REAR SUSPENSION

CONTENTS OF THIS SECTION

GENERAL DESCRIPTION

The rear suspension is of the Hotchkiss drive type, utilizing a hypoid ring gear and pinion set, semi-floating axle shafts, and semi-elliptical springs. The weight of the car is carried on the axle shafts through heavy-duty ball bearings. The axle shaft bearings have a press fitted seal assembly located between the inner and outer bearing race. A rubber "O" ring fits into a groove in the outer diameter of the bearing race and seals between the bearing and axle housing. The bearing assembly is lubricated by oil from the axle housing. Driving and braking torque is cushioned through the rear springs. A rubber bumper (Fig. 4-1) is attached to the underside of the body above the differential to prevent propeller shaft from striking against underside of body when the car is under fast acceleration or being driven over severe bumps. Rubber bumpers mounted on the axle housing, above each spring, bear against the frame to arrest motion of the rear suspension when springs are under extreme compression.

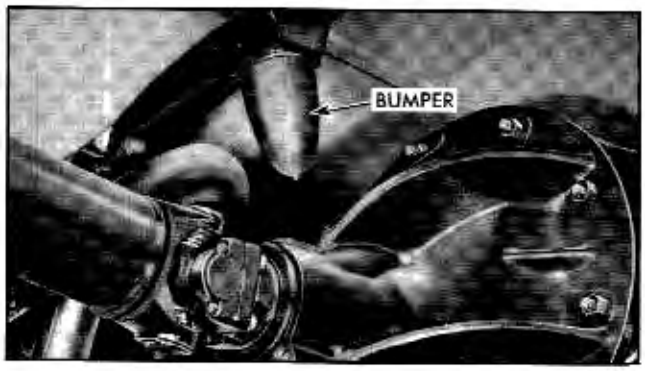


Fig. 4-1 Differential Bumper

AXLE HOUSING

The "banjo" type rear axle housing is provided with a pressure vent by means of a hole drilled in the bolt which fastens the brake line "Tee" connector to the left side of the axle housing. A breather cap over the bolt head protects the vent from entrance of dirt and water.

REAR SPRINGS

The semi-elliptical car springs are mounted parallel to centerline of chassis to improve roll stability. Springs are bolted firmly to spring seats on the axle housing and pivoted at the ends by rubber bushings. Full length liners are used between the four top spring leaves. No lubrication of any kind is recommended or required on rear springs. Springs of different stiffness are used for various models because of differences in car weights and expected passenger loads.

AXLE RATIOS

Axle ratios differ for various car models. They can be identified by a color marking on the ends of the axle shaft as well as by a code number that is stamped on a pad on a differential carrier. The different axle ratios that are available are shown below.

Model	Gear Ratio and No. of Teeth		Code No.	Color
HYDRA-MATIC				
27 and 28 Series (Standard)	3.23:1	42-13	9	Brown
27 and 28 Series (Optional Plains Ratio for Sedans & Catalina Coupes)	3.08:1	40-13	0	Yellow
SYNCHRO-MESH				
27 and 28 Series (Standard)	3.42:1	41-12	8	Gray
27 and 28 Series (Hills)	3.64:1	40-11	6	Blue
28 Series (Heavy duty chassis)	3.90:1	39-10	4	Red

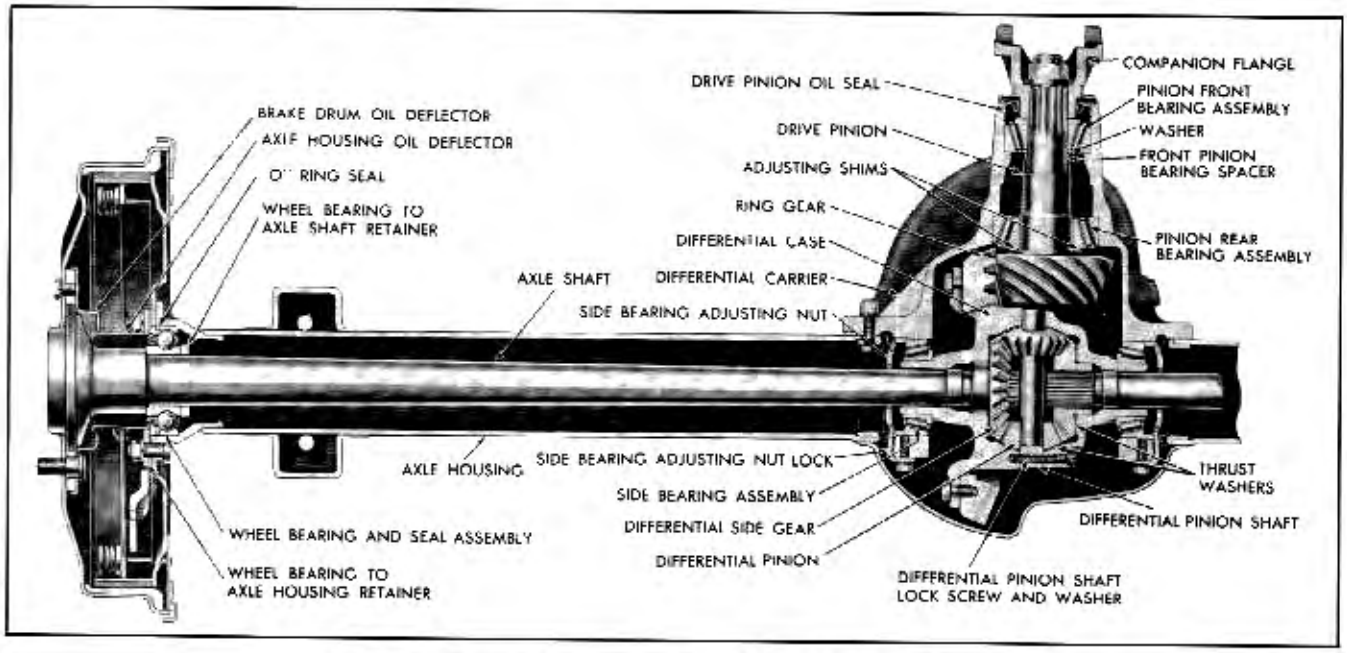


Fig. 4-2 Differential Carrier and Axle Assembly—Cross Section

SHOCK ABSORBERS

Direct acting, sealed, and shielded shock absorbers are mounted at the front side of the axle housing. The upper ends are inclined toward the chassis center line to provide maximum stability.

DIFFERENTIAL

The drive pinion is mounted on pre-loaded taper roller bearings (Fig. 4-2). The inner race of the rear bearing is a tight press fit on pinion; the inner race of the front bearing is from a light press fit to a close sliding fit on pinion stem. The outer race of each bearing is pressed against a shoulder recessed in the carrier. Adjustment of the pinion along its axis is obtained by shims placed between the pinion rear bearing inner race and the pinion head. A splined companion flange is fastened to the pinion stem by a special self-locking nut which bears against a special washer. Tightening the pinion nut compresses a spacer (Fig. 4-3) which bears against inner race of front bearing. This spacer is used to preload pinion bearings and to prevent the inner race of front bearing from turning on the pinion stem.

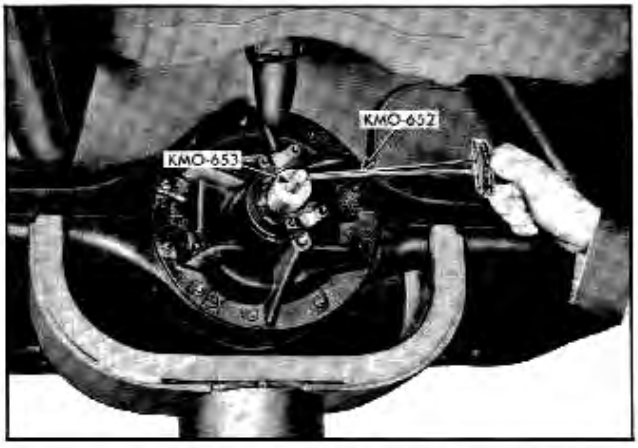


Fig. 4-3 Checking Pinion Bearing Preload With Torque Wrench KMO 652

The ring gear is attached to the differential case by twelve special hex head bolts. The differential case is of one-piece construction with a large opening on one side for assembling the differential gears and a smaller opening on the other side that facilitates making this assembly. Sideways adjustment for backlash between the ring gear and drive pinion as well as a preload adjustment for the differential side bearings are obtained by means of large diameter adjusting nuts which bear against the outer races of the side bearings.

The differential pinions are carried on a solid cross shaft mounted and locked in the differential case. These pinions mesh with side gears which are splined to the axle shafts and run in counterbores in the case. Pinions and side gears have thrust washers behind them to prevent scoring of thrust surfaces.

AXLE SHAFTS AND BEARINGS

The rear axle shafts are mounted on heavy duty ball bearings. Each bearing is pressed to a shoulder on the shaft and is held in place by a pressed-on inner retainer. An outer retainer, which also clamps the brake backing plate to the axle housing, secures the bearing in the end of the axle housing.

PERIODIC SERVICE

DIFFERENTIAL

See lubrication section.

MINOR REPAIRS

COMPANION FLANGE—REMOVE AND REPLACE

NOTE: When replacing companion flange, it is important that new flange be properly installed to provide correct pinion bearing preload. The following procedure must be used to insure correct pinion bearing adjustment.

1. With rear wheels off the floor, turn rear wheels and rap brake backing plates with a soft hammer to ensure that brakes are free.

2. Turn down lock plates and remove "U" bolts which hold rear universal joint to companion flange. Use a heavy rubber band or tape to hold bearings onto journal to prevent loss of bearing rollers when joint is diconnected if retainer strap has been removed. (Fig. 4-45).

3. Using pound inch Torque Wrench KMO-652 with Adapter KMO-653 and socket placed over drive pinion nut, turn pinion two or three revolutions to ensure free movement, and then take a torque reading while rotating pinion to measure bearing preload (Fig. 4-3). Record reading. NOTE: Additional clearance to check preload can be obtained between differential and body by raising body a few inches by means of a jack or stand placed under frame rear cross member.

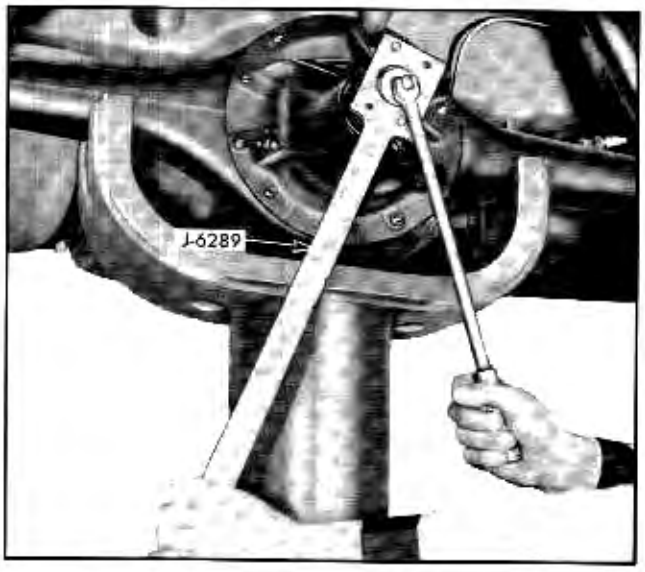


Fig. 4-4 Holding Companion Flange With Holding Tool J-6289

4. Hold companion flange with Holding Tool J-6289 (Fig. 4-4) and remove drive pinion nut and washer using a heavy duty socket.

5. Remove companion flange using Puller J-6295 (Fig. 4-5).

6. Install new companion flange and install washer and nut. Hold companion flange with Holding Tool J-6289 and tighten nut only a little at a time, stopping frequently to check preload (step 3). Tighten nut to reading noted in step 3, however, if reading obtained in step 3 was less than 10 lb. in., increase preload to 10-12 lb. in.

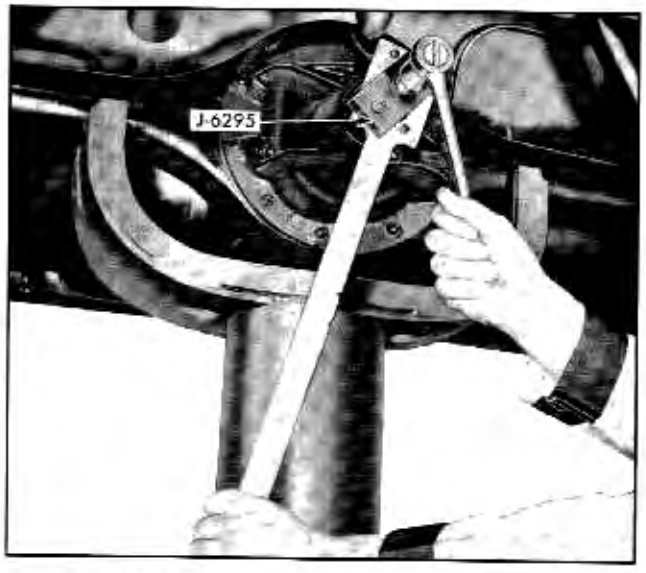


Fig. 4-5 Removing Companion Flange With Puller J-6295

7. Connect universal joints. Use new lock plates and tighten U-joint to companion flange "U" bolt nuts to 14 to 20 lb. ft. torque. Turn up lock plate ears against flats of "U" bolt nuts.

PINION BEARING OIL SEAL—REMOVE AND REPLACE

NOTE: Since inspection of companion flange after removal may reveal damage to this part necessitating its replacement, preload reading of pinion bearings must be checked prior to removing flange so proper preload can be maintained should new flange be required. Follow steps 1, 2 and 3 of companion flange replacement procedure, page 4–3, then proceed as follows:

1. Mark position of companion flange, pinion nut and pinion stem since they must be reinstalled in exactly the same position, providing companion flange is not replaced.

2. Remove drive pinion nut and washer using Holding Tool J-6289 (Fig. 4-4); remove companion flange, using Puller J-6295 (Fig. 4-5).

3. Remove oil seal by prying it out of carrier with a blunt tool applied between rim of retainer and front of carrier. CAUTION: Use care to keep dirt, dust, and other matter away from exposed pinion front bearing.

4. Oil lip of new seal and coat outer diameter of seal with Permatex No. 3 or similar compound. Install seal by tapping into place using tool J-5395 (Fig. 4-35).

5. Inspect companion flange. If it is nicked, scratched, burred, or rough so as to damage seal, hone carefully or install new flange following step 6 of companion flange replacement procedure. NOTE: If a new companion flange is installed disregard marked position of step 1. Pinion nut should be tightened until preload is 3 to 4 lbs. in. over original reading noted in step 3 of "Companion Flange Replacement". Nut will turn relatively easy until original position is approached, at which point spacer begins to compress and bearings begin to preload causing sharp increase in effort required to turn nut. Stop turning nut and check preload at this point.

6. If inspection shows original companion flange to be satisfactory, reinstall it and install washer and pinion nut. Tighten nut until it and companion flange are in SAME position noted in step 1 above. NOTE: Nut will turn relatively easy until original position is approached, at which point spacer begins to compress and bearings begin to preload causing sharp increase in effort required to turn nut. Stop turning nut and check position when this point is reached.

7. Connect rear universal joint. Use new lock plates and tighten U-joint to companion flange "U" bolt nuts to 14 to 20 lb. ft. torque. Turn up lock plate ears against flats of "U" bolt nuts.

AXLE SHAFT BEARING OIL SEALS— REMOVE AND REPLACE

1. Remove rear wheel. NOTE: It will be necessary to raise body away from axle housing to provide clearance to remove wheel.

2. Clean away all dirt from area where brake backing plate seats against flanged end of axle housing to prevent any possible entry of dirt into wheel bearing.

3. Remove brake drum.

4. Remove four nuts from bearing outer retainer bolts.

5. Remove axle shaft, using Puller J-942, if necessary (Fig. 4-6). Do not dislodge backing plate or brake pipe may be damaged.

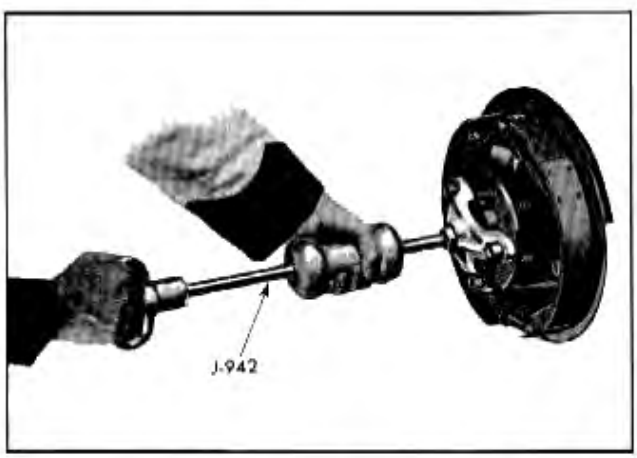


Fig. 4-6 Removing Axle Shaft With Puller J-942

6. Remove rubber "O" ring from outer diameter of bearing race. Use offset screw driver or other similar tool and remove oil seal assembly from axle shaft bearing.

7. Lubricate oil seal assembly and start into bearing assembly with lip side of seal toward bearing. Be sure that seal has started evenly all around. Lubricate rubber "O" ring and install into grove of outer bearing race.

8. Coat recess in axle housing, where bearing seats, with Lubriplate 110; coat gasket surfaces on backing plate and oil deflector with Permatex No. 3 or similar compound.

9. Install axle shaft. If both axle shafts have been removed, shaft with left hand threads on wheel bolts must be on left side of car. Caution should be taken when installing axle shafts not to damage rubber "O" ring seal.

10. Position oil deflector gasket, oil deflector, and outer bearing retainer, and tighten self-locking bearing retainer nuts to 30-45 lb. ft. torque

11. Install brake drum and wheel. NOTE: When installing brake drum, check to see that edge of drum flange is even with shield on the backing plate as shown in Fig. 4-7. If flange extends over shield, install sufficient gaskets between axle flange and drum to obtain correct alignment.

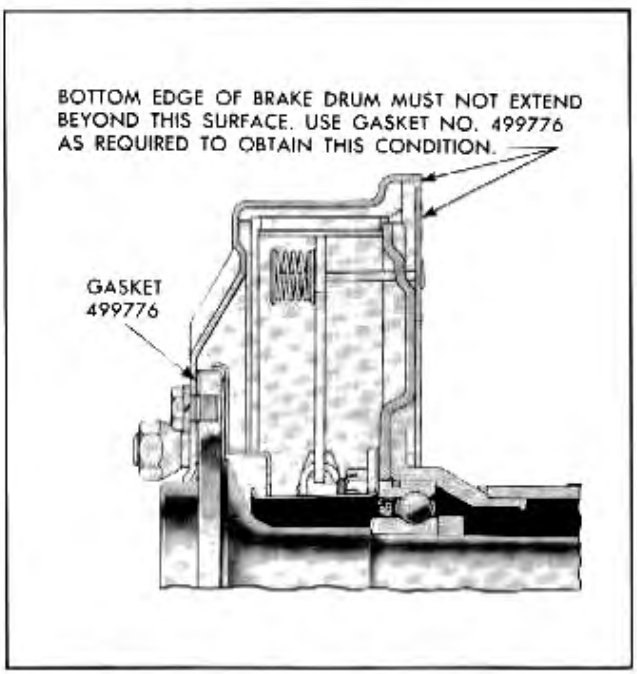


Fig. 4-7 Correct Alignment of Brake Drum Flange

AXLE SHAFT OR SHAFT BEARING— REMOVE AND REPLACE

1. Remove axle shaft as outlined in steps 1 through 5 of preceding procedure.

2. Remove bearing inner retainer ring by carefully cutting it with a cold chisel as shown in (Fig. 4-8). Do not cut into shaft with chisel. It is not necessary to cut entirely through retainer. If a new bearing is to be installed, unserviceable bearing and retainer may be pressed off shaft together. This must not be done if bearing is to be used again because of danger of brinelling bearing.

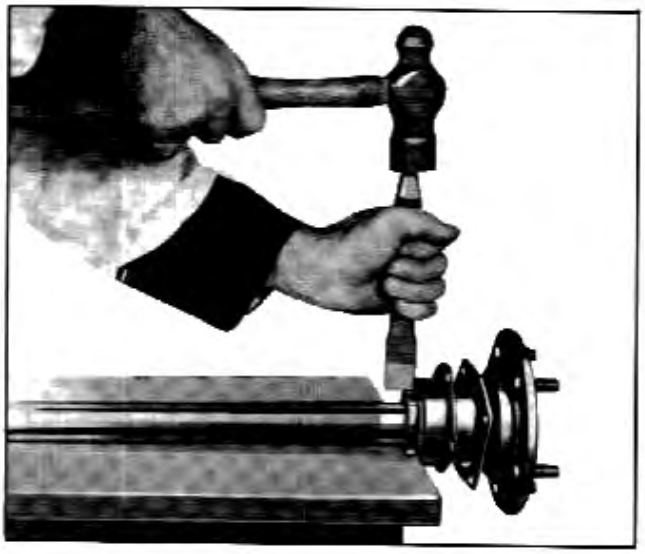


Fig. 4-8 Splitting Bearing Retainer Ring

3. With tool J-947-P engaging outer race of bearing and ring enclosing bearing (Fig. 4-9), press shaft from bearing in arbor press.

4. If removed, install oil deflector and bearing outer retainer plate and gasket on shaft. Install bearing on shaft using tool J-947-P to bear only on inner race and press bearing firmly against shoulder on shaft (Fig. 4-10).

5. Press a new bearing inner retainer ring in place firmly against bearing using tool J-947-P.

6. Install axle shaft as outlined in steps 8 through 10 of preceding procedure.

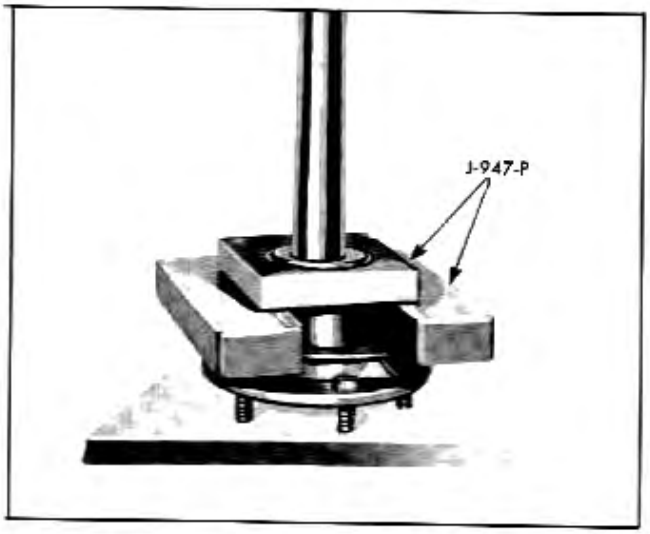


Fig. 4-9 Bearing Replacer Tool J-947-P in Place for Pressing Bearing Off Shaft

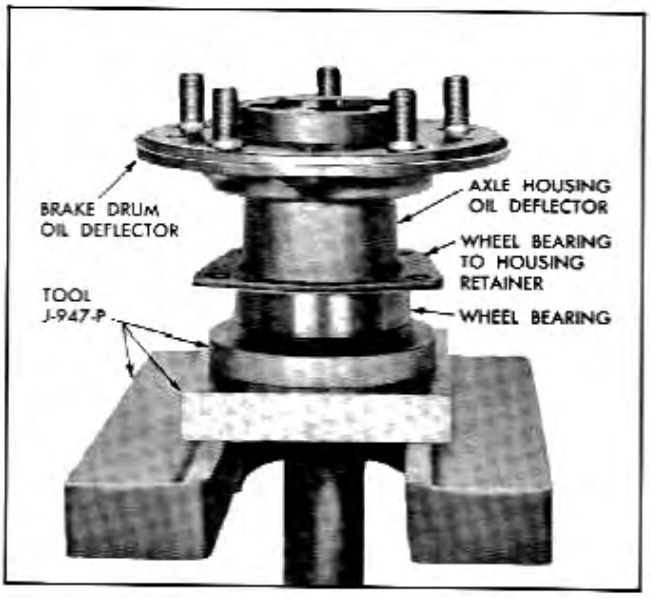


Fig. 4-10 Bearing Remover and Replacer Tool J-947-P in Place for Pressing Bearing on Shaft

REMOVAL OF DIFFERENTIAL

1. Remove axle shafts as instructed in steps 1 through 5 under "Axle Shaft Oil Seal—Remove and Replace," page 4-5.

2. Disconnect propeller shaft as instructed in step 2 under "Companion Flange—Remove and Replace," page 4-3.

3. Thoroughly clean differential carrier and surrounding area of axle housing to avoid dirt entering housing or falling on the gears.

4. Drain oil by loosening all differential attaching nuts and then pulling carrier out about ⅛ inch.

5. Allow oil to drain thoroughly then remove attaching nuts and remove carrier assembly from housing.

MAJOR REPAIR OF DIFFERENTIAL

BEARING FAILURE

Bearings fail by "lapping", "spalling" or "locking".

Lapping. Lapping is caused by fine particles of abrasive material such as scale, sand or emery which are circulated by oil and which cause wearing away of roller and race surfaces. Bearings which are worn loose but remain smooth without spalling or pitting are clear evidence of dirty oil.

Spalling. Spalling failure of bearings is caused by overload or faulty assembly. Bearings which failed by spalling have either flaked or pitted rollers or races. Faulty assembly consists of misalignment or cocking of bearings, or adjustments which are too tight.

Locking. Locking of bearings is caused by large particles of foreign material becoming wedged between rollers and race usually causing one of the races to turn. Preloading of taper roller bearings higher than specified can also cause locking of bearings.

PRE-REPAIR INVESTIGATION

NOTE: A close examination of the differential prior to disassembly will often reveal valuable information as to the extent and type of repairs or adjustments necessary. The information thus gained, coupled with the report of malfunctioning, will provide a basis for determining the degree of disassembly required. Since the frequent causes of axle noise are improper backlash or side bearing preload, or both, a few simple adjustments may be all that is necessary to correct a discrepancy.

Use care at all times to keep dirt and other foreign matter, such as grinder dust, soot, or sand, away from differential to prevent possibility of subsequent failure of differential.

1. Wash interior parts of assembly with cleaning fluid and mount in Carrier Fixture J-6571 (Fig. 4-11).

2. Mark pinion nut and end of pinion with a punch or other suitable means for reference purposes.

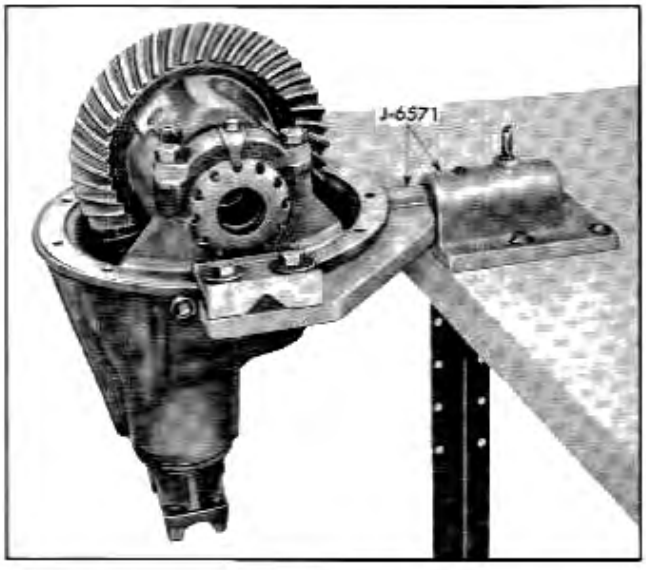


Fig. 4-11 Differential Mounted in Carrier Fixture J-6571

3. Check pinion nut for tightness (pinion bearing preload). If reading is less than 10-12 lb. in. increase preload reading to 10-12 lb. in. See instructions for checking preload and tightening pinion nut on page 4–17.

4. See that ring gear attaching screws are tightened evenly and alternately across the diameter to 55-60 lb. ft. torque.

5. Check ring gear runout using dial indicator on backside of ring gear (Fig. 4-12). Runout should not exceed .002". Excessive runout could be the result of: warped ring gear or mounting flange on case, worn side bearings, misaligned carrier cross-bore, or burrs on case mounting flange or side bearing hubs.

Fig. 4-12 Checking Ring Gear Run-out With KMO-30 Set

6. Examine ring gear and pinion teeth for nicks or scoring. If no scoring is present, the gear and pinion should be checked for evidence of excessive wear. Any of these conditions will require replacement of ring gear and pinion set (page 4–20). Relatively new gears that are noisy due to improper tooth contact, but have not run long enough to damage the original lapped surfaces, can usually have the noise level reduced by correct adjustment to the point where it is not objectionable.

7. Check differential side bearing preload and backlash as described in following procedures.

8. Check ring and pinion gear tooth contact by red lead test as outlined on page 4–11.

DIFFERENTIAL SIDE BEARING PRELOAD ADJUSTMENT

1. Remove adjusting nut locks and mark adjusting nuts for lock location.

2. Loosen each bearing cap bolt, retighten a little more than finger tight, and tap caps lightly to assure freedom of bearings and nuts.

3. Back off right hand adjusting nut using Adjusting Wrench J-972-A (Fig. 4-13) and watch outer race of side bearing to see if it turns with adjusting nut. (NOTE: The right hand adjusting nut is farthest from ring gear.) Race should turn with the nut, as nut is backed off, until nut is turned two to three notches (holes in adjusting nut); count notches from original mark to point where race stops turning to check original adjustment and retighten two to three notches.

4. Check backlash before retightening bearing cap bolts and installing nut locks.

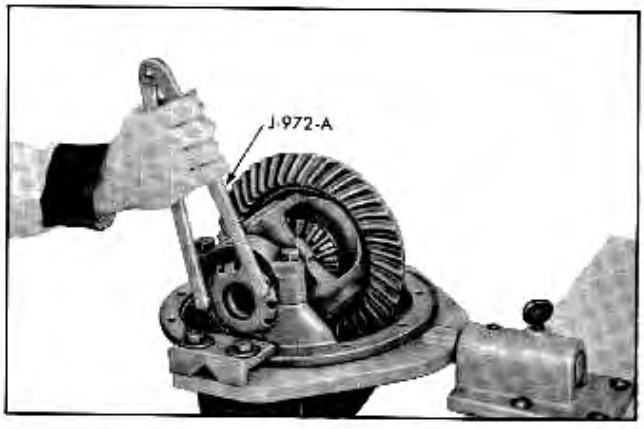


Fig. 4-13 Turning Adjusting Nuts With Wrench J-972-A

ADJUSTMENT OF BACKLASH

NOTE: Location of dial indicator should be at as much of a tangent to ring gear as possible when checking backlash. When rechecking backlash, after an adjustment has been made, indicator should be repositioned as nearly as possible in same position. Backlash readings will vary as much as .003" with various positions of indicator.

1. Check backlash between ring gear and pinion using indicator set KMO-30 (Fig. 4-14). Backlash should be between .003" and .012", checked at two or more equally spaced points around ring gear. If backlash is outside limits, it will be necessary to move gear away from the pinion to increase backlash or toward pinion to decrease it. To change backlash, move adjusting nuts in same direction one notch at a time until correct backlash is obtained; that is if left nut is backed off one notch, the right nut must be tightened one notch.

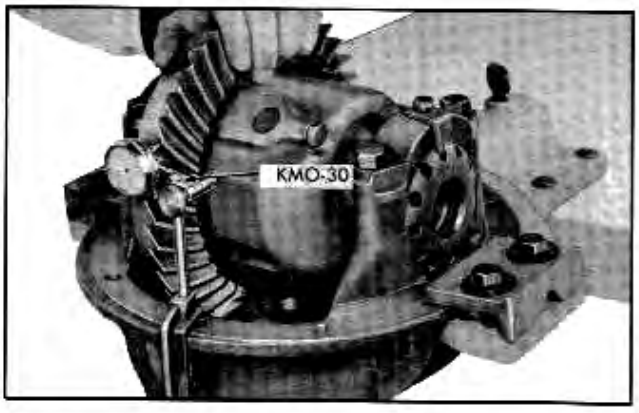


Fig. 4-14 Checking Backlash With Indicator KMO-30 Set

2. Tighten bearing cap bolts to 70-75 lb. ft. torque. Tap bolts with steel hammer while tightening to ensure caps seating properly and a correct torque reading.

GENERAL INFORMATION ON TOOTH CONTACT PATTERN

GEAR TOOTH NOMENCLATURE

Tooth contact pattern is revealed by observing teeth on ring gear after conducting a red lead test (page 4-11). The teeth on the ring gear (and drive pinion) are helically cut, therefore the teeth are curved and larger at one end. The side of the ring gear tooth which curves outward, or is convex, is referred to as the "drive" side; concave side is "coast" side. The end of the tooth nearest center of ring gear is referred to as the "toe" end; end of tooth farthest away from center is "heel" end. Toe end of tooth is smaller than heel end. Nomenclature of ring gear teeth is shown in (Fig. 4-15).

DESIRED TOOTH CONTACT PATTERN

The desired tooth contact pattern (Fig. 4-16) is one which starts near toe end of tooth and extends along toward, but not to heel of tooth. The pattern on coast may be, and usually is nearer top of tooth. This pattern has a large contacting area, centered between top and bottom of tooth, and should result in minimum noise during operation. (All gear trains produce a certain amount of noise.)

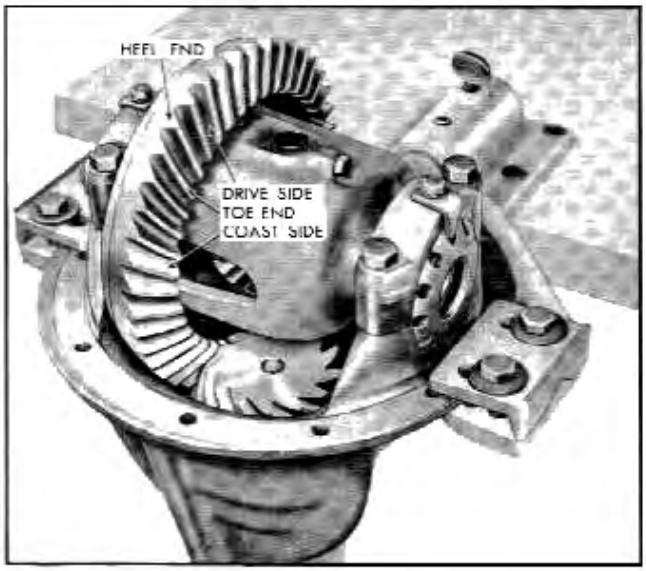


Fig. 4-15 Nomenclature of Ring Gear Teeth

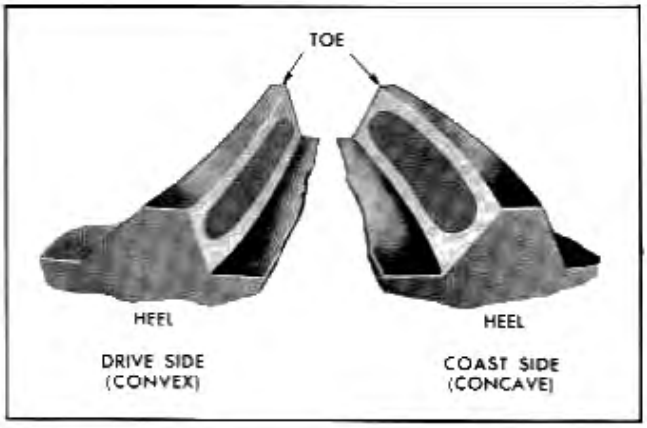


Fig. 4-16 Desired Tooth Contact Pattern

ADJUSTMENTS AFFECTING TOOTH CONTACT

Four adjustments can be made which will affect tooth contact pattern: side bearing preload, drive pinion bearing preload, backlash, and position of drive pinion in carrier. The effects of bearing preloads are not readily apparent on (hand loaded) red lead tests; however, these adjustments should be within specifications before proceding with backlash and drive pinion adjustments.

Backlash is adjusted by means of the side bearing adjusting nuts which move the entire case and ring gear assembly closer to or farther from drive pinion. (The adjusting nuts are also used to set side bearing preload.)

The position of the drive pinion is adjusted by increasing or decreasing the shim pack between the pinion head and inner race of rear bearing. The shim pack is used in the differential to compensate for manufacturing tolerances. Increasing shim pack thickness will move pinion closer to centerline of ring gear (Fig. 4-17). Decreasing shim pack thickness will move pinion farther away from centerline of ring gear.

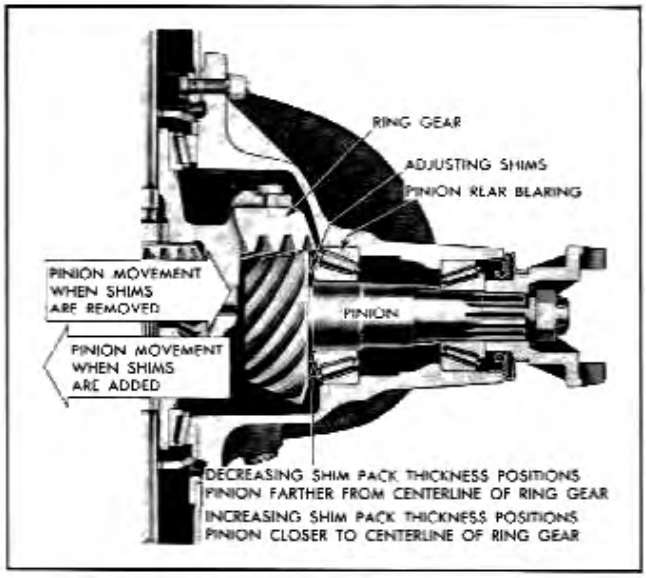


Fig. 4-17 Effects of Shim Pack Thickness on Pinion Position

EFFECTS OF BACKLASH ON TOOTH PATTERN

NOTE: The terms "excess" and "insufficient" refer to settings which are greater than .012" or less than .003" as specified. With respect to tooth contact patterns, "excess" refers to backlash which, although less than .012", is more than necessary to provide desired pattern. Similarly, "insufficient" refers to backlash which, although .003" or more, is less than necessary to provide desired pattern.

Excess backlash, provided pinion is properly positioned, will give a pattern on heel of tooth on both drive and coast sides (Fig. 4-18). Decreasing backlash by moving case and ring gear assembly closer to pinion will cause pattern to move toward toe end of tooth on both drive and coast sides.

Insufficient backlash, provided pinion is properly positioned, will give a pattern on toe of tooth on both drive and coast sides (Fig. 4-19). Increasing backlash will cause pattern to move toward heel end of tooth on both drive and coast sides.

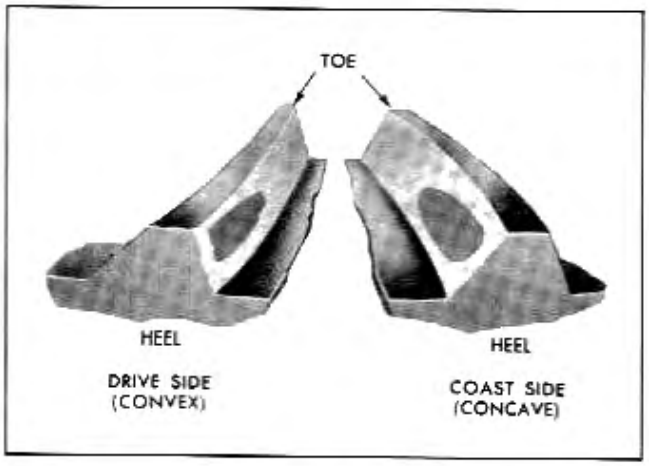


Fig. 4-18 Tooth Pattern When Backlash is Excessive

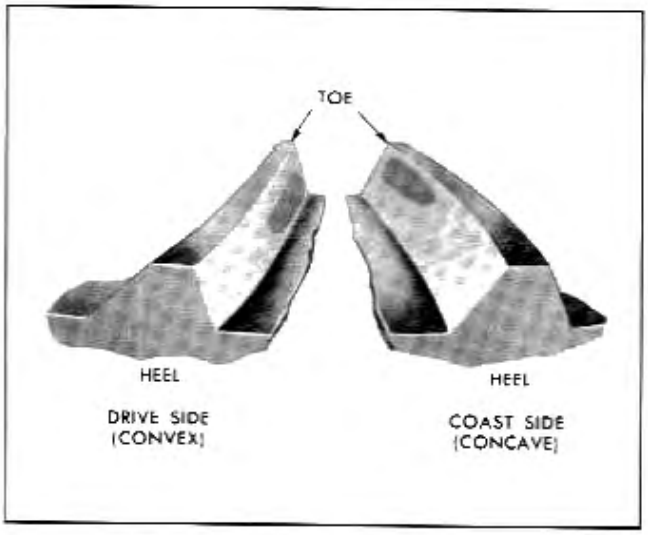


Fig. 4-19 Tooth Pattern When Backlash is Insufficient

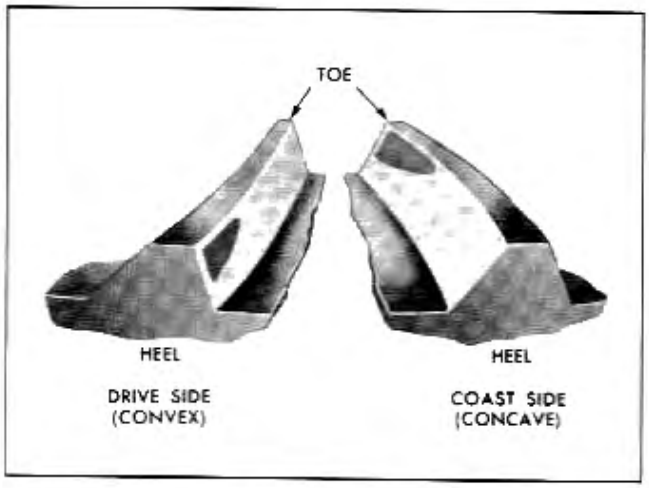


Fig. 4-20 Tooth Pattern When Pinion is Too Far Away From Ring Gear

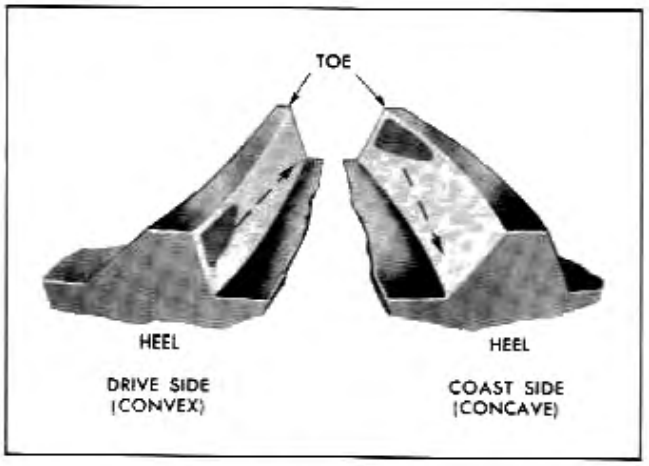


Fig. 4-21 Direction of Movement of Tooth Contacts When Shim Pack Thickness is Increased

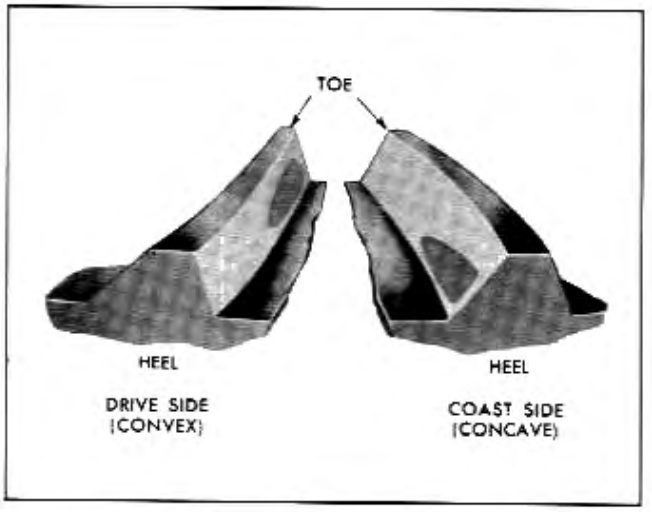


Fig. 4-22 Tooth Pattern When Pinion is Too Close to Ring Gear

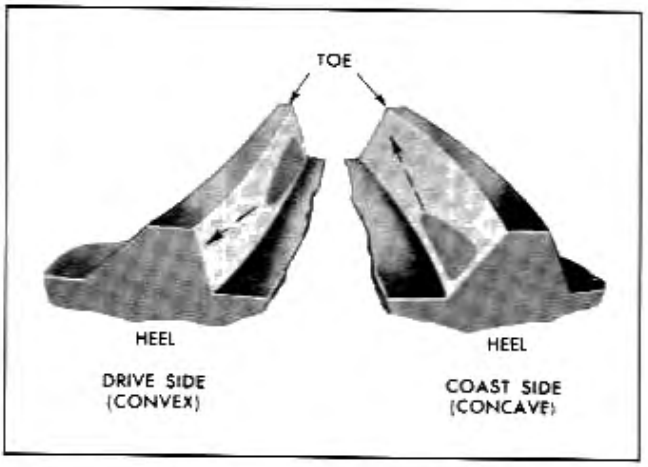


Fig. 4-23 Direction of Movement of Tooth Contacts When Shim Pack Thickness is Decreased

EFFECTS OF PINION POSITION ON TOOTH PATTERN

When drive pinion is too far away from centerline of ring gear, the pattern will be a high heel contact on drive side and a high toe contact on coast side (Fig. 4-20), provided backlash is within specifications of .003" to .012". Moving pinion closer to centerline of ring gear by increasing shim pack thickness will cause the high heel contact on drive side to lower and move toward toe; the high toe contact on coast side will lower and move toward heel (Fig. 4-21).

When pinion is too close to ring gear the pattern will be a low toe contact on drive side, and a low heel contact on coast(Fig. 4-22), provided backlash is within specifications of .003" to .012". Moving pinion farther away from ring gear by decreasing shim pack thickness will cause the low toe contact on drive side to raise and move toward heel; the low heel contact on coast will raise and move toward toe (Fig. 4-23).

EFFECTS OF INCREASING LOAD ON TOOTH CONTACT PATTERN

When "load" on ring and pinion gear is increased, such as when car is accelerated from standstill or from normal drive, the tooth contact will tend to spread out, and under very heavy load will extend from near toe to near heel. The entire contact also tends to shift toward heel under increasingly heavier loads and will become somewhat broader with respect to tops and bottoms of teeth. The patterns obtained by red lead test, dependent upon degree of "loading", approximate a normal light load.

RED LEAD TEST

NOTE: It is very important that tooth contact be tested before differential carrier assembly is disassembled and before it is installed. Allowable variations in the carrier or pinion rear bearing may cause pinion to be too far away from, or close to ring gear even when shimmed according to chart on page 4-21. Thus, tooth contact must be tested and corrected if necessary or the gears may be noisy. To make this test, proceed as follows:

1. Tighten bearing cap bolts to 70-75 lb. ft. torque. NOTE: Tap heads of bolt intermittently while tightening to ensure proper seating of caps and sufficient tightness

2. Remove differential pinion lock screw and washer.

3. Remove differential pinion shaft, pinion gears, side gears, and thrust washers.

4. Install a companion flange shipping cover or improvise a drag on the companion flange.

5. Mix a small amount of powdered red lead with a drop of engine oil and apply the heavy paste to all ring gear teeth using a medium stiff brush. (NOTE: Powdered red lead, available from paint manufacturers and suppliers, has proven the most satisfactory for checking tooth pattern.) A very small quantity of paste should be used. When properly used, area of pinion tooth contact will be visible when hand load is applied.

6. Insert a ¾" diameter bar into pinion shaft holes in differential case. Load gear set by using left hand (protected by a cloth) as a brake on flange shipping cover while right hand is rocking the ring gear back and forth several times with a grip on the bar about 16" from the case (Fig. 4-24). A pattern should be impressed on all ring gear teeth. A test made without loading the gears will not give a satisfactory pattern.

7. Observe pattern on ring gear teeth and compare with Figs. 4-16, -18, -19, -20, and -22.

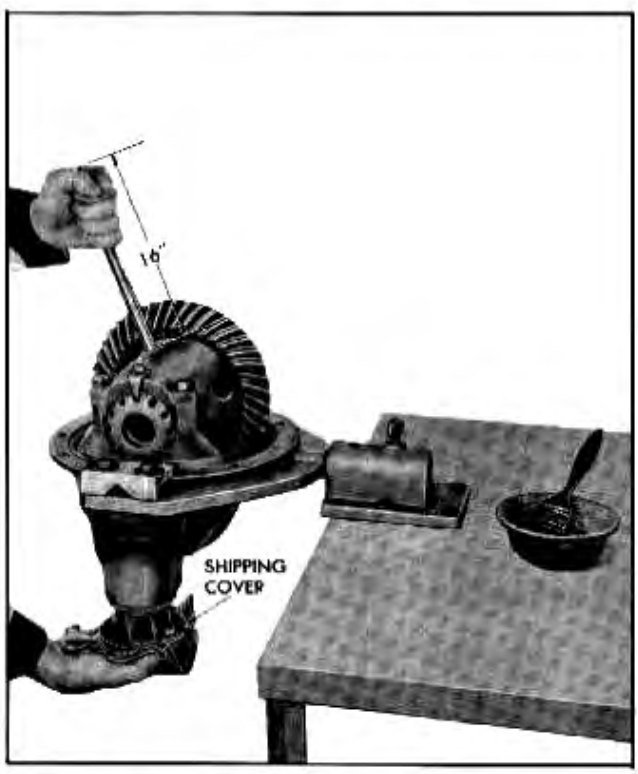


Fig. 4-24 Checking Tooth Contact Pattern—Red Lead Test

ADJUSTING TOOTH CONTACT BY CHANGING BACKLASH

NOTE: In many cases the tooth contact pattern may not look exactly like those illustrated in Figs. 4-16, -18, -19, -20, and -22. In such case, try adjusting backlash to several different values, from minimum to maximum, testing tooth contact after each adjustment. By this means a pattern should be found which will look similar to one of those illustrated in the above figures. Correction can then be made by changing backlash or pinion position as may be required.

If red lead test produces a tooth pattern on heel of tooth, similar to that in Fig. 4-18, backlash is excessive. To correct this condition proceed as follows:

1. Loosen bearing cap bolts and retighten slightly more than finger tight.

2. Back off right hand adjusting nut (Fig. 4-13) one notch and tighten left hand adjusting nut one notch (each notch of adjustment will change backlash .003″-.004″). CAUTION: Do not decrease backlash below minimum specification of .003″. Tap each bearing cap and rock case to ensure proper seating of bearings.

3. Tighten bearing cap bolts to 70-75 lb. ft. torque. NOTE: Tap heads of bolts intermittently while tightening to ensure proper seating of caps and sufficient tightness.

4. Recheck backlash.

5. Recheck tooth contact pattern by red lead test. NOTE: Repaint all teeth with red lead.

6. Repeat adjustments one notch at a time, rechecking pattern by red lead test to determine whether backlash will give correct pattern. CAUTION: Do not reduce backlash below minimum specification of .003″. If backlash adjustment does not give desired pattern, pinion position will have to be adjusted (pages 4–13 and 4–19).

7. If correct contact pattern is obtained, proceed as follows:

a. Examine differential pinions and side gears for scoring, chipping or other signs of wear on teeth, and thrust surfaces and side gear hubs.

b. Inspect pinion shaft for unusual wear. Blackened surfaces are caused by hypoid lubricant and are not harmful.

c. Inspect differential pinion and side gear thrust washers for damage.

d. Inspect differential case for cracks or other damage. See that surfaces which thrust washers bear against are not badly worn or scored. Fit side gears into place in case counterbores to check for excessive radial looseness indicating excessive wear. Wear is also indicated by a ridge at the edge of counterbores which can be felt with fingers when gears are removed. Case must be replaced if counterbores indicate excessive wear (over .006″). See page 4–19 for replacement of case.

e. Install side gears and thrust washers, pinions and thrust washers, pinion shaft, and differential pinion shaft lockscrew and washer. Oil parts with hypoid lubricant before installing.

f. Check tightness of bearing cap bolts (70 to 75 lb. ft. torque).

g. Install adjusting nut locks.

h. Reinstall differential carrier assembly in housing as instructed on page 4–21.

i. Road test for noise appraisal.

CORRECTION FOR INSUFFICIENT BACKLASH

If red lead test produces a tooth pattern on toe of tooth, similar to that in Fig. 4-20, backlash is insufficient. This type of pattern may be the result of carrying adjustment for backlash, described above, too far. Follow preceding procedure (reversing backlash instructions, step 2) to determine if increasing backlash will produce desired pattern. Do not exceed maximum backlash specification of .012″. NOTE: On very high mileage gear sets, where a definite wear pattern has been established, it is permissible to exceed .012″ backlash if so doing will give desired pattern. It is important, however, that backlash not be exceeded except on very high mileage gear sets.

If backlash adjustment does not give desired pattern, pinion position will have to be adjusted (see below). If correct pattern is obtained, proceed with step 7 of preceding procedure.

ADJUSTING TOOTH CONTACT BY CHANGING PINION POSITION

Should differential side bearing preload correction or backlash adjustment fail to give correct tooth contacts or if axle is still too noisy, pinion adjustment by reshimming is necessary. Examine gear tooth con-

tacts after adjusting backlash to best condition (red lead test) and compare with Fig. 4-20 and Fig. 4-22. NOTE: Changing position of drive pinion will cause a change in backlash if case is replaced in same position in carrier crossbore as it was before pinion was shimmed. For example, if backlash is .006" and pinion is shimmed from .010" to .013" and case is replaced in same position in carrier crossbore, backlash will decrease to less than .006". Since there is only one combination of shim thickness and backlash (that is, pinion position and case position) which will give correct pattern, it will be necessary to adjust backlash to several values and check pattern after each adjustment in order to obtain correct pattern or to determine if a different shim thickness is required to obtain correct pattern.

CORRECTION FOR PINION ADJUSTMENT TOO FAR AWAY FROM CENTERLINE OF RING GEAR

If there is insufficient shim thickness between pinion head and bearing race, contact between gear teeth will be similar to that shown in (Fig. 4-20). Note that tooth contact is on heel of drive side and high, and on toe of coast and high. To remedy this condition, proceed as follows:

1. Mark bearing caps and adjusting nuts by some suitable method such as punch marks to distinguish right from left so they can be replaced on correct sides (Fig. 4-25).

2. Loosen bearing cap bolts and back off on left adjusting nut to relieve side bearing preload.

3. Remove bearing caps, adjusting nuts, and case and ring gear assembly. NOTE: Keep side bearing outer races with side bearings so these mating parts can be correctly replaced during build-up.

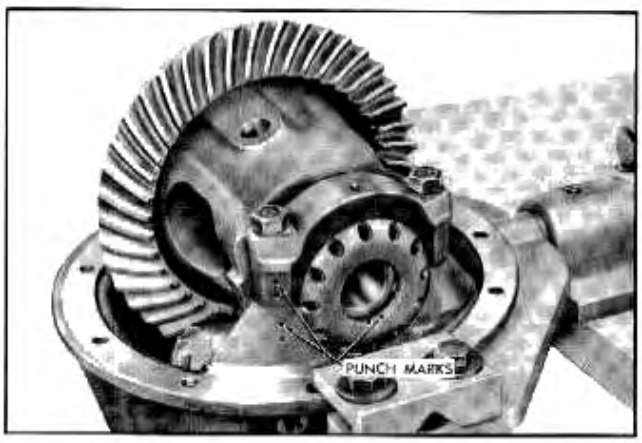


Fig. 4-25 Bearing Cap and Adjusting Nut Marked for Side Location

4. Oil pinion bearings with hypoid lubricant and turn pinion several revolutions. If pinion turns smoothly, a visual inspection of the pinion bearings, after pinion has been removed, will be sufficient. If roughness is detected when turning pinion, pinion bearings should be carefully inspected to determine whether a change is necessary.

5. Remove drive pinion nut and washer using heavy duty socket and Holding Tool J-6289 (Fig. 4-26).

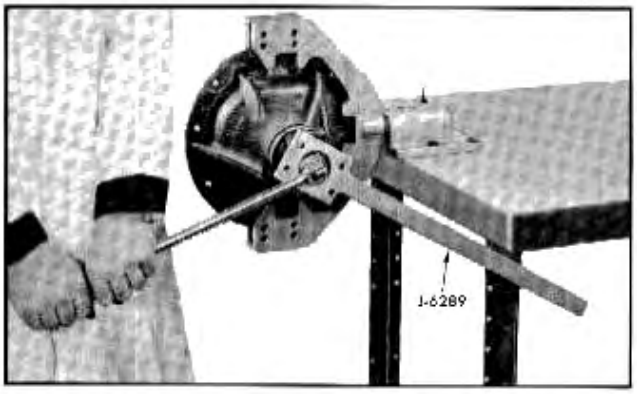


Fig. 4-26 Holding Companion Flange With Holding Tool J-6289

6. Remove companion flange using Puller J-6295 and Holding Tool J-6289 (Fig. 4-27).

7. Carefully remove pinion from carrier so as not to injure threads or oil seal. If pinion stem does not slide freely from front bearing, temporarily reinstall pinion nut and lightly tap pinion out of bearing with a soft faced hammer. If necessary, use an arbor press to press pinion through bearing. (Use washer and nut on pinion stem to keep pinion from dropping.)

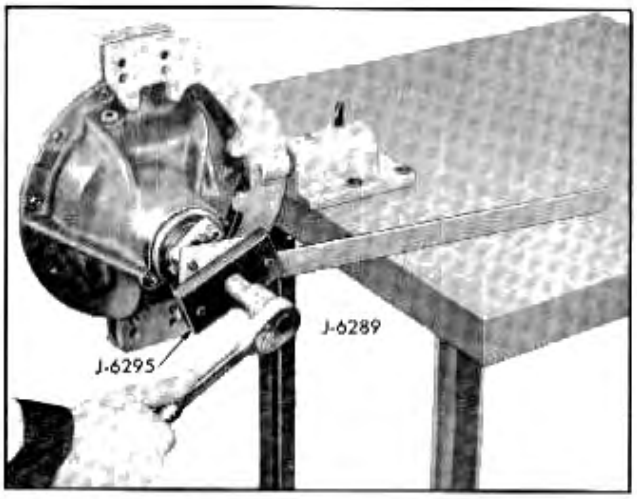


Fig. 4-27 Removing Companion Flange With Puller J-6295

8. Remove spacer and spacer washer, if washer was installed.

9. Remove pinion oil seal from bore in carrier using screw driver applied to rim of retainer.

10. Lift front bearing inner race and roller assembly from carrier.

11. Wash front bearing inner race in cleaning fluid and examine for damaged rollers or pitted inner race. Clean outer race in carrier and examine for failure. Place inner race in outer race and turn while pressing. If bearing turns smoothly and has no visual defects, do not remove outer race from carrier. If bearing is to be replaced, press outer race from carrier using Remover J-6198 and Drive Handle J-8092 (Fig. 4-28).

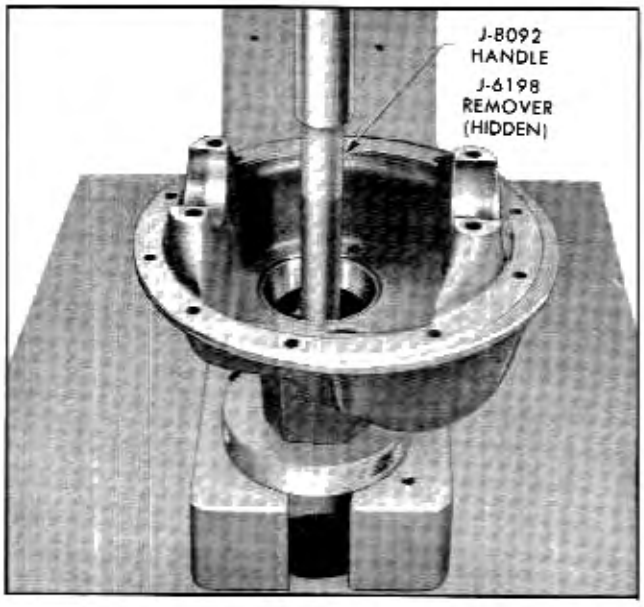


Fig. 4-28 Removing Front Pinion Bearing Outer Race With Remover J-6198 and Drive Handle J-8092

12. Without removing rear bearing from pinion, wash inner race and roller assembly in cleaning fluid and examine for failure. Clean rear bearing outer race and examine visually for failure. Place drive pinion, with rear bearing inner race and roller assembly installed, in outer bearing race in carrier; rotate pinion while pressing on bearing (Fig. 4-29). If bearing turns smoothly and has no visual defects, do not remove outer race from carrier.

13. To remove pinion rear bearing inner race use bearing remover J-6555 and press plate holder J-6407 less insert between bearing and pinion head (Fig. 4-30). Press pinion from bearing. NOTE: Flange sides of press plate should be placed against bearing; concave sides. Remove adjusting shims from pinion.

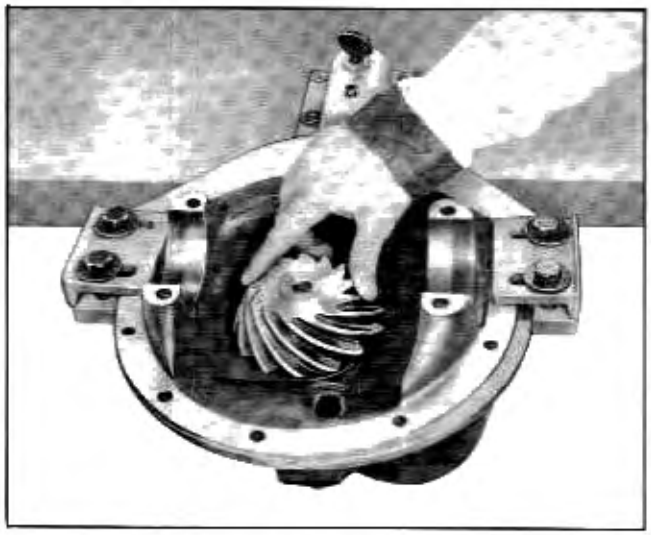


Fig. 4-29 Checking Rear Bearing for Roughness

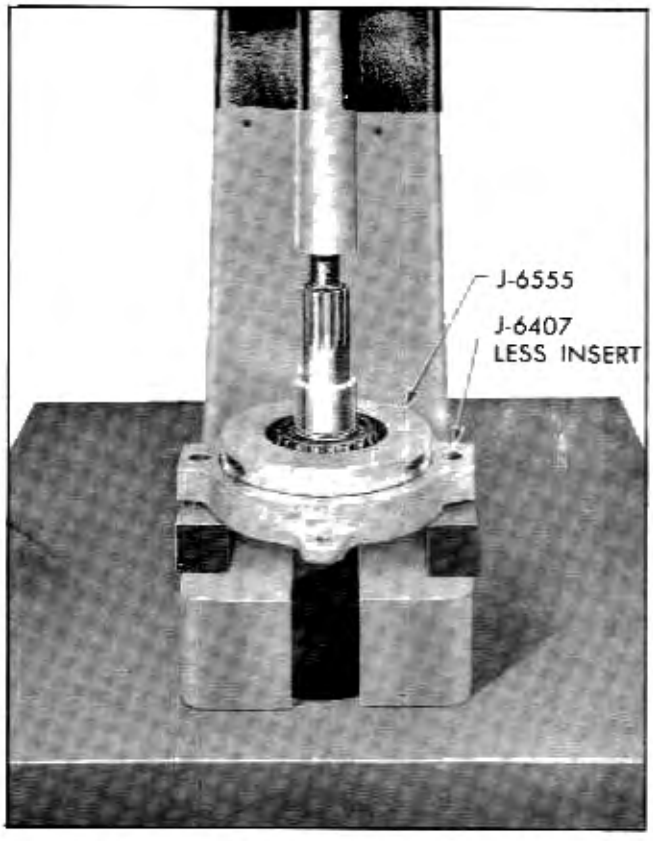


Fig. 4-30 Removing Bearing With Remover J-6555 and Press Plate J-6407 Less Insert

14. If pinion rear bearing is to be replaced, press pinion rear bearing outer race from carrier using Remover J-6533 and drive Handle J-8092 (Fig. 4-31). Use care to prevent race from dropping and causing possible damage to race.

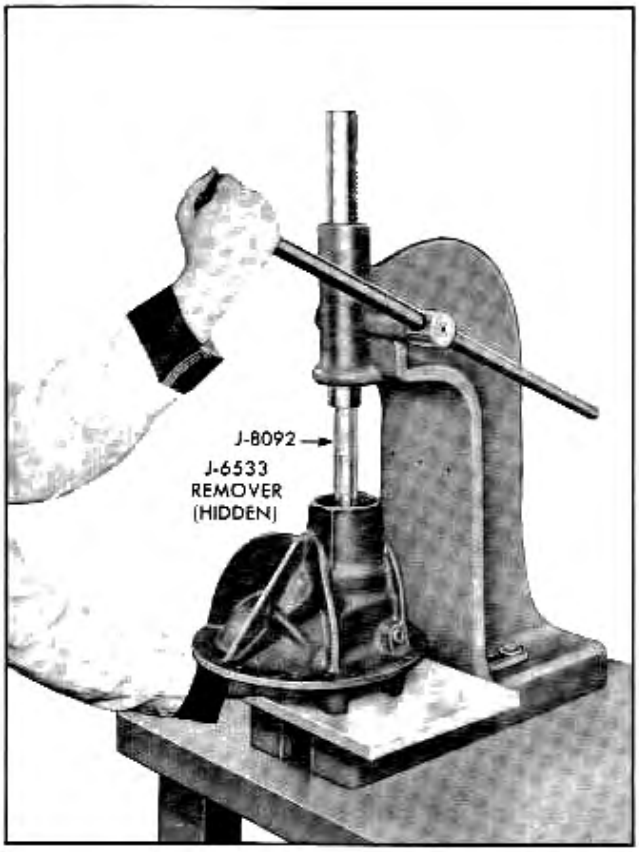


Fig. 4-31 Removing Rear Bearing Outer Race With Remover J-6533 And Drive Handle J-8092

15. Thoroughly clean and inspect carrier. Ensure that oil passages in carrier are clear. Inspect carrier for cracks or other damage. Inspect threads in pedestals and caps to ensure that differential bearing adjusting nuts will turn freely. Carefully inspect pinion bore and shoulder against which pinion bearing race seats to ensure they are free of burrs, nicks, or material which would prevent proper seating of bearing race.

16. If rear bearing outer race was removed, replace by pressing firmly in place against shoulder of carrier using Installer J-6255 and handle J-8092 (Fig. 4-32).

17. If pinion front bearing outer race was removed, press outer race firmly into place against shoulder in carrier using Installer J-6197 (Fig. 4-33).

18. Clean pinion adjusting shims and measure total thickness with micrometer. Increase by adding or exchanging shims to secure .002" to .003" greater total thickness. See Pontiac Master Parts Catalog (Group 5.460) for shims which are available in thicknesses of .004", .005", 006", .007", and .010". Always measure shims being used to determine exact size.

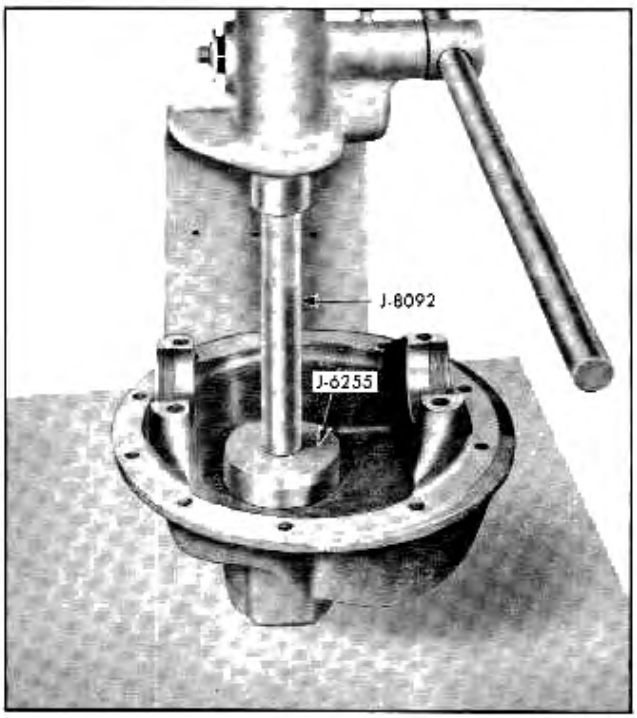


Fig. 4-32 Installing Rear Bearing Outer Race With Installer J-6255 And Drive Handle J-8092

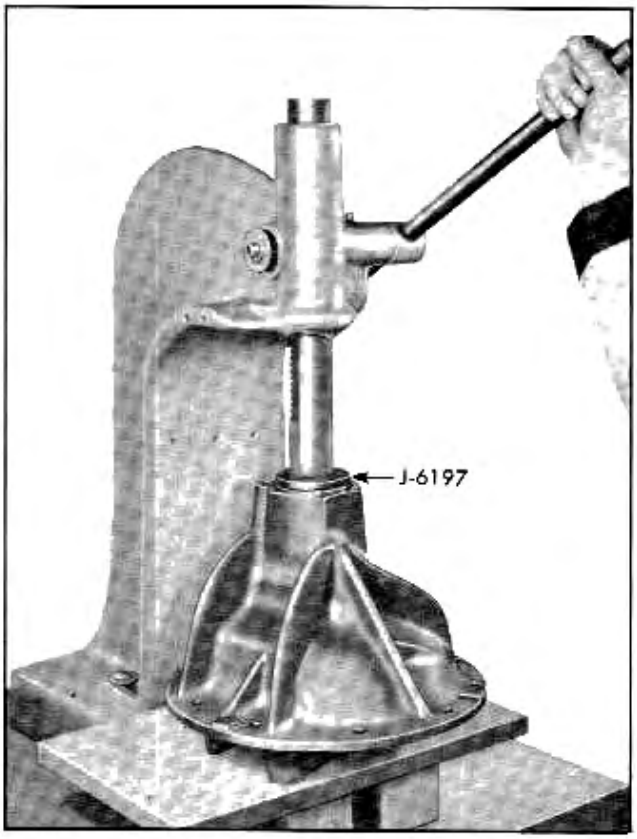


Fig. 4-33 Installing Front Bearing Outer Race With Installer J-6197

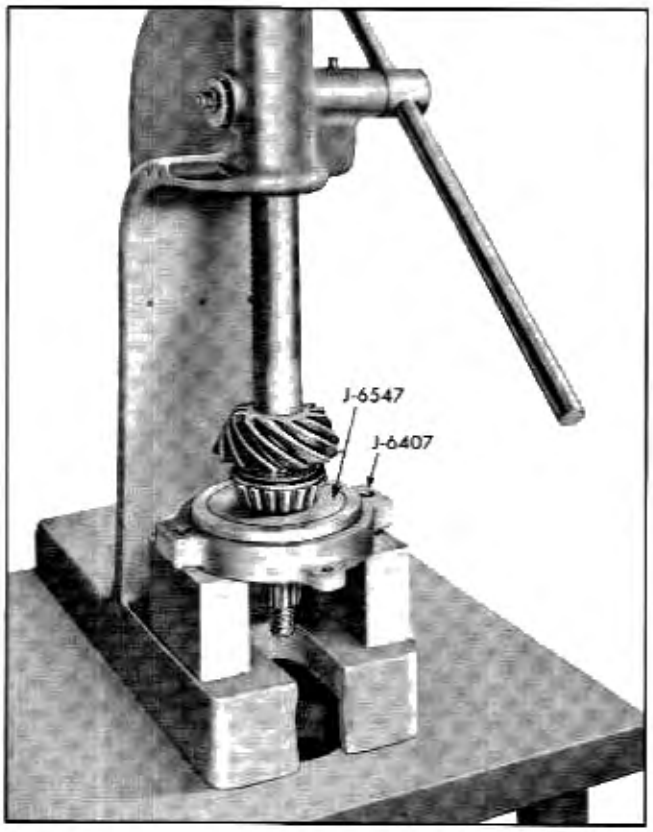


Fig. 4-34 Installing Rear Bearing With Installer J-6547 and Press Plate J-6407

19. Place pinion adjusting shims against pinion head shoulder and press rear bearing inner race against shims using Installer J-6547 and press plate J-6407. (Fig. 4-34).

20. Place new spacer over pinion.

21. Oil rear bearing with hypoid lubricant and position pinion in carrier.

22. Oil pinion front bearing and roller assembly with hypoid lubricant and install on pinion stem. CAUTION: Do not take up all end play of pinion or bearing spacer will not be effective.

23. Inspect pinion oil seal for damage. If seal retainer does not appear bent and lip of seal is not damaged, seal may be reused. Coat outside surface of seal retainer with Permatex No. 3 or similar compound. Install seal by tapping into place using tool J-5395-A against face of seal (Fig. 4-35). NOTE: Placing carrier so pinion is horizontal will reduce possibility of pinion falling out when seal is being tapped into place.

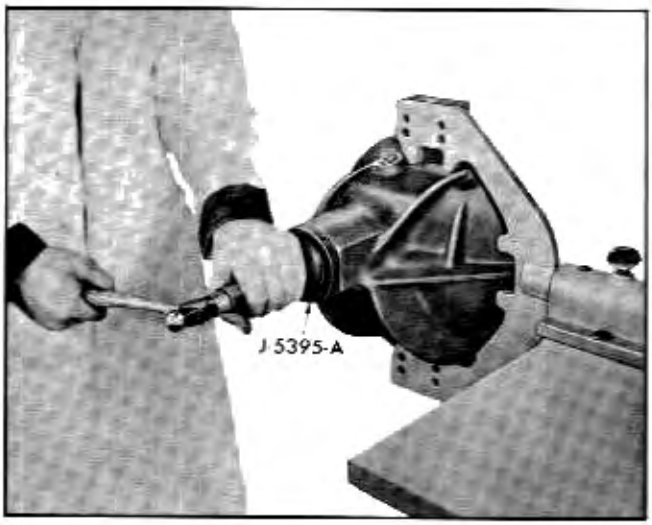


Fig. 4-35 Installing Pinion Oil Seal

24. Examine surface of companion flange for defects which may cause oil leak. Small scratches and nicks will cause leaks and can usually be satisfactorily removed with No. 00 sandpaper or by honing. When new flange is to be installed it should be carefully cleaned and inspected. Oil seal and place flange on pinion spline.

25. Oil threads of pinion nut and face of washer. Install washer and nut.

26. Position assembly as shown in Fig. 4-36 and tighten nut only enough to remove most of end play, using Flange Holding Tool J-6289 and heavy duty socket.

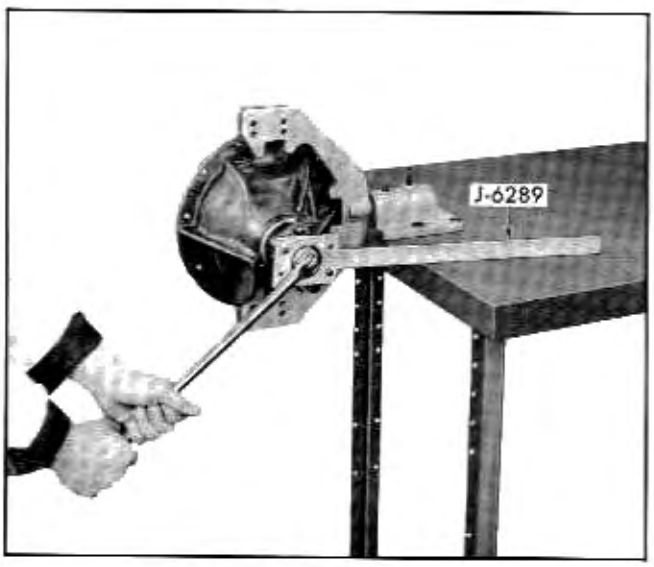


Fig. 4-36 Tightening Drive Pinion Nut

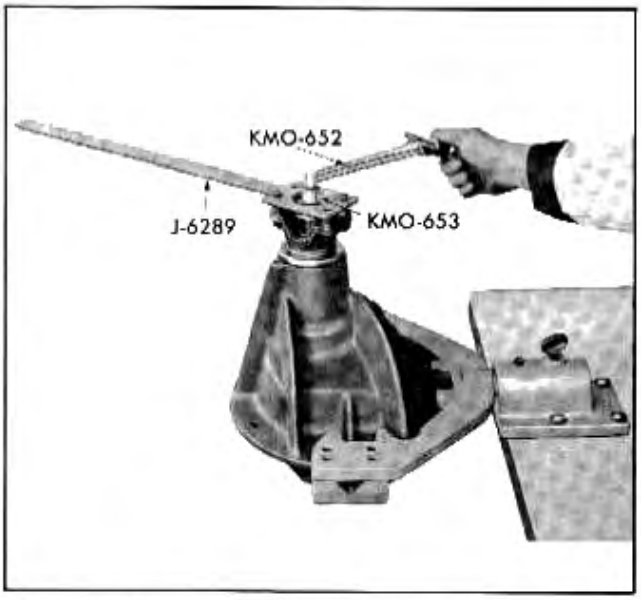


Fig. 4-37 Checking Pinion Bearing Preload With Torque Wrench KMO-652

27. Continue to tighten the nut a little at a time, stopping frequently to turn the pinion several revolutions to seat rollers and to check turning effort with pound-inch Torque Wrench KMO 652 (Fig. 4-37). Repeat until torque required to keep turning is as follows:

Torque	Condition
10-12 lb. inches	Old bearings and old pinion oil seal. (2000 miles or more).
12-15 lb. inches	Old bearings and new pinion oil seal.
22-26 lb. inches	New bearings and old pinion oil seal.
24-32 lb. inches	New bearings and new pinion oil seal.

If torque required to keep pinion turning exceeds maximum of above specifications, it will be necessary to install a new bearing spacer. CAUTION: Extreme care must be used in tightening pinion nut to preload the bearings correctly. Incorrect preload may result in bearing failure. Never back off nut to reduce preload—replace spacer.

NOTE: Torque measurement may be taken using steering gear adjusting spring scale J-544-A hooked to Holding Tool J-6289 at a point 10 inches from pinion shaft center (Fig. 4-38). Reading in pounds times 10 inches will give pound-inches; thus three pounds on spring scale will indicate thirty pound-inches. Readings between pound graduations must be read in tenths rather than in ounces, for example, 3 pounds 8 ounces is read 3.5 pounds or 35 pound-inches.

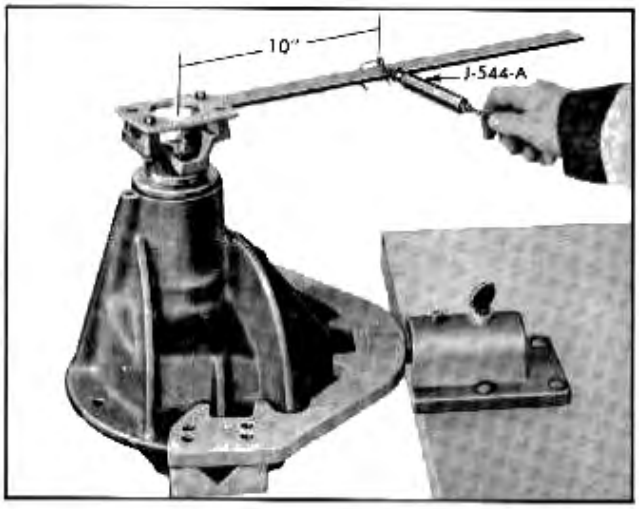


Fig. 4-38 Checking Pinion Bearing Preload With Scale J-544-A

28. Inspect differential side bearings for visible defects on rollers and in outer races. Place outer race onto roller and cone assembly. Apply hand load and turn slowly. If bearing outer race turns smoothly and no visible defects were found, bearing is probably good to reuse. Inspect fit of inner races on case hubs by prying against shoulders at puller recesses. Bearing inner races must be tight on case hubs. If either bearing is loose on case, the case must be replaced (page 4-19).

If bearing inspection indicates that bearing should be replaced, proceed as follows:

a. Remove side bearing from case using Remover J-986-P (Fig. 4-39). Hooks of puller must be placed in recesses in differential case.

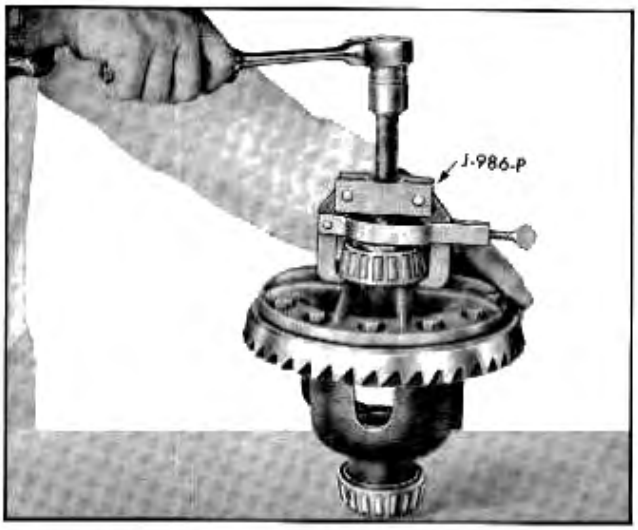


Fig. 4-39 Removing Side Bearing With Puller J-986-P

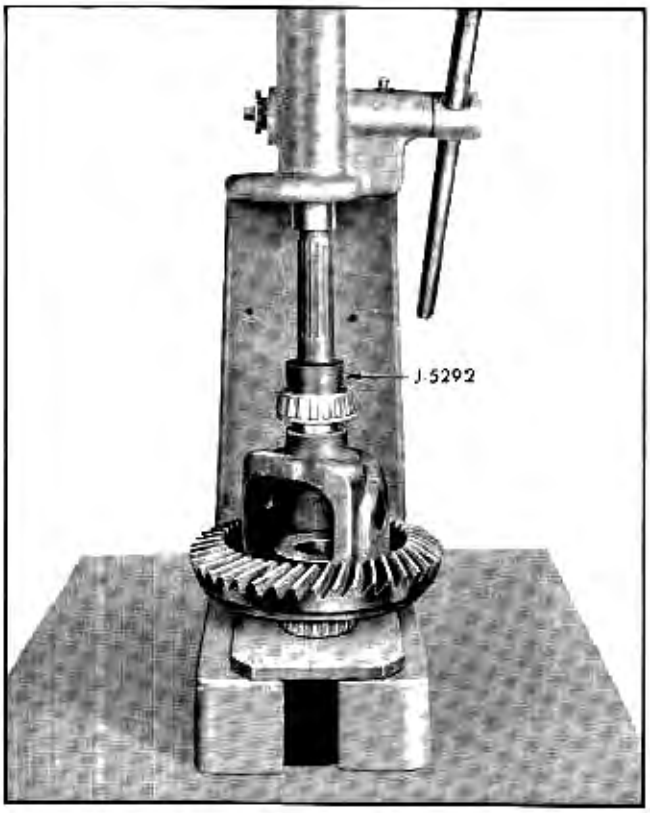


Fig. 4-40 Installing Side Bearings With Installer J-5292

b. Install bearing by pressing or driving inner race onto case using Installer J-5292 (Fig. 4-40). Press only on inner race of bearing or bearing will be damaged.

Support other side bearing by inner race by means of a front wheel bearing outer race or other suitable means. NOTE: Inner race must be press fit on hub. If not, try a new bearing and if still loose install new case (page 4–19).

29. Wipe oil off drive pinion teeth to prevent red lead from "running" during red lead test. Clean and inspect machined surfaces of pedestal; apply thin film of oil to surfaces.

30. Hold outer races squarely on side bearing rollers, install case and ring gear assembly in carrier, positioning ring gear against pinion.

31. Place adjusting nuts (on correct sides as indicated by marks) into threads of pedestals and squarely against outer races.

32. Install bearing caps and cap screws making certain that threads in caps match those in adjusting nuts. Tighten cap screws slightly more than finger tight.

33. Adjust side bearing preload as follows:

a. Tighten right adjusting nut, backing off left nut if necessary, to bring adjusting nuts in full contact with outer races and to provide a slight amount of backlash. When turning nuts keep nuts in contact with races to maintain a slight amount of preload on side bearings.

b. Tighten left nut, backing off on right nut, if necessary, but keeping nuts against races to maintain preload while rocking case until backlash has just been eliminated. If left nut is not in a locking position when backlash has been eliminated, back off to nearest locking position.

c. Back off right nut to ensure that nut and outer race do not turn together. Retighten right nut until outer race just starts to turn with nut; mark this point on adjusting nut.

d. Tighten right nut one notch, tap each bearing cap, and rock ring gear for backlash check.

34. Repeat above step until right nut has been tightened a total of two to three notches to properly seat bearings and correctly preload bearings.

35. Check backlash as described on page 4–8.

36. Tighten bearing cap bolts to 70-75 lb. ft. torque. Tap each bearing cap several times with hammer while tightening to ensure proper seating of caps.

37. Check tooth contact pattern by performing red lead test (page 4–11). Adjust backlash to several different values to obtain correct pattern and to determine whether further shimming is necessary. If additional shimming is necessary, repeat foregoing steps, as may apply, to increase or decrease shim pack thickness.

38. When proper tooth contact pattern has been obtained, install adjusting nut locks, install differential side gears and pinions with thrust washers after oiling with hypoid lubricant, differential pinion shaft and install pinion shaft lock screw and washer.

39. Install differential carrier assembly in housing as instructed on page 4–21 and road test for gear noise.

CORRECTION FOR PINION ADJUSTMENT TOO CLOSE TO CENTERLINE OF RING GEAR

If there is too much shim thickness back of pinion rear bearing outer race, contact between gear teeth will be similar to that shown in (Fig. 4-22). Note that tooth contact is low on toe of drive side and low on heel of coast side. To remedy this condition follow the procedure on Page 4-13, "Correction For Pinion Adjustment Too Far Away From Centerline of Ring Gear," except that shim thickness should be reduced .002" to .003" at a time to obtain correct pattern.

DIFFERENTIAL CASE— REMOVE AND REPLACE

NOTE: Two cases are serviced. The gear ratio determines which should be used. Refer to Pontiac Master Parts Catalog, Group 5.510.

1. If not previously done, mark right and left bearing caps and adjusting nuts (Fig. 4-25); remove adjusting nut locks.

2. Loosen bearing cap bolts and back off on left adjusting nut to relieve side bearing preload.

3. Remove bearing caps and adjusting nuts; remove case and ring gear assembly. NOTE: Keep side bearing outer races with side bearings so these mating parts can be correctly replaced during build-up.

4. Remove side bearings using Puller J-986-P (Fig. 4-39). CAUTION: Be sure end of puller arms are in recesses in sides of hub and fully against inner race of bearing.

5. Remove pinion shaft lock screw and washer.

6. Drive pinion shaft out of case.

7. Remove differential pinion, side gears, and thrust washers.

8. Remove ring gear. NOTE: If case is clamped in vise (Fig. 4-41), it should be positioned so jaws of vise are at 90° to pinion shaft holes.

9. Thoroughly clean new case in suitable cleaning solvent.

10. Inspect case, paying particular attention to ring gear mounting flange, ring gear pilot, and side bearing hubs. Remove nicks or burs with mill file (Fig. 4-42).

11. Inspect side gears, pinions, thrust washers and pinion shaft for excessive wear. Check fit of side gears in counterbores of case. If excessive radial looseness (.006" or more) is evident, it will be necessary to replace side gear or case. Replace parts as necessary, coat with hypoid lubricant, and install in case.

Fig. 4-41 Removing Ring Gear From Case

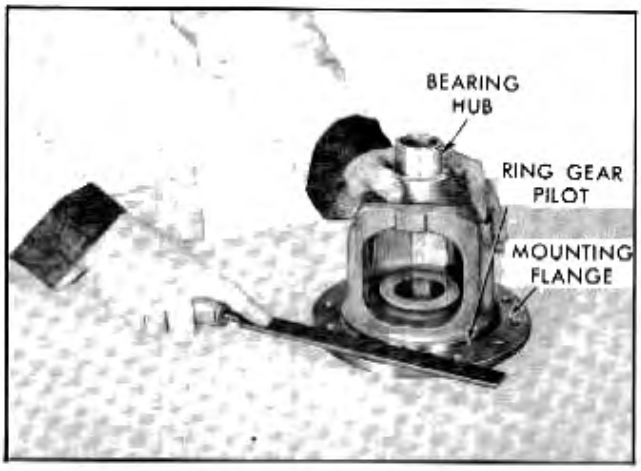


Fig. 4-42 Removing Burrs and Nicks From Mounting Flange

12. Clean ring gear. Inspect back of ring gear for any adhering material which may affect runout.

13. Position ring gear on case and check fit of gear on flange and pilot. CAUTION: Do not use hammer to force ring gear on case.

14. Install ring gear attaching bolts. Tighten all bolts evenly to 55-60 lb. ft. torque. NOTE: Tighten screws finger tight, then tighten evenly and alternately across the diameter in progressive stages of tightness until final torque is reached.

15. Visually inspect side bearings for wear and replace if necessary. Install inner race and roller assemblies on hubs using Installer J-5292 (Fig. 4-40). After bearing has been installed on one side, it should be supported by the inner race by some suitable means such as an outer race from a front wheel bearing, when bearing on other side is being installed. NOTE: After bearings have been installed, inspect fit of inner races on case hubs by prying against shoulders at puller recesses. Bearing inner races must be tight on case hubs; if loose, replace with new bearing or, if necessary, new case.

16. Install case and ring gear assembly as outlined in steps 30-39, page 4–18 and check runout of ring gear.

17. Align hole in pinion shaft with similar hole in case.

18. Drive pinion shaft into case with differential pinions and side gears assembled.

19. With hole in pinion shaft indexed with hole in case, install pinion shaft lock screw and washer.

RING GEAR AND PINION SET OR CARRIER—REMOVE AND REPLACE

NOTE: Ring gear and pinion sets are matched in sets at the factory and are serviced only in sets. Never attempt to replace either a ring gear or pinion without its mating member. Use lubricant supplied with new gear set. Failure to do so may result in gear failure. Differential parts are given a heavy coating of protective compound before packaging. Thoroughly clean off coating before using parts.

1. Disassemble differential following procedure on page 4–13 under "Correction For Pinion Adjustment Too Far Away From Ring Gear," steps 1 through 15, as may apply.

2. If gear set is being replaced follow steps 8, 12, 13, and 14 under "Differential Case – Remove and Replace," page 4–19.

3. If carrier is being replaced, thoroughly clean and inspect new carrier, paying particular attention to machined surfaces in bearing caps and pedestals. Remove burrs with curved mill file and stone. Ensure that caps seat squarely on pedestals; use mill file lightly to remove nicks and burrs.

4. When replacing either gear set or carrier, refer to pinion and carrier markings (Fig. 4-43) and chart (Fig. 4-44) for correct shims to be installed. Differential carriers are marked on the face of the flange (Fig. 4-43) to indicate the number of thousandths "deep" (D) or "shallow" (S) the shoulder for the rear bearing outer race happens to be. Carriers marked "D" require more shims than those marked "O" or "S". The pinion is marked on the end with a number indicating thousandths in shims from basic setting to put it in correct position with "O" carrier. Pinions which are not marked are "O" or basic. Thus, a pinion marked +2 would require a .002" additional shim thickness for an "O" carrier. NOTE: Letters and symbols are also stamped on pinions during inspection at the factory. Do not mistake inspector's marks for numbers which indicate pinion variations from standard size.

To use shim chart (Fig. 4-44) read marking on pinion and carrier (Fig. 4-43). In the table, read to the right from the carrier marking and down from the pinion marking; the intersection of the carrier line and the pinion column shows the correct total shim thickness to be used. As an example; with markings of S-2 and +1, the correct shim thickness is .015" while the S-2 and −2 markings shown would be .012".

See Pontiac Master Parts Catalog (Group 5.460) for shims available in thicknesses of .004", .005", .006", .007" and .010". Always measure total shims being used to ensure correct thickness. This method of determining shims thickness (and setting of correct backlash) must be checked by red lead test (page 4–11) and corrected when proper tooth contacts are not obtained.

5. Assemble differential following procedure on page 4–13 under "Correction For Pinion Adjustment Too Far Away From Ring Gear," steps 16 through 39, as may apply. NOTE: Tooth contact must be checked by red lead test (page 4–11) before installing differential in car.

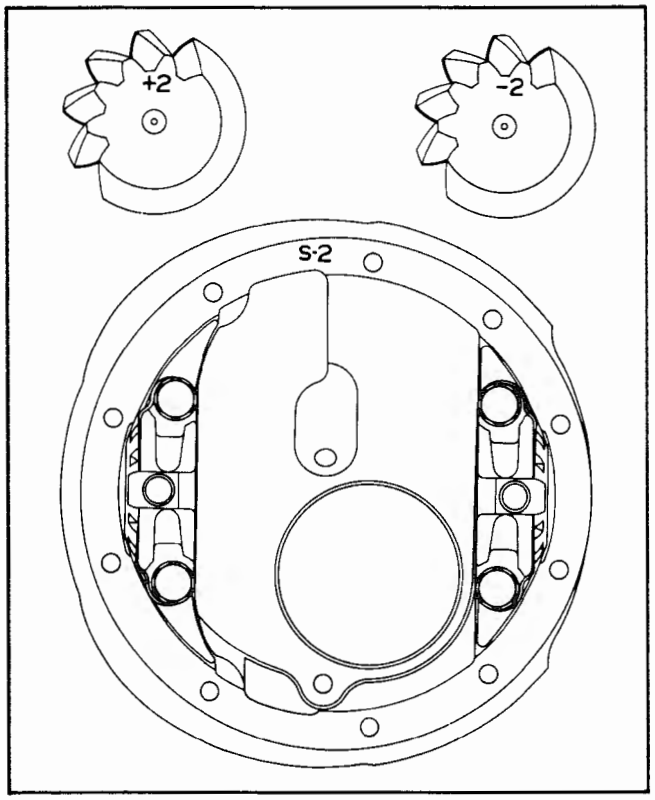


Fig. 4-43 Differential Carrier and Drive Pinion Depth Markings

SERVICE SHIM SELECTION CHART

524014-.004 SHIM—PLAIN
524015-.005 SHIM—BLUE
524016-.006 SHIM—COPPER
524017-.007 SHIM—PLAIN
524020-.010 SHIM—PLAIN

Use these shims in combinations to get required thickness as shown below.

Diff. Carrier Depth Marking	PINION MARKING								
	MINUS					PLUS			
MARK	—4	—3	—2	—1	0*	+1	+2	+3	+4
S-5	.007	.008	.009	.010	.011	.012	.013	.014	.015
S-4	.008	.009	.010	.011	.012	.013	.014	.015	.016
S-3	.009	.010	.011	.012	.013	.014	.015	.016	.017
S-2	.010	.011	.012	.013	.014	.015	.016	.017	.018
S-1	.011	.012	.013	.014	.015	.016	.017	.018	.019
0	.012	.013	.014	.015	.016	.017	.018	.019	.020
D-1	.013	.014	.015	.016	.017	.018	.019	.020	.021
D-2	.014	.015	.016	.017	.018	.019	.020	.021	.022
D-3	.015	.016	.017	.018	.019	.020	.021	.022	.023
D-4	.016	.017	.018	.019	.020	.021	.022	.023	.024
D-5	.017	.018	.019	.020	.021	.022	.023	.024	.025

*No Mark

Fig. 4-44 Differential Drive Pinion Shim Chart

INSTALLATION OF DIFFERENTIAL

1. Thoroughly wash interior of axle housing with cleaning fluid. Clean surface of housing contacting carrier gasket and install new gasket.

2. Install carrier over attaching bolts in housing and tighten attaching nuts with 45 to 60 lb. ft. torque.

3. Install axle shafts, rear axle bearing retainers, brake drums and wheels as instructed in steps 7–11 on page 4–5.

4. Connect rear universal joint to companion flange, using new lock plates. Tighten nuts to 14 to 20 lb. ft. torque. Ensure that ears of lock plate are bent up against flat side of nuts.

5. Fill axle housing to filler plug level with recommended hypoid lubricant. NOTE: Use lubricant supplied with new gear set if these parts were replaced.

6. Road test for noise appraisal.

TROUBLE DIAGNOSIS AND TESTING—DIFFERENTIAL

Many noises reported as coming from the differential actually result from other sources such as tires on certain road surfaces, body drumming, muffler roar, transmission rear bearing, wheel bearing, Hydra-Matic transmission rear oil pump, engine fan, intake silencer, etc. A careful check should be made to ensure that noise is in the differential before disassembling. It should be remembered that rear axle gears, like any other mechanical device, are not absolutely quiet and should be accepted as being commercially quiet unless some abnormal noise is present.

To make a systematic check for axle noise under standard conditions observe the following:

a. Select a level tarvia or asphalt road to reduce tire noise and body drumming.

b. Drive car far enough to thoroughly warm up rear axle lubricant.

c. If noise is present, note speed at which it occurs. With car standing and clutch disengaged, or Hydra-Matic in neutral, accelerate engine to approximate speed where noise was noticed to determine if it is caused by exhaust or muffler roar or other engine condition. Repeat while engaging and disengaging clutch, transmission in neutral, to see if noise is in transmission. (Transmission rear bearing noise can be isolated only by removing propeller shaft and

operating transmission in "high".) See Hydra-Matic Transmission Manual on distinguishing between Hydra-Matic transmission and axle noises.

d. Distinguish between tire noise and differential noise by noting if noise varies with various speeds, sudden acceleration and deceleration; exhaust and axle noise show variations under these conditions while tire noise remains constant and is more pronounced at speeds of 20 to 30 miles per hour. Further check for tire noise by driving car over smooth pavements or dirt roads (not gravel) with tires at normal pressure. If noise is caused by tires, it will noticeably change or disappear and reappear with changes in road surface.

e. Rear spring rubber bushings dampen out rear axle noise when correctly installed. Check to see that no metallic contact exists between the springs and brackets or shackles. Metal to metal contact at those points may result in "telegraphing" of road noise and normal axle noise which would not be objectionable if dampened by bushings. NOTE: It is important that a check also be made to ensure that the floor of body is not in metallic contact with frame.

AXLE NOISE

1. GEAR NOISE

After the noise has been determined as being in the axle by following the above appraisal procedure, the type of axle noise should be determined to aid in making repairs if necessary.

Gear noise, whine, is audible from 20 to 65 MPH under four driving conditions:

a. Acceleration or heavy pull.

b. Car driving load or constant speed.

c. Float—using enough throttle to keep the car from driving the engine—car slows down gradually but engine still pulls slightly.

d. Coast—throttle closed and car in gear.

Gear noise most frequently has periods where noise is more prominent, usually 30 to 40 MPH and 50 to 60 MPH.

When objectionable axle noise is encountered, the driving condition and speed range should be noted and then differential removed for a red lead check following procedure on page 4-11. Shim and adjust to obtain best possible tooth pattern. If noise still persists, replace gear set.

2. BEARING NOISE

Bad bearings generally produce more of a rough growl or grating sound rather than the whine typical of gear noise. Bearing noise frequently "wow-wow's" at bearing RPM which indicates a pinion or differential side bearing. NOTE: This noise could easily be confused with rear wheel bearing noise. Inspect and replace as required. A preponderance of axle noise is gears rather than bearings.

3. KNOCK AT LOW SPEEDS

Low speed knock can be caused by worn and brinelled universal joints or a side gear hub counterbore in case worn oversize. Inspect and replace universal joint or case and side gear as required.

4. DRIVE-LINE SNAP

A snap on sudden start either forward or reverse may be caused by loose companion flange. Remove flange, turn 180° apply white lead and oil to spline and reinstall. Pinion nut must be tightened to original position following procedure on page 4–3.

5. BACKLASH CLUNK

Excessive clunk with acceleration and deceleration is caused by worn differential pinion shaft, excessive clearance between axle shaft and side gear splines, worn pinion and side gear teeth, worn thrust washers and excessive drive pinion and ring gear backlash. Remove worn parts and replace as required selecting close fitting parts when possible. Adjust pinion and ring gear backlash following procedure on page 4–8.

6. DRIVE-LINE SQUEAL AND SQUEAK

Squeals and squeaks are audible only at low speeds, seldom over 20 MPH. A continuous squeal is from the pinion oil seal and an intermittent squeak is caused by dry cork washer in the universal joint. Seal squeaks frequently correct themselves but replace persistent squealing seal following procedure on page 4–4. Universal joint cork washers should be replaced and lubricated following procedure on page 4–25.

PROPELLER SHAFT—DESCRIPTION

The propeller shaft is of tubular construction with a needle bearing universal joint at each end. The bearings assemblies in the yoke members are retained by snap rings. The propeller shaft is shortened to accommodate design requirements. A "U" bolt type clamp and locking plate is used to attach the universal joint to the companion flange. The front joint attaches to the output shaft of the transmission by means of a splined yoke which permits fore and aft movement of the propeller shaft when rear axle assembly moves up and down. This splined connection is lubricated from the transmission. An oil seal pressed into the transmission rear bearing retainer protects it from dust and loss of lubricant. On Synchro-Mesh and Strato-Flight equipped cars the front yoke is carried by a bushing in the transmission rear extension housing. Additional protection of the spline and seal is provided on Synchro-Mesh cars by a splash shield which extends back from the transmission a short distance.

PERIODIC SERVICE

Universal joints should be lubricated every 25,000 miles. To lubricate joints they must be completely disassembled and packed with high melting point wheel bearing lubricant.

REMOVAL OF PROPELLER SHAFT

1. Remove "U" bolt nuts, locking plate and "U" bolts. Use a heavy rubber band to hold bearings onto journal if tie wire has been removed to prevent loss of needle bearings when rear joint is disconnected (Fig. 4-45).

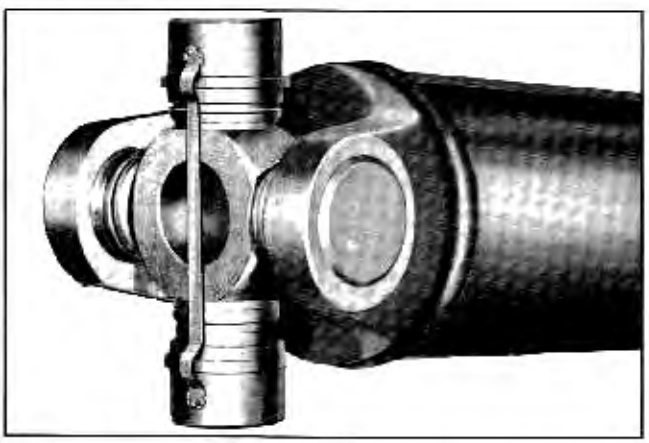


Fig. 4-45 Bearings Held in Place by Tie Wire

2. Remove propeller shaft by sliding shaft rearward to disengage front yoke from transmission output shaft.

DISASSEMBLY OF PROPELLER SHAFT

NOTE: When removing bearings from universal joint yokes, use extreme care so as not to lose needle rollers from bearings.

FRONT UNIVERSAL JOINT—DISASSEMBLE

1. Remove snap ring from yoke members by using screw driver or similar tool.

2. Remove bearings from splined yoke member as follows:

a. Lay or clamp end of shaft in vise so fixed yoke member welded to tube bears against vise. (Do not lay or clamp tubular member in vise.) Shaft should be horizontal and splined yoke member must be free to move vertically between jaws of vise.

b. Using a piece of pipe or similar tool with diameter sufficiently large to encircle bearing (slightly larger than 1⅛ inch), apply force on yoke around bearing (Fig. 4-46). This will drive yoke down causing journal assembly (spider) to force bearing partially out of yoke.

Fig. 4-46 Removing Bearing From Splined Yoke Member

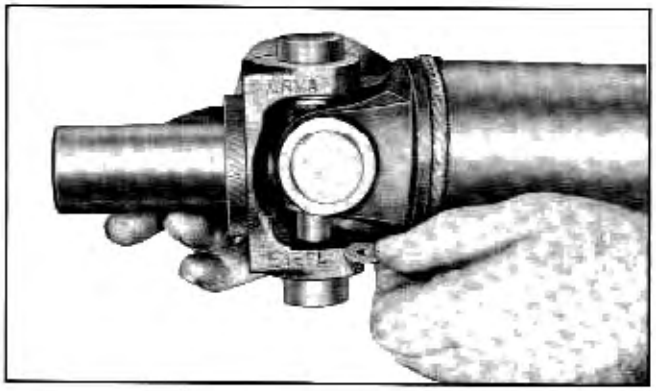


Fig. 4-47 Placing Washers Inside Bearing of Splined Yoke Member

c. Rotate shaft 180° and repeat above step to partially remove opposite bearing.

d. With yoke down as far as possible, place one or more flat washers (9/16" O.D.) inside lower bearing (Fig. 4-47). NOTE: Total thickness of washers should be 1/8" - 3/16".

e. Rotate shaft 180° and again apply force around bearing in which washers were installed. This will completely remove bearing from yoke.

f. Remove splined yoke member from journal.

g. Remove remaining bearing from splined yoke member using brass drift.

3. Remove bearings and journal (spider) from yoke member which is welded to tubular shaft as follows:

a. With yoke member clamped or supported in vise, drive bearing out as far as possible using drift applied to center part of journal (Fig. 4-48).

b. Rotate shaft 180° and drive opposite bearing out as far as possible using drift in same manner as in above step.

c. Hold journal up and install three or four small flat washers (Fig. 4-49). Lower journal onto washers and drive bearing out using drift applied to journal.

d. Remove journal from yoke.

e. Remove remaining bearing using brass drift.

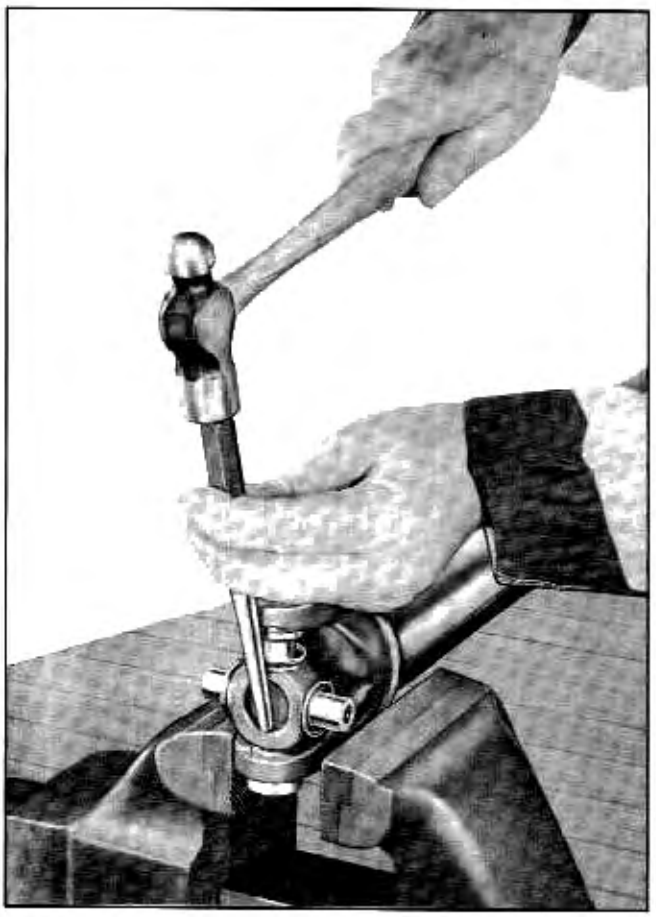


Fig. 4-48 Removing Bearing From Fixed Yoke Member

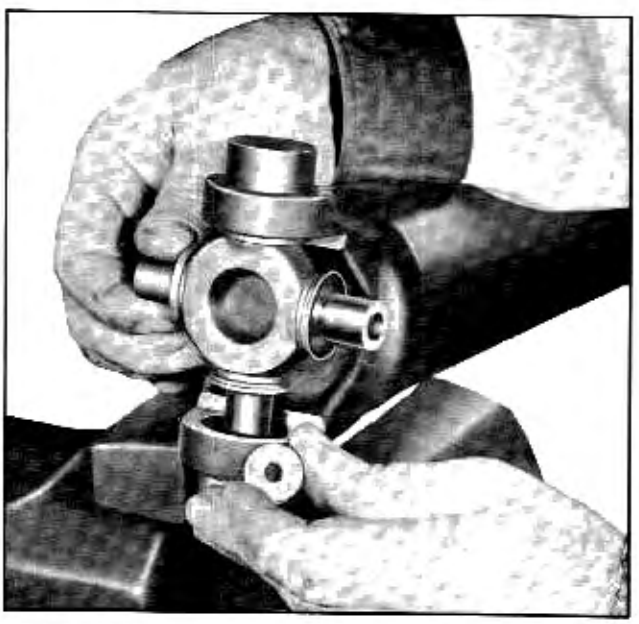


Fig. 4-49 Placing Washers Inside Bearing of Fixed Yoke Member

REAR UNIVERSAL JOINT—DISASSEMBLE

1. Remove wire or rubber band holding U-joint bearings, remove bearings and cork washers.

2. Remove snap ring from yoke members as described for front universal joint step 1.

3. Remove bearings from yoke as described for front universal joint, step 3.

CLEANING AND INSPECTION

1. Wash all parts thoroughly in cleaning fluid. Probe holes in ends of journals to remove any hardened grease.

2. Inspect roller bearing surfaces of journals, inner bearing surfaces of outer races, and rollers for wear, scores, flat spots, or other damage.

3. Inspect cork washers and journal dust shields for wear or injury. Replace if necessary. Cork washers should be flexible; if brittle or hard, replace with new washers.

ASSEMBLY OF PROPELLER SHAFT

FRONT UNIVERSAL JOINT—ASSEMBLE

1. Repack roller bearings and fill holes in ends of journal with high melting point wheel bearing lubricant. NOTE: 18 rollers are used for each bearing

2. Install bearing journal and bearings in fixed yoke member as follows:

a. Press cork washer into position in recess of bearing and install bearing about one quarter way in on one side of fixed yoke using soft faced hammer.

b. Position journal, with dust shields installed, between arms of yoke and place journal in partially installed bearing. NOTE: Journal assembly must be installed so locating lugs are facing toward propeller shaft (Fig. 4-50).

c. Hold journal in place and complete installing bearing.

d. Install opposite bearing, with cork washer in place, ensuring that bearing rollers do not bind on journal. Check movement of journal in bearings for smoothness.

3. Install splined yoke member onto journal as follows:

Fig. 4-50 Correct Installation of Journal in Yoke

a. Press cork washer into bearing and start bearing into place in splined yoke member with a soft faced hammer.

b. Position yoke over journal so arm of journal seats in bearing. Support yoke on opposite side and complete installation of bearing.

c. Press cork washer in place in remaining bearing and install bearing, ensuring that bearing rollers do not jam on journal. Check for free movement of universal joint.

4. Install snap rings in yoke members with gap toward yoke.

REAR UNIVERSAL JOINT—ASSEMBLE

1. Install journal in yoke following procedure for front universal joint, steps 1, 2, and 4.

2. Place bearings onto journal and retain in place with rubber band.

INSTALLATION OF PROPELLER SHAFT

1. Inspect outer diameter of splined yoke to ensure that it is not burred so as to damage seal. Apply engine oil to spline and slide propeller shaft front joint onto the transmission output shaft.

2. With snap rings in place on all bearings, connect rear universal joint to companion flange using two "U" bolts, two locking plates, and four nuts. Tighten "U" bolt nuts to 14 to 20 lb. ft. torque. Ensure that ears of lock plates are bent up against flat side of "U" bolt nuts.

TROUBLE DIAGNOSIS AND TESTING—PROPELLER SHAFT

OIL LEAK AT FRONT YOKE

CAUSE	REMEDY
Rough outside surface on splined yoke or defective transmission rear oil seal. An occasional drop of oil dripping from the splined yoke is normal and requires no correction.	Replace seal if cut by burrs on yoke. Replace yoke if outside surface is rough and burred badly. Minor burrs can be smoothed by careful use of crocus cloth or honing with a fine stone.

KNOCK IN DRIVE LINE

CAUSE	REMEDY
Worn universal joints. NOTE: "Clunking" noise when car is operated under "floating" condition at approximately 10 MPH in high gear or neutral.	Disassemble universal joints, inspect and replace worn parts.

PROPELLER SHAFT VIBRATION

CAUSE	REMEDY
Propeller shaft out of balance. NOTE: Vibration which comes in at a definite speed while car is moving. Check by driving car at speed above which vibration comes in, shutting off engine and coasting in neutral down through speed where vibration came in when operating car. If vibration comes in at same speed when coasting, it is probably caused by propeller shaft.	Replace propeller shaft and repeat test. NOTE: Tires may give a vibration at certain high speeds which could be mistaken for propeller shaft vibration. By inflating tires above normal pressure and retesting, it may be possible to distinguish tire noise from propeller shaft vibration. See Section 10 on "Testing For Tire Noises."

REAR SPRINGS AND SHOCK ABSORBERS

DESCRIPTION

Rear springs are equipped with full length liners between the four top leaves. The leaves are held in place by the spring center bolt together with spring "U" bolts and spring clips. The effect of the liner is to reduce friction in the rear springs and also eliminates the need of spring covers and lubrication of rear springs. The springs are mounted parallel to the center line of chassis. To accommodate parallel mounting, the front hangers are located on the outside of the frame members and the spring seats on the axle housing are installed parallel to the center line of the chassis.

The springs are bolted to the spring seats on the axle housing and are pivoted at the ends through rubber bushings installed in the ends of the springs. These rubber bushings prevent the transmission of road noise and provide constant low friction pivots requiring no lubrication.

Direct, double action shock absorbers are mounted in front of the axle to provide sway control as well as ride control. Shock absorbers are of sealed construction and require no servicing.

PERIODIC SERVICE

No periodic service is required on rear springs or shock absorbers. Spring leaves, liners, rubber mounting bushings for springs and shock absorbers should never be lubricated. To do so may result in subsequent squeaks and will cause dirt and grit to accumulate which will accelerate wear.

MINOR REPAIRS

REAR SHACKLE PINS AND BUSHINGS— REMOVE AND REPLACE

REMOVE

1. Disconnect lower end of shock absorber from spring clip plate.
2. Raise car to take load off rear spring and remove

bolt which draws shackle links together. Make sure weight is off spring so end of spring will not fly upward when shackle is removed.

3. With a sharp blow of a hammer, remove shackle links from pins.

4. Pull upper pin and bushing assembly from frame using Rear Spring Front and Rear Bushing Remover and Replacer, J-4161-A, as follows:

a. Oil threads and insert screw and nut assembly 4161-7 through thrust bearing 4161-6, washer 4161-11, flanged adapter 4161 4, and large sleeve 4161-3 (Fig. 4-51).

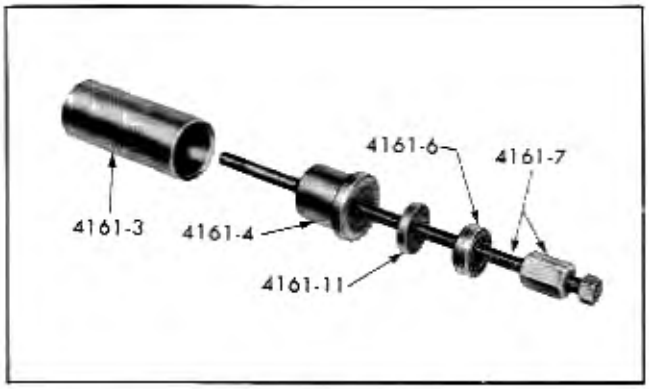


Fig. 4-51 Component Parts of Bushing Replacer Tool J-4161-A

b. Position pilot 4161-12 over bushing and outside of frame: insert threaded end of screw through bushing and turn small knurled adapter 4161-1 onto threaded end of screw (Fig. 4-52).

c. With all parts of tool properly positioned, turn hex nut of 4161-7 (Fig. 4-52) until bushing is pulled out of frame into sleeve of tool.

5. Pull lower pin and bushing assembly from spring eye using set J-4161-A as follows:

a. Oil threads and insert screw and nut assembly 4161-7 through thrust bearing 4161-6, washer 4161-11, flanged adapter 4161-4, and large sleeve 4161-3 (Fig. 4-51); then slip small sleeve 4161-10 into large sleeve.

b. Place pilot 1161-12 over spring bushing, insert threaded end of bolt through spring bushing, and turn small knurled adapter 4161-1 onto threaded end of screw.

c. Turn hex nut of screw and nut assembly 4161-7 until bushing is pulled from spring eye into sleeve of tool.

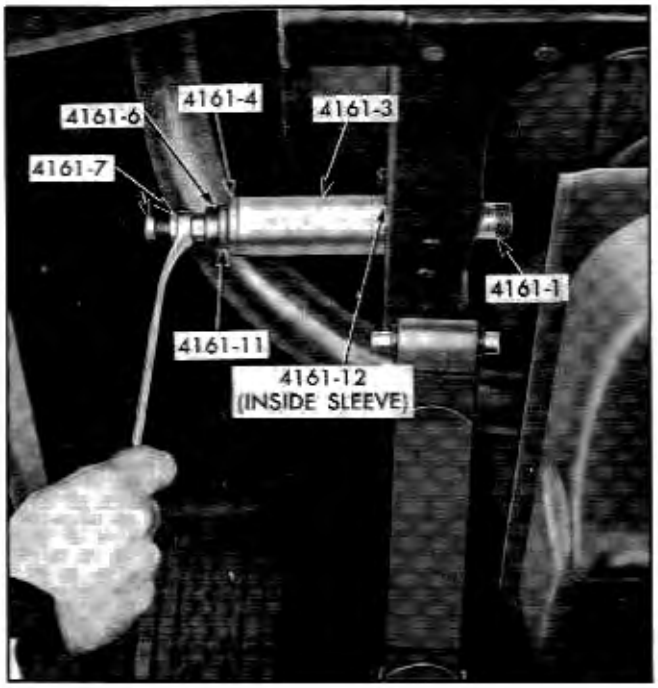


Fig. 4-52 Bushing Replacer Tool J-4161-A Positioned for Removal of Rear Bushing

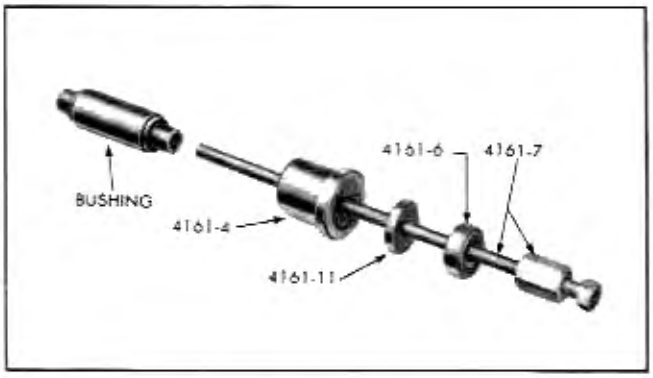


Fig. 4-53 Rear Bushing and Components of Replacer Tool J-4161-A

REPLACE

1. To install new bushing assembly in frame proceed as follows using set J-4161-A:

a. Oil threads and insert screw and nut assembly 4161-7 through thrust bearing 4161-6, washer 4161-11, flanged adapter 4161-4, and new bushing assembly (Fig. 4-53).

b. Insert threaded end of screw through hole in frame hanger and turn adapter 4161-2 onto threaded end of screw.

c. Center bushing on one side and adapter 4161-2 on opposite side of hole in spring hanger; turn hex nut of 4161-7 (Fig. 4-54) until bushing is forced into place so bushing pin projects equally on each side of frame hanger.

2. To install new rear bushing assembly in spring eye proceed as follows using set J-4161-A:

a. Oil threads and insert draw bolt 4161-5 with hex nut 4161-7 through thrust bearing 4161-6, washer 4161-11, flanged adapter 4161-4, and new spring bushing assembly (Fig. 4-53).

b. Insert threaded end of screw through spring eye and turn adapter 4161-2 onto threaded end of bolt.

c. Center bushing on one side of spring eye and adapter 4161-2 on opposite side of spring eye; turn hex nut 4161-7 until bushing is forced into place so bushing pin projects equally on each side of spring eye.

3. Install shackle links on taper of pins and insert shackle bolt with head toward inside of car. Install shackle bolt lockwasher and nut. Draw links lightly onto pin tapers seeing that links draw up evenly on all four tapered pins.

4. Lower car so as to have weight of car on springs before final tightening of shackle link bolt. This allows rubber to assume a neutral and unstrained position.

5. Strike each end of each shackle link a sharp blow with hammer to ensure seating on tapers and tighten shackle bolt to 15-20 lb. ft. torque.

6. Connect shock absorber to spring clip plate. Tighten mounting bolt nut to 50-65 lb. ft. torque.

REAR SPRING FRONT BUSHING— REMOVE AND REPLACE

REMOVE

1. Disconnect shock absorber lower eye from spring clip plate.

2. Raise car to unload rear springs.

3. Remove spring front bolt.

4. Pull spring front bushing using Rear Spring Front and Rear Bushing Remover and Replacer, J-4161-A, as follows:

a. Oil threads and insert screw and nut assembly 4161-7 through thrust bearing 4161-6, washer 4161-11, flanged adapter 4161-4, and large sleeve 4161-3 (Fig. 4-51).

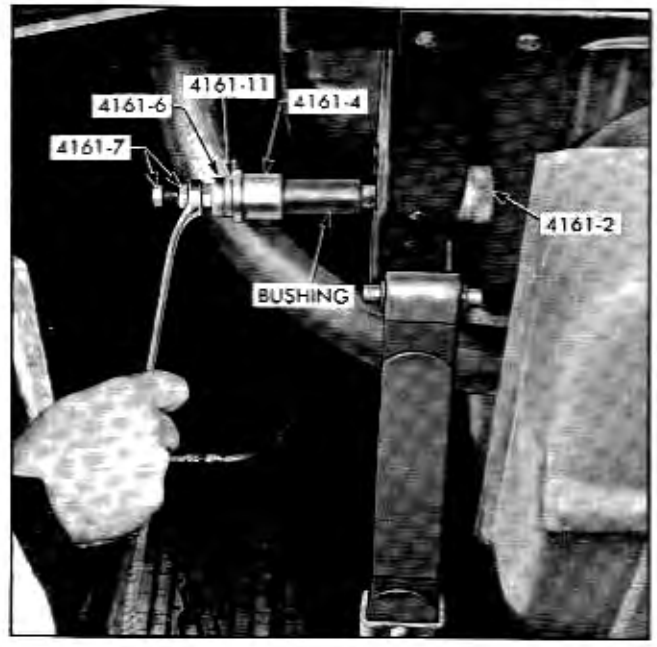


Fig. 4-54 Bushing Replacer Tool J-4161-A Positioned for Installation of Rear Bushing

b. Insert threaded end of screw through spring front bushing, and turn adapter 4161-8 onto threaded end of bolt.

c. Turn hex nut of 4161-7 until bushing is pulled into sleeve and out of spring eye. CAUTION: *Ensure that adapter 4161-8 does not "hang-up" on spring eye when nut of assembly 4161-7 is turned. If adapter does not pass freely through spring eye, screw will break; since the parts are under a stress, personal injury may result.*

REPLACE

1. To install new bushing in spring eye proceed as follows using set J-4161-A:

a. Oil threads and insert screw and nut assembly 4161-7 through thrust bearing 4161-6, washer 4161-11, adapter 4161-9, and new spring bushing assembly.

b. Pass threaded end of screw through spring front eye and turn adapter 4161-2 onto threaded end of bolt.

c. Center bushing on one side of spring eye and adapter 4161-2 on opposite side of spring eye; turn hex nut of 4161-7 until bushing is forced into place so it projects equally on each side of spring eye.

2. Install front spring bolt through frame hanger and spring bushing (bolt head toward inside of car). Tighten self-locking nut only finger tight at this time.

3. Lower car so as to have weight of car on springs before tightening spring bolt.

4. Tighten self-locking nut on spring bolt to 60-80 lb. ft. torque. NOTE: If bushing is not sufficiently tight in frame bracket, squeaking may result.

5. Connect shock absorber to spring clip plate. Tighten mounting nut to 50-65 lb. ft. torque.

REAR SPRING LINERS—REMOVE AND REPLACE

1. Remove spring from car.

2. Place spring in vise.

3. Bend spring clips outward. NOTE: Do not bend clips by prying against ends from top of springs. To do so may cause breakage.

4. Remove spring center bolt.

5. Remove spring from vise and remove spring leaf liners.

6. Clean surfaces of spring leaves to remove any rust or foreign matter.

7. Install long spring leaf liner with guide strips up between first and second spring leaves.

8. Install second size spring leaf liner between second and third spring leaves.

9. Install third size spring leaf liner with guide strips up between third and fourth spring leaves.

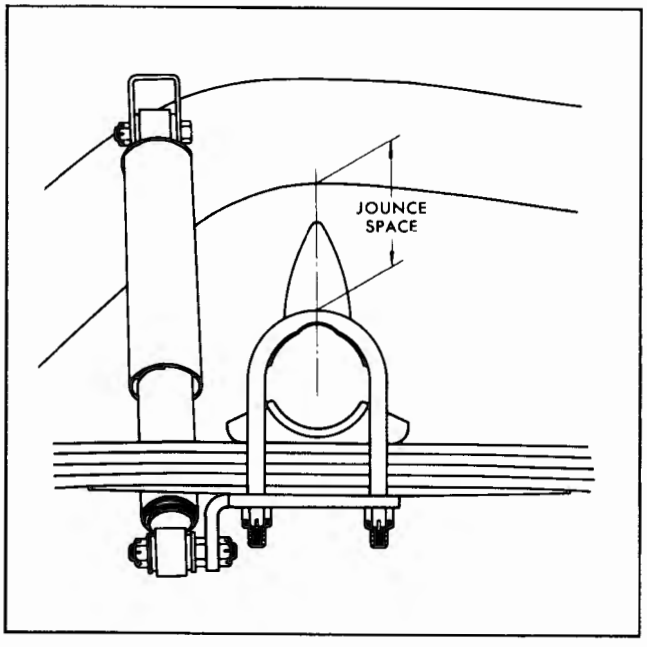


Fig. 4-55 Rear Suspension Jounce Space Measurement

10. Insert punch in spring leaves center bolt hole and clamp spring leaves in vise.

11. Install new spring center bolt and nut (stake nut).

12. Bend spring clips back into position making sure there is clearance between top and sides of spring leaves. This clearance is necessary to avoid squeaks, however, clearance should never be more than 1/16".

13. Replace spring in car.

REAR SPRING ASSEMBLY—REMOVE AND REPLACE

NOTE: When rear springs seem to have sagged, they may be checked by measuring as shown in Fig. 4-55. This measurement should be the same on both sides and indicate no spring sag when compared to a standard car. (Make sure cars being compared have similar loads, i.e., load in trunk, heavy accessories, mud, etc.)

REMOVE

1. Raise car.

2. Disconnect shock absorber from spring clip plate.

3. Support car by some suitable means and lower rear axle assembly to relieve load from springs.

4. Remove rear shackle bolt and links.

5. Remove four nuts holding spring clip plate in position.

6. Swing spring down from seat on axle.

7. Remove spring front bolt and remove spring.

REPLACE

1. Position spring front eye in frame hanger and install bolt with head toward inside of car. Tighten self-locking nut finger tight at this time.

2. Position spring against seat on axle housing.

3. Install spring clip plate and U-bolt nuts. Turn nuts up finger tight at this time to hold spring against seat on axle housing.

4. Assemble rear spring shackle to spring and frame, but do not tighten shackle bolt completely at this time.

5. Tighten U-bolt nuts to 45-60 lb. ft. torque.

6. Raise rear axle assembly and tighten shackle bolts, with weight of car on springs to 15-20 lb. ft. torque.

7. Tighten spring front bolt to 60-80 lb. ft. torque. NOTE: If front bushing is not sufficiently tight in frame bracket, squeaking may result.

8. Connect shock absorber to clip plate and tighten nut of mounting bolt to 50-65 lb. ft. torque.

REAR SHOCK ABSORBER—REMOVE AND REPLACE

1. Remove nuts from upper and lower shock absorber mounting bolts and remove shock absorber.

2. Clean and inspect rubber grommets. If grommets appear deteriorated, spongy, or have taken a "set", discard defective grommets and replace with new parts.

3. Install shock absorber, making sure rubber grommets are in place.

SPECIFICATIONS

REAR AXLE

Type	Semi-floating
Type of drive	Hotchkiss
Drive—Final	Hypoid Gear
Lubricant capacity	3¼ pints
Lubricant	See Lubrication Section
Lubricant level	Bottom of filler plug hole
Rear Wheel Tread	59.4"
Road Clearance (Rear Axle)	
With Pasengers	
With 7.50 x 14 Tires	6.50
With 8.00 x 14 Tires	6.60
With 8.50 x 14 Tires	7.00

RING AND PINION GEAR

Backlash	.003"-.012"
Ring gear runout maximum	.002"
Ratios	See page 4–2

PROPELLER SHAFT

Length center to center	
27 Series	60.24
27 and 28 Series H. D. Chassis	60.24
28 Series Except H. D. Chassis	62.24
Outside diameter	3"

REAR SPRINGS

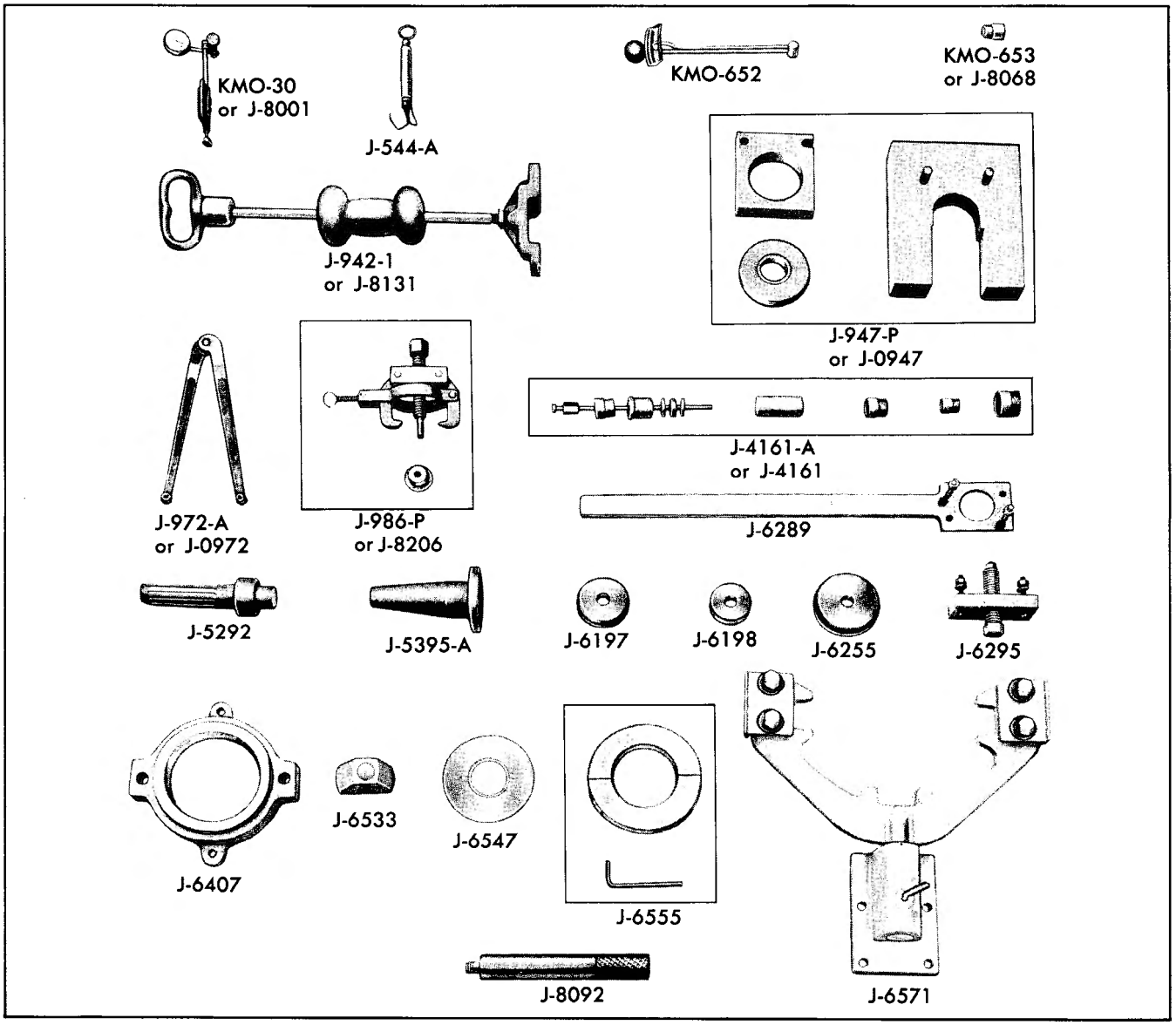
Length	
27 series	58"
28 series	60"
Width	2"
Number of leaves	
27 series	
All models, exc. taxi, police cars and cust. station wagon	6
Taxi, police cars and custom station wagon	6
28 series	
All models	6

SHOCK ABSORBERS

Collapsed length (measured to center of eyes)	Approx. 12 7/16"
Extended length (measured to center of eyes)	Approx. 20 1/8"

TORQUE SPECIFICATIONS

	Lb. Ft. Torque
Ring Gear to Case Bolts	55-60
Bearing Cap Bolts	70-75
Shock Absorber to Frame Nut	50-65
Shock Absorber to Anchor Nut	50-65
Universal joint "U" bolt nuts	14-20
Spring Front Bolt to Frame	60-80
Spring Rear Shackle Bolt	15-20
Spring U-bolts	45-60
Brake Assembly to Axle Housing Bolt	30-45
Differential Carrier to Housing Nut	45-60



SPECIAL TOOLS—REAR SUSPENSION

KMO-30 or J-8001	Dial Indicator Set
J-544-A	Tension Checking Scale (Differential Bearing Preload)
KMO-652	Tension Wrench (0-50 in. lbs. with 3/8" sq. drive)
KMO-653 or J-8068	Adapter (for 3/8" Drive KMO-652 Tension Wrench)
J-942-1 or J-8131	Rear Axle Shaft and Bearing Puller
J-947-P or J-0947	Rear Axle Bearing Remover and Installer
J-972-A or J-0972	Differential Side Bearing Adjusting Wrench
J-986-P or J-8206	Differential Side Bearing Puller
J-4161-A or J-4161	Rear Spring Bushing Remover and Replacer
J-5292	Differential Side Bearing Installer
J-5395-A	Differential Pinion Oil Seal Installer
J-6197	Front Pinion Bearing Race Installer
J-6198	Front Pinion Bearing Race Remover
J-6255	Rear Pinion Bearing Race Installer
J-6289	Companion Flange Holding Tool
J-6295	U-Joint Companion Flange Puller
J-6407	Press Plate Holder and Insert
J-6533	Rear Pinion Bearing Race Remover
J-6547	Rear Pinion Bearing Installer
J-6555	Rear Pinion Bearing Remover
J-6571	Differential Carrier Holding Fork, Clamps and Fixture Assembly
J-8092	Drive Handle