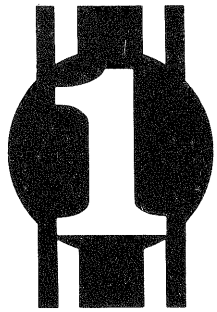
RAYGO WAGNER

A SUBSIDIARY OF RAYGO, INC.



3418P AXLE

SERVICE INSTRUCTIONS

80-043

INTENTIONALLY BLANK

3418 P AXLE ASSEMBLY

The following instructions cover the complete disassembly and reassembly of the axles. If only portions of the axle assembly require service or repair, such as on axle shafts, wheel bearings, etc., use that portion of instructions covering the parts in question.

The axle and differential are large and heavy. In event the differential has to be removed from the axle housing, it may be advisable to remove the complete axle from the vehicle. This will depend on the vehicle the axle is installed in and the type of shop equipment available. The illustrations used in the instructions are from an axle assembly prior to installation in a vehicle.

It is very essential the exterior of the axle assembly be cleaned before disassembly. Any foreign material falling or entering into the planetary section or any part of the axle assembly and not removed will shorten the life of the assembly drastically.

Rotate the hubs so that the drain plugs for the planetaries are pointing downward, remove the plugs and drain the lubricant.

FIGURE 1: Remove the six capscrews from the planetary cover; remove the cover. The sun gear is splined to the axle shaft and retained on the shaft with a snap ring. The sun gear and axle shaft can be removed as a unit.

FIGURE 2: Remove the capscrews from the planetary spider. All but four of the capscrews are used to secure the planetary spider to the hub. Four of the capscrews are shorter in length and are threaded into the planetary spider. Use four of the long capscrews as puller screws by inserting in the threaded holes the short capscrews were removed from. As the capscrews are tightened, they will act as pullers and pull the planetary spider away from the hub. Remove the planetary spider.

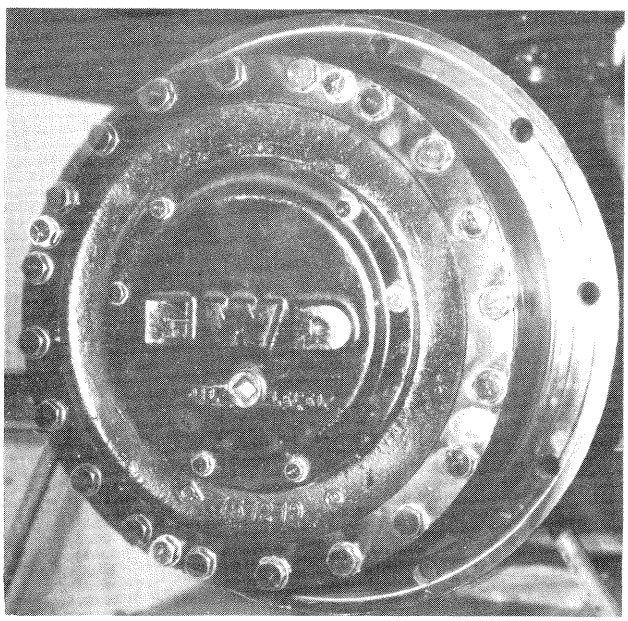


FIGURE 1

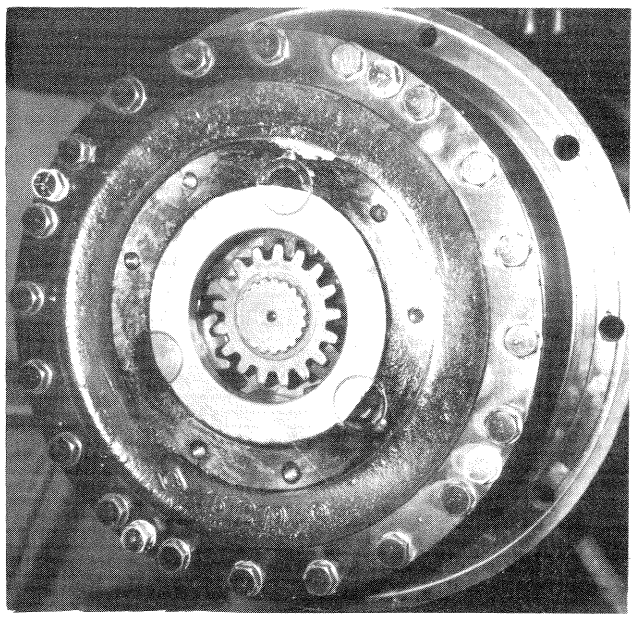


FIGURE 2

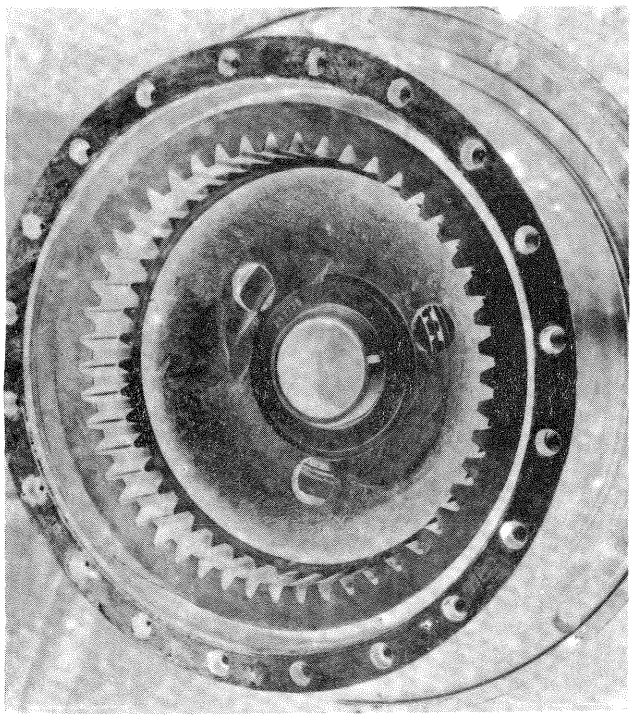


FIGURE 3

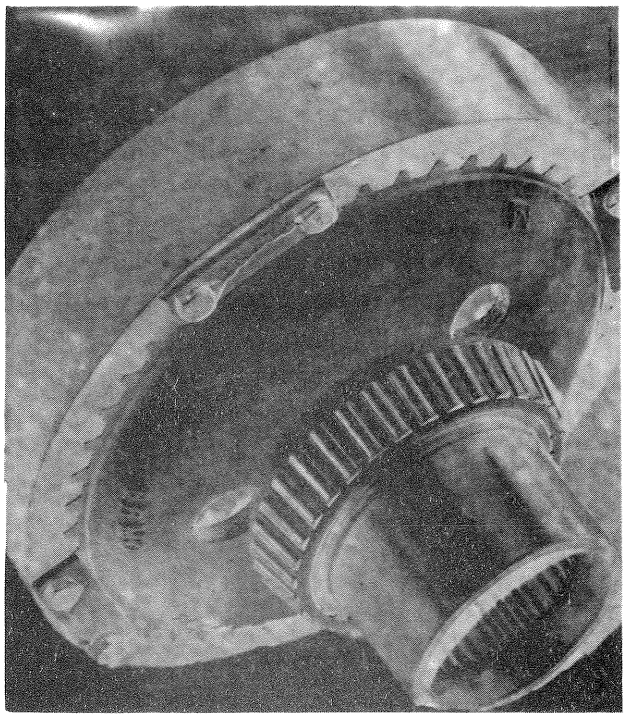


FIGURE 4

FIGURE 3: Remove the outer skein lock nut spacer and the inner lock nut. Remove the hub ring gear and the internal tooth ring gear as a unit.

FIGURE 4: The wheel hub can now be removed; lift the assembly off from the skein.

FIGURE 5: Remove the nuts from the studs; remove the skein from the axle housing. It may be necessary to tap the skein with a lead hammer or block of wood to loosen the skein from the housing.

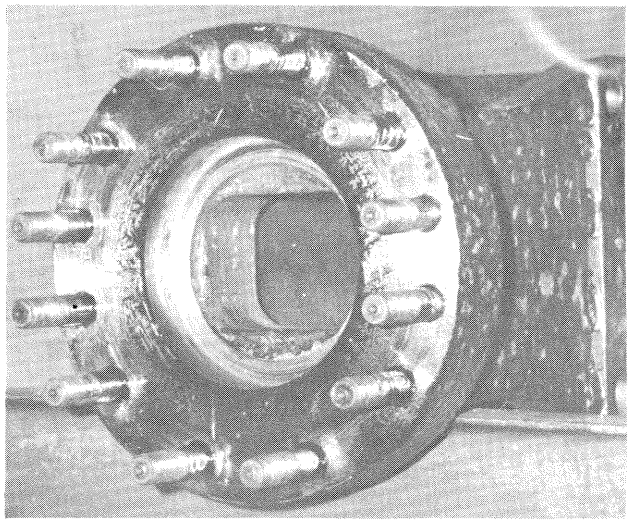


FIGURE 5

DIFFERENTIAL REMOVAL

Drain the lubricant from the differential housing. After draining the lubricant, rotate the axle housing so that the pinion is on the top. Remove the capscrews which secure the differential assembly to the axle housings. Attach a hoist to the pinion yoke and lift the differential from the axle housing. NOTE: Both axle shafts must be removed before attempting to remove the differential assembly on a work bench or other suitable work space.

The pinion assembly can be removed as a unit or partially disassembled. Remove the capscrews which secure the pinion assembly to the differential carrier. Remove the pinion assembly from the differential carrier.

FIGURE 6: If the pinion assembly cannot be removed from the carrier easily, remove the yoke nut, washer and yoke. Remove the pinion bearing cover. The pinion bearing housing has two threaded holes 180° from each other. Insert two capscrews into the threaded holes of the pinion cover. Tighten the capscrews, they will act as a puller to remove the assembly from the differential carrier.

FIGURE 7: Disassemble the pinion assembly. The pinion shaft is ground to a slightly smaller diameter at the spline end to promote easy removal of the outer tapered bearing. The inner tapered bearing has a press fit on the pinion shaft; a puller or a press is required to remove the bearing. To complete the disassembly, drive or press the two bearing cups out of the pinion housing and remove the oil seal from the pinion bearing cover.

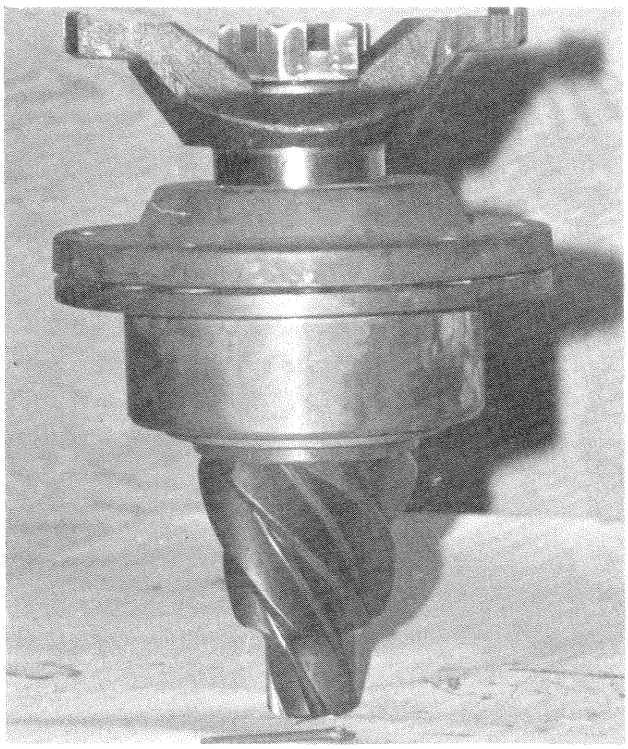


FIGURE 6

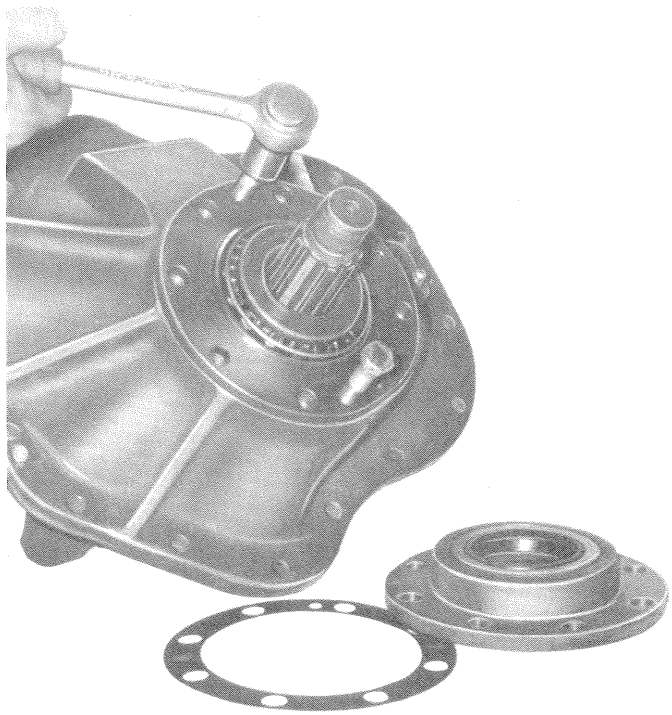


FIGURE 7

DIFFERENTIAL DISASSEMBLY

The oil scoop assembly is located above the pinion bore, remove the pipe plug, spring and oil scoop from the carrier.

Remove the two capscrews from the side carrier bearing adjusting nut locks, remove the locks. Remove the lock wire from the bearing cap capscrews; remove the capscrews. Remove the bearing caps and adjusting nuts. Lift the differential assembly from the differential carrier.

The pinion pilot bearing is positioned in the differential carrier, a shoulder machined at the differential side of the bearing bore prevents the bearing from moving toward the differential. Drive the pilot bearing out toward the pinion assembly opening of the carrier.

FIGURE 8: Press or drive a new pilot bearing in the carrier. If the bearing is driven into the carrier, drive on the outer race only. Make certain the bearing is snug against the retaining flange.

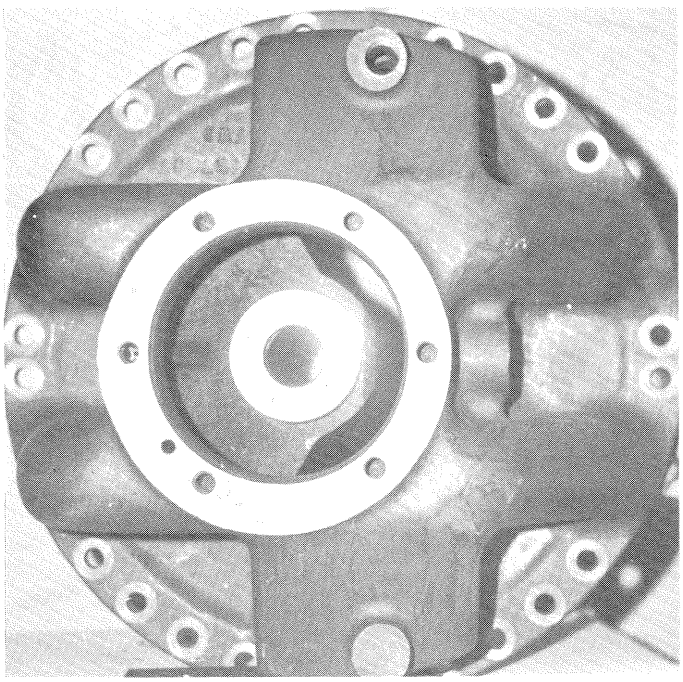


FIGURE 8

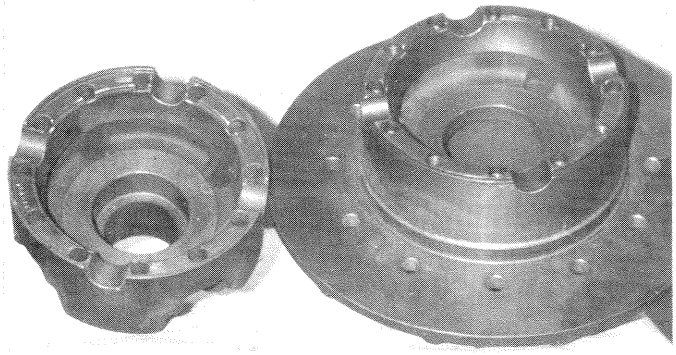


FIGURE 9

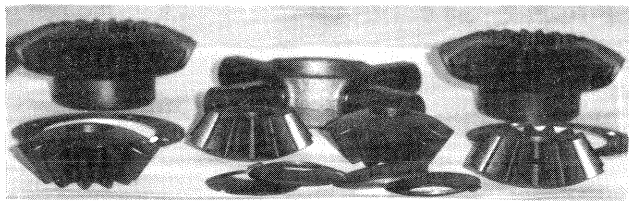


FIGURE 10

Remove the self-locking nuts and capscrews from the ring gear, remove the ring gear from the differential case. Punch mark both halves of the differential case so that when being reassembled, the two halves of the case can be placed in their original position. Remove the eight long capscrews from the differential case, separate the two halves of the case.

Remove the spider gears and spider, side gears and thrust washers from the differential case. Clean all parts and inspect them thoroughly; if in doubt about the serviceability of any part, replace it.

DIFFERENTIAL REASSEMBLY AND ADJUSTMENTS

FIGURE 9: Both halves of the differential case are machined separately. If one side or the other is worn or damaged, it is not necessary to replace the complete case assembly, only the damaged part.

FIGURE 10: The internal gears and associate parts of the differential assembly consist of four spider gears, four spider gear thrust washers, a spider, two side gears and two side gear thrust washers.

FIGURE 11: Lubricate the spider, thrust washers and all gears. Install all parts in case as shown.

FIGURE 12: Place the two halves of the differential case together. If the original case is being used, make certain the punch marks on each half line up so that the two halves will be in the same relative position to each other as they were originally. A new case assembly or a new half of a case will fit in four different positions; however, after the case has been bolted together, check the spider and side gears for free movement. If they do not move or revolve freely, remove the bolts, separate the case and reassemble in a different position until the gears move more freely.

Torque the capscrews to 145-160 ft. pounds - dry threads on the 3418 P assembly. Secure the capscrews with safety or lock wire. Install the two side carrier bearings. The differential assembly is shown with one side carrier bearing installed.

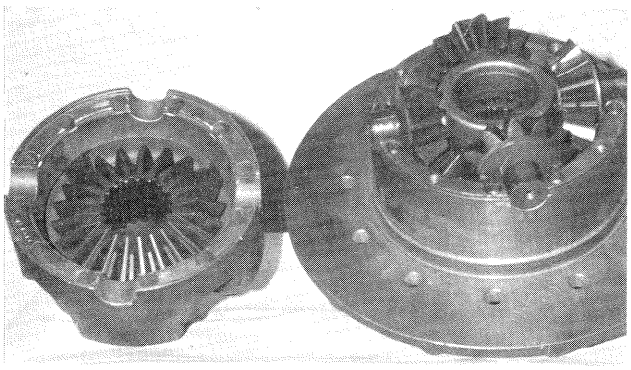


FIGURE 11

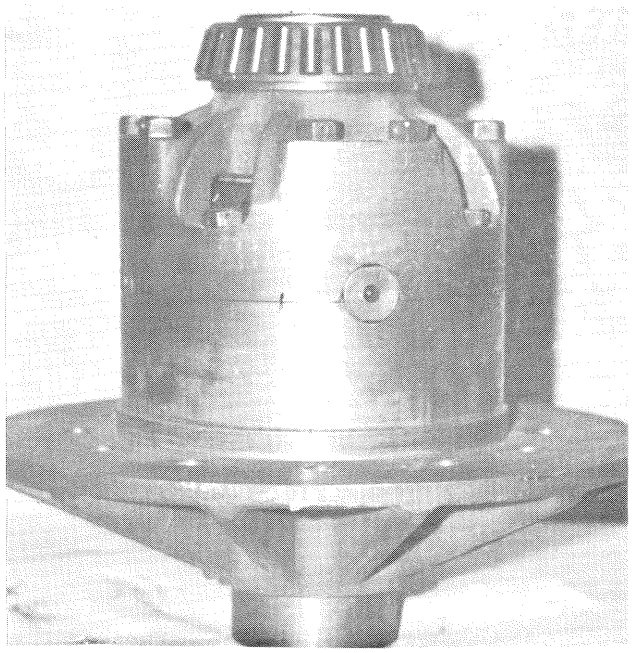


FIGURE 12

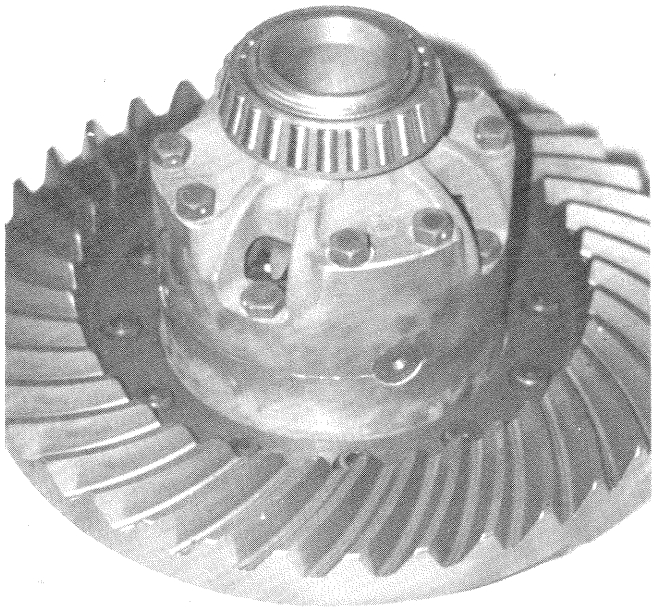


FIGURE 13

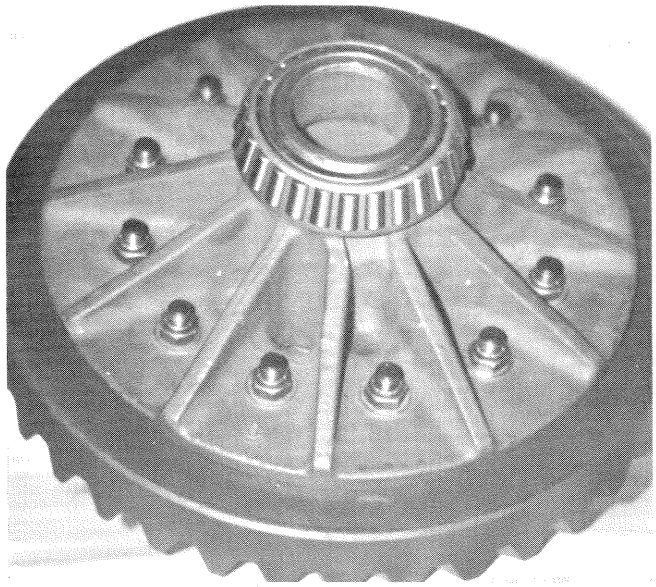


FIGURE 14

FIGURE 13: Place ring gear over differential assembly and install the capscrews.

FIGURE 14: Install the twelve self-locking nuts on the capscrews, torque the capscrews to 100-110 ft. pounds - dry threads.

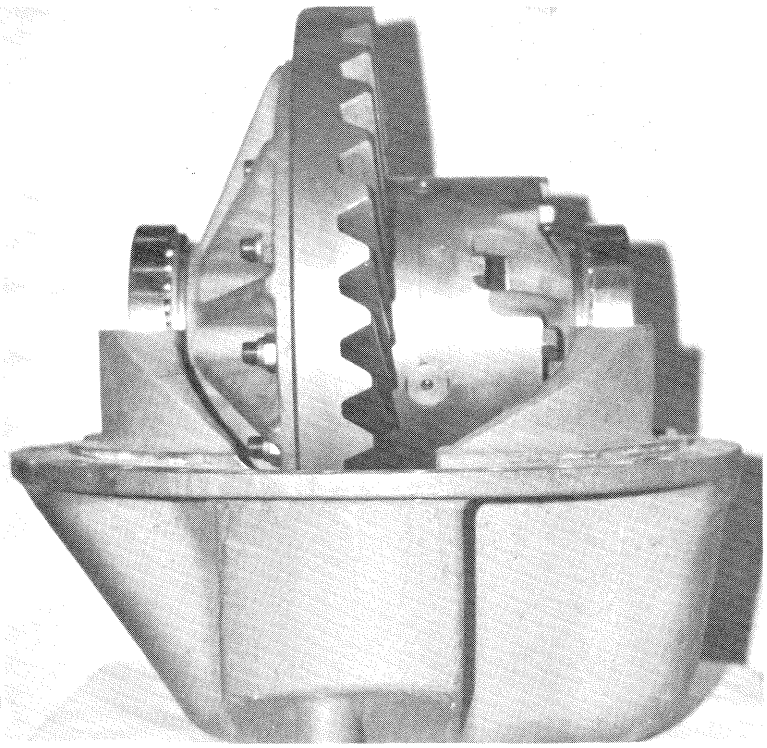


FIGURE 15

FIGURE 15: Before assembling pinion into carrier, assemble carrier bearing to differential case and differential case to carrier housing. Assemble bearing caps, cap bolts, and lock nuts. Tighten cap bolts to snug fit.

Equalize differential assembly (approximately) by having the same amount of thread engagement on both bearing lock nuts.

Tighten the lock nuts until there is a substantial drag on the ring gear. This can be measured by applying a string, wrapped around the differential case, and pulling on the string with a spring scale. Scale should read from 30 to 50 pounds at this stage of assembly.

Loosen the lock nut on one side until drag is just noticeable. If scale is used, it should read from 2 to 8 pounds. Tighten the cap bolts. Drag will increase due to the compression of the outer bearing races.

A scale reading from 7 to 13 pounds is acceptable. If a gauge for checking across the surfaces on the bearing caps that enter the housing backup pads is available, check the dimension across these surfaces. They should not exceed .005" over the original dimension before pre-load was applied. RayGo Wagner has standard No-Go gauges that are designed for this purpose and are available through the Service Department. NOTE: This gauge is not necessary to make correct adjustments. It is used where a large number of carriers are to be assembled.

FIGURE 16: If dimension exceeds the required amount, back off one of the bearing lock nuts one notch. Loosen the cap bolts to allow the bearing cup to slide and retighten. If no gauge is available, use the housing as a guide. Carrier should not be forced into the axle housing by use of the mounting studs or bolts. Mark the position of the bearing lock nuts with chalk.

FIGURE 17: Attach a dial indicator to the differential carrier and check the ring gear for run out. Maximum permissible run out is .005". Run out exceeding .005" indicates the differential case has become sprung or distorted and must be corrected by machining or by replacing the case.

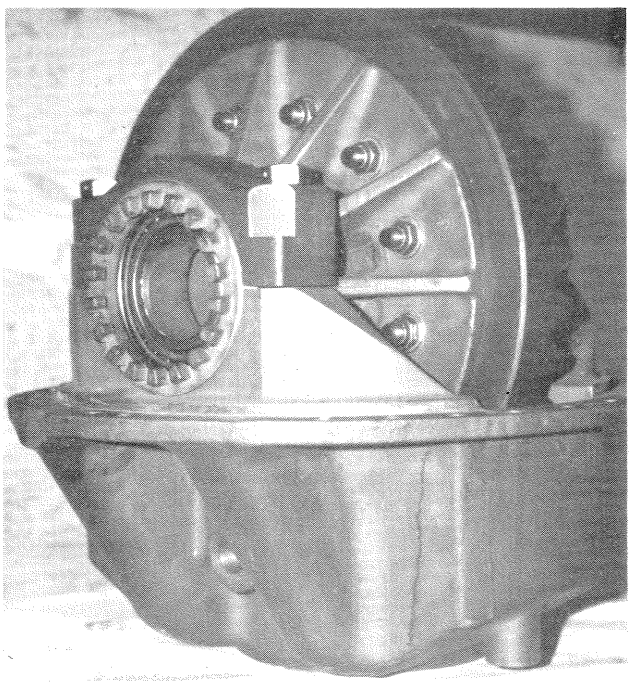


FIGURE 16

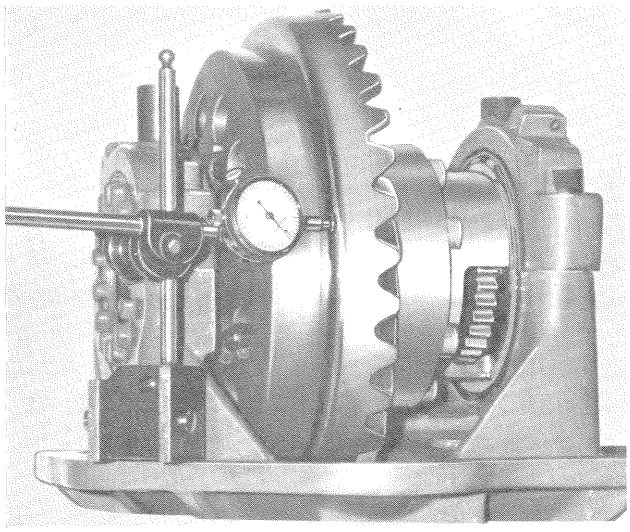


FIGURE 17

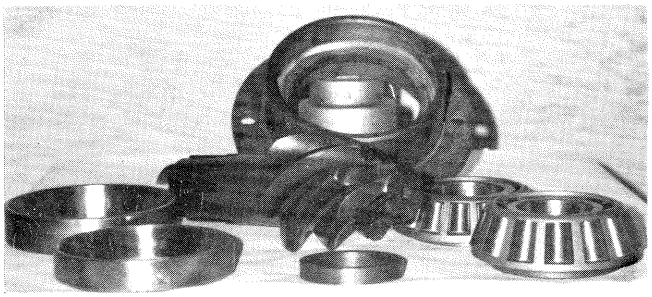


FIGURE 18

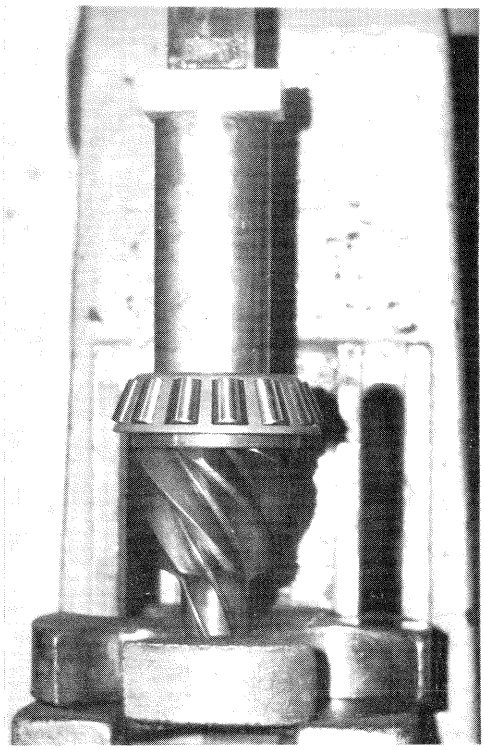


FIGURE 19

FIGURE 18: The pinion assembly consists of the pinion carrier, pinion, two tapered bearings, two bearing cones and a bearing spacer. A press should be used to install the bearing. The bearings in the 3418 P pinion assembly are the same size.

FIGURE 19: Press the two bearing cups into the pinion carrier. Press the cups into the carrier until they bottom on the flange in the carrier. Place the bearing spacer on the pinion shaft next to the bearing.

FIGURE 20: Proper preload on the tapered pinion bearings is extremely important; therefore, the bearing spacers are available in various sizes or thicknesses. The following is a suggested method to determine the approximate thickness the spacer must be to obtain the proper preload on the pinion bearings. Place the pinion shaft, bearing and spacer in the pinion carrier.

FIGURE 21: Install the outer tapered bearing on the pinion shaft next to the bearing spacer. Install the pinion yoke and nut. Do not install the cover plate and oil seal until after correct preload on pinion bearings has been established. Place pinion assembly in a vise and torque pinion nut to 350-500 ft. pounds.

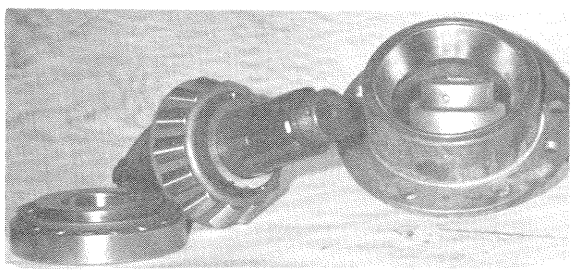


FIGURE 20

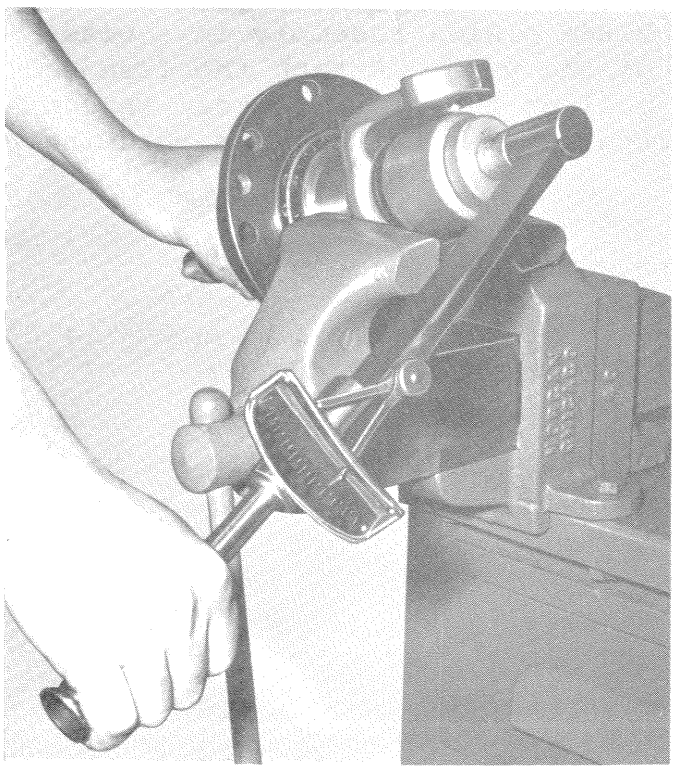


FIGURE 21

FIGURE 22: With the pinion carrier resting firmly on the tapered bearing, adjust the dial indicator so that the pointer rests on "0". Grasp the carrier and lift upward until upper tapered bearing is firmly seated. Check the dial indicator reading; the figure the pointer indicates is the amount of end play between the tapered bearings. Add .002" to the end play reading on the dial indicator; the end play reading on the dial indicator plus .002" subtracted from the thickness of the spacer is the approximate thickness the spacer should be to obtain the correct preload on the pinion bearings. If a spacer of the correct size is not available, the thickness of a spacer can be reduced in a lathe or surface grinder. If a lathe or surface grinder is not available, a few thousandths of an inch can be removed as follows: Place a sheet of emery paper or other abrasive on a flat surface, such as a piece of glass, slide the spacer back and forth across the abrasive until the proper amount of material has been removed. After the spacer has been machined or ground, reassemble the pinion, spacer and bearings in the pinion carrier. Install the yoke and pinion nut, again torque the nut to 350-500 ft. pounds. (NOTE: Do not install oil seal and cover plate). Place pinion assembly in a vise, wrap a stong cord around the neck of the yoke. Attach the free end of the cord to a spring scale, pull on the scale to keep the yoke rotating. Read the pointer on the scale with the yoke rotating.

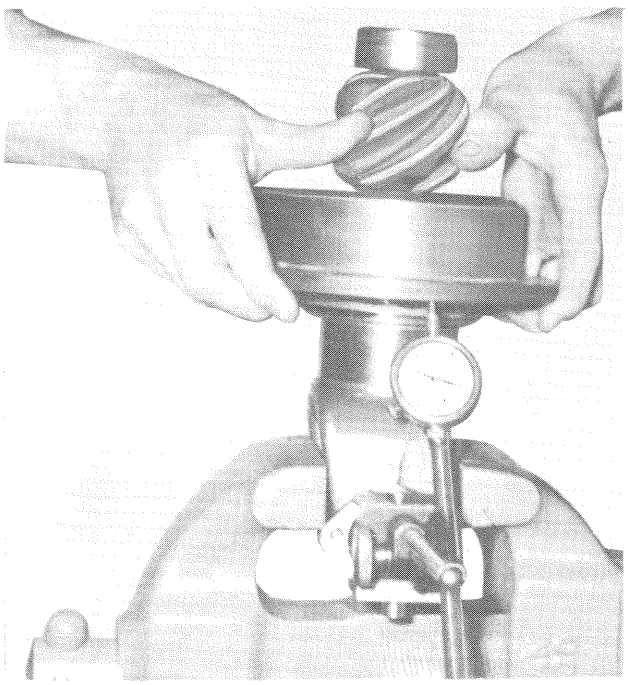


FIGURE 22

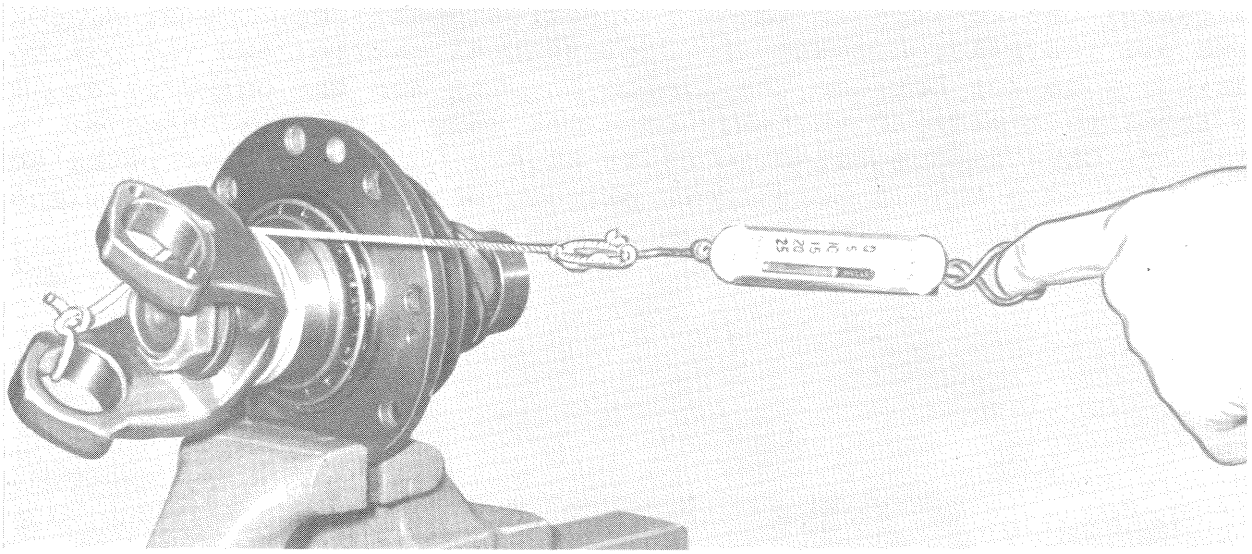


FIGURE 23

FIGURE 23: The correct preload on the tapered pinion bearings is between 15 and 20 inch pounds. The pinion yoke neck on the 3418 P differential is 2 3/4" in diameter; therefore the reading on the spring scale should be between 5.5 and 7.5 pounds. If the reading on the scale with the yoke revolving is less than 5.5 pounds, the spacer is too thick and must be changed or ground. If the scale reading is more than 7.5 pounds, the spacer is too thin and will have to be replaced with a thicker spacer.

After the correct pinion bearing preload has been established, the yoke must be removed so that the outer cover and seal can be installed. The yoke can be reinstalled after the cover is in place; again, torque the pinion nut to 350-500 ft. pounds.

FIGURE 24: Shows the pinion assembly being installed to the differential carrier without the yoke so that the sequence of shims and the gasket can be seen in their respective positions. Metal spacer shims are installed between the differential carrier and the pinion housing, a gasket between the pinion housing and the outer cover. The total thickness of the shim pack may vary slightly; however, a total of .060" is suggested to start with. Shims may have to be added or removed to obtain a good tooth pattern between the ring gear and pinion. Install the pinion assembly and cover gasket.

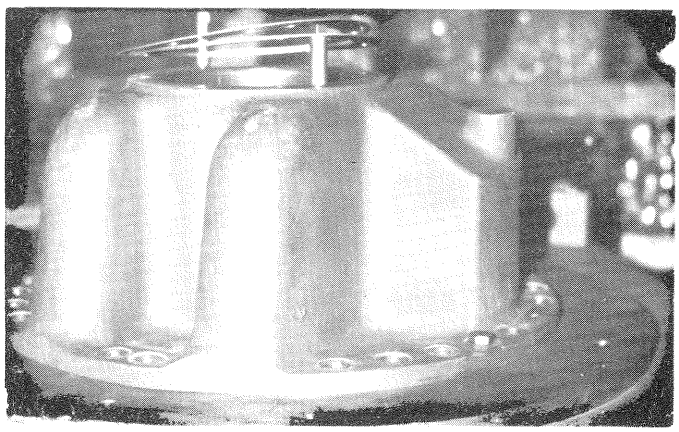


FIGURE 24

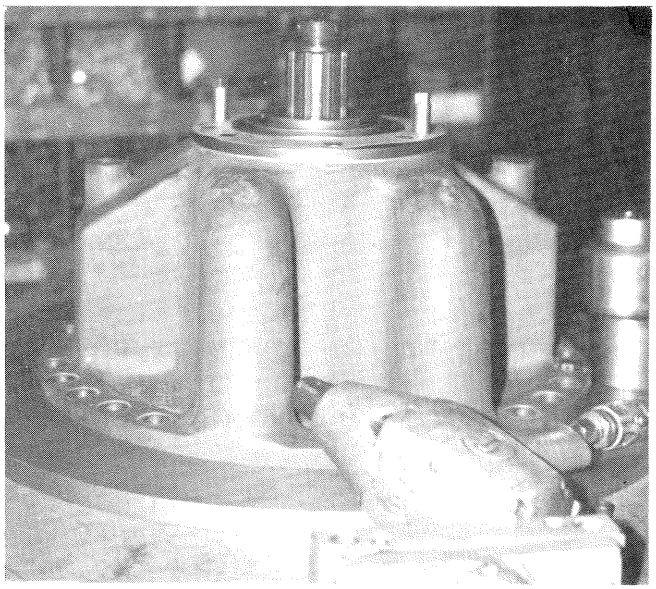


FIGURE 25

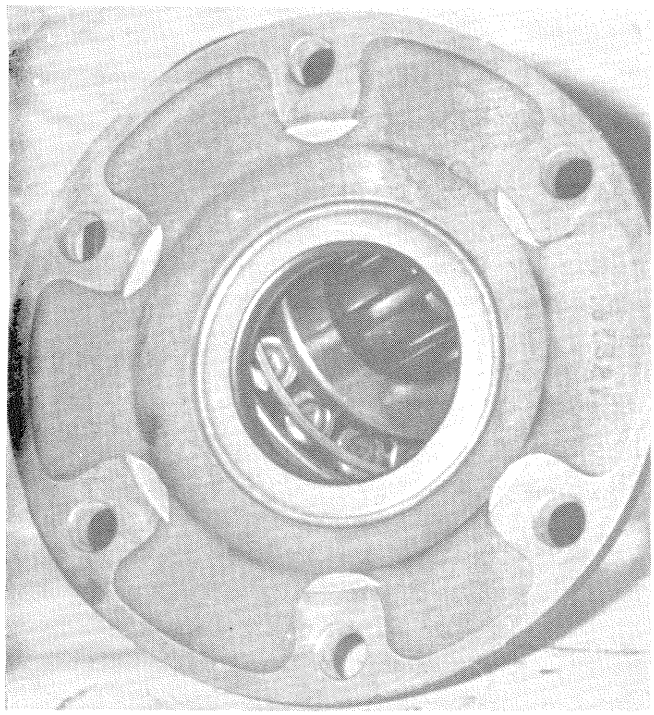


FIGURE 26

FIGURE 25: Install the pinion oil seal in the housing cover. The seal is pressed in the cover from the outside face.

FIGURE 26: Install the cover and yoke. Torque the cover capscrews to 140-160 ft. pounds, dry threads.

RING GEAR AND PINION ADJUSTMENT

The side carrier bearing caps have previously been adjusted to a snug fit against the bearings.

Attach a dial indicator to the differential carrier so plunger contacts a tooth on the ring gear. Check ring gear back lash. The minimum back lash is marked on the ring gear, the back lash can be several thousandths more than the markings on the ring gear, never less.

FIGURE 27: If the back lash between the ring gear is not correct, loosen the four bearing cap capscrews so that the bearing adjusting nuts can be rotated. If there is too much back lash, rotate the bearing adjustment nuts so as to move the ring gear toward the pinion; if not enough back lash, move the ring gear away from the pinion. Back off the bearing adjusting nut one notch at a time and tighten the oposite adjusting nut one notch at a time so as to retain the side bearing preload. Continue this procedure until the correct ring gear-pinion back lash is established.

After the ring gear-pinion back lash has been adjusted correctly, the next step is to check the tooth contact or pattern. Paint the ring gear with red lead or equivalent, place as much drag on the ring gear as possible by hand. Rotate the pinion yoke until the ring gear has rotated several turns in each direction.

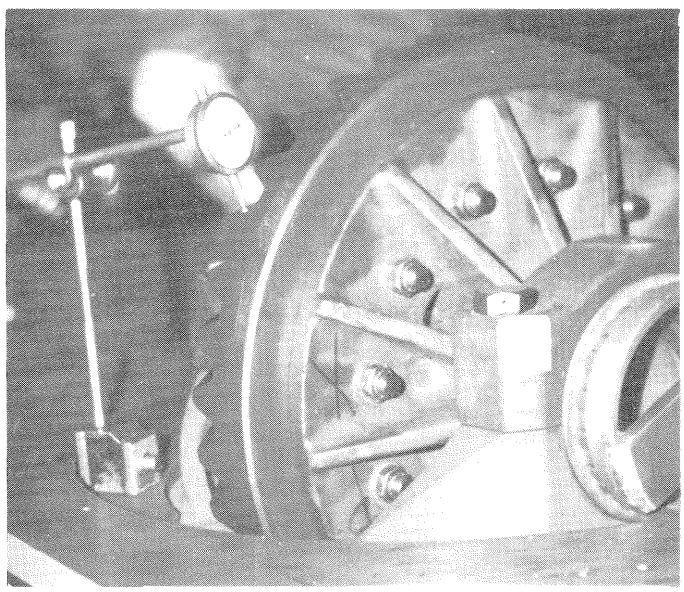


FIGURE 27

TEST PATTERNS

The following tooth pattern illustrations were obtained from photographs of a ring gear and pinion in a test machine. The braking action produced by the machine is greater than it is possible to produce by hand; therefore, the tooth pattern shown in the illustrations may be longer than those obtained with reduced drag between the gears.

FIGURE 28: The correct tooth pattern for the drive side or convex side of the ring gear teeth is as shown. The bearing or contact pattern starts near the toe and extends approximately 60% of the length of the tooth toward the heel. The bearing pattern will progress toward the heel as load pressure is increased.

FIGURE 29: Both sides of the ring gear teeth must be checked. The correct pattern for the reverse or concave side of the ring gear teeth is as shown. The pattern is similar to the pattern on the drive side of the teeth. Please note, the contact pattern is in the same position on both sides of the ring gear teeth. Similar patterns on both the convex and the concave side of the ring gear teeth can occur only when the adjustment is correct. Checking the pattern on both sides of the teeth is important and must be done when adjusting the ring gear and pinion tooth contact.

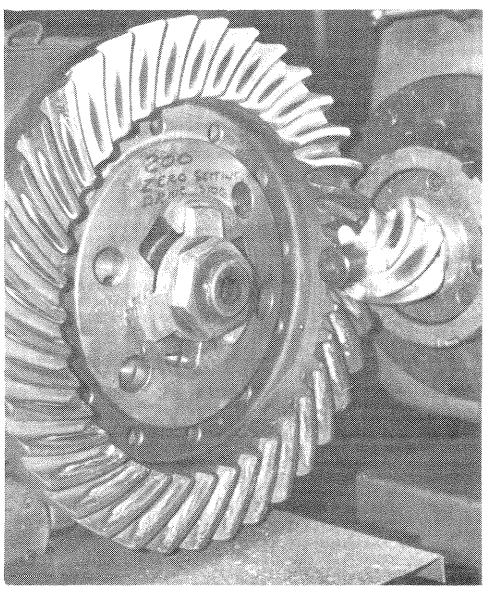


FIGURE 28

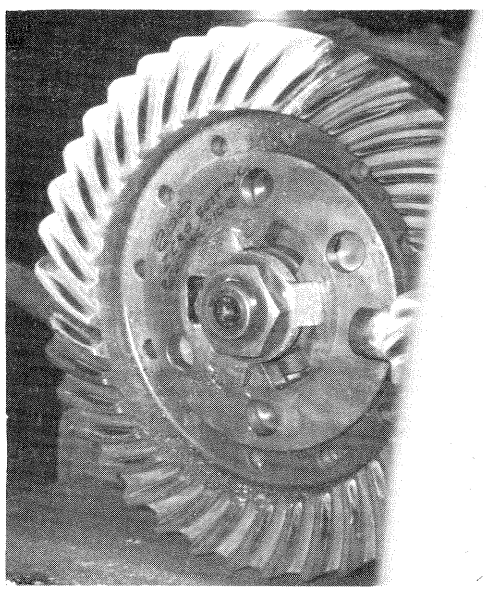


FIGURE 29

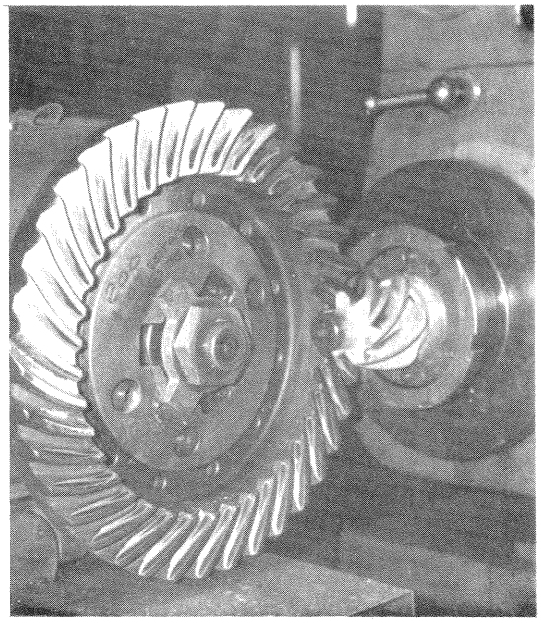


FIGURE 30

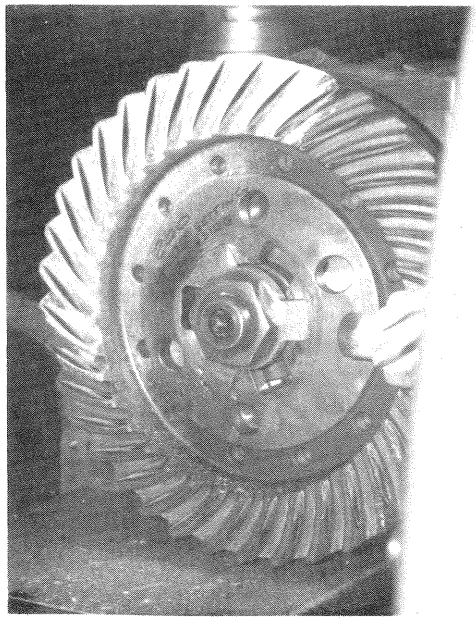


FIGURE 31

FIGURES 30 and 31 are photos of the type of patterns resulting from the shim pack between the differential carrier and pinion housing being too thick. The pinion is back .030" from the true or correct position.

FIGURE 30: Shows the drive or convex side, FIGURE 31: Shows the reverse or concave side of the ring gear teeth. Note the difference in the two patterns on opposite sides of the ring gear teeth. The concave side of the teeth has the pattern reversed, compared to the convex side. This is a normal reaction; the tendency is for the patterns on opposite sides of the teeth to reverse or run in opposite directions whenever the pinion is not positioned correctly.

A ring and pinion adjusted as shown would have very short life and would be noisy. The photos were taken under controlled conditions; therefore, knowing the pinion was .030" out or back of the correct position, removing .030" shims from the shim pack will correct the setting. The .030" figure is used only as a guide to make it easier to estimate the amount of shims to be removed when adjusting a differential and comparing patterns from the photos with the pattern of the actual adjustment.

Changing shims in the shim pack will also change the back lash between the ring gear and pinion. Readjust the back lash as described previously; be sure to adjust both side bearing caps to retain the side bearing preload.

FIGURES 32 and 33 are photos of the pattern resulting from the pinion set too far into the differential and ring gear. The pattern on either side of the ring gear teeth is not good; the wear pattern extends too far toward the toe on the drive on convex side and extends too far toward the heel, FIGURE 32. The pattern on the reverse or concave side, FIGURE 33, extends too far toward the toe, is too long and too narrow. Early failures and noise could be expected if a ring gear and pinion were adjusted so as to have a pattern as shown.

Both pinions in the illustrations have been extended into the differential assemblies .030" beyond the proper setting. The correction is to add .030" shims to the pinion assembly shim pack, to move the pinion back. In actual practice, it may be necessary to use the trial and error method in adding or removing shims until the proper setting is reached. The .030" figure in the illustrations are meant to assist in estimating how many shims are to be added or removed to obtain a perfect pattern.

We cannot over-emphasize the importance of proper gear adjustment, including both the wear pattern and ring gear-pinion back lash. At the final adjustment, the carrier bearing lock nuts should be indexed to the same number of notches. Example: When one side indicates the nut was turned in five (5) notches, the opposite nut should be turned out (5) notches from the marks obtained. This will insure the preload adjustments previously made.

A recheck across bearing caps with the gauge should indicate the same dimension obtained in previous adjustments. If no gauge is available, use the housing as a guide. Forcing the carrier in the housing by using excessive wrench force on the carrier mounting studs is not recommended. Housing should be withdrawn and preload relieved by backing nut on gear side off one notch. The slight shift from this adjustment will not vary the gear pattern or backlash enough to cause incorrect gear mesh. If more than one notch is required, recheck pattern and backlash adjustments. After all adjustments are complete, torque the side bearing capscrews to 330-350 ft. pounds - dry threads for the 3418 P differential.

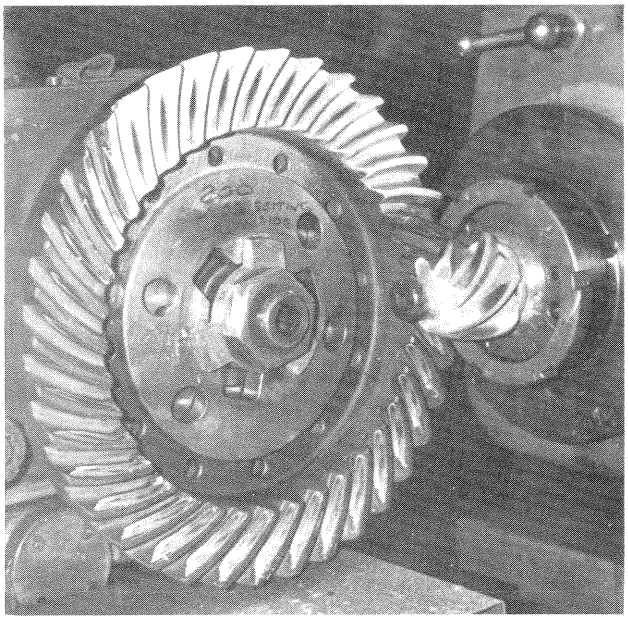


FIGURE 32

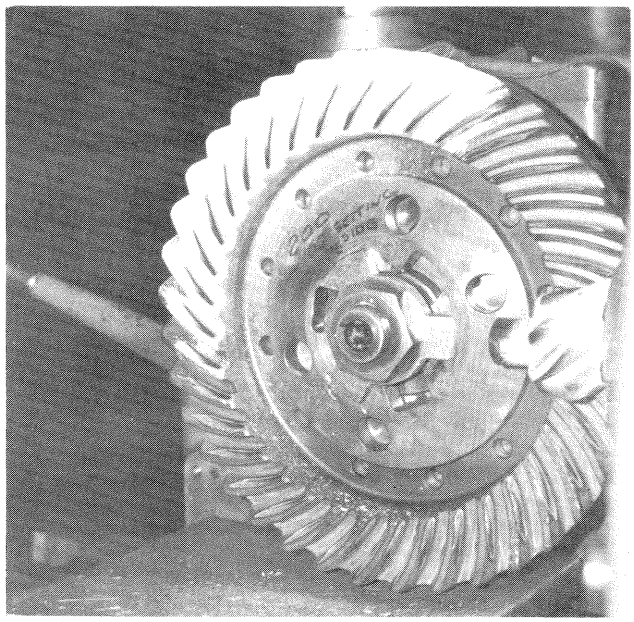


FIGURE 33

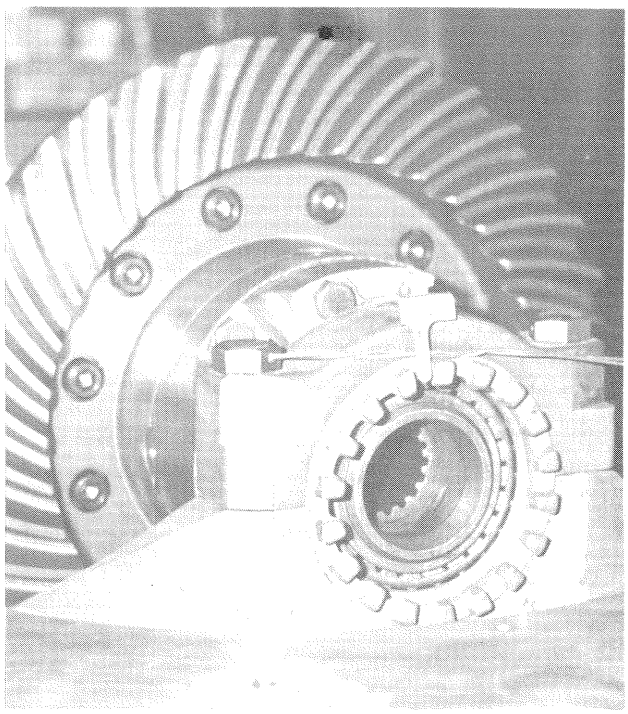


FIGURE 34

FIGURE 34: Install the safety wire in the bearing cap capscrews and install the bearing cap locks.

FIGURE 35: A tubular oil scoop is used to pick up lubricant from the ring gear. The lubricant is forced through the scoop and directed through passages in the carrier to the tapered pinion bearings. The scoop is spring loaded and contacts the ring gear. The scoop is inserted through the drilled opening in the carrier. A set screw through the side of the oil scoop bore retains the scoop in a fixed position. To adjust the scoop, place a .010" feeler gauge between the scoop and the ring gear, push the scoop so that it touches the feeler gauge, tighten the set screw and remove the feeler gauge. Install the pipe plug.

The differential assembly is now ready to be installed in the axle housing. A locktite plastic gasket is used between the axle housing and the carrier in the 3418 P model axle. Install the differential assembly and torque the carrier-housing capscrews to 80-90 ft. pounds - dry threads.

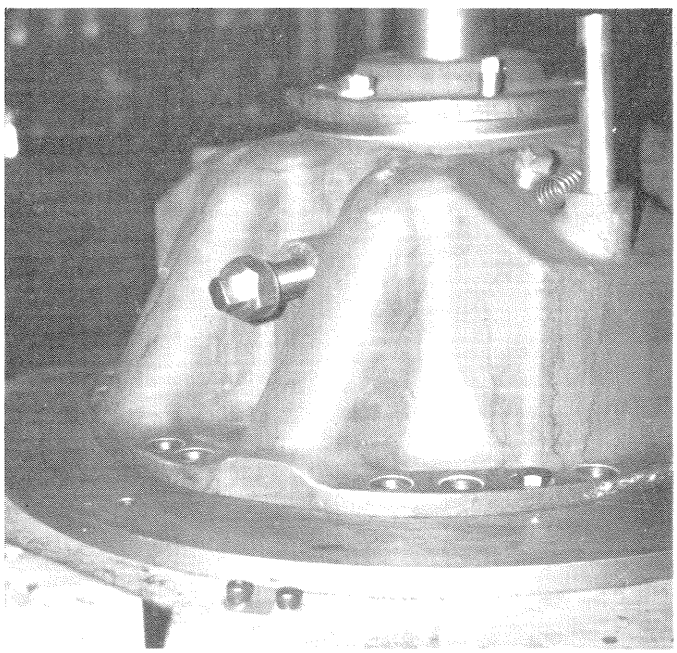


FIGURE 35

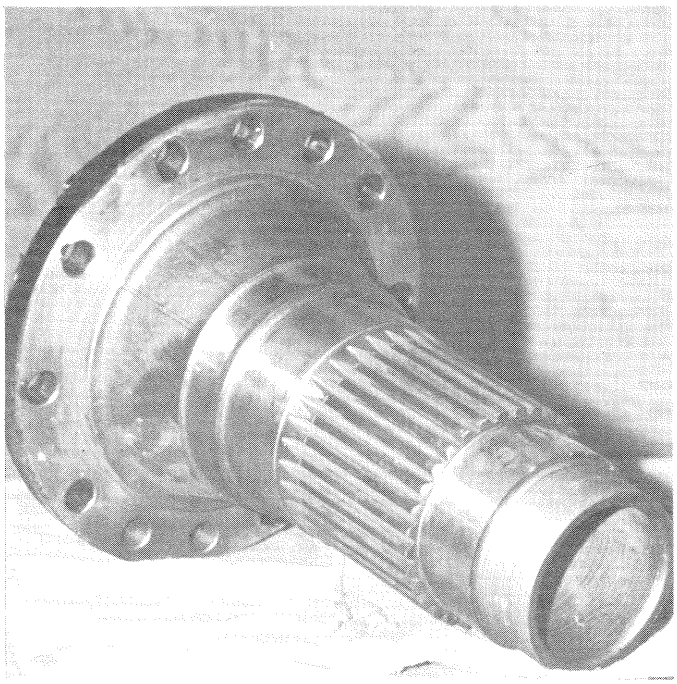


FIGURE 36

The axle spindles are to be installed next, FIGURE 36. Gaskets are not used between the spindle and the axle housing. Use Permatex Form-A-Gasket Type 3 between the spindle and housing. Install the spindle to the axle housing so that the groove for the hub bearing lock washer is at the top. Install the hardened washers and nuts and torque to 205-225 ft. lbs. Install the hub onto the axle spindle.

FIGURE 37: The planetary ring gear is secured to the ring gear hub by four plates and eight capscrews. Torque the eight capscrews to 50-58 ft. pounds. Secure the capscrews with lock wire. Install the outer hub bearing. The inner bore of the ring gear hub is splined to match the splines on the axle skein. Line up the splines between the axle skein and ring gear hub. Slide the assembly into the wheel hub-outer bearing on the ring gear hub toward the inside of the axle hub.

Before wheel bearing adjustment is made, it is MOST IMPERATIVE that all bearing cups be pressed to full position in their respective locations. You cannot depend on the wheel bearing adjusting nuts to "seat or shoulder" bearing cups.

The wheel bearing adjusting nut should be tightened to its limit while rolling the wheel. Strike the rim and surrounding parts with a mallet to shock the wheel end and better seat the cups and cones that may not be fully seated. Loosen the nut, retighten, and again strike the rim with a mallet.

Adjust the nut so that the hub bearings are snug, check the preload on the bearings by wrapping a cord around the hub, (similar to checking the preload on pinion bearings). Attach a spring scale to the free end of the cord and pull on scale. The rolling force should read between 16 and 20 pounds. This is 10-12 ft. pounds.

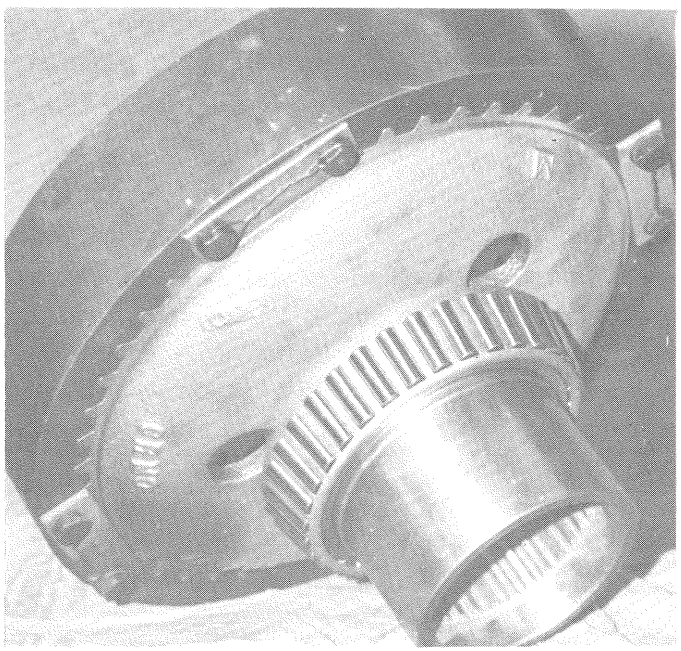


FIGURE 37

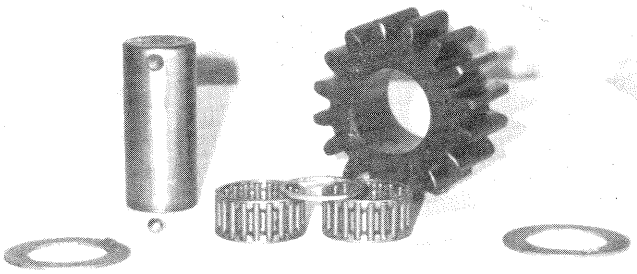


FIGURE 38

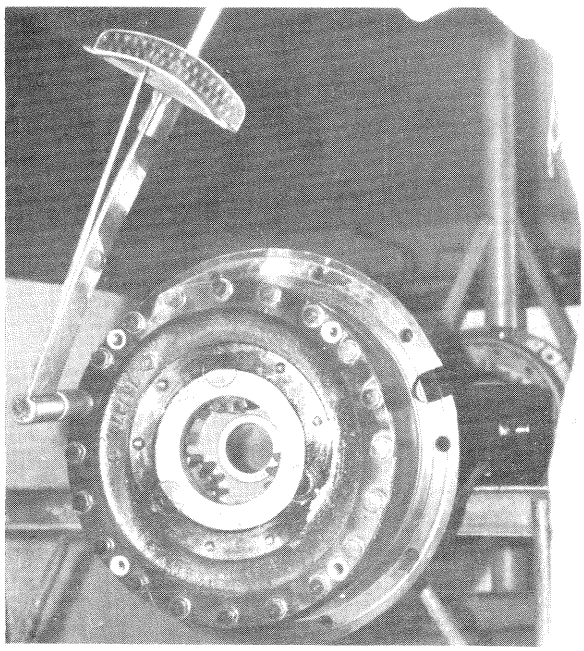


FIGURE 39

FIGURE 38: The outer portion of the planetary assembly for each hub consists of the cover, planetary, the spider planetary, three planet gears, three planet gear pins, six thrust washers, six bearings, three spacers and three lock balls.

FIGURE 39: Install two bearings, "one spacer between the bearings", in each planet gear. Place a thrust washer on each side of the gear and insert gear assembly in position in planetary spider. Insert the planet gear pin through the spider from the outside, line the planet gear assembly with the pin and tap pin through the gear. Caution must be used so as not to damage tht bearings or spacer when tapping pin through the gear assembly. Place the lock ball in the recess for the ball in the pin, tap pin and ball into the spider until the pin is flush with the outside face of the spider. Peen the spider slightly over the lock ball to secure the pin. Install the two additional gear and pin assemblies and attach the spider to the hub. Plastic Gasket is used in place of Gaskets in both series axles. Torque the retaining capscrews to 100-110 ft. pounds.

FIGURE 40: The sun gear is splined to match the splines on the outer end of the axle shaft. The sun gear is secured to the axle shaft with a snap ring. A thrust washer is placed between the sun gear and the planet spider. Place the thrust washer over the outer end of the axle shaft, slide the sun gear onto the axle shaft and install the snap ring. Install the axle shaft assembly in through the planetary hub, through the axle housing. Line up the inner axle spline with differential side gear and engage the sun gear with the three planet gears. Slide the axle assembly all the way into the housing and planetary hub, (see FIGURE 2). Install the planetary cover plate. A gasket is used in the 3418 P axle and the capscrews are torqued to 50-58 ft., pounds.

The axle assembly is now complete and if removed from a vehicle, can be reinstalled. Fill the differential to the level plug with multi-purpose gear lubricant, meeting MIL Spec. L-2105, Type SCL. For summer operation, use No. 90 viscosity, for winter use No. 80.

The planetary system and hub bearings use the same type lubricant as the differential and the same viscosity, depending on temperature or season. Rotate the hub so that the level plug in the planet cover is at the low vertical position and fill to the plug, (see FIGURE 1).

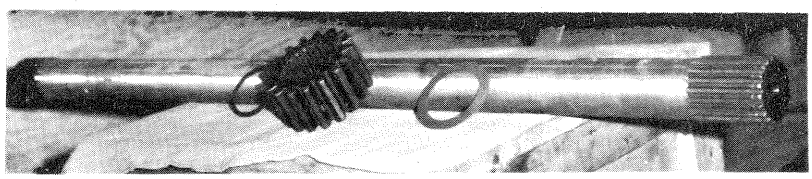


FIGURE 40