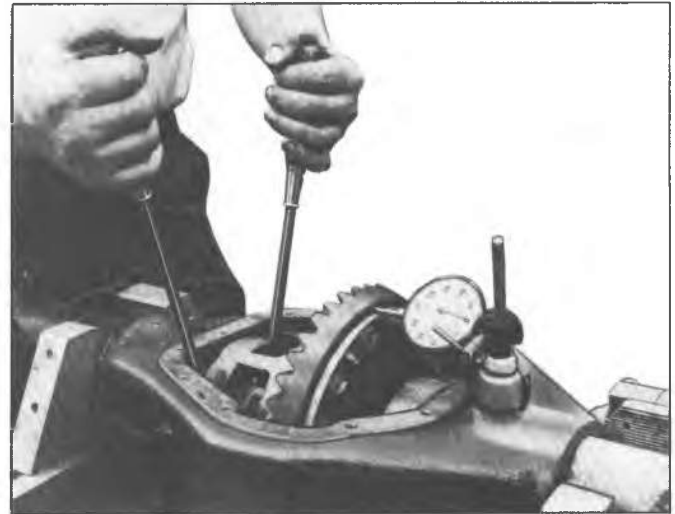


Fig. 8F—Screwdrivers Against Case

Pinion Shims

Ring gears and pinions are supplied in matched sets only. Matching numbers on both pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring gear before proceeding with assembly.

On the rear face of each pinion there is etched a plus (+) number, a minus (−) number, or a zero (0) number, which indicates the best running position for each particular gear set. This dimension is controlled by the shimming behind the inner bearing cup. Whenever baffles or oil slingers are used, they become a part of the adjusting shim pack.

For example: if a pinion is etched +3, this pinion would require .003" less shims than a pinion etched "0". This means by removing shims, the mounting distance of the pinion is increased by .003" which is just what a +3 etching indicates. Or if a pinion is etched −3 we would want to add .003" more shims than would be required if the pinions were etched "0". By adding .003" shims, the mounting distance of the pinion was decreased .003" which is just what a −3 etching indicated. Refer to figure 10F.

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this same dimension. If baffle is in the axle assembly, it is considered as part of the shim pack.

To change the pinion adjustment, shims are available in thicknesses of .003", .005" and .010".

NOTE: If baffle or slinger is bent or mutilated, it should be replaced.

Measure each shim separately with a micrometer and add together to get total shim pack thickness from original build up.

If a new gear set is being used, notice the plus or minus etching on both the old and new pinion, and adjust the

Old Pinion Marking	New Pinion Marking								
	- 4	- 3	- 2	- 1	0	+ 1	+ 2	+ 3	+ 4
+ 4	+ 0.008	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0
+ 3	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001
+ 2	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002
+ 1	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003
0	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004
- 1	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005
- 2	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006
- 3	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007
- 4	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007	- 0.008

Fig. 9F—Dana Pinion Code Chart



Fig. 10F—Pinion Code Location

thickness of the old shim pack to compensate for the difference of these two figures.

For example: If the old pinion reads (+2) and the new pinion is (-2), add .004" shims to the original shim pack.

DRIVE PINION

Assembly and Installation

1. Determine the correct pinion depth shim by using the chart in figure 9F.
2. Install the pinion depth shim in rear cup bore.
3. Install rear bearing cup by using driver handle J-8092 and installer J-24381.
4. To the outer shim pack (for setting preload) add or

remove an equal amount as was added or removed from the inner shim pack.

5. Install outer cup in carrier bore, using installer J-7818 with Drive Handle J-8092.
6. Press rear pinion bearing onto pinion shaft, using installer J-24433.
7. Install drive pinion and bearing into the differential carrier.
8. Install preload shims and front pinion bearing. Do not install oil seal at this time.
9. Install flange and holding bar J-8614-11 as shown in "Drive Pinion—Removal".
10. Install washer and nut onto pinion shaft. Torque nut to 250 lbs. ft.
11. Remove holding bar and with an inch pound torque wrench measure rotating torque. Rotating torque should be 10 to 20 in. lbs. with original bearings or 20 to 40 in. lb. with new bearings.

NOTE: Torque reading to start shaft turning must be disregarded.

12. If torque requirements (preload) are not to specifications, adjust shim pack as necessary.
 - a. To increase preload, decrease the thickness of preload shims.
 - b. To decrease preload, increase the thickness of preload shims.
13. When bearing preload meets specifications, remove nut, washer and flange from pinion shaft.
14. Install new pinion oil seal into housing as shown in figure 11F, using J-24384.
15. Install flange, washer and nut. Using holder bar J-8614-11, torque nut to 250 lbs. ft.

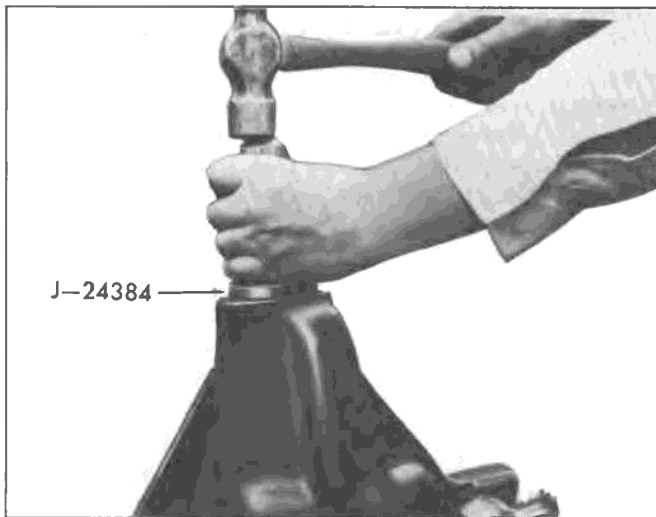


Fig. 11F—Installing Pinion Oil Seal

DIFFERENTIAL CASE

Installation and Adjustment

1. Place the differential case, with side bearings and cups installed, into position in the carrier.
2. Select the smallest of the original shims as a "gauging" shim and place it between the bearing cup and the carrier on the ring gear side of the case.
3. Install bearing caps and bearing screws finger tight. Make sure bearing caps are in correct marked position.
4. Mount a dial indicator on the ring gear side of the carrier, with the indicator probe in contact with the back face of the ring gear.
5. Position two screwdrivers between the bearing cup and the carrier on the side opposite the ring gear.
6. Pull on the screwdrivers and force the differential case as far as possible toward the indicator. With force still applied, set the dial indicator to zero.
7. Reposition the screwdrivers on the ring gear side of the case. Force the ring gear into mesh with the drive pinion and observe the dial indicator. Repeat this operation several times until the same reading is obtained.
8. Add the indicator reading to the "gauging" shim thickness to determine the correct shim dimension for installation on the ring gear side of the case.

For example, if the gauging shim was .155 inch, and the indicator reading in step 7 was .017 inch, the correct shim would be $.155 + .017 = .172$ inch.
9. Remove the "gauging" shim and install the correct size shim into position between the bearing cup and the carrier on the ring gear side of the case.
10. To determine the correct dimension for the remaining shim, first refer to the dimension obtained in step 8 of "Gauging Procedures—Side

Bearing Shims". From that figure, subtract the size of the shim installed in step 9 above; then add .006 inch for preload and backlash.

For example, if the reading in step 18 was .329 inch, and the shim just installed on the ring gear side of the case was .172 inch, the correct shim dimension would be $.329 - .172 = .157 + .006 = .163$ inch.

11. Spread the differential carrier as shown in figure 2F.
12. Assemble the shim determined in step 10 into place between the bearing cup and the carrier.
13. Remove the spreader and the dial indicator.
14. Install the bearing caps in marked positions and torque cap screws to specifications.
15. Install dial indicator and check ring gear backlash at four equally spaced points around the ring gear. Backlash must be held to .004" to .009" and must not vary more than .002" between positions checked.
16. Whenever backlash is not within limits, differential bearing shim pack should be corrected to bring backlash within limits.
 - a. Low backlash is corrected by decreasing the shim on the ring gear side and increasing the opposite side shim **an equal amount**
 - b. High backlash is corrected by increasing the shim on the ring gear side and decreasing the opposite side shim **an equal amount**
17. Check gear tooth contact, using yellow lead method, as described in "Gear Tooth Contact Pattern Check".
18. Using a new gasket, install housing cover and torque bolts to specifications.
19. Reinstall the rear universal joint, and torque "U" bolt nuts to specifications.
20. Install axles into carrier and axle flange over hub studs.
21. Torque hub stud nuts to specifications.
22. Fill differential with lubricant.
23. Install wheel and tire assembly.

CHECKS AND ADJUSTMENTS

Four adjustments are essential for proper operation of the differential and its related parts. These adjustments are a) Pinion Bearing Preload, b) Side Bearing Preload, c) Pinion Depth and d) Ring Gear-to-Pinion Backlash.

Pinion Bearing Preload is set to specifications in step 12 of "Drive Pinion—Assembly and Installation". Side Bearing Preload is set to specifications in step 10 of "Differential Case—Installation and Adjustment". Following service to the Differential Case or to the Drive Pinion and Ring Gear, a Gear Tooth Contact Pattern Check **must** be made, to verify the accuracy of the work

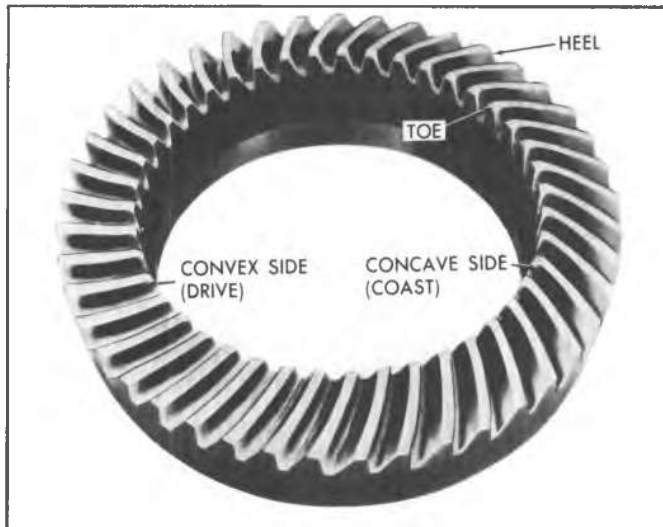


Fig. 12F—Gear Tooth Nomenclature

GEAR TOOTH CONTACT PATTERN CHECK

Prior to final assembly of the differential, a Gear Tooth Contact Pattern Check is necessary to verify the correct relationship between ring gear and drive pinion. Gear sets which are not positioned properly may be noisy, or have short life, or both. With a pattern check, the most desirable contact between ring gear and drive pinion for low noise level and long life can be assured.

Gear Tooth Nomenclature

The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side. The concave side is the "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end. The end of the tooth farthest away from center is the "heel" end. Toe end of tooth is smaller than heel end. See Figure 12F.

Test

in setting the pinion depth and the ring gear-to-pinion backlash.

1. Wipe oil out of carrier and carefully clean each tooth of ring gear.

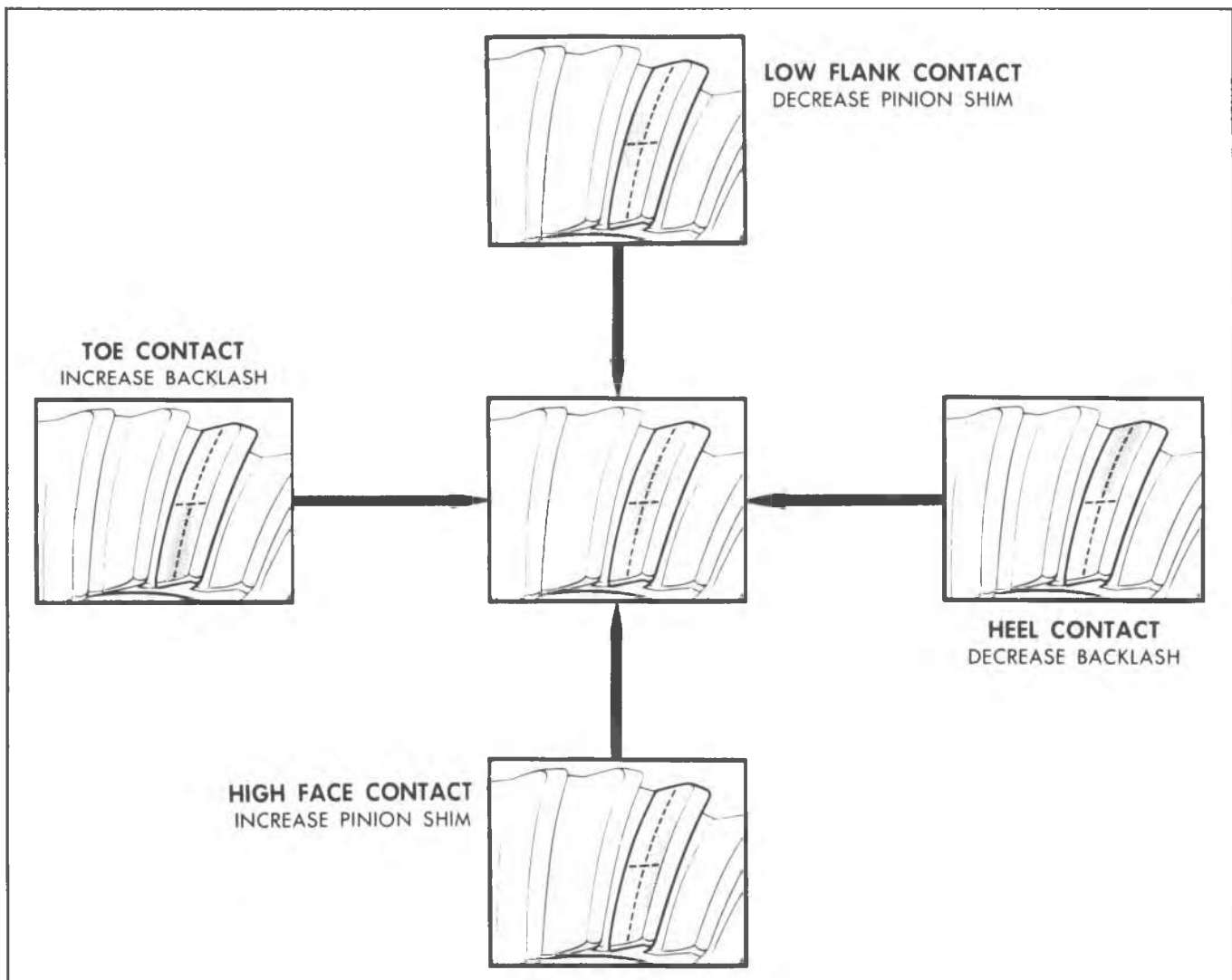


Fig. 13F—Gear Teeth Contact Pattern Check

2. Use gear marking compound (yellow lead chromate or equivalent) and apply this mixture sparingly to all ring gear teeth using a medium stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten bearing cap bolts to specifications.
4. Apply load to gears by expanding brake shoes or by wrapping a heavy rag around the companion flange to resist rotation.

NOTE: A test made without loading the gears will not give a satisfactory pattern. Turn companion flange with wrench so that ring gear rotates one full revolution then reverse rotation so that ring gear rotates one revolution in opposite direction. Excessive turning of ring gear is not recommended.

5. Observe pattern on ring gear teeth and compare with figure 13F. Make adjustments as necessary.
6. The important thing to achieve in the pattern check and subsequent adjustments is to locate the contact pattern centrally on the face of the ring gear teeth.

Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern. These adjustments are backlash and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on hand loaded teeth pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

NOTE: It may be necessary to adjust both pinion depth and backlash to obtain the correct pattern.

The position of the drive pinion is adjusted by increasing or decreasing the shim thickness of the inner shim, located between the rear bearing cup and the carrier housing. Increasing the shim thickness will move the pinion closer to centerline of the ring gear. Decreasing shim thickness will move pinion farther away from centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims which moves the entire case and ring gear assembly closer to, or farther from the drive pinion. (The adjusting shims are also used to set side bearing preload). To increase backlash, increase right shim and decrease left shim an equal amount. To decrease backlash, decrease right shim and increase left shim an equal amount.

DANA 9-3/4" RING GEAR

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GENERAL DESCRIPTION

This Dana Spicer axle is similar in design to other Salisbury type axles with the following exceptions:

1. The differential side bearing shims are located between the side bearing cone and roller assembly and the differential case. See figure 14F. These bearings are of the tapered roller design and are

preloaded. In order to remove the differential case the carrier must be spread.

2. The pinion assembly incorporates an inner and outer bearing shim. The inner shim is used to maintain proper pinion depth. The outer shim is used to maintain proper preload on the pinion bearing.

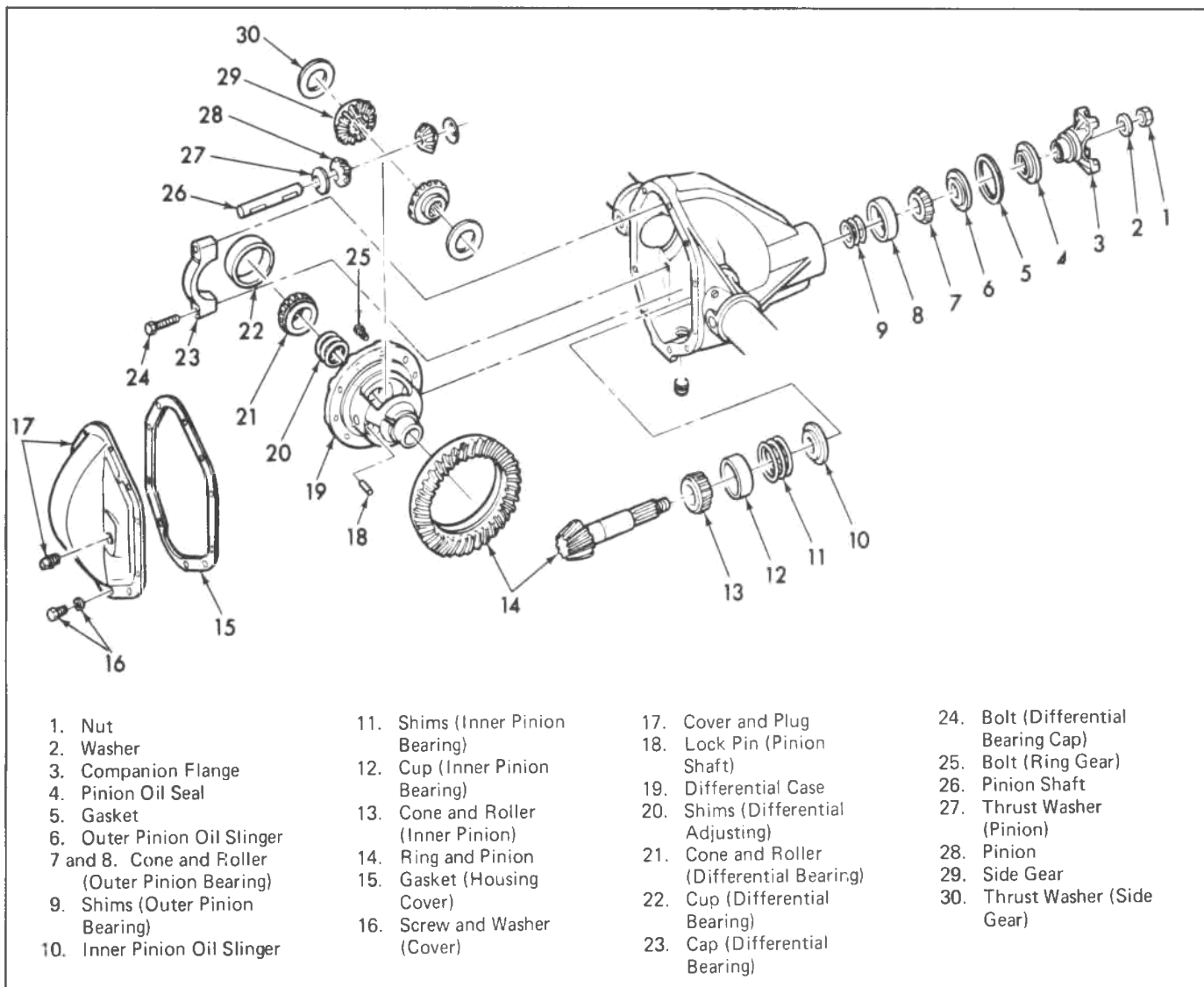


Fig. 14F—Dana Differential With 9-3/4" Ring Gear—Exploded View

DIFFERENTIAL CASE

Removal

- Place vehicle on hoist with rear axle hanging free.
- Remove wheel and tire assemblies.
- The axle shafts are full-floating type with flanged outer end of shaft attached to wheel hub by studs and nuts. Wheel is supported by tapered roller bearings at outer end of axle housing.
 - Remove axle shaft to hub attaching nuts.
 - Rap on axle shaft to loosen shaft from hub and remove shafts.
- Remove plug in carrier and drain lubricant.
- Remove cap screws and lock washers attaching cover to carrier. Remove cover and gasket.
- Mark one side of carrier and matching cap for reassembly. Remove cap screws attaching bearing caps to carrier.

- Using spreader Tool J-24385 and dial indicator as shown in figure 15F, spread carrier a maximum of .020".

CAUTION: Do not exceed this dimension as carrier may be permanently damaged.

- Remove dial indicator and with the use of a pry bar remove differential case from carrier. Remove spreader.

Disassembly

- Remove differential bearing cups and identify with a tag for reassembly.
- Place differential in vise and drive out pinion shaft lock pin.
- Remove differential bearing cone and roller using Puller J-22888, with Plug J-8107-3, as in figure 16F. Tag cone and rollers for assembly.

NOTE: If ring gear and pinion are to be reassembled, note position of shims and replace accordingly.

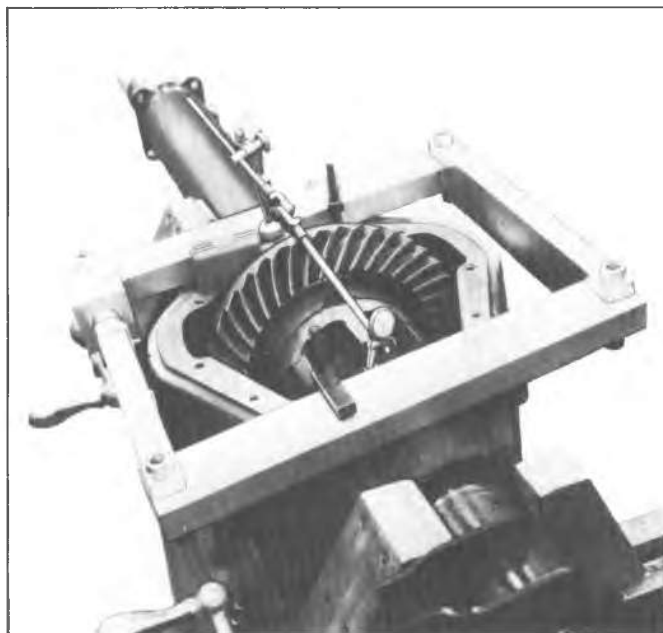


Fig. 15F—Tool J-24385 Mounted on Carrier

4. Remove spacer, pinion shaft, pinions, side gears and thrust washers from differential case.
5. Remove screws attaching ring gear to differential case. Remove gear.

DRIVE PINION

Removal

1. Separate rear universal joint, tape trunnion bearings to joint, position propeller shaft to one side and tie propeller shaft to frame side rail.
2. Using Holding Bar J-8614-11, attached to pinion shaft flange, remove self-locking nut and washer from pinion shaft.

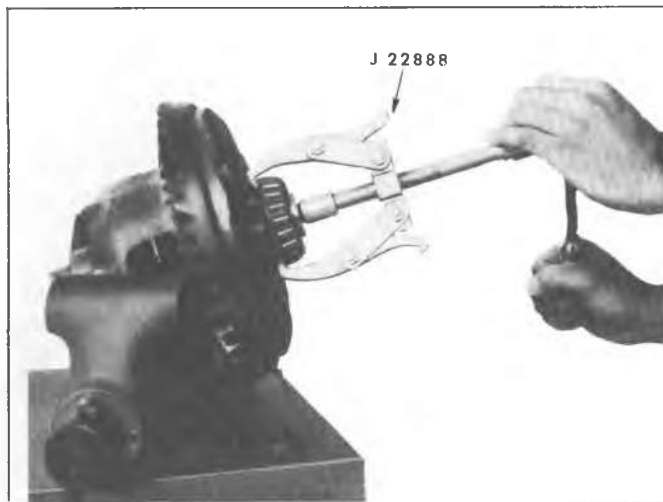


Fig. 16F—Removing Differential Side Bearings

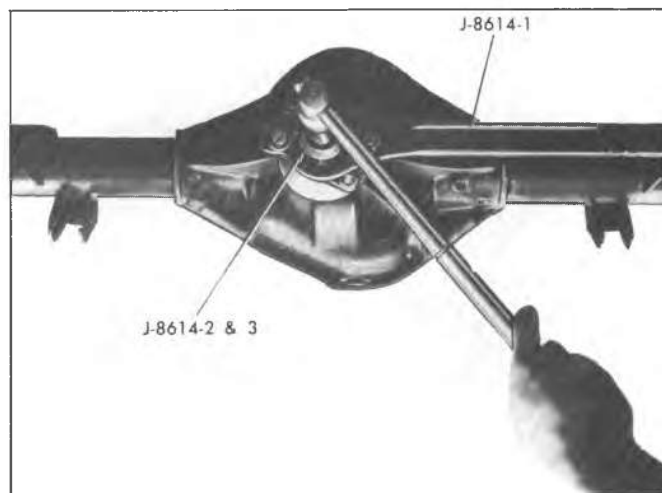


Fig. 17F—Removing Pinion Flange

3. Install Tool J-8614-2, and 3 into holding bar as shown in figure 17F and remove flange from drive pinion. Remove drive pinion from carrier.
4. With a long drift, tap on inner race of outer pinion bearing to remove pinion oil seal, slinger, gasket, outer pinion cone and roller and shim pack. Tag shim pack for reassembly.
5. Should inspection indicate necessity, pinion bearing cups can be removed from carrier using a long drift and hammer. Remove shims and oil slinger which are located behind the inner bearing cup. Tag shims for reassembly.
6. Remove inner pinion cone and roller using Tool J-22912, installed as shown in figure 18F, and press pinion from bearing.

Inspection

1. Clean all gears and bearings in cleaning solvent and inspect all bearing cups, races and rollers for

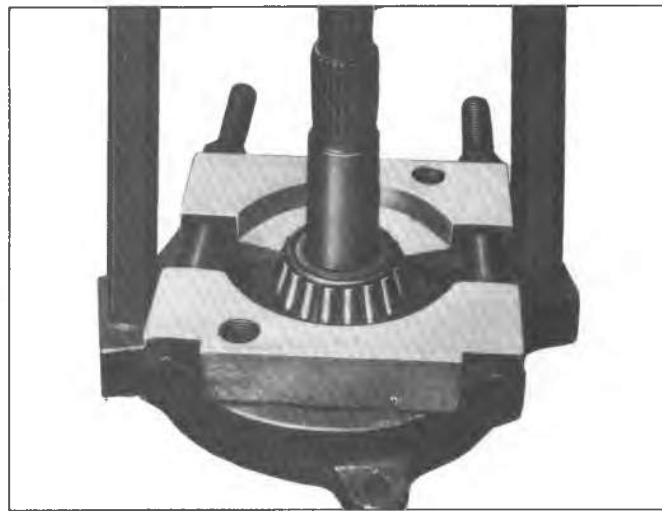


Fig. 18F—Removing Inner Pinion Bearing Cone and Roller

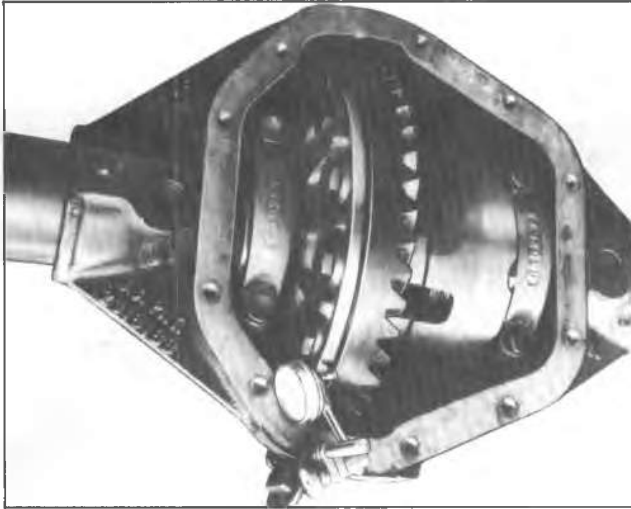


Fig. 19F—Checking Runout

scoring, chipping or evidence of excessive wear. On pinion bearing rollers, inspect large end of rollers for wear. This is where wear is most evident on tapered roller bearings.

NOTE: The pinion bearings are of the tapered type, and the natural wear pattern is a frosted condition with occasional slight scratches on races or rollers. This does not indicate a defective bearing.

2. Inspect pinion splines and flange splines for evidence of excessive wear.
3. Inspect ring gear and pinion teeth for possible scoring, cracking or chipping.
4. Inspect differential case for cracks or scores. Inspect side gears, thrust washers, and pinion thrust faces.
5. Check fit of differential side gears in case.
6. Check fit of side gears and axle shaft splines.
7. Inspect differential pinion shaft and spacer for scoring or evidence of excessive wear.

DIFFERENTIAL CASE

Reassembly

1. Position differential side gears and new thrust washers in differential case.
2. Position differential pinions and new thrust washers in differential case. Align pinions with holes in differential case.
3. Install pinion shaft in differential case. Align hole in shaft with hole in case, then install lock pin. Peen hole to prevent pin dropping out of case.
4. Position ring gear to case, then install cap screws. Tighten cap screws evenly and alternately to specifications.
5. With an arbor press, press differential side bearings onto case using Tool J-21051. Do not install shims at this time.
6. Place differential case in carrier and install bearing caps. Care should be taken to install caps in original position. Use mark placed on caps and carrier at removal. Tighten caps just enough to keep bearing caps in place.
7. Install dial indicator on carrier with indicator button contacting back of ring gear, as in figure 19F. Rotate differential case and check for runout. If runout is greater than .002", the assembly should be removed and the ring gear removed from the case. Again install differential case and check runout at differential case flange.
8. Should runout of case flange be greater than .002", the defect is probably due to bearings or differential case, and should be corrected before proceeding further.
9. Position two screwdrivers between bearing cup and carrier on opposite side of ring gear (away from dial indicator side). Pull on screwdrivers and force differential case as far as possible toward the dial indicator. Rock the ring gear to set the bearings. With force still applied, set indicator at "O".
10. Reposition screwdrivers between bearing cup and carrier on ring gear side. Pull on screwdrivers and force differential case as far as possible toward center of carrier. Record the indicator reading. This will be the total amount of shims needed (less preload) for setting backlash later during assembly.
11. Remove differential from carrier.

DRIVE PINION

Installation and Adjustment of Depth and Preload

Ring gears and pinions are supplied in matched sets only. Matching numbers on both pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring before proceeding with assembly.

On the button end of each pinion there is etched a plus (+) number, a minus (−) number, or a zero (0) number, which indicates the best running position for each particular gear set. This dimension is controlled by the shimming behind the inner bearing cup. Whenever baffles or oil slingers are used, they become a part of the adjusting shim pack.

For example: If a pinion is etched +3, this pinion would require .003" less shims than a pinion etched "O". This means by removing shims, the mounting distance of the pinion is increased by .003" which is just what a +3 etching indicates. Or if a pinion is etched −3 we would want to add .003" more shims than would be required if the pinions were etched "O". By adding .003" shims, the mounting distance of the pinion was decreased .003" which is just what a −3 etching indicated. See figure 20F.

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this

Old Pinion Marking	New Pinion Marking								
	- 4	- 3	- 2	- 1	0	+ 1	+ 2	+ 3	+ 4
+ 4	+ 0.008	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0
+ 3	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001
+ 2	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002
+ 1	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003
0	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004
- 1	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005
- 2	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006
- 3	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007
- 4	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007	- 0.008

Fig. 21F—Dana Pinion Code Chart

same dimension. If baffle is in the axle assembly, it is considered as part of the shim pack.

To change the pinion adjustment, shims are available in thicknesses of .003", .005" and .010".

NOTE: If baffle or slinger is bent or mutilated, it should be replaced.

Measure each shim separately with a micrometer and add together to get total shim pack thickness from original build up.

If a new gear set is being used, notice the plus or minus etching on both the old and new pinion, and adjust the thickness of the old shim pack to compensate for the difference of these two figures.

For example: If the old pinion reads (+2) and the new pinion is (-2), add .004" shims to the original shim pack.

1. Determine proper inner shim pack (for setting pinion depth) by using chart in figure 21F.
2. Install inner shim pack and oil slinger in inner cup bore and drive inner cup into position using Tool J-21059 used with J-8092.
3. To the outer shim pack (for setting preload) add or remove an equal amount as was added or removed from the inner shim pack.
4. Install outer cup in carrier bore, using installer J-7818 with Drive Handle J-8092 as shown in figure 22F.
5. Press inner pinion bearing cone and roller onto pinion shaft using Installer J-9772 on arbor press as shown in figure 23F.
6. Install drive pinion and inner bearing cone and roller assembly in differential carrier.
7. Install shims and outer pinion cone and roller on

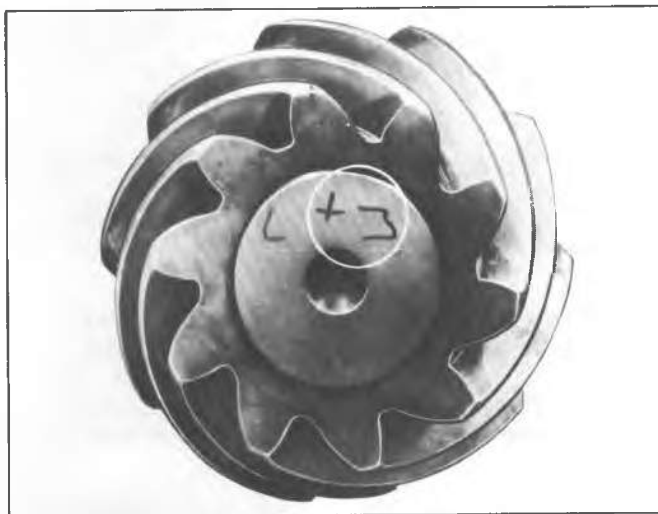


Fig. 20F—Marking From Nominal on Pinion

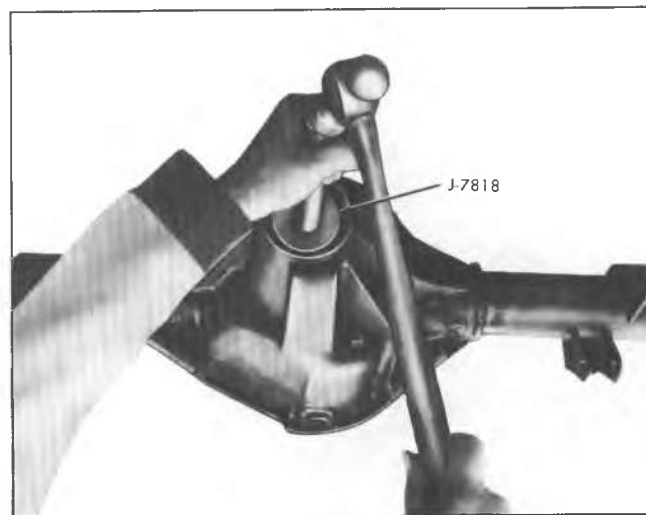


Fig. 22F—Installing Outer Pinion Bearing Cup

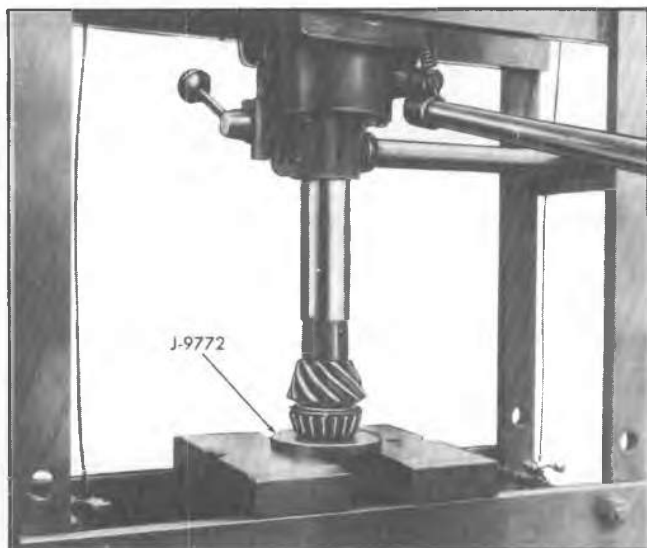


Fig. 23F—Installing Inner Pinion Cone and Roller

pinion shaft using Tool J-5590 and companion flange to press bearing onto pinion, as in figure 24F.

8. Install flange holding bar and install washer and nut on pinion shaft. Torque nut to 255 ft. lbs.
 9. Remove holding bar and with an inch pound torque wrench measure rotating torque. Rotating torque should be 10 to 20 in. lbs. with original bearings or 20 to 40 in. lb. with new bearings.
- NOTE: Torque reading to start shaft turning must be disregarded.
10. If torque requirements (preload) are not to specifications, adjust shim pack as necessary. Increase the outer shim pack to reduce rotation torque. Decrease shim pack to increase rotating torque.
 11. Remove nut, washer and flange from pinion shaft.
 12. Install oil slinger, gasket and using Tool J-22804 install oil seal.

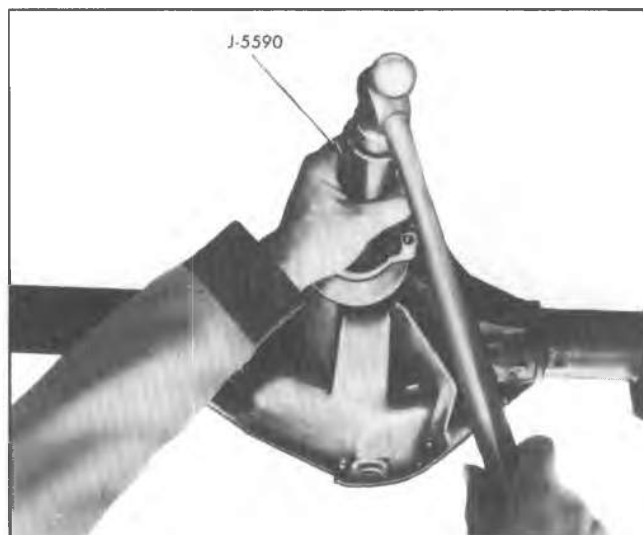


Fig. 24F—Installing Pinion Flange

13. Install flange, washer and nut. Torque nut to specifications.

DIFFERENTIAL CASE

Preload and Adjustment

1. Place differential assembly (with pinion assembled) into housing. Install bearing caps in their proper position and tighten screws just enough to hold the bearing cups in place.
2. Install dial indicator on carrier with indicator button contacting back of ring gear, as in figure 19F.
3. Place two screwdrivers between bearing cup and housing on ring gear side of case, and pry ring gear into mesh with pinion gear as far as it will go. Rock ring gear to allow bearings to seat and gears to mesh. With force still applied, set indicator to "O".
4. Reposition screw drivers on opposite side of ring gear and pry ring gear as far as it will go. Now take an indicator reading. Repeat until the same reading is obtained every time. This reading will be the necessary amount of shims between the differential case and differential bearing on the ring gear side. Remove differential bearing from the ring gear side and assemble proper amount of shims. Reassemble bearing.
5. Remove the differential bearing from the opposite side of ring gear. To determine the amount of shims needed here, use the following method.
 - a. Subtract the size of shim pack just installed on ring gear side of case from the reading obtained and recorded in step 10 of Differential Case—Reassembly.
 - b. To this figure, add an additional .015" shims to compensate for preload and backlash.

Example: If reading in step 10 of Differential Case—Reassembly was .085", and the shims installed on ring gear side of case was .055", the correct amount of shim will be $.085" - .055" + .015" = .045"$.
6. Install shims as indicated in step 5, (which will give the proper bearing preload and backlash) and install side bearing.

Installation

1. Spread differential carrier, using spreader as shown in figure 15F.
2. Install differential bearing outer races in their correct location, then install differential case into carrier.
3. Install differential bearing caps in the correct location as indicated by marks made at disassembly. Install cap screws finger tight. Rotate differential assembly and rap on case with a soft faced hammer to ensure proper seating of case in carrier.
4. Remove spreader and torque cap bolts to specifications.

5. Install dial indicator and check ring gear backlash at four equally spaced points around the ring gear. Backlash must be held to .004" to .009" and must not vary more than .002" between positions checked.
 6. Whenever backlash is not within limits, differential bearing shim pack should be corrected to bring backlash within limits.
 7. Check gear tooth contact, using yellow lead method, as described earlier in "Dana 10-1/2" Ring Gear" section, under "Gear Tooth Contact Pattern Check". Refer to figure 25F.
 8. Using a new gasket, install housing cover and torque bolts to specifications.
 9. Reinstall the rear universal joint, and torque "U" bolt nuts to specifications.
 10. Install axles into carrier and axle flange over hub studs. Torque hub stud nuts to specifications.
 11. Fill differential with lubricant.
 12. Install wheel and tire assembly.
- CAUTION:** See Caution on page 1 of this section regarding the fasteners referred to in the above steps.

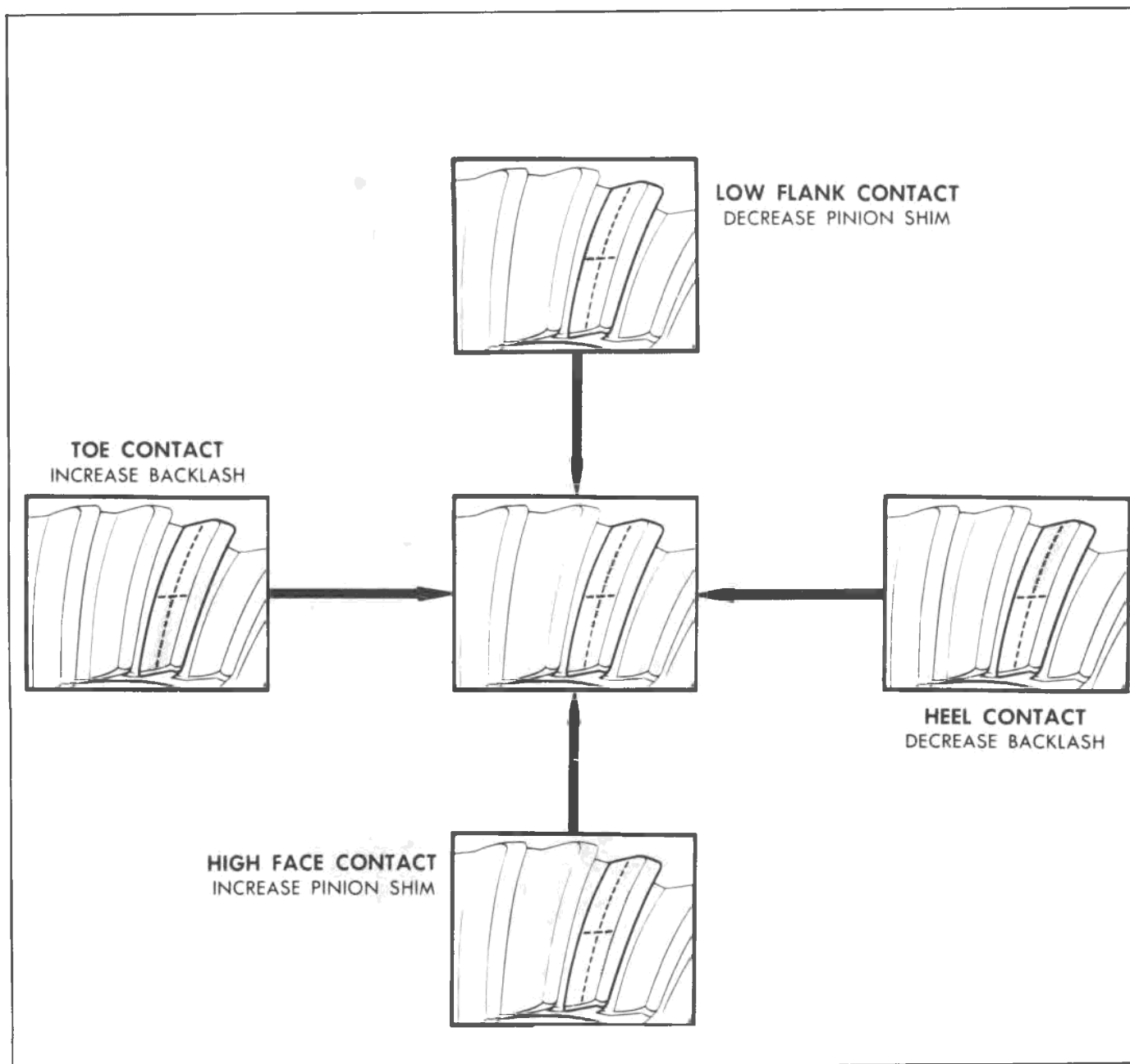


Fig. 25F—Gear Teeth Contact Pattern Check

CHEVROLET TRUCK DIFFERENTIAL 12-1/4" RING GEAR

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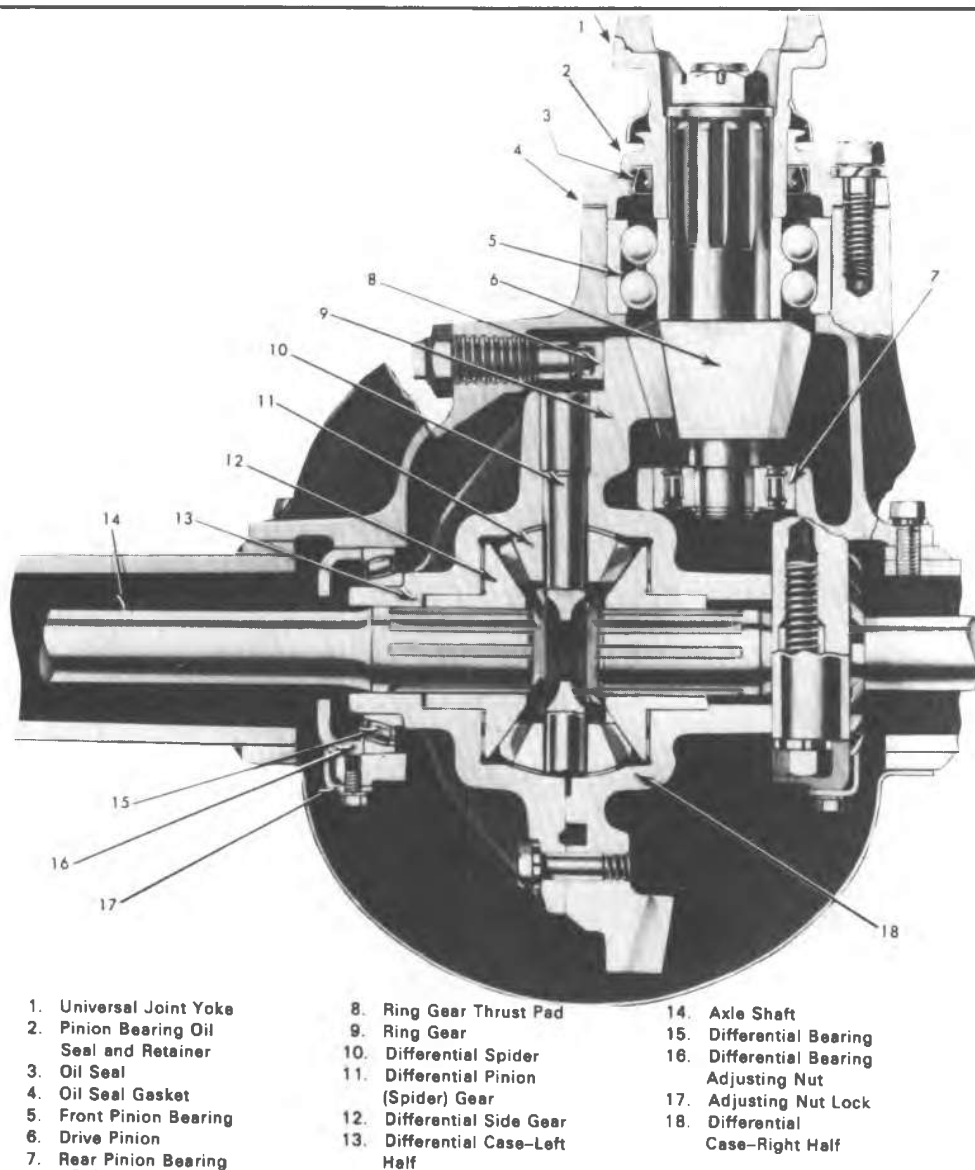


Fig. 1G—Cross Section of Truck Differential with 12 1/4" Ring Gear

CASE AND DRIVE PINION

Removal

1. Drain lubricant from differential, remove axle shaft as outlined in Truck Service Manual. See "Axle Shaft Removal".
2. Remove two trunnion bearing "U" bolts from the rear yoke and split the rear universal joint.
NOTE: The bearings can be left on the trunnion and held in place with tape.
3. Swing propeller shaft to one side and tie to the frame side rail.
4. Remove bolts and lock washers which retain the carrier assembly to the axle housing. Support the differential housing with a floor jack and roll it from under truck.

Disassembly

1. Mount carrier assembly in a bench vise or holding fixture.
2. Loosen ring gear thrust pad locknut and remove thrust pad.
3. Remove differential adjusting nut locks and bearing cap bolts and lock washers.
4. Mark bearing caps and carrier for reassembly in same position. Remove bearing caps and adjusting nuts by tapping on bosses of caps with a soft faced hammer until caps are free from dowels.

CAUTION: Do not attempt to pry cap off as this may damage machined face of cap.

5. Remove differential and ring gear assembly from the carrier.

CAUTION: Exercise care that differential bearing outer races are not dropped while removing assembly from carrier.

6. Remove the bolts which attach the pinion bearing retainer to the carrier.
7. Remove the pinion and bearing assembly from the carrier.

NOTE: It may be necessary to drive this unit from carrier. Use brass drift against pilot end of pinion.

Repairs

Pinion Disassembly

1. Clamp pinion drive flange in bench vise.
2. Remove cotter pin, nut and washer from end of pinion.
3. Remove drive flange and bearing retainer assembly from pinion.
4. Drive oil seal from retainer. Discard seal as new parts should be used at assembly.
5. Remove pinion rear bearing snap ring and press

bearing from pinion, using Tool J-1453, as shown in figure 2G.

6. Position drive pinion in an arbor press so that the bearing is supported by two pieces of flat steel stock as shown in Figure 3G. Place flat stock parallel to each other and against pinion so as to pick up a large area of bearing outer race. Press pinion from bearing making sure pinion is supported to prevent damage when removed from bearing.

Pinion Inspection

1. Wash all parts in cleaning solvent.
2. Inspect pinion for scored, cracked, chipped or worn teeth.
3. Inspect splines on pinion shaft for excessive wear.
4. Inspect pinion bearing assemblies for roughness, defects or excessive wear.

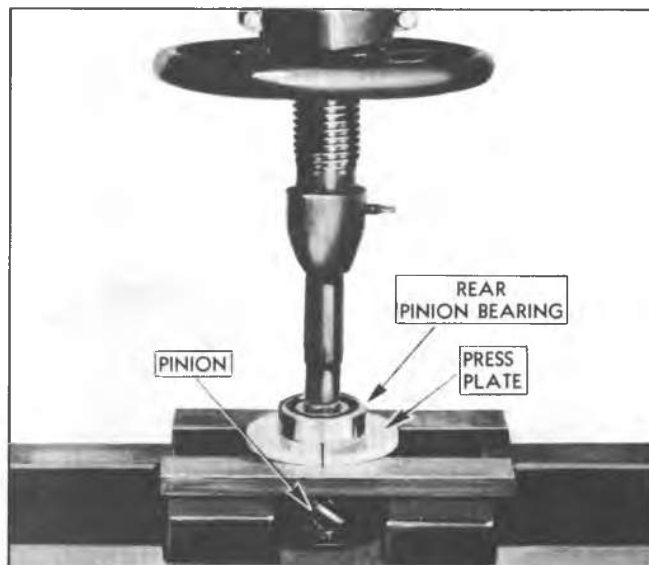


Fig. 2G—Pinion Rear Bearing Removal

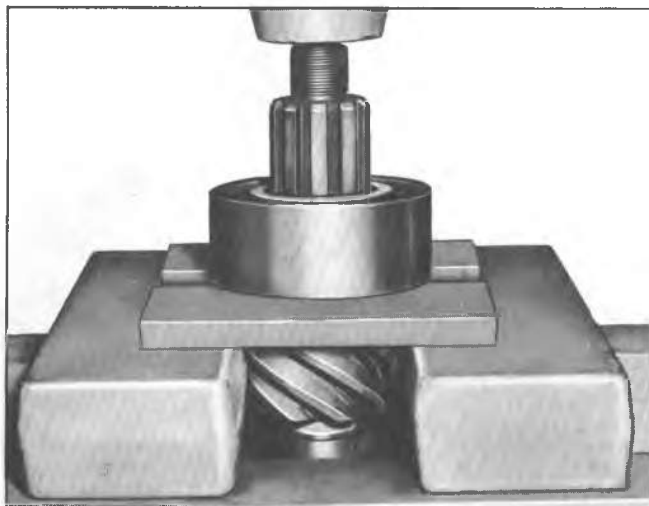


Fig. 3G—Drive Pinion Front Bearing Removal

Pinion Reassembly

1. Pack the cavity between the pinion oil seal lips with a lithium-base EP lubricant to provide initial lubrication and to aid in inserting pinion flange.
2. Press the oil seal into the retainer. Position seal lips toward the pinion bearing, using Tool J-22281 as shown in Figure 4G.
3. Install the pinion rear bearing assembly on pinion shaft making sure that chamfered side of inner race seats against shoulder on pinion shaft. Then install pinion bearing lock ring using Tool J-1364 as shown in Figure 5G.
4. To install pinion front bearing, position the one-piece double row ball bearing on pinion shaft, so that extended portion of inner race is toward pinion head. Then, using a suitable length of 2 inch pipe, press bearing onto shaft until it seats against the pinion head.

CAUTION: When pressing bearing on pinion,



Fig. 4G—Pinion Oil Seal Installation

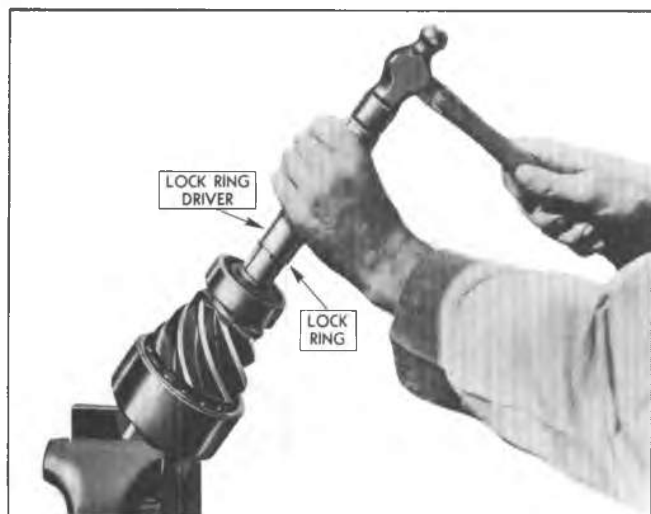


Fig. 5G—Pinion Rear Bearing Lock Ring Installation

exercise care to prevent damage to ground surface of pilot.

5. Slide oil seal retainer on pinion shaft, then tap drive flange onto pinion splines.
6. Clamp drive flange in a bench vise and install flange washer and nut. Torque nut to specifications and install cotter pin without backing off on nut.

Differential Disassembly

1. Check differential case to make sure that the two halves are marked so they may be reassembled in same relation. See Figure 6G.

2. Remove bolts holding case and cover together.

NOTE: Ring gear is mounted on the case.

3. Separate cover from case and remove differential side gears and thrust washers, pinion gears with thrust washers and differential spider.

Differential Inspection

1. Wash all parts thoroughly in cleaning solvent.
2. Inspect ring gear for chipped, scored or worn teeth.
3. Check radial clearance between differential side gears and differential case, also fit of differential pinions on spider.
4. Inspect spider arms for wear and distortion.
5. Inspect splines and teeth of differential side gears and pinions for chipping or excessive wear.
6. Check thrust washers for wear and replace if even slight wear is indicated.
7. Check differential side bearings and cups for broken races, discoloration or roughness.
8. Inspect differential case for cracks or distortion.

Ring Gear Replacement

1. Remove ring gear from case by tapping the back of the gear with a soft faced hammer.

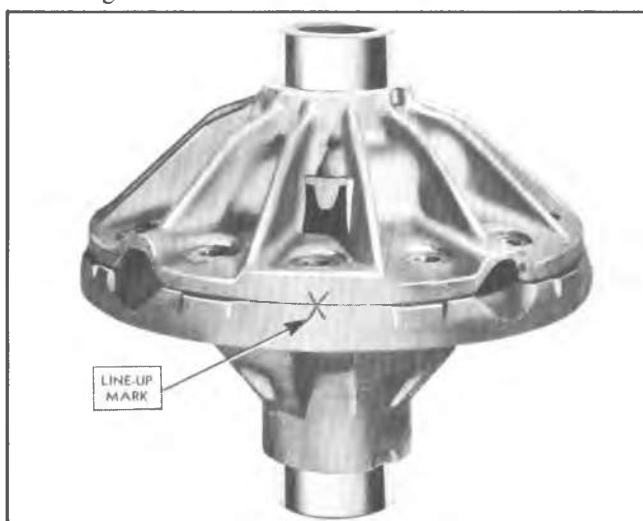


Fig. 6G—Differential Case Line-Up Marks

2. Inspect ring gear pilot case flange and back of ring gear for dirt or burrs.
3. Install two guide pins (made from cap screws with heads cut off and ends slotted) to new gear diametrically opposite each other.
4. Start guide pins through case flange and tap ring gear on case.

Differential Bearing Replacement

1. Install Tool J-8107 making sure puller legs are fitted securely in notches in case and tighten retaining yoke as shown in Figure 7G.
2. Tighten puller screw to remove bearing.
3. Place new bearing on hub with thick side of inner race toward case and install bearing using J-1488 as shown in Figure 8G.

NOTE: The side bearing tool is counterbored



Fig. 7G—Differential Bearing Removal



Fig. 8G—Differential Bearing Installation

and has pilot to assure proper installation and seating of bearing.

Differential Reassembly

1. Lubricate differential side gears, pinions and thrust washers.
2. Place differential pinions and thrust washers on spider.
3. Assemble side gears and pinions and thrust washers to left half of differential case.
4. Assemble right half of case to left half being sure to line up marks on the two halves.
5. Install differential-to-ring gear bolts and lock washers and tighten evenly until ring gear is flush with case flange.
6. Remove two guide pins and install remaining two bolts. Torque all bolts alternately and evenly to specifications.

Reassembly

1. Place new pinion bearing retainer gasket on the retainer and install pinion assembly in carrier.

NOTE: The pinion assembly should be pressed into the carrier to prevent the possibility of damaging the shims.

2. Install pinion bearing retainer bolts and lock washers and torque bolts to specifications.
3. Lubricate differential bearing rollers with engine oil and place outer races over them.
4. Install differential assembly in carrier and install adjusting nuts.

CAUTION: Carefully slide adjusting nuts alongside the bearings so that threads on nuts fit into threads in carrier.

5. Install differential bearing caps making sure the marks on the caps line up with the marks on the carrier.
6. Install bearing cap bolts and lock washers and tighten until lock washers just flatten out.

Backlash and Preload Adjustment

1. With differential bearing cap bolts loosened just enough to permit turning the bearing adjustment nuts with Tool J-0972, remove all lash between ring gear and pinion. See Figure 9G.
2. Back off left hand adjusting nut one to two notches to a locking position.
3. Tighten right hand adjusting nut firmly to force differential in solid contact with left hand adjusting nut.
4. Back off right hand adjusting nut until free of bearing; then retighten snugly against bearing.
5. Tighten right hand nut from one to two additional notches to a locking position.

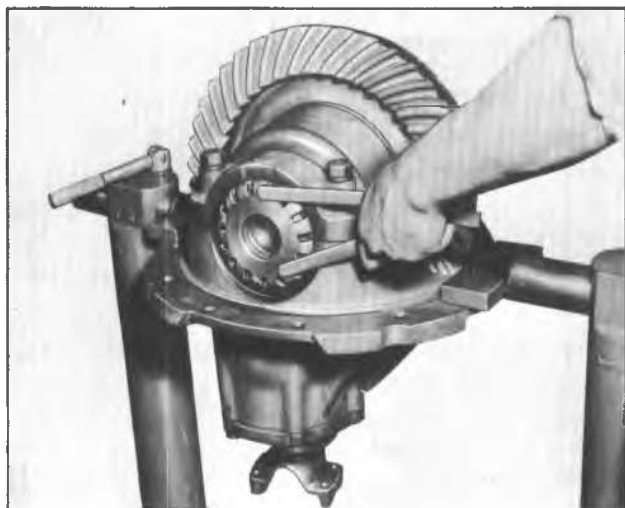


Fig. 9G—Backlash and Preload Adjustment

NOTE: This method of adjustment provides for proper preload of bearings.

6. Mount a dial indicator on the carrier and check the backlash between ring gear and pinion as shown in Figure 10G. Backlash should be from .003" to .012" (.005" to .008" preferred).

NOTE: If backlash is more than .012 inch, loosen the right hand adjusting nut one notch and tighten left hand adjusting nut one notch. If backlash is less than .003 in. loosen the left hand adjusting nut one notch and tighten right hand nut one notch.

7. Tighten bearing cap bolts to specifications.
8. Install side bearing adjusting nut locks and torque to specifications.

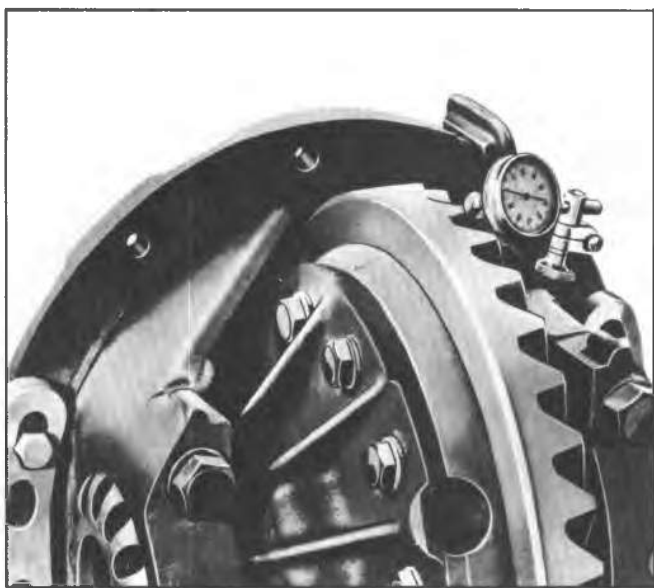


Fig. 10G—Checking Backlash

Ring Gear Thrust Pad Adjustment

1. Inspect bronze tip of thrust pad and if worn install a new one.
2. Install thrust pad and tighten screw until bronze tip engages back face of ring gear while rotating gear.
3. Back off screw one-twelfth (1/12) turn and tighten locknut to specifications. See Figure 11G.

NOTE: Make sure screw does not turn during locking process. This adjustment provides .005 in. to .007 in. clearance between thrust pad and ring gear face.

Installation

1. Clean out axle housing and cover and place new gasket over axle housing.
2. Assemble differential carrier to axle housing, install lockwashers and bolts and tighten securely.
3. Replace axle housing inspection cover, if removed, using new gasket.
4. Assemble rear universal joint.

CAUTION: This propeller shaft to pinion flange fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

5. Install axle shafts as outlined in applicable axle installation procedure in Service Manual.
6. Fill axle with lubricant to a level even with bottom of filler hole. See Section 0 in the Truck Service Manual for proper lubricant.

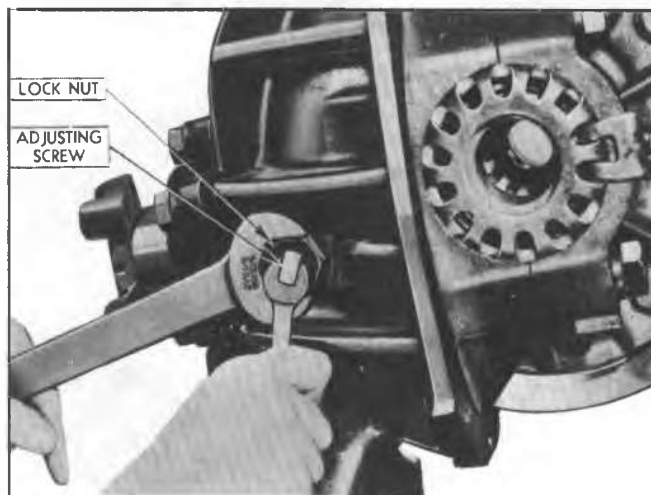


Fig. 11G—Ring Gear Thrust Pad Adjustment

EATON POSITIVE LOCKING DIFFERENTIAL

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GENERAL DESCRIPTION

Chevrolet Trucks equipped with locking differentials use one of the Eaton locking units in Figure 4B-1H, 2H. These differentials provide true differential action and also incorporate a speed sensitive device which automatically and positively locks both rear wheels together if either wheel should spin excessively during slow vehicle operation.

Locking is accomplished through the use of a flyweight governor mechanism, cam system, and multi-disc clutch. The flyweights on the governor mechanism move outward to

engage a latching bracket whenever the wheel-to-wheel speed varies by approximately 100 rpm or more. This action retards a cam which, in turn, compresses a multi-disc clutch locking one side gear to the case. At wheel-to-wheel differentials of less than approximately 100 rpm, the unit operates as a standard or open differential.

NOTE: At vehicle speeds above approximately 20 mph, the latching bracket overcomes a spring preload and swings away from the flyweights. At this vehicle speed

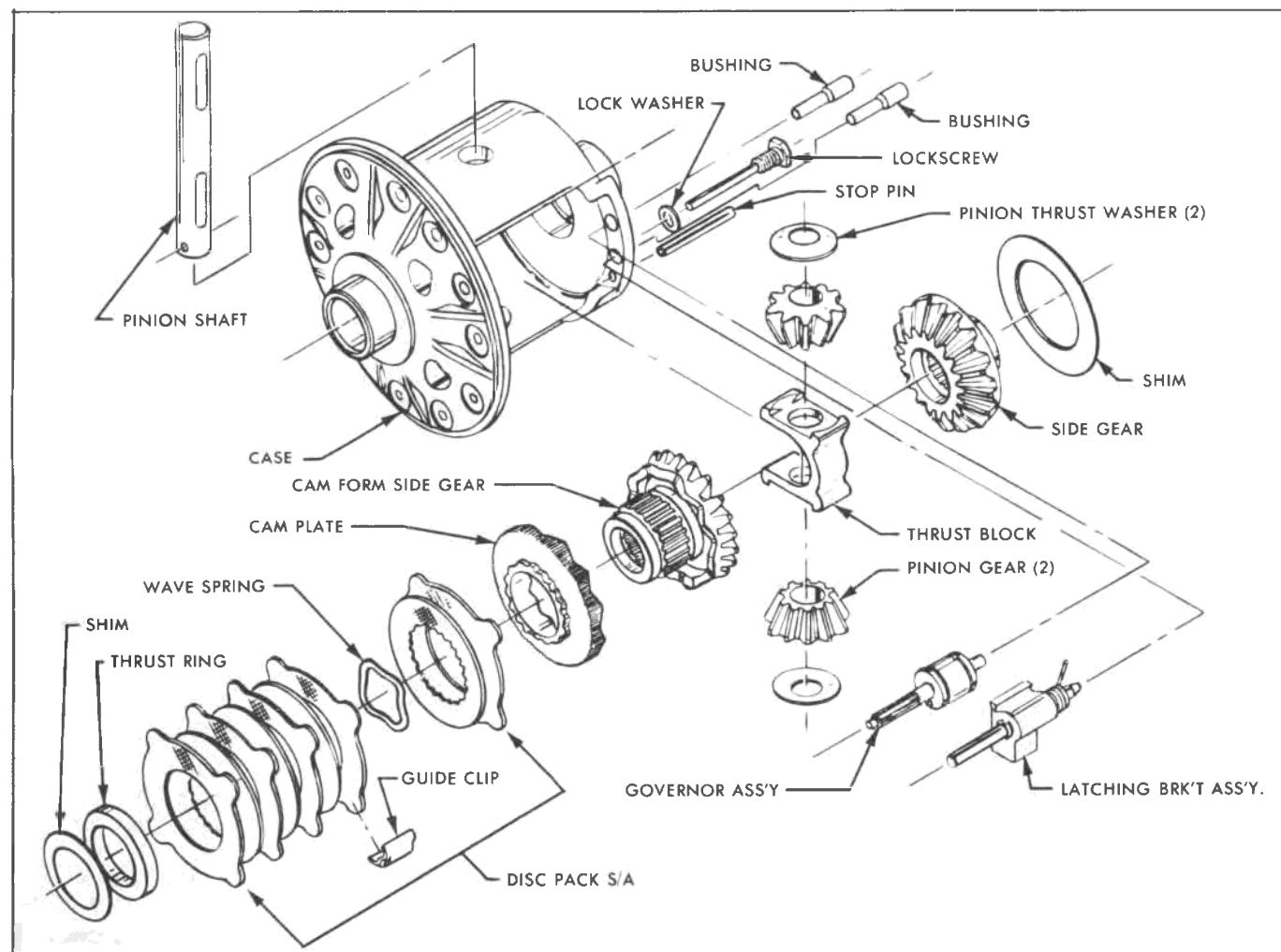


Fig. 4B-1H--1/2 Ton Unit

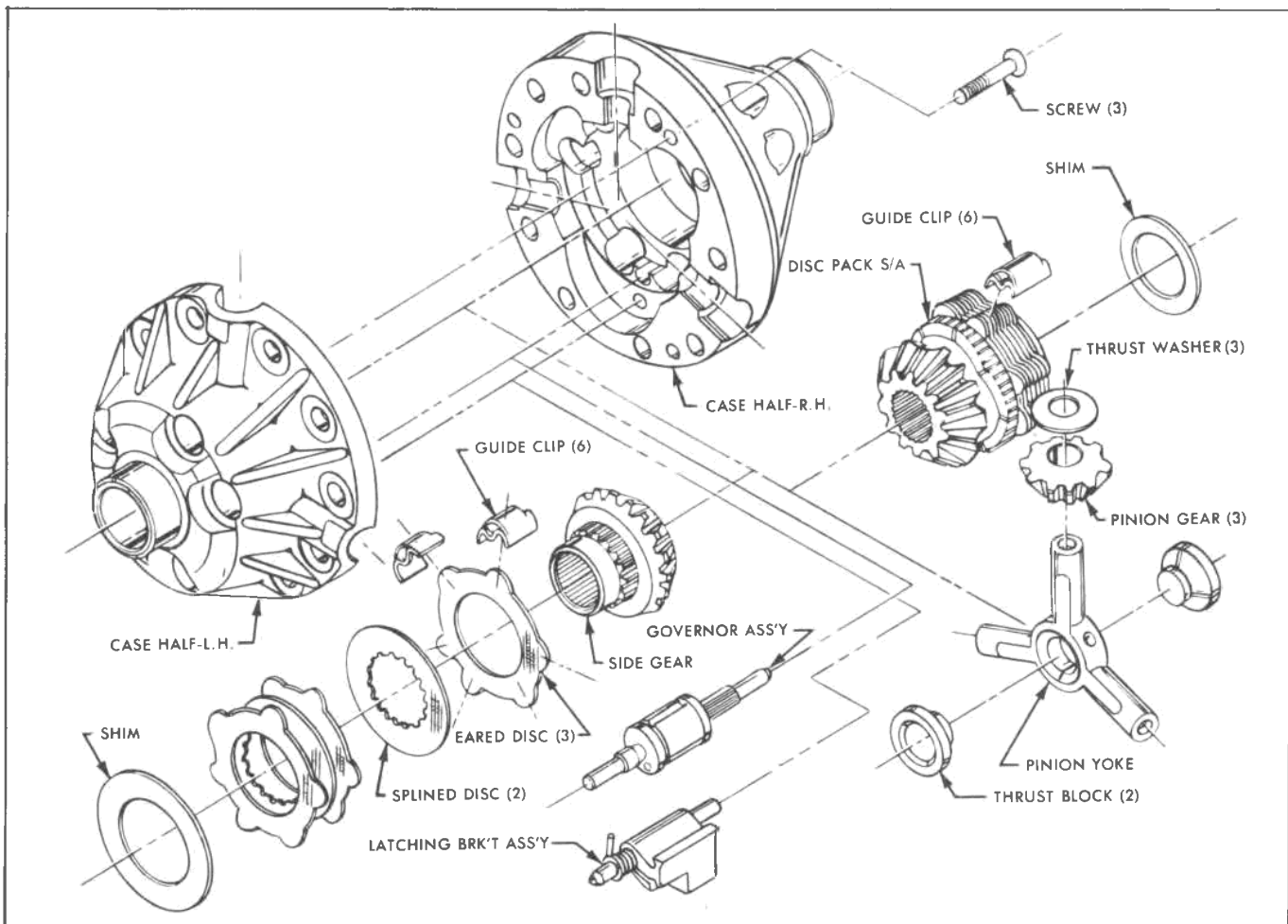


Fig. 4B-2H-3/4 Ton Unit

or greater, the differential will not lock as the added traction is not necessary.

Service Test Procedure

1. Place the Truck on a frame-contact hoist, allowing free rotation of the rear wheels.

2. Raise hoist until wheels clear floor. Holding one wheel stationary, slowly rotate other wheel approximately 1/2 revolution per second, in both the forward and reverse directions. Wheel should rotate freely. If both wheels attempt to turn together, the differential is locking and is defective.

NOTE: Rapid wheel rotation will cause a properly operating differential to lock and both wheels will rotate in the same direction.

3. Raise hoist to maximum height with one person in vehicle.

4. Start engine making sure that carburetor is set to provide a low idle speed of 600-800 rpm.

5. Place transmission in drive range and apply brakes. With manual transmission, depress clutch and place transmission in first gear.

6. Lock one rear wheel by pulling one parking brake cable from under the vehicle.

7. With engine at low idle, slowly release brakes. With manual transmission, slowly engage clutch.

8. Locked rear wheel will remain stationary and free wheel will begin turning. It is important that brakes or clutch be released slowly enough to start the free wheel turning and

allow the free wheel to gradually increase in speed. As speed of the free wheel is increased, the differential will lock causing the rotating wheel to stop or both wheels to turn at the same speed. The engine may stall if equipped with a manual transmission. It may be necessary to accelerate engine until approximately 10 mph is indicated on vehicle speedometer to cause differential lock. If indicated speed can be increased beyond 20 mph without causing differential lock, the unit is not functioning properly.

NOTE: Rapid release of brakes or clutch, or rapid acceleration of engine will invalidate test.

9. Lock opposite rear wheel and repeat procedure. The following chart provides guidelines for diagnosis and repair of differential complaints.

OVERHAUL PROCEDURES 8-7/8 RING GEAR AXLE 1/2 TON TRUCKS

CAUTION: Due to critical internal clearance dimensions, differential side gears and case cannot be serviced separately. If any side gear or case damage is found, the entire differential must be replaced.

Internal clearances are such that shims, reaction block, and thrust rings should not be replaced unnecessarily even if slight wear indications are present. If shims, reaction block, or thrust ring must be replaced due to damage, correct measurement and replacement procedures must be

DIFFERENTIAL DIAGNOSIS

Complaint	Possible Cause	Correction
Does not lock:	A. Little or no spring preload on the latching bracket.	A. Replace governor assembly and latching bracket.
	B. Flyweights on governor assembly stuck closed.	B. Replace governor assembly and latching bracket.
	C. Broken Drive teeth on governor and/or cam gear assembly.	C. Replace cam plate, governor assembly and latching bracket.
	D. Broken clutch plates in cam gear assembly.	D. Replace clutch plates and wave spring.
Locks in turns:	A. Governor assembly tight in case.	A. Free up governor assembly.
	B. Broken or weak governor flyweight spring.	B. Replace governor assembly and latching bracket.
	C. Flyweight in governor assembly stuck open.	C. Replace governor assembly and latching bracket.
	D. Broken cam plate and/or governor drive teeth.	D. Replace cam plate, governor assembly and latching bracket.
Noisy:		
NOTE: In addition to normal axle noise (see section on standard differential), the locking differential exhibits some clutch noise upon engagement and disengagement.	A. Broken clutch plates.	A. Replace clutch plates and wave spring.
	B. Broken reaction block.	B. Replace reaction block.* Check closely for other damage. Replace entire unit if housing, side gear, or pinion gears are damaged.
	C. Broken differential gears.	C. Replace entire unit.

*Reaction blocks must be replaced with blocks of identical thickness.

Fig. 4B-3H--Diagnosis Chart

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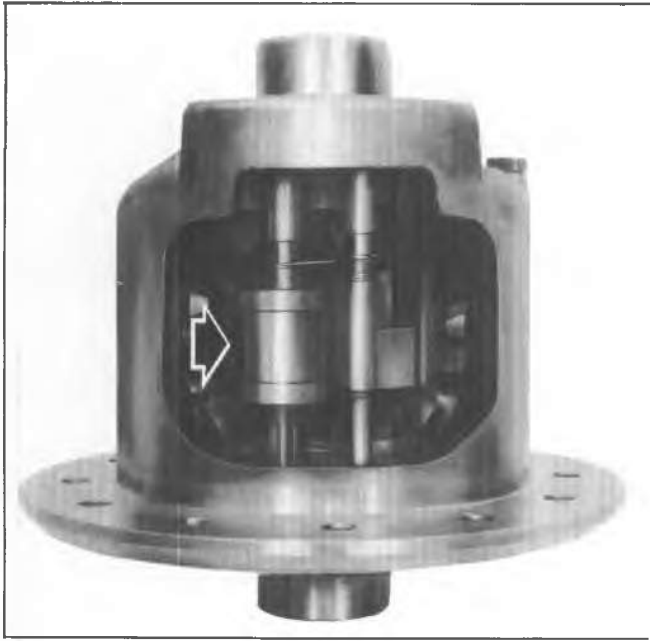


Fig. 4B-4H--Governor and Latching Bracket

followed. Failure to do so may disturb critical clearances and could result in differential complaints.

Internal components can be inspected through the windows of the differential housing.

If the governor assembly and latching bracket are the only items to be replaced, proceed only through step No. 2 of the disassembly procedure. To install new governor and latching bracket, begin at step No. 6 of the reassembly procedure.



Fig. 4B-5H--Bearing Puller J-26252

Disassembly

1. Note position of governor and latching bracket assembly, Figure 4B-4H. Remove ring gear and side bearings following procedures established for the standard differential.

2. Using bushing puller tool No. J-26252, remove governor assembly and latching bracket by pulling the retaining bushings as shown in Figure 4B-5H. Pull the latching bracket spring out of the way while pulling the governor assembly bushing to prevent damage. Remove the stop pin by driving through the case with a drive pin punch.

3. Remove lock screw and pinion shaft, and roll out differential pinion gears.

4. Remove thrust block and pinion thrust washers.

5. Remove cam gear, disc pack assembly and disc pack guide clips.

6. Remove plain side gear and shims.

Inspection

1. Clean all parts with solvent. Inspect all bearing for chipping or evidence of excessive wear. Replace parts as needed.

2. Inspect all differential components for excessive wear and breakage. Replace parts as needed. The following are serviceable components for this differential:

- Governor assembly and latching bracket with spring and stop pin.

- Cam plate.

- Clutch disc pack with guides and guide clip.

- Pinion cross-shaft.

- Pinion gears.

- Pinion thrust washers.

- Reaction block (4 sizes).

- Thrust ring.

- Flange end shim (4 sizes).

CAUTION: Attempts to service other components may disturb critical clearances and could result in differential complaints.

If reaction block or flange end shim must be replaced, the original pieces must be carefully measured for thickness and replaced with a piece of the same size.

CAM/CLUTCH SERVICE

Disassembly

If cam plate or clutch discs must be replaced, the cam gear sub-assembly must be serviced as follows:

1. Measure and record overall length of gear assembly (front face of gear to back side of thrust ring, include shim). This dimension will be needed to reassembly unit if thrust ring is replaced. **DO NOT REPLACE THRUST RING UNLESS NECESSARY.** If ring is excessively worn or scored, check bore in case for scoring. If bore is scored, replace entire differential.

2. With gear hub end up, compress disc pack and install jaws of split ring bearing remover (J-22912) between the thrust ring and the top eared disc. Bevel side of bearing remover should face up toward thrust ring.

3. Place cam gear assembly with bearing remover attached in an arbor press supporting the bearing remover on both sides.

4. Install a 1-1/2" to 1-3/4" diameter plug similar to (J-8107-4) on gear hub. Press against plug with ram of press to remove thrust ring. Keep all components in the proper order, Figure 4B-6H.

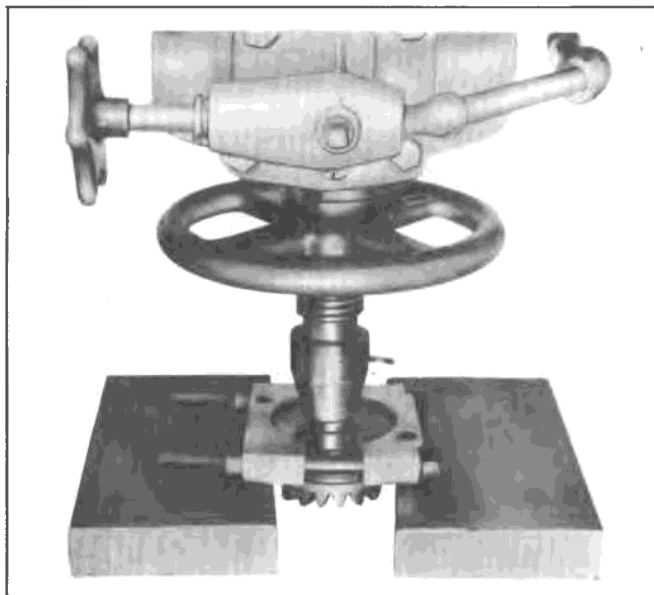


Fig. 4B-6H--Bearing Remover J-22912

Reassembly

Replace cam plate and wave spring or clutch discs as necessary and reassemble as follows: See Fig. 4B-1H.

1. Place gear on bench with hub end up.

2. Assemble cam plate with cam form down to mate with cam form on gear.

3. Assemble onto cam plate: (2) eared discs, (1) splined disc, and (1) wave spring alternately as shown.

4. Assemble on to gear hub (3) splined discs and (3) eared discs alternately as shown. Begin with a splined disc and end with an eared disc.

5. Locate cam gear assembly in arbor press with hub end up. Place thrust ring on gear hub and press to shoulder making sure that ring is square with hub.

NOTE: Compress disc pack by pushing down on the discs to keep the splined discs from becoming wedged between the thrust ring and gear shoulder while pressing the sub-assembly together. Completed sub-assembly should be checked for proper disc sequence. Also, make sure the first splined disc (large spline) is properly located on the cam plate.

Reassembly

1. Install (4) clutch pack guide clips on the ears of the cam gear clutch pack using grease for retention.

2. Install cam gear assembly and original shim in flange end of case. If a new thrust ring has been pressed on the cam gear, reshimming may be necessary. Measure the overall length of the new cam gear assembly, including the shim and compare to the dimension obtained in Step A of cam gear service section. If the length of the new assembly varies by more than .003" larger or smaller than the original dimension, reshimming will be necessary. Select a shim which will result in a reading closest to the original.

NOTE: INCORRECT SHIMMING WILL DISTURB CRITICAL CLEARANCE DIMENSIONS AND MAY RESULT IN DIFFERENTIAL FAILURE.

3. Lock an axle shaft in vise, in a vertical position. Mount the differential case over the end of the axle shaft engaging the spline of the side gear with the shaft. Grease the two pinion gear thrust washers and locate them in their proper

position. Install the opposite end side gear and original shim.

NOTE: ORIGINAL SHIM MUST BE USED TO MAINTAIN PROPER CLEARANCE DIMENSIONS.

4. Insert one pinion gear through the small window opening in the case while at the same time inserting the reaction block and other pinion gear through the large window opening. Rotate the two pinion gears and thrust block 90° so as to position the reaction block with the open side towards the small window opening in the case. Be sure the two pinion gears and thrust washers are in their proper location.

NOTE: REACTION BLOCK MUST BE REPLACED WITH A BLOCK OF THE IDENTICAL THICKNESS. INCORRECT BLOCK THICKNESS WILL DISTURB CRITICAL CLEARANCE DIMENSIONS AND MAY RESULT IN DIFFERENTIAL FAILURE.

5. Install shaft and lock screw.

6. Insert governor assembly and latching bracket into case, Figure 4B-4H. Place straight end of latching bracket spring over and to the outside of the engagement shaft to preload the latching bracket against the governor assembly. Press bushing and 1/4" stop pin into case. Press bushing for governor assembly into case to give .004 to .020 shaft end play. Press bushing for latching bracket into case to remove end play. A 3/8 diameter plug or socket will aid in pressing the bushings into the housing. Press stop pin flush with top of case.

NOTE: For the latching bracket use bushing with the tapered hole. The bushing for the governor assembly has a straight hole.

7. Install ring gear and side bearings using the procedure outlined for conventional differentials.

8. Place differential unit in carrier and adjust ring gear and pinion backlash and gear tooth pattern as outlined in the conventional differential section.

9. Check operation as outlined in the Service Test Procedure.

NOTE: USE STANDARD DIFFERENTIAL LUBRICANT. DO NOT USE LUBRICANT DESIGNED FOR "LIMITED SLIP" DIFFERENTIALS.

10-1/2" RING GEAR AXLE 3/4 TON AND 1-TON TRUCKS

CAUTION: Due to critical internal clearance dimensions, differential side gears and case cannot be serviced separately. If any side gear or case damage is found, the entire differential must be replaced.

Internal clearances are such that shims, reaction blocks, and thrust ring should not be replaced unnecessarily even if slight wear indications are present. If shims, reaction blocks, or thrust ring must be replaced due to damage, correct measurement and replacement procedures must be followed. Failure to do so may disturb critical clearances and could result in differential complaints.



Fig. 4B-7H--3/4 Ton Unit

Disassembly

1. Remove ring gear and side bearings following procedures established for the standard differential.
2. Remove (3) screws on front face of ring gear flange.
3. Set unit on right side case half and gently pry apart at yoke hole locations Fig. 4B-7H.
4. Remove left side case half. To prevent side gear from falling out, hold thumb against inside of gear hub while separating case halves.
5. Inspect components for damage. If the governor assembly and latching bracket are the only items to be replaced, remove and proceed to Step 7 of reassembly procedure. Pry under pinion yoke and remove and proceed with detailed inspection if further damage is observed.

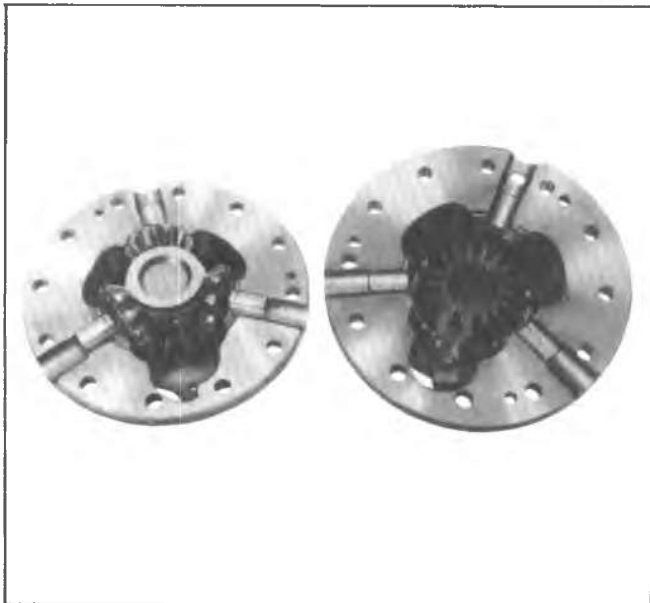


Fig. 4B-8H--3/4 Ton Assembly

Inspection

1. Clean all parts with solvent. Inspect all bearings for chipping or evidence of excessive wear. Replace parts as needed.
2. Inspect all differential components for excessive wear and breakage. Replace parts as needed. **THE FOLLOWING ARE SERVICEABLE COMPONENTS FOR THIS DIFFERENTIAL.**

- Governor assembly and latching bracket with spring.
- Cam Plate.
- Clutch disc pack with wave spring and guide clips.
- Pinion yoke.
- Pinion gears.
- Pinion thrust washers.
- Reaction blocks (4 sizes).
- Thrust ring.
- Right side shim (4 sizes).
- Left side guide clips.

Attempts to service other components will disturb critical clearances and may result in differential failure. If reaction blocks or right side shim must be replaced, the original pieces must be carefully measured for thickness and replaced with a piece of the same size.

CAM/CLUTCH SERVICE

Disassembly

If cam plate or clutch discs must be replaced, the cam gear sub-assembly must be serviced as follows: Refer to Figure 4B-9H.

1. Measure and record overall length of gear assembly (front face of gear to back side of thrust ring, include shim). This dimension will be needed to reassemble unit if thrust ring is replaced. **DO NOT REPLACE THRUST RING UNLESS NECESSARY.** If ring is excessively worn or scored, check bore in case for scoring. If bore is scored, replace entire differential.
2. With gear hub end up, compress disc pack and install jaws of split ring bearing removed (J-22912) between the thrust ring and the top eared disc. Bevel side of bearing remover should face up toward thrust ring.
3. Place cam gear assembly with bearing remover attached in an arbor press supporting the bearing remover on both sides.
4. Install a 1-1/2" to 1-3/4" diameter plug (J-8107-4) on gear hub. Press against plug with ram of press to remove thrust ring. Keep all components in the proper order.

Reassembly

Replace cam plate and/or clutch discs as necessary and reassemble as follows:

1. Place gear on bench with hub end up.
2. Assemble cam plate with cam form down to mate with cam form on gear.
3. Assemble onto cam plate: (2) eared discs, (1) splined disc, and (1) wave spring alternately as shown, Fig. 4B-9H.
4. Assemble onto gear hub: (4) eared discs and (3) splined discs alternately as shown. Begin and end with an eared disc.
5. Locate cam gear assembly in arbor press with hub end up. Place thrust ring on gear hub and press to shoulder making sure that ring is square with hub.

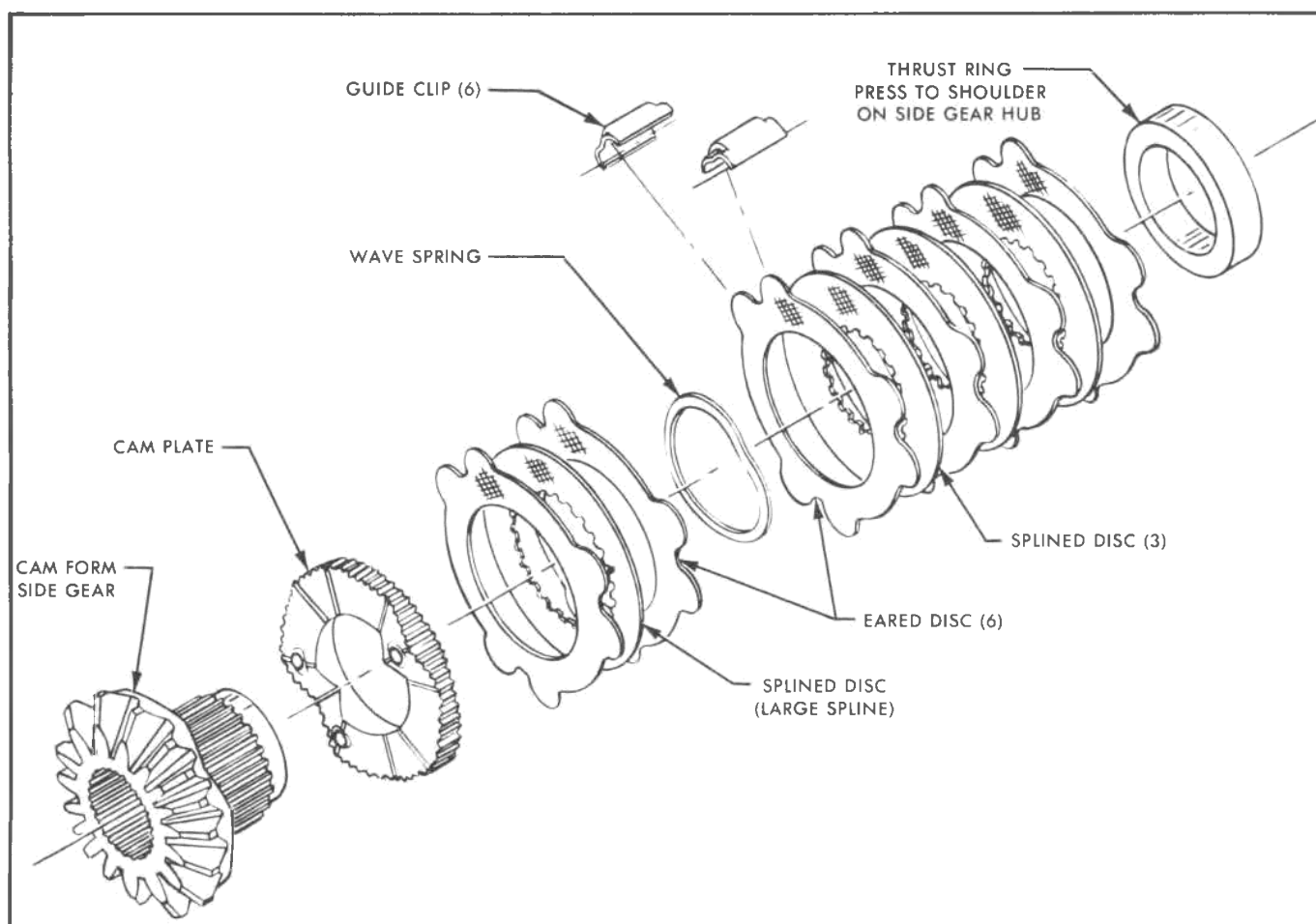


Fig. 4B-9H--Cam Plate and Clutch Disc

NOTE: Compress disc pack by pushing down on the discs to keep the splined discs from becoming wedged between the thrust ring and gear shoulder while pressing the sub-assembly together. Completed sub-assembly should be checked for proper disc sequence. Also, make sure the first splined disc (large spline) is properly located on the cam plate.

Reassembly

1. Install (6) clutch pack guide clips on the ears of the cam gear clutch pack using grease for retention.

2. Install cam gear assembly and original shim in right side case half. If a new thrust ring has been pressed on the cam gear, reshimming may be necessary. Measure the overall length of the new cam gear assembly, including the shim and compare to the dimension obtained in Step A of cam gear service section. If the length of the new assembly varies by more than .003" larger or smaller than the original dimension, reshimming will be necessary. Select a shim which will result in a reading closest to the original.

NOTE: INCORRECT SHIMMING WILL DISTURB CRITICAL CLEARANCE DIMENSIONS AND MAY RESULT IN DIFFERENTIAL FAILURE.

3. Install right side reaction block on gear face with button side of block facing up. Use original block unless severely scored or worn. If new block is used, determine face-to-face thickness of original block with calipers and replace with a service block of the same thickness.

NOTE: INCORRECT BLOCK THICKNESS WILL DISTURB CRITICAL CLEARANCES AND MAY

RESULT IN DIFFERENTIAL FAILURE.

4. Preassemble pinions and pinion thrust washers on pinion yoke. Index yoke to proper position and install in housing with center over button end of reaction block. A light tap on the yoke may be needed to seat it in the housing.

5. Install left side reaction block unless severely scored or worn. If new block is used, determine face-to-face thickness of original block with calipers and replace with a service block of the same thickness.

NOTE: Right and left side reaction blocks may not be the same thickness. If blocks are broken or cannot be accurately measured for thickness, the entire differential must be replaced. Incorrect block thickness will disturb critical clearances and may result in differential failure.

6. Install governor assembly and latching bracket in their respective locations. Place straight end of latching bracket spring over and to the outside of the governor shaft to preload the latching bracket against the governor assembly.

7. Install the original (3) eared and (2) splined clutch plates on the left side gear alternately, starting and ending with an eared disc.

NOTE: ORIGINAL DISCS MUST BE USED. ATTEMPTS TO INSTALL OTHER THAN ORIGINAL DISCS WILL DISTURB CRITICAL CLEARANCES AND MAY RESULT IN DIFFERENTIAL FAILURE.

8. Install (6) clutch pack guide clips on the left side disc pack assembly using grease for retention.

9. Install original shim in left side case half.

NOTE: ORIGINAL SHIM MUST BE USED. ATTEMPTS TO INSTALL OTHER THAN ORIGINAL SHIM WILL DISTURB CRITICAL CLEARANCES AND MAY RESULT IN DIFFERENTIAL FAILURE. Slight polishing or scuffing on discs and shims is normal.

10. Remove disc pack from side gear and carefully lower disc pack assembly into left side case half. Make sure car guide clips are in their proper position.

11. Install side gear in left side case half. Rotate gear to engage spline with splines on discs.

12. Being careful not to dislodge side gear assembly (hold thumb on inside of side gear spline), lower the left hand case assembly onto the right hand case. Index left hand case so holdes in housing will line up for the governor assembly and ltaching bracket shafts.

13. Turn entire unit over and install three (3) screws.

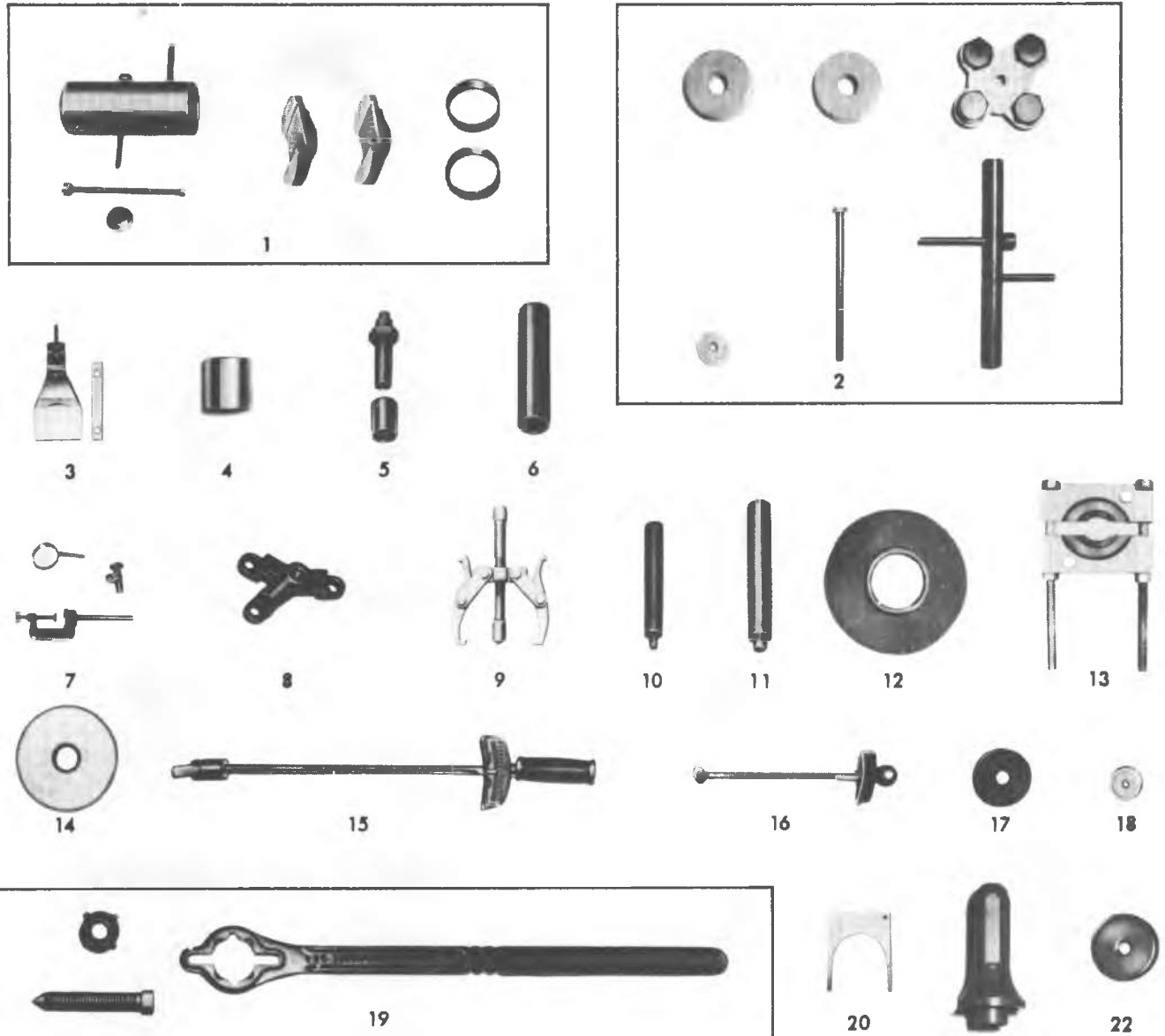
14. Lock an axle shaft in a vise in a vertical position. Install differential assembly on axle shaft engaging the spline of the axle with a side gear. Rotate unit slowly. A short shaft held in pinion yoke hole will aid in rotating. The unit should turn smoothly without binding or locking up.

NOTE: Differential will lock if turned rapidly—50 rpm or greater.

15. Install ring gear and side bearings using the procedure outlined for conventional differentials.

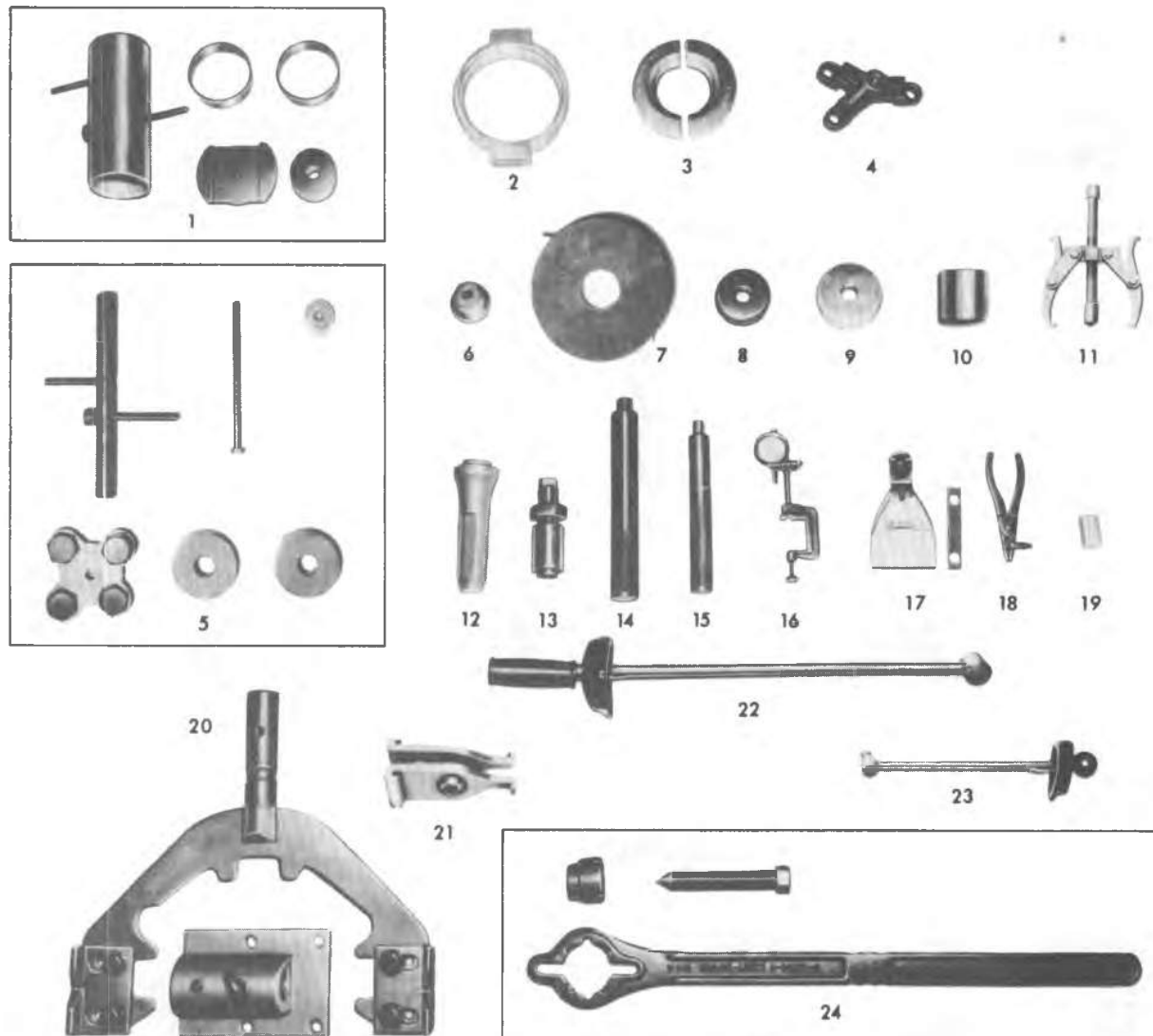
16. Place differential unit in carrier and adjust ring gear to pinion backlash and gear tooth pattern as outlined in the conventional differential section.

NOTE: Use standard differential lubricant. DO NOT use lubricants specifically designed for "limited slip".



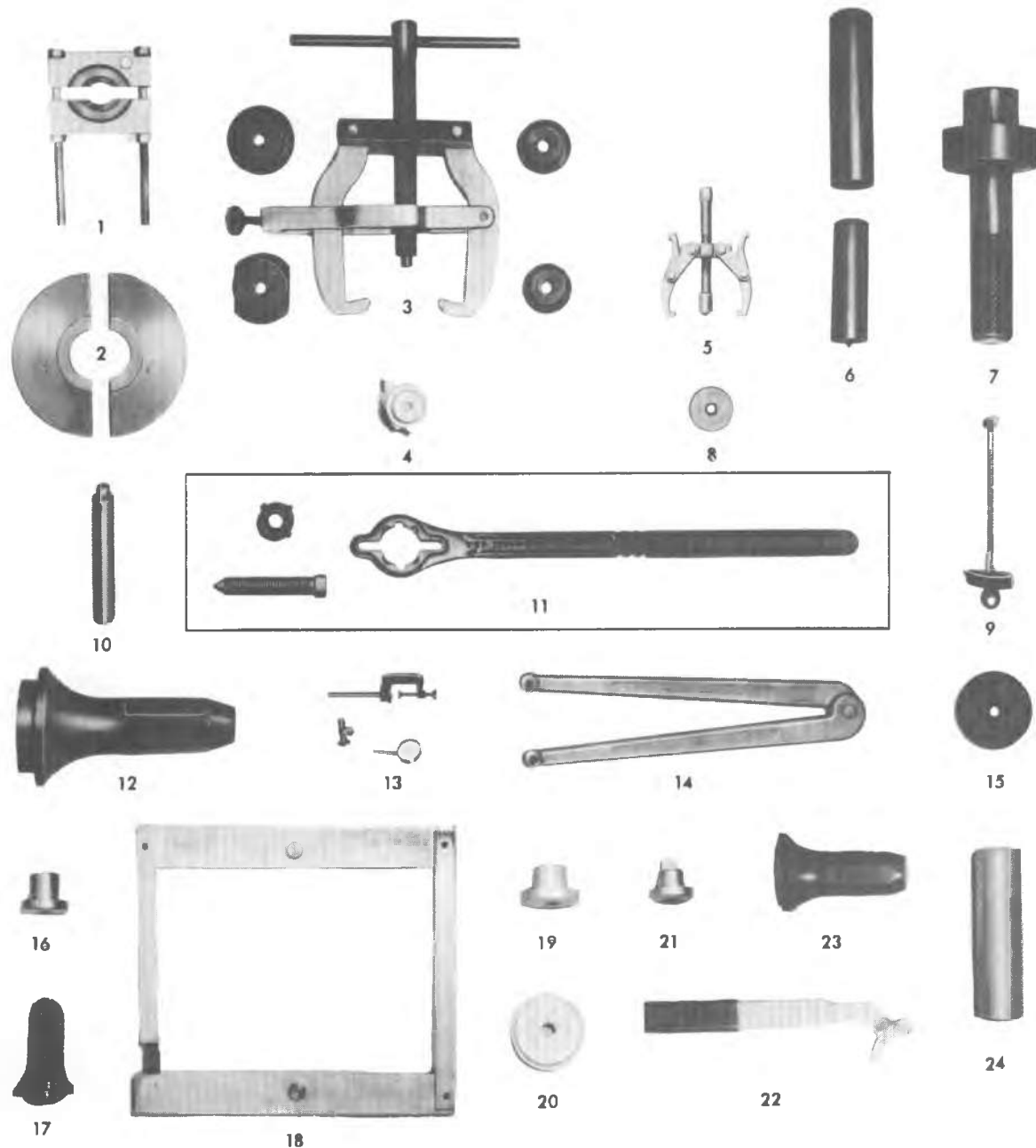
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|--------------|--|------------------|--|
| 1. J-6266 | Pinion Setting Gauge | 9. J-22888 | Differential Bearing Remover |
| | J-6266-28 Barrel Adapter | 10. J-7079-2 | Driver Handle (Insert Type) |
| | J-6266-25 Plug | 11. J-8092 | Driver Handle (Threaded Type) |
| | J-6266-52 Gauge Plate | 12. J-8609-01 | Pinion Rear Bearing Installer - Passenger Car |
| | J-6266-53 Gauge Plate | | (7-1/2") |
| | J-6266-31 Adapter Rings | 13. J-8612 | Rear Pinion Bearing Remover |
| 2. J-23597-1 | Pinion Setting Gauge (7-1/2") | | (7-1/2") |
| | J-21777-1 Arbor | 14. J-8608 | Pinion Rear Bearing Cup Installer |
| | J-21777-45 Side Discs | | (7-1/2") |
| | J-21777-29 Gauge Plate | 15. J-1313 | 0-150 Ft. Lbs. Torque Wrench |
| | J-21777-42 Front Bearing Plug | 16. J-5853 | In. Lbs. Torque Wrench |
| | J-21777-43 Stud | 17. J-7137 | Pinion Front Bearing Cup Installer |
| 3. J-22779 | Side Bearing Shim Gauge | | (Used with J-8092) |
| | J-22779 Strap | | (7-1/2") |
| 4. J-22175 | Side Bearing Installer (8-3/4")-(8-7/8") | 18. J-8107-4 | Differential Bearing Remover - Installer |
| J-22761 | (8-1/2") | | (Used with J-9537 and J-22779) |
| J-25299 | (7-1/2") | 19. J-8614 | Companion Flange Holder |
| 5. J-9458 | Companion Flange Installer - Passenger Car | 20. J-22864-1, 2 | Pinion Seal Gauge Plate (7-1/2", 8-1/2", 8-7/8") |
| 6. J-5590 | Pinion Rear Bearing Cup Installer - Truck Axle | 21. J-23911 | Pinion Oil Seal Installer (7-1/2", 8-1/2", 8-7/8") |
| 7. J-8001 | Dial Indicator Set | 22. J-0270-14 | Pinion Rear Bearing Cup Installer |
| 8. J-5748 | Positraction Torque Measuring Adapter | | Truck Axle (Used with J-8092) |

Fig. 1T—Special Tools—7 1/2", 8 1/2", 8 3/4", 8 7/8" Ring Gear Differentials



- | | | | |
|---------------|--|--------------|---|
| 1. J-6266 | Pinion Setting Gauge | 10. J-22175 | Differential Bearing Installer |
| | J-6266-28 Barrel Gauge | 11. J-22888 | Differential Bearing Remover (Used with J-8107-4) |
| | J-6266-31 Sleeves | | |
| | J-6266-53 Gauge Plate | 12. J-9774 | Differential Yoke Bearing Seal Installer |
| 2. J-0358-1 | Press Plate Holder | 13. J-5780 | Companion Flange Installer |
| 3. J-9771 | Drive Pinion Bearing Cone and Roller Assembly Remover (Used with J-0358-1) | 14. J-8092 | Driver Handle (Threaded Type) |
| 4. J-5748 | Positraction Torque Measuring Adapter | 15. J-7079-2 | Driver Handle (Insert Type) |
| 5. J-21777-01 | Pinion Setting Gauge | 16. J-8001 | Dial Indicator Set |
| | J-21777-45 Side Discs | 17. J-22779 | Side Bearing Shim Gauge |
| | J-21777-29 Gauge Plate | | J-22779-6 Strap |
| | J-21777-42 Front Bearing Pinion | 18. J-4880 | Snap Ring Pliers |
| | J-21777-43 Stud | 19. J-5810 | Torque Wrench Adapter (3/4" Male to 3/8" Female) |
| | J-21777-1 Arbor | 20. J-3289 | Differential Carrier Holding Fixture |
| 6. J-9773 | Differential Yoke Bearing Installer (Used with J-7079-2) | 21. J-22311 | Positraction Clutch Pack Remover and Installer |
| 7. J-8609 | Positraction Torque Measuring Adapter | 22. J-1313 | Ft.-Lb. Torque Wrench |
| 8. J-7137 | Drive Pinion Front Bearing Cup Installer (Used with J-8092) | 23. J-5853 | In.-Lb. Torque Wrench |
| 9. J-8608 | Drive Pinion Rear Bearing Cup Installer (Used with J-8092) | 24. J-8614 | Companion Flange Holder and Remover |

Fig. 2T—Special Tools—Corvette Differentials



- | | | | |
|-------------|---|-------------|-----------------------------------|
| 1. J-22912 | Press Plate | 13. J-8001 | Dial Indicator Set |
| 2. J-1453 | Pinion Bearing Press Plate | 14. J-0972 | Differential Nut Wrench |
| 3. J-8107 | Differential Bearing Puller Set | 15. J-24381 | Pinion Rear Bearing Cup Installer |
| 4. J-8107-3 | Adapter Plug | 16. J-24383 | Side Bearing Installer |
| 5. J-22888 | Differential Side Bearing Remover | 17. J-24384 | Pinion Oil Seal Installer |
| 6. J-1364 | Pinion Bearing Ring Drive | 18. J-24385 | Case Spreader Tool |
| 7. J-1488 | Differential Side Bearing Replacer | 19. J-24430 | Side Bearing Installer |
| 8. J-8608 | Drive Pinion Rear Bearing Cup Installer
(Used with J-8092) | 20. J-24432 | Pinion Rear Cup Installer |
| 9. J-5853 | In.-Lbs. Torque Wrench | 21. J-23322 | Pinion Straddle Bearing Installer |
| 10. J-8092 | Drive Handle | 22. J-24429 | Adjusting Nut Wrench |
| 11. J-8614 | Companion Flange Holder and Remover | 23. J-24434 | Pinion Oil Seal Installer |
| 12. J-22281 | Pinion Flange Oil Seal Installer | 24. J-24433 | Pinion Rear Bearing Installer |

Fig. 3T—Special Tools—10-1/2" and 12-1/4" Ring Gear Truck Differentials

