FIELD MAINTENANCE MANUAL No. 7

HYPOID-HELICAL TWO-SPEED DOUBLE-REDUCTION DRIVE UNIT

ROCKWELL R STANDARD

Use Only Genuine TIMKEN-DETROIT Parts

ROCKWELL–STANDARD CORPORATION
(A Consolidation of The Timken-Detroit Axle Company and Standard Steel Spring Company)
TRANSMISSION AND AXLE DIVISION
DETROIT 32, MICHIGAN

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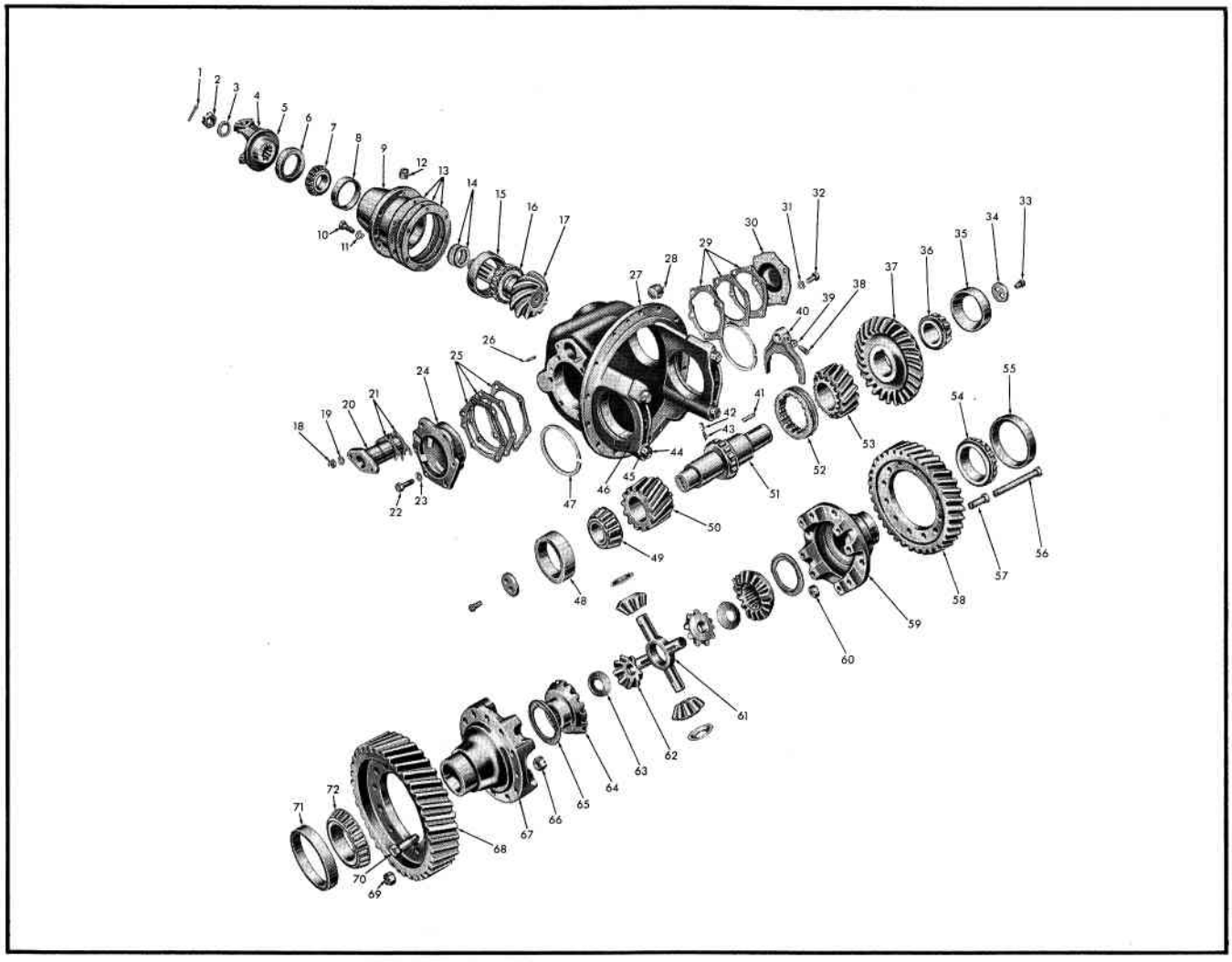


1. Cotter key
2. Yoke nut
3. Washer
4. Yoke
5. Slinger
6. Pinion oil seal
7. Drive pinion outer bearing
8. Drive pinion outer bearing cup
9. Pinion cage
10. Cap screw
11. Lock washer
12. Oil filler plug
13. Drive pinion shims
14. Drive pinion bearing spacer
15. Drive pinion inner bearing cup
16. Drive pinion inner bearing
17. Drive pinion
18. Nut
19. Lock washer
20. Shift shaft sleeve
21. Sleeve shims
22. Cap screw
23. Lock washer
24. Cross shaft bearing cage
25. Shims
26. Sleeve stud
27. Differential carrier housing
28. Oil filler plug
29. Shims
30. Cross shaft bearing cover
31. Lock washer
32. Cap screw
33. Bearing retainer cap screw
34. Bearing retainer plate
35. Cross shaft bearing cup
36. Cross shaft bearing
37. Drive gear
38. Shift fork set screw
39. Shift fork set screw lock nut
40. Shift fork
41. Cross shaft key
42. Poppet
43. Spring
44. Differential bearing cap cap screw
45. Washer
46. Differential bearing cap
47. Differential split adjusting ring (some models use threaded adjusting rings)
48. Cross shaft bearing cup
49. Cross shaft bearing
50. Helical pinion
51. Cross shaft
52. Cross shaft shift collar
53. Helical pinion
54. Differential bearing
55. Differential bearing cup
56. Differential case bolt
57. Gear to case bolt
58. Helical gear
59. Differential case half
60. Gear to case bolt nut
61. Differential spider
62. Differential pinion
63. Differential pinion thrust washer
64. Differential pinion side gear
65. Differential pinion side gear thrust washer
66. Gear to case bolt nut
67. Differential case half
68. Helical gear
69. Differential case bolt nut
70. Gear to case bolt
71. Differential bearing cup
72. Differential bearing

FRONT-MOUNTED TYPE

REMOVE DIFFERENTIAL CARRIER FROM HOUSING ASSEMBLY

A. Remove plug from bottom of axle housing and drain lubricant.

B. Remove the axle shaft drive stud nuts and lockwashers.

C. Hold a short drift firmly against the center of axle shaft flange between the driving lugs, and strike drift a sharp blow to loosen the tapered dowels. Remove the dowels and shaft.

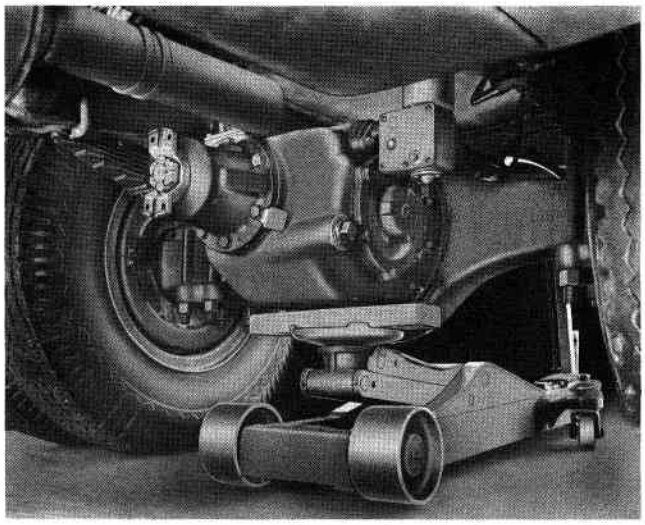
CAUTION: *Do not hit the shaft driving lugs with hammer. Do not pry shaft loose. Pry bars, chisels and wedges will damage hub, shaft flange and oil seals.*

D. Disconnect the universal joint at pinion shaft.

E. Disconnect the power shift unit.

F. Remove the carrier to housing stud nuts and washers leaving the two top nuts partially screwed on studs to prevent the carrier from falling.

G. Break the carrier loose from the axle housing with a rawhide mallet. (Remove tapered dowels where used.)



ROLLER JACK FOR CARRIER REMOVAL

H. Place a roller jack under carrier, remove the two top nuts and work carrier free using puller screws in holes provided.

A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange circle.

TOP-MOUNTED TYPE

REMOVE DIFFERENTIAL CARRIER FROM HOUSING ASSEMBLY

A. Disconnect universal joint at the pinion.

B. Remove plug from bottom of axle housing and drain lubricant.

C. Remove axle shaft flange stud nuts and washers.

D. Hold a short drift firmly against the center of axle shaft flange between the driving lugs, and strike drift a sharp blow to loosen the tapered dowels. Remove the dowels and shaft.

CAUTION: *Do not hit the shaft driving lugs with hammer. Do not pry shaft loose. Pry bars, chisels and wedges will damage hub, shaft flange and oil seals.*

E. Disconnect the power shift unit.

F. Remove the carrier to housing stud nuts and washers.

G. Break carrier loose from housing with rawhide mallet and remove the tapered dowels. If necessary, back out the studs.

H. Pull the carrier straight out of housing with chain falls, boom, "A" frame or puller screws. A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange circle.

E. If necessary to replace the cross shaft bearing cups, remove cross shaft bearing cover (hypoid gear side). Wire the shim pack together to facilitate adjustment on reassembling.

F. Remove cups from cages with suitable puller. Cup in cover side of carrier can be removed by tapping.

PREPARE FOR REASSEMBLY CLEAN, INSPECT AND REPAIR

Clean parts having ground and polished surfaces, such as gears, bearings and shafts, with solvent type cleaners such as emulsion cleaners, carbon tetrachloride or petroleum solvents excluding gasoline. Do not clean these parts in a hot solution tank or with water and alkaline solutions such as sodium hydroxide, orthosilicates or phosphates.

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

ROUGH PARTS

Rough parts such as differential carrier castings, torque divider and transfer case housings, 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 cleaning solution and the rinse water.

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

Parts cleaned in solution tanks or with alkali cleaners should be thoroughly rinsed after cleaning to remove all traces of alkali.

COMPLETE ASSEMBLIES

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

DRYING

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

CORROSION PREVENTION

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

INSPECT

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

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

B. Inspect first reduction hypoid and second reduction helical gears for wear or damage. Gears which are scored, pitted, ridged or worn should be replaced. When necessary to replace either the pinion or gear of a 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.

L. Find "corrected nominal distance" by adding nominal assembly dimension, 3.125", and pinion variation, plus .006". This equals 3.131". Make a note of this dimension.

When the step plate is used, it is necessary to subtract .400" (step plate thickness) from the corrected nominal dimension.

FOR EXAMPLE:

1. Corrected nominal distance (3.125" + .006")		3.131"
Step plate thickness	Minus	.400"
2. Corrected micrometer distance (final measurement to be obtained)		2.731"
3. Initial micrometer reading (using original shim pack)	Minus	2.692"
4. Shim pack correction (add shims)		.039"

When corrected nominal distance (1 or 2) is greater than the initial micrometer reading (3), it is necessary to add shims to the pinion cage pack (4). This moves the pinion AWAY FROM the gear.

M. Remove the gauge assembly and pinion cage assembly from drive unit and add .039" shims to the shim pack. Check corrected micrometer distance of 2.731" by reinstalling the pinion and cage assembly with the corrected shim pack. Be sure pinion cage cap screws or stud nuts are tightened to specified torque.

In another example, assume the pinion variation distance from nominal assembly dimension is minus .007".

1. Corrected nominal distance (3.125" — .007")		3.118"
Step plate thickness	Minus	.400"
2. Corrected micrometer distance (final measurement to be obtained)		2.718"
3. Initial micrometer reading (using original shim pack)		2.743"
Corrected micrometer distance	Minus	2.718"
4. Shim pack correction (remove shims)		.025"

When initial micrometer reading (3) is greater than the corrected nominal distance (1 or 2), it is necessary to REMOVE shims from the pinion cage pack (4). This will move the pinion TOWARD the gear.

N. Remove the gauge assembly and pinion cage assembly from the drive unit and remove .025" shims from the shim pack. Check corrected micrometer distance of 2.718" by reinstalling the pinion and cage assembly with corrected shim pack being sure pinion cage cap screws or stud nuts are tightened to specified torque.

O. Remove pinion cage assembly and shims.

INSTALLATION OF CROSS SHAFT ASSEMBLY IN CARRIERS

Gaskets at the pinion cage, cross shaft covers and cages are not used in current production drive units. When reassembling a drive unit formerly incorporating gaskets, add approximately 0.015" shim stock to the original pack to maintain correct bearing preload and gear adjustment. Thin shims should be located on both sides of the pack to obtain maximum sealing ability.

A. *On wide range ratio carriers requiring assembly of high speed helical pinion and bearings after the cross shaft is in the carrier, follow the steps as listed below.*

1. Lubricate cross shaft bearings and cups with light machine oil.
2. Install cross shaft assembly minus the high speed helical pinion into carrier with the cage or cover of the hypoid side removed.
3. Install high speed helical pinion and set up in a press so that bearing retaining plate at hypoid side of the cross shaft may be rested on a support at the cover or cage opening.
4. Press bearing opposite the hypoid gear onto the shaft. Install the bearing retaining plate and cap screws. Tighten all cap screws to correct torque and safety wire.

5. Install bearing cage or cover with the shim pack on the hypoid side of the carrier. Replace cap screws and lock washers, then tighten to proper torque.

Should a press not be available, the cross shaft bearing opposite the gear side may be installed with a suitable driver placed against the inner race of the bearing providing the gear side of the shaft is blocked up against the bearing retainer. Do not drive or press bearings onto the cross shaft with the opposite bearing resting on the cage or in the cup. To do so will brinell the cup and roller surfaces.

B. On carriers permitting complete assembly of cross shaft before threading into carrier housing follow steps listed below.

1. Lubricate cross shaft bearings and cups with light machine oil.

2. If the bearing cover or cage on the hypoid gear side has been removed, replace it using the correct shim pack. Tighten the cap screws to the proper torque. If the cover has not been removed, check the torque on the cap screws to be sure that they are to specifications.

3. Thread the cross shaft assembly past the differential bearing supports and position in the bearing cup.

C. Carriers with front mounted shift units:

1. Position the shift fork and install the shift shaft.

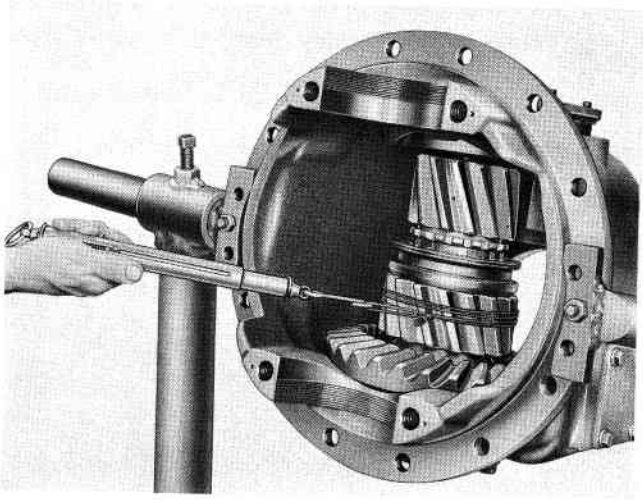
2. Align lock nut hole in the fork with the shaft indent and tighten the lock screw and lock nut to the specified torque.

3. Wire the lock screw to the fork through the holes provided.

D. Start the bearing cage (side opposite the hypoid gear) into the carrier housing.

E. Tap bearing cage into position with a soft mallet. Install cap screws and lock washers and tighten to proper torque.

F. In checking cross shaft bearing preload torque, always rotate cross shaft and gear assembly several revolutions before checking preload to assure normal bearing contacts.



G. Lock low speed helical pinion and the cross shaft with the shift collar. Wrap a strong cord around the helical pinion and pull on a horizontal line with a pound scale.

For Example:

Assuming the helical pinion diameter to be 4″, the radius would be 2″, and with a pull of 7 pounds on the scale, the bearing preload would be equal to 14 pound inches of preload torque.

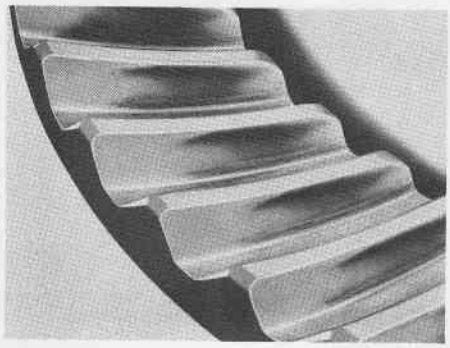
H. Read rotating pull, not starting pull. If preload torque is not within 5 to 15 pound inches, add shims under cage (opposite hypoid gear) to decrease or remove shims to increase cross shaft bearing preload torque.

INSTALLATION OF PINION AND CAGE ASSEMBLY

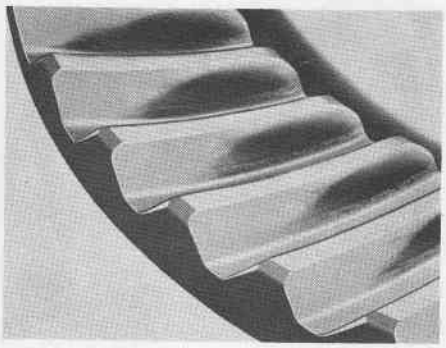
A. Install pinion cage assembly using corrected shim pack if pinion setting gauge was used, or original shim pack if gauge was not used.

B. Install cap screws and lock washers, tighten to proper torque.

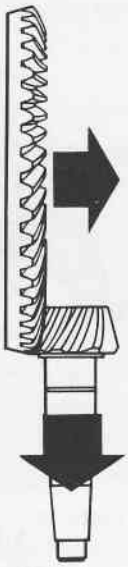
INCORRECT TOOTH CONTACT



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



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

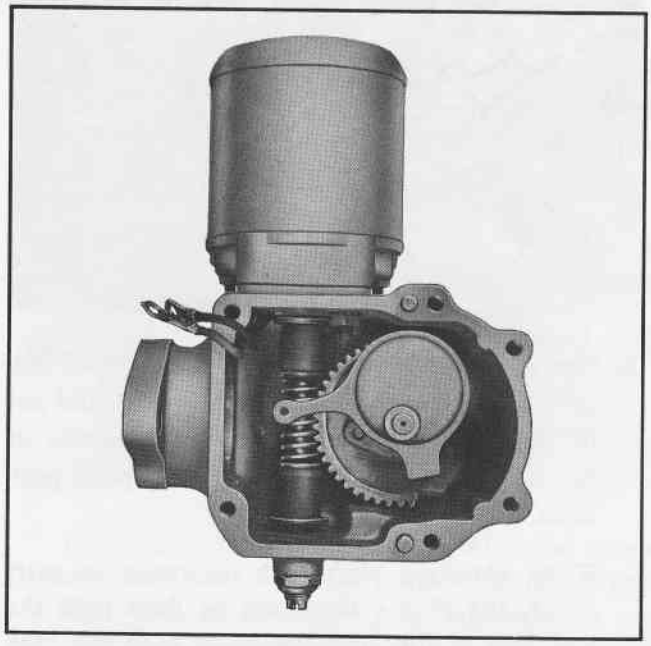


SERVICING THE SHIFT UNIT

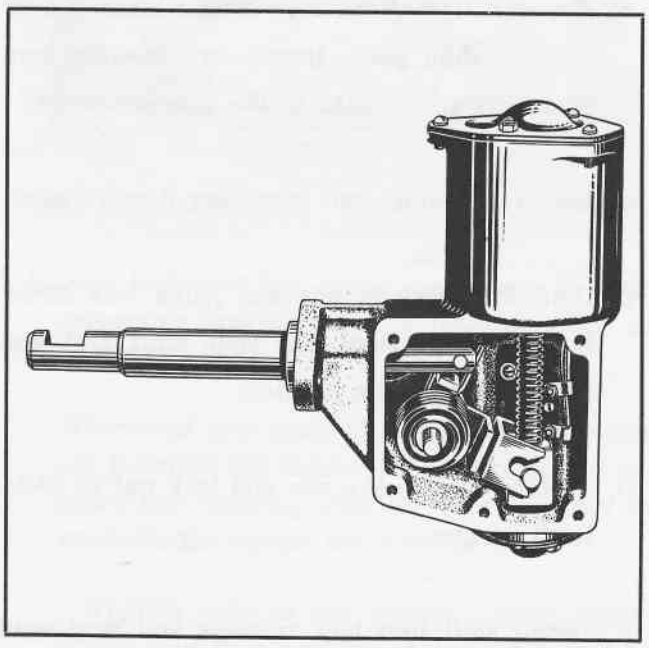
Different types of shift units are used on Rockwell-Standard two-speed axles depending on axle size and individual vehicle manufacturer's specifications.

Service instructions on the Rockwell-Standard electric shift unit may be obtained from the Technical Publications department of Rockwell-Standard Corporation.

Service instructions on other units may be obtained from the vehicle manufacturer.



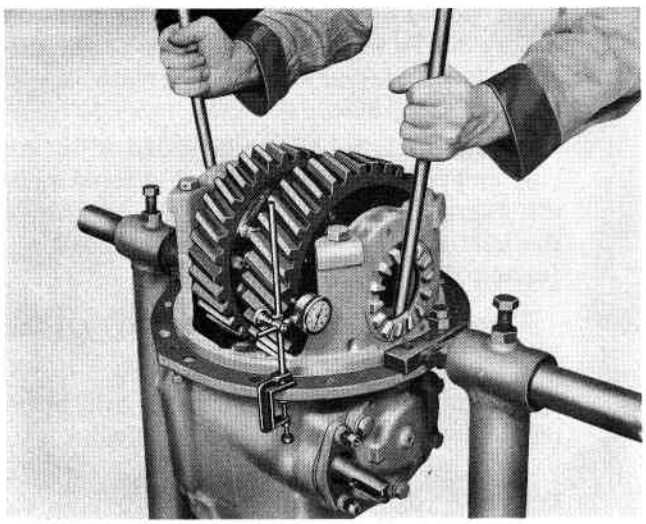
ROCKWELL-STANDARD
ELECTRIC SHIFT UNIT



ELECTRIC SHIFT UNIT

USE THE FOLLOWING PROCEDURE FOR ADJUSTING DIFFERENTIAL BEARINGS ON UNITS EMPLOYING EITHER ONE OR TWO THREADED RINGS:

A. On units employing two threaded rings, center the helical gears in relation to the helical pinions by means of the threaded rings.



B. Using a dial indicator at the side face of the helical gear, and starting with a definite amount of end play, adjust the differential bearings of the differential assembly to zero end play. A pair of pinch bars may be used as pictured.

NOTE: Rotate the assembly several revolutions each time the adjusting rings are moved before checking end play to assure normal bearing contact.

C. Either of the following procedures will result in proper differential bearing preload (threaded adjusting ring type):

1. Tighten the adjusting rings 1¾ to 2½ notches (total for both rings) to correctly preload the bearings; or

2. Tighten adjusting rings to spread the differential bearing legs .006″ to .010″ (total for both legs) as determined by a crescent shaped micrometer gauge held at the level of the leg pilot surfaces and parallel to the carrier mounting flange.

D. Install adjusting ring locks and cap screws where employed. Install lock wire.

USE THE FOLLOWING PROCEDURE FOR ADJUSTING DIFFERENTIAL BEARINGS ON UNITS EMPLOYING TWO SPLIT RINGS:

A. Temporarily install differential with bearings and cups in carrier housing and center between carrier leg grooves.

B. Insert thin split rings making certain that there is clearance between bearing cup faces and rings. (Do not install bearing caps.)

C. By means of a dial indicator measure end play of differential assembly by shifting the assembly back and forth between the rings with a small pair of pinch bars placed between the carrier legs and the spur gears.

D. Remove and measure the thickness of the rings. To the total thickness of the two thin rings add the end play figure plus another .017″ to .022″ to obtain the total thickness of the two thicker rings required to obtain proper bearing preload.

E. NOTE: Hardened split rings are ground in increments of .005″.

For Example:

If temporary thin rings used to measure end play were .290″ each for a total of .580″ and the end play is .005″, then .580″ plus .005″ end play equals .585″ (or zero end play).

Here an additional .020″ (interference) would be required to preload the bearings or a total of .605″ thicker split rings. The total of .605″ may be divided between the two rings such as .300″ and .305″.

F. See previous section for completing the installation of the differential and gear assembly.

CLEAN AND INSPECT HOUSING, ASSEMBLE DRIVE UNIT

A. Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.

B. Inspect housing for cracks, loose studs, nicks, and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacement before installing drive unit in housing.

C. Install new drive unit to housing gasket over housing studs.

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

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

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

D. Tighten the four nuts over flat washers alternately to draw carrier squarely into axle housing.

E. Remove nuts and flat washers. Install taper dowels, lock washers and stud nuts. Tighten to the correct torque.

F. Connect universal at pinion shaft.

G. Connect air, vacuum or electric lines to power actuated shift unit depending on type.

H. Install axle shafts.

LUBRICATION

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

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

A. Remove pipe plug in pinion cage and add one pint of *specified lubricant.*

B. Fill axle housing to the correct level with *specified lubricant.*

C. Lubricate universal joint.

D. Jack up *both* rear wheels and operate vehicle in *high* transmission gear at approximately 25 to 30 miles per hour for *five minutes* to assure satisfactory lubrication of all parts of the carrier assembly.

Do not operate with one wheel jacked up. Operation in this manner will result in overheating the differential spider with resultant galling or shearing of the spider pins.

Both wheel brakes should be free to allow both wheels to rotate at approximately the same speed.

NEW AND RECONDITIONED AXLE SERVICE

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

Fill axle housings to bottom of level hole with specified lubricant with the vehicle level.

REGULAR AXLE SERVICE

Refer to Field Maintenance Manual No. 1, "Lubrication," for recommended service interval.

Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain.

Some newer model axles have a smaller 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.

TORQUE SPECIFICATIONS

These torque specifications supersede all previous specifications for this series of drive units and should be used accordingly.

WRENCH TORQUE FOR PINION SHAFT NUTS

DIAMETER OR SIZE	THREADS PER INCH	TORQUE—LB. FT.	
		MIN.	MAX.
7/8"	20	175	250
1"	20	300	400
1 1/4"	18	700	900
1 1/2"	12	800	1100
1 1/2"	18	800	1100
1 3/4"	12	800	1100

DIFFERENTIAL BEARING CAP CAP SCREWS OR STUD NUTS

(Earlier Axle Models Without Hardened Washers)

CAP SCREW OR STUD NUT DIAMETER	CAP SCREW OR COARSE STUD THREAD	STUD NUT OR FINE THREAD	TORQUE—LB. FT.	
			MIN.	MAX.
5/8"	11	18	126	140
3/4"	10	16	225	250
7/8"	9	14	330	370
7/8"	14	14	375	415
1"	14	14	375	415

DIFFERENTIAL BEARING CAP CAP SCREWS OR STUD NUTS

(Later Axle Models Employing Hardened Washers)

CAP SCREW OR STUD NUT DIAMETER	CAP SCREW OR COARSE STUD THREAD	STUD NUT OR FINE THREAD	TORQUE—LB. FT.	
			MIN.	MAX.
5/8"	11	18	160	180
3/4"	10	16	290	320
7/8"	9	14	470	520
7/8"	14	14	510	570
1"	14	14	570	630

TORQUE SPECIFICATIONS

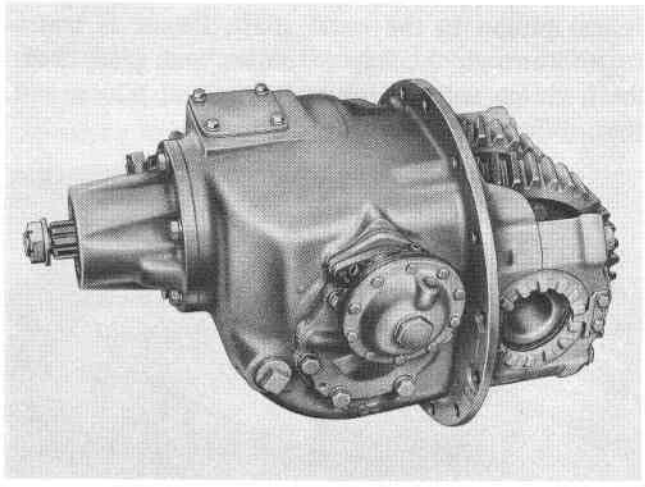
WRENCH TORQUE FOR CAP SCREWS OR STUD NUTS

Location	Diameter	Threads Per Inch	Torque Lb. Ft. Min. Max.
Carrier to Housing	7/16"	14	52-58
	7/16"	20	52-58
	1/2"	13	82-91
	1/2"	20	82-91
	5/8"	11	160-180
	5/8"	18	160-180
Pinion Cage	3/8"	16	33-37
	7/16"	14	52-58
	7/16"	20	52-58
	1/2"	13	82-91
	1/2"	20	82-91
	9/16"	12	116-129
	9/16"	18	116-129
	5/8"	11	160-180
Cross Shaft Bearing Cage and Cover	1/2"	13	82-91
	1/2"	20	82-91
	9/16"	12	116-129
	9/16"	18	116-129
	5/8"	11	160-180
Cross Shaft Bearing Lock	7/16"	14	42-45
	9/16"	12	92-101
Differential Bolts	3/8"	16	33-37
	7/16"	14	52-58
	1/2"	20	92-102
	9/16"	18	130-145
	5/8"	18	185-205
	3/4"	16	320-360
Adjusting Nut Lock	5/16"	18	15-17
Inspection Cover	3/8"	16	26-29
Shift Unit (Mounting)	3/8"	16	26-29
Shift Unit Lock Nut, Set Screw and Clamp Screw	3/8"	24	30-33
	7/16"	20	30-33
Shift Unit Travel Limiting Screws	1/2"	13	55-60
	5/8"	11	30-35

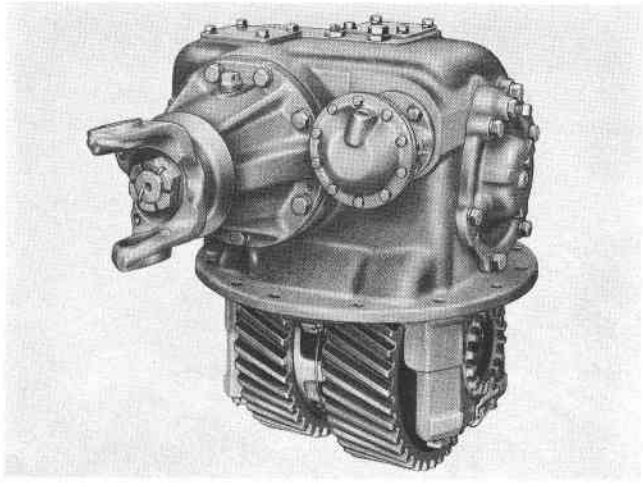
Torques given apply to parts coated with machine oil; for dry (or "as received") parts increase torques 10%; for parts coated with multi-purpose gear oil decrease torques 10%. Nuts on studs to use same torque as for driving the stud.

ROCKWELL-STANDARD TWO-SPEED DOUBLE REDUCTION DRIVE UNIT

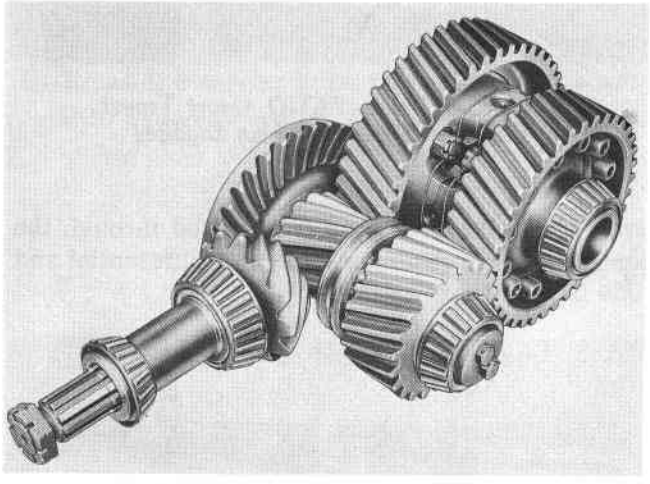
CARE AND MAINTENANCE



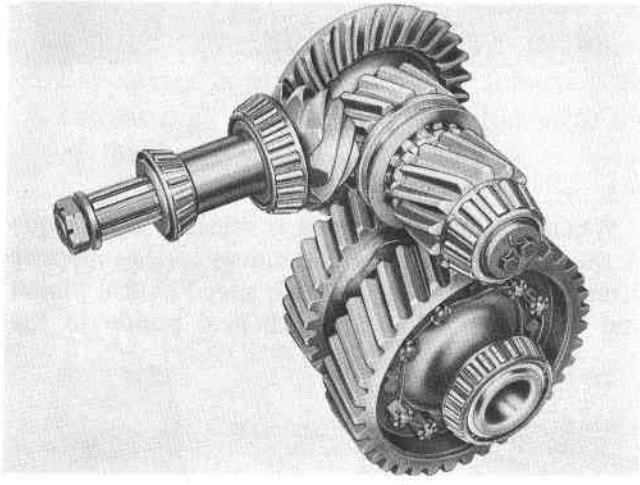
FRONT MOUNTED DRIVE UNIT



TOP MOUNTED DRIVE UNIT



FRONT MOUNTED GEAR TRAIN



TOP MOUNTED GEAR TRAIN

OPERATION

The first reduction in the Rockwell-Standard Two-Speed Double Reduction Drive Axle is through a hypoid pinion and gear. The hypoid pinion and gear set operates in conjunction with either of two sets of helical gears and pinions of different ratios. This second reduction is selective between a high and low ratio.

The hypoid pinion is mounted on two tapered roller bearings in a pinion cage. The hypoid gear is locked on the cross shaft by a press fit and key. The cross shaft is mounted on tapered roller bearings and carries two free-rolling helical pinions. Both helical pinions engage helical gears attached to the differential, which is mounted on tapered roller bearings.

DESIGN GROUPS

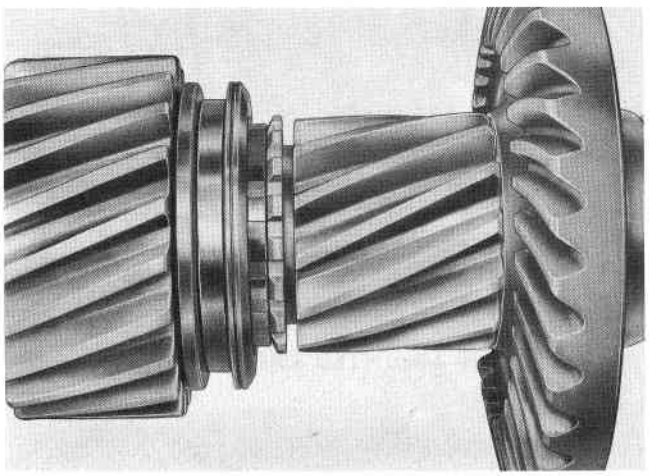
Both the "Wide Range Ratio" and the "Conventional Ratio" Two-Speed Double Reduction Drive Units are available in the Front Mounting Type and Top Mounting Type Axles.

The "Wide Range" group provides ratio spreads of approximately 2 to 1 to 2½ to 1.

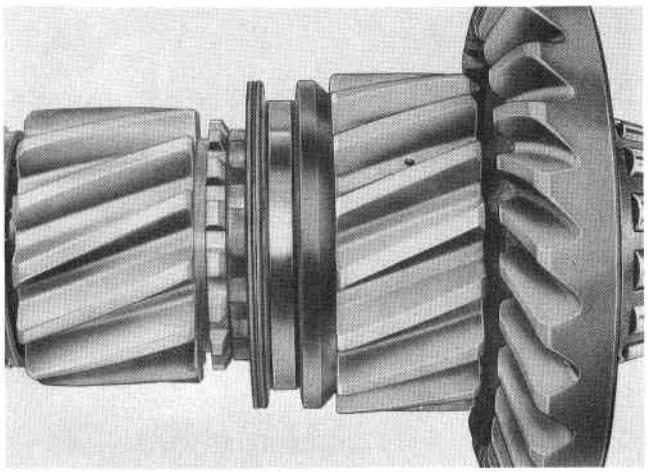
The "Conventional" group provides ratio spreads of approximately 1¼ to 1 to 1½ to 1.

On the inner side of each helical pinion are integral splines. On the cross shaft is a row of splined teeth. A shift fork, actuated by a power shift unit, moves the collar on the splined portion of the cross shaft to engage the splines of the high or low speed helical pinion as desired.

When the high axle speed is selected and drive torque is released, the shift collar is moved toward the high speed helical pinion, disengaging the low speed helical pinion and locking the high speed helical pinion to the cross shaft. Power is transmitted through the hypoid pinion and gear, cross shaft, clutch collar, high speed helical pinion and gear, differential and axle shafts.

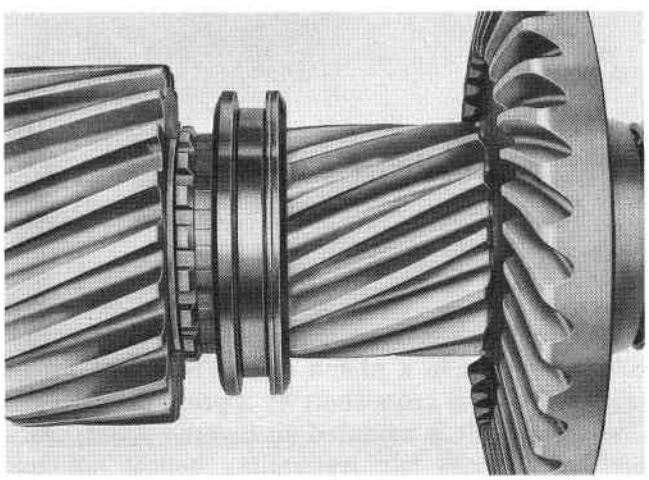


WIDE RANGE RATIO
(and some conventional ratios)
High Speed Helical Pinion Engaged

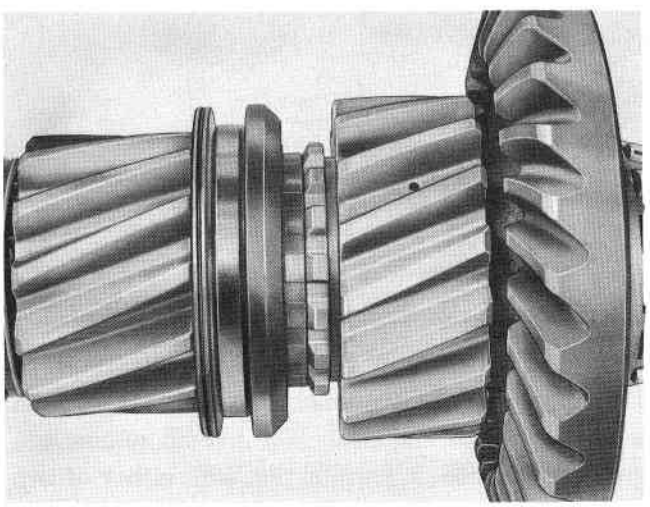


CONVENTIONAL RATIO (Most Types)
High Speed Helical Pinion Engaged

When the low axle speed is selected and torque is released, the shift collar moves in the opposite direction disengaging the high speed helical pinion and locking the low speed helical pinion to the cross shaft. Power is then transmitted through the low speed helical pinion and gear, differential and axle shafts.



WIDE RANGE RATIO
(and some conventional ratios)
Low Speed Helical Pinion Engaged



CONVENTIONAL RATIO (Most Types)
Low Speed Helical Pinion Engaged

DESIGN GROUPS

Both the "Wide Range Ratio" and the "Conventional Ratio" Two-Speed Double Reduction Drive Units are available in the Front Mounting Type and Top Mounting Type Axles.

The "Wide Range" group provides ratio spreads of approximately 2 to 1 to 2½ to 1.

The "Conventional" group provides ratio spreads of approximately 1¼ to 1 to 1½ to 1.

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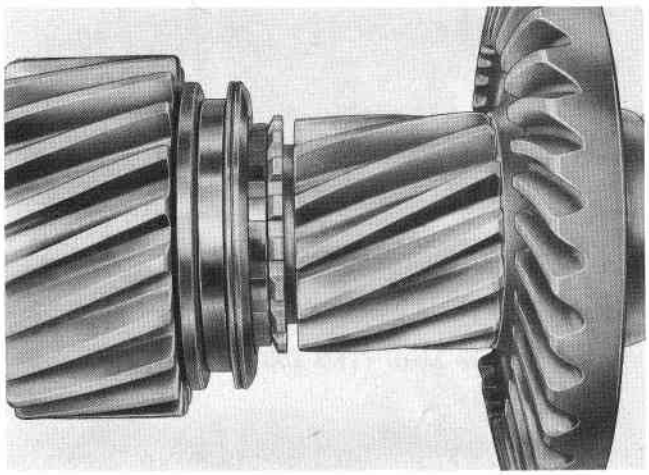
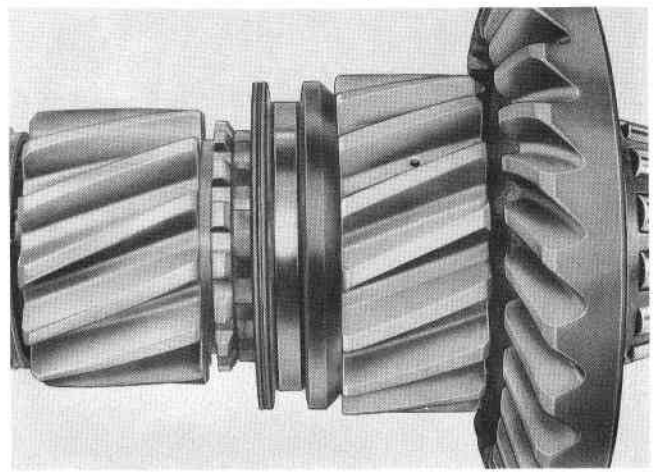
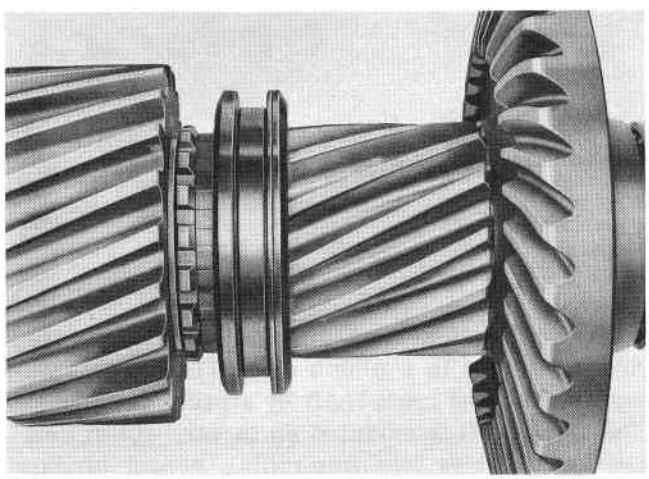


WIDE RANGE RATIO
(and some conventional ratios)
High Speed Helical Pinion Engaged

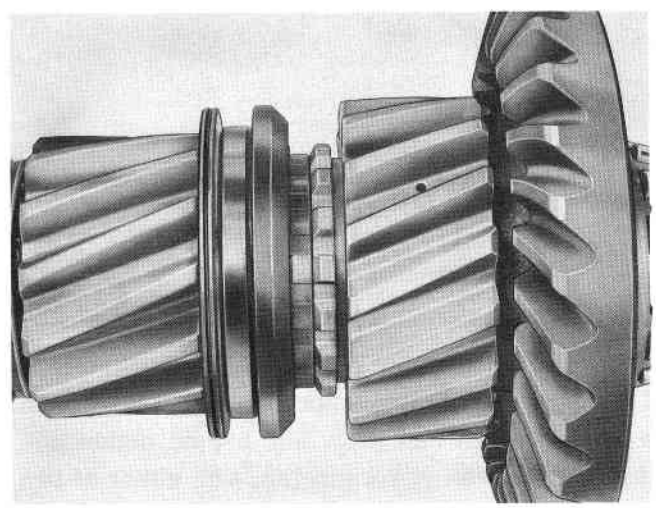


CONVENTIONAL RATIO (Most Types)
High Speed Helical Pinion Engaged

When the low axle speed is selected and torque is released, the shift collar moves in the opposite direction disengaging the high speed helical pinion and locking the low speed helical pinion to the cross shaft. Power is then transmitted through the low speed helical pinion and gear, differential and axle shafts.



WIDE RANGE RATIO
(and some conventional ratios)
Low Speed Helical Pinion Engaged



CONVENTIONAL RATIO (Most Types)
Low Speed Helical Pinion Engaged

FRONT-MOUNTED TYPE

REMOVE DIFFERENTIAL CARRIER FROM HOUSING ASSEMBLY

A. Remove plug from bottom of axle housing and drain lubricant.

B. Remove the axle shaft drive stud nuts and lockwashers.

C. Hold a short drift firmly against the center of axle shaft flange between the driving lugs, and strike drift a sharp blow to loosen the tapered dowels. Remove the dowels and shaft.

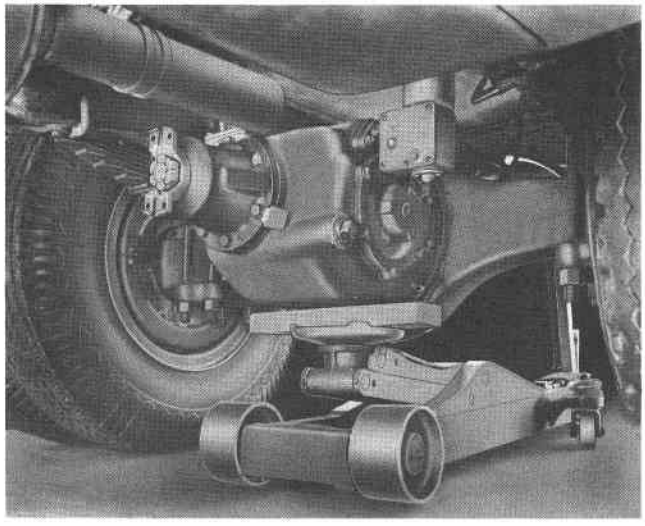
CAUTION: *Do not hit the shaft driving lugs with hammer. Do not pry shaft loose. Pry bars, chisels and wedges will damage hub, shaft flange and oil seals.*

D. Disconnect the universal joint at pinion shaft.

E. Disconnect the power shift unit.

F. Remove the carrier to housing stud nuts and washers leaving the two top nuts partially screwed on studs to prevent the carrier from falling.

G. Break the carrier loose from the axle housing with a rawhide mallet. (Remove tapered dowels where used.)



ROLLER JACK FOR CARRIER REMOVAL

H. Place a roller jack under carrier, remove the two top nuts and work carrier free using puller screws in holes provided.

A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange circle.

TOP-MOUNTED TYPE

REMOVE DIFFERENTIAL CARRIER FROM HOUSING ASSEMBLY

A. Disconnect universal joint at the pinion.

B. Remove plug from bottom of axle housing and drain lubricant.

C. Remove axle shaft flange stud nuts and washers.

D. Hold a short drift firmly against the center of axle shaft flange between the driving lugs, and strike drift a sharp blow to loosen the tapered dowels. Remove the dowels and shaft.

CAUTION: *Do not hit the shaft driving lugs with hammer. Do not pry shaft loose. Pry bars, chisels and wedges will damage hub, shaft flange and oil seals.*

E. Disconnect the power shift unit.

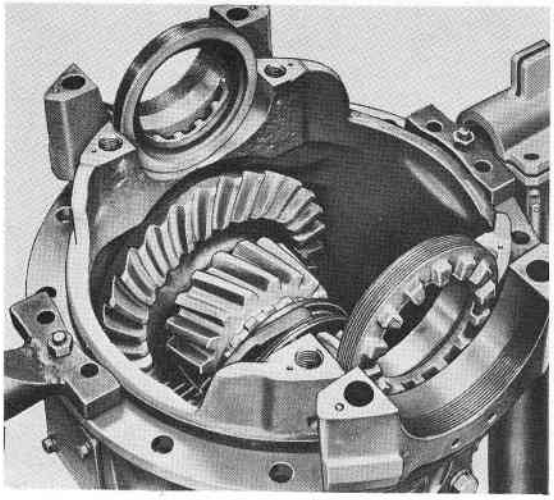
F. Remove the carrier to housing stud nuts and washers.

G. Break carrier loose from housing with rawhide mallet and remove the tapered dowels. If necessary, back out the studs.

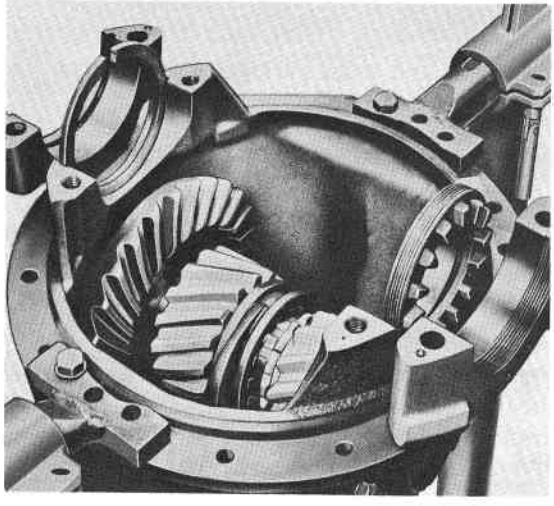
H. Pull the carrier straight out of housing with chain falls, boom, "A" frame or puller screws. A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange circle.

TWO-SPEED DOUBLE REDUCTION CARRIER LEGS AND CAPS

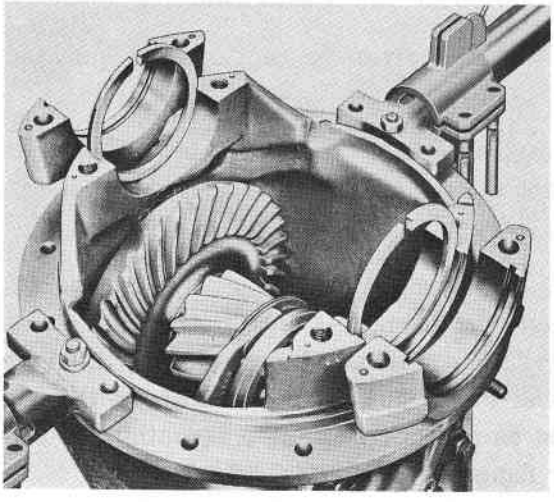
Two-Speed Double Reduction Drive Units may incorporate any one of the following three types of carrier leg and cap machining for establishing and maintaining differential bearing preload.



TYPE NUMBER I Threaded adjusting rings in both sides. This type requires positioning of the differential as well as preloading the bearings by moving the threaded rings either in or out.

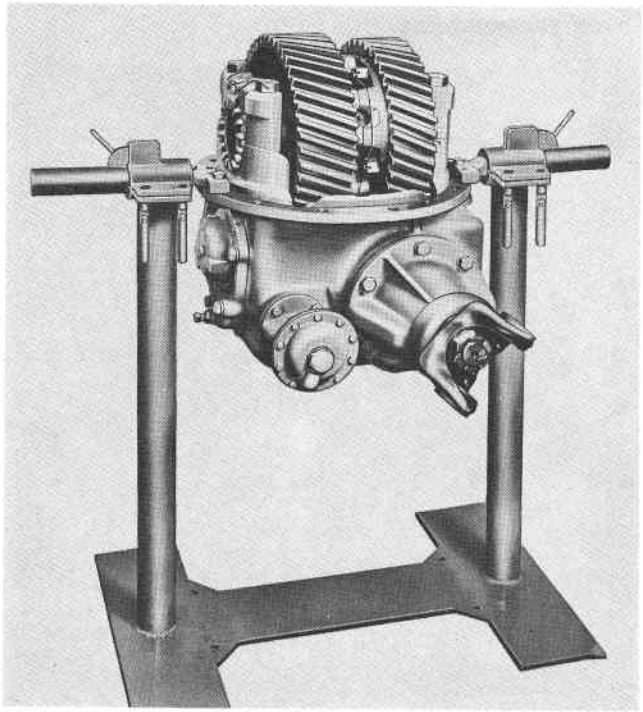


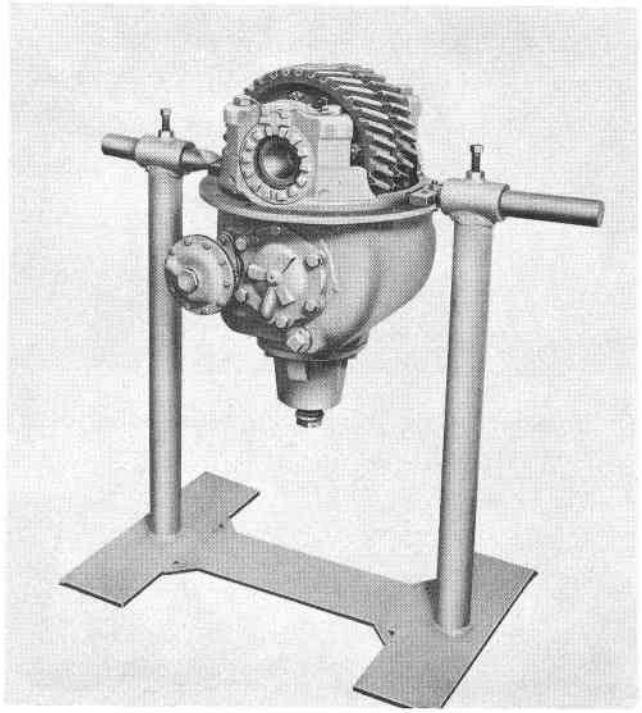
TYPE NUMBER II This type is a combination of a threaded adjusting ring on one side and a hardened split ring, located in a groove on the opposite side. On this type the hardened split ring and groove locates the differential assembly in a definite position. The threaded ring is moved in or out for bearing preload adjustment.



TYPE NUMBER III This type employs the use of hardened split rings located in grooves on both sides of carrier. On this type the differential bearing preload is established by using various thicknesses of the hardened split rings. Positioning is automatic.

DISASSEMBLE CARRIER

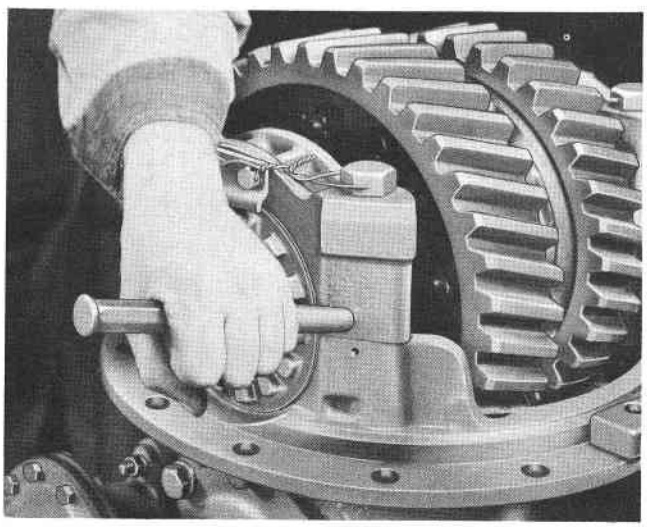




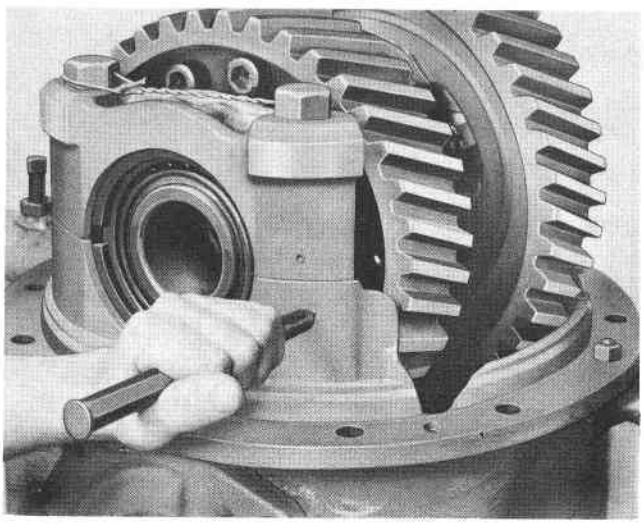
CARRIERS IN REPAIR STANDS TOOL NO. 3-11456

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

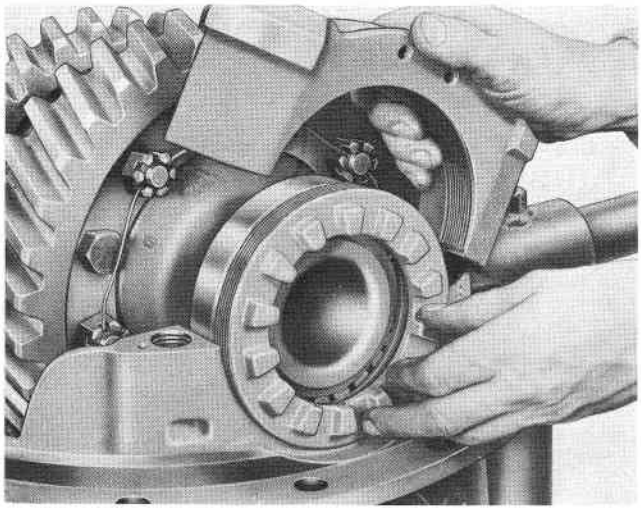
REMOVE DIFFERENTIAL AND GEAR ASSEMBLY



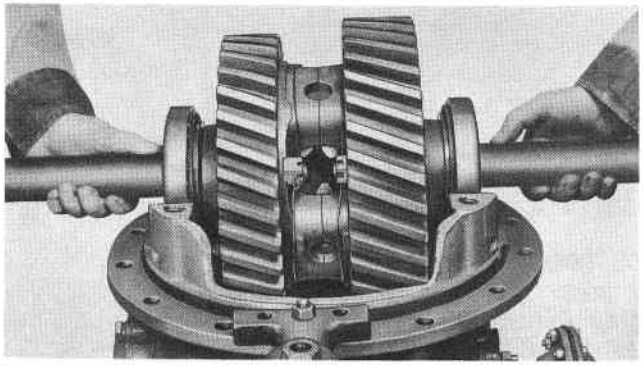
A. Center-punch one differential carrier leg and bearing cap to identify for proper reassembling.



B. Clip lock wire. Remove cap screws and adjusting ring locks where employed.



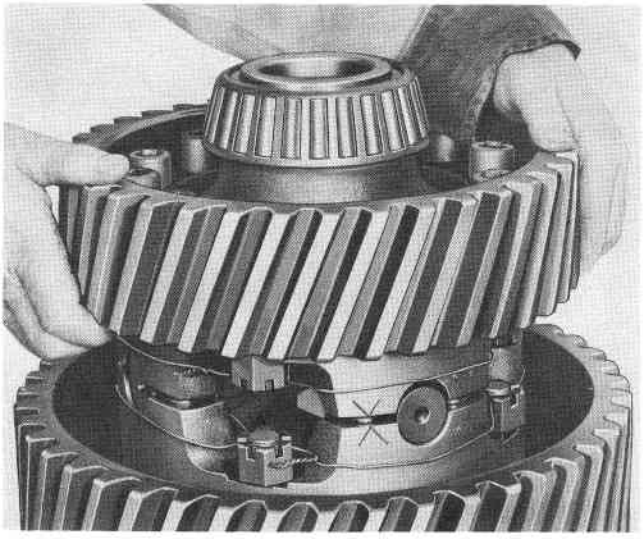
C. Remove cap screws, bearing caps and adjusting rings or split rings.



D. Lift out differential and gear assembly.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY

A. If original identification marks are not clear, center-punch case halves for correct alignment on reassembling.

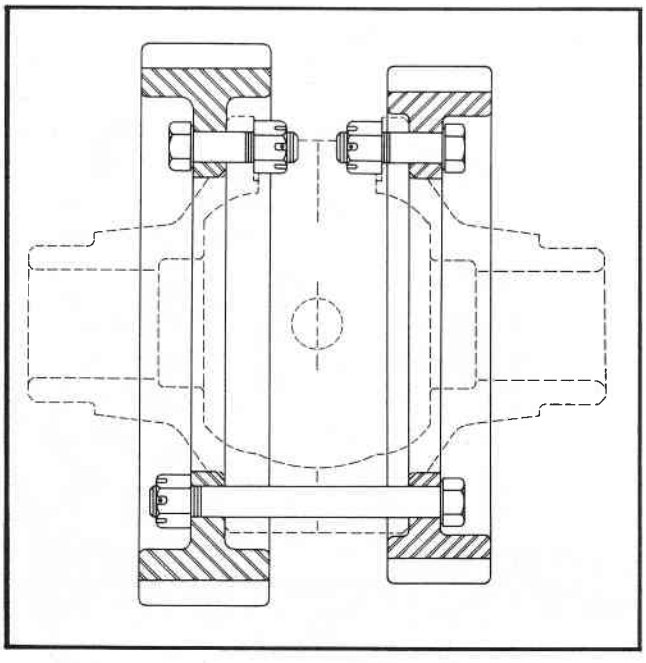


B. Clip lock wire, remove long bolts and separate case halves.

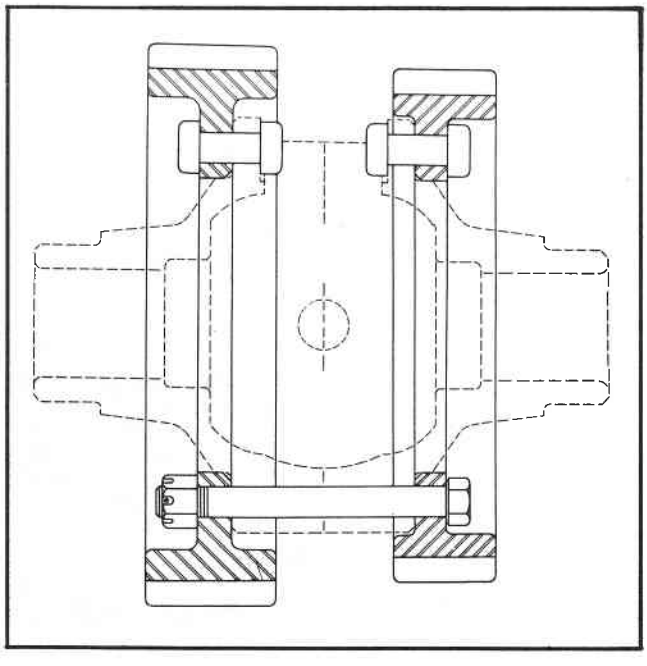
C. Remove spider, pinions, side gears and thrust washers.

D. Remove short bolts (or rivets) and separate gears from case when gear or case is to be replaced.

E. Remove differential bearings with a suitable puller if necessary.



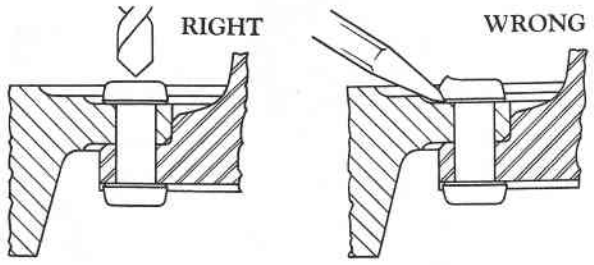
DIFFERENTIAL CROSS SECTION SHOWING USE OF LONG AND SHORT BOLTS



DIFFERENTIAL CROSS SECTION SHOWING USE OF LONG BOLTS AND RIVETS

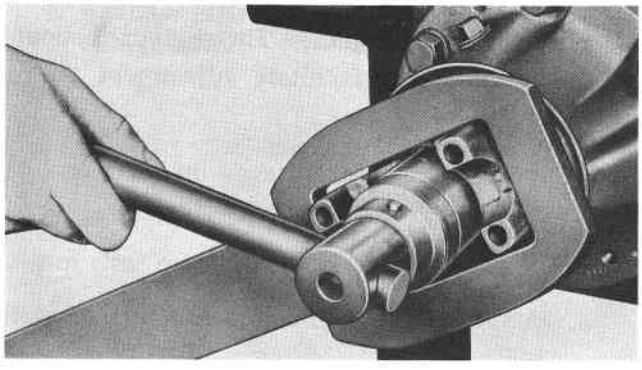
PROPER METHOD FOR REMOVAL OF GEAR RIVETS

1. Carefully center-punch rivets in the center of head.



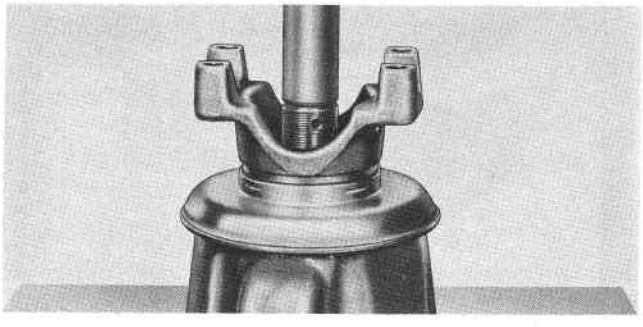
2. Use drill $^{1}/_{32}$" smaller than body of rivet to drill through head.
3. Press out rivets.

REMOVE PINION AND CAGE ASSEMBLY



A. Hold flange and remove pinion shaft nut.
B. Remove pinion cage cap screws and lock washers and lift out cage assembly. If cage is not free, tap loose using a soft drift on inner face of pinion or use puller screws in holes provided.
C. Wire shim pack together to keep intact to facilitate adjustment on reassembling.

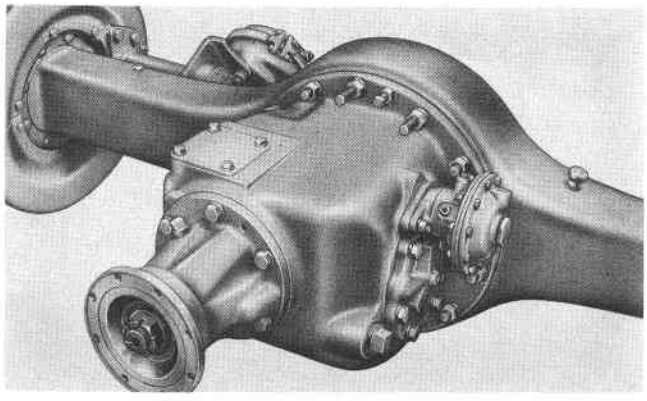
DISASSEMBLE PINION AND CAGE ASSEMBLY



A. Press pinion shaft out of flange and cage.
B. Remove adjusting spacers.
C. If necessary to renew the pinion or rear bearing, remove bearing with a suitable puller.
D. Press front bearing and pinion shaft oil seal from cage.

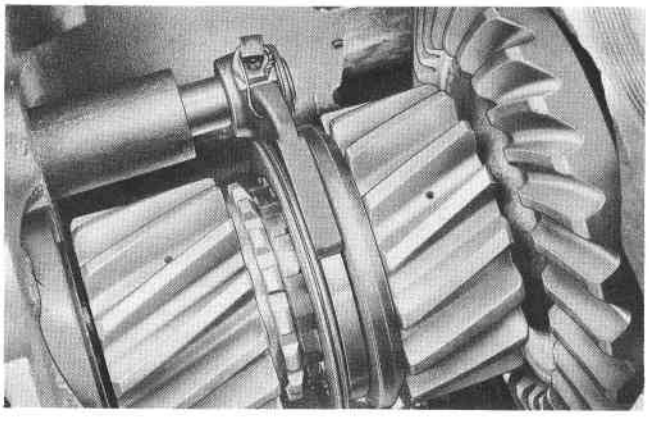
REMOVE SHIFT UNIT

The power operated shift units are either "Side Mounted" or "Front Mounted."

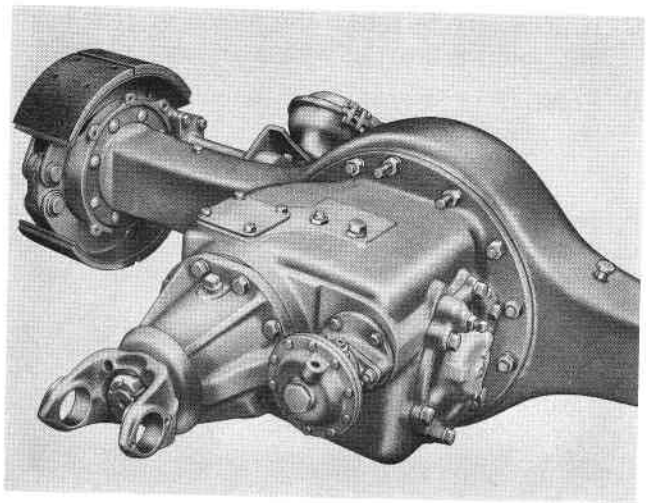


Side Mounted Shift Unit in front mounted carrier. (Illustration above.)

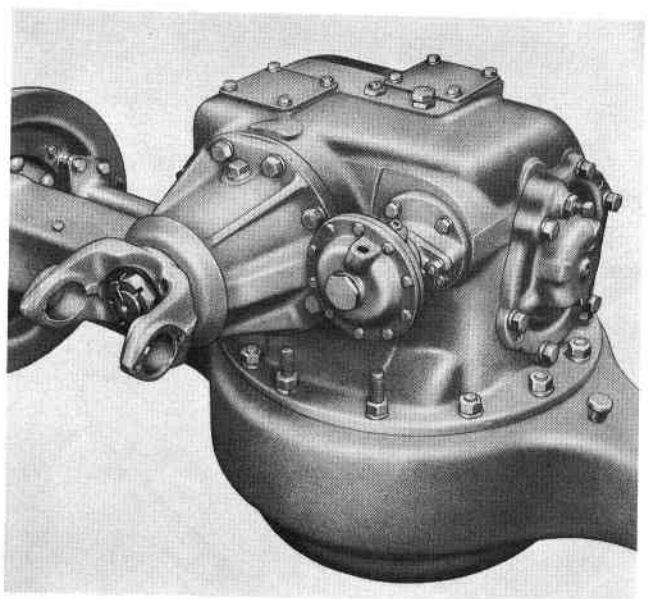
Side Mounted Shift Units are also employed in some top mounted carriers.



A. Clip and remove lockwire at fork locking screw.
B. Loosen lock nut on shift fork lock screw and remove screw and nut.
C. Remove the two shift unit stud nuts and lock washers.
D. Remove the shift unit and shaft assembly and lift out shift fork.
E. Tap sleeve from carrier with a soft mallet. (Avoid use of steel hammers or drifts to prevent distortion of sleeve bore.)
F. Wire shim pack to keep intact to facilitate adjustment on reassembling.



FRONT MOUNTED SHIFT UNIT
FRONT MOUNTED CARRIER



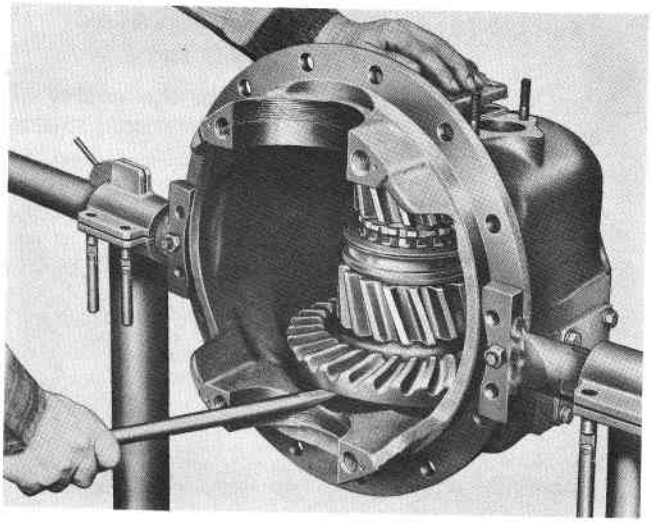
FRONT MOUNTED SHIFT UNIT
TOP MOUNTED CARRIER

A. Remove four shift unit adapter screws and lock washers.

B. Remove shift unit and adapter assembly from carrier.

REMOVAL OF CROSS SHAFT ASSEMBLIES

A. Remove cap screws and lock washers from cross shaft bearing cage (side opposite hypoid gear).

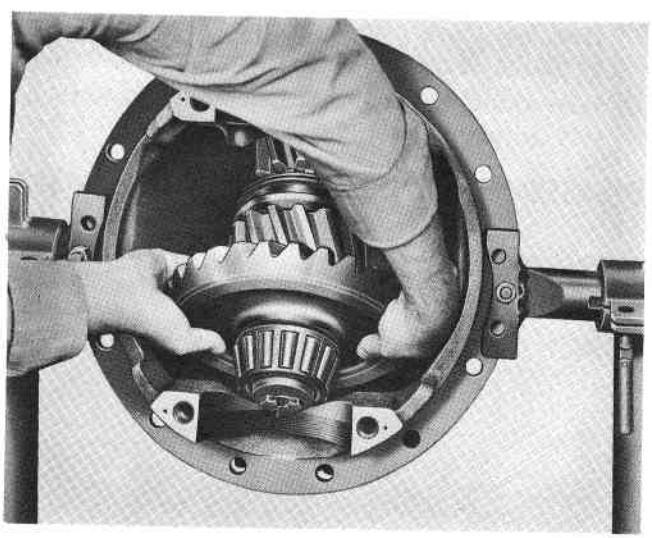


B. Force out bearing cage with a small pinch bar between the back of hypoid gear and the carrier housing. (Puller screw holes also provided.)

C. Wire shim pack together. The shim pack should remain intact to facilitate adjustment on re-assembling.

D. After removing bearing cage on carriers with front mounted shift units:

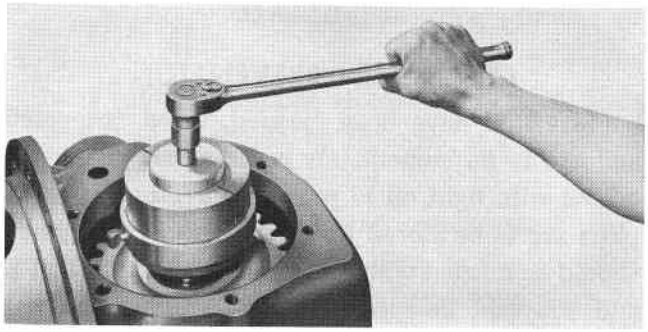
1. Clip and remove lock wire from shift fork.
2. Remove set screw holding shift fork on shift shaft.
3. Slide out shift shaft and remove shift fork from inside housing.



E. Thread out cross shaft assembly. (Some wide range ratio carriers will require the removal of the high speed pinion and bearing from the

cross shaft before removing the cross shaft assembly from the carrier. On these units proceed as follows.)

1. Raise cross shaft assembly through cage bore.
2. Clip lock wire and remove cap screws and bearing retaining plate.

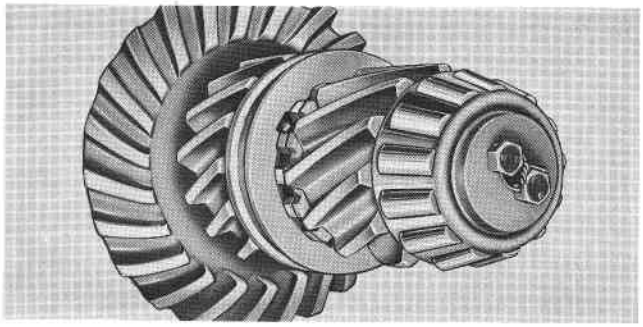


3. Remove bearing by use of suitable puller.
4. Remove high speed helical pinion from the cross shaft.

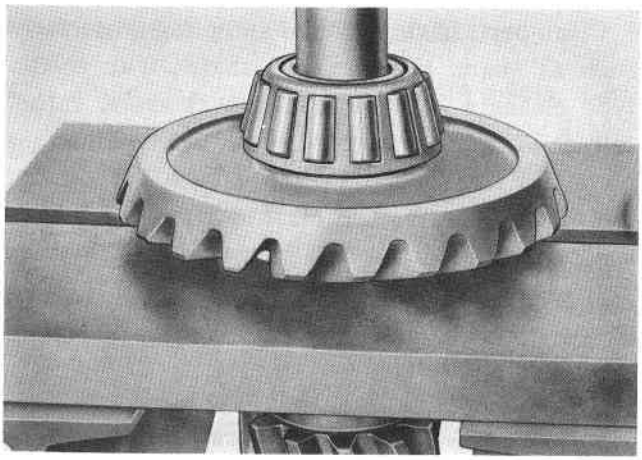
5. Some wide range carriers will permit raising cross shaft assembly so that high speed helical pinion and bearing can be pulled off together.
6. Thread out cross shaft assembly.

DISASSEMBLE CROSS SHAFT ASSEMBLY

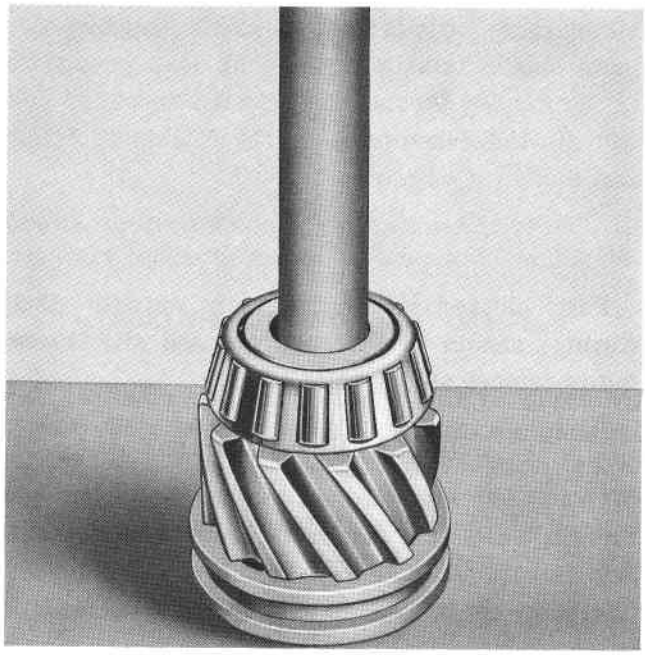
Cross shaft bearings are retained by plates and cap screws which are lock wired.



A. Clip lock wire and remove cap screws and retaining plates.



B. Press cross shaft from hypoid gear and bearing.
C. Lift off helical pinion. Remove shift collar, poppets and springs.



D. Replace shift collar and press shaft through remaining helical pinion and bearing.

2. Wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

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

REPAIR

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

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

B. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.

C. All Rockwell-Standard bronze bushed differential pinions should be ball burnished after bushing installation. Install the bushing with a small stepped drift. The small O.D. should be .010" smaller than the bushing burnished I.D. and 1½ times bushing length. Always install bushings so end is even with the I.D. chamfer or about $^{1}/_{16}$" below the spherical surface.

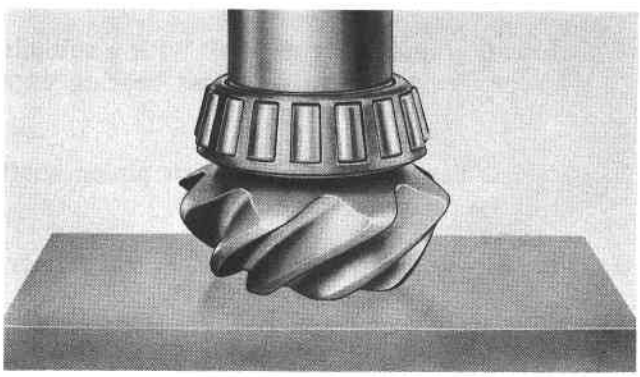
D. When assembling component parts use a press where possible.

E. Tighten all the nuts to the correct torque. (See torque limits following service instructions.) Use soft iron locking wire to prevent possibility of wire breakage.

F. The burrs, caused by lock washers, at the spot face of stud holes of cages and covers should be removed to assure easy reassembly of these parts.

REASSEMBLE CARRIER

ASSEMBLE HYPOID PINION AND CAGE ASSEMBLY



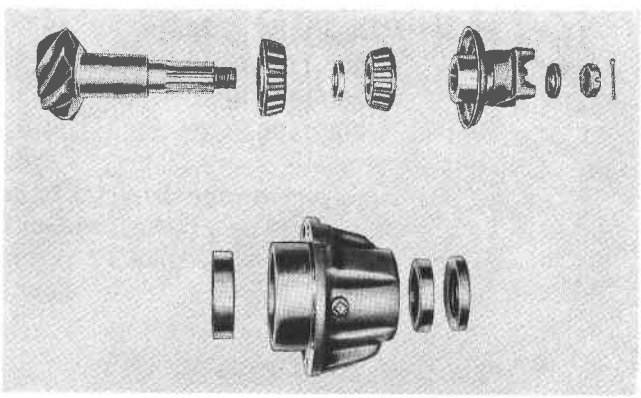
A. Press rear bearing squarely and firmly against pinion shaft shoulder.

B. Press bearing cups squarely and firmly against pinion cage shoulder.

C. Lubricate bearing and cups with light machine oil.

D. Insert pinion and bearing assembly in pinion cage.

E. Install selective single or combination spacers over pinion shaft.

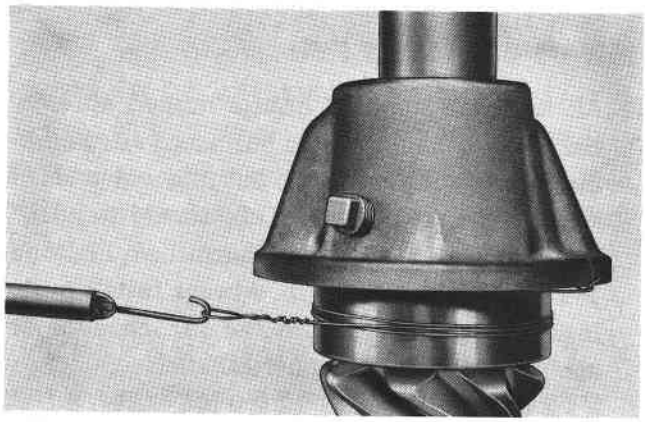


HYPOID PINION AND CAGE ASSEMBLY

Install a single spacer with O.D. bevel toward the outer bearing cone. Install two combination spacers with I.D. bevels opposite each other and the large flat faces together. Spacers must be installed in this manner to prevent interference with outer bearing cone roller cage.

F. Press front bearing squarely and firmly against the selective spacer with a suitable sleeve.

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



H. *While in press under pressure,* check pinion bearing preload torque. Wrap strong cord around pinion cage and pull on horizontal line with a pound scale.

If a press is not available, the pinion nut may be tightened to the correct torque and the preload checked.

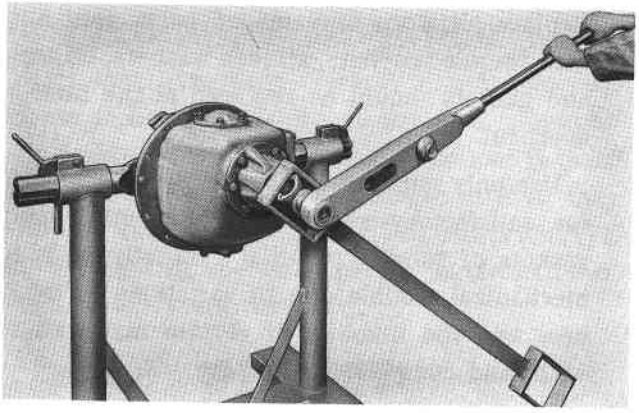
The correct pressures or torques for checking pinion bearing preload are as follows:

Pinion Shaft Thread Size	Specified Nut Torque	Equivalent Press Pressure in Tons
1″ x 20	300-400 lb. ft.	6
1¼″ x 18	700-900 lb. ft.	11
1½″ x 12	800-1100 lb. ft.	14
1½″ x 18	800-1100 lb. ft.	14
1¾″ x 12	800-1100 lb. ft.	14
2″ x 16	800-1100 lb. ft.	14
2⅛″ x 12	800-1100 lb. ft.	14

Example: *Assuming pinion cage diameter to be 6 inches, the radius would be 3 inches, and with 4 pounds pull on scale would equal 12 pound inches bearing preload torque.*

Read rotating pounds pull on scale, not starting pounds pull. If rotating torque is not within 5 to 15 pound inches, use a thinner spacer to increase or a thicker spacer to decrease preload torque.

I. Press flange or yoke firmly against pinion forward bearing.



J. Use the carrier as a convenient holding fixture for the pinion and cage assembly. Hold flange and *tighten pinion shaft nut to the correct torque.*

K. Recheck pinion bearing preload torque. *If rotating torque is not within 5 to 15 pound inches repeat foregoing procedure.*

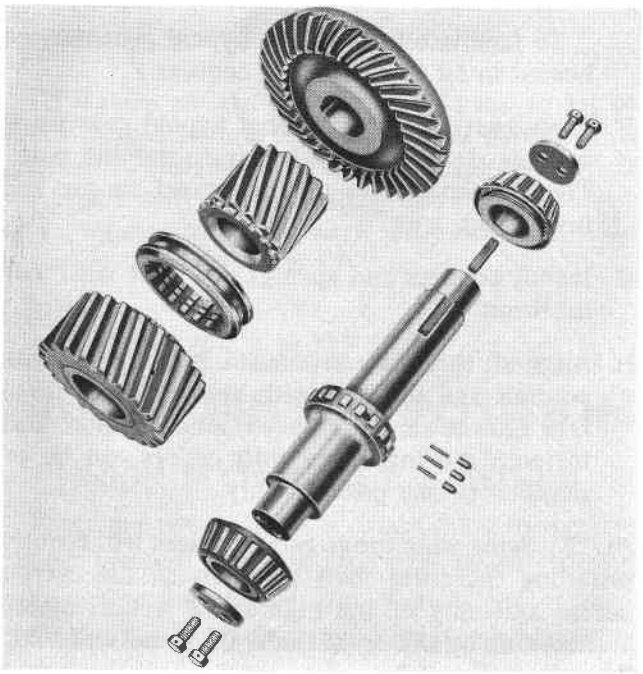
L. Hold flange and remove pinion shaft nut and yoke or flange.

M. Lubricate pinion shaft oil seal. With a suitable sleeve, press seal firmly against bearing cage shoulder.

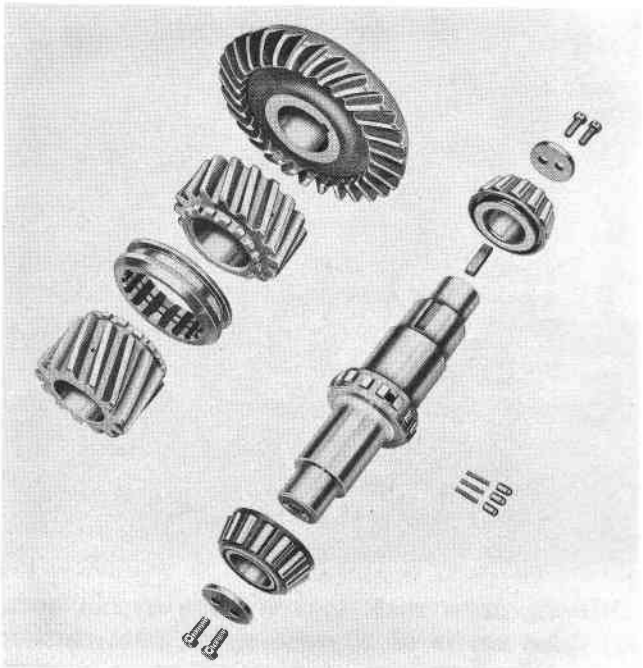
N. Reinstall flange or yoke. Tighten pinion shaft nut to the correct torque.

O. Remove pinion and cage assembly from carrier.

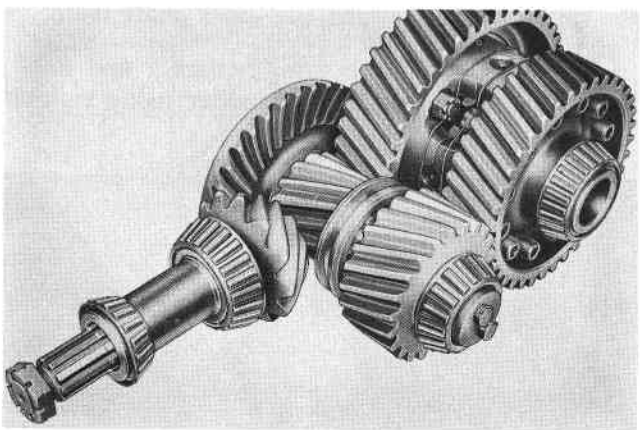
CROSS SHAFT ASSEMBLIES OF WIDE RANGE AND CONVENTIONAL RATIO CARRIERS



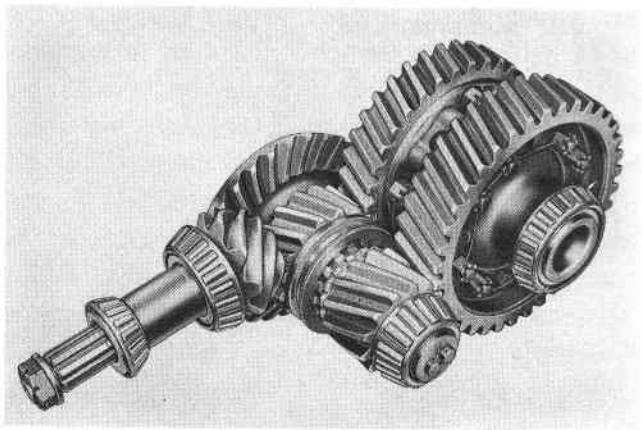
EXPLODED VIEW OF WIDE RANGE RATIO AND SOME CONVENTIONAL RATIO CROSS SHAFT ASSEMBLIES



EXPLODED VIEW OF MOST CONVENTIONAL RATIO CROSS SHAFT ASSEMBLIES



GEAR TRAIN OF WIDE RANGE RATIOS AND SOME CONVENTIONAL RATIOS



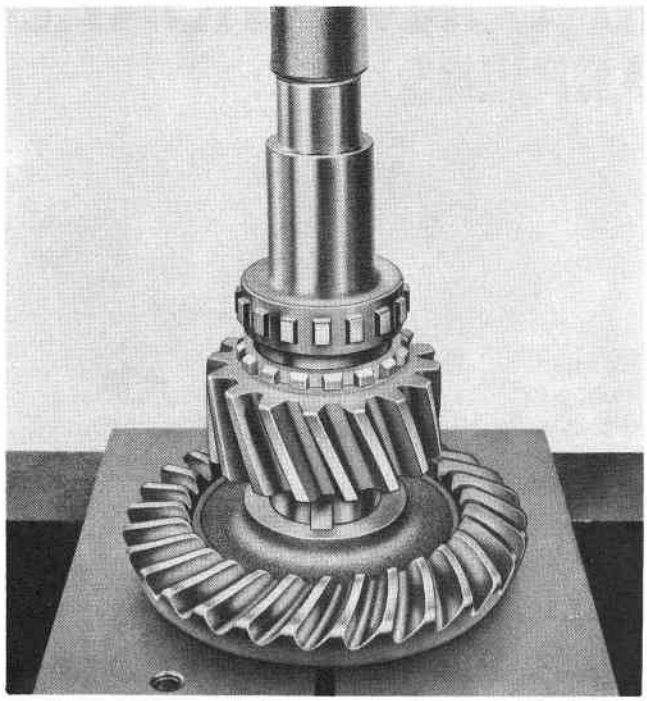
GEAR TRAIN OF MOST CONVENTIONAL RATIOS

CROSS SHAFT ASSEMBLY OF WIDE RANGE RATIO AND CONVENTIONAL RANGE RATIO CARRIERS

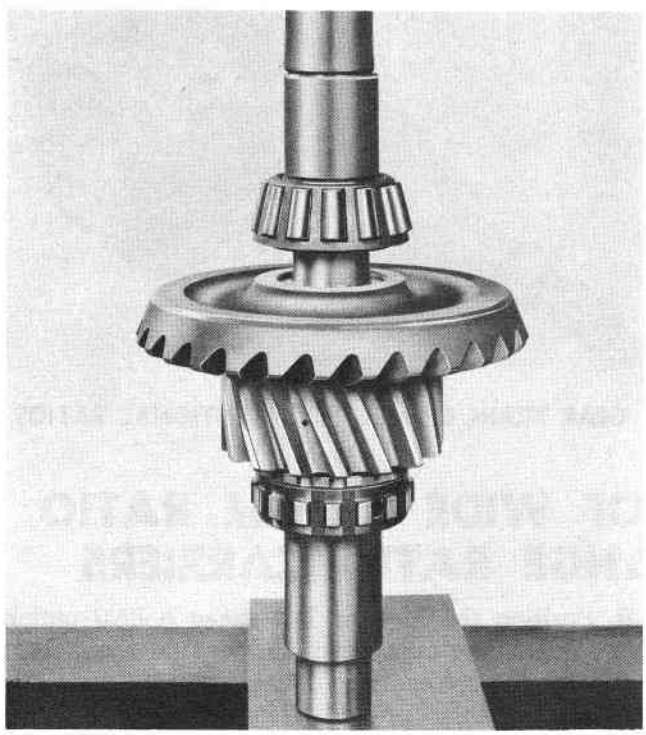
A. Lubricate the inner bearing surfaces on the low and high speed helical pinions with axle lubricant.

B. Position the high or low speed helical pinion (depending on type of carrier) on cross shaft with the splined row of teeth toward the cross shaft teeth.

C. Install key and start cross shaft and pinion in hypoid gear in line with keyway.



D. Press cross shaft squarely into hypoid gear. Cross shafts of all wide range ratio carriers and a number of conventional range carriers employ no hypoid gear shoulder. Extreme care must be exercised while pressing cross shaft into gear to assure helical pinion end play of .010″ minimum.



E. Check helical pinion end play with feeler gauge. End play must be within .010″ minimum to .026″ maximum. (On conventional ratio carriers where definite gear stop is provided by cross shaft shoulder, it is still necessary to check helical pinion end play to assure a clearance of .010″ minimum to .020″ maximum.)

To facilitate installation, hypoid gear may be heated in oil to 200 to 250 degrees F.

F. Press bearing firmly against hypoid gear using suitable sleeve. Install bearing retaining plate. Tighten cap screws to the correct torque and install lock wire.

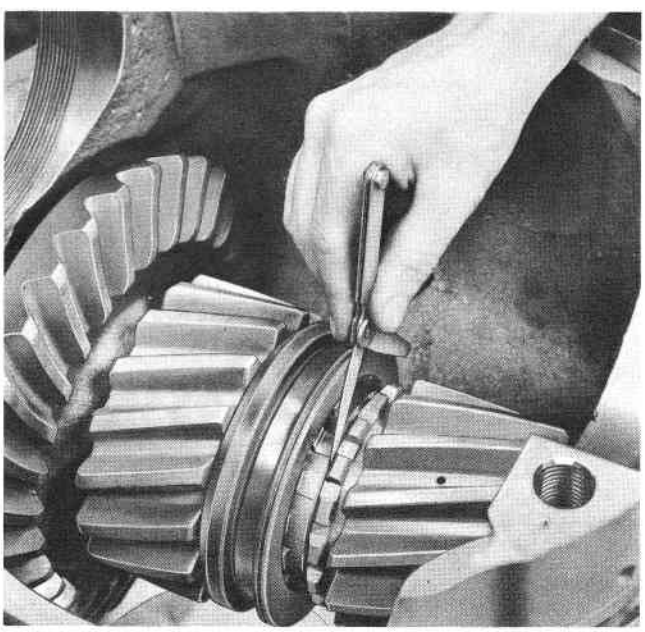
G. Install poppets and springs and coat with axle lubricant.

H. Align all three tapered shift collar splines with poppets and position with shift collar marked Low Side toward low speed helical pinion. Due to tooth spacing, some shift collars can be assembled in one position only.

NOTE: Some wide range ratio carriers will require installing the cross shaft assembly in the carrier before assembly of the high speed helical pinion and bearing on the cross shaft. On these units skip items I, J, K and L.

I. Install the opposite helical pinion (high or low speed depending on type of carrier) with splined teeth toward the cross shaft teeth.

J. Press cross shaft bearing squarely and firmly against the cross shaft shoulder using suitable sleeve.



K. Check low speed helical pinion end play. End play must check to minimum of .010". Less than the minimum clearance of .010" may result in seizure.

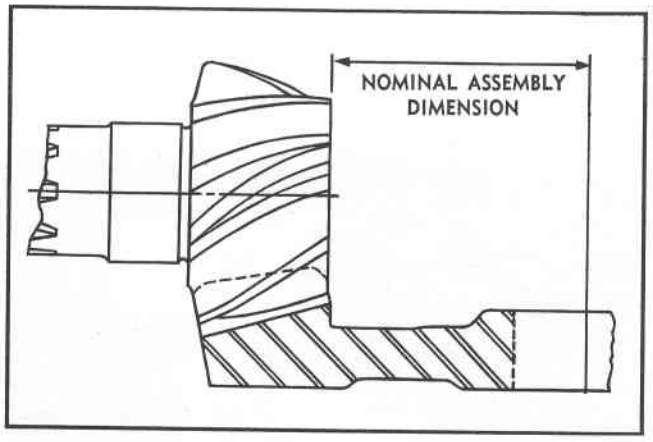
L. Install bearing retaining plates. Tighten cap screws to the correct torque and install lock wire.

(If a cone setting gauge will be used to set or check hypoid pinion position, do this operation as outlined. Otherwise skip the following section on the pinion setting gauge. Note that the pinion setting gauge is not to be used unless the gear and pinion are being replaced.)

ESTABLISH PROPER PINION POSITION

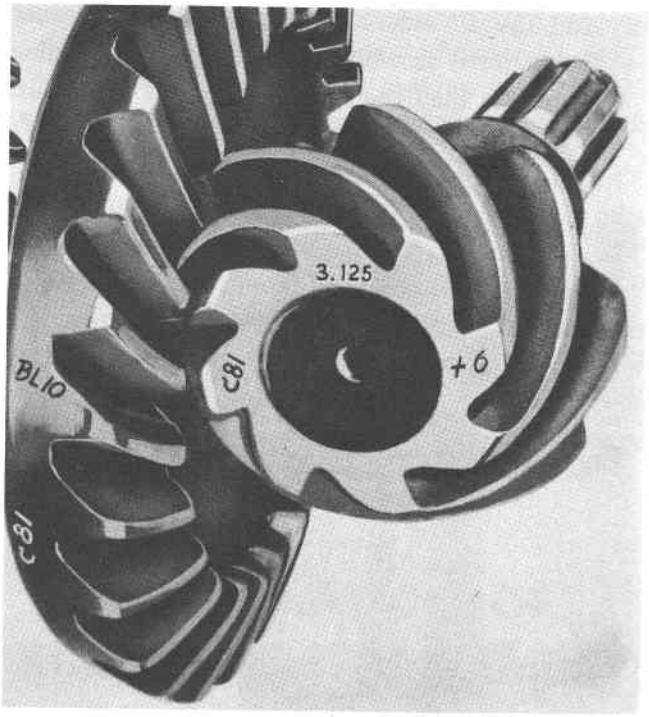
PINION SETTING GAUGE METHOD

There are two methods of establishing the proper pinion position. One is with the pinion setting gauge, described below, the other is the original method of red leading the gear teeth which is described later.



"Nominal assembly dimensions" are now used to simplify the correct positioning of new pinions.

These dimensions are stamped or etched on the toe end of all hypoid pinions: Example 3.125". Each pinion is also etched with its individual variation from the "nominal assembly dimension." The variation is expressed in thousandths of an inch preceded by a minus or a plus sign: Example +6. The gear and pinion matching number is etched on the toe end of the pinion and stamped on the face or O.D. of the gear.



All Rockwell-Standard hypoid pinions and gears are made only in matched sets. A gear and pinion which do not have the same matching number should not be run together.

PINION SETTING GAUGE

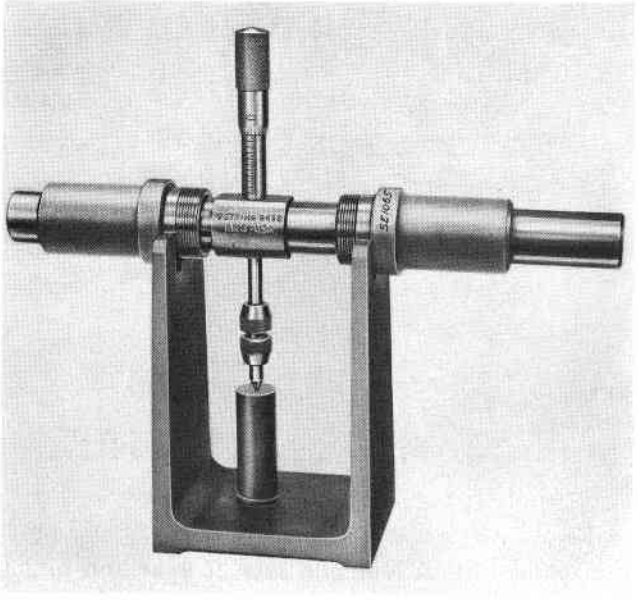
The gauge is a direct reading depth micrometer mounted in an arbor. Tapered discs which fit in the cross shaft bearing bores or bearing cage bores are mounted on sleeves that fit over the arbor. They hold the gauge assembly so the center line of the arbor coincides with the center line of the cross shaft. The tapered discs for two-speed double reduction units are identified by the double letter following the disc part number: Example, discs SE-1065-9-HH and SE-1065-9-LL are for S and U-300 drive units.

HOW TO USE THE GAUGE

Assume a new A-35460 hypoid gear set is to be installed in a U-300 drive unit. The gear set is composed of the 35460 gear and the 35461 pinion.

A. Carefully note the end of the 35461 pinion to find the stamped or etched nominal assembly dimension. In this instance it is 3.125".

B. Add the 1″ extension to micrometer because the nominal assembly dimension of the pinion is greater than the micrometer span. BE SURE THE PARTS ARE CLEAN AND SECURELY HELD TOGETHER.



C. Check the assembled micrometer in the master gauge using the proper checking block. The micrometer should be accurate within .0005″.

D. Polish the cross shaft bearing cage bores with crocus cloth to remove burrs and nicks. Thoroughly clean abrasive from the drive unit.

E. Carefully note the etched variation distance on the end of the pinion before installing the pinion and cage assembly in the drive unit.

This distance is always added to or subtracted from the nominal assembly dimension as indicated by the "+" and "—" sign. Assume the digit is a "6" preceded by a plus sign. This means the pinion varies from nominal assembly dimension by plus .006″.

F. Install the pinion and cage assembly in the drive unit using the original shim pack.

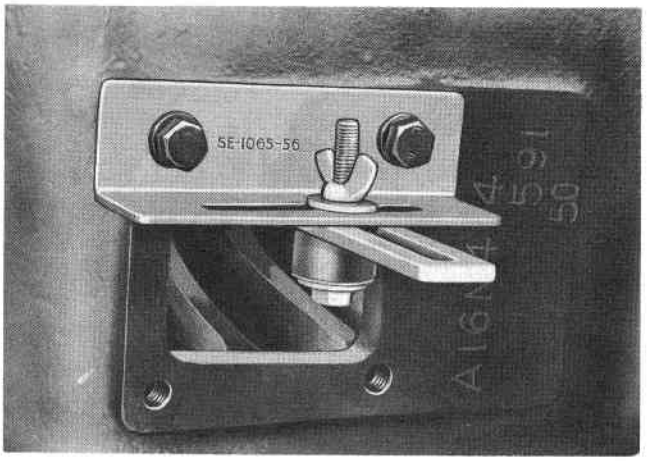
Be sure the shims are clean and holes in shim pack, carrier and pinion cage are properly aligned.

G. Assemble the adapter discs to the arbor and tighten the sleeve nuts. Assemble the sleeves and discs so the smaller O.D.'s of the tapered discs will be to the outside of the drive unit.

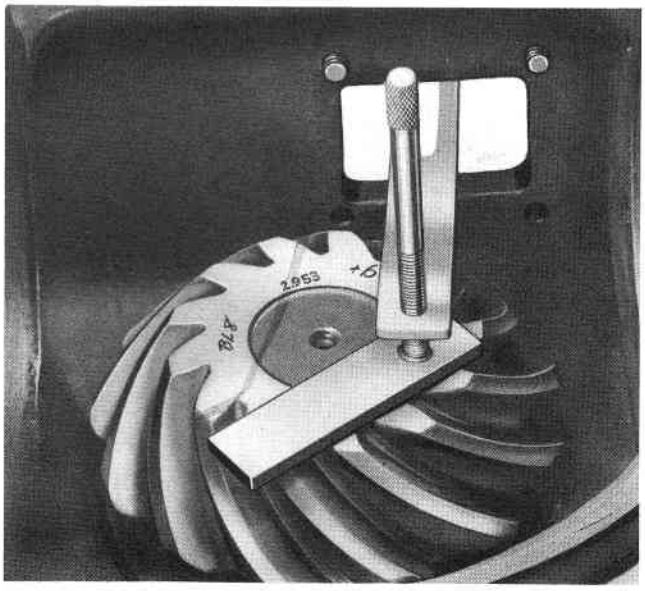
H. Retract the micrometer and install the gauge assembly as illustrated. Do not force the discs into the cross shaft bore I.D.'s.

I. Adjust the micrometer arbor so it is directly over and at a 90 degree angle to the pinion.

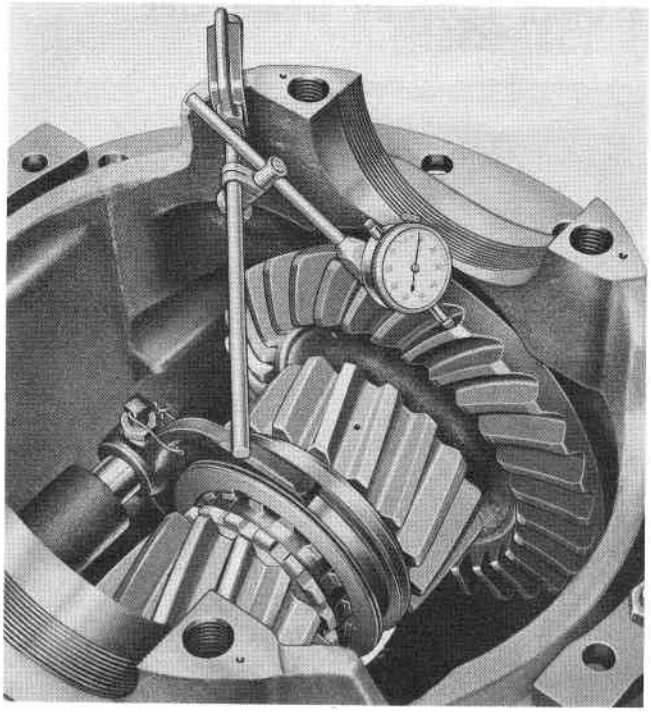
If micrometer misses end of pinion it will be necessary to use step plate.



J. Attach the bracket No. SE-1065-56 to the drive unit to hold the step plate clamp assembly. Attach the clamp assembly to the bracket as illustrated.



K. Clean the end of the hypoid pinion and step plate. Install the step plate and tighten the clamp screw to hold it securely in place.



DIAL INDICATOR USED TO DETERMINE GEAR LASH

HYPOID GEAR BACKLASH ADJUSTMENT

A. Adjust hypoid gear backlash to the correct specifications of .020″ to .026″ (regardless of what markings might be etched on the gear set) by transposing cross shaft bearing cage or cover shims.

1. To move bevel gear away from pinion, remove shims from pack under cross shaft bearing cage on the side opposite bevel gear and add shims of equal thickness to pack under cross shaft bearing cover or cage on the bevel gear side. Shims should be transposed in this manner to maintain the established preload.

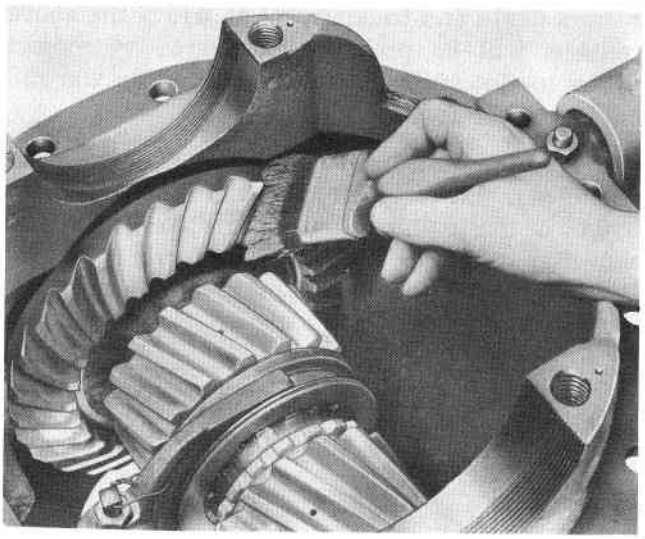
2. To move bevel gear toward pinion remove shims from pack under cross shaft bearing cover or the cage on the bevel gear side and add shims of equal thickness to pack under cross shaft bearing cage on the side opposite bevel gear. Shims should be transposed in this manner to maintain the established preload.

The actual backlash changes approximately .008″ for each .010″ movement of the gear.

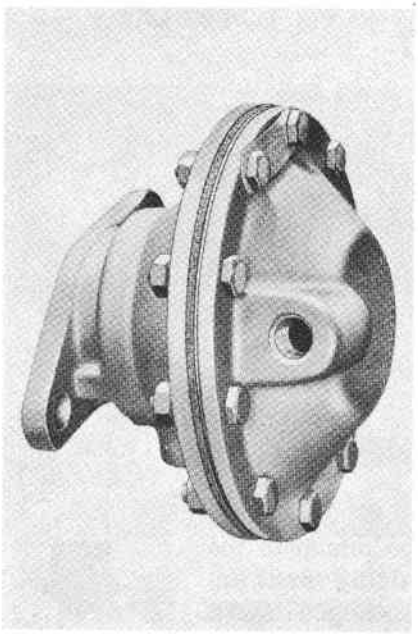
B. Check tooth contact using the following procedure whether or not the pinion setting gauge was used.

GEAR ADJUSTMENT FOR CORRECT TOOTH CONTACT

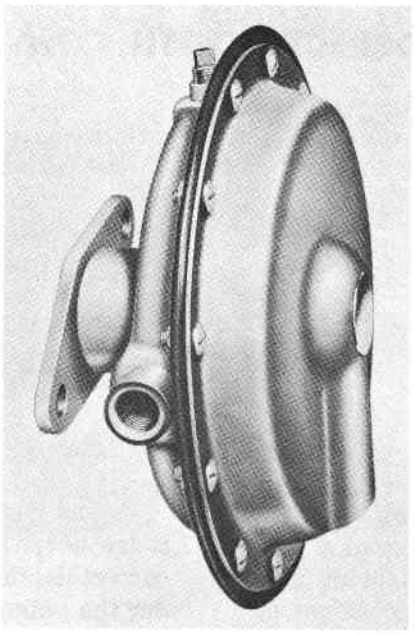
Checking tooth contact is accomplished by means of oiled red lead applied lightly to the bevel gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.



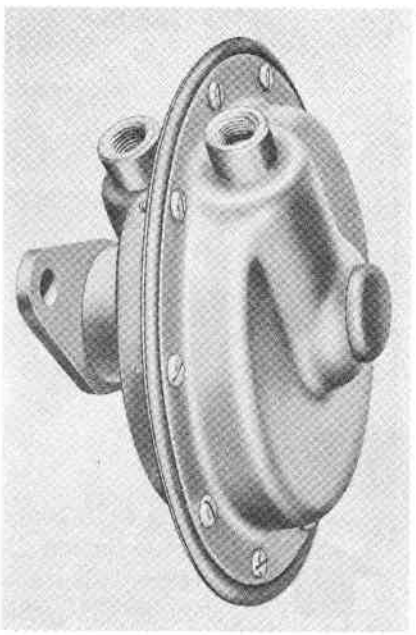
Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the bevel gear teeth. Coast side contact should be automatically correct when drive side contact is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



SINGLE LINE
AIR SHIFT UNIT



SINGLE LINE
VACUUM SHIFT UNIT



DOUBLE LINE
VACUUM SHIFT UNIT

INSTALLING SHIFT UNITS

POWER ACTUATED SHIFT, SIDE MOUNTED

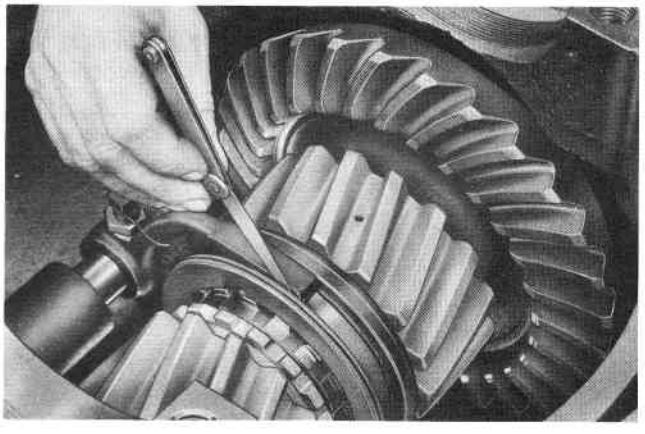
A. Tap shift unit sleeve into carrier housing over original shim pack. Install lock washers and stud nuts and tighten to the proper torque.

B. Install new shift unit mounting flange gasket.

C. Hold shift fork in position. Align lock screw holes in shift shaft and slide shift unit and shaft assembly into position.

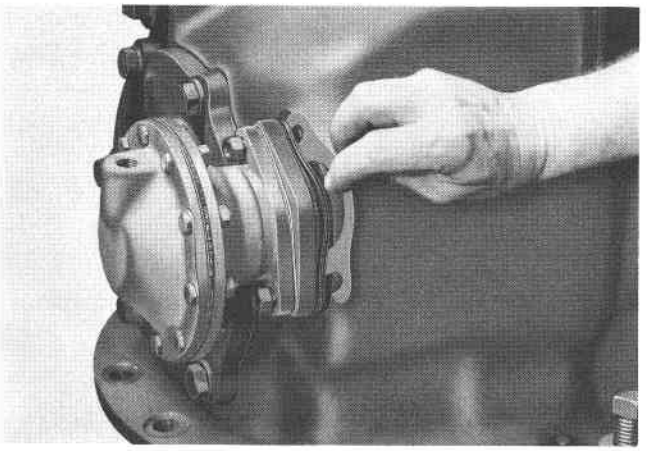
D. Tighten fork lock screw and lock nut to 30-35 lb. ft. torque.

E. Install shift unit lock washers and stud nuts and tighten to the proper torque.



F. Check clearance of shift fork pads in shift collar with feeler gauge. The clearance should not be less than .010″ minimum on each side of the fork in both the high and low speed positions.

When checking shift fork clearance in shift collar, the shift collar must be flush with the end face of the spur pinion in both the high and low speed positions.



Add or remove shims from pack under sleeve to obtain the correct adjustment.

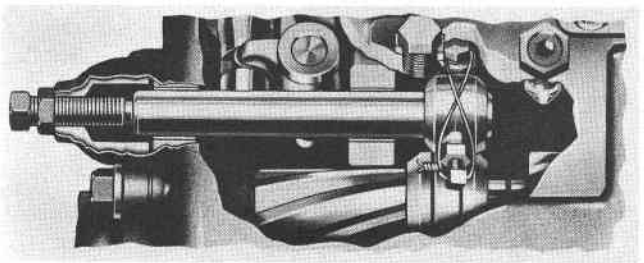
G. Check operation of shift unit. (Ten pounds of air may be used to check the vacuum type unit by applying the air to the opposite side of the diaphragm, using the vent opening on the single line shift unit.)

POWER ACTUATED SHIFT, FRONT MOUNTED

A. Check bellcrank buttons and remove any scores at operating faces.

B. *Place both the shift fork, collar and the shift unit in the high speed position. They must be in the same position to install the shift unit.*

C. Install a new gasket and position shift unit with the bellcrank in the slot of the shift shaft. Install the lock washers and cap screws and tighten to the proper torque.



CAUTION: *Do not disturb the Allen set screw and lock nut or travel positioning screw and lock nut unless shift fork adjustments are needed. If adjustments are required, proceed as follows:*

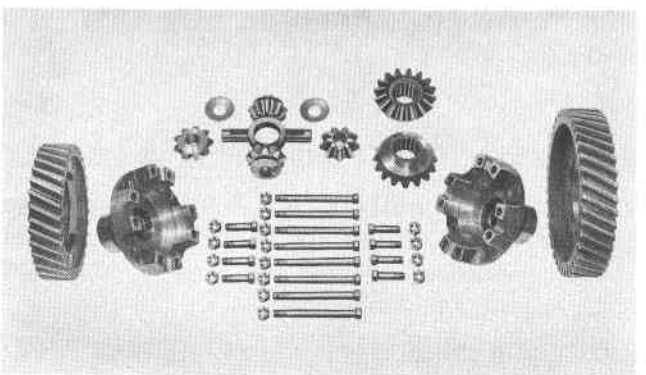
D. With the fork and collar shifted to engage the helical pinion next to the hypoid gear, adjust the Allen screw and lock nut in the top of the carrier so that the fork is centered in the collar groove within .005".

E. With the fork and collar shifted to engage the helical pinion away from the hypoid gear, adjust hex head screw and lock nut in the cross shaft cage so that the fork is centered in the collar groove within .005".

When checking shift fork clearance in the shift collar, the shift collar must be flush with the end face of the spur pinion in both the high and low speed positions.

F. Check operation of shift unit. (Ten pounds of air may be used to check the vacuum type unit by applying the air to the opposite side of the diaphragm, using the vent opening on the single line shift unit.

ASSEMBLE DIFFERENTIAL AND SPUR GEAR ASSEMBLY



A. Join high and low speed spur gears to their respective case halves with bolts or rivets as desired.

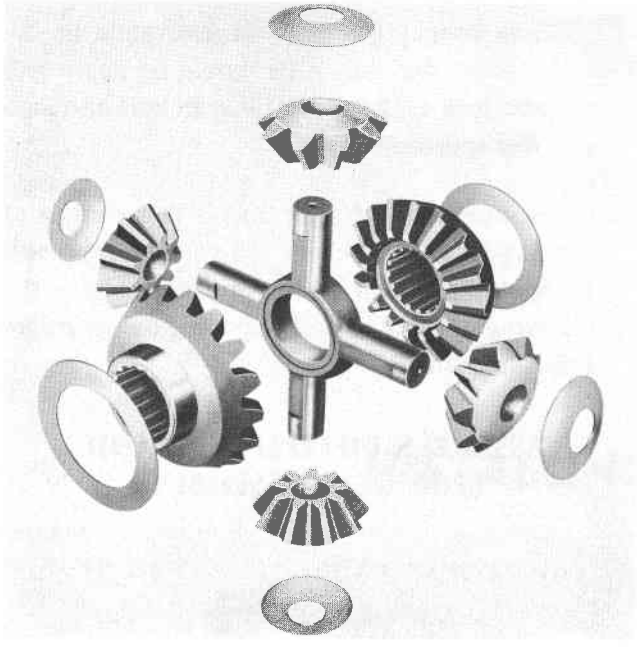
When new spur gears or new differential cases are installed, the differential case holes may require line reaming with the gear in order to assemble the correct size bolts or rivets.

Tighten nuts to the correct torque. Rivets where used should not be heated but should be upset cold.

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

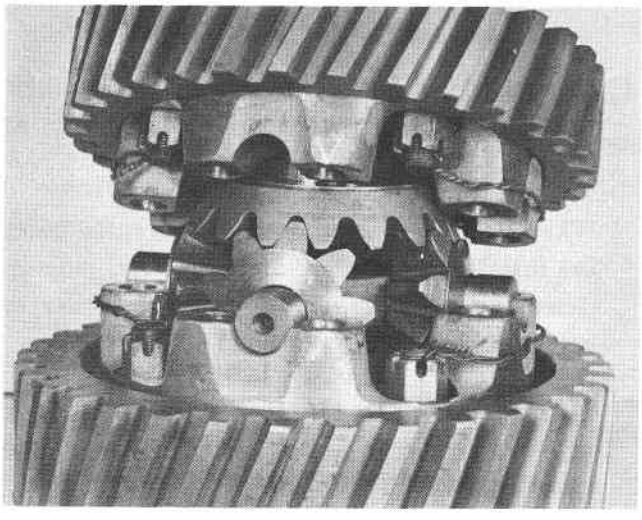
DIAMETER OF RIVET	TONNAGE REQUIRED
7/16"	22
1/2"	30
9/16"	36
5/8"	45

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



DIFFERENTIAL PINION AND SIDE GEAR ASSEMBLY

C. Install thrust washer and side gear in one of the case halves. Place spider with pinions and thrust washers in position. Install component side gear and thrust washer.



D. Align mating marks, position component case half and draw assembly together with four long bolts or cap screws equally spaced.

E. Check assembly for free rotation of differential gears and correct if necessary.

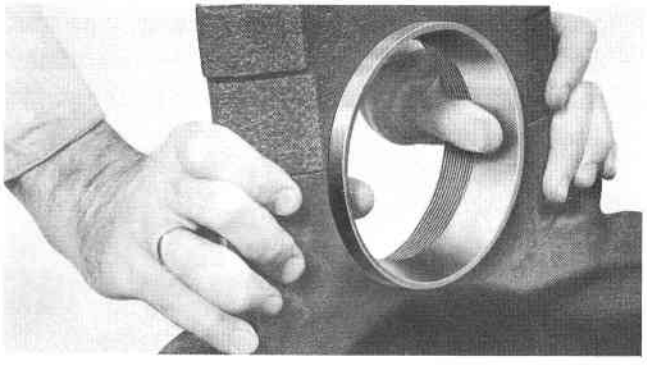
F. Install remaining bolts and tighten to the correct torque.

G. Install lock wire.

H. Press differential bearings squarely and firmly on differential case halves.

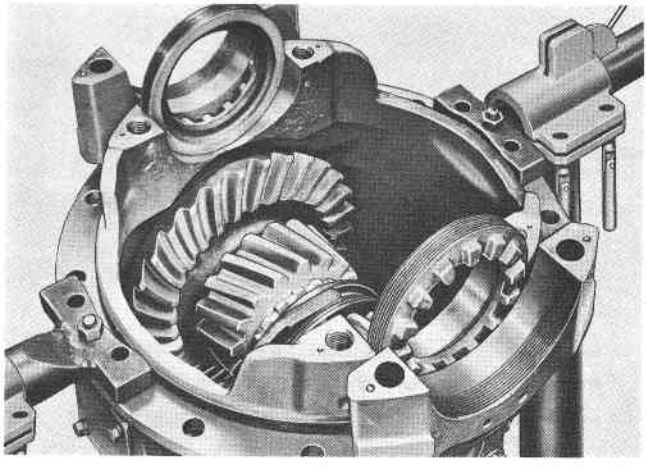
INSTALLATION OF BEARING CUPS IN CARRIER LEG BORES

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

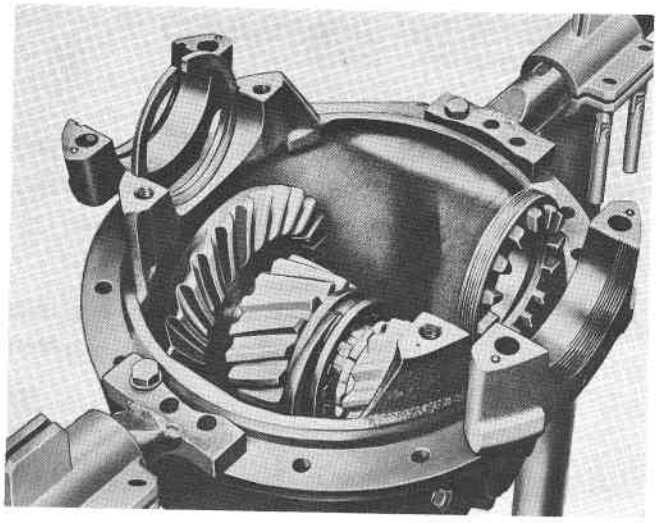


B. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked with a scraper or some emery cloth until a hand push fit is obtained. Use a blued bearing cup as a gauge and check the fits as work progresses.

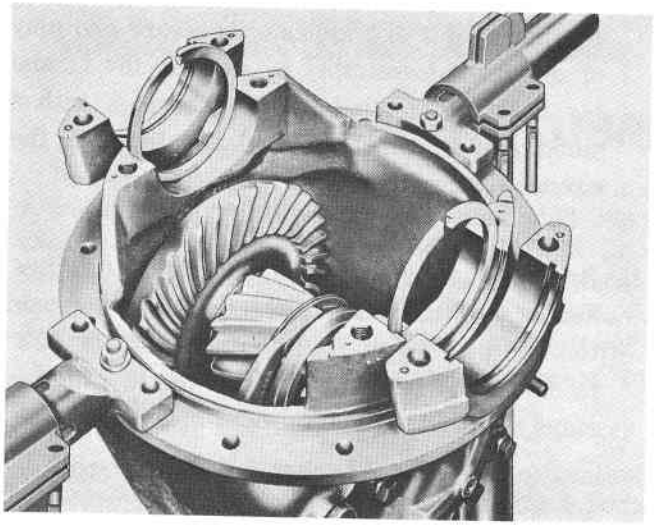
This applies to all three types of carrier leg bores.



THREADED ADJUSTING RING TYPE



COMBINATION TYPE, ONE THREADED RING AND ONE SPLIT RING



TWO SPLIT RING TYPE

C. Carriers employing adjusting rings: If adjusting rings cannot be turned by hand or with a maximum force of 10 lbs. applied at the end of a 2-ft. wrench (20 lb. ft. torque), the O.D. should be slightly reduced with a fine mill file or use others that turn more freely. Be sure adjusting rings and threads are free from burrs or nicks.

INSTALL DIFFERENTIAL AND SPUR GEAR ASSEMBLY

A. After checking related parts, coat the differential bearing cones and cups with specified rear axle lubricant.

B. Place the bearing cups over the assembled differential bearing cones, then position the differential assembly in the carrier.

1. Threaded adjusting ring type:

   Insert bearing adjusting rings and turn them hand tight against bearing cups.

   Position differential bearing caps in place making sure they are properly aligned.

   CAUTION: *If bearing caps do not seat easily and properly, the adjusting nuts may be cross threaded. Forcing caps into position will result in irreparable damage to the differential carrier or the bearing caps.*

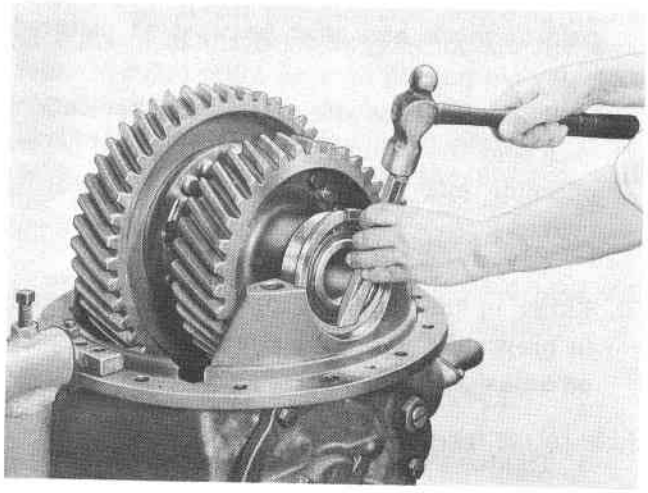
2. Combination types of one threaded adjusting ring and one split ring are used in some models. Position the split ring in the groove of the carrier leg and insert the threaded adjusting ring on the opposite side.

   Turn threaded ring hand tight against the bearing cup.

   Position differential bearing caps in place making sure they are properly aligned.

3. Split ring type:

   Insert one split ring in carrier leg groove. Move differential assembly over so that face of bearing cup is held tightly against inserted ring.

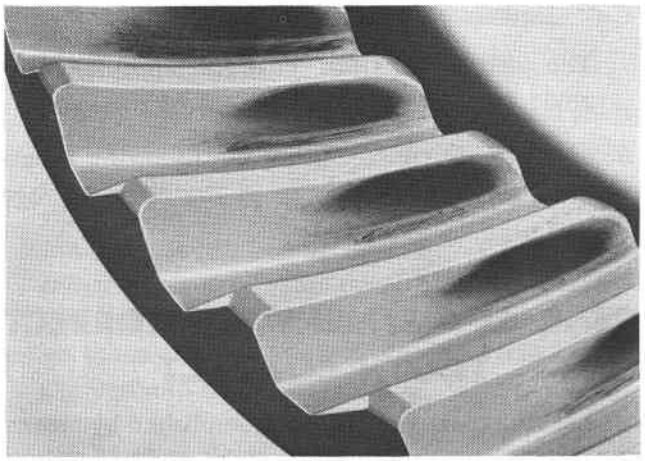


Install opposite split ring by tapping it into the groove by use of a blunt end drift tapping on the lower I.D. of the ring.

Position differential bearing caps in place making sure they are properly aligned. (Also see section on adjustment of bearings.)

C. Install carrier leg cap screws and tighten to specified torque.

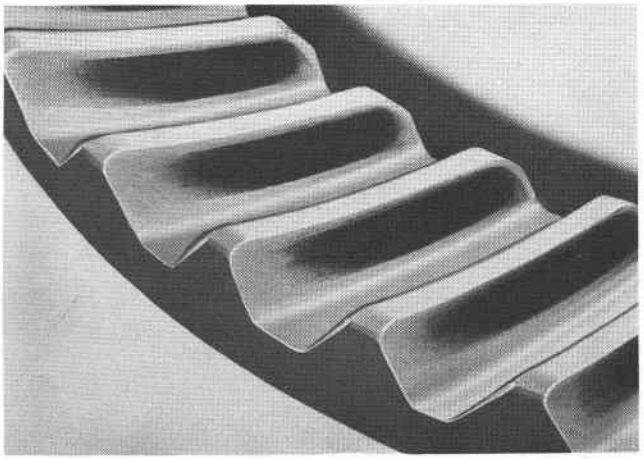
CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE



SATISFACTORY TOOTH CONTACT
(GEARS UNLOADED)

With adjustments properly made (pinion at correct depth and backlash set at .010″) the above contacts will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

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



SATISFACTORY TOOTH CONTACT
(GEARS LOADED)

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

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