

## C O N T E N T S

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### DESCRIPTION AND CONSTRUCTION

**a. GENERAL DESCRIPTION.** Kaiser and Frazer automobiles are equipped with a semi-floating type hypoid rear axle. 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. The pinion, differential and axle shafts are mounted on tapered roller bearings to provide long trouble-free operation.

In the hypoid type of rear axle (Fig. 254) the pinion is mounted below the center line of the drive gear; therefore, the drive gear teeth are longer and

mesh over a wider surface providing greater tooth contact. Generally, one more tooth is in contact in the hypoid axle than in the spiral bevel type. The hypoid construction provides longer wear and quieter operation. Due to the sliding action of the gears, it is important that especially processed **hypoid lubricant** be used in the rear axle.

Two different model hypoid type axles are used in both the Kaiser and Frazer models. The difference between the two axles is in the size of the ring gear and pinion and the shape of the housing and cover. The ring gear and pinion of the Model 44 axle (hexagon shaped cover) cannot be interchanged with the gears in the Model 41 axle (oval shaped cover), Fig. 254.

**b. REAR AXLE SHAFTS.** The axle shafts are splined on the inner ends to fit into the mating splines of 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 pressed on the outer or hub end of the shaft and seats in a bearing cup in the outer end of the axle housing. Inner and outer oil seals are provided to prevent grease working into either the brake drum or the axle housing from this bearing. Side thrust from the wheels is transferred from one shaft to the other by a thrust block which straddles the differential pinion shaft.

**c. DRIVE PINION AND DIFFERENTIAL.** The drive pinion is supported in two opposed tapered roller bearings, the cups of these bearings being pressed into recessed pockets in the axle housing. The

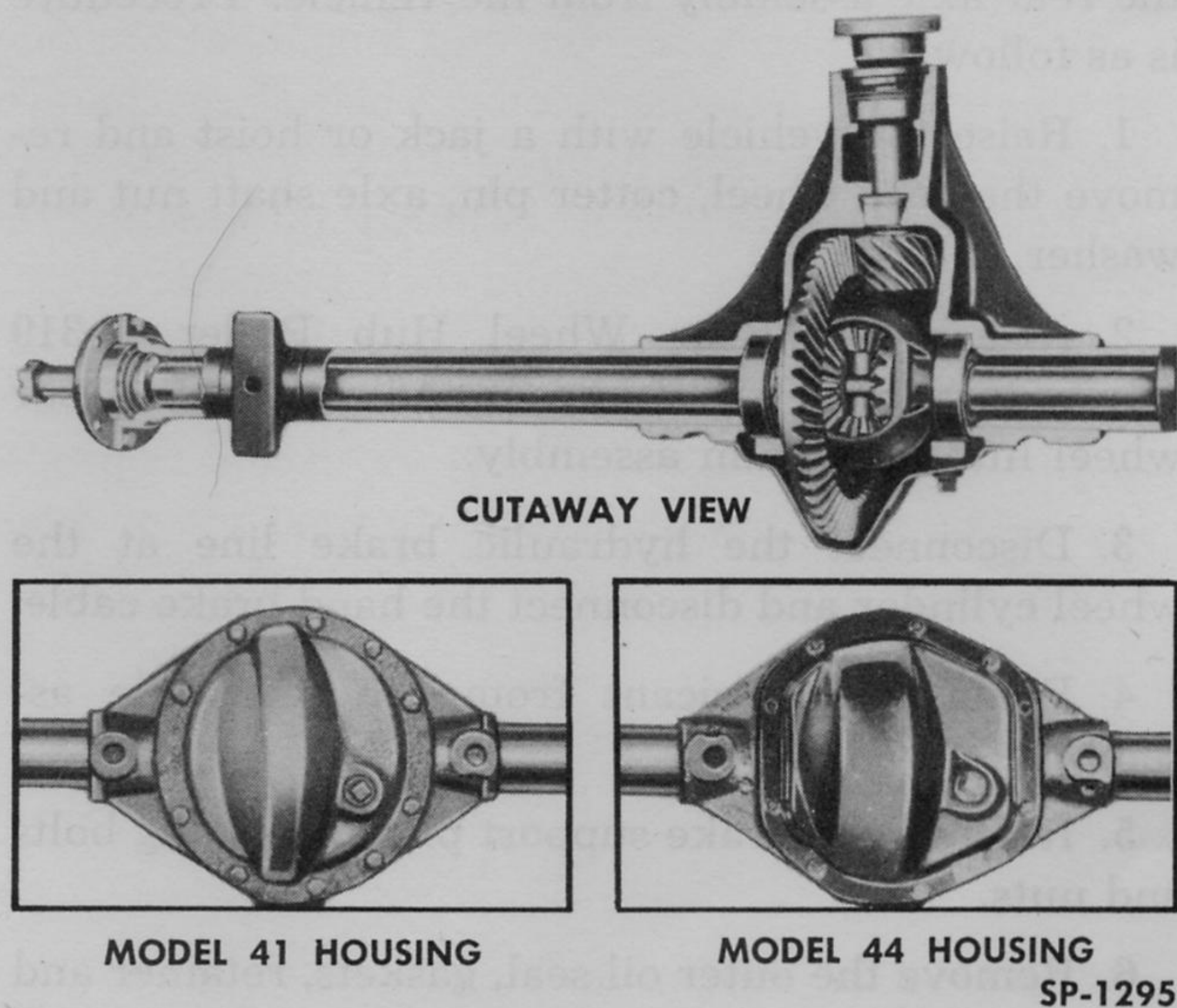


Fig. 254—Rear Axle Assemblies—Models 41 and 44

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pinion is adjustable endwise to provide proper position of the pinion relative to the drive (ring) gear, by the use of shims between the rear bearing cup and the axle housing. Proper pre-loading of the pinion shaft bearings is obtained by the use of shims between the front bearing cone and the shoulder on the pinion shaft (Model 44 axle) or the spacer (Model 41 axle). An oil seal at the front end of the pinion prevents loss of lubricant.

The differential is mounted in the axle housing in two opposed tapered roller bearings. Shims are used between the bearings and the differential case at each side of the differential for adjustment of the position of the differential in the axle housing. Alignment of the drive gear to the drive pinion and proper gear backlash is obtained by this adjustment. 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. When installing these parts and assembling the axle it is important that shims be used correctly to provide the proper adjustments and establish the correct tolerances and clearances.

**d. REAR AXLE GEAR RATIOS.** The standard gear ratios used in Kaiser and Frazer automobiles, selected as a result of research and experimentation, have proven to be satisfactory for all reasonable variations of normal operating conditions. Optional gears have been provided for use in rear axles to obtain special gear ratios to compensate for unusual operating conditions. Application of the various rear axle gear ratios to vehicle models is given in the REAR AXLE RATIOS chart below.

Model	3.54:1	3.91:1	4.09:1	4.55:1
K-511	HYD	STD	STD	OD
K-512	HYD	STD	STD	OD
F-515	HYD			OD
F-516	HYD			OD

STD— Standard Transmission

OD— With Overdrive

HYD—With Hydra-Matic Drive

The rear axle ratio may be determined from a metal tag attached to the differential housing cover. This tag will give the number of teeth on the drive gear and pinion. The small or lowest number represents the pinion. The large or high number is the drive gear. To determine the ratio, divide the num-

ber of pinion teeth into the number of drive gear teeth.

$$\frac{41}{9} \text{ Number of teeth on the drive gear} \quad \frac{4.55}{9/41.00} \text{ Number of teeth on the pinion}$$

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 Overdrive," for detailed information.

## 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 that the bolts attaching the propeller shaft rear universal joint to the rear flange or yoke on the axle pinion are tight and that the flange or yoke is tight on the pinion.

## AXLE SHAFT REPLACEMENT

**a. AXLE SHAFT REMOVAL.** The rear axle shafts can be removed for replacement without removing the rear axle assembly from the vehicle. Procedure is as follows:

1. Raise the vehicle with a jack or hoist and remove the rear wheel, cotter pin, axle shaft nut and washer.
2. Attach the Rear Wheel Hub Puller C-319 (Refer to Section 11 "Brakes") and remove the rear wheel hub and drum assembly.
3. Disconnect the hydraulic brake line at the wheel cylinder and disconnect the hand brake cable.
4. Drain the lubricant from the rear axle assembly.
5. Remove the brake support plate attaching bolts and nuts.
6. Remove the outer oil seal, gaskets, retainer and support plate.

7. Remove the shims, noting the number and gauge. Keep shims from right and left axle shafts separated.

8. Remove the rear axle shaft using Axle Shaft Puller KF-15 (Fig. 255). Care must be exercised as

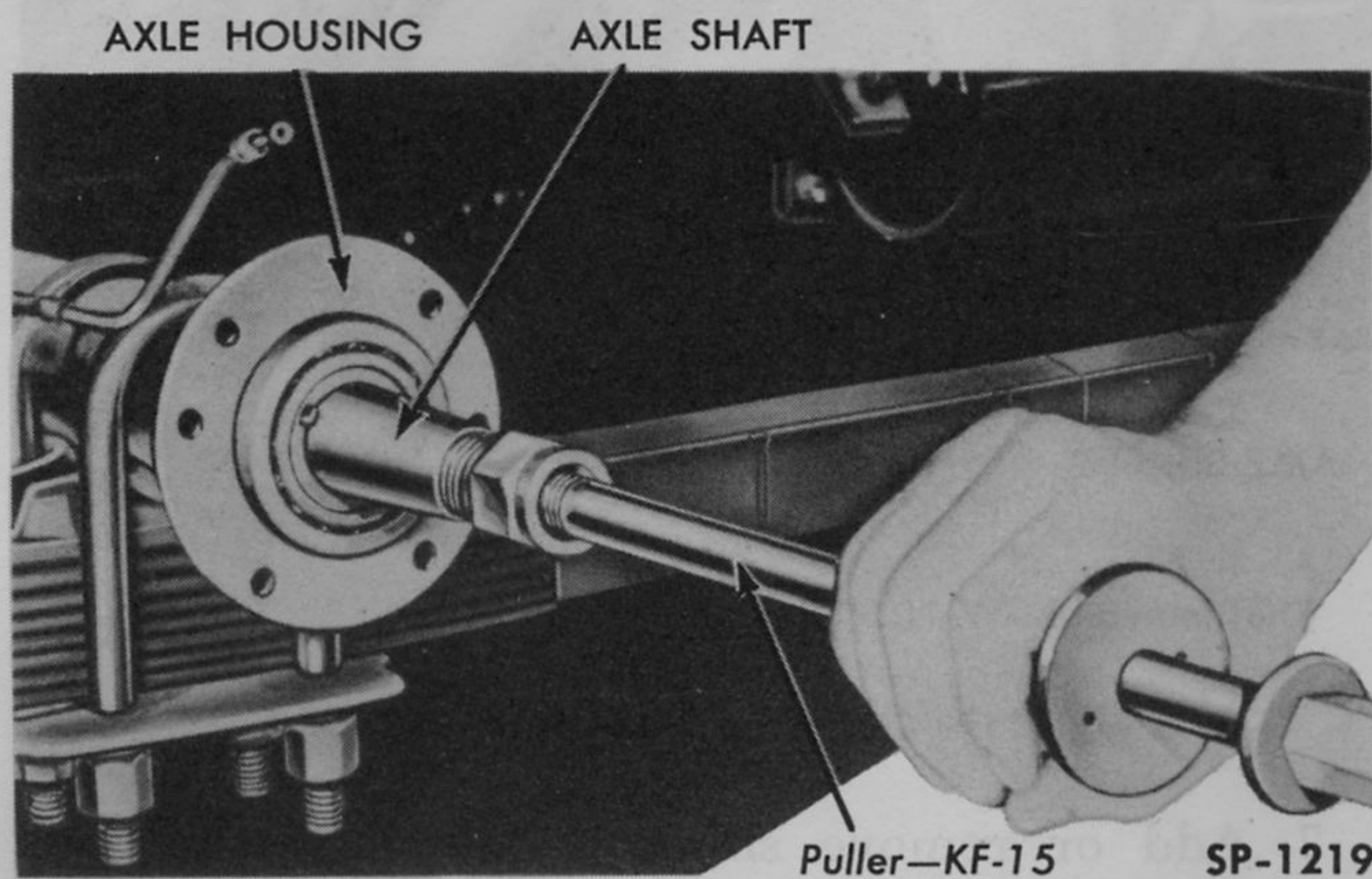


Fig. 255—Removing Rear Axle Shaft

the shaft becomes free; it must be lifted out to prevent damage to the bearing, cup and inner oil seal. Remove the bearing cone from the axle shaft using a universal puller. **NOTE: If an axle shaft is broken at the splined end and is caught in the differential, remove and disassemble the rear axle to remove the splined end of the broken shaft.** Removal by disassembling the axle will also permit thorough cleaning and inspection which will disclose any other damage.

9. Remove the inner oil seal, using Puller and Adapter KF-15 (Fig. 256).

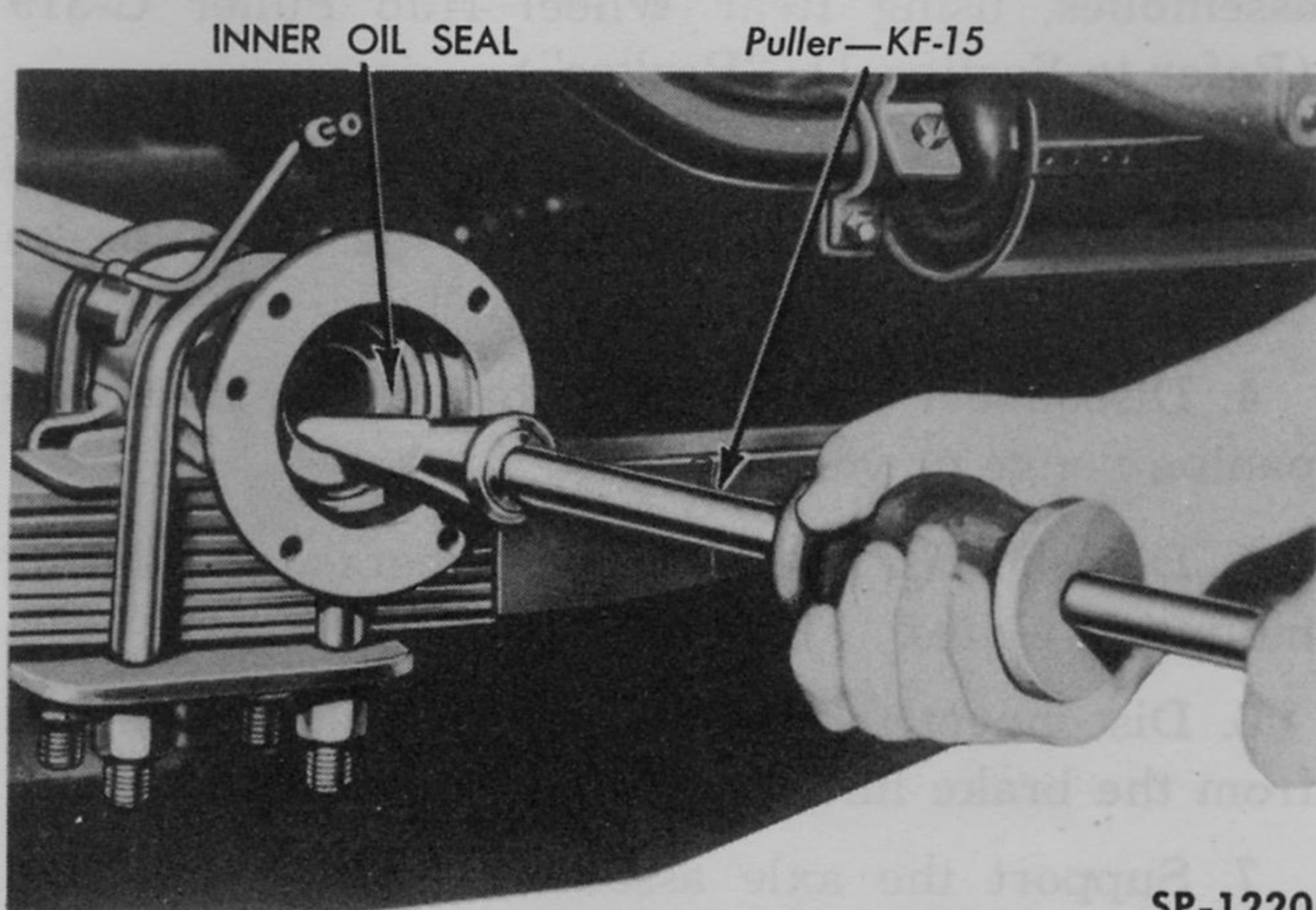


Fig. 256—Removing Axle Shaft Inner Oil Seal

**b. AXLE SHAFT INSTALLATION.** Install rear axle shafts in accordance with the following procedure

paying particular attention to the checking of the 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 the inner oil seal (Fig. 257), using Driver W-186. Drive the seal into the axle housing until it is fully seated. It is recommended that a new seal be used as an assurance against grease leaks.

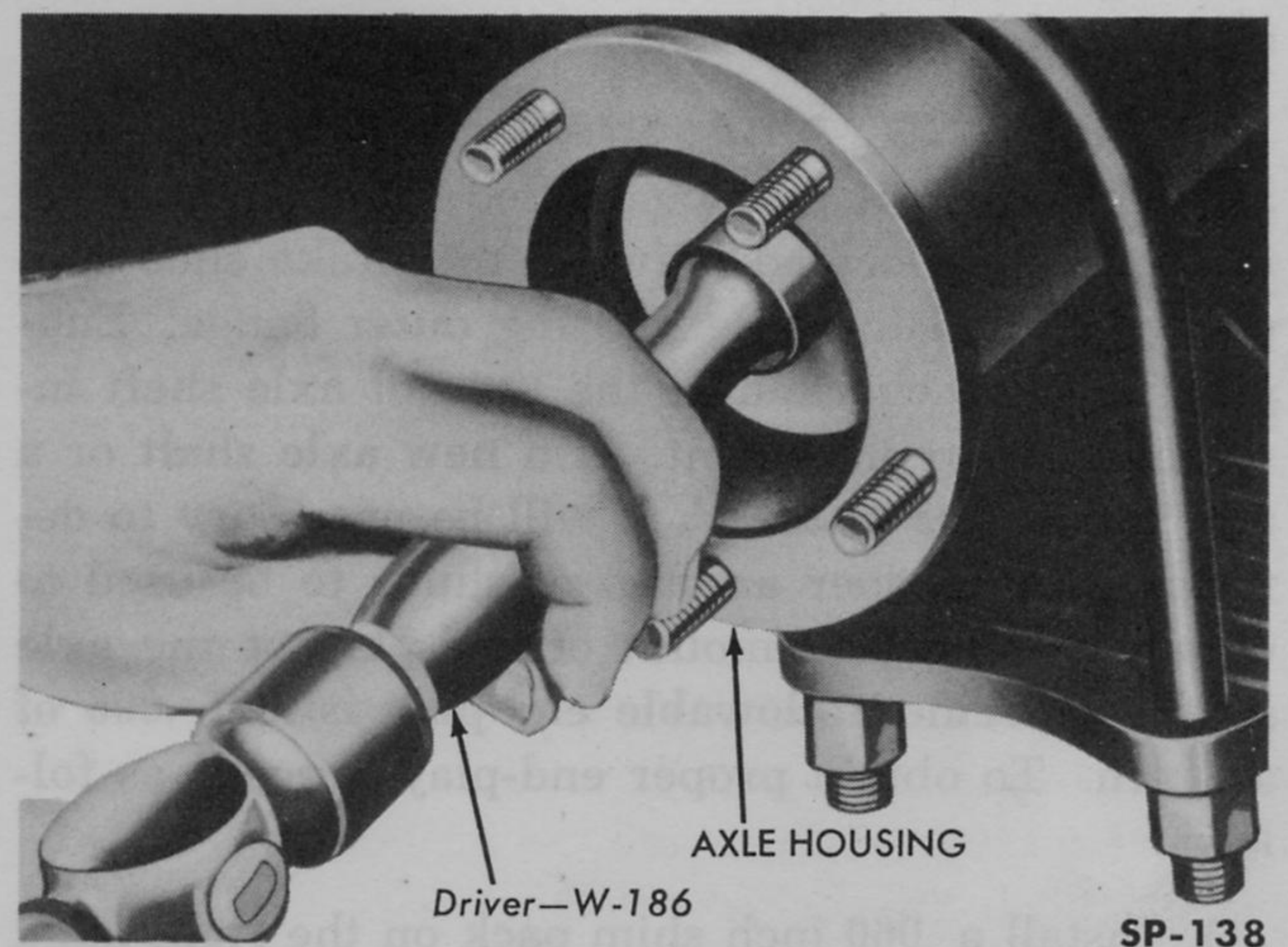


Fig. 257—Installing Axle Shaft Inner Oil Seal

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

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

5. With the axle shaft fully seated, install the bearing cup, using Driver C-413 (Fig. 258).

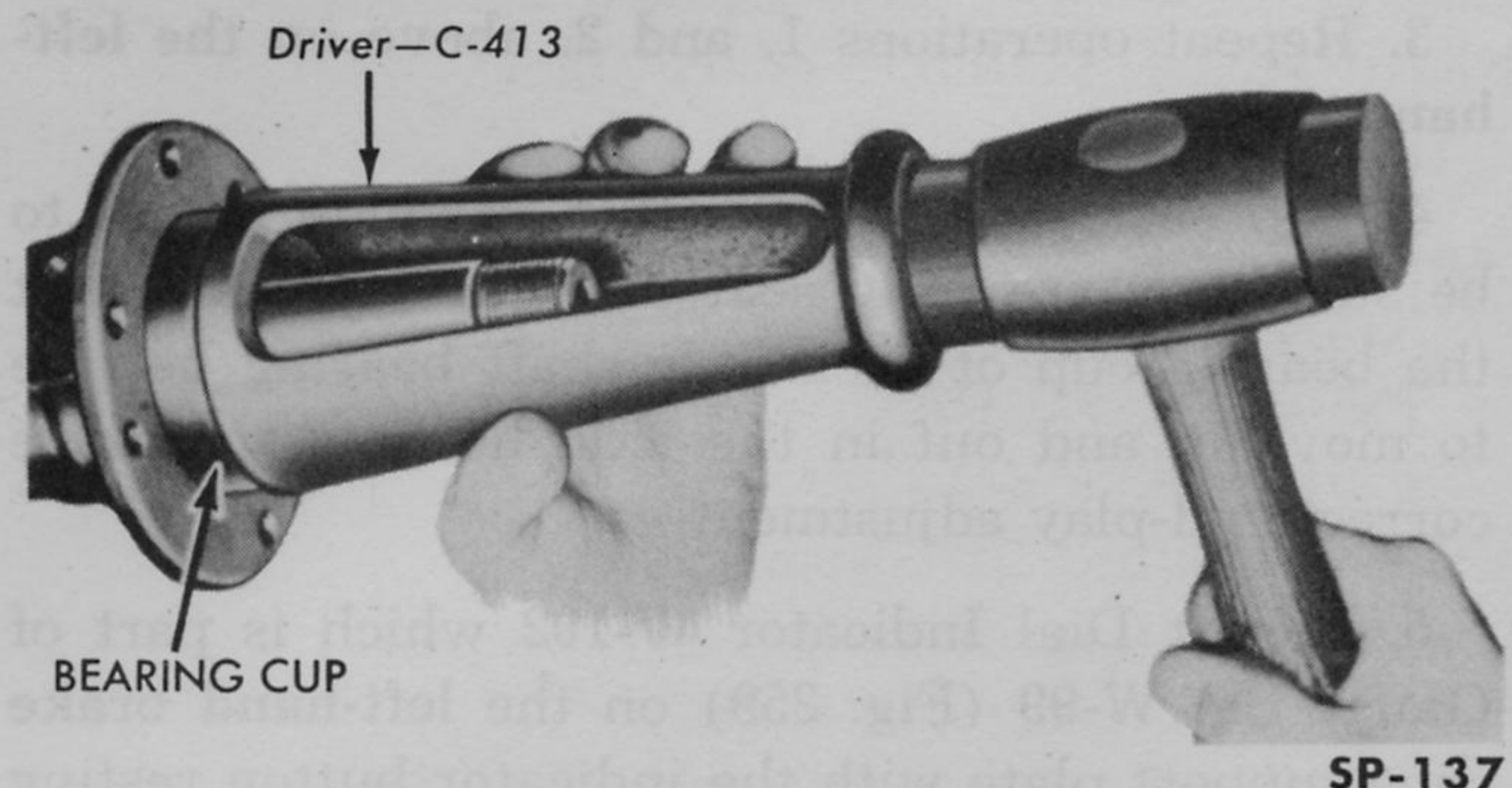


Fig. 258—Installing Rear Axle Shaft Bearing Cup

6. Install the shims, brake support plate, gasket, retainer, gasket, outer grease seal, attaching bolts, nuts and washers. When installing these parts, it will be necessary to check and adjust axle shaft end-

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play as described under CHECKING AXLE SHAFT END-PLAY, below.

7. After correct end-play has been established and the brake support plates and related parts are completely installed, connect the hydraulic line and hand brake cable and install the axle shaft key, the hub and drum, washer, nut, cotter pin, and the wheel. The axle shaft nut should be tightened to a minimum of 160 foot pounds torque. Refill axle housing with proper type and quantity of lubricant as described in Section 17, "Lubrication."

**c. CHECKING AXLE SHAFT END-PLAY.** Rear axle shaft end-play is controlled by adding or removing shims located between the brake shoe support plate and the axle housing outer flange. End-play must be **checked** at the time of axle shaft installation or replacement. 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 end-play of the axle shafts. **Specified allowable end-play is .001-.006 of an inch.** To obtain proper end-play proceed as follows:

1. Install a .060 inch shim pack on the **right-hand** axle shaft between the brake shoe support plate and the rear axle housing outer flange. This will center the differential thrust block at the differential pinion shaft.

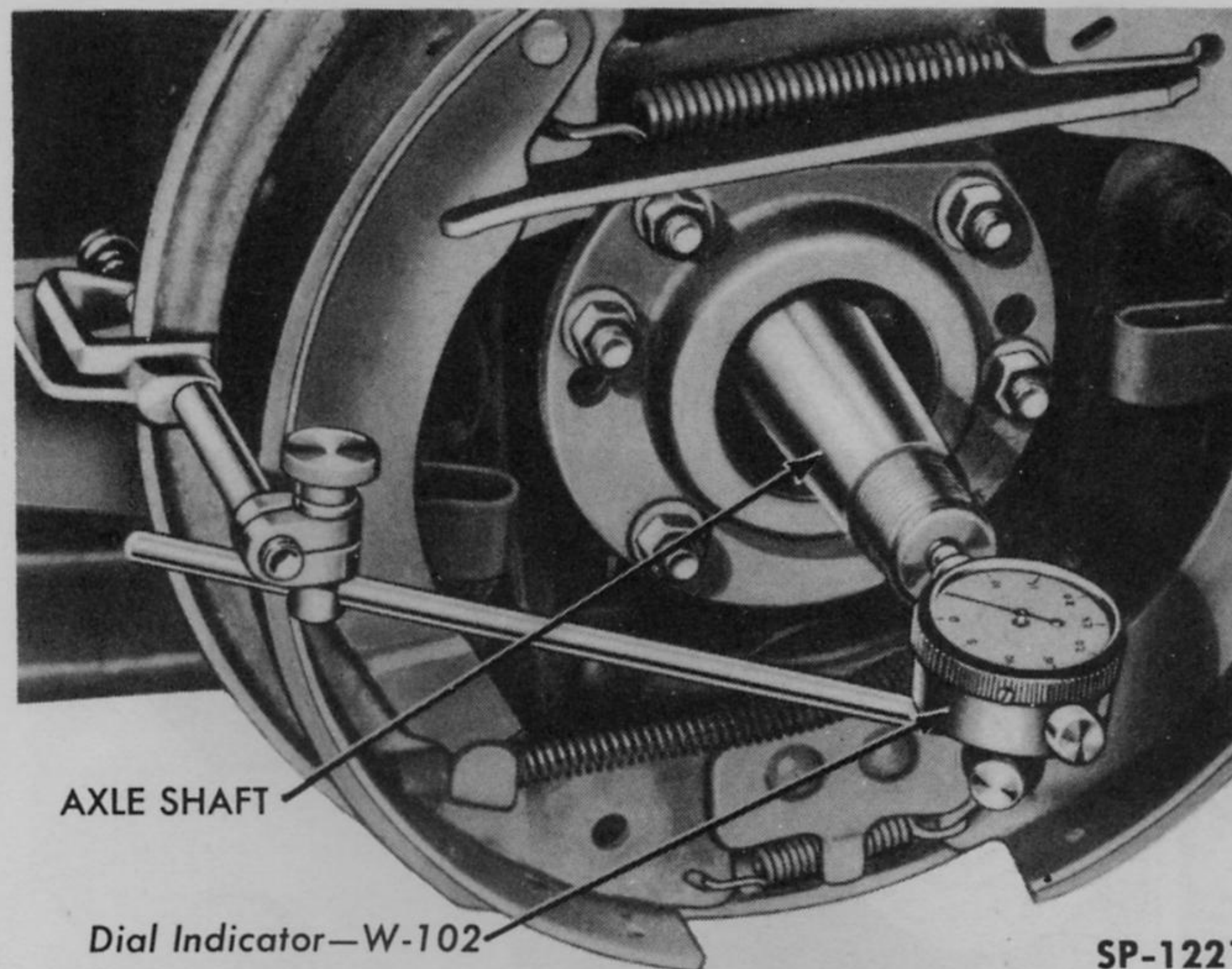
2. Complete the installation of the right-hand brake shoe support plate, gasket, retainer, gasket, outer grease seal, attaching bolts, nuts and washers. Tighten the bolt nuts to 30-35 foot pounds torque.

3. Repeat operations 1. and 2. above on the **left-hand** side.

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 which is part of Gauge Set W-99 (Fig. 259) on the **left-hand** brake shoe support plate with the indicator button resting on the end of the axle shaft.

6. With the axle shaft pulled **out** as far as possible, set the indicator to zero. Move the axle shaft in as far as possible and note the dial indicator reading which is the amount of end-play.



**Fig. 259—Checking Axle Shaft End-Play**

7. Add or remove shims at the left-hand axle shaft only, to obtain correct end-play of .001-.006 of an inch. Shims are available in .003, .005, .010 and .030 inch thicknesses.

## AXLE ASSEMBLY REMOVAL

a. Rear axle overhaul is best accomplished with the axle out of the vehicle. The following procedure covers removal of the complete rear axle assembly from the vehicle.

1. Raise the vehicle with a hoist or jack and place supports under the frame.

2. Remove the rear wheels and the hub and drum assemblies, using Rear Wheel Hub Puller C-319 (Refer to Section 11, "Brakes").

3. Disconnect the hydraulic brake lines at the wheel cylinders and disconnect the hand brake cable.

4. Disconnect the propeller shaft at the rear companion flange or yoke.

5. Detach both rear shock absorbers at the spring mounting plates.

6. Disconnect the main rear hydraulic brake line from the brake line tee fastened to the rear axle.

7. Support the axle assembly with a jack, and detach the rear springs from the axle by removing the four U bolts and the two spring seat plates. Disconnect and remove the rear spring shackles to lower the rear end of the springs. Support the rear

springs while removing the shackles to prevent them from dropping free and possibly causing injury. Refer to Section 8, "Chassis Suspension," for detailed information.

8. Pull the rear axle assembly out from under the rear of the vehicle by means of the supporting jack.

**AXLE DISASSEMBLY**

**a. GENERAL.** Before attempting work on the rear axle, it is of the utmost importance that suitable tools be available for disassembly and assembly. It is assumed that factory recommended tools or their equivalent will be used in the overhaul procedure as outlined in this Section. Adequate space must be provided in a dirt free area and disassembly should be in the sequence outlined herein with the removed parts carefully separated in the order of removal.

The rear axle assembly consists of two axle shafts and a series of precision fitted gears and bearings. These parts are illustrated and identified in Fig. 260. For proper operation, tolerances are close and are controlled by the use of shims.

Gears and bearings in the housing are fitted within allowable tolerances; however, due to the extreme precision required and eventual wear of the working parts, adjustment through the use of shims, is provided. For instance, pinion location in the housing is controlled by a shim pack in back of the rear pinion bearing cup, while the pre-loading of the pinion bearings is controlled by the amount of shims behind the front bearing cone. The differential assembly is properly aligned in the axle housing by the use of shims between the differential side bearings and the differential case.

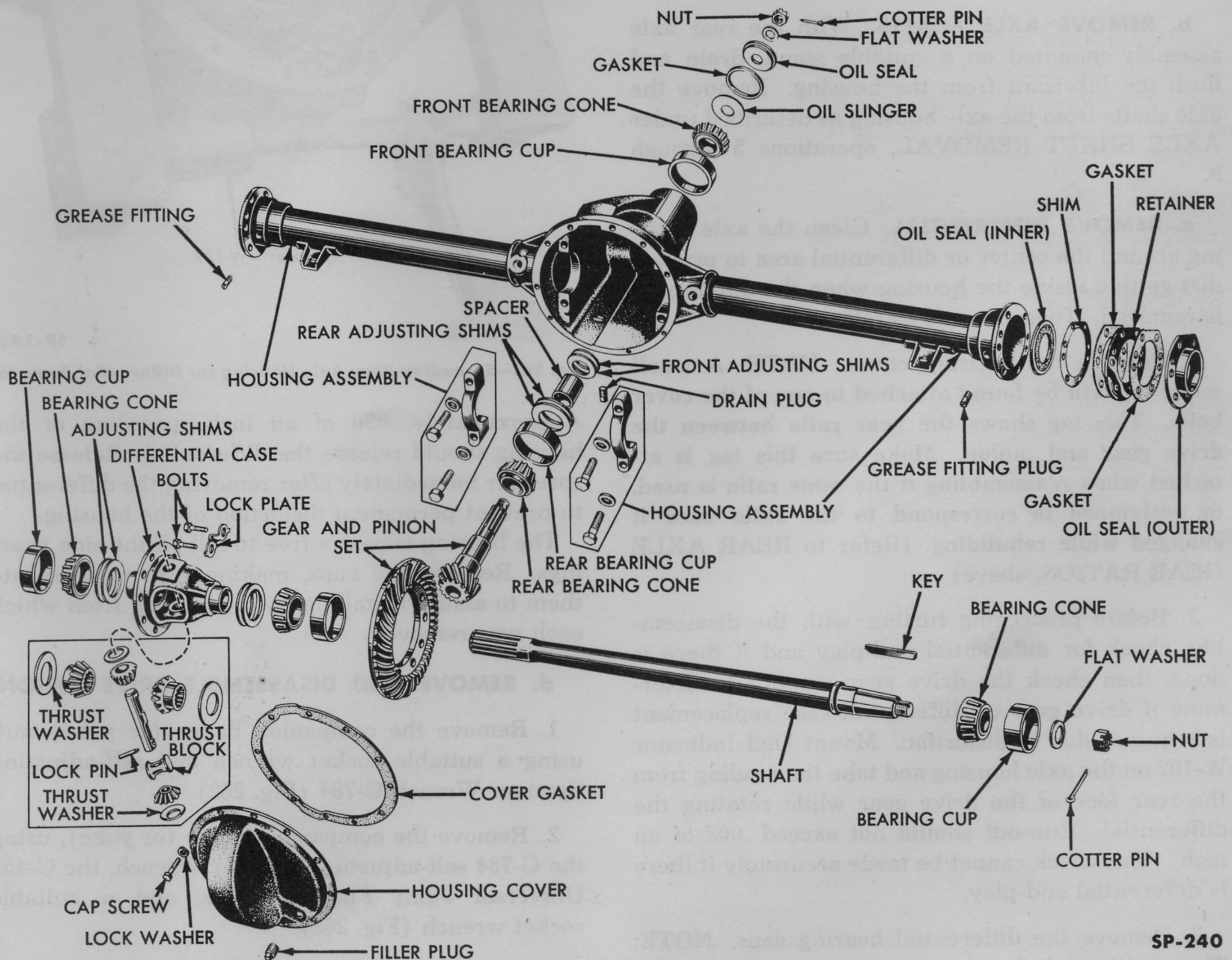


Fig. 260—Rear Axle Assembly—Exploded View

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The drive gear and pinion are a **matched gear set**. Their proper relationship is controlled by shims. The pinion has a numerical marking on the end, preceded by a **minus** or **plus** sign, (except a pinion having a **zero** setting) that designates in thousandths of an inch the proper adjustment required in relation to the drive gear. The adjustment is controlled by transferring shims from between the pinion rear bearing cup and the housing seat to between the front bearing cone and spacer or shoulder on the pinion shaft or vice versa depending on which direction the pinion must be moved.

In making a drive gear and pinion replacement, to avoid the necessity of changing shims, the marking on the new pinion should correspond with the replaced part, if possible. However, if this is impossible, other drive gear and pinion sets may be used.

**b. REMOVE AXLE SHAFTS.** With the rear axle assembly mounted on a suitable stand, drain and flush the lubricant from the housing. Remove the axle shafts from the axle housing as described under **AXLE SHAFT REMOVAL**, operations 5 through 9.

**c. REMOVE DIFFERENTIAL.** Clean the axle housing around the center or differential area to prevent dirt getting inside the housing when the differential is removed. Then proceed as follows:

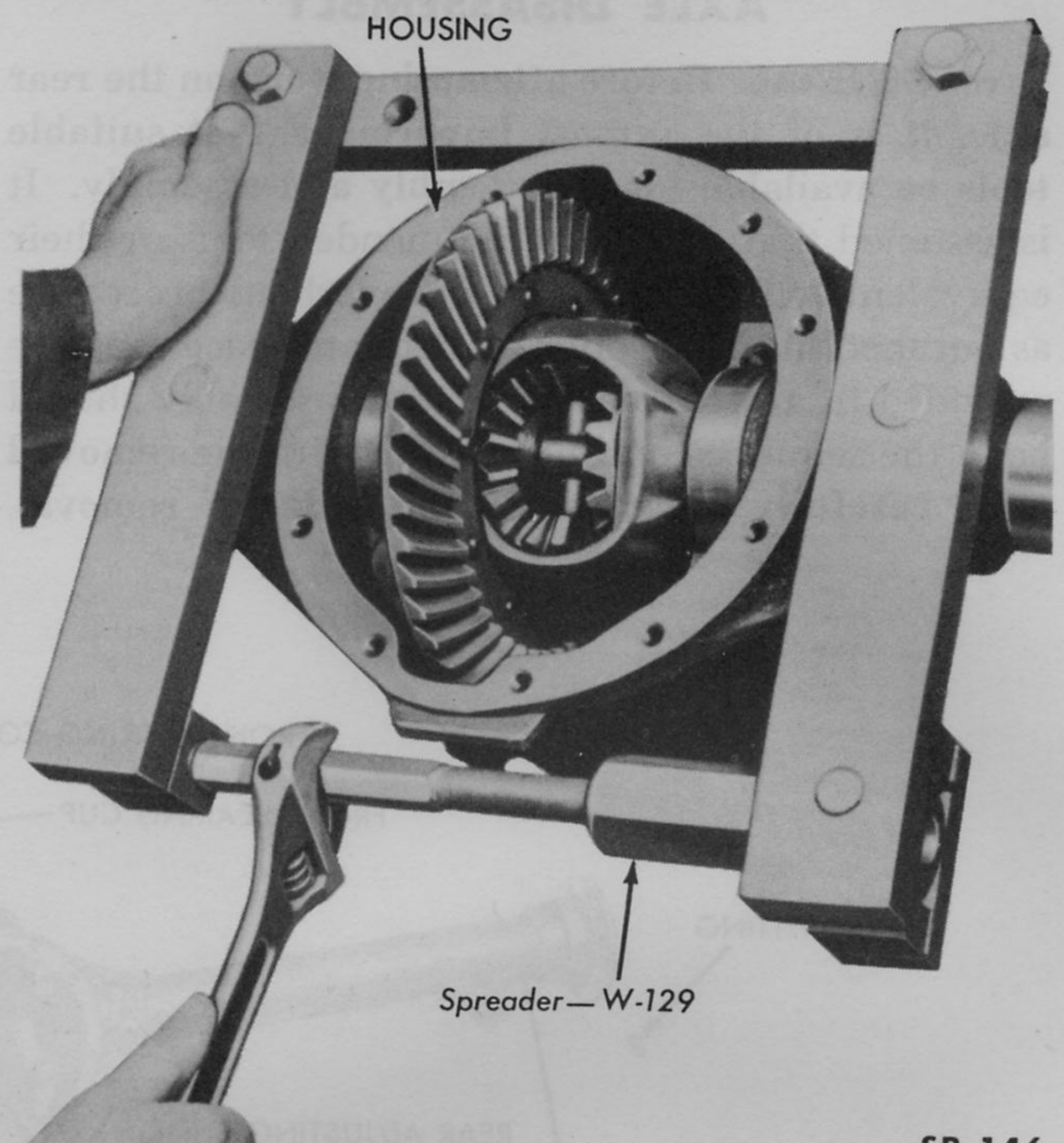
1. Remove the housing cover. **NOTE: A small metal tag will be found attached to one of the cover bolts. This tag shows the gear ratio between the drive gear and pinion. Make sure this tag is attached when reassembling if the same ratio is used, or restamped to correspond to the ratio used if changed while rebuilding.** (Refer to **REAR AXLE GEAR RATIOS**, above).

2. Before proceeding further with the disassembly, check for differential end-play and if there is none, then check the drive gear run-out to determine if drive gear or differential case replacement is required due to distortion. Mount Dial Indicator W-102 on the axle housing and take the reading from the rear face of the drive gear while rotating the differential. Run-out should not exceed .002 of an inch. This check cannot be made accurately if there is differential end-play.

3. Remove the differential bearing caps. **NOTE: The position of the caps in the housing is deter-**

mined by the figure or letter stamped on the housing directly opposite and facing in the same direction as the cap figure or letter.

4. Remove the differential and side bearings from the axle housing using Differential Housing Spreader W-129 (Fig. 261). **NOTE: Caution should be exercised to prevent excessive strain on the housing.**



**Fig. 261—Spreading Rear Axle Housing for Differential Removal**

Approximately .020 of an inch spreading of the housing should release the differential. Release the spreader immediately after removing the differential to prevent permanent distortion of the housing.

The bearing cups are free to fall off the side bearings. Remove the cups, making sure to segregate them to assure installing on the bearing from which each was removed.

**d. REMOVE AND DISASSEMBLE DRIVE PINION.**

1. Remove the companion flange (or yoke) nut, using a suitable socket wrench and self-adjusting Spanner Wrench C-784 (Fig. 262).

2. Remove the companion flange (or yoke), using the C-784 self-adjusting Spanner Wrench, the C-452 Universal Joint Flange Puller, and a suitable socket wrench (Fig. 263).

3. With the companion flange self-locking nut re-

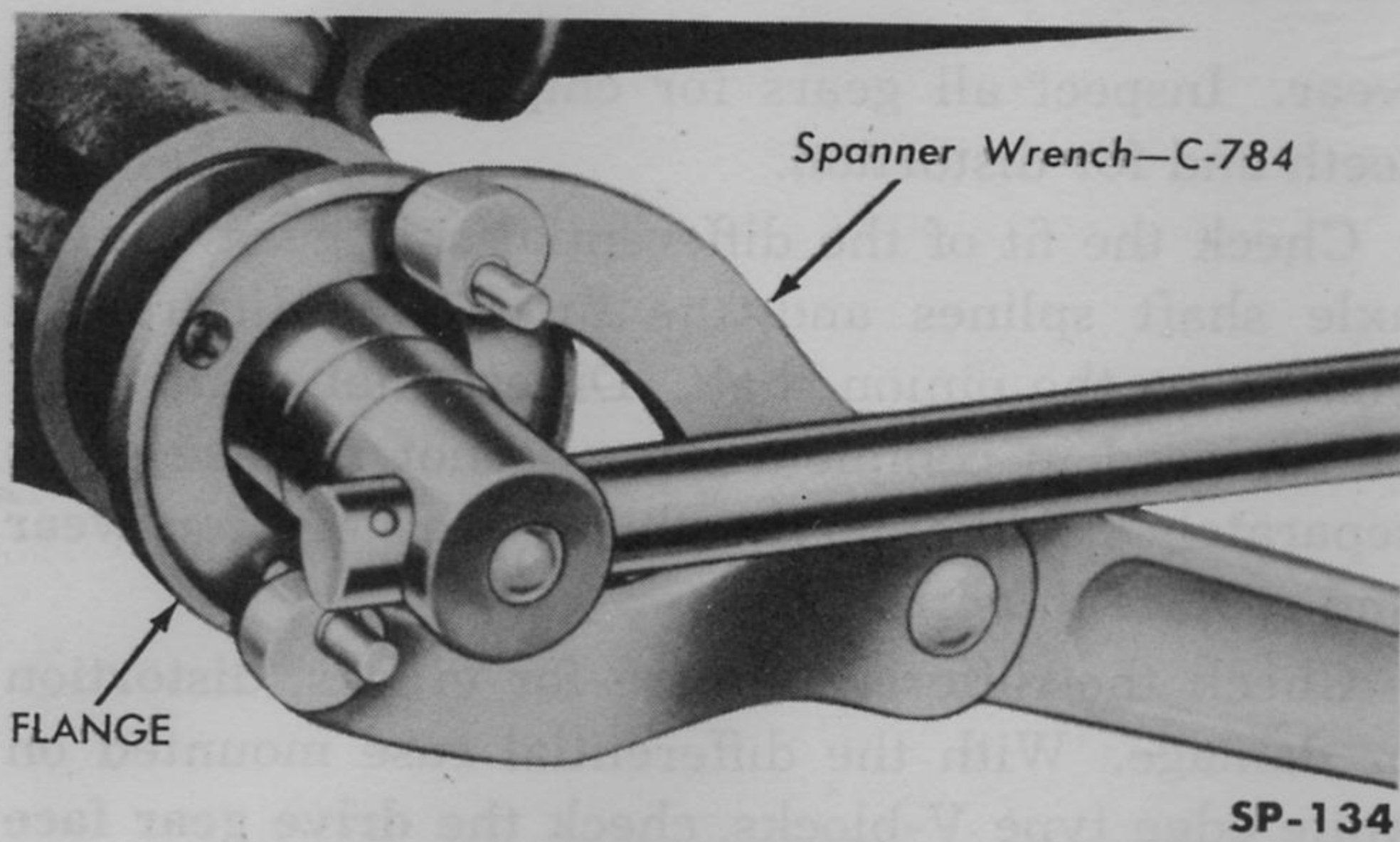


Fig. 262—Removing Companion Flange Nut

installed upside down and flush with the top of the pinion shaft, to prevent the pinion from dropping out and to prevent damage to the threads, strike the end of the shaft with a rawhide mallet to loosen it from the front bearing. Remove the nut and the pinion assembly from the housing.

4. Remove the pinion oil seal, gasket, oil slinger, and front bearing cone from the housing. Remove the front bearing cup from the housing if it is to be replaced.

5. Remove the pinion rear bearing cup and shims from the axle housing, if necessary, using Puller W-100 which is part of Gauge Set W-99 (Fig. 264). All of the adjusting shims should be carefully removed from the bearing cup seat. The shim pack should be measured for thickness and carefully set aside in preparation for reassembly.

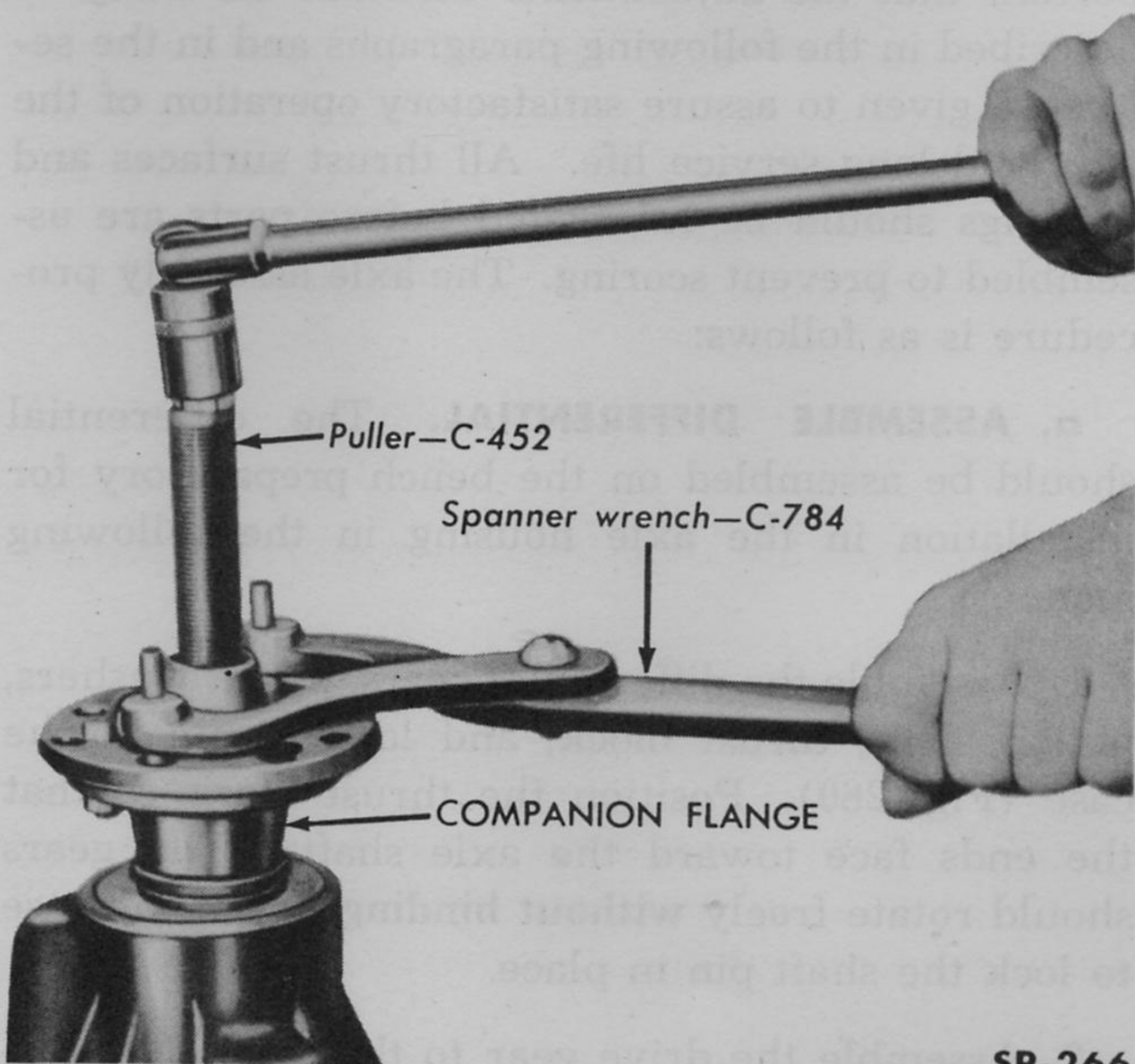


Fig. 263—Removing Companion Flange

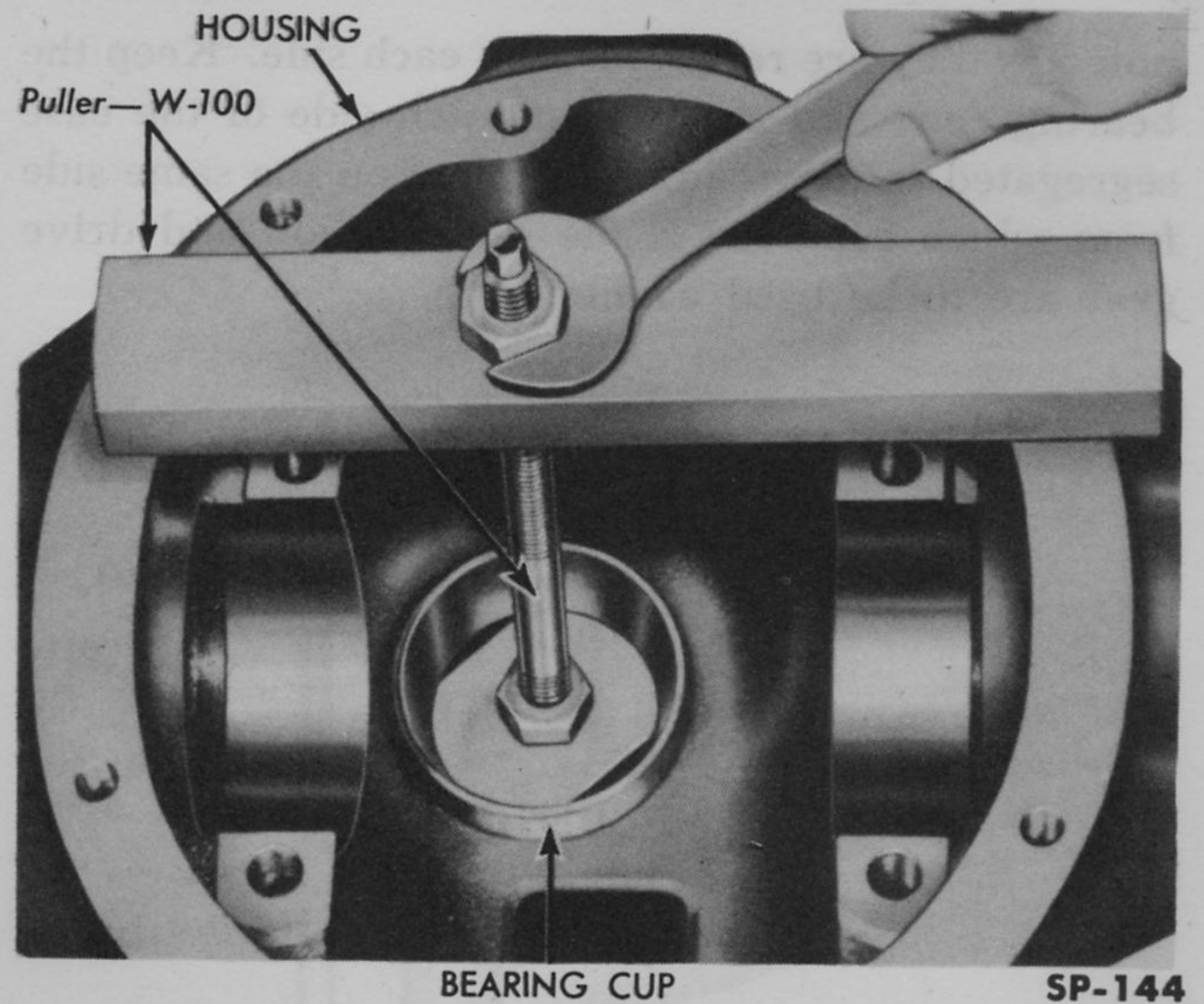


Fig. 264—Removing Pinion Rear Bearing Cup

6. Remove the front adjusting shim pack, spacer (Model 41 axle only), and rear bearing cone from the drive pinion. **NOTE: A shoulder on the pinion shaft in Model 44 axles serves the same purpose as the spacer used in Model 41 axles.** The rear bearing cone may be removed with Puller KF-3 (Fig. 265).

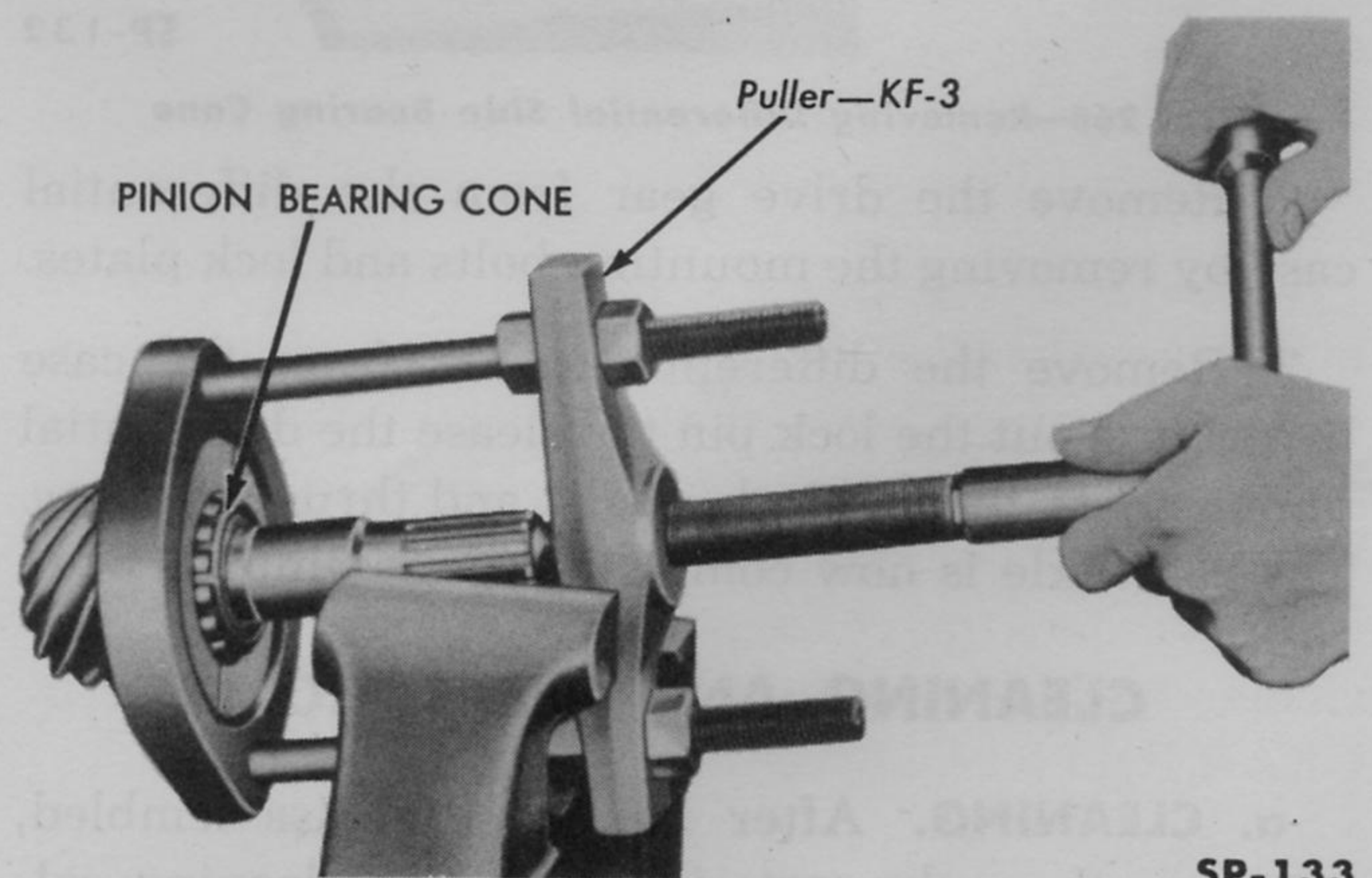


Fig. 265—Removing Pinion Rear Bearing Cone

**e. DISASSEMBLE DIFFERENTIAL.** The differential should be disassembled in the following manner, with removed parts carefully segregated in the order of their removal.

1. Remove the differential side bearing cones using Puller KF-3 (Fig. 266). **NOTE: The differential bearing adjusting shim packs will be found between the side bearing cones and the differential case.** The total thickness of these shims should be

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noted as they are removed from **each side**. Keep the bearing cone and shims from each side of the case segregated so they can be installed on the same side from which removed if the same pinion and drive gear are to be used again.

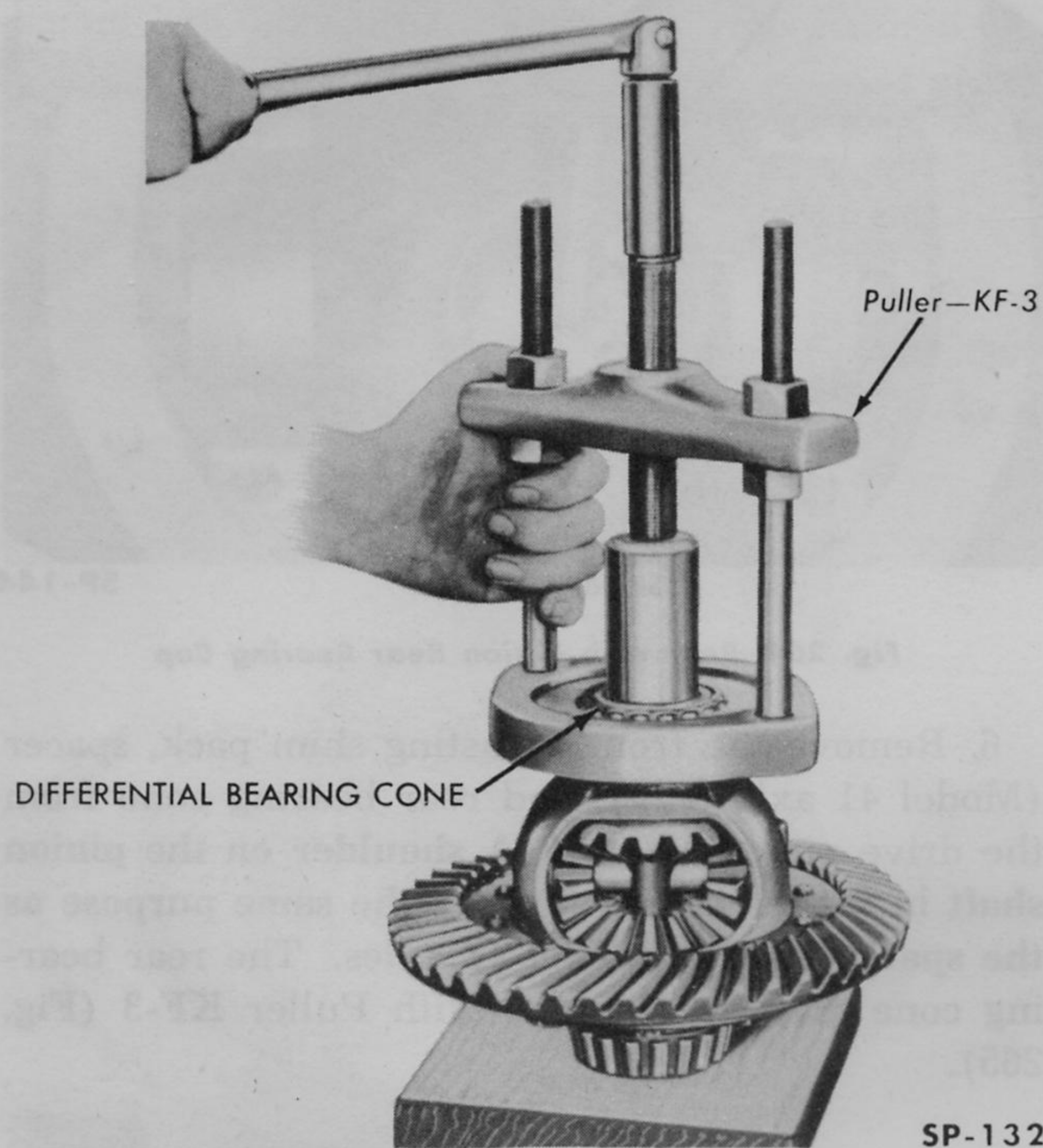


Fig. 266—Removing Differential Side Bearing Cone

2. Remove the drive gear from the differential case by removing the mounting bolts and lock plates.

3. Remove the differential gears from the case by driving out the lock pin to release the differential pinion shaft, thrust block, gears, and thrust washers. The rear axle is now completely disassembled.

## CLEANING AND INSPECTION

**a. CLEANING.** After the axle is disassembled, immerse the axle parts in a suitable cleaning solvent and clean them thoroughly, using a stiff bristle brush as necessary. The bearings should also be immersed in clean solvent and thoroughly cleaned. After cleaning, **do not spin the bearings** while blowing them dry with compressed air. Dip bearings in differential lubricant (See Section 17, "Lubrication") and wrap in clean cloth or paper until ready to install them.

**b. INSPECTION.** Bearings should be checked for roughness looseness or wear and for other damage. Examine the bearing cups for pitting, scoring and

wear. Inspect all gears for chipped or worn gear teeth and for distortion.

Check the fit of the differential side gears on the axle shaft splines and the fit of the differential pinions on the pinion shaft. Differential gears must be replaced in complete sets—do not replace gears separately. Examine the thrust washers for wear and replace if worn.

Check the differential case for cracks, distortion or damage. With the differential case mounted on knife edge type V-blocks, check the **drive gear face** of the case with a dial indicator for alignment (run-out). The allowable run-out is .000–.002 of an inch. The indicator reading should be taken as closely to the bolt holes as possible while rotating the differential case. Be sure the case does not move endwise on the V-blocks while rotating or the reading will not be accurate. If misalignment is evident, the case should be replaced. If the differential case requires replacing, the differential assembly will require repositioning in the housing. Refer to DIFFERENTIAL END-PLAY.

Inspect the axle shafts for twisting or bending and examine the shaft splines for cracks, distortion and wear. Evidence of any of these conditions requires shaft replacement.

## AXLE ASSEMBLY

When assembling the rear axle, it is especially important that the adjustments be made carefully as described in the following paragraphs 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:

**a. ASSEMBLE DIFFERENTIAL.** The differential should be assembled on the bench preparatory for installation in the axle housing in the following manner:

1. Assemble the differential gears, thrust washers, pinion shaft, thrust block, and locking pin in the case (Fig. 260). Position the thrust block so that the ends face toward the axle shafts. The gears should rotate freely **without binding**. Peen the case to lock the shaft pin in place.

2. Assemble the drive gear to the case. The correct torque for the attaching bolts is 40–50 foot



pounds. It is recommended that new lock plates be used under the attaching bolt heads.

3. Check the alignment of the drive gear **mounted on the differential case**. Mount the case on knife edge type V-blocks and, with a dial indicator, obtain a reading from the rear face of the drive gear while rotating the case. The allowable run-out is .000-.002 of an inch. Be sure the case does not move endwise on the V-blocks while rotating or the reading will not be accurate. If misalignment is in excess of .002 of an inch make sure the mounting surfaces of the case and gear are clean. If no foreign matter is found the ring gear or case is probably distorted and should be replaced as necessary.

**b. DIFFERENTIAL END-PLAY.** The total amount of differential end-play in the housing must be determined **prior to installing the drive pinion**. Determine the total end-play as follows:

1. Install the side bearing cones on the differential case with Driver W-188 (without the shim packs), fully seating the bearing cones against the differential case. (Fig. 267). Install the bearing cups on the cones.



Fig. 267—Installing Differential Side Bearing Cone

2. Install the differential in the axle housing. With the dial indicator W-102 (Part of Gauge Set

W-99) mounted on the housing cover face and the indicator button resting against the rear face of the drive gear, use two screwdrivers to move the differential endwise either way in the housing as far as possible to fully seat the differential bearing cup in the housing bore (Fig. 268). Adjust the dial indicator to zero.

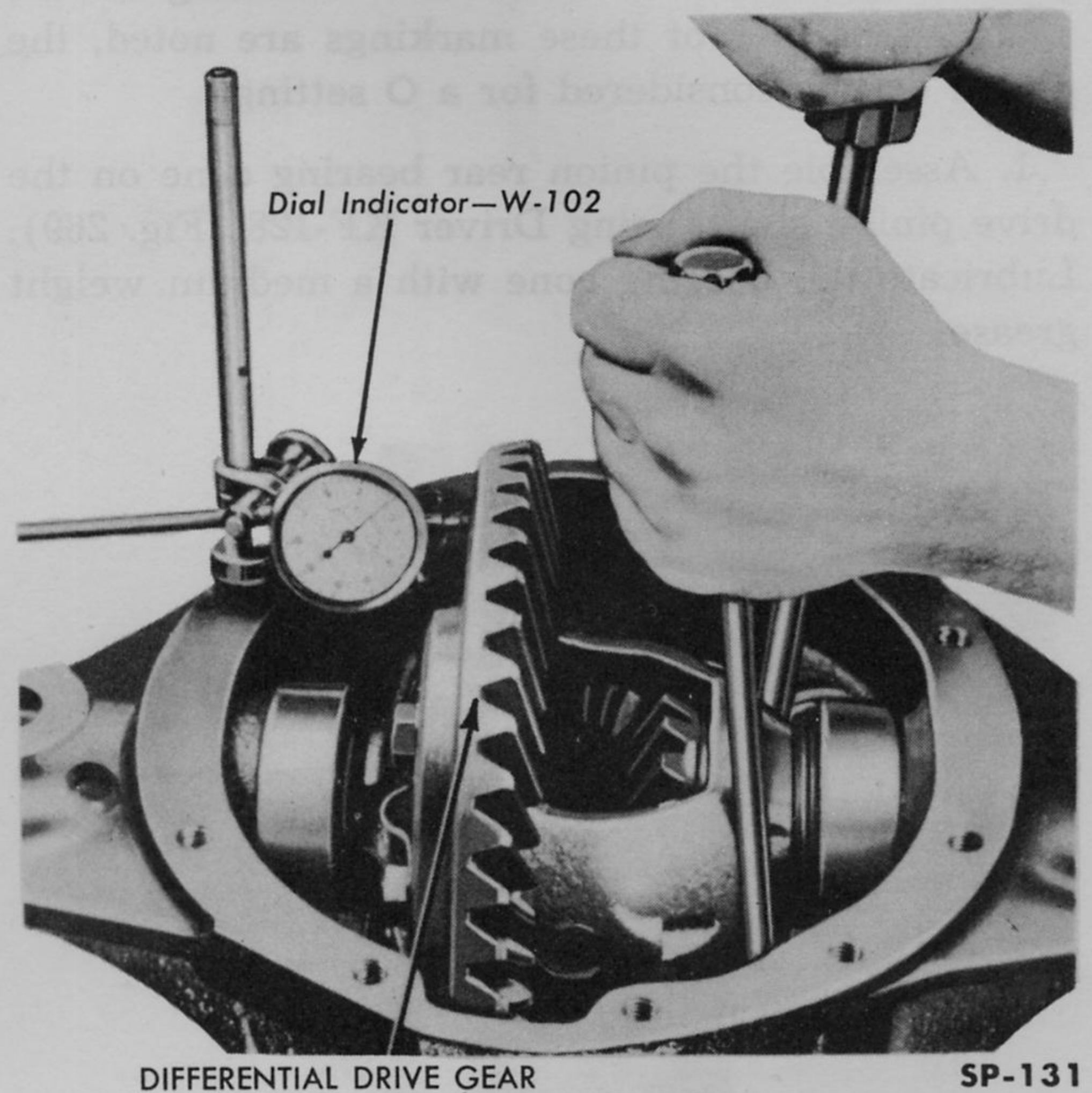


Fig. 268—Checking Differential End-Play

3. Move the differential toward the opposite end of the housing as far as possible to fully seat the differential bearing cup in the housing. Note the reading on the dial indicator.

This reading denotes the shim thickness required to eliminate all end-play of the differential in the housing. Remove the differential from the housing.

**c. ASSEMBLE AND INSTALL DRIVE PINION.** The assembly and installation of the drive pinion will require extreme care and accuracy to maintain the proper tolerances. The pinion tolerances are controlled by means of shims which determine the relationship of the pinion teeth to the drive gear and the proper pinion bearing pre-load.

Note figures that are etched on the end of the drive pinion. Four sets of figures will be etched on the shaft. One figure will be found on both the drive gear and pinion, this designates a matched set. Directly opposite this figure will be a number with either a + or - marking before it, if not, the figure

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will be a O. This number must be positively identified before continuing with the assembly procedure.

Midway between the two sets of figures described above are numbers and letters etched for manufacturing purposes only; however, one of these numbers may be a O and may be confused for a O etching. A rule to eliminate any confusion would be to examine the shaft for a + or — marking on the shaft. If neither of these markings are noted, the pinion can be considered for a O setting.

1. Assemble the pinion rear bearing cone on the drive pinion shaft, using Driver KF-128 (Fig. 269). Lubricate the bearing cone with a medium weight grease.

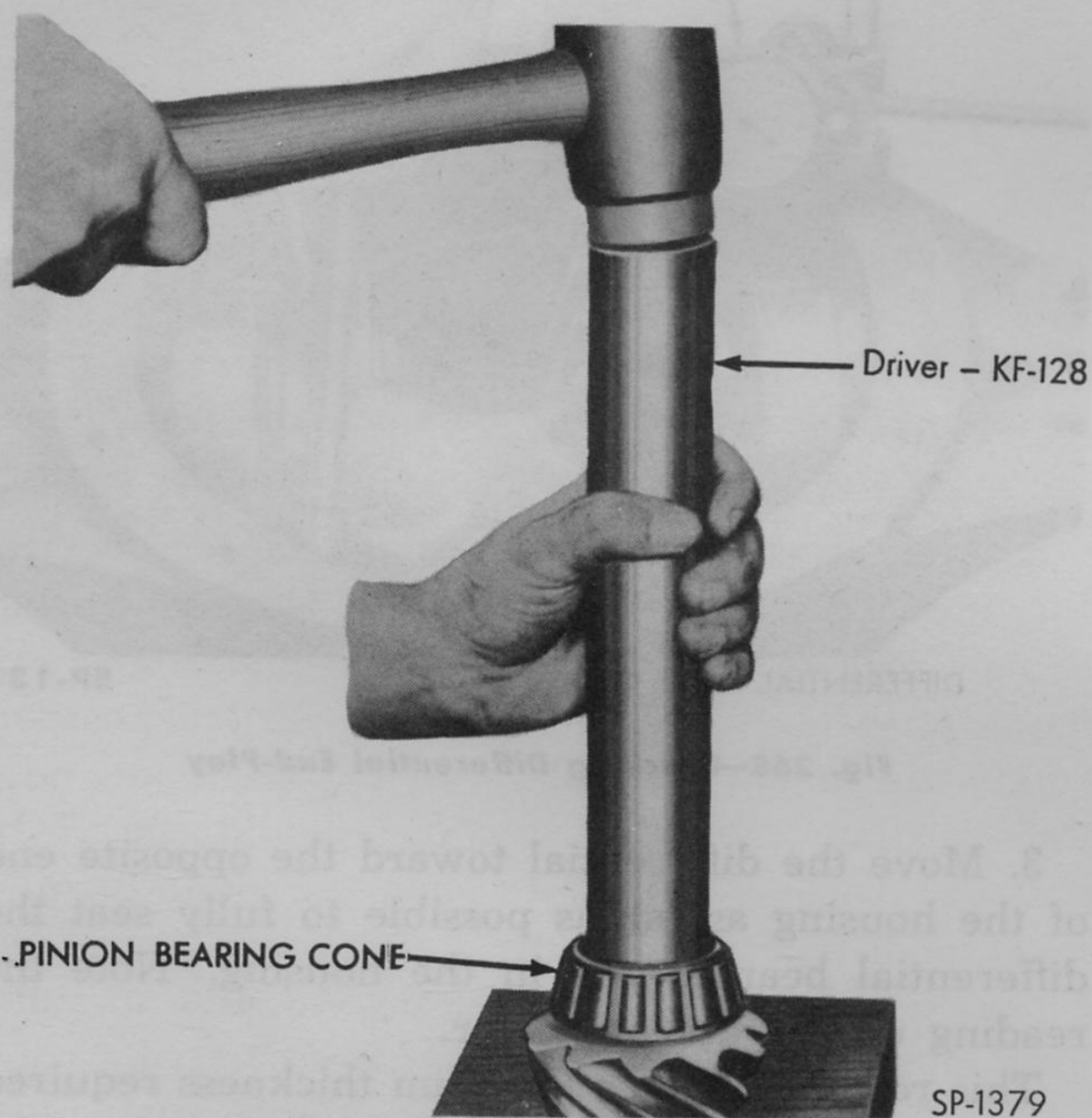


Fig. 269—Installing Pinion Rear Bearing Cone

2. Install the pinion front bearing cup in the axle housing, using Driver W-126 (Fig. 270).

3. Install the shim pack and bearing cup in the rear bearing seat of the housing, using Puller W-100 (part of Gauge Set W-99) inverted (Fig. 271).

The thickness of shims to be placed between the bearing cup and housing can be determined from the shims removed and the etched number on the pinions.

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

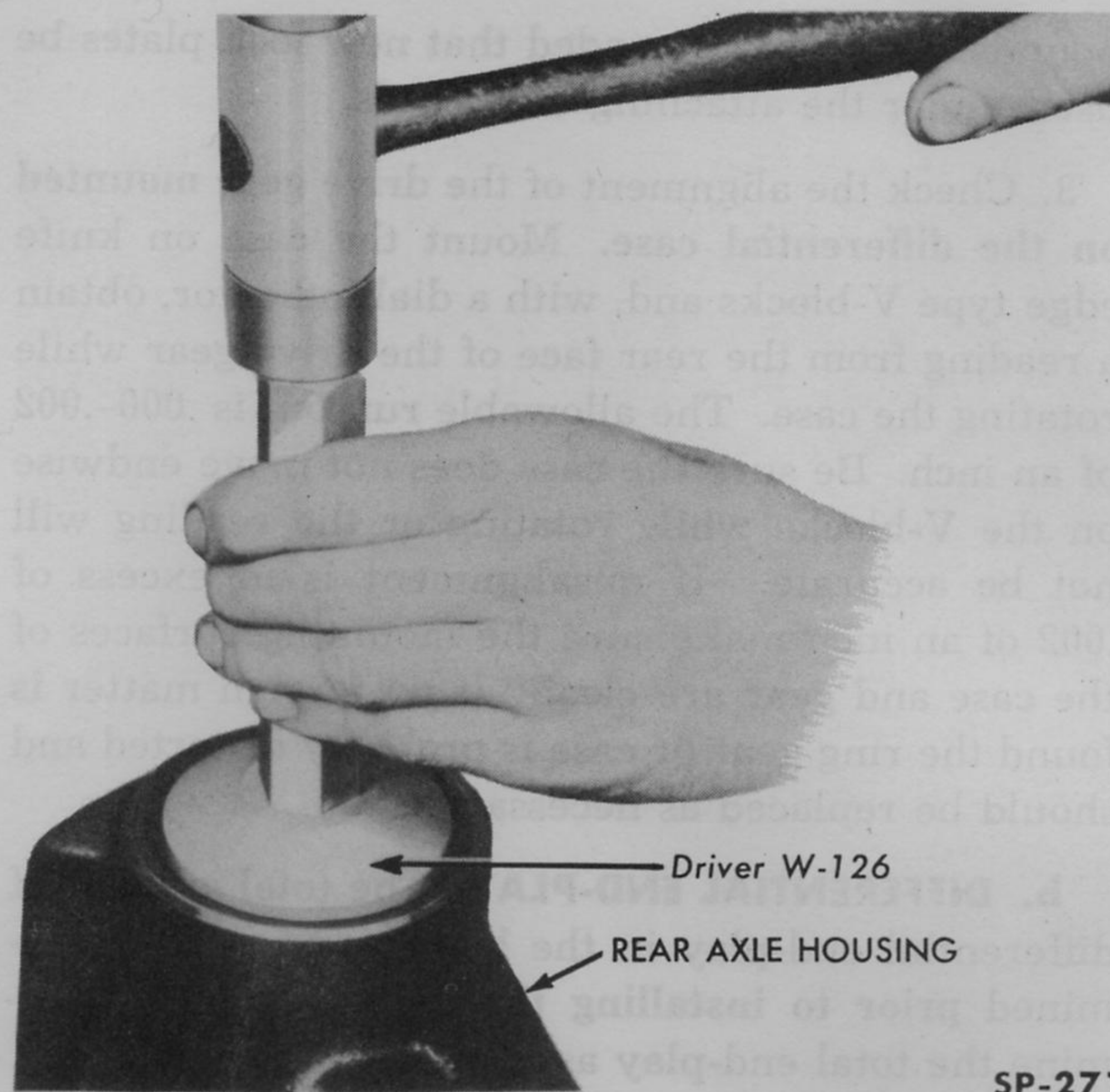


Fig. 270—Installing Pinion Front Bearing Cup

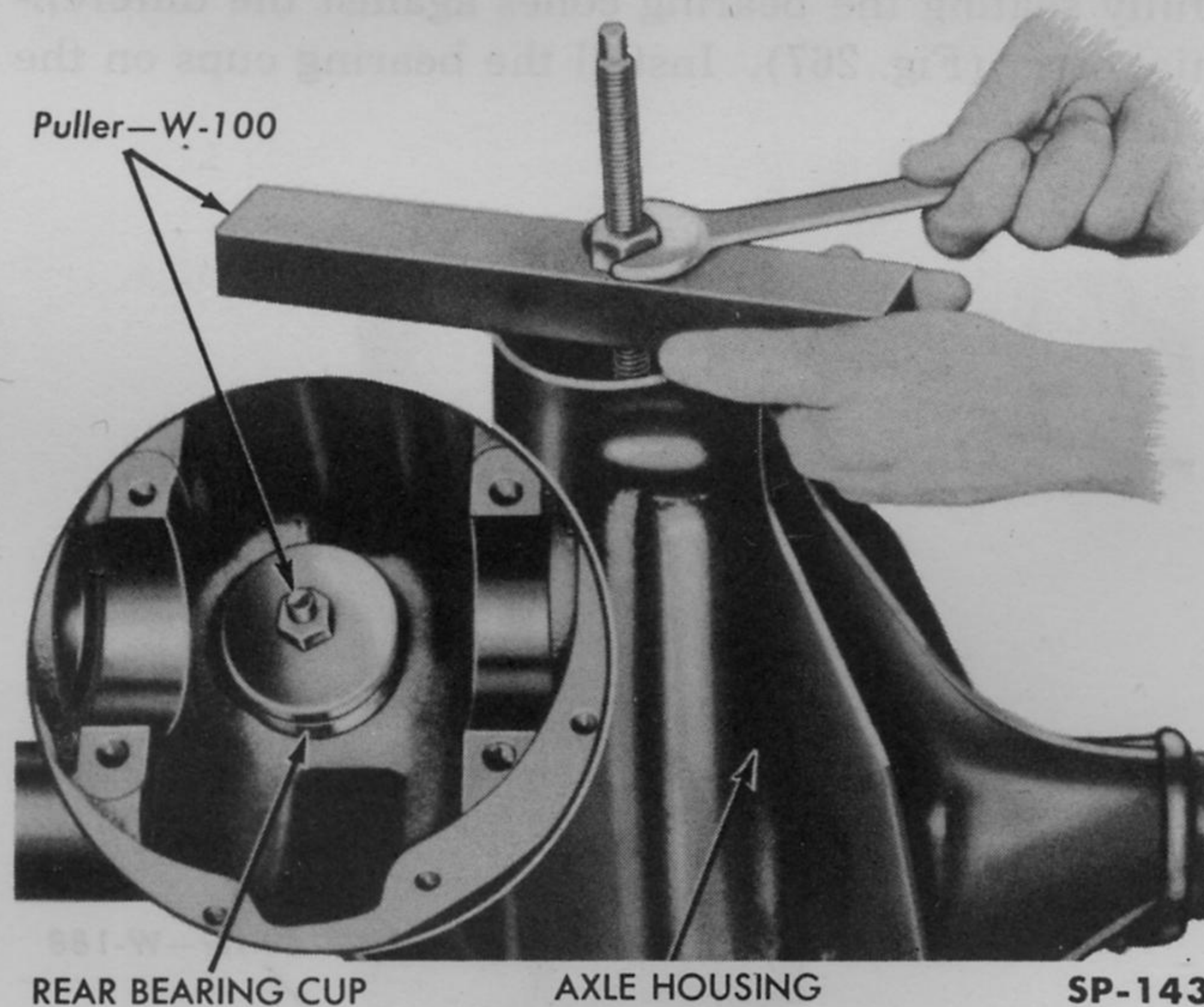


Fig. 271—Installing Pinion Rear Bearing Cup

+2 was 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. Shims are available in .003, .005, and .010 inch thicknesses.

If the new pinion has a + figure and the old pinion had a — figure then shims would be removed from the original shim pack instead of added.

4. If working on a Model 41 axle, install the spacer on the pinion. A spacer is not required on a Model 44 axle due to the shoulder on the pinion shaft. Install the drive pinion in the axle housing.

Install the same thickness of shims on the pinion as removed, unless shims were added or removed from the rear shim pack. If shims were **removed** due to a + marking on the pinion shaft, the same thickness of shims must be **added** to the front shim pack. Likewise, the same thickness of shims as added to the rear shim pack must be removed from the front shim pack when compensating for a — marking on the pinion.

5. Install the front bearing cone, oil slinger, companion flange or yoke (Fig. 272), flat washer and nut. Tighten the nut to 140–150 foot pounds torque.

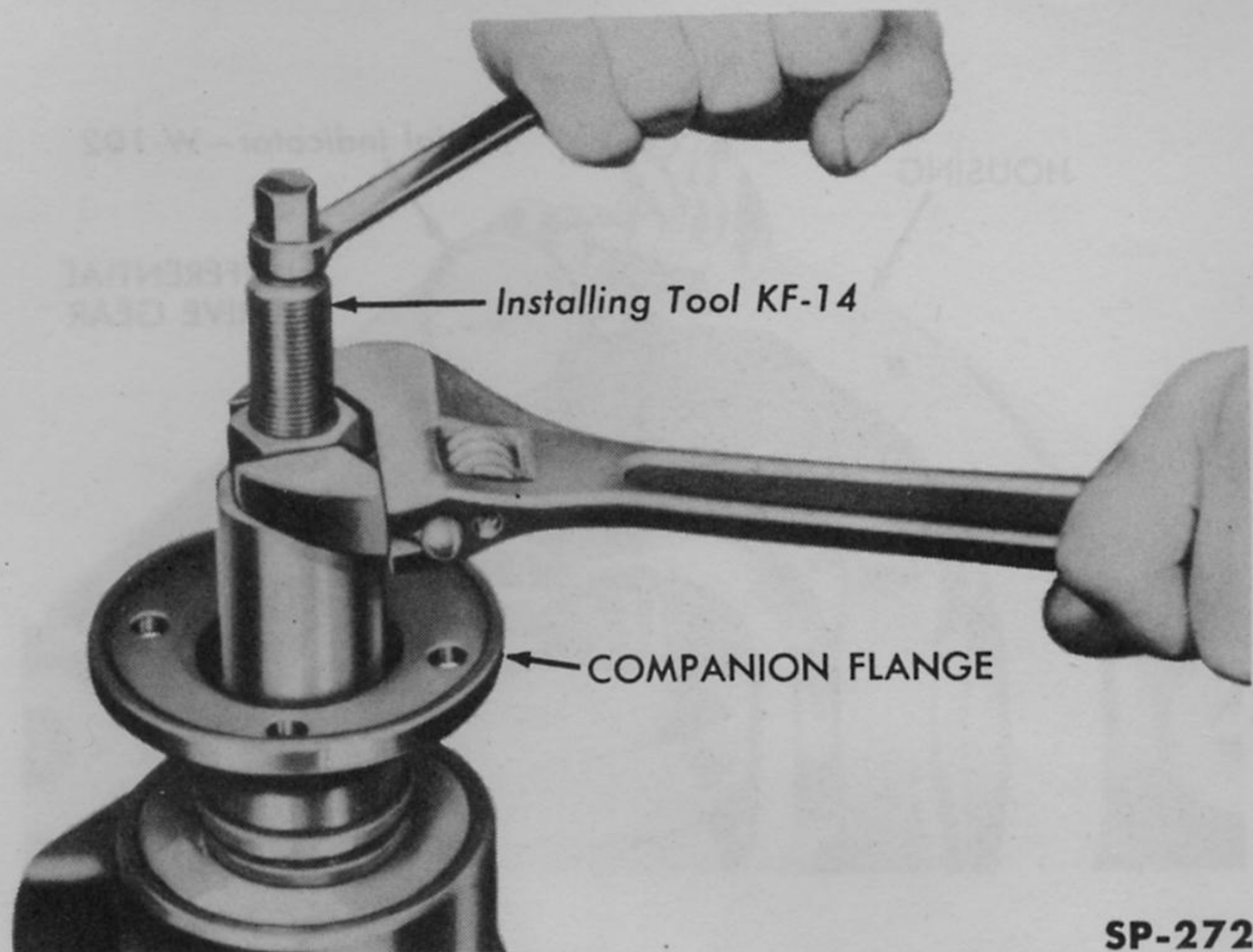


Fig. 272—Installing Companion Flange

6. Adjust the Pinion to Drive Gear Gauge W-99 to “B” setting if working on a Model 41 axle, or to the “E” setting if working on a Model 44 axle. Clean the pinion shaft centers to allow the pivot points of the gauge to seat properly.

7. With the dial indicator adjusted to the correct section of the Gauge Block, rotate the gauge assembly so that the dial indicator button contacts the bottom surface of the differential housing right side bearing bore (Fig. 273).

8. Swing the dial indicator button back and forth across the bottom of the bore. The lowest dial reading indicates the center of the bearing bore and should be zero, if the proper shim thickness was installed between the rear bearing cup and the housing.

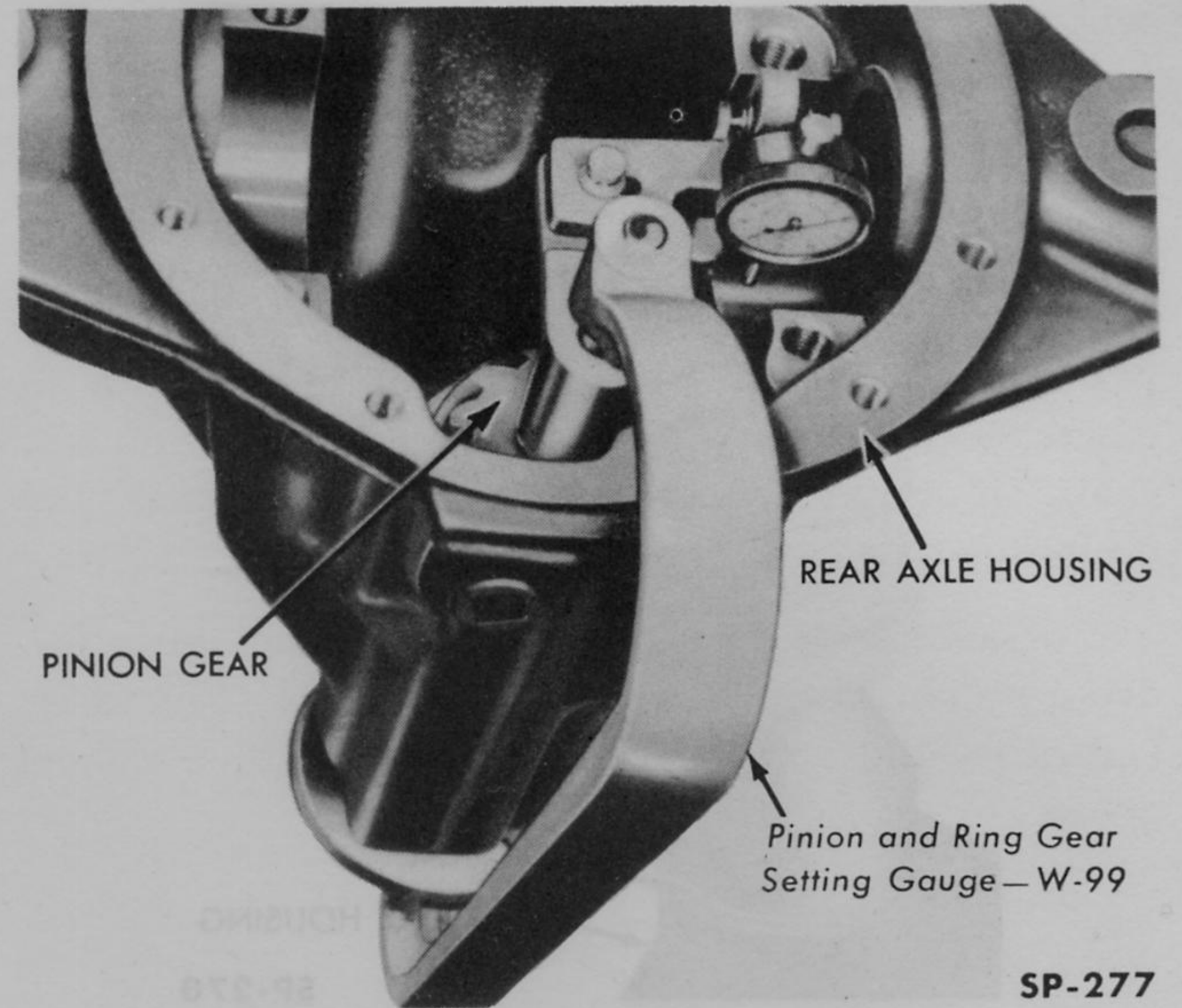


Fig. 273—Pinion to Drive Gear Adjustment

If it is necessary to add or remove shims from behind the rear bearing cup to obtain a zero reading on the gauge, the same thickness in shims must be added or removed from between the front bearing cone and the spacer or shoulder on the pinion.

9. After a zero reading is obtained remove the Pinion to Drive Gear Gauge W-99. Connect Spring Scale C-690 to one of the holes in the companion flange or yoke. With the pinion in a vertical position rotate the pinion by pulling on the scale and note the reading. Turning torque should be 7–12 pounds. Torque reading to start the shaft turning must be disregarded. If turning torque is more than 12 pounds it will be necessary to **add** a sufficient number of shims between front bearing cone and the spacer or shoulder on the pinion shaft until the specified torque is obtained. Likewise if the torque is less than 7 pounds it will be necessary to **remove** the shims to increase the torque.

Shims are available in .003, .005, .010, and .030 inch thicknesses. After the correct turning torque is obtained recheck the pinion position as detailed in paragraph 8 above.

10. Remove the companion flange or yoke. Install the oil seal gasket and seal using Driver W-147 (Fig. 274). Then again install the companion flange or yoke, flat washer and self-locking nut. Tighten the nut to 140–150 foot pounds torque.

**d. INSTALL DIFFERENTIAL.** The following information covers installation of the differential in the

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Fig. 274—Installing Pinion Oil Seal

axle housing after the pinion is installed. Final positioning of the differential in relation to the pinion is very important and should be done carefully to obtain the proper alignment and backlash.

To complete the positioning of the differential, with the pinion installed and one-half the required total amount of shims (determined as described under DIFFERENTIAL END-PLAY), installed between each of the differential side bearing cones and the differential case, install the differential and check the pinion to drive gear setting as follows:

1. With the Differential Housing Spreader W-129 mounted on the housing and the housing expanded approximately .020 of an inch (Fig. 261) install the differential and release the spreader.

2. Install the differential bearing caps, matching figures or letters on the caps with figures or letters on the housing to be sure the caps are installed in the position from which removed. The proper torque for the bearing cap bolts is 70-90 foot pounds. Coat threads of bolts with sealing compound.

3. Drive gear should rotate and have no backlash. If any backlash exists between the gears, shims to eliminate backlash must be removed from behind the side bearing on the tooth side of the drive gear and added behind the opposite bearing. Likewise, if the gears bind while rotating, shims must be transferred to the bearing on the tooth side from the opposite side bearing.

4. After all backlash has been eliminated and the drive gear can be rotated without binding, add an additional .015 inch thickness of shims behind the side bearing on the tooth side of the gear and install the differential in the housing. The extra .015 inch thickness of shims should provide the proper backlash and pre-loading of the side bearings.

5. Check the backlash between the drive gear and pinion with a Dial Indicator W-102 (part of Gauge Set W-99) mounted on the housing cover face so that the dial indicator contact button rests on a tooth of the drive gear (Fig. 275). Hold the pinion firmly at the companion flange and move the drive gear back and forth. The amount of free motion indicated on the dial indicator represents the amount of backlash.

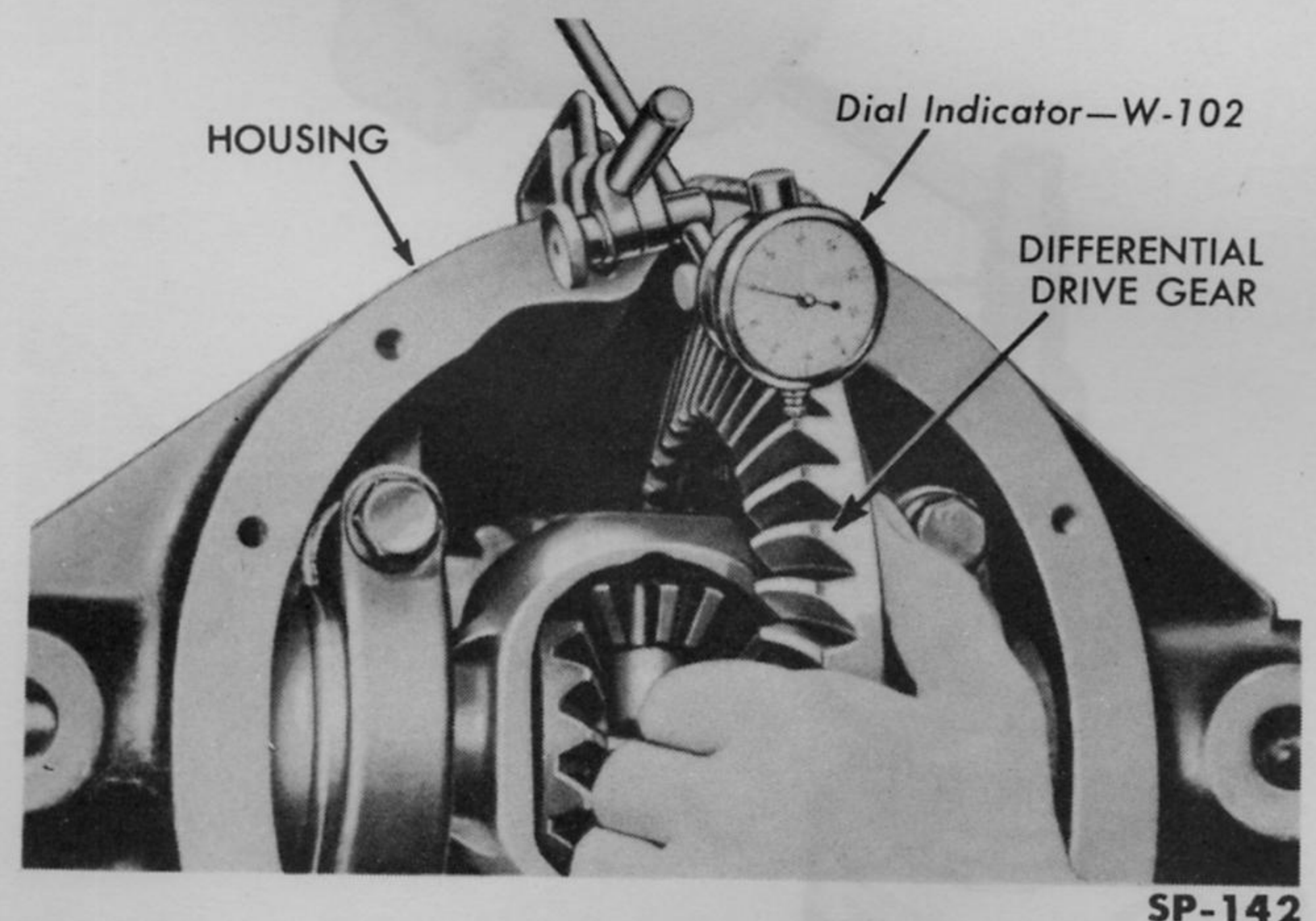


Fig. 275—Checking Differential Backlash

The correct backlash is .003-.006 of an inch. If the backlash is less than .003 inch, shims must be transferred to the bearing on the tooth side of the drive gear from behind the opposite bearing. Conversely, if the backlash is greater than .006 inch, shims must be transferred from behind the bearing on the tooth side of the drive gear and added behind the opposite bearing to move the drive gear closer to the pinion and decrease the backlash.

6. After proper backlash has been established it may be desirable to check for proper tooth contact. Apply a mixture of ground red lead and engine oil to a few drive gear teeth. Rotate the drive gear over the pinion until a good impression of the tooth contact is obtained. If the adjustment is correct the impression should be similar to the example illustrated in Fig. 276.

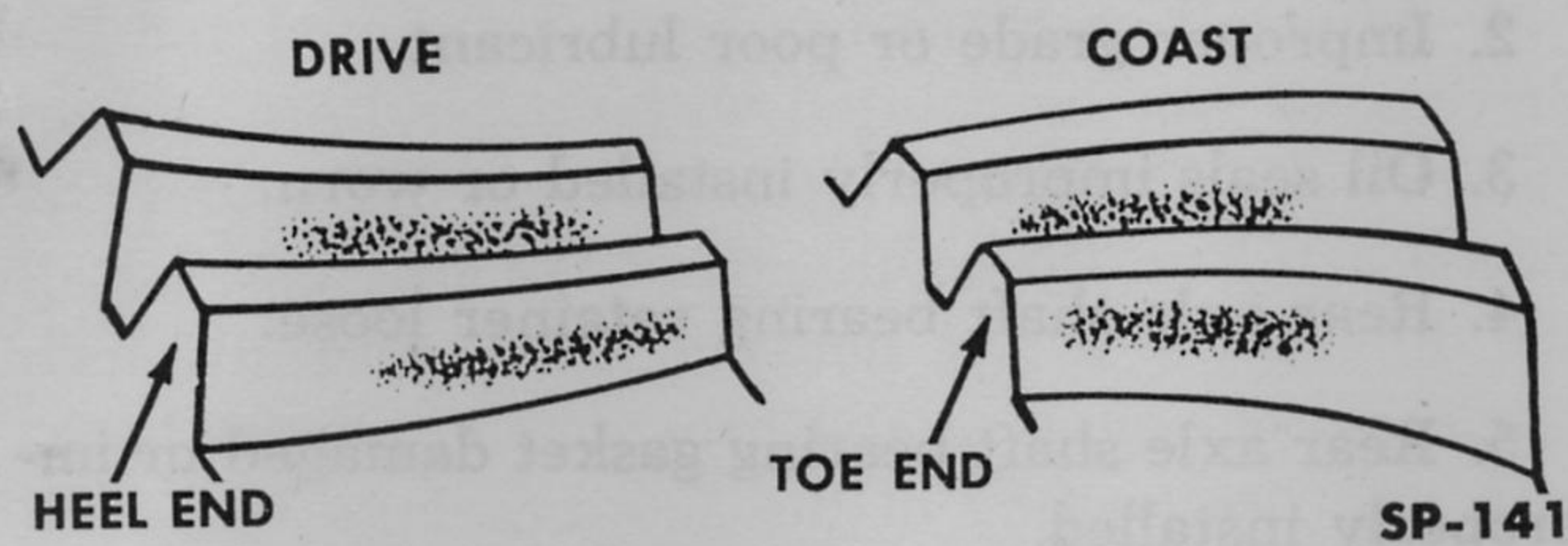


Fig. 276—Proper Gear Tooth Contact

7. Install the differential housing cover, using a new gasket. Tighten the bolts securely. **NOTE:** The tag identifying the gear ratio of the rear axle should be installed under the head of one of the attaching bolts unless the gear ratio has been changed, in which case a new tag should be made up and installed.

**e. INSTALL AXLE SHAFTS.** Install the axle shafts in the axle housing as described under AXLE SHAFT INSTALLATION elsewhere in this Section. It is important that axle shaft end-play be checked carefully and adjusted properly by the use of shims as directed.

## AXLE ASSEMBLY INSTALLATION

The following instructions are for the installation of the rear axle assembly in the vehicle.

1. Place the axle on a jack and roll the axle assembly into position under the rear end of the vehicle.
2. Raise the rear axle and assemble the rear spring rear shackles. Refer to Section 8, "Chassis Suspension," for detail information on assembling shackles. Position the axle so the center bolt of each spring fits into the hole for it in the spring pad on the axle. Install the two seat plates and the four U bolts. Refer to Section 8, "Chassis Suspension," for detailed information.
3. Connect the propeller shaft to the rear flange or yoke on the axle pinion.
4. Connect the rear shock absorbers to the studs on the rear spring plates.
5. Connect the hand brake cable and the hydraulic brake line at each rear wheel cylinder.
6. Connect the main hydraulic brake line at the tee fitting on the rear axle housing.
7. Install the axle shaft key, the hub and drum assembly, washer, nut and cotter pin at each end

of the rear axle. Tighten the axle shaft nuts to a minimum of 160 foot pounds torque. Install the rear wheels and tires. Remove the supports from under the frame.

8. Refill the axle housing with the proper type and quantity of lubricant as described in Section 17, "Lubrication."

9. Fill the hydraulic brake system with hydraulic brake fluid and bleed the lines as described in Section 11, "Brakes."

## SERVICE DIAGNOSIS

**a. 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 from that heard when the engine is driving. Quite often the rear axle will be noisy when the engine is driving the car while no noise is heard when coasting.

Improper diagnosis of 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 the 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, chipped or improperly cut teeth of the pinion or drive gear.
7. Loose bearings in the differential.
8. Drive gear does not run true causing an intermittent hum. It may be created by foreign substances between gears, warped drive gear, loose drive gear attaching bolts, sprung differential case, or loose and distorted differential bearings.

**b. 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.

