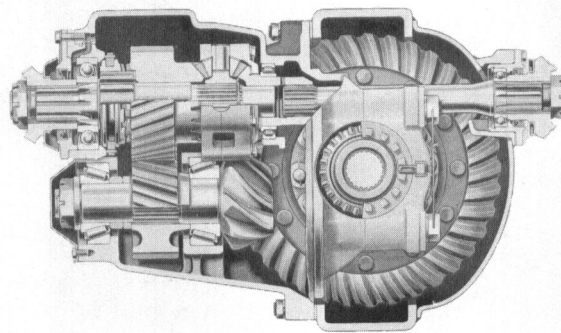


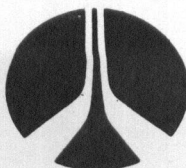
Field Maintenance Manual No. 5B

Single-Reduction Hypoid-Drive Unit

Two-Gear Transfer Train



Use Only Genuine Rockwell Parts



Rockwell International

Technical Communications
2135 West Maple Road
Troy, Michigan 48064



FRONT MOUNTED SINGLE REDUCTION DRIVE UNITS

(FORWARD/REAR TANDEM AXLES—TWO GEAR TRANSFER TRAIN—SSHD)

FASTENER TORQUE CHART

GEAR TO CASE BOLT AND NUT

WITH PLAIN NUT
5/8"-11 180-230 LB. FT.
WITH LOCKNUT
5/8"-11 150-190 LB. FT.

THRUST SCREW JAM NUT

7/8"-14 150-190 LB. FT.

AIR CHAMBER TO SHIFT HOUSING STUD NUT

GRADE 5 NUT
5/8"-24 30-40 LB. FT.
GRADE 8 NUT
5/8"-24 35-50 LB. FT.

SHIFT HOUSING TO CARRIER CAPSCREW

* GRADE 5 SCREW
5/8"-16 30-40 LB. FT.
* GRADE 8 SCREW
5/8"-16 35-50 LB. FT.

SHIFT SHAFT ADJUSTING SCREW LOCKNUT

1/2"-20 40-55 LB. FT.

SHIFT YOKE NUT AND BOLT

WITH COTTER PIN
TIGHTEN NUT TO SEAT SPHERICAL WASHER AGAINST SHOULDER BACK OFF IF NECESSARY TO LINE UP WITH COTTER PIN HOLE

WITH LOCK NUT
5/8"-24 20-30 LB. FT.

INPUT BEARING CAGE CAPSCREW

7/8"-14 40-55 LB. FT.

DIFF. BEARING CAP TO CARRIER CAPSCREW

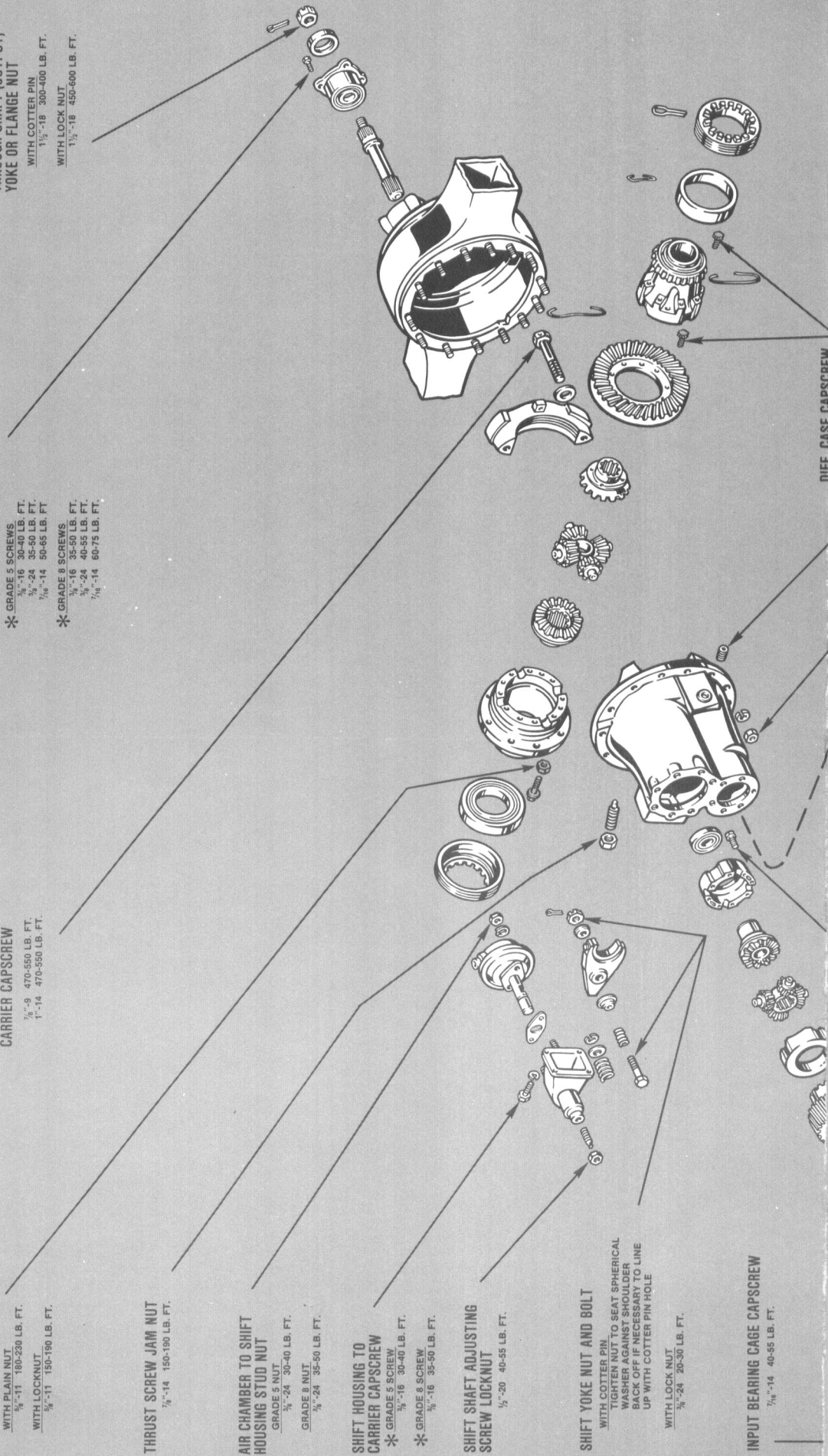
7/8"-8 470-550 LB. FT.
1"-14 470-550 LB. FT.

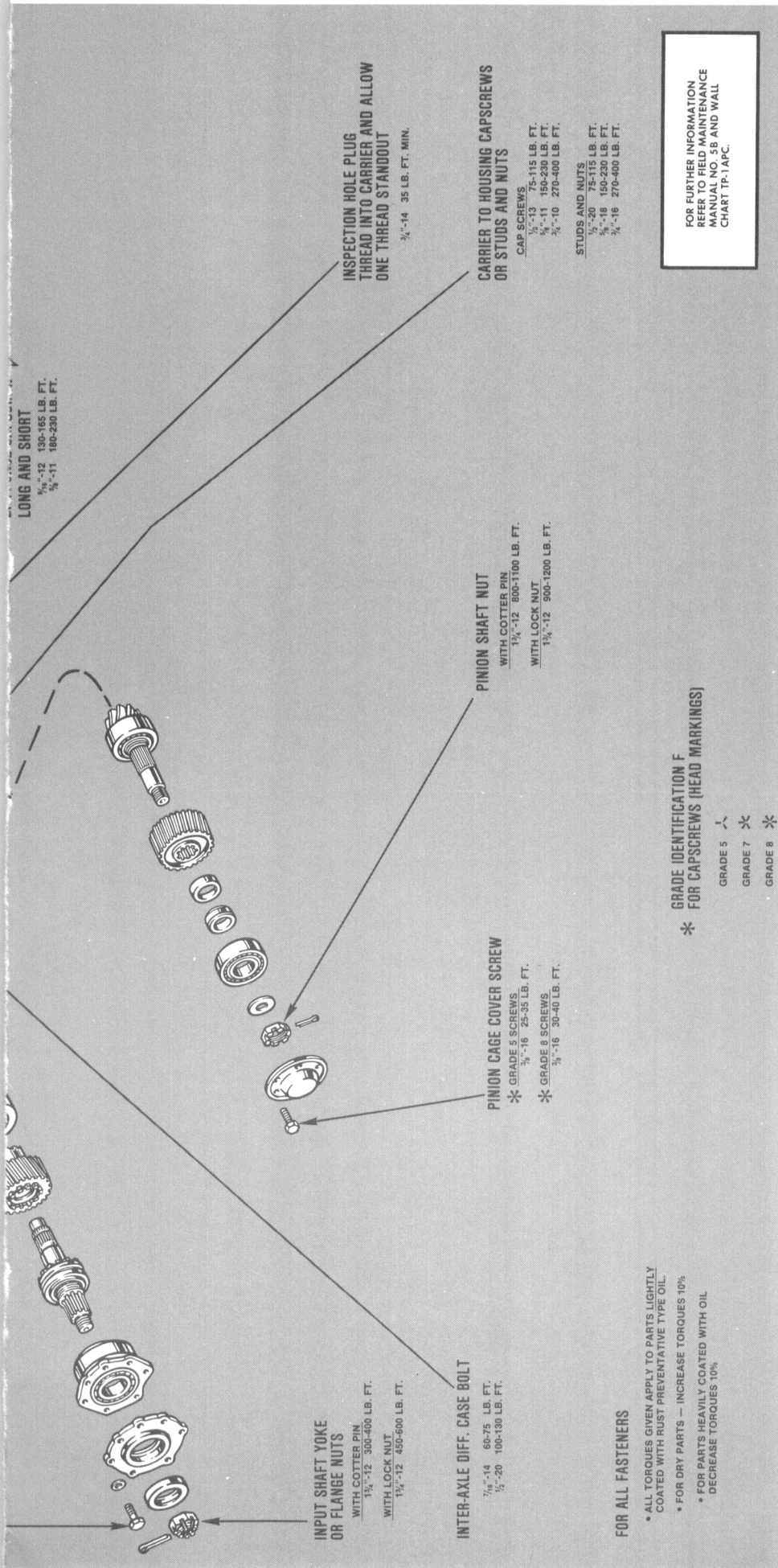
REAR BEARING CAGE CAPSCREW

* GRADE 5 SCREWS
5/8"-24 35-50 LB. FT.
5/8"-24 35-50 LB. FT.
1/2"-14 50-65 LB. FT.
* GRADE 8 SCREWS
5/8"-16 35-50 LB. FT.
5/8"-24 40-55 LB. FT.
1/2"-14 60-75 LB. FT.

THROUGH SHAFT (OUTPUT) YOKE OR FLANGE NUT

WITH COTTER PIN
1 1/2"-18 300-400 LB. FT.
WITH LOCK NUT
1 1/2"-18 450-600 LB. FT.





Rockwell International

Automotive Operations

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 Troy, Michigan 48064



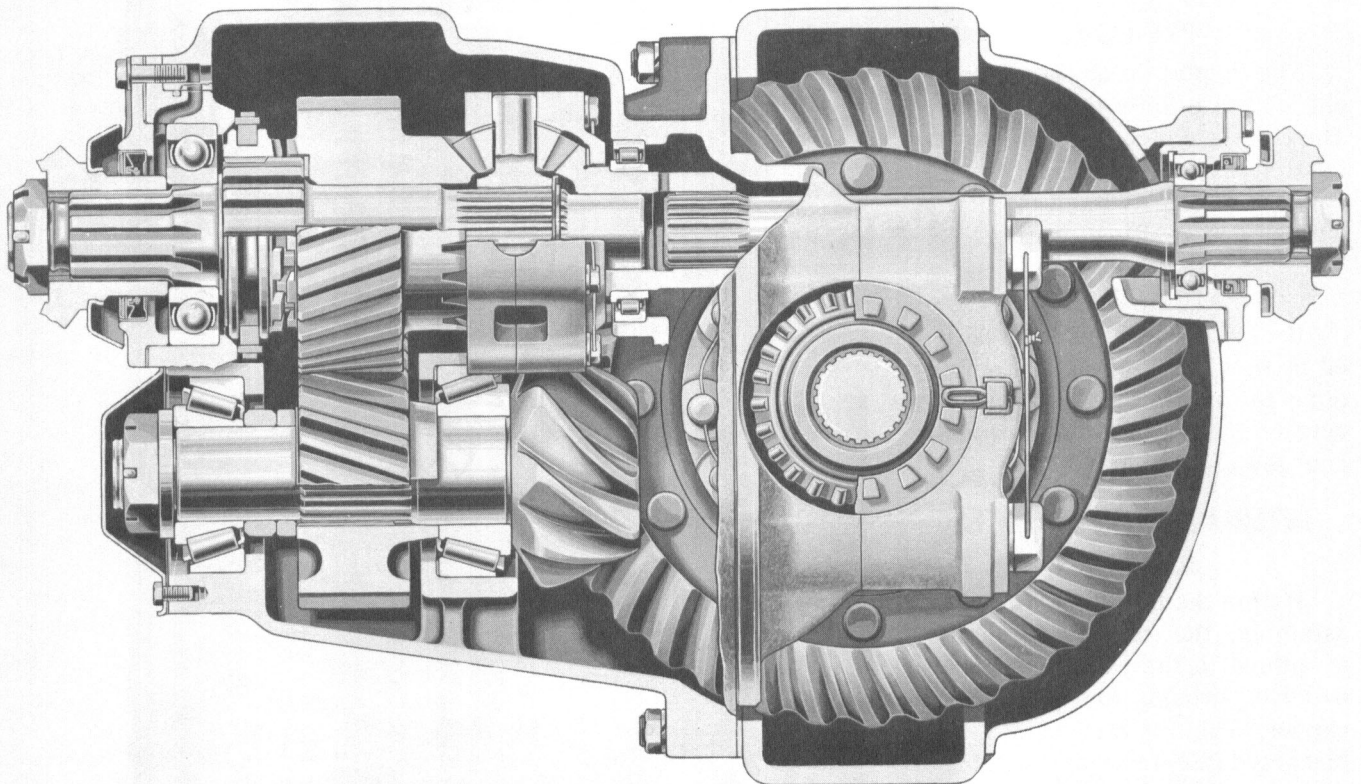
FRONT MOUNTED SINGLE REDUCTION DRIVE UNITS

(FORWARD/REAR TANDEM AXLES—TWO GEAR TRANSFER TRAIN—SSHHD)

FASTENER TORQUE CHART

CARE AND MAINTENANCE

FRONT-MOUNTED THROUGH DRIVE SINGLE-REDUCTION DRIVE UNITS WITH INTER-AXLE DIFFERENTIAL EMPLOYING TWO-GEAR TRANSFER TRAIN



Front-mounted Single Reduction Through Drive Type Drive Units with a two-gear transfer train built by Rockwell incorporate hypoid reduction gears and bevel type gears in the inter-axle differential assembly. This unit differs from other Rockwell front-mounted through drive type drive units by the omission of an idler shaft and the corresponding gear within the transfer gear train. Correct rotation of the hypoid reduction gears is accomplished in the design of the unit by simply cutting both gear and pinion* with the opposite (R.H.) spiral angle and mounting the gear on the opposite side of the pinion as compared to other through drive type drive units.

The input shaft is mounted on one ball bearing and one straight roller bearing, mounted in the single-piece carrier and gear case. Current models employ an input shaft mounted on tapered bearings. Refer to page 22. The through-shaft is splined to the rear of the inter-axle differential assembly and is supported by a ball bearing in a rear bearing cage located in the housing.

*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 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.

PINION

PRE-LOAD

The lower driving shaft with the integrally machined pinion reduction gear is mounted on two tapered bearings. Pinion bearing pre-load is maintained and adjusted by the use of a hardened precision spacer mounted between the bearings (using the driven transfer gear as a spacer as well).

ADJUSTMENT

The hypoid adjustment is made by increasing or decreasing shim or spacer thickness behind the inner bearing cup. This requires a corresponding change in the hardened cone spacer so as not to change the bearing pre-load.

GEAR

PRE-LOAD

The hypoid gear is riveted to one of the differential case halves. The cases are mounted between two tapered bearings in the carrier legs. Pre-load is adjusted and maintained with threaded adjusting rings.

ADJUSTMENT

Backlash is corrected or adjusted by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

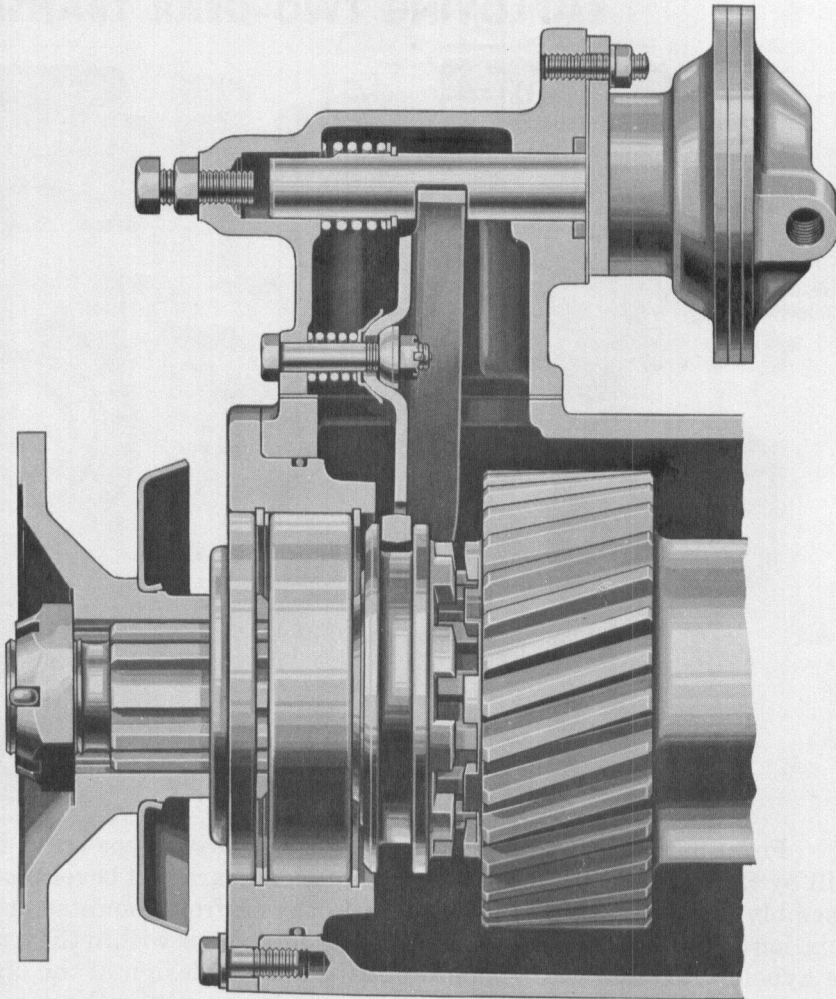
INTER-AXLE DIFFERENTIAL ASSEMBLY

Within the inter-axle differential assembly, the rear through-shaft is splined to the rear side gear for a drive through to the rear carrier. The forward side gear is machined integrally on the rear portion of the input transfer gear.

SHIFT UNIT

The inter-axle differential assembly may be either "locked up" or "unlocked" by a power actuated shift unit which moves a sliding dog clutch collar on the input shaft as illustrated in the picture. The dog clutch engages corresponding teeth on the forward portion of the input transfer drive gear.

The shift unit is controlled by a selector switch (or lever) within the cab of the vehicle and the differential may be "locked up" or "unlocked" under any normal operating conditions. However, the differential should not be "locked up" while wheels are spinning (after losing traction). In this event, slack off on throttle before shifting to "lock up." When shifting to "unlock" we recommend slacking off on the throttle to facilitate "unlocking" of the differential. The inter-axle differential, when "unlocked," divides the engine torque between the forward and rear axles; when "locked up," converts the two axles to a through drive type tandem axle assembly.



REMOVE AND DISASSEMBLE DRIVE UNIT

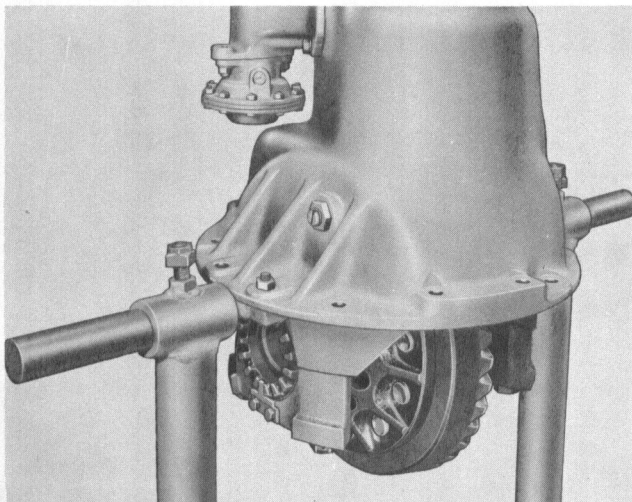
REMOVE DRIVE UNIT FROM HOUSING

- A. Remove plug from bottom of axle housing and drain lubricant.
- B. Remove the axle shaft stud nuts, lockwashers and tapered dowels.

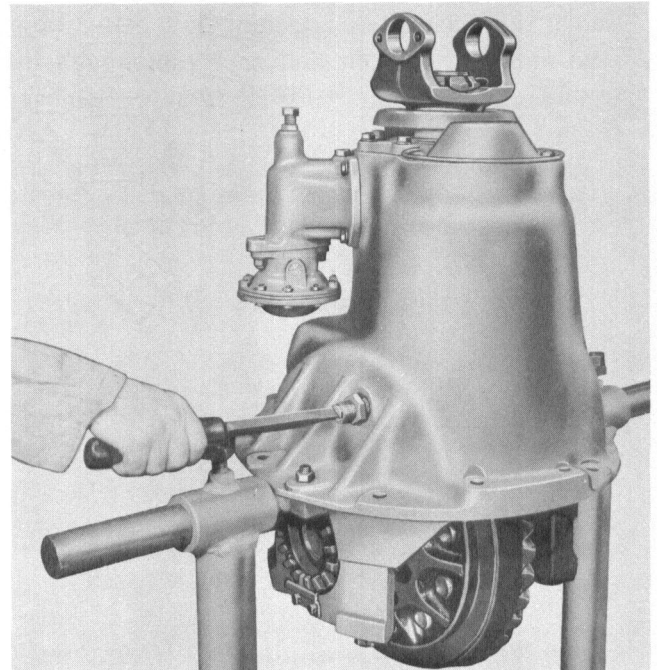
IMPORTANT: To loosen the dowels, hold a 1½ inch diameter brass drift against the center of the axle shaft head, **INSIDE THE CIRCULAR DRIVING LUGS**. Strike the drift a sharp blow with a 5 to 6 pound hammer or sledge. A 1½ inch diameter brass hammer is an excellent and safe drift.

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.

- C. Remove the axle shaft from the drive unit and housing.
- D. Disconnect the forward and rear propeller shafts.
- E. Remove carrier to housing stud nuts and lock washers. Loosen two top nuts but leave on studs to prevent carrier from falling.
- F. Break carrier loose from housing with a rawhide mallet.
- G. To remove carrier from housing, place roller jack under carrier. Remove top nuts and lock 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.

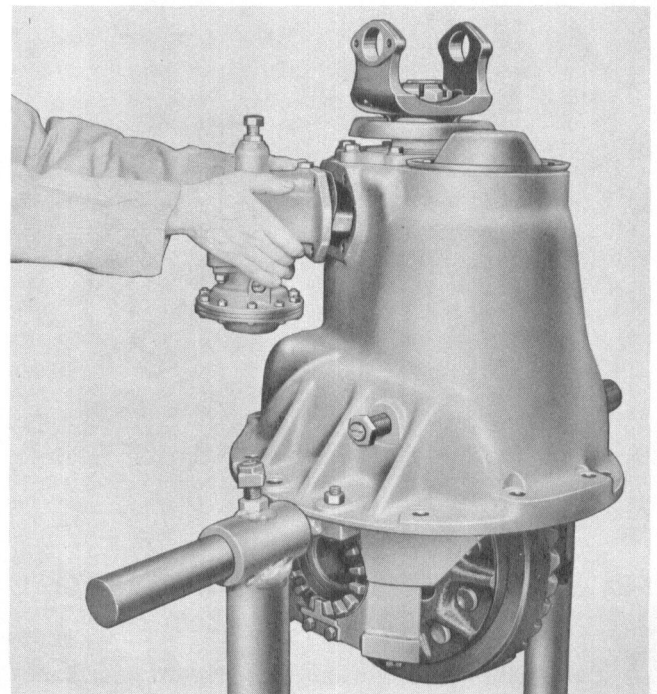


- H. Place carrier in suitable holding fixture as illustrated. Prints of carrier repair stand are available upon request.



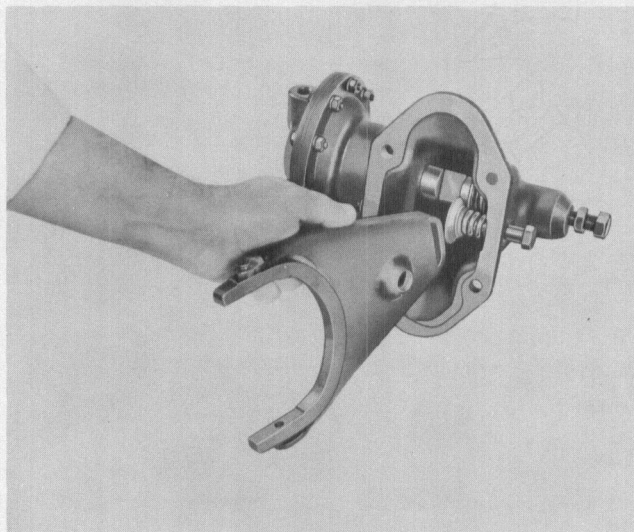
- J. Loosen jam nut and back off thrust block adjusting screw. Roll differential gear slightly to allow thrust block if used to drop out.

REMOVE AND DISASSEMBLE SHIFT UNIT HOUSING ASSEMBLY

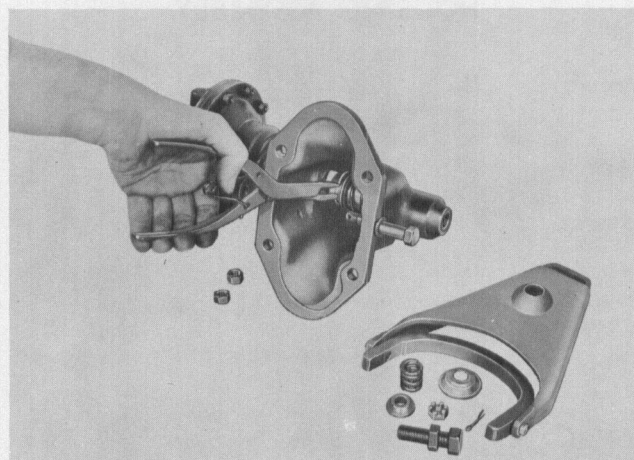


- A. Remove the shift housing cap screws and lock washers.

- B. Remove the shift housing assembly and gasket.
- C. To disassemble the shift housing assembly remove the shift lever attaching nut cotter key and nut. Tap body fit bolt back far enough to remove lever from shift shaft slot. Remove lever cup and spring.



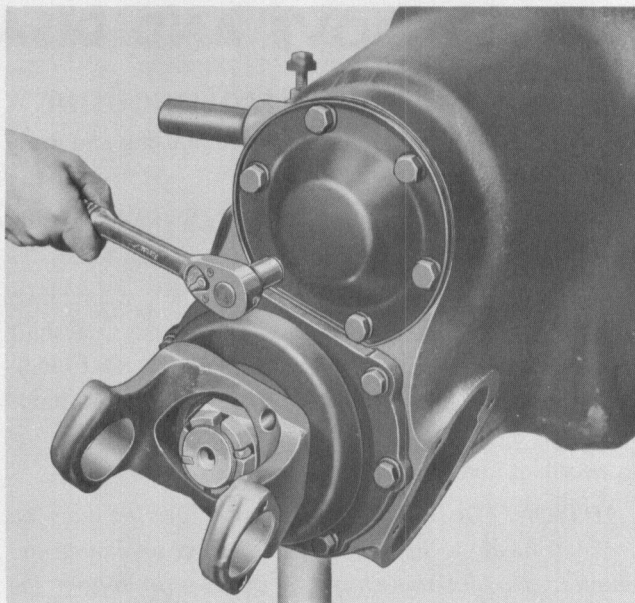
- D. Remove the shift chamber attaching nuts and lock washers. By use of snap ring pliers, expand lock ring to clear shaft groove and slide out shaft and chamber assembly.



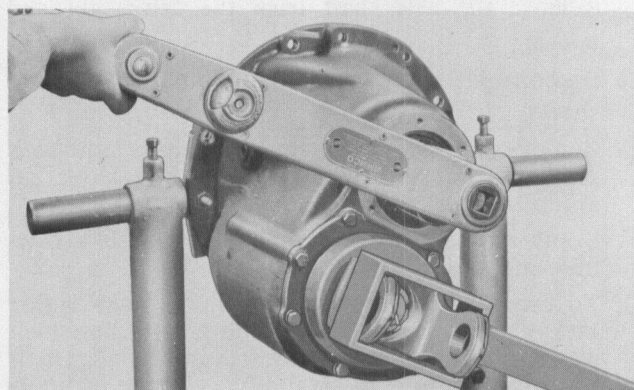
- E. Remove from the housing the spring retainer and spring.

REMOVE INTER-AXLE (3rd) DIFFERENTIAL AND CAGE ASSEMBLY

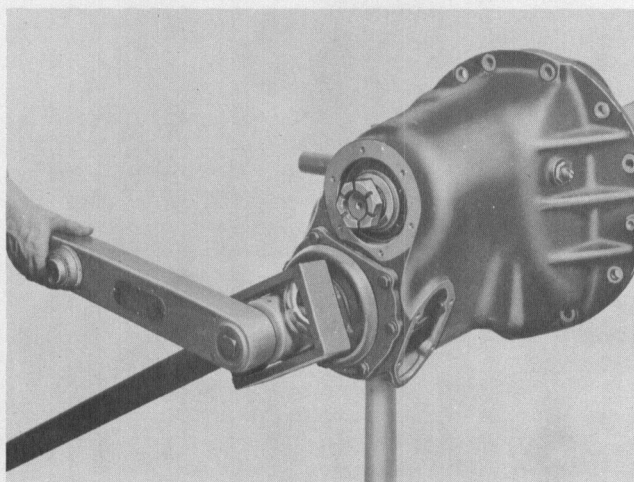
Before disassembly is started, record gear backlash. Gear must be reset to this figure at reassembly.



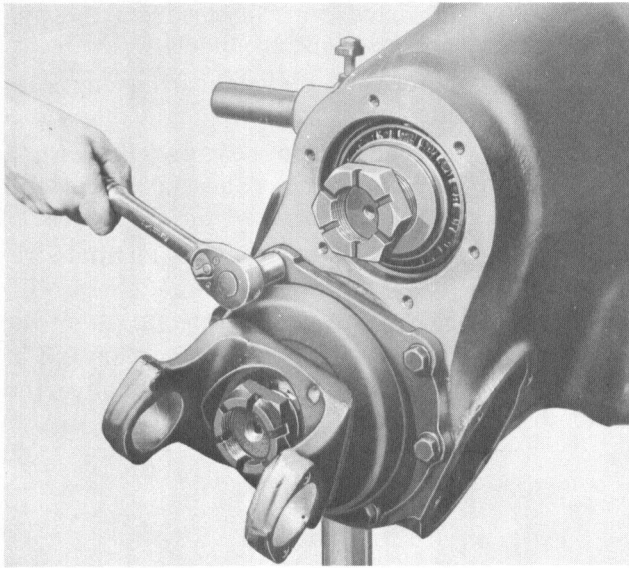
- A. Remove the pinion bearing cover cap screws and lock washers. Remove cover and gasket.



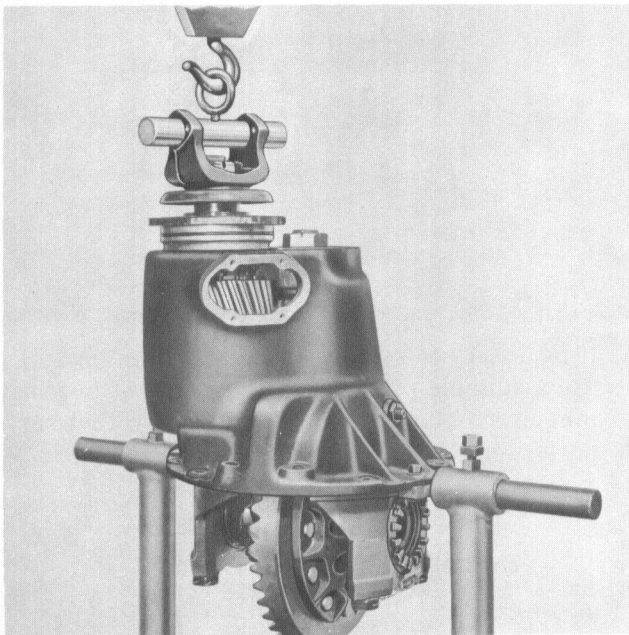
- B. Remove pinion nut cotter key, if used and loosen pinion nut. (Do not remove pinion nut at this time.)



- C. Remove input shaft cotter key, if used and loosen yoke or flange nut. (Do not remove nut at this time.)



D. Remove the input shaft cage cap screws and lock washers.

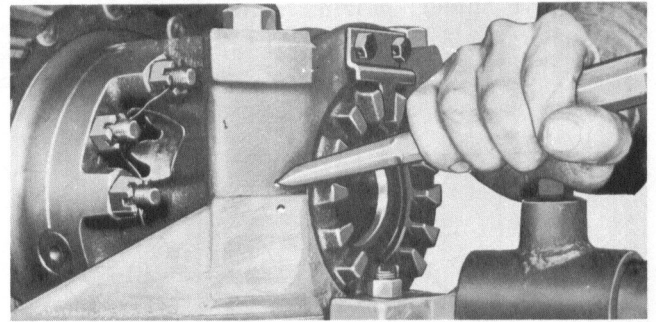


- E. Turn the drive unit assembly to a vertical position in the carrier stand and remove the inter-axle differential assembly with a chain fall.
- F. Lightly tap housing with rawhide hammer to free assembly. It may be necessary to rotate the input shaft to align one flat at rear of inter-axle differential case with the transfer gear.

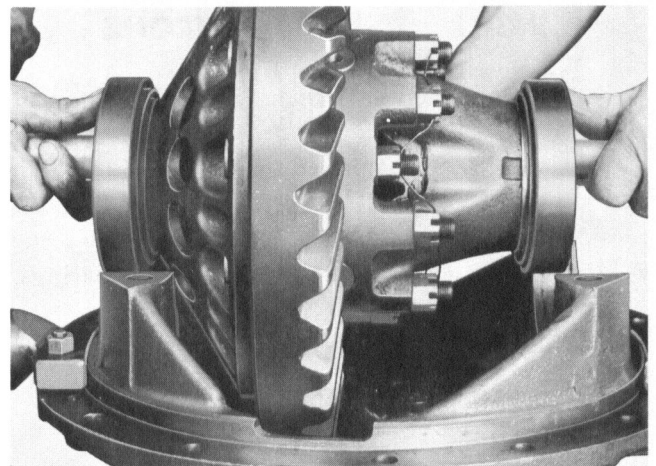
REMOVE DIFFERENTIAL AND GEAR ASSEMBLY

- A. Cut lock wire, if used. Remove cap screws and adjusting nut locks.
- B. Center punch one differential carrier leg and

bearing cap to identify for properly reassembling.

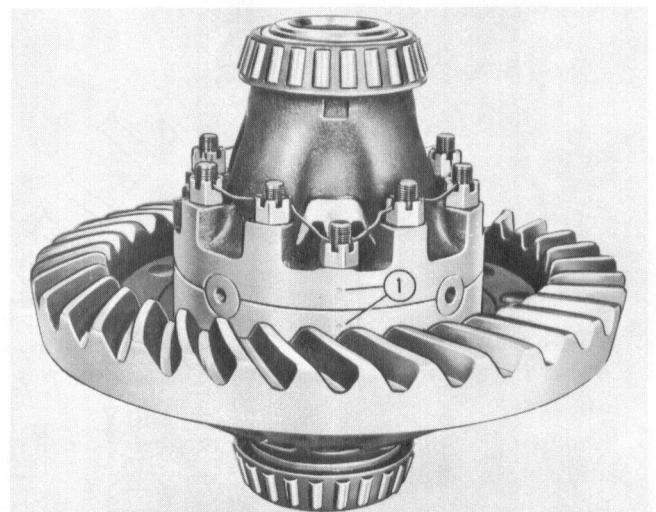


C. Remove bearing cap stud nuts or cap screws, bearing caps and adjusting nuts.



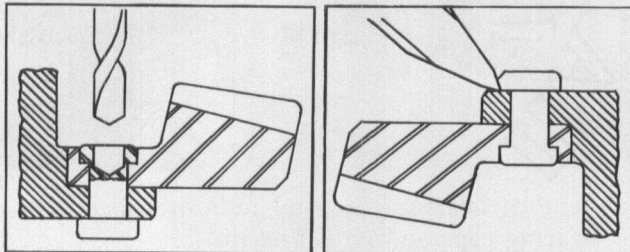
D. Lift out differential and gear assembly.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY



- A. If original identification marks are not clear, mark differential case halves with a punch or chisel for correct alignment on reassembling.

- B. Cut lock wire, if used, remove bolts and separate case halves.
- C. Remove spider, pinions, side gears and thrust washers.
- D. Remove rivets and separate gear and case.

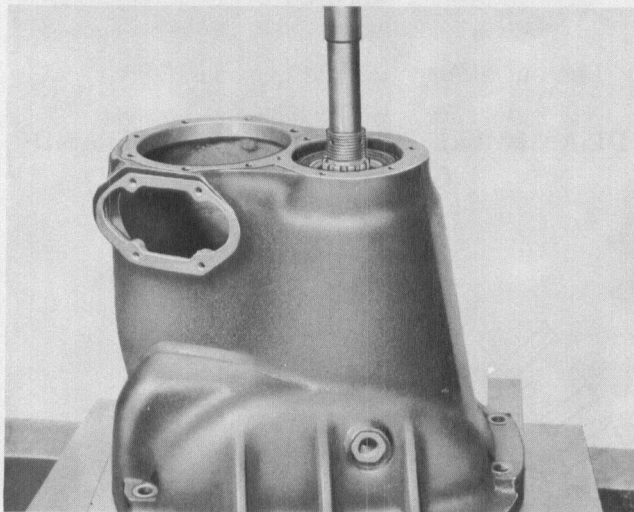


RIGHT

WRONG

1. Carefully center punch rivets in center of head.
 2. Use drill $\frac{1}{32}$ " smaller than body of rivet to drill through head.
 3. Press out rivets.
- E. If necessary to replace differential bearings, remove with a suitable puller.

REMOVE PINION ASSEMBLY

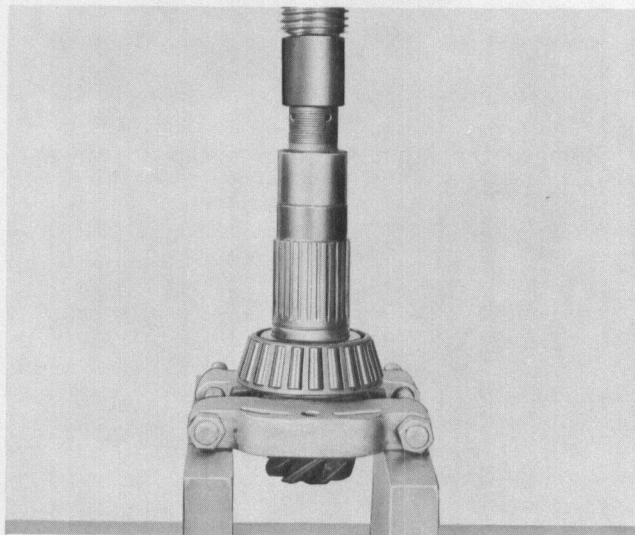


- A. Position the drive unit in a press supported by press plates under the carrier to housing mounting flange.
- B. Remove the pinion nut (previously loosened) and spacing washer.
- C. Press the pinion shaft through the forward pinion bearing cone and drive gear.
- D. Lift out the forward pinion bearing cone and two spacers. Remove the drive gear and pinion.

(Remove the drive gear spacer from the pinion shaft—not used on all models.)

- E. Remove the forward pinion bearing cup with suitable puller.
- F. Remove the rear pinion bearing cup with a suitable puller and remove the cup spacer and shim pack. (Spacer not used on all models.)
- G. Wire the shim pack together to facilitate re-assembly.

NOTE: This shim pack controls the depth of pinion in relation to the hypoid gear and it may be increased or decreased to change the tooth contact at time of reassembly.

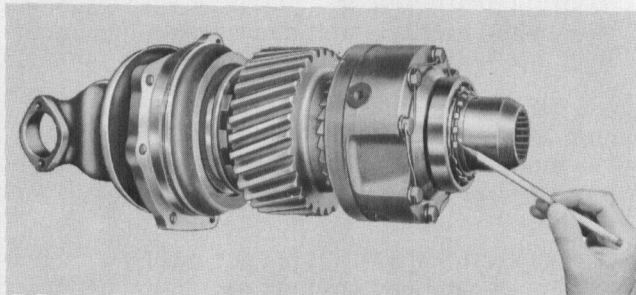


- H. If necessary to remove the rear pinion bearing, use a suitable puller that bears against bearing inner race or press off with a fixture that supports inner race.

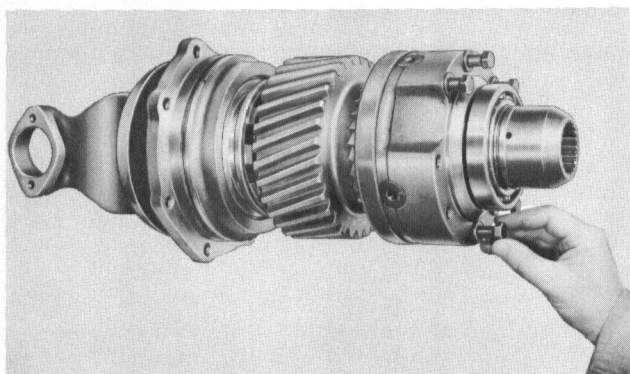
DISASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLIES

EMPLOYING BALL AND STRAIGHT ROLLER BEARINGS

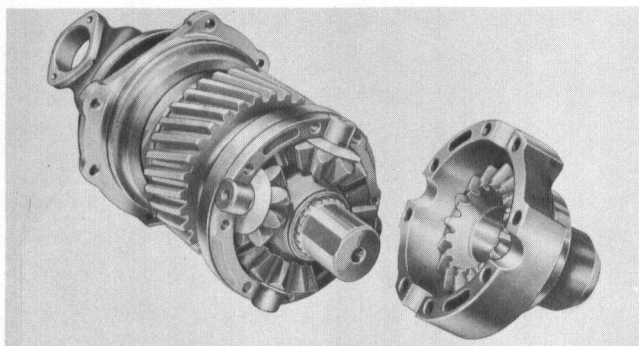
NOTE: For units employing taper bearings refer to page 22.



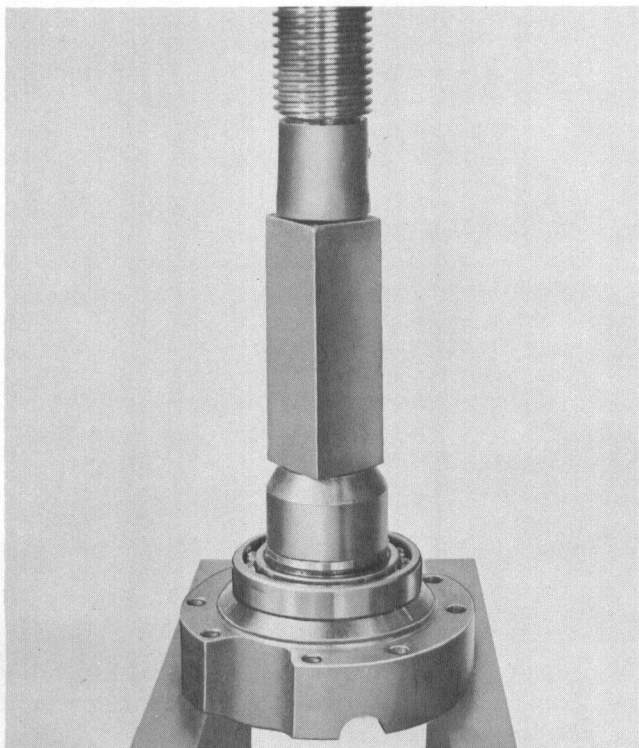
- A. If a snap ring is used, fold out the tabs on rear bearing snap ring retainer and remove snap ring with snap ring pliers. Remove snap ring retainer.



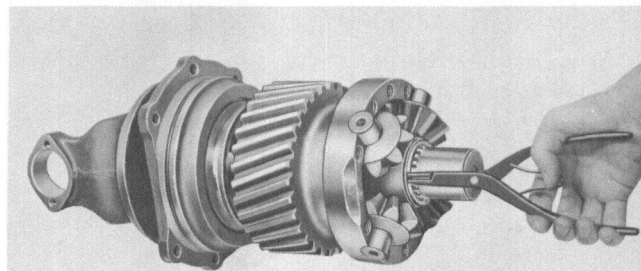
B. Cut and remove the inter-axle case bolt locking wire, if used. Remove the case bolts and hardened washers. Center punch each case half before separating to insure correct alignment in reassembly.



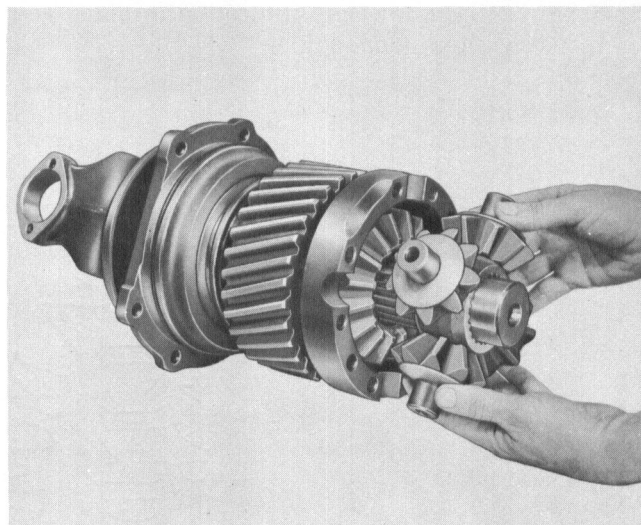
C. Separate the inter-axle differential case halves.



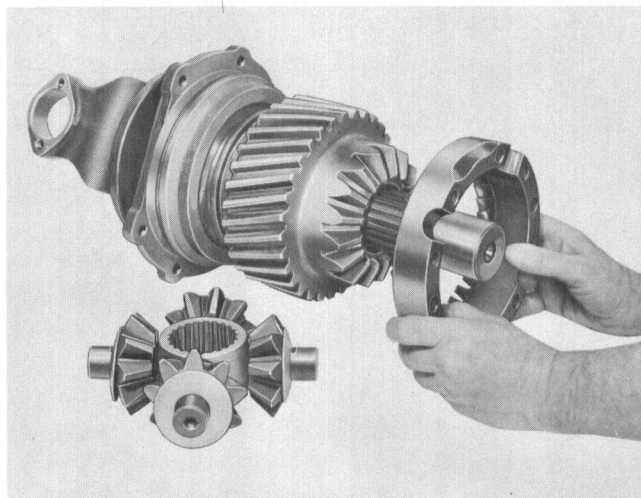
D. Set the rear case half up on press plates and press the rear side gear from bearing.



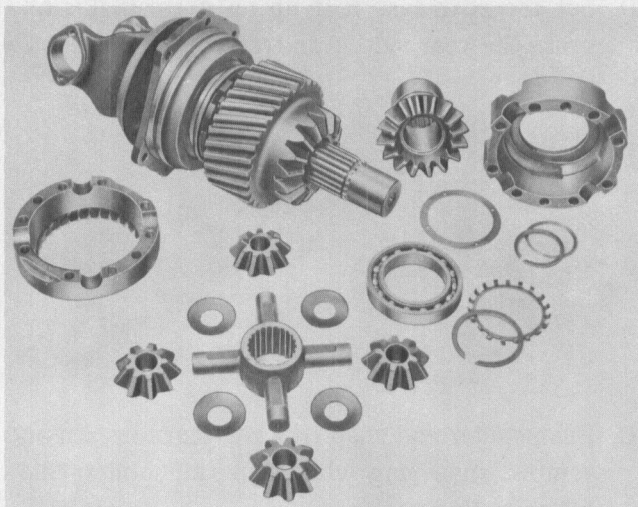
E. Push spider and snap ring retainer forward and remove snap ring with snap ring pliers. Slide off snap ring retainer.



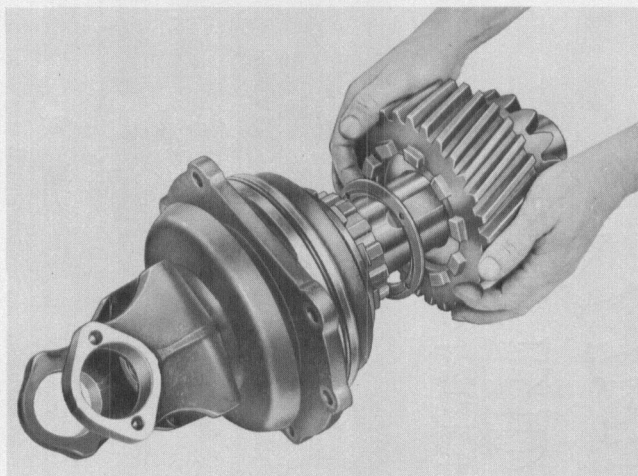
F. Slide spider, pinion and thrust washer assembly off shaft splines.



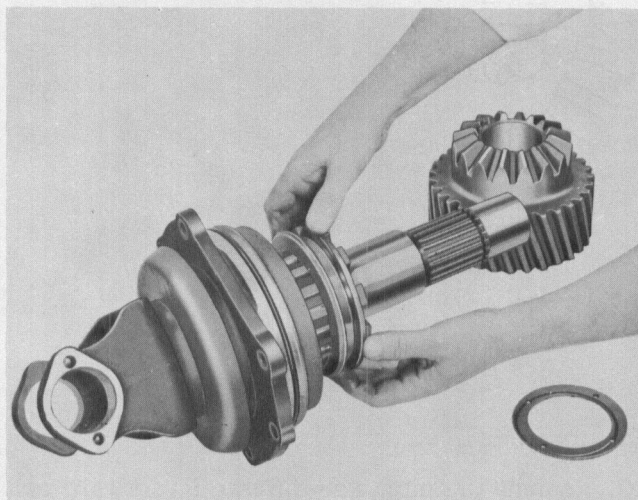
G. Remove the inter-axle differential forward case half.



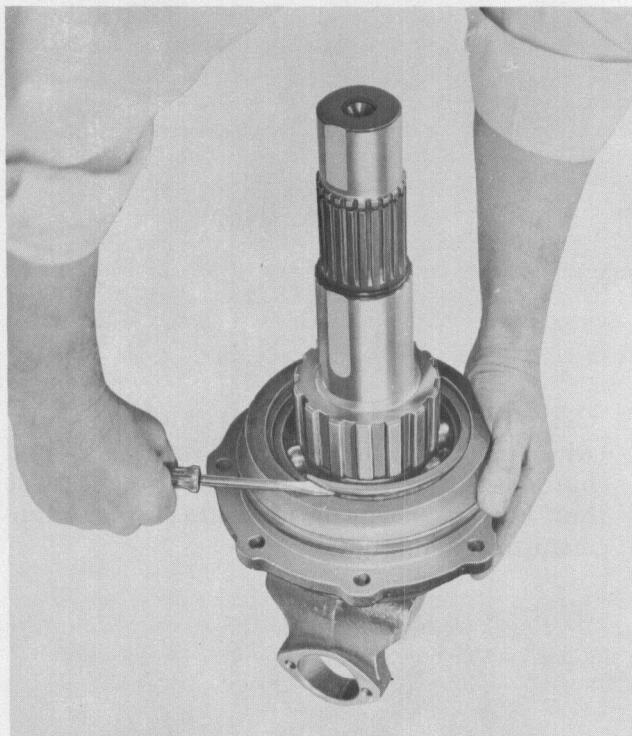
H. Separate the inter-axle differential pinions and thrust washers from spider.



I. Remove the transfer gear and thrust washer from input shaft. (Transfer gear and forward side gear are integral.)

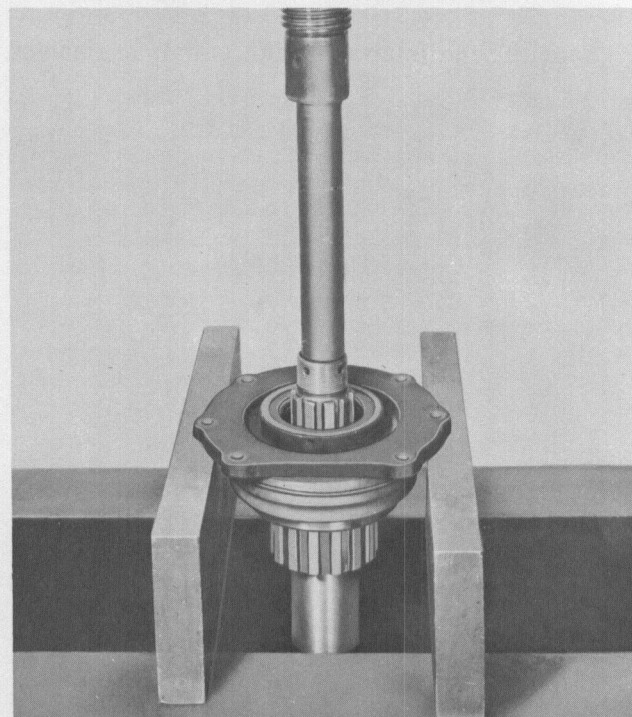


J. Slide off the clutch collar.



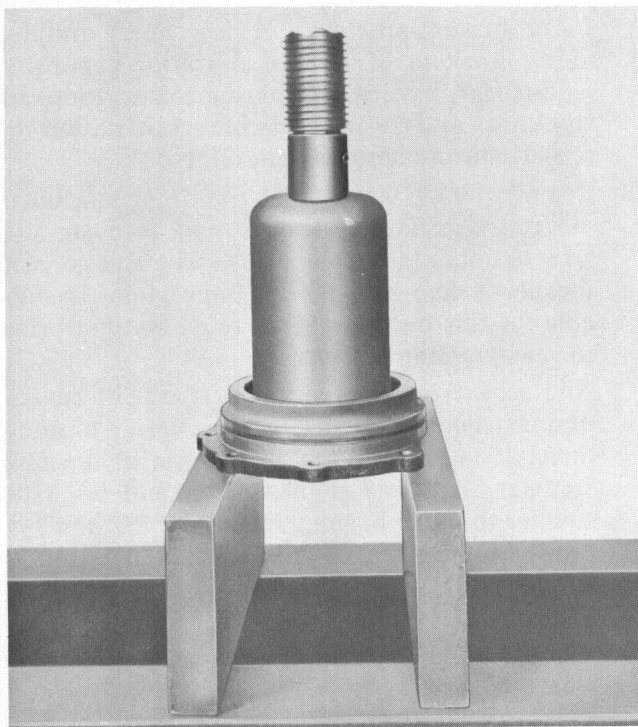
K. If a radial bearing rear snap ring is used, remove snap ring from bearing cage.

L. Remove the input shaft nut and remove yoke or flange with suitable puller.

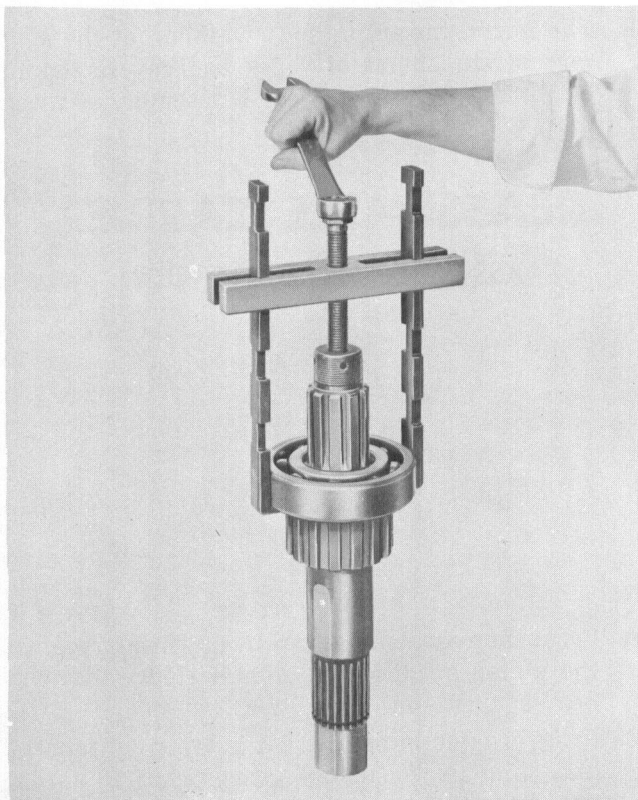


M. Tap or press shaft and radial bearing assembly from cage. Remove the radial bearing spacer, if used.

N. Remove snap ring.



O. Press out the oil seal with a suitable sleeve and discard.



P. Remove the radial bearing with a press or suitable puller equipped with fingers that bear against inner race.

PREPARE FOR REASSEMBLY CLEAN, INSPECT AND REPAIR

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.

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 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 mate-

rial, 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. 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.
- B. Inspect hypoid or spiral bevel 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 hypoid set, the entire gear set should be replaced.
- C. 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. Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

REPAIR

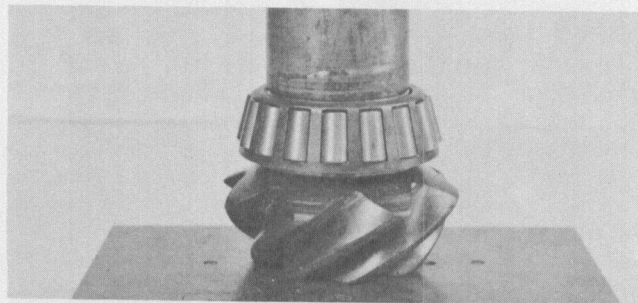
- A. Replace all worn or damaged parts. Hex nuts with rounded corners, all lock washers, oil seals and gaskets should be replaced at the time of overhaul.

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. All Rockwell-Standard bronze bushed differential pinions should be ball burnished after bushing installation. Install the bushing with a small stepped drift. The small O.D. should be .010" smaller than the bushing burnished I.D. and 1½ times bushing length. Always install bushings so end is even with the I.D. chamfer or about 1/16" below the spherical surface.
- D. When assembling component parts use a press where possible.
- E. Tighten all the nuts to the specified torque. (See torque limits following service instructions.) Use soft iron locking wire to prevent possibility of wire breakage.
- F. The burrs, caused by lock washers, at the spot face of stud holes of cages and covers should be removed to assure easy reassembly of these parts.

REASSEMBLE CARRIER

ASSEMBLE HYPOID PINION



- A. Press the rear cone squarely and firmly against the pinion head. Use a suitable sleeve that will bear against cone race.
- B. Prior to assembling the rear bearing cup, spacer and shim pack (install gear spacer if used), note following:

If original gears and rear bearings are re-used, install original shim pack. If gears have been replaced, alter the original shim pack as

follows: Note the variation from the nominal assembly dimension on both the old and new pinion. (The nominal dimension is stamped and the variation is etched on the "nose" of the pinion.) Increase or reduce the shim pack in accordance with the change in the variation from the old to the new pinion. After changing the sign of the old variation—plus to minus or minus to plus—add to the new variation (sign unchanged). The answer will be increase or decrease of the original shim pack in thousandths of an inch.

EXAMPLE:

OLD PINION MARKED	NEW PINION MARKED
3.125 + 6	3.125 + 2

First, we change the sign of the variation of the old pinion (+) which changes the variation from +6 to -6. Then we add -6 to the variation of the new pinion, +2, which gives us an answer of -4. This means that we must add .004" from the shim pack used with the old pinion.

- C. Install rear bearing cup against the shim pack (and spacer, if used).
- D. Install the outer pinion bearing cup to bottom in cup bore.
- E. Lubricate bearing and cups with light machine oil.
- F. Place the carrier and cap under a press, carrier legs down. Hold transfer gear in position and thread pinion shaft up through inner bearing cup and transfer gear. Support pinion and carrier under pinion head. Install "fixed" (thick) cone spacer.
- G. Start outer bearing cone on pinion shaft. Press bearing on with a suitable sleeve that will bear against the cone race. Press bearing in place with two tons pressure to seat rollers.
- H. Assemble pinion nut washer and nut with only 100 pound feet torque. Hold pinion by placing a hardwood block between pinion teeth and carrier wall.

ASSEMBLE DIFFERENTIAL AND GEAR

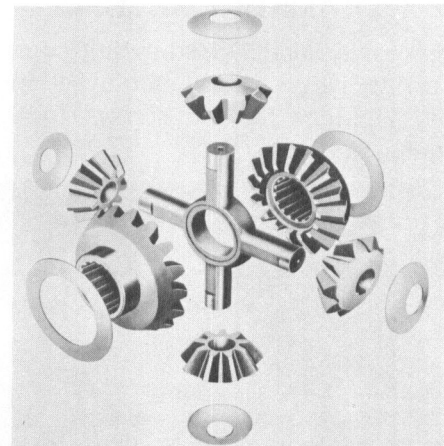
- A. Rivet the hypoid gear to the case half with new Rockwell-Standard rivets. Rivets should not be heated, but always upset cold. When the correct rivet is used, the head being formed will be at least 1/8" larger in diameter than the rivet hole. The head will then be approximately the same height as the preformed head. Excessive pressure will cause distortion of the case holes and result in gear eccentricity.

Tonnage required for squeezing cold rivets: these pressures are approximate for annealed steel rivets and pressure can be adjusted to suit individual working conditions.

DIAMETER OF RIVET	TONNAGE REQUIRED
7/16"	22
1/2"	30
9/16"	36
5/8"	45

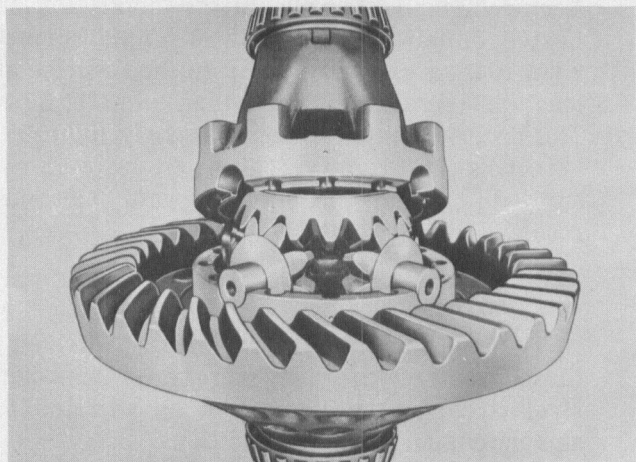
Differential case and gear bolts are available for service replacement of rivets. The use of bolts greatly facilitates servicing these units in the field and eliminates the need for special equipment necessary to correctly cold upset rivets. Consult chart for service bolt instruction shown with the torque chart on last page of manual.

- B. Lubricate differential case inner walls and all component parts with axle lubricant.



DIFFERENTIAL PINION AND SIDE GEAR ASSEMBLY

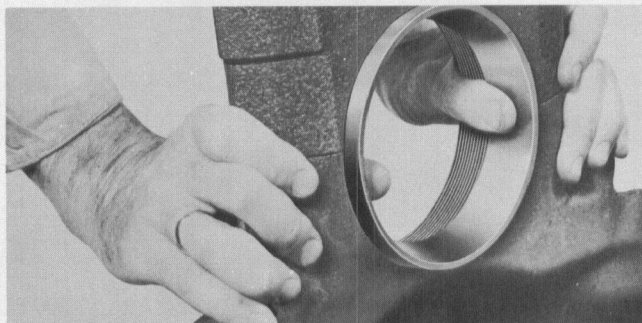
- C. Position thrust washer and side gear in bevel gear and case half assembly.



- D. Place spider with pinions and thrust washers in position.
 E. Install component side gear and thrust washer.
 F. Align mating marks, position component case half and draw assembly together with four bolts or cap screws equally spaced.
 G. Check assembly for free rotation of differential gears and correct if necessary.
 H. Install remaining bolts and cap screws, tighten to the correct torque and lock wire, if used.
 I. If bearings are to be replaced, press squarely and firmly on differential case halves.

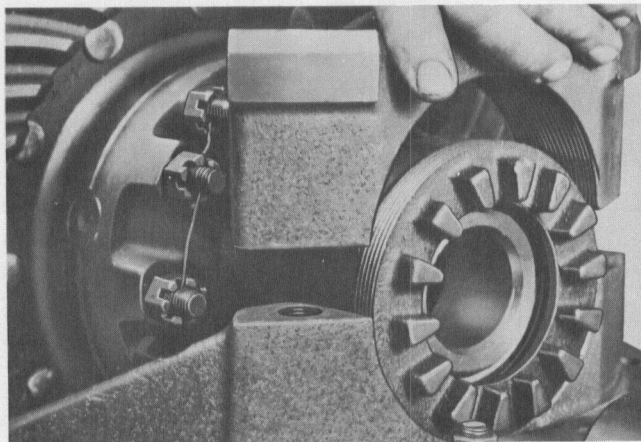
INSTALL BEARING CUPS IN CARRIER LEG BORES

- A. Temporarily install the bearing cups, threaded adjusting rings where employed and bearing caps. Tighten the cap screws to the proper torque.



- B. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be re-worked with a scraper or some emery cloth until a hand push fit is obtained. Use a blued bearing cup as a gauge and check the fits as work progresses.

INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

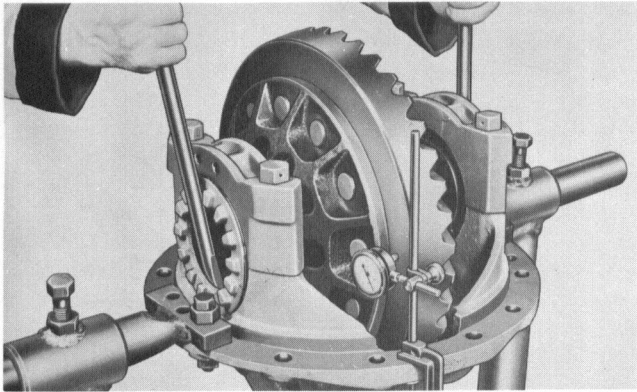


- A. After checking related parts, coat the differential bearing cones and cups with specified rear axle lubricant.
 B. Place the bearing cups over the assembled differential bearing cones, then position the differential assembly in the carrier.
 C. Insert bearing adjusting nuts and turn hand-tight against bearing cups.
 D. Install bearing caps in the correct location as marked and tap lightly into position.

If bearing caps do not position properly, adjusting nuts may 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.

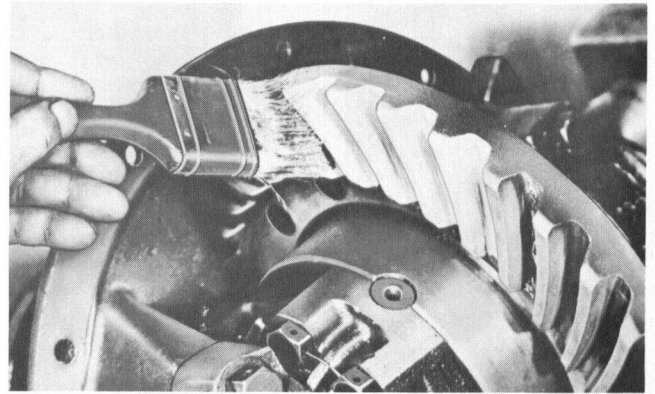
- E. Install flat washers where used and stud nuts or cap screws. Tighten stud nuts or cap screws to correct torque.

ADJUST DIFFERENTIAL BEARING PRE-LOAD



- 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.

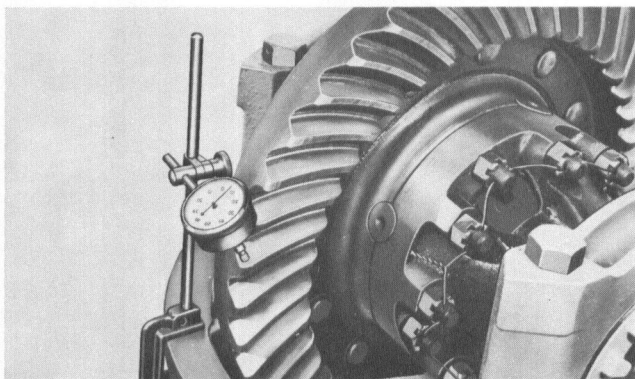
CHECK TOOTH CONTACT



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

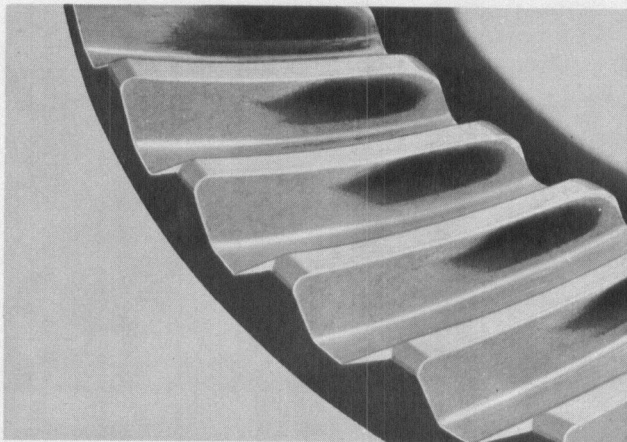
Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when the drive side is correct. As a rule,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

CHECK HYPOID GEAR BACKLASH



If original gears are reused the backlash should be made the same as before disassembly. For new gears the new backlash should be initially set at .010". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

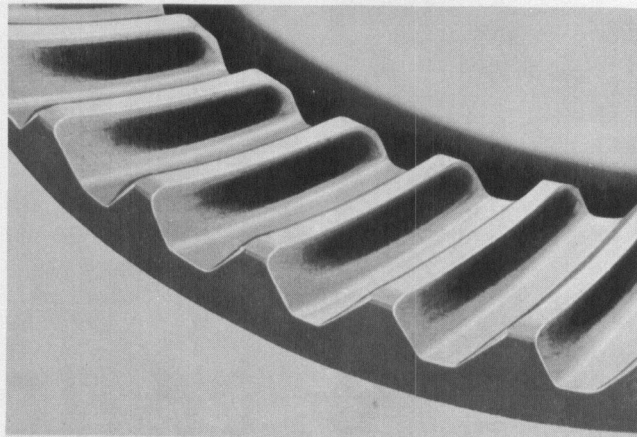
CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE



**SATISFACTORY TOOTH CONTACT
(GEARS UNLOADED)**

With adjustments properly made (pinion at correct depth and backlash set at .010") 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 at left (gears unloaded), will result in a pattern centered in the length of the tooth when the gears are under load, shown at right. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

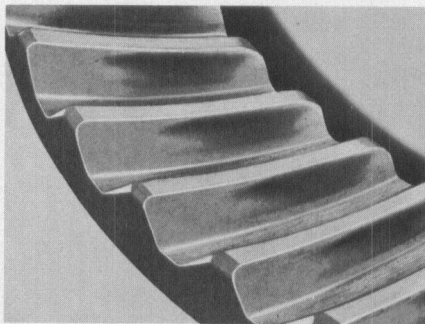


**SATISFACTORY TOOTH CONTACT
(GEARS LOADED)**

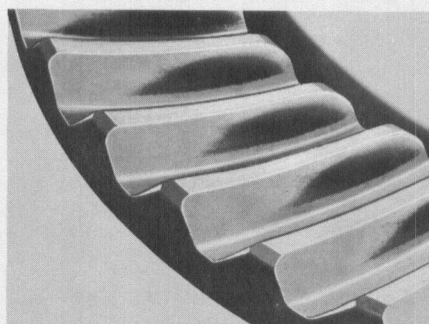
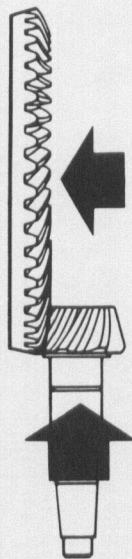
The pattern on the coast side of teeth will appear the same width as the drive side shown above; however, the over-all length will be centered between the toe and heel of gear tooth. *After the correct contacts shown above have been established with a backlash of .010", open the backlash to measure between .020"-.026".*

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.

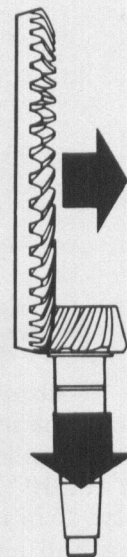
INCORRECT TOOTH CONTACT



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.



CHECK FOR PINION BEARING PRE-LOAD

Now that the proper tooth contact and shim pack for the rear bearing cup have been determined, determine the pinion bearing pre-load.

- A. Remove the differential and gear assembly and associated parts.
- B. Remove pinion nut and washer. Press the hypoid pinion out of outer bearing cone. Press transfer gear back in position on pinion.
- C. Make sure "fixed" (thick) spacer is in position against transfer gear. Cut two lengths of bar lead (or solder) approximately $\frac{9}{16}$ " long and insert both on top of the "fixed" spacer, 180° apart. Press bearing cone in place with two tons pressure and with a suitable sleeve that will bear against the cone race. This process will compress the bar lead (or solder).
- D. Press pinion out of outer bearing cone.
- E. Measure the compressed bar lead (or solder) thickness with a micrometer. To this figure add .004" to determine the thickness of the required variable spacer to be employed to obtain pinion bearing pre-load.
- F. Install variable spacer over pinion stem — against gear side.
- G. Place a support under pinion head and press on the outer pinion bearing cone with a suitable sleeve that will bear against the bearing inner race. Apply press pressure of approximately two tons to seat bearing rollers. Rotate carrier and cap in this process. Remove from under press.
- H. Assemble pinion washer and nut. Tighten to specified torque. To apply proper torque hold pinion by placing a hardwood block between pinion teeth and carrier wall.
- I. Check for proper pinion bearing pre-load of 5-15 pound inches by installing appropriate wrench socket over pinion nut. Wrap a cord or soft wire around socket and pull on horizontal line with a pound "fish" scale. Use rotating torque, not starting torque. If rotating torque is not within 5 to 15 pound inches, use thinner hardened spacer to increase, or thicker spacer to decrease, pre-load.

EXAMPLE: Assuming socket diameter to be 4 inches, the radius would be 2 inches and with 5 pounds pull would equal 10 pound inches pre-load torque.

REASSEMBLE DIFFERENTIAL AND GEAR ASSEMBLY

Follow instructions as before for installing the differential and gear assembly in subsequent steps:

1. Adjust for differential bearing pre-load.
2. Adjust for hypoid gear backlash and check for tooth contact.

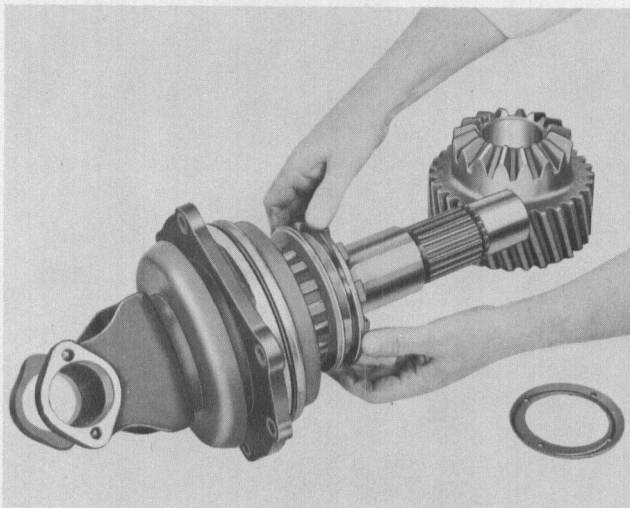
ASSEMBLE INTER-AXLE DIFFERENTIAL AND THROUGH-SHAFT CAGE ASSEMBLIES EMPLOYING BALL AND STRAIGHT ROLLER BEARINGS

NOTE: For units employing taper bearings refer to page 22.

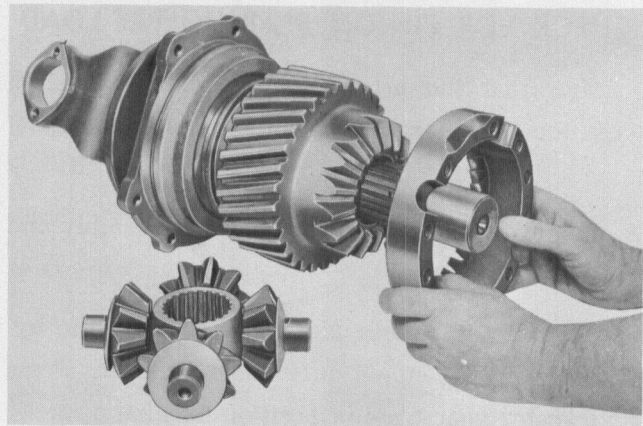
- A. Install the input forward radial bearing snap ring into cage.
- B. Press the input shaft oil seal into cage, from forward side, flush with snap ring.
- C. Press the forward radial bearing on input shaft with suitable sleeve bearing against inner race.
- D. Position the input shaft radial bearing into the cage bore flush with forward snap ring and install the rear radial bearing snap ring.

If input cage "O" ring has been scuffed or damaged in any way, replace with new.

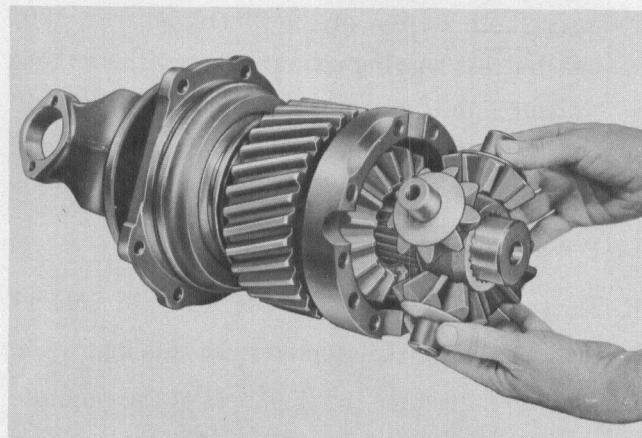
- E. Install yoke or flange on splines and install washer, if used, and nut. Nut may be run up on threads only sufficient for handling assembly in chain falls and later tightened to correct torque when assembly is mounted into housing.



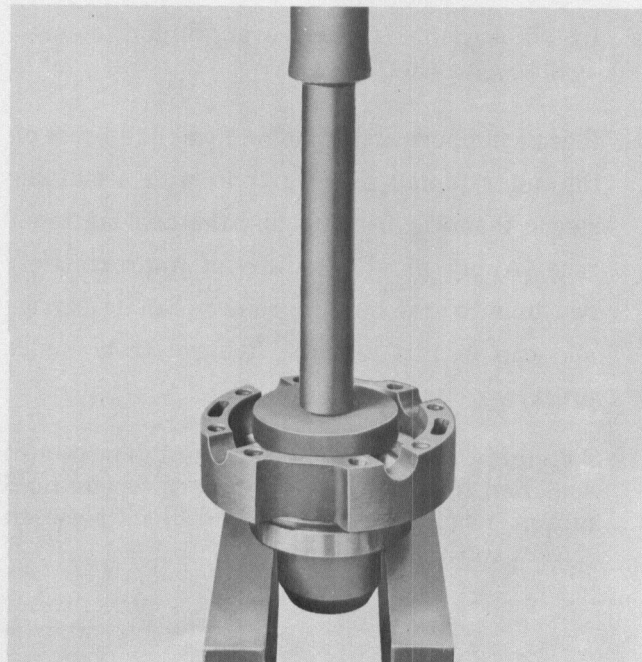
- F. Install the dog clutch collar on input shaft splines with the smooth side next to cage.
- G. Install the transfer gear thrust washer and transfer gear.
- H. Position the inter-axle differential forward case half over the forward side gear and assemble the spider pinions and thrust washers on spider.



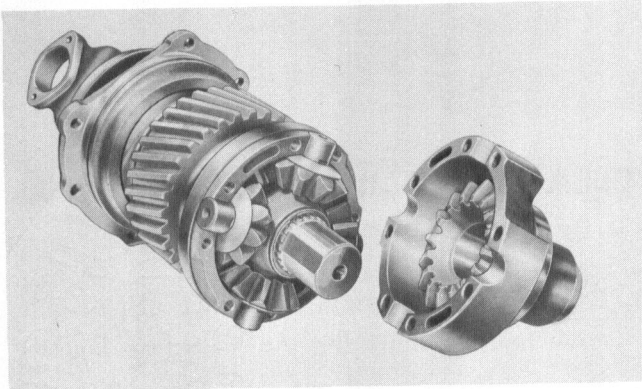
- I. Locate the assembly on input shaft splines. Turn the case half so that trunnion holes align with trunnions and slide assembly into case half.



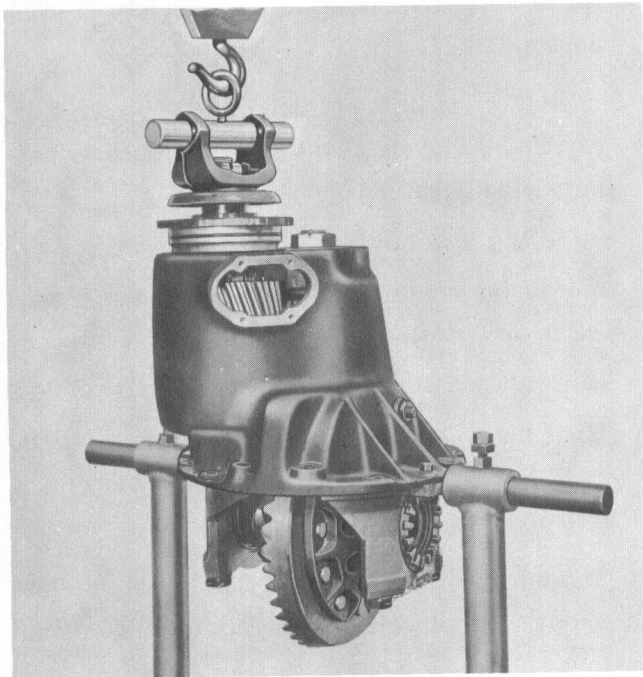
- J. Install the spider retainer and snap ring.



- K. Set the rear case half and rear side gear and thrust washer up on press plates and press the rear bearing into position.



- L. Position the rear case half, side gear and bearing assembly to mate with forward case half and nest assembly. Install hardened washers and case bolts.
- M. Tighten the case bolt to specified torque and install lock wire, if required.
- N. Install snap ring tab lock and snap ring, if used. Fold down the lock tabs to secure snap ring.



- O. Position the carrier housing with pinion and differential assembly upright in the carrier stand. By use of chain falls lower the inter-axle differential and input shaft assembly against a new gasket.

NOTE: Production drive gears and driven gears are mated at time of lapping. One drive gear

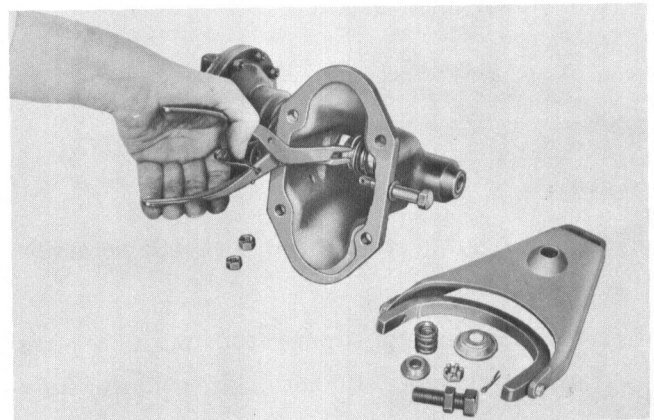
tooth is marked with an "X" and one driven gear tooth space is marked with a corresponding symbol (). We suggest these mating marks be lined up.

- P. Install the input cage lock washers and cap screws. Tighten cap screws to specified torque.
- Q. Tighten the input shaft or flange nut to specified torque and install cotter key.
- R. Tighten the pinion nut to specified torque and install cotter key.
- S. Position the pinion cover against a new gasket and install lock washers and cap screws. Tighten cap screws to specified torque.

INSTALL THRUST BLOCK

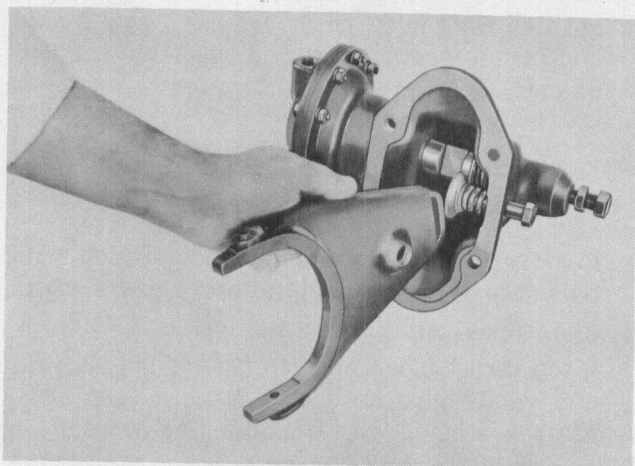
- A. Remove carrier from stand and position with back face of hypoid or spiral bevel gear upward.
- B. Remove adjusting screw and lock nut.
- C. Place thrust block on rear face of hypoid gear and rotate gear until the hole in the thrust block is aligned with the adjusting screw hole.
- D. Install adjusting screw and lock nut and tighten adjusting screw sufficient to locate thrust block firmly against back face of hypoid gear.
- E. To secure the correct adjustment of .010"-.015" clearance, loosen adjusting nut ¼ turn and lock securely with nut.
- F. Recheck to assure minimum clearance of .010" during full rotation of bevel gear.

ASSEMBLE AND INSTALL SHIFT UNIT HOUSING AND DIAPHRAGM ASSEMBLY



- A. Install the shift shaft and chamber assembly into housing assembly and install snap ring in shaft groove.

- B. Install next to snap ring the snap ring spring retainer and spring.
- C. Proceed with inserting the shaft until chamber mates with housing studs and gasket. Install lock washers and nut and tighten nuts to specified torque. Install the adjusting screw and lock nut.



- D. Install on the body fit housing bolt the spring, cup and lever. Make sure lever end enters the shift shaft slot. Install the button and nut. Tighten nut securely with box wrench and cotter key.
- E. Position the shift and housing assembly into the carrier assembly against a new gasket, exercising care to properly locate the shifter yoke into clutch collar groove.

LOCK-OUT ENGAGED, REAR ADJUSTING SCREW

- 1. Back-off adjusting screw lock nut so screw is free-turning.
- 2. Shift assembly to engaged position with power chamber. Be sure shift collar is fully engaged with rear gear.
- 3. Turn-in screw until it is finger-tight against push rod.

- 4. Turn-in screw $\frac{1}{2}$ revolution more to center fork in groove.
- 5. Tighten lock nut to specified 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, loose studs, nicks, and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacement before installing drive unit in housing.
- C. Install new drive unit to housing gasket over housing studs.

Roll carrier into position on roller jack. Start carrier into housing with four flat washers and nuts equally spaced.

Do not drive carrier into housing with a hammer at the carrier stud flange. The flange may easily be distorted and cause severe oil leakage.

Install lock washers and stud nuts on any studs under carrier housing offsets. It is impossible to start these nuts after carrier is drawn into housing.

- D. Tighten the four nuts over flat washers alternately to draw carrier squarely into axle housing.
- E. Remove nuts and flat washers. Install taper dowels, lock washers and stud nuts. Tighten to the correct torque.
- F. Connect universal at pinion shaft.
- G. Install axle shafts.

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.

LUBRICATION

Proper lubrication of the drive units is extremely important. Our "Standard" Specification O-65, S.A.E. 140 viscosity, multipurpose gear lubricant. Unusual operating conditions such as extremes in climatic temperatures may require lubricants of "Optional" viscosities. Refer to Field Maintenance Manual No. 1, "Lubrication," for detailed information.

Since Rockwell lubricant specifications are periodically revised, always refer to Field Maintenance Manual No. 1 for current complete lubricant specifications and applications.

NEW AND RECONDITIONED AXLE SERVICE

The original rear axle lubricant should be drained at the end of the drive-away or before the maximum of 3,000 miles prior to placing the vehicle in regular service. Drain the lubricant initially used in the assembly following reconditioning at the same interval. Completely drain the lubricant while the unit is warm.

Fill axle housings to bottom of level hole with specified lubricant with the vehicle level. Put an additional 2 U. S. pints of specified lubricant in the inter-axle differential housing.

REGULAR AXLE SERVICE

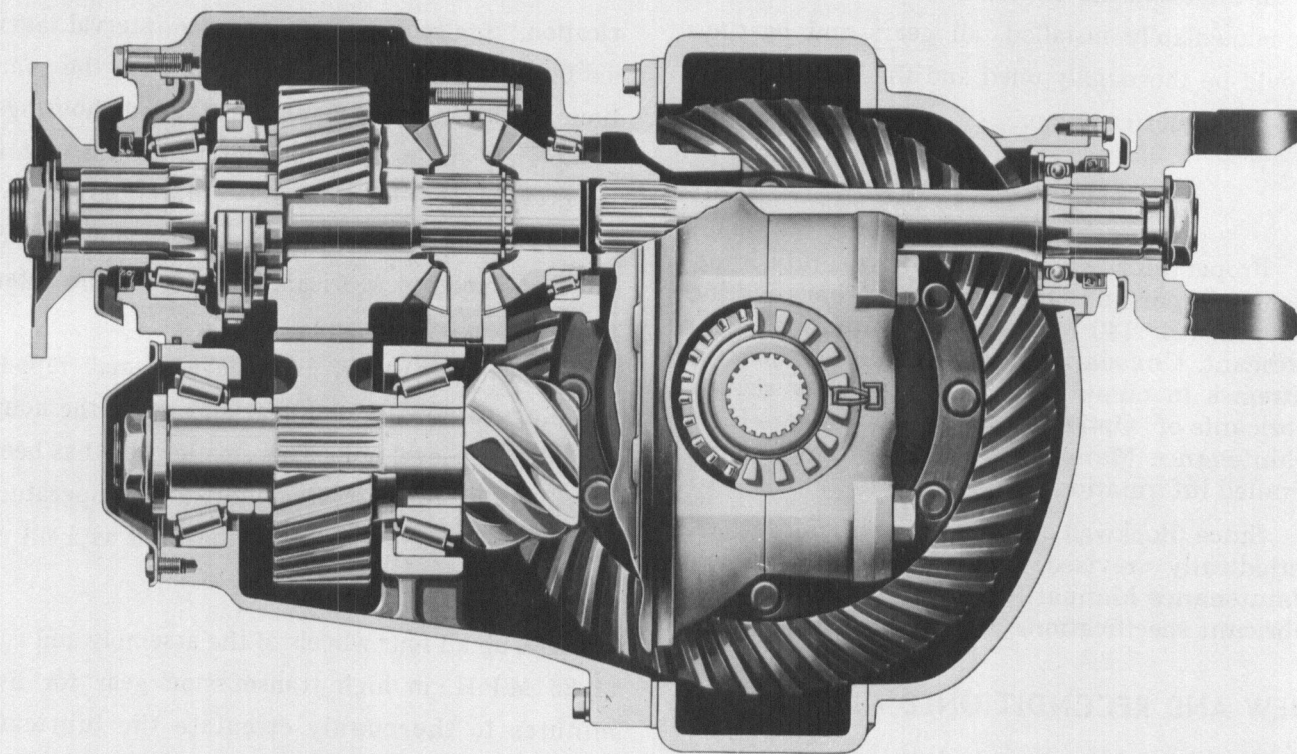
Refer to Field Maintenance Manual No. 1, "Lubrication," for recommended service interval. Service the inter-axle differential housing at the same time and in the same manner as the axle housings. Completely drain the lubricant while the unit is warm. Whenever the inter-axle differential housing has been drained, always add an additional 2 U. S. pints of specified lubricant directly to the inter-axle differential housing.

Some newer model axles have a small tapped and plugged hole located near and below the housing lubricant level hole. This smaller hole has been provided for the use of a lubricant temperature indicator only and should not be used as a fill or level hole.

Jack up all four wheels of the assembly 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.

For information on tires and tandem axle tire matching refer to Rockwell Technic Aid Section 3, Aid #37.

CURRENT MODEL



DISASSEMBLE INTER-AXLE (3RD) DIFFERENTIAL ASSEMBLIES EMPLOYING TAPER BEARINGS

- A. Remove rear inter-axle differential side gear and bearing cone from carrier.
- B. If bearings require replacement, remove rear side gear bearing cup from carrier, using a suitable puller. Remove the bearing cone from rear side gear using a press and bearing puller.
- C. Remove the spider retaining snap ring from input shaft and slide inter-axle differential nest from shaft.
- D. Disassemble inter-axle case halves by removing capscrews and washers. This will free the spider, 4 pinions and thrust washer.
NOTE: Before splitting inter-axle differential case halves, make certain identification marks are clear for correct reassembly. If markings are not clear use a punch or chisel and remark.
- E. Slide off helical drive gear, thrust washer and clutch collar from input shaft.
- F. Remove yoke or flange nut and washer, if used, from input shaft. Using a suitable puller

remove yoke or flange. This will free the input bearing cage, lift cage off from shaft.

NOTE: Inspect input bearing cage to carrier "o" ring for cracks, breaks, etc. Remove "o" ring from cage and discard if found defective in anyway. Also inspect input oil seal in bearing cage, replace if required.

- G. If bearings require replacement, remove bearing cone from input shaft and bearing cup from bearing cage.

REASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLIES EMPLOYING TAPER BEARINGS

NOTE: Before reassembly and installation of inter-axle differential (input) assembly into carrier, first install hypoid pinion, differential and ring gear assembly and adjust for correct pinion bearing pre-load, tooth contact, etc. Refer to pages 12 through 17.

- A. Press the input shaft rear bearing cup into bore in carrier. Use a press and sleeve of the correct diameter to press in cup.
- B. Press the input shaft forward bearing cone

onto the new input shaft. Use a sleeve to press on cone by the inner race only. Coat the bearing rollers with the recommended axle lubricant.

- C. Install the clutch collar onto the input shaft splines with the clutch teeth facing the rear of shaft.
- D. Prelubricate both sides of the helical drive gear thrust washer and the gear journal of the input shaft. Place the thrust washer into its pilot bore in the helical drive gear and install the gear and washer onto the input shaft.
- E. Assemble the inter-axle differential spider, pinions and thrust washers between the case halves. Thoroughly prelubricate both sides of the thrust washers and spider legs as the parts are being assembled.
- F. Secure the assembly together with hardened washers and capscrews. Tighten capscrews to 60-75 lb. ft. torque.
- G. Prelubricate the forward side gear teeth (integral with helical drive gear) and install the inter-axle differential nest assembly onto the input shaft with the capscrew heads facing toward rear of shaft.
- H. Retain the inter-axle differential nest assembly on the input shaft by installing the new snap ring into groove in shaft.
- J. Press the input shaft rear bearing cone onto rear side gear. Use a sleeve to press on cone by the inner race only.
- K. Prelubricate the bearing rollers and side gear teeth. Position the carrier upright and place the rear side gear with bearing cone into carrier against bearing cup previously installed.
- L. Using a chain fall, carefully lower the new input shaft assembly into carrier.
IMPORTANT: One helical gear is marked with an "X" at one tooth, while the other helical gear is marked with a corresponding symbol "(" at one tooth. These marks must be aligned at installation for correct gear contact.
- M. Install the new "o" ring in groove in the input bearing cage pilot O.D. Applying axle lubricant to "o" ring will facilitate installation.
- N. Place the input bearing cage and cup into position over the shaft against the input bearing cone. Continue by adjusting input shaft endplay as follows:

ADJUST INPUT SHAFT ENDPLAY

1. Install bearing cage to carrier capscrews and tighten to finger tight only. As capscrews are tightened rotate the input shaft several revolutions to seat bearings. Keep the hypoid ring gear from rotating by blocking gear with wood wedge.

2. Using a feeler gauge measure the gap between the bearing cage, and machined carrier face. Add .003" to the gap measurement (.003" + gap measurement) and select a new shim pack to correspond to this value.

NOTE: Use a minimum of three shims in the pack with the thinnest shims positioned at both sides to allow pack to compress for sealing.

3. Remove the cage capscrews and lift the input assembly slightly using a chain fall. Slide the shim pack into position under the bearing cage and lower the input shaft assembly and cage back into carrier.
NOTE: The shims may be split. With split shims it is not necessary to completely remove the cage or input shaft assembly from carrier to install shim pack.
4. Secure the cage to carrier with two capscrews and lockwashers positioned in opposite holes. Tighten capscrews to 40-55 lb. ft. torque. As capscrews are tightened rotate the input shaft several revolutions to seat bearings.
5. Mount a dial indicator onto the front face of carrier with the pointer (plunger) seated against the end of the input shaft. Turn the input shaft in both directions while pushing inward. Set the dial indicator to zero.
NOTE: The use of a magnetic base will facilitate mounting the indicator.
6. While observing the dial indicator pull the input shaft outward and take note of reading. Final endplay must be .003"-.007". If endplay is not within correct range adjust shim pack by adding or removing shims as required.
Adding shims will increase endplay, while removing shims will decrease endplay. If shim pack requires further adjustment repeat steps 3 thru 6.
7. After correct endplay has been established, assemble the remaining capscrews and lockwashers. Tighten capscrews to 40-55 lb. ft. torque.
- P. Using the 3 piece installation tool, draw the yoke or flange onto the input shaft.
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 Int'l, 2135 W. Maple, Troy, Mi., 48084.
- Q. Refer to page 35 under "Install Through Shaft Yoke" for yoke or flange installation procedures.
- R. Continue with reassembly, refer to page 46, items S and T.

TABULATION OF TORQUE LIMITS

