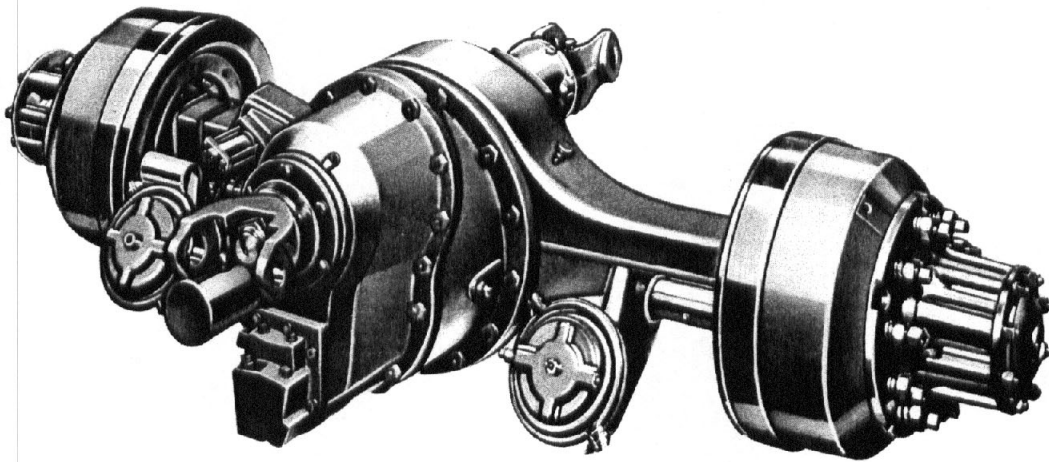


Field Maintenance Manual No. 5E

**FORWARD/REAR AXLE DRIVE UNITS FOR
SR-170, SU-170, SU-270, SW-170, SW-270,
and SPR-570 TANDEM AXLES**



Use Only Genuine Rockwell Parts

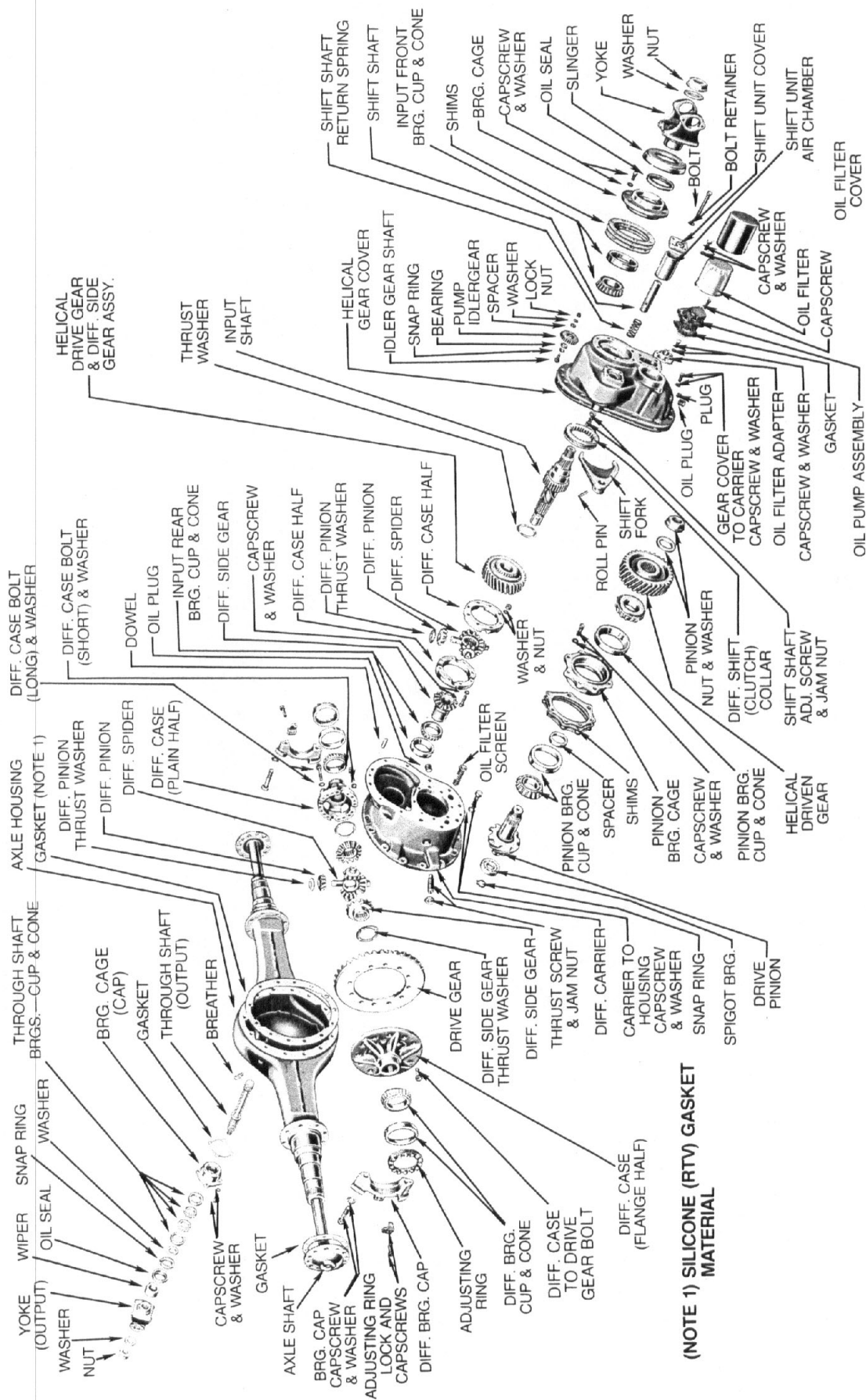
(SEE BACK COVER FOR LIST OF ADDITIONAL
MANUALS COVERING THESE TANDEMS.)



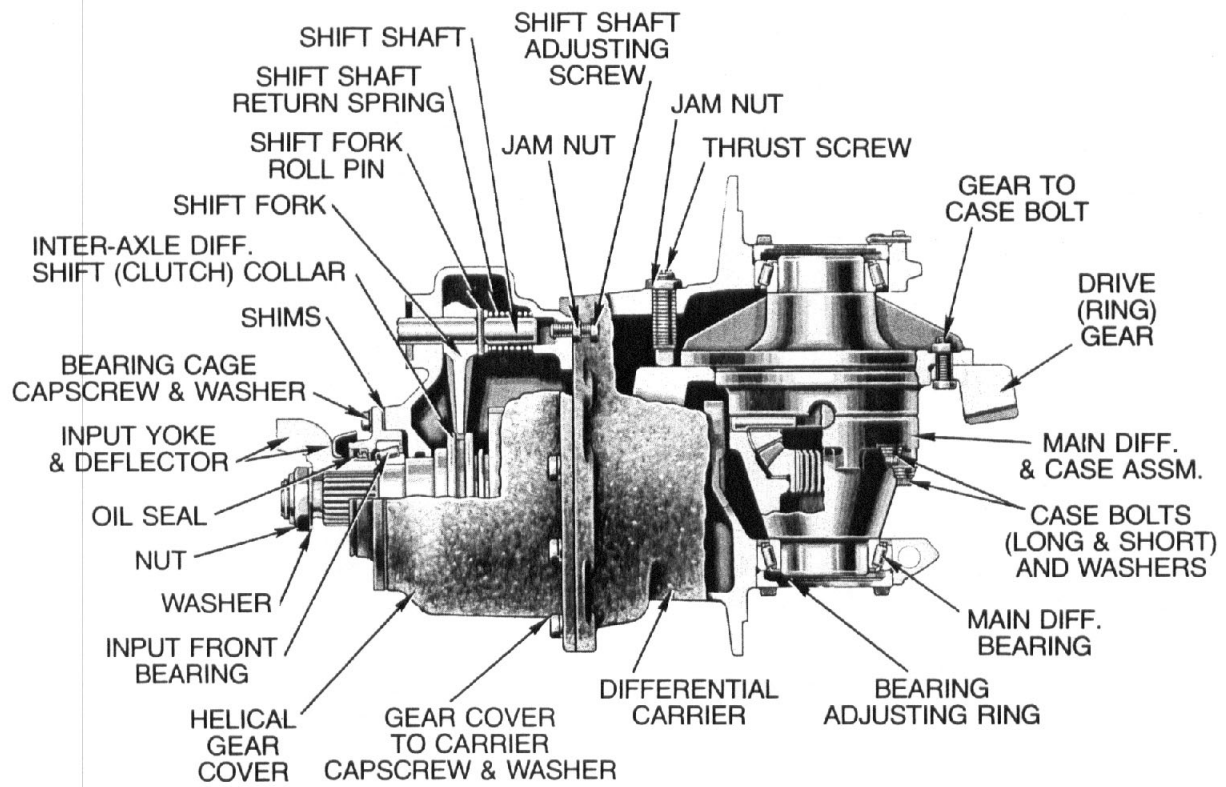
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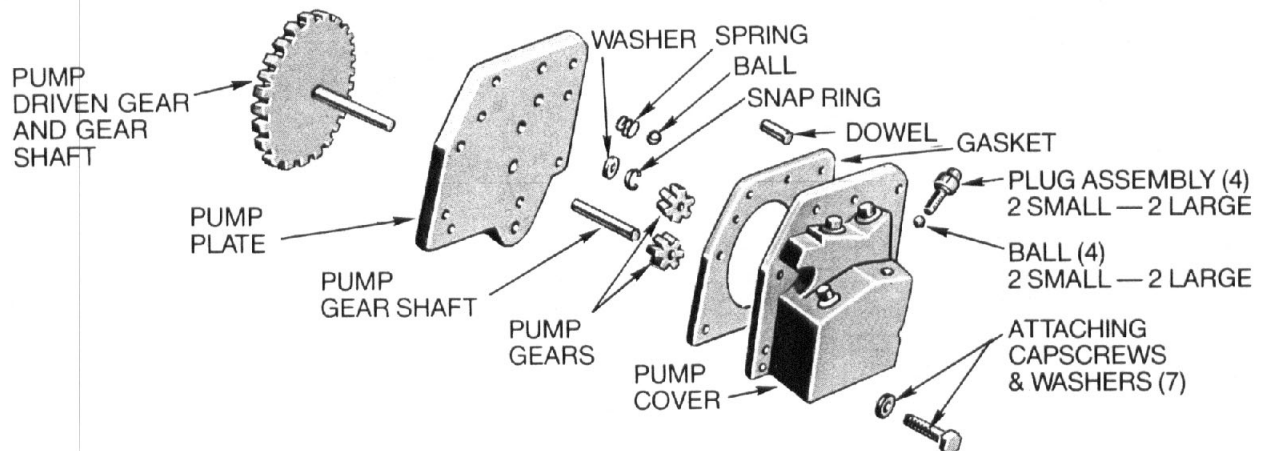
FORWARD/REAR AXLE



(NOTE 1) SILICONE (RTV) GASKET MATERIAL



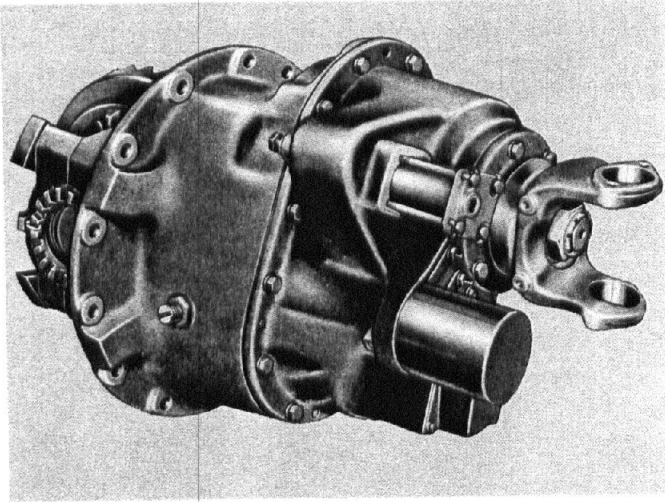
TOP VIEW



OIL PUMP ASSEMBLY

FORWARD/REAR AXLE DRIVE UNITS FOR SR-170, SU-170, SU-270, SW-170, SW-270, and SPR-570 TANDEM AXLES

- 170 SERIES (Single Reduction)
- 270 SERIES (Double Reduction)
- 570 SERIES (Planetary Axles) — Wheel End Reduction

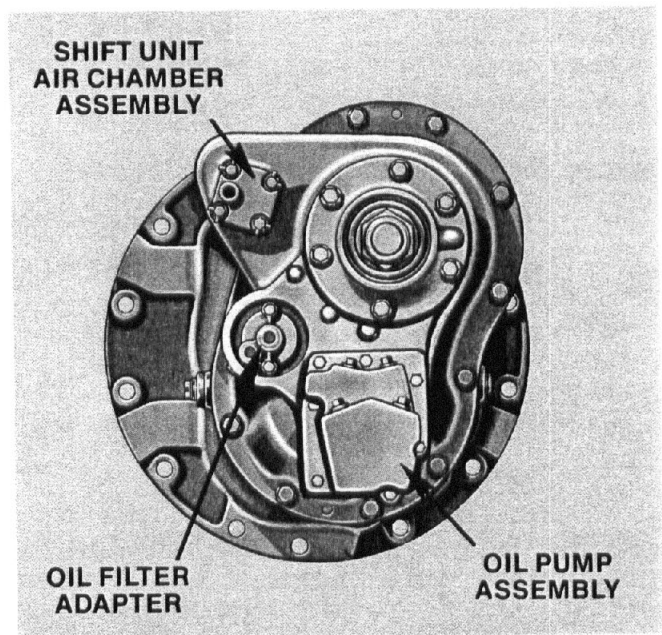


These front mounted drive units employ 18.875" hypoid gearing,* through drive design, bevel type inter-axle differentials with two gear transfer trains, and pump forced lubrication. The 170 Series models are single reduction carriers, the 270 Series models are double reduction carriers with the second reduction taking place in the two gear transfer train, and the 570 Series models are single reduction carriers with an overdrive option in the two gear transfer trains plus a planetary wheel end reduction.

The rear/rear axles of the 170 Series single reduction tandems employ the basic R-170 single axle carrier and complete maintenance information on them can be found in the Rockwell Field Manual FMM#5 "Single Reduction Drive Unit." The rear/rear axles of the 270 and 570 Series tandems employ the same carrier as used in the forward/rear tandem axle except that they do not incorporate the inter-axle differential. Therefore use this manual for servicing the rear/rear axle of the 270 and 570 Series tandems.

Lubrication of these units is accomplished by both gravity feed (splash) and forced feed (pump) systems.

To lubricate the inter-axle differential and the forward input bearing assemblies a bi-directional pump is employed to force the oil through special oil passages and grooves in the helical gear cover and input shaft. The pump is driven by an integral gear on the input shaft, an idler gear, and a pump drive gear.



A gravity feed (splash) system incorporating special troughs and reservoirs lubricates all other areas of the carrier.

It is important to adhere to the instructions whenever "caution" precedes them. Failure to do so could result in personal injury or severe damage to the unit.

**NOTE: The hypoid gear set in this carrier must be serviced as a matched set only. We can assume no responsibility for gears of this design serviced in any other manner. Also, the bevel type gears employed in both the inter-axle differential and the carrier main differential assembly should be serviced in matched sets; that is, all four pinions, thrust washers and/or side gears and side gear thrust washers should be replaced as individual sets even if only one piece is in need of replacement.*

REMOVE DIFFERENTIAL CARRIER FROM HOUSING

- A. Remove plug from bottom of axle housing and drain lubricant. Do not remove filter plug except to check lube pressure.
- B. On the forward rear drive units the oil filter may be removed from the helical gear cover at this time if desired. Remove the filter cover and use a suitable filter strap wrench for removal. Discard the filter and replace with a new filter at reassembly.

CAUTION: *There may be approximately one pint of lubricant remaining within the filter. Be careful not to spill it when removing the filter.*

- C. Remove the axle shaft stud nuts, washers and tapered dowels.

IMPORTANT: *To loosen the dowels, hold a 1 1/2 inch diameter brass drift against the center of the axle shaft head, INSIDE THE CIRCULAR DRIVING LUGS. Strike the drift a sharp blow with a 5 to 6 pound hammer or sledge. A 1 1/2 inch diameter brass hammer is an excellent and safe drift.*

CAUTION: *Do not hit the circular driving lugs on the shaft head — This may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels — This will damage the hub, shaft and oil seal.*

- D. Remove the axle shaft from the drive unit and housing.
- E. Disconnect the forward and rear propeller shafts.

Also, disconnect air lines at the shift unit of the forward rear drive unit.

- F. Remove the through-shaft (output) nut, yoke and spacer. It may be necessary to use a yoke puller to remove the yoke from the shaft.
- G. Remove through-shaft bearing retainer (cage), capscrews and washers and pull the cage, shaft and bearing assembly from the axle housing. To free the cage from the housing, it may be necessary to tap the shaft and cage with a soft mallet. Care must be taken not to damage seal. Also, remove the bearing cage to housing gasket.
- H. To remove carrier from housing, first loosen the two top nuts or capscrews and leave attached to the housing. This will prevent carrier from falling.

Remove all other nuts and/or capscrews and washers.

- J. Break carrier loose from housing with a rawhide mallet.
- K. To remove carrier from housing, place roller jack under carrier. Remove top capscrews and washers and work carrier free. A small pinch bar may be used to straighten carrier in housing bore. However, the end must be rounded to prevent indenting the carrier flange. Discard carrier to housing gasket if used.

DISASSEMBLE DRIVE UNIT

REMOVE THROUGH-SHAFT BEARINGS AND SEAL FROM OUTPUT CAGE

- A. Press the through-shaft from the bearing and cage assembly by placing the shaft and cage assembly in a press, cage to the top. Use a spacer against the through-shaft threaded end and press the shaft from the bearings and cage.

IMPORTANT: *The spacer diameter must be less than the O.D. of the through-shaft to avoid damaging the oil seal and bearings.*

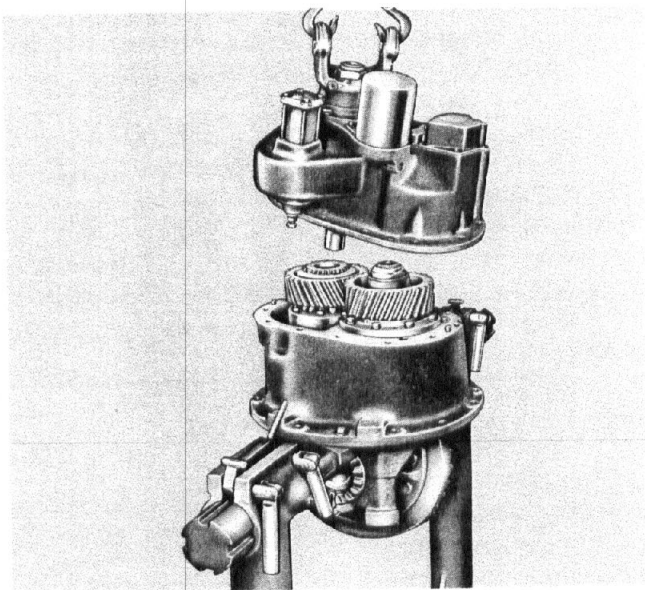
NOTE: *The oil seal, snap ring spacer and bearings will remain in the bearing cage. If disassembly is required, continue with Item "B," otherwise set aside for assembly.*

- B. Remove the oil seal from the cage using a suitable tool such as a screwdriver to pry seal out. Be careful not to damage the I.D. of the cage. Discard seal after removal.

- C. Disassemble the snap ring bearing spacer from its groove in the cage I.D. using snap ring pliers.
- D. Remove both inner and outer bearings (cups and cones) from the cage.

REMOVE HELICAL GEAR COVER ASSEMBLY

- A. Place the complete drive unit in a suitable repair stand. Lift the unit by the input (front) yoke using a chain fall.
- B. Place the drive unit (attached to repair stand) in an upright position (input yoke pointing upward).
- C. Loosen the input yoke nut, using a suitable wrench or socket. However, leave the nut and yoke on the input shaft at this time to facilitate gear cover removal.
- D. Remove helical gear cover to carrier cap-screws and washers.



- E. Separate the gear cover from the carrier by attaching a chain fall to the input yoke as shown. It may be necessary to use a rawhide mallet to break the cover from the carrier.

NOTE: The helical gear — side gear assembly and the inter-axle differential assembly are “loose” in the carrier. Exercise caution in lifting the helical gear cover from the base carrier to insure that these loose assemblies are not dropped.

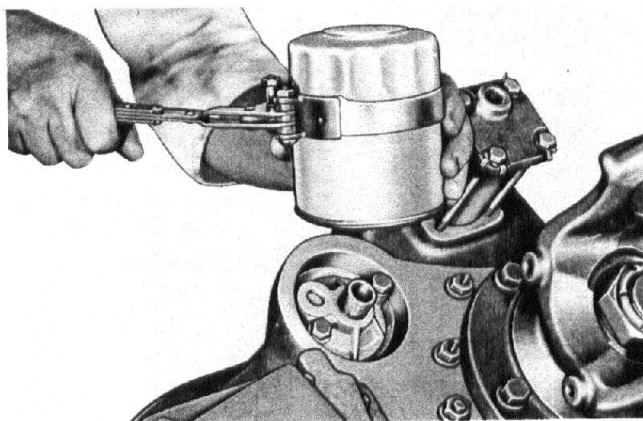
CAUTION: Do not use pry bars, chisels or wedges to loosen the cover — This will damage the cover and carrier flange mating surfaces.

- F. After separating the parts, remove the cover to carrier gasket or gasket material and discard. (Refer to page 13)

NOTE: To disassemble the helical gear cover, continue with the following procedures. However, if only the helical gears, inter-axle differential or carrier are to be disassembled, refer to page 9.

REMOVE FILTER AND PUMP

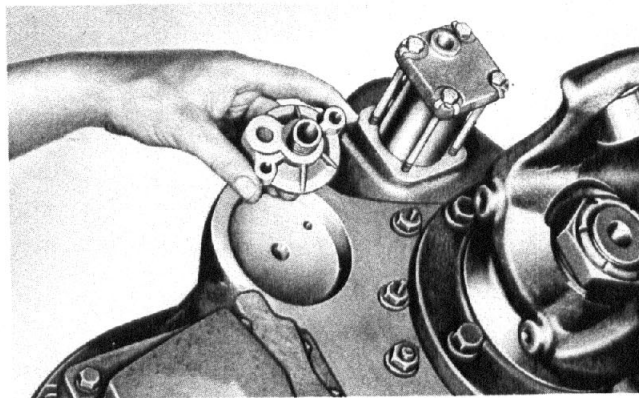
If the oil filter and cover have not been removed as yet, follow Item “A,” otherwise continue with Item “B.”



- A. Remove the two capscrews securing the filter cover. Remove the oil filter cover and filter from the helical gear cover. Use a suitable filter strap wrench.

Discard the filter and replace it with a new filter at reassembly.

CAUTION: There may be approximately one pint of lubricant remaining within the filter. Be careful not to spill it when removing the filter.



- B. Disassemble oil filter adapter from gear cover by removing capscrews and washers.

IMPORTANT: Check adapter casting and threads on filter mounting tube. If threads are stripped or casting is cracked, discard and replace at reassembly.

DISASSEMBLE OIL PUMP

If pump is to be serviced, continue with items "A" through "G." Otherwise proceed to the next set of instructions.

- A. Disassemble the pump from the helical gear cover by removing the seven attaching capscrews and washers. Tapping with a rawhide mallet may be necessary to loosen the assembly from the gear cover. Do not attempt to pry the unit loose.

CAUTION: Pump should be removed perpendicular to the helical gear cover. Cocking it may result in pump drive shaft or gear damage.

- B. Remove and discard gasket, clean the mating surfaces of the pump and helical gear covers and make sure that all oil passages are free of dirt and obstructions. A new gasket will be required at reassembly.
- C. The pump cover and the pump plate, shaft and gear assembly are held together with two dowels. Tapping with a rawhide mallet will facilitate the separation of parts. Remove gasket and discard.

CAUTION: To give the pump its bi-directional feature, steel balls are used as check valves. When the pump cover and plate are separated these balls may fall out. The pressure relief valve is a spring loaded ball which will be exposed when the pump cover is removed.

- D. Lift off the two pump gears from the pump plate, shaft and gear assembly.

- E. Remove the four pipe plugs from the pump cover and clean the pump passages.

CAUTION: The pipe plugs have roll pins which retain the check valve balls at the correct height in their passages. Do not cock or bend the roll pins.

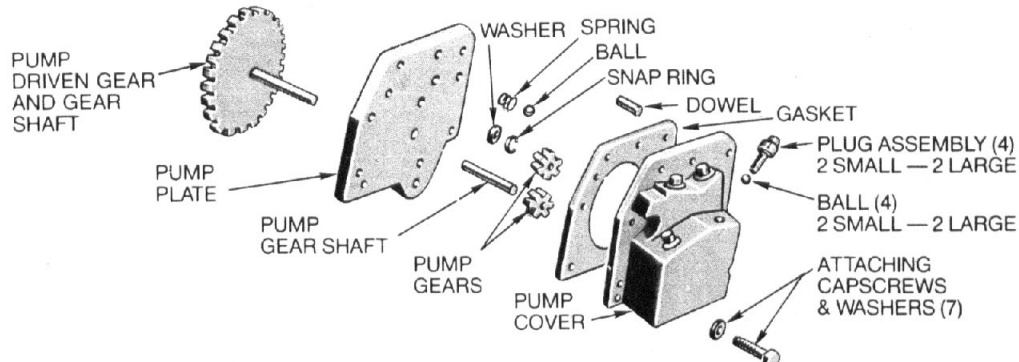
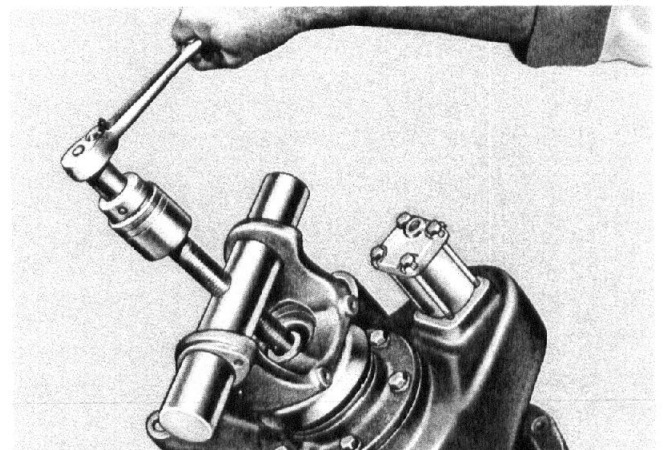
- F. Remove the snap ring and washer from the pump drive shaft and remove the shaft and pump drive gear assembly.

- G. If the pump drive gear or drive shaft needs replacing, it must be serviced as one assembly.

REMOVE INPUT SHAFT, FORWARD BEARING AND SHIFT COLLAR

NOTE: To remove the inter-axle differential shift collar, it is necessary to disassemble the input shaft from the helical gear cover. Use the following procedures:

- A. Remove the input yoke nut from the input shaft.



- B. Remove the input yoke from the shaft using a yoke puller as shown.

IMPORTANT: If the input oil seal is not to be serviced, care must be taken when pulling the yoke so as not to damage the seal in the bearing cage.

CAUTION: Do not use a hammer to loosen yoke — This will damage the yoke and splines and cause excessive yoke runout and misalignment.

- C. Disassemble the input bearing cage from helical gear cover by removing cage to cover capscrews and washers. Remove bearing cage, bearing and shim pack. The bearing cup will remain in the cage.

NOTE: As the input shaft is pressed through the helical gear cover and the inter-axle differential shift collar inside the cover, the collar will drop from the shift fork and shaft. Also, the input bearing will remain loose in the cover. If seal and/or bearing removal is necessary, continue with Item "D."

- D. Press the input shaft out of the helical gear cover from the front (input) end.

CAUTION: Do not strike these hardened steel pieces directly with a steel hammer.

IMPORTANT: Keep the shim pack from under the bearing cage wired together for reassembly.

- E. Remove the bearing cup from the cage by using a press or suitable puller.
- F. Remove the oil seal from the bearing cage using a press and suitable sleeve. If press is not available, use a drift and hammer and tap out seal.

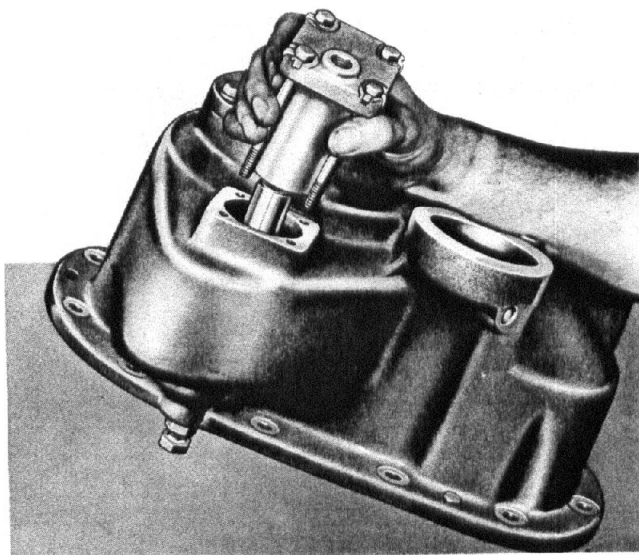
NOTE: SPR-570 units are equipped with a double sealing arrangement. The outer seal is cast iron and must be pulled out first.

REMOVE SHIFT UNIT AND OIL PUMP IDLER GEAR

NOTE: To remove the oil pump idler gear and shaft assembly, it is necessary to first remove the shift unit components. Use the following procedures, otherwise skip to page 9.

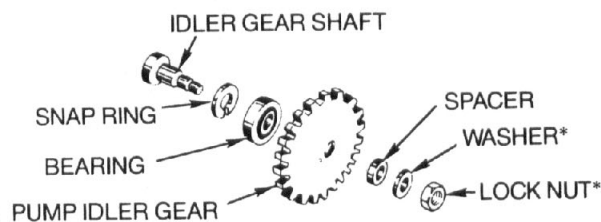
- A. Using a screwdriver or other sharp bladed tool, bend back the shift unit air chamber bolt retainer ears. There is one retainer per bolt with one ear bent against the bolt head and two ears bent against the top chamber plate.

- B. Unthread the four air chamber bolts and pull the unit from its seat on the helical gear cover.



NOTE: The components within the air chamber are not serviceable as individual parts. If the air chamber is defective, the complete unit must be replaced.

- C. Working from the inside of the helical gear cover, remove the shift fork to shift shaft roll pin. Use a small diameter drift or punch and hammer to tap pin out.
- D. Remove the shift shaft, spring and fork from inside the helical gear cover by first pulling the shift shaft through the air chamber opening in the gear cover. The fork and spring will drop out after shaft removal.
- E. If desired, remove the shift shaft adjusting screw and jam nut from the helical gear cover.



*LOCATED OUTSIDE HELICAL GEAR COVER

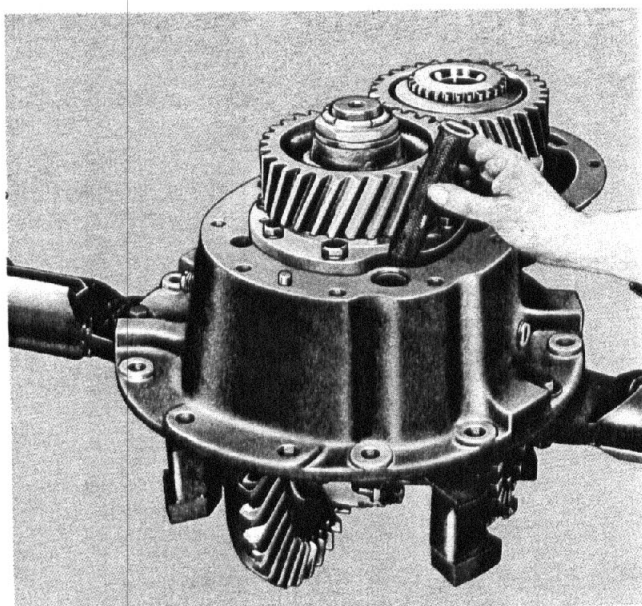
- F. To disassemble the pump idler gear remove the gear shaft nut and washer from the exterior of the helical gear cover. A screwdriver slot is provided on the gear shaft head.

Remove the gearshaft, bearing and spacer assembly from inside the cover. It may be necessary to use a small brass drift and hammer to tap out the shaft.

- G. The bearing has a light press fit on the shaft and is secured in the gear bore by a snap ring. Remove the snap ring, and supporting the bearing at its inner race, press or tap the shaft out.

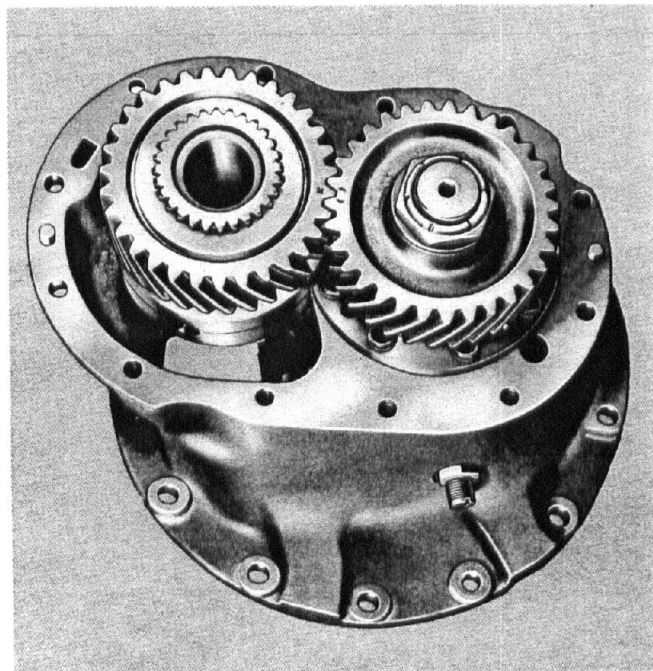
CARRIER OIL FILTER SCREEN (INTERNAL)

Before continuing with the major disassembling of the drive unit, remove the internal oil filter screen from the carrier housing. The screen is located in the lower left of the housing adjacent to the pinion driven (helical) gear as shown.



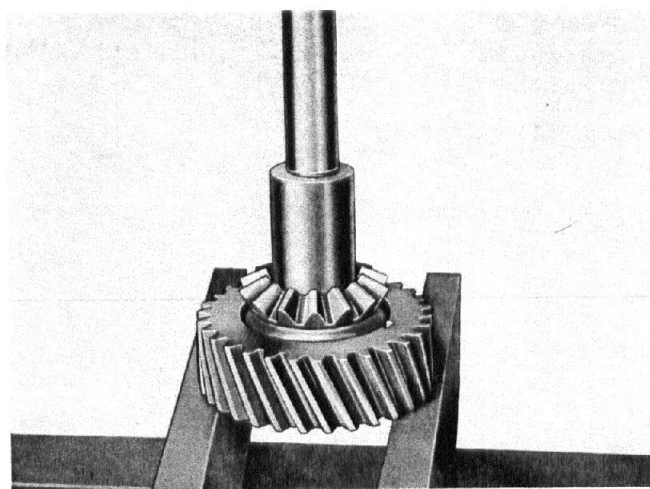
Remove the screen from its seat and make a visual check. If the screen is damaged in any way, discard and replace at reassembly. Otherwise, set it aside for cleaning.

DISASSEMBLE INTER-AXLE DIFFERENTIAL



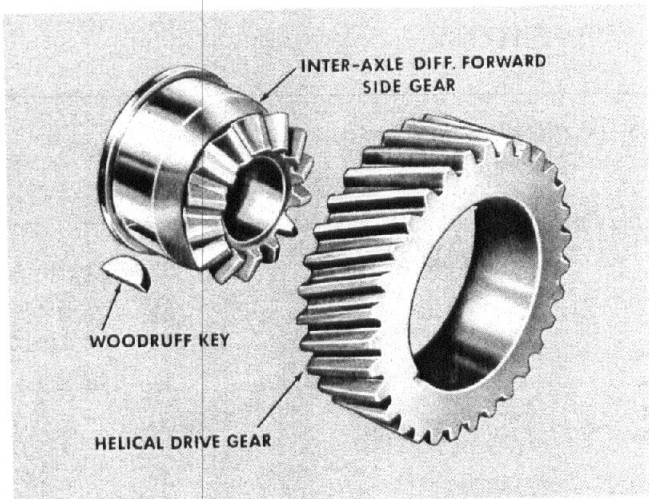
- A. Lift off the inter-axle differential forward side gear and helical drive gear assembly and thrust washer from the inter-axle differential nest located to the top of the carrier.

For 170 Series carriers continue with item "B." The 270 Series side gear and helical drive gear are serviced as an assembly only.

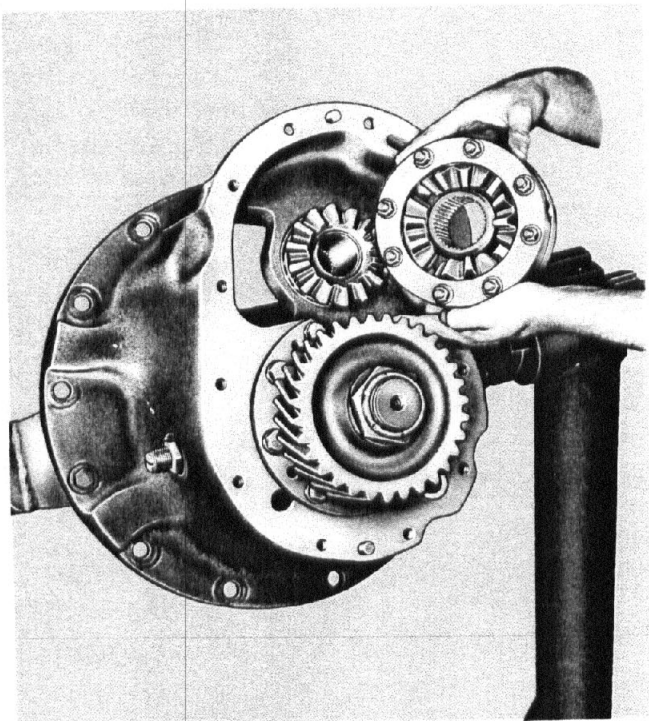


- B. Separate the side gear from the helical drive gear. Place the assembly in a press and use a sleeve with an O.D. that will fit the front hub portion of the side gear as shown.

CAUTION: Do not press side gear out by the gear teeth; damage to the teeth surfaces will occur.



NOTE: When pressing the side gear from the helical drive gear, the woodruff key will drop out. Set it aside for reassembly.



- C. Lift out the inter-axle differential nest and case assembly from the carrier housing.

NOTE: The rear side gear and rear input bearing will remain loose in the carrier housing. (Refer to Item "F.")

- D. Before disassembling the inter-axle differential case halves and gear nest, match mark the case halves with a punch for correct alignment at reassembly.

- E. Disassemble the case halves by removing eight (8) bolts, nuts and washers. Remove the spider (cross), four pinions and thrust washers.

NOTE: There are washers under both the capscrew heads and nuts.

- F. Lift out the rear side gear and bearing cone from the carrier housing. The bearing cup will remain in the carrier. If replacement is necessary, remove cup using a suitable bearing puller.
- G. To remove bearing cone from the rear side gear, place the gear in a press. Use a suitable sleeve and press the gear from the bearing. If a press is not available, use a suitable bearing puller.

REMOVE MAIN DIFFERENTIAL AND GEAR ASSEMBLY

- A. With the carrier still in an upright position, loosen jam nut and back off drive gear thrust screw.
- B. Rotate the carrier 180° and bring the drive gear to an upright position.
- C. Check and record the backlash. This information will be needed in reassembling unless a new gear set is used.
- D. Center punch one differential carrier leg and bearing cap to identify at reassembly.
- E. Remove bearing adjusting ring lock capscrews.
- F. Loosen bearing adjusting ring.
- G. Remove the carrier cap capscrews, washers and cotter keys from both sides of the carrier.
- H. Remove the bearing adjusting rings and the carrier caps.
- J. Lift out the differential and gear assembly.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

- A. If original identification (matching) marks are not clear, mark the differential case halves with a punch for correct alignment at reassembly.

- B. Remove the capscrews and washers and separate the case halves.
- C. Remove spider, pinions, side gear and thrust washers.
- D. If gear is to be replaced for any reason, remove the gear to case bolts, nuts and washers, and press the case half from the gear.
- E. If necessary to replace differential bearings, remove with a suitable puller.

REMOVE PINION AND CAGE ASSEMBLY

- A. On single reduction carriers remove the pinion cage capscrews and then remove the cage. On 270 Series double-reduction carriers with larger transfer gears loosen pinion cage capscrews until heads contact the back (under) face of the helical driven gear. Continue loosening capscrews approximately three turns each alternating to the other capscrews. This will avoid cocking the cage in the carrier while the capscrews act as puller screws.

Continue loosening capscrews until the cage and capscrews are free. Remove shims from under cage and wire together for reassembly.

NOTE: *It may be necessary to tap out the pinion and cage assembly by using a brass bar and hammer on the pinion end. Care should be exercised not to damage the spigot bearing or retaining ring shoulder. In either case the spigot bearing will remain on the pinion.*

- B. Remove pinion nut and washer.
- C. Press pinion shaft through cage, bearings and helical driven gear.
- D. Remove outer bearing cone from cage and bearing spacer from pinion shaft.
- E. If required, remove the pinion inner bearing cone from the pinion shaft with a suitable puller.
- F. If required, remove the spigot bearing snap ring and use a suitable puller to remove the bearing from the pinion nose.
- G. If necessary to replace pinion bearing cups, remove with a suitable puller (if cups are in good condition, do not disturb.)

PREPARE FOR REASSEMBLY

CLEAN

Parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in a suitable solvent, such as kerosene or diesel fuel oil.

Clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful not to damage mating surfaces.

CAUTION: *Exercise care to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.*

GASOLINE SHOULD BE AVOIDED.

Do NOT clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates or phosphates.

We do NOT recommend steam cleaning assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

ROUGH PARTS

Rough parts, such as differential carrier castings, cast brackets and some brake parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali.

CAUTION: Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

COMPLETE ASSEMBLIES

Completely assembled axles, torque dividers and transfer cases may be steam cleaned on the outside only, to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

CORROSION PREVENTION

Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good *rust preventive* and wrapped in special paper or other material designed to prevent corrosion.

INSPECT

It is impossible to overstress the importance of careful and thorough inspection of drive unit parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable drive unit failure.

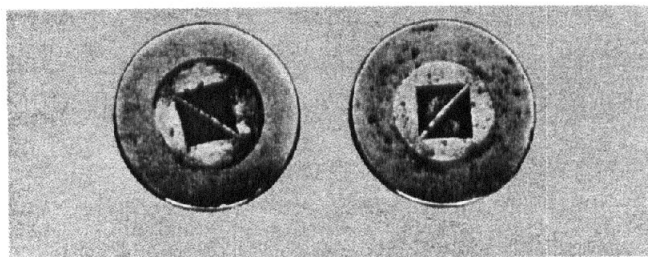
A. TAPERED ROLLER BEARINGS

The forward/rear carrier employs tapered roller bearings in five (5) areas: at the input and output shafts, the drive pinion, the inter-axle differential and main differential.

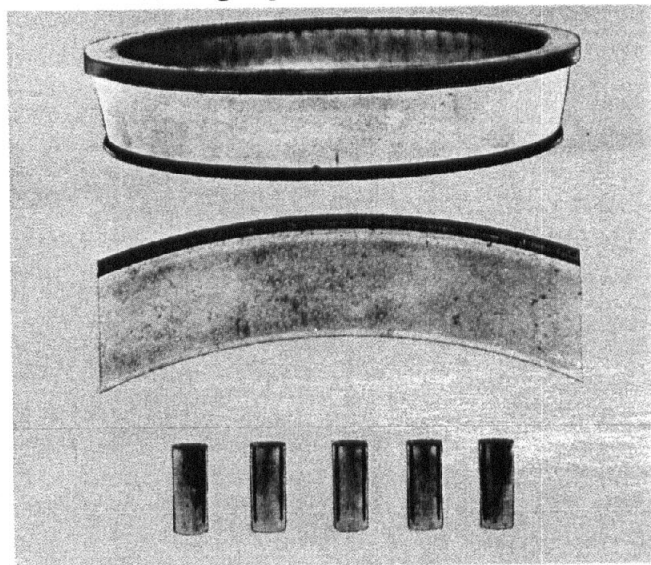
Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

If any of the following bearing conditions exist, **bearings must be replaced:**

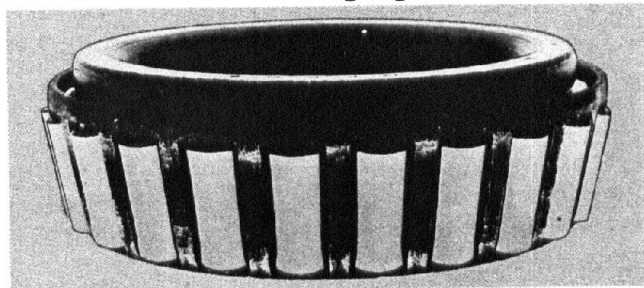
1. Large ends of rollers worn flush to recess or radii at large ends of rollers worn sharp.



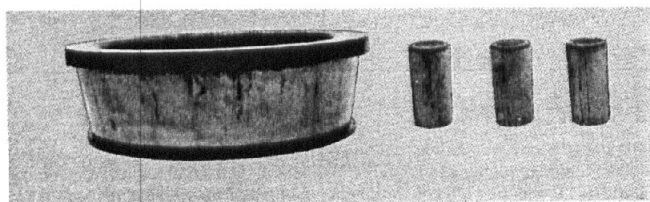
2. (a) Visible step wear, particularly at the small end of the roller track.
(b) Deep indentations, cracks or breaks in bearing cup and/or cone surfaces.



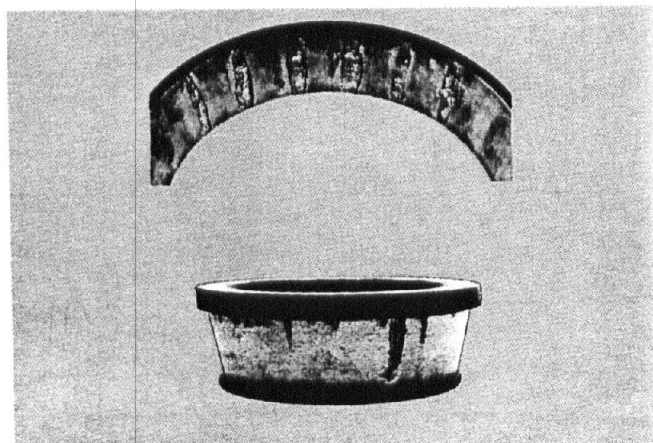
3. Bright rubbing marks on the dark phosphate surfaces of the bearing cage.



4. Etching or pitting on functioning surfaces.



5. Spalling or flaking on bearing cup and/or cone surfaces.



B. DRIVE PINION AND RING GEARS

Inspect hypoid gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. When necessary to replace either the pinion or gear of a hypoid set, the entire gear set must be replaced.

C. DIFFERENTIAL NEST GEARS

Inspect the differential assembly for the following:

1. Pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.
2. Wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

D. HELICAL GEARS (Drop Box, Transfer Train)

Inspect helical gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. Helical gears of two-gear transfer trains or drop boxes with one to one ratios must be replaced in sets.

Further, new helical gears used in sets must be permanently marked with matching or timing symbols to aid in correctly positioning the teeth of both gears at reassembly.

E. AXLE SHAFTS

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

REPAIR

- A. Replace all worn or damaged parts. Hex nuts with rounded corners, all lock washers, oil seals and gaskets or silicone gasket material should be replaced at the time of overhaul.

Use only genuine Rockwell replacement parts for satisfactory service. For example, using gaskets of foreign material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression, oil etc.

- B. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.
- C. When assembling component parts, use a press where possible.
- D. Tighten all the nuts to the specified torque. (Refer to torque charts following service instructions.

SILICONE (RTV) GASKET APPLICATION

NOTE: Where silicone RTV gasket material is used, Dow Silastic No. RTV-732 Black and General Electric No. RTV-1473 Black meet our requirements. However, silicone RTV is also available in bulk under Rockwell part number 1199-Q-2981; in 10 oz. tubes, part number 1250-X-388, or in 3 oz. tubes, part number 1199-T-3842.

SERVICE

Removal of all gaskets including silicone RTV is accomplished by peeling or scraping the used gasket off the carrier to housing surfaces.

Application of silicone RTV gasket material is as follows:

1. Remove dirt, grease or moisture from the surface of the carrier and housing.
2. Dry the surface.
3. Apply thin bead, maximum 1/8" diameter, completely around one mating surface and all fastener holes to assure complete sealing and prevent leakage.

CAUTION: Minor concentrations of acetic acid vapor may be produced during application. Adequate ventilation should be provided when silicone RTV is applied in confined areas.

Further, eye contact with these silicone (RTV) materials may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

4. Assemble the components *immediately* to permit silicone RTV gasket material to spread evenly.

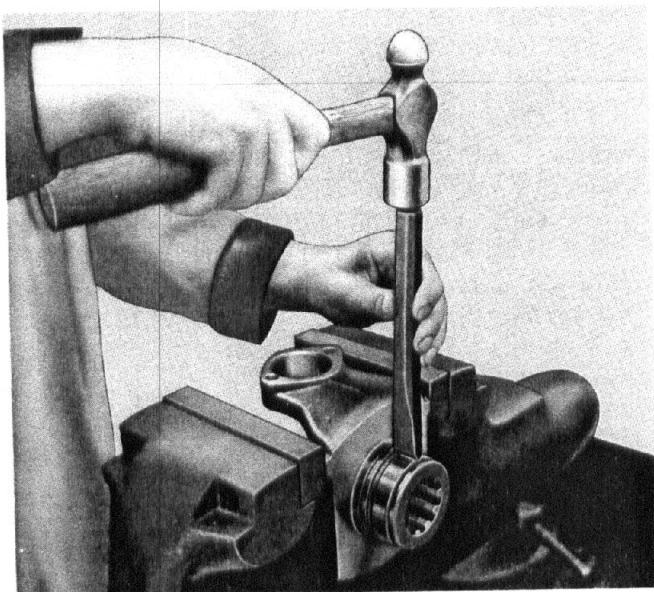
When rebuilding any assembly, always use torque values on fasteners as specified by either Rockwell or the vehicle manufacturer.

CAUTION: Failure to use appropriate gasket material will cause axle to leak.

WEAR SLEEVE REPLACEMENT (THROUGH-SHAFT YOKE ONLY)

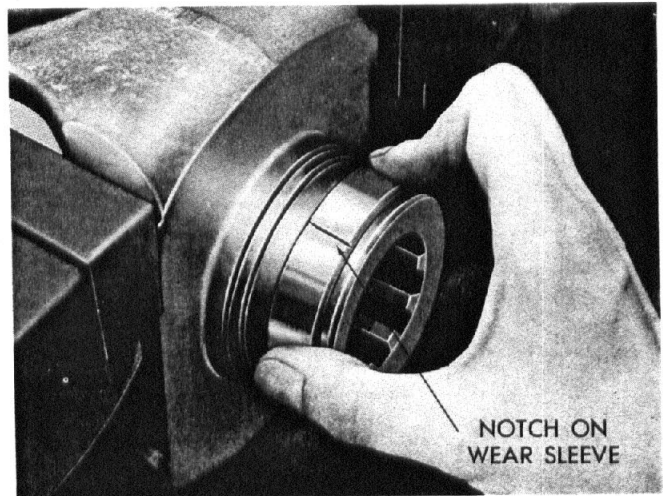
REMOVAL

- A. Place the yoke on its side in a vice.



- B. Using a cold chisel, notch the wear sleeve slightly to expand the sleeve and permit its removal from the yoke.

CAUTION: Do not completely split or penetrate the wear sleeve and damage the yoke.

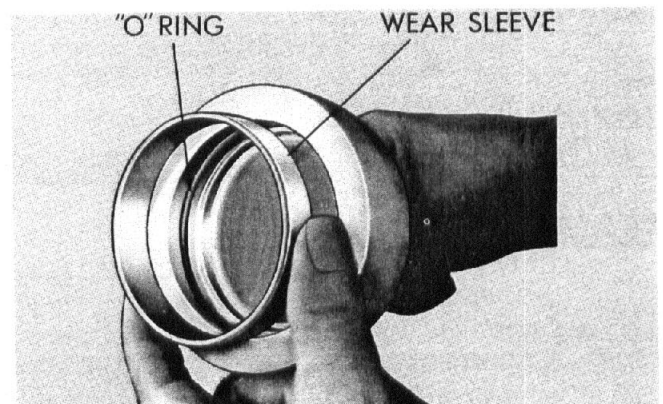


- C. Remove the sleeve.
 - D. If unsuccessful, notch the sleeve in the same location again.
- DO NOT SPLIT THE SLEEVE.**
- E. Remove the sleeve.
 - F. If unsuccessful, rotate yoke 180°, notch slightly again and remove sleeve.

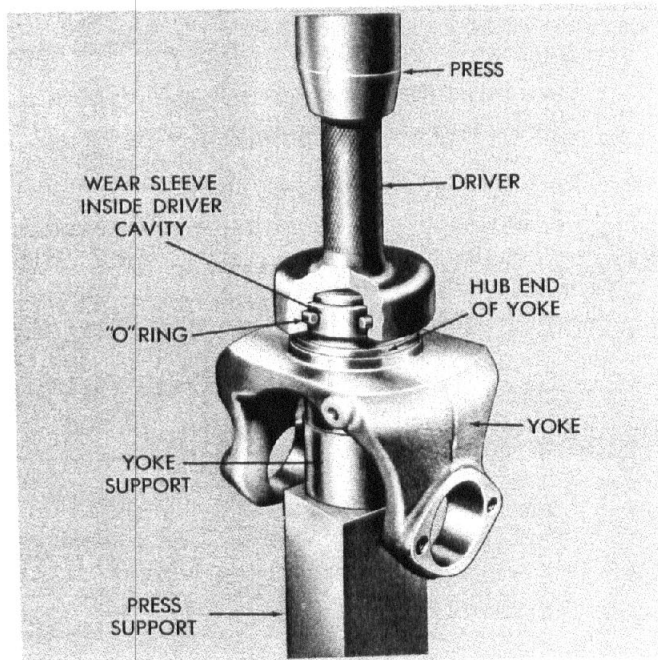
INSTALLATION

Replacement of the wear sleeve will require a wear sleeve driver. This tool can be made from drawings available from Rockwell International or by most major tool manufacturers.

- A. Grease "O" ring inside tool with bearing grease to facilitate sliding new wear sleeve into tool.



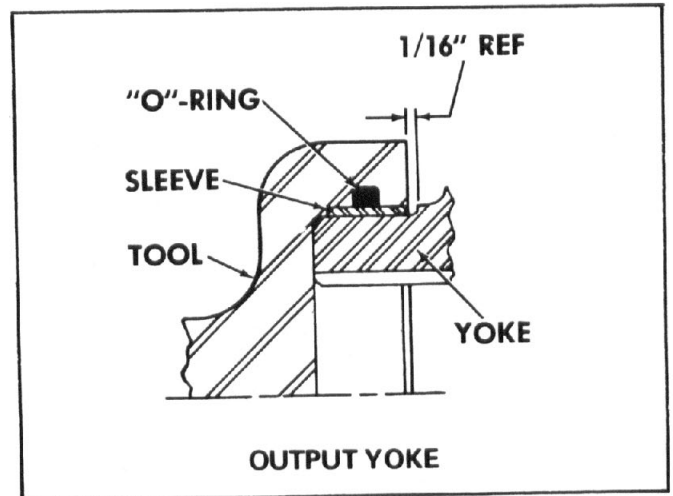
- B. Position the driver and wear sleeve into the tool cavity, tapered end first.



- C. Place the driver and wear sleeve squarely against the hub end of the yoke.

IMPORTANT: The driver is designed to bottom on the hub end of the yoke which will correctly position the wear sleeve on the yoke.

- D. Employing a small mechanical press, place the driver, wear sleeve and yoke into the press.



- E. Activate the press, forcing the driver to push the wear sleeve onto the yoke in the correct position.
- F. When removing driver, pull driver straight off. Do *not* work driver in a circular or alternately back and forth motion, as this may damage the wear sleeve surface.

Examine wear sleeve, after installation, for nicks or burrs that may cut or wear the seal. These may be removed by careful filing.

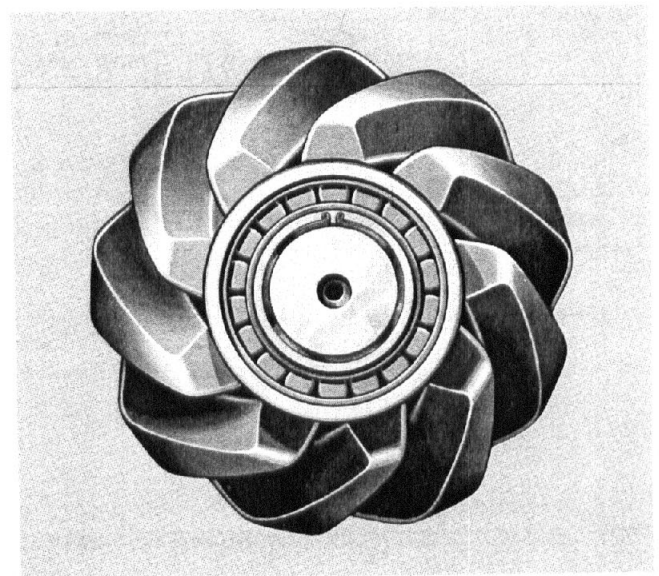
Rockwell does not recommend installation of the wear sleeve by striking the driver, as this practice may cause excessive expansion of the wear sleeve and will permit the sleeve to rotate on the yoke.

REASSEMBLE DRIVE UNIT

REASSEMBLE PINION AND CAGE ASSEMBLY

IMPORTANT: Before assembling, coat all parts of bearings with recommended axle lubricant.

- A. Press rear bearing firmly against the pinion shoulder with a suitable sleeve against the bearing inner race.
- B. Press the spigot bearing into position on pinion end.



- C. To retain the spigot bearing on the pinion end, assemble the snap ring on the nose of the pinion.
- D. If new cups are to be installed, press cups into cage using suitable sleeve. Make sure cups are firmly against the cage shoulders.
- E. Insert pinion and bearing assembly in pinion cage and position spacer over the pinion shaft.
- F. Press forward bearing firmly against the spacer.
- G. Rotate cage several revolutions to assure normal bearing contact.
- H. While in the press under pressure, check the bearing pre-load torque. Wrap a soft wire around the cage pilot and pull on a horizontal line with a pound scale. (If the press is not equipped with a pressure gauge, the pinion nut may be tightened to the correct torque and the pre-load checked in a vise).

For new pinion bearings, the rotating torque must be within 5 — 25 lb. ins.

For reused pinion bearings, the rotating torque must be within 5 — 15 lb. ins.

If the rotating torque is not within these values, use a thinner spacer to increase, or a thicker spacer to decrease the pre-load torque.

The correct pressure and nut torque for checking pinion bearing pre-load are as follows:

PINION SHAFT THREAD SIZE	REQUIRED NUT TORQUE TO OBTAIN CORRECT PRE-LOAD	REQUIRED PRESSURE TO OBTAIN CORRECT PRE-LOAD
2" x 12	900 — 1200 lb. ft.	11 — 14 tons

EXAMPLE: Assuming pinion cage diameter is 6 inches, the radius would be 3 inches; with 5 pounds pull, pre-load torque would equal 15 pounds inches.

$\frac{1}{2}$ cage dia. (ins.) x lbs. pull = in. lbs. pre-load.

- J. Insert pinion cage to carrier capscrews and washers in their respective holes in the pinion cage.
- K. Press the drive pinion helical gear against the forward bearing and install washer and pinion shaft nut.

IMPORTANT: If the transfer train has a 1:1 ratio and the helical driven gear must be replaced with a new gear, replace both the drive and driven gears as a set.

- L. Using a suitable holder on gear, tighten the pinion shaft nut to the required torque.
- M. Recheck pinion bearing pre-load torque. If rotating torque is not within specified values, repeat the foregoing procedure. After establishing correct pre-load, continue with adjusting pinion cage shim pack thickness.

ADJUST PINION CAGE SHIM PACK THICKNESS

- A. Measure the thickness of the original shim pack used with the gear set being replaced; use a micrometer or vernier gauge. Make a note of this measurement.
- B. Note the "PC" or variation number on the original pinion being replaced. If this number is a plus (+) value, subtract it from the original shim pack measurement taken in Item "A." If the variation number is a minus (-) value, add it to the measurement from Item "A." Make a note of this value.

NOTE: The value calculated in Item "B" will establish a "standard shim pack thickness" without a variation. This value will be used in calculating the shim pack thickness used with a new pinion and gear set.

- C. Note the "PC" or variation number on the new pinion. Add or subtract this number as indicated by the variation sign (+ add or - subtract from the calculated "standard shim pack thickness" determined in Item "B.")

The resulting answer indicates the thickness (in thousandths) of the new shim pack to be used. (Refer to examples on page 17).

IMPORTANT: Use a minimum of three (3) shims per pack.

- D. Assemble the new pinion and cage assembly with the correct shim pack into the carrier.

(NOTE: After assembling the pinion and cage assembly with new shim pack and differential and gear assembly into carrier, make a gear tooth contact check. (Refer to page 19).

EXAMPLES OF CALCULATION:

EXAMPLE NO. 1

Original Pack Thickness	.030"
Original Variation (PC + 2)	— .002
Standard Pack Thickness	.028"
New Variation (PC + 5)	+ .005
New Pack Thickness	.033"

EXAMPLE NO. 2

Original Pack Thickness	.030"
Original Variation (PC — 2)	+ .002
Standard Pack Thickness	.032"
New Variation (PC + 5)	+ .005
New Pack Thickness	.037"

EXAMPLE NO. 3

Original Pack Thickness	.030"
Original Variation (PC + 2)	— .002
Standard Pack Thickness	.028"
New Variation (PC — 5)	— .005
New Pack Thickness	.023"

EXAMPLE NO. 4

Original Pack Thickness	.030"
Original Variation (PC — 2)	+ .002
Standard Pack Thickness	.032"
New Variation (PC — 5)	— .005
New Pack Thickness	.027"

- E. Position the pinion and cage assembly in the carrier pinion cage bore and tap into place with a soft mallet. Make certain that capscrews are aligned with respective holes in carrier, and that cage is not cocked in its bore.
- F. Start turning-in pinion cage capscrews approximately three turns each and alternating to other capscrews. This will avoid cocking the cage in the carrier while the capscrews push the cage into position. When the cage is seated in the carrier back off capscrews (loosen) and retighten to correct torque. (Refer to Torque Chart at the end of this manual).

ASSEMBLE MAIN DIFFERENTIAL AND GEAR

- A. Proper service replacement of the differential ring gear onto the differential case half is necessary for correct gear adjustment and longer drive unit service life. For correct installation, Rockwell recommends heating the ring gear in water to approximately 160° — 180°F for about ten minutes before assembly. This will allow an easier fit of the gear over the differential case pilot, without the use of a press, and without damaging the case and ring gear mating surfaces.

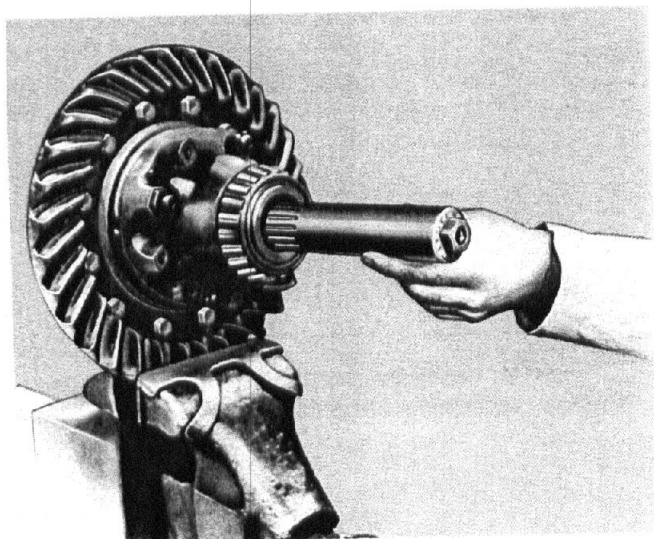
The gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and case, thus resulting in gear runout. Proper installation should, therefore, incorporate preheating the gear as described above to assure correct interference fit and to eliminate metal pick-up.

- B. After the gear is correctly positioned onto the case half secure it with the nuts, bolts and washers. Assemble the bolts from the gear side and position the washers under the nuts. Tighten to the correct torque value. (Refer to the torque chart at the end of the manual.)
- C. Pre-lubricate differential case inner walls and all component parts with the recommended axle lubricant.
- D. Position thrust washer and side gear in gear case half.
- E. Place spider with pinions and thrust washers in position.
- F. Install second side gear and thrust washer.
- G. Position other case half over assembly aligning match marks of both halves. Draw the assembly together with three (3) equally spaced capscrews.
- H. Install remaining capscrews and tighten to correct torque. (Refer to Torque Chart at the end of this manual).
- J. If new bearings are to be used, press squarely and firmly on differential case halves with suitable sleeve.

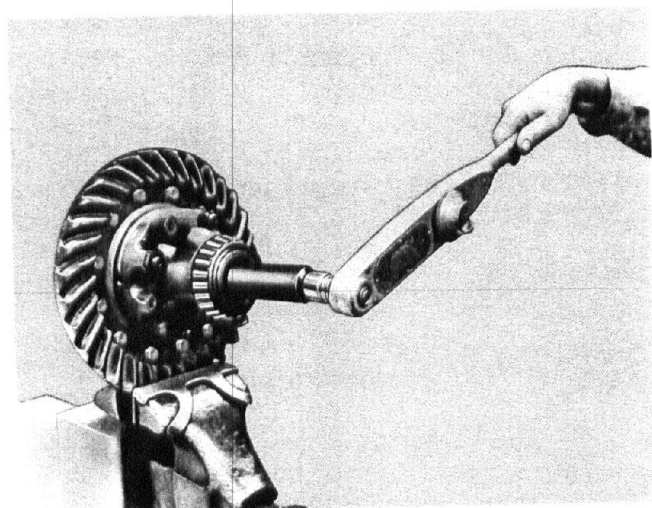
ROLLING RESISTANCE CHECK OF DIFFERENTIAL NEST

- A. Place differential and ring gear assembly in a vise.

IMPORTANT: Use soft metal covers over vise jaw to protect ring gear.



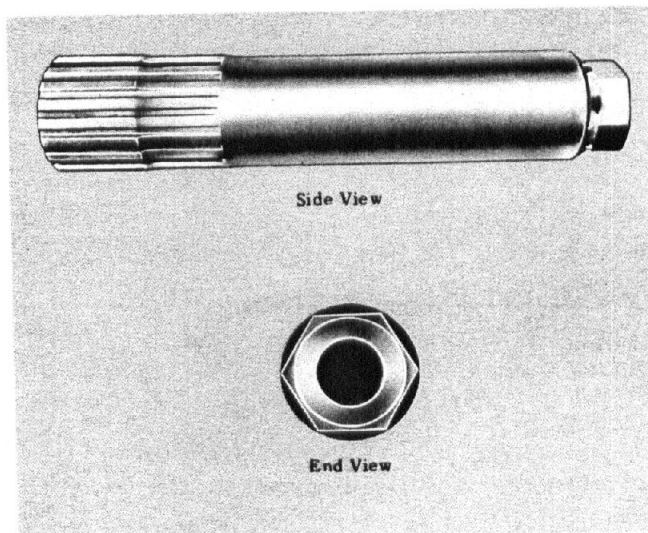
- B. Insert checking tool (made from splined axle shaft end) into differential nest. Allow splines of tool to engage with spline of one side gear only.



- C. Using a suitable socket and torque wrench, rotate differential nest while observing scale on torque wrench.

Correct rolling resistance of differential assembly is 50 lb. ft. torque maximum applied to one side gear. This applies to all differential assemblies, except the inter-axle differential assemblies.

- D. A suitable checking tool can be made by cutting an axle shaft to an appropriate length and welding a nut on the end to accept a wrench socket.



INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

- A. Pre-lubricate differential bearings and cups with the recommended axle lubricant.
- B. Place cups over bearings and position assembly in carrier housing.
- C. Insert bearing adjusting nuts and turn hand-tight against bearing cups.
- D. Install bearing caps in the correct location as marked and tap lightly into position.

CAUTION: If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting nuts. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

- E. Install carrier leg capscrews and washers and tighten to required torque. Install adjusting ring and adjusting ring lock and capscrews. Tighten capscrews to required torque after final adjustments are made.

ADJUST DIFFERENTIAL BEARING PRELOAD

- A. Using dial indicator at backface of gear, loosen the bearing adjusting nut on *the side opposite gear only* sufficient to notice end play on the indicator.

- B. Tighten the same adjusting nut only sufficient to obtain .000 end play.
- C. Check gear for runout. If runout exceeds .008", remove differential and check for cause.
- D. Tighten adjusting nuts *one notch each* from .000 end play to pre-load differential bearings, or spread legs from .006" to .010" (15 — 35 lb. in.) rolling resistance.

CHECK HYPOID GEAR BACKLASH

If the drive gear is not going to be replaced, we suggest the established backlash recorded before disassembly be used. For new gears the new backlash should be initially set at .014". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

CHECK TOOTH CONTACT

Apply gear marking compound lightly to the gear teeth. When the pinion is rotated, the marking compound is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.

Sharper hand roll impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve (12) teeth is sufficient for checking purposes.

After obtaining a satisfactory tooth contact, the backlash can be altered within the limits of .008" — .020" to obtain a better contact position relative to the length of the tooth.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

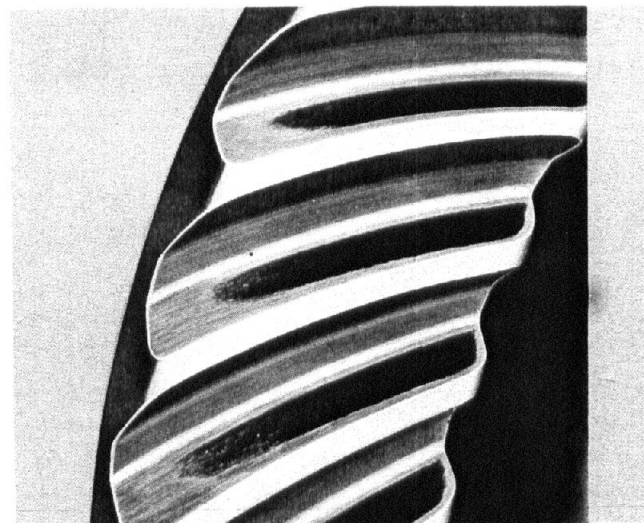
After correct tooth contact has been established, install adjusting nut locks (cotter pins) and capscrews. Tighten capscrews to correct torque. Set adjusting ring locks into notch to assure lock.

CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE

FOR HYPOID GEARS ONLY



SATISFACTORY HYPOID TOOTH CONTACT
(GEARS UNLOADED)



SATISFACTORY HYPOID TOOTH CONTACT
(GEARS LOADED)

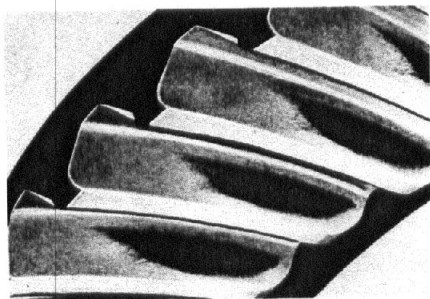
With adjustments properly made (pinion at correct depth and backlash set at .014") the above contacts will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

The hand-rolled pattern shown (gears unloaded) will result in a pattern centered in the length of the tooth when the gears are under load, as shown (gears loaded). The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

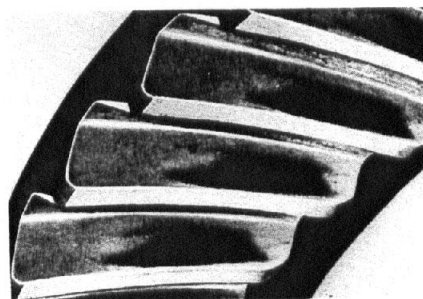
The pattern on the coast side of teeth will appear the same width as the drive side shown on page 9; however, the over-all length will be centered between the toe and heel of gear tooth. *After the correct contacts, as shown, have been established with a backlash of .014", open the backlash to measure between .008"-.020".*

Set used hypoid gear to have the tooth contacts to match wear patterns. Hand-rolled patterns of used gears will be smaller in area and should be at the toe-end of wear patterns.

INCORRECT TOOTH CONTACT



A high contact indicates pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. Slight outward movement of hypoid gear may be necessary to maintain correct backlash.

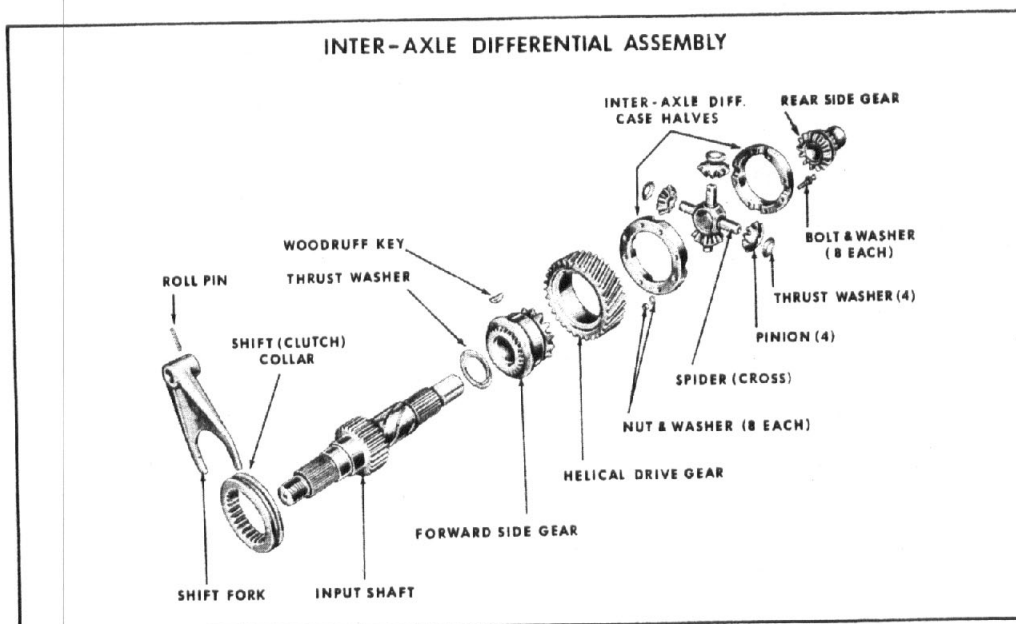


A low contact indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the hypoid gear may be necessary to maintain correct backlash.



ADJUST DRIVE GEAR THRUST SCREW

- A. Back out thrust screw and jam nut.
- B. Coat thrust end of screw with grease and reinstall screw and jam nut into carrier.
- C. Tighten screw until it is firm against back face of hypoid drive gear.
- D. To secure the correct adjustment of .010" — .015" clearance, loosen thrust screw 1/4 turn and lock securely with nut. (Refer to Torque Chart at end of manual).
- E. Recheck clearance between end of thrust screw and back face of gear for .010" — .015" clearance.

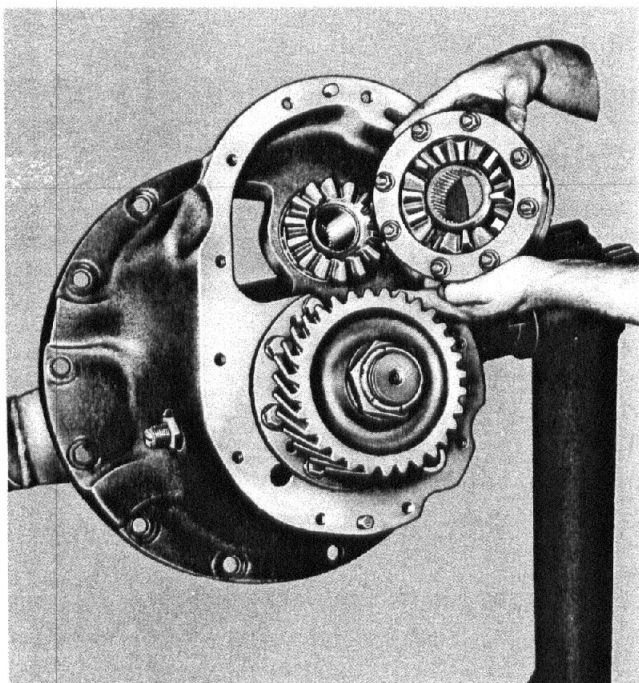


REASSEMBLE INTER-AXLE DIFFERENTIAL

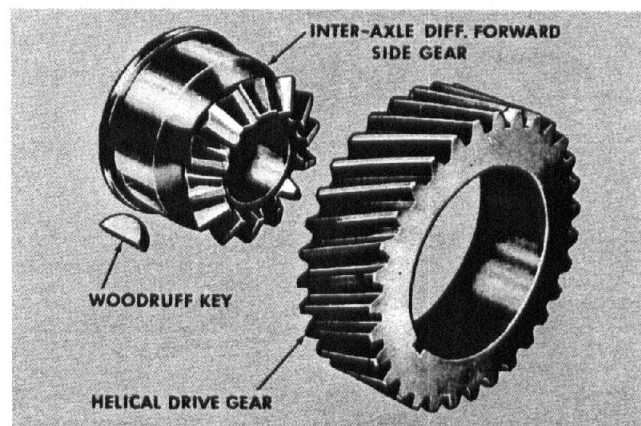
Before starting the reassembly procedures, place the differential carrier (attached to repair stand) in an upright position (pinion nut pointing upward).

- A. Pre-lubricate all inter-axle differential parts, such as inside walls of inter-axle differential case halves, spider, pinions, bearings and thrust washers, etc. with the recommended axle lubricant.
- B. If new rear input bearing is to be used, press bearing cup squarely into differential carrier and bearing cone squarely onto rear inter-axle differential side gear hub.
- C. Install rear side gear with bearing cone into differential carrier.
- D. Place pinions and thrust washers on spider and position spider into one case half.
- E. Position the second case half over first, making sure that mating marks of both halves are aligned.
- F. Install the case capscrews, washers and nuts and tighten to correct torque.

NOTE: There is one washer under each capscrew head and one washer under each nut.



- G. Position the inter-axle differential case and nest assembly (capscrew heads up) into the carrier and over the rear side gear.



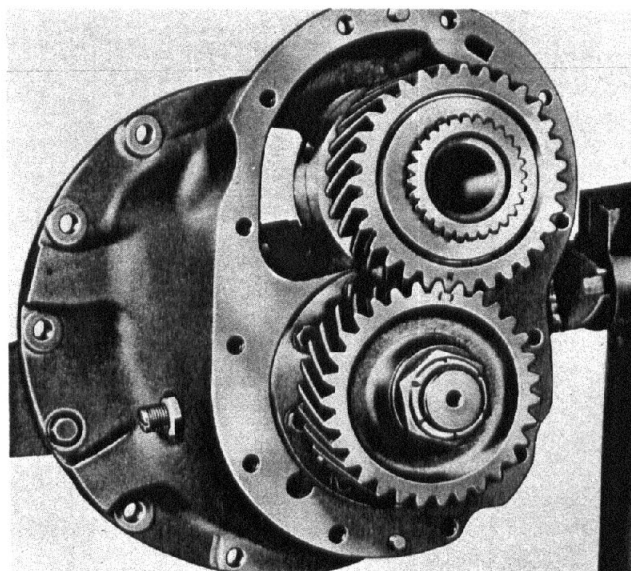
For units employing the 270 Series carriers, the side gear and helical drive gear are serviced as an assembly. Proceed to item "L."

For 170 Series carriers continue with reassembly as follows:

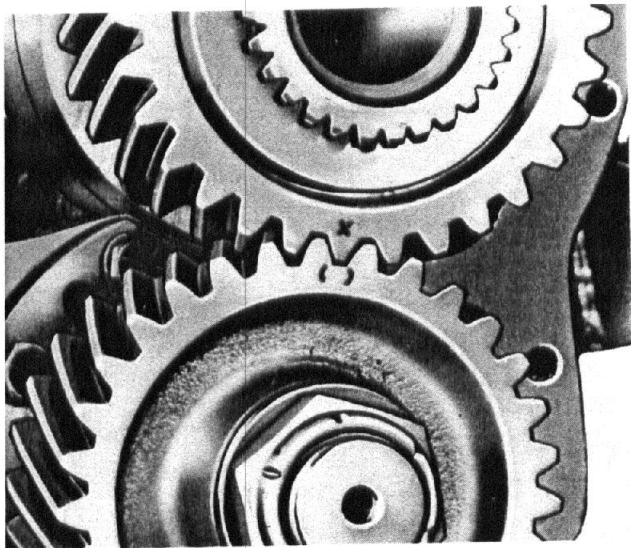
- H. To reassemble forward side gear and helical drive gear, first heat helical gear to 160°-180° F. as done with the hypoid gear. Position the woodruff key in place on the side gear hub.

IMPORTANT: If the helical drive gear must be replaced with a new gear, replace both the drive and driven gears as a set.

- J. Place helical drive gear in a press with the flat side down and position the side gear (gear side down) with woodruff key over the helical gear. Make sure the woodruff key aligns with the key-way in the I.D. of the helical gear.
- K. Press the side gear into the helical gear until it bottoms.

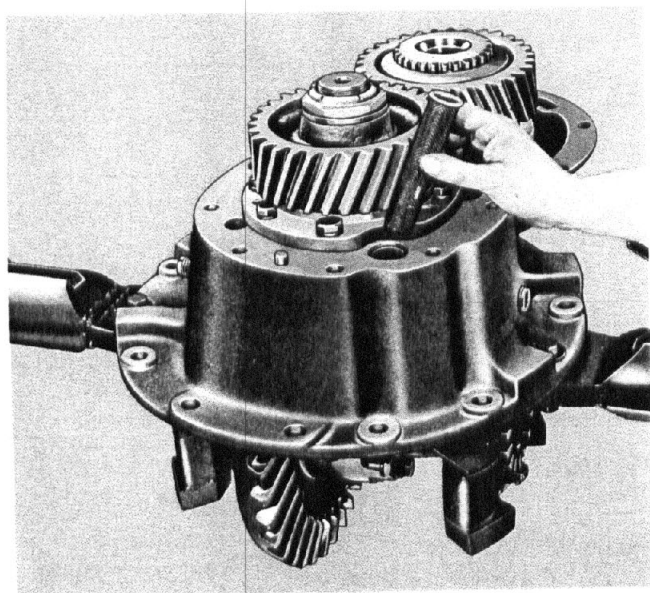


Position the forward side gear and helical drive gear assembly over the inter-axle differential case and nest assembly already in position.



IMPORTANT: When placing side gear and helical drive gear assembly in position on carrier, be sure to align mating marks of both the helical drive and driven gears as shown; if new gears are installed, mark one tooth of each gear, as shown.

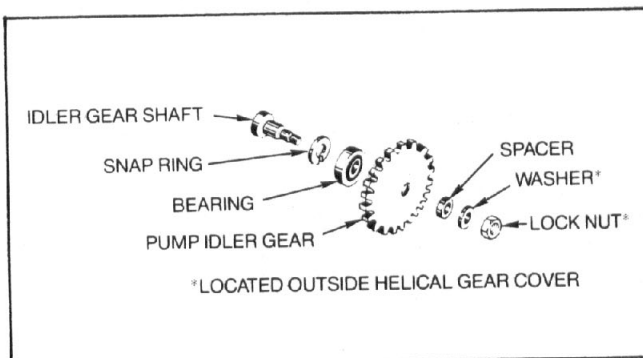
Also, check for free rotation of gears and correct if necessary.



- M. Clean and install the oil screen in its seat in the carrier.

Set the differential carrier assembly aside at this time and continue with reassembling the helical gear cover.

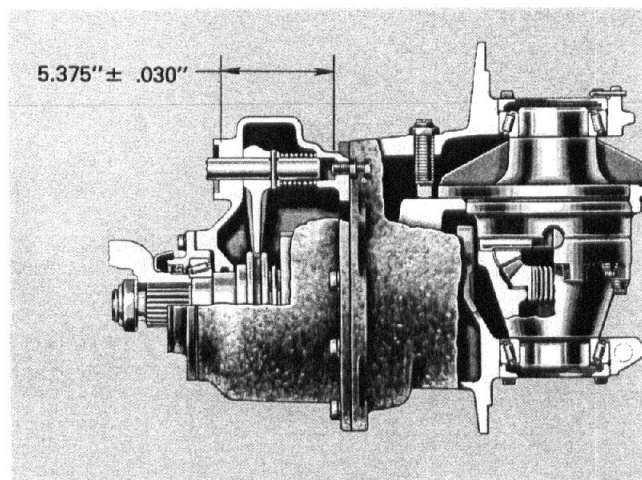
ASSEMBLE AND INSTALL THE PUMP IDLER GEAR, SHAFT AND BEARING ASSEMBLY



- Replace the bearing on the idler shaft by supporting the bearing on its inner race and pressing the shaft in.
- Reassemble the idler gear to the bearing with the snap ring.
- Reassemble the idler shaft to the helical gear cover by placing the spacer over the shaft and into the gear I.D. Press against the head of the shaft until the spacer seats against the gear cover. Affix the nut and washer on the exterior of the gear cover.

REASSEMBLE SHIFT UNIT, FORK AND SHAFT

IMPORTANT: Before installing the shift shaft into the helical gear cover and shift fork, inspect and remove any rough spots or burrs by polishing the shaft with fine emery cloth.



- Set shift shaft adjusting screw as shown. Lock in place with jam nut. Torque nut to Torque Chart specifications.

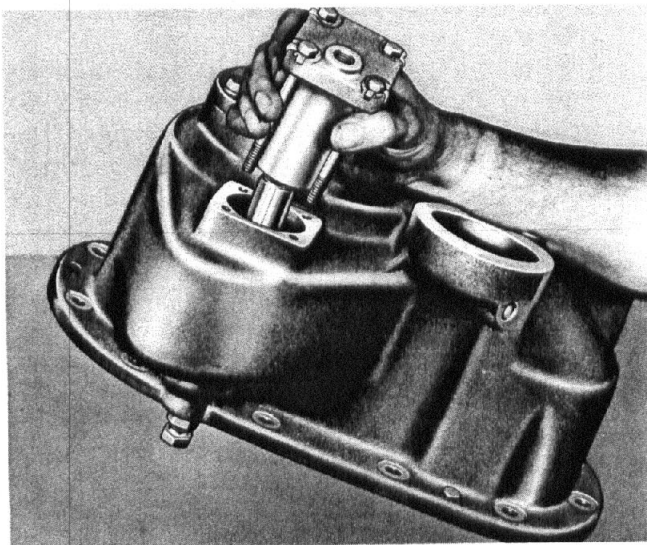
- B. Install the shift shaft partially through its bore in the shift unit opening of the helical gear cover. Use a rawhide mallet to tap shaft through.

IMPORTANT: *Install the short end of shaft first — measure from the roll pin hole to shaft ends to determine short end.*

- C. Position the shift fork to the inside front of the helical gear cover aligning its shaft bore with the bore in the cover. The long boss of the fork with the drilled roll pin hole must be facing toward the back.
- D. Holding the shift fork in position, continue to tap the shift shaft through the gear cover and fork. Tap in shaft enough to support the fork.
- E. Install the shift fork return spring between the fork and rear shaft bore in the gear cover. Make sure I.D. of spring coils are aligned with the shaft bores of the fork and gear cover.
- F. Continue to tap the shift shaft into position with the rawhide mallet.

NOTE: As the shaft is installed, make sure the roll pin holes of the fork and shaft are aligned. Rotate shaft if necessary to align holes.

- G. Assemble roll pin through hole in fork boss and shaft. Use a small drift and hammer.

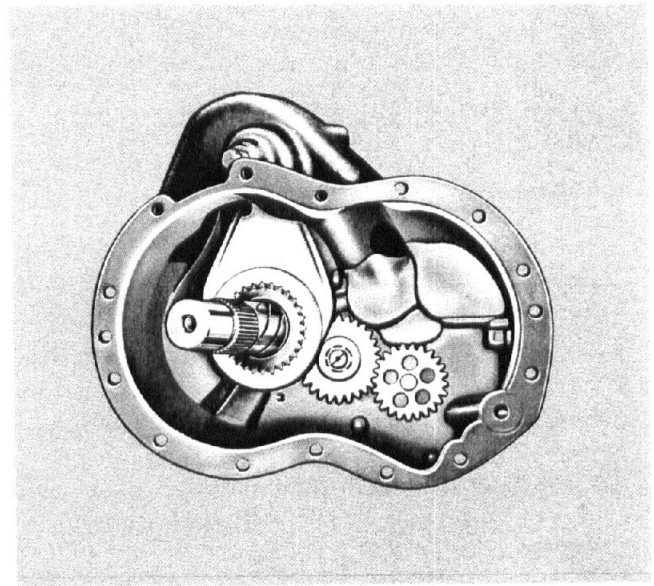


- H. Assemble the shift unit air chamber over the shift shaft and onto the helical gear cover. Install capscrew retainers and capscrews. Tighten capscrews to correct torque. (Refer to Torque Chart at the end of this manual).

- J. After tightening capscrews, bend one ear of each retainer up against the capscrew head. Bend the other two down against the top plate of the chamber.

REASSEMBLE INPUT SHAFT AND BEARINGS INTO HELICAL GEAR COVER

- A. Install the input shaft and the inter-axle differential shift collar into the helical gear cover. While holding the shift collar in position engaging it with the shift fork, insert the input shaft through the collar. Index shaft and/or collar to engage splines. At the same time the shaft splines must engage oil pump/idler gear.
- B. Press the forward bearing cone onto the input shaft while securing shaft in position in helical gear cover.



- C. Press the forward input bearing cup squarely into bearing cage.
- D. If the front oil seal was removed, install new seal onto front of bearing cage. Coat sealing lip with *Lubriplate* and O.D. of retainer with a non-hardening sealing material, such as *Permatex*. Use a press or arbor and suitable sleeve and press seal into position, $.530'' \pm .015$ below surface of bearing cage.

CAUTION: *Do not exert pressure on seal retainer — damage to seal will result.*

- I. When the original bearing, input shaft and rear side gear is reused, assemble the original shim pack and bearing cage with bearing cup onto the helical gear cover. Secure the cage with capscrews and washers and tighten to correct torque. Recheck bearing end play following Items "D" thru "H" of "Adjust Input Bearing End Play" on pages 26 and 27.

If a new bearing, input shaft and rear side gear is used, assemble the bearing cage with new cup over the helical gear cover. Do not install shim pack. Assemble and tighten capscrews and washers to finger-tight while rotating shaft to seat bearings. Check bearing end play following items in "Adjust Input Bearing End Play" on pages 26 and 27.

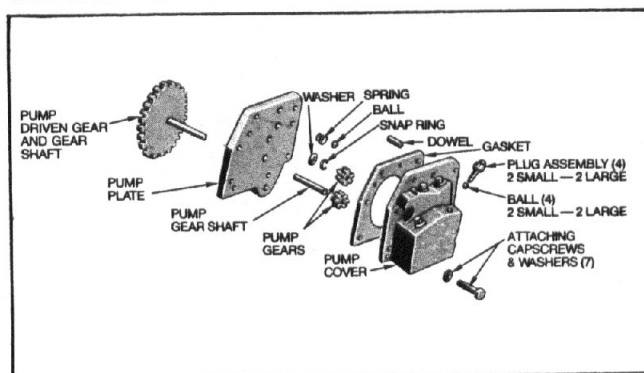
REASSEMBLE OIL PUMP

- A. Clean the driveshaft bore and lube feed passage.
- B. If required due to damage or wear, remove and replace the bushings from the driveshaft bore in the pump plate.
- C. If required, replace the pump gear shaft on the suction (lower) side of the pump. Support the pump plate with the gear shaft extending down, and using a brass drift, drive the shaft out from the rear.
- D. To install new shaft, support the pump plate from the rear and press the pump gear shaft into the housing.
- E. Assemble pump drive shaft and gear to the pump plate using the washer and snap ring previously removed.
- F. Place the two pump gears on their respective shafts.

- G. Insert the pressure relief spring (larger end down) into its bore and place the ball on top of the spring.
- H. Reassemble the pump cover to the pump plate using the two dowels and a new gasket.
- J. Insert the check valve balls and pipe plug roll pins into their respective cavities in the pump cover.

The pump is now ready for reassembly into the helical gear cover.

INSTALL OIL PUMP AND FILTER



- A. Insert the pump assembly into the helical gear cover so that the pump drive and idler gears mesh. Install the seven attaching cap-screws and tighten them to 35-50 lb. ft.
- B. The oil pump gears require a coating of lubricant to prevent an abnormal wear or scoring of the parts during the first start-up of the vehicle. Pour or squirt the specified drive unit lubricant into the two passages sealed by the larger sized pipe plugs.
- C. Position the oil filter adapter in its bore in helical gear cover. Install washers and cap-screws, and tighten to correct torque. Refer to Torque Chart.
- D. Coat face of gasket on new oil filter with the specified drive unit lubricant. Install oil filter over the adapter and tighten one full turn after gasket contacts base. Do not overtighten. It may be necessary to use a filter strap wrench.

CAUTION: If filter is tightened more than one turn after contacting gasket, damage to filter may result.

- E. Assemble filter cover over filter on helical gear cover. Secure with the two capscrews and washers. Tighten capscrews to correct torque. Refer to Torque Chart.

INSTALL INTERFERENCE FIT YOKES

On carriers that employ slip fit yokes, continue with item "A" and "Reassemble Helical Gear Cover Onto Carrier," Page 25.

On carriers with interference fit yokes, installation will require the use of a press or the three-piece installation tool and the following procedures:

IMPORTANT: *If a press is not available, the three-piece tool must be used to avoid damaging parts. DO NOT DRIVE YOKE ON BY STRIKING WITH HAMMER.*

- A. For original design carriers (with slip fit splines), install the through-shaft yoke on splines with a suitable sleeve.

NOTE: The three-piece installation tool (for interference fit splines) may be used when installing the original design parts if desired.

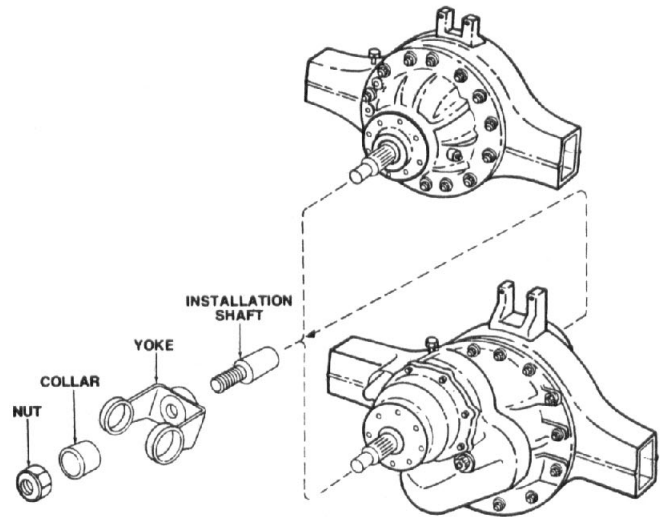
- B. For current design carriers employing interference fit splines, use the following procedures:

IMPORTANT: *Do not drive yokes onto pinion, input, output or through shafts by pounding or tapping. This will damage the yoke, splines, shafts and bearings.*

1. Coat yoke seal elements with recommended axle lubricant. Also, ensure that there are no burrs or nicks on the yoke wiper surface or on any surfaces that will pass through the seal during installation.
2. Thread the yoke installation shaft onto pinion input, output or through shaft until installation shaft bottoms.

NOTE: The installation tool can be purchased from Kent-Moore, Tool Division, 1501 South Jackson St., Jackson, Michigan 49203 or can be made from drawings available from the Technical Communications Dept, Rockwell International, 2135 W. Maple, Troy, Michigan 48084.

3. Slide the yoke over the installation shaft, aligning yoke and shaft splines of drive unit.



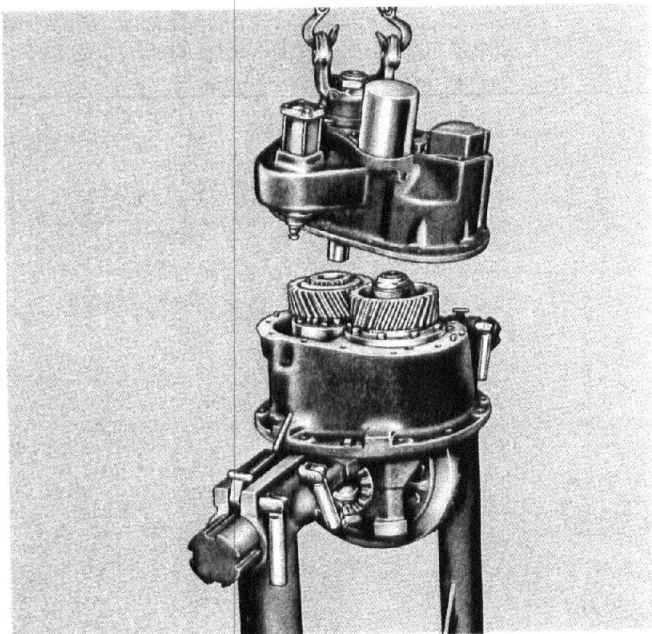
4. Place installation collar over the installation shaft, against yoke.
5. Thread nut onto installation shaft, against the collar. Continue threading the nut against collar until yoke seats against bearing. A torque value of 200 lb. ft. on nut may be required to properly install and seat the yoke.

CAUTION: *Do not use a prevailing torque nut to install the yoke, as damage to the threads will result. Use only the nut furnished with tool.*

6. Remove all parts of the installation tool from the drive unit.
- C. Install pinion input, output or through-shaft washer (if employed) and nut. Tighten nut enough to eliminate any play between yoke and bearing. If bearing end play adjustment is not required, tighten nut to correct torque. Refer to Torque Chart at end of manual.

REASSEMBLE HELICAL GEAR COVER ONTO CARRIER

IMPORTANT: *Before reassembling cover to carrier, coat the recess in the forward inter-axle differential side gear assembly and the thrust washer with grease. Place the thrust washer in the recess of the forward inter-axle differential side gear assembly. The grease will allow the washer to stick to the gear and stay in place during installation.*



- A. Assemble the input yoke (slip-fit) and nut onto input shaft hand-tight and with the differential carrier in an upright position in the repair stand. Apply RTV gasket material and assemble the gear cover onto the carrier. (Refer to page 13.) Use a chain fall through the input yoke to lift the gear cover.
- B. As the helical gear cover is lowered onto the carrier, make certain the input shaft aligns with bore through the inter-axle differential; continue to lower the cover onto the carrier. As the input shaft enters the inter-axle differential, it may be necessary to index the shaft through the splines of the spider (cross).
- C. With the gear cover in position on the carrier, assemble the gear cover to carrier capscrews and washers. Tighten capscrews to correct torque.

ADJUST INPUT BEARING END PLAY

- A. With the forward input bearing in place and the bearing cage assembled finger-tight on the helical gear cover with no shim pack, measure the gap between the bearing cover and helical gear cover. Use a suitable feeler gauge.

Adjustment With Carrier In Vertical Position:

This adjustment may be made without removing the forward side gear and inter-axle differential if care is exercised. However, Rockwell recommends removing these components to assure an accurate reading.

Adjustment With Carrier in Horizontal Position:

The forward side gear and the inter-axle differential must be removed to adjust endplay otherwise a false reading may occur.

- B. Add approximately .005" to measurement figure of gap. Add this amount of shims under the bearing cover.

EXAMPLE:

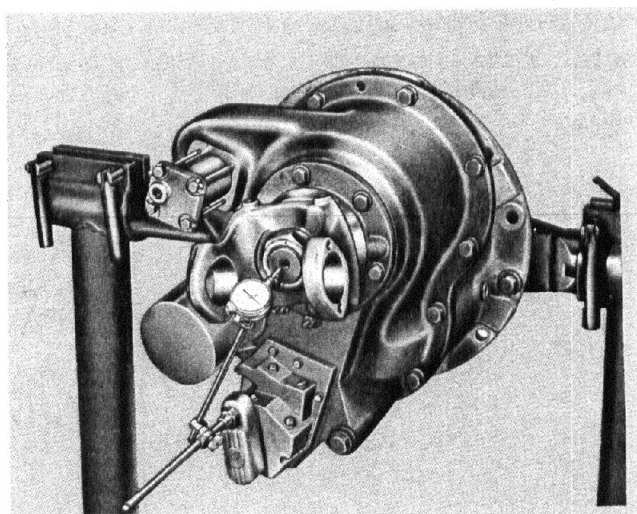
Gap .010"
Add .005"

.015" — Thickness of Initial Shim Pack

IMPORTANT: Use a minimum of three shims under bearing cover with the thinnest shims on outer sides.

- C. Remove the input yoke if assembled and bearing cage and install initial amount of shims. Reassemble the cover, washers and capscrews. Tighten capscrews to correct torque.
- D. Assemble the input yoke (slip-fit) and nut over the input shaft. Tighten the yoke nut enough to eliminate any play between the yoke and bearing.

If yokes with interference fit splines are employed, refer to "Install Interference Fit Yokes" on page 25.



- E. Check the bearing end play by using a dial indicator mounted against the nose of the input shaft. Use a dial indicator with a magnetic base or "C" clamp arrangement mounted on the helical gear cover.

- F. Holding the input yoke, rack in the input bearing while turning the yoke side to side to seat bearing and inter-axle differential pinions. Set indicator to zero.

Next, pull the yoke outward, again turning it side to side and take note of reading on dial indicator.

Final end play must be between .001" — .007".

- G. If reading is not within .001" — .007" end play, adjust by either adding or removing shims from under the bearing cover and repeat above procedures.

NOTE: Add shims to increase end play, remove shims to decrease end play.

- H. After end play has been established, remove helical gear cover and install the forward side gear and inter-axle differential assembly. Tighten input yoke to correct torque.

CLEAN AND INSPECT HOUSING, ASSEMBLE DRIVE UNIT

- A. Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.
- B. Inspect housing for cracks, nicks and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacements before installing drive unit in housing. Be sure housing is thoroughly cleaned after repairing.
- C. Apply drive unit to housing silastic (RTV) gasket material over drive unit opening in housing. Refer to "Silicone (RTV) Gasket Application" on page 13.
- D. Roll carrier into position on roller jack. Start carrier into housing with four flat washers and capscrews equally spaced and tighten alternately to draw the carrier squarely into axle housing. *Driving carrier into housing with a steel hammer will damage carrier flange and cause severe oil leakage.*
- E. After drive unit has been drawn up tightly to the housing, install balance of washers and capscrews. Tighten capscrews to correct torque.

ASSEMBLE OUTPUT BEARINGS THROUGH-SHAFT AND SEAL

NOTE: If it was not necessary to disassemble the output bearings, snap ring spacer and oil seal from the cage, reassemble into housing. It may be necessary to rotate the shaft to index splines of the shaft and side gear. Secure the bearing cage to housing with capscrews. For correct torque values, refer to Torque Chart.

If complete disassembly was required, use the following procedures for reassembly:

- A. Coat bearings with recommended axle lubricant and press both inner and outer bearing cones (back to back) onto end of through-shaft until inner bearing cone bottoms on the shaft shoulder. Use a press and suitable sleeve.
- B. Secure the through-shaft bearing cage in a vise and place the inner bearing cup in position in the bearing cage and insert the through-shaft with bearing cones through the cage.

CAUTION: Use soft metal shields over vise jaws to avoid damaging the cage.

- C. Position the outer bearing cup into the cage and over the bearing cone on the through-shaft. Secure bearings and shaft in the cage with a snap ring bearing spacer. This snap ring also controls bearing end play.

NOTE: Do not assemble the oil seal or yoke and spacer at this time.

Continue by checking for bearing end play as follows:

ADJUST OUTPUT BEARING END PLAY

The output bearing end play is controlled by the thickness of the snap ring bearing spacer. The snap ring is available in thicknesses ranging from .155" to .182" in increments of .003". Select and install one snap ring (as in Item "C" above) to obtain a .0001" to .0030" bearing end play. Use the following procedures:

1. With the bearing cage and through-shaft assembly secured in a vise, attach a dial indicator to the cage flange. Adjust the indicator so its pointer contacts the end of the through-shaft, and set the dial to zero.
2. While observing the dial, pull the through-shaft to rack in the output bearings while turning the shaft side to side to seat bearings.
3. Next, push the through-shaft while turning it side to side and take note of dial indicator reading.

Final end play should be between .0001" to .0030". If the bearing end play does not fall within this range, replace the snap ring bearing spacer.

NOTE: A thinner snap ring will increase end play, and a thicker snap ring will decrease end play.

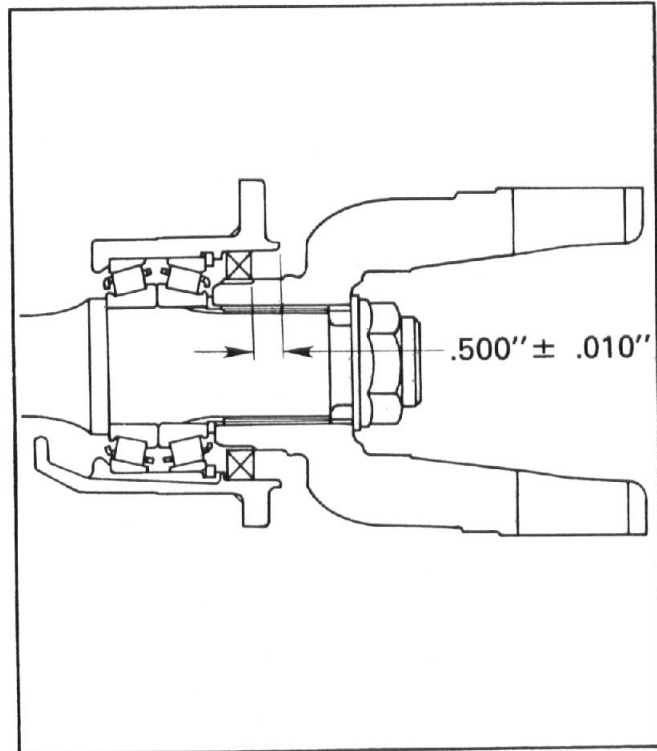
4. After establishing correct bearing end play, assemble the yoke spacer and yoke onto the through-shaft against the outer bearing. Secure the yoke with nut and tighten to specific torque. Refer to Torque Chart.

NOTE: Use a yoke holder while tightening yoke nut.

5. Using the dial indicator, make a second check of the bearing end play with the yoke and spacer installed. Use the same procedures as with the first check, Items 1 thru 3.

Continue with reassembly as follows:

- D. Remove the yoke and spacer from the through-shaft using a yoke holder while loosening the nut.
- E. Coat output seal lips with *Lubriplate* and O.D. of retainer with a non-hardening sealing material, such as *Permatex*.



- F. Assemble the oil seal into the cage by placing the through-shaft and cage assembly in a press. Use a suitable sleeve having a diameter that will fit inside the cage I.D. and press in seal until it is $.500'' \pm .010''$ below cage face.

If a press is not available, use the sleeve and a mallet to seat the seal in the cage.

CAUTION: Do not bottom seal — damage to seal will result.

- G. Install the through-shaft and cage assembly into the axle housing. It may be necessary to rotate the shaft to index splines of shaft and side gear. Secure the bearing cage to housing with capscrews. (Refer to Torque Chart).

NOTE: Before final installation of yoke, inspect yoke wear sleeve for excessive wear or damage. If replacement is necessary, refer to "Wear Sleeve Replacement," page 14. If replacement is not necessary, continue with yoke installation, Item "H."

- H. Assemble the yoke spacer, (slip-fit) yoke, washer and nut onto the through-shaft. Further, if yokes with interference fit splines are employed, refer to "Install Interference Fit Yokes," page 25. Tighten nut to specific torque. Refer to Torque Chart.

NOTE: Use a yoke holder while tightening yoke nut.

LUBRICATION

The forward/rear drive units employ a pump forced lubrication system in the inter-axle differential. This lubrication system uses a common type automotive oil filter which should be replaced every time the oil is changed or at least every 50,000 miles maximum.

“Standard” S.A.E. 140 viscosity lubricants, Rockwell specifications 0-76, 0-76-A and 0-76-B, are to be used in drive units that operate under average conditions, except where atmospheric temperatures require the use of the lower viscosity S.A.E. 90, Rockwell specifications 0-76-C, 0-76-D, 0-76-F and 0-76-J.

“Optional” S.A.E. 90 viscosity lubricants should be used when starting or storage temperatures fall below the channel point of the particular S.A.E. 140 viscosity lubricant being used.

Generally speaking, the “Standard” lubricants will render satisfactory service in most areas of the continental United States.

Unusual temperature or operating conditions may require other or more specific lubricant recommendations. Rockwell will review these circumstances, upon request, and make optional gear oil or grease recommendations. It is essential that all details of vehicle operation, loads, area temperatures, etc., are clearly and completely stated when applying to our Engineering Department for an optional lubricant recommendation.

The design of hypoid and amboid gear teeth, which mesh with a sliding action, enables them to withstand higher unit pressures. Therefore, the lubricant should have extreme pressure properties. Lubricants meeting the requirements of S.A.E. designation API-GL-5 best meet most requirements. For detailed oil specifications, refer to Rockwell Field Maintenance Manual No. 1 on Lubrication.

Further, since Rockwell lubricant specifications are periodically revised, always refer to Manual No. 1 for current complete lubricant specifications and applications.

MAGNETIC DRAIN PLUGS

Magnetic drain plugs perform the vital function of trapping small iron particles that circulate in the lubricant, through the gears and bearings, causing rapid wear and premature failure. The magnet must be strong enough to firmly hold the particles under service conditions. We recom-

mend plugs with elements having a minimum pick-up capacity of 2 pounds of low carbon steel in plate or flat bar form. (See Plug section in Field Maintenance Manual No. 1).

Spare clean plugs should be kept on hand for replacement at regular intervals. The change schedule can easily be established by periodic plug examination.

NEW AND RECONDITIONED AXLE SERVICE

With new axles, the original drive axle lubricant should be drained at 1,000 miles, but not later than 3,000 miles. Drain the lubricant initially used in the assembly while the assembly is still warm. Axles must not be flushed with any solvent, such as kerosene.

All new axles should be checked for correct oil level before being placed into service.

Also, change the oil filter at the same time the oil is changed (1,000-3,000 miles).

For reconditioned axles, follow the same procedures as above after overhaul.

Fill forward/rear axle with 51 pints (24 litres) of specified lubricant through fill hole in left side of carrier housing.

NOTE: This lubricant capacity is with pinion at horizontal centerline.

REGULAR AXLE SERVICE

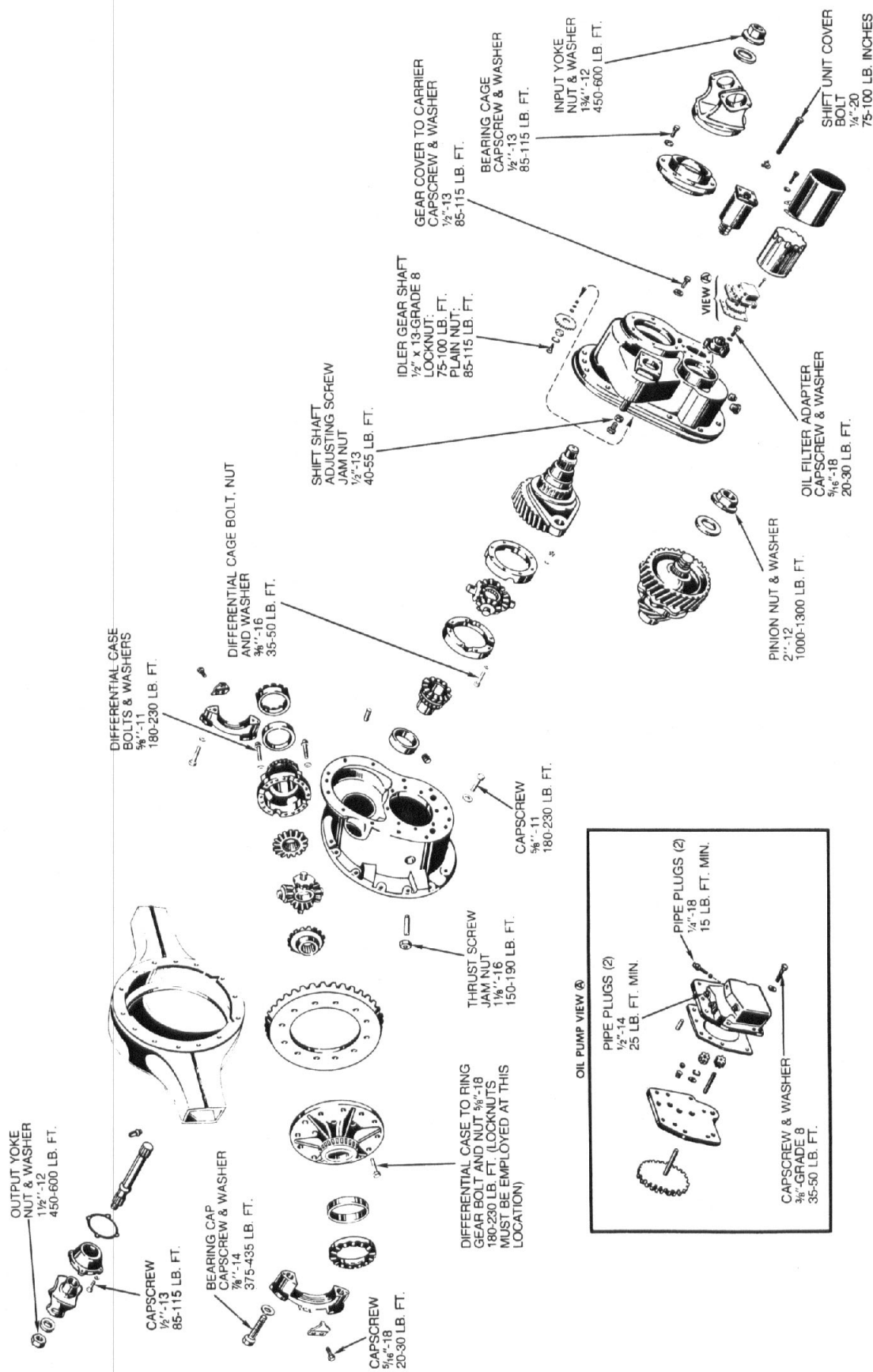
Refer to Field Maintenance Manual No. 1, “Lubrication,” for recommended service interval. Servicing the inter-axle differential is accomplished when normal service to the axle housing is performed as discussed under new and reconditioned axle service.

After the specified amount of lubricant has been added to the drive unit, jack up all four wheels of the vehicle and run at 25 M.P.H. in high transmission gear for five minutes to thoroughly circulate the lubricant throughout the assembly. Be sure brakes are fully released. Install pressure gauge in oil filter passage and check pump pressure. Pressure should be 10 P.S.I. minimum.

PREPARATION FOR STORAGE

In the event the carrier is a spare and may not be immediately installed, all gears and bearings should be thoroughly oiled and the carrier placed in a dustproof container.

TABULATION OF TORQUE LIMITS



ADDITIONAL MANUALS FOR THESE TANDEMS

COMPONENT	PUBLICATION
Rear/Rear Axle, Single Reduction	FMM #5
Rear/Rear Axle, Double Reduction	FMM #6
Wheel Ends, Planetary	FMM #9



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