THE MASTER TECHNICIAN'S

SERVICE REFERENCE BOOK

SESSION NO.

63-8

VALIANT AND DART

REAR AXLE SERVICE

MASTER TECHNICIANS SERVICE CONFERENCE
PREPARED BY CHRYSLER CORPORATION
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Bringing up the rear!

A shop humorist once made this wisecrack: "The differential *can't* be very important—after all, they put it way back in the rear of the car, didn't they?" Our tongue-in-cheek Technician knew better, of course. But we'll bet he had in mind the flanged axle design in all Valiants, Lancers, and current Darts. No, not because it's unimportant. Naturally, *it is important*—but it's such a trouble-free unit that it seldom comes to a Service Technician's attention.

However, many of these flanged rear axle units have been on the road for well over three years now. Most of them have piled up considerable mileage. Some of them may have taken a lot of abuse. So it stands to reason that you're going to service more of these units as time goes by.

With the proper know-how, rear-end service can be handled by any capable Technician. Of course, it takes time and patience to do the job right. You've got to adjust bearing preload and gear contact precisely, and give careful attention to other details if you want to avoid comebacks.

Among the time-saving tips in this Reference Book is a new and faster procedure for establishing differential bearing preload and ring-gear backlash. This information could easily save you more time on every rear-end job than it takes you to read about it!

TABLE OF CONTENTS:

DISASSEMBLY AND INSPECTION

The flanged rear axle design with a one-piece axle housing and differential carrier is used on 1963 Valiants and Darts. It was also used on all previous models of Valiant and Lancer. So the service information in this Reference Book applies to all these cars.

REMOVE REAR AXLE FOR SERVICE

If you have to do anything more to the rear axle assembly than remove the axle shafts or the pinion oil seal, it's best to remove the entire rear axle assembly from the car. That's because it's difficult to do a good job of servicing the axle assembly when it's installed in the car.

Brakes: Don't neglect to block or tie up the brake pedal before you disconnect the brake lines. This will minimize the loss of brake fluid when the lines are disconnected. You should remove the rear brake support plates and install new plastic foam water seals on every major rear axle job. New seals are necessary to prevent water leakage into the axle bearings and the rear brakes.

REAR AXLE BEARINGS

To check the condition of the rear axle shaft ball bearings, rotate the bearings. They should turn smoothly and freely. Don't remove the bearings from the axle shafts *unless it's necessary to replace them,* since removal of the bearings will damage them and make them unfit for further use.

BEARING REMOVAL

If it is necessary to replace a bearing, first remove the bearing collar. The easiest way to do this is to make one or two deep notches across the full width of the collar with a chisel. This spreads the collar slightly, increasing its inside diameter enough so you can slip it off the shaft.

After removing the collar, the bearing can be pressed off the shaft. If the bearing comes apart as you're pressing it off the shaft, you'll have to grind a deep notch across the inner race of the bearing. Cut into the race as deeply as you can without hitting the axle shaft. Then use a blunt chisel to crack the bearing race at this point.

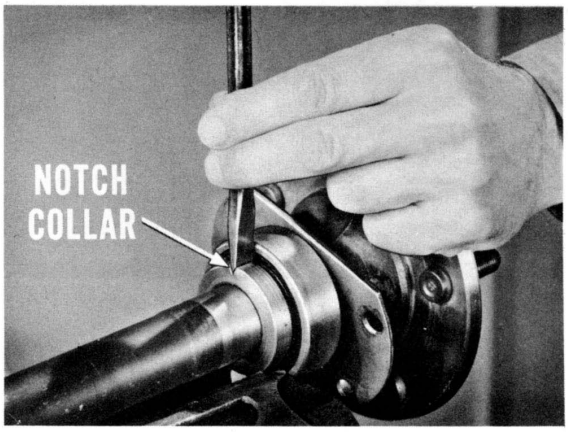


Fig. 1—Removing rear axle bearing collar

Be sure you don't damage the axle shaft. If you do damage the shaft, replace it. Even a small nick can cause shaft failure. And never try to remove the bearing by heating it. You'll affect the heat treating and weaken the shaft.

DIAGNOSIS DURING DISASSEMBLY

Look for clues to the cause of trouble during disassembly of the differential. Careful inspection and testing will help you pinpoint the probable cause, and will give you a good idea of what parts must be replaced. Diagnosis during disassembly saves time in the long run, and cuts down the chances of comebacks.

CHECK FOR DIFFERENTIAL SIDE PLAY

Always check for differential side play! Don't trust to your sense of feel—use the dial indicator. Set up the indicator as you would to check ring-gear runout. If there's any needle movement as you push firmly sideways in both directions on the ring-gear, side play is indicated.

Differential side play means that the differential carrier bearings have failed or that the carrier housing is sprung. If the side play has

Fig. 2—Check side play

been there for an appreciable length of time, the pinion and ring gear will be worn and you'll have to replace them with a new set.

MEASURE RING-GEAR RUNOUT

If there's no differential side play, measure ring-gear runout through several complete rotations of the ring gear. This will insure an accurate runout reading. Ring-gear runout should not exceed .005″. If ring-gear runout is excessive, mark the gear and the flange at the point of highest runout to indicate the area you should concentrate on when you're trying to find the cause of trouble. Then remove the ring gear and put the differential case back in place to measure case flange runout. The case flange runout measurement will help you decide if the trouble is in the ring gear, the case flange, or in the attachment of the gear to the flange.

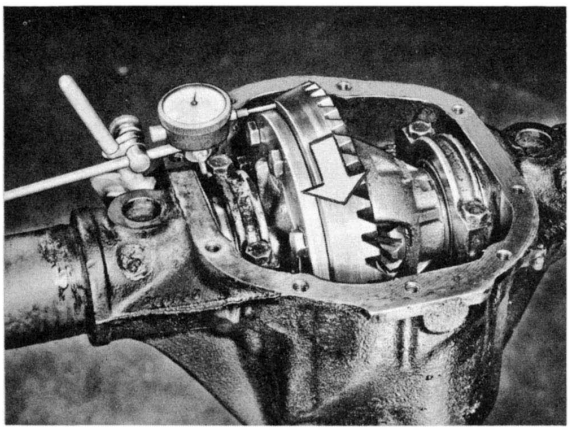


Fig. 3—Check for excessive ring-gear runout

MARK BEARING CAPS

It's very important that the two differential bearing caps be installed in their same positions when the differential is reassembled. So before you remove the two bearing caps, be sure that both caps and the bearing pedestals in the carrier housing are marked to show the proper location of the caps.

SPREAD THE CARRIER HOUSING

Differential bearings are preloaded or "squeezed" in place by the carrier housing to prevent differential side play. You'll have to spread the housing slightly to remove or install the differential. The C-3721 spreader tool is used for this purpose. Spread the housing only enough to remove the differential assembly—about .015″ to .020″. Never spread the housing more than .020″. If you do, you might distort the housing permanently.

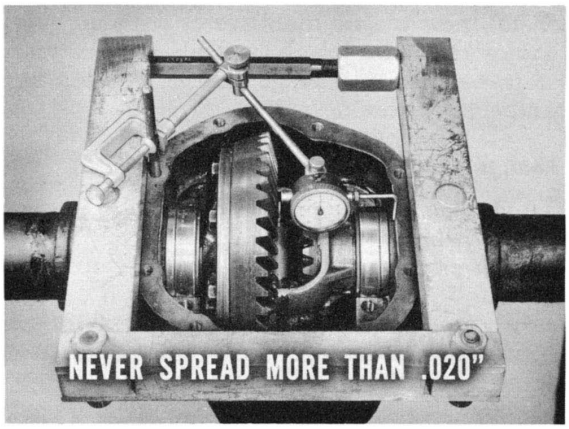


Fig. 4—Spreading the carrier housing

Don't keep the housing spread any longer than necessary. A sharp blow when the housing is spread could cause it to take a set. In case you have to check case flange runout, however, it's okay to keep the housing spread until you put the differential case back with the ring gear removed.

To control the spread accurately, use a dial indicator with the spreader tool. Be sure to mount the indicator to one of the bolt holes in

the housing. Don't mount it to the spreader by mistake, or you won't get a true indication of the amount the housing is spread. After you've spread the housing, remove the dial indicator so you won't accidentally damage it when removing the differential.

REMOVE DIFFERENTIAL ASSEMBLY

The two differential bearing cups have a tendency to stick in the carrier housing counterbores. To loosen the bearing cups, you'll have to jar the differential assembly. An old axle shaft makes a good tool for this job. Place one end of the axle shaft under the ring gear. Hold the other end of the shaft so that the shaft isn't resting against the cross arm of the spreader. Then bump the shaft firmly against the spreader cross arm to jar the differential assembly loose. Once the differential is jarred loose, you can lift it out of the carrier housing without any difficulty.

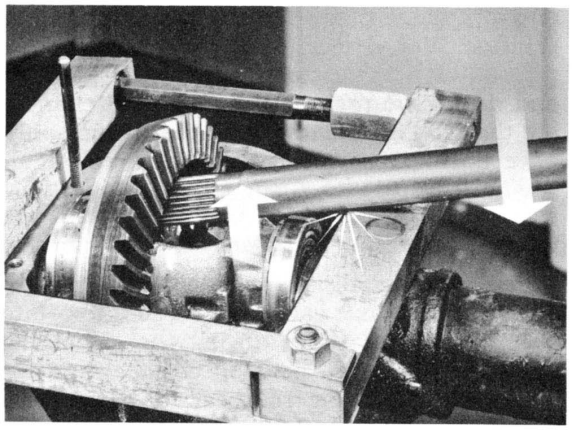


Fig. 5—Loosening bearing cups

CHECK CASE FLANGE RUNOUT

If there is excessive ring-gear runout, this is the time to check differential case flange runout. This check will tell you if the trouble is in the ring gear, the case flange, or in the attachment of the ring gear to the flange. Don't loosen the carrier housing spreader tool until you've put the differential case back in place with its bearings and spacers to measure case flange runout.

When you remove the ring-gear bolts, remember that they have left-hand threads. And

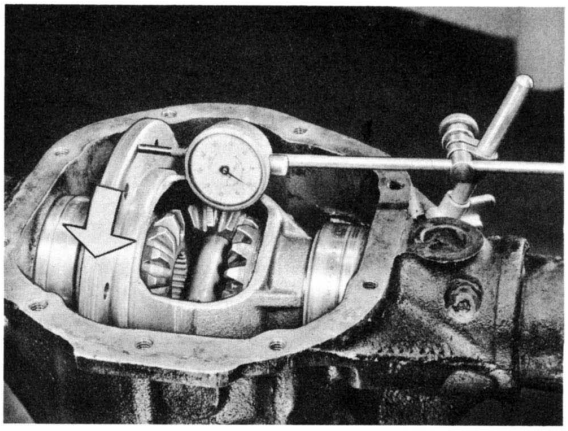


Fig. 6—Measure case flange runout

before separating the gear from the case, make sure the gear and the case are both marked to show gear position on the case.

After you've removed the ring gear, put the differential case back in the carrier housing with the original differential bearings and bearing spacers installed. When sliding these parts in place, don't let the bearing cups or spacers become cocked.

When the differential case is in place, loosen the spreader and mount the dial indicator to read case flange runout. Measure runout while rotating the case through several turns. If runout exceeds .003", replace the differential case. If flange runout is within limits, inspect both the flange and the gear face carefully to see if the excessive gear runout was caused by a small metal chip or dirt caught between the flange and the gear. The high runout marks you made earlier will show you where to look.

IDENTIFY BEARINGS AND SPACERS

When you remove the differential bearings and bearing spacers, it's advisable to keep the bearing and spacer from one side separate from those on the other side. Tie each bearing and spacer to its own bearing cap. That way, you'll be able to tell which side all of these parts came from.

CLEAN AND INSPECT DIFFERENTIAL PARTS

Cleanliness is very important throughout the entire rear axle and differential, so be sure to do a thorough job of cleaning every part that

you plan to reuse. Be sure that no small metal chips or dirt remain in the bearing counterbores in the carrier housing. If a counterbore isn't perfectly clean and smooth, you'll have trouble installing the bearing correctly.

EXAMINE GEARS AND BEARINGS

It's important to inspect *all* the differential parts after they've been cleaned, but pay particular attention to gears and bearings. Gear teeth should have smooth, unbroken surfaces without excessive wear. The tooth contact wear pattern should be uniform on all teeth. If bearings have a galled, chewed-up appearance with a blue color, it probably means that they weren't lubricated properly. Flaked bearing surfaces indicate that the bearing was overloaded.

PINION DEPTH AND PINION BEARING PRELOAD

PINION POSITION IS IMPORTANT

Before the ring gear and differential case can be installed, the pinion must be in its proper position. Pinion position is determined by the thickness of the pinion spacer washer. The relative positions of the pinion and ring gear are extremely critical. If the contact area between the pinion teeth and the ring-gear teeth isn't reasonably centered on the ring-gear teeth, gear noise and early wear will result.

DETERMINING CORRECT PINION DEPTH

The C-3715 rear axle gauge set is a real time-saver. Without it, you'll have to arrive at correct pinion depth through "trial and error". That means guessing at the correct pinion rear bearing washer, which acts as a pinion depth spacer. Both the pinion and the differential assembly must be installed with correct bearing preload. Ring-gear backlash must be measured and corrected if necessary. Then you must make a red lead test to determine what corrections are needed. Unless you're very lucky, you'll have to repeat this procedure several times.

A much more efficient way to set the pinion properly is to use the C-3715 rear axle gauge set to select the right size pinion spacer washer. Parts of the complete gauge set are used to install the pinion bearing cups. Then, after the gauge block is attached to the tool shaft, the cross bore arbor is installed. The cross bore arbor establishes a reference point in relation to the gauge block that can be used to establish the thickness of the pinion spacer washer for proper pinion depth.

NEW TIME-SAVING PROCEDURE

There's a new, faster procedure for assembling and adjusting the Valiant, Lancer and '63 Dart differential. With this procedure, you use the C-3715 rear axle gauge set to install and adjust the pinion before you set ring-gear position and determine differential bearing preload. It's easier to set ring-gear position and determine preload this way, and chances are that you'll have to spread the housing only once during reassembly. That's a real time-saving feature!

SET UP C-3715 GAUGE COMPONENTS

When you install the pinion bearing cups, using the rear axle gauge set, be sure to rotate the tool several times during the tightening operation. This will position the bearing cups and avoid brinelling the bearings. Leave the tool in the carrier. Loosen the tool compression nut and retighten it enough to give a 15-to-25 inch-pound drag as measured by a torque wrench when turning the tool. This preloads the tool and sets its position accurately so that it can be used to select the right size pinion spacer washer.

Attach the gauge block to the tool shaft, with the straight edge of the block against the differential bearing pedestal in the carrier housing casting. Never attach the gauge block on the tool shaft before you put the shaft in the carrier housing. You could damage the gauge set or misposition the gauge block so that you would select the wrong size spacer. Install the cross bore arbor. Tighten both caps firmly.

SELECT PINION SPACER WASHER

Select a pinion spacer washer that just fits between the cross bore arbor and the gauge block with a definite drag. Be sure to hold the washer *flat* against the surface of the gauge block when you slip it between the block and the cross bore arbor. The spacer washer you've selected is the correct one to use *only* if the pinion is marked "O".

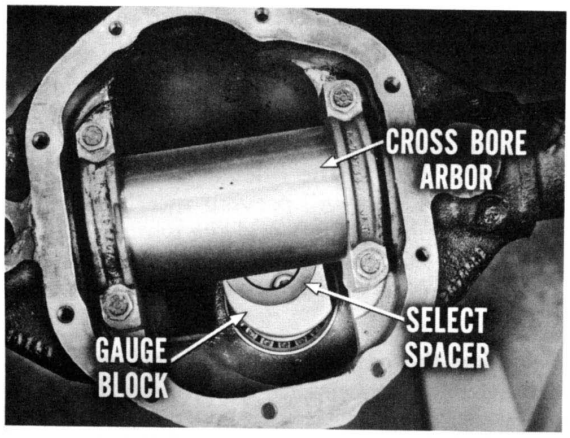


Fig. 7—Gauging pinion spacer washer

If the pinion has a mark other than an "O", you'll have to make allowance for the figure shown when you make your spacer selection.

PINION MARKINGS

Let's take a moment to discuss the reason for pinion markings. As mentioned earlier, correct gear tooth contact pattern is very important.

In production, ring gears are individually matched to pinions to give the best contact pattern. Due to minute variations in production gears, it's sometimes necessary to increase or decrease pinion depth a few thousandths of an inch from a nominal position to obtain the best pattern.

NOMINAL PINION POSITION

The design of the C-3715 gauge set is based on the nominal pinion position. So when you select a pinion spacer with this gauge set, it is the correct one to use *if* the best tooth contact pattern can be obtained with the pinion at the nominal position. A pinion in this category is marked with a zero (0).

MARKINGS TELL DESIRED PINION POSITION

When the pinion must be moved *away* from the ring gear to achieve the best tooth contact pattern, the pinion is marked with a plus sign (+). This is followed by a number that indicates the distance, in thousandths of an inch, that the pinion must be moved from the nominal position. Conversely, when the pinion must be moved *toward* the ring gear from the nominal position, the pinion is marked with a minus sign (—) and a number indicating the distance the pinion must be moved.

SPACERS FOR "PLUS" PINIONS

Accordingly, if a pinion is marked with a plus number, it should be positioned farther from the ring gear than the nominal position. Do this by using a spacer *thinner* than the one originally selected by the gauge set. How many thousandths thinner depends upon the number following the plus sign. A "+2" marking, for example, would call for a spacer .002″ thinner than the one originally selected.

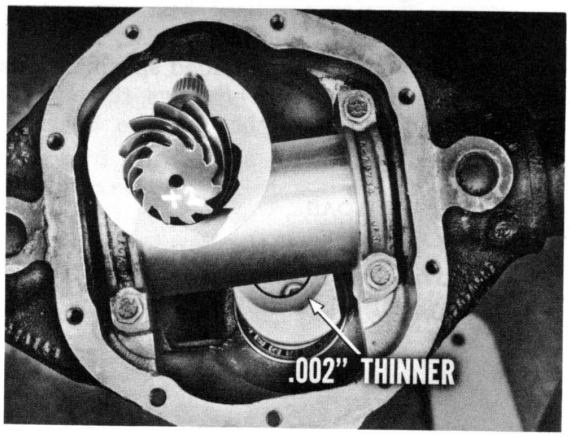


Fig. 8—Selecting spacer for "+2" pinion

SPACERS FOR "MINUS" PINIONS

On the other hand, a pinion marked with a minus number should be set closer to the ring gear than the nominal position. Do this by using a spacer *thicker* than the one originally selected. Increase the spacer thickness by an amount in thousandths equal to the number on the pinion.

REMEMBER—SELECTING A PINION SPACER IS ONE CASE WHERE "PLUS" MEANS SUBTRACT

AND "MINUS" MEANS ADD! AND DON'T GUESS —USE YOUR "MIKES".

PINION BEARING PRELOAD

Bearing preload is necessary to keep the gears aligned under the stresses of operating loads. All parts of the bearings must be under compression to insure full seating and to minimize gear deflection. This is known as "preloading" a bearing. If there's too much preload, excess heat will be generated and the bearing will fail prematurely. But remember this—a bearing that's preloaded too much won't make noise until it's burned out. On the other hand, a pinion bearing that has too little preload will let the pinion gear run out of position and result in gear noise and bearing failure.

PRELOAD SPECIFICATIONS DIFFER

The correct preload for *new* pinion bearings is 15 to 25 inch-pounds. If the old bearings are still good and you're planning on reusing them, the correct preload for reused bearings is 5 to 13 inch-pounds. The reason for this lower specification for used bearings is that they have become polished in use, reducing friction. If you used the preload specifications for new bearings on used bearings, the adjustment would be too tight and the bearings would fail.

SET BEARING PRELOAD

After selecting the proper pinion spacer washer and removing all parts of the C-3715 gauge set, your next step is to set bearing preload. Pinion bearing preload is determined by the thickness of the preload spacer just to the rear of the front pinion bearing. *A thinner spacer increases preload, while a thicker spacer decreases preload.*

Lubricate all bearing surfaces with light engine oil and install all the pinion parts except the oil seal. The seal would create extra drag on the pinion shaft and result in a faulty preload reading. There's also a possibility of damaging the seal if you have to change the preload spacer.

When you install the pinion spacer washer that you selected with the C-3715 gauge set, be sure the chamfered inside edge of the washer is next to the fillet at the base of the pinion gear. This will prevent interference between the pinion shaft and the washer. Before you press the rear pinion bearing cone into position, make sure it is started squarely on the pinion shaft.

Selecting the correct pinion preload spacer is a matter of "cut and fit". However, the original preload spacer is usually the best one to start with when you're adjusting preload. After you've installed all pinion parts except the oil seal, tighten the pinion nut to at least 240 foot-pounds, or your preload readings will be affected. And before you take a preload reading, rotate the pinion a few times in both directions to align the bearing rollers.

TEST BEARING PRELOAD

Use an inch-pound torque wrench to test pin-

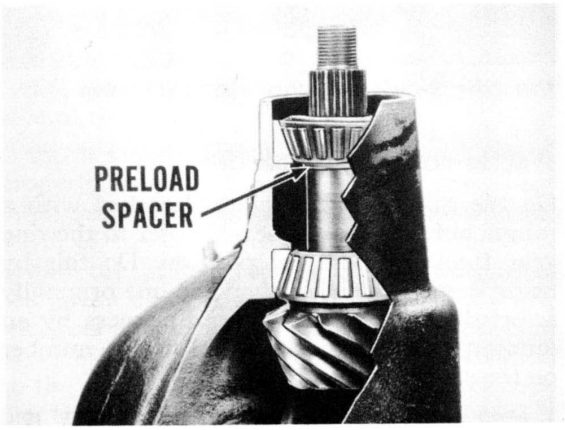


Fig. 9—Spacer determines pinion preload

Fig. 10—Testing pinion bearing preload

ion bearing preload. Position the axle housing assembly so that the nose of the differential carrier is pointed up. Preload readings will be accurate only if the carrier is in this position. Take your preload reading while the torque wrench is moving through several full turns, to be sure the reading is equal throughout the complete revolution of the pinion.

Remember—the preload reading should be 15 to 25 inch-pounds *if you're using new bearings.* The preload reading should be 5 to 13 inch-pounds *if the old bearings are still good and you're reusing them.* If preload is not within these limits, you'll have to change the preload spacer. Use a thinner spacer to increase preload, or a thicker spacer to decrease preload.

BINDING PINION

If your torque readings vary when you're checking pinion bearing preload, it's a sign of a binding pinion. This is usually caused by dirty or unoiled pinion bearings. It's even possible that a bearing may have slight damage that wasn't detected during inspection. In any event, you'll have to correct the trouble before continuing.

INSTALL OIL SEAL AND YOKE

When you've set pinion bearing preload correctly, install the pinion oil seal, pinion yoke, washer and nut. Place the washer under the nut with its cupped side away from the nut, and be sure to tighten the nut to at least 240 foot-pounds with a torque wrench.

Also remember to tighten the pinion nut to at least 240 foot-pounds whenever you replace a pinion oil seal. Otherwise, pinion bearing preload will be affected. The nut will eventually work loose and fall off, resulting in gear noise and extensive damage to the differential.

RING-GEAR BACKLASH AND DIFFERENTIAL BEARING PRELOAD

OBJECTIVE OF ADJUSTMENTS

One objective of differential adjustments is a well-centered gear tooth contact pattern. A good pattern depends on proper pinion position and the backlash between the pinion and ring gear. If you've done a good job of selecting the right pinion spacer washer with the rear axle gauge set, pinion position should be correct. Now you've got to select differential bearing spacers that will position the ring gear to give the right amount of backlash with the right amount of differential bearing preload. The new procedure saves time in this phase of differential assembly and adjustment.

INSTALL RING GEAR

Assembling the differential poses no problems but there are a few suggestions on installing the ring gear that you might find helpful. Be sure to set the ring gear squarely over the case and slide it straight on, against the case flange. Start all the bolts through the flange into the ring gear, finger-tight. In some cases, you may have to tap lightly all around the ring gear with a fiber mallet or similar tool to be sure the gear is seated. When you're sure the gear is seated against the flange, tighten the bolts down evenly, a bit at a time, to the proper torque. On all models except early 1960 Valiants, the bolts should be tightened to 55 foot-pounds. Early 1960 Valiants have smaller ring-gear bolts which should be tightened to *only 35 foot-pounds.*

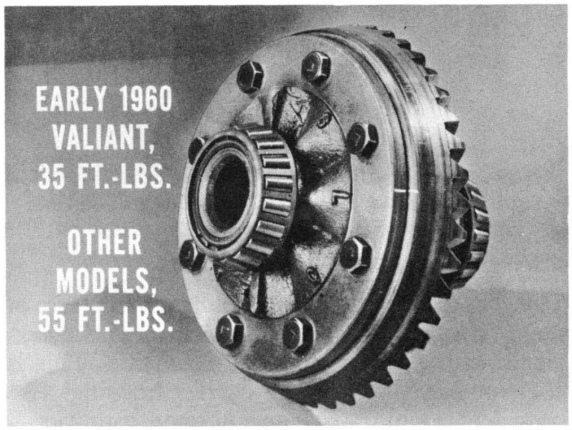


Fig. 11—Tighten ring gear bolts

SUMMARY OF NEW PROCEDURE

Using this new procedure, you put the differential assembly in place, together with its bearings and the thinnest bearing spacers available. You won't need to spread the carrier housing to do this. Next, you use feeler gauges to eliminate and measure differential side play. Then you measure ring-gear backlash and refer to a chart in this Reference Book. The chart will guide you in selecting final spacers that will give the correct backlash with proper differential bearing preload.

TEMPORARILY INSTALL DIFFERENTIAL

Choose two of the thinnest differential bearing spacers available—.254" thick. Always "mike" every bearing spacer to be sure of its size, because you can't afford to take chances with these adjustments. Put the cups and spacers on the differential bearings and slide the differential in place in the carrier housing. You won't need to spread the housing to slide the differential in place. If the edge of the bearing spacer is chamfered on only *one* side, install the chamfered side outward, toward the carrier housing.

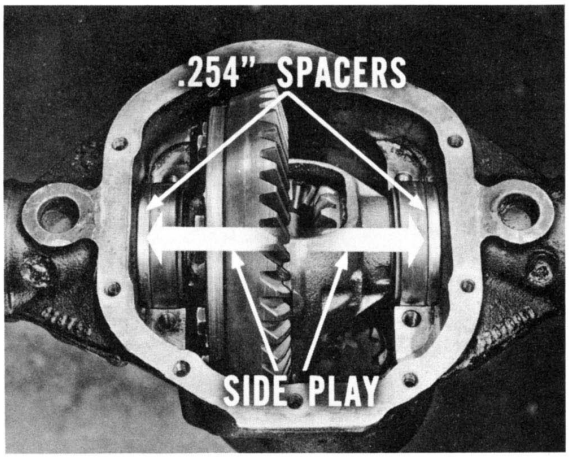


Fig. 12—Temporarily install thinnest spacers available

ELIMINATE DIFFERENTIAL SIDE PLAY

Use blades of equal thickness from two sets of feeler gauges between the spacer and the carrier housing casting at the right side. This is the "pinion side" of the carrier housing. Use only feeler gauges that are in good condition—don't use one that's creased, worn or damaged

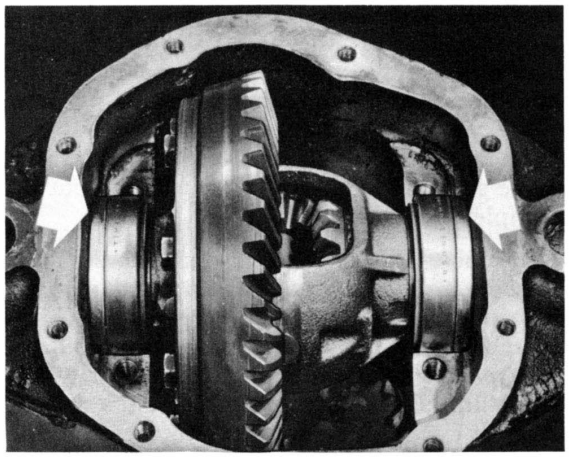


Fig. 13—Install chamfered side of spacer outward

in any way that would lead to inaccurate measurements. Be sure the tips of the feeler gauges are actually between the spacer and the casting, *and not merely touching the inner edge of the spacer.*

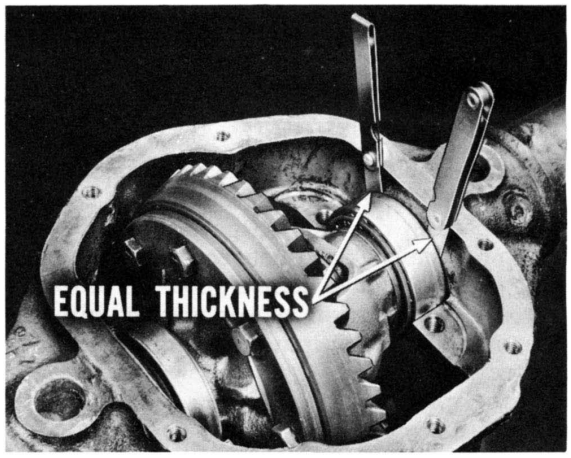


Fig. 14—Feeler gauges eliminate side play

Insert the thickest stack-up of feeler gauges that will fit, then rotate the differential a few times in both directions to align the bearing rollers. When the bearings are aligned, you can fit still thicker feeler blades in the pinion side.

USE MODIFIED PRELOAD SPACERS AS GAUGES

If your shop does much differential work, you'll find it helpful to make a set of special gauges out of a series of differential bearing

spacers of graduated thicknesses to use in place of the two feeler gauge sets and the .254" spacer at the pinion side. To modify the spacers for use as gauges, remove a segment from each spacer 2¼ inch wide, to permit the spacer to slide around the differential bearing boss on the differential case.

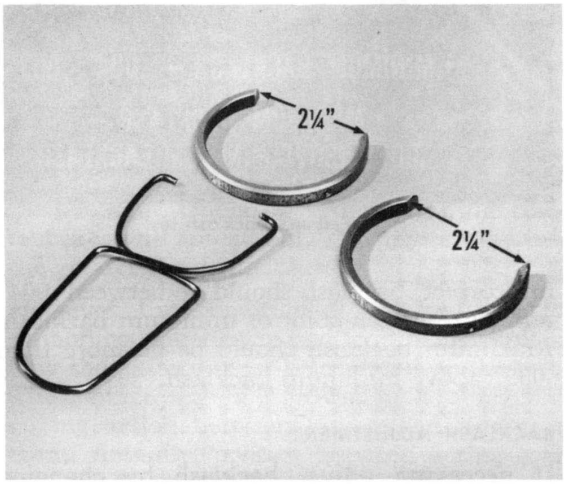


Fig. 15—Make gauges from spacers

Form a clamp-like gauge holder with bent-in prongs from ⅛-inch welding rod, as shown in the illustration. Drill two holes into the rim of each spacer to match the bent-in prongs of the gauge holder. "Mike" each spacer and mark its thickness in thousandths on the rim of the spacer.

To use a spacer gauge, grip it firmly with the gauge holder and slide it in place between the bearing cup and the carrier housing casting at the side nearest the pinion. Use the thickest spacer gauge that will fit.

READ RING-GEAR BACKLASH

Next, install the bearing cap on the ring gear side of the differential, while keeping the full stack-up of feeler gauge blades in position. Tighten the bearing cap bolts firmly to maintain differential alignment while checking backlash. Set up the dial indicator to read ring-gear backlash. Find the point of minimum backlash by measuring backlash at four ring-gear teeth, about 90° apart. Mark this point for future reference. Make a note of the gauge reading at the point of minimum backlash.

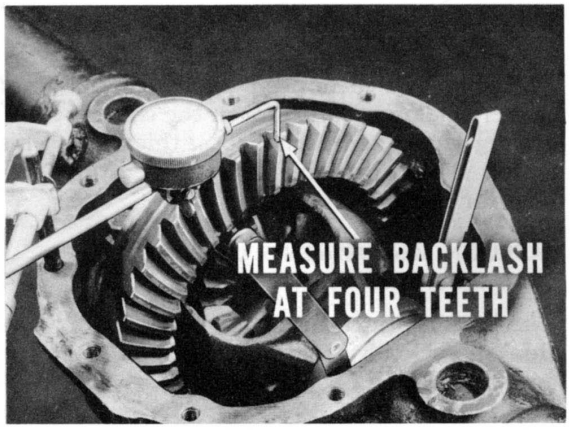


Fig. 16—Finding minimum backlash

Refer to the following chart to see how much change in the thickness of both spacers is required to give the desired preload and ring-gear backlash.

MINIMUM BACKLASH vs.
CHANGE IN SPACER THICKNESS, LEFT AND RIGHT

Backlash—With No Preload, No Side Play	Change Spacer Thickness At Ring Gear Side by:	Change Spacer Thickness At Pinion Side by:
.020	+.026	—.016
.019	+.024	—.014
.018	+.022	—.012
.017	+.022	—.012
.016	+.020	—.010
.015	+.020	—.010
.014	+.018	—.008
.013	+.016	—.006
.012	+.014	—.004
.011	+.014	—.004
.010	+.012	—.002
.009	+.010	.000
.008	+.008	+.002
.007	+.008	+.002
.006	+.006	+.004
.005	+.004	+.006
.004	+.002	+.008
.003	+.002	+.008
.002	.000	+.010
.001	.000	+.012

Should backlash with no preload and no side play measure more than the maximum chart figure of .020", increase the thickness of the spacer at the ring-gear side from the specified .254" to a thickness great enough to reduce backlash to within the chart limits. Then follow the procedure.

SPACER THICKNESS INCREASED .010" FOR PRELOAD

Probably you've noticed that the final *total* spacer thickness called for in the chart is .010" greater than the original *total* thickness. This added .010" gives the desired operating preload for the differential bearings.

BACKLASH MEASUREMENTS CHECK RING-GEAR MOUNTING

The backlash measurements you make during this operation will also tell you if the ring gear and case flange runout is okay. This is a quick double check to be sure you've mounted the ring gear to the case correctly. There should be a difference of no more than .005" from the highest backlash reading to the lowest.

INSTALL DIFFERENTIAL

Attach the C-3721 spreader tool and set up the dial indicator to be sure you don't spread the housing more than .020". With this new procedure, chances are that this is the only time you'll have to spread the housing during reassembly of the differential. Slide the differential in place, holding the two bearing cups and spacers in position as you do so. Don't try to install these parts one piece at a time —they won't fit that way.

RECHECK BACKLASH

After you've loosened and removed the spreader tool, install the differential bearing caps. Tighten all four bearing cap bolts to 40 foot-pounds. Then make a final backlash test with the dial indicator. If all the adjustments

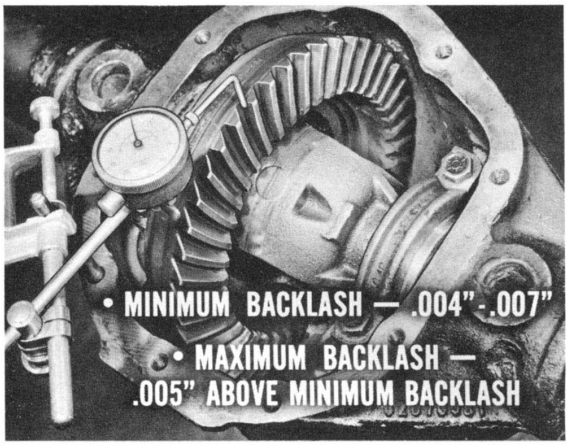


Fig. 17—Final backlash test

are correct, backlash should be between .004" and .007" at the point of minimum backlash. Maximum backlash should be no more than .005" above minimum backlash.

BACKLASH ADJUSTMENT

If necessary, adjust backlash by changing spacers. To increase backlash, install a thinner differential bearing spacer on the ring-gear side of the differential, and a correspondingly thicker spacer on the pinion side. A thicker spacer on the ring-gear side of the differential and an equally thinner spacer on the pinion side will decrease backlash. Whenever you change the spacers, it's absolutely essential that the *total* thickness of the two spacers remains constant. In other words, whatever you add to one side must be subtracted from the other side to maintain the correct bearing preload.

GEAR-TOOTH CONTACT PATTERN TEST

GOOD TOOTH CONTACT IS ESSENTIAL

The gear-tooth contact pattern tells the story of how well you've adjusted the ring gear and pinion. If the gear teeth mesh correctly with all bearings properly preloaded, and if the pinion's set right and backlash is within limits, the axle will operate quietly without noticeable wear.

RED-LEAD TEST

The red-lead test will tell you if the gear-tooth contact pattern is as it should be. The

test will verify that pinion depth is set correctly and that ring-gear backlash is properly adjusted. You should get a pattern similar to the correct one shown here. Never be satisfied with a tooth contact pattern that just comes *fairly* close to the ideal one. Aim for the best one possible. Otherwise, it won't be long before you'll have an unhappy owner on your hands, complaining about a noisy rear axle.

CORRECT PATTERN IS CENTERED

Notice that the correct gear-tooth contact pattern is well-centered. If you get a contact area that appears rather small, don't worry. This can happen when the test load on the gears is light. Under operating loads, the contact area will spread out. The higher the load, the greater the contact area.

However, this condition of the contact area expanding under increased load helps explain why the pattern must be centered on the test. The contact pattern is created by a rolling and wiping action between pinion and ring-gear teeth. Actually, contact between a ring-gear tooth and a pinion tooth at a given instant is practically a line contact, not an area contact.

In other words, the entire load borne by the gear teeth is concentrated along this moving contact line. It might help to imagine the line of contact as a wiper blade wiping the contact area on the gear tooth. Consequently, if the contact pattern spreads under heavy load and reaches any edge of the gear tooth, the entire load on the gear is brought to bear on this edge for an instant. This high load may exceed the strength of the metal. Then gear-tooth damage will result. But if the contact pattern is well-centered, it won't spread enough to damage an edge of the gear tooth under normal operating loads.

PROPER TEST REQUIRES PRACTICE

If your pattern appears wrong the first time you try the red-lead test, repeat the test before you decide to change any adjustments. It takes some practice to make this test correctly, so the improper pattern could be the result of your technique and not because of an improper adjustment.

SUGGESTED TESTING METHOD

Here are some suggestions that will improve your "batting average" when using red lead to test tooth contact pattern. Install the axles, brakes and drums. Tighten the brakes to give a drag on the gears. Apply red lead to the gear teeth and turn the pinion. If the gear tooth contact pattern isn't right, you'll have to decide what's wrong and how to correct it. Here are more details on this procedure.

INSTALL BRAKES AND AXLES

When you install the rear brakes, use new plastic foam seals, on both sides of each brake support plate. Make sure the drain passage in the bottom of the axle shaft retainer plate is unobstructed. And before installing the axle, coat the axle shaft bearing with lithium-base grease (MoPar Part No. 2206020). These precautions are all essential to prevent corrosion and premature bearing failure.

LOAD GEARS WITH BRAKES

Put both rear brake drums in place temporarily. Tighten the brake adjuster on one brake enough to lock the drum. Then tighten the other brake adjuster to the point where there's a drag of 30 to 50 foot-pounds at the pinion nut when you turn the pinion with a torque wrench. This applies a measured load on the pinion and ring gear. And since the size of the tooth contact area depends on the load on the gears, the measured load will give a more consistent contact pattern.

Although it's not necessary to put any wheel stud nuts on the drum that's locked, it is advisable to install at least one, finger-tight, on the drum that is dragging. This will keep the drum from working away from the brake support plate and dropping off as it turns.

APPLY RED LEAD

The red lead must be smooth and just slightly moist—a bit thicker than toothpaste. If it's too thin, it will run and fill in the tooth contact pattern. Mix in a small amount of cup grease to thicken the mixture. Apply the red lead by brushing a light coat evenly on the ring-gear teeth.

TEST TOOTH CONTACT

Turn the pinion to rotate the ring gear one complete turn in each direction. Check the

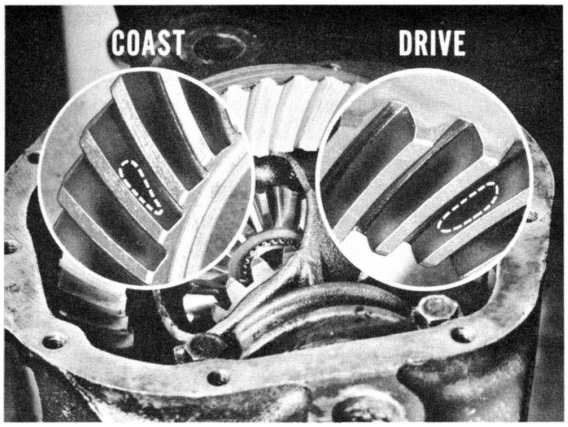


Fig. 18—Correct contact pattern

contact pattern on the ring-gear teeth. If all your adjustments are correct, the pattern will be centered on both sides of the ring-gear teeth. The pattern should also be the same on every tooth. If the pattern you get doesn't match this description, readjustment of the ring gear and pinion is called for.

HEAVY FACE CONTACT

If the pattern is narrow and high on the *tooth face,* the teeth will gall. This causes wear in a hurry, combined with gear noise. To correct this kind of pattern, you'll have to install a *thicker* pinion spacer washer to move the pinion closer to the ring gear. Then check ring-gear backlash and readjust it if necessary. Do this by decreasing the thickness of the differential bearing spacer on the ring-gear side and increasing the thickness of the spacer on the pinion side a corresponding amount.

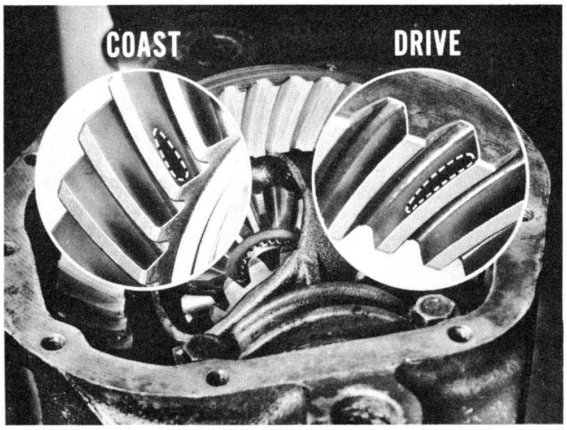


Fig. 19—Heavy face contact

HEAVY FLANK CONTACT

If the pattern is narrow and low on the lower half of the tooth, *or tooth flank,* the teeth will gall. If this is not corrected, you'll get gear wear and noise. To correct this pattern, install a *thinner* pinion spacer washer to move the pinion away from the ring gear. Then make sure backlash is within specifications.

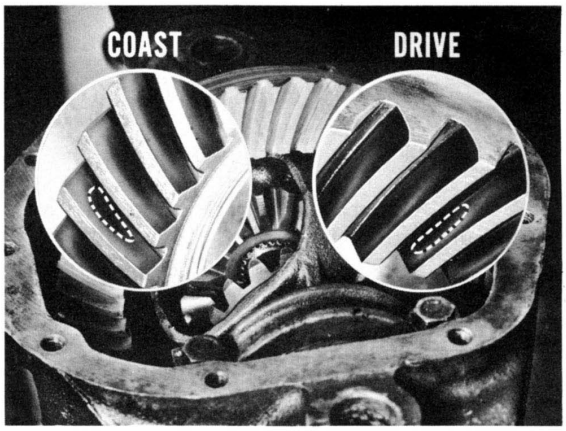


Fig. 20—Heavy flank contact

HEAVY TOE CONTACT

If the contact pattern is too heavy on the inside edges, *or toe,* of the teeth, these edges will chip and wear due to the terrific pressure on the small contact area. To correct this condition, install a thinner differential bearing spacer on the ring-gear side and a correspondingly thicker one on the pinion side to move the ring gear away from the pinion.

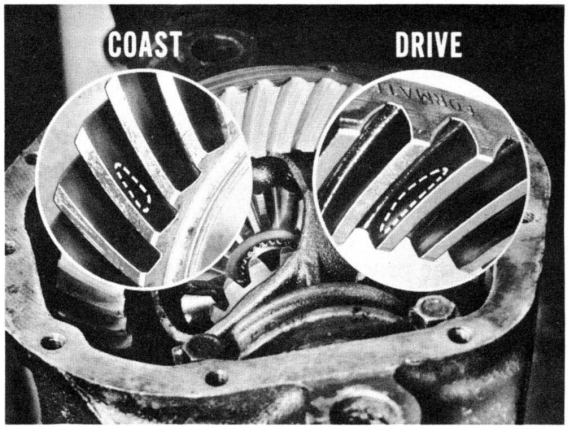


Fig. 21—Heavy toe contact

Ring-gear backlash may now be excessive, so check it. If backlash is beyond limits, install a thicker pinion spacer washer to move the pinion in a bit and bring the backlash back within limits.

HEAVY HEEL CONTACT

If the contact pattern is too heavy on the outer end, *or heel,* of the tooth, chipping and rapid wear will occur. To correct for heavy heel contact, you should do just the opposite of heavy toe correction. Install a thicker differential bearing spacer on the ring-gear side and a correspondingly thinner one on the other side.

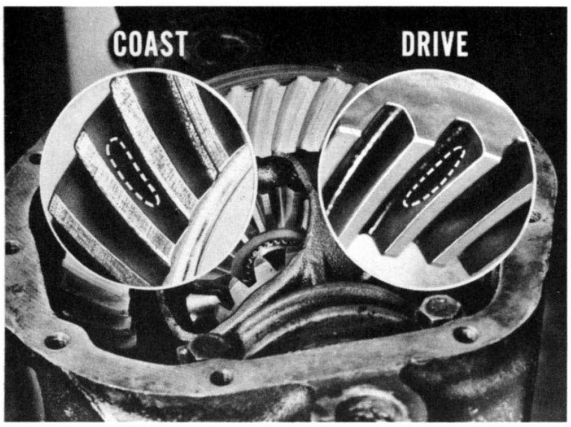


Fig. 22—Heavy heel contact

This will move the ring gear closer to the pinion. But backlash may now be too tight. In that case, you'd have to install a thinner pinion spacer washer to move the pinion away from the ring gear and increase backlash to the specified limits.

READJUSTMENT PRECAUTIONS

If you have to change any adjustments in order to arrive at the best gear tooth contact pattern, remember these points. When changing the thickness of a differential bearing spacer, be sure to maintain the same *total* spacer thickness for proper preload. For example, if you *increase* spacer thickness at one side, *decrease* spacer thickness an equal amount at the other bearing.

If you change the pinion depth washer, remember to change the pinion preload washer. If you *increase* pinion depth washer thickness, *increase* pinion preload washer thickness an equal amount. If you *decrease* pinion depth washer thickness, *decrease* preload spacer washer by the same amount. Retest pinion bearing preload.

INSTALL DIFFERENTIAL COVER

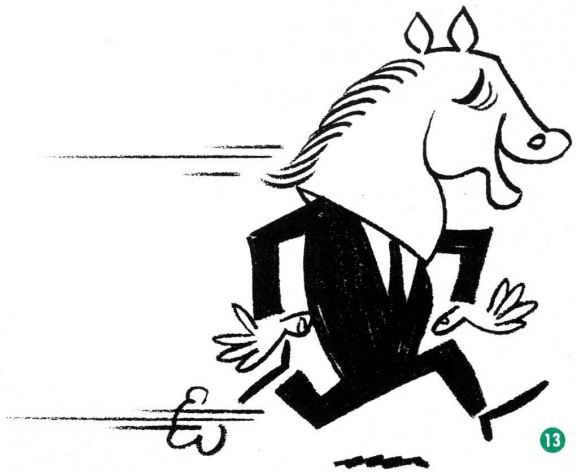
When you're sure the differential is adjusted properly, check to be sure the sealing surface of the differential cover is flat. If it's not, replace the cover. Distorted edges won't seal tightly. Install the cover with a new gasket and torque the cover bolts down evenly to no more than 20 foot-pounds. Over-torquing the cover bolts can distort the cover and cause a leak.

FILL DIFFERENTIAL BEFORE INSTALLATION

Fill the differential with 2 pints (1¾ pints, Imperial measure) of a lubricant conforming to MIL-L-2105 B&A specifications. MoPar and Chryco supply an excellent lubricant that meets these specifications. It's available in one-quart size under Part No. 1879414, or in larger quantity drums under Part No. 2298930. You'll find it's easier to do this before you install the differential on the car. In fact, if the car's on a frame contact hoist, the carrier nose will tip up and you won't be able to get the full amount of lubricant in the housing.

TIGHTEN "U" BOLTS CAREFULLY

When you install the rear axle assembly, be careful to tighten the "U" bolts to no more than 45 foot-pounds. If you go above this value, you might distort the bearing bores in the axle housing. This will cause early bearing failure.



SERVICE REFERENCE BOOK

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Litho in U.S.A.