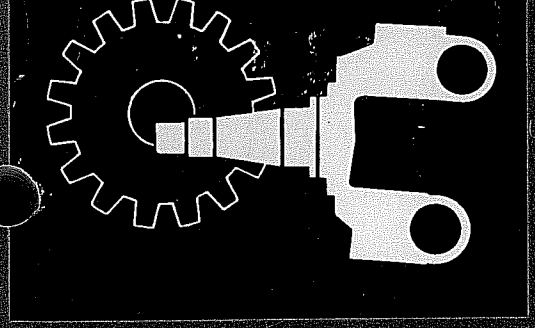

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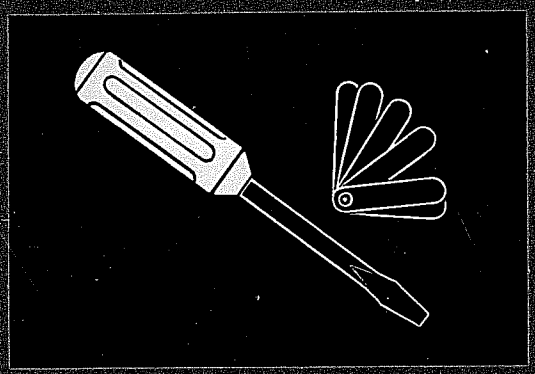

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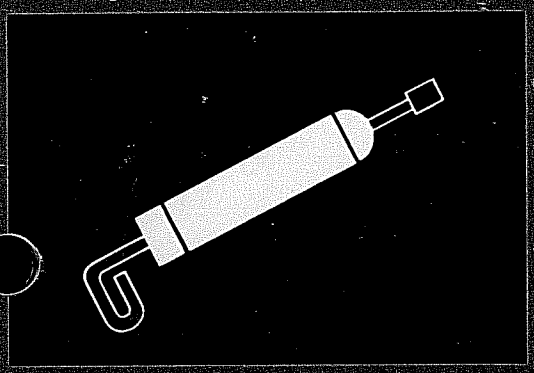

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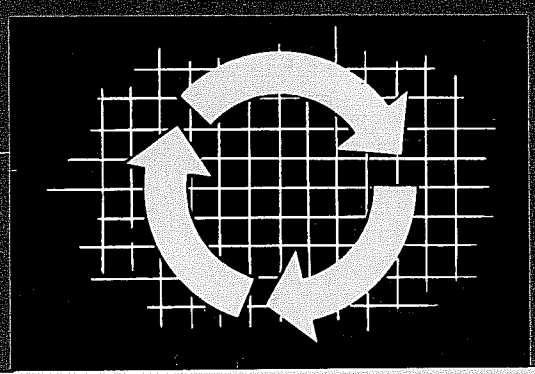

Torque Values

Field Maintenance Manual for Rockwell Highway Truck & Tractor Axles

Rockwell International

...where science gets down to business

Automotive Operations

Communications

2135 West Maple Road

Troy, Michigan, U.S.A. 48084

Field Maintenance Manual For Rockwell Highway Truck and Tractor Axles

The Automotive Operations of Rockwell International Corporation has prepared this Field Maintenance Manual as an aid to the efficient service and maintenance of Rockwell Axles. This manual is a consolidation of all the material previously published in the following Field Maintenance Manuals relating to highway truck and tractor axles:

FMM #1	Lubrication
FMM #2	Non-Driving Front Axles (all models)
FMM #5	Single Reduction Drive Unit— Single Axles and Rear/Rear of Tandems
FMM #5B	Single Reduction Forward Rear Drive Units— 2Gear Transfer Train—See FMM #5 for Rear/Rear
FMM #5C	Single Reduction Forward Rear Drive Units— 2 Gear Transfer Train—See FMM #5 for Rear/Rear
FMM #5C	Single Reduction Forward Rear Drive Units— 3 Gear Transfer Train—See FMM #5 for Rear/Rear
FMM #5D	SQHP Tandem Front Mounted Hypoid and Amboid Drive Units

This manual is divided into sections pertaining to the specific operations to be performed. The Table of Contents will quickly show you the section(s) which detail the information you require. The pages are identified by page numbers at the lower outside corners and by section description in the upper outside corners.

Every effort has been extended to make this manual complete and easy to understand. If isolated questions arise which are not covered by this manual or by previously published material, contact the end product manufacturer or, if this is not possible, the Technical Communications Department of the Automotive Operations, Rockwell International Corporation, Troy, Michigan.

Use only Genuine Rockwell Parts

$1.00 per copy

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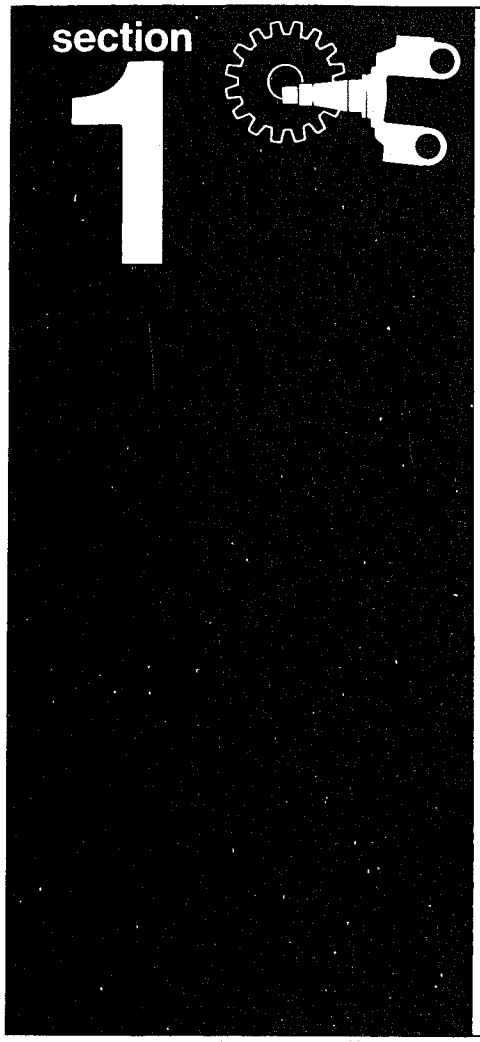

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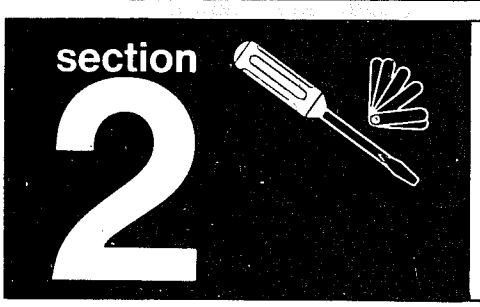

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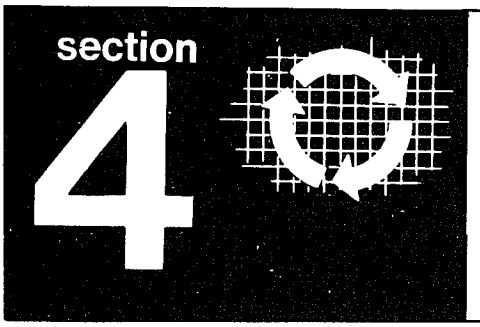

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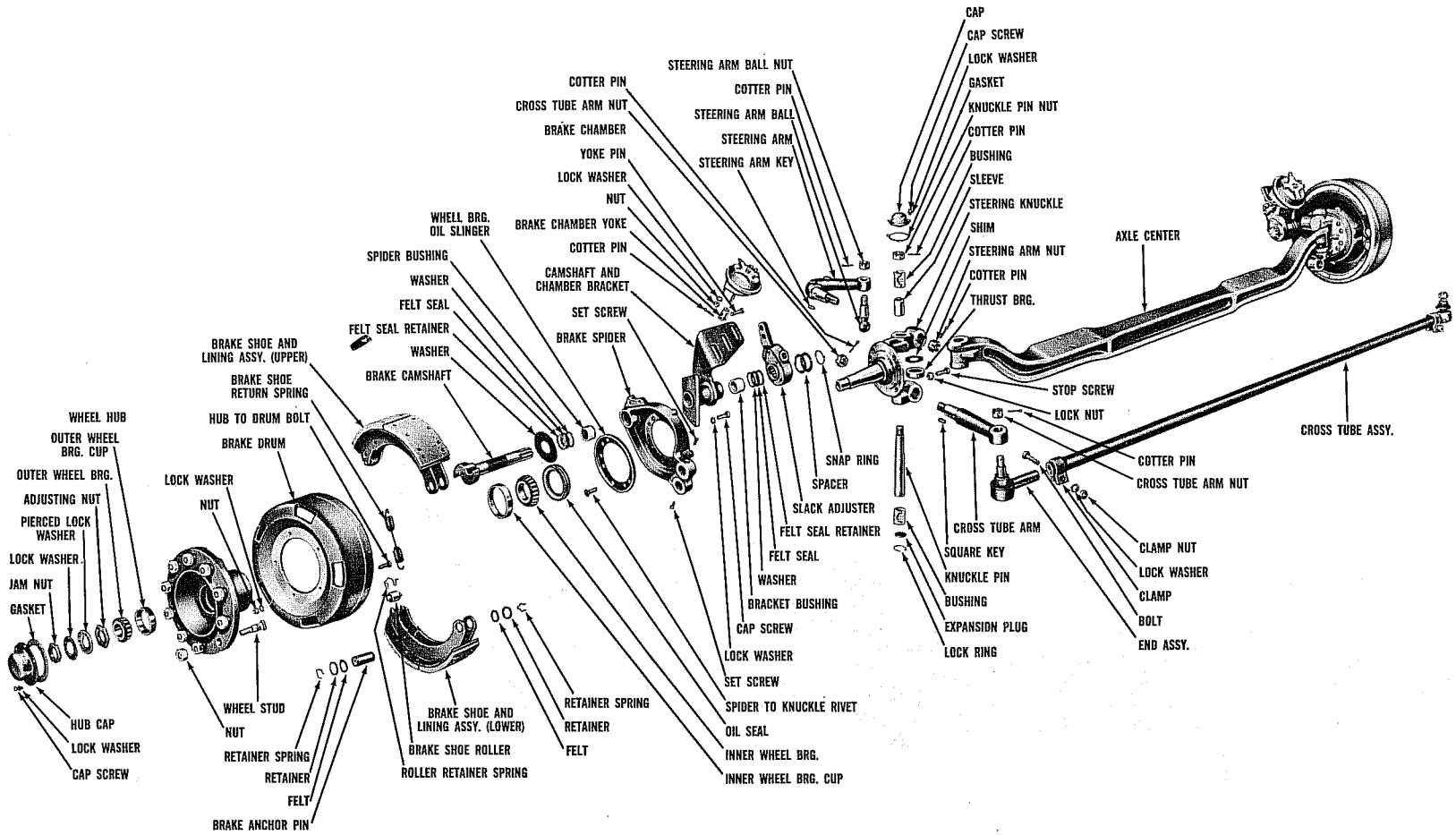
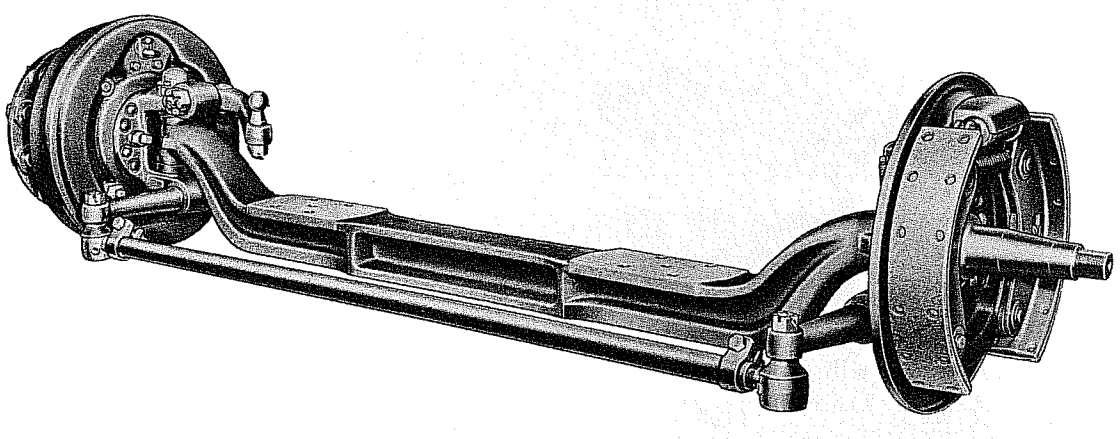
FRONT AXLE EXPLODED VIEW
(TAPERED KNUCKLE PIN DESIGN)





NON-DRIVING FRONT AXLES

(MODEL SERIES TYPE — 900 & 901)

Component Description

AXLE CENTERS

All "I-beam" type non-driving front axle centers, though varying in size, are machined from heat-treated steel forgings with "I-beam" section and spring pads integral.

All tubular type non-driving front axle centers are built of tempered seamless steel tube center sections with heat-treated steel forged knuckle pin ends. The knuckle pin ends and spring pads are electrically welded in position on the tube and become integral parts of the axle center.

Both the "I-beam" and the tubular type are of the "Reversed Elliot" design.

STEERING KNUCKLE PINS

Rockwell non-driving front axles may be equipped with tapered knuckle pins (900 Series) or straight knuckle pins (901 Series), depending on model. Tapered knuckle pins are drawn into the axle center by tightening the nut at the upper end of pin, while the straight pins may employ one or two flats and are held in the axle center by means of tapered dowel keys. Both the tapered pins and the straight pins effectively become an integral or rigid part of the axle center.

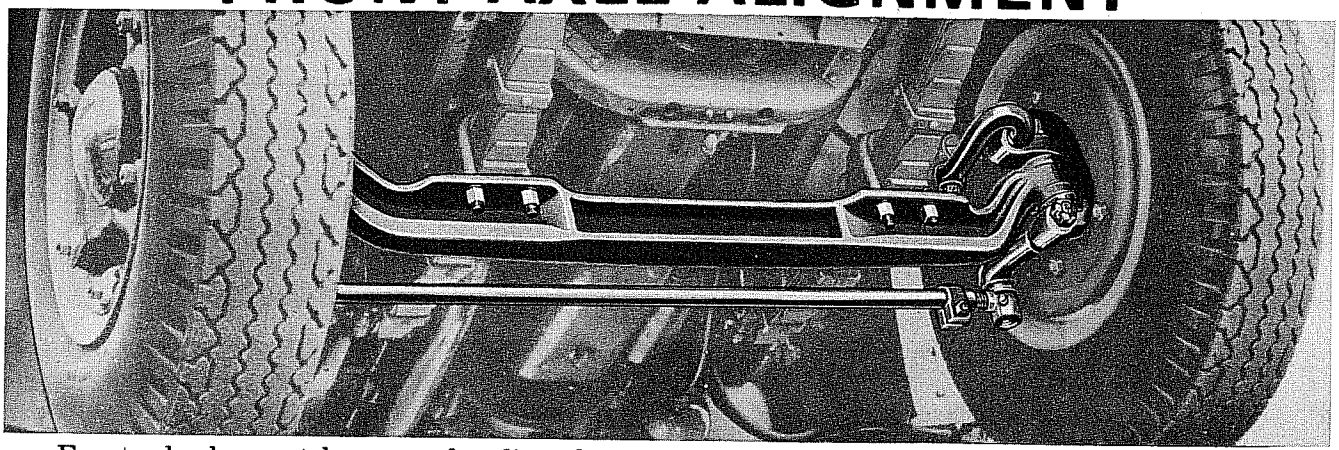
STEERING KNUCKLE AND BUSHING ASSEMBLY

Steering knuckles are bushed in the upper and lower pin bosses so that they may turn freely about the pins. Bushings, depending on model, may be bronze, steel backed bronze, or plastic material, all of which contain grooves to allow grease to flow uniformly to the high-pressure areas. Grease fittings are installed in both upper and lower knuckle pin bosses.

TIE ROD

The two steering knuckle assemblies are connected to each other by a tie rod. The tie rod is threaded at each end and held securely in position by clamp bolts. Right and left hand or "differential" threads are provided on the tie rod to facilitate toe-in adjustment.

FRONT AXLE ALIGNMENT



Front wheels must be properly aligned to assure efficient steering and optimum tire life. Recommendations for proper alignment of front axles, as furnished by the various vehicle manufacturers, should be carefully followed.

DISASSEMBLE FRONT AXLE

REMOVE THE STEERING KNUCKLE

A. Jack up the front end of vehicle so that tires clear floor. Block up securely at this position and remove jacks.

CAUTION: Do not attempt to disassemble or perform knuckle repair with vehicle supported by jacks only.

B. Remove the hub cap from hub. Then, remove jam nut, wheel bearing adjusting nut and lock washers from knuckle spindle.

C. Remove the outer wheel bearing cone.

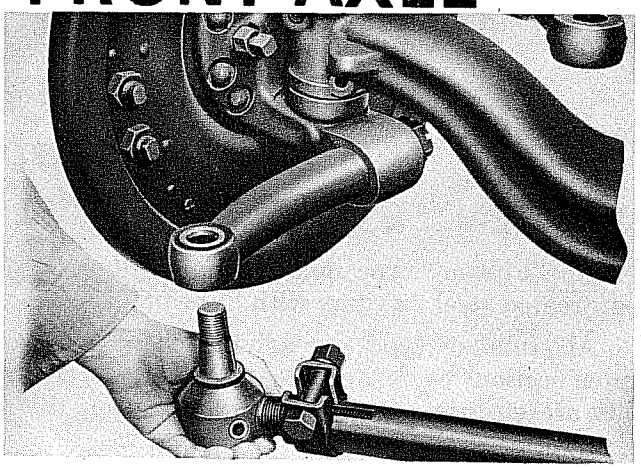
D. Remove wheel and hub assembly.

E. Remove brake air chambers on units equipped with air brakes, or hydraulic lines on units equipped with hydraulic brakes.

F. Remove brake assembly from steering knuckle.

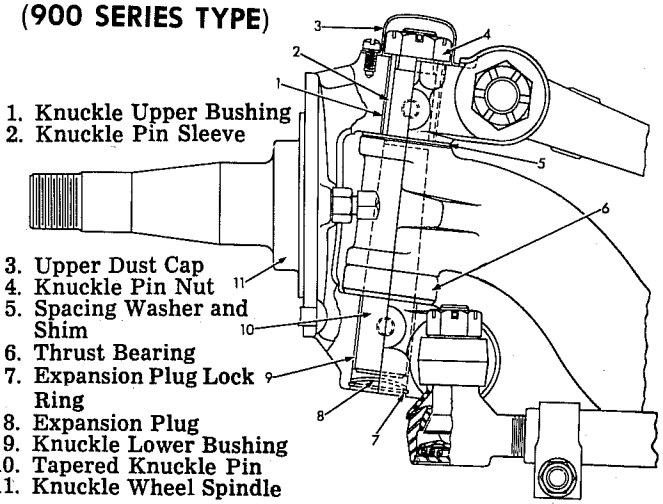
G. Remove tie rod end nut and disassemble cross tube assembly from cross tube arm.

H. Remove cross tube arm nut, and steering arm nut and disassemble cross tube arm and steering arm from knuckle.

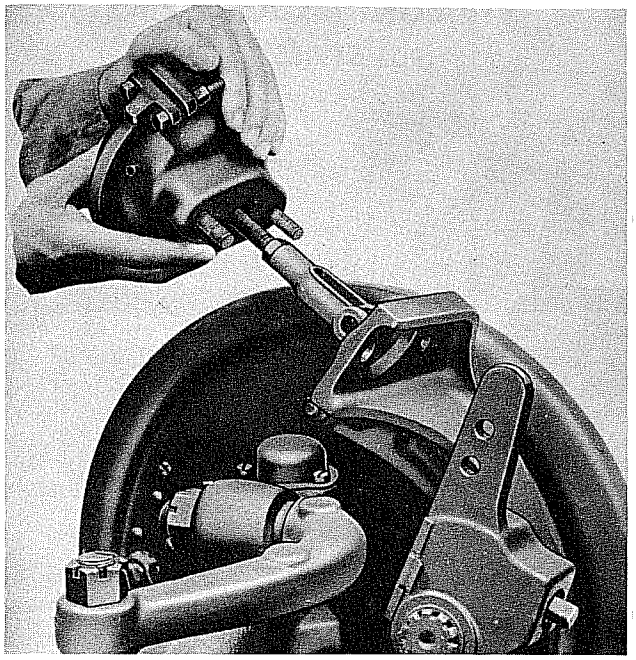


NOTE: It is not necessary to remove cross tube arm or steering arm from knuckle unless service is necessary.

TAPERED KNUCKLE PIN UNITS (900 SERIES TYPE)

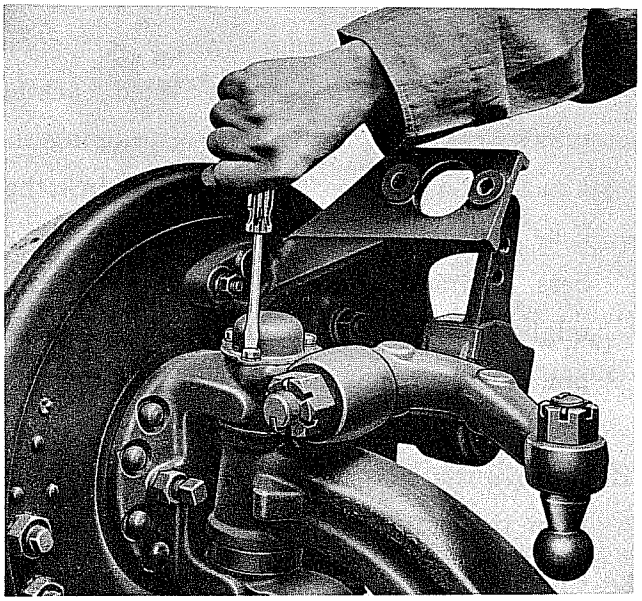


1. Knuckle Upper Bushing
2. Knuckle Pin Sleeve
3. Upper Dust Cap
4. Knuckle Pin Nut
5. Spacing Washer and Shim
6. Thrust Bearing
7. Expansion Plug Lock Ring
8. Expansion Plug
9. Knuckle Lower Bushing
10. Tapered Knuckle Pin
11. Knuckle Wheel Spindle

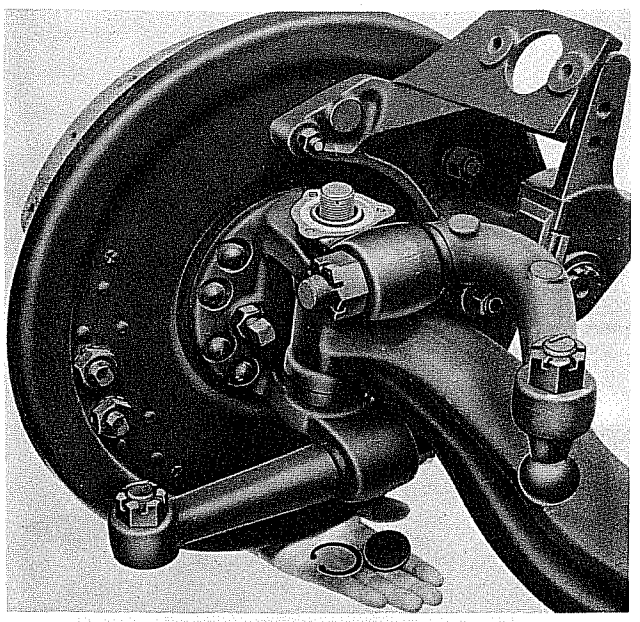


A. Tapered knuckle pins must be removed from the bottom side of the knuckle.

1. Disconnect push rod and remove brake chamber on units equipped with air brakes where clearance is needed for knuckle pin removal.
2. Remove cylinder brake fluid adapter fitting on units equipped with hydraulic brakes where clearance is needed for knuckle pin removal.



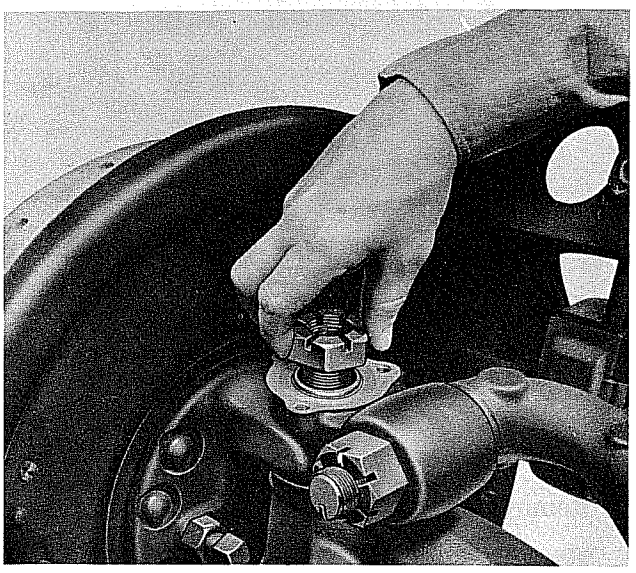
3. On some models it will be necessary to remove the brake shoe assembly and backing plate to provide clearance for knuckle pin removal.



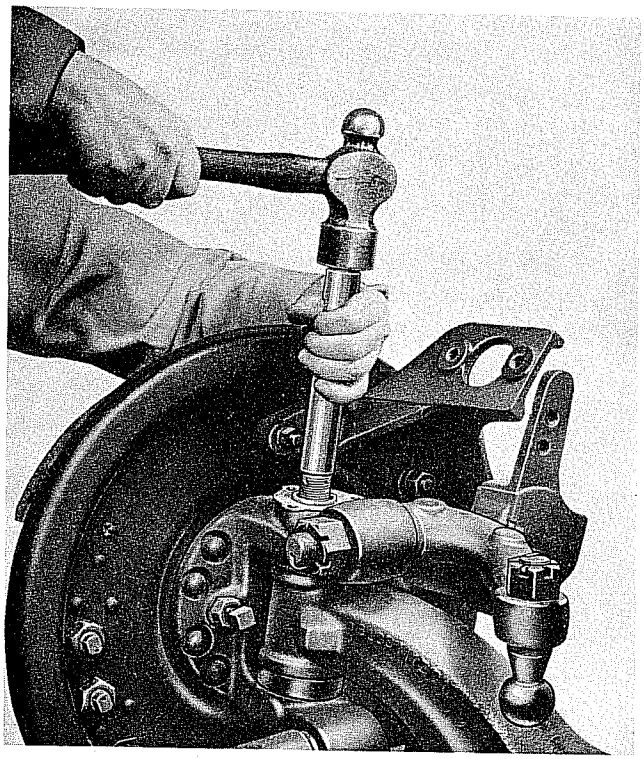
B. Remove the knuckle pin cover cap screws, cover and cover gasket.

C. Knuckles employing expansion plugs and lock rings:

1. Remove the lock ring with a pair of snap ring pliers.
2. Dislodge and remove expansion plug with a small drift.

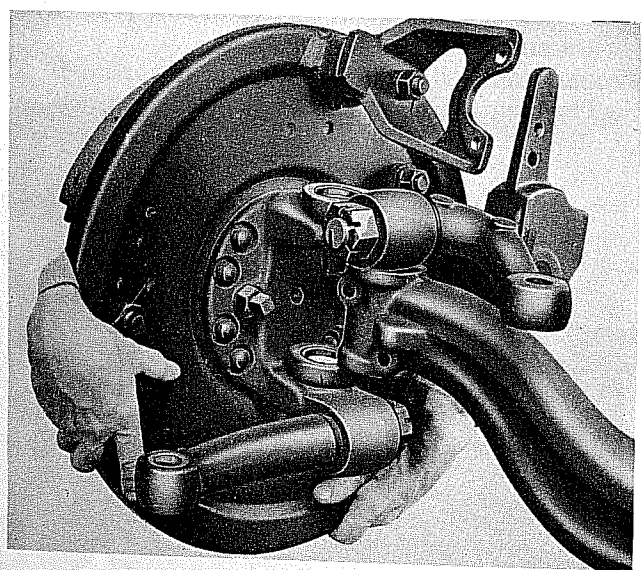


D. Remove knuckle pin cotter key and nut.



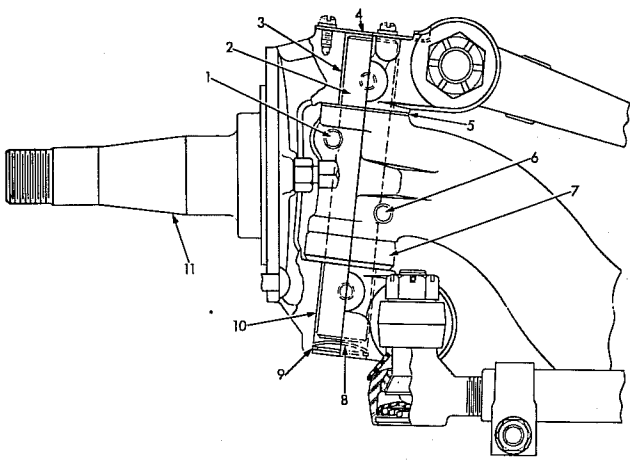
E. Drive knuckle pin out by use of drift on upper end. Bronze drift should be used to avoid any damage to threads.

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



F. Remove the knuckle pin sleeve and lift off steering knuckle, thrust bearing and spacing washers.

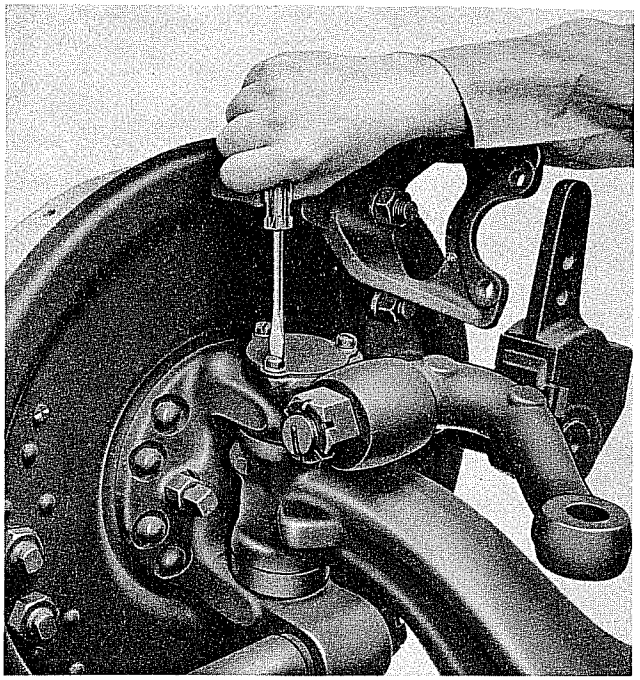
STRAIGHT KNUCKLE PINS
(901 SERIES TYPE)



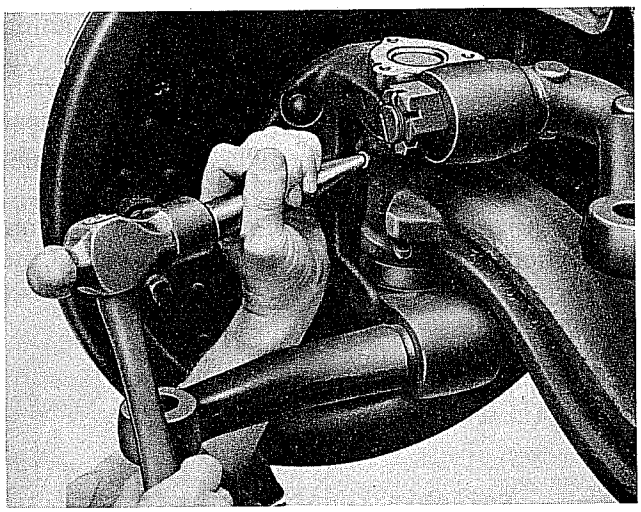
1. Draw Key—Upper
2. Knuckle Pin
3. Knuckle Bushing—Upper
4. Dust Cover
5. Spacing Washer and Shim
6. Draw Key—Lower
7. Thrust Bearing
8. Expansion Plug
9. Expansion Plug Lock Ring
10. Knuckle Bushing—Lower
11. Knuckle Wheel Spindle

A. Straight knuckle pins may be removed from the bottom of the knuckle where adequate clearance is provided; however, on some models such as those with riveted backing plates, less work is involved by tapping the knuckle pin out the top of knuckle. In either case the adjacent parts, such as air chambers, hydraulic lines or fittings, etc., that might cause an obstruction to the knuckle pin, must be removed first.

B. Remove the snap rings and expansion plug from the bottom of the knuckle where employed. If plug employs no snap ring and is expanded and staked, remove plug by use of a cape chisel and discard.



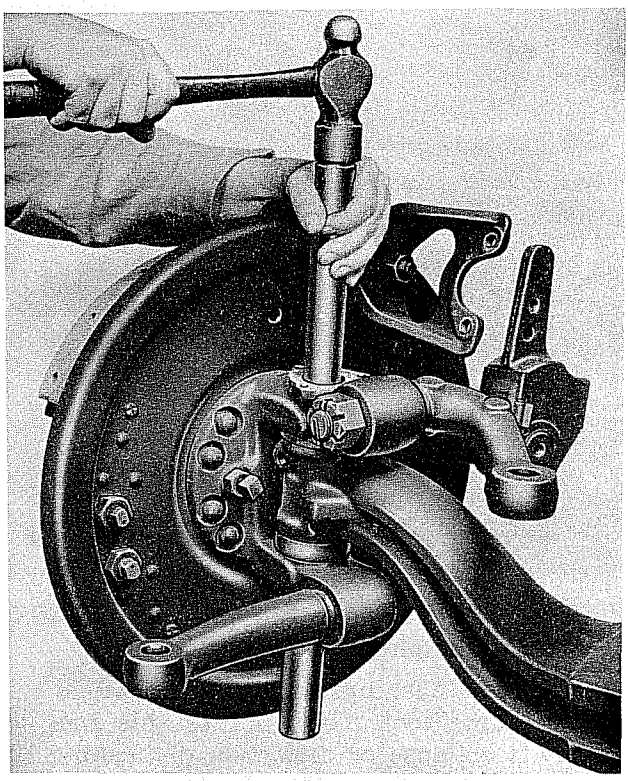
C. Remove the cap screws, cover plate and gasket from top of knuckle or remove lock ring retainer and seal, depending on model.



D. Tap out the knuckle pin draw key (or keys) from the small end using a suitable small slender drift.

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

(Older models may employ tapered draw keys that are threaded on the small end and drawn into place by a nut. On these models, remove the nut and lock washer. Drive the draw key out by use of brass hammer on threaded end.)



E. Tap out the knuckle pin by use of a bronze drift.

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

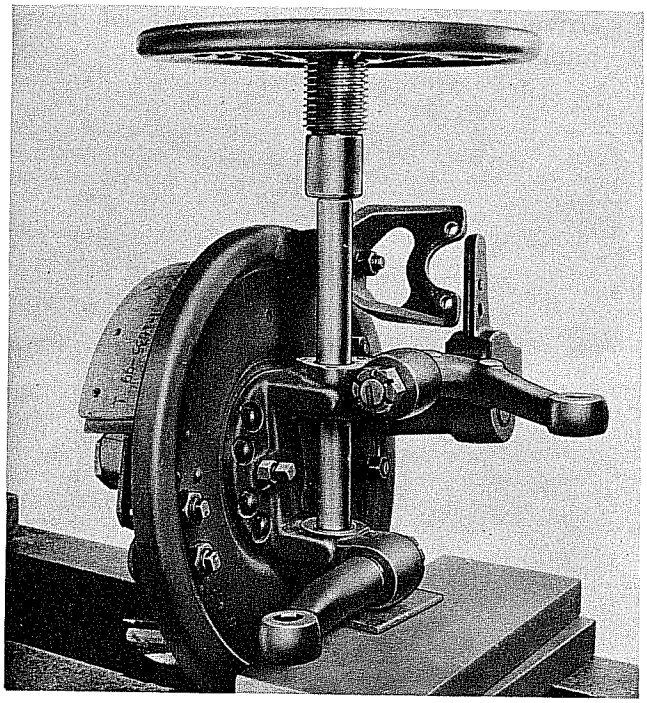
F. Lift off the knuckle assembly, thrust bearing and spacing washers. Retain shim, thrust bearing and seal for reassembly.

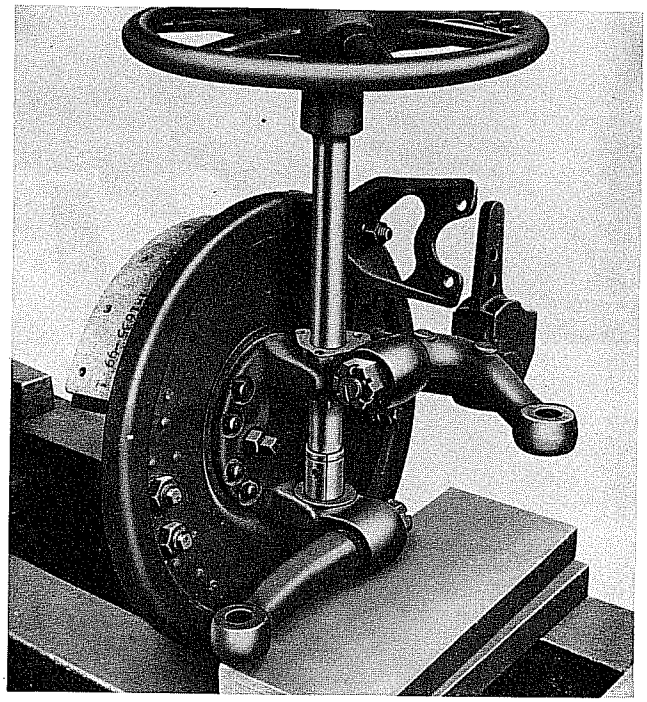
G. Refer to Section 2 for cleaning, inspection and component repairs.

REPLACEMENT OF BRONZE OR STEEL BACKED BRONZE STEERING KNUCKLE BUSHINGS

When it is desirable to service the steering knuckle bushings the following procedure is recommended and the tools shown in the sketches will facilitate this operation.

The tool utilized for removal of old and installation of new steering knuckle bushings is shown on the following page. The tool can be made from a piece of round bar stock which is ground with a step to serve as a pilot.





A. **The worn bushings are pressed out of the** knuckle, employing tool shown below.

B. The new bushings should be installed with the same tool. The pilot of this tool prevents collapse or distortion of bushing during installation. The bushing should be pressed into the knuckle in three or more steps to allow it to align itself with the bore. Oil hole in bushing must line up with oil hole in knuckle.

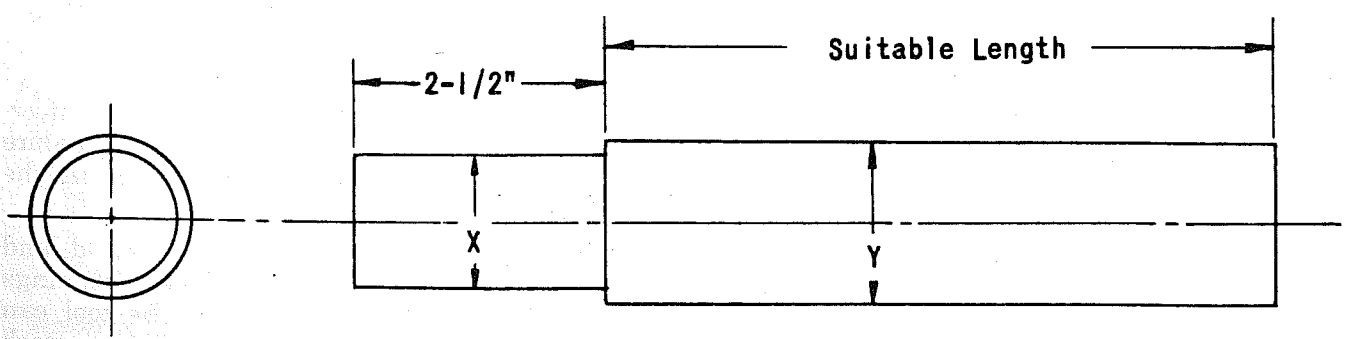
First press bushing into knuckle approximately ⅛" and relieve press pressure, press bushing in another ½" and relieve press pressure. The bushing can now be **pressed in until it is flush with the inner** machined surface of the knuckle.

This applies to both upper and lower bushings.

C. To finish a bushing, either a burnishing bar or reamer must be employed. The dimensional limits of these tools at finishing surfaces should correspond to those listed in columns "B" and "C" for the desired axle. (See table, page 11.)

Utilization of burnishing ball for this operation must be avoided, as it does not insure a true alignment between the two bushings.

BUSHING REMOVAL AND INSTALLATION TOOL



Dimension "X" is 0.010" less than the bushing bore.
Dimension "Y" is 0.010" less than the steering knuckle bore.

See table on following page

TABLE OF REAMER DIMENSIONS

Axle No.	A	B and C	D	E	Bushing	Knuckle Pin	X	Y
FC-900	1.225 1.227	1.2345 1.2355	6.500	5.750	1225-B-366	3101-L-90	1.215 1.217	1.348 1.350
FC-901	1.225 1.227	1.2345 1.2355	6.900	9.750	1225-B-366	3101-N-92	1.215 1.217	1.348 1.350
FC-931*	1.427 1.429	1.4365 1.4375	8.000	7.125	1225-J-816	3102-X-180	1.417 1.419	1.550 1.552
FD-900	1.427 1.429	1.4365 1.4375	8.000	7.125	1225-J-348	3101-G-85	1.417 1.419	1.550 1.552
FD-901	1.427 1.429	1.4365 1.4375	8.000	7.125	1225-G-761	3101-M-91	1.417 1.419	1.550 1.552
FD-931*	1.600 1.602	1.6095 1.6105	8.500	7.125	1225-V-828	3102-D-186	1.590 1.592	1.723 1.725
FE-900	1.600 1.602	1.6095 1.6105	8.500	7.625	1225-Y-337	3101-B-80	1.590 1.592	1.723 1.725
FE-970	1.600 1.602	1.6095 1.6105	8.312	7.437	1225-Y-337	3101-X-102	1.590 1.592	1.723 1.725
FF-901	1.789 1.787	1.7975 1.7965	8.625	7.750	1225-V-750	3101-E-109	1.779 1.777	1.692 1.694
FF-921	1.789 1.787	1.7975 1.7965	10.00	9.125	1225-Z-650	3101-P-146	1.779 1.777	1.909 1.911
FF-931*	1.787 1.789	1.7965 1.7975	10.000	9.125	1225-D-836	3102-W-179	1.777 1.779	1.909 1.911
FG-900	1.787 1.789	1.7965 1.7975	8.875	8.000	1225-A-417	3101-Q-95	1.777 1.779	1.909 1.911
FH/FL-901	1.992 1.994	2.0015 2.0025	10.50	9.625	1225-C-523	3101-A-105	1.982 1.984	1.993 1.991
FL-931*	1.992 1.994	2.0020 2.0030	10.500	9.625	1225-L-818	3102-V-178	1.982 1.984	2.114 2.116
FQ-901	2.0545 2.0565	2.0640 2.0650	12.19	11.315	1225-F-760	3101-Q-173	2.0445 2.0465	2.1765 2.1785
FQ-921	2.0545 2.0565	2.0640 2.0650	12.19	11.315	1225-F-760	3101-U-177	2.0445 2.0465	2.1765 2.1785
FU-900	2.054 2.056	2.0635 2.0645	12.375	11.490	1225-F-318	3101-Y-77	2.044 2.046	2.177 2.179
FU-901	2.054 2.056	2.0635 2.0645	12.626	11.751	1225-F-318	3101-S-175	2.044 2.046	2.177 2.179
FU-910/915/935	2.054 2.056	2.0635 2.0645	12.75	11.875	1225-F-318	3101-R-174	2.044 2.046	2.177 2.179
FU-930	2.054 2.056	2.0635 2.0645	12.626	11.751	1225-F-318	3101-S-175	2.044 2.046	2.177 2.179
2661 2770	1.710 1.712	1.717 1.718	8.500	7.625	1225-A-157	3101-Q-43	1.700 1.702	2.083 2.085

* FMVSS-121 AXLE MODELS

Two sets of reamers, shown on next page, are designed to permit line reaming of the bushings without removing the dust shields. Reamers "Nos. 1 and 1A" comprise one set while the second set, "No. 2," consists of a reamer and pilot.

When using the "Types 1 and 1A" reamer set to ream the bushings, use reamer "Type 1" first to ream the upper bushing, then "Type 1A" to ream the lower bushing.

To use reamer "Type 2", first insert the pilot into the reamer to ream upper bushing then remove the pilot to ream the lower bushing. Length of "D" dimension is dependent on mode.

Avoid the possibility of tapering or enlarging the upper bushing while inserting the tool to ream the lower bushing. To do this, the reamer should be turned slightly in the non-cutting direction. Do not turn it in excess of 90°, as this may damage the cutting edges of the reamer.

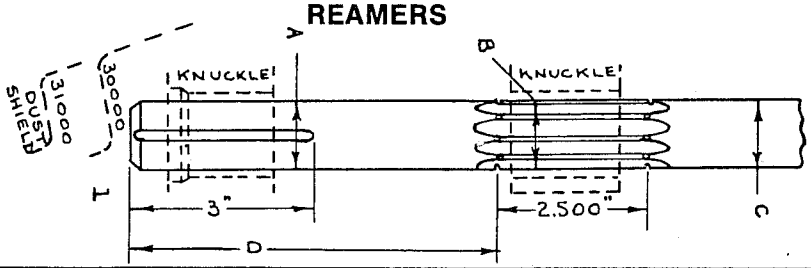
Both the "Types 1 and 1A" reamer set and the "Type 2" reamer and pilot can be made by a reliable tool source from the specifications on this page.

Reamers may be purchased from Wright Tool Company, 1738 Maplelawn, Troy, Michigan 48084, or from L.O. Beard Company, Lancaster, Pennsylvania.

REAMERS

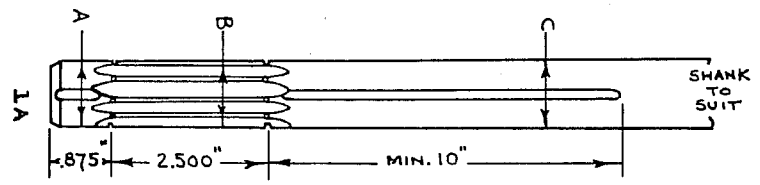
TYPE 1

FOR UPPER BUSHING



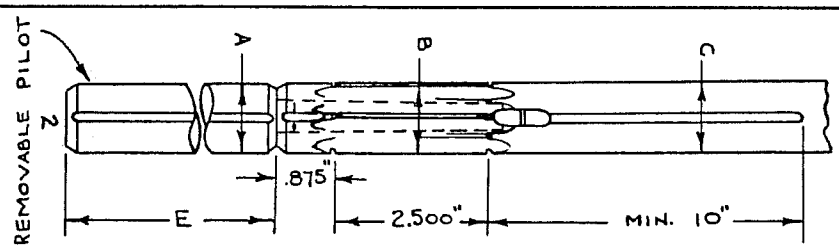
TYPE 1A

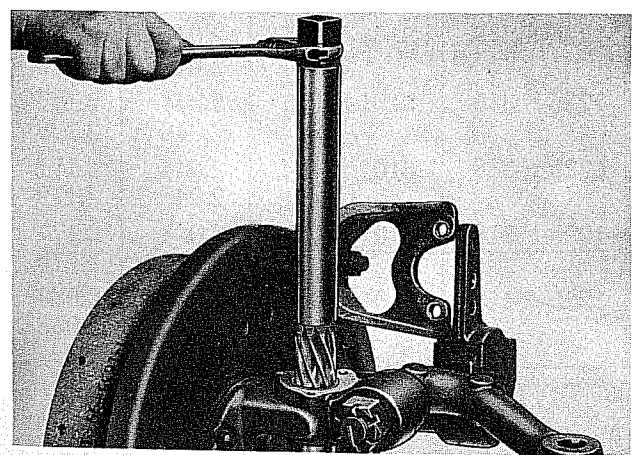
FOR LOWER BUSHING



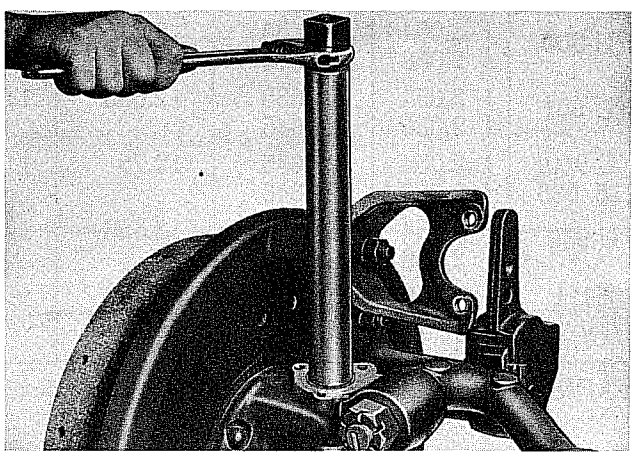
TYPE 2

FOR BOTH BUSHINGS





USING "NO. 1" REAMER FIRST TO REAM UPPER BUSHING



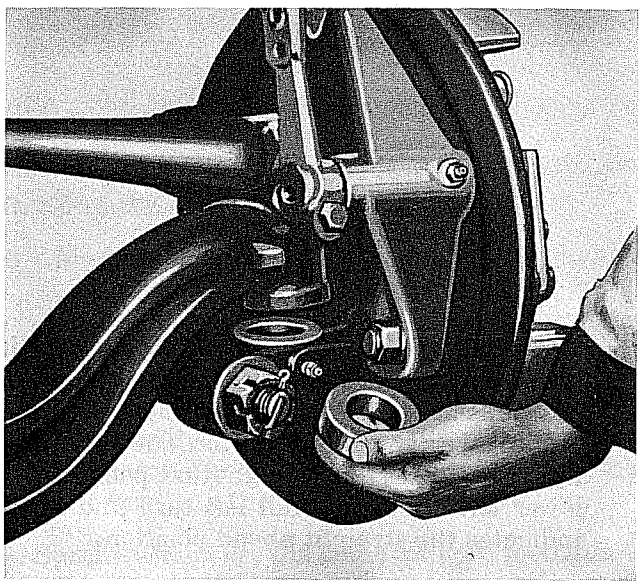
USING "NO. 2" REAMER TO REAM LOWER BUSHING

REASSEMBLE FRONT AXLE

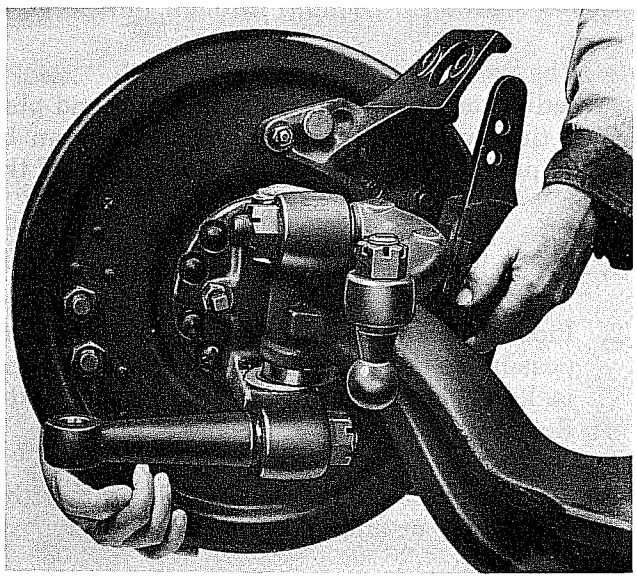
KNUCKLE PIN INSTALLATION

A. Make certain that knuckle pin hole in axle center is clean and dry.

B. Position and support the steering knuckle assembly on the axle center.



C. Slide the thrust bearing between the lower face of axle center and lower steering knuckle yoke. Thrust bearings that are not



marked "top" to indicate proper installation position must be positioned with retainer lip down.

D. Align the steering knuckle yoke holes with axle center and thrust bearing holes.

E. Place a jack under the lower side of steering knuckle yoke and raise knuckle so that all clearance is taken up between lower yoke, thrust bearing and lower face of axle center end.

F. TAPERED PIN UNITS

1. Make sure the knuckle pin nut turns freely on the knuckle pin threads. Insert the knuckle pin from the bottom yoke of knuckle and tap pin into seat of axle center end by use of a bronze drift.

2. Place the steel knuckle pin sleeve over the pin and tap into place. Install nut and tighten to specified torque. If necessary, align cotter pin hole by advancing nut to nearest castellation and install cotter pin.

G. STRAIGHT PIN UNITS

1. Align knuckle pin flat (or flats) to mate with draw key holes, and tap knuckle pin through knuckle yoke, axle center and thrust bearing from top or bottom side.

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

2. Install the draw keys so that the flat on the key mates with the corresponding flat on the knuckle pin.

   NOTE: Before setting the draw key, center knuckle pin to equalize gap between upper and lower gap mounting surfaces.

   Draw keys should be installed one from each side of the axle center. DO NOT INSTALL BOTH KEYS FROM THE SAME SIDE.

3. On models employing threaded draw keys, install the draw key nuts and tighten to correct torque. Refer to page 96.

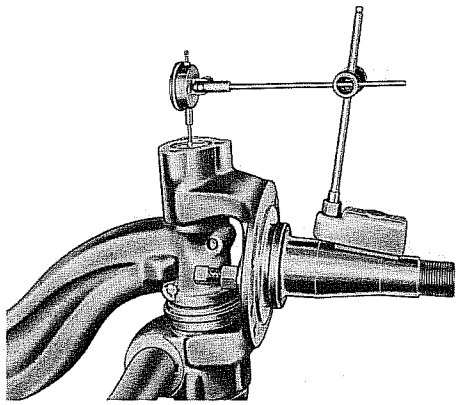
   On models without threaded draw keys, secure each key in the axle center by prick punching edge of hole.

H. Check the clearance between the top face of upper axle center end and lower face of upper knuckle pin boss.

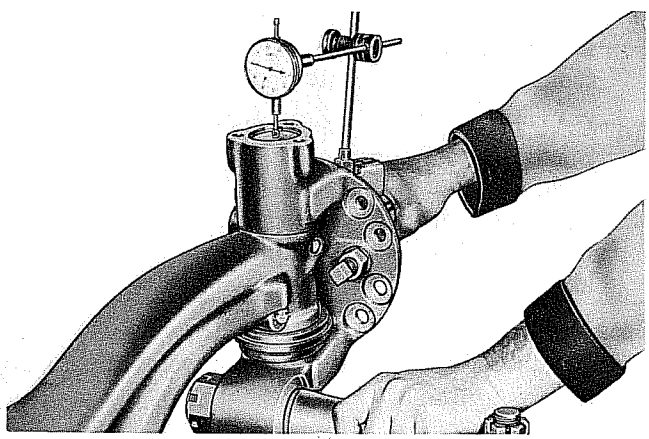
Rockwell does not recommend measurement of clearance tolerances on steering knuckles with shim gauges (feeler gauge). Use only a dial indicator.

Procedure for measurement of knuckle end play when axle is being assembled is as follows:

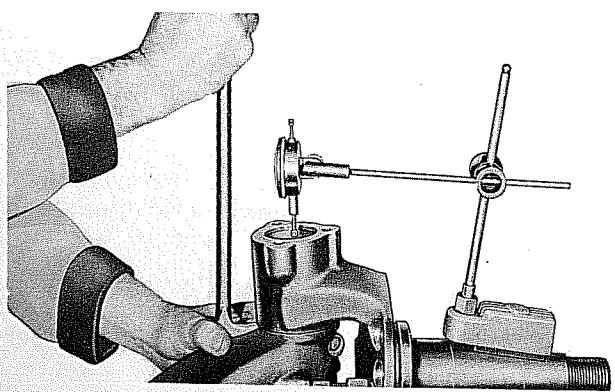
1. Attach the dial indicator with a "C" clamp or magnetic base to the knuckle as shown.



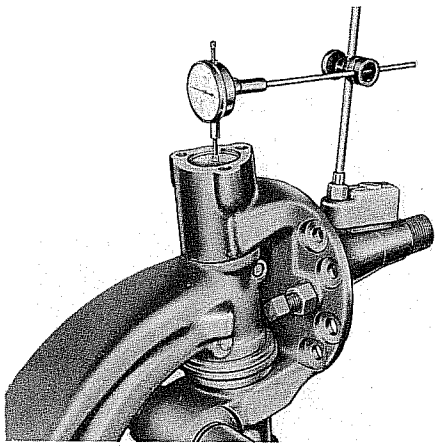
2. Place the dial indicator plunger on the exposed end of the knuckle pin so that its line of action is approximately parallel to the knuckle pin center line.



3. Zero the dial indicator.



4. Measure the knuckle clearance (end play) by using a suitable lever to lift the knuckle while observing the dial indicator. Make a note of the measurement.



5. Repeat steps 1 through 4 with the knuckle in three positions. The three steering knuckle positions are necessary to obtain true end play reading with the dial indicator. The middle left figure indicates the full right turn position, the lower left shows the full left turn and above indicates the straight ahead position.

IMPORTANT:

After measuring knuckle clearance (end play) add shims between upper knuckle pin boss and axle center end as required to obtain an end play of .005" - .025" (.12 - .64mm) through full range of turn.

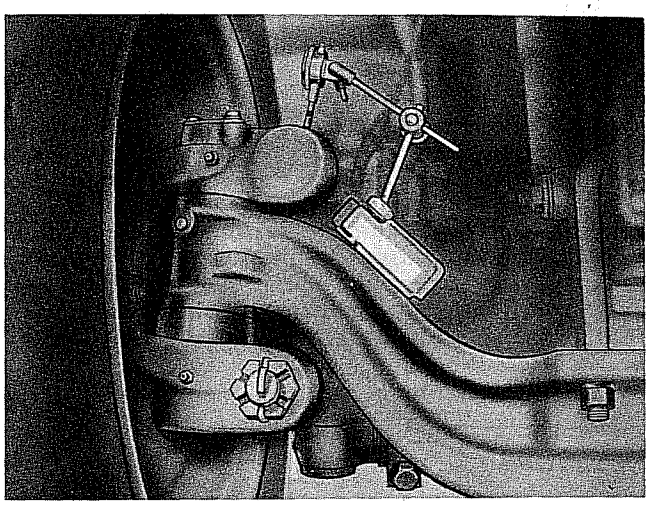
Procedure for measurement of knuckle end play with tire and wheel assembly mounted can be accomplished by raising axle wheel end off the floor.

1. Securely block vehicle to prevent rolling.

2. Place a jack under the axle beam as close as possible to the knuckle end being checked and jack the vehicle up until the tire is clear of the floor.

3. Attach a dial indicator to the axle beam with a "C" clamp or magnetic base.

4. Place the dial indicator plunger on top of the knuckle pin cap so that its line of action is approximately parallel to the knuckle pin center line.



5. **Zero the dial indicator.**
6. Measure the knuckle clearance (end play) by using a suitable lever to lift the knuckle while observing the dial indicator. Make a note of the measurement.
7. Three steering knuckle positions are necessary to accurately measure end play with the dial indicator. The positions are: full right turn, full left turn and the straight ahead position.

Specifications are the same for both methods of checking end play.

On axles in service, the end play may increase to a maximum of .065″ (1.70mm) at which time it will be necessary to re-shim end play back to .005″-.025″ (.12-.64mm). Measure the knuckle clearance again after any shim corrections have been made.

Note: Both knuckles should be checked if an increase of end play is detected on either wheel end.

Refer to Section 2 for additional inspection information.

I. EXPANSION PLUGS

1. On axles that have grooved holes, install lock rings.
2. On axles not grooved for lock rings, install grease retainer plate and secure in place by staking in four equally spaced places.
3. On units employing grooved knuckle pins that protrude below the knuckle lower yoke, install lock ring in groove.

J. The upper ends of steering knuckle are protected with covers, caps, or retainers and felts.

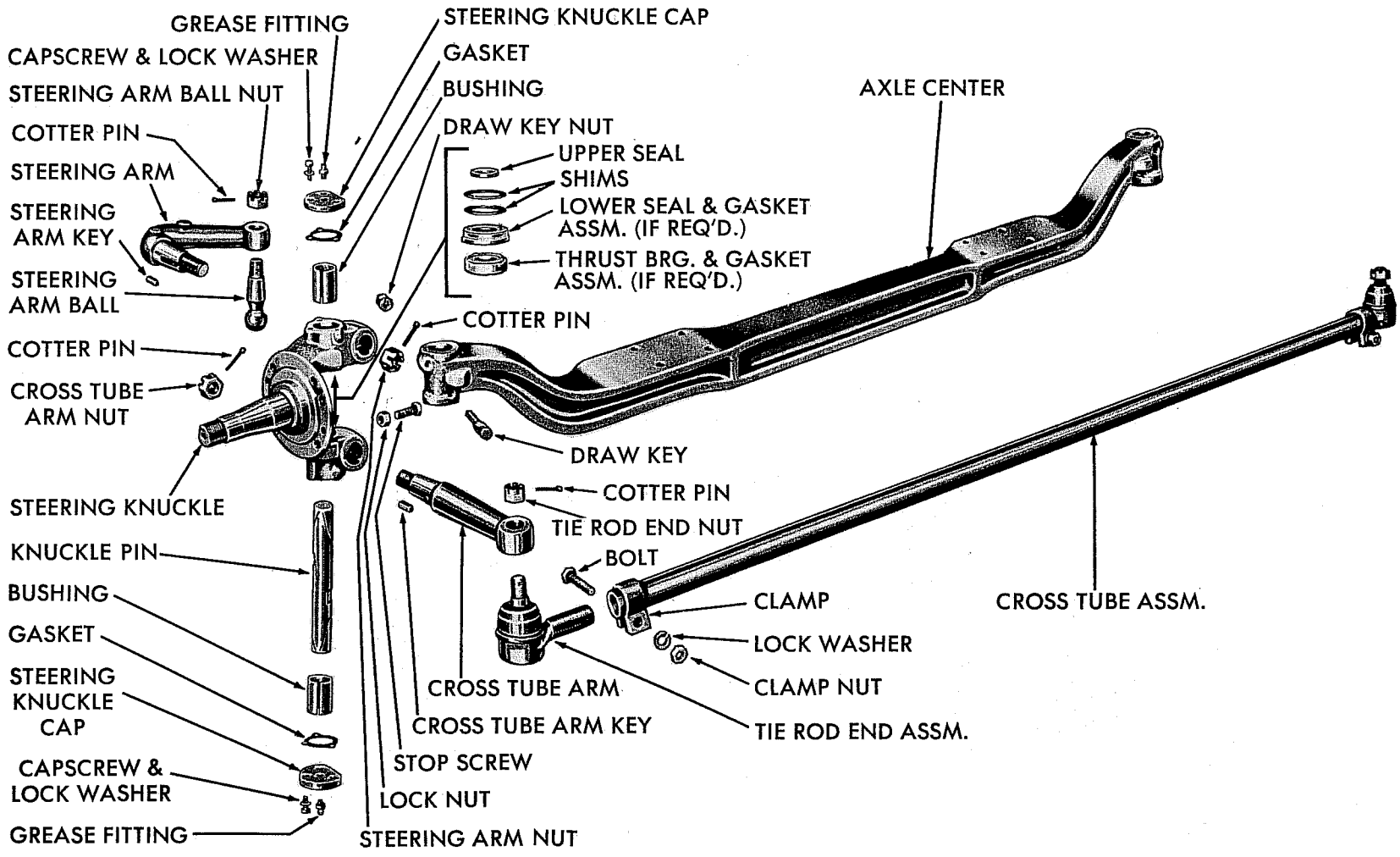
1. Install the cover or cap and gasket with cap screws where used.
2. Install the felt, retainer and lock ring on protruding straight pins that are not provided with covers or caps.

COMPLETE ASSEMBLY AS FOLLOWS:

Reinstall the tie-rod tapered ends into the steering arms and install nuts. Tighten the nuts to correct torque and install cotter pin. Refer to Section 3 for lubrication recommendations. Refer to Section 4 for correct torque specifications.

Connect brake chambers, push rods or any other parts that were removed. (If brakes require service, refer to Rockwell Field Maintenance Manual No. 4.)

TYPICAL "SEALED KNUCKLE PIN" TYPE FRONT AXLE

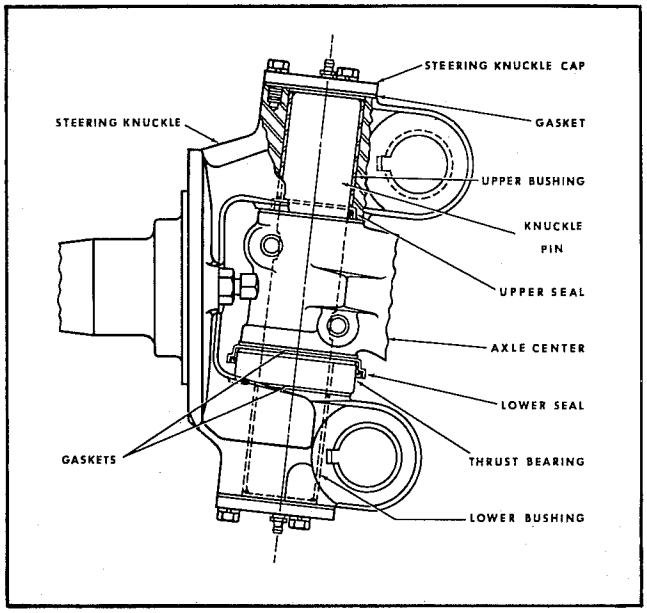


NON-DRIVING FRONT AXLES

(MODEL SERIES TYPE — 921 & 931*)

EMPLOYING SEALED KNUCKLE PINS AND PERMANENTLY LUBRICATED TIE ROD ENDS

Rockwell non-driving front axles incorporating sealed knuckle pins and permanently lubricated (sealed) tie-rod end assemblies have less maintenance requirements than front axle models employing conventional knuckle pins and tie-rod end assemblies.



SEALED KNUCKLE PIN

The sealed type knuckle pins are of the straight design and may or may not be grooved depending on the type of bushing employed. Knuckle pins of this type also employ two flats for correct positioning inside the axle center, and are held in place by tapered dowel keys.

The lubricant is protected within the knuckle from road contamination by grease seals and gaskets that enclose the upper and lower knuckle pin bushings. The upper bushing is sealed from the top by a gasket located beneath the upper knuckle pin cap. It is protected from the bottom by a grease seal positioned below the bushing, inside the upper knuckle boss. The lower bushing is enclosed on the top by the thrust bearing and seal assembly, and on the bottom by a gasket positioned between the lower knuckle boss and the lower knuckle pin cap. Some models may employ an integral gasket in the lower seal or thrust bearing.

**FMVSS-121 Axle Models*

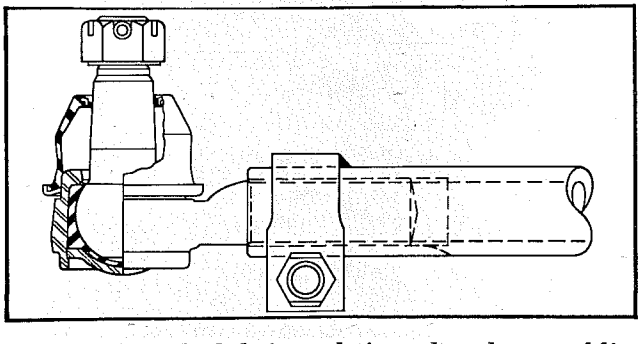
STEERING KNUCKLE AND BUSHING ASSEMBLY

Steering knuckles are bushed in the upper and lower knuckle pin bosses with steel backed bronze bushings.

Many front axle models employing sealed knuckle pins also incorporate enlarged steering knuckle assemblies (oversized for specific applications). These assemblies will include larger steering knuckles with stronger knuckle yokes, longer knuckle pins and longer knuckle pin bushings. This will slightly increase the over-all track of the front axle assembly, but more significantly, it will reduce bushing stress.

Steering knuckle caps for front axles employing sealed knuckle pins are equipped with top and bottom mounted grease fittings. This allows lubricants to be forced into the bushing area through the top and bottom ends of the steering knuckle and, therefore, provide a more even distribution of lubricants for easier steering.

PERMANENTLY LUBRICATED TIE ROD ENDS



Permanently lubricated tie rod end assemblies also employ lube seals that are designed to keep road contaminants from the tie-rod ball cavity. This will prevent lubrication contamination due to the accumulation of corrosion and dirt around the tie rod ball, and thus give longer service life. Since these tie rod end assemblies are permanently lubricated and sealed, periodic lube intervals are not necessary, however, periodic inspection is recommended. Refer to Section 2, item "B" under Tie Rod End Inspection.

GREASABLE TIE ROD ENDS

On some axle models in the 931 series a greasable tie rod end is employed as standard equipment, however on other models in the 931 series they may be used only as optional equipment. Refer to Section 2, "Tie Rod End Inspection" and Section 3, "Lubrication" on page 94.

DISASSEMBLE FRONT AXLE

A. Follow procedures A through H under "Remove the Steering Knuckle" on page 6.

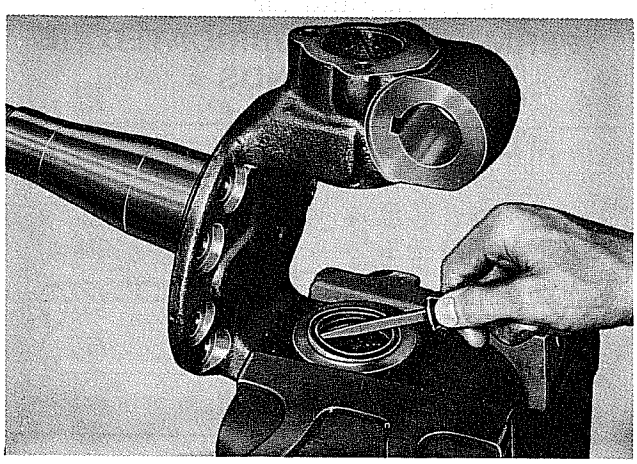
B. Remove steering knuckle cap capscrews, caps and gaskets from top and bottom of knuckle. Some models may employ an integral gasket in the lower seal and thrust bearing.

C. Follow procedures D through G under "Disassemble Front Axles With Straight Knuckle Pins" on page 9.

REMOVE UPPER SEAL FROM STEERING KNUCKLE

With the steering knuckle assembly removed from the axle center, inspect the upper grease seal for tears, rips and deterioration. Do not attempt to remove the seal from the steering knuckle unless replacement is necessary. If seal must be removed, follow these procdures:

A. Place steering knuckle bottom side up in a vise equipped with soft metal jaws. Position upper knuckle boss (top end down) between jaws of vise and lock securely.



NOTE: To facilitate positioning knuckle in vise, brake assembly and steering arm must be removed.

B. With the top end of the knuckle held firmly in this position, insert a screwdriver or other suitable tool between the knuckle counterbore and the seal case and pry the seal out of knuckle.

C. Remove knuckle from vise for inspection.

D. Refer to Section 2 for cleaning, inspection and component repairs.

E. Refer to pages 9 through 12 for bushing replacements.

REASSEMBLE FRONT AXLE

GREASE SEAL INSTALLATION

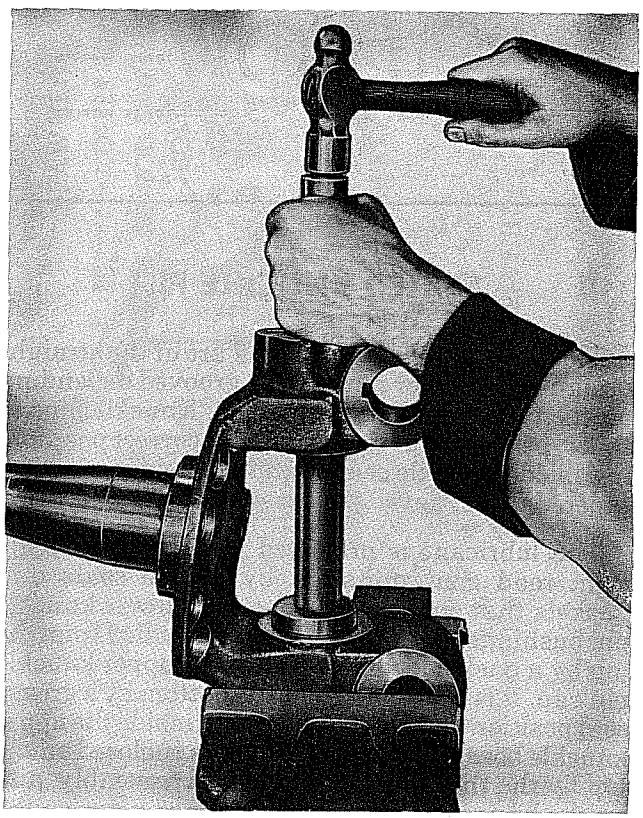
It is impossible to overstress the importance of proper grease seal installation in both the top and bottom positions of the steering knuckle. Incorrect installation could result in premature lubricant contamination and a need for more frequent lubrication and overhaul service intervals. Therefore, for maximum operating service from the front axle assembly grease seals should be installed by the following procedures.

UPPER GREASE SEAL INSTALLATION

If it was necessary to remove the upper seal from the steering knuckle, use the following to install a new seal.

A. Place steering knuckle bottom side up in a vise equipped with soft metal protectors. Position upper knuckle boss (top end down) between jaws of vise and lock securely.

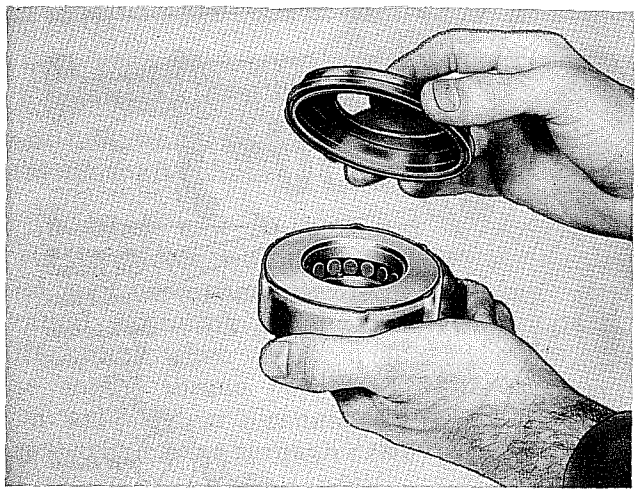
B. With the top end of the knuckle held firmly in this position, place the seal over the knuckle counterbore, with the rubber lip facing up.



C. Using a suitable sleeve and a bronze drift, tap the seal into the knuckle counterbore until it bottoms.

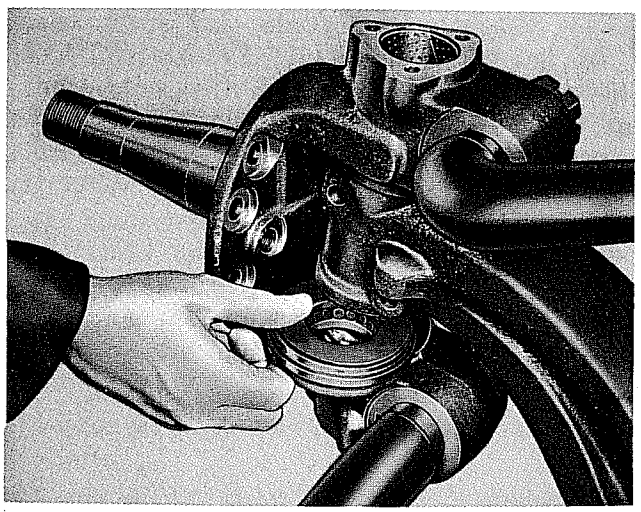
THRUST BEARING AND LOWER SEAL INSTALLATION

A. Before attempting to install the thrust bearing and lower seal assembly on the steering knuckle, make certain the lower seal is positioned correctly over the thrust bearing retainer lip.



NOTE: To facilitate correct positioning, hold thrust bearing with thrust bearing gasket face down. Then, snap lower seal over the thrust bearing chamfered side as shown.

B. With the knuckle pin hole in the axle center clean and dry, position and support the steering knuckle on the axle.



C. With the seal positioned over the thrust bearing, slide the thrust bearing and lower seal assembly between the lower face of the axle center and the lower knuckle boss.

IMPORTANT: The bottom side of the thrust bearing must be seated on the face of the lower knuckle yoke. The lower seal must be positioned beneath the bottom face of the axle center.

KNUCKLE PIN INSTALLATION

A. Follow procedures D through H under "Knuckle Pin Installation" on pages 13 and 14.

COMPLETE REASSEMBLY

A. Install gaskets and steering knuckle caps at top and bottom of steering knuckle bosses. Install capscrews and lockwashers and tighten to specified torque.

B. Install steering arm and ball assembly into upper steering knuckle boss and tighten steering knuckle nut to specified torque.

C. Install cross tube arm in lower steering knuckle boss and tighten cross tube arm nut to specified torque.

D. Assemble cross tube assembly and cross tube arm, and tighten tie rod end nut to correct torque.

E. Install wheel and hub assembly in reverse order of disassembly.

NOTE: If brakes require service, refer to Rockwell Field Maintenance Manual No. 4 for Cam-Master brakes, or Field Maintenance Manual No. 4R for Stopmaster brakes.

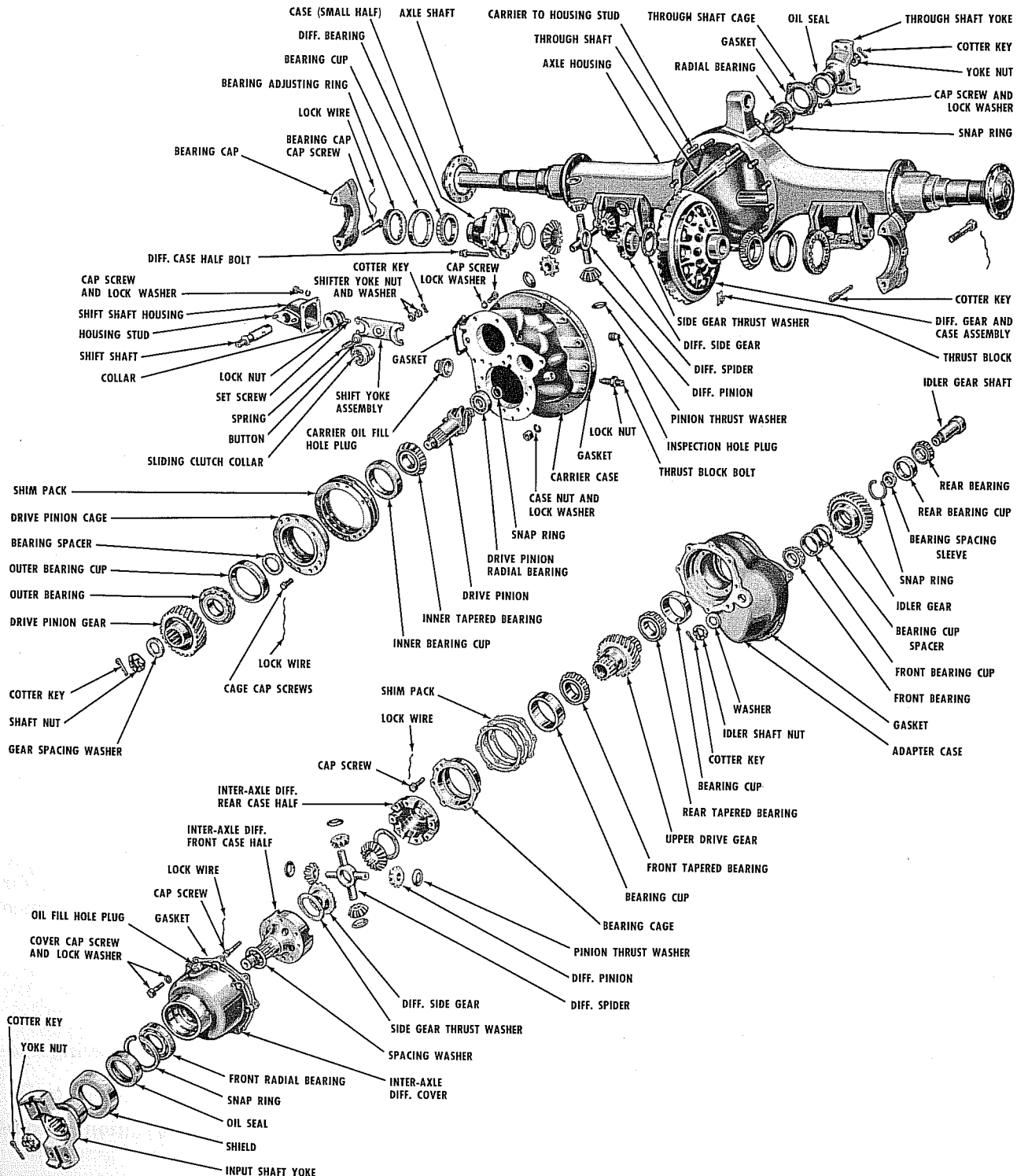
F. Refer to Section 2 for Wheel Bearing Adjustment.

G. Refer to Section 3 for lubrication recommendations.

H. Refer to Section 4 for correct torque specifications.

TANDEM FORWARD/REAR AXLE
THREE GEAR TRANSFER TRAIN

BALL BEARING OUTPUT SHOWN



SINGLE REDUCTION FORWARD REAR DRIVE UNIT

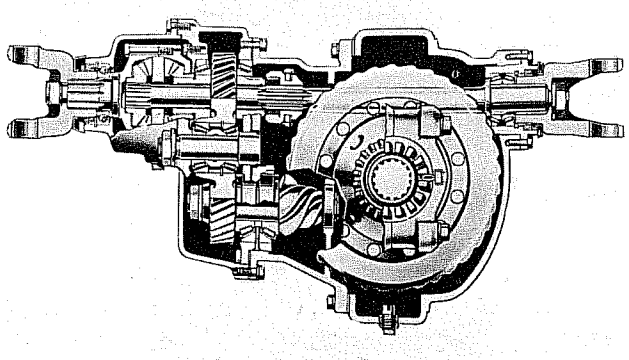
(MODEL TYPE — LHD & QHD)

THREE GEAR TRANSFER TRAIN AND INTER-AXLE DIFFERENTIAL ASSEMBLY

Front Mounted Single Reduction Through Drive Units built by Rockwell, incorporate hypoid reduction gears and bevel type inter-axle differential gears.

The inter-axle differential may be either engaged or disengaged by a power actuated shift unit which moves a sliding collar on the through-shaft splines.

The shift unit is controlled by a selector switch or lever within the cab of the vehicle and may be engaged or disengaged under any normal operating conditions. The inter-axle differential when engaged (unlocked) divides the engine torque between the forward and rear axles, when disengaged (locked) converts the two axles to a through drive type tandem.



The Upper Helical Gear, Idler Gear, Drive Pinion and Differential Assembly are supported by tapered bearings.

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 shift shaft housing cap screws and lock washers. Remove shift shaft housing assembly.

F. Disassemble and remove shift lever attaching nut, button, lever, cup and spring. Body fit bolt should not be removed.

G. Remove through-shaft cage capscrews and washers.

H. Remove through-shaft, cage and yoke assembly as follows:

1. To free cage from case bore it may be necessary to tap yoke with a soft mallet.
2. While through-shaft assembly is being pulled out, the sliding clutch must be eased along the shaft at shift lever opening. When through-shaft clears the opening, the clutch may be lifted out.

J. Remove carrier to housing stud nuts and washers. Loosen two top nuts but leave on studs to prevent carrier from falling.

K. Break carrier loose from housing with a rawhide mallet.

L. 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.

DISASSEMBLE THROUGH-SHAFT ASSEMBLY

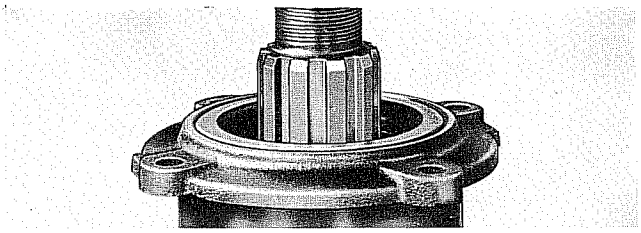
ORIGINAL MODEL — BALL BEARINGS

A. Remove the through shaft yoke cotter key, nut and washer. It may be desirable to use a torque multiplying wrench.

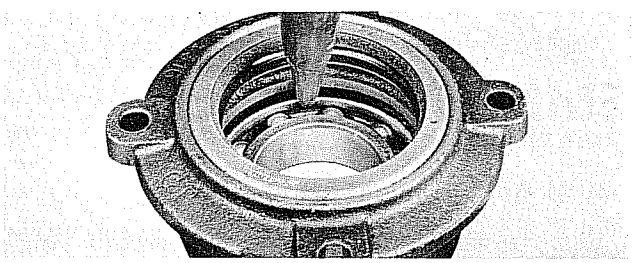
B. Remove the yoke with a suitable puller.

C. For carriers employing output ball bearings (single or double row) continue with disassembly as follows:

1. Press through shaft from cage assembly, using a suitable sleeve against the bearing inner race.



2. Remove cage snap ring, if necessary.



3. Tap the radial ball bearing out of bore from seal end. Care must be taken not to damage seal.

CURRENT MODEL — TAPERED BEARINGS

A. Remove the through-shaft yoke cotter key, if used, nut and washer.

B. Remove the yoke and spacer with a suitable puller.

C. 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 cage. Discard the oil seal.

D. Remove the bearing retaining snap ring from groove in the cage I.D. using snap ring pliers.

E. Using a press and suitable sleeve, press the bearing cage from the through shaft. If a press is not available, secure the through shaft in a vise with soft metal jaw covers and use a rawhide mallet to tap off bearing cage from shaft.

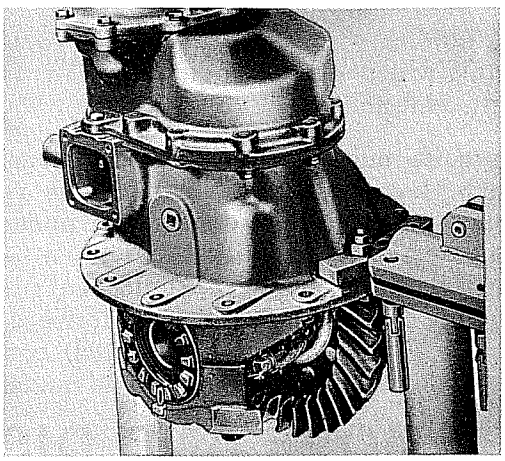
NOTE: The inner and outer cones and outer bearing cup will remain on the shaft, while the inner cup remains in the cage.

F. Inspect both inner and outer bearings (cups and cones) and if required, remove as follows:

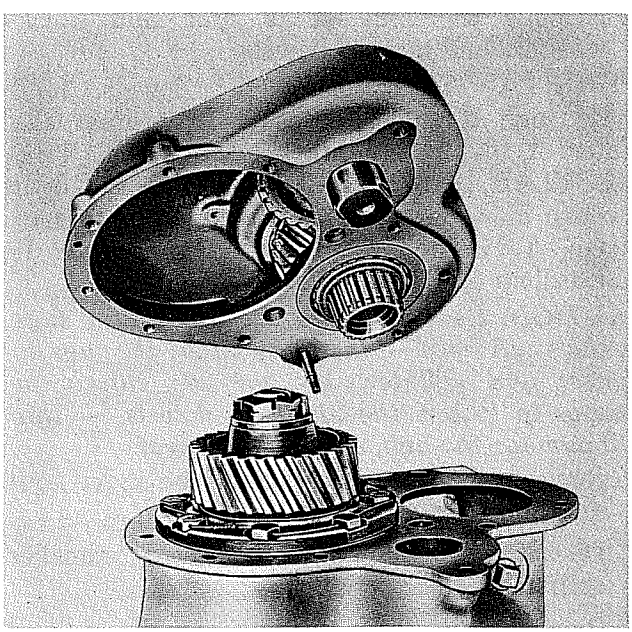
To remove the inner bearing cup from cage use a drift and hammer and tap out cup.

To remove the bearing cones from shaft, position a spare bearing cup of the correct size over the inner cone. Using a press and sleeve or bearing puller against the cup, remove cones.

REMOVE ADAPTER CASE AND INTER-AXLE DIFFERENTIAL ASSEMBLY



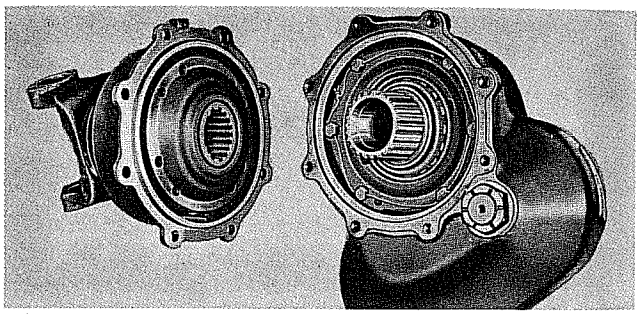
A. Place carrier assembly in repair stand.



B. Remove the adapter case to carrier lock washers and cap screws.

C. Separate the assemblies and remove the gasket or gasket material.

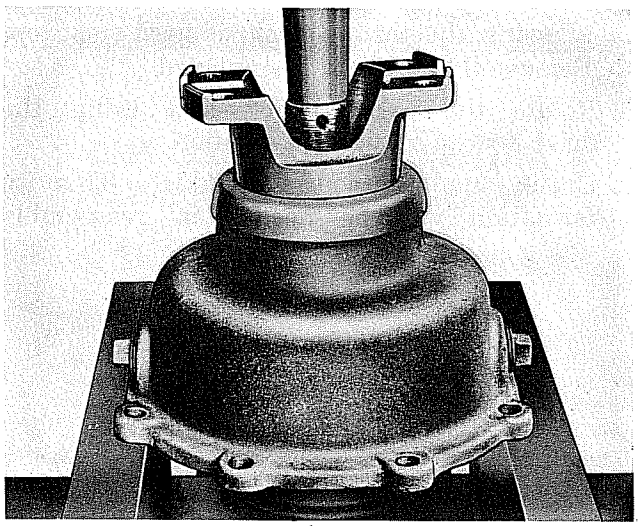
REMOVE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLY



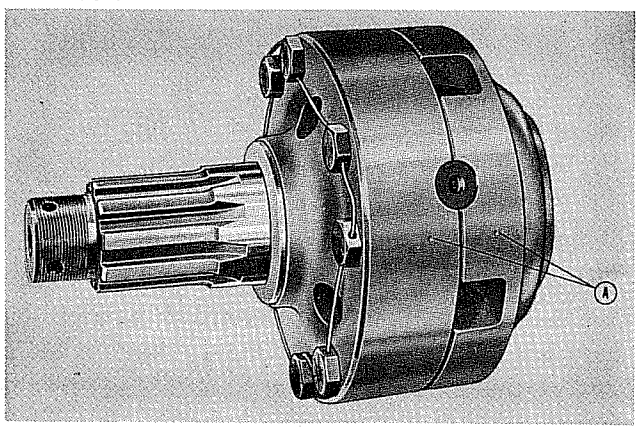
A. Remove the inter-axle differential cover cap screws and washers and lift the assembly from the adapter case.

DISASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLY

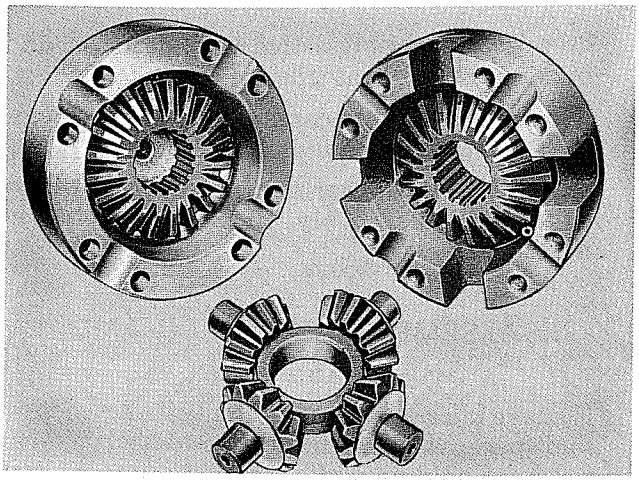
A. Remove input shaft cotter key, if used, nut and washer using a suitable holder for flange or yoke.



B. Press inter-axle differential assembly from cover.



C. If original identification marks are not clear, mark the differential case halves with a punch or chisel for correct alignment at reassembly.



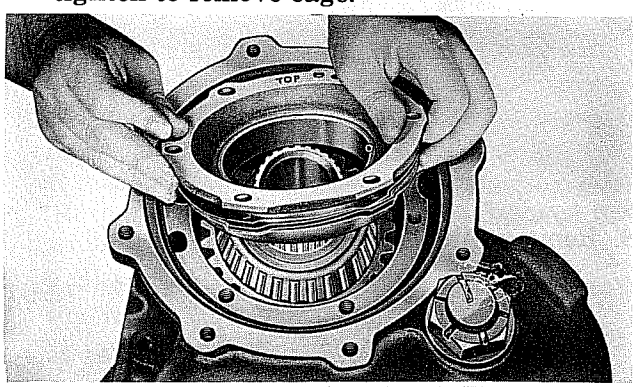
D. Disassemble case halves and remove spider, spider pinions, side gears and thrust washers. Do not remove the radial bearing from the case unless replacement is necessary.

E. If it is necessary to replace the bearing, press or tap out the oil seal from the cover and remove the snap ring and bearing.

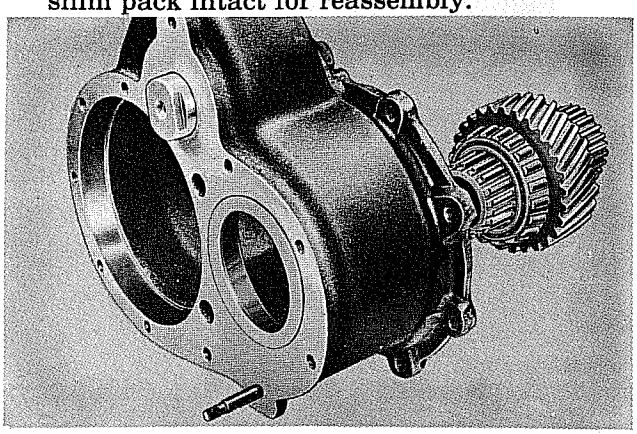
DISASSEMBLE THE ADAPTER CASE ASSEMBLY

A. Cut the lockwire, if used, and remove the cap screws from the bearing cage.

B. Insert two (2) cap screws in the puller holes and tighten to remove cage.



C. Lift off cage and shim pack. Be sure to keep the shim pack intact for reassembly.



D. At the rear of the adapter case, tap the helical

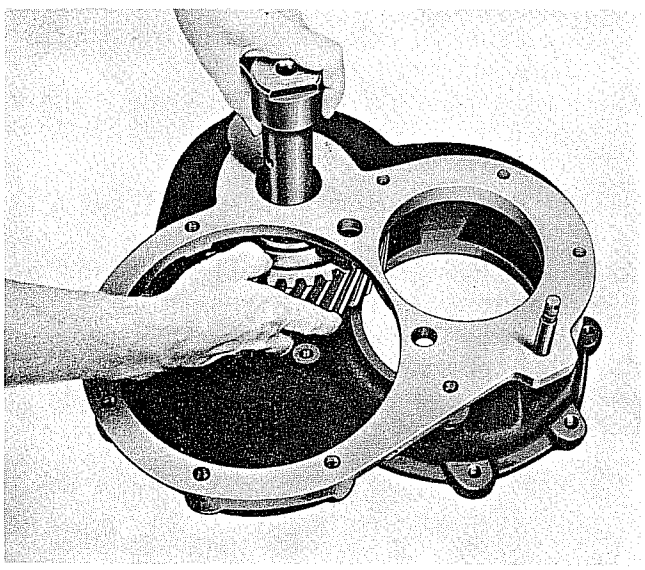
drive gear assembly with a rawhide mallet and remove assembly at front of the case.

E. If replacement is necessary, remove the bearing cups from cage and adapter case.

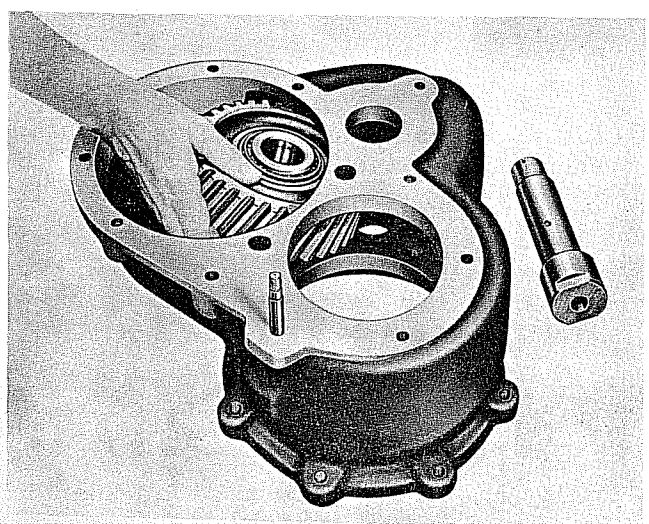
F. Remove the taper bearings from the gear with a suitable puller only if replacement is necessary.

DISASSEMBLE IDLER GEAR AND SHAFT ASSEMBLY

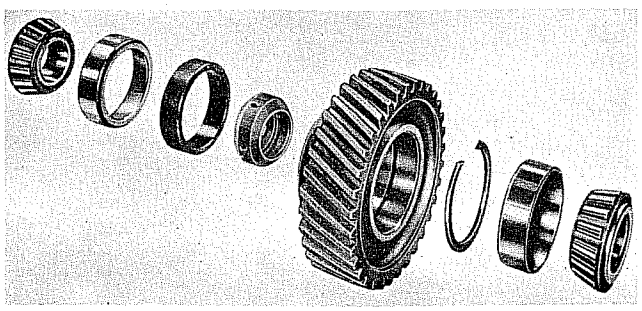
A. Remove idler gear shaft cotter key, if used, nut and spacer washers (flats are provided on idler shaft for holding while removing nut).



B. Remove idler gear shaft.



C. Slide out idler gear and bearing assembly.



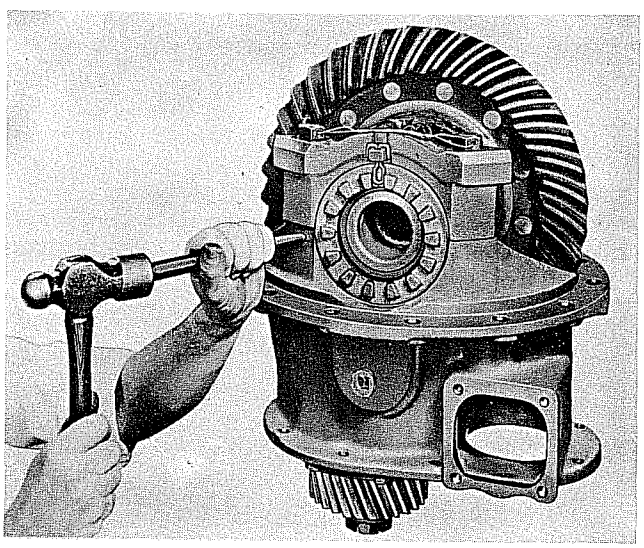
D. Remove tapered bearings. For complete disassembly tap out cups, remove hardened bearing spacer, or spacers, and bearing cup spacer.

REMOVE DIFFERENTIAL AND GEAR ASSEMBLY

A. With the carrier still in an upright position, loosen jam nut and back off thrust screw, allowing the thrust block, if used, to drop. Remove thrust block, if employed.

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 reassembly unless a new gear set is used.

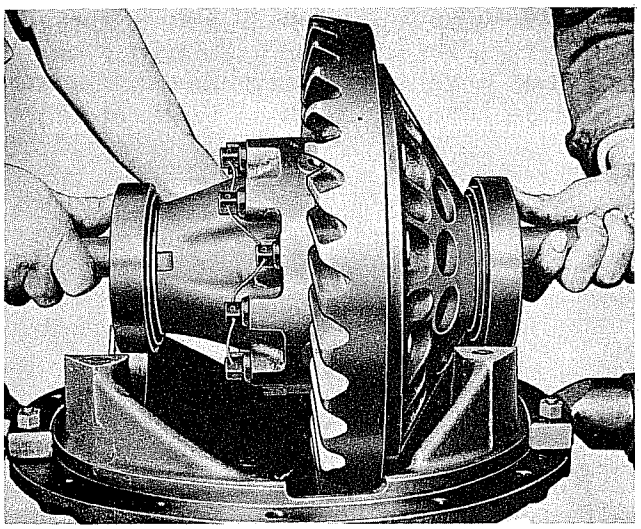


D. Center punch one differential carrier leg and bearing cap to identify in reassembly.

E. Cut the lockwire, if used, and remove the leg cap screws and cotter key.

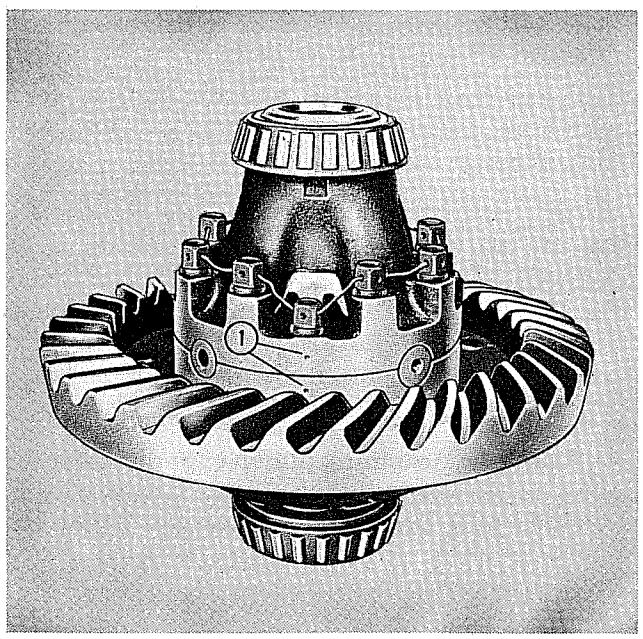
F. Remove the bearing adjusting ring and the carrier cap.

G. Repeat steps E and F for removal of carrier cap on the opposite side.



H. Lift out the differential and gear assembly.

DISSASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

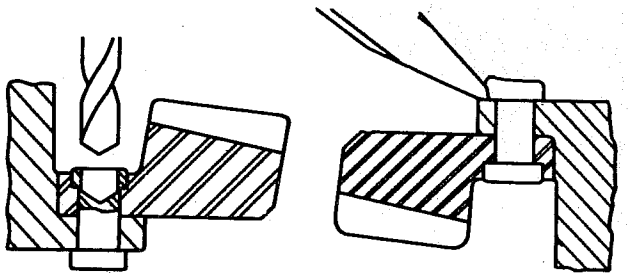


A. If original identification marks are not clear, mark the differential case halves with a punch or chisel for correct alignment on reassembly.

B. Remove the lockwire, if used, and cap screws and separate the case halves.

C. Remove spider, spider pinions, side gears and thrust washers.

RIGHT WRONG



D. If gear is to be replaced for any reason, remove rivets and separate gear from case.

1. Carefully center-punch rivets in center of head.
2. Use drill 1/32″ smaller than body of rivet to drill through head from gear side.
3. Press out rivets.

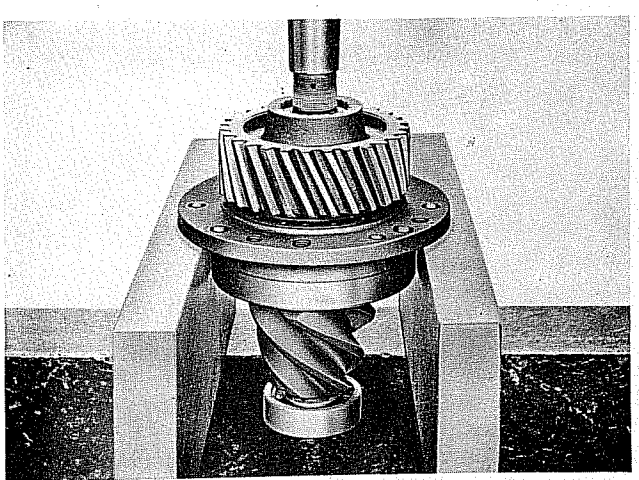
E. If necessary to replace differential bearings, remove with a suitable puller.

REMOVE PINION AND CAGE ASSEMBLY

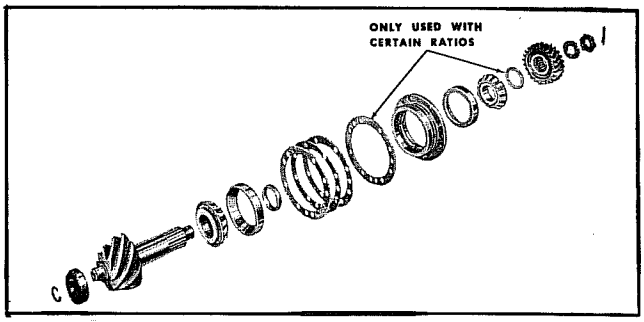
A. Cut lock wire, if used. Remove pinion cage cap screws.

B. Remove pinion cage assembly by tapping end of pinion shaft with a brass bar and hammer. (Care should be exercised not to damage the pinion radial bearing.)

C. Remove pinion cotter key, if used, nut and washer.



D. Press pinion shaft through cage and bearings (and helical driven gear on SQHP model).

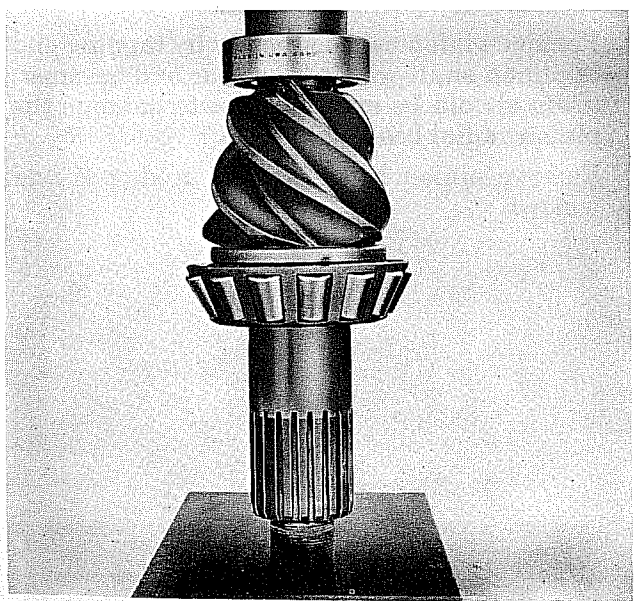


E. Remove gear (and gear spacer where employed).
F. Remove outer bearing from cage.
G. Remove bearing spacer from pinion shaft.
H. If necessary, remove the pinion inner thrust bearing and the end radial bearing with a suitable puller.
J. If necessary to replace pinion bearing cups, remove with a suitable puller (if cups are in good condition, do not disturb).
K. Refer to Section 2 for cleaning, inspection and component repairs.

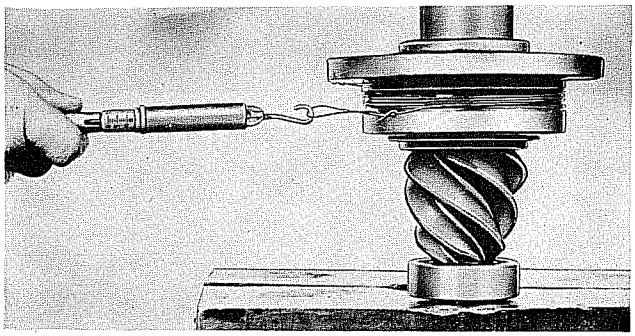
REASSEMBLE DRIVE UNIT

REASSEMBLE PINION AND CAGE ASSEMBLY

A. Press rear thrust bearing firmly against the pinion shoulder with a suitable sleeve against the bearing inner race.



B. Press the radial bearing into position.
C. Install radial bearing retaining ring.
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. Lubricate bearing and cups with the recommended axle lubricant.
F. Insert pinion and bearing assembly in pinion cage and position spacer over the pinion shaft.
G. Press forward bearing firmly against the spacer.
H. Rotate cage several revolutions to assure normal bearing contact.



I. While in the press under pressure, check the bearing preload 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.)

(If the rotating torque is not within 5-25 lb. ins. for new bearings or 5-15 pound inches for re-used bearings, use a thinner spacer to increase, or a thicker spacer to decrease, the pre-load torque.)

The correct pressures and nut torques for checking pinion bearing pre-load are as follows:

PINION SHAFT THREAD SIZE	PRESSURE REQUIRED TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED(FOR FASTENERS USING LOCKWIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED (FOR FASTENERS NOT USING LOCKWIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD
1¼"—18	27 tons	700 - 900 lb. ft.	700 - 900 lb. ft.
1¾"—12	25 tons	800 - 1100 lb. ft.	900 - 1200 lb. ft.

Use rotating torque, not starting torque.

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

J. Press the drive pinion helical gear against the forward bearing (or spacer where employed) and install washer and pinion shaft nut.
K. Using a suitable holder on gear, tighten the pinion shaft nut to the required torque and install cotter key.
L. Recheck pinion bearing pre-load torque. If rotating torque is not within 5-25 lb. ins. for new bearings or 5-15 lb. ins. for re-used bearings, repeat the foregoing procedure.

M. If original gears are reused, install original shim pack (and spacing washer where employed). 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 the shim pack increase or decrease in thousandths of an inch.

N. Position the pinion and cage assembly in the carrier pinion cage bore and tap into place with a soft mallet.

O. Install pinion cage cap screws and tighten to correct torque. (Do not lock wire until final carrier adjustments are made. (Refer to Section 4.)

ASSEMBLE DIFFERENTIAL AND GEAR

IMPORTANT: The ring gear must be heated before assembling onto the case half, otherwise damage to the case half will result. Refer to page 82 for procedures before continuing with item "A".

A. Rivet the hypoid gear to the case half with new 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.

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

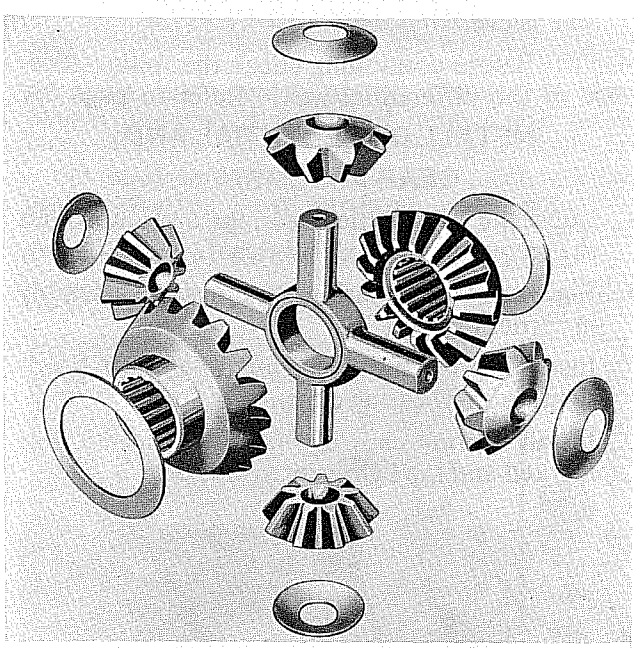
DIAMETER OF RIVET	TONNAGE REQUIRED
7/16"	22
1/2"	30
9/16"	36
5/8"	45

Final pressure should be held for approximately one minute to make sure the rivet has filled the hole.

Check for gap (at four different areas) between backface of gear and case flange with a feeler gauge of .003 maximum thickness. If gauge can be inserted more than one-half the distance between the flange outside diameter and gear pilot diameter, the gear must be removed and cause of condition determined and remedied.

Differential case and gear bolts are also 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.

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

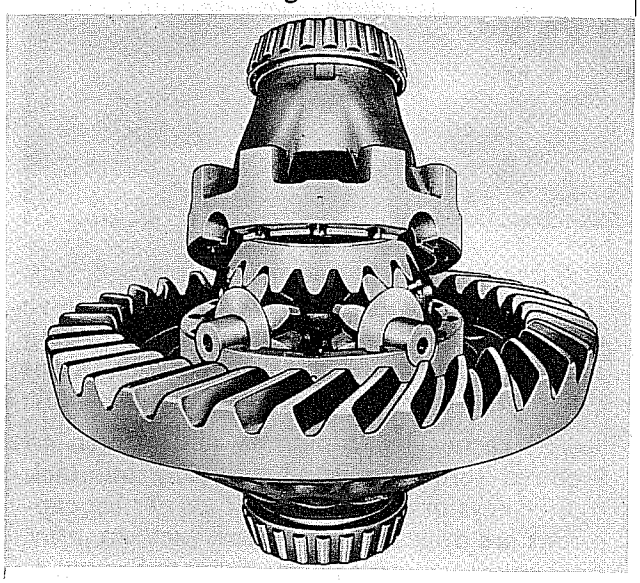


DIFFERENTIAL PINION AND SIDE GEAR ASSEMBLY

C. Position thrust washer and side gear in gear case half.

D. Place spider with pinions and thrust washers in position.

E. Install second side gear and thrust washer.



F. Align mating marks, position mating case half and draw assembly together with three (3) equally spaced capscrews.

G. Install remaining capscrews and tighten to correct torque and lockwire, if employed. Refer to Section 4.

H. If bearings are to be replaced press squarely and firmly on differential case halves with suitable sleeve.

NOTE: Before continuing check the rolling resistance of the differential nest. Refer to page 83.

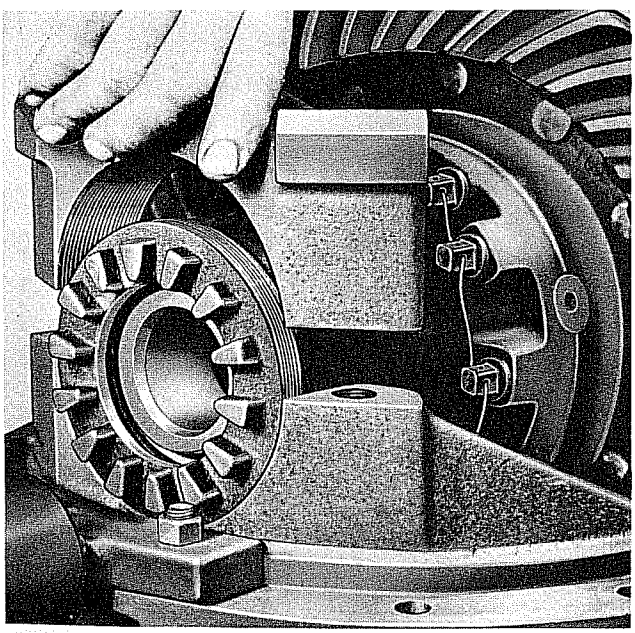
INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

A. 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.

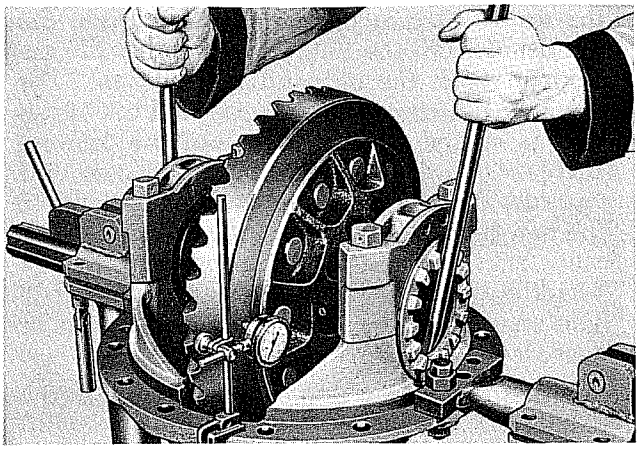
D. Install bearing caps in the correct location as marked and tap lightly into position.



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 tighten to required torque. Install adjusting nut lock (cotter keys or lock plate). If carrier leg capscrews are drilled or castellated, lockwire *after* final adjustments are made. Refer to Section 4.

ADJUST DIFFERENTIAL BEARING PRELOAD



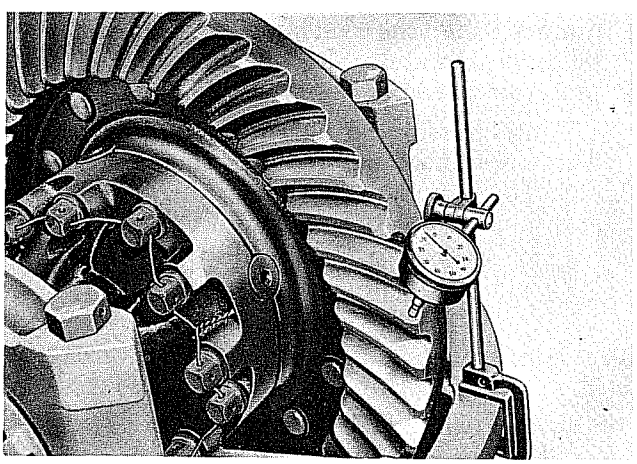
A. Using dial indicator at backface of gear, loosen the bearing adjusting nut on *the side opposite gear only* sufficient to notice end play on the indicator.

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. Adjust differential bearings to spread legs .006 —.013 or a differential bearing rolling resistance of 15 - 35 lbs. inch.

CHECK GEAR BACKLASH



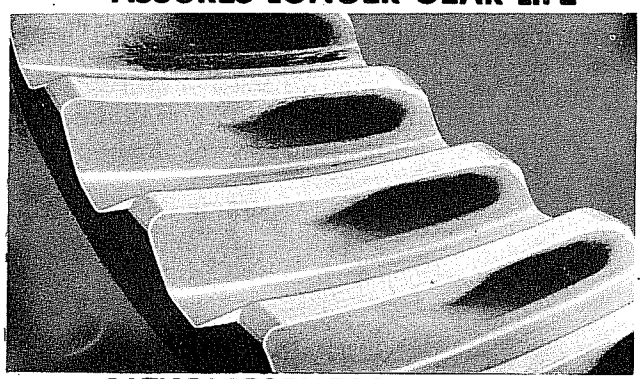
If the drive gear is not going to be replaced, we suggest the established backlash recorded before disassembly be used. For new gears the new backlash should be initially set at .010". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount. After satisfactory contacts have been established the backlash can be altered within the limits of .005" - .015" to obtain a better contact position.

CHECK TOOTH CONTACT

A. Apply oiled red lead lightly to the 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.

B. 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 drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

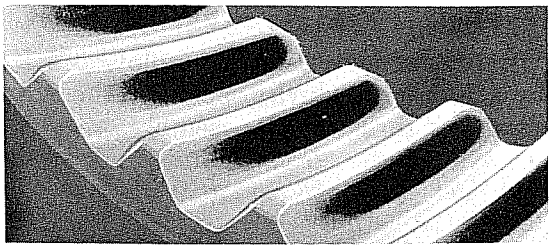
FOR HYPOID GEARS ONLY
CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE



SATISFACTORY TOOTH CONTACT (HYPOID 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 above (gears unloaded) will result in a pattern centered in the length of the tooth when the gears are under load, shown on top of this page. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear.

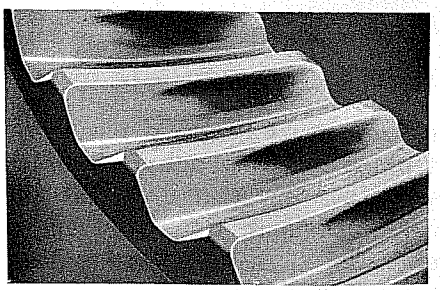


SATISFACTORY TOOTH CONTACT (HYPOID GEARS LOADED)

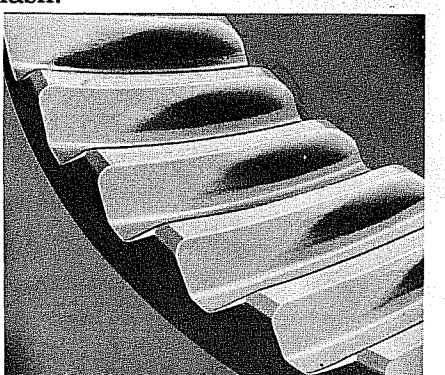
The pattern on the coast side of teeth will appear the same width as the drive side shown above; however, the overall length will be centered between the toe and heel of gear tooth.

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

INCORRECT HYPOID 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.

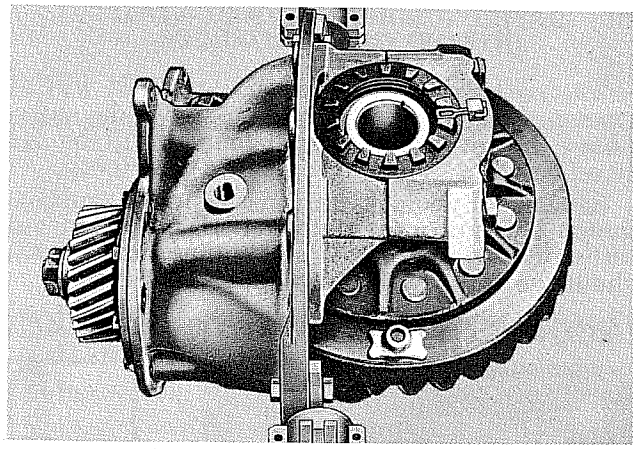
For adjustment of drive pinion and gear refer to Section 2.

INSTALL THRUST SCREW OR BLOCK

A. Current carrier designs employ only the thrust screw, which replaces the thrust screw and thrust block assembly.

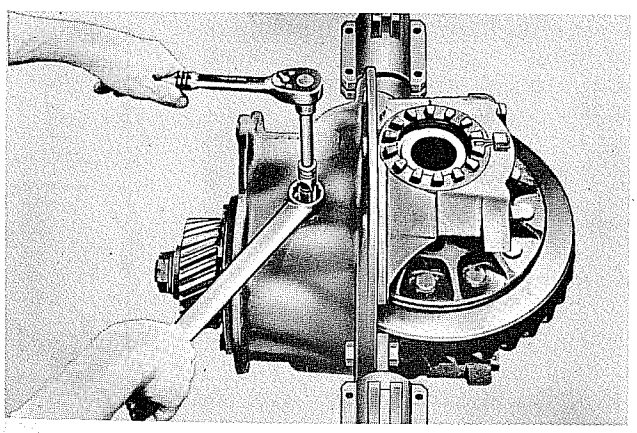
B. Remove carrier from stand and position with back face of hypoid gear upward.

C. Remove adjusting screw and lock nut.



D. Coat face of the thrust block, if used, with grease and place on the back face of the hypoid gear; rotate the gear until the hole in the thrust block is in line with the adjusting screw hole.

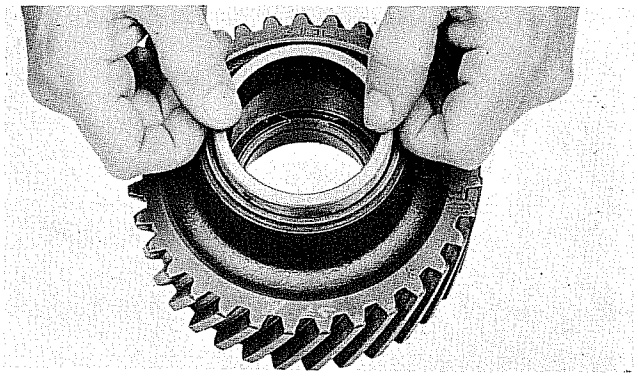
E. Install thrust screw and lock nut and tighten thrust screw (and thrust block, if used) firmly against back face of hypoid gear.



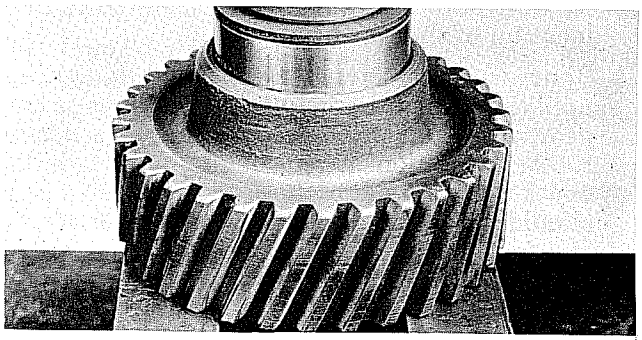
F. To secure the correct adjustment of .010"-.020" clearance. Loosen adjusting screw ¼ turn and lock with jam nut, 150-190 lb. ft. torque.

ASSEMBLE ADAPTER CASE

A. Install the snap ring and press idler gear inner bearing cup squarely against snap ring.

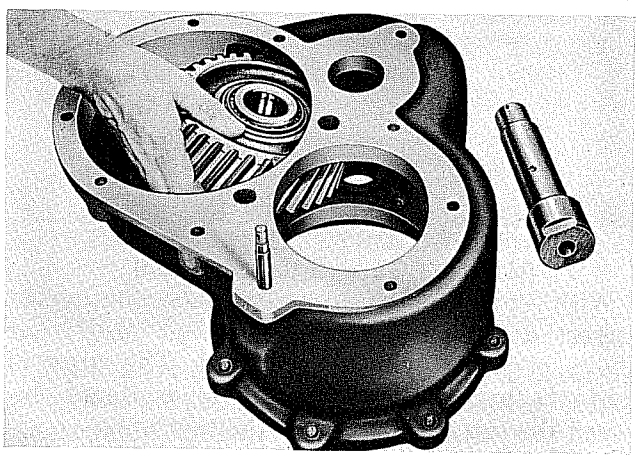


B. Insert the idler gear cup spacing sleeve against opposite side of snap ring.



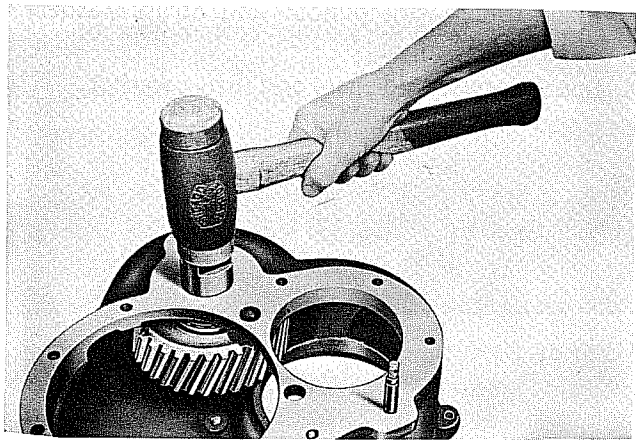
C. Press idler gear outer bearing cup squarely against the spacing sleeve.

D. Position the idler gear inner and outer bearings into cups with the hardened bearing spacer (or combination of two spacers) between them.



E. Slide the complete assembly through the adapter case drive pinion opening.

Position the assembly so that the bearings are aligned with adapter case shaft hole.



F. Tap the idler shaft through the idler gear assembly so that the inner bearing is squarely against the idler shaft shoulder.

IDLER SHAFT BEARING ADJUSTMENT

Hold the adapter case and idler gear assembly securely in vise with jaws clamped on flattened end of idler shaft.

A. Install washer and nut, and torque nut to the correct value as follows:

If nut is slotted and shaft is drilled for cotter key, tighten to 350-400 lb. ft.

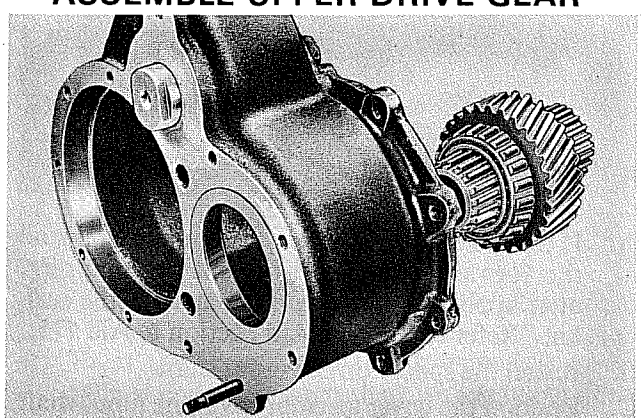
If nut is unslotted and shaft is not drilled, tighten to 500-600 lb. ft.

B. Measure the idler shaft bearing end play by use of a dial indicator mounted to the adapter case proper with stem set against idler gear face. Correct limits .0001″-.0050″.

C. If bearing end play does not measure within these limits, use a thinner or thicker spacer or combination of two spacers as required.

D. After end play has been established within the .0001″-.0050″ limits, remove the washer and nut. Insert "O" ring and reinstall washer and nut. Tighten nut to correct torque as shown above. Install cotter key, if used.

ASSEMBLE UPPER DRIVE GEAR

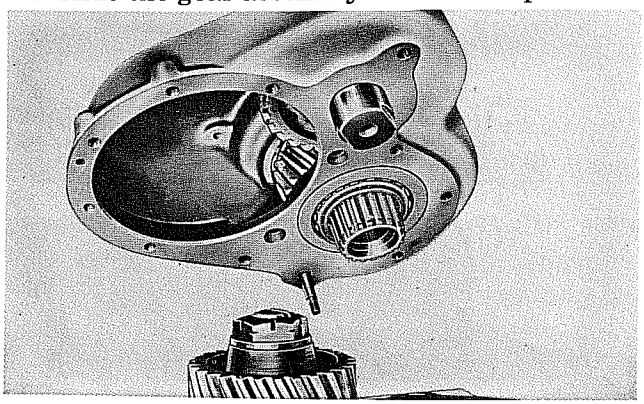


A. Press the front and rear tapered bearings onto the gear.

B. If removed in disassembly, press the front bearing cup into the bearing cage.

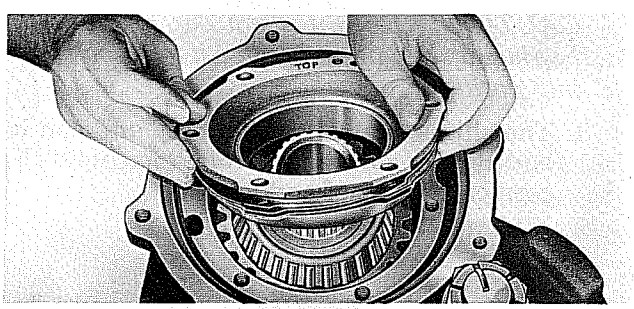
C. Tap the rear bearing cup into the adapter case.

D. Slide the gear assembly into the adapter case.

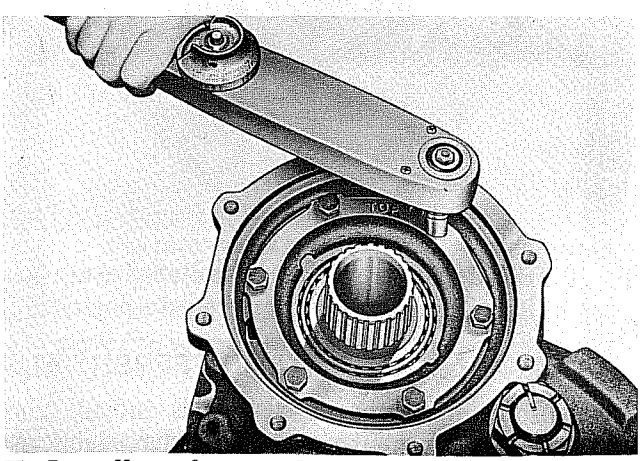


E. Mount the carrier in the stand in an upright position. Apply a 1/8″ bead of silicone RTV gasket material to one mating surface, adapter case or carrier. Refer to page 82 for instructions. Place the adapter case assembly immediately over the carrier. (The idler shaft flat must be lined up with the corresponding flat in the carrier.)

F. Install the lock washers and capscrews and tighten the capscrews to specified torque.

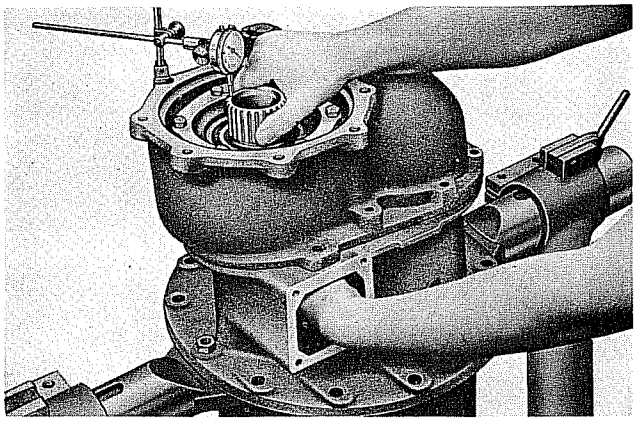


G. Using the original shim pack, install the bearing cage over the upper helical gear. "TOP" is marked.



H. Install washers and capscrews and tighten to specified torque.

ADJUST UPPER DRIVE GEAR BEARINGS

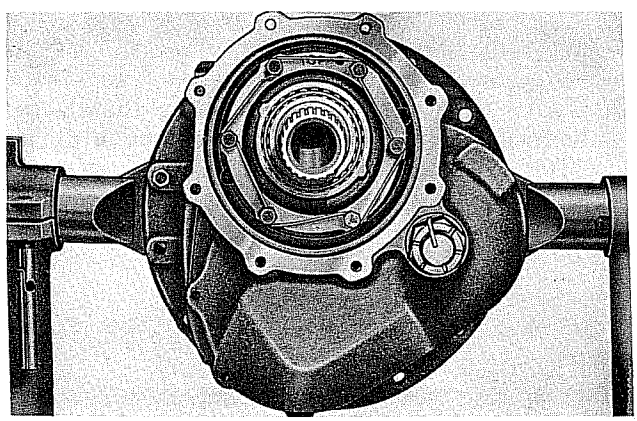


A. Adjust the tapered bearings to .0001"-.0030" endplay using a dial indicator set against the end of the gear as follows:

1. Rotate the bearings by hand to seat them in position.
2. With one hand through the shift slot and the other on top, move the gear assembly up and down. The amount of movement should be within the specified amount of endplay.

CAUTION: Do not use a bar to move the bearings up and down because it may cock them into position.

3. The shims control the endplay and can be added to or subtracted from, to achieve the correct amount of endplay.



B. If drilled capscrews or castellated nuts are employed, lockwire capscrews into position.

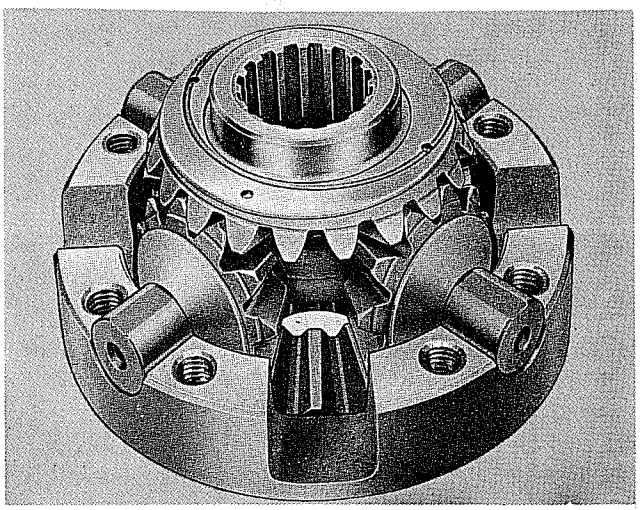
ASSEMBLE INTER-AXLE DIFFERENTIAL

A. Lubricate differential case walls and all component parts with the recommended axle lubricant.

B. Position thrust washer and rear side gear into rear case half.

C. Place spider with pinions and thrust washers in position.

D. Install forward side gear and thrust washer.

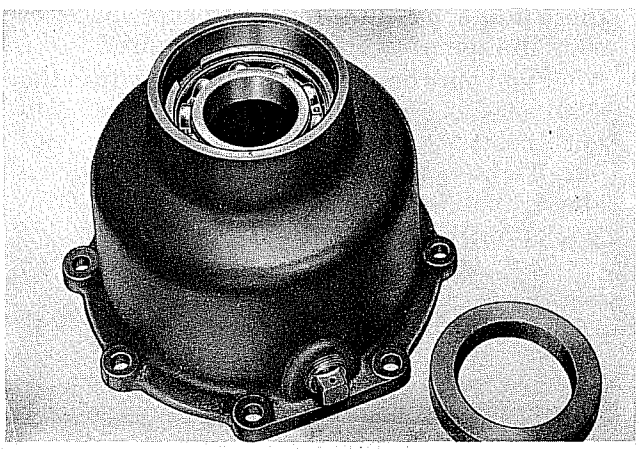


E. Align mating marked, position forward case half.

F. Secure the case bolts, using new Dri-Loc bolts or Rockwell #2297-C-3747 liquid adhesive in threaded holes. Tighten to correct torque and lockwire if drilled or castellated fasteners are employed.

G. Check for free rotation of gears and correct if necessary. Refer to page 83.

ASSEMBLE INTER-AXLE DIFFERENTIAL COVER



A. If the cover assembly was disassembled, install the forward radial bearing and the snapring, after applying Locquic primer and Loctite sealant. Refer to Technic Aid Section 3, Aid #75.

B. Install the spacer on the input shaft.

C. Position the cover assembly over the input shaft and tap down until the radial bearing seats against the spacer.

D. Apply a 1/8" bead of silicone RTV gasket material to one mating surface, inter-axle differential cover or adapter case. Refer to page 82 for instructions. Position the cover and differential assembly into position. (It will be necessary to line up the splines of the gear with those of the side gear.)

E. Install the capscrews and lock washers. Tighten the capscrews to specified torque.

F. Install the cover oil seal with a specified torque.

F. Install the cover oil seal with a suitable driver.

G. Mount the cover assembly on the adapter case with gasket in position.

H. Install the capscrews and lock washers. Tighten the capscrews to specified torque.

ASSEMBLE DRIVE UNIT

A. Follow steps A through B under "Inspect Drive Unit Housing" in Section 2.

B. Apply silicone RTV gasket material to drive unit or housing. Refer to page 82.

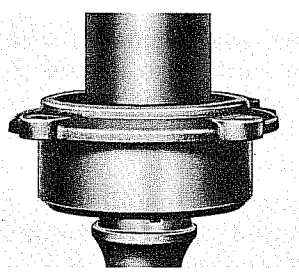
C. Roll carrier into position on roller jack. Start carrier into housing with four flat washers and nuts equally spaced and tighten alternately to draw the carrier squarely into axle housing. (Driving carrier into housing with a steel hammer will damage carrier flange.)

D. Remove nuts and flat washers and install lock washers and stud nuts. Tighten to correct torque. Refer to Section 4 for correct torque specifications.

ASSEMBLE THROUGH-SHAFT AND CAGE

ORIGINAL MODEL—BALL BEARINGS

A. Install the through-shaft rear radial bearing into the cage and lock in place with snap-ring.



B. Press the cage and bearing assembly on the splined end of through-shaft with suitable sleeve.

C. Install the through-shaft cage oil seal with a suitable driver.

CURRENT MODEL—TAPERED BEARINGS

A. If removed, press both inner and outer bearing cones onto the through shaft, against bearing sholder. Use a sleeve of the correct diameter that will bare against the bearing inner race only.

B. Press the inner bearing cup into cage using a suitable sleeve.

C. Position the through shaft into the bearing cage until the inner cone seats against the cup. Using a press and sleeve install the outer bearing cup into cage against the outer cone.

D. Install bearing retaining snapring in groove in I.D. of cage and adjust bearing endplay as follows:

Adjust Through Shaft (output) Bearing Endplay

The thickness of the bearing retaining snapring controls the through shaft bearing endplay. Correct reading is 10 lb. ft. preload to .003" endplay.

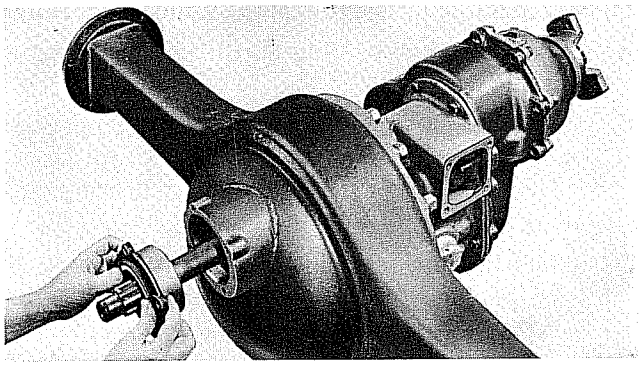
1. Place the through shaft and cage assembly in a vise with soft metal jaw covers. Secure the assembly by the through shaft.
2. Assemble the yoke and yoke spacer onto the through shaft, against the outer bearing. Using a yoke holder, thread the yoke nut onto shaft and tighten to correct torque value. Refer to "Install Yokes" on page 34.
   NOTE: Do not install the yoke oil seal into cage at this time.
3. Reposition the through shaft and cage assembly in the vise, clamping on the cage O.D. Mount a dial indicator onto the cage flange area with the pointer stem against the through shaft threaded (nut) end.
4. Holding the yoke, rack in the bearings while turning the yoke side to side to seat bearings. Set the indicator to zero (0).
5. While observing the dial indicator, pull the yoke outward, again turning it side to side. Make note of reading. Final reading must be within 10 lb. ft. preload to .003" endplay.
   If endplay is not within correct limits install a thinner or thicker bearing retaining snapring as required. A thinner snapring will increase endplay while a thicker snapring will decrease endplay.

E. After correct endplay has been established, remove the yoke. Using a press and sleeve or seal driver and mallet install the oil seal into cage bore.

F. Squirt an adequate amount of the recommended axle lubricant through the front and rear of

the bearing cage. Rotate the bearings to insure lubrication.

INSTALL ASSEMBLY INTO DRIVE UNIT



A. Enter the through shaft and cage assembly with new cage gasket into the cage bore in the rear of the axle housing until the forward end of shaft is even with shift lever opening.

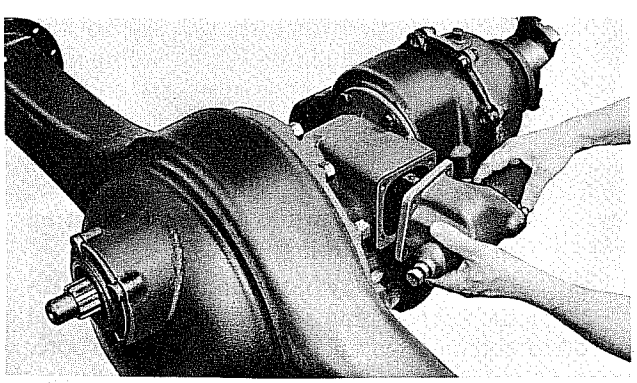
B. Install the sliding shift collar over the forward end of shaft through the shift housing opening. Ease shaft into the forward side gear of the inter-axle differential, while at the same time passing the shift collar onto the collar splines.

IMPORTANT: With current models employing tapered bearings — be certain to assemble the bearing cage with the oil trough in the bottom position. The bearing cage is marked "top" on the outside.

C. Install through-shaft cage capscrews and lock washers and tighten to correct torque.

D. Install over the shift lever bolt the shift lever spring, cup and lever. Lever inner yoke must be properly located in collar groove at this time. Install shift lever button and nut. Tighten nut securely with box wrench and install cotter key.

INSTALL THE SHIFT SHAFT HOUSING



A. Position the gasket and shift housing assembly.

B. Install washers and capscrews and tighten to specified torque.

ADJUSTMENT OF SHIFT SHAFT

Adjust the positioning screw at the rear of the shift housing assembly in the following manner:

A. With the shift shaft moved back its full travel locking the inter-axle differential, turn the adjusting screw in until the end of screw touches the end of shift shaft.

B. From this point proceed 1 to 1¼ turns more and lock adjusting screw with jam nut.

(This will allow approximately .012" clearance between the yoke and groove of collar and thus eliminate yoke or collar wear.) The shift collar provides a definite stop against housing wall when shifted in the opposite direction.

INSTALL YOKES (INPUT AND OUTPUT)

SLIP FIT YOKES

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. Using a holder on the yoke, tighten the yoke nut to the proper torque and install cotter key if used.

INTERFERENCE FIT YOKES

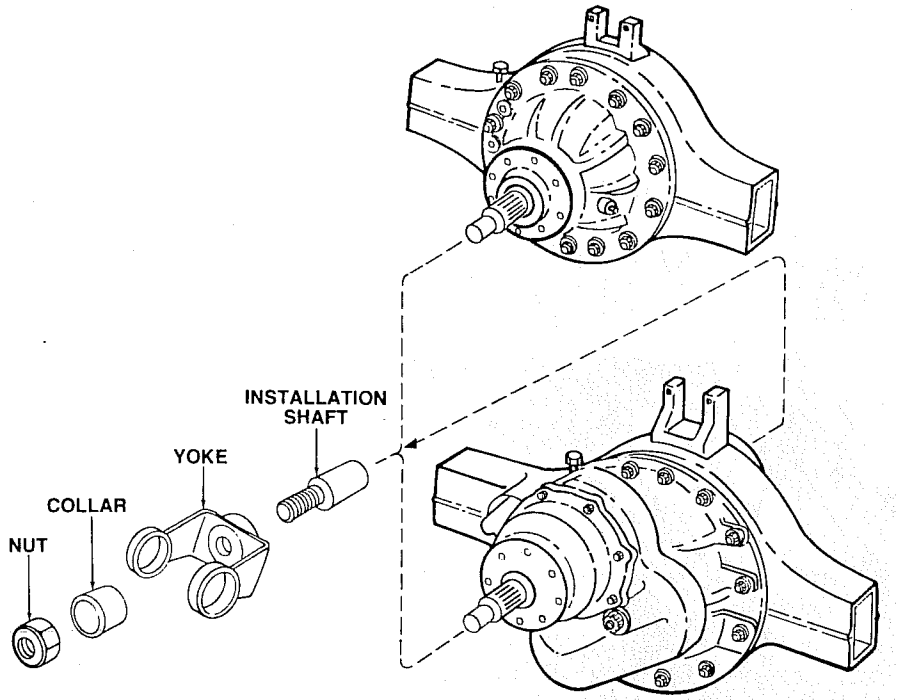
On current model carriers with interference fit yokes, installation will require the use of a press or the three-piece installation tool and the following procedures:

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

A. 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.

B. 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 Int'l, 2135 W. Maple, Troy, Mi. 48084.

C. Slide the yoke over the installation shaft, aligning yoke and shaft spines of drive unit.

D. Place installation collar over the installation shaft, against yoke.

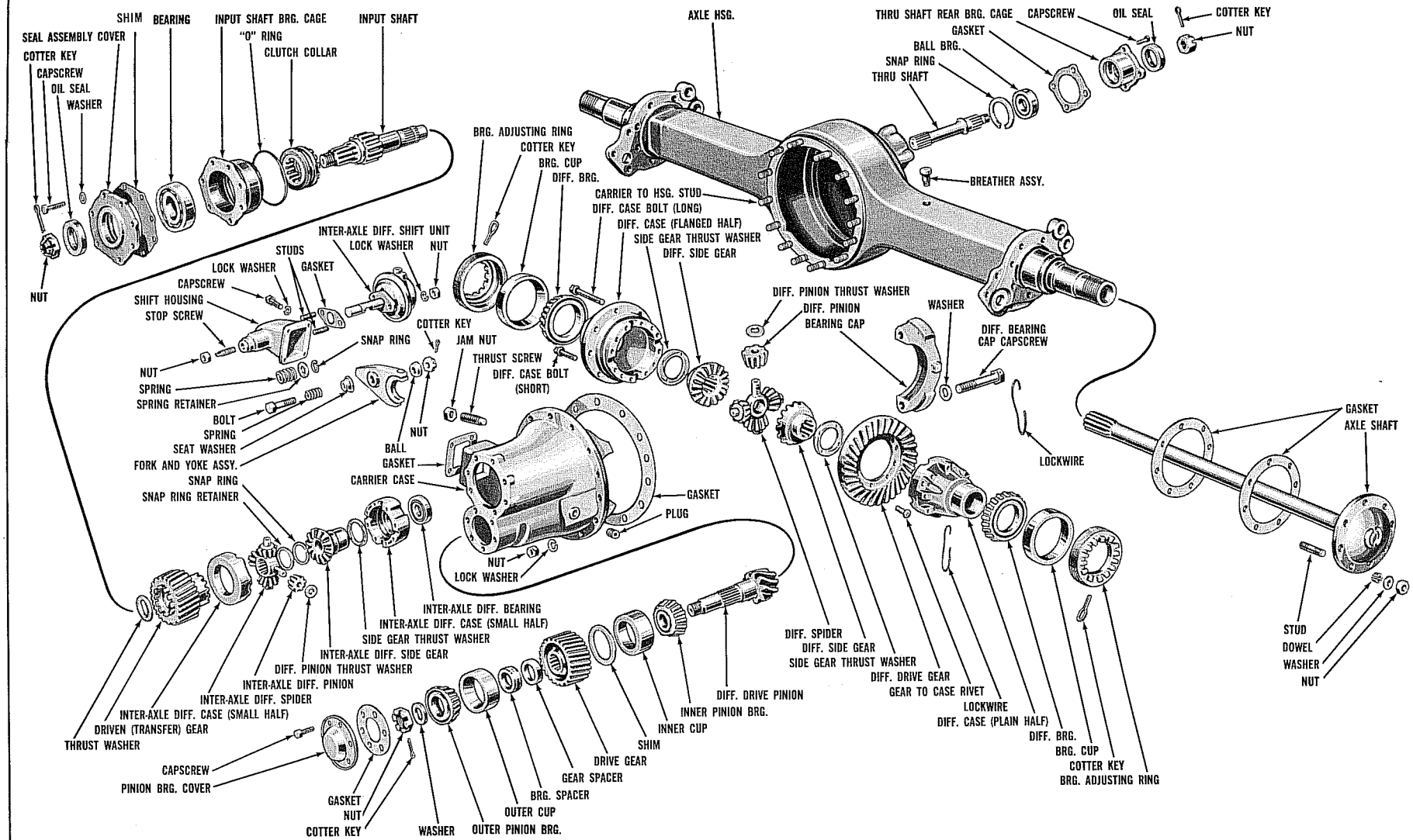
E. Thread nut onto installation shaft, against the collar. Continue threading the nut against collar until yoke seats against bearing. A torque value of 200 lb. ft. on nut may be required to properly install and seat the yoke.

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.

F. Remove all parts of the installation tool from the drive unit.

G. Install pinion, input, output or through-shaft washers (if employed) and nut. Tighten nut to the required torque value. Refer to Section 4.

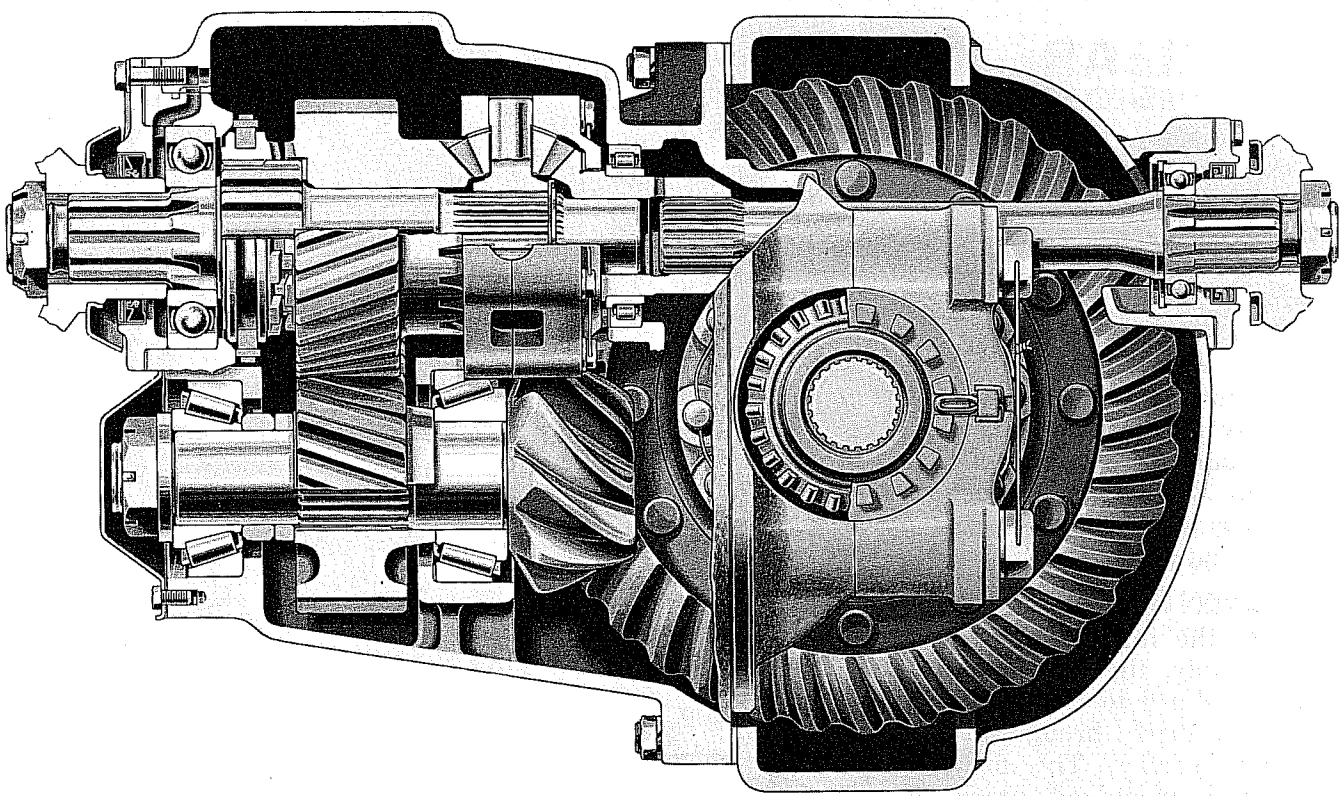
TANDEM FORWARD/REAR AXLE
TWO GEAR TRANSFER TRAIN



SINGLE-REDUCTION FORWARD REAR DRIVE UNITS

(MODEL TYPE — RHD & SHD)

EMPLOYING TWO-GEAR TRANSFER TRAIN AND INTER-AXLE DIFFERENTIAL ASSEMBLY



Front-mounted Single Reduction Through Drive Type Drive Units with a two-gear transfer train built by Rockwell International 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 48. 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

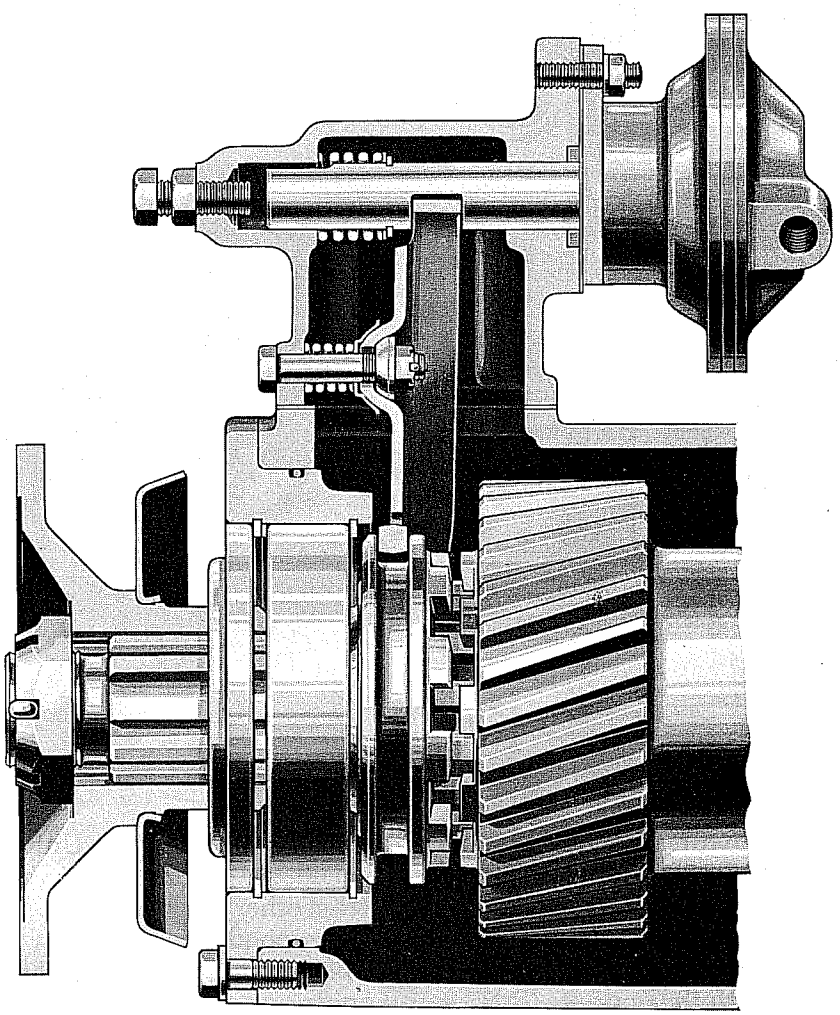
Backlash is corrected or adjusted by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

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 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.



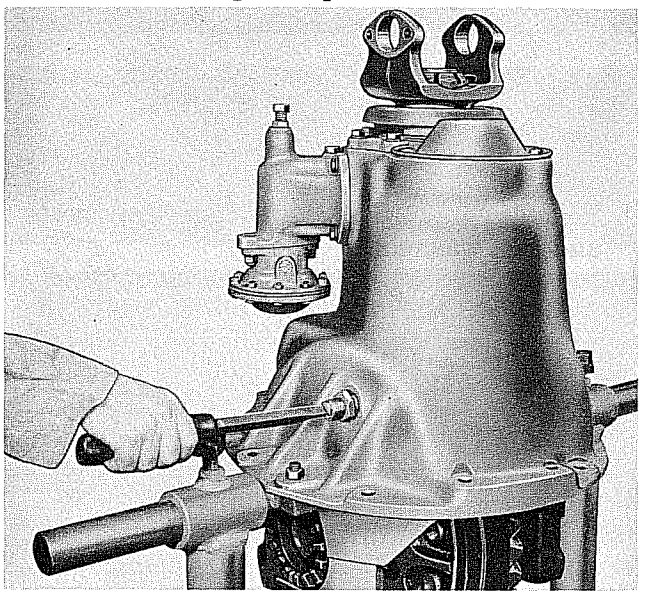
The shift unit is controlled by a selector switch (or lever) within the cab of the vehicle and the differential may be "locked up" or "unlocked" under any normal operating conditions. However, the differential should not be "locked up" while wheels are spinning (after losing traction). In this event, 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 FORWARD REAR DRIVE UNIT

REMOVE DRIVE UNIT FROM HOUSING

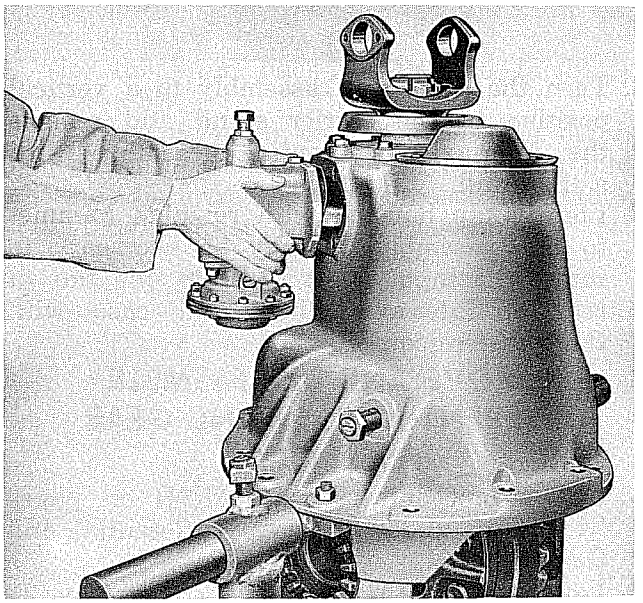
A. Refer to "Remove Drive Unit From Housing" on page 21 and follow procedures A through D. Then, proceed to steps J through L to complete removal of drive unit.

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



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

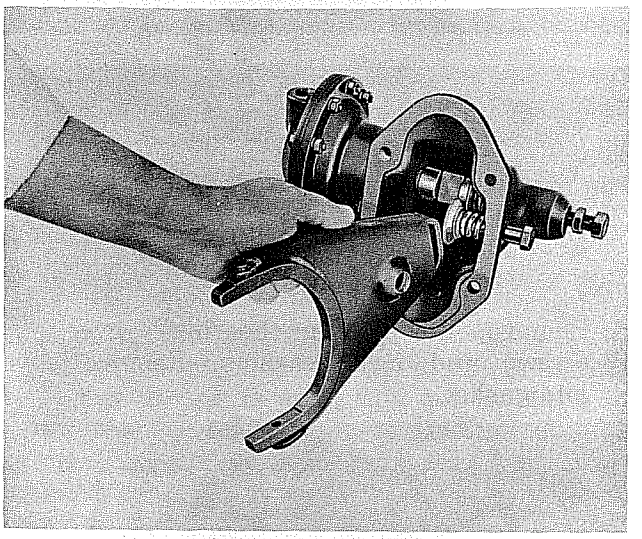
REMOVE AND DISASSEMBLE SHIFT UNIT HOUSING ASSEMBLY



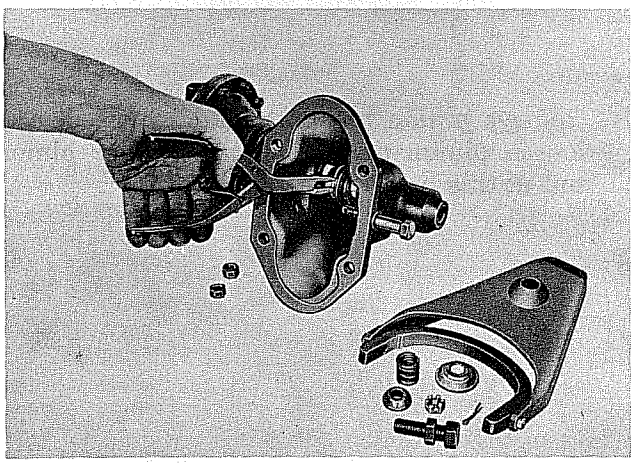
A. Remove the shift housing cap screws and lock washers.

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.



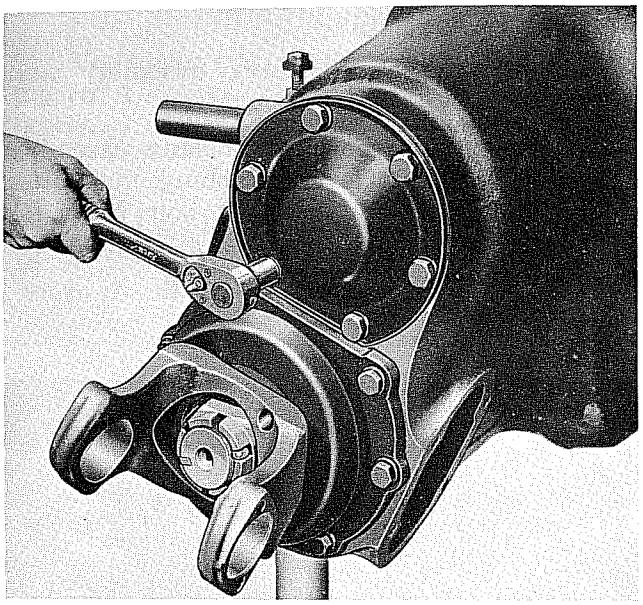
D. Remove the shift chamber attaching nuts and lock washers. By use of snap ring pliers, expand lock ring to clear shaft groove and slide out shaft and chamber assembly.



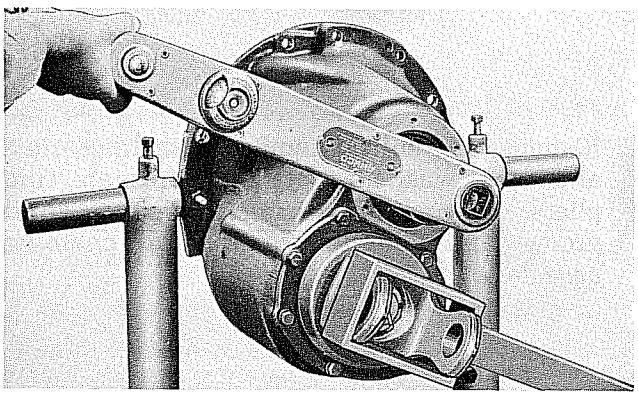
E. Remove from the housing the spring retainer and spring.

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

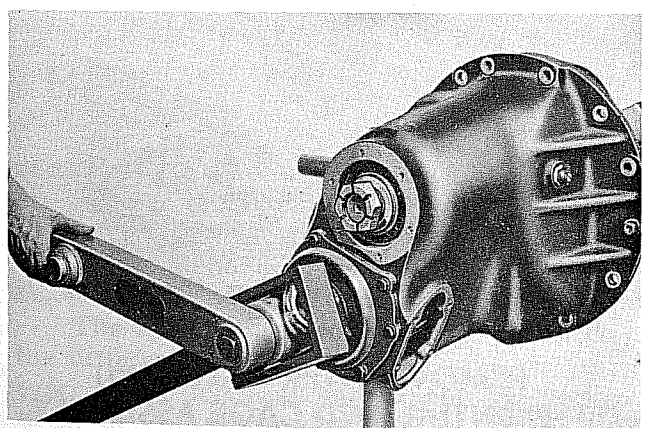
Before disassembly is started, record gear backlash. Gear must be reset to this figure at reassembly.



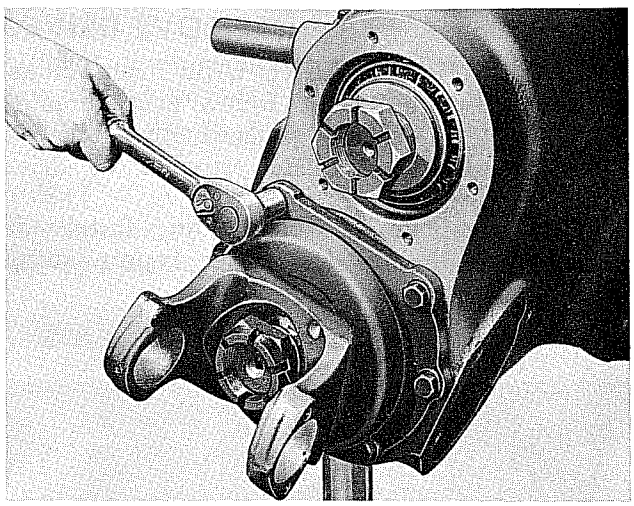
A. Remove the pinion bearing cover cap screws and lock washers. Remove cover and gasket.



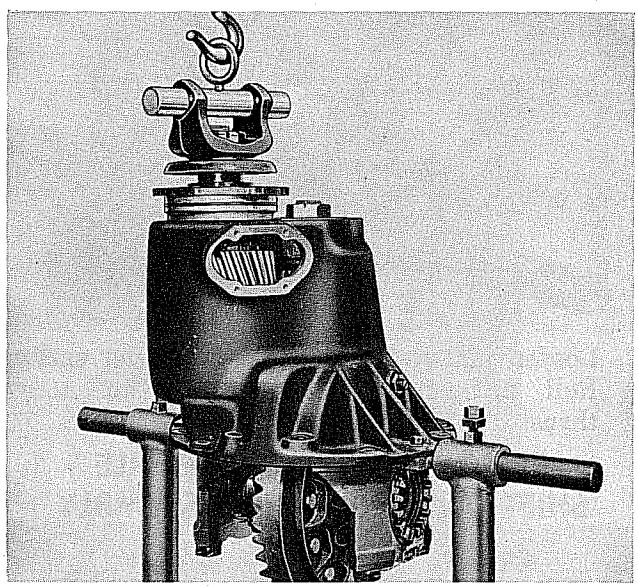
B. Remove pinion nut cotter key, if used, and loosen pinion nut. (Do not remove pinion nut at this time.)



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.

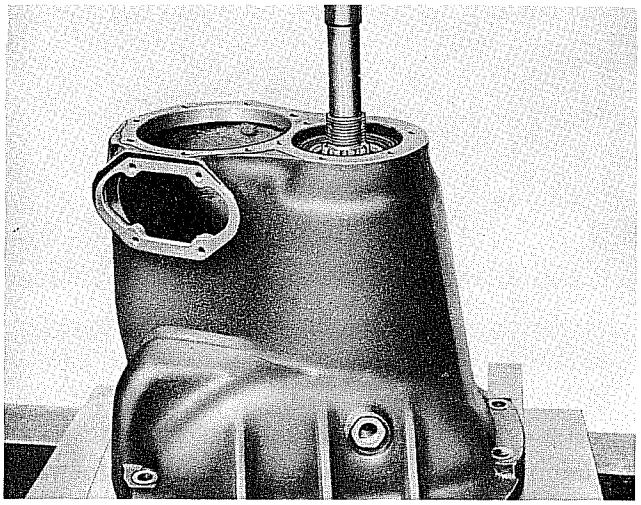
F. Lightly tap housing with rawhide hammer to free assembly. It may be necessary to rotate the input shaft to align one flat at rear of inter-axle differential case with the transfer gear.

REMOVE AND DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

A. Follow procedures D through H on pages 24 and 25 under "Remove Differential and Gear Assembly".

B. Follow procedures A through E on page 25 under "Disassemble Differential Case and Gear Assembly".

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.

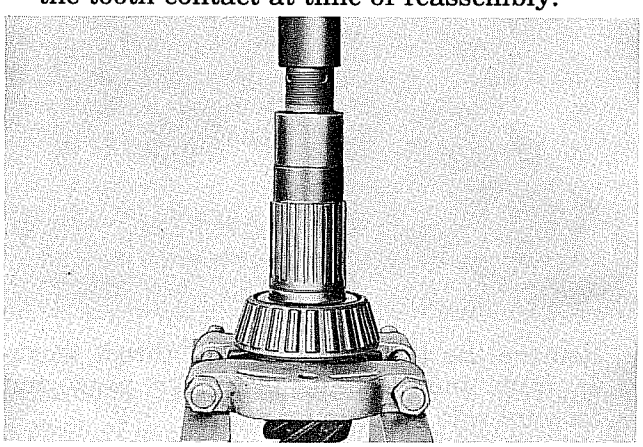
C. Press the pinion shaft through the forward pinion bearing cone and drive gear.

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.)

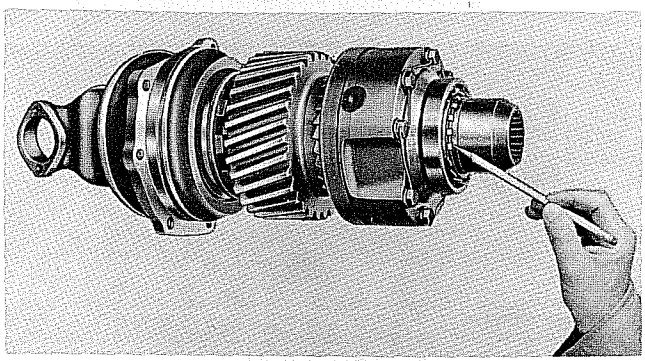
G. Wire the shim pack together to facilitate reassembly.
NOTE: This shim pack controls the depth of pinion in relation to the hypoid gear and it may be increased or decreased to change the tooth contact at time of reassembly.



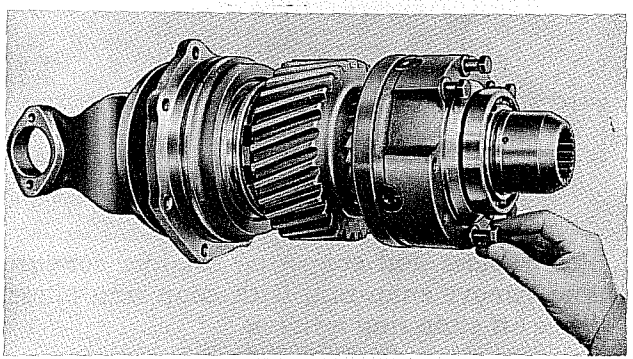
H. If necessary to remove the rear pinion bearing, use a suitable puller that bears against bearing inner race or press off with a fixture that supports inner race.

DISASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLIES EMPLOYING BALL AND STRAIGHT ROLLER BEARINGS

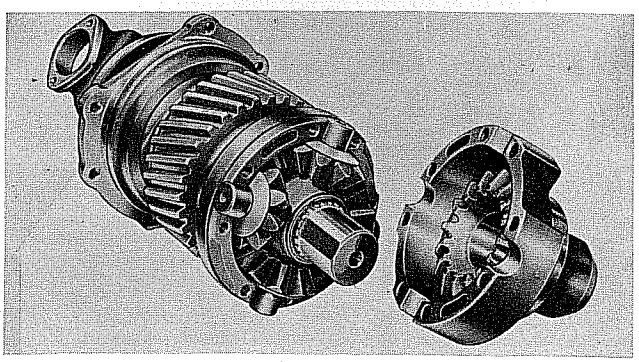
For units employing taper bearings refer to page 48.



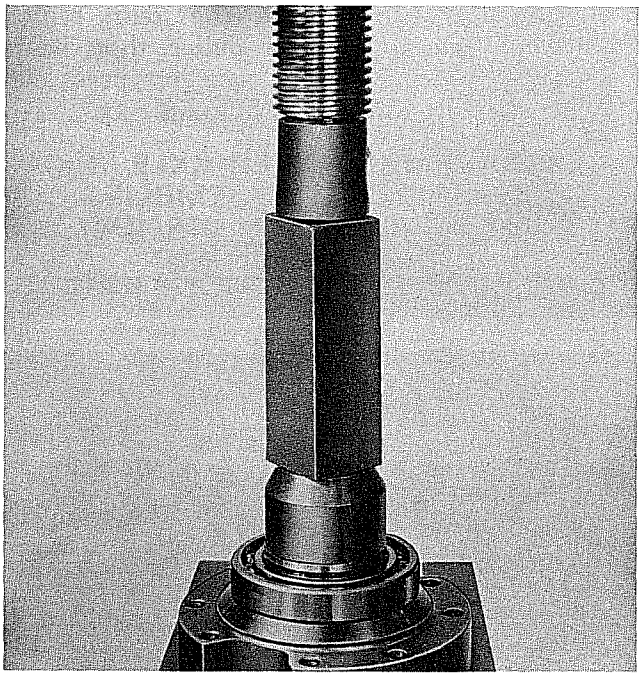
A. If a snap ring is used, fold out the tabs on the rear bearing snap ring retainer and remove snap ring with snap ring pliers. Remove snap ring retainer.



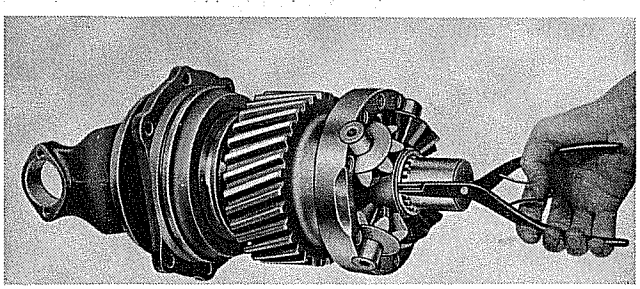
B. Cut and remove the inter-axle case bolt locking wire, if used. Remove the case bolts and hardened washers. Center punch each case half before separating to insure correct alignment in reassembly.



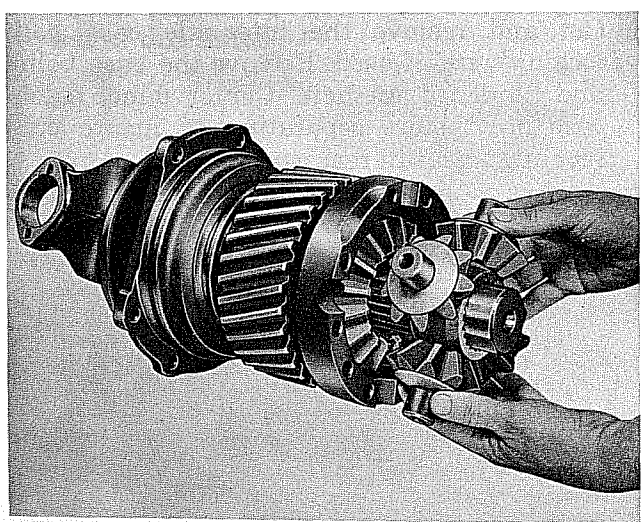
C. Separate the inter-axle differential case halves.



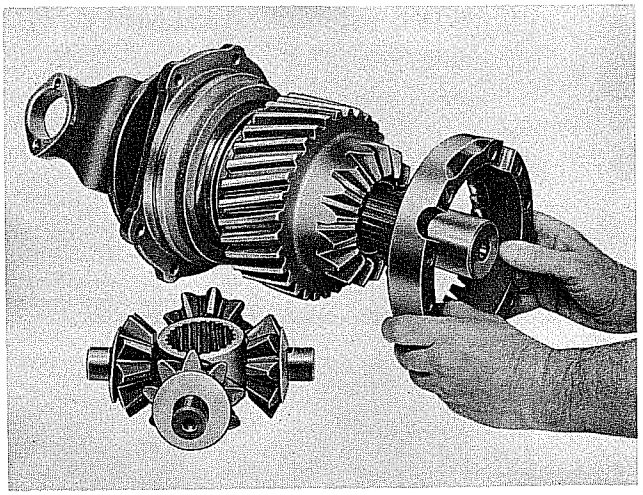
D. Set the rear case half up on press plates and press the rear side gear from bearing.



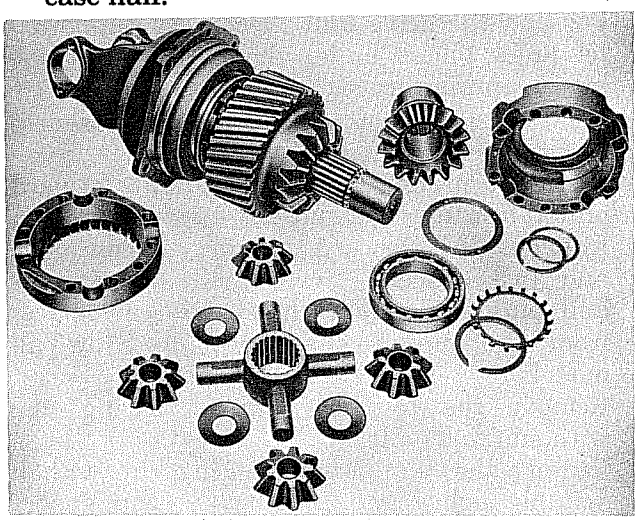
E. Push spider and snap ring retainer forward and remove snap ring with snap ring pliers. Slide off snap ring retainer.



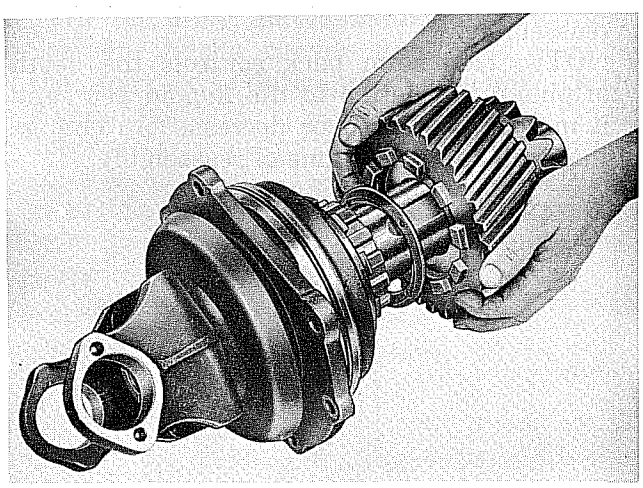
F. Slide spider, pinion and thrust washer assembly off shaft splines.



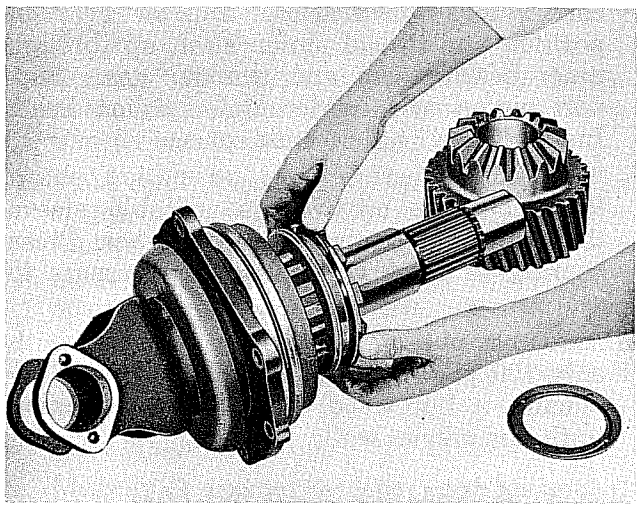
G. Remove the inter-axle differential forward case half.



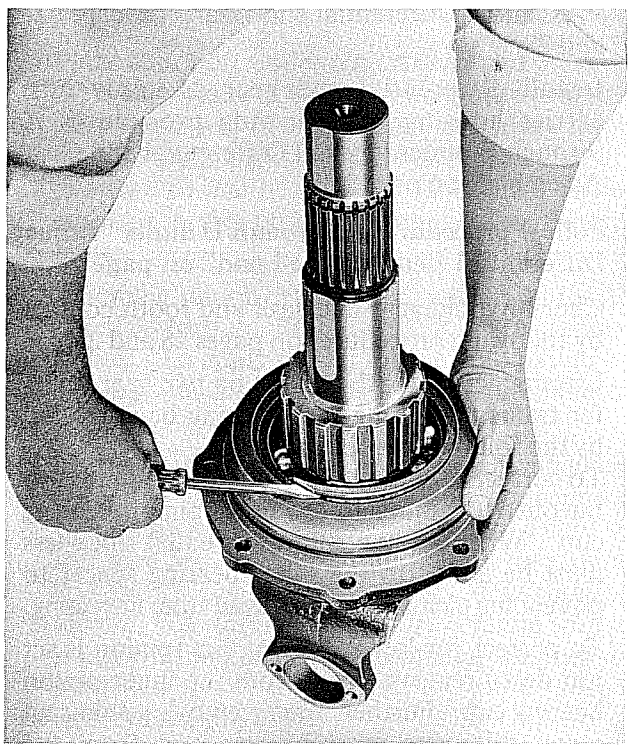
H. Separate the inter-axle differential pinions and thrust washers from spider.



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

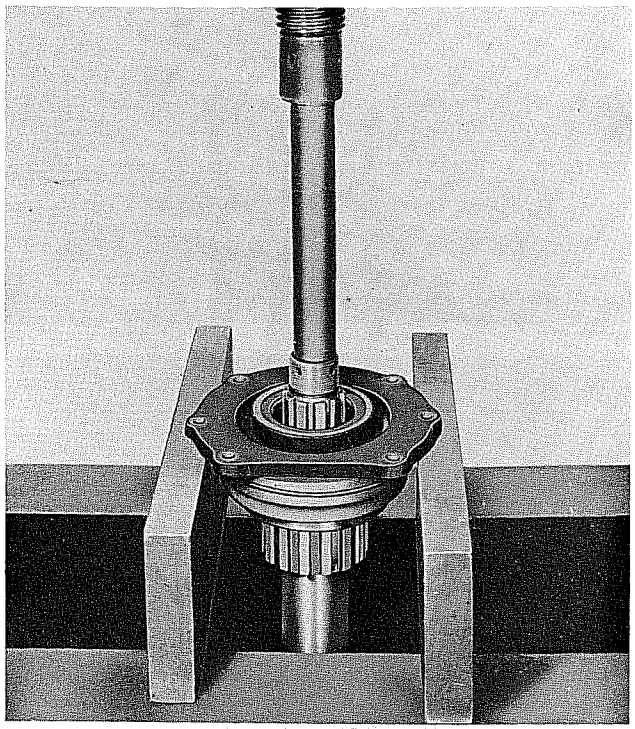


J. Slide off the clutch collar.



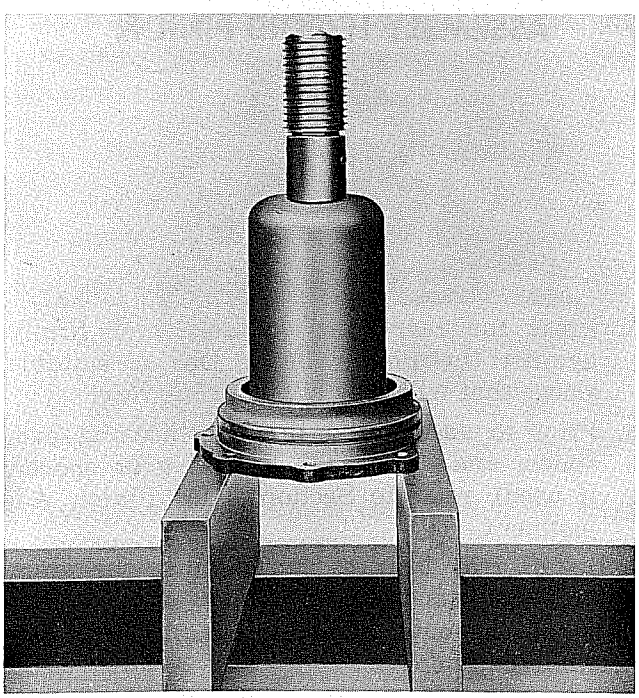
K. If a radial bearing rear snap ring is used, remove snap ring from bearing cage.

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

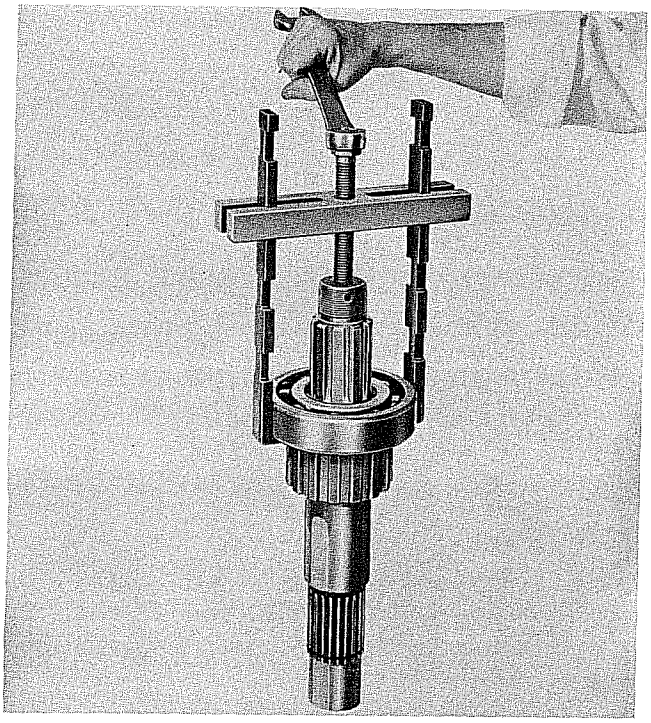


M. Tap or press shaft and radial bearing assembly from cage. Remove the radial bearing spacer, if used.

N. Remove snap ring if used, from cage.



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



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

Q. Refer to Section 2 for cleaning, inspection and component repairs.

REASSEMBLE DRIVE UNIT

ASSEMBLY 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), refer to Section 2 for Pinion Adjustment.

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 AND INSTALL DIFFERENTIAL AND RING GEAR ASSEMBLY

A. Assemble differential and ring gear assembly by following procedures A through H under "Assemble Differential and Gear" on pages 27 and 28.

B. Install differential and gear assembly into carrier housing by following procedures A through E under "Install Differential and Gear Assembly" on page 28.

C. Follow procedures A through D under "Adjust Differential Bearing Pre-Load" on page 28.

D. Check hypoid gear backlash and tooth contact by following procedures on pages 28 and 29.

E. Unsatisfactory tooth contact on two gear transfer trains (overhung pinion) may be corrected by the following procedures:
To correct for high tooth contact (pinion is too far out) add shims to the inner pinion bearing cup. When adding shims, an equal thickness must be added to the outer bearing spacer to prevent the pinion bearing preload from increasing.

To correct for low tooth contact (pinion is set too deep) remove shims from the inner pinion bearing cup. Further, when removing shims an equal thickness must be removed from the outer bearing spacer to prevent the pinion bearing preload from decreasing.

CHECK FOR PINION BEARING PRELOAD

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 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 preload.

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. Refer to Section 4 on Torque Values. To apply proper torque hold pinion by placing a hardwood block between pinion teeth and a carrier wall.

I. Check for proper pinion bearing preload of 5-25 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 25 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 preload 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 preload.
2. Adjust for hypoid gear backlash an check for tooth contact.

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

For units employing taper bearings refer to page 48.

A. Install the input forward radial bearin snap ring into cage.

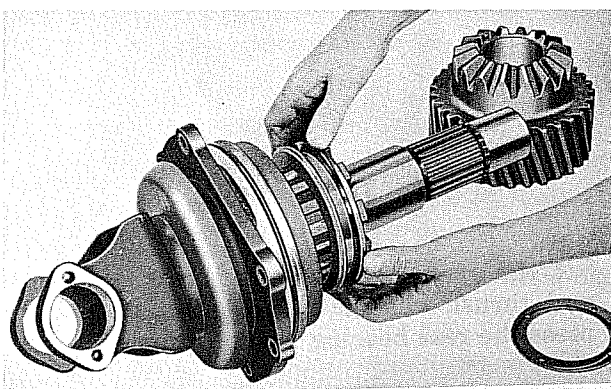
B. Press the input shaft oil seal into cag from forward side, flush with snap ring.

C. Press the forward radial bearing on inpu shaft with suitable sleeve bearing again inner race.

D. Position the input shaft radial bearing int the cage bore flush with forward snap rin and install the rear radial bearing sna ring.

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

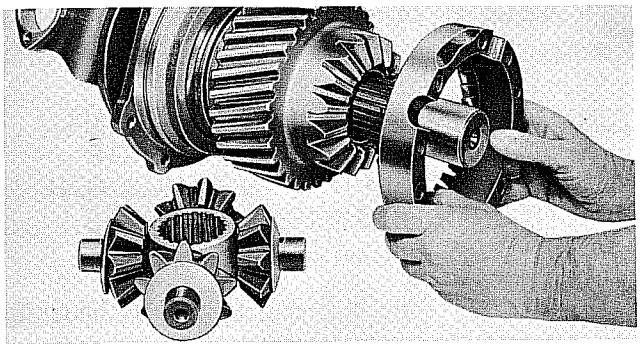
E. Install yoke or flange on splines and insta washer, if used, and nut. Nut may be ru up on threads only sufficient for handlin assembly in chain fall and later tightene to correct torque when assembly is moun ed into housing.



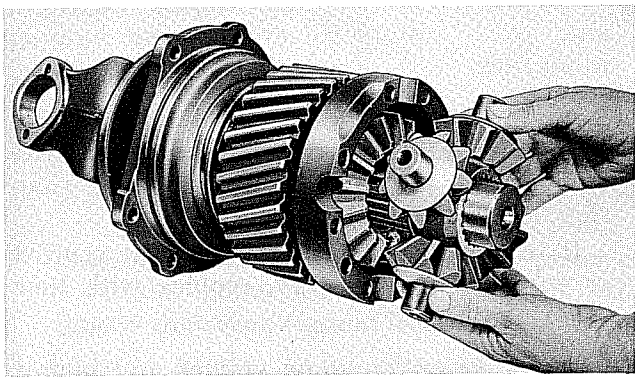
F. Install the dog clutch collar on input sha splines with the smooth side next to cage.

G. Install the transfer gear thrust washer an transfer gear.

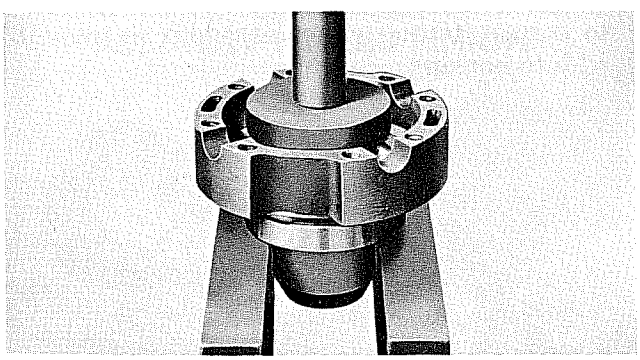
H. Position the inter-axle differential forwa case half over the forward side gear an assemble the spider pinions and thru washers on spider.



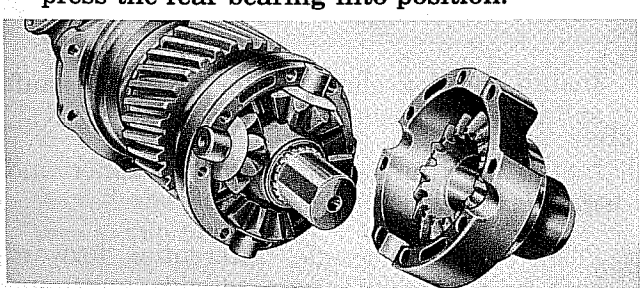
I. Locate the assembly on input shaft splines. Turn the case half so that trunnion holes align with trunnions and slide assembly into case half.



J. Install the spider retainer and snap ring.



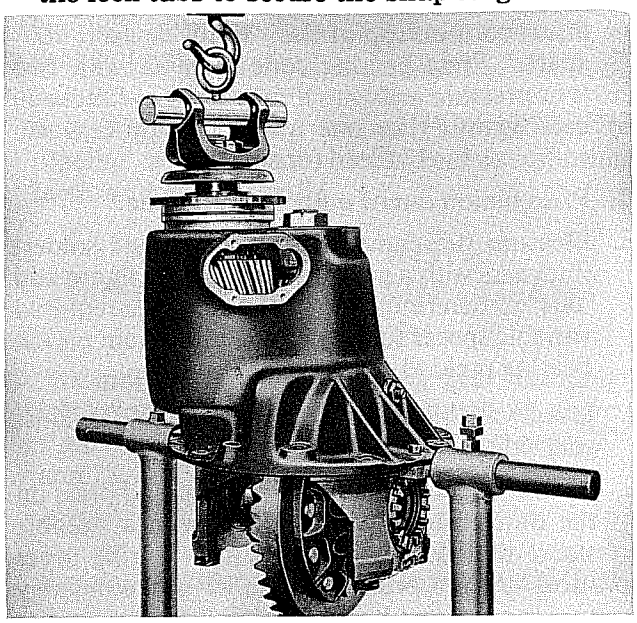
K. Set the rear case half and rear side gear and thrust washer up on press plates and press the rear bearing into position.



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 used. Refer to Section 4.

N. Install snap ring tab lock and snap ring, if used. If snap ring is employed, fold down the lock tabs to secure the snap ring.



O. Position the carrier housing with pinion and differential assembly upright in the carrier stand. By use of chain fall,lower the inter-axle differential and input shaft assembly against the case.

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 capscrews. Tighten capscrews to specified torque.

Q. Tighten the input shaft or flange nut to specified torque and install cotter key, if used.

R. Tighten the pinion nut to specified torque and install cotter key, if used.

S. Clean the pinion cover gasket surfaces on both the carrier and pinion cover. Dry both surfaces thoroughly and apply a 1/8" diameter bead of silicone room temperature vulcanizing (RTV) gasket material (liquid gasket) to the pinion cover face of the carrier. Apply the gasket material to one surface only and around all fastener holes. Refer to page 82 for instructions.

T. Assemble the pinion cover *immediately* to carrier to permit the silicone RTV gasket material to spread evenly. Secure cover to carrier with capscrews and hardened flat washers. Tighten capscrews to specified torque. Refer to Section 4.

INSTALL THRUST SCREW OR BLOCK

A. Remove carrier from stand and position with back face of hypoid or spiral bevel gear upward.

B. Remove thrust screw and lock nut.

NOTE: *Current carrier designs employ only the thrust screw, which replaces the thrust screw and thrust block assembly.*

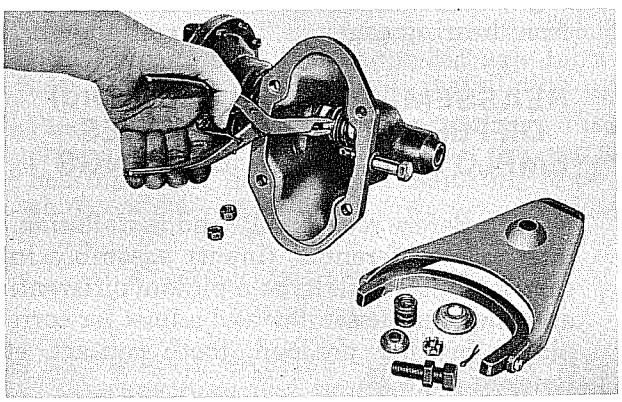
C. If a thrust block is employed, place thrust block on rear face of hypoid gear and rotate gear until the hole in the thrust block is aligned with the thrust screw hole.

D. Install thrust screw and lock nut, and tighten thrust screw sufficiently to locate thrust block, if used, firmly against back face of hypoid gear.

E. To secure the correct adjustment of .010"-.015" clearance, loosen adjusting nut or thrust screw 1/4 turn and lock securely with nut.

F. Recheck to assure minimum clearance of .010" during full rotation of bevel gear.

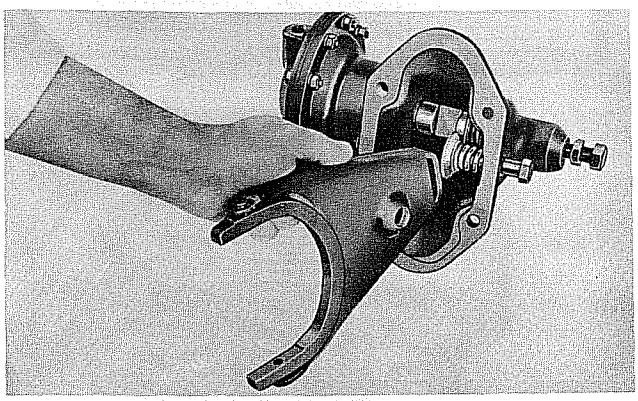
ASSEMBLE AND INSTALL SHIFT UNIT HOUSING AND DIAPHRAGM ASSEMBLY



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, if used. Shim as required to obtain slight compression on spring.

E. Position the shift and housing assembly into the carrier assembly against a new gasket or silicone RTV gasket material. Refer to page 44, item S.

ADJUST SHIFT SHAFT

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 ½ revolution more to center fork in groove.
5. Tighten lock nut to specified torque.

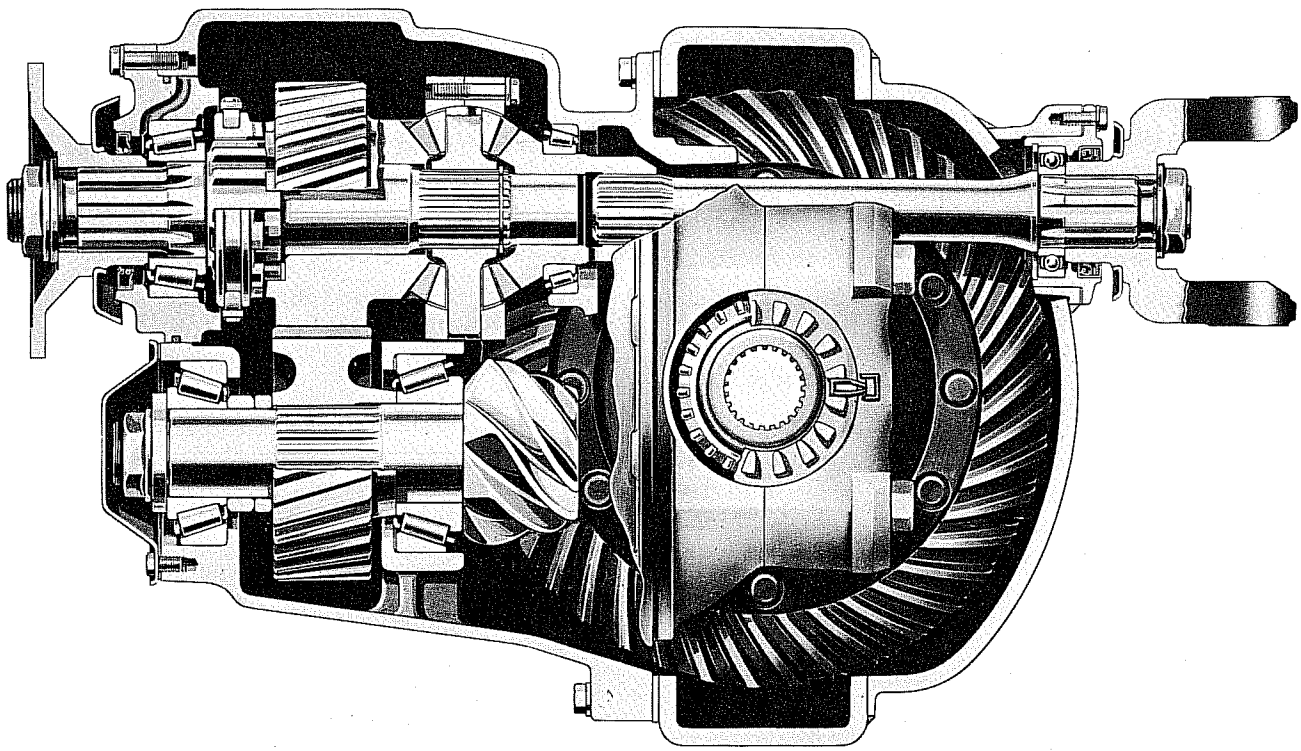
ASSEMBLE DRIVE UNIT

A. Follow procedures A through D under "Assemble Drive Unit" on page 33.

B. Connect universal at input shaft.

C. Install axle shafts.

CURRENT MODEL TYPE — RHD & SHD



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 page 28.

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 .001" to the gap measurement (.001" + 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 end play must be .001"-.007". If end play 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.

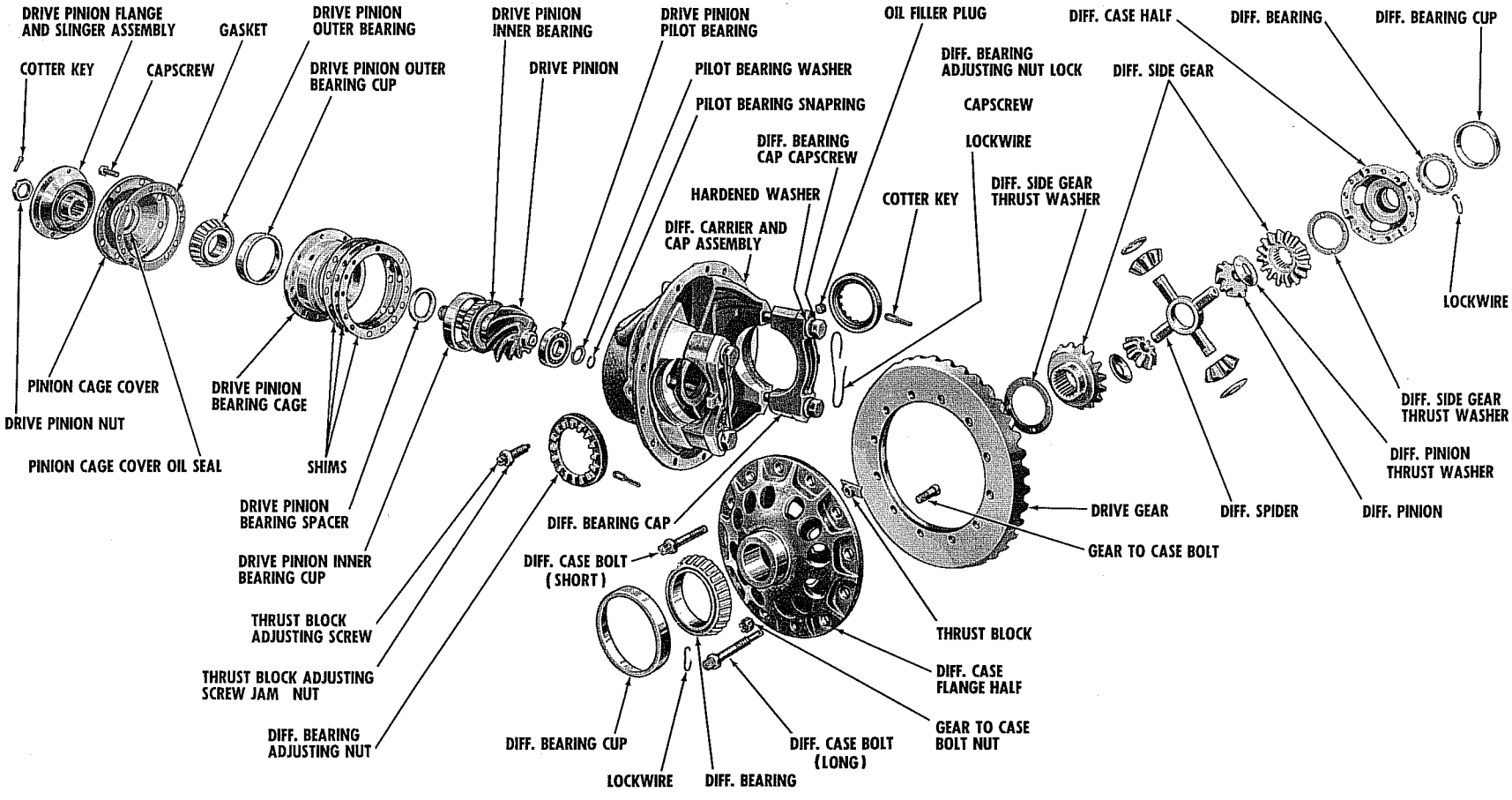
P: Using the 3 piece installation tool, draw the yoke or flange onto the input shaft.

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 34 under "Install Yokes" for yoke or flange installation procedures.

R. Continue with reassembly, refer to page 46, items S and T.

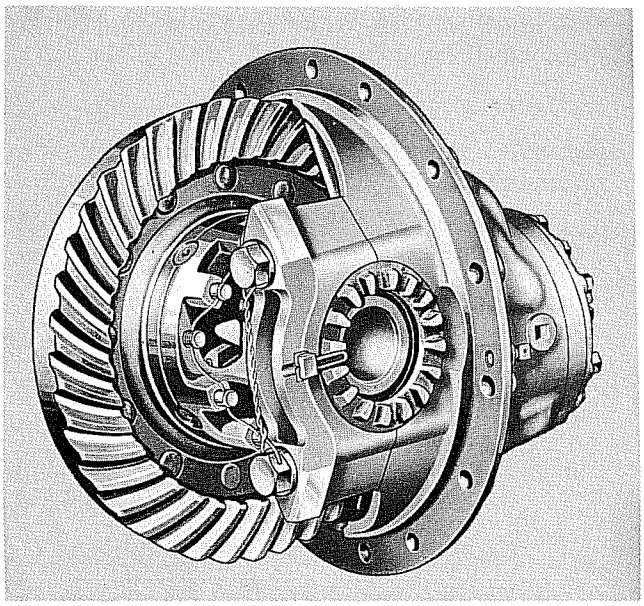
TANDEM REAR/REAR OR SINGLE REAR DRIVE UNIT



SINGLE-REDUCTION DRIVE UNITS SINGLE AXLES AND REAR/REAR TANDEM UNITS

(MODEL TYPES — 100 SERIES SINGLE AXLES & LHR, QHR, RHR AND SHR REAR/REAR TANDEM AXLE TYPES)

CARE AND MAINTENANCE



SINGLE-REDUCTION CARRIER

The Rockwell Single-reduction Final Drive employs a heavy duty spiral bevel or hypoid pinion and gear. The differential and gear assembly is mounted on tapered roller bearings. The straddle mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust and a third bearing behind the pinion teeth to carry the radial load.

Single-Reduction Final Drives are available in a wide range of gear ratios and sizes to cover most operating conditions.

REMOVE AND DISASSEMBLE DRIVE UNIT

A. Refer to "Remove Drive Unit from Housing" on page 21, and follow procedures A through D. Then, follow procedures J through L.

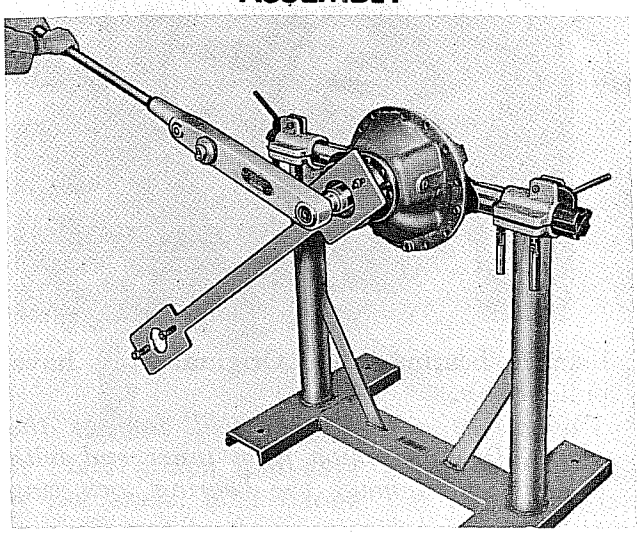
B. Place carrier in suitable holding fixture.

REMOVE AND DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

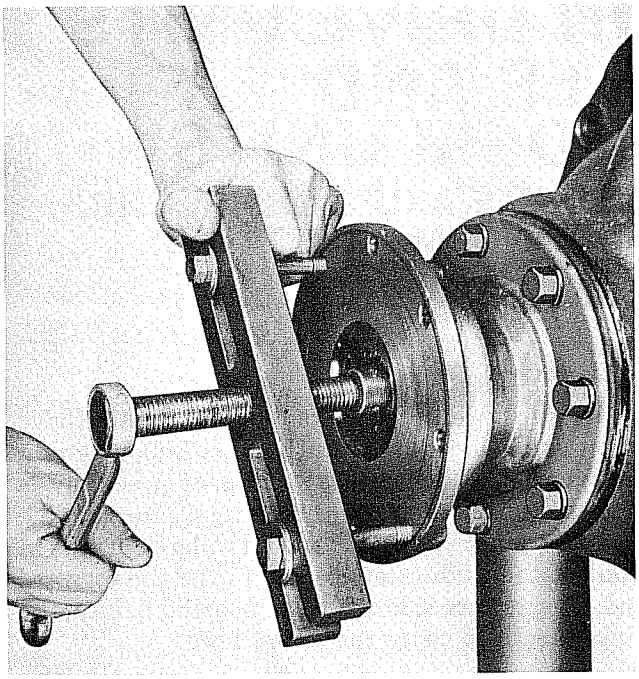
A. Follow procedures D through H on pages 24 and 25 under "Remove Differential and Gear Assembly".

B. Next, follow procedures A through E on page 25 under "Disassemble Differential Case and Gear Assembly".

REMOVE PINION AND CAGE ASSEMBLY



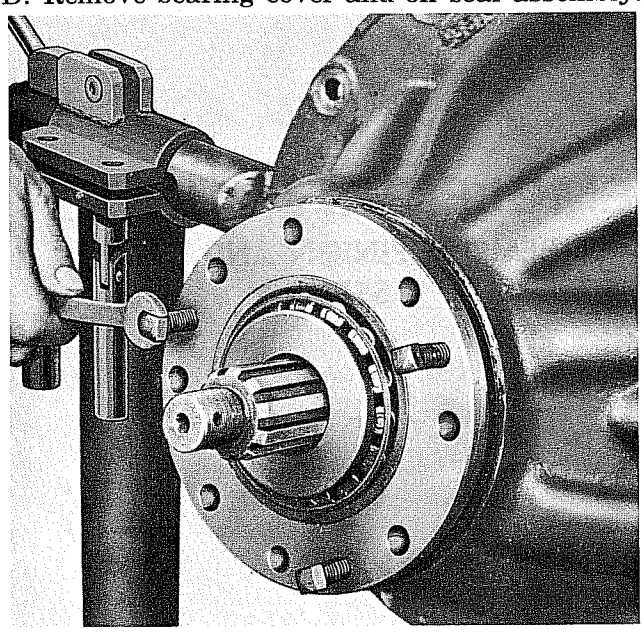
A. Hold flange or yoke with suitable tool and remove pinion shaft nut and washer.



B. Remove flange or yoke with a suitable puller. *Driving the flange off will cause exessive runout.*

C. Remove pinion cage stud nuts or cap screws.

D. Remove bearing cover and oil seal assembly.



E. Remove bearing cage. Original may have puller holes.
The use of a pinch bar will damage the shims. Driving pinion from inner end with a drift will damage the bearing lock ring groove.

F. Wire shim pack together to facilitate adjustment on reassembling.

DISASSEMBLE PINION AND CAGE ASSEMBLY

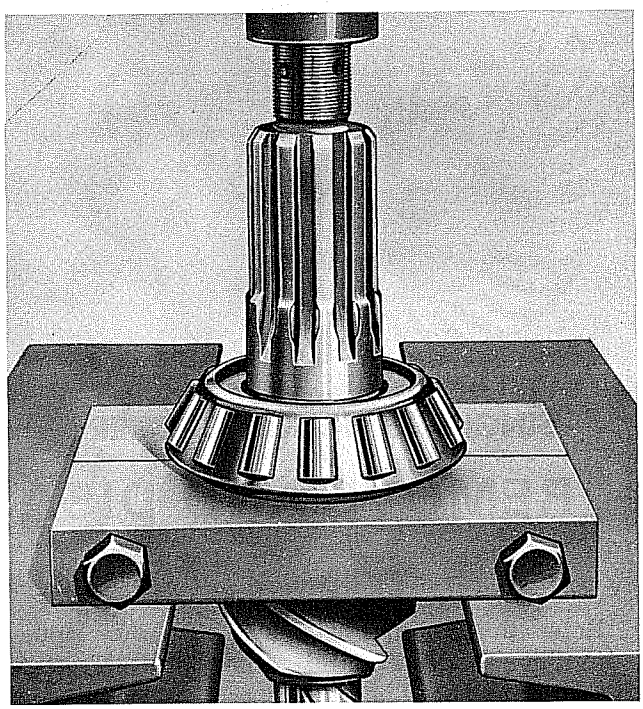
Both splined and tapered pinion shafts are used in single reduction carriers. Where the tapered shaft is used, the thrust bearings are adjusted by means of adjusting screws and lock nuts or thrust screws. On the splined shaft this adjustment is secured with a selective spacer or spacer combination.

Splined Shaft

A. Tap shaft out of cage with soft mallet or press shaft from cage.

B. Remove outer bearing from cage.

C. Remove spacer or spacer combination from pinion shaft.



D. If necessary to replace rear thrust bearing or radial bearing, remove with suitable puller.

E. Remove oil seal assembly from bearing cover.

Tapered Shaft

A. Straighten lock washer and remove lock nut, washer, adjusting nut and thrust washer.

B. Tap pinion out of cage with soft mallet or press shaft from cage.

C. Remove bearing from cage.

D. Remove bearings from shaft with suitable puller if necessary.

E. Remove oil seal assembly from bearing cover.

F. Refer to Section 2 for cleaning, inspection and component replacement.

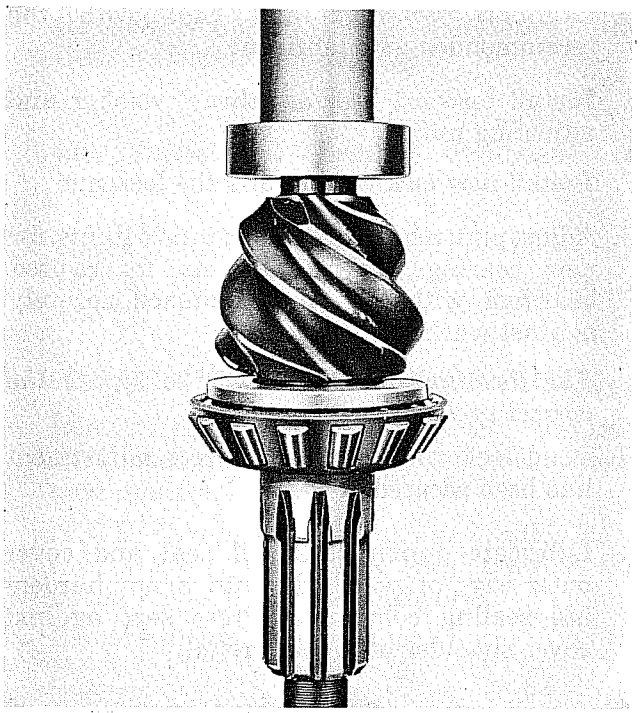
REASSEMBLE DRIVE UNIT

REASSEMBLE PINION AND CAGE ASSEMBLY

Splined Shaft

A. If new cups are to be installed, press firmly against pinion bearing cage shoulders.

B. Lubricate bearings and cups with the recommended axle lubricant.



C. Press rear thrust and radial bearings firmly against the pinion shoulders with a suitable sleeve that will bear only on bearing inner race.

D. Install radial bearing lock ring and squeeze ring into pinion shaft groove with pliers.

E. Insert pinion and bearing assembly in pinion cage and position spacer or spacer combination over pinion shaft.

F. Press front bearing firmly against spacer.

G. Rotate cage several revolutions to assure normal bearing contact.

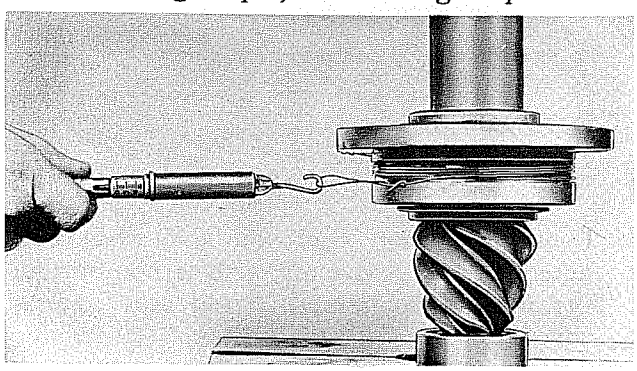
H. While in press under pressure, check bearing preload torque. Wrap soft wire around cage and pull on horizontal line with pound scale. If a press is not available, the pinion nut may be tightened to the correct torque and preload checked.

The correct pressures and torque for checking pinion bearing preload are as follows:

HYPOID PINION PRELOAD TORQUE VALUES

PINION SHAFT THREAD SIZE	PRESSURE REQUIRED TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED (FOR FASTENERS USING LOCKWIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED (FOR FASTENERS NOT USING LOCKWIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD
7/8"—20	11 tons	175- 200 lb. ft.	200- 275 lb. ft.
7/8"—20	6 tons (elastic nut)	200- 275 lb. ft.	—
1"—20	15 tons	300- 400 lb. ft.	300- 400 lb. ft.
1¼"—18	27 tons	700- 900 lb. ft.	700- 900 lb. ft.
1½"—12	27 tons	800-1100 lb. ft.	800-1100 lb. ft.
1½"—18	27 tons	800-1100 lb. ft.	800-1100 lb. ft.
1¾"—12	25 tons	—	900-1200 lb. ft.
2"—12	25 tons	800-1100 lb. ft.	1200-1500 lb. ft.

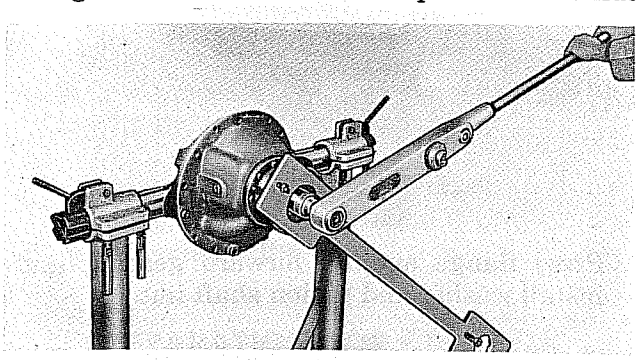
Use rotating torque, not starting torque.



If rotating torque is not within 5-25 lb. ins. for new bearings or 5-15 lb. ins. for re-used bearings, use thinner spacer to increase or thicker spacer to decrease preload.

Example: Assuming pinion cage diameter to be 6 inches, the radius would be 3 inches and with 5 pounds pull would equal 15 pound inches preload torque.

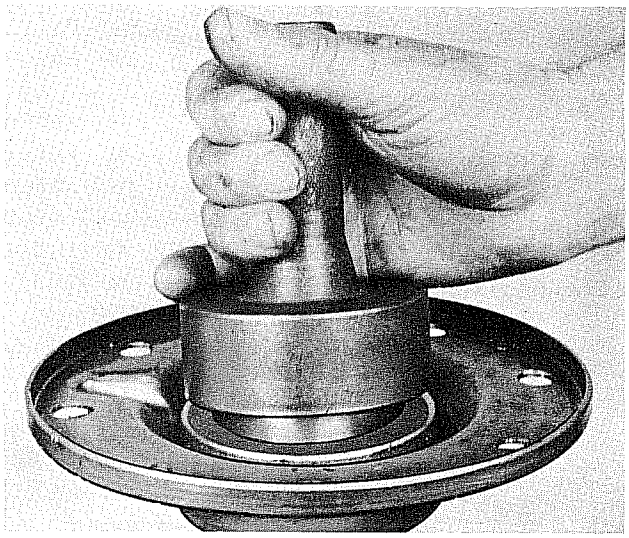
I. Press flange or yoke against forward bearing and install washer and pinion shaft nut.



J. Place pinion and cage assembly over carrier studs, hold flange and tighten pinion shaft nut to the correct torque. The flange must be held with a suitable tool or fixture to tighten nut.

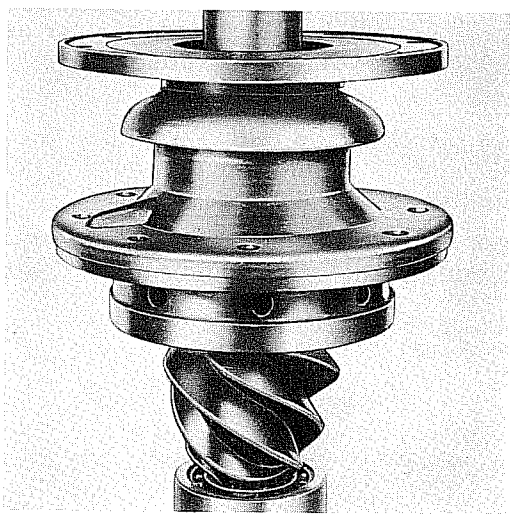
K. Recheck pinion bearing preload torque. If rotating torque is not within 5-25 lb. ins. for new bearings or 5-15 lb. ins. for re-used bearings, repeat the foregoing procedure.

L. Hold flange and remove pinion shaft nut and flange.



M. Lubricate pinion shaft oil seal and cover outer edge of seal body with a non-hardening sealing compound. Press seal against cover shoulder with seal driver.

N. Install new gasket and bearing cover.



O. Press flange against forward gearing and install washer and pinion shaft nut.

P. Tighten to the correct torque. If a drilled or castellated fastener is employed install a cotter key. Refer to Section 4 for Torque Values.
Do not back off to align cotter key holes.

TAPERED SHAFT

A. Press rear thrust and radial bearings firmly against the pinion shaft shoulder.

B. Install radial bearing lock ring and squeeze ring into pinion shaft groove with pliers.

C. If new cups are to be installed, press firmly against pinion cage shoulders.

D. Lubricate bearings and cups with the recommended axle lubricant.

E. Install forward bearing, thrust washer and adjusting nut.

F. Install new lock washer and the lock nut.

G. Adjust pinion bearing preload to 5-25 lb. ins. for new bearings, or 5-15 lb. ins. for re-used bearings with lock nut tightened securely against washer.

The lock nut must be tight to secure the correct preload.

H. Bend lock washer when correct adjustment has been secured.

I. Lubricate pinion shaft oil seal and cover outer edge of seal body with a non-hardening sealing compound. Press seal against cover shoulder with seal driver.

J. Install new gasket and bearing cover. Cover should be carefully installed to prevent cutting seal on keyway.

K. Install key, press flange on taper and install washer and pinion shaft nut.

L. Tighten to the correct torque. If a drilled or castellated fastener is employed install a cotter key. Refer to Section 4 for Torque Values.
Do not back off to align cotter key holes.

INSTALL PINION AND CAGE ASSEMBLY

A. Install correct shim pack. *Locate thin shims on both sides for maximum sealing ability.*

B. Position pinion and cage assembly over studs and tap into position with soft mallet.

C. Install lock washers and stud nuts or cap screws. Tighten to the correct torque.

ASSEMBLE AND INSTALL DIFFERENTIAL AND RING GEAR ASSEMBLY

A. Assemble differential and ring gear assembly by following procedures A through H under "Assemble Differential and Gear Assembly" on pages 27 and 28.

B. Install differential and gear assembly into carrier housing by following procedures A through E under "Install Differential and Gear Assembly" on page 28.

C. Follow procedures A through D under "Adjust Differential Bearing Pre-Load" on page 28.

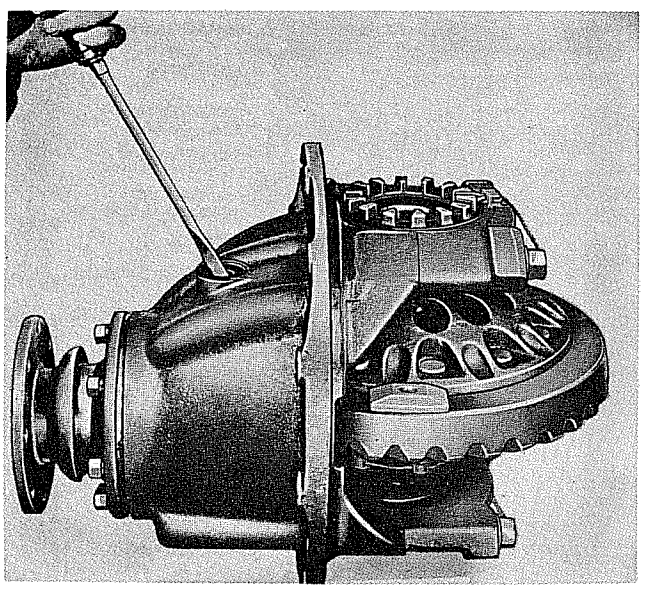
D. Check hypoid gear backlash and tooth contact by following procedures on pages 28 and 29.

INSTALL THRUST SCREW OR BLOCK

A. Remove carrier from stand and position with back face of hypoid or spiral bevel gear upward.

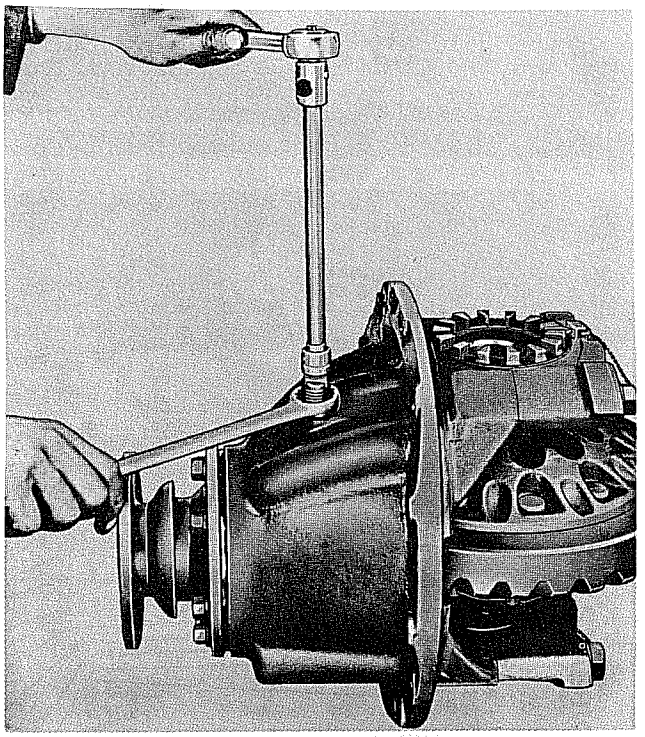
NOTE: *Current carrier designs employ only the thrust screw, which may replace the thrust screw and block assembly.*

B. Remove thrust screw and lock nut.



C. If a thrust block is employed, place thrust block on rear face of hypoid gear and rotate gear until the hole in the thrust block is aligned with the thrust screw hole.

D. Install thrust screw and lock nut, and tighten thrust screw sufficiently to locate thrust block, if used, firmly against back face of hypoid gear.



E. To secure the correct adjustment of .010"-.020" clearance, loosen adjusting screw (or thrust screw) 1/4 turn and lock securely with nut.

F. Recheck to assure at least a minimum clearance of .010" during full rotation of bevel gear.

ASSEMBLE DRIVE UNIT

A. Follow procedures A through D under "Assemble Drive Unit" on page 33.

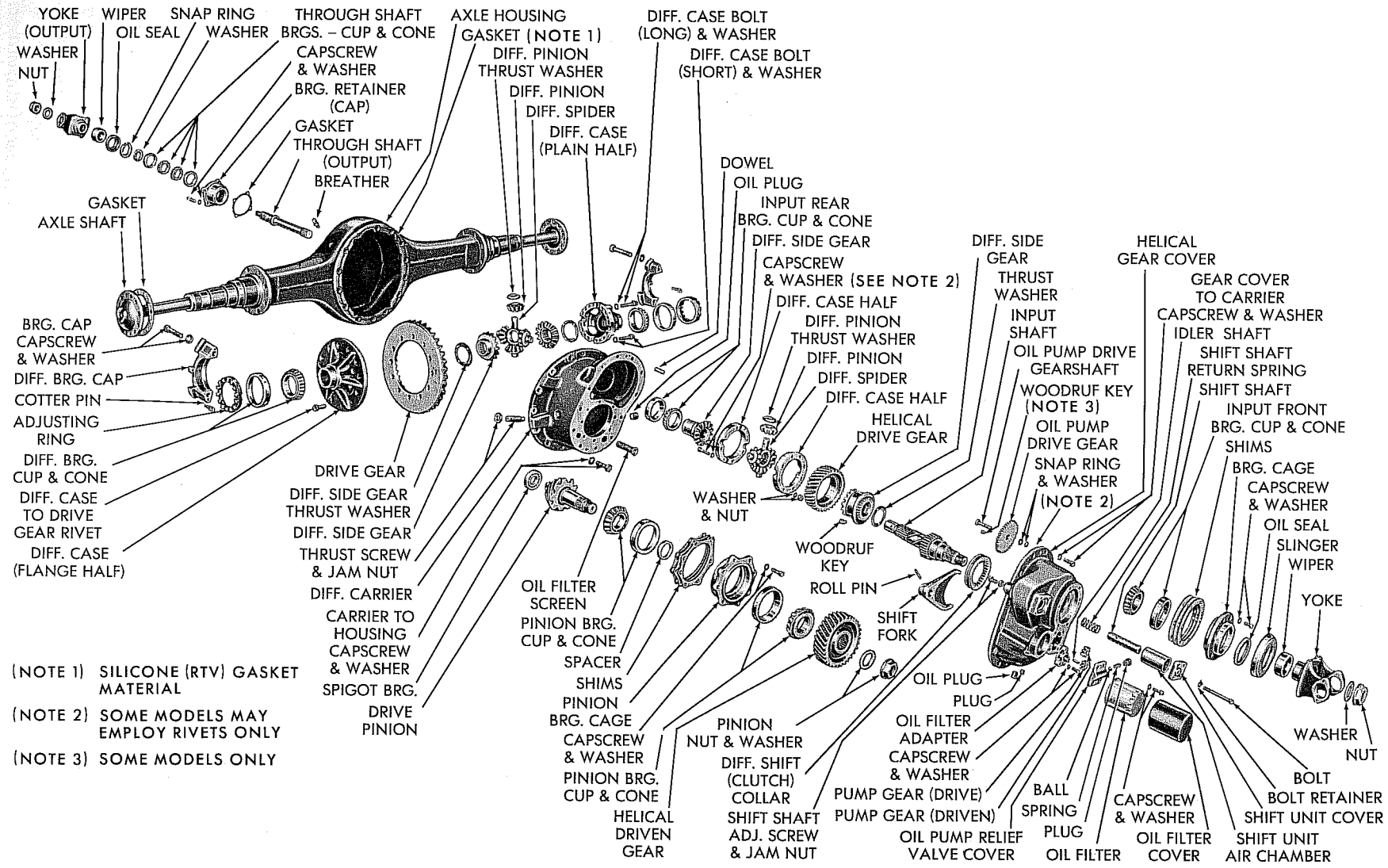
B. Connect universal at pinion shaft.

C. 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.

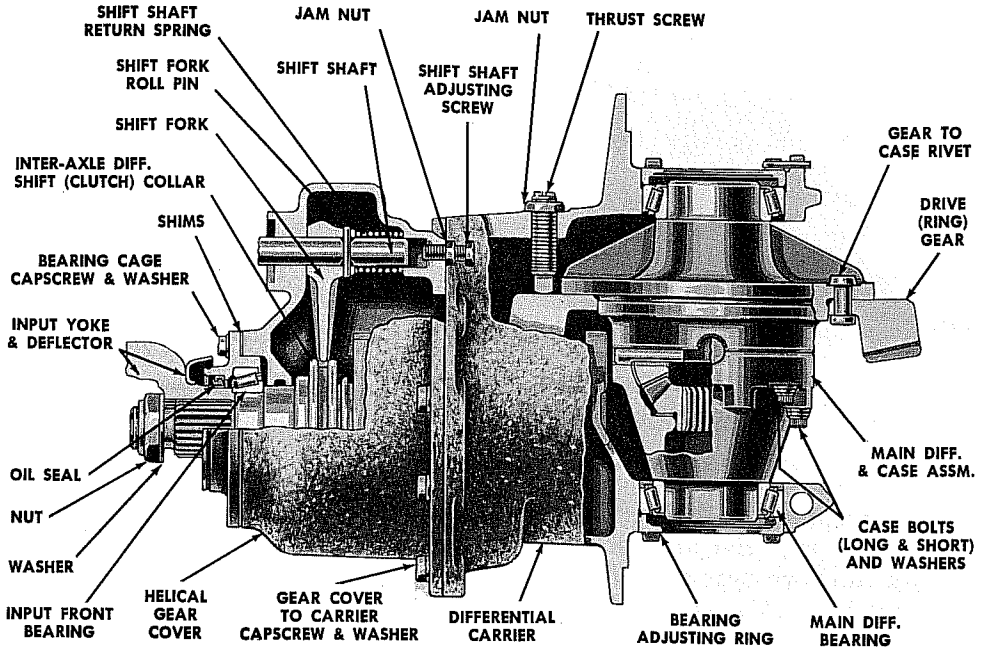
FORWARD/REAR AXLE



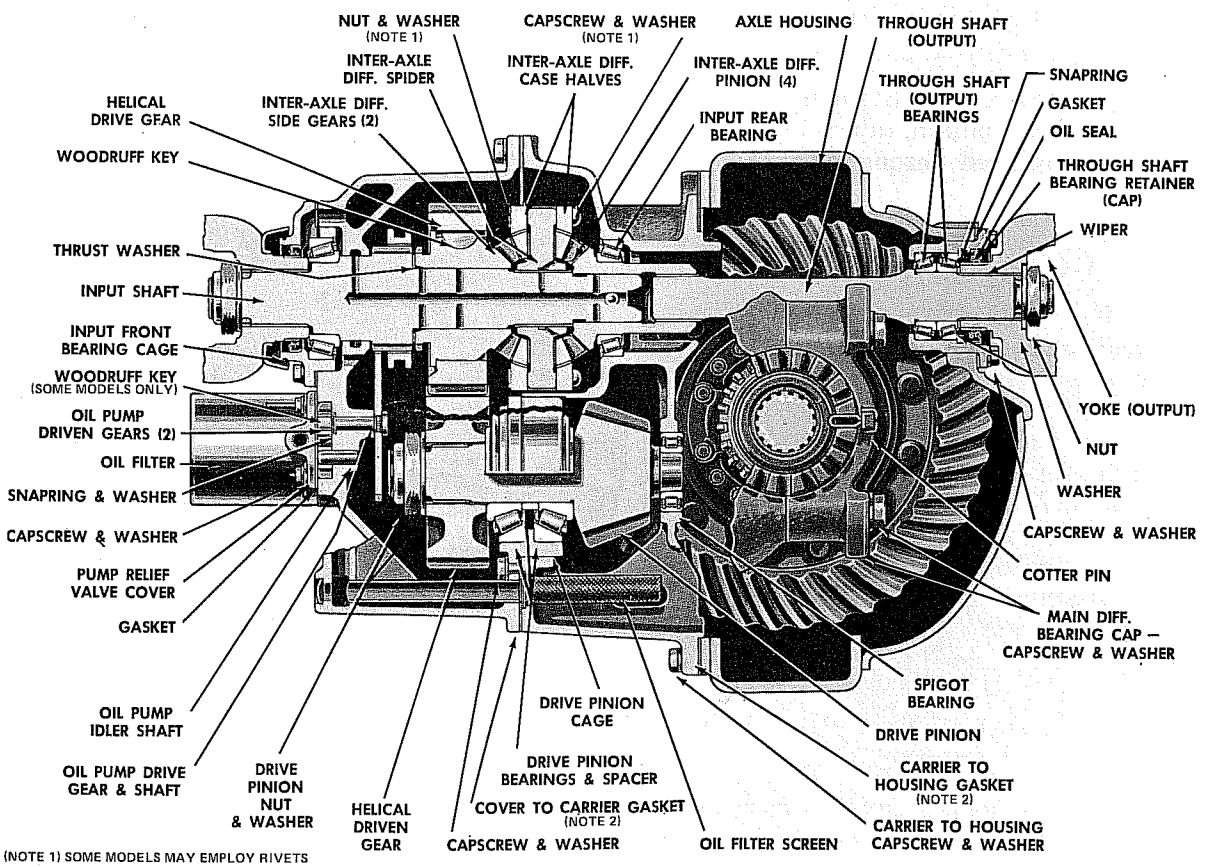
(NOTE 1) SILICONE (RTV) GASKET MATERIAL

(NOTE 2) SOME MODELS MAY EMPLOY RIVETS ONLY

(NOTE 3) SOME MODELS ONLY



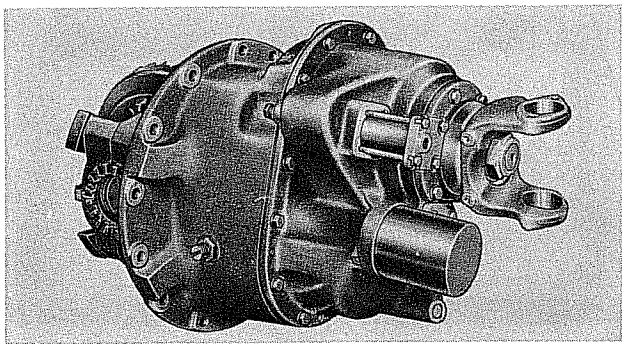
TOP VIEW



(NOTE 1) SOME MODELS MAY EMPLOY RIVETS INSTEAD OF CAPSCREWS & NUTS

(NOTE 2) SOME MODELS MAY EMPLOY A ROOM TEMPERATURE VULCANIZING GASKET MATERIAL

SIDE VIEW



SQHP Series Tandem

(QHP Forward/Rear Axle)

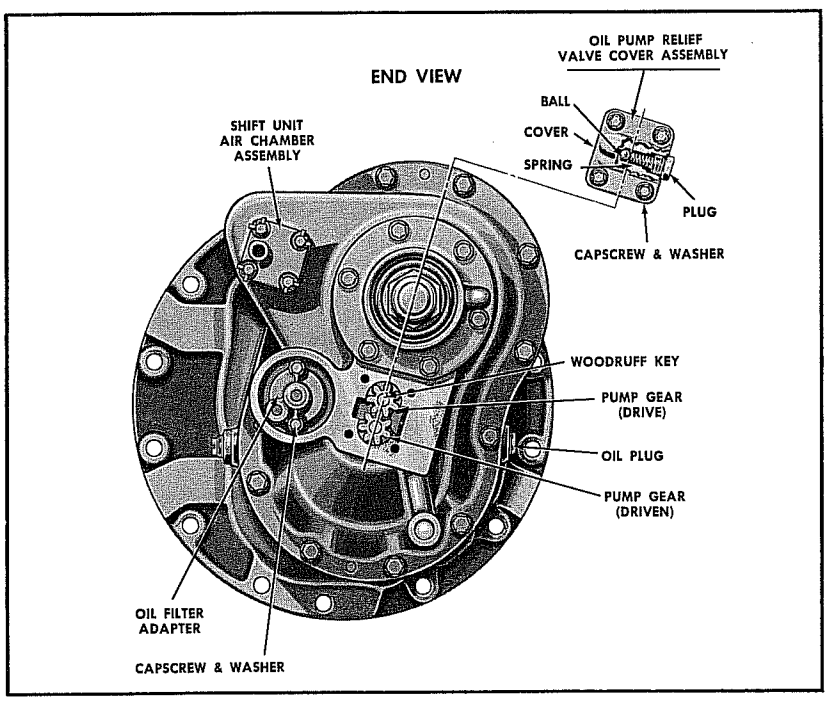
Front-mounted single reduction hypoid drive units employing hypoid gearing, through drive design, bevel type inter-axle differential two gear transfer-train and pump forced lubrication.

The forward rear drive units of SQHP series tandem axles built by Rockwell are front-mounted Single Reduction Through Drive Type Drive units employing a two-gear Transfer Train. These units incorporate hypoid reduction gears and bevel type gears in the main differential and inter-axle differential assemblies.

This unit differs from other Rockwell-Standard "Q" series front-mounted through drive type drive units by the omission of an idler gear assembly within the transfer gear train. Therefore, to accomplish correct rotation of the hypoid reduction gears* (drive gear and pinion), right hand gearing is employed as compared to left hand gearing used in units having a three gear transfer gear train.

Further, except for a straight roller bearing on the drive pinion, tapered bearings are employed throughout the unit.

Lubrication of this drive unit is accomplished by both the gravity feed (splash) and forced systems. To lubricate the inter-axle differential assembly a pump is employed to force oil through passage-ways and grooves in the helical gear cover and input shaft. The pump is driven by an integral gear on the input shaft which meshes with the pump drive gear. The gravity feed system is used to lubricate all other areas of the drive 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 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.

IMPORTANT: If milage on filter is 50,000 miles or more, discard and replace with 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. Refer to "Remove and Disassemble Drive Unit" on page 21 and follow procedures A through D.

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

E. 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.

F. 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.

G. Refer to J through L in the above mentioned section on page 21.

DISASSEMBLE DRIVE UNIT

REMOVE THROUGH-SHAFT, BEARINGS AND SEAL

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 reassembly.

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.

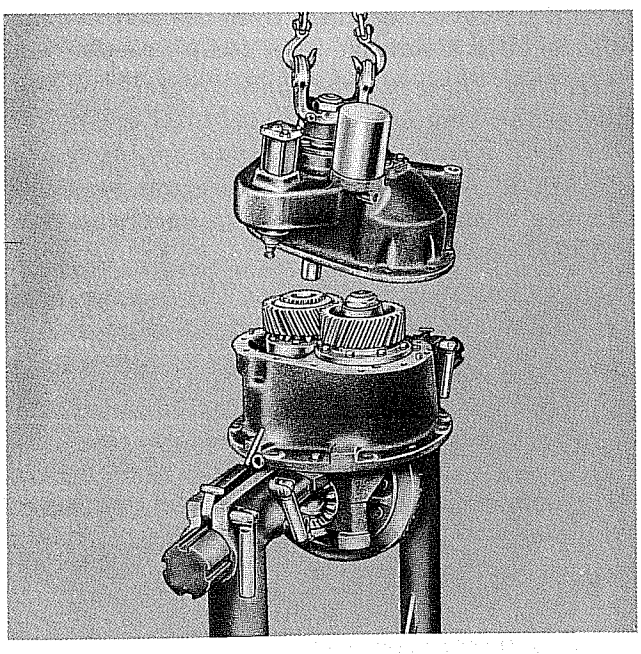
REMOVE HELICAL GEAR COVER ASSEMBLY

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. Use 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 capscrews 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.

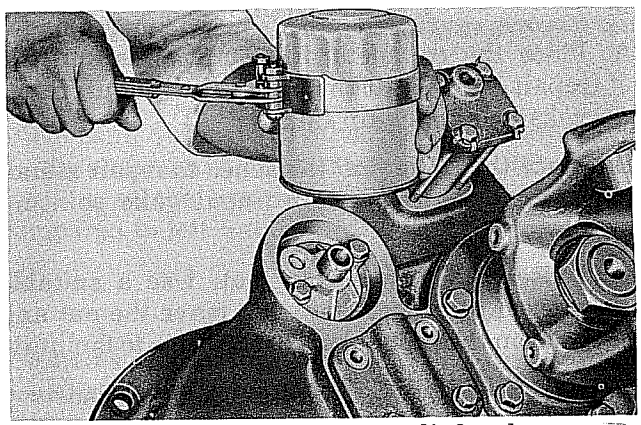
CAUTION: Do not use pry bars, chisels or wedges to loosen the cover — this will damage the cover and carrier flange mating surfaces.

F. After separating the parts, remove the cover to carrier gasket or gasket material and discard.

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 62.

REMOVE FILTER AND PUMP

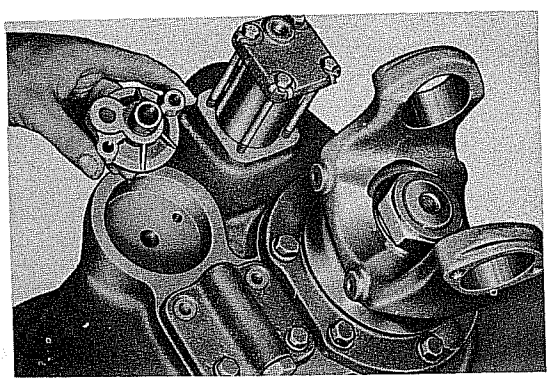
If the oil filter and cover have not been removed as yet, follow Item "A", otherwise continue with Item "B"



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

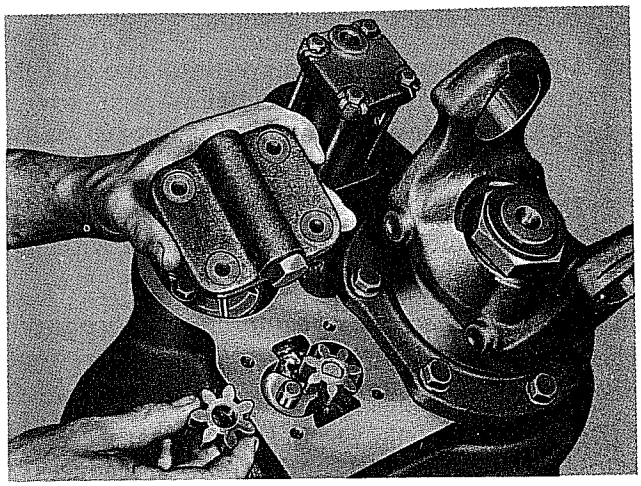
CAUTION: There may be approximately one pint of lubricant remaining within the filter. Be careful not to spill it when removing the filter.

IMPORTANT: If mileage on filter is 50,000 miles or more, discard and replace with new filter at reassembly.



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

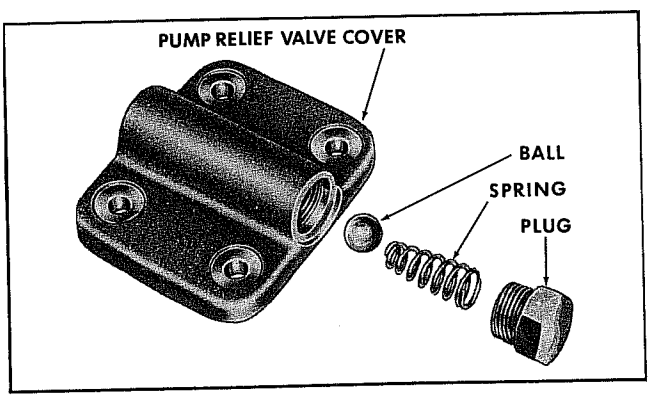
IMPORTANT: Check adapter casting and threads on filter mounting tube. If threads are striped or casting is cracked, discard and replace at reassembly.



C. Disassemble the oil pump relief valve cover assembly from the gear cover. Remove the remaining two capscrews and washers and lift the cover from pump.

D. Remove the two pump gears from their shafts within the pump cavity. Both gears are slip fits and can be removed by hand.

IMPORTANT: Be careful, one gear is mounted on the pump drive gear shaft and is attached by a small woodruff key. Current models do not employ a woodruff key. Care must be taken when removing the key.

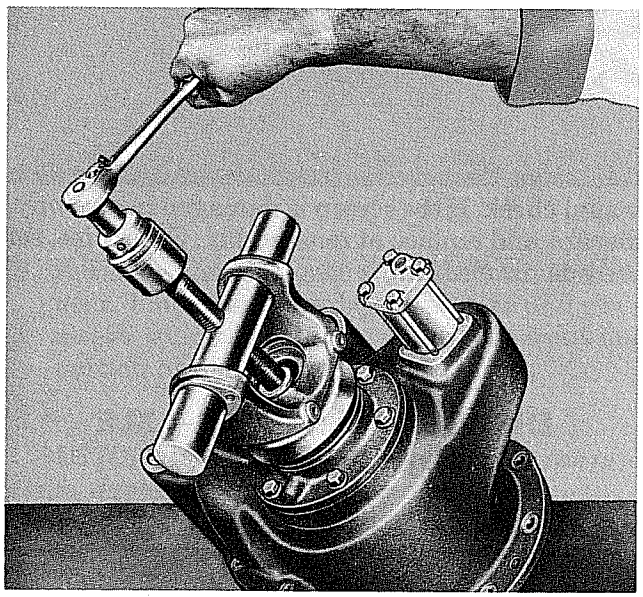


E. Disassemble the oil pump relief valve cover assembly by unthreading the hollow capscrew (plug) and removing the spring and ball from the cover cavity.

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 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. Using a rawhide mallet tap out the input shaft from the helical gear cover. Tap out shaft from the front (input) end.

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

NOTE: As the input shaft is tapped 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. Disassemble the input bearing cage from helical gear cover by removing cage to cover capscrews and lock washers. Remove bearing cage, bearing and shim pack. The bearing cup will remain in the cage.

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

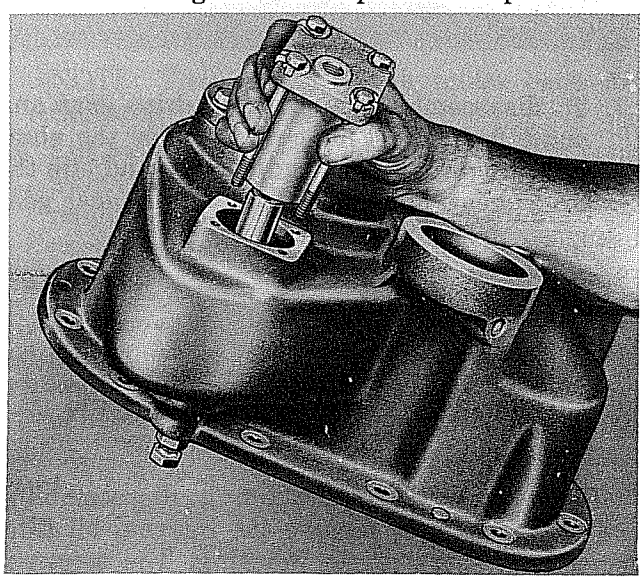
E. Remove the bearing cup from the cage by using a press or suitable puller.

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.

REMOVE SHIFT UNIT AND OIL PUMP DRIVE GEAR

NOTE: To remove the oil pump drive gear and shaft assembly, it is necessary to first remove the shift unit components. Use the following procedures, otherwise skip to page 62.

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.



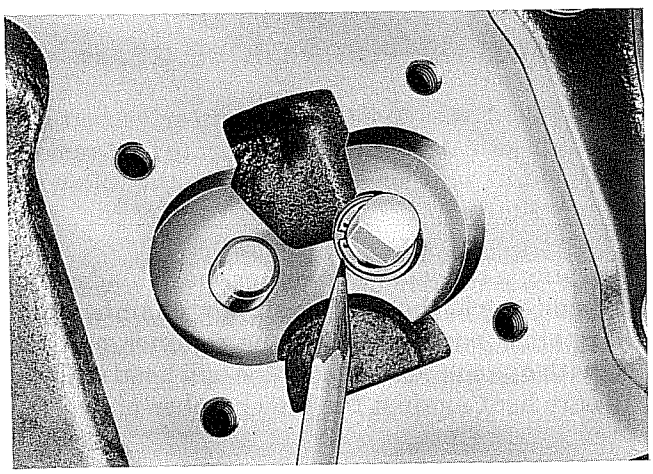
B. Unthread the four air chamber bolts and pull the unit from its seat on the helical gear cover.

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.

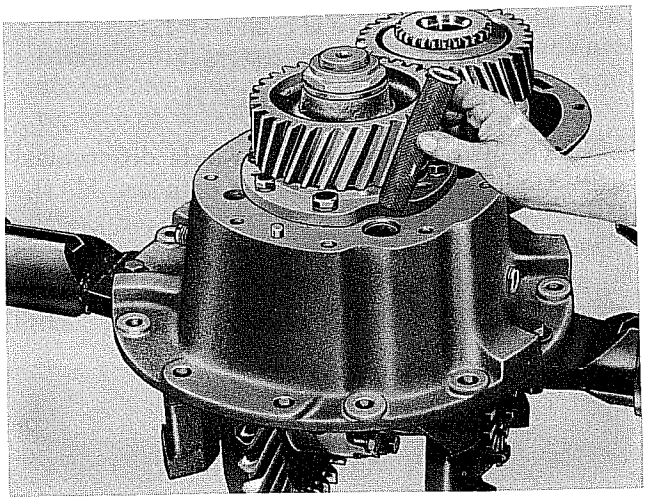
E. If desired, remove the shift shaft adjusting screw and jam nut from the helical gear cover.



F. To disassemble the oil pump drive gear and shaft from the gear cover remove the shaft retaining snap ring and washer and slip the drive gear and shaft from the helical gear cover.

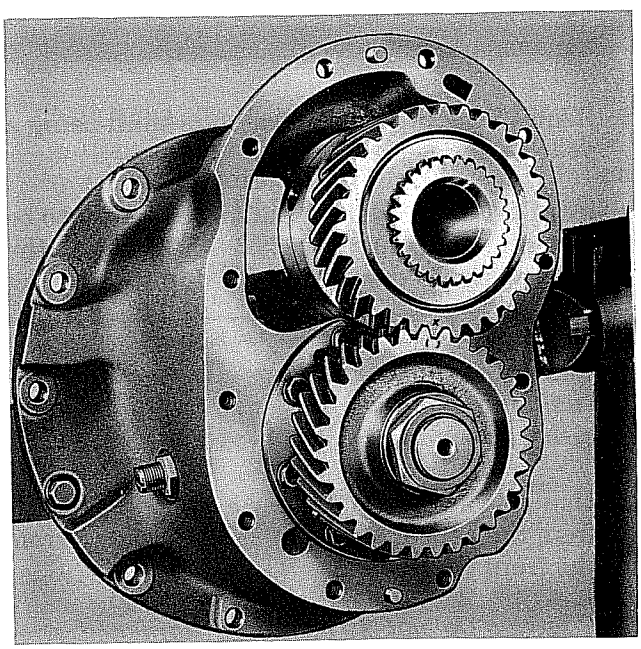
CARRIER OIL FILTER SCREEN (INTERNAL)

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.

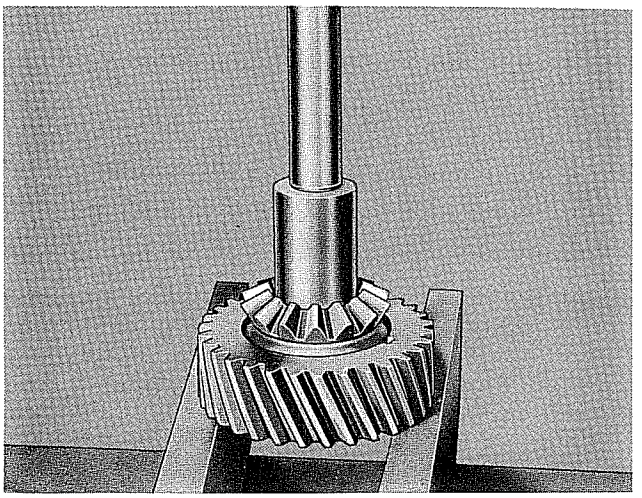


Remove the screen from its seat and make a visual check. If the screen is damaged in any way, discard and replace at reassembly. Otherwise, set it aside for cleaning.

DISASSEMBLE INTER-AXLE DIFFERENTIAL

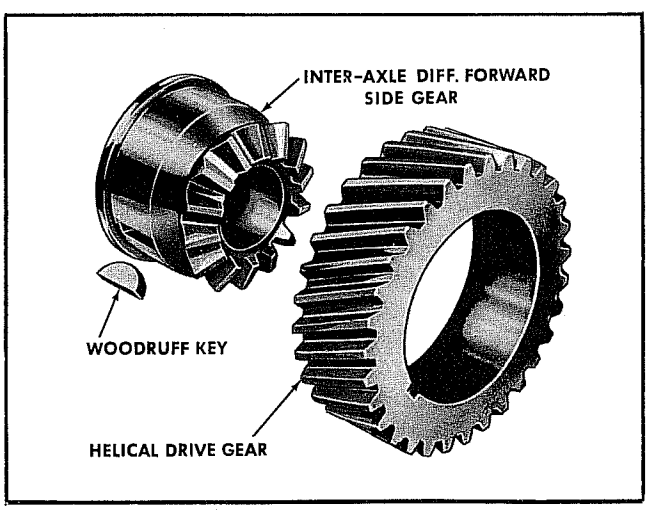


A. Lift off the inter-axle differential forward side gear and helical drive gear assembly and thrust washer from the inter-axle differential nest located to the top of the carrier.

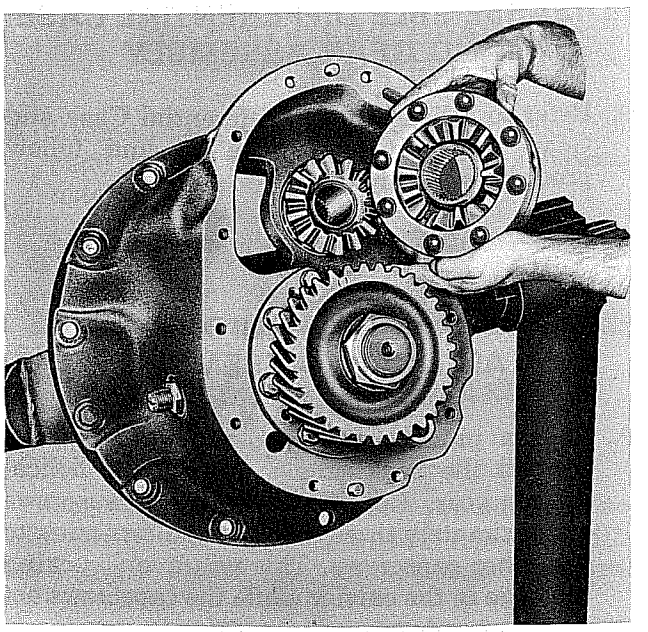


B. Separate the side gear from the helical drive gear. Place the assembly in a press and use a sleeve with an O.D. that will fit the front hub portion of the side gear as shown.

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



NOTE: When pressing out 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) capscrews, nuts and washers. Current models employ rivets. (Refer to "Disassemble Differential Case and Gear Assembly", page 25, item D, section 1 thru 3). 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. Refer to "Remove Differential and Gear Assembly" on page 24 and 25 and follow procedures A through H.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

A. Refer to "Disassemble Differential Case and Gear Assembly" on page 25 and follow procedures A through E.

REMOVE PINION AND CAGE ASSEMBLY

A. 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. In either case the spigot bearing will remain on the pinion.

B. Follow instructions under "Remove Pinion and Cage Assembly" on pages 25 and 26. Use steps C through K.

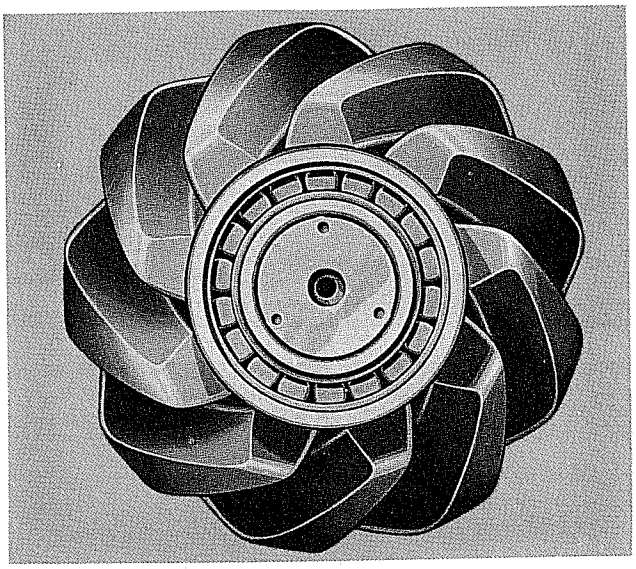
REASSEMBLE DRIVE UNIT

REASSEMBLE PINION AND CAGE ASSEMBLY

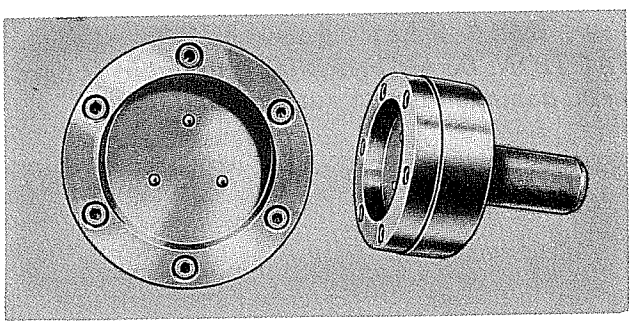
IMPORTANT: Before assembling, coat all parts of bearings with the recommended axle lubricant.

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, it is necessary to stake the pinion at three points as shown above. Use the proper staking tool to fit over the end of the pinion and spigot bearing to correctly achieve this.



NOTE: For information on the staking fixture shown, contact Rockwell International, Engineering Dept., 2135 West Maple Rd., Troy, Michigan under part number TL.W-10608.

CAUTION: Do not strike the spigot bearing or attempt to stake bearing onto pinion using a punch and hammer — damage will result.

D. Position the drive pinion with spigot bearing pointing upward in a press and place the staking tool over the pinion end bearing. Apply a 3 to 3½ ton pressure to the staking tool.

CAUTION: Staking points are not to be spotted at root angle grooves of pinion if present.

E. Refer to "Reassemble Pinion and Cage Assembly" on page 26 and follow steps D through J.

F. Insert pinion cage to carrier capscrews and washers in their respective holes in the pinion cage.

G. Follow remaining steps J through N on pages 26 and 27.

H. Make certain that capscrews are aligned with respective holes in carrier, and that cage is not cocked in its bore.

J. 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 of capscrews (loosen) and retighten to correct torque. Refer to Torque Chart in Section 4 of this manual.

ASSEMBLE MAIN DIFFERENTIAL AND GEAR

A. Refer to "Assemble Differential and Gear" on pages 27 and 28 and follow procedures A through H.

INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

A. Follow procedures A through E under "Install Differential and Gear Assembly" on page 28.

ADJUST DIFFERENTIAL BEARING PRE-LOAD

A. Procedures for adjusting the differential bearing preload are on page 28, steps A through D under "Adjust Differential Bearing Pre-Load."

CHECK HYPOID GEAR BACKLASH

A. Refer to page 28 under "Check Gear Backlash".

CHECK TOOTH CONTACT

A. Follow procedures under "Check Tooth Contact" on page 29 for hypoid gearing only.

B. After the correct contacts have been established with a backlash of .010", open the backlash to measure between .005"-.015".

C. Procedures for correcting incorrect high or low tooth contact can be found on page 29.

ADJUST DRIVE GEAR THRUST SCREW

A. Refer to "Install Thrust Screw or Block" on page 30 part A through F and the following note.

NOTE: Adjustment for QHP thrust screw is .010"-.015".

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. 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.

B. Install rear side gear with bearing cone into differential carrier.

C. Pre-lubricate inside walls of inter-axle differential case halves, spider, pinions, and thrust washers with the recommended axle lubricant.

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. Current models employ riveted differential cases.

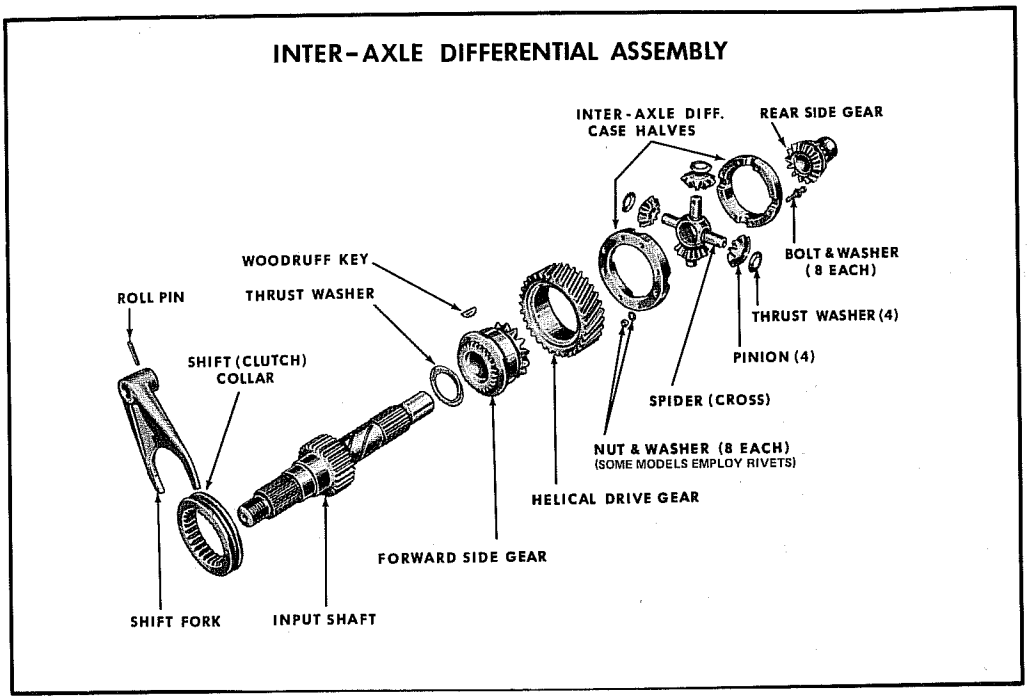
Do not replace differential case rivets with cold upset rivets as this could damage the case.

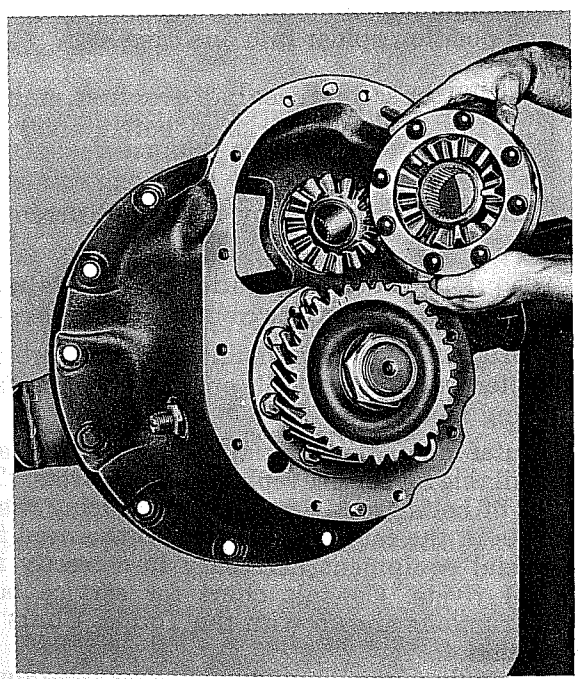
Original rivets are installed with an orbital riveter usually available only at the manufacturing facility.

Inter-axle differential case 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 install rivets. Consult chart for service bolt instructions shown with the Torque Chart in Section 4.

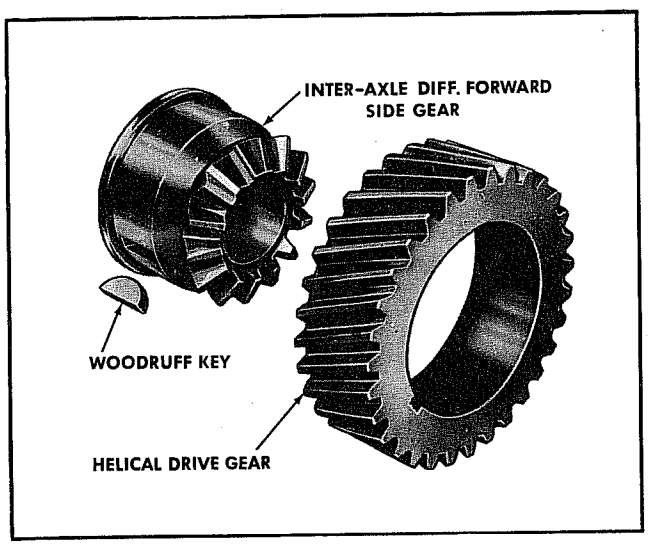
G. Install the case capscrews, washers and nuts and tighten to correct torque.

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





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

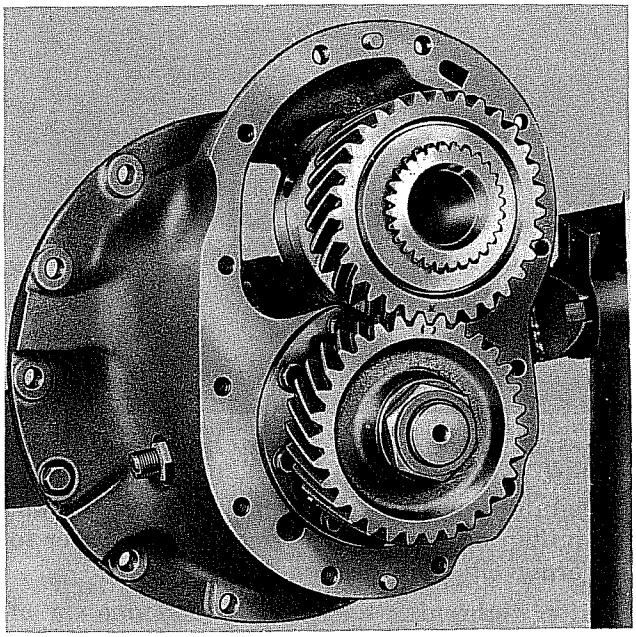


J. To reassemble forward side gear and helical drive gear, first position the "woodruff" key in place on the side gear hub.

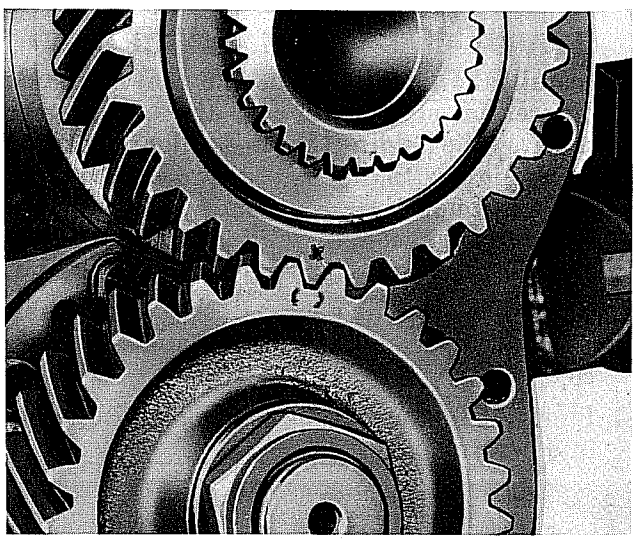
IMPORTANT: If the helical drive gear must be replaced with a new gear, replace both the drive and driven gears as a set.

K. 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.

L. Press the side gear into the helical gear until it bottoms.

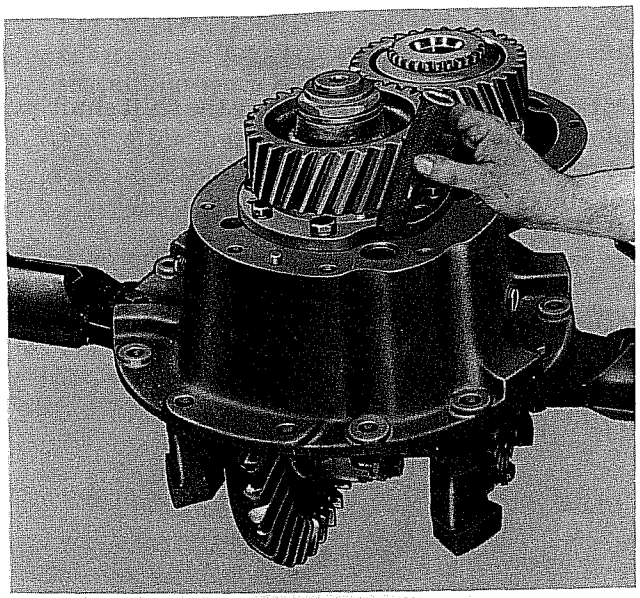


M. Position the forward side gear and helical drive gear assembly over the inter-axle differential case and nest assembly already in position.



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.

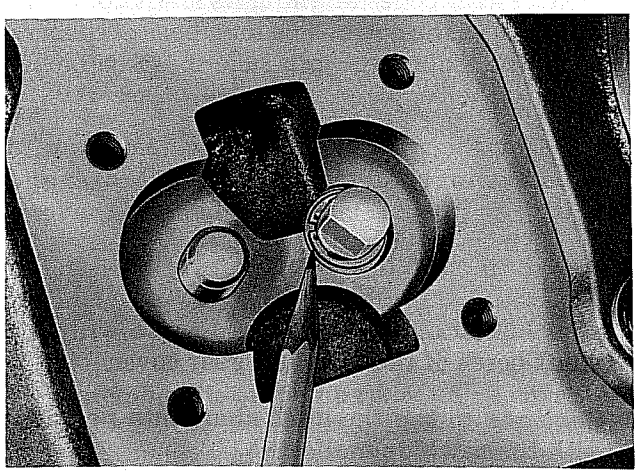


N. Clean and install the oil filter screen in its seat in the carrier.

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

INSTALL OIL PUMP DRIVE GEAR

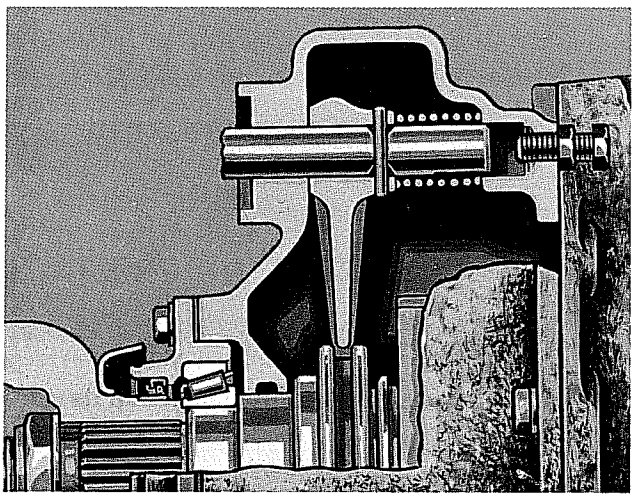
A. Insert the shaft of the oil pump drive gear through bore inside the helical gear cover.



B. While holding the gear in place from the inside of gear cover, position washer over the opposite end of pump drive gear shaft and install the shaft retaining snap ring.

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.



A. 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.

B. 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.

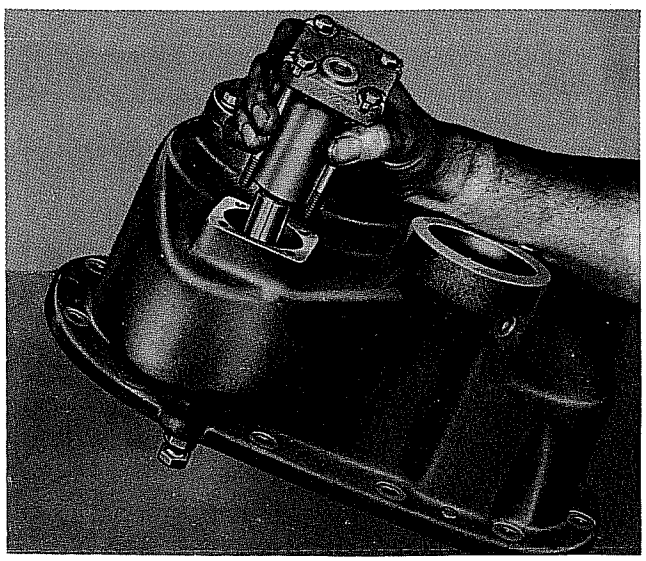
C. Holding the shift fork in position continue to tap the shift shaft through the gear cover and fork. Tap in shaft enough to support the fork.

D. 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.

E. 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.

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



G. 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 in Section 4.

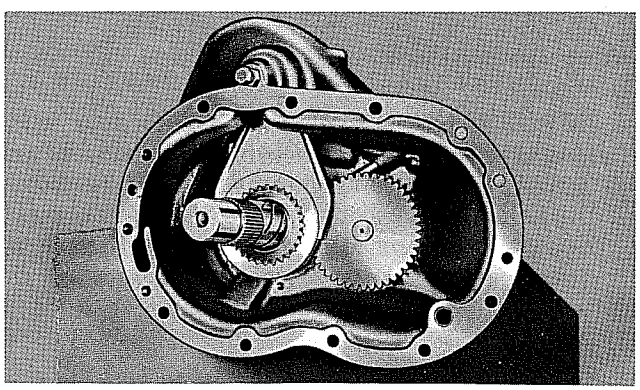
H. After tightening capscrews, bend one ear of each retainer up against the capscrew head. Bend the other two down against the top plate of the chamber.

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 drive gear.

B. Press the forward 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 into 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 until it bottoms in bearing cage.

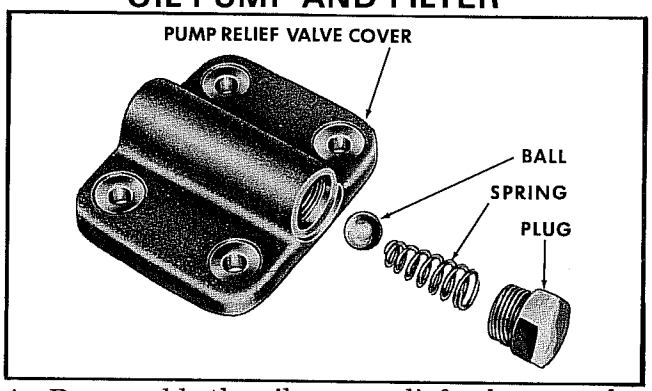
CAUTION: Do not exert pressure on seal retainer after it bottoms. Damage to seal will result.

E. When the original bearing 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 through H of "Adjust Input Bearing End Play" on page 84.

If a new bearing 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 page 84.

NOTE: If desired at this time complete reassembly of the helical gear cover on the bench. Use the following procedures, otherwise, assemble the cover onto the carrier. Refer to page 72.

REASSEMBLE OIL PUMP COVER, OIL PUMP AND FILTER

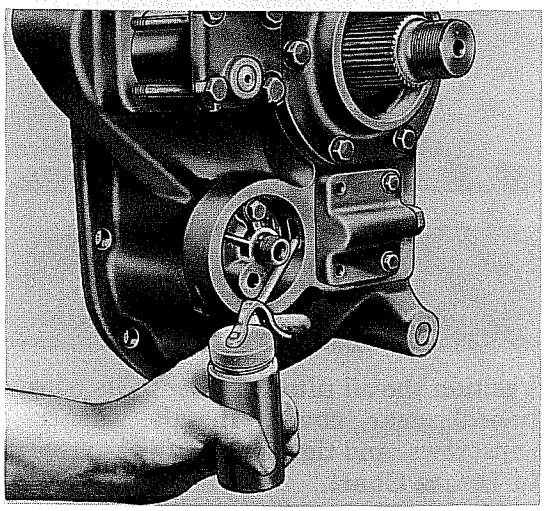


A. Reassemble the oil pump relief valve cover by inserting ball, spring (small diameter against ball) and hollow capscrew (plug). Tighten plug to correct torque.

B. Reassemble both oil pump gears over their respective shafts in the helical gear cover.

Assemble the drive gear (with keyway or "D" shaped hole) first. If keyway is employed, position the woodruff key into slot in shaft and slip the gear over the shaft, making sure the keyway aligns with key. Place other pump gear over its shaft.

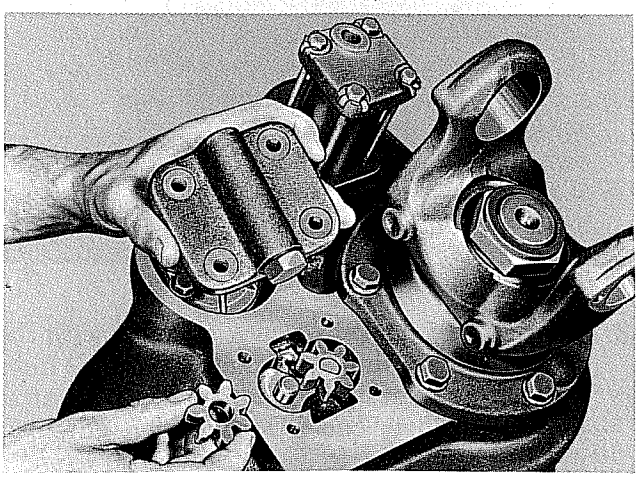
C. For re-conditioned drive units, pack pump cavity completely with *Lubriplate* before installing pump relief valve cover.



For new units:

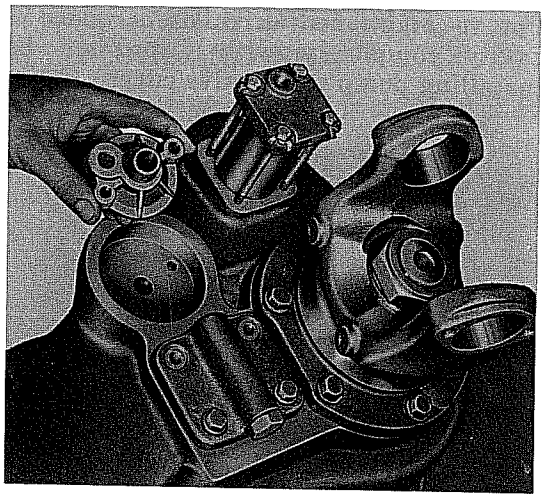
IMPORTANT: SQHP oil pump gears must be provided an initial coating of lubricant to prevent abnormal wear or scoring of the parts during the first start-up of the vehicle.

Pour or squirt two ounces of specified drive unit lubricant into the oil pump to filter passage.

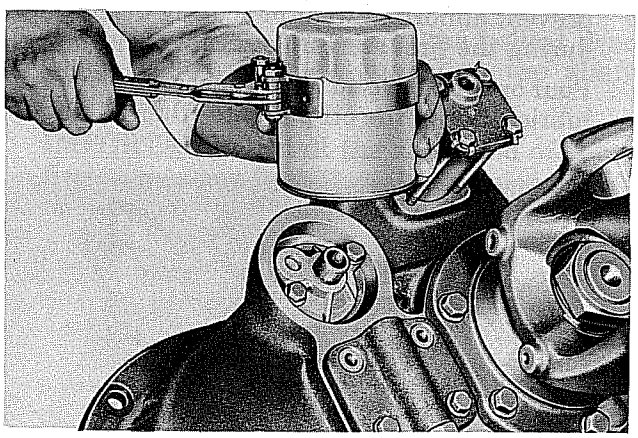


D. Assemble the oil pump relief valve cover over gears and secure to the helical gear cover with two washers and short capscrews. Assemble capscrews in holes farthest from the filter opening in cover. Tighten capscrews to correct torque. Refer to Torque Chart in Section 4.

NOTE: Position the pump cover so the plug points to the left side (away from oil filter).



E. Position the oil filter adapter in its bore in the helical gear cover. Install washers and capscrews, and tighten to correct torque. Refer to Torque Chart.



F. 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.

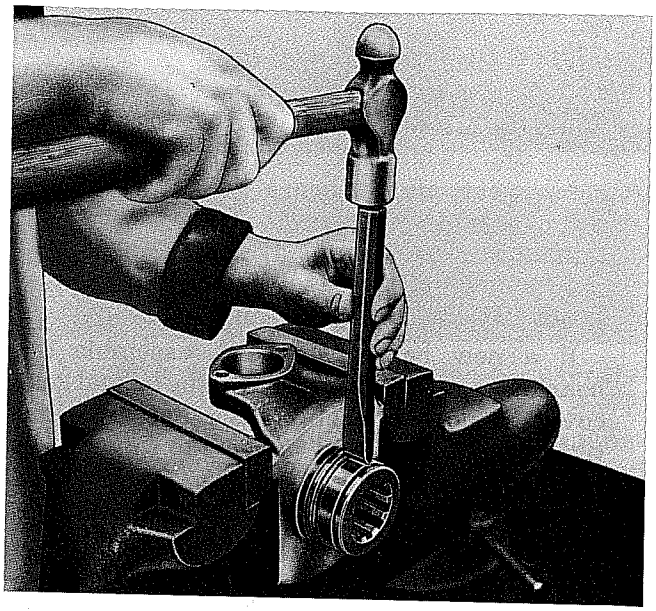
CAUTION: If filter is tightened more than one turn, after contacting gasket, damage to filter may result.

G. Assemble filter cover over filter on helical gear cover. Secure with the two long oil pump relief valve cover capscrews and washers. Tighten capscrews to correct torque. Refer to Torque Chart.

WEAR SLEEVE REPLACEMENT

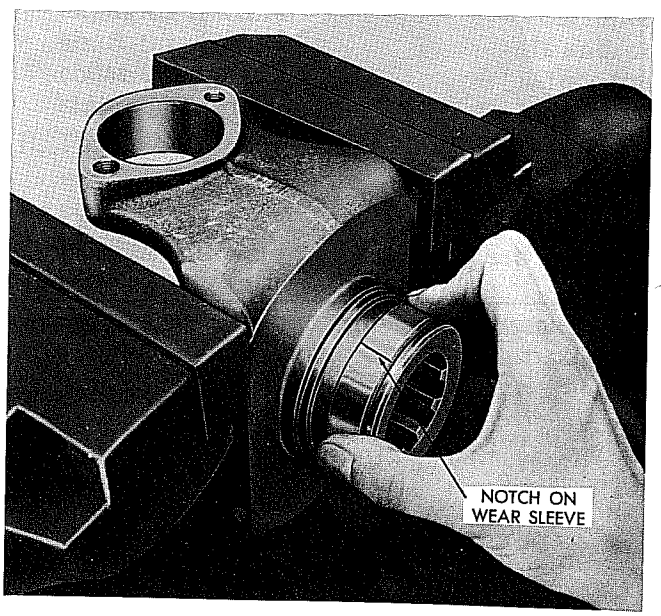
REMOVAL

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.

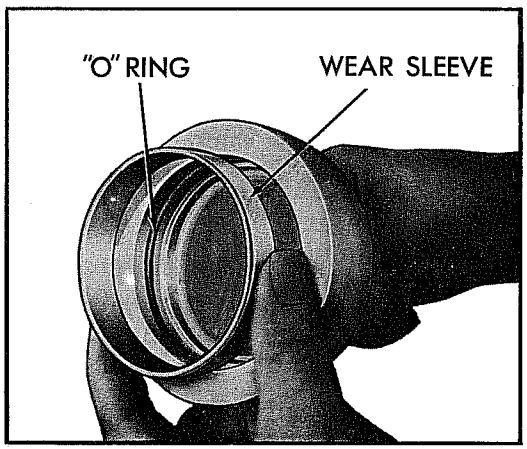
E. Remove the sleeve.

F. If unsuccessful, rotate yoke 180°, notch slightly again and remove sleeve.

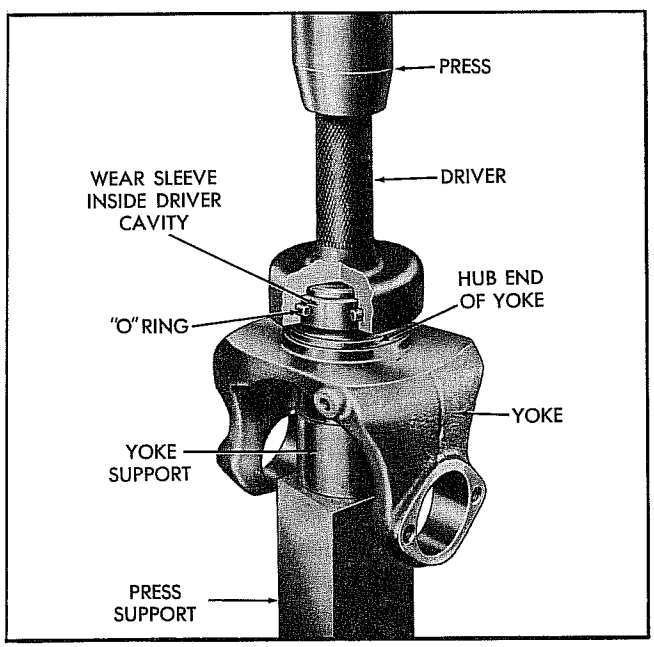
INSTALLATION

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.



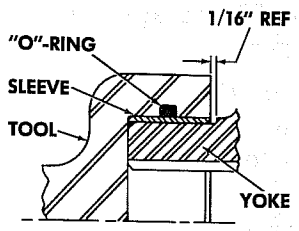
B. Position the driver and wear sleeve into the tool cavity, tapered end first.



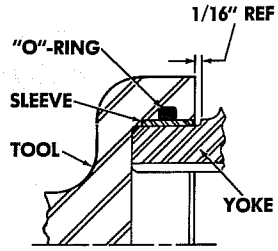
C. Place the driver and wear sleeve squarely against the hub end of the yoke.

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.



QHP OUTPUT YOKE
QAR INPUT YOKE



QHP INPUT YOKE

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 surfce.

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

INSTALL INTERFERENCE FIT YOKES

On carriers that employ slip fit yokes, continue with item "A" of "Reassemble Helical Gear Cover Onto Carrier", on page 72.

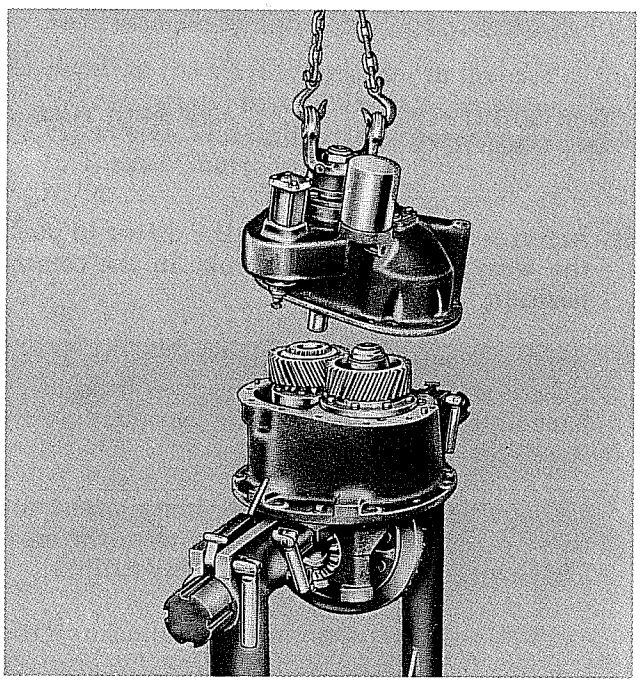
On carriers with interference fit yokes, installation will require the use of a press or the three-piece installation tool, refer to page 34.

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.

REASSEMBLE HELICAL GEAR COVER ONTO CARRIER

IMPORTANT: Before reassembling cover to carrier coat the forward inter-axle differential side gear thrust washer and back face of integral shift collar gear (on input shaft) with grease. Place the thrust washer onto the back face of shift collar gear. The grease will allow the washer to stick to gear.

CAUTION: Do not assemble thrust washer onto forward side gear in carrier. Damage to washer will occur if the slightest misalignment is present.



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 82). 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 interaxle 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 and tighten capscrews to correct torque.

ADJUST INPUT BEARING END PLAY

A. Refer to Section 2 and follow procedures A through H under "Adjust Input Bearing End Play" on page 84.

ADJUST SHIFT SHAFT

A. If the shift adjusting screw and jam nut have not been assembled, install both parts into the helical gear cover in back of the shift shaft. Turn in adjusting screw approximately 2 turns at this time.

B. Using an auxiliary air supply, apply air pressure to the air chamber. This will move the shift shaft, fork and collar back, locking the inter-axle differential.

IMPORTANT: Make sure the collar travels over the splines and engages with the rear side gear. If necessary, index the shift collar by turning the input shaft.

C. With the shift shaft moved back its full travel, turn in the adjusting screw until it touches the end of the shift shaft.

D. From this point continue turning in screw 1 to 1¼ turns more and lock adjusting screw with jam nut, 45-60 lb. ft. torque. (This will allow correct clearance between the fork and groove of collar thus eliminating wear.)

E. After shift shaft adjustment has been made, remove the auxiliary air line from the air chamber.

ASSEMBLE DRIVE UNIT

A. Follow Steps A and B under "Inspect Drive Unit Housing" on page 81 in Section 2.

B. Follow procedures B through D on page 33 under "Assemble Drive Unit."

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. Refer

to Torque Chart in Section 4 for correct torque values.

If complete disassembly was required use the following procedures for re-assembly.

A. Coat bearings with the recommended axle lubricant and press both inner and outer bearing cones (back to back) onto end of through shaft until 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 snapring bearing spacer. This snapring also controls bearing endplay.

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

Continue by checking for bearing endplay as follows:

ADJUST OUTPUT BEARING ENDPLAY

A. Refer to Section 2 and follow procedures A thru E under "Adjust Output Bearing Endplay" on page 85.

Continue with reassembly as follows:

B. Remove the yoke and spacer from the through shaft using a yoke holder while loosening the nut.

C. Coat output seal lips with *Lubriplate* and O.D. of retainer with a non-hardening sealing material, such as *Permatex.*

D. 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 bottoms in cage.

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

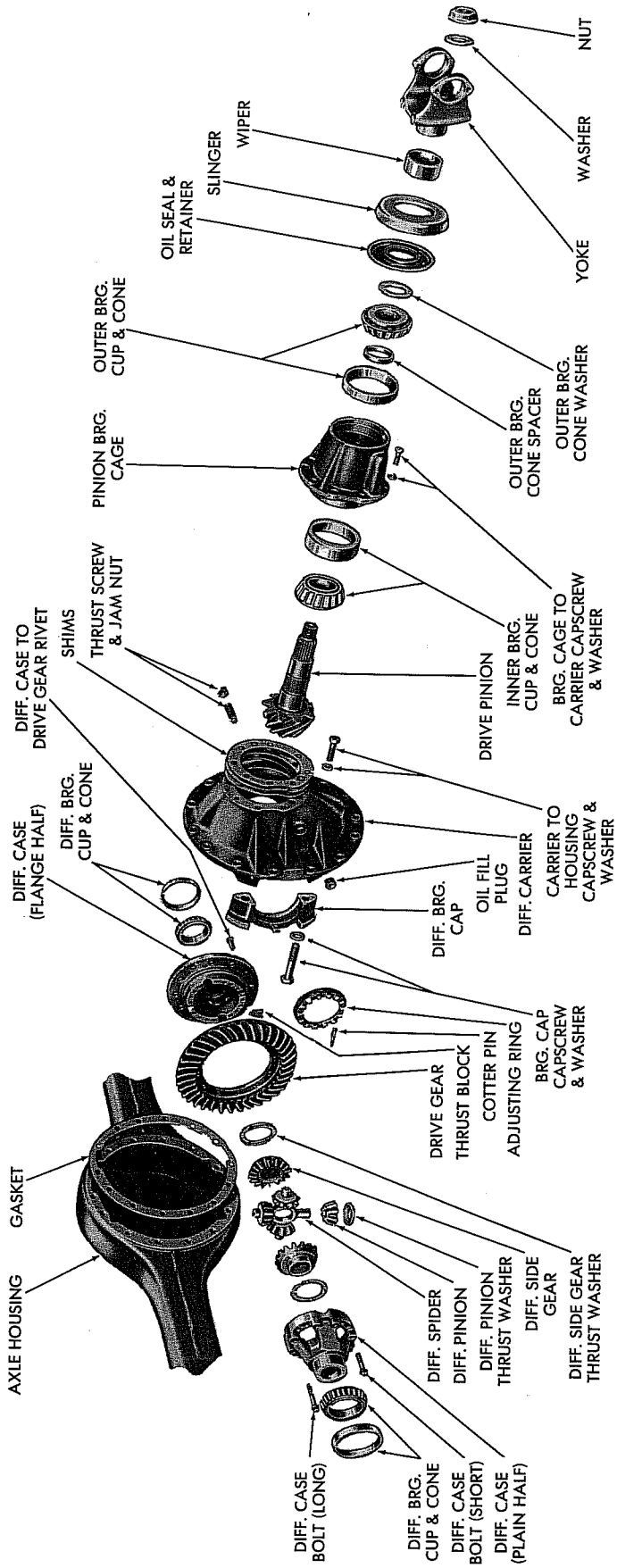
CAUTION: Do not exert pressure on seal retainer after it bottoms. Damage to seal will result.

E. 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 in Section 4.

F. Assemble the yoke spacer, yoke, washer and nut onto the through shaft. Tighten nut to specific torque. Refer to Torque Chart.

NOTE: Some carriers may employ interference fit splines. These carriers will require the yoke installation tools and procedures as described on pages 34 and 35. Use a yoke holder while tightening yoke nut.

AMBOID DRIVE UNIT (REAR/REAR AXLE)



Single-Reduction Amboid Drive Unit
(QAR REAR/REAR OF SQHP TANDEM)
CARE AND MAINTENANCE

The Rockwell Amboid Single- Reduction Final Drive Unit is employed as the rear / rear drive unit of SQHP series tandem axle units. This type of drive unit employs a heavy duty amboid pinion and gear set.

The differential and gear assembly is mounted between tapered roller bearings, and the pinion being the overhung design is mounted with two tapered roller bearings in front of the pinion head to take the forward and reverse thrusts and radial loads.

Further, the pinion is mounted above the differential centerline as opposed to hypoid pinions which are mounted below this centerline. This feature allows for a lesser propeller shaft angle between drive units in tandem.

REMOVE DIFFERENTIAL CARRIER FROM HOUSING

A. Refer to "Remove Drive Unit From Housing" on page 21, and follow procedures A through D. Then follow procedures J through L.

DISASSEMBLE CARRIER

REMOVE DIFFERENTIAL AND GEAR ASSEMBLY

A. Follow procedures A through H on page 24 under "Remove Differential and Gear Assembly."

B. Remove thrust block from inside of carrier housing.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

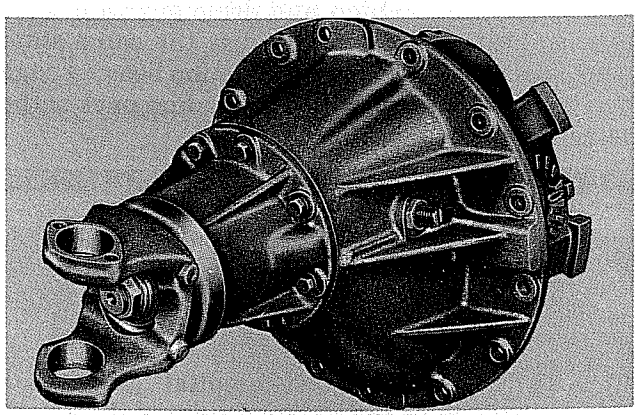
A. Refer to page 25 under "Disassemble Differential Case and Gear Assembly" and follow procedures A through E.

REMOVE PINION AND CAGE ASSEMBLY

A. Follow procedures A through F under "Remove Pinion and Cage Assembly" on pages 25 and 26.

DISASSEMBLE PINION AND CAGE ASSEMBLY

A. Refer to "Disassemble Pinion and Cage Assembly" on page 52. The amboid drive unit employs a splined pinion shaft. Therefor follow procedures A through E under the Splined Shaft section.



B. Refer to Section 2 for cleaning, inspection and component replacement and repair.

REASSEMBLE CARRIER

REASSEMBLE PINION AND CAGE ASSEMBLY

A. Follow procedures A through C on page 53 under "Reassemble Pinion and Cage Assembly - Splined Shaft".

B. Next, follow procedures E through H on page 53. Disregard hypoid pinion preload torque values.

The correct pressure and torque for checking amboid pinion bearing preload is:

Pinion Shaft Thread Size	Pressure Required to Obtain Correct Preload	Nut Torque Required to Obtain Correct Preload
1¼"x12	27 Tons	700-900 lb. ft.

Use rotating torque, not starting torque.

Preload new Amboid pinion bearings to 20 - 45 lb. ins. Preload serviceable Amboid pinion bearings to 10 - 22 lb. in.

C. Install flange or yoke using the three piece yoke installation tool and procedures as described on page 34.

D. Follow procedure J (on page 53) then recheck pinion bearing preload torque. If rotating torque is not within the correct range, repeat the foregoing procedure.

E. Follow steps L through P on page 54.

INSTALL PINION AND CAGE ASSEMBLY Original Gear Set

If the original pinion and drive gear are to be reassembled into the carrier use the same shim pack, if reusable, between the pinion bearing cage and carrier. Otherwise use a new shim pack of the same thickness.

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

A. Refer to page 54 and follow procedures A through C under "Install Pinion and Cage Assembly."

NOTE: After the differential and gear assembly is installed into carrier make a gear tooth contact check.

NEW GEAR SET

IMPORTANT: If the pinion or drive gear require replacement both must be replaced in matched sets.

Before installing a new pinion and gear set check and compare the "Matching number" of both the pinion and drive gear, they must be the same. Refer to page 86 for details on "Matching number" comparison.

ASSEMBLE DIFFERENTIAL AND GEAR

A. Refer to page 27 under "Assemble Differential and Gear" and follow procedures A through H.

INSTALL BEARING CUPS IN CARRIER LEG BORES

A. Temporarily install the bearing cups, threaded adjusting rings and bearing caps. Tighten the capscrews to the proper torque.

B. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked 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. Once the cups fit properly, remove the bearing caps.

INSTALL DIFFERENTIAL AND GEAR ASSEMBLY

A. Follow procedures A through E under "Install Differential and Gear Assembly" on page 28.

ADJUST DIFFERENTIAL BEARING PRELOAD

A. Refer to page 28 under "Adjust Differential Bearing Preload" and follow procedures A through C.

B. Tighten adjusting nuts (rings) approximately one notch each from .000 end play to spread carrier legs .006"-.010" or a differential bearing rolling resistance of 15-35 lb. ins.

CHECK AMBOID 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 .015". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount. Use a dial indicator mounted on the carrier to housing flange with the indicator pointer against one ring gear tooth.

CHECK TOOTH CONTACT

Refer to page 29 under "Check Tooth Contact", items "A & B" only.

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.

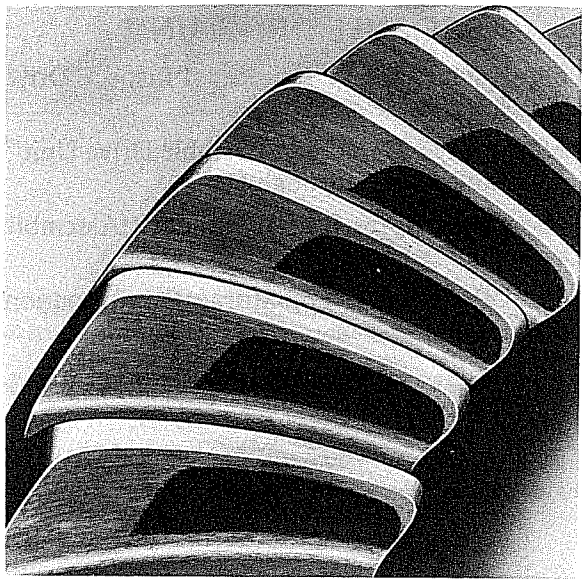
A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

After correct tooth contact has been established, install adjusting nut locks (cotter pins) and capscrews. Tighten capscrews to correct torque. Refer to Section 4.

FOR AMBOID GEARS ONLY
CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE

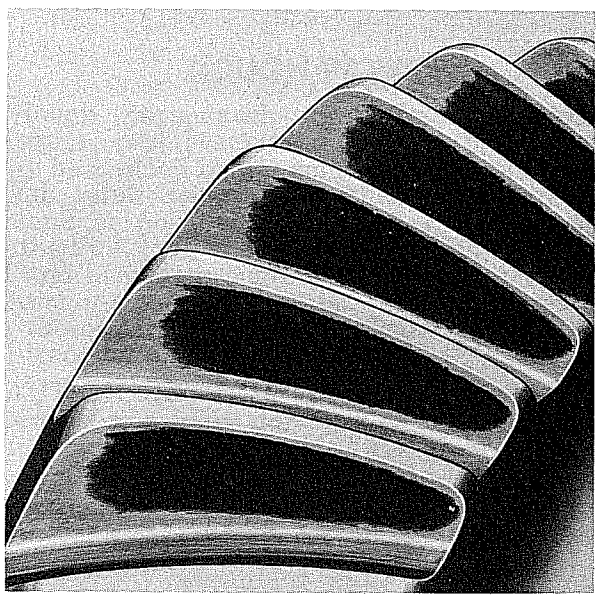
With adjustments properly made (pinion at correct depth and backlash set at .015") the following contact will be procured. The area of contact is at the toe and deep in the gear.

If facilities are available for applying approximately 200 lbs. feet of torque to the pinion shaft, the following tooth contact is expected.



SATISFACTORY TOOTH CONTACT

The hand rolled pattern (5 - 200 lb. ft. resistance) shown above will result in a pattern centered in the length of the tooth when the gears are under load, (in service) as shown at bottom of page. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.



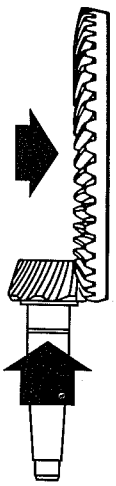
SATISFACTORY TOOTH CONTACT (AMBOID GEARS LOADED - IN SERVICE)

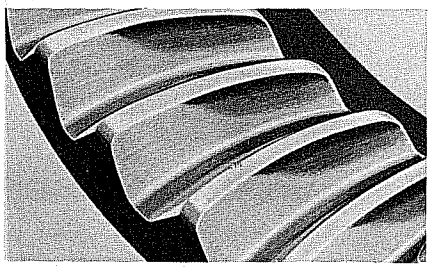
The pattern on the coast side of teeth will appear the same width as the drive side shown above.

If the correct contact location shown at left cannot be established with a backlash of .015", adjust the backlash as required between the limits of .008"-.020".

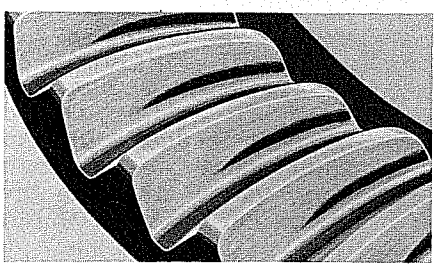
Set used amboid gear to have the tooth contacts match wear patterns. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns.

INCORRECT AMBOID TOOTH CONTACT

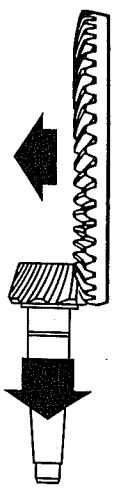




A high contact indicates pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. Slight outward movement of amboid gear may be necessary to maintain correct backlash (.008"-.020").



A low contact with a hard line at the root indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the amboid gear may be necessary to maintain correct backlash (.008"-.020").



INSTALL THRUST BLOCK

A. Remove carrier from stand and position with back face of amboid gear upward.

B. Remove adjusting screw and lock nut.

C. Place thrust block on rear face of amboid 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 amboid gear.

E. To secure the correct adjustment of .010" - .020" clearance, loosen adjusting screw ¼ turn and lock securely with nut.

F. Check to assure clearance of .010" - .020" during full rotation of amboid gear.

ASSEMBLE DRIVE UNIT

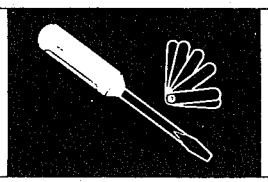
A. Follow steps A and B under "Inspect Drive Unit Housing" in Section 2.

B. Refer to page 33 under "Assemble Drive Unit" and follow steps B through D.

C. Follow procedures B and C under "Assemble Drive Unit" on page 47.

D. Note "Preparation For Storage" information on page 55.

section 2



Cleaning, Inspection Repairs and Adjustment

CLEANING

Parts having ground and polished surfaces such as knuckle pins, gears, shafts, bearings and spindles, 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: *Rockwell does not recommend attempts to salvage damaged ends by repacking and replacing the boot seal on non-greasable ends.*

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 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.

INSPECTION

It is impossible to overstress the importance of careful and thorough inspection of drive unit and steering knuckle components 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 front end and drive unit difficulties.

INSPECT FRONT AXLES

A. Inspect the steering knuckle thrust bearing, wheel bearing cones and cups. Replace if rollers or cups are worn, pitted or damaged in any way. If wheel bearing cups are to be replaced, remove from hubs with a suitable puller. Avoid the use of drifts and hammers as they may easily mutilate cup bores.

B. Inspect the steering knuckles and replace if indications of weakness or excessive wear is found.

C. Check the tightness of the steering connections such as tie-rod arms, steering arm, etc.

D. For units with sealed knuckle pins, check upper knuckle pin seal for rips, tears and excessive wear. Do not remove upper seal

from steering knuckle counterbore unless replacement is necessary. If seal must be replaced, follow removal procedures on page 18.

E. Remove lower knuckle pin seal from thrust bearing case and inspect seal for wear, rips and tears.

F. Check thrust bearing and lower seal gaskets for wear. Some axles may employ an integral gasket in the lower seal or thrust bearing.

G. Check knuckle pin bushings for flaking and galling. Compare with correct specification. Do not remove bushings from steering knuckle unless replacement is necessary.

IMPORTANT: *Any indication of looseness in the total steering linkage arrangement under normal steering loads is sufficient cause to immediately check all pivot points for wear, regardless of accumulated mileage. Steering linkage pivot points should be checked each time the axle assembly is lubricated. If any indication of lateral movement is found, tie rod ends should be removed for inspection. Looseness at the steering linkage pivot points can be visually detected during movement of the vehicle steering wheel in Dry Park Position.*

TIE ROD END INSPECTION

A. Check seals visually for any indications of damage. Also check to make sure seal is securely seated on socket. If tie rod end has a grease fitting, replace damaged seals. Tie rod ends not having greasing provision should be replaced if seals are damaged or loose.

CAUTION: *Rockwell does <u>not</u> recommend attempts to salvage damaged ends by repacking and replacing the boot seal on non-greasable ends.*

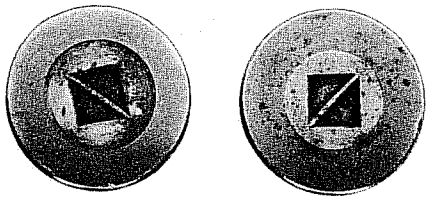
B. Check the turning torque value between the tie rod end assembly stud and the ball cavity. If torque value is less than five (5) inch pounds, the tie rod end assembly should be replaced. This is not to say the end assembly will fail at this point, but it can no longer provide the type of steering control designed in to it once lateral movement develops between the stud and ball cavity.

INSPECT DRIVE UNITS

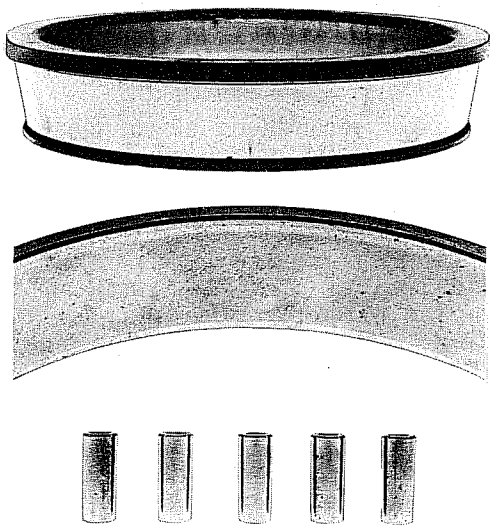
A. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily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

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

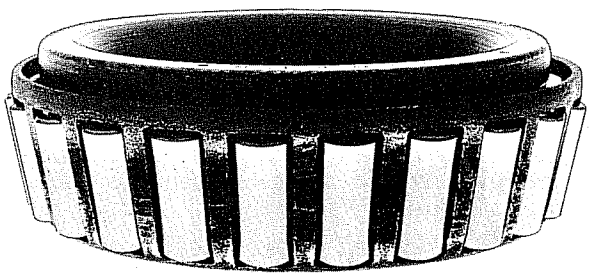
1. Large ends of rollers worn flush to recess or radii at large ends of rollers worn sharp.



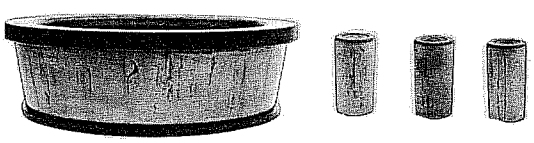
2. (a) Visible step wear, particularly at the small end of the roller track.
   (b) Deep indentations, cracks or brakes in bearing cup and/or cone surfaces.



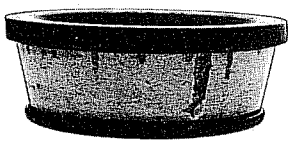
3. Bright rubbing marks on the dark phosphate surfaces of the bearing cage.



4. Etching or pitting on functioning surfaces.



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



B. 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 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.

INSPECT DRIVE UNIT HOUSING

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.

INSPECT WHEEL BEARINGS

Wheel bearings should be very closely inspected at the time of knuckle inspection or when knuckle repair is being made.

Remove all the old grease from the wheel bearings, spindle, hub cavity, and hub cap. (The old grease may contain moisture which would lead to an early bearing failure if not removed.) Use kerosene or diesel fuel oil and a stiff brush. Gasoline and heated solvents which are commonly used should be avoided.

Allow the cleaned parts to dry, or dry them with a clean absorbent cloth or paper. Clean and dry the hands and all tools used in the service operation. Grease will not adhere to a surface which is wet with solvent, and solvent may dilute the lubricant.

Replace any worn or damaged parts. Refer to the four bearing conditions under "Inspect Drive Units".

REPAIRS

FRONT AXLES

Repairs of Forged Parts Bent In Service

A. In the interest of safety and preserving the service life of front axle assemblies, Rockwell-Standard recommends that front axle assemblies not be repair welded. Repair welding can detract from the structural integrity of a component, particularly as to heat treated parts where the benefit of heat treatment may be nullified by the welding.

Since it can be extremely hazardous and detrimental to repair weld components of any kind, repair welding can be approved only where stringent controls are imposed and equipment, customarily located only at manufacturing facilities, is employed, so as to minimize the potentially detrimental effects of repair welding.

In deciding whether to repair or scrap any damaged part, always keep in mind that we, as manufacturers, never hesitate to scrap any part which is in any way doubtful.

B. Straightening of bent parts should be done cold. Various components are heat-treated and hot straightening would destroy some of the heat treatment.

Axle centers (that are bent no more than 1/2") may be straightened cold; if bent more than 1/2" they should be replaced.

C. Bent steering arms, cross tube arms or steering knuckles should be replaced rather than straigntened. (It is not necessary to remove steering arms and cross tube arms from the knuckle unless replacements are required.)

DRIVE UNITS

A. In the interest of safety and preserving the service life of drive axle assemblies, Rockwell recommends that axle assemblies not be repair welded. Repair welding can detract from the structural integrity of a component, particularly as to heat treated parts where the benefit of heat treatment may be nullified by the welding.

   Since it can be extremely hazardous and detrimental to repair weld components of any kind, repair welding can be approved only where stringent controls are imposed and equipment, customarily located only at manufacturing facilities, is employed, so as to minimize the potentially detrimental effects of repair welding.

   In deciding whether to repair or scrap any damaged part, always keep in mind that we, as manufacturers, never hesitate to scrap any part which is in any way doubtful.

B. 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.

C. Remove nicks, mars and buffs 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.

D. When assembling component parts use a press where possible.

E. Tighten all the nuts to the specified torque. (Refer to Section 4 for correct torque specifications.) Where lockwire is employed, 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.

HEATING AND ASSEMBLING RING GEAR ONTO CASE HALF

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.

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 1199-T-3842.

SERVICE

Removal of all gaskets including silicone RTV is accomplished by peeling or scraping the used gasket off both mating surfaces.

Application of silicone RTV gasket material is as follows:

1. Remove dirt, grease or moisture from both mating surfaces.
2. Dry both surfaces.
3. Apply thin bead, approximately 1/8″ diadeter 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 gasket 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.

USE OF DRI-LOC CASE BOLTS, LOCTITE 277/ ROCKWELL 2297-C-3747 LIQUID ADHESIVE

We have released for production and service Dri-Loc main and inter-axle differential case bolts (pre-applied adhesive) and liquid adhesive for the retention of differential bolts in threaded case holes when service is required.

Rockwell assembles all threaded hole differential cases with Dri-Loc bolts. When service is required, rebuild these assemblies with new Dri-Loc bolts or reuse the old bolts by applying liquid adhesive to the threaded holes in the cases. *(NOTE: Dri-Loc bolts or liquid adhesive is not used in nut and bolt constructed cases.)*

When new Dri-Loc bolts are used, identified by a visible patch of adhesive on threads, the locking feature is usable only once. When the same bolt is reused, liquid adhesive must be applied to the threaded hole in the case to achieve the locking feature. Use the following procedures:

SERVICE

New Dri-Loc Bolts

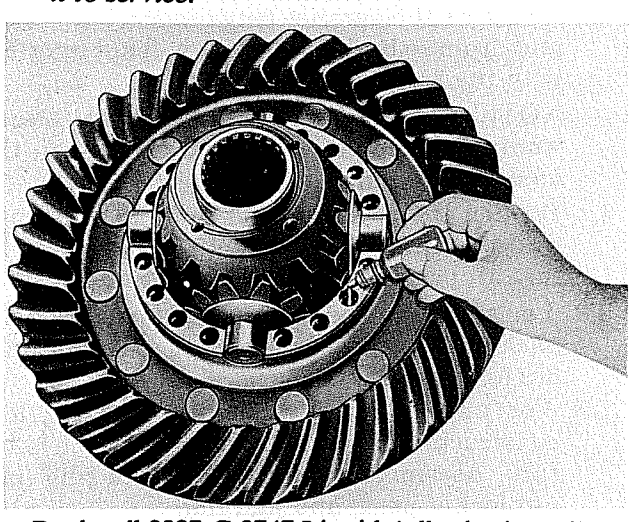
1. Wipe excess oil and any residue from the threaded holes in the case. The holes should be relatively oil free, however, no special cleaning is required.
2. Assemble the differential case components using the new Dri-Loc bolts. DO NOT APPLY LIQUID ADHESIVE OR ANY OTHER TYPE OF FASTENER RETAINER MATERIAL, SEALANT OR ADHESIVE ON NEW DRI-LOC BOLTS OR IN THE THREADED HOLES.
3. Tighten the Dri-Loc case bolts to the specified torque value recommended for the same regular bolt. Dri-Loc will not alter the torque requirement. Refer to the specific Rockwell Field Maintenance Manual or Fastener Torque Chart covering the drive unit being serviced.

   NOTE: No cure time is required for Dri-Loc bolts prior to rebuilding the axle and returning it to service.

Reuse of Dri-Loc Bolts or Use of Regular Bolts and Liquid Adhesive

1. Wipe excess oil residue from the bolts and threaded holes in the case. The bolts and holes should be relatively oil free, however, no special cleaning is required. When reusing Dri-Loc bolts, it is not necessary to remove the Dri-Loc residue from threads.
2. Apply liquid adhesive to the threaded holes only, by letting four or five drops run down the side of each hole. Before threading in the bolts, visually check to make sure that the liquid adhesive has contacted the threads. **IMPORTANT:** Do not apply liquid adhesive to the bolt, since trapped air in the hole will create back pressure and "blow out" the liquid adhesive as the bolt advances.
3. Tighten the bolts to the specific torque value recommended for that size bolt. Liquid adhesive will not alter the torque requirement. Refer to the specific Rockwell Field Maintenance Manual or Fastener Torque Chart covering the drive unit being serviced.

   NOTE: No cure time is required for liquid adhesive prior to rebuilding the axle and returning it to service.



Rockwell 2297-C-3747 Liquid Adhesive is available in ten (10) bottle cartons (10 cc per bottle) from Rockwell International, Florence Distribution Center, Florence, Kentucky 41042. Liquid adhesive is presently available at your local dealer.

IMPORTANT: When servicing drive units assembled with Dri-Loc bolts or liquid adhesive in threaded case holes where the bolts do not require removal—check each bolt for tightness by applying the minimum amount of torque specified for that size fastener. If the bolt does not rotate, it is satisfactory. If the bolt rotates to any degree, it must be removed from the case halves and liquid adhesive must be applied to the threaded hole. Use the procedures under "Reuse of Dri-Loc Bolts or Use of Regular Bolts and Liquid Adhesive."

Further, if bolt removal becomes difficult due to worn bolt heads or unusually high breakaway

torques, the locking strength of either liquid adhesive or Dri-Loc bolts can be reduced by heating. Heat the bolt for only a few seconds at a time while trying to loosen it. DO NOT EXCEED 350° F MAXIMUM. Heating should be done slowly to avoid thermal stresses in the differential case and gears. Application of heat reduces the strength of liquid adhesive and Dri-Loc below recommended installation torque.

Rockwell does not recommend removing bolts with an impact wrench or by striking with a hammer.

ADJUSTMENTS

GENERAL WHEEL BEARING ADJUSTMENT

For specific instructions on a particular construction of nut refer to Rockwell Technic Aid Section 9 Aid #10. Copies are available from the Technical Communications Dept., Rockwell International, 2135 West Maple, Troy, Mi., 48084.

1. Assemble bearings and hub on the axle spindle.
2. Install thrust washer, if used.
3. Install the wheel bearing adjusting nut. Thread the nut against the bearing or thrust washer as the wheel is revolved. Be sure there is sufficient clearance between the brake shoe and drum so brake shoe drag will not interfere with the bearing adjustment.

   NOTE: It is recommended that a torque wrench be employed for assembly of the adjusting nut and jam nut.
4. Tighten the adjusting nut to 50 lb. ft. torque while rotating wheel in both directions to be sure all bearing surfaces are in contact.

5A. For axles that have single nut construction, back off adjusting nut 1/8 to 1/6 turn. Cotter pin (or lock) nut in place.

5B. For axles that have double nut and lock construction, back off adjusting nut 1/6 to 1/4 turn. Assemble wheel bearing lock ring (jam nut lock if used) and jam nut.

5C. For assemblies using the bending type jam nut lock torque the jam nut as follows:

NUT SIZE	LB. FT. TORQUE	
	Min.	Max.
1⅛" to 2⅝"	100	150
2⅝" and over	100	200

Bend the jam nut lock over the jam nut and over the adjusting nut if no lock ring is used.

5D. For assemblies using the doweled lock ring only, torque jam nut as follows:

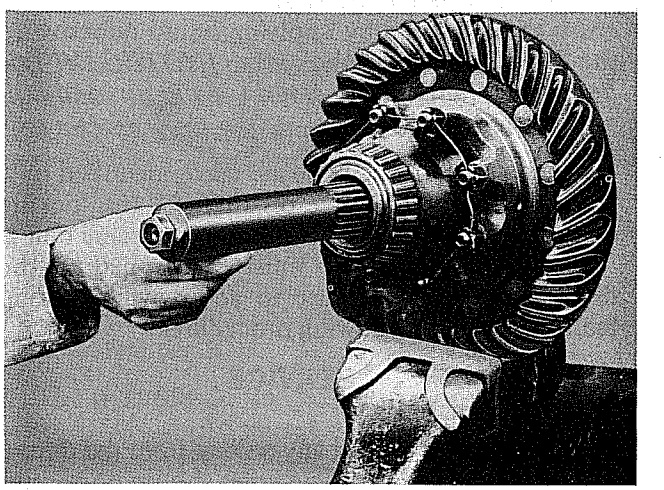
NUT SIZE	LB. FT. TORQUE	
	Min.	Max.
1⅛" to 2⅝"	200	300
2⅝" and over	250	400

The resulting end play must be within limits of .001 to .010.

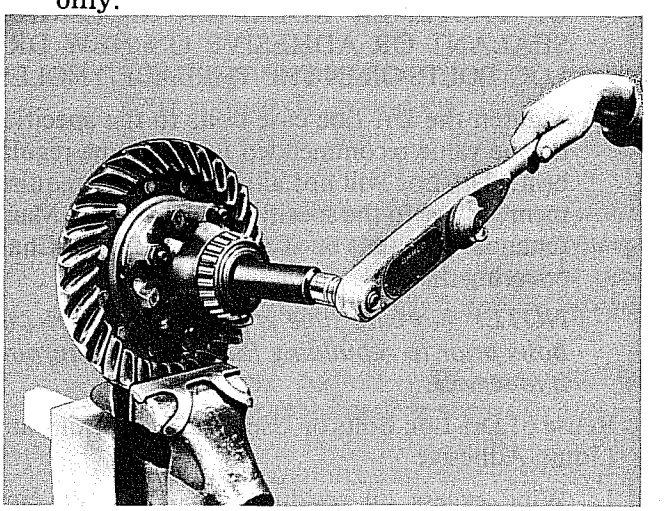
ROLLING RESISTANCE CHECK OF DIFFERENTIAL NEST

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

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

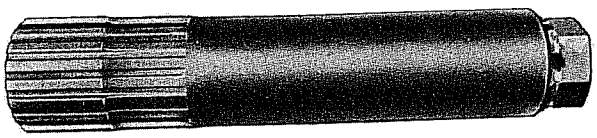


B. Insert checking tool (made from splined axle shaft end) into differential nest. Allow splines of tool to engage with spline of one side gear only.



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, including inter-axle differential assemblies.



Side View

End View

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.

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) to obtain a .0001″ to .0030″ bearing end play. Use the following procedures:

A. 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.

B. While observing the dial pull the through-shaft to rack in the output bearings while turning the shaft side to side to seat bearings.

C. Next, push the through-shaft while turning it side to side and take note of dial indicator reading.

Final end play must 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.

D. 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 specified torque. Refer to Section Four.

NOTE: Some carriers may employ interference fit splines. These carriers will require the yoke installation tools and procedures as describe on page 34.

Use yoke holder while tightening yoke nut.

E. 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 A through C.

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.

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.

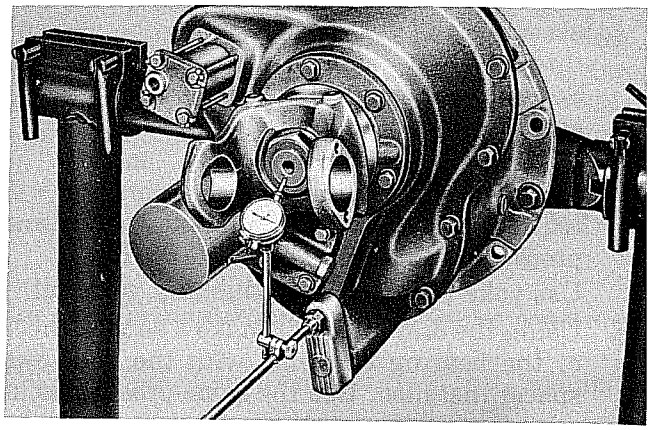
C. Remove the input yoke if assembled and bearing cover and install initial amount o shims. Re-assemble the cover, washers and capscrews. Tighten capscrews to correct tor que.

D. Assemble the input yoke, and nut over th input shaft. Tighten the yoke nut enough t eliminate any play between the yoke an bearing.

NOTE: Some carriers may employ in terference fit splines. These carriers wi require the yoke installation tools an procedures as described on page 34.

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

F. Holding the input yoke, rack in the inp bearing while turning the yoke side to side seat bearing.



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

Final end play must be between .003" - .007".

G. If reading is not within .003" - .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, tighten input yoke nut to correct torque.

DRIVE PINION AND GEAR ADJUSTMENT

A. GEAR SET IDENTIFICATION

The following information is stamped or etched on to drive pinion and gear sets and will be used for adjustment.

1.&2. The Part Number and Tooth Combination Number are found on the shank or threaded end of all pinions. On the ring gears the numbers are normally found on the front face of the gear. However, as an option, they may be located at the gear O.D.

For any given pinion and gear set the ring gear always has an even part number (i.e. 36786).

The tooth combination number (i.e. 5-37) indicates the gear set has a 5-tooth pinion and a 37-tooth ring gear, the equivalent of a 7.4 to 1 gear ratio.

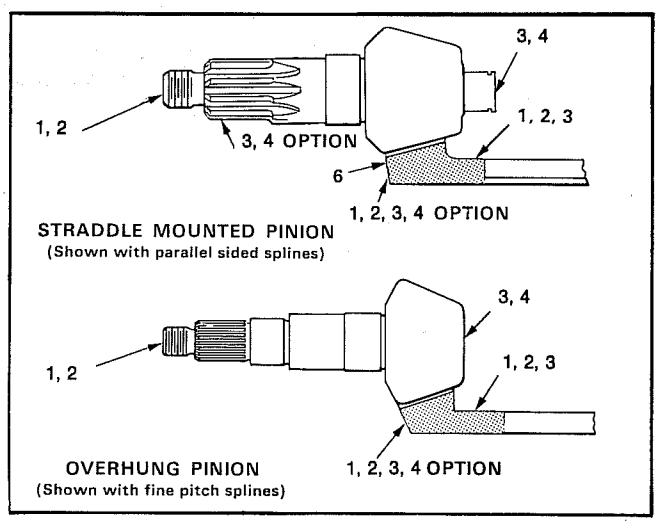
Always refer to Part Number and the Tooth Combination Number before starting the reassembly. Check to be certain the pinion and gear match.

3. All Rockwell drive pinion and gear sets are manufactured and sold only in matched sets. Both pieces of the set have a matching number such as "M29" or any combination of a letter and number.

On most pinions the number is usually etched on the head end. However, on pinions with parallel-sided splines the number may be etched on the top flat of one of the splines.

On the ring gear the number is usually found on the front face of the gear, although sometimes it may be on the gear O.D.

A gear and pinion which do not have the same matching numbers must *not* be run together. Therefore,if either a pinion or a ring gear should require replacement *both must be replaced in a matched set.*



4. Each pinion has a Pinion Cone (P.C.) Variation Number which indicates variations (in thousandths of an inch) from the nominal mounting dimension. This Pinion Cone Variation Number is necessary because pinion and gear sets for a specific series of axles cannot be manufactured exactly alike, and there may be slight differences in the Nominal Mounting Dimensions of the individual gear sets. This P.C. Variation Number must be used to modify the Nominal Pinion Mounting Dimension when using a pinion setting gauge or when calculating pinion cage shim pack thicknesses. Refer to part B or C for shim pack adjustment.

The Pinion Cone Variation Number (i.e. P.C. +3 or P.C. -5) is normally found on the pinion head end; however, it may sometimes be located on a spline of a pinion with the larger parallel-sided-type splines.

5. Current drive pinion and ring gear sets no longer have the nominal pinion mounting distance, nominal pinion gauging dimension or backlash number marked on them. Therefore, the information included in the following two charts must be used when adjusting the pinion depth using a pinion setting tool or gauge, and when adjusting the backlash setting of new "unmarked" gear sets.

It should be noted at this time however, that if the original (reusable) pinion and gear set is being installed back into the carrier it is not necessary to use the pinion setting gauge. Accurate gear adjustment is accomplished by installing the original pinion bearing cage to carrier shim pack or a new pack of the same thickness, as removed, and set the gear backlash adjustment to the original setting.

NOMINAL PINION MOUNTING DISTANCE

SINGLE AXLE MODELS

	NOMINAL PINION MOUNTING DISTANCE
B-100, B-101	5.250" (133.35 mm)
C-100	6.125" (155.58 mm)
D-100 D-140	6.500" (165.10 mm)
F-106 F-130 F-140, F-142, F-145, F-146, F-147, F-149	6.812" (173.03 mm)
H-140, H-141, H-145	7.500" (190.50 mm)
H-150	7.156" (181.77 mm)
H-162 H-170, H-172	7.625" (193.68 mm)
L-100 with 3.545 thru 5.833 ratios except 4.875 ratios with 6.166 thru 8.600 ratios including 4.875 ratio	7.562" (192.08 mm) 7.688" (195.28 mm)
L-140, L-145, L-148	7.625" (193.68 mm)
L-155 with 3.545 thru 5.833 ratios except 4.875 ratios with 6.166 thru 8.600 ratios including 4.875 ratio	7.562" (192.08 mm) 7.688 (195.28 mm)
L-172	7.625" (193.68 mm)
Q-145, Q-146, Q-148	8.250" (209.55 mm)
R-100, R-110 R-114, R-115 R-120 R-140, R-141, R-143 R-155, R-158 R-160, R-162, R-164	8.750" (222.25 mm)
R-170, R-171, R-173 R-180	10.000" (254.00 mm)
U-140	8.750" (222.25 mm)
U-170 U-180	10.000" (254.00 mm)

NOTE: The norminal pinion mounting distances listed indicates the distance from the center of the ring and differential bearing bores of single reduction carriers.

TANDEM AXLE MODELS

SHHD fwd./rear & r./rear)		7.500" (190.50 mm)
SLHD (fwd./rear & r./rear)	with 3.545 thru 5.833 ratios except 4.875 ratio with 6.166 thru 8.600 ratios including 4.875 ratio	7.562" (192.08 mm)
SQJD (fwd./rear & r./rear)		7.688" (195.28 mm)
SQRHD (fwd./rear & r./rear)		
SQHP (fwd./ rear) (r./rear)		7.688" (195.28 mm) 7.875" (200.03 mm)
SSHD (fwd./rear & r./rear)		8.750" (222.25 mm)
STHD (fwd./read & r./rear)		
SUHD (fwd./rear & r./rear)		

BACKLASH SETTING

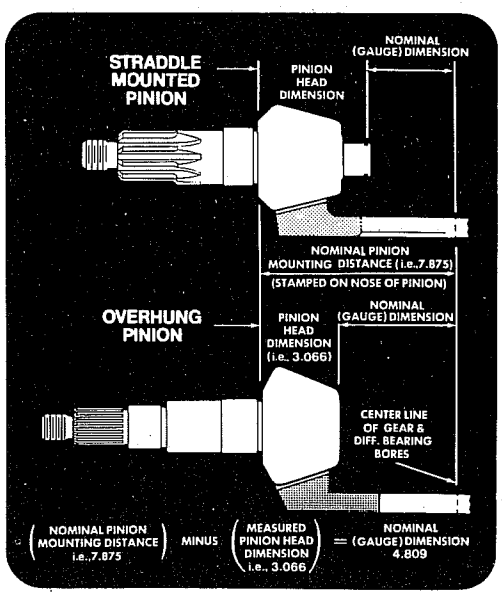
CARRIER TYPE & PITCH DIAMETER	PINION MOUNTING	BACKLASH SETTING
Single Reduction Carriers *(Less than 17- Pitch Dia.)	Either Straddle or Overhung	.005"-.015" (.13-.39mm)
Amboid Single Reduction Carrier only	Overhung only	.008"-.020" (2.1-.51mm)
Single Reduction Carriers *(17" Pitch Dia. & over)	Either Straddle or Overhung	.008"-.020" (.21-5.1mm)

***NOTE:** To determine approximate pitch diameter, measure the ring gear outer diameter.

B. ADJUSTING THE PINION CAGE SHIM PACK THICKNESS WITH A PINION SETTING GAUGE.

The correct use of a pinion setting gauge will simplify the accurate installation of the pinion and cage assembly into the carrier. When using the pinion setting gauge, never use the stamped nominal pinion mounting dimension without first modifying it to a workable value. The Nominal Pinion Mounting Dimension (i.e. 7.875) which is stamped on the head end of the pinion indicates the proper distance from the center of the ring gear to the bearing shoulder on the pinion.

However, because the pinion setting gauge measures the distance from the ring gear center to the nose of the pinion rather



than the bearing shoulder, it becomes necessary to subtract the length of the pinion head from the Nominal Pinion Mounting Dimension in order to establish the correct nominal or gauge dimensions to work with.

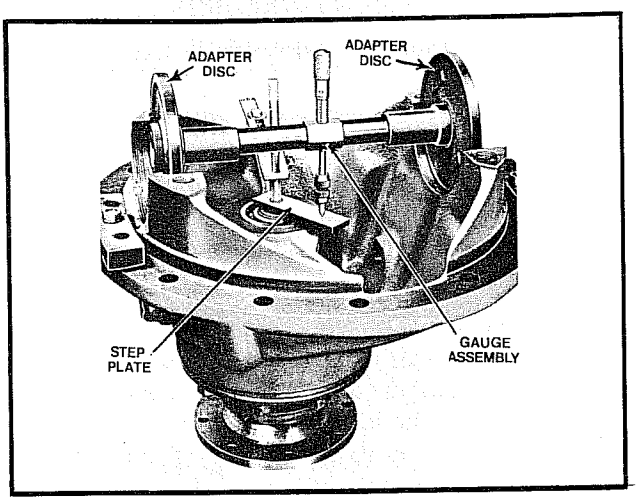
To accurately install and adjust the pinion and cage assembly in a typical single reduction carrier using a pinion setting gauge, follow these procedures:

1. Record the Nominal Pinion Mounting Dimension and the original shim pack thickness for future reference.
2. With a micrometer or vernier scale, measure the length of the pinion head from its nose to its bearing shoulder. Mark the spot on the pinion nose from which this measurement was taken. Later, when using the pinion setting gauge, measure to or clamp step plate to this same spot for consistency in the calculations.
3. Subtract the measured pinion head length from the Nominal Pinion Mounting Dimension to establish the pinion nominal gauge dimension. Repeating the example in Figure 1 this would be 7.875 - 3.066 = 4.809. The remainder 4.809 is the basic value or Nominal Gauge Dimension used for calculations when using the pinion setting gauge.
4. Modify the nominal gauge dimension (4.809) by the Pinion Cone Variation Number etched on the pinion (i.e. P.C. +3 or P.C. -5). This P.C. number indicates the variation in thousandths of an inch from the nominal mounting distance of that specific gear set. Add or subtract this value as indicated by its sign from the nominal gauge dimension established in Step 3. This will give the corrected pinion gauge dimension.

   Example: P.C. = +3
   4.809 + .003 = 4.812

   Example: P.C. = -5
   4.809 - .005 = 4.804

5. Install the pinion and cage assembly into carrier, using the original shim pack that was removed when the unit was disassembled. Tighten all pinion cage cap screws or stud nuts to the specified torque.
6. Assemble the pinion setting gauge and step plate (if required) into the differential bearing bores using proper adapter discs. Refer to Technic Aid Section 8, Aid #19 for specifics on adapter discs. Adjust the micrometer arbor so it is directly over and at a 90° angle to the pinion nose or step plate.



7. Run the micrometer down to measure the distance to the pinion or step plate. Make note of this measurement and use the following procedures to calculate for correct shim pack thickness.

   If a step plate is required, subtract its thickness (.400″) from the corrected pinion gauge dimension calculated in Step 4.

   Example:

Corrected Nominal Gauge Distance (4.809″-.005″)	4.804″

   Example:

Corrected Nominal Gauge Distance (4.809″-.005″)	4.804″
Step Plate Thickness	-.400″
Corrected Micrometer Distance (Final measurement to be obtained)	4.404″
Initial Micrometer Reading (Using original shim pack)	-4.384″
Shim Pack Correction (To be added)	.020″

8. After making the necessary corrections to the shim pack and tightening the cap screws or nuts to the specified torque, recheck the micrometer measurement

again to be certain of the correct pinion adjustment.

C. ADJUSTING THE PINION CAGE SHIM PACK THICKNESS WITHOUT A PINION SETTING GAUGE.

A second means of accurately installing a new pinion and cage assembly into the carrier is to mathematically calculate the proper pinion cage shim pack thickness.

The following are the procedures to use:

1. Measure the thickness of the original shim pack used with the gear set being replaced. Use a micrometer or vernier gauge. Record this measurement for future use.
2. Observe 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 "1". If the variation number is a minus (-) value add it to the measurement from item "1". Make a note of this value.
   NOTE: *The value calculated in item "2" 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.*
3. Observe the "PC" or variation number on the new pinion, (locations of the "PC" number are shown above). Add or subtract this Number as indicated by the variation sign (+ add or - subtract) from the calculated "standard shim pack thickness" determined in item "2".

   The resulting answer indicates the thickness (in thousandths) of the new shim pack to be used. Refer to the following examples which cover all the possible combinations of + or - original and new "PC" variations.

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"

After calculating the shim pack thickness, assemble the new pinion and cage assembly with the correct shim pack into the carrier as follows:

IMPORTANT: *Remember, that all Rockwell-Standard drive pinion and gear sets are manufactured and sold only in matched sets. Therefore, if either a pinion or a ring gear should require replacement both must be replaced in a matched set.*

4. Position the correct shim pack between the pinion cage and carrier.
   IMPORTANT: *Use a minimum of three (3) shims per pack. If the pack is made up from various thicknesses of shims locate thinnest shims on both sides of the pack for maximum sealing ability.*
5. Install the pinion and cage assembly with shims into carrier and tap into position with soft mallet.
6. Install pinion cage cap screws. Tighten cap screws to the correct torque.
7. After the differential and gear assembly is installed into carrier make a gear tooth contact check.

FOR ALL

Rockwell

INTER-AXLE DIFFERENTIALS

AND THROUGH DRIVES

WHEN ADDITIONAL TRACTION IS NEEDED
TO GET OVER ROUGH AND SLIPPERY TERRAIN

follow these easy steps:

1. Flip switch to "lock" position while maintaining vehicle speed.
2. Let up momentarily on accelerator. This will engage differential lock.
3. Proceed cautiously.

CAUTION

DO NOT ACTUATE SELECTOR WHILE ONE OR MORE WHEELS ARE ACTUALLY SLIPPING OR SPINNING as damage to the gearing may result.

CAUTION

DO NOT SPIN WHEELS WITH INTER-AXLE DIFFERENTIAL UNLOCKED as a spin-out condition will rapidly result.

FOR ALL

Rockwell

INTER-AXLE DIFFERENTIALS

AND THROUGH DRIVES

Under normal operating conditions selector should remain in "Unlock" position. This provides differential action between axles. To maintain maximum pulling power when wheels are likely to slip use "Lock" position to provide positive power to both axles.

DO NOT ACTUATE SELECTOR WHILE WHEELS ARE ACTUALLY SLIPPING OR SPINNING

Switch to "Unlock" position when requirement for "Lock" position has passed.

Rockwell International
Automotive Operations
Technical Communications
2135 West Maple Road
Troy, Michigan 48084

Heavy stock 5x7 shift cards, shown above, are available for use in the cab of the vehicle through the Technical Communications Dept.; Rockwell International, 2135 W. Maple Rd., Troy, Mich., 48084.

TIRE MATCHING

Unmatched tires on either Tandem Drive Units or Tridem Drive Units will cause tire wear and scuffing and possible damage to the drive units. Consequently we recommend the tires be matched to within 1/8" of the same rolling radius, ¾" of the same rolling circumference.

TANDEM UNITS

IMPORTANT: The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an inter-axle "fight", unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

In addition to matching individual tire rolling radii or rolling circumference, we recommend matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

TRIDEM UNITS

When three driving axles are "hooked" together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs.

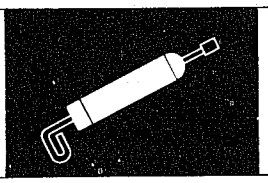
Therefore, we recommend matching, as nearly as possible, the total tire circumference of each of the three driving axles.

HOW TO MATCH TIRES TANDEM UNITS

The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size. (Measure new tires to be sure they will be correctly matched.)

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire pressure, within the tire manufacturer's recommended range, so the lubricant temperature of both axles is within 30° F of each other and not in excess of 220° F. This will usually result in uniform tire loading and good tire life.

section 3



Lubrication

The efficiency and life of mechanical equipment is as dependent on proper lubrication as on proper engineering design. The importance of proper lubrication is increased because of greater gear tooth and bearing pressures and higher speeds in present day vehicles. For this reason, we are vitally interested in promoting widespread usage of the best possible lubricants for our products.

Our grease recommendations are based on commercial products that have given satisfactory results in normal operation. However, there are many proprietary grease products on the market which will perform satisfactorily, and may be preferable because of supply problems, common usage for other truck components, etc. Where such products are recommended by reputable grease suppliers for the specific lubrication of our components, Rockwell-Standard has no objections, provided that these substitute products are equal or better than the Rockwell-Standard recommendations in lubrication properties, water resistance, corrosion protection, high and low temperature characteristics, oxidation stability, shear stability, etc.

It is advisable to consider the reputation of the refiner or vendor when selecting a lubricant. He is responsible for the quality and correct application of his product. A high quality lubricant incorrectly applied may greatly reduce the maximum service built into our product. Past experience has proven that a large portion of service problems can be traced to an improper lubricant application.

Our purpose in compling these specifications is to provide a guide to aid in the selection of a lubricant which will render the most satisfactory service.

RECOMMENDED LUBRICATION PRACTICES

NEW AND RECONDITIONED AXLE SERVICE

With new axles, the original drive axle lubricant should be drained at 1,000 miles but no later then 3,000 miles. Drain the lubricant initially used in the assembly while the assembly is still warm. Axles should not be flushed with any solvent such as kerosene.

Also, change the oil filter of drive units employing a pump forced lubrication system. Initially the filter should be changed at the same time as the oil, or at 1,000 - 3,000 miles.

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

Fill axle housings to bottom of level hole (in carrier or housing) with specified lubricant with the vehicle on level ground. If the new or reconditioned axle employs an inter-axle differential of the type that can be directly filled through a top filler plug hole, pour an additional 2 U.S. pints of the same lubricant into the inter-axle differential housing.

MAGNETIC DRAIN PLUGS

Any drive axle, while it is working, generates wear particles at a fairly steady rate. These wear particles are very fine but hard. If these hard wear particles are allowed to circulate in the lubricant, the anti-friction bearings will wear at a faster rate than they would if the hard wear particles were removed as they are generated.

Magnetic drain plugs perform the vital function of trapping these small metallic 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 recommend plugs with elements having a minimum pickup capacity of 2 pounds of low carbon steel in plate or bar forms.

Magnets will rapidly lose effectiveness as collected material bridges the gap between the two poles. Change plugs before this occurs. It may be necessary to change plugs one or more times between complete lubrication changes. The removed plugs can be cleaned and re-used.

NOTE: *For maximum protection against wear particles it is desirable that magnetic plugs be employed at any drain, fill or level hole location of the drive unit.*

REGULAR AXLE SERVICE

When the inter-axle differential housing employs a filler and drain plug servicing the unit is done 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 into 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.

LUBRICANT CHANGE SCHEDULE

There are very practical reasons for recommending lubricant changes. Fluid lubricants serve more than one purpose. They not only lubricate but they transport chemically reactive additives, they wash away minute wear particles, serve as a corrosion inhibitor and also act as a heat transfer medium. Draining and refilling with a fresh supply assists in eliminating both magnetic and non magnetic wear particles which may not have been trapped by a magnetic plug. Exposure to heat and use may also alter the desirable performance properties which are re-assured through a lubricant change.

A regular schedule for changing the axle lubricant in a particular vehicle and operation can be accurately determined by analysis of samples taken from the assembly at specified intervals or mileages. The lubricant supplier frequently makes available his laboratory facilities for determining the useful life of his product under actual service conditions. The finally recommended schedule may be correlated, for economic reasons, with lubricant changes governed by climatic conditions and magnetic drain plug maintenance. Lubricant changes should be made as climatic temperatures demand, regardless of vehicle mileage or established change schedule.

If it is desirable to select an arbitrary lubricant change schedule, we recommend changing the lubricant at 25,000 to 30,000 mile intervals when the yearly mileage accumulation is in excess of 60,000 miles. When yearly mileage accumulation is less than 60,000 miles, we recommend changing the lubricant twice yearly (spring and fall) irrespective of mileage.

The normal operating temperature of compounded lubricants during the summer season is approximately 160°F to 220°F. The chemicals and additives that give these lubricants increased load carrying capacity oxidize faster at temperatures above 220°F, contributing to more rapid lubricant deterioration. For this reason, lubricants of this type that operate continuously at high temperatures must be changed more frequently to realize the inherent advantages they offer.

TEMPERATURE INDICATOR

Many Rockwell tandem axles, particularly the larger ones, have a 1/2" pipe tap hole for the installation of a lubricant temperature thermocouple. We recommend indicators be installed in these axles, especially hypoid thru-drive units. A sudden upward change in lubricant temperature may indicate tire or mechanical trouble that can be corrected, avoiding expensive repair. When the lubricant temperature reaches 250°F, the vehicle should be immediately stopped to find the cause of overheating.

OIL VISCOSITIES

For service purposes and the convenience of description in this Field Maintenance Manual the term "Standard" indicates a lubricant of proper viscosity for average temperature conditions during the spring, summer, and fall in the continental United States (except for Alaska), and a part of the continental United States during the winter.

Optional viscosity lubricants should be used whenever vehicles are parked at outside temperatures lower than the minimum given for the "Standard" lubricant.

The proper viscosity of oil for the specific component shall be selected from the table of ambient temperatures on page 96. Where more than one lubricant can be selected from this table, the higher viscosity oil should be used.

Experience has shown that the use of an S.A.E. 140 viscosity grade lubricant (Rockwell specifications 0-76, 0-76-A and 0-76-B) will result in longer gear life.

Unusual temperature or operating conditions may require other or more specific lubricant recommendations. The Rockwell Group 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, and so forth, are clearly and completely stated when applying to our Engineering Department for an optional lubricant recommendation.

Multigrade and synthetic lubricants may be used provided that the complete specifications (including viscosity stability in service) of each viscosity grade listed are met.

CAUTION: The synthetic lubricant must be compatible with the standard commercial seals used in the axle (pinion and wheel end), otherwise special seals must be installed. Further, the seals used must pass Rockwell Specification J-11 when tested in the synthetic lubricant.

Synthetic lubricants to be tested do not require S.A.E. 90 viscosity grade (as noted in Specification J-11) to determine compatible seals and lubricants.

SPECIFICATIONS OF RECOMMENDED LUBRICANTS (Oil and Grease)

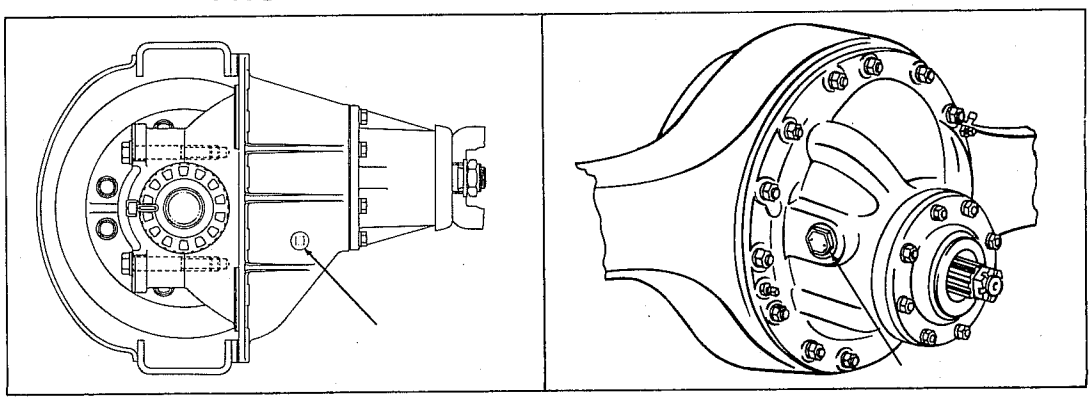
Material specifications and change intervals of lubricants recommended by Rockwell are as follows:

DRIVE UNITS (DIFFERENTIALS)

A. HYPOID GEARS AND AMBOID GEARS SINGLE REDUCTION

The design of hypoid gear teeth, which mesh with a sliding action, enables them to withstand higher unit pressures. Therefore, the lubricant should have extreme pressure properties. Only lubricants with the S.A.E. designation API-GL-5 meet these requirements and are recommended for both hypoid and amboid gears.

FRONT MOUNTED SINGLE REDUCTION

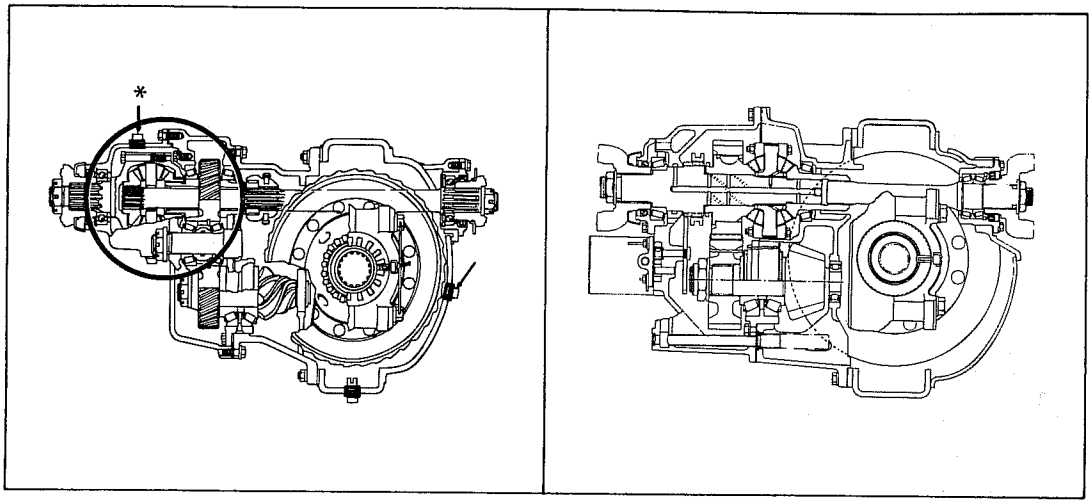


AMBOID BEVEL GEARING — HYPOID GEARING

LUBRICANT: standard: 0-76, 0-76-A, or 0-76-B; optional: 0-76-C, 0-76-D, 0-76-F, or 0-76-J } Refer to page 90 "Oil Viscosities"

CHANGE INTERVAL: Heavy duty on-highway, on/off-highway and off-highway service — check every 1,000 miles (1,600 km). Drain and refill to top of filler neck or bottom of tapped hole every 25,000 to 30,000 miles (40,000-48,000 km) when yearly mileage is in excess of 60,000 miles (96,000 km). If yearly mileage is less than 60,000 miles (96,000 km) change twice a year (spring and fall).

Regular Common Carrier Type Duty-On-Highway Vehicles — Change every 50,000 miles (80,000 km) when yearly mileage is in excess of 100,000 miles (160,000 km). If yearly mileage is less than 100,000 miles (160,000 km) change twice a year (spring and fall) irrespective of mileage.



FORWARD/REAR AXLE INTER-AXLE DIFF.

FORWARD/REAR AXLE-INTER-AXLE DIFF. PUMP FORCED LUBRICATION

OIL FILTER

Replace the oil filter of drive units employing a pump forced lubrication system every time the oil is changed or at least every 50,000 miles (80,000 km) maximum.

OIL PUMP

New units — Pre-lubricate oil pump gears with 2 oz. of recommended axle lubricant through the oil pump to filter passage.

Reconditioned units — Pack the pump cavity with grease (O-617-A or O-617-B) before installing pump cover.

*NOTE: Add two (2) extra pints of lubricant to axles employing inter-axle differentials of the type that can be directly filled through a top filler plug hole. Refer to "Capacities" on page 99

OIL LUBRICANT SPECIFICATIONS

As a quick guide to Rockwell Material Specifications, the following are very brief descriptions. They are not meant to replace the complete specification, or to serve in their places.

GEAR LUBRICANT SPECIFICATIONS	MINIMUM OUTSIDE TEMP.	MAXIMUM OUTSIDE TEMP.	CROSS REFERENCE	DESCRIPTION
0-73**	+40°F	*	GL-2, S.A.E. 140	Worm Gear Oil
0-74**	Spring Seat Application — no upper or lower limit		GL-2, S.A.E. 250	Spring Seat Oil
0-76	+40°F	*	GL-5, S.A.E. 140	Hypoid Gear Oil
0-76-A	+10°F	*	GL-5, S.A.E. 85W/140	Hypoid Gear Oil
0-76-B	-15°F	*	GL-5, S.A.E. 80W/140	Hypoid Gear Oil
0-76-C	+10°F	*	GL-5, S.A.E. 85W/90	Hypoid Gear Oil
0-76-D	-15°F	*	GL-5, S.A.E. 80W/90	Hypoid Gear Oil
0-76-F	-15°F	+70°F	GL-5, S.A.E. 80W	Hypoid Gear Oil
0-76-J	-40°F	+35°F	GL-5, S.A.E. 75W	Hypoid Gear Oil

*There is no upper limit on these outside temperatures, but the axle sump temperature MUST NEVER EXCEED 250° F. Whenever there is an overlap in the above temperature ranges, the higher viscosity oil should be used.

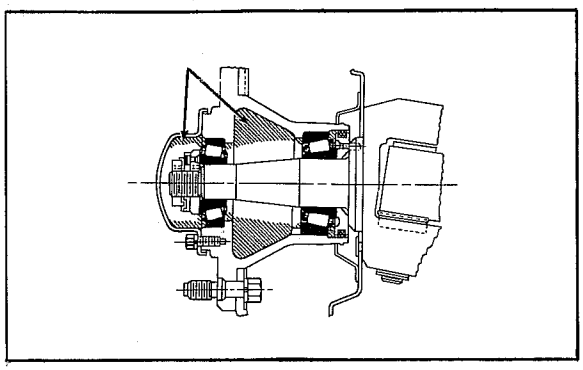
**These lubricants are never to be used in axles employing hypoid, amboid, spiral bevel or planetary gearing.

GREASE LUBRICANT SPECIFICATIONS

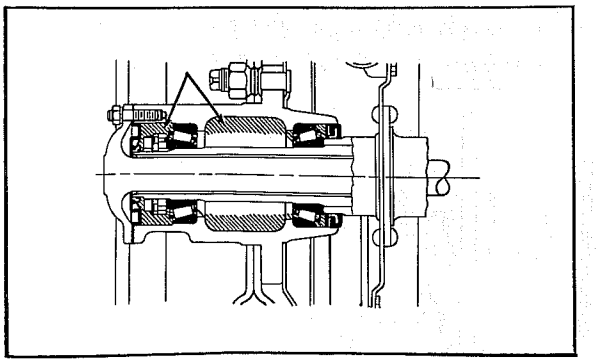
0-617-A	----	----	NLGI Grade No. 1	6% 12-hydroxy lithium stearate grease
0-617-B	----	----	NLGI Grade No. 2	8% 12-hydroxy lithium stearate grease

WHEEL BEARINGS

GREASE LUBRICATED



Non-Drive Axle Hub Assembly



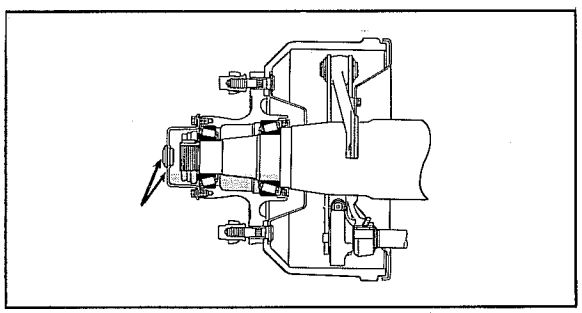
Drive Axle Hub Assembly

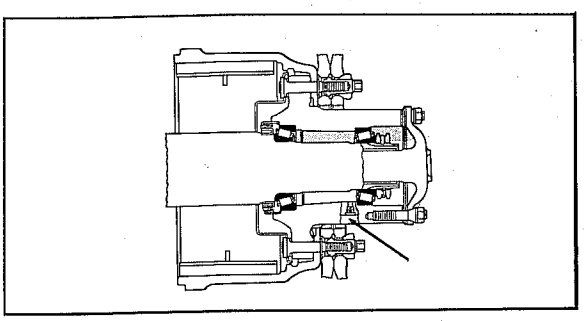
LUBRICANT: 0-617-A (preferred) or 0-617-B (acceptable)

APPLICATION NOTE: *0-617-A has a consistency which is preferred to take advantage of slumping characteristic, and for insurance against possibility of fretting corrosion in wheel bearings. 0-617-B has a consistency which is preferred for ease of packing wheel bearings.*

CHANGE INTERVAL: The frequency of lubricant changes depends upon individual operating conditions, speed and loads. Change whenever seals are replaced or when brakes are relined or at 30,000 miles. If yearly mileage is less than 30,000 miles change twice a year (spring and fall).

OIL LUBRICATED





LUBRICANT: standard 0-76-C } Refer to page 94
optional 0-76-F or 0-76-J } "Oil Viscosities"

Also 0-76 or 0-76-A if drive axle employs oil lubricated hubs with a common hub/axle housing oil level and axle requires 0-76 or 0-76-A for proper operation.

IMPORTANT: *Use the following procedures to assure that oil lubricated wheel bearings of drive axles are initially lubricated after servicing and before vehicle is put back into operation:*

● **HUBS WITH OIL FILL HOLES** — *Pour one (1) pint of oil (same as used in drive unit) directly into each hub.*

● **HUBS WITHOUT OIL FILL HOLES** — *Pour the specific amount of recommended drive unit lubricant through the carrier or housing bowl oil fill hole.*

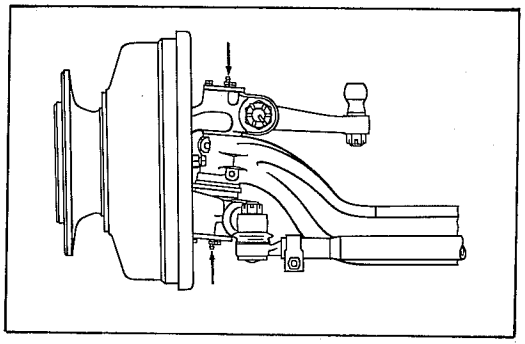
Next, tilt the vehicle to the right and to the left enough to allow oil to flow into hub cavities. This may be accomplished by jacking up the axle from each end. Keep the axle in each tilted position for one minute to allow hub cavities to fill. Approximately one pint of oil will be trapped in each hub cavity.

With the vehicle on a level surface add the appropriate amount of drive unit lubricant back into the carrier or housing bowl to bring the oil level back up to the correct point, approximately two (2) pints.

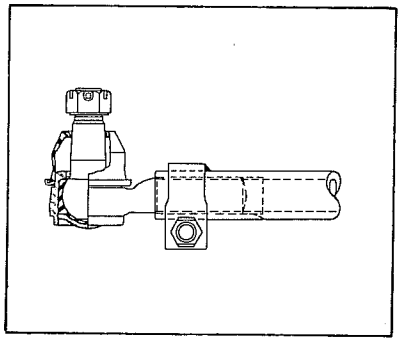
CHANGE INTERVAL: Check every 1,000 miles and change whenever seals are replaced or when brakes are relined, or at least once a year.

FRONT AXLE Knuckle Pins and Bushings Cross Tube and Drag Link

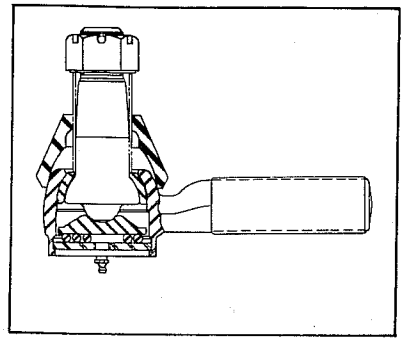
NOTE: *Permanently lubricated tie rod ends do not require lubrication.*



Conventional



Permanently Lubricated



Greasable Tie Rod End

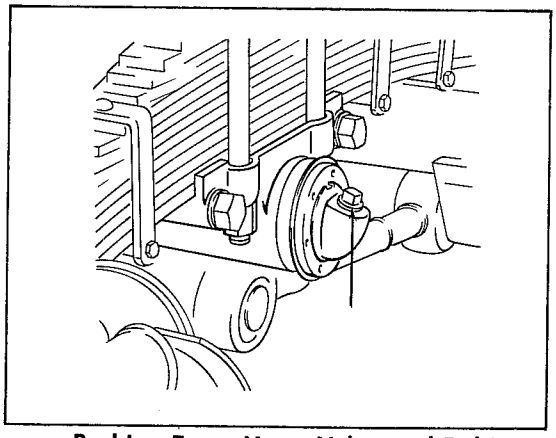
LUBRICANT: 0-617-A or 0-617-B

CHANGE INTERVAL: Standard axles every 3,000 miles. Axles employing sealed knuckle pins every 50,000 miles. Greasable tie rod ends every 50,000 miles.

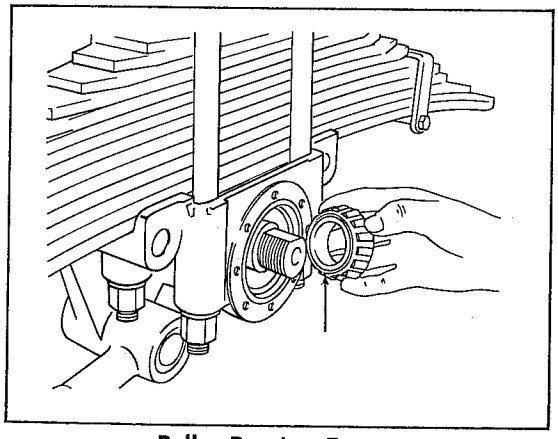
NOTE: Permanently lubricated tie rod ends do not require lubrication, however, periodic inspection at 96,000 mile intervals is recommended.

IMPORTANT: *Pressure gun should be held on fittings until new grease appears. This will assure that all the old contaminated grease has been forced out. On sealed knuckle pins, it is not necessary to exceed 4,000 psi. However, our experience indicates that the best distribution of new lubricant and the best purging of old lubricant is obtained when approximately 4,000 psi pressure is applied at the grease gun nozzle. Thus, using a 40 to 1 booster, the air should be limited to 100 psi; using a 50 to 1 booster, the air should be limited to 80 psi. Appreciable higher or lower pressures are not recommended.*

SPRING SEATS



Bushing Type, Meta, Nylon and Delrin



Roller Bearing Type

LUBRICANT: 0-74*
GL-2, SAE 250

CHANGE INTERVAL As required — Keep reservoir filled with specified oil.

*NOTE: *Use 0-73 (SAE Grade 140) if 0-74 (SAE Grade 250) is not available. However, check oil level more frequently when using lighter grade.*

LUBRICANT: 0-617-B

CHANGE INTERVAL: Whenever wheel bearings are lubricated or at 30,000 miles. If yearly mileage is less than 30,000 miles change twice a year (spring and fall).

LUBRICANT CAPACITIES OF ROCKWELL AXLES

Lubricant capacities are given as a guide only. All measurements are taken still filled, with the pinion shaft on the horizontal centerline (unless otherwise stated ●), to top of filler neck on earlier models and bottom of the tapped level hole on later models.

The lubricant capacities of two similar axles in the same series may vary considerably due to design changes and the vehicle manufacturer's installation. The actual service capacity may be accurately determined by carefully measuring the amount of specified lubricant necessary to fill the assembly to the correct level and measuring the lubricant again as it is drained from the unit. The vehicle should be on a level floor when this inspection is made.

"Make-up" quantities are less than 1/2 unit capacity.

SINGLE REDUCTION TANDEM

REFERENCE ONLY

MODEL			CAPACITY U.S. Pints	Capacity Litres
●SDHD	forward	DHD	‡16	‡7.0
	rear	DHR	16	7.0
●SFHD	forward	FHD	‡17	‡8.0
	rear	FJR	16½	7.5
●SHHD	forward	HHD	‡26	‡12.0
	rear	JJR	26	12.0
●SLHD	forward	LHD	‡32½	‡15.25
	rear	LHR	32	15.0
●SQHD	forward	QHD	‡34	‡16.0
	rear	QHR	31	14.5
SRHD	forward		39	18.5
	rear		36	17.0
SSHDA	forward	SHD	34	16.0
	rear	SHR	28	13.0
SQHP	forward	QHP	40	19.0
	rear	QAR	36	17.0

IMPORTANT:

‡Add two pints of lubricant to inter-axle differential housing when new or reconditioned drive unit is installed in addition to specified amount of lubricant in housing.

●Pinion shaft 6° above horizontal centerline.

SINGLE AXLES

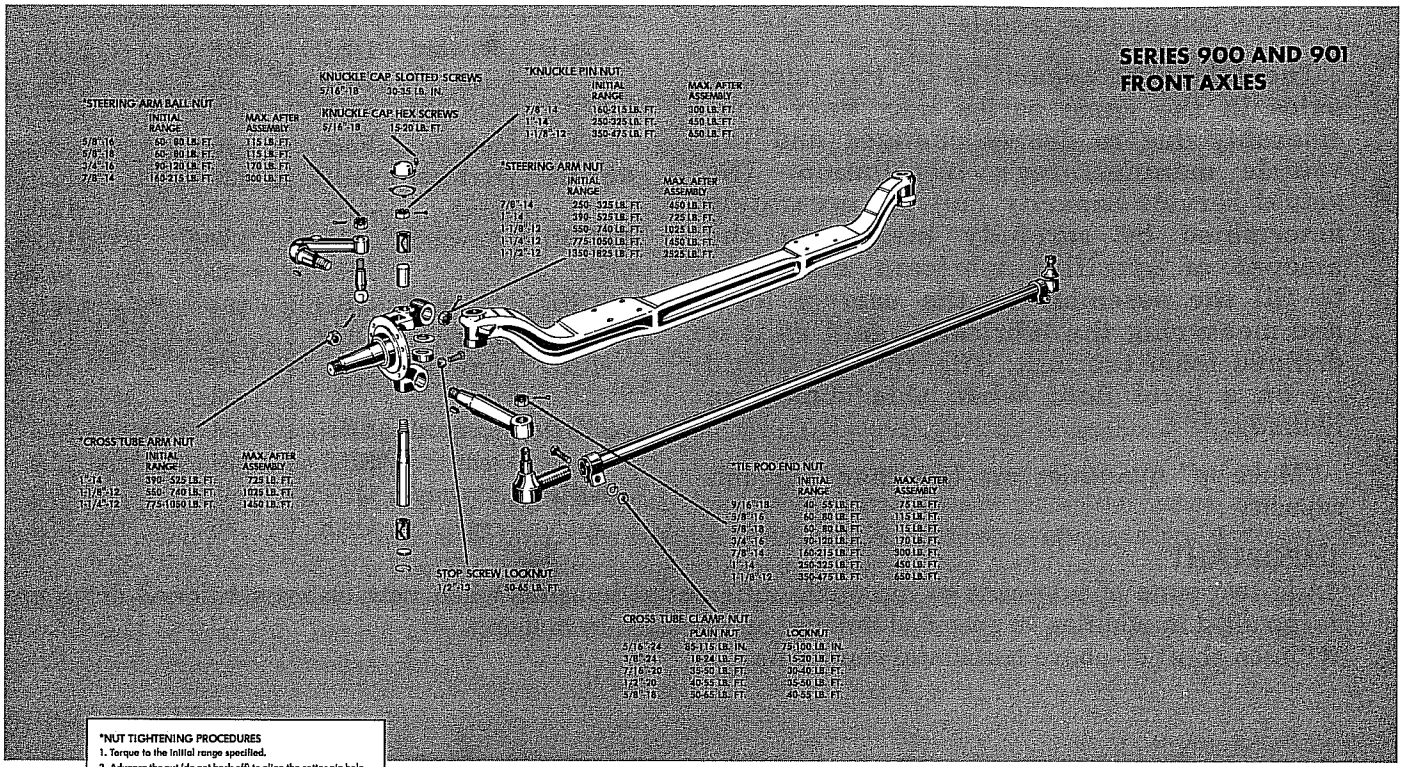
REFERENCE ONLY

MODEL	CAPACITY U.S. Pints	CAPACITY Litres	MODEL	CAPACITY U.S. Pints	CAPACITY Litres	MODEL	CAPACITY U.S. Pints	CAPACITY Litres
A-150	5½	2.5	F-140	14	6.5	QT-140	24	11.5
B-100	10	4.5	G-161	21	10.0	R-100	30	14.0
B-140	12	5.5	H-100	20	9.5	R-140	28	13.0
B-150	3½	1.5	H-140	21	10.0	R-160	28	13.0
C-100	12½	6.0	H-150	11	5.0	R-163	34	16.0
D-100	12½	6.0	H-162	20	9.5	R-170	43	20.0
E-100	15	7.0	H-170	27	12.5			
E-105	12½	6.0	L-100	23	10.5			
E-150	9	4.0	L-140	24	11.5			
F-100	13	6.0	Q-100	31	14.5			

Torque Values

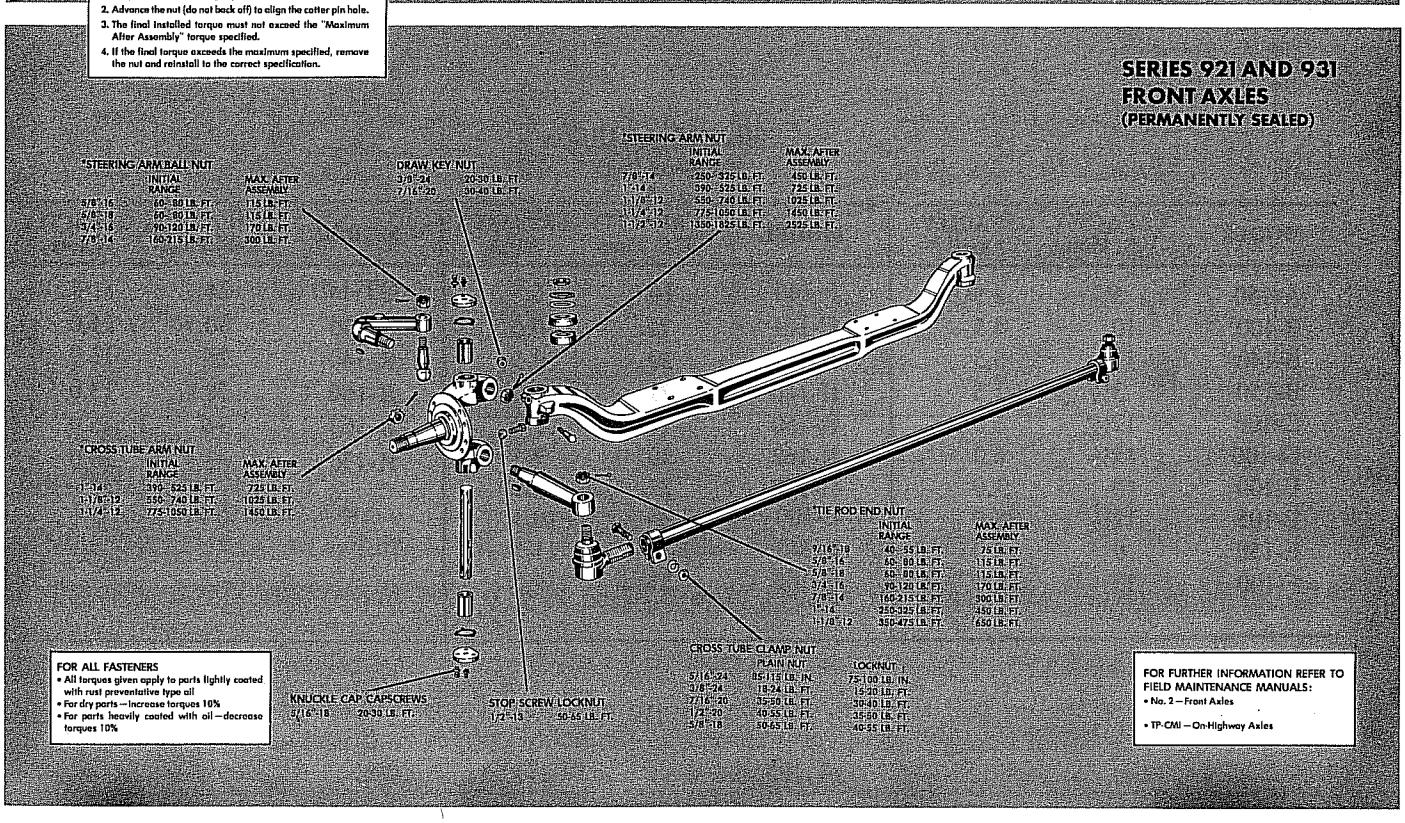
NON-DRIVING FRONT AXLES

FASTENER TORQUE CHART



***NUT TIGHTENING PROCEDURES**

1. Torque to the initial range specified.
2. Advance the nut (do not back off) to align the cotter pin hole.
3. The final installed torque must not exceed the "Maximum After Assembly" torque specified.
4. If the final torque exceeds the maximum specified, remove the nut and reinstall to the correct specification.



FOR ALL FASTENERS

- All torques given apply to parts lightly coated with rust preventative type oil
- For dry parts—increase torques 10%
- For parts heavily coated with oil—decrease torques 10%

FOR FURTHER INFORMATION REFER TO FIELD MAINTENANCE MANUALS:

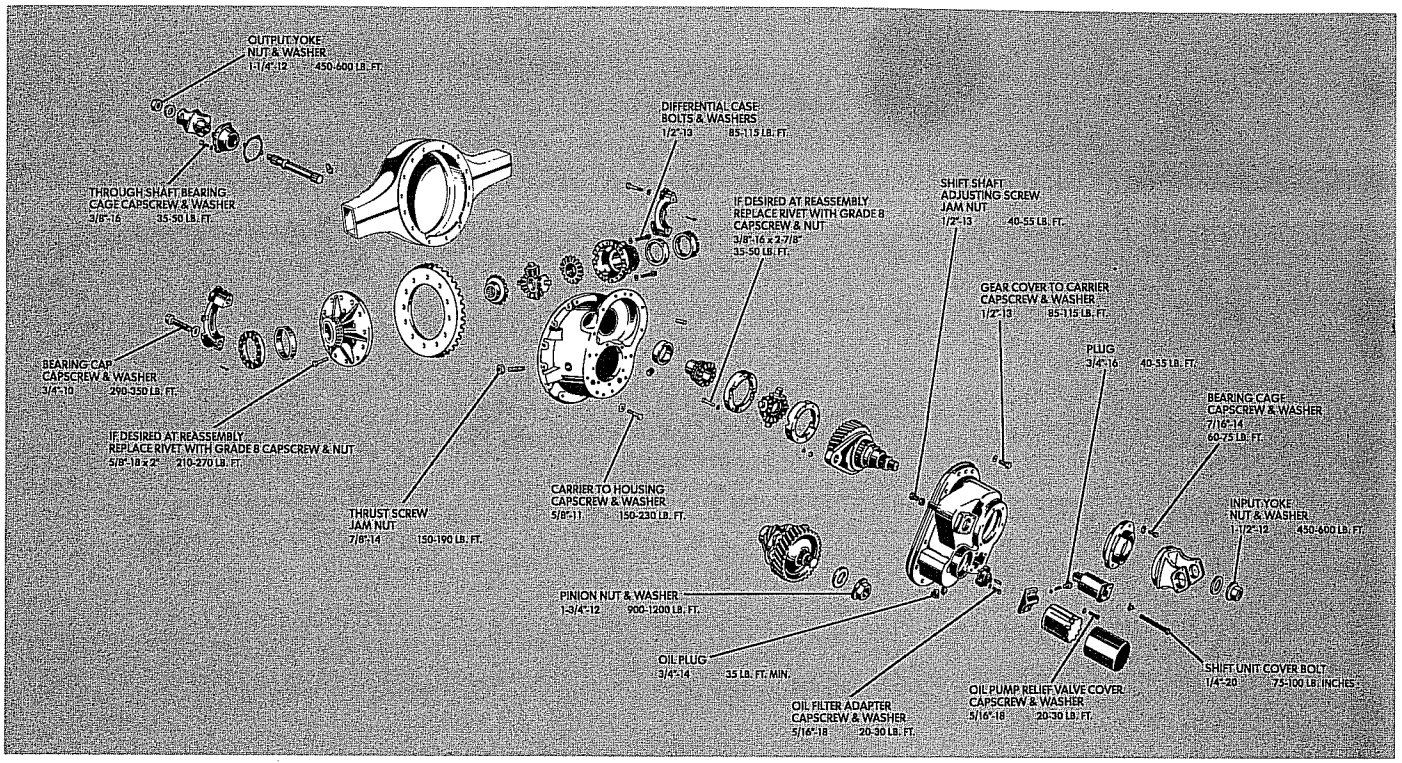
- No. 2—Front Axles
- TP-CMI—On-Highway Axles

SQHP TANDEM AXLES

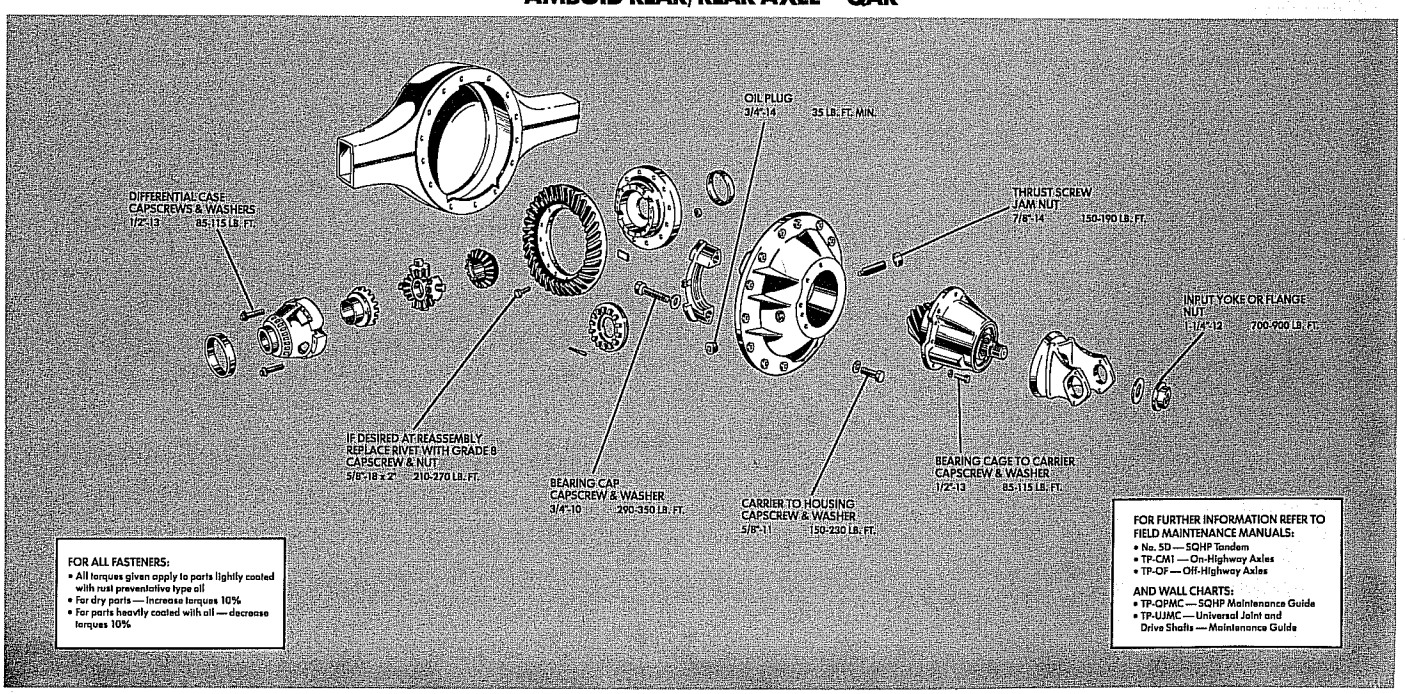
(HYPOID FORWARD/REAR AXLE AND AMBOID REAR/REAR AXLE)

FASTENER TORQUE CHART

HYPOID FORWARD/REAR AXLE — QHP



AMBOID REAR/REAR AXLE — QAR



FOR ALL FASTENERS:

- All torques given apply to parts lightly coated with rust preventative type oil
- For dry parts — increase torques 10%
- For parts heavily coated with oil — decrease torques 10%

FOR FURTHER INFORMATION REFER TO FIELD MAINTENANCE MANUALS:

- No. 5D — SQHP Tandem
- TP-CM1 — On-Highway Axles
- TP-OF — Off-Highway Axles

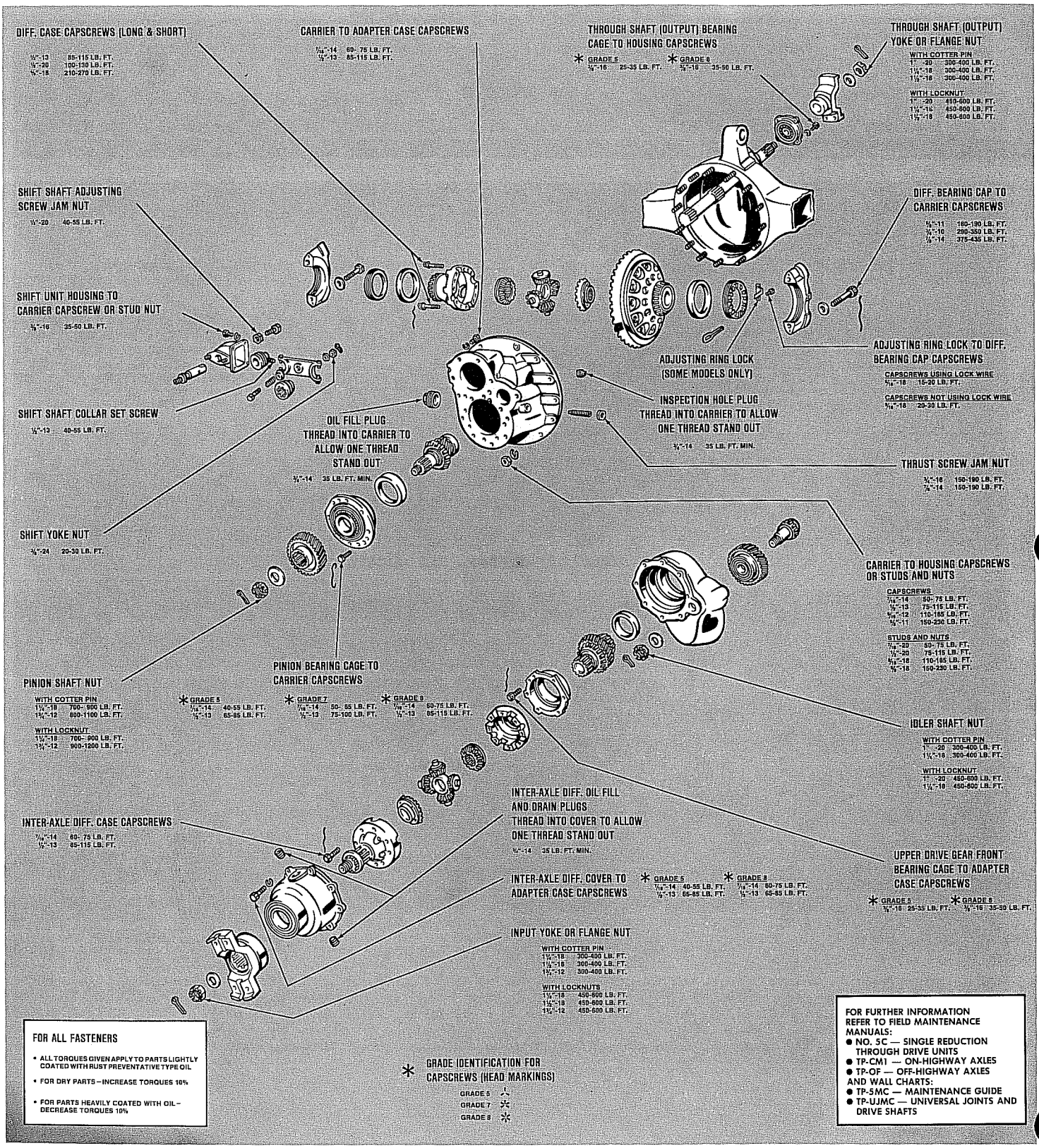
AND WALL CHARTS:

- TP-QPMC — SQHP Maintenance Guide
- TP-UJMC — Universal Joint and Drive Shafts — Maintenance Guide

FRONT MOUNTED SINGLE-REDUCTION DRIVE UNITS

(FORWARD/REAR TANDEM AXLE — THREE GEAR TRANSFER TRAIN — SLHD and SQHD)

FASTENER TORQUE CHART



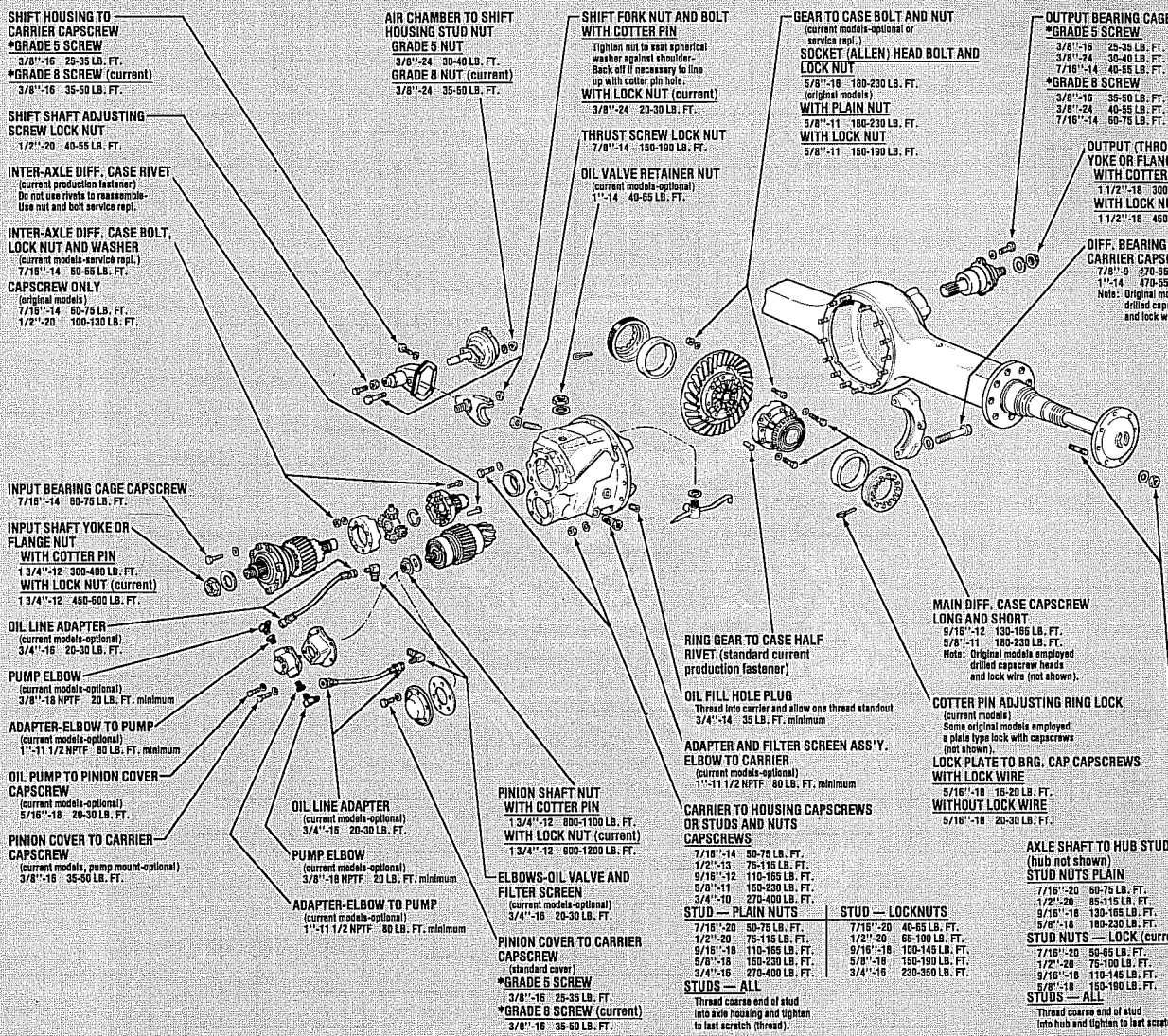
FRONT MOUNTED SINGLE-REDUCTION DRIVE UNITS

(FORWARD/REAR TANDEM AXLES—TWO GEAR TRANSFER TRAIN—OPTIONAL EXTERNAL MOUNTED OIL PUMP)

SSHD TYPE DRIVE UNIT

FASTENER TORQUE CHART

UNLESS OTHERWISE SPECIFIED THE FASTENER TORQUE VALUES LISTED ON THIS CHART ARE FOR BOTH ORIGINAL AND CURRENT MODELS. (CURRENT MODEL IS ILLUSTRATED)



SHIFT HOUSING TO CARRIER CAPSCREW
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
*GRADE 8 SCREW (current)
3/8"-16 35-50 LB. FT.

SHIFT SHAFT ADJUSTING SCREW LOCK NUT
1/2"-20 40-55 LB. FT.

INTER-AXLE DIFF. CASE RIVET
(current production fastener)
Do not use rivets to reassemble-
Use nut and bolt service repl.

INTER-AXLE DIFF. CASE BOLT, LOCK NUT AND WASHER
(current models-service repl.)
7/16"-14 50-65 LB. FT.

CAPSCREW ONLY
(original models)
7/16"-14 60-75 LB. FT.
1/2"-20 100-130 LB. FT.

AIR CHAMBER TO SHIFT HOUSING STUD NUT
GRADE 5 NUT
3/8"-24 30-40 LB. FT.
GRADE 8 NUT (current)
3/8"-24 35-50 LB. FT.

SHIFT FORK 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 (current)
3/8"-24 20-30 LB. FT.

THRUST SCREW LOCK NUT
7/8"-14 150-190 LB. FT.

OIL VALVE RETAINER NUT
(current models-optional)
1"-14 40-55 LB. FT.

GEAR TO CASE BOLT AND NUT
(current models-optional or service repl.)
SOCKET (ALLEN) HEAD BOLT AND LOCK NUT
5/8"-18 180-230 LB. FT.
(original models)
WITH PLAIN NUT
5/8"-11 180-230 LB. FT.
WITH LOCK NUT
5/8"-11 150-190 LB. FT.

OUTPUT BEARING CAGE CAPSCREW
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
3/8"-24 30-40 LB. FT.
7/16"-14 40-55 LB. FT.
*GRADE 8 SCREW
3/8"-16 35-50 LB. FT.
3/8"-24 40-55 LB. FT.
7/16"-14 60-75 LB. FT.

OUTPUT (THROUGH) SHAFT YOKE OR FLANGE NUT
WITH COTTER PIN
1 1/2"-18 300-400 LB. FT.
WITH LOCK NUT (current)
1 1/2"-18 450-600 LB. FT.

DIFF. BEARING CAP TO CARRIER CAPSCREW
7/8"-9 270-350 LB. FT.
1"-14 470-550 LB. FT.
Note: Original models employed drilled capscrew heads and lock wire (not shown).

INPUT BEARING CAGE CAPSCREW
7/16"-14 60-75 LB. FT.

INPUT SHAFT YOKE OR FLANGE NUT
WITH COTTER PIN
1 3/4"-12 300-400 LB. FT.
WITH LOCK NUT (current)
1 3/4"-12 450-600 LB. FT.

OIL LINE ADAPTER
(current models-optional)
3/4"-16 20-30 LB. FT.

PUMP ELBOW
(current models-optional)
3/8"-18 NPTF 20 LB. FT. minimum

ADAPTER-ELBOW TO PUMP
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT. minimum

OIL PUMP TO PINION COVER CAPSCREW
(current models-optional)
5/16"-18 20-30 LB. FT.

PINION COVER TO CARRIER CAPSCREW
(current models, pump mount-optional)
3/8"-16 35-50 LB. FT.

OIL LINE ADAPTER
(current models-optional)
3/4"-16 20-30 LB. FT.

PUMP ELBOW
(current models-optional)
3/8"-18 NPTF 20 LB. FT. minimum

ADAPTER-ELBOW TO PUMP
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT. minimum

PINION SHAFT NUT WITH COTTER PIN
1 3/4"-12 800-1100 LB. FT.
WITH LOCK NUT (current)
1 3/4"-12 900-1200 LB. FT.

ELBOWS-OIL VALVE AND FILTER SCREEN
(current models-optional)
3/4"-16 20-30 LB. FT.

PINION COVER TO CARRIER CAPSCREW
(standard cover)
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
*GRADE 8 SCREW (current)
3/8"-16 35-50 LB. FT.

RING GEAR TO CASE HALF RIVET (standard current production fastener)

OIL FILL HOLE PLUG
Thread into carrier and allow one thread standout
3/4"-14 35 LB. FT. minimum

ADAPTER AND FILTER SCREEN ASS'Y. ELBOW TO CARRIER
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT. minimum

CARRIER TO HOUSING CAPSCREWS OR STUDS AND NUTS
CAPSCREWS
7/16"-14 50-75 LB. FT.
1/2"-13 75-115 LB. FT.
9/16"-12 110-165 LB. FT.
5/8"-11 150-230 LB. FT.
3/4"-10 270-400 LB. FT.

STUD — PLAIN NUTS		STUD — LOCKNUTS	
7/16"-20	50-75 LB. FT.	7/16"-20	40-65 LB. FT.
1/2"-20	75-115 LB. FT.	1/2"-20	65-100 LB. FT.
9/16"-18	110-165 LB. FT.	9/16"-18	100-145 LB. FT.
5/8"-18	150-230 LB. FT.	5/8"-18	155-190 LB. FT.
3/4"-16	270-400 LB. FT.	3/4"-16	230-350 LB. FT.

STUDS — ALL
Thread coarse end of stud into axle housing and tighten to last scratch (thread).

MAIN DIFF. CASE CAPSCREW LONG AND SHORT
9/16"-12 130-195 LB. FT.
5/8"-11 180-230 LB. FT.
Note: Original models employed drilled capscrew heads and lock wire (not shown).

COTTER PIN ADJUSTING RING LOCK
(current models)
Some original models employed a plate type lock with capscrews (not shown).

LOCK PLATE TO BRG. CAP CAPSCREWS WITH LOCK WIRE
5/16"-18 15-20 LB. FT.
WITHOUT LOCK WIRE
5/16"-18 20-30 LB. FT.

AXLE SHAFT TO HUB STUDS AND NUTS
(hub not shown)
STUD NUTS PLAIN
7/16"-20 60-75 LB. FT.
1/2"-20 85-115 LB. FT.
9/16"-18 130-165 LB. FT.
5/8"-18 180-230 LB. FT.
STUD NUTS — LOCK (current)
7/16"-20 50-65 LB. FT.
1/2"-20 75-100 LB. FT.
9/16"-18 110-145 LB. FT.
5/8"-18 150-190 LB. FT.
STUDS — ALL
Thread coarse end of stud into hub and tighten to last scratch (thread).

FOR ALL FASTENERS
- ALL TORQUES GIVEN APPLY TO PARTS LIGHTLY COATED WITH RUST PREVENTATIVE TYPE OIL.
- FOR DRY PARTS — INCREASE TORQUES 10%
- FOR PARTS HEAVILY COATED WITH OIL DECREASE TORQUES 10%

*** GRADE IDENTIFICATION FOR CAPSCREWS (HEAD MARKINGS)**

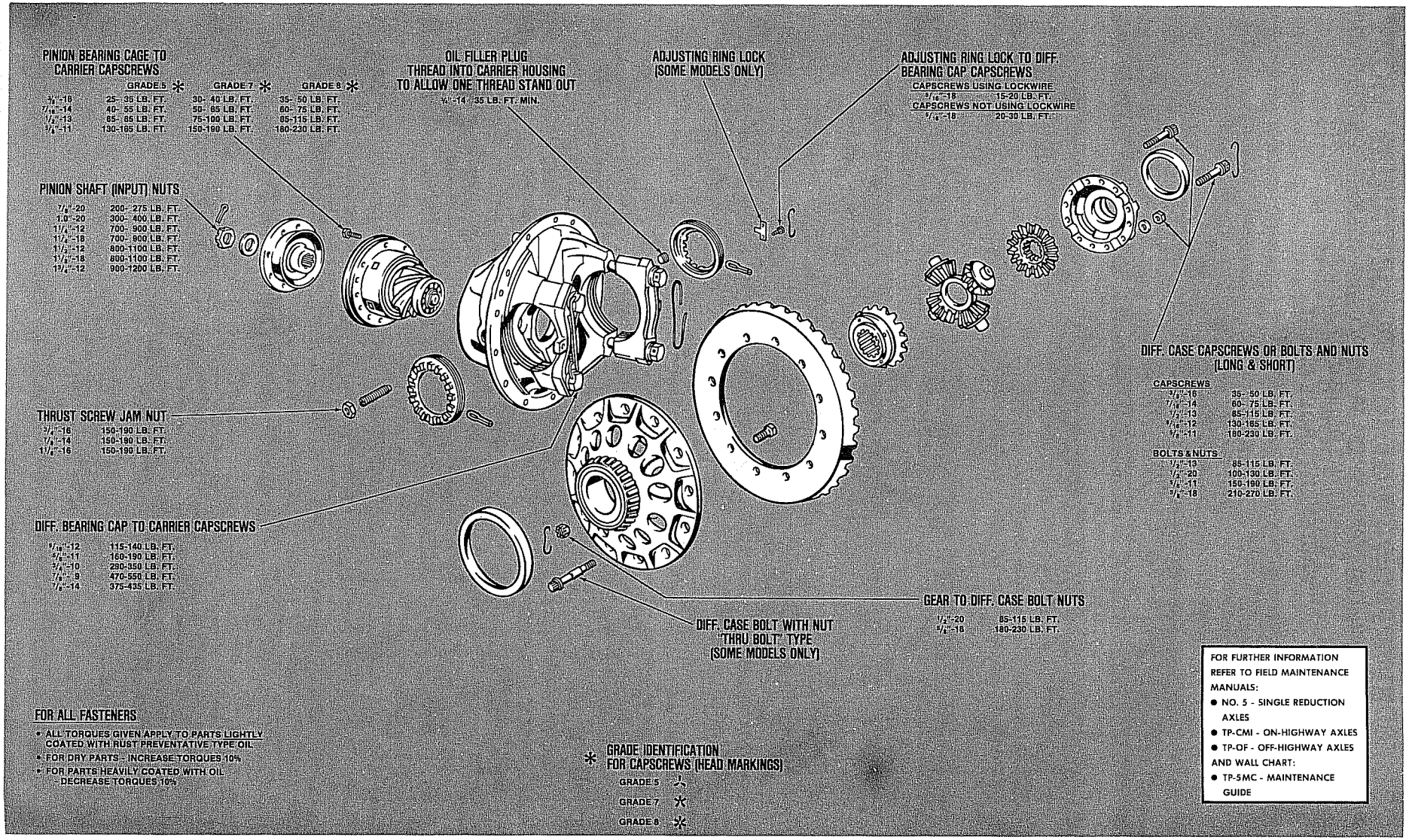
GRADE 5
GRADE 7
GRADE 8

FOR FURTHER INFORMATION REFER TO FIELD MAINTENANCE MANUAL NO. 58 AND WALL CHART TP-IAPC.

SINGLE REDUCTION DRIVE UNITS

(SINGLE AXLES AND REAR/REAR TANDEM UNITS)

FASTENER TORQUE CHART



PINION BEARING CAGE TO CARRIER CAPSCREWS

	GRADE 5 *	GRADE 7 *	GRADE 8 *
1/4"-18	25- 35 LB. FT.	30- 40 LB. FT.	35- 50 LB. FT.
7/16"-14	40- 55 LB. FT.	50- 65 LB. FT.	60- 75 LB. FT.
1/2"-13	65- 85 LB. FT.	75-100 LB. FT.	85-115 LB. FT.
3/4"-11	130-165 LB. FT.	150-190 LB. FT.	180-230 LB. FT.

OIL FILLER PLUG THREAD INTO CARRIER HOUSING TO ALLOW ONE THREAD STAND OUT

1/4"-14 - 35 LB. FT. MIN.

ADJUSTING RING LOCK (SOME MODELS ONLY)

ADJUSTING RING LOCK TO DIFF. BEARING CAP CAPSCREWS

CAPSCREWS USING LOCKWIRE

5/16"-18 15-20 LB. FT.

CAPSCREWS NOT USING LOCKWIRE

5/16"-18 20-30 LB. FT.

PINION SHAFT (INPUT) NUTS

7/8"-20	200- 275 LB. FT.
1.0"-20	300- 400 LB. FT.
1 1/2"-12	700- 900 LB. FT.
1 1/2"-18	700- 900 LB. FT.
1 1/2"-12	800-1100 LB. FT.
1 1/2"-18	800-1100 LB. FT.
1 3/4"-12	900-1200 LB. FT.

DIFF. CASE CAPSCREWS OR BOLTS AND NUTS (LONG & SHORT)

CAPSCREWS

3/8"-16	35- 50 LB. FT.
7/16"-14	60- 75 LB. FT.
1/2"-13	85-115 LB. FT.
9/16"-12	130-165 LB. FT.
3/4"-11	180-230 LB. FT.

BOLTS & NUTS

1/2"-13	85-115 LB. FT.
1/2"-20	100-130 LB. FT.
3/4"-11	150-190 LB. FT.
3/4"-18	210-270 LB. FT.

THRUST SCREW JAM NUT

7/8"-18	150-190 LB. FT.
7/8"-14	150-190 LB. FT.
1 7/8"-16	150-190 LB. FT.

DIFF. BEARING CAP TO CARRIER CAPSCREWS

7/16"-12	115-140 LB. FT.
3/4"-11	160-190 LB. FT.
1"-10	290-350 LB. FT.
7/8"-9	470-550 LB. FT.
7/8"-14	375-435 LB. FT.

GEAR TO DIFF. CASE BOLT NUTS

1/2"-20	85-115 LB. FT.
5/8"-18	180-230 LB. FT.

DIFF. CASE BOLT WITH NUT THRU BOLT TYPE (SOME MODELS ONLY)

FOR ALL FASTENERS

- ALL TORQUES GIVEN APPLY TO PARTS LIGHTLY COATED WITH RUST PREVENTATIVE TYPE OIL.
- FOR DRY PARTS - INCREASE TORQUES 10%
- FOR PARTS HEAVILY COATED WITH OIL - DECREASE TORQUES 10%

* GRADE IDENTIFICATION FOR CAPSCREWS (HEAD MARKINGS)

GRADE 5

GRADE 7

GRADE 8

FOR FURTHER INFORMATION REFER TO FIELD MAINTENANCE MANUALS:

- NO. 5 - SINGLE REDUCTION AXLES
- TP-CMI - ON-HIGHWAY AXLES
- TP-OF - OFF-HIGHWAY AXLES

AND WALL CHART:

- TP-5MC - MAINTENANCE GUIDE