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GENERAL DESCRIPTION

The rear axle assembly is the semi-floating type with hypoid gears (Fig. 174). The axle shaft housings are fabricated from hot rolled or seamless steel tubing, permanently secured in the differential housing.

The differential housing is amply reinforced with ribbing to withstand shock and stress. Major components such as the pinion, differential and axle shafts are mounted on tapered roller bearings to provide long, trouble-free operation.

The hypoid construction provides longer wear and quieter operation. Due to the sliding action of the

gears, it is important that specially processed hypoid lubricant be used in the rear axle.

The axle shafts are splined on the inner ends to fit into the differential side gears. The outer ends of the shafts are tapered and provided with a keyway to match the rear wheel hub.

A tapered roller bearing is assembled on the outer end of the shaft and seats in a bearing cup in the axle housing. Inner and outer oil seals are provided to prevent grease from working into either the wheel hub and brake drum or the axle housing.

Side thrust from the wheels is transferred from one shaft to the other by a thrust block which straddles the differential pinion shaft.

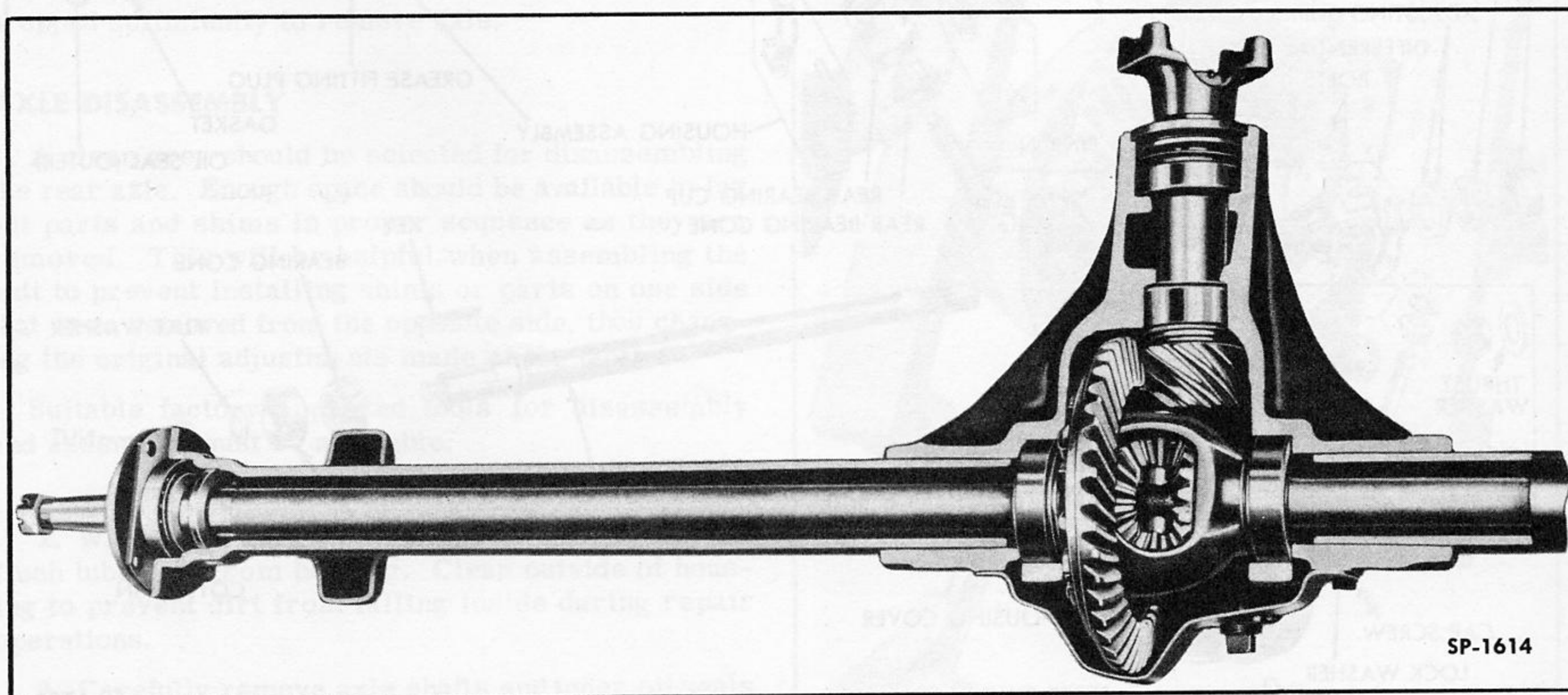


Fig. 174—Rear Axle Assembly—Sectional View

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The drive pinion is supported by two opposed tapered roller bearings. The pinion is adjustable endwise to provide proper position of the pinion relative to the differential drive gear, by the use of shims between the rear bearing cup and the axle housing. An oil seal at the outer end of the pinion prevents loss of lubricant.

The differential is mounted in two opposed tapered roller bearings in the axle housing. Shims are used between the bearings and the differential case at each side of the differential for alignment of the drive gear to the drive pinion and to obtain proper gear backlash. The drive gear is bolted to a flange on the differential case. For satisfactory performance the drive gear and pinion must be replaced at the same time using a new matched gear set.

MAINTENANCE

At regular intervals, check the lubricant level in the rear axle. Add proper lubricant as required according to instructions in Section 17, "Lubrication." If lubricant has to be added, the axle should be checked for lubricant leaks which may occur around the housing cover gasket, at the pinion oil seal or at the oil seals at the outer ends of the axle shafts. Be sure to lubricate the axle shaft bearings at indicated regular intervals.

Check periodically and tighten the U-bolts which attach the rear springs to the rear axle. Also check periodically to be sure the bolts attaching the propeller shaft rear universal joint to the rear flange or yoke on the axle pinion shaft are tight and that the flange or yoke is tight on the pinion shaft.

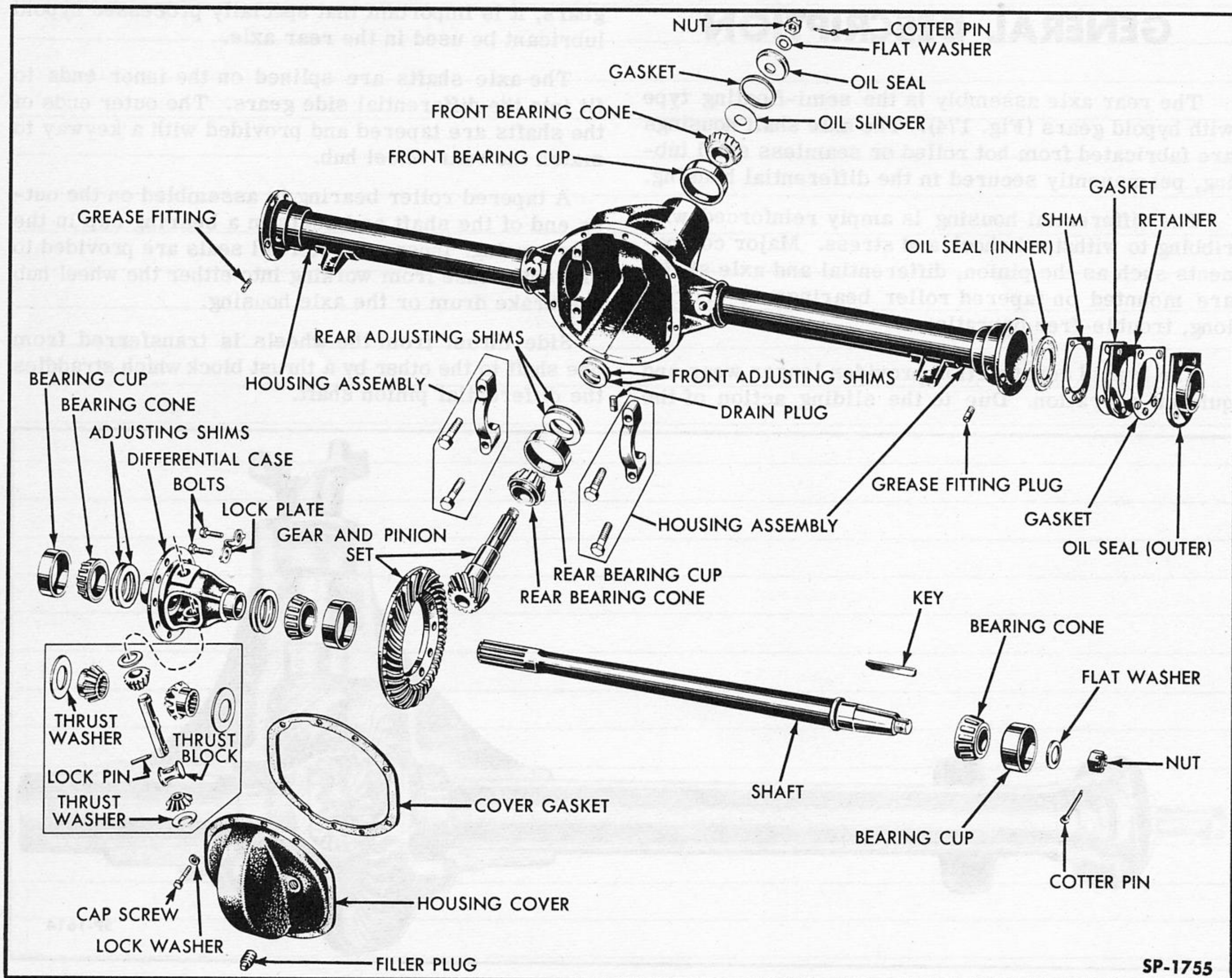


Fig. 175—Rear Axle Assembly—Exploded View

REAR AXLE ASSEMBLY

Certain repairs can be easily performed with the axle assembly in position on the vehicle. These repairs are described in detail under "Axle Shaft Replacement" and "Oil Seal Replacement" elsewhere in this section. A complete rear axle overhaul, however, is best accomplished with the axle assembly removed from the vehicle as a unit.

AXLE ASSEMBLY REMOVAL

The following procedure covers removal of the complete rear axle assembly from the vehicle.

1. Raise vehicle with a hoist or jack and place supports under frame.
2. Remove rear wheels and wheel hub and drum assemblies, using Rear Wheel Hub Puller C-319.
3. Disconnect hydraulic brake lines and hand brake cable at wheels and remove brake support plate bolts, outer oil seal, gaskets, retainer, support plate and shims.
4. Disconnect propeller shaft at rear companion flange.
5. Detach both rear shock absorbers from spring mounting plates.
6. Disconnect main hydraulic brake line from brake line tee fastened to rear axle.
7. Remove U-bolts and spring mounting plates attaching axle to springs and remove axle. If desired, rear springs can be disconnected at rear shackle and dropped sufficiently to remove axle.

AXLE DISASSEMBLY

A clean area should be selected for disassembling the rear axle. Enough space should be available to lay out parts and shims in proper sequence as they are removed. This will be helpful when assembling the unit to prevent installing shims or parts on one side that were removed from the opposite side, thus changing the original adjustments made at the factory.

Suitable factory approved tools for disassembly and assembly must be available.

1. With rear axle on a suitable stand, drain and flush lubricant from housing. Clean outside of housing to prevent dirt from falling inside during repair operations.
2. Carefully remove axle shafts and inner oil seals as described under "Axle Shaft Removal" in this section.

3. Remove cover from axle housing. The metal tag attached by one of the cover bolts indicates the gear ratio of the rear axle. For complete information, refer to "Rear Axle Gear Ratios" in this section. Two other cover bolts hold clips which attach hydraulic brake line.

4. If differential case has no end-play, check ring gear run-out by mounting Dial Indicator W-102 on axle housing and take readings from rear face of drive gear while rotating differential case. If run-out exceeds .002 of an inch, the drive gear and/or differential case should be replaced.

5. Remove differential bearing caps (note identification on caps and on housing to assure proper assembly). Remove differential and differential side bearings from axle housing, using Axle Housing Spreader W-129 as shown in Fig. 176. CAUTION: APPROXIMATELY .020 OF AN INCH SPREADING IS SUFFICIENT TO REMOVE DIFFERENTIAL. FURTHER SPREADING MAY CRACK HOUSING. RELEASE SPREADER AFTER REMOVING DIFFERENTIAL TO PREVENT PERMANENT DISTORTION OF HOUSING.

6. Place Universal Joint Flange Holding Wrench C-784 on companion flange and remove attaching nut. Then, using Universal Joint Flange Puller C-452, remove companion flange (Fig. 177).

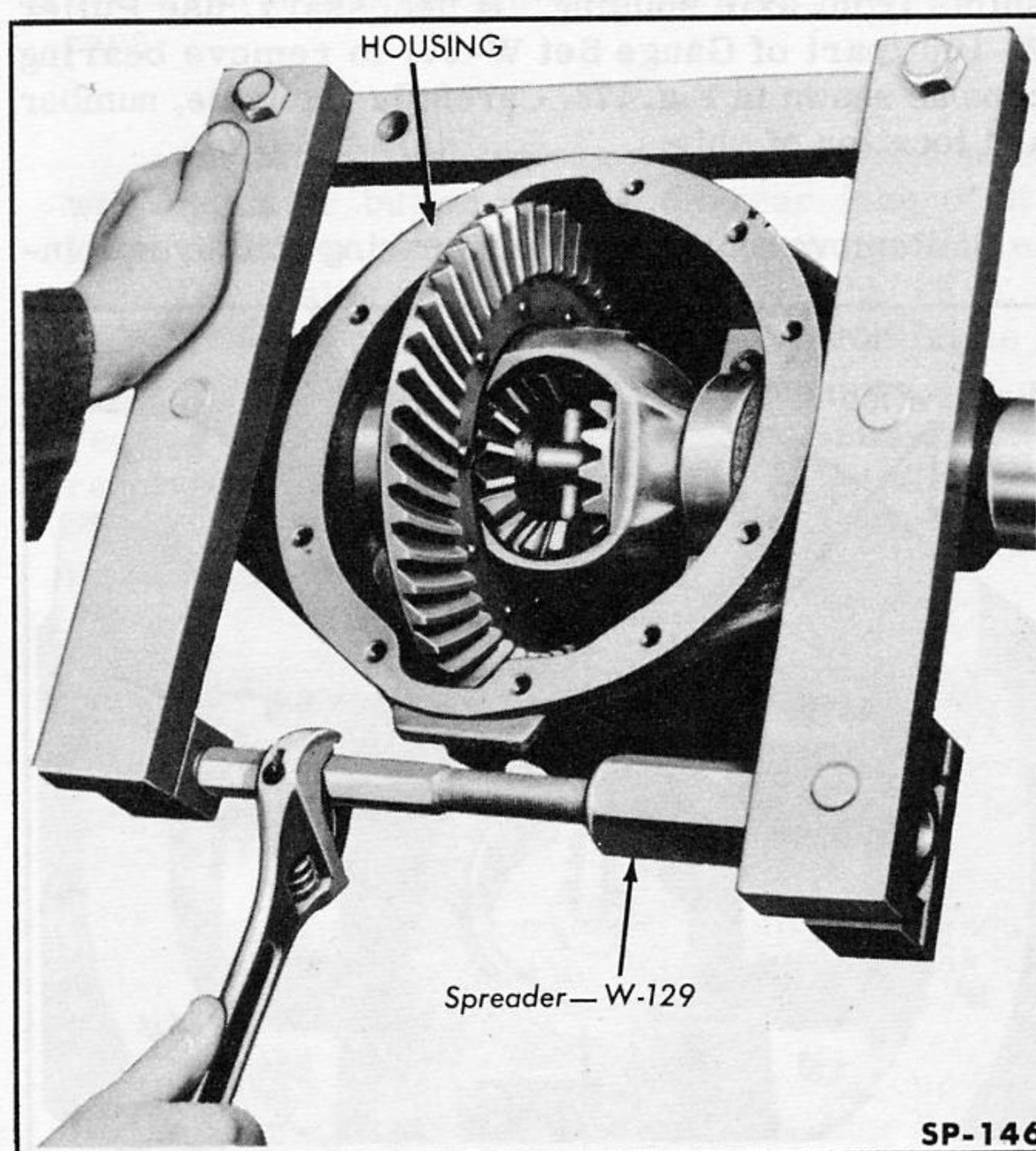


Fig. 176—Spreading Rear Axle Housing

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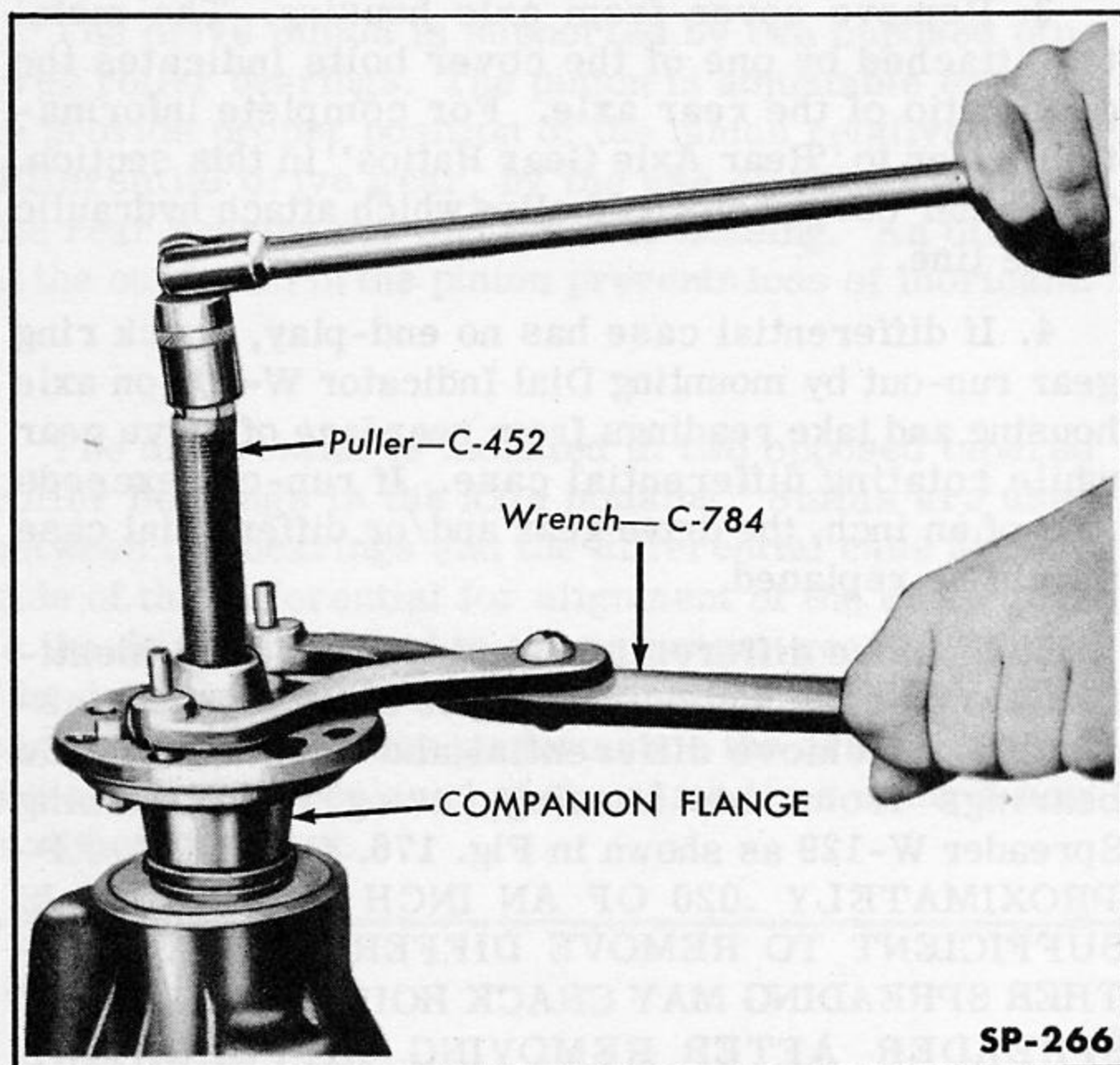


Fig. 177—Removing Companion Flange

7. Install nut upside down on pinion shaft and strike end of shaft with rawhide mallet to loosen pinion from bearings. Remove pinion.

8. Remove pinion oil seal, gasket, oil slinger, front bearing cone, front and rear bearing cups and shims from axle housing. If necessary, use Puller W-100 (part of Gauge Set W-99) to remove bearing cups as shown in Fig. 178. Carefully note size, number and location of shims.

9. Remove shims and rear bearing cone from pin-

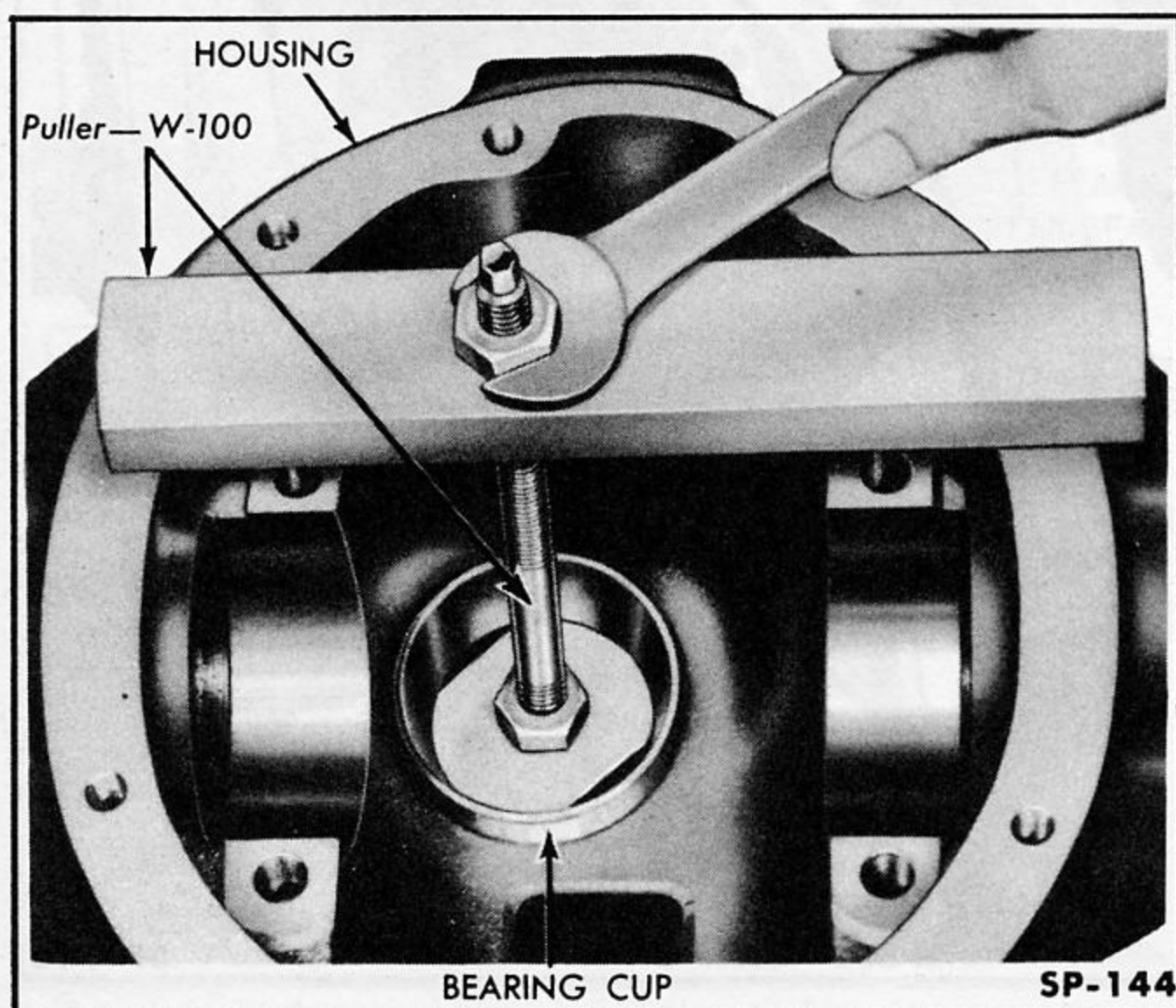


Fig. 178—Removing Pinion Bearing Cup

ion, carefully noting size, number and location of shims. Use Tapered Roller Bearing Puller KF-3 to remove bearing cone (Fig. 179).

10. Remove bearing cones from sides of differential, using Puller KF-3. Remove shims from under cones, carefully noting their size, number and location. Also, place bearing cones so they will be installed on same sides from which they were removed.

11. Remove drive gear from differential case by removing attaching bolts and lock plates. (Use new lock plates for assembly.)

12. Take out lockpin and remove differential pinion shaft, thrust block, gears and thrust washers from case.

13. Wash parts in clean solvent and inspect each part for damage, distortion or wear. If either the pinion gear or drive gear need replacement, both should be replaced with a factory matched set. Differential side gears and pinion gears should also be replaced with a complete matched set instead of replacing individual gears.

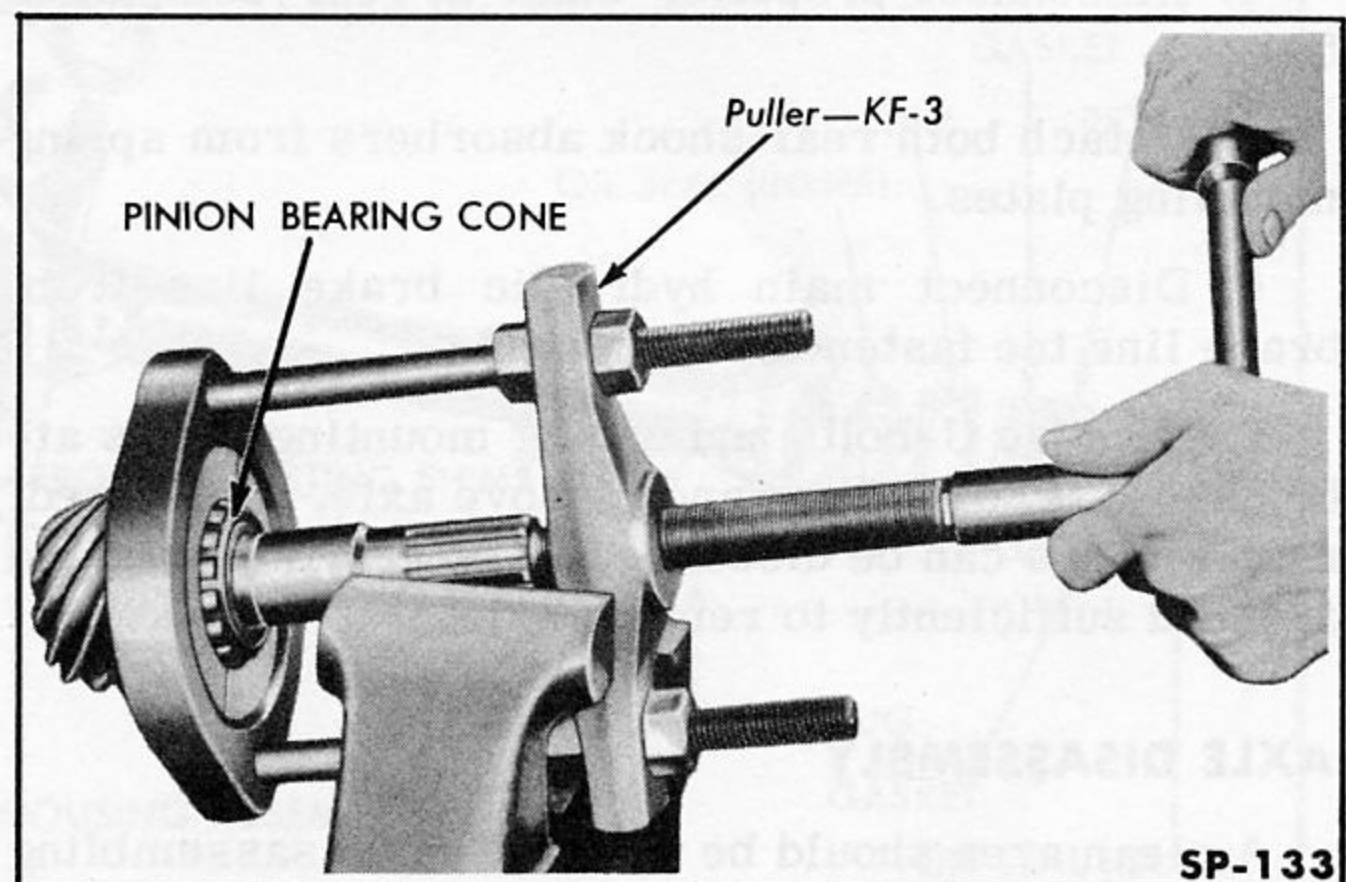


Fig. 179—Removing Pinion Rear Bearing Cone

AXLE ASSEMBLY

When assembling the rear axle, it is especially important that the adjustments be made carefully and in the sequence given to assure satisfactory operation of the axle and long service life. All thrust surfaces and bearings should be lubricated before parts are assembled to prevent scoring. The axle assembly procedure is as follows:

1. Compare diameters of differential side gear hubs and bore in differential case. Difference should be .003 - .006 inch. If clearance is excessive, replace both the case and the gears. If clearance is correct, assemble differential gears, thrust washers, pinion shaft, thrust block, and lockpin in differential case

(Fig. 175). Position thrust block so ends face toward axle shafts. If new differential parts (side gears, pinion gears and thrust washers) are used, there should be considerable drag on side gears after differential is assembled to allow for initial wear of new parts. If old parts are reinstalled, the clearance between side gear washer and differential case should not be over .008 of an inch. Peen the case to hold the lockpin in place.

2. Check alignment of differential case. Mount differential case on knife edge type V-blocks and, with a dial indicator, obtain a reading from drive gear attaching face while rotating case. The allowable run-out is .002 of an inch. Be sure case does not move endwise on V-blocks while rotating or reading will not be accurate. If misalignment is in excess of .002 of an inch, case is probably distorted and should be replaced.

3. Assemble drive gear to case making sure both attaching surfaces are clean. Use new lock plates under the attaching bolts. Tighten bolts to 40-50 foot-pounds torque. Check alignment of drive gear by repeating step 2 above, with indicator against rear face of drive gear. If variation is in excess of .002 of an inch, the drive gear is distorted and a new, matched drive gear and pinion set should be installed. In some cases, the drive gear can be rotated 90° - 180° on the differential case and run-out will be within limits.

4. Obtain total amount of differential end-play in housing as follows:

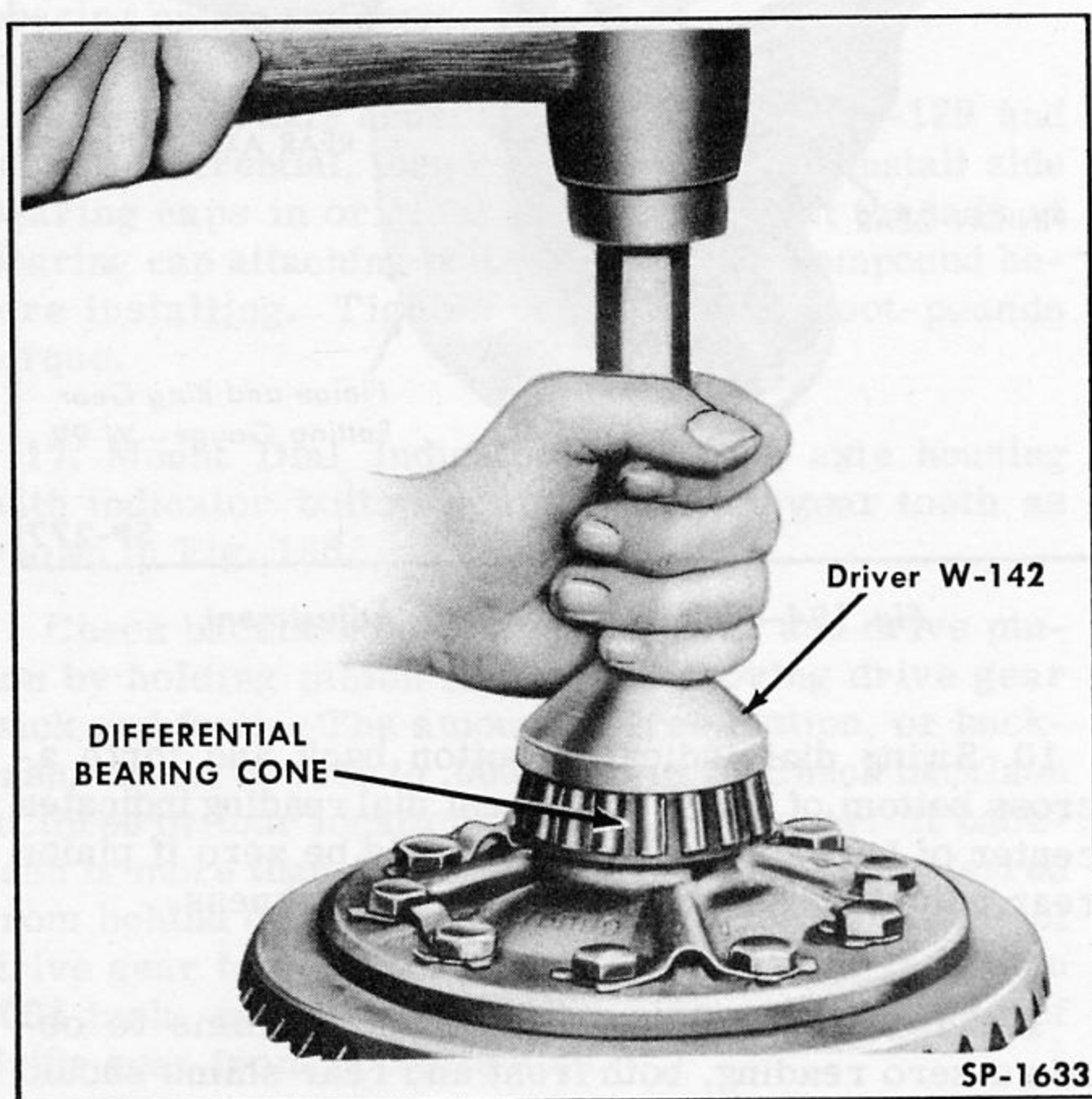


Fig. 180—Installing Differential Side Bearing Cone

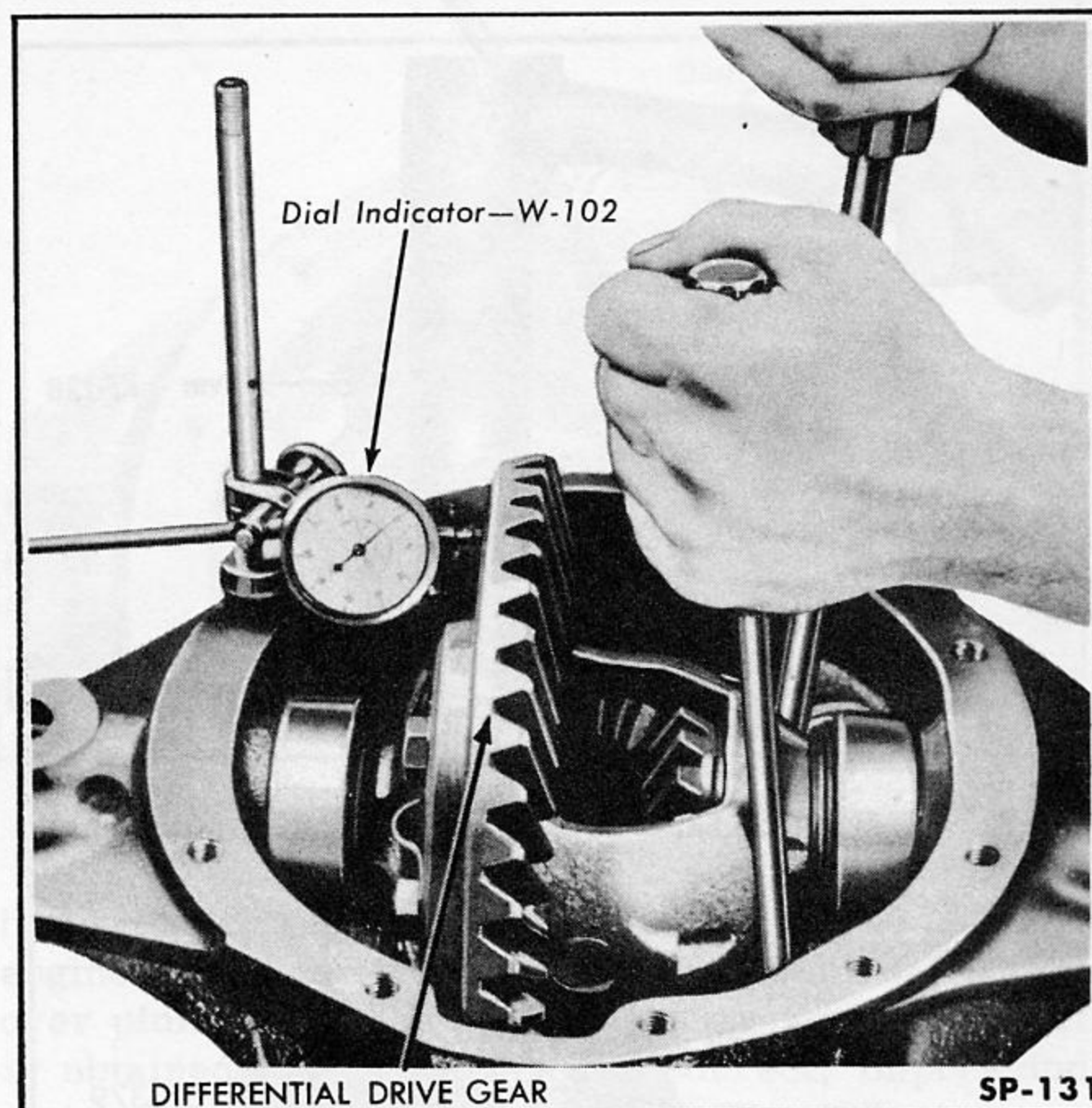


Fig. 181—Checking Differential End-Play

(a) Install side bearing cones on differential case without shim packs (Fig. 180). Use Differential Case Bearing Cone Driver W-142 to fully seat cones. Install bearing cups on cones, place differential assembly in axle housing and install differential bearing caps.

(b) Mount Dial Indicator W-102 on axle housing with indicator button resting on rear face of drive gear. With two screw drivers, move drive gear endwise in housing as far as possible (Fig. 181). Set indicator dial at zero, then move differential as far as possible toward opposite end of housing and note reading on dial. This reading denotes shim thickness required to eliminate end-play of differential in housing. This reading will be used later in the procedure. Remove differential from housing.

5. Assemble pinion rear bearing cone on drive pinion shaft using Pinion Bearing Driver KF-128 (Fig. 182). Lubricate bearing cone with a medium weight grease.

6. Install pinion front bearing cup in axle housing using Pinion Front Bearing Cup Driver W-126.

7. Install shim pack and rear bearing cup in axle housing, using Puller W-100 (part of Gauge Set W-99) inverted as shown in Fig. 183. Thickness of shims can be determined as follows:

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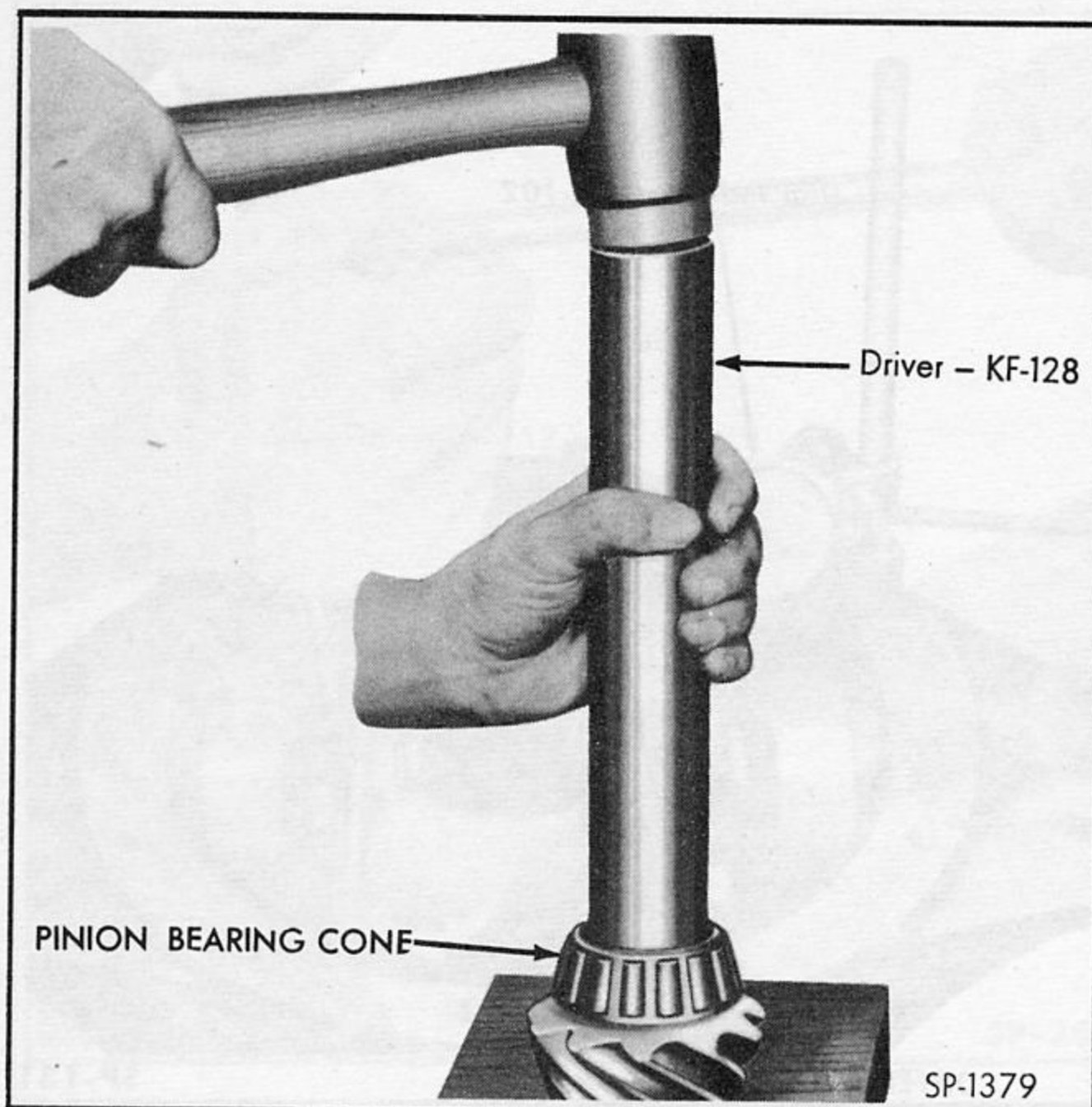


Fig. 182—Installing Pinion Rear Bearing Cone

On end of pinion shaft, four sets of figures are etched. One figure is on both pinion shaft and drive gear to designate a matched set. Directly opposite this figure is another figure with a + or - marking (if a + or a - marking is not found, pinion can be considered for a zero setting).

The + or - figure indicates the axial position of the pinion with relation to the center of the differential carrier. For example: If a pinion marked + 2 was

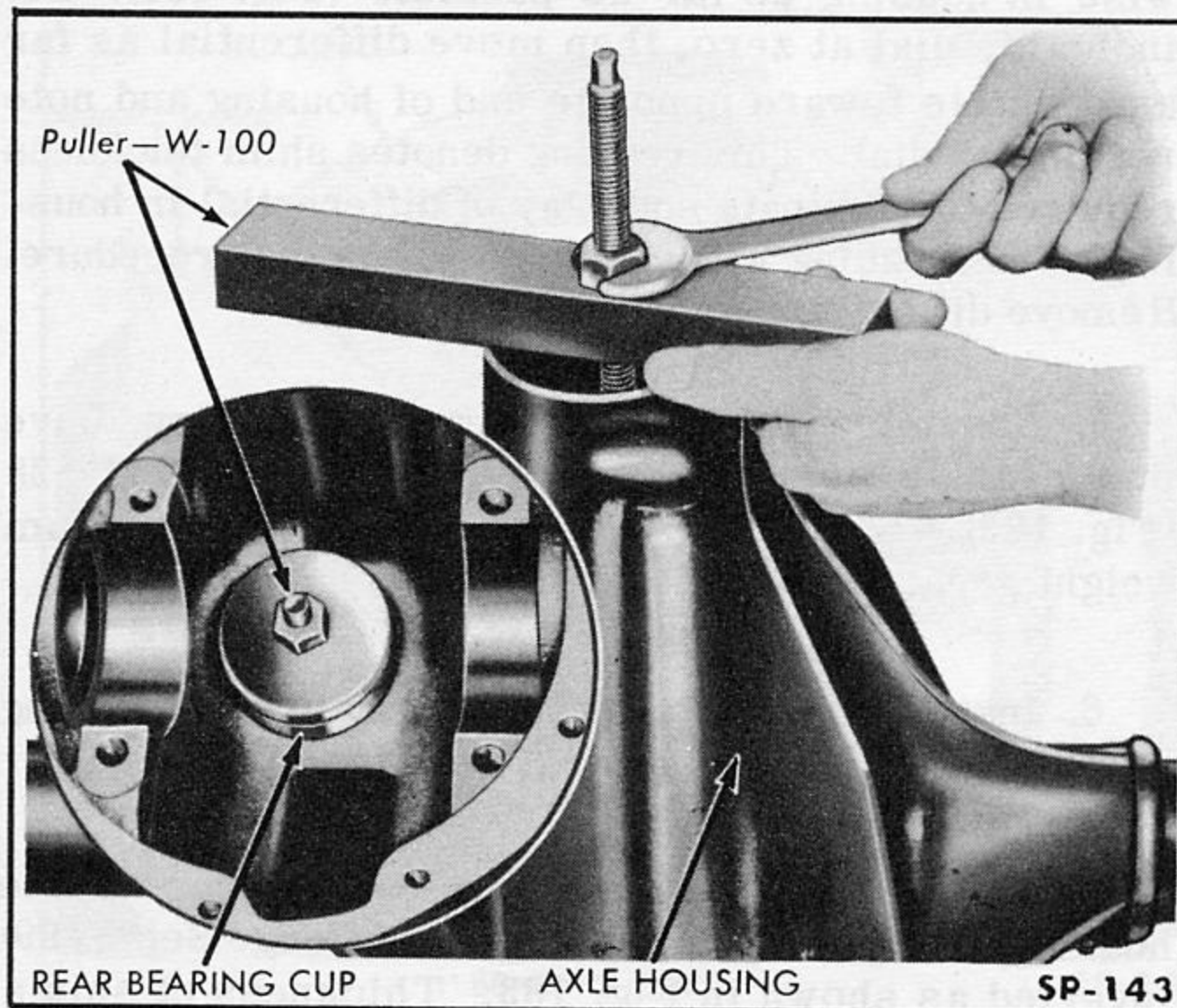


Fig. 183—Installing Pinion Rear Bearing Cup

originally installed with a shim pack of .035 inch thickness and a new pinion to be installed is marked -1, the original shim pack should be increased .003 inch in thickness to bring the new pinion to its correct position. The new shim pack would be .038 inch thick. If the new pinion was marked +3, then shims would be removed from the original rear shim pack. Whatever the amount of change necessary in the rear shim pack, the same amount of change is necessary in the front shim pack, which is installed in the next step.

8. Install pinion in axle housing and install front shims (changed the same amount that rear shims were changed), front bearing cone, oil slinger, and companion flange using Universal Joint Flange Installer KF-14. Tighten companion flange nut to 140-150 foot-pounds torque.

9. Hold the Pinion Center Aligning Fixture on "D" Gauge Block (part of Gauge Set W-99) and set the dial to zero. Then place the Pinion Center Aligning Fixture on pinion shaft centers with dial indicator button contacting bottom surface of bearing bore in differential case as shown in Fig. 184.

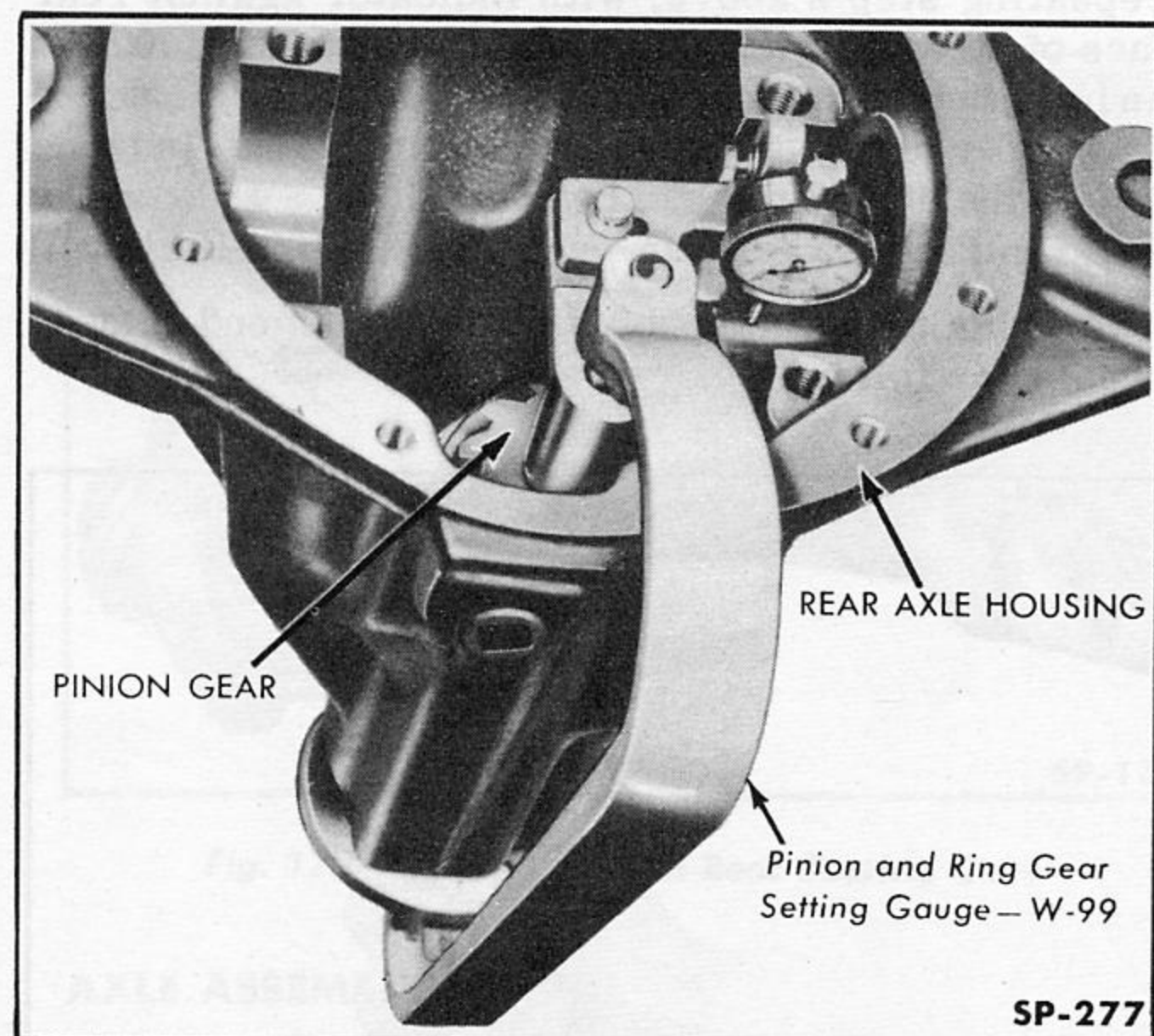


Fig. 184—Pinion to Drive Gear Adjustment

10. Swing dial indicator button back and forth across bottom of bore. The lowest dial reading indicates center of bore. This reading should be zero if pinion rear adjusting shims were correct thickness.

If it is necessary to add or remove shims to obtain a zero reading, both front and rear shims should be changed a like amount. After a zero reading is obtained, remove fixture.

11. Check the pinion pre-load with the rear axle drive pinion shaft in a vertical position. This can be measured by attaching an arm to the companion flange and pulling with a spring scale hooked on the arm a distance of 10 inches out from the center of the pinion shaft. The scale should register between 1 and 2 pounds to turn the pinion (disregard initial pull to start shaft turning). If reading is high, add shims to pinion front shim pack. If reading is low, remove shims from front shim pack. If shims were added or removed, re-check pinion position as detailed in step 10 above.

12. Remove companion flange to install gasket and oil seal with Pinion Oil Seal Driver W-147, then install companion flange.

13. Place differential assembly, with bearing cones and cups in place on sides of case, in rear axle housing. Install bearing caps in their original position (by matching identification marks on caps and housing) and tighten bolts with fingers.

14. Slide differential case over until drive gear rests against pinion gear and, from shim requirements as determined in step 4. Place shims between bearing cups and axle housing, forcing their edges in on both sides until total amount of shims have been used, and drive and pinion gears have no backlash.

15. Lift differential assembly out of axle housing. Remove side bearing cups and cones, and install shims as determined in step 14. Add .015 inch additional shim on drive gear tooth side to give proper amount of housing spread and gear backlash. Install side bearing cones and cups.

16. Spread axle housing with Spreader W-129 and install differential, then release spreader. Install side bearing caps in original positions. Coat threads of bearing cap attaching bolts with sealing compound before installing. Tighten bolts to 70-90 foot-pounds torque.

17. Mount Dial Indicator W-102 on axle housing with indicator button against a drive gear tooth as shown in Fig. 185.

Check backlash between drive gear and drive pinion by holding pinion firmly and moving drive gear back and forth. The amount of free motion, or backlash, should be .003 to .006 of an inch. Check backlash at three or four locations around drive gear. If backlash is more than .006 inch, shims must be transferred from behind differential side bearing on tooth side of drive gear to opposite side. If backlash is less than .003 inch, move shims to bearing on tooth side of drive gear from opposite side.

18. After correct backlash is established, check

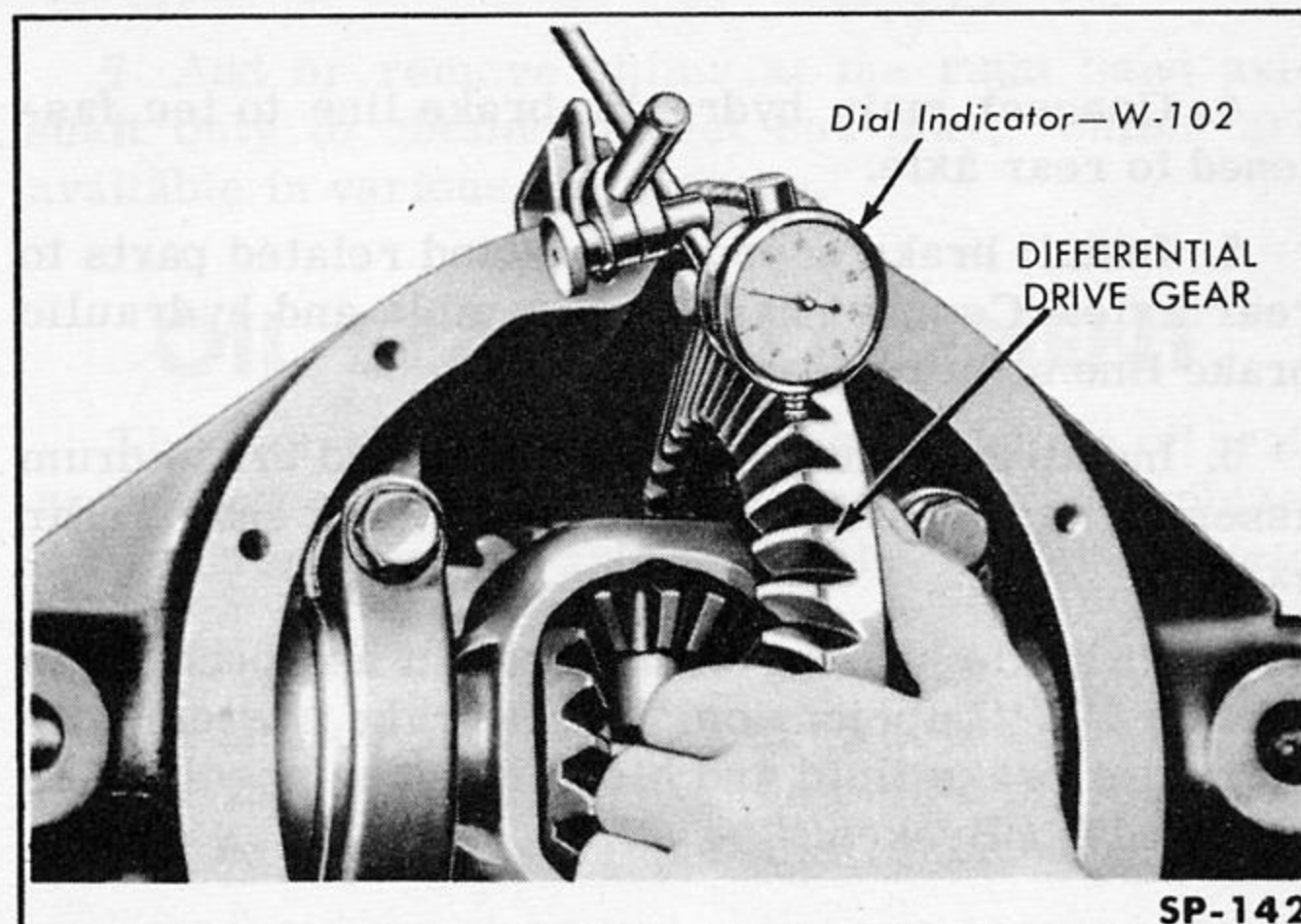


Fig. 185—Checking Drive Gear Backlash

tooth contact. Apply a mixture of ground red lead and engine oil to a few drive gear teeth. Rotate drive gear over pinion until a good impression of tooth contact is obtained. If adjustment is correct, impression should be similar to that shown in Fig. 186.

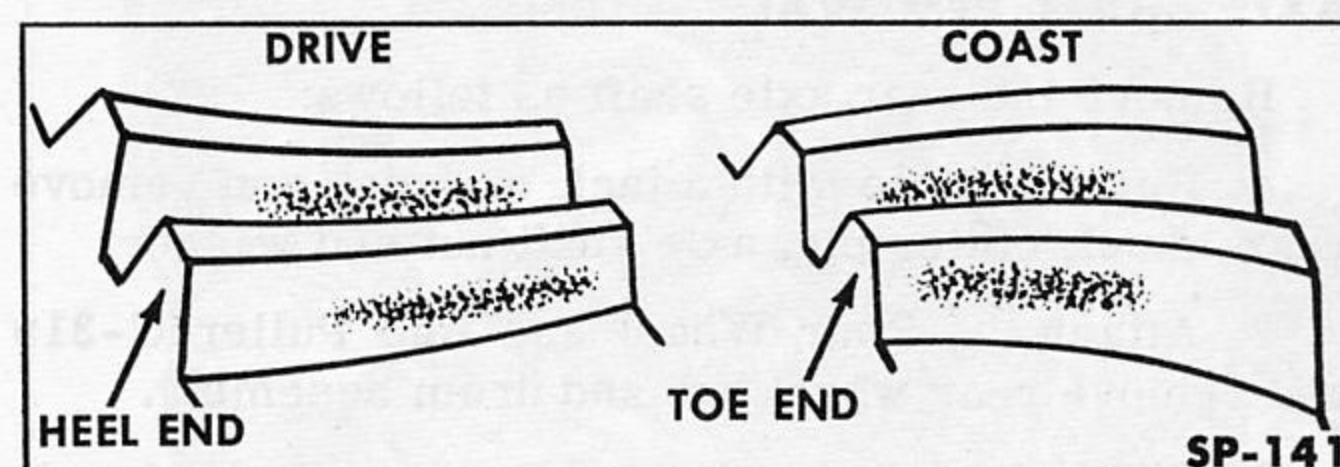


Fig. 186—Proper Gear Tooth Contact

19. Install axle housing cover, using a new gasket. Attach axle gear ratio tag and hydraulic brake line clips under heads of cover bolts. If rear axle ratio was changed, make up a new tag showing new ratio.

20. Install axle shafts as described in "Axle Shaft Installation" in this section. Also check axle shaft end-play. Leave brake support plate off until after axle is installed to vehicle.

AXLE ASSEMBLY INSTALLATION

Install the axle assembly to the vehicle as follows:

1. Place rear axle assembly in position under rear end of vehicle so spring center bolt fits hole in pad on axle housing. Install spring seat plates and U-bolts.

2. Connect propeller shaft to rear companion flange.

3. Connect rear shock absorbers to studs on spring seat plates.

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4. Connect main hydraulic brake line to tee fastened to rear axle.

5. Install brake support plate and related parts to rear axle. Connect hand brake cable and hydraulic brake line at brake support plate.

6. Install axle shaft key, wheel hub and brake drum assembly, and rear wheel and tire on each end of rear axle.

7. Fill axle housing with lubricant as specified in Section 17, "Lubrication." Fill brake system with hydraulic brake fluid and bleed lines as specified in Section 11, "Brakes."

AXLE SHAFT REPLACEMENT

The rear axle shafts can be replaced without removing the rear axle assembly from the vehicle. The axle shaft oil seals and bearings may also be replaced by this procedure.

AXLE SHAFT REMOVAL

Remove the rear axle shaft as follows:

1. Raise vehicle with a jack or hoist and remove rear wheel, cotter pin, axle shaft nut and washer.

2. Attach the Rear Wheel and Hub Puller C-319 and remove rear wheel hub and drum assembly.

3. Disconnect hydraulic brake line at wheel cylinder and disconnect hand brake cable.

4. Drain lubricant from rear axle assembly.

5. Remove brake support plate attaching bolts and nuts and remove outer oil seal, gaskets, retainer and support plate.

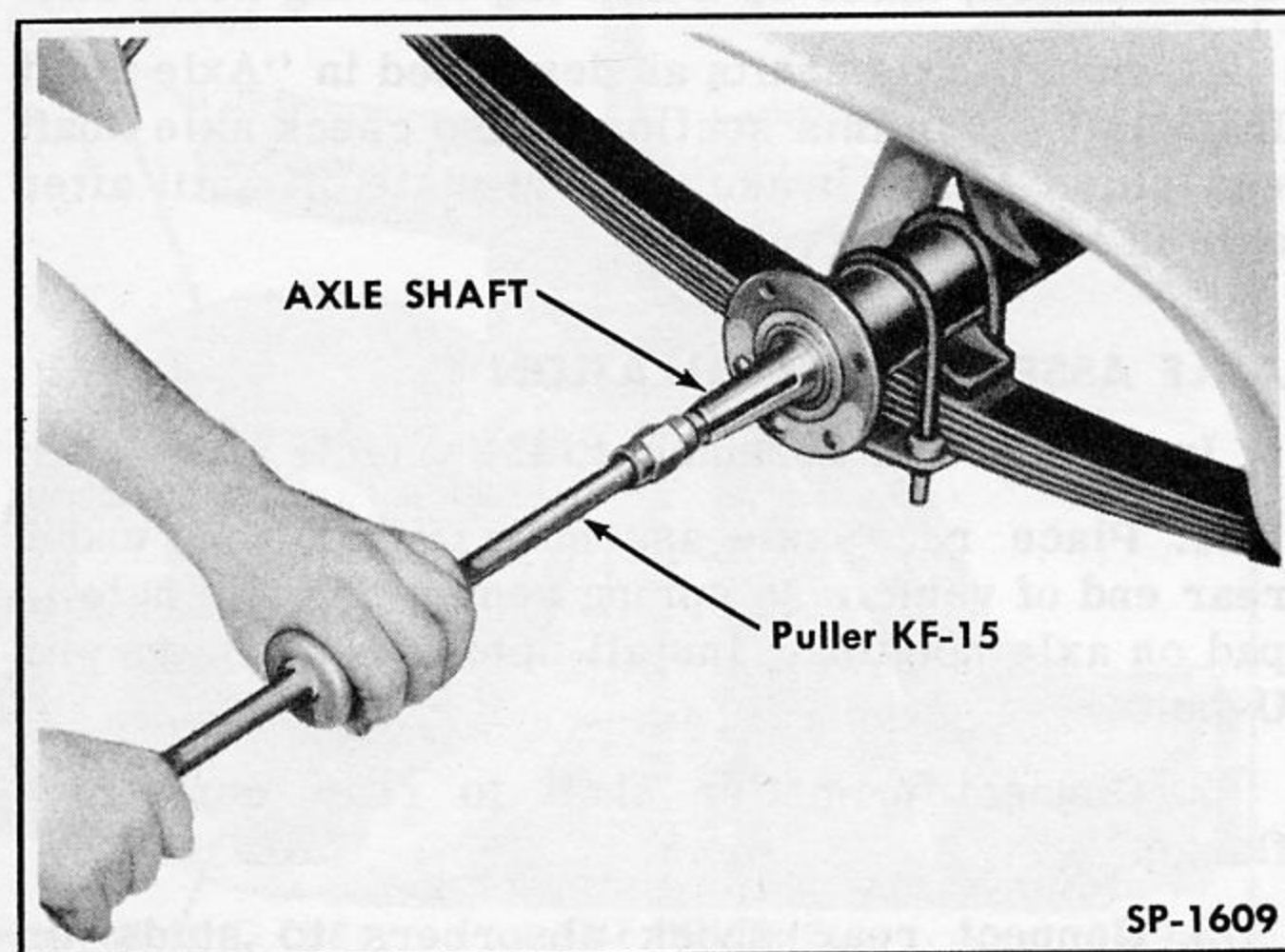


Fig. 187—Removing Rear Axle Shaft

6. Remove shims, noting the number and thickness. Keep shims from right and left axle shafts separated.

7. Remove rear axle shaft using Axle Shaft Puller KF-15 (Fig. 187). Care must be exercised as shaft comes free; it must be lifted out to prevent damage to bearing, cup and inner oil seal. Remove bearing cone from axle shaft using a universal puller. NOTE: IF AN AXLE SHAFT IS BROKEN AT SPLINED END AND IS CAUGHT IN DIFFERENTIAL, REMOVE AND DISASSEMBLE REAR AXLE TO REMOVE SHAFT. Removal by disassembling the axle will also permit thorough cleaning and inspection which will disclose any other damage.

8. Remove inner oil seal, using Puller KF-15 with hooked adapter (Fig. 188).

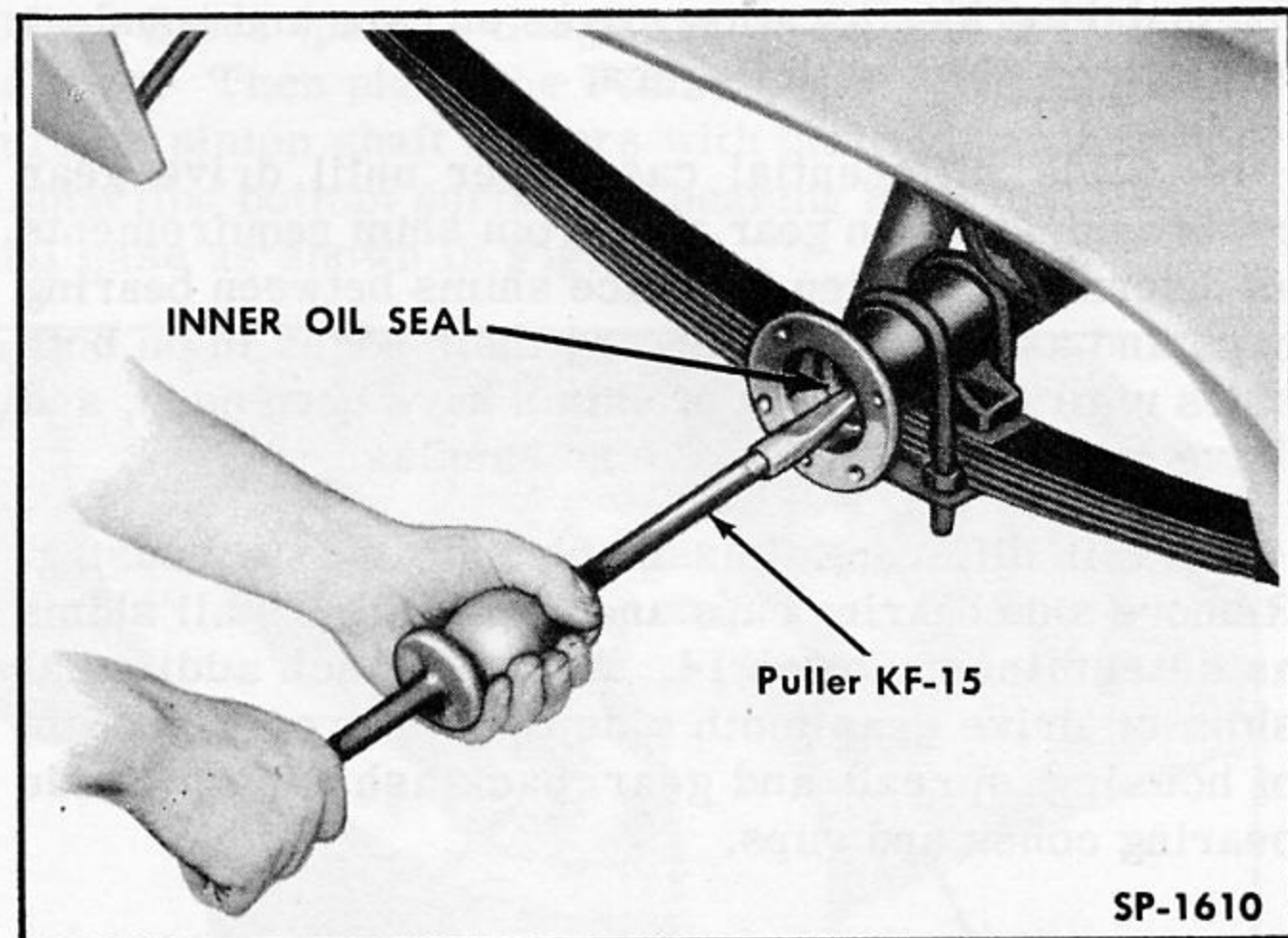


Fig. 188—Removing Axle Shaft Inner Oil Seal

AXLE SHAFT INSTALLATION

Install rear axle shafts in accordance with the following procedure paying particular attention to axle shaft end-play.

1. Inspect and clean all components thoroughly in preparation for assembly. Replace parts showing evidence of wear and damage.

2. Install inner oil seal, using Axle Shaft Inner Oil Seal Driver W-207. Drive seal into axle housing until it is fully seated. It is recommended that a new seal be used as an assurance against grease leaks.

3. Install bearing cone on axle shaft. Lubricate rollers with medium weight grease.

4. Install axle shaft in housing being careful not to damage oil seal.

5. With axle shaft fully seated, install bearing cup, using Outer Bearing Cup Driver C-413.

6. Check axle shaft end-play as described under "Checking Axle Shaft End-Play" in this section.

7. After correct end-play has been established and brake support plates and related parts are completely installed, connect hydraulic line and hand brake cable and install axle shaft key, hub and drum, washer, nut, cotter pin, and wheel. The axle shaft nut should be tightened to a minimum of 70 - 100 foot-pounds torque. Refill axle housing as described in Section 17, "Lubrication".

CHECKING AXLE SHAFT END PLAY

Axle shaft end-play is controlled by shims located between the brake support plate and the axle housing outer flange. If a new axle shaft or a new housing is installed, it will be necessary to determine the proper amount of shims to be used to obtain the correct amount of axle shaft end-play. Specified allowable end-play is .001 - .006 of an inch. To obtain proper end-play proceed as follows:

1. On 1951 and early 1952 vehicles, install a .060 inch shim pack on the left-hand axle shaft between brake support plate and rear axle housing outer flange. This will center the differential thrust block at differential pinion shaft. On later built automobiles, the left-hand axle housing has been extended .060 inch, thereby eliminating the need for shims to center the thrust block. (When the axle is disassembled, absence of shims on left-hand side will identify it as a later type axle).

2. Complete the installation of the left-hand brake support plate, gasket, retainer, gasket, outer oil seal, attaching bolts, nuts and washers. Tighten nuts to 25-30 foot-pounds torque.

3. Install a .060 shim pack on the right-hand axle shaft between brake support plate and rear axle housing on both early and late built vehicles. Install gaskets, retainer, outer oil seal, attaching bolts, nuts and washers.

4. Tap each axle shaft with a rawhide mallet to be sure they are fully seated. It is important that the bearing cup of each axle shaft bearing be free to move in and out in the axle housing to assure correct end-play adjustment.

5. Mount Dial Indicator W-102 (part of Gauge Set W-99) on right-hand brake support plate with indicator button resting on end of axle shaft (Fig. 189).

6. Pull axle shaft out as far as possible and set indicator to zero. Move axle shaft in as far as possible and note dial indicator reading which is the amount of end-play. Correct reading should be .001 - .006 of an inch.

7. Add or remove shims at the right hand axle shaft only to obtain correct end-play. Shims are available in various thicknesses.

OIL SEAL REPLACEMENT

The rear axle pinion shaft oil seal and the oil seals at the outer ends of the axle shafts can be replaced without removing the axle assembly from the vehicle.

PINION SHAFT OIL SEAL

If a lubrication leak is noticed at the forward end of the rear axle assembly, the pinion shaft oil seal should be replaced. Before it is replaced, however,

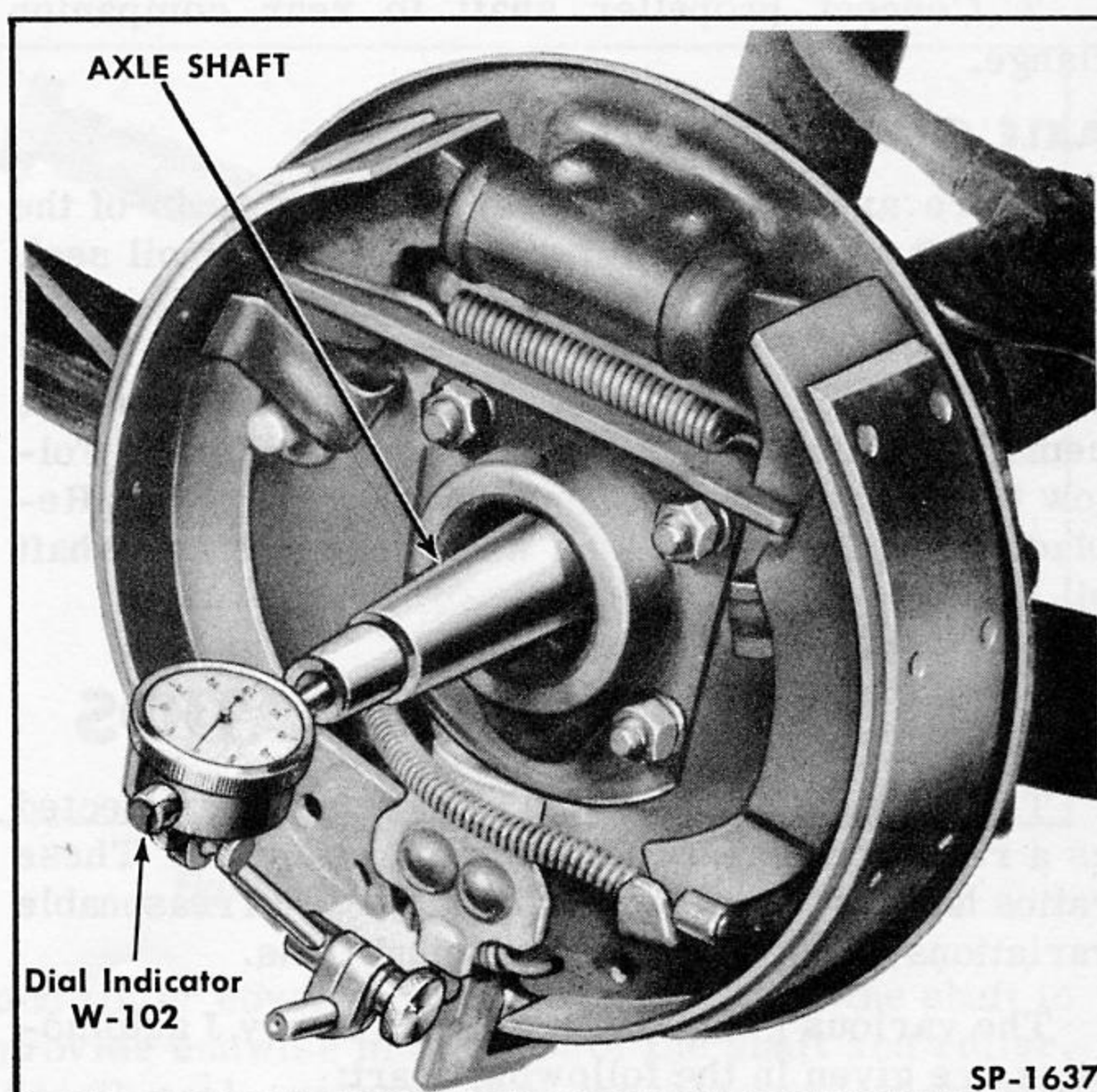


Fig. 189—Checking Axle Shaft End-Play

the pinion preload should be checked and, if necessary, the thickness of the pinion front shim pack should be changed to obtain proper preload. Proceed as follows:

1. Disconnect propeller shaft from rear companion flange on rear axle pinion shaft.

2. Attach an arm to the companion flange and hook a spring scale on the arm a distance of 10 inches out from the pinion shaft center. The scale should read between 1 and 2 pounds to turn the pinion (disregard initial pull to start shaft turning). If reading is low, remove pinion front bearing cone and add shims to the front shim pack until proper pre-load is obtained.

3. Remove rear companion flange by placing Universal Joint Flange Holding Wrench C-784 on companion flange and remove attaching nut. Then, using

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Universal Joint Flange Puller C-452, remove companion flange.

4. Install Pinion and Transmission Shaft Oil Seal Puller W-165 into the pinion oil seal by turning it until the threads cut sharply into the oil seal. Remove seal by turning puller center screw against pinion shaft.

5. Install a new oil seal using Pinion Oil Seal Driver W-147.

6. Install gasket and companion flange using Universal Joint Installing Tool KF-14. Then install attaching nut and tighten to 140-150 foot-pounds torque.

7. Connect propeller shaft to rear companion flange.

AXLE SHAFT OIL SEALS

There are two oil seals at the outer ends of the axle shaft — the outer oil seal and the inner oil seal. The outer oil seal can be replaced after the wheel and tire, wheel hub and brake drum assembly, and brake support plate are removed. The axle shaft must be removed, however, to replace the inner oil seal. Follow the procedure described under "Axle Shaft Replacement" in this section when changing axle shaft oil seals.

REAR AXLE GEAR RATIOS

The rear axle gear ratios used have been selected as a result of research and experimentation. These ratios have proven to be satisfactory for all reasonable variations of normal operating conditions.

The various gear ratios used on Henry J automobiles are given in the following chart:

MODEL	TRANSMISSION	AXLE RATIO	NO. OF GEAR TEETH	
			Drive Gear	Pinion
4 and 6 cyl.	Overdrive	4.55	41	9
4 cyl. (early production)	Standard	4.55	41	9
4 cyl. (later production)	Standard	4.27	47	11
6 cyl.	Standard	4.10	41	10

The rear axle ratio may be determined from a metal tag attached to the axle housing cover which indicates the number of teeth on the drive gear and the pinion gear. The ratio is obtained by dividing the number of pinion teeth into the number of drive teeth.

If the rear axle gear ratio is changed, it may be necessary to change the speedometer drive gear and pinion. Refer to Section 6, "Transmission and Over-drive" for detailed information.

SERVICE DIAGNOSIS

REAR AXLE AND DIFFERENTIAL NOISE

An apparent hum or growl in the rear axle may often be inconsistent in tone depending on operational conditions. Usually the tone of a rear axle noise differs when a car is coasting and when the engine is driving.

Alleged rear axle noise may sometimes be traced to wheel bearings, universal joints or tire noise. A careful diagnosis should precede actual rear axle repairs.

Rear axle and differential noise may be caused by:

1. Improper or insufficient lubricant in housing.
2. Rear axle shaft or differential bearings rough or scored.
3. Excessive or insufficient backlash in gears.
4. Gears not matched.
5. Drive gear and pinion improperly adjusted.
6. Worn or chipped pinion or drive gear teeth.
7. Loose bearings in differential.
8. Excessive drive gear run-out.
9. Improper axle shaft end-play.
10. Rear wheel bearings dry.
11. Propeller shaft yoke or flange loose.

REAR WHEELS WILL NOT ROTATE

When vehicle is in gear with propeller shaft rotating and the wheels will not rotate, the cause may be:

1. Rear axle shaft key sheared or missing.
2. Broken axle shaft.
3. Drive gear or pinion teeth sheared.
4. Differential side gear or differential pinion teeth stripped.
5. Drive gear to differential case mounting bolts sheared.

LUBRICANT LOSS AT REAR AXLE SHAFTS OR AXLE PINION SHAFT

Lubricant loss at these points may be caused by:

1. Lubricant level too high in housing.
2. Improper grade of lubricant.
3. Oil seals improperly installed or worn.
4. Rear axle shaft bearing retainer loose.
5. Improper axle shaft end-play.
6. No preload on pinion shaft bearings.
7. Rear axle shaft bearing gasket damaged or improperly installed.
8. Cracked rear axle housing.
9. Companion flange hub rough, scored, or out-of-round.