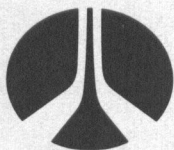
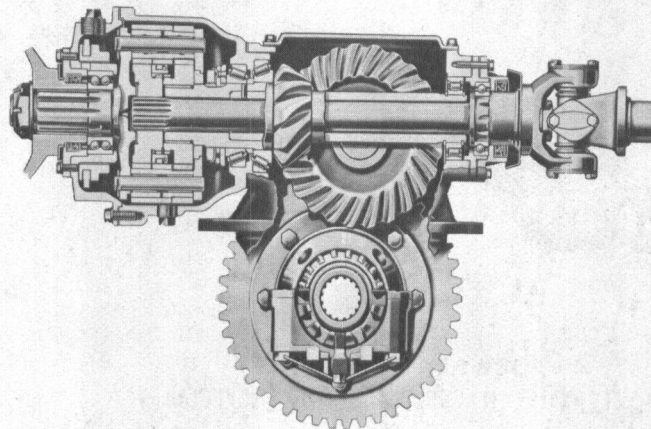


Field Maintenance Manual No. 6A

Double-Reduction Drive Unit

Spiral Bevel and Hypoid Gear First Reduction
With Spur Type Inter-Axle Differential

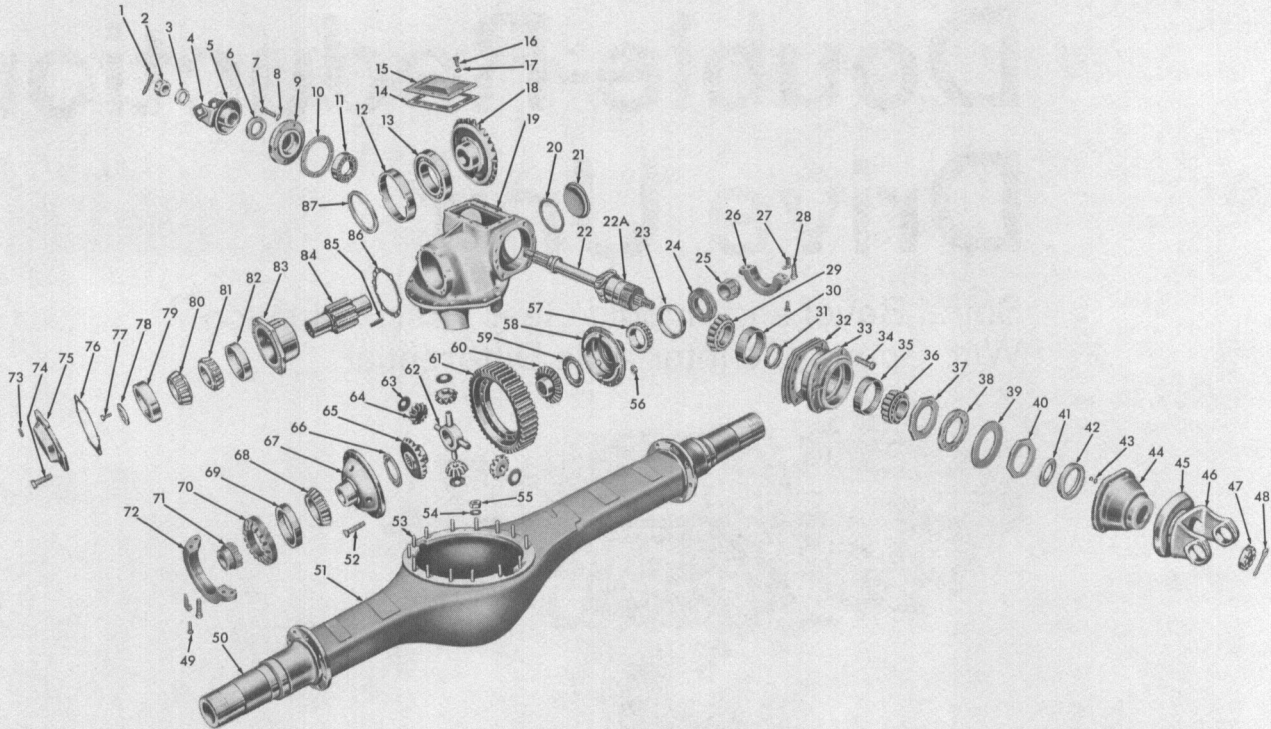


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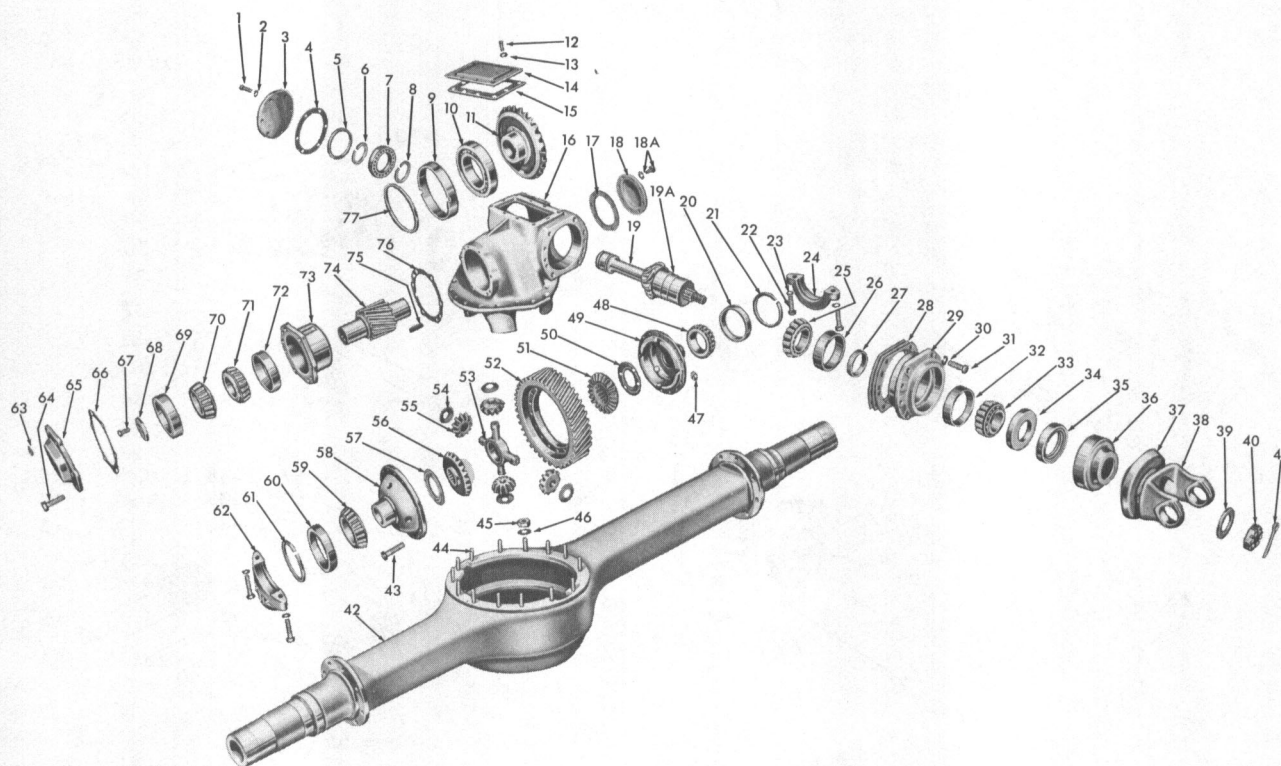
SFD AND SFDD 4600, SFD AND SFDD 4700 SERIES



FORWARD DRIVE UNIT
WITHOUT INTER-AXLE DIFFERENTIAL

- | | | |
|---|--|---|
| 1. Cotter key | 29. Drive pinion inner bearing | 58. Differential case half |
| 2. Nut | 30. Drive pinion inner bearing cup | 59. Differential side gear thrust washer |
| 3. Washer | 31. Drive pinion bearing spacer | 60. Differential side gear |
| 4. Output yoke | 32. Shims | 61. Spur gear |
| 5. Slinger | 33. Drive pinion bearing cage | 62. Differential spider |
| 6. Oil seal | 34. Cap screw | 63. Differential pinion thrust washer |
| 7. Cap screw | 35. Drive pinion outer bearing cup | 64. Differential pinion |
| 8. Lock washer | 36. Drive pinion outer bearing | 65. Differential side gear |
| 9. Thru shaft rear bearing cover | 37. Drive pinion bearing adjusting nut and dowel | 66. Differential side gear thrust washer |
| 10. Gasket | 38. Pierced lock washer | 67. Differential case half |
| 11. Thru shaft rear bearing | 39. Bending lock washer | 68. Differential bearing |
| 12. Drive gear bearing sleeve | 40. Drive pinion bearing lock nut | 69. Differential bearing cup |
| 13. Drive gear bearing | 41. Washer | 70. Differential bearing adjusting nut |
| 14. Top cover gasket | 42. Oil seal | 71. Differential bearing adjusting nut extension ring |
| 15. Top cover | 43. Lock washer | 72. Differential bearing cap |
| 16. Cap screw | 44. Drive pinion bearing cage cover | 73. Lock washer |
| 17. Lock washer | 45. Slinger | 74. Cap screw |
| 18. Drive gear | 46. Input yoke | 75. Cross shaft, bearing cage cover |
| 19. Differential carrier housing | 47. Thru shaft nut | 76. Shim (bearing preload) |
| 20. Gasket | 48. Cotter key | 77. Cap screw |
| 21. Inspection hole plug | 49. Differential bearing cap adjusting nut lock | 78. Cross shaft bearing retainer |
| 22. Thru shaft | 50. Axle housing sleeve | 79. Cross shaft outer bearing cup |
| 22A. Drive pinion | 51. Axle housing | 80. Cross shaft outer bearing |
| 23. Differential bearing cup | 52. Differential case bolt | 81. Cross shaft inner bearing |
| 24. Differential bearing adjusting nut | 53. Carrier to housing stud | 82. Cross shaft inner bearing cup |
| 25. Differential bearing adjusting nut extension ring | 54. Lock washer | 83. Cross shaft bearing cage |
| 26. Differential bearing cap | 55. Carrier to housing stud nut | 84. Cross shaft and spur pinion |
| 27. Differential bearing adjusting nut lock | 56. Differential case bolt nut | 85. Square key |
| 28. Differential bearing cap cap screw | 57. Differential bearing | 86. Shim |
| | | 87. Drive pinion radial bearing spacer |

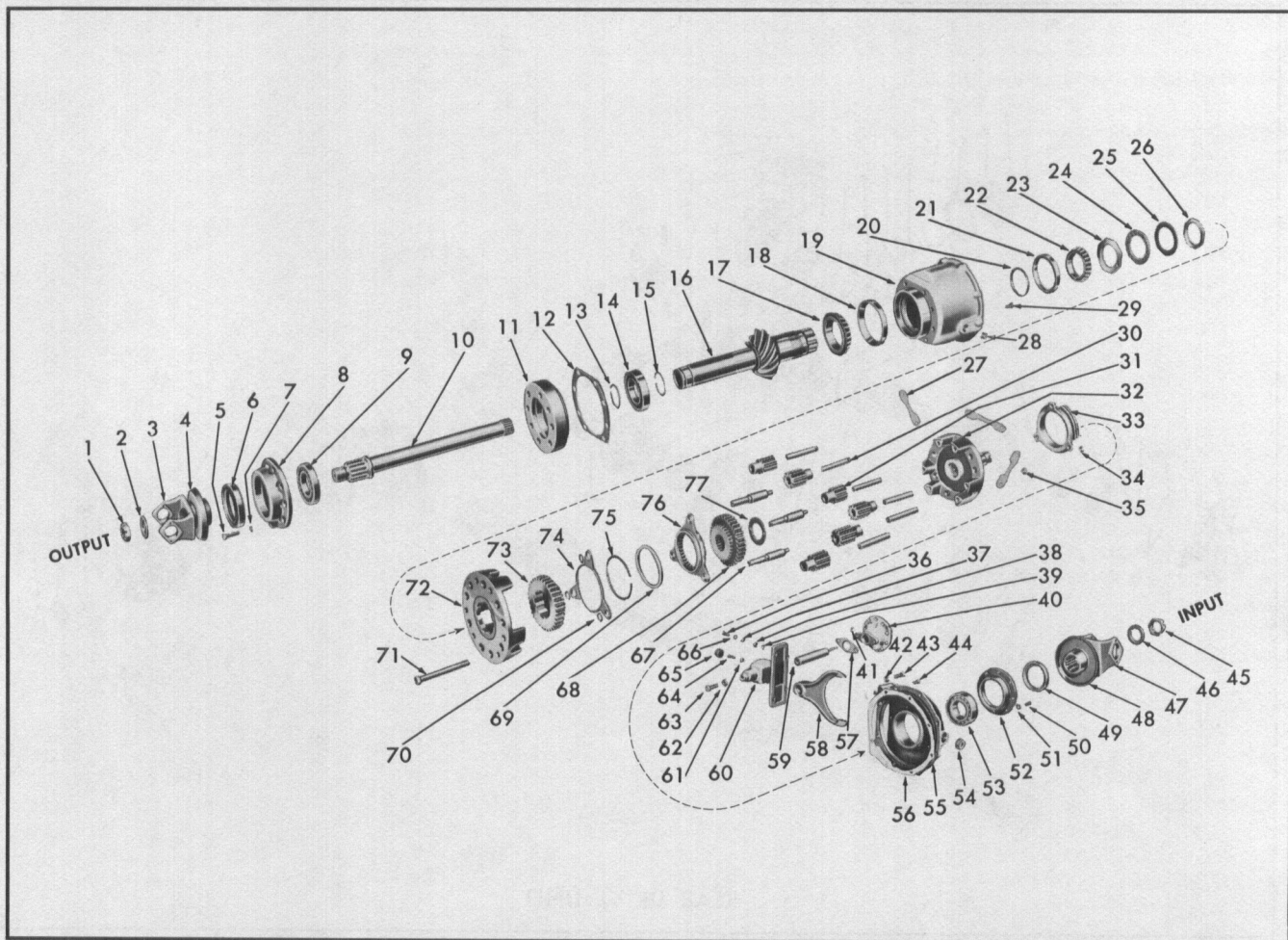
SLD, SLDD, SQD, SQDD, SRD, SRDD SERIES



REAR DRIVE UNIT

- | | | |
|---|--|---|
| 1. Cap screw | 26. Drive pinion inner bearing cup | 53. Differential spider |
| 2. Lock washer | 27. Bearing spacer | 54. Differential pinion thrust washer |
| 3. Thru shaft rear bearing cover | 28. Shims | 55. Differential pinion |
| 4. Gasket | 29. Drive pinion bearing cage | 56. Differential side gear |
| 5. Thru shaft rear bearing spacer | 30. Cap screw | 57. Differential side gear thrust washer |
| 6. Snap ring | 31. Drive pinion outer bearing cup | 58. Differential case half |
| 7. Thru shaft rear bearing | 32. Drive pinion outer bearing | 59. Differential bearing |
| 8. Snap ring | 33. Thrust washer | 60. Differential bearing cup |
| 9. Drive gear radial bearing sleeve | 34. Oil seal | 61. Differential bearing split adjusting ring |
| 10. Drive gear radial bearing | 35. Lock washer | 62. Differential bearing cap |
| 11. Drive gear | 36. Drive pinion bearing cage cover | 63. Lock washer |
| 12. Cap screw | 37. Slinger | 64. Cap screw |
| 13. Lock washer | 38. Yoke | 65. Helical pinion shaft bearing cage cover |
| 14. Top cover | 39. Washer | 66. Shim (bearing preload) |
| 15. Gasket | 40. Nut | 67. Cap screw |
| 16. Differential carrier housing | 41. Cotter key | 68. Bearing retainer |
| 17. Gasket | 42. Axle housing | 69. Helical pinion outer bearing cup |
| 18. Inspection hole plug | 43. Differential case bolt | 70. Helical pinion outer bearing |
| 18A. Cap screw and washer | 44. Carrier to housing stud | 71. Helical pinion inner bearing |
| 19. Thru shaft | 45. Lock washer | 72. Helical pinion inner bearing cup |
| 19A. Drive pinion | 46. Nut | 73. Helical pinion bearing cage |
| 20. Differential bearing cup | 47. Differential case bolt nut | 74. Helical pinion shaft |
| 21. Differential bearing split adjusting ring | 48. Differential bearing | 75. Square key |
| 22. Differential bearing cap cap screw | 49. Differential case half | 76. Shim |
| 23. Washer | 50. Differential side gear thrust washer | 77. Drive gear bearing spacer |
| 24. Differential bearing cap | 51. Differential side gear | |
| 25. Drive pinion inner bearing | 52. Spur gear | |

INTER-AXLE DIFFERENTIAL

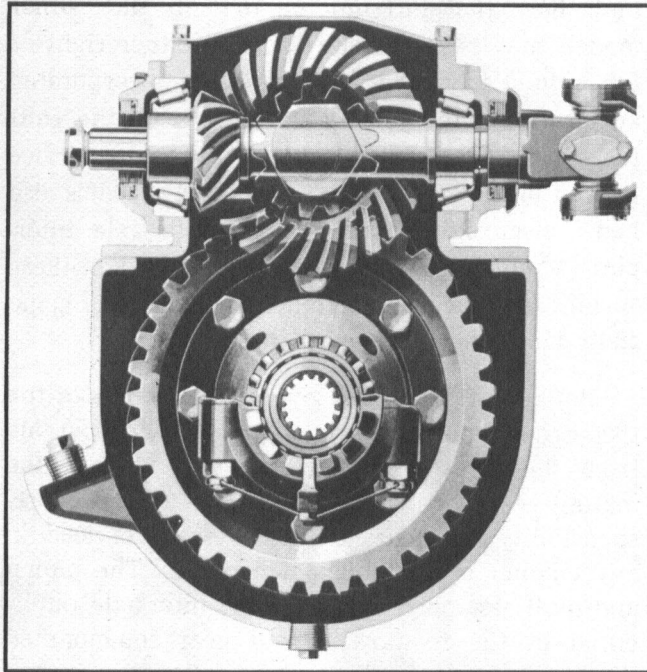


- | | | |
|--|---|---|
| 1. Output yoke nut | 27. Inter-axle differential pinion shaft lock | 52. Oil seal |
| 2. Washer | 28. Oil filler plug | 53. Double row ball bearing |
| 3. Output yoke | 29. Cap screw | 54. Inspection plug |
| 4. Slinger | 30. Inter-axle differential pinion shaft | 55. Inter-axle differential housing cover |
| 5. Cap screw | 31. Inter-axle differential pinion | 56. Cover to housing gasket |
| 6. Oil seal | 32. Inter-axle differential forward case half | 57. Air shift assembly gasket |
| 7. Lock washer | 33. Inter-axle axle differential shift yoke | 58. Shift fork |
| 8. Rear bearing cover | 34. Shift shaft nut | 59. Air shift assembly push rod |
| 9. Rear ball bearing | 35. Pinion shaft nut | 60. Inter-axle differential shift housing |
| 10. Thru shaft | 36. Cap screw | 61. Shift fork set screw lock nut |
| 11. Rear bearing cage | 37. Split tapered dowel | 62. Shift fork adjusting screw lock nut |
| 12. Shim | 38. Stud nut | 63. Shift fork adjusting screw |
| 13. Outer roller bearing snap ring | 39. Washer | 64. Shift fork set screw |
| 14. Rear roller bearing | 40. Air shift chamber assembly | 65. Shift housing plug |
| 15. Inner roller bearing snap ring | 41. Stud nut | 66. Washer |
| 16. Pinion and quill assembly | 42. Shift fork adjusting screw nut | 67. Inter-axle differential shift shaft |
| 17. Drive pinion inner bearing | 43. Shift fork adjusting screw | 68. Inter-axle differential forward side gear |
| 18. Inner bearing cup | 44. Cover to housing cap screw | 69. Shift collar washer |
| 19. Inter-axle differential housing | 45. Input yoke nut | 70. Shift collar snap ring |
| 20. Drive pinion bearing spacer | 46. Washer | 71. Inter-axle differential case bolt |
| 21. Outer bearing cup | 47. Input yoke | 72. Inter-axle differential rear case half |
| 22. Drive pinion outer bearing | 48. Slinger | 73. Inter-axle differential rear side gear |
| 23. Pinion bearing adjusting nut (doweled) | 49. Cap screw | 74. Shift collar retainer cover |
| 24. Pierced lock washer | 50. Washer | 75. Shift collar retaining ring |
| 25. Bending lock washer | 51. Oil seal cover | 76. Shift collar and yoke assembly |
| 26. Pinion bearing jam nut | | 77. Thrust washer |

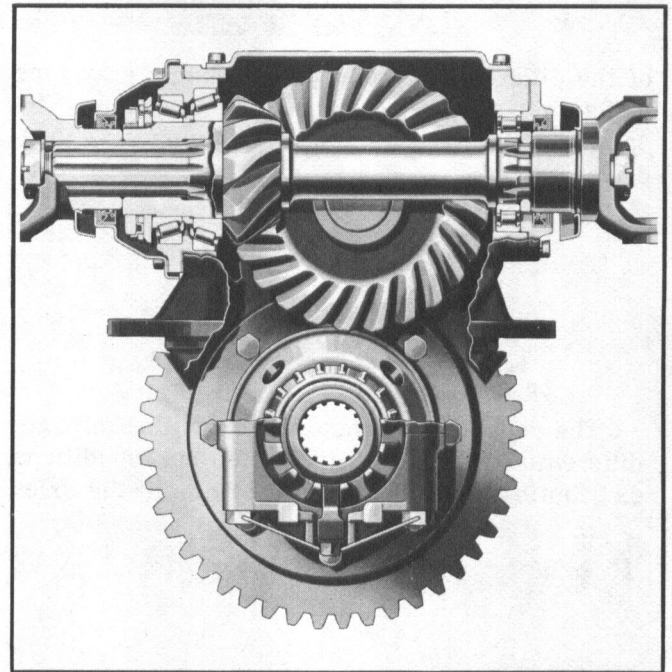
DOUBLE REDUCTION DRIVE UNIT

SPIRAL BEVEL AND HYPOID TOP-MOUNTED THROUGH DRIVE TYPE

CARE AND MAINTENANCE



Spiral Bevel Drive Unit



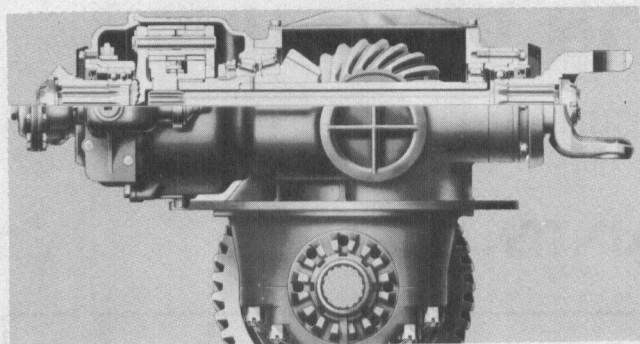
Hypoid Drive Unit

Top-mounted double-reduction drive units made by Rockwell-Standard Company incorporate either spiral bevel or hypoid first reduction gears. Either straight spur or helical spur gears are used in the second reduction.

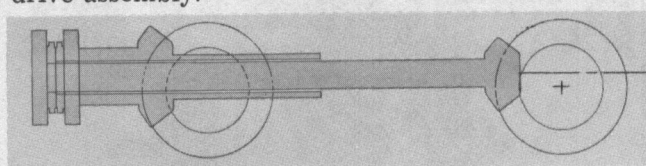
Tapered roller bearings support the forward and rear ends of the thru-shaft and pinion assembly of spiral bevel gear units. Bearing preload is adjusted and maintained by shim packs between the carrier machined faces and bearing covers. Yokes or flanges held in place by thru-shaft nuts press against the bearing cones or spiral bevel pinion splined to the thru-shaft.

The thru-shafts of the hypoid gear drive units are supported at the forward end by tapered roller bearings in a cage and at the rear end by a straight roller bearing. Pinion bearing preload is adjusted and maintained by a hardened precision spacer between the inner and outer tapered bearings which are held in place on the pinion journal by large nuts. Yokes and flanges are held in place on the thru-shaft by separate thru-shaft nuts.

Hypoid gear top-mounted forward drive units may be equipped with an inter-axle (3rd) differential of the planetary type which divides engine torque between the forward and rear axles. The differential is equipped with a lock-up device which converts the tandem assembly to a thru-drive type tandem. The lock-up is actuated by an air chamber and controlled from the vehicle cab. It can be engaged and disengaged under all normal operating conditions. The following schematic drawing illustrates the action

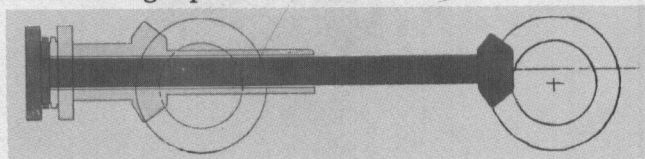


of the differential assembly. The single gray tone of figure 1 shows the differential "locked-up," inoperative, with the tandem functioning as a thru-drive assembly.



Forward Rear Axle Figure 1 Rear Rear Axle

The double gray tone of figure 2 illustrates the differential operating under normal conditions, distributing equal amounts of torque to the axles.



Forward Rear Axle Figure 2 Rear Rear Axle

The rear gear of the inter-axle differential has a large I.D. spline and engages a mating spline of the forward pinion and quill assembly, driving the forward axle. The front gear of the differential has a smaller I.D. spline and engages the mating spline of the thru-shaft that extends through the pinion and quill assembly and drives the rear axle.

Some models of the inter-axle differential drive units have the shift unit on the left side. Other models may have the shift unit on either right or left side. Early models of all units incorporated an electric switch that was actuated by the shift fork push rod and connected to a warning device located in the vehicle cab. These early models also had 3 disengaging springs in the inter-axle differential assembly. Later improved models omit these springs and incorporate other changes that materially lengthen differential life.

Both spiral bevel and hypoid drive units of the thru-drive type have pinions that are separable from the thru-shafts and are serviced with the mating gears as matched sets. We assume no responsibility for gears of these types serviced in any manner other than matched sets. The pinion and quill assembly used with the inter-axle differential of the forward hypoid gear top-mounted drive units is serviced as an assembly with matched hypoid gear.

REMOVE AND DISASSEMBLE DRIVE UNIT

REMOVE DRIVE UNIT FROM HOUSING

- A. Remove plug from bottom of axle housing and drain lubricant. Drain lubricant from inter-axle differential by removing plug at bottom of inter-axle differential housing.
- 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.

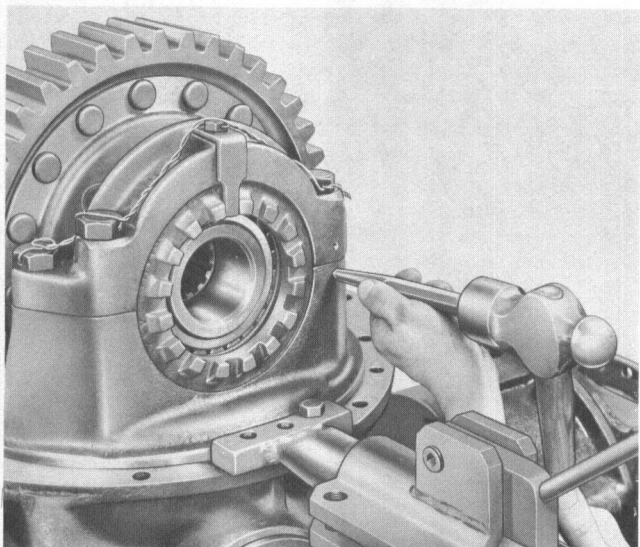
CAUTION: Do not hit the circular driving lugs on the shaft head — this may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels — this will damage the hub, shaft and oil seal.

- C. Remove the axle shaft from the drive unit and housing.
- D. Disconnect universal at pinion or inter-axle differential input shaft.
- E. Remove carrier to housing stud nuts and washers.
- F. Break carrier loose from housing with rawhide mallet and remove tapered dowels. Dowels must be removed. If necessary, back out studs.
- G. Pull carrier straight out of housing with chain fall, boom or "A" frame.

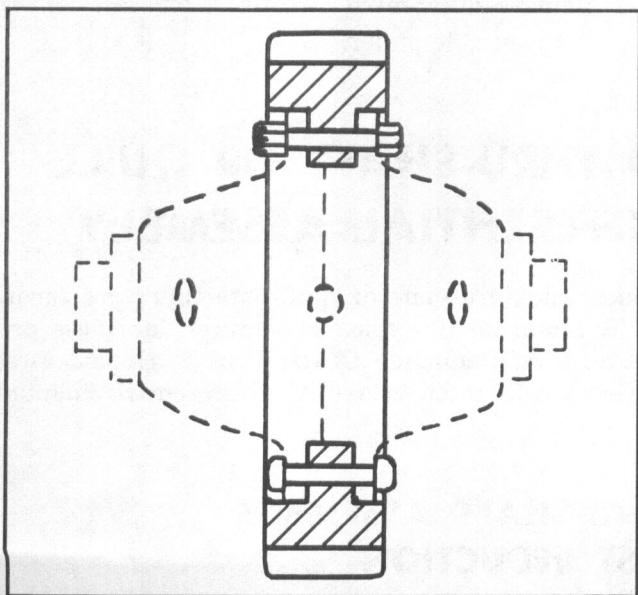
A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange.

REMOVE AND DISASSEMBLE DIFFERENTIAL

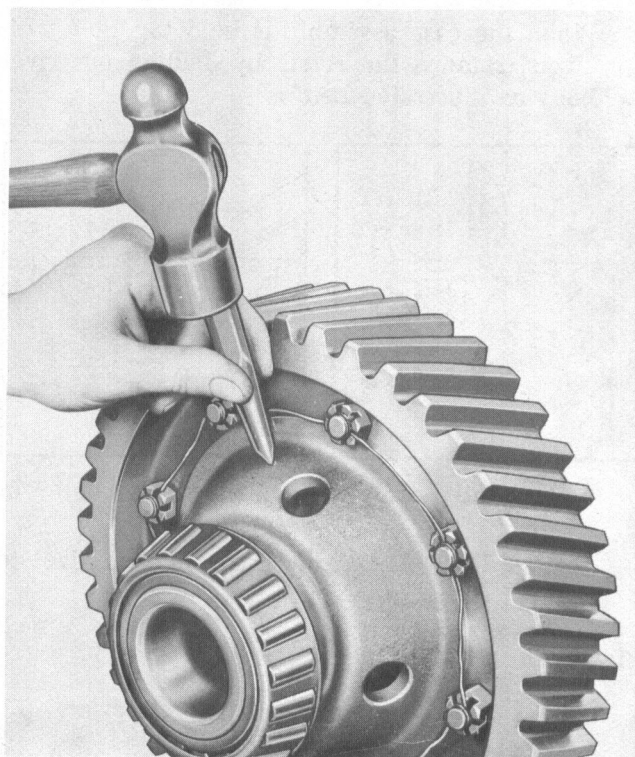
- A. Mount drive unit in suitable repair stand and cut lock wire. Remove cap screws and adjusting nut locks.



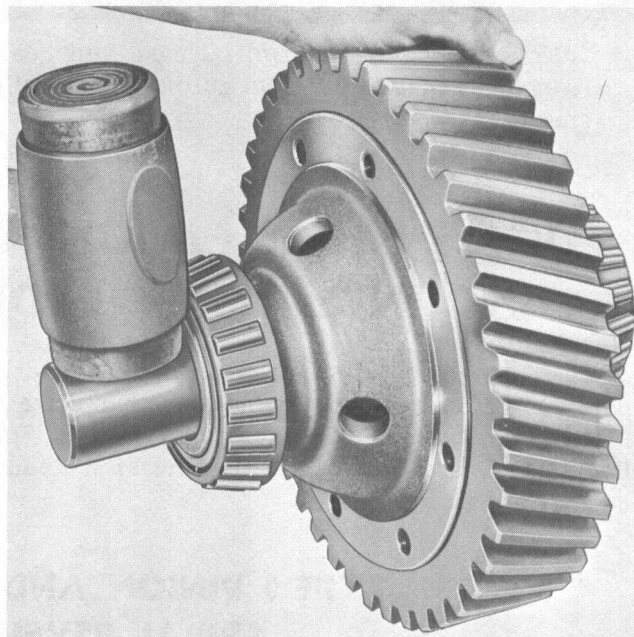
- B. Center-punch one differential carrier leg and bearing cap to correctly identify for proper reassembly.
- C. Remove bearing cap stud nuts or cap screws, bearing caps and adjusting nuts and bearing cups.
- D. Lift out differential and gear assembly.



Differential may be held together with bolts and nuts or rivets.

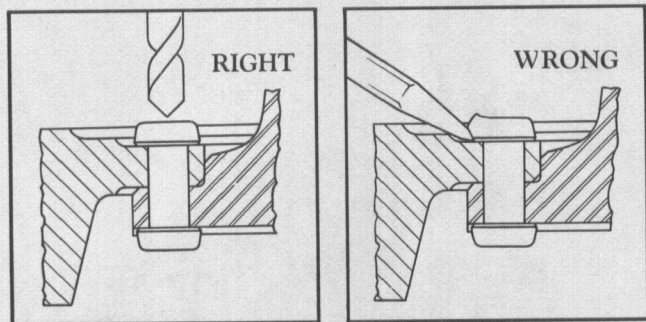


- E. If original identification marks are not clear, center-punch case halves for correct alignment during reassembly.
- F. When bolts are used, cut lock wire or cotter pins and remove nuts. Drive bolts from case assembly with convenient drift.

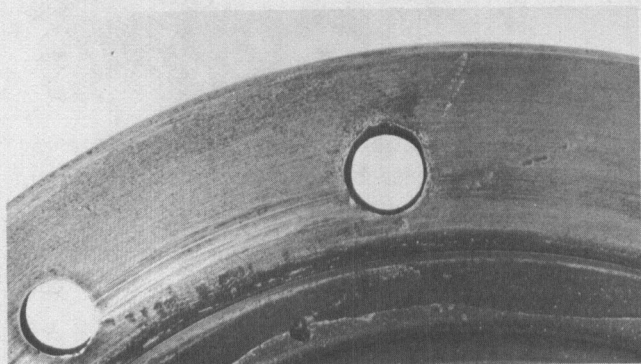


- G. Insert short sleeve in case axle shaft bore and separate assembly by striking sleeve as illustrated.

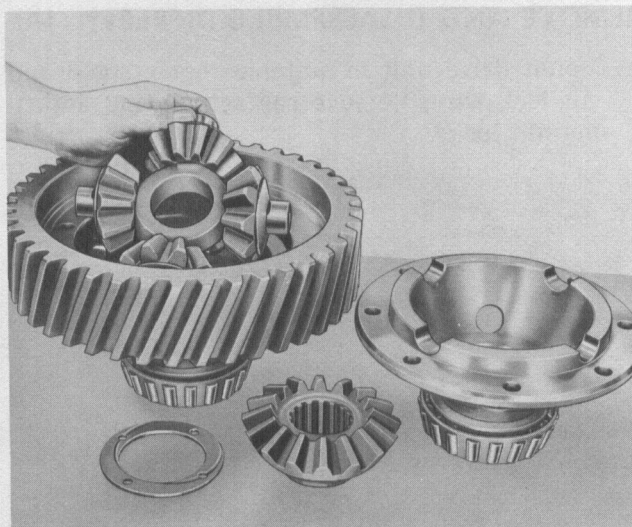
H. When the case assembly is held together with rivets, remove the rivets by drilling out rivet body as illustrated below:



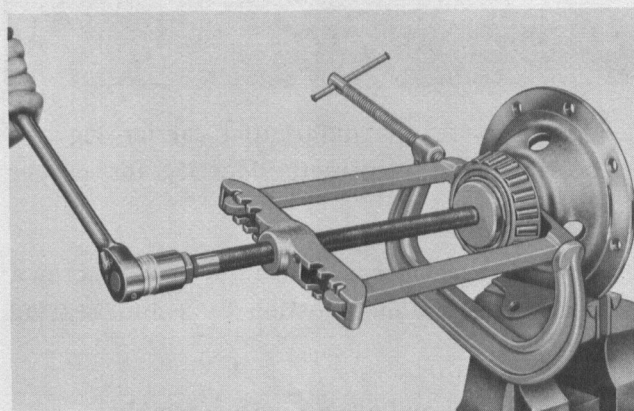
1. Carefully center punch rivets in center of head.
2. Use drill $\frac{1}{32}$ " smaller than body of rivet to drill through head.
3. Press out rivets.



Note elongated differential case and gear rivet holes that result from cutting rivets with chisel.



- I. Remove side gears, spider and pinion assembly and thrust washers.



- J. Remove differential bearings from case halves with suitable puller.

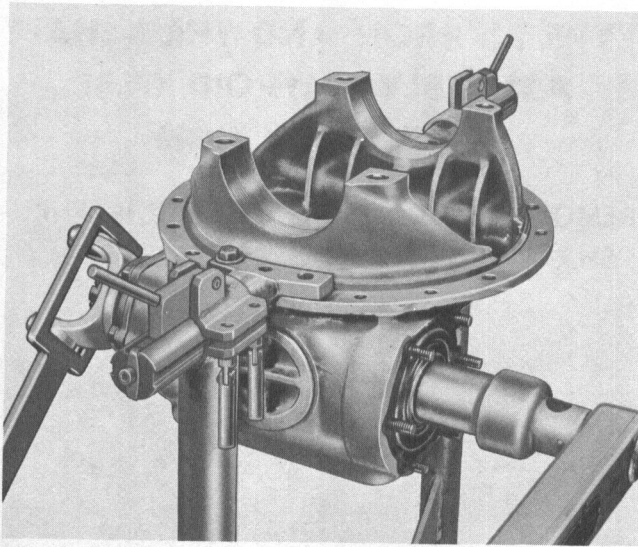
DISASSEMBLE PINION AND THRU-SHAFT OR QUILL AND INTER-AXLE (3RD) DIFFERENTIAL ASSEMBLY

Three types of spiral bevel or hypoid drive pinion and thru-shaft or quill assemblies are incorporated in top-mounted double-reduction drive units. Recommended service procedures for these are noted under the following headings: Type 1, Spiral Bevel First Reduction Gears; Type 2, Hypoid First Reduction Gears; and Type 3, Hypoid First Reduction Gears with Inter-Axle (3rd) Differential Mounted on Forward Drive Unit.

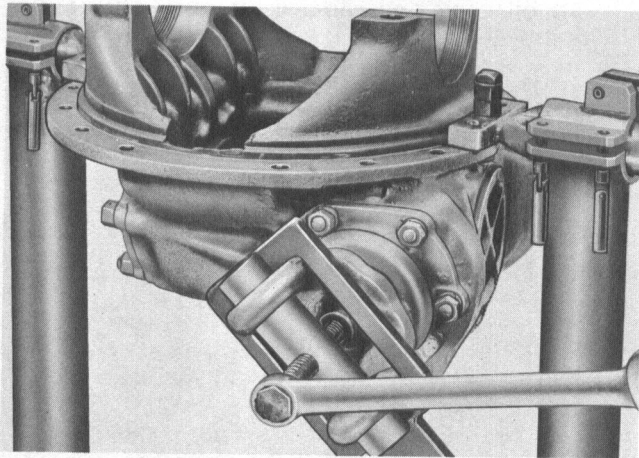
TYPE 1 PINION AND THRU-SHAFT ASSEMBLY SPIRAL BEVEL FIRST REDUCTION

REMOVE AND DISASSEMBLE PINION, THRU-SHAFT AND BEARINGS

- A. Remove cover enclosing tapered or short splined end of thru-shaft, where used on rear drive units.



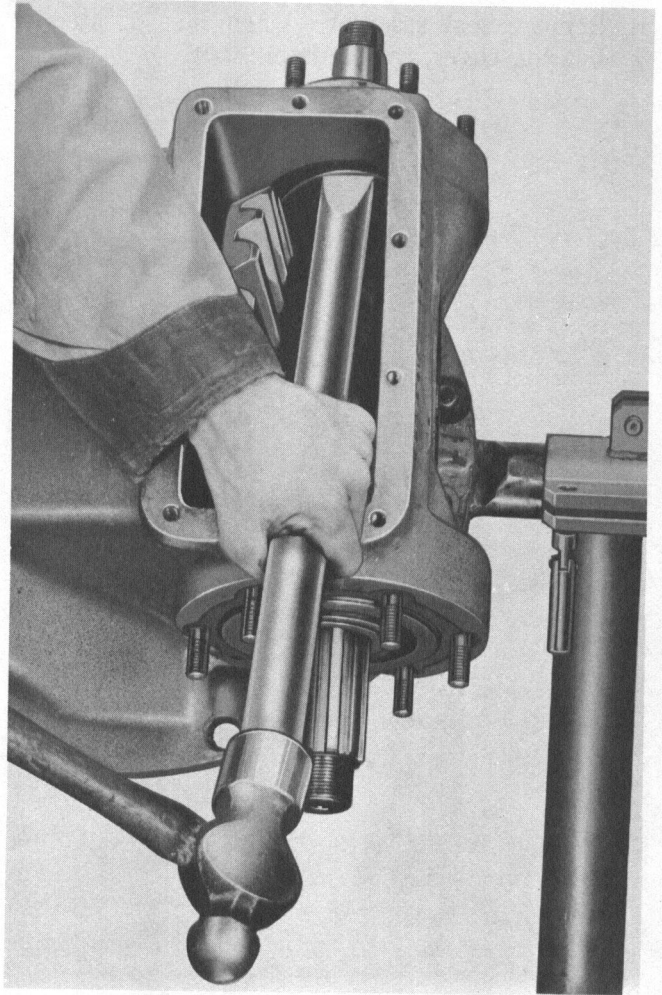
- B. Hold flange or yoke with suitable tool and remove nuts from both ends of thru-shaft.



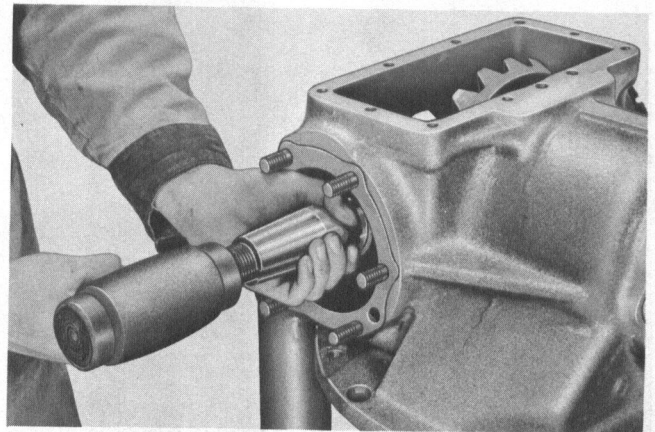
- C. Remove flange or yoke from end of shaft with suitable puller. Do not drive flanges or yokes from thru-shaft as this may result in serious damage to these components.
- D. Remove stamped inspection cover and threaded inspection hole plug from drive unit.

A small spanner wrench for removing and installing the threaded inspection hole plug can be easily made of a piece of 2" pipe about 8" long. Cut right angle slots approximately $\frac{3}{8}$ " wide and $\frac{1}{2}$ " deep in one end of the pipe. Drill a $\frac{9}{16}$ " hole through the opposite end to insert a "T" handle.

- E. Remove stud nuts or cap screws, lock washers and bearing covers and seal assemblies from both ends of thru-shaft. Attach shim packs to their respective covers to facilitate bearing pre-load adjustment when reassembling drive unit.

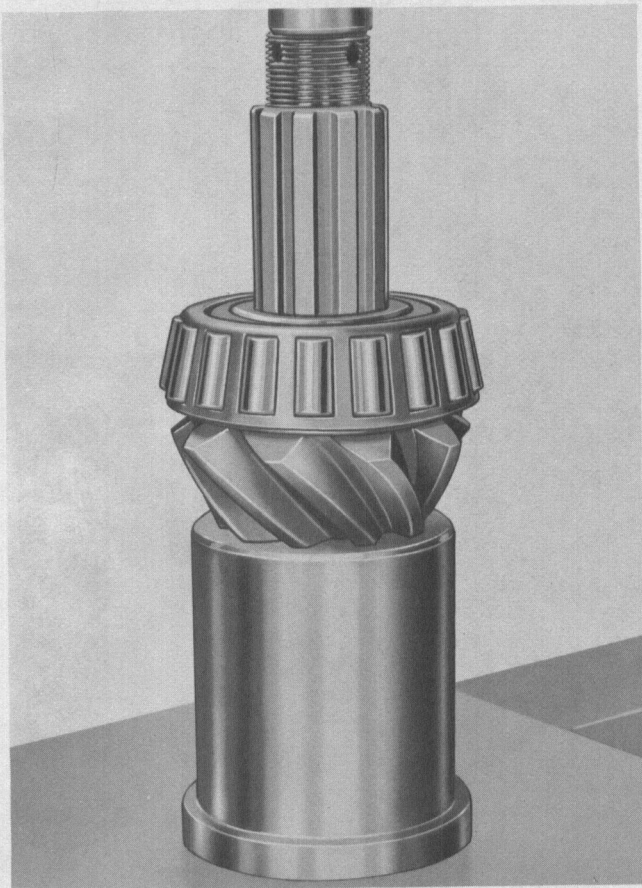


- F. Carefully tap bearing from tapered or short splined end of thru-shaft with brass drift. Drift should fit against bearing inner race. Cup will come out with bearing cone.

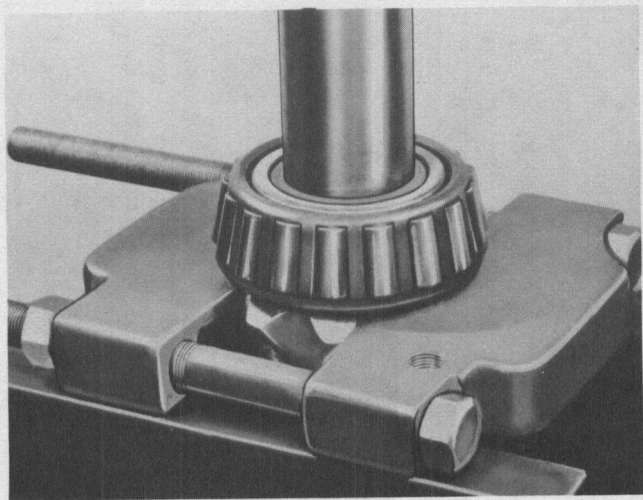


- G. Tap on tapered or short splined end of thru-shaft with soft mallet to remove opposite bearing, thru-shaft and pinion assembly. Cup will come out with bearing cone.

- H. Remove seal assembly, when incorporated in bearing cover, with suitable tool.



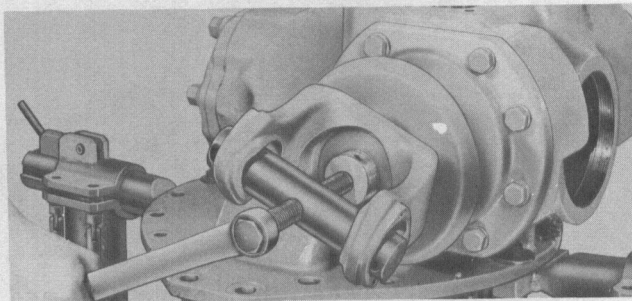
- I. Remove pinion and bearing assembly from thru-shaft by supporting gear with plate having a bored hole which will slip over largest O.D. of thru-shaft, or use a sleeve of convenient size. Press against splined end of shaft.



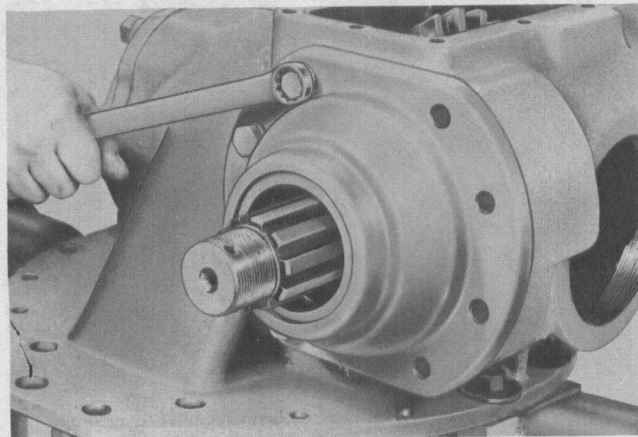
- J. Remove pinion bearing from pinion with suitable puller, or in press, as is most convenient.

TYPE 2 PINION AND THRU-SHAFT ASSEMBLY – HYPOID GEAR FIRST REDUCTION

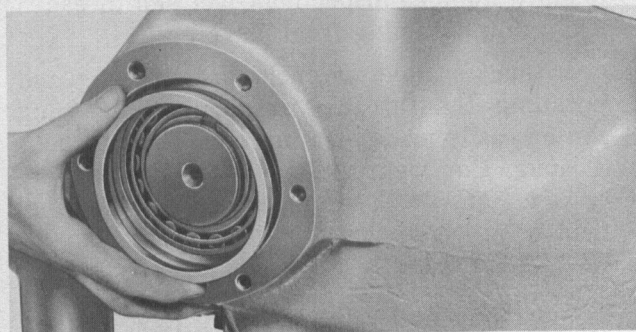
REMOVE AND DISASSEMBLE PINION, THRU-SHAFT AND BEARING CAGE ASSEMBLY



- A. Loosen front and rear flange or yoke nuts with suitable tools and remove the parts with puller as illustrated.

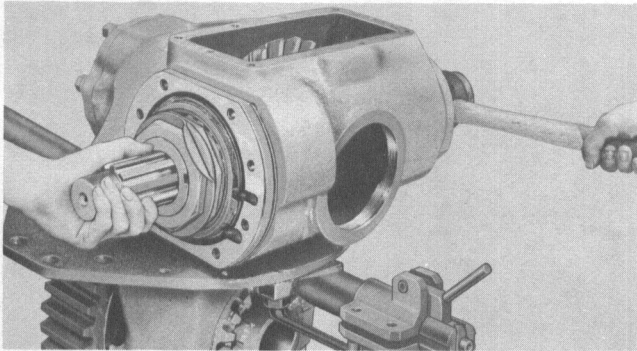


- B. Remove cap screws or stud nuts from front and rear cover and seal assemblies and from rear cover of rear carrier.

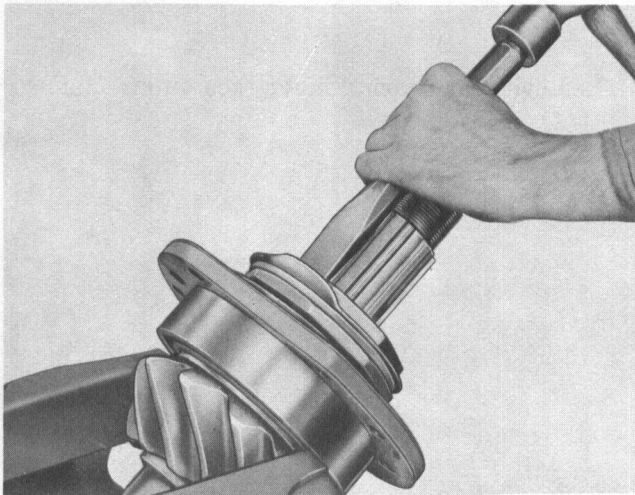


- C. Remove covers and rear bearing inner race spacer of forward unit. When rear thru-shaft has splines at rear end, remove the rear cover, nut, washer, long spacer and short spacer that

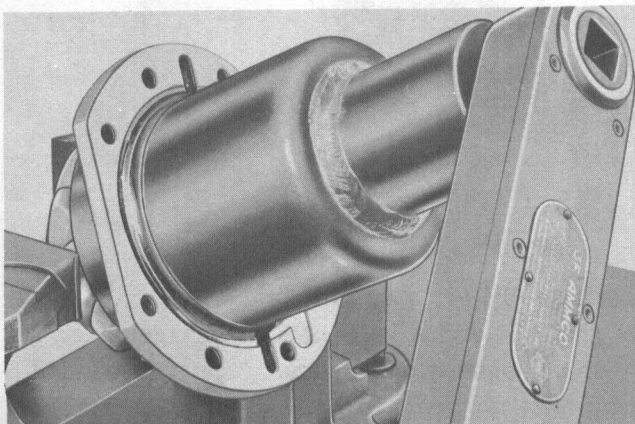
hold inner race in position. When rear carrier thru-shaft is not splined at rear end, remove rear bearing spacer as illustrated.



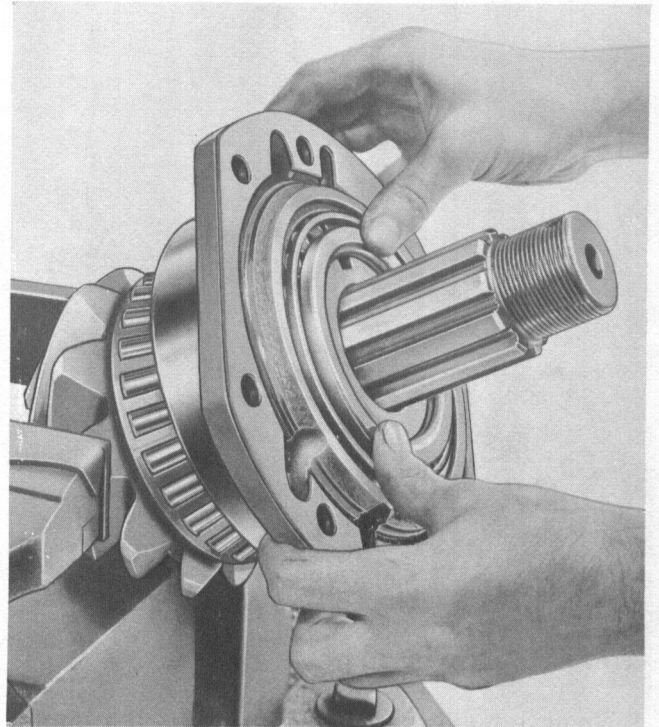
D. Carefully tap pinion, bearing cage and thru-shaft assembly from carrier. Retain and identify shims between cage and carrier to aid reassembly.



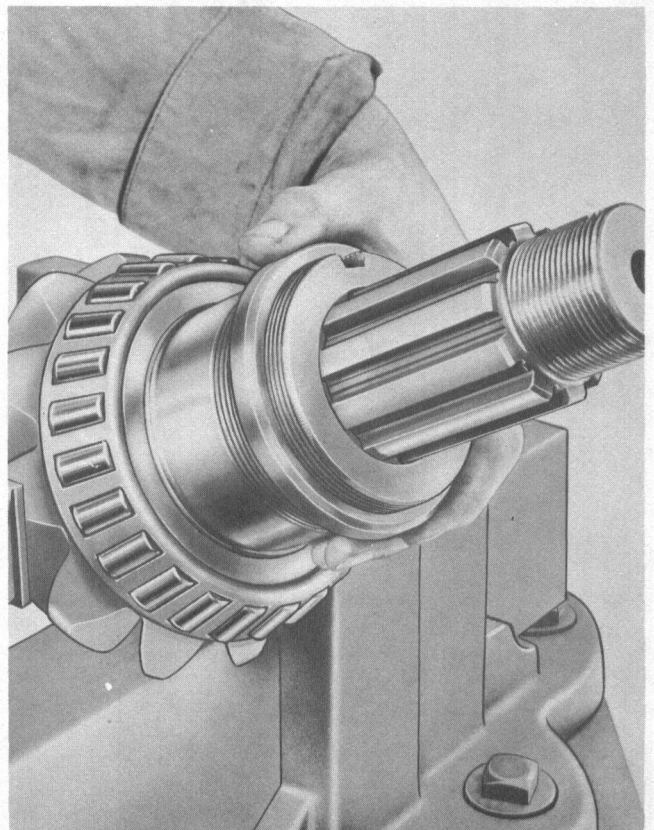
E. Hold pinion cage assembly in soft jaw vise and straighten flat lock washer.



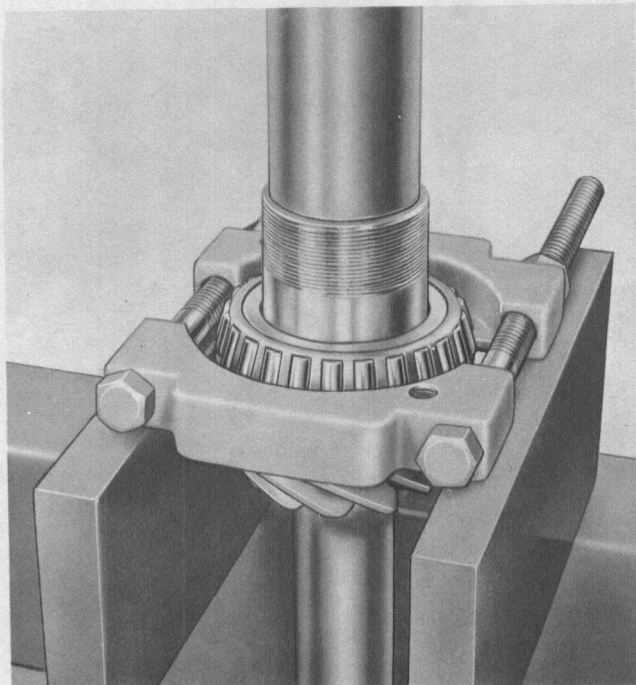
F. Loosen outer lock nut with suitable tools. Remove nut, flat washer and nut lock, loosen and remove inner nut.



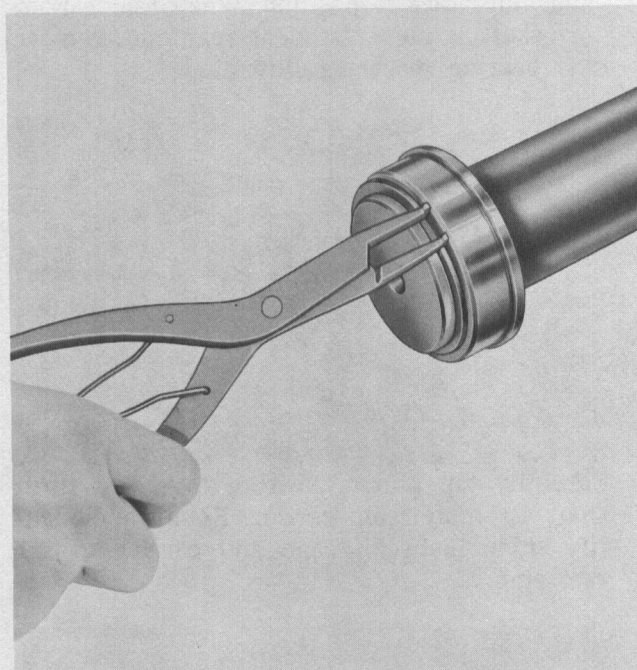
G. Remove pinion outer bearing cone, cage and cup assembly.



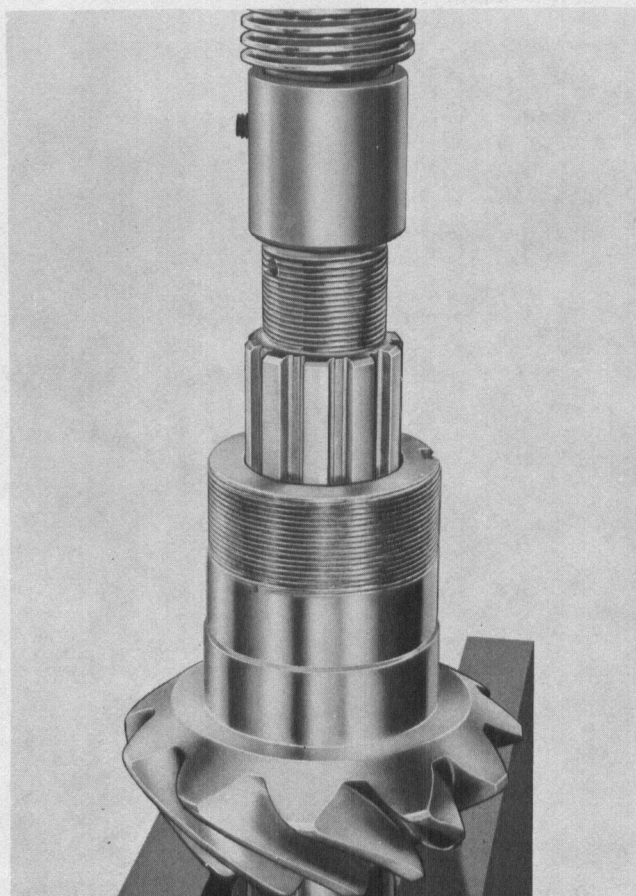
H. Remove pinion bearing spacer. Retain and identify spacer to aid reassembly of parts.



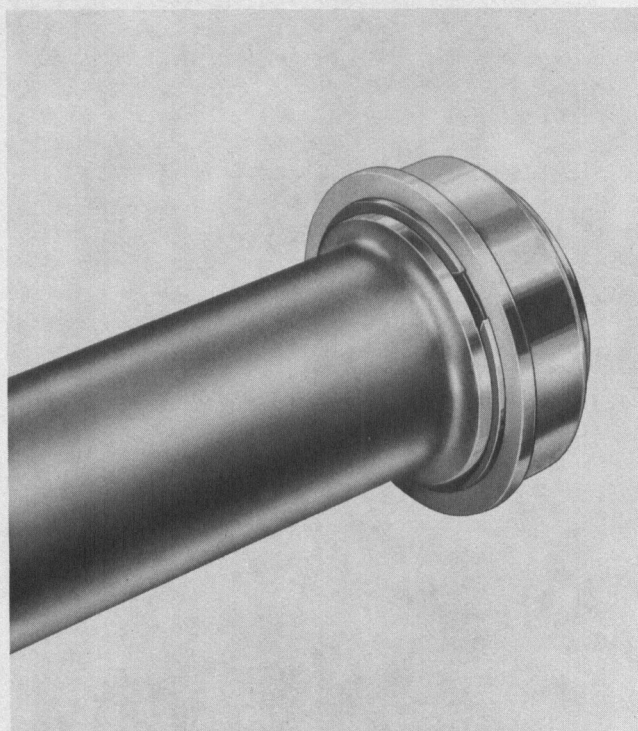
I. Remove pinion inner bearing cone with puller or suitable tool in press.



K. Remove rear bearing inner race outer retainer.



J. Remove pinion from thru-shaft in press.



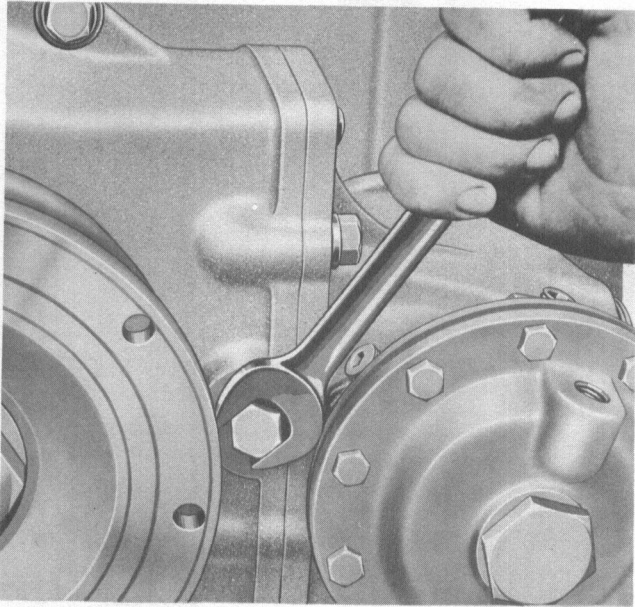
L. Carefully press or pull inner race from thru-shaft. Exercise care not to damage inner retainer against which inner race is assembled.

M. Remove thru-shaft rear bearing from carrier with puller and pinion bearing cups from cage with suitable puller or with sleeves in press.

TYPE 3 PINION AND QUILL ASSEMBLY

HYPOID GEAR FIRST REDUCTION WITH INTER-AXLE (3RD) DIFFERENTIAL

REMOVE AND DISASSEMBLE SHIFT UNIT HOUSING AND DIAPHRAGM ASSEMBLY



- A. Loosen inter-axle differential shift fork adjusting screw jam nut. Back-off adjusting screw.

Earlier models employed a five-piece yoke assembly and return springs for each shift shaft. (See numbers 5 and 7 in figure 1.)

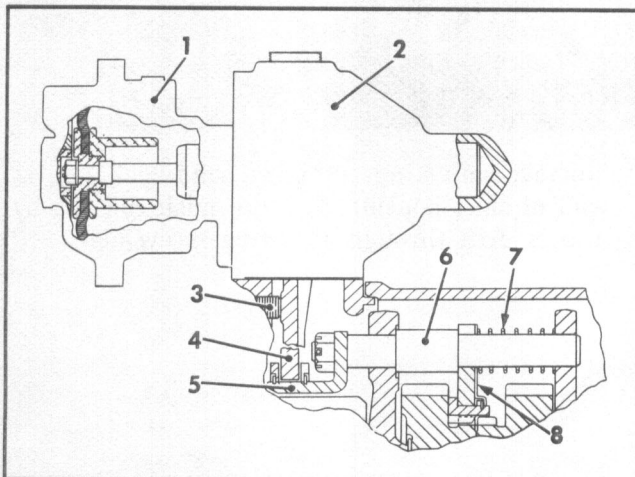
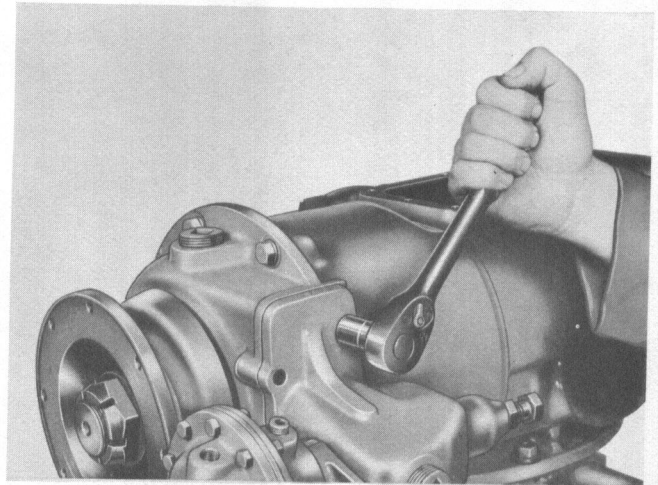


Figure 1

- | | |
|-------------------------|---------------------------|
| 1. Shift Unit (S/L Air) | 5. Shift Yoke Assy. |
| 2. Shift Housing | 6. Shift Shaft (3) |
| 3. Adjusting Screw | 7. Shift Shaft Spring (3) |
| 4. Shift Fork | 8. Collar Retainer Cover |



- B. Remove shift housing cap screws, stud nuts, dowels and washers, and remove shift unit housing and diaphragm assembly.

Current shift housings have a set screw and lock nut at the end of push rod bore to control push rod travel.

In the inter-axle, a one-piece yoke is employed, shift shaft springs are omitted and the return spring is located in the shift chamber.

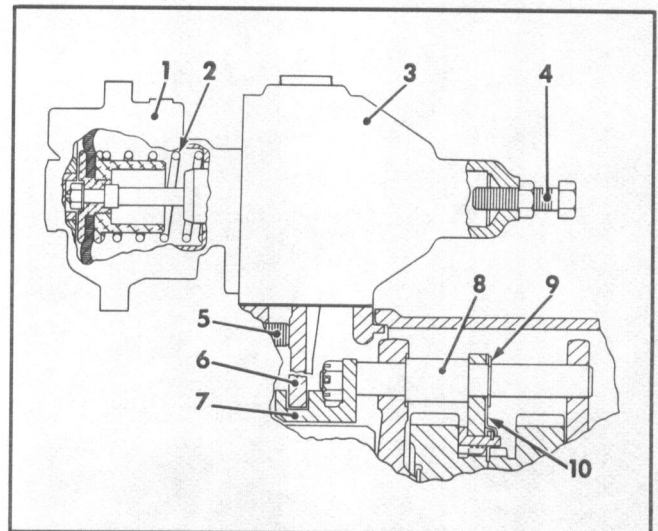
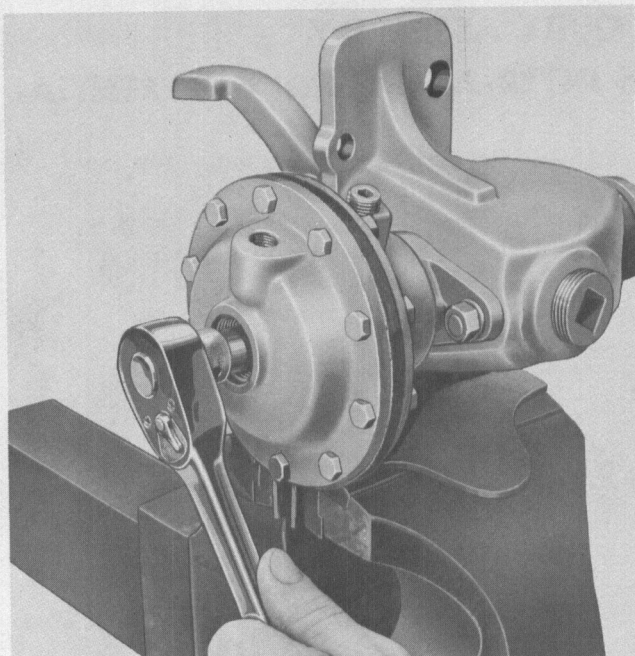
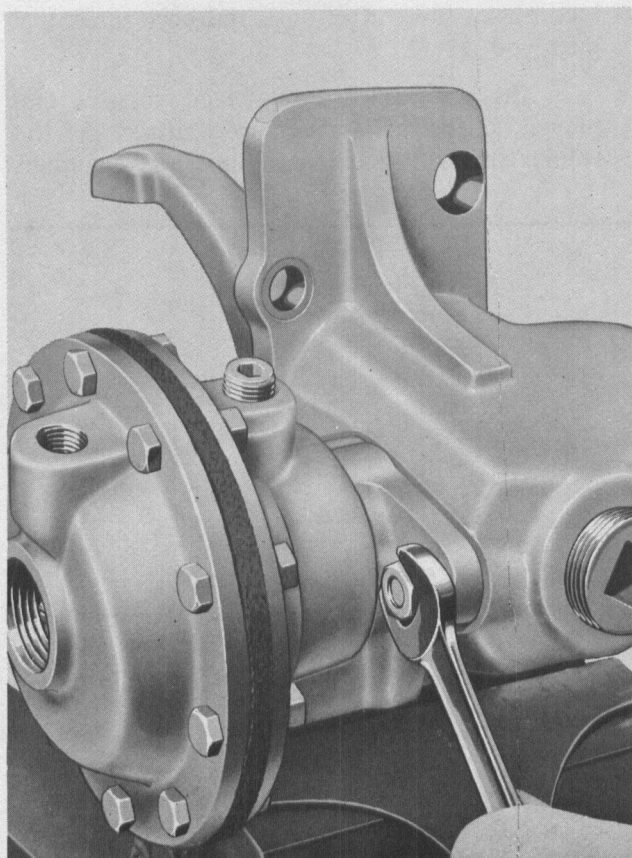


Figure 2

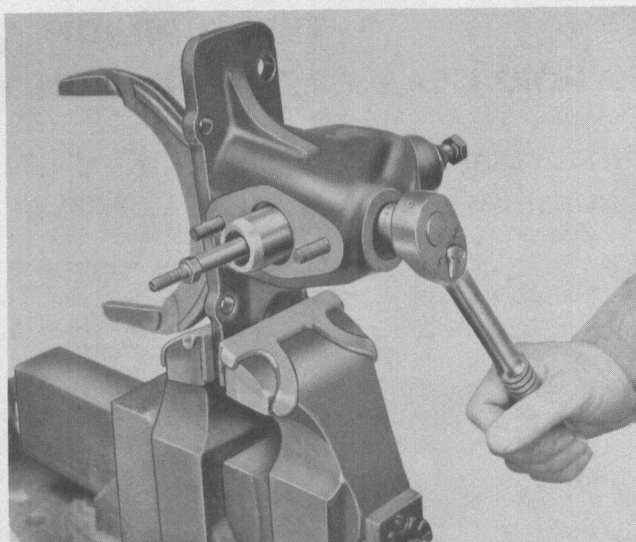
- | | |
|----------------------------|---------------------------|
| 1. Shift Unit (S/L Air) | 6. Shift Fork |
| 2. Shift Unit Spring | 7. Shift Yoke |
| 3. Shift Housing | 8. Shift Shaft (3) |
| 4. Rear Adjusting Screw | 9. Retainer (3) |
| 5. Forward Adjusting Screw | 10. Collar Retainer Cover |



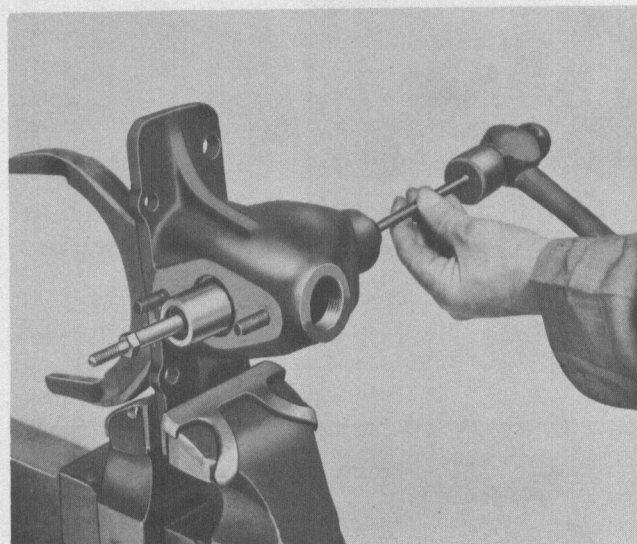
C. Remove diaphragm cover plug and push rod lock nut.



D. Remove shift housing to diaphragm stud nuts and lock washers and remove diaphragm assembly.

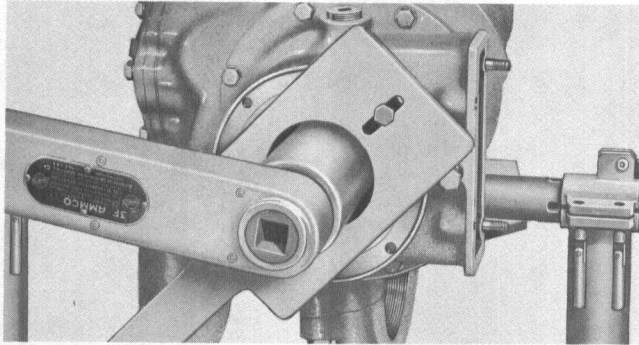


E. Remove shift housing plug and remove shift fork set screw and jam nut.

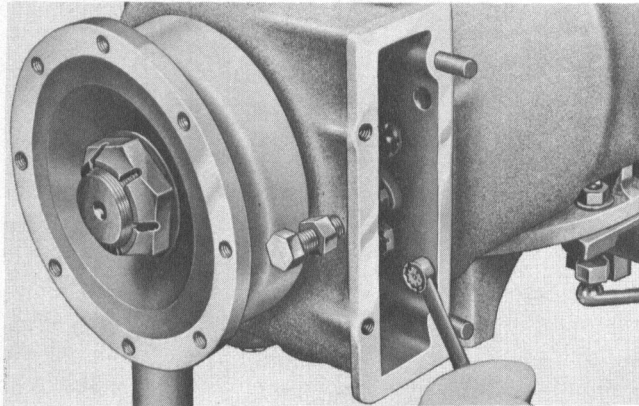


F. Remove adjusting set screw and lock nut at end of shift housing. Tap the push rod out by use of drift through adjusting screw hole.

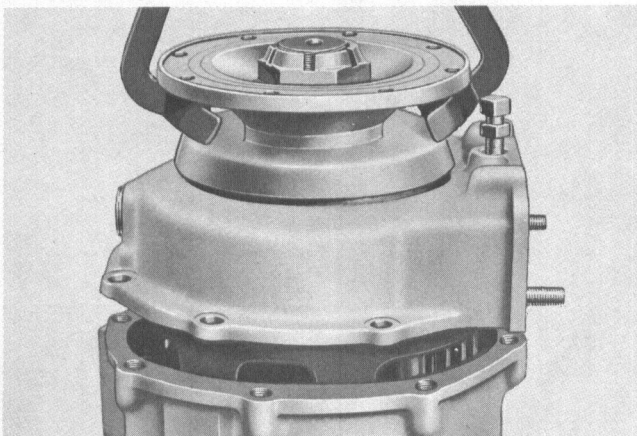
REMOVE INTER-AXLE (3rd) DIFFERENTIAL, BEARING AND COVER ASSEMBLY



- A. Remove input shaft cotter key and loosen nut with suitable tools. Do not remove nut. Loosen and remove rear thru-shaft nut, yoke or flange.

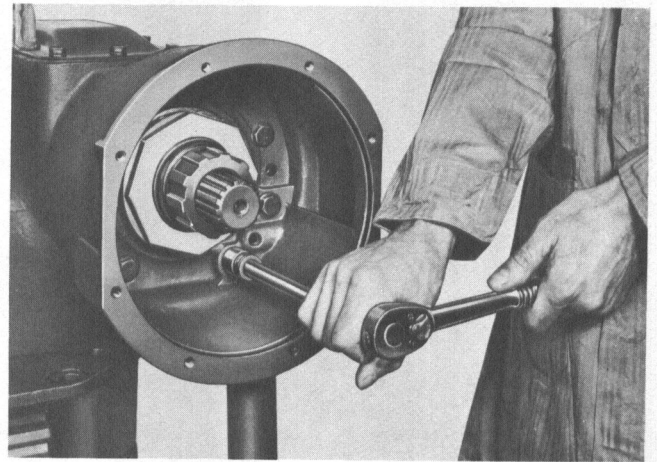


- B. Remove inter-axle differential housing cover internal cap screw lock wire at shift housing opening. Remove cap screws and lock washers.

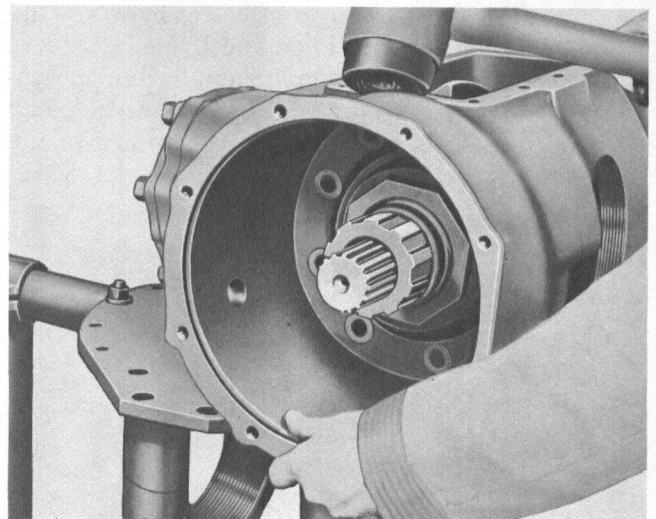


- C. Turn drive unit assembly in vertical position and remove inter-axle differential assembly with chain fall. Lightly tap housing with rawhide hammer to free assembly.
D. Put aside inter-axle differential for later disassembly.

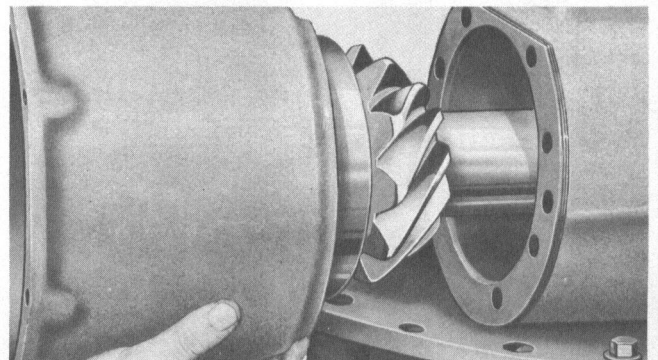
REMOVE AND DISASSEMBLE HYPOID PINION AND QUILL, BEARING AND HOUSING ASSEMBLY



- A. Cut housing cap screw or stud nut lock wire. Remove cap screws or stud nuts.



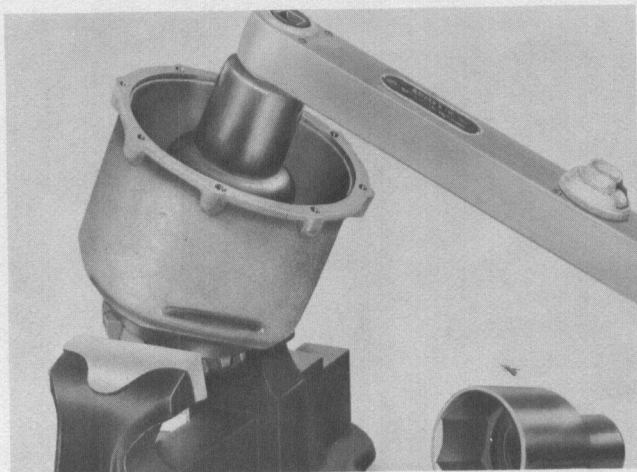
- B. Lightly tap on the top edge of housing with a rawhide hammer to loosen it from carrier.



- C. Remove housing and pinion quill assembly. Wire shim pack to carrier to aid reassembly.

DISASSEMBLE TYPE 3 PINION

- D. Clamp the pinion and quill assembly in a copper-jawed vise and straighten pinion bearing outer nut lock washer.

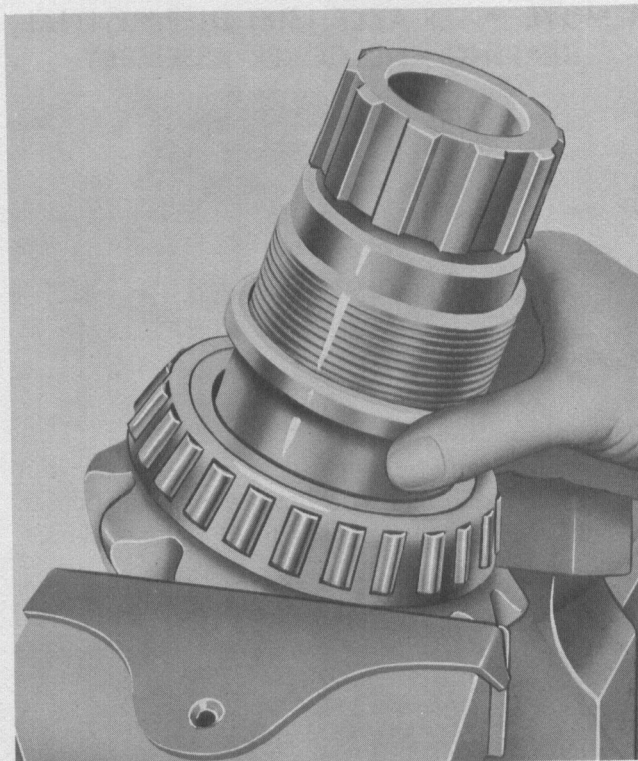


- E. Remove the pinion bearing outer nut and lock washer, inner nut lock and inner nut.

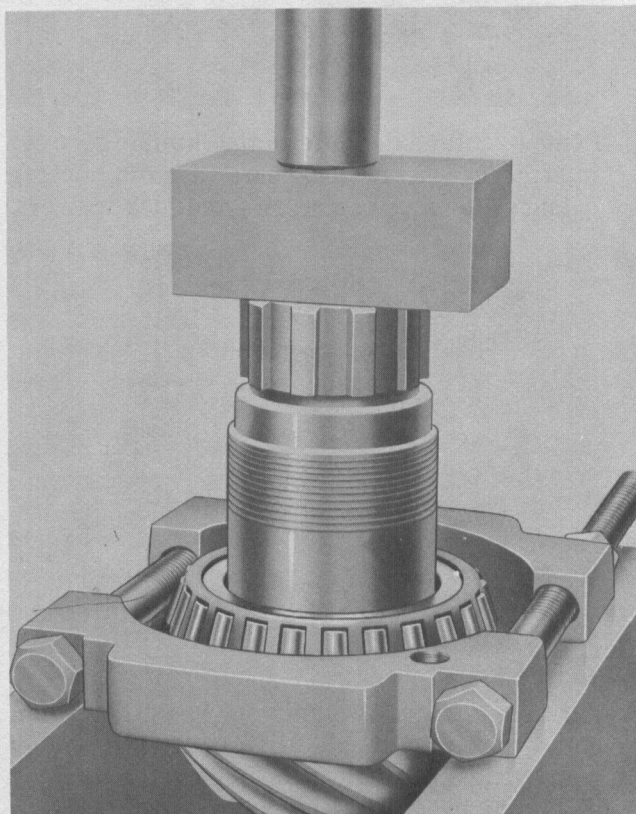
A hard wood wedge inserted between the teeth of the hypoid pinion and hypoid gear will prevent the gears from turning while loosening and tightening the bearing adjusting and jam nuts when the gears are assembled in the carrier.



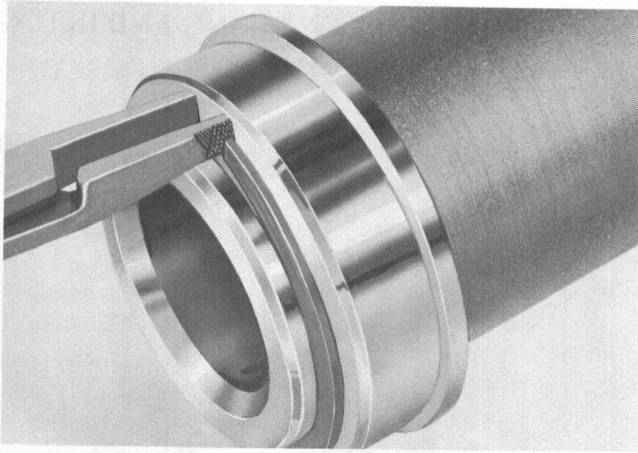
- F. Remove housing and outer bearing from the pinion and quill assembly.



- G. Remove the pinion bearing spacer. Note O.D. chamfer is toward outer bearing.



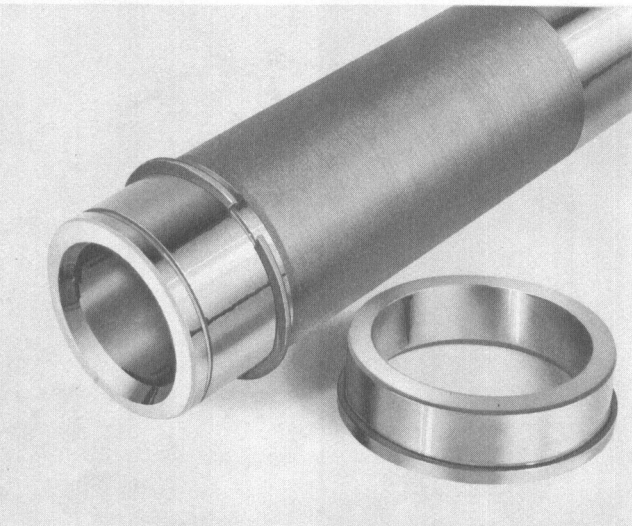
- H. Remove the rear pinion bearing using a suitable puller or other tool in press.



I. Remove pinion quill rear bearing inner race outer retainer.



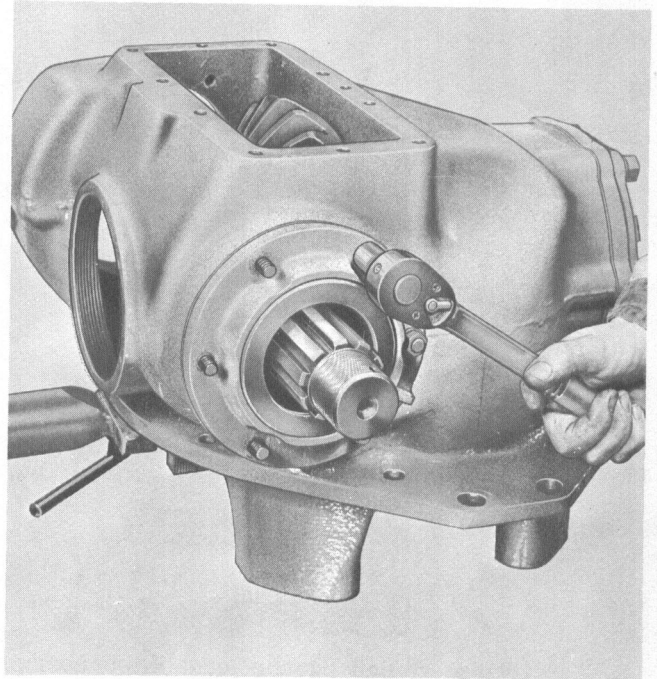
J. Remove the pinion quill rear bearing inner race using a suitable puller or press. Exercise care not to damage inner retainer against which race is assembled.



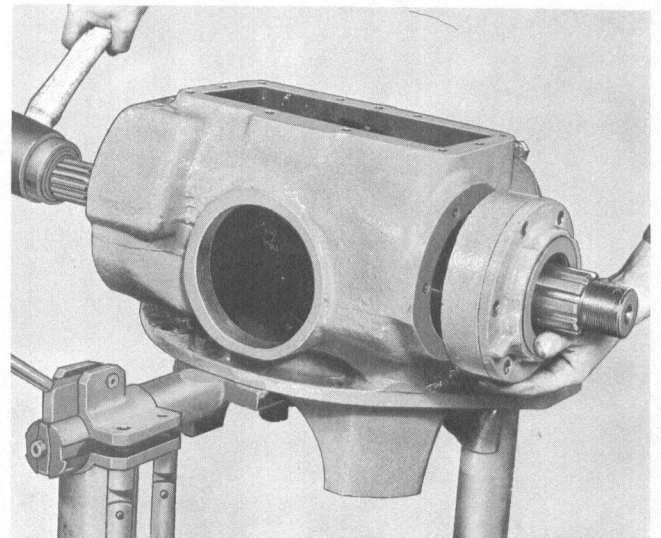
K. Remove rear bearing inner race inner retainer.

L. Remove pinion bearing cups from housing with suitable puller or with sleeves in press.

REMOVE AND DISASSEMBLE THRU-SHAFT ASSEMBLY

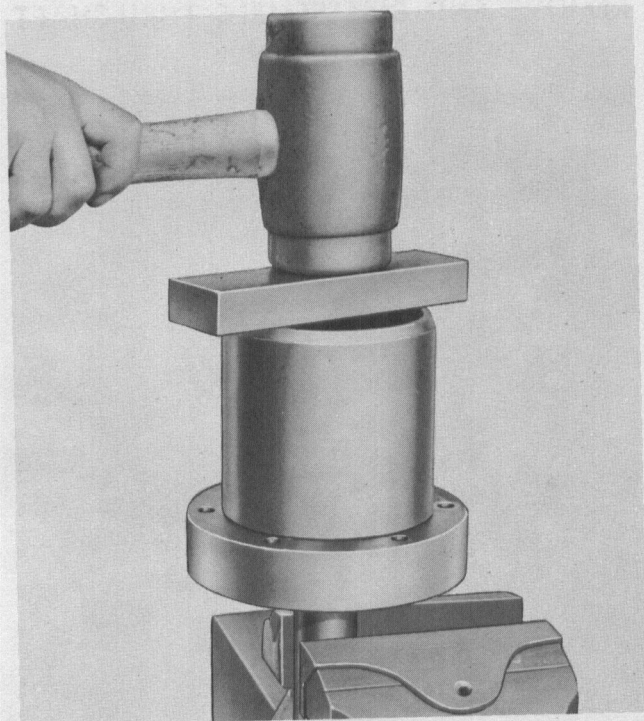


A. Remove the thru-shaft bearing cage, cover and seal assembly stud nuts.

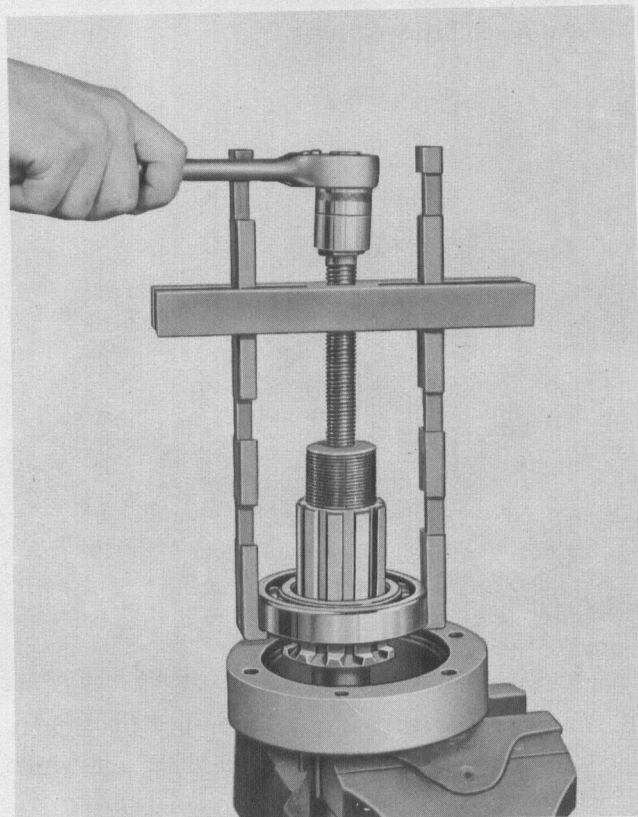


B. Remove the thru-shaft assembly by lightly tapping on the forward end with a rawhide hammer.

C. Remove the pinion quill rear bearing from carrier with suitable puller.



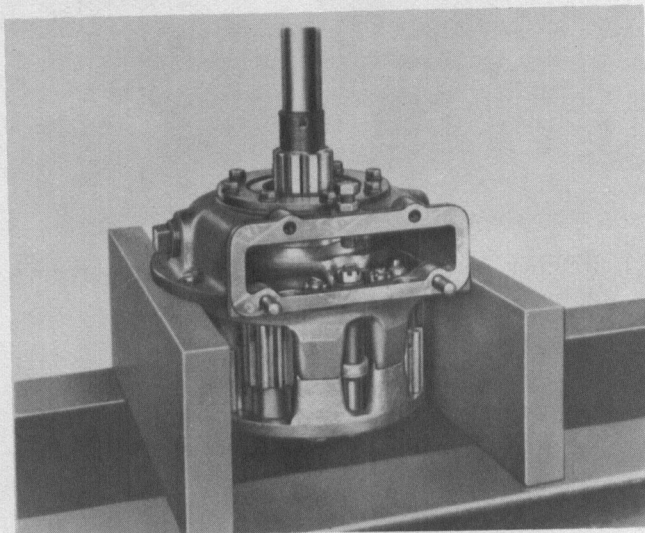
D. Tap thru-shaft ball bearing cage from bearing with sleeve.



E. Remove thru-shaft ball bearing with puller having long fingers that pull against bearing inner race.

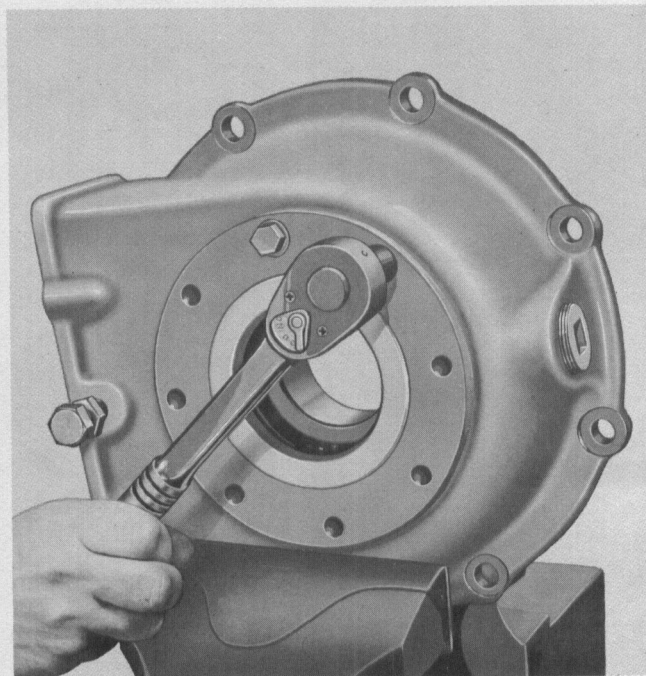
DISASSEMBLE COVER, BEARING AND INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLY

- A. Remove input shaft nut and washer. Remove flange or yoke with suitable puller.

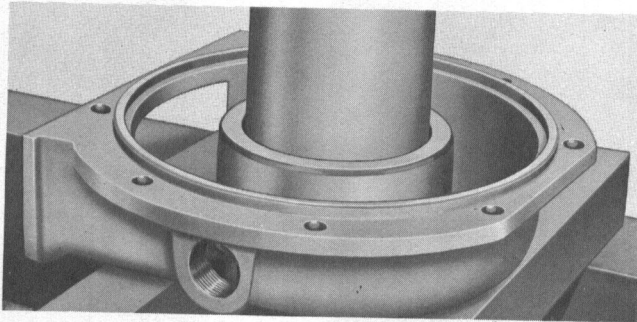


- B. Place assembly in press and remove the case assembly from the cover, bearing and retainer assembly. Exercise care not to damage the cover while in the press.

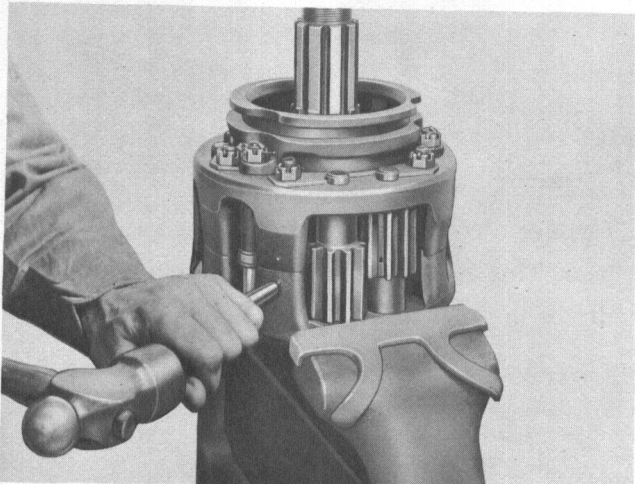
CAUTION: Do not use a hammer or mallet to disassemble the parts. Hammering on the differential shaft may damage the ball bearing.



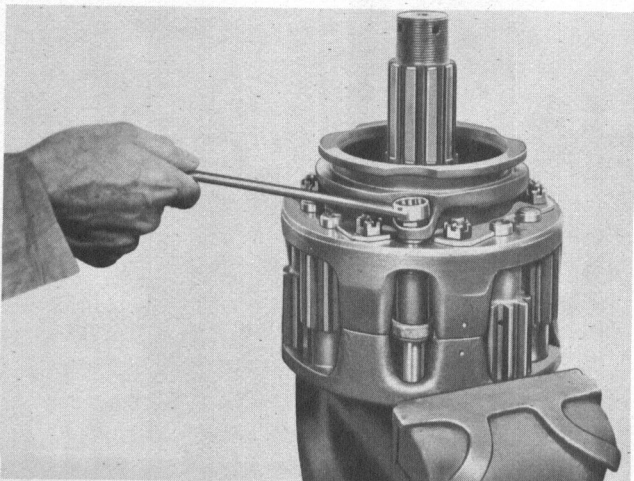
- C. Remove cover bearing retainer cap screws and lock washers. Remove the bearing retainer and seal assembly.



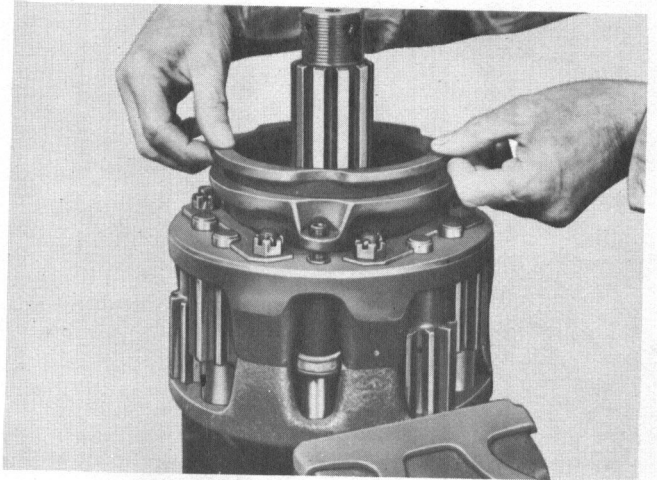
- D. Remove the cover bearing in press with sleeve against outer bearing race. Do not drive or press on bearing inner race.



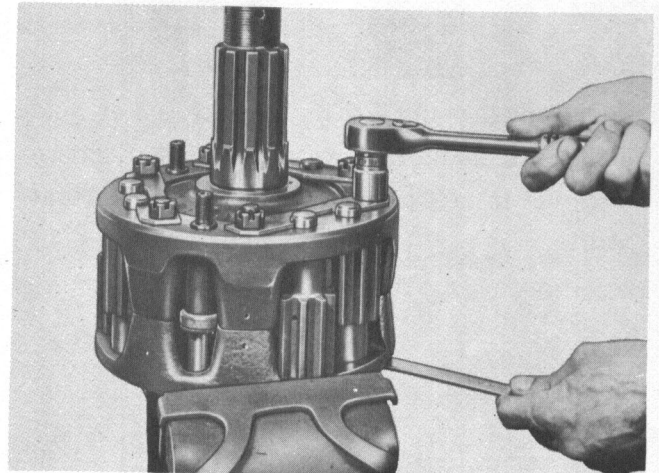
- E. Clamp the case assembly in a vise and center punch case halves to aid in correct alignment at reassembly.



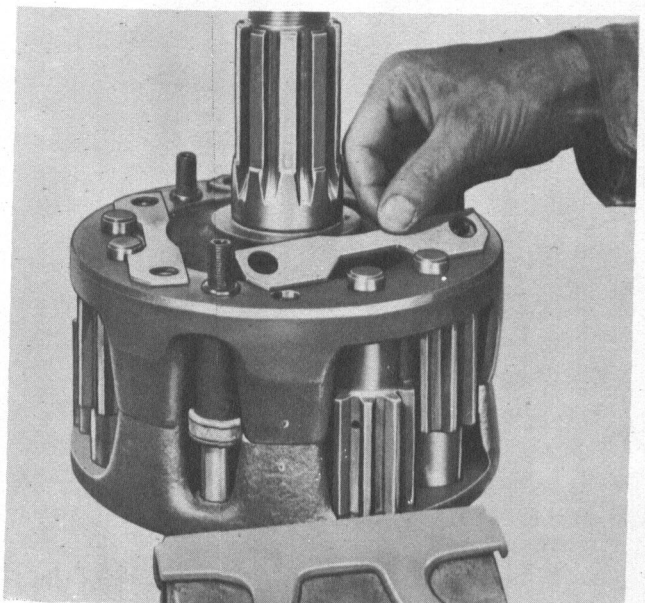
- F. Remove the shift shaft nut cotter pins and nuts, holding shafts with large screwdriver at inner end.



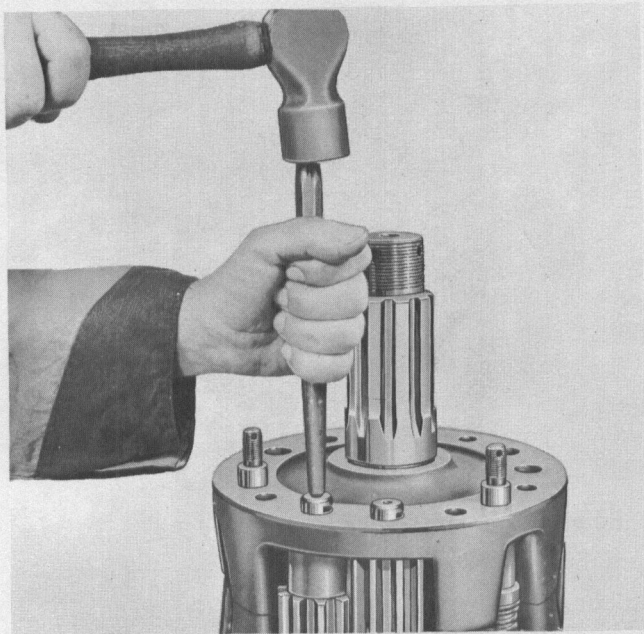
- G. Remove the shift yoke.



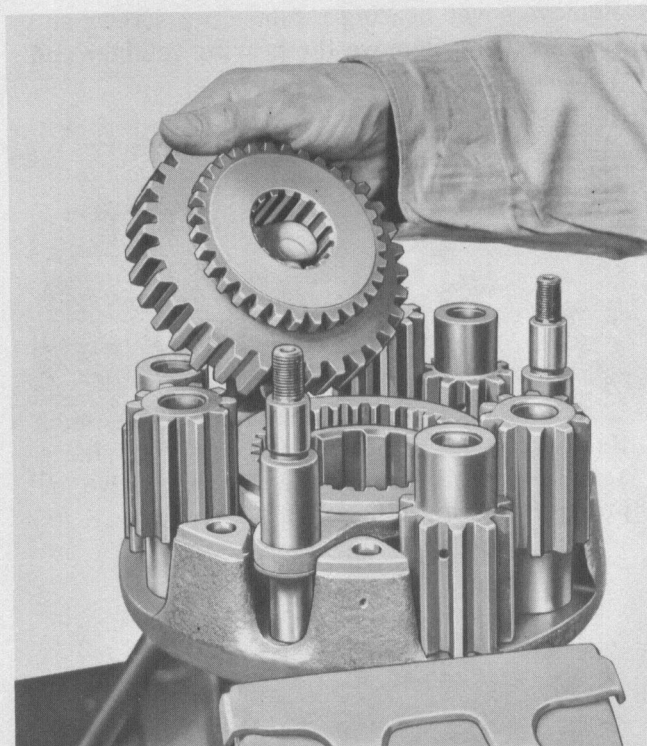
- H. Remove the case bolt nut cotter pins and nuts.



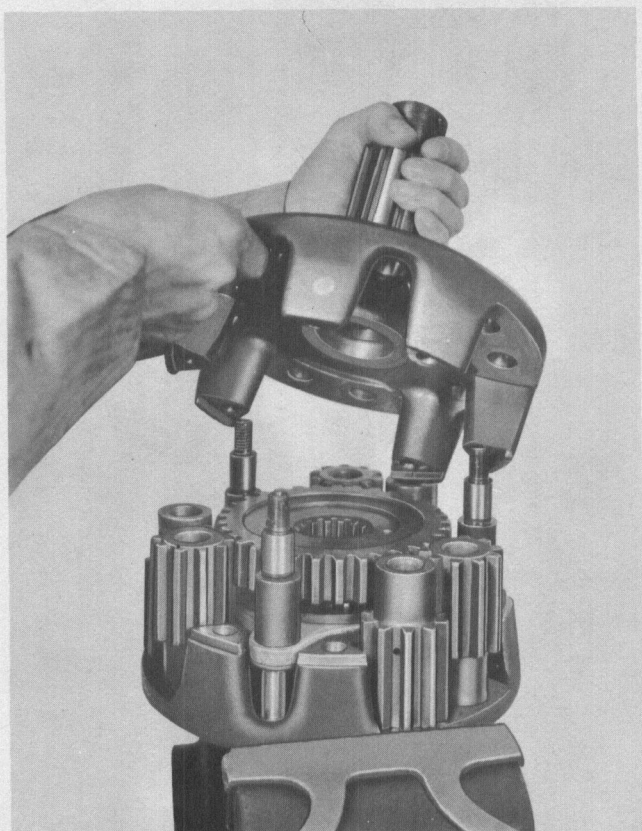
- I. Remove the pinion shaft locks.



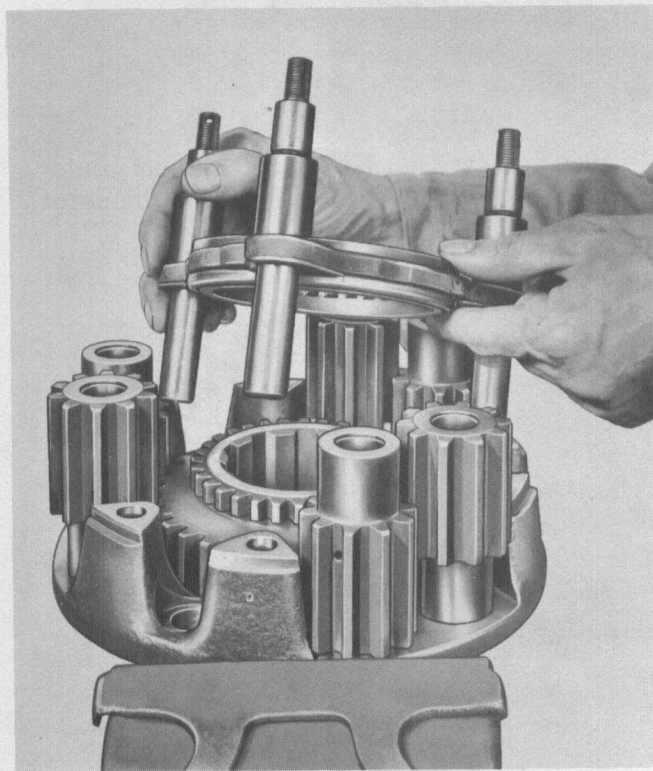
J. Place small pointed drift in shaft center hole and drive shafts from case assembly. Exercise care not to break off ends of shafts with blunt drift.



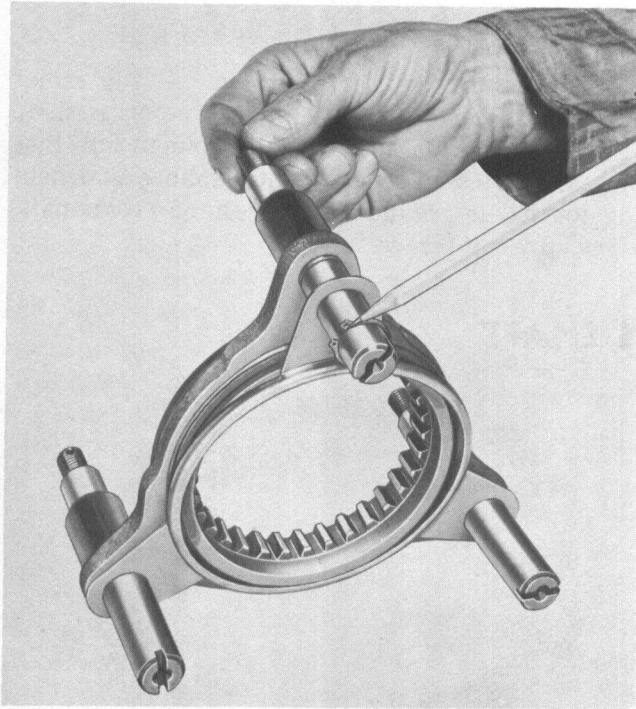
L. Remove the forward gear thrust washer and gear. This gear is splined to the thru-shaft that drives the rear axle.



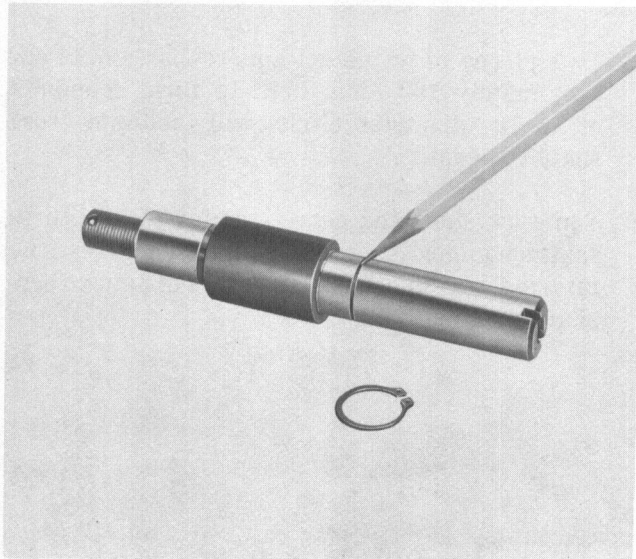
K. Remove the forward case half, pinions and pinion shafts.



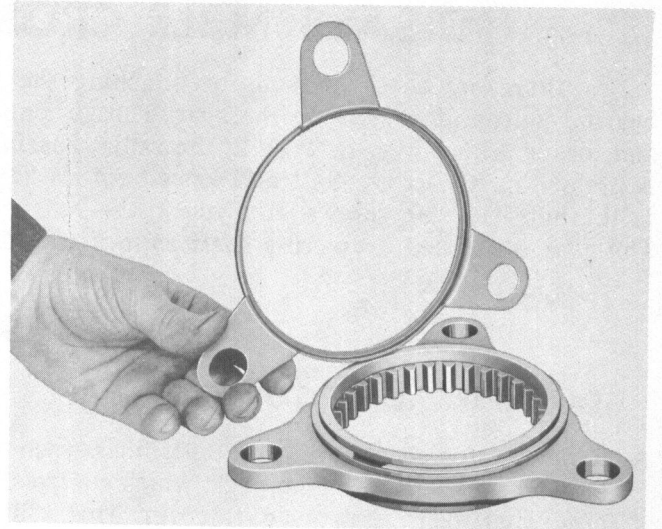
M. Remove the shifter yoke, collar and shifter shafts as an assembly.



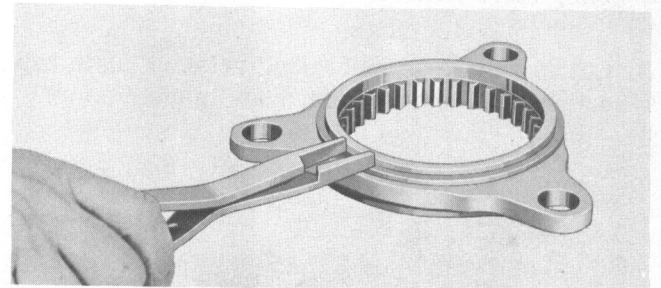
N. Remove retainer lock from shift shaft groove.



Note: Each shift shaft is grooved to accommodate shift collar retainer lock.

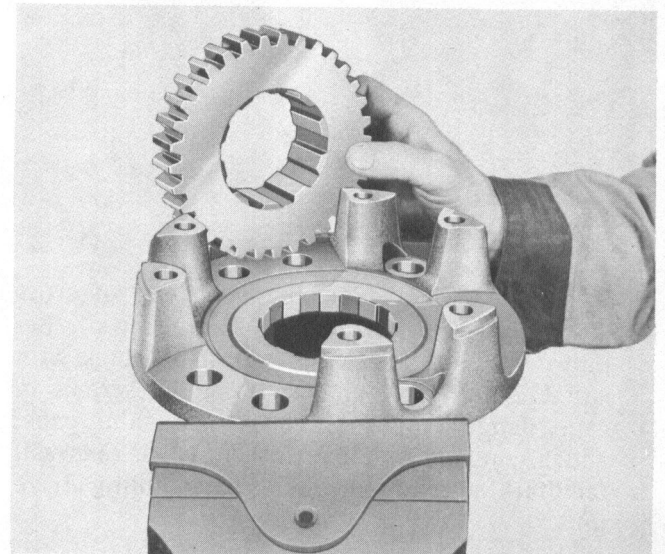


O. Remove the shift collar stamped retainer cover.



P. Remove the collar retainer and spacer and shift collar yoke.

Q. Carefully cut through bushings with a hacksaw blade to remove them from inter-axle differential pinions.



R. Remove the rear gear. This gear is splined to the pinion and quill assembly that drives the forward axle.

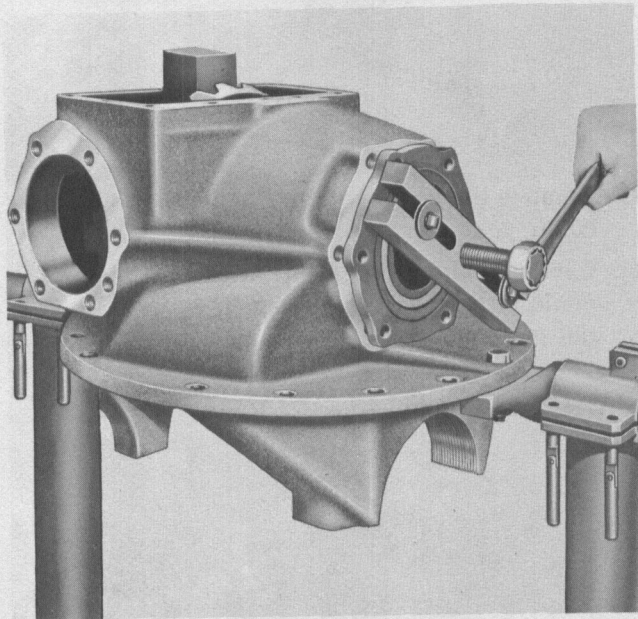
DISASSEMBLE CROSS SHAFT ASSEMBLY

There are three methods of attaching the bevel gear to the cross shaft. In Type 1, the radial bearing journal is ground on the gear. The gear and the bearing assembly is pressed on the cross shaft and locked with a key. In Type 2, the radial bearing journal is ground on an externally splined hub that is pressed on the cross shaft and locked with a key. The gear is pressed over the hub splines and held to the hub with cap screws. In Type 3, the radial bearing journal is ground on the splined cross shaft. The gear is pressed over cross shaft splines and held in place by cap screws.

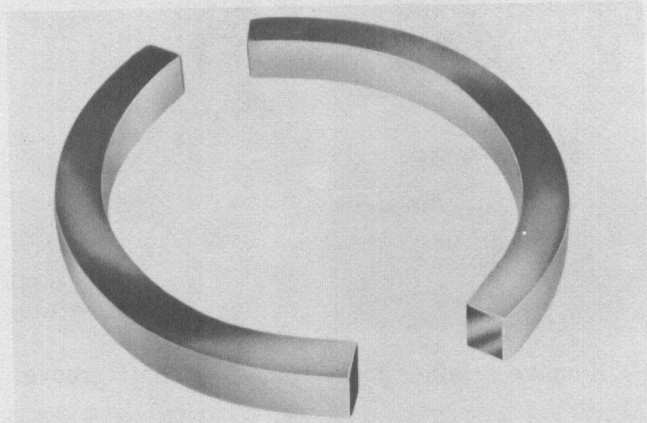
TYPE 1 CROSS SHAFT

GEAR JOURNAL FIT TO CROSS SHAFT

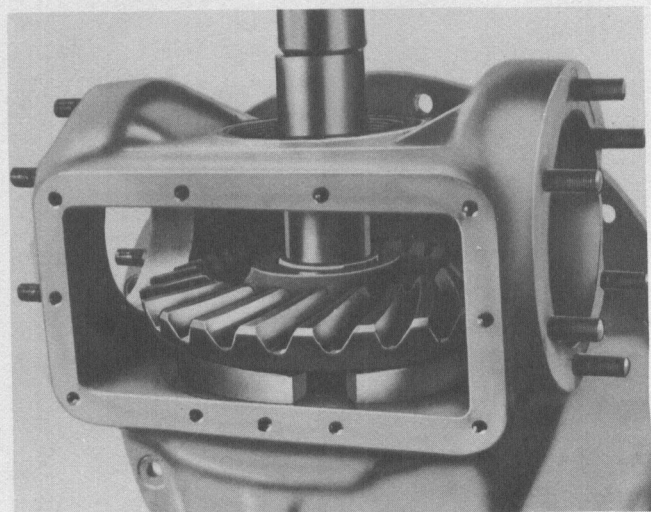
- A. Remove cross shaft cover stud nuts, lock washers and cover. Attach shim pack, which controls cross shaft bearing preload, to cover. This will facilitate preload adjustment when reassembling drive unit.
- B. Cut lock wire from bearing retainer plate cap screws and remove screws and plate.



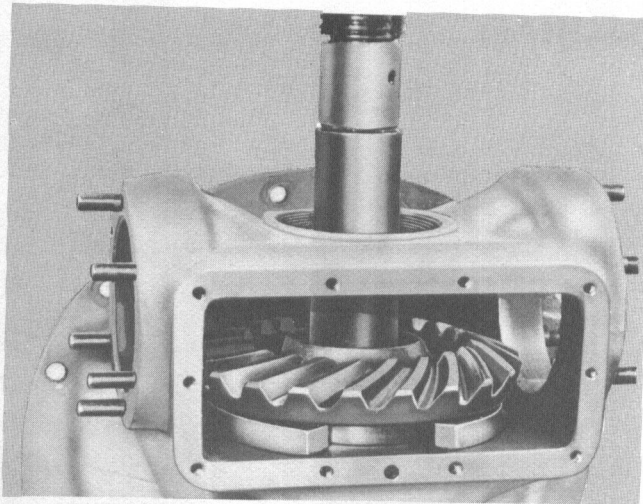
- C. Insert hard wood block between end of cross shaft and outer thru-shaft chamber wall. Remove bearing cage and tapered bearings with suitable puller, using $\frac{3}{8}$ "-16 puller screws in cage flange tapped holes. Attach shim pack, which controls gear backlash to cage. This will facilitate adjustment when reassembling drive unit.
- D. Remove six studs from cross shaft chamber to facilitate positioning drive unit in press for further disassembly.



- E. Two pieces of $\frac{3}{4}$ " steel square bar stock, approximately 10" long, bent to form segments of an 18" diameter circle, will facilitate cross shaft removal.
- F. Tap cross shaft and gear assembly toward thru-shaft chamber, so semi-circular blocks can be inserted between back of gear and inner thru-shaft chamber wall.



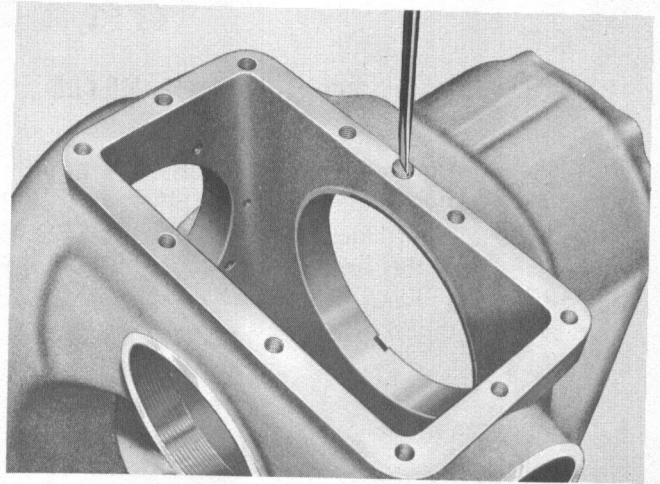
- G. Position drive unit in press, thru-shaft chamber up, with blocks under gear and press cross shaft from gear.



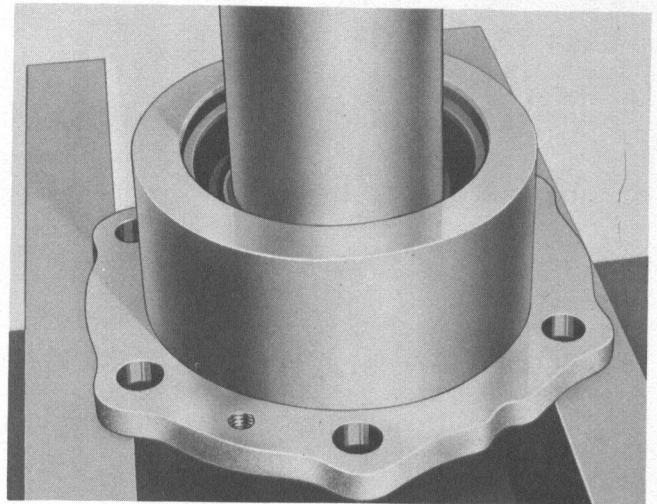
Provide a rigid support on the press bed for the drive unit during this operation. A sleeve with a $\frac{3}{4}$ " or 1" wall and I.D. approximately the size of the cross shaft cage O.D. is suitable; or, the drive unit may be supported by a horizontal flat plate 10" x 10" x 1" with a bored hole about the same size as the cross shaft cage O.D. Support the horizontal plate on heavy vertical plates of a convenient size.



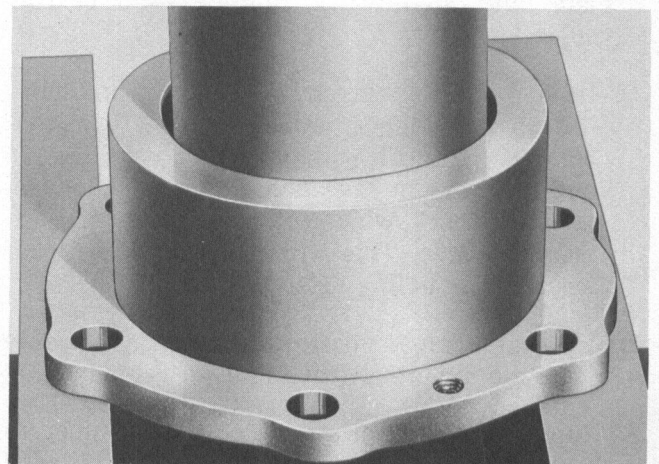
H. Lift or tap out radial bearing and gear assembly from drive unit; do not lose gear washer. Remove bearing from gear with pry bars or suitable puller.



I. Do not remove radial bearing sleeve from drive unit unless replacement of sleeve is necessary.



J. Remove cross shaft tapered bearing inner and outer cones and outer cup from cage with suitable puller or with sleeve in press.

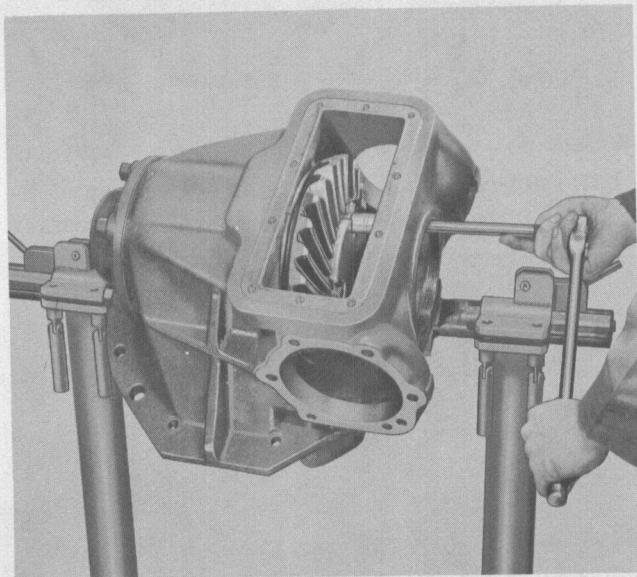


K. Remove cage inner cup with suitable puller or with sleeve in press.

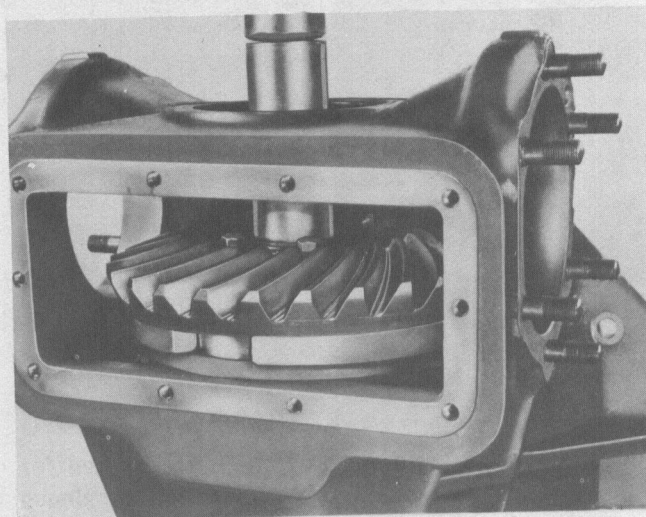
TYPE 2 CROSS SHAFT

GEAR SPLINED TO HUB, HUB KEYED TO CROSS SHAFT

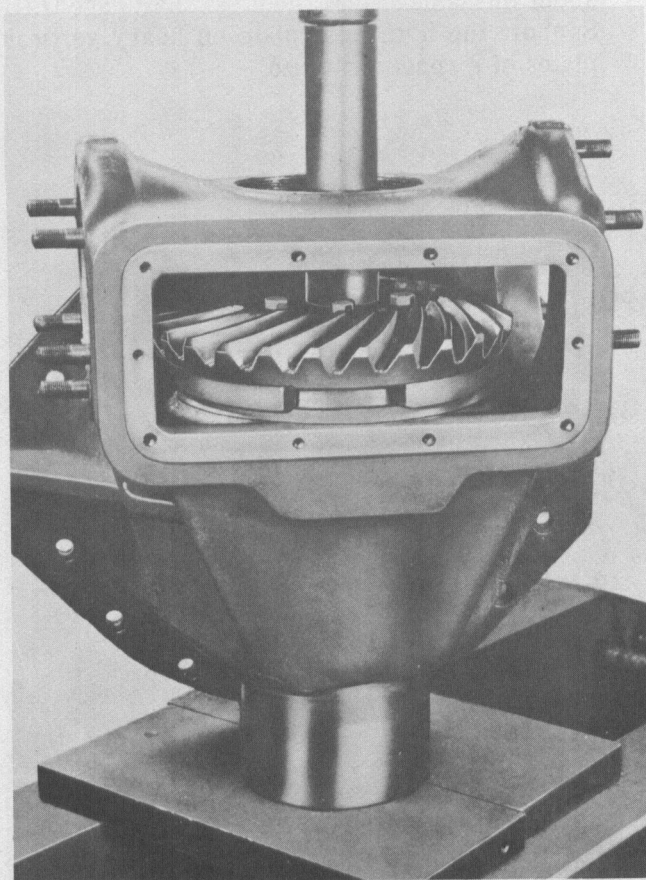
In Type 2, the radial bearing journal is ground on an externally splined hub that is pressed on the cross shaft and locked with a key. The gear is pressed over the hub splines and held to the hub with cap screws.



- A. Straighten gear cap screw cover locks and remove 3 cover cap screws, cover and spacers. Do not lose spacers under cover. Remove lock wire from 6 gear and hub cap screws.
- B. Remove cross shaft bearing cage cover.
- C. Lock gear in place with piece of brass or hard wood and straighten thin lock washer. Remove jam nut, thin washer, nut lock and bearing adjusting nut.
- D. Insert hard wood block between gear and outer thru-shaft chamber wall. Remove cross shaft bearing cage with suitable puller using $\frac{3}{8}$ "-16 puller screws in cage flange tapped holes. Attach shim pack, which controls backlash adjustment, to cage. This will facilitate adjustment when reassembling drive unit.
- E. Remove 6 cross shaft bearing cage studs to facilitate mounting drive unit on press bed.
- F. Tap cross shaft toward thru-shaft chamber so 2 semicircular steel blocks can be inserted between back of gear and inner thru-shaft chamber wall.



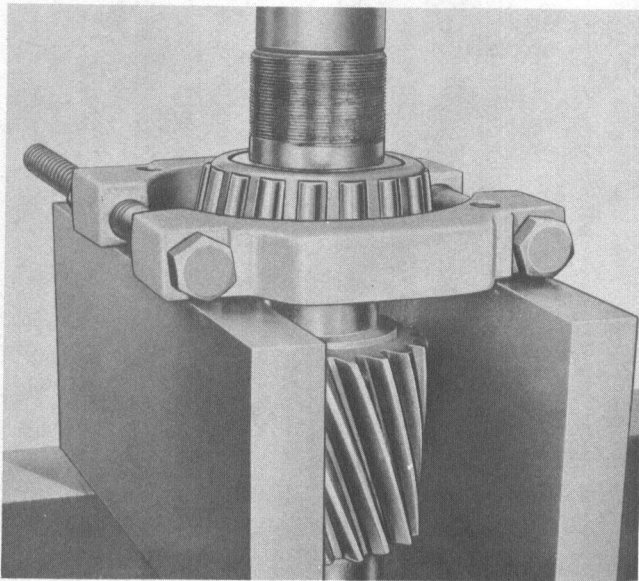
- G. Position drive unit in press, thru-shaft chamber up, with blocks under gear and press cross shaft from gear.



Provide a rigid support on the press bed for the drive unit during this operation. A sleeve with a $\frac{3}{4}$ " or 1" wall and I.D. approximately the size of the cross shaft cage O.D. is suitable;

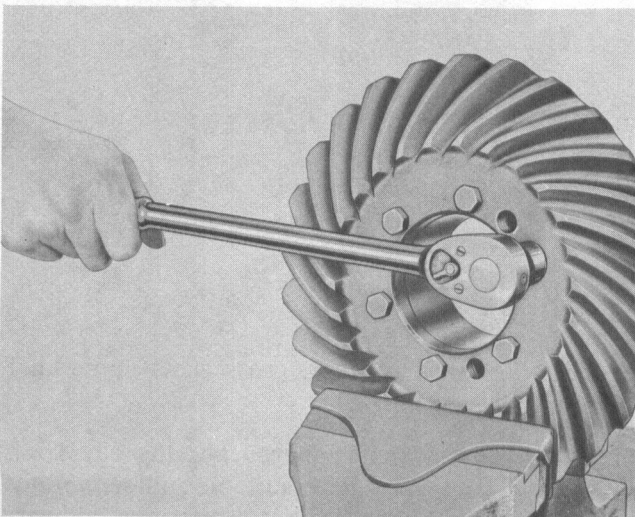
or, the drive unit may be supported by a horizontal flat plate 10" x 10" x 1" with a bored hole about the same size as the cross shaft cage O.D. Support the horizontal plate on heavy vertical plates of a convenient size.

- H. Remove drive unit from press and lift or tap out gear, hub and radial bearing assembly from drive unit.

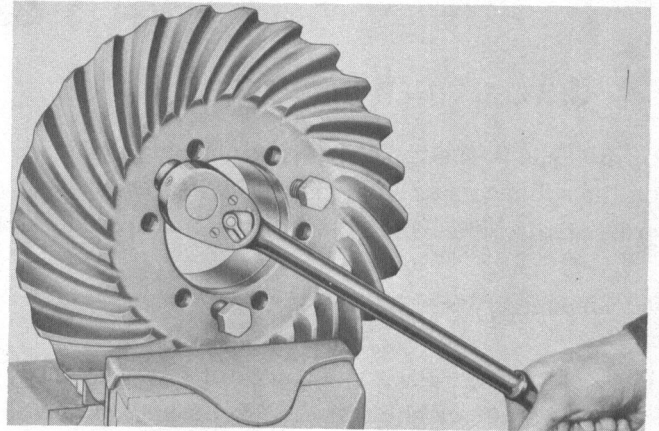


- I. Pull or press cross shaft inner tapered bearing from shaft with suitable puller, or mount in press and remove, as illustrated.

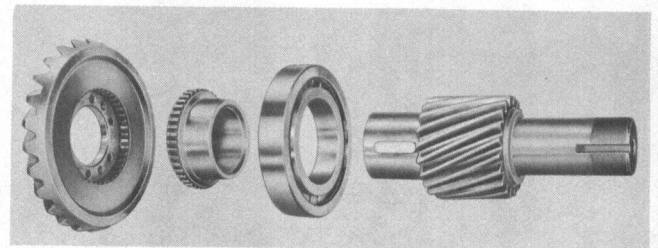
- J. Remove radial bearing from gear and hub assembly using pry bars or suitable puller.



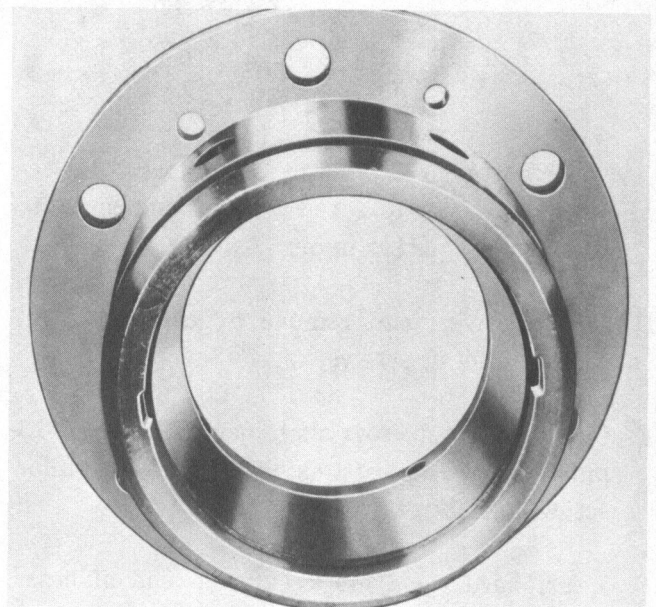
- K. Mount gear and hub assembly in copper jaw vise and remove 6 gear and hub cap screws.



- L. Pull gear from hub using three 1/2"-13 puller screws approximately 2" long in puller screw holes in gear.



- M. Exploded view of components of cross shaft assembly showing gear, hub, radial bearing and cross shaft.



- N. Remove cross shaft tapered bearing cup from cage, if necessary, with suitable puller, or in press using bearing cone, pulling or pressing toward cage flange.

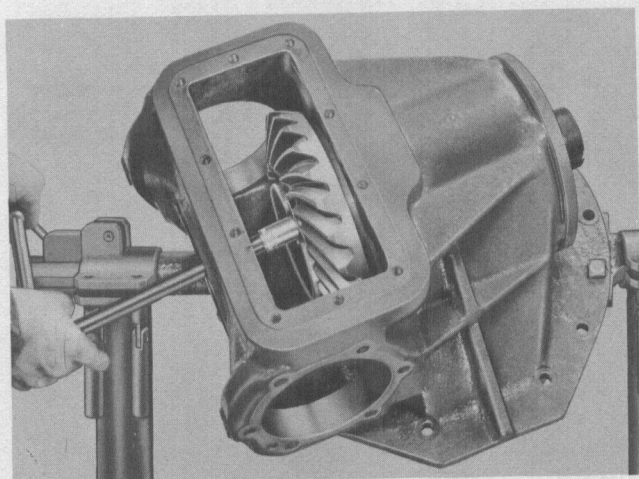
Do not remove radial bearing sleeve from drive unit unless replacement is necessary.

TYPE 3 CROSS SHAFT

GEAR SPLINED TO CROSS SHAFT

In Type 3, the radial bearing journal is ground on the splined cross shaft. The gear is pressed over cross shaft splines and held in place by cap screws.

- A. Remove cross shaft bearing cage cover.
- B. Lock gear in place with piece of brass or hard wood and straighten thin lock washer. Remove jam nut, thin washer, nut lock and bearing adjusting nut.

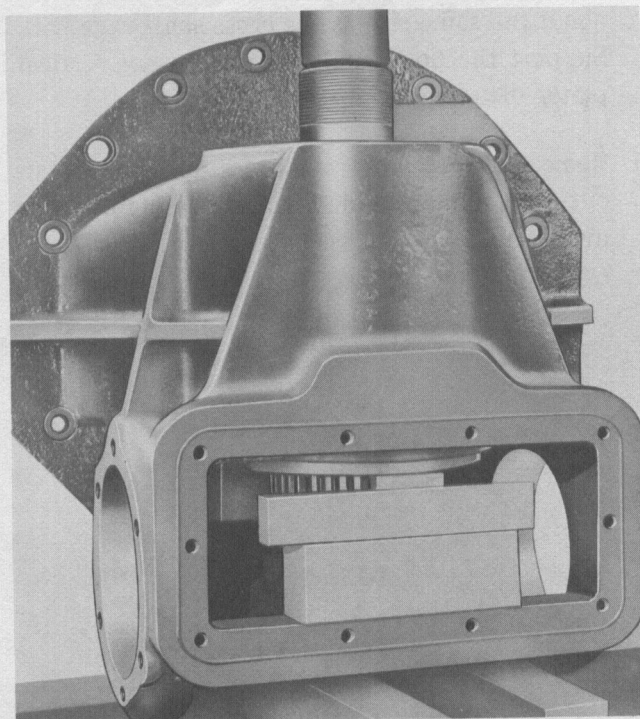


- C. Straighten gear cap screw cover locks and remove 3 cover cap screws, cover and spacers. Do not lose spacers under cover.

- D. Cut lock wire and remove 6 gear and cross shaft retaining screws.

- E. Pull gear from cross shaft using three $\frac{1}{2}$ "-13 puller screws approximately 2" long in puller screw holes in gear.

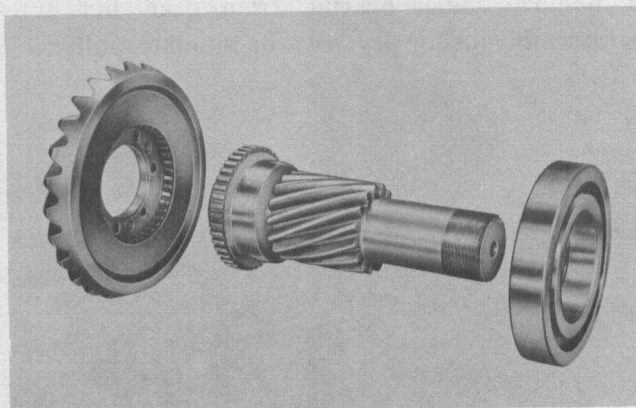
- F. Insert hard wood block between end of cross shaft and outer thru-shaft chamber wall. Pull cross shaft bearing cage with suitable puller using $\frac{3}{8}$ "-16 puller screws in cage flange tapped holes. Attach shim pack, which controls backlash, to cage. This will facilitate adjustment when reassembling drive unit.



- G. Position drive unit in press, thru-shaft chamber down. Block up outer race of bearing and press cross shaft out through threaded inspection hole.

- H. Continue pressing operation to remove inner tapered bearing from cross shaft.

- I. Lift or tap radial bearing from drive unit.



- J. Exploded view of gear, cross shaft and radial bearing.

- K. Remove cross shaft tapered bearing cup from cage, if necessary, with suitable puller, pulling toward cage flange. Do not remove radial bearing sleeve from drive unit unless replacement is necessary.

CLEAN, INSPECT AND REPAIR

CLEAN

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

GASOLINE SHOULD BE AVOIDED.

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

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

ROUGH PARTS

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

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

COMPLETE ASSEMBLIES

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

DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive 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 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 bevel or hypoid and second reduction spur gears for wear or damage. Gears which are pitted, galled or worn or broken through case hardening should be replaced.

When necessary to replace the pinion or gear of a spiral bevel or hypoid gear set, the entire gear set should be replaced. We assume no responsibility for gears of these types when replaced in any other manner.

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. Spur pinions for wear or damage to teeth.

E. Check end of pinion for indications of brinelling caused by worn splines. Replace the parts if the splines of the pinion and/or thru-shaft are worn, permitting movement of the pinion on the thru-shaft.

F. Axle shafts for indications of torsional fractures and runout. Axle shafts should be inspected between centers to ascertain the amount of runout of the ground surfaces. Runout at the shaft flange and splines should not exceed .005" total indicator reading.

REPAIR

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

Use only genuine Rockwell-Standard 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 axle differential and inter-axle 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 $1\frac{1}{2}$ times bushing length. Always install bushings so end is even with the I.D. chamfer or about $\frac{1}{16}$ " below the machined surface.

D. When assembling component parts use a press where necessary. Avoid hammering.

E. Tighten all nuts to specified torque. See torque limits following service instructions.

Lock wire must not be brittle; use soft iron 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. The stud holes are standard sizes (fractions of an inch) and may be reamed with standard size reamers. Start the reamer or drill on side of flange opposite spot face so the tool will have from $\frac{3}{8}$ " to $\frac{1}{2}$ " pilot as it cuts the burr from the hole.

REASSEMBLE AND INSTALL DRIVE UNIT

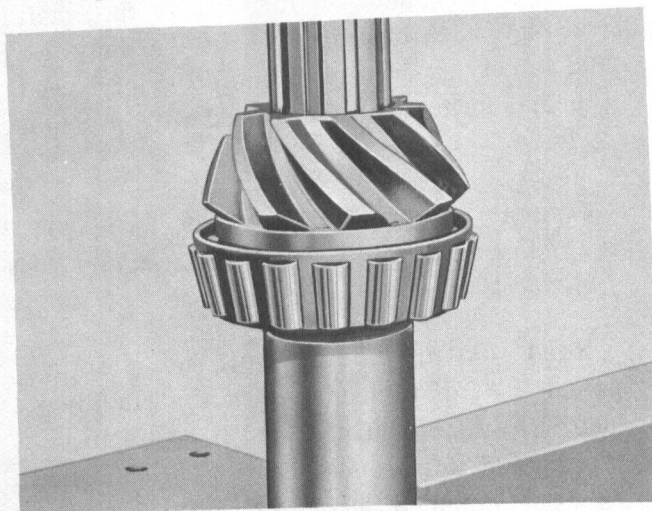
The thru-shaft, pinion and bearing assembly of spiral bevel (Type 1) drive units must be installed in the carrier before the cross shaft assembly is installed. This permits determining the thickness of shim packs that control pinion bearing preload without interference of the cross shaft assembly. The thru-shaft assembly is then removed and the cross shaft assembly installed. Cross shaft bearing preload must be established at this time before final installation of the thru-shaft assembly with previously determined shim packs. The cross shaft assembly of hypoid gear drive units (Types 2 and 3) must be installed in the carrier first so cross shaft bearing preload can be established without interference of the thru-shaft and pinion assembly. The thru-shaft, pinion, bearing and cage may be assembled at the bench and then installed in the carrier.

REASSEMBLE PINION AND THRU-SHAFT OR QUILL AND INTER-AXLE (3RD) DIFFERENTIAL ASSEMBLY TYPE 1 PINION AND THRU-SHAFT SPIRAL BEVEL FIRST REDUCTION

ASSEMBLE AND INSTALL PINION,
THRU-SHAFT AND BEARINGS

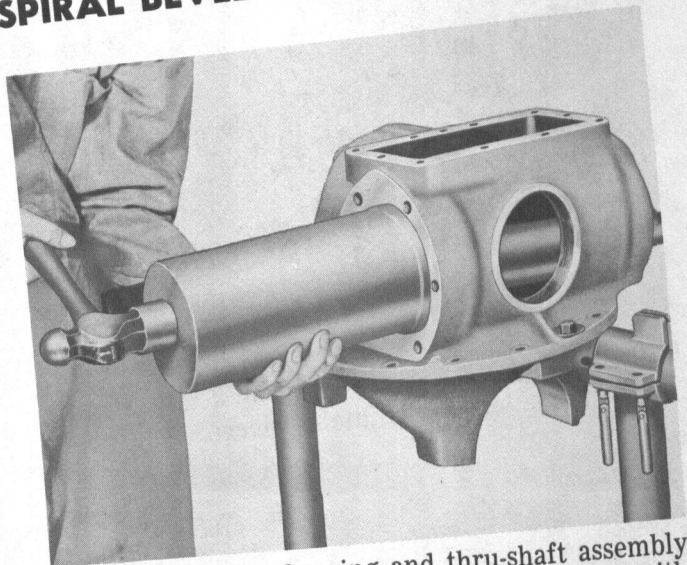


A. Lubricate all bearing journals only with a few drops of engine oil and press tapered bearing on pinion using suitable sleeve.



B. Coat pinion and thru-shaft splines with a heavy grease such as Rockwell-Standard Spec. O-616A and press the parts firmly together.

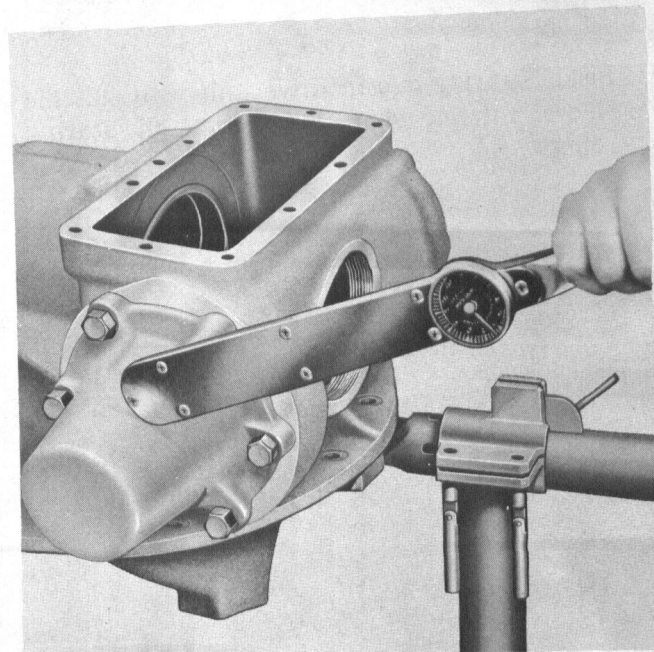
Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the press pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.



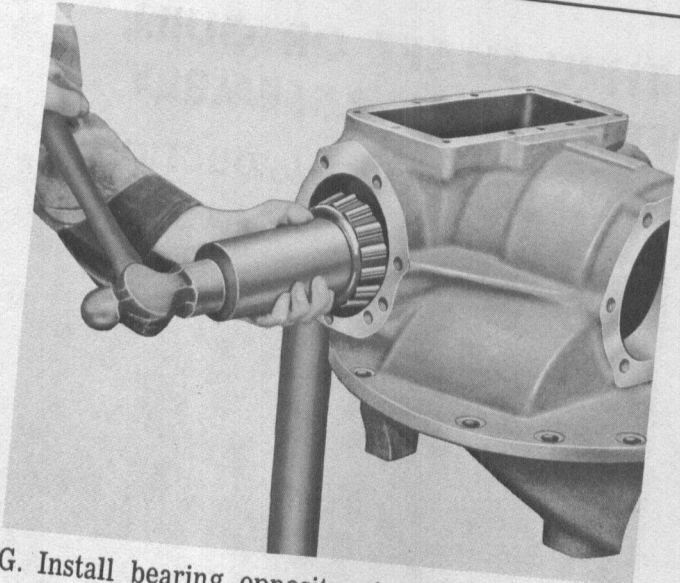
C. Install pinion, bearing and thru-shaft assembly in drive unit. Install pinion bearing cup with suitable sleeve.

D. Install spacer, where used, over splined end of thru-shaft and tighten nut on spacer end of thru-shaft to specified torque.

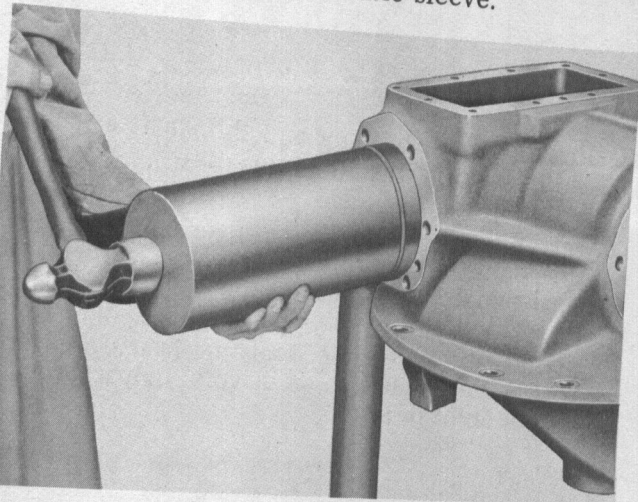
E. Coat oil seal with non-hardening sealing compound and assemble seals in bearing covers with suitable sleeves or drivers. Lubricate sealing element of seal.



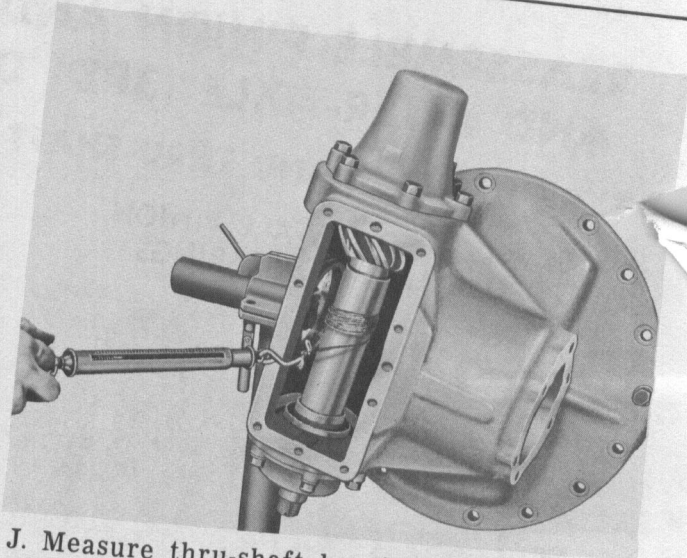
F. Install bearing cover and oil seal assembly, where used, and original shim pack over splined end of thru-shaft. Tighten cover nuts to specified torque.



G. Install bearing opposite pinion firmly against shaft shoulder with suitable sleeve.



H. Install bearing cup in drive unit with suitable sleeve, rotating shaft to position all bearing rollers.



J. Measure thru-shaft bearing preload. Wrap strong cord around thru-shaft and pull on horizontal line with pound scale.

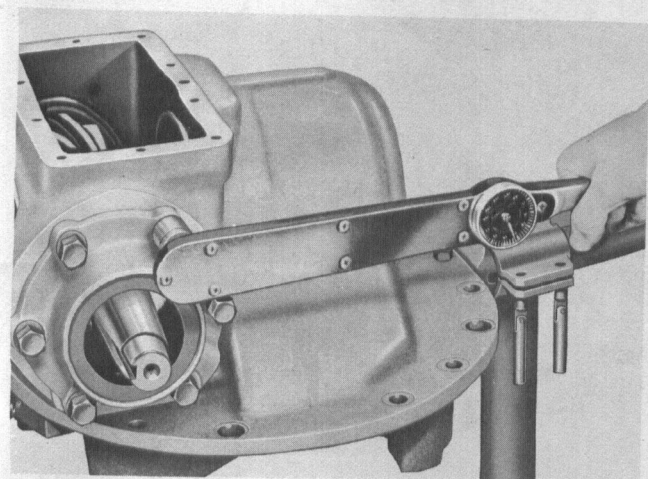
The preload torque specification for tapered roller bearings at opposite ends of spiral bevel pinion thru-shafts is .000" thru-shaft end play to 5 pound inches torque (new and serviceable used bearings).

Alter the shim pack under bearing cover at end opposite pinion so there is no thru-shaft end play when measured with a dial indicator and so bearing preload torque does not exceed 5 pound inches when measured with a pound scale.

Example: Assume thru-shaft diameter is $1\frac{1}{2}$ ", the radius is $\frac{3}{4}$ " and with 4 pounds pull on the scale, preload torque is 3 pound inches.

Read rotating pounds pull, not starting pounds pull. If preload torque is not between .000" thru-shaft end play and 5 pound inches torque, add shims under bearing cover at end opposite pinion to decrease torque or remove shims at same location to increase preload torque. Complete all bearing adjustments before installing flanges or yokes.

K. Remove thru-shaft assembly as previously described. Keep both shim packs with their respective covers to maintain established bearing preload.



I. Install bearing cover and seal assembly over original shim pack and tighten stud nuts to specified torque.

REASSEMBLE CROSS SHAFT ASSEMBLY

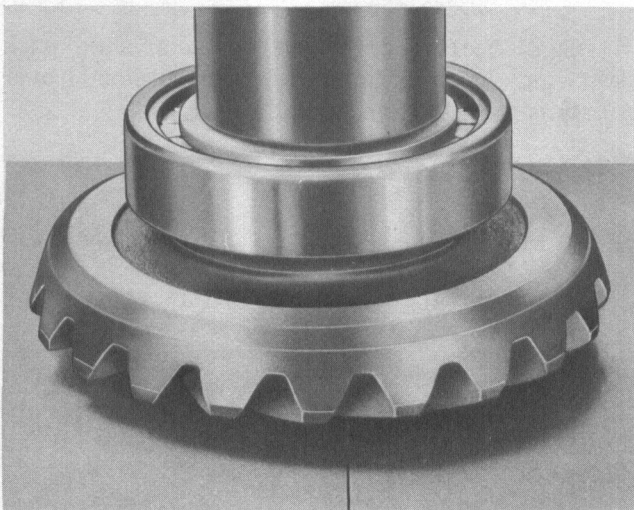
TYPE 1 CROSS SHAFT

GEAR JOURNAL FIT TO CROSS SHAFT

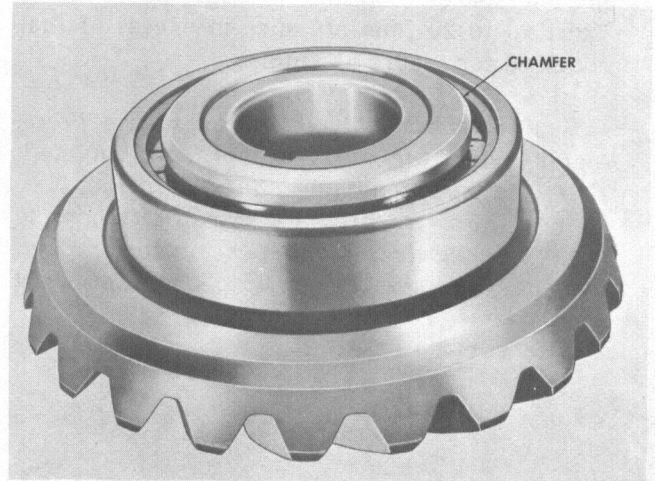
- A. Check sleeve I.D. and radial bearing O.D. Replace sleeve and/or bearing if the parts are damaged, or if there is more than .006" clearance between the sleeve and bearing. When these parts are new the sleeve I.D. should be .0024" to .004" larger than the bearing O.D. The radial bearing must be free to float in the sleeve.

Carefully check the I.D. of the bearing bore of older drive units that do not have replaceable sleeves. If the I.D. is more than .006" larger than the bearing O.D. replace the carrier and cap assembly with the newer type carrier and cap assembly that incorporates replaceable sleeves.

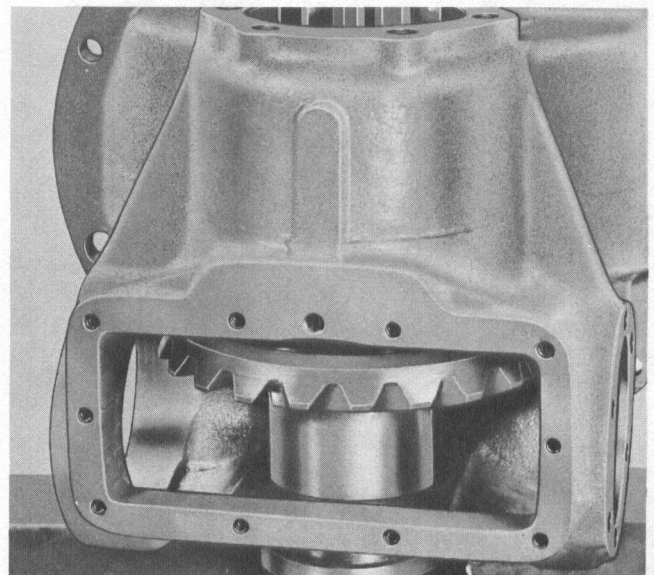
- B. If radial bearing sleeve is to be replaced, press new sleeve firmly against housing shoulder. Drill hole for lock screw and remove burrs from sleeve I.D. Install lock screw and tighten securely, or install pin and stake in place. Install 6 studs, which were removed to facilitate drive unit disassembly, at cross shaft cage.



- C. Assemble radial bearing on gear hub, large radius of bearing inner race toward back of gear.



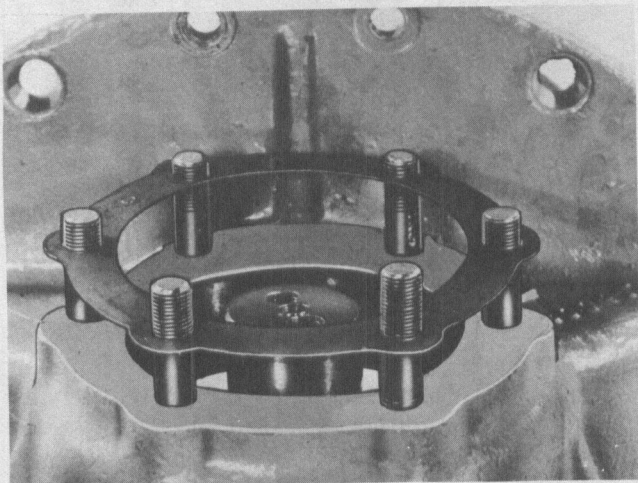
- D. Install bearing washer on gear hub against bearing with chamfer of spacer away from radial bearing. Install spacers with I.D. chamfer so chamfer is next to radius at root of pinion teeth. A large flat washer is used at this location when the O.D. of the pinion teeth is smaller than the I.D. of the radial bearing.
- E. Coat I.D. of gear with heavy grease such as Rockwell-Standard Spec. O-616A. Install gear bearing and spacer assembly in drive unit sleeve and block up to hold in place.
- F. Inspect entering end of cross shaft and remove any nicks or burrs. Coat O.D. of shaft and I.D. of gear with a heavy grease such as Rockwell-Standard Spec. O-616A.



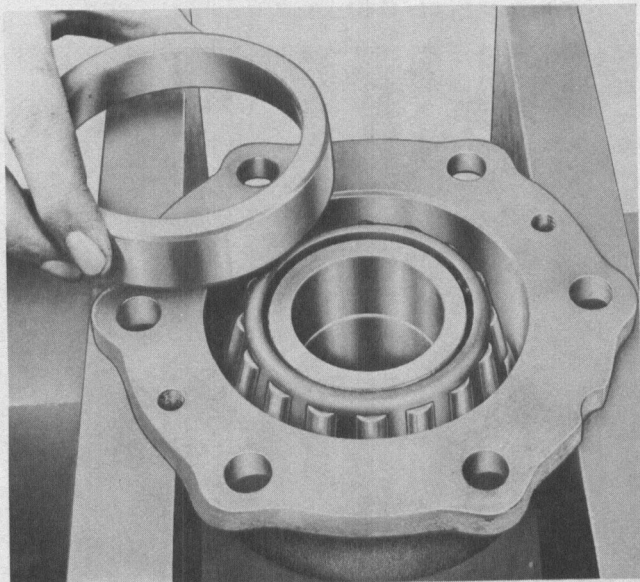
- G. Position housing in press, thru-shaft chamber down with gear supported on suitable sleeve.

H. Align key in cross shaft with keyway in gear hub and press shaft firmly against gear, bearing and spacer. Continue pressing operation to exert 10 to 20 tons pressure in excess of that required for secure assembly.

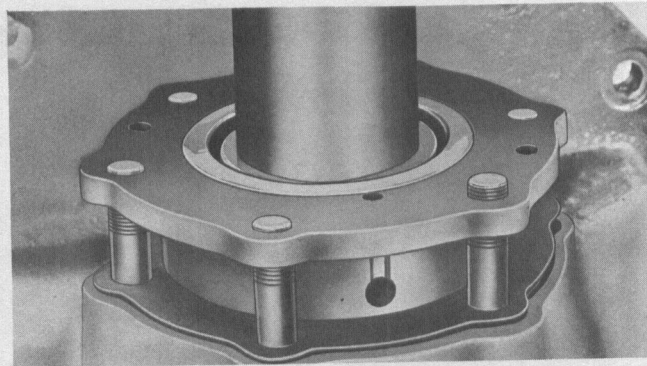
Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the press pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.



I. Install tapered bearing cage original shim pack (which controls gear position) over cross shaft cage studs.

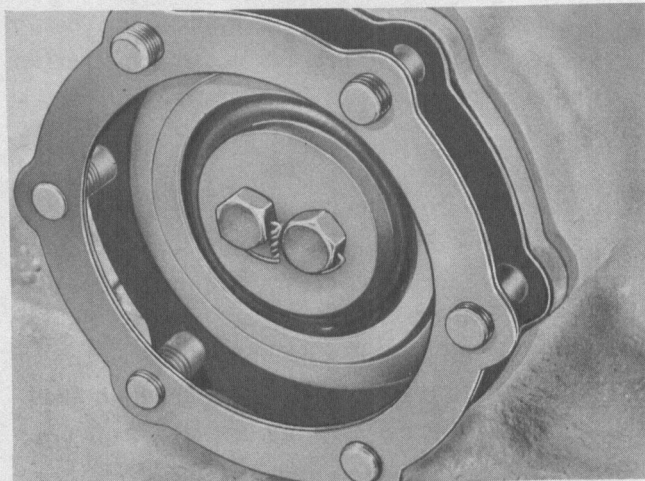


J. Apply colloidal graphite lubricant to cross shaft tapered bearing journal and assemble inner and outer bearings using suitable sleeves.

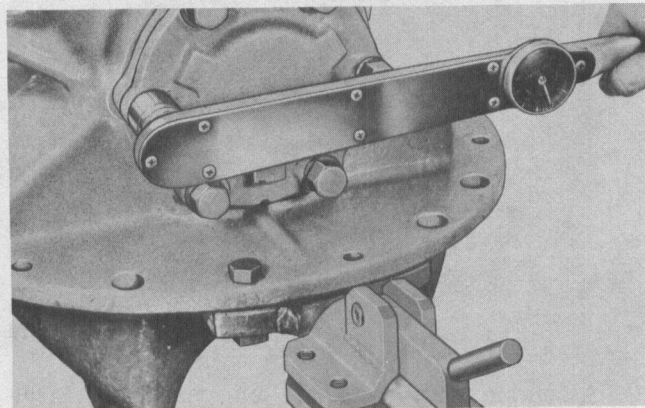


K. Install cage and bearing assembly in drive unit, pressing against outer bearing cone with suitable sleeve. Be sure oil holes in cage are properly aligned with oil holes in drive unit.

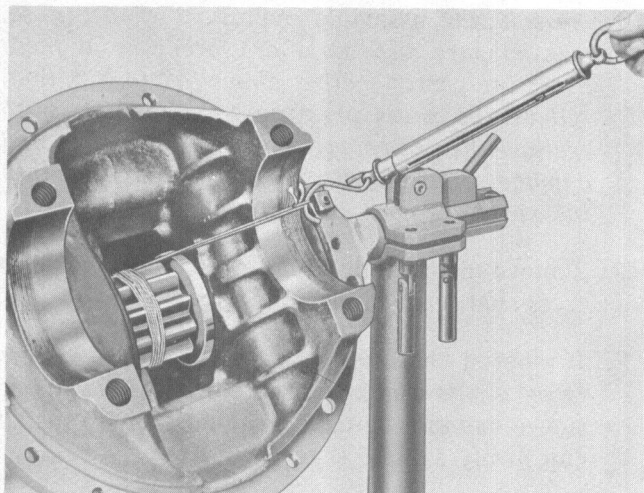
L. Assemble bearing retainer plate with 2 cap screws. Tighten cap screws to specified torque and lock with soft iron wire.



M. Install bearing cage cover original shim pack (which controls tapered bearing preload) over studs next to cage flange.



N. Assemble bearing cage cover, lock washers and stud nuts. Tighten nuts to specified torque.



- O. Measure cross shaft bearing preload torque. Wrap strong cord around spur pinion and pull on horizontal line with pound scale.

The preload torque specification for tapered roller bearings mounted close together in the bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

Example: Assume spur pinion diameter is 4", the radius is 2", and with 5 pounds pull on the scale, preload torque is 10 pound inches.

Read rotating pounds pull, not starting pounds pull. If preload torque is not within 5 to 15 pound inches, add shims between cover and cage to decrease, or remove shims to increase cross shaft bearing preload torque.

- P. Install pinion and thru-shaft assembly as previously described
- Q. Adjust pinion and gear to secure correct gear tooth contact and backlash. Refer to tooth contact section of Manual.

TYPE 2 CROSS SHAFT

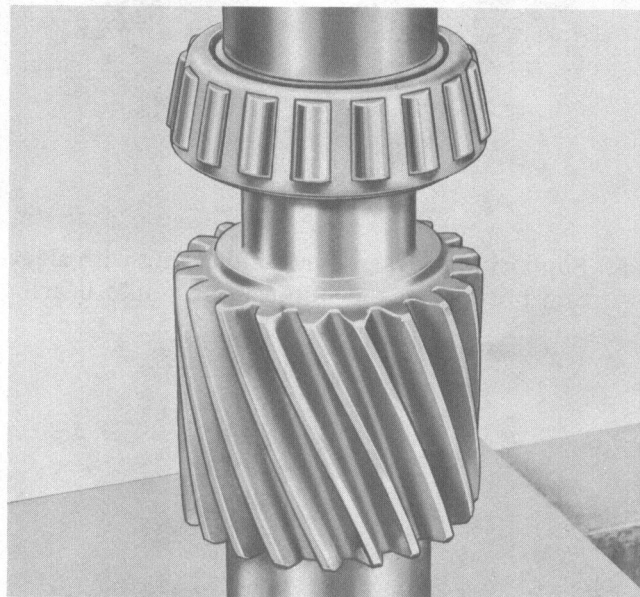
GEAR SPLINED TO HUB, HUB KEYED TO CROSS SHAFT

- A. Check sleeve I.D. and radial bearing O.D. Replace sleeve and/or bearing if the parts are damaged, or if there is more than .006" clearance between the sleeve and bearing. When these parts are new the sleeve I.D. should be .0024" to .004" larger than the bearing O.D. The radial bearing must be free to float in the sleeve.

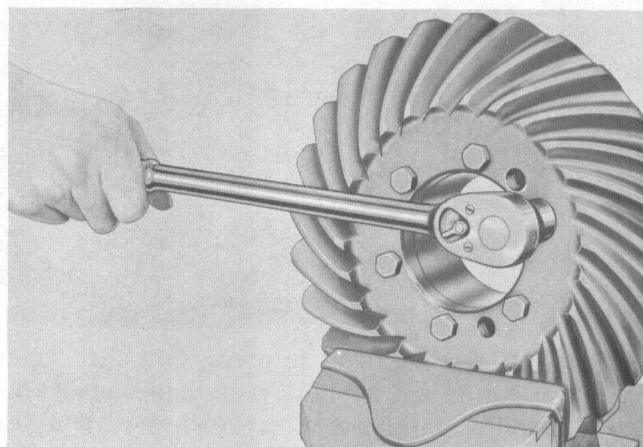
Carefully check the I.D. of the bearing bore of older drive units that do not have replaceable sleeves. If the I.D. is more than .006" larger than the bearing O.D. replace the carrier

and cap assembly with the newer type carrier and cap assembly that incorporates replaceable sleeves.

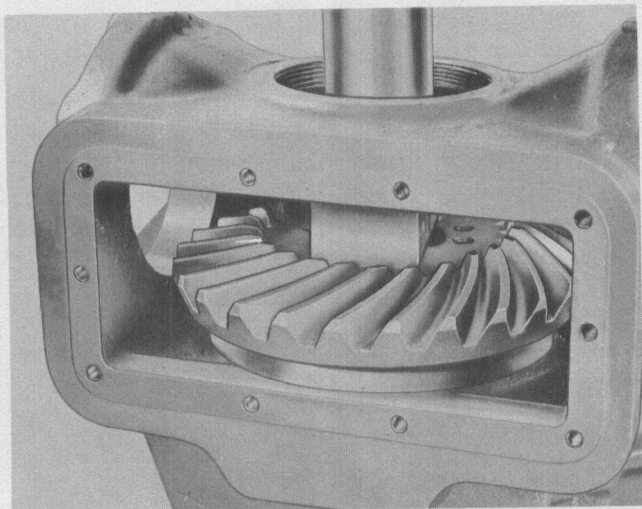
- B. If radial bearing sleeve is to be replaced, press new sleeve firmly against housing shoulder. Drill hole for lock screw and remove burrs from sleeve I.D. Install lock screw and tighten securely or install pin and stake in place.



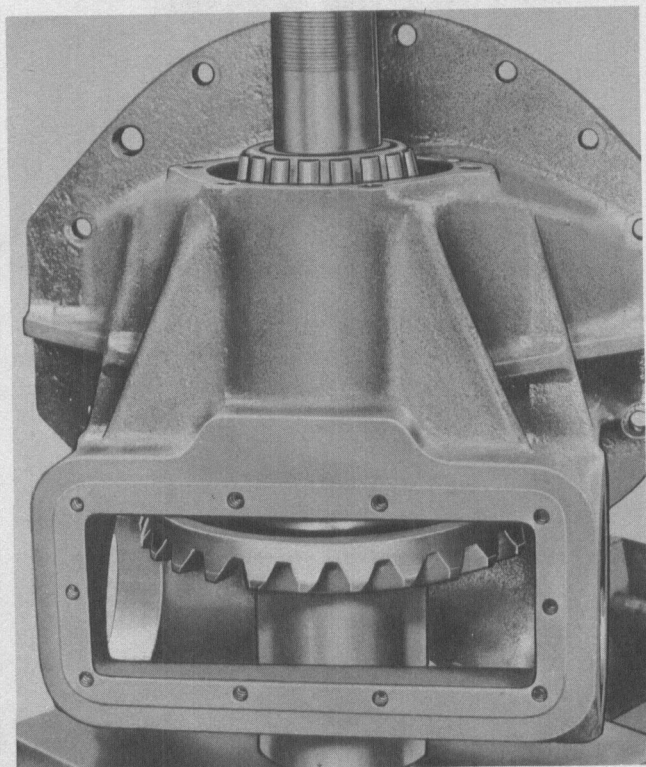
- C. Apply colloidal graphite lubricant to cross shaft tapered bearing journal. Press inner bearing firmly against shaft shoulder with suitable sleeve.



- D. Assemble bevel gear to hub correctly aligning 6 gear and hub cap screw holes. Tighten screws to 65-85 lb. ft. torque.
- E. Position drive unit on press bed, thru-shaft chamber up, and install radial bearing in drive unit sleeve. Large radius of bearing inner race must be towards bevel gear.



F. Support inner race of radial bearing with sleeve and press gear and hub assembly into bearing.



G. Turn drive unit over in press, thru-shaft chamber down, and support gear, hub and bearing assembly on sleeve with notches in end that will fit over cap screw heads.

H. Inspect entering end of cross shaft and remove any nicks or burrs. Coat O.D. of shaft with heavy grease such as Rockwell-Standard Spec. O-616A.

I. Align keyway in hub with key in cross shaft and press cross shaft and inner tapered bearing assembly firmly against hub.

Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the press pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.

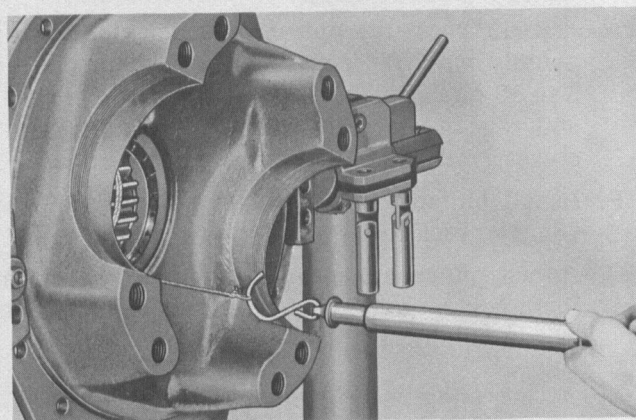
J. Remove drive unit from press and install 6 cross shaft cage studs.

K. If tapered bearing cup has been removed from cross shaft cage, reassemble in press using sleeve or other suitable installation tool. Install cup firmly against cage shoulder.

L. Install original shim pack (which controls gear backlash) over studs, and cross shaft cage over pack carefully aligning oil holes in cage with oil holes in drive unit.

M. Install 4 evenly spaced cross shaft cage stud nuts over thick flat washers to hold assembly in place. Tighten nuts securely.

N. Install outer tapered bearing using suitable sleeve.



O. Install cross shaft bearing adjusting nut. Tighten nut as cross shaft assembly is revolved to correctly position all bearing rollers.

P. Measure cross shaft bearing preload torque. Wrap strong cord around spur pinion and pull on horizontal line with pound scale.

The preload torque specification for tapered bearings mounted close together in a bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

Example: Assume spur pinion diameter is 4", the radius is 2" and with 5 pounds pull on the scale, preload torque is 10 pound inches.

Read rotating pounds pull, not starting pounds pull. If preload torque is not within 5 to 15 pound inches, tighten bearing adjusting nut to increase, or loosen the nut to decrease preload torque.

- Q. Back off adjusting nut $\frac{1}{4}$ (90°) to $\frac{1}{3}$ (120°) turn. Install nut lock, flat washer and jam nut. Tighten jam nut to 500 lb. ft. torque.
- R. Recheck bearing preload, and if necessary, re-adjust adjusting nut to have proper preload. Bend flat washer over jam nut.
- S. Install 6 gear and hub cap screws, tighten to 65-85 lb. ft. torque and lock with soft iron wire. Install cap screw cover spacers, cover and 3 cap screws. Bend up cover tang to lock screws in place.
- T. Install pinion and thru-shaft assembly as previously described.
- U. Adjust pinion and gear to secure correct gear tooth contact and backlash. Refer to tooth contact section of Manual.
- V. Remove stud nuts and flat washers. Install bearing cage cover gasket, cover, stud nuts and lock washers. Tighten nuts to specified torque.

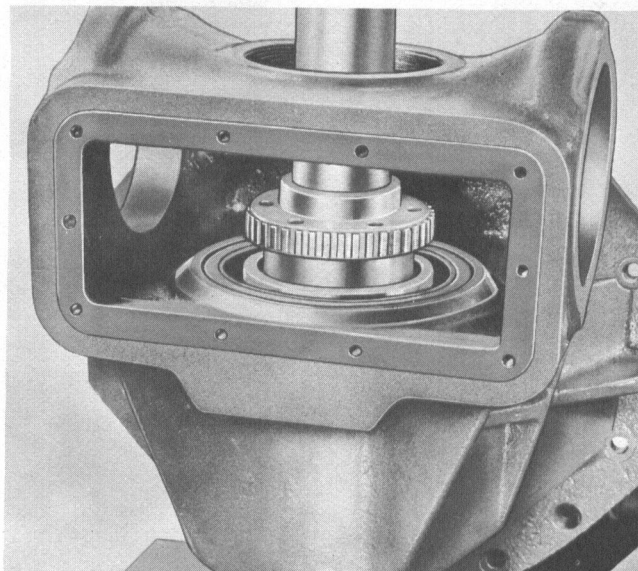
TYPE 3 CROSS SHAFT

GEAR SPLINED TO CROSS SHAFT

- A. Check sleeve I.D. and radial bearing O.D. Replace sleeve and/or bearing if the parts are damaged, or if there is more than .006" clearance between the sleeve and bearing. When these parts are new the sleeve I.D. should be .0024" to .004" larger than the bearing O.D. The radial bearing must be free to float in the sleeve.

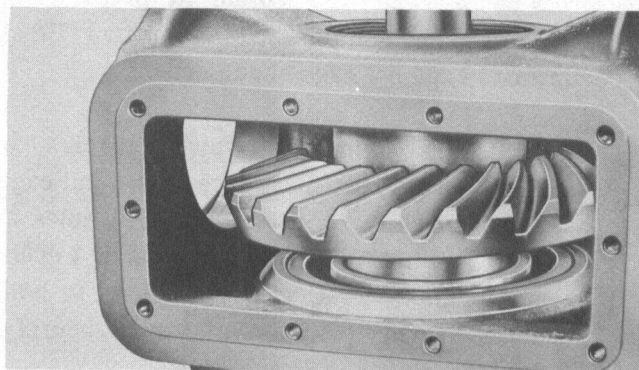
Carefully check the I.D. of the bearing bore of older drive units that do not have replaceable sleeves. If the I.D. is more than .006" larger than the bearing O.D., replace the carrier and cap assembly with the newer type carrier and cap assembly that incorporates replaceable sleeves.

- B. If radial bearing sleeve is to be replaced, press new sleeve firmly against housing shoulder. Drill hole for lock screw and remove burrs from sleeve. Install lock screw and tighten securely or install pin and stake in place.
- C. Install radial bearing in drive unit. Large radius of bearing inner race must be toward bevel gear.



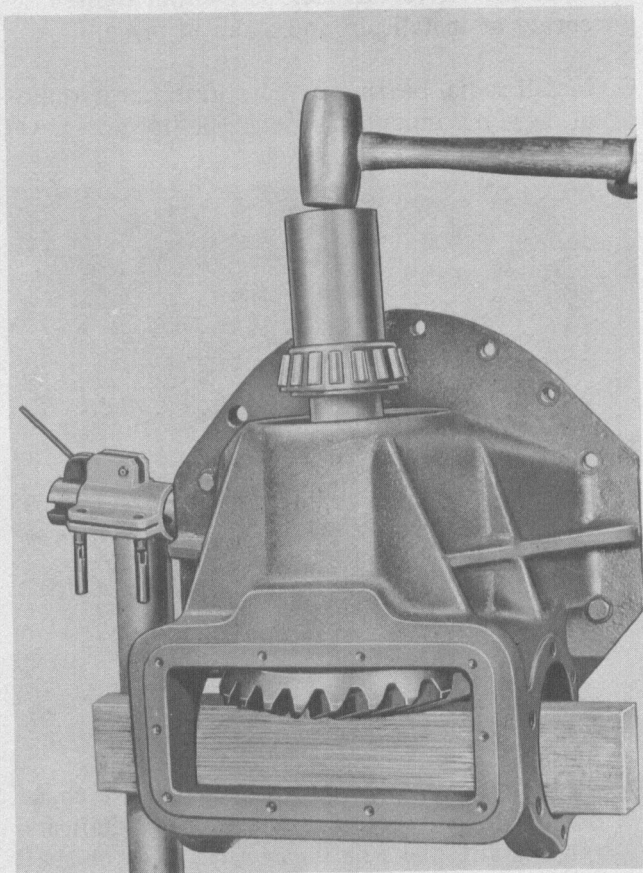
- D. Position drive unit in press, thru-shaft chamber up. Inspect entering end of cross shaft and remove any nicks or burrs. Coat O.D. of shaft with heavy grease such as Rockwell-Standard Spec. O-616 A.

Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the press pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.



- E. Align gear and cross shaft cap screw holes and assemble gear to shaft.

- F. Install and tighten 6 gear and cross shaft cap screws. Lock cap screws with soft iron wire. Specified torque is 65-85 lb. ft.



- G. Block up gear with piece of hard wood. Apply colloidal graphite lubricant to cross shaft tapered bearing journal. Install inner bearing firmly against shaft shoulder with suitable sleeve.
- H. If tapered bearing cup has been removed from cross shaft cage, reassemble in press using sleeve or other suitable installation tool. Press cup firmly against cage shoulder.
- I. Install original shim pack (which controls gear backlash) over cross shaft cage studs, and cage over shim pack, carefully aligning oil holes in cage with oil holes in drive unit. Install 4 evenly spaced nuts over thick flat washers to hold assembly in place. Tighten stud nuts securely.
- J. Install outer cross shaft tapered bearing with suitable sleeve.

- K. Install cross shaft bearing adjusting nut. Tighten nut as cross shaft assembly is revolved to correctly position all bearing rollers.

- L. Measure cross shaft bearing preload torque. Wrap strong cord around spur pinion and pull on horizontal line with pound scale.

The preload torque specification for tapered bearings mounted close together in a bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

Example: Assume spur pinion diameter is 4", the radius is 2" and with 5 pounds pull on the scale, preload torque is 10 pound inches.

Read rotating pounds pull, not starting pounds pull. If preload torque is not within 5 to 15 pound inches, tighten bearing adjusting nut to increase, or loosen the nut to decrease preload torque.

- M. Back off adjusting nut $\frac{1}{4}$ (90°) to $\frac{1}{3}$ (120°) turn. Install nut lock, flat washer and jam nut. Tighten jam nut to 500 lb. ft. torque.

- N. Recheck bearing preload, and if necessary, re-adjust adjusting nut to have correct preload. Bend flat washer over jam nut.

- O. Install gear cover spacers, cover and 3 cap screws, tighten the cap screws to specified torque. Bend up cover tang to lock screws in place.

- P. Install pinion and thru-shaft assembly as previously described.

- Q. Adjust pinion and gear to secure correct gear tooth contact and backlash. Refer to tooth contact section of Manual.

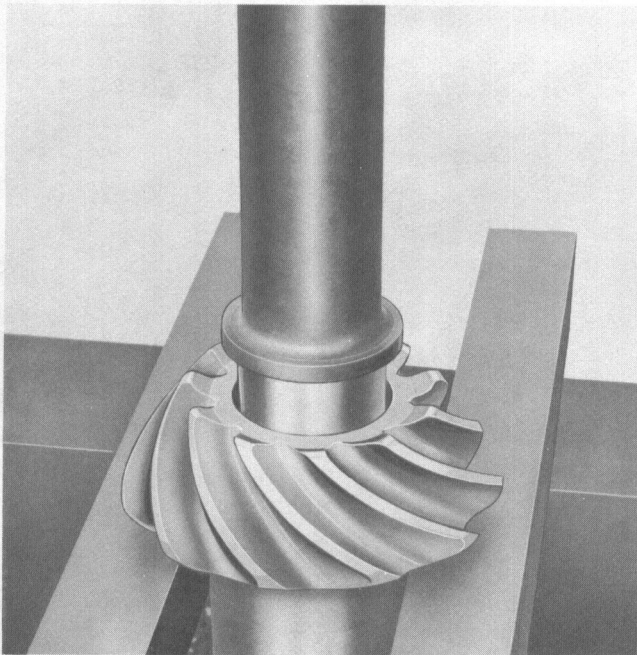
- R. Remove stud nuts and flat washers. Install bearing cage cover gasket, cover, stud nuts and lock washers. Tighten to specified torque.

TYPE 2 PINION AND THRU-SHAFT ASSEMBLY HYPOID GEAR FIRST REDUCTION

ASSEMBLE AND INSTALL PINION, THRU-SHAFT AND BEARING CAGE ASSEMBLY

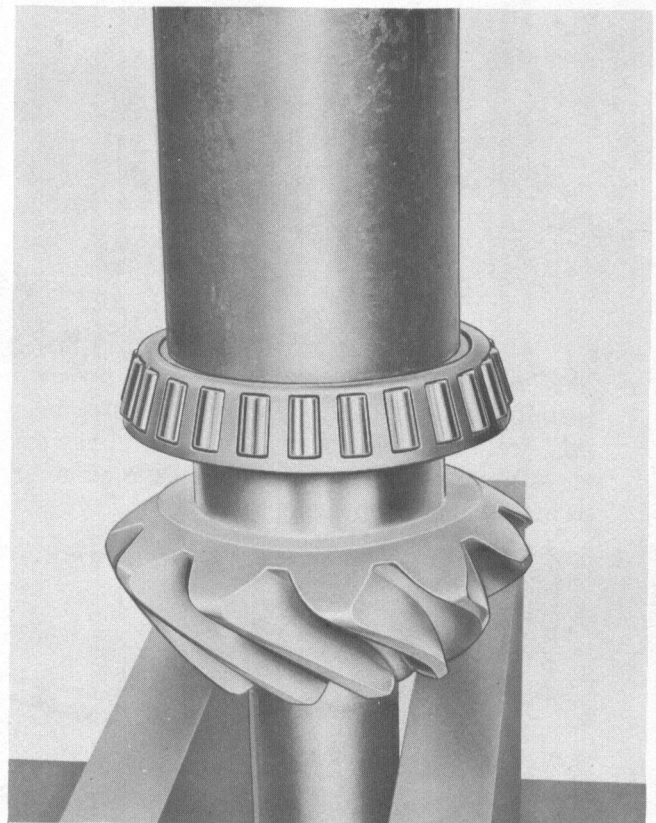
- A. Press pinion bearing cups in cage firmly against shoulder with suitable sleeve.
- B. Coat thru-shaft O.D. and rear bearing inner race I.D. with heavy grease, such as Rockwell-Standard Spec. O-616A.

Press rear bearing inner race against rear shoulder of thru-shaft of forward carriers and rear carriers that have double splined end shafts. On rear carriers with short single end thru-shafts, install rear bearing inner race retainer, then press race in place and install outer retainer.

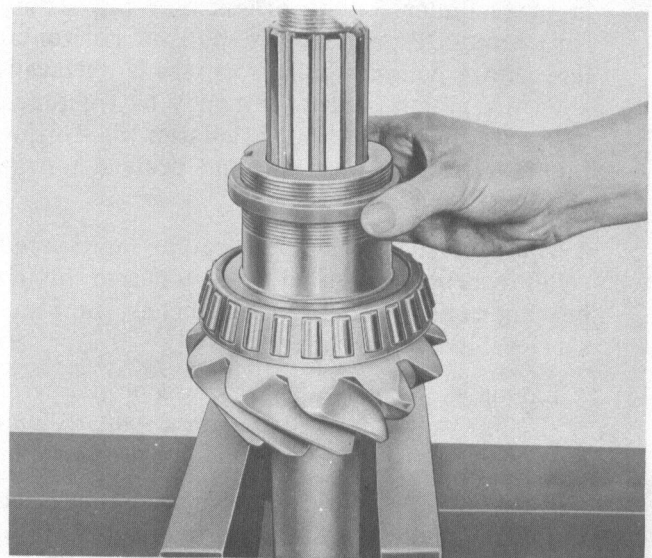


- C. Coat pinion and thru-shaft splines with a heavy grease, such as Rockwell-Standard Spec. O-616A, and press parts firmly together.

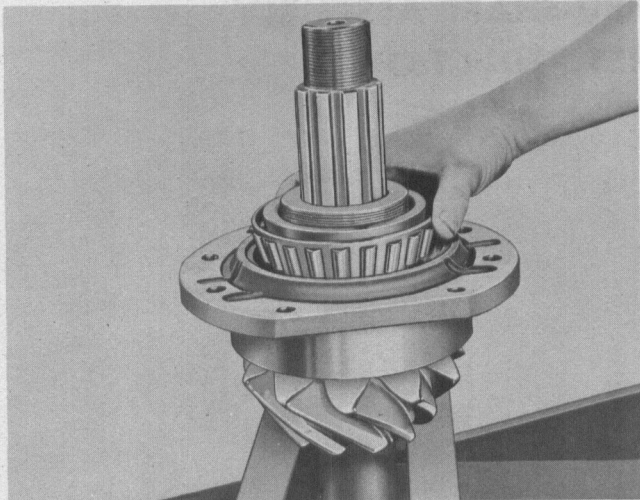
Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the press pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.



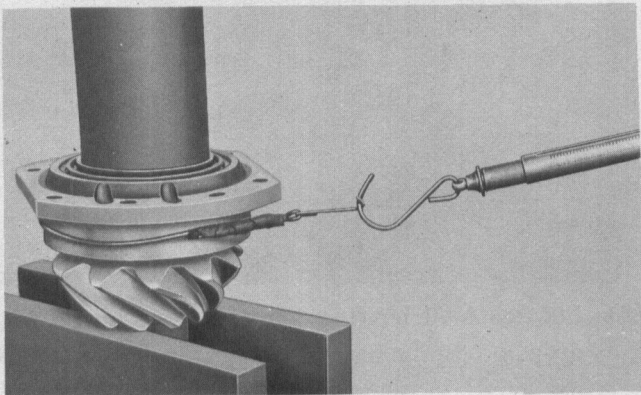
- D. Lubricate all bearing journals only with a few drops of engine oil and press inner pinion bearing firmly in place with sleeve.



- E. Position original bearing spacer next to bearing. Be sure O.D. chamfer is toward outer bearing.



F. Install cage and cup assembly and outer bearing. Press bearing firmly against selective spacer with suitable sleeve, rotating cage assembly to assure normal bearing contact.

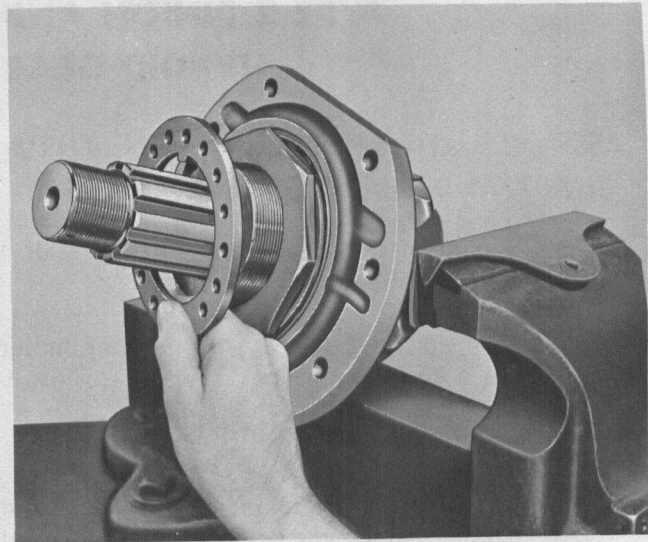


G. Measure pinion bearing preload torque while in press under 9 tons pressure. Wrap strong cord around cage pilot and pull on horizontal line with a pound scale. If a press is not available, the pinion bearing nut may be tightened to the torque noted in "Tabulation of Torque Limits" (back of Manual) and preload torque checked.

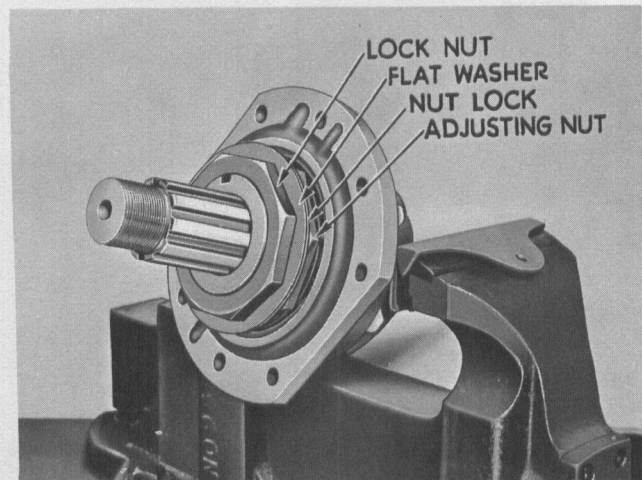
The preload torque specification for tapered roller bearings mounted close together in the bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

Example: Assume the pinion cage diameter is 6", the radius is 3" and with 3 pounds pull on the scale, preload torque is 9 pound inches.

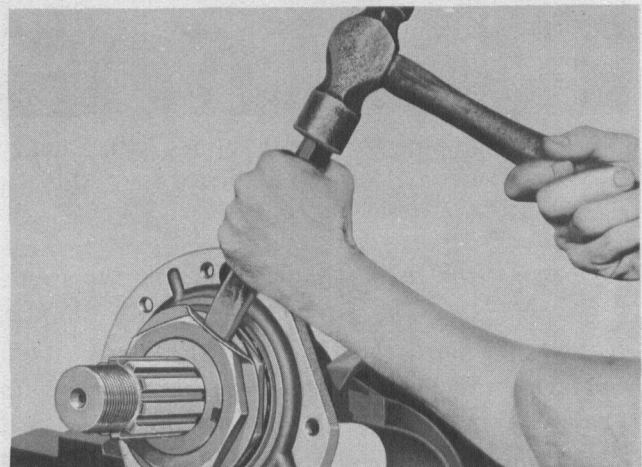
Read rotating pounds pull on scale, not starting pounds pull. If rotating torque is not within 5 to 15 pound inches, use a thinner spacer to increase, or a thicker spacer to decrease preload torque.



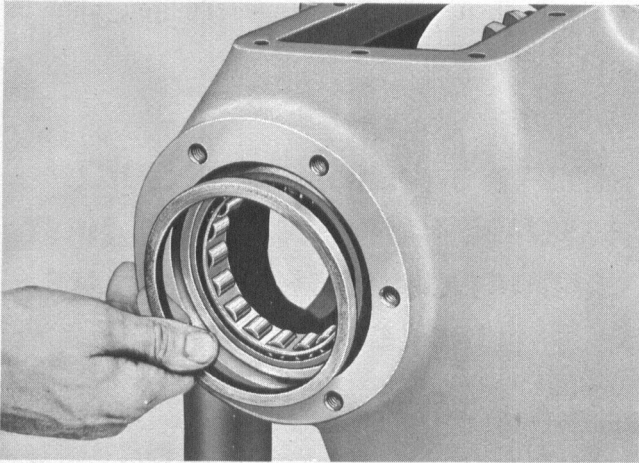
H. Remove assembly from press. Install and tighten inner nut to specified torque, install nut lock.



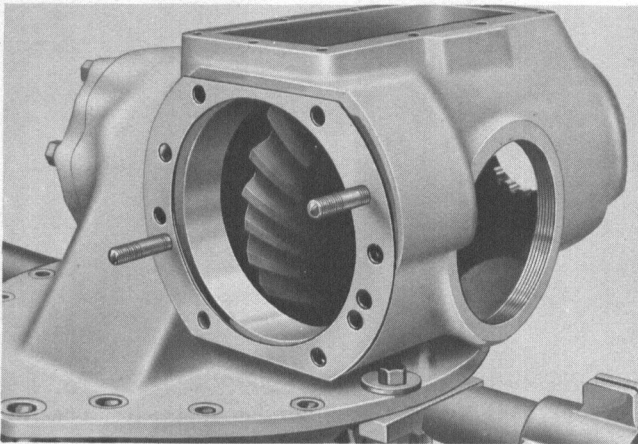
I. Install flat washer next to nut lock. Install and tighten outer lock nut to specified torque.



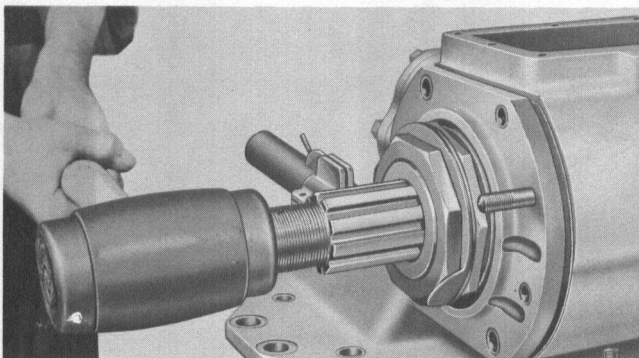
J. Bend washer over nut flat.



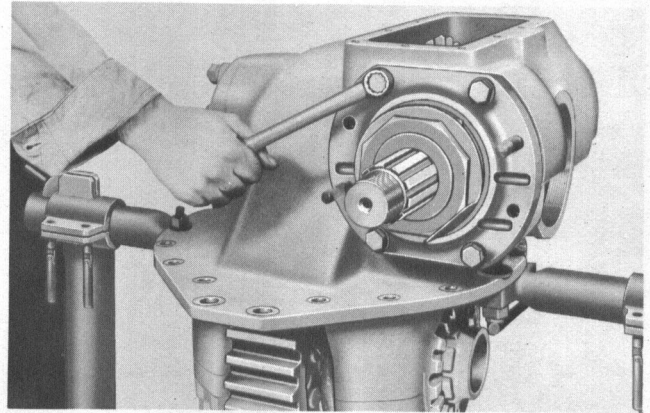
- K. Install thru-shaft rear bearing with suitable sleeve. Check position in forward carrier with cover and seal assembly. In rear carriers with long thru-shaft (both ends splined) check position with cast end cover. In rear carriers with short thru-shaft, use large bearing spacer as a gauge as illustrated.



- L. Loosely install two guide studs in pinion cage cap screw holes to aid reassembly. Position original shim pack over studs so oil holes are in correct alignment.

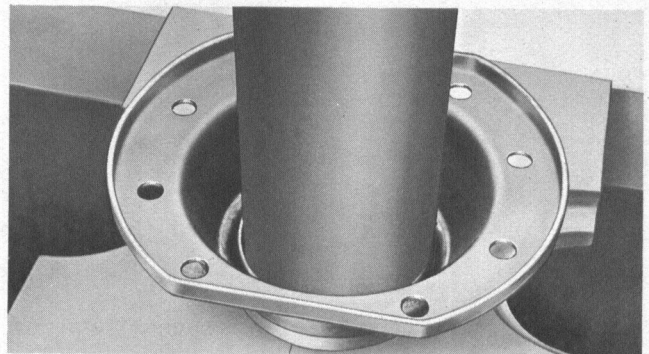


- M. Carefully tap pinion, bearing cage and thru-shaft assembly in place.

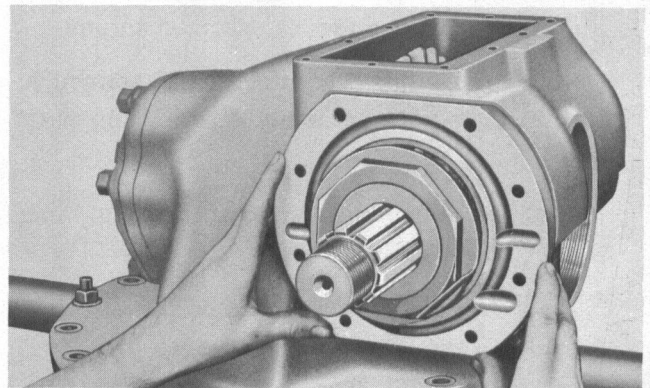


- N. Install and tighten four cap screws over flat washers as illustrated, to hold the pinion cage assembly firmly in place while checking hypoid tooth contact. Alter shim packs under cross shaft bearing cage and pinion bearing cage to secure correct gear tooth contact.

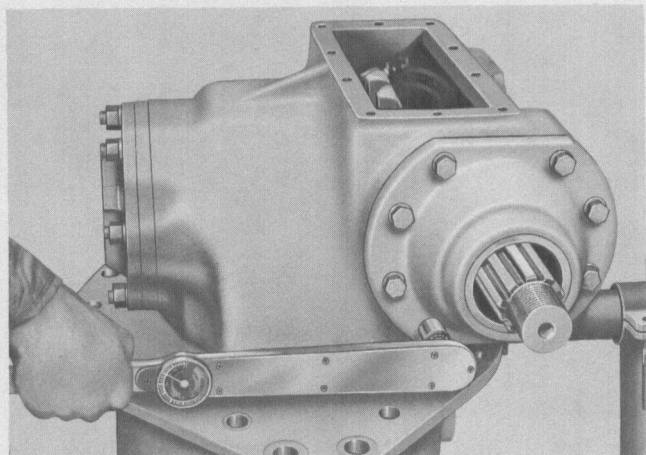
Refer to gear tooth contact section of Manual for complete details of tooth pattern adjustments.



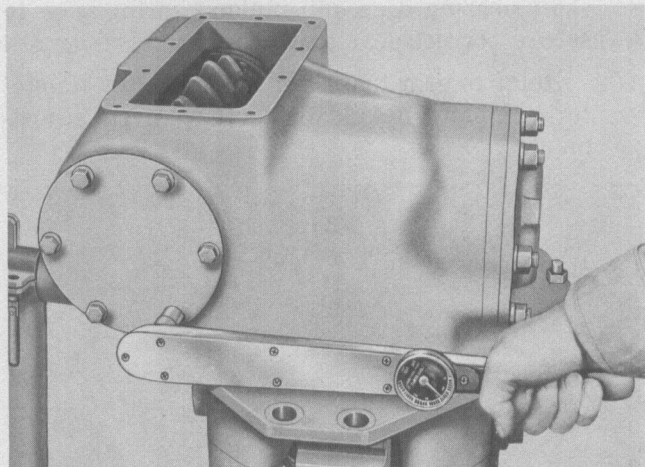
- O. Coat pinion oil seal with non-hardening sealing compound and install in cover with suitable sleeve. Lubricate sealing element.



- P. Remove four cap screws and guide studs. Coat outer machined surface of cage and inside of cover with gasket cement. Install new gasket on cage flange.



Q. Install cover and seal assembly. Tighten cap screws over lock washers to specified torque.



R. Apply gasket cement to all sheet metal or stamped covers and mating surfaces. Install new gaskets. Install rear cover and seal assemblies of forward carriers and rear bearing spacers of rear carriers. Install rear cover. Tighten stud nuts or cap screws to specified torque.

Rear drive units with thru-shafts splined at both ends require assembly of following parts in order:

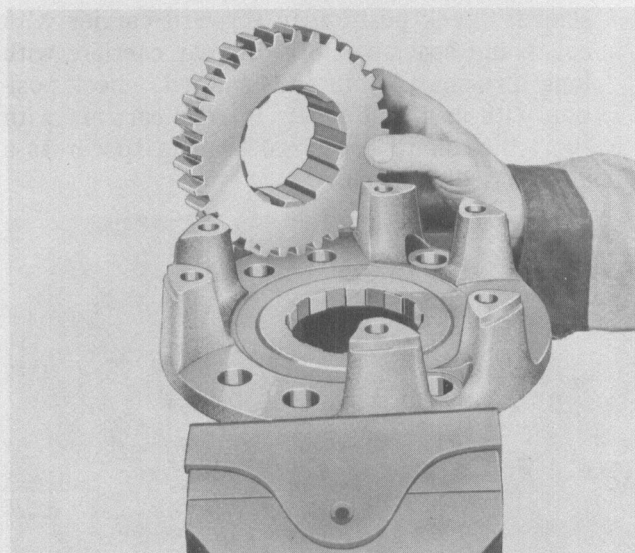
1. Narrow spacer next to rear bearing inner race.
2. Wide spacer next to narrow spacer.
3. Nut washer.
4. Rear nut. Tighten to specified torque.

S. Install forward yokes or flanges. Install narrow spacer at rear end of forward carrier thru-

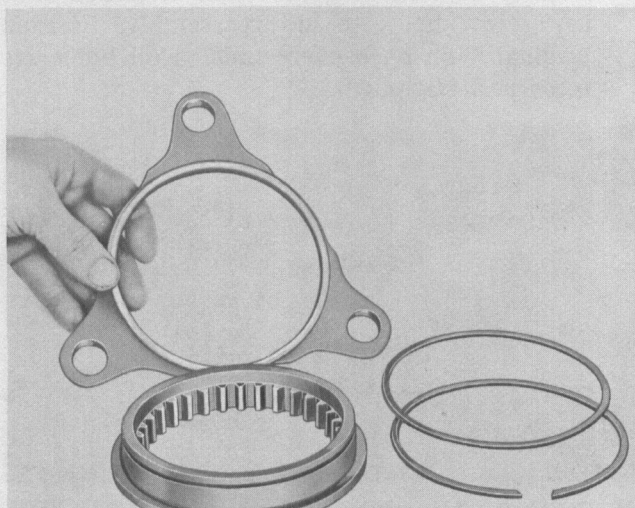
shaft, then yoke or flange. Tighten nuts to specified torque.

TYPE 3 PINION AND QUILL ASSEMBLY – HYPOID GEAR FIRST REDUCTION WITH INTER-AXLE (3RD) DIFFERENTIAL

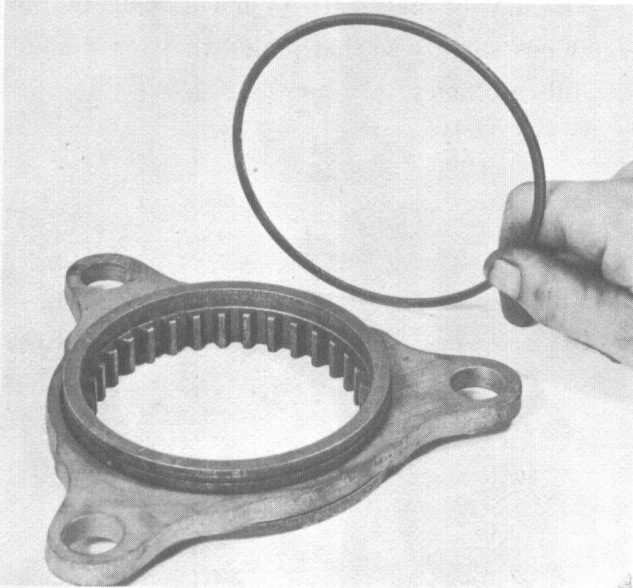
REASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL, BEARING AND COVER ASSEMBLY



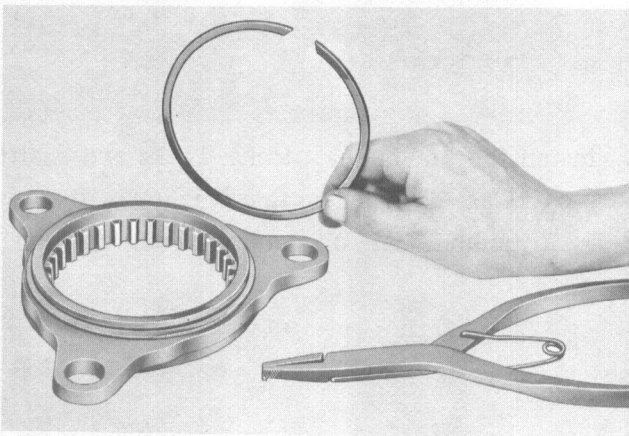
A. Coat all parts with axle lubricant and assemble rear gear against hardened insert with locking teeth up.



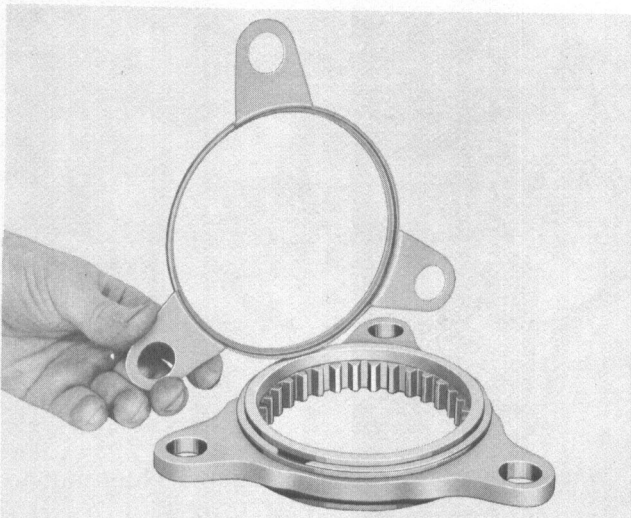
B. Assemble shift collar yoke to shift collar.



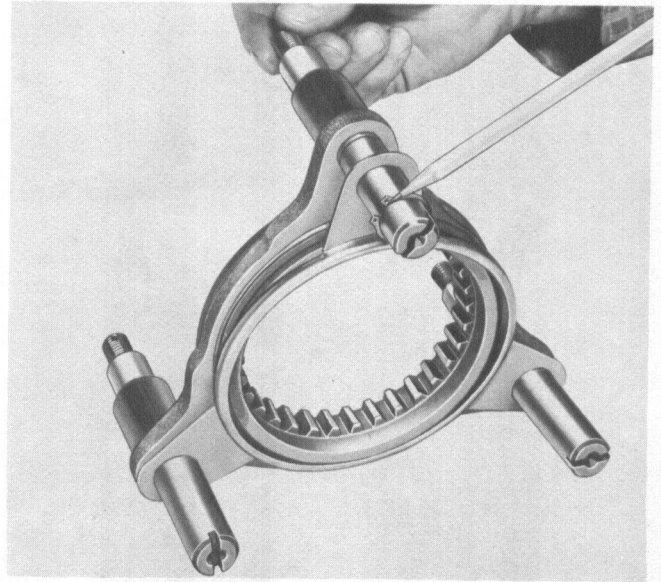
C. Assemble spacer over collar yoke.



D. Install retainer in shift collar groove.



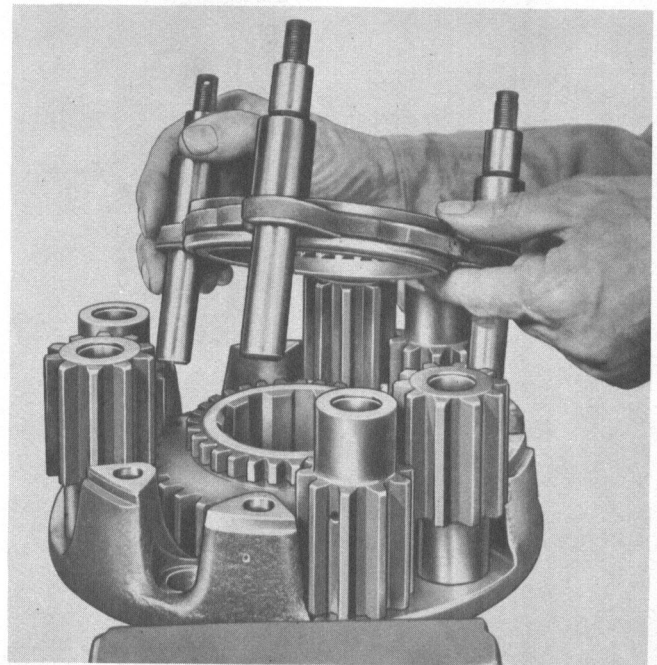
E. Position the stamped collar retainer cover over retainer.



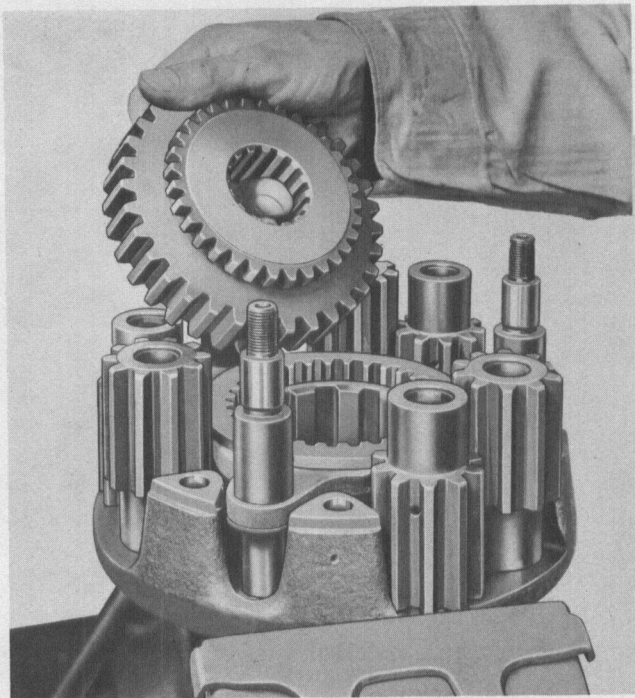
F. Assemble the shift shafts in the collar and yoke assembly and install the cover retainers in the shift shaft grooves.

G. Position three pinions with teeth down, evenly spaced (120 degrees), aligning the bores with shift shaft holes in case.

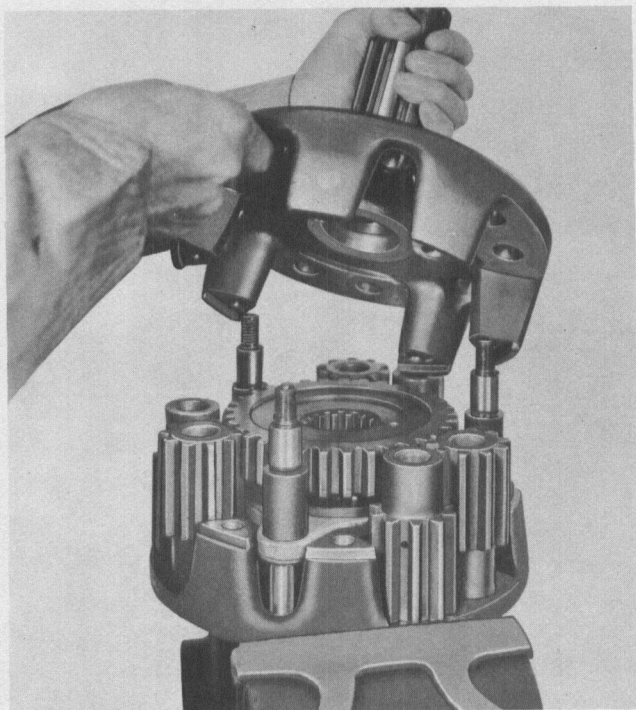
Position remaining three pinions with teeth up, in the same manner.



H. Position the shifter yoke, collar and shaft assembly into case, mating internal teeth of collar with integral teeth of rear side gear.

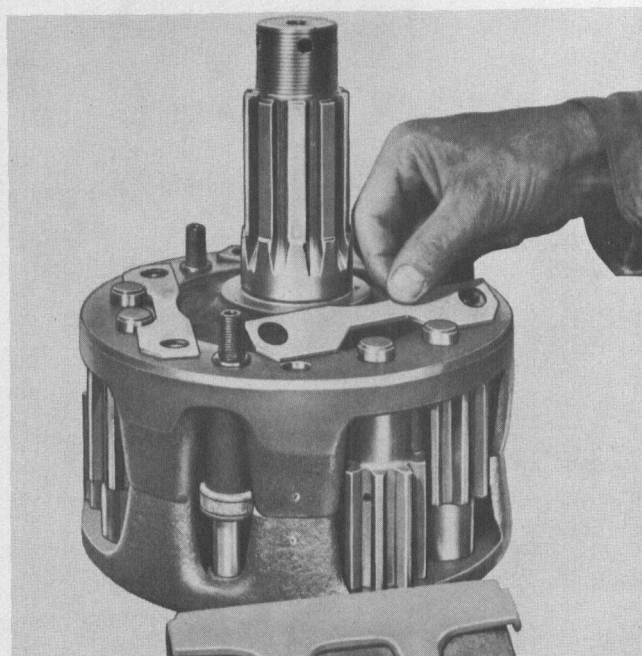


- I. Install forward differential gear, having small I.D. spline, with locking teeth down meshing with teeth in I.D. of collar and O.D. teeth meshing with 3 pinions. Turn gears to be sure all parts are correctly assembled and free-moving. Install forward gear thrust washer.

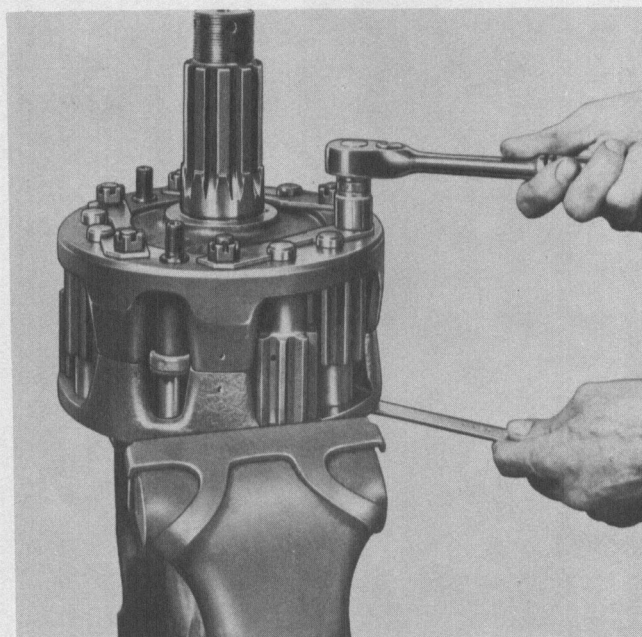


- J. Install the forward case half, exercising care to position correctly by the identification marks.

It may be necessary to move some of the pinions slightly so that pinion shafts will align with case holes.



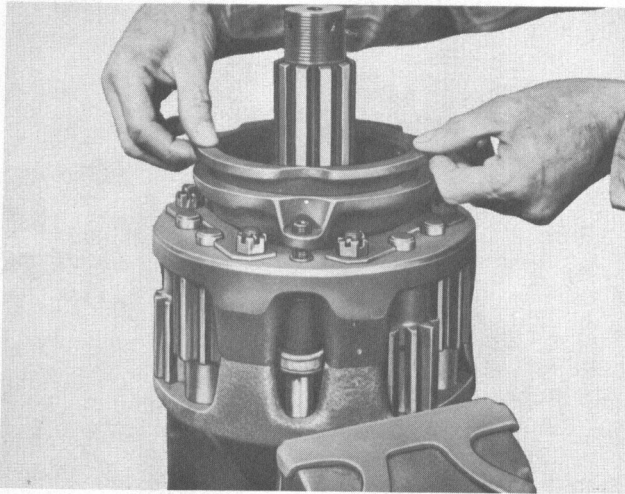
- K. Install the pinion shaft locks. Locks and shaft grooves are designed so that it is impossible to locate pinion shaft oil flats in wrong position.



- L. Install the case bolts and nuts. Tighten nut to specified torque by holding bolt head.

Check assembly for free movement by rotating pinions. If parts are not free-moving, check for cause before proceeding with further assembly.

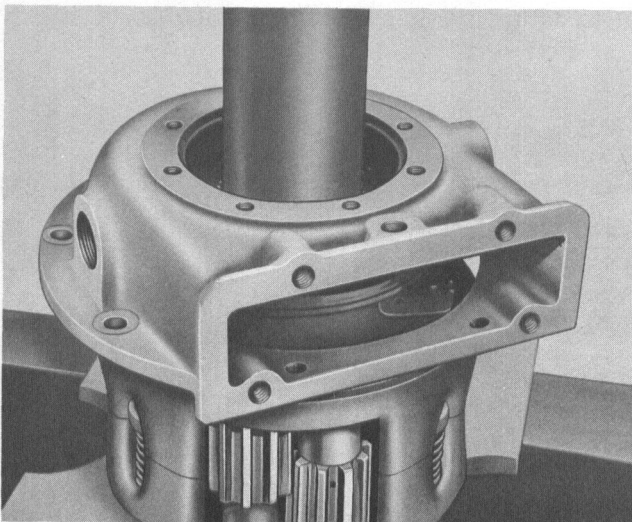
If assembly is satisfactory, install case bolt cotter keys.



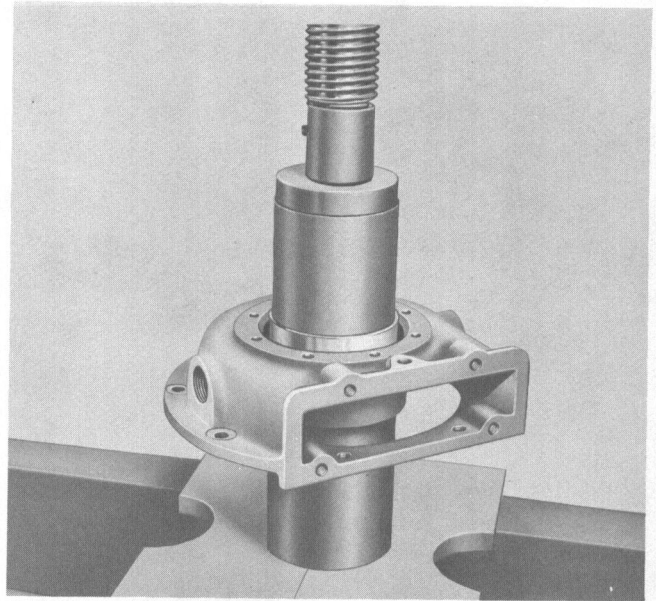
- M. Install the shift collar on the shifter shafts and install the shifter shaft nuts. Tighten nuts to specified torque of 65-85 pound feet.

Check assembly to be sure shift collar and shafts work up and down freely. Should the shafts tend to bind or stick after the nuts have been tightened, rap the assembly at several points on the case to free.

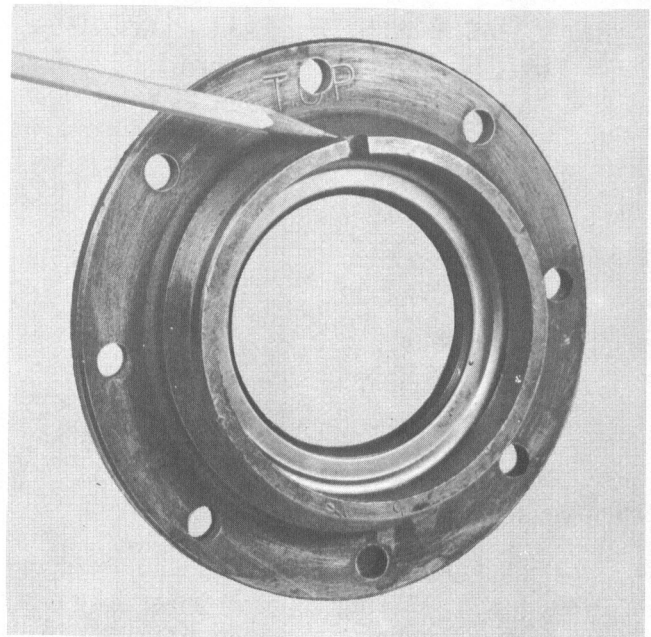
Install shift shaft cotter keys.



- N. Install ball bearing in housing cover with suitable sleeve.

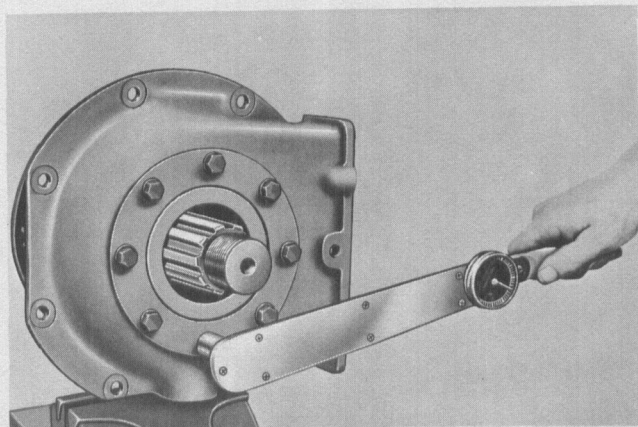


- O. Assemble cover and bearing assembly to differential assembly as illustrated. Use a small sleeve over input shaft against bearing inner race. Rotate cover to be sure it is clear of differential assembly.



- P. Coat seal O.D. and seat with non-hardening sealing compound and install in retainer with suitable sleeve.

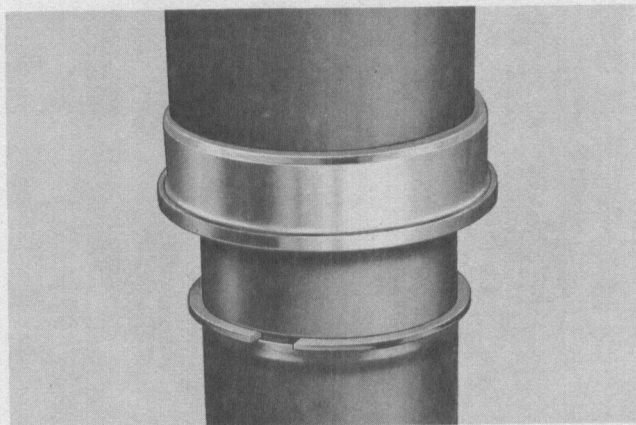
Note position of slot in bearing retainer and stamped word "Top". Retainer must be installed so slot is up, aligned with lubricant hole in cover.



- Q. Position new gasket on cover and install bearing and seal retainer. Tighten cap screws to specified torque.

Carefully inspect completed assembly to be sure cap screw ends do not interfere with shift yoke or shift rings. Install yoke or flange, washer and nut. Nut can be conveniently tightened later.

REASSEMBLE AND INSTALL HYPOID PINION AND QUILL, BEARING AND HOUSING ASSEMBLY

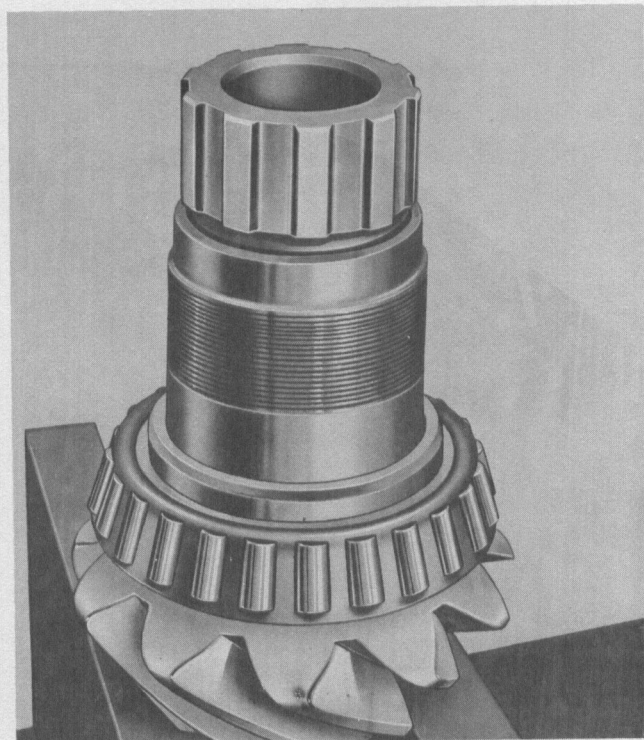


- A. Press pinion bearing tapered cups firmly in place against housing shoulder. Assemble rear bearing inner race inner retainer. Coat quill O.D. and race I.D. with heavy grease such as Rockwell-Standard Spec. O-616A and press inner race in place. Install outer retainer.

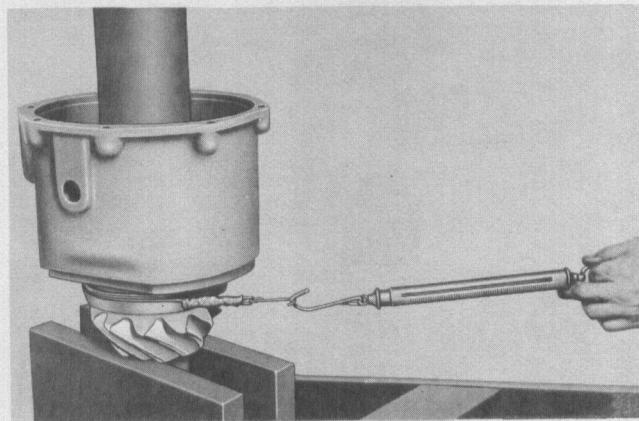
Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about $\frac{1}{4}$ " to $\frac{3}{8}$ ", then relieve the pressure to permit them to realign themselves to prevent distortion and damage.

Continue the pressing operation until the parts are correctly assembled.

- B. Lubricate all bearing journals only with a few drops of engine oil and firmly press inner bearing on pinion and quill assembly.



- C. Install original spacer on inner bearing. O.D. chamfer of spacer must be toward outer (forward) bearing.
- D. Position housing and cup assembly on pinion. Press bearing firmly against selective spacer with suitable sleeve, rotating housing assembly to assure normal bearing contact.



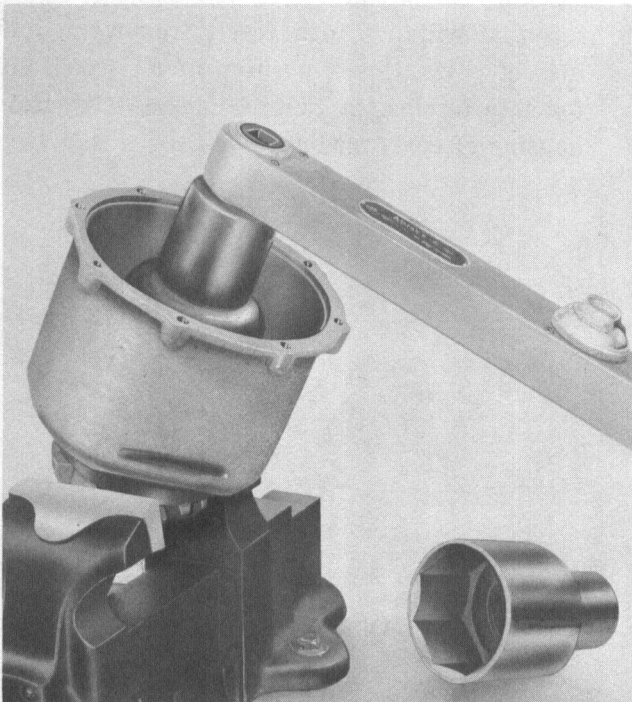
- E. Measure pinion bearing preload torque while in press under 9 tons pressure. Wrap strong

cord around housing pilot and pull on horizontal line with a pound scale. If a press is not available, the pinion bearing nut may be tightened to the torque noted in "Tabulation of Torque Limits" (back of Manual) and preload torque checked.

The preload torque specification for tapered roller bearings mounted close together in the bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

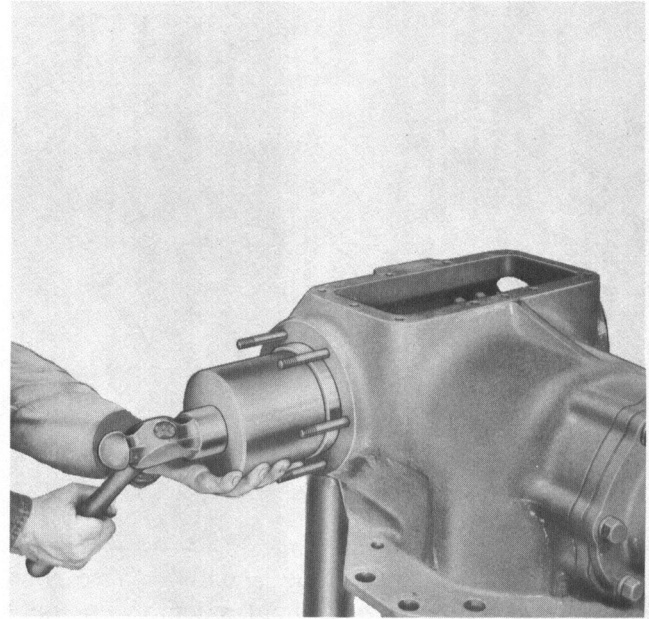
Example: Assume the housing pilot diameter is 6", the radius is 3" and with 3 pounds pull on the scale, preload torque is 9 pound inches.

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.

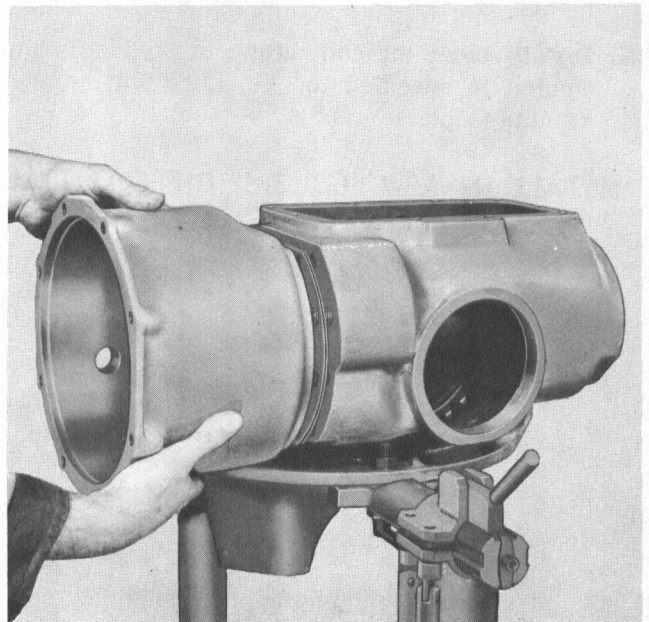


F. Tighten adjusting nut to specified torque. Re-check bearing preload. Install nut lock, flat washer and lock nut. Bend flat washer over nut flat.

(A hardwood wedge inserted between the teeth of the hypoid pinion and hypoid gear will prevent the gears from turning while loosening and tightening the bearing adjusting and jam nuts when the gears are assembled in the carrier.)

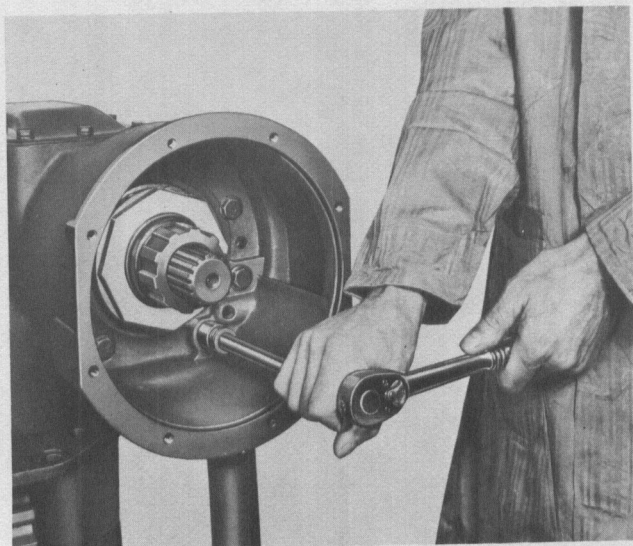


G. Install pinion quill rear bearing in carrier with suitable sleeve. Check location with thru-shaft ball bearing retainer.



H. Loosely install two guide studs in carrier if cap screws are used to hold housing assembly in place. Position original shim pack over studs so oil holes are in correct alignment.

I. Carefully tap pinion, housing and gear assembly in place.

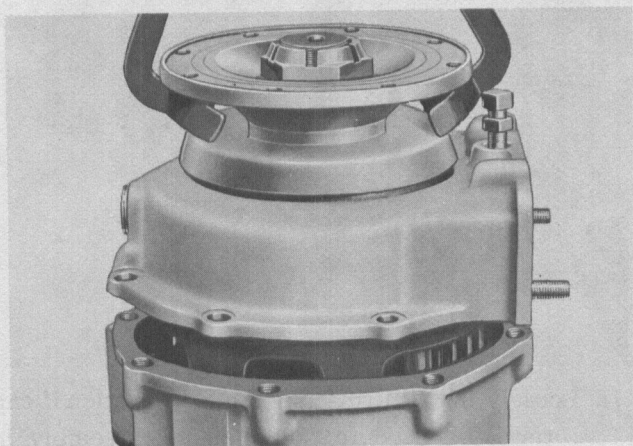


J. Install and tighten four equally spaced stud nuts or cap screws to hold assembly in place while checking hypoid gear tooth contact. Alter shim pack under cross shaft bearing cage and inter-axle differential housing to secure correct tooth contact.

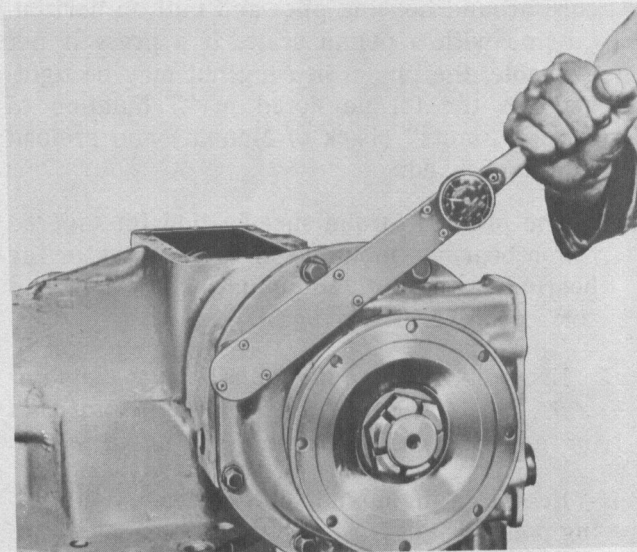
Refer to gear tooth contact section of Manual for complete details of tooth pattern adjustments.

K. Install remaining cap screws or stud nuts and tighten to specified torque. Lock wire screws or nuts in place.

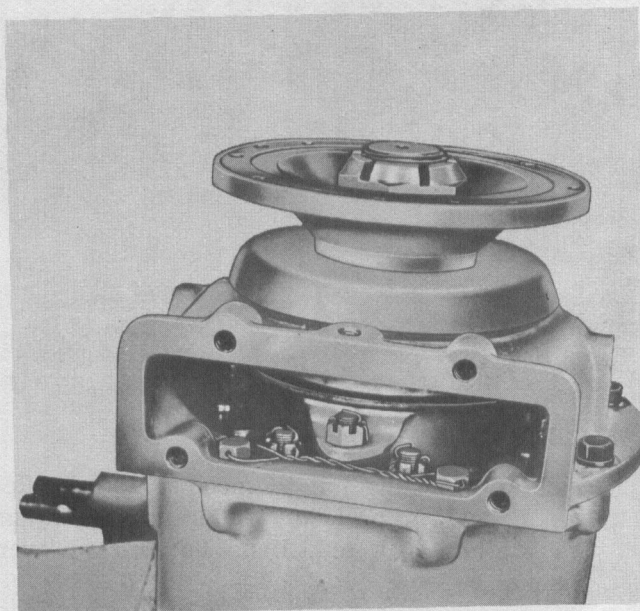
INSTALL INTER-AXLE (3rd) DIFFERENTIAL, BEARING AND COVER ASSEMBLY



A. Turn carrier so pinion and quill assembly is in vertical position and loosely install three guide studs in differential housing. Position gasket in place and install differential and cover assembly. Revolve differential assembly back and forth to engage splines of pinion with rear gear.



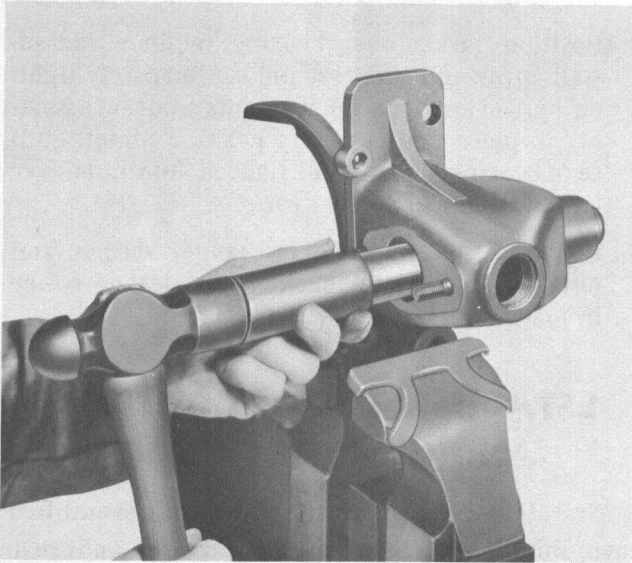
B. Install and tighten cap screws over lock washers to specified torque. Revolve differential assembly to be sure it is free turning. If differential will not turn freely, remove it and inspect parts. Check position of oil scoop and for interference at helix baffle at left inside housing of early models.



C. Install, tighten securely and lock wire two cap screws at shift housing opening.

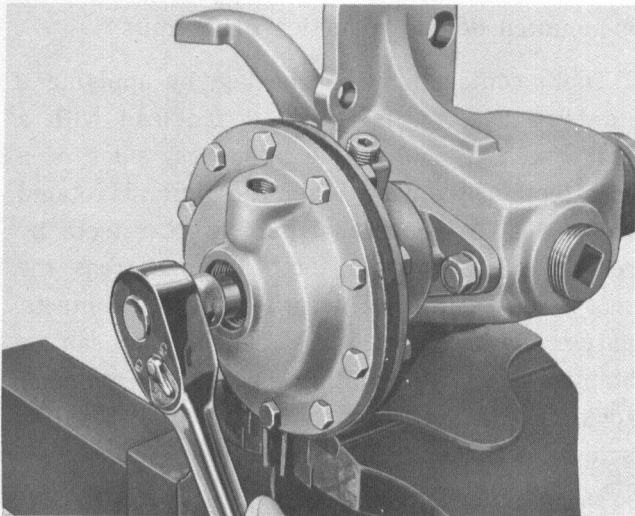
D. Tighten previously installed yoke or flange nut to specified torque. Cotter nut in place.

ASSEMBLE AND INSTALL SHIFT UNIT HOUSING AND DIAPHRAGM ASSEMBLY

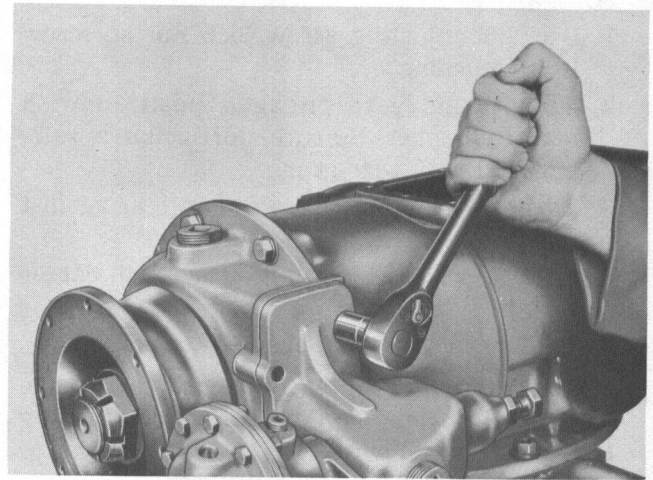


A. Hold shift unit housing in vise and position push rod in housing and fork. Be sure round button of fork faces front. Carefully assemble push rod in place with sleeve.

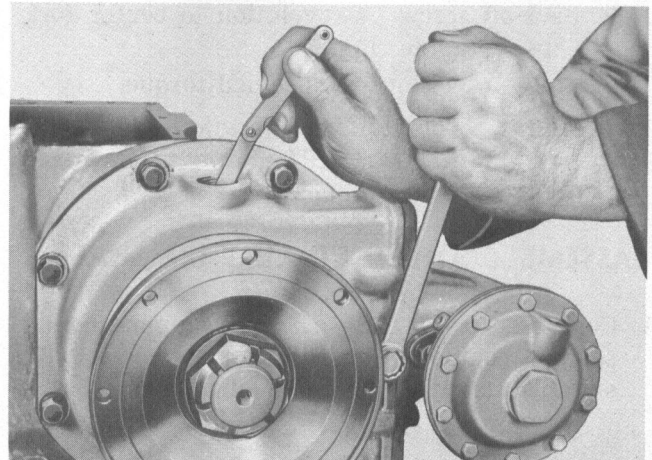
B. Install and tighten shift fork set screw and lock nut to specified torque. Apply sealer to housing plug and tighten securely.



C. Position copper gasket over end of push rod and install diaphragm assembly. Tighten stud nuts over lock washers to specified torque. Hold push rod with screwdriver while starting nut over lock washer. Be sure flats of push rod fit in slot of diaphragm insert as nut is tightened. Tighten nut to 4-6 lb. ft. torque. Install and tighten shift unit cover plug.



D. Attach assembly to cover with two cap screws over lock washers. Install 2 tapered dowels, special lock washers and stud nuts. Tighten nuts and cap screws to specified torque.



E. Adjust shift fork of later models without shift shaft springs that have both forward and rear adjusting screws as follows:

LOCK-OUT DISENGAGED, FORWARD ADJUSTING SCREW

1. Back-off adjusting screw lock nut so screw is free-turning.
2. Shift assembly to disengaged position with power chamber.
3. Turn-in adjusting screw until it is finger-tight against fork.
4. Turn-in screw $\frac{1}{2}$ revolution more to center fork in groove.
5. Tighten lock nut to specified torque.

LOCK-OUT ENGAGED, REAR ADJUSTING SCREW

1. Back-off adjusting screw lock nut so screw is free-turning.
2. Shift assembly to engaged position with power chamber. Be sure shift collar is fully engaged with rear gear.
3. Turn-in screw until it is finger-tight against push rod.
4. Turn-in screw $\frac{1}{2}$ revolution more to center fork in groove.
5. Tighten lock nut to specified torque.

Adjust shift fork of early models that have shift shaft springs and the forward adjusting screw only as follows:

LOCK-OUT DISENGAGED

1. Back-off adjusting screw lock nut so screw is free-turning.
2. Turn-in screw until it is finger-tight against fork. This forces fork against inner-guide ring.
3. Back-off screw $\frac{1}{2}$ revolution to center fork between guide rings.
4. Tighten lock nut to specified torque.

Always check shift fork location with feeler to be sure there is .010" minimum clearance at guide rings or groove.

ASSEMBLE AND INSTALL THRU-SHAFT ASSEMBLY

- A. Coat seal body and seat with non-hardening sealing compound and install in cover with suitable sleeve. Lubricate sealing element.



- B. Install thru-shaft ball bearing firmly against shaft shoulder and assemble shaft and bearing assembly in retainer.

- C. Position gasket over studs and install shaft, bearing and retainer assembly. Be sure thru-shaft splines mesh with forward gear of inter-axle differential. Do not force assembly in place.
- D. Position gasket over bearing retainer and install cover and seal assembly. Alternately tighten four evenly spaced stud nuts to draw assembly in place and correctly position pinion quill rear bearing. Install and tighten stud nuts over lock washers to correct torque.
- E. Install thru-shaft yoke or flange, washer and nut. Tighten nut to specified torque and cotter in place.

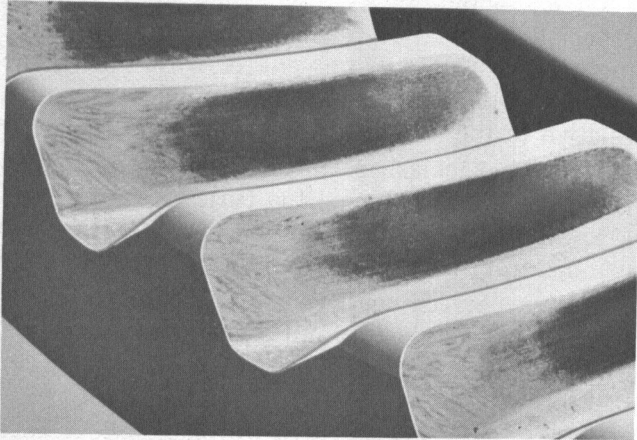
ESTABLISH TOOTH CONTACT AND GEAR BACKLASH

Spiral bevel gear first-reduction assemblies have shim packs between the forward and rear thru-shaft tapered bearing covers and the carrier to control pinion position. Hypoid gear first-reduction units have a single shim pack between the pinion cage and carrier or inter-axle differential housing and carrier to control pinion position. A shim pack between the cross shaft bearing cage flange and the carrier controls the position of the first-reduction spiral bevel or hypoid gear in all top-mounted double reduction drive units.

Tooth contact may be checked by applying a thin even coat of lightly oiled red lead with a small brush to both drive and coast sides of a dozen teeth of the gear. When the pinion is rotated the red lead is squeezed from the gear teeth by pressure of the pinion teeth leaving areas the exact size, shape and location of the contacts. Sharper, better defined areas of contact can be obtained by applying rolling resistance to the gear providing the gear is not forced out of location during the checking operation.

Use the smallest amount of the lead and oil mixture that will render good impressions. The drier the mixture the better the impressions. Clean the material from the gear and pinion teeth when the operation is complete. Always judge tooth contact by noting pattern on the drive side of the gear teeth. The coast side pattern should be correct when the drive side pattern is correct.

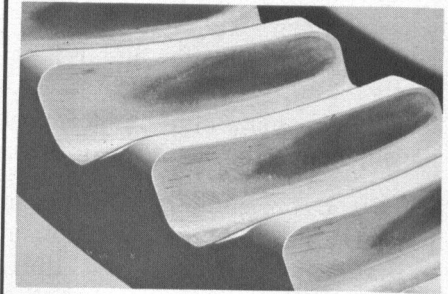
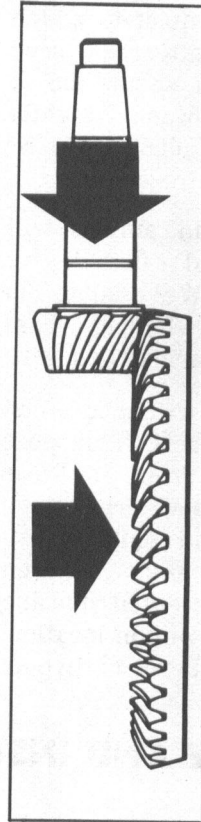
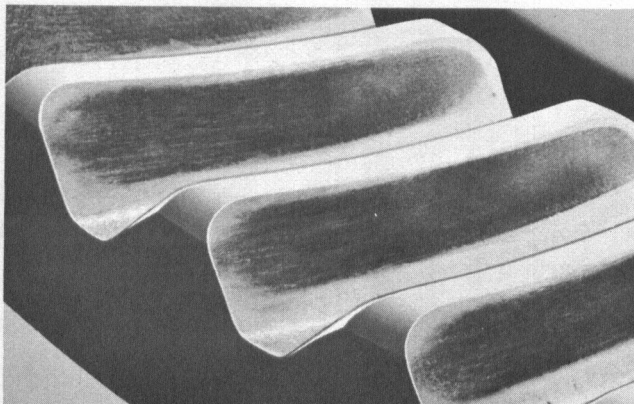
Set backlash to amount specified on gear O.D. Set backlash to .005"-.015", when amount is not specified.



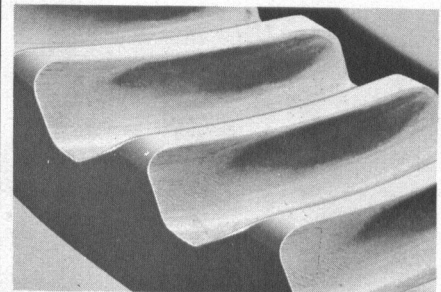
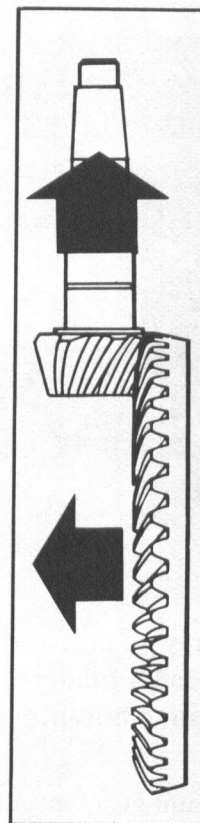
With adjustments properly made (pinion at correct depth and backlash set at .010") the illustrated contacts above and below will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

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

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



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.

Set used gears to have tooth contact to match wear pattern. The hand rolled pattern of used gears will be smaller in area and should be at toe end of wear pattern. Backlash may slightly exceed the maximum limit of the .005" to .015" specification. Do not mix worn and new gears.

Mixed or unmatched gears and pinions will probably be noisy in operation and will not give optimum performance and life. We assume no responsibility for spiral bevel or hypoid gears serviced in any manner other than matched sets.

Be sure all bearing preloads are within specified limits before checking tooth contacts. Transpose equal amounts of shims between front and rear pinion bearing covers of spiral bevel drive units to maintain correct bearing preload while adjusting tooth contact. Add or remove shims between the pinion cage or inter-axle differential housing of hypoid gear drive units to alter pinion location. Change the location of the spiral bevel or hypoid

gear by altering the thickness of the shim pack between the cross shaft bearing cage flange and carrier.*

After obtaining a satisfactory tooth contact, especially in relation to the top and bottom of the tooth, the backlash can be altered within the limits of .005"-.015" to obtain a better contact position relative to the length of the tooth.

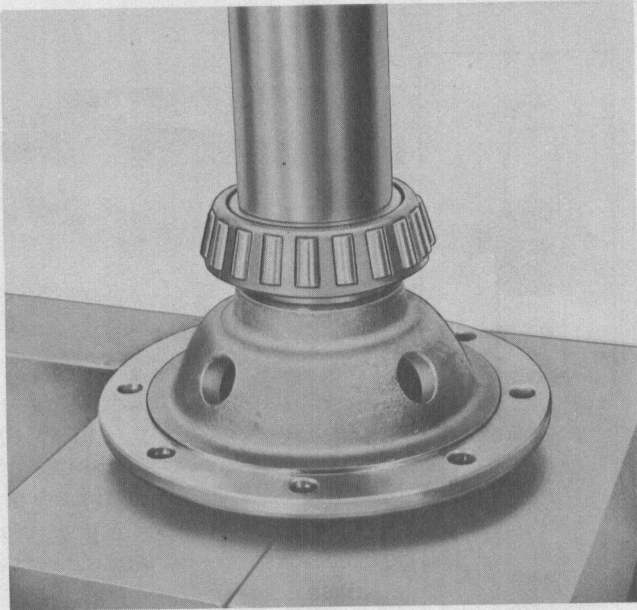
A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.†

After correct tooth contact has been established, install adjusting nut locks and cap screws. Tighten cap screws and lock wire to bearing cap screws.

*In Rockwell-Standard hypoid gearing, the actual backlash changes .008" for each .010" movement of the gear. In Rockwell-Standard spiral bevel gearing, the actual backlash changes .007" for each .010" movement of the gear.

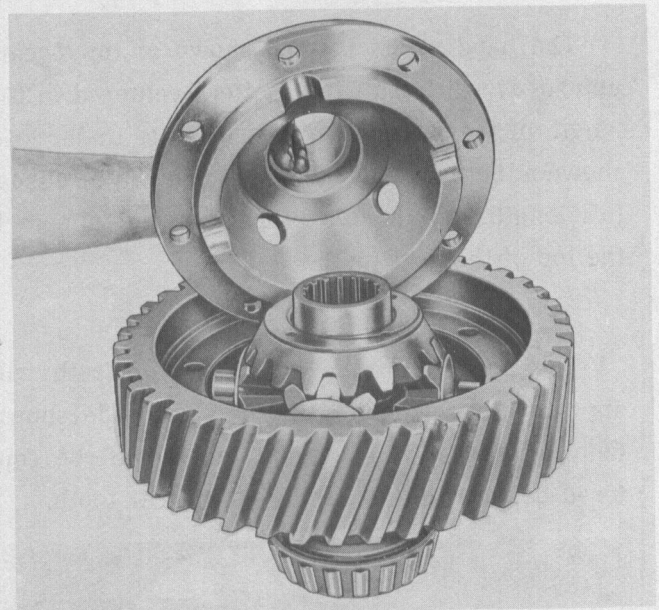
†For further detailed information refer to SAE Paper SP-228, Section 2, by W. A. Johnson and R. F. Cornish.

ASSEMBLE AND INSTALL AXLE DIFFERENTIAL

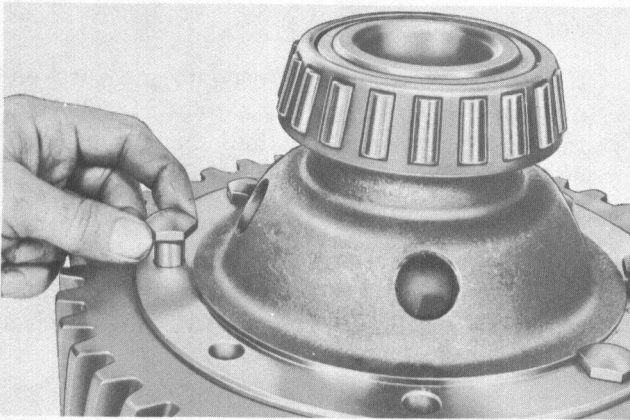


A. Press differential bearings firmly against case shoulders. Coat inside of case and all differential parts with specified rear axle lubricant.

B. Assemble differential case half and gear. Install side gear thrust washers, side gears and differential pinion gears, thrust washers and spider.

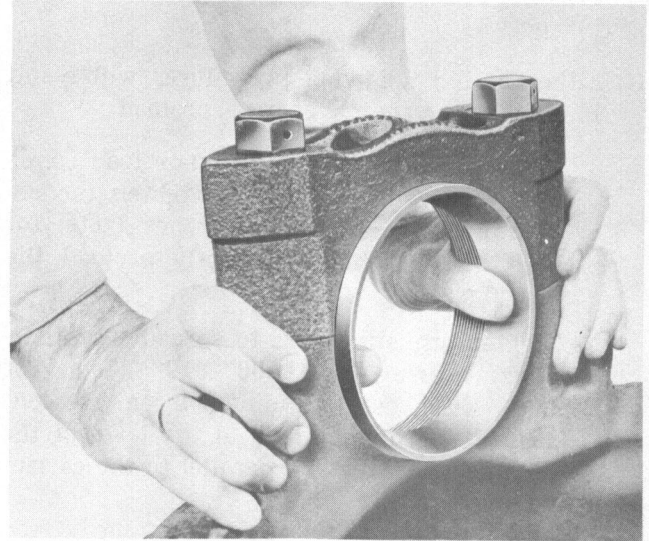


C. Note case alignment marks and assemble opposite case half. Hold assembly together with 4 bolts and nuts and check for free rotation of parts.



INSTALLATION OF BEARING CUPS IN CARRIER LEG BORES

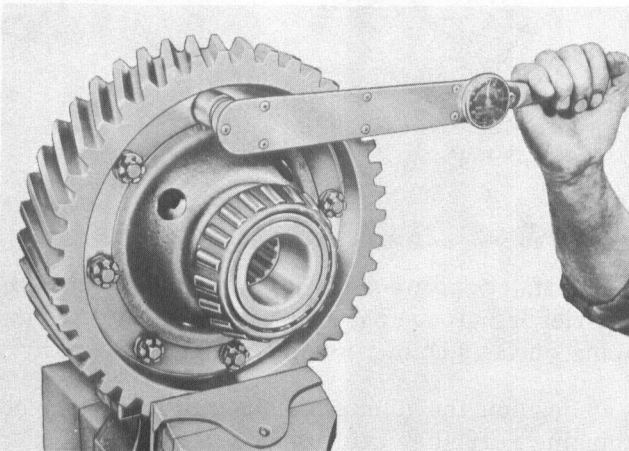
- A. Temporarily install the bearing cups, threaded adjusting rings where employed and bearing caps. Tighten the cap screws to the proper torque.



- D. Install remaining differential case bolts so heads are locked by machined relief in case half. Be sure case halves are assembled to gear so there is adequate nut clearance. Check clearance in carrier before completing assembly.

When a new gear or a new differential case is installed the case holes must be line reamed with the gear in order to assemble the parts using the correct size rivets or bolts. Align the case halves and hold case and gear assembly together with 4 bolts and nuts. Line ream the holes. Thoroughly clean the parts before assembly.

Hold differential case assembly together with 4 bolts when riveting the parts together. Use a rivet set that will shape the formed head $\frac{1}{8}$ " larger in diameter than the rivet hole. The formed head height should not be more than $\frac{1}{16}$ " lower than the preformed head. A lower formed head indicates high riveting pressures that may distort the case and cause gear eccentricity.



- E. Tighten bolt nuts to specified torque and lock wire or cotter in place.

- 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 types of carrier leg bores.

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

- A. Inspect carrier legs and bearing caps to be sure they are properly relieved at I.D. parting line.
- B. Apply specified axle lubricant to bearing cups and cones. Position cups over cones and install assembly in carrier.
- C. Insert differential bearing adjusting nuts and turn hand tight against bearing cups.
- D. Position bearing caps in place over bearing cups and adjusting nuts, making sure they are properly aligned.

Caution: If bearing caps do not seat easily and correctly, the adjusting nuts may be cross threaded. Forcing caps in place will result in irreparable damage to the differential carrier and caps.

- E. Install and tighten the stud nuts or cap screws to specified torque noted in "Tabulation of Torque Limits" at back of Manual.
- F. Alternately loosen one adjusting nut and tighten the opposite adjusting nut while turning the differential assembly to assure normal bearing contact and to keep bearing cups straight in the bores.
- G. Either of the following procedures will result in proper differential bearing preload:
 1. Establish a zero end play; no-preload condition with a dial indicator. Tighten the adjusting nuts $1\frac{3}{4}$ to $2\frac{1}{2}$ notches (total for both nuts) tight to correctly preload the bearings; or:
 2. Tighten adjusting nuts to spread the differential bearing legs .006"-.010" (total for both legs) as determined by a crescent shaped micrometer held at the level of the leg pilot surfaces and parallel to the carrier mounting flange.
- H. Install adjusting nut locks and cap screws. Tighten to specified torque.
- I. Lock all parts in place with soft iron 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:

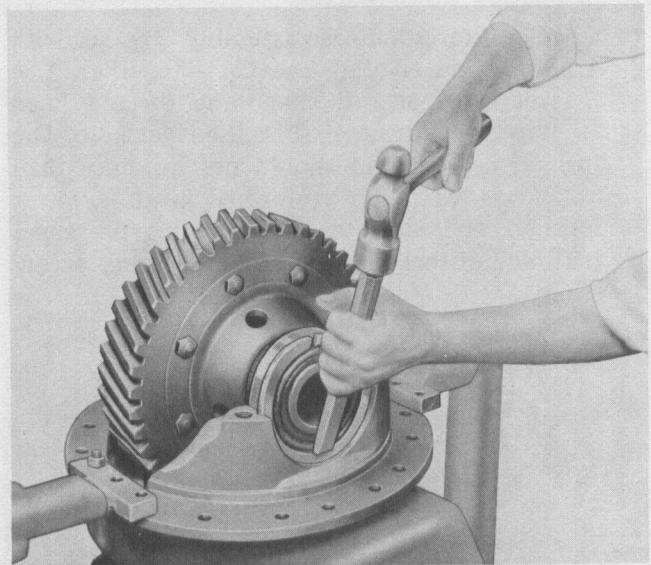
If temporary thin rings used to measure end play were .290" each for a total of .580" and the end play is .005", then .580" plus .005" end play equals .585" (or zero end play).

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. It should be understood that the .017" to .022" interference of which we speak is *not* bearing preload torque but that it is the amount of *interference required* to establish bearing preload torque within the desirable limits.

COMPLETE ASSEMBLY AS FOLLOWS:

Insert one split ring in carrier leg groove. Move differential assembly over so that face of bearing cup is held tightly against inserted ring. Rings should be positioned in carrier leg grooves so that split portion will locate in center of cap.



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

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

Install carrier leg cap screws and tighten to specified torque.

COMPLETE DRIVE UNIT ASSEMBLY

- A. Apply non-hardening sealer to gaskets under stamped cover and threaded inspection hole plug. Apply sealer to threads of all plugs. Install plugs and tighten securely. Lock thru-shaft chamber plug with soft iron wire.
- B. Assemble yokes and flanges, tighten nuts to specified torque.
- C. Check flange runout. If runout exceeds .005" total indicator reading, replace flange.

CORRECT ADJUSTMENT OF DIFFERENTIAL EXTENSION NUTS

The drive units of some of the larger capacity axles are equipped with adjusting extension nuts 2, Fig. 1, which screw into the differential bearing adjusting nuts.

The extension nuts should be adjusted to maintain a minimum of $\frac{1}{16}$ " and a maximum of $\frac{1}{8}$ " clearance at the inner end of the axle housing sleeve 1, Fig. 1.

Proper installation of the adjusting extension nuts will be obtained by the following procedure:

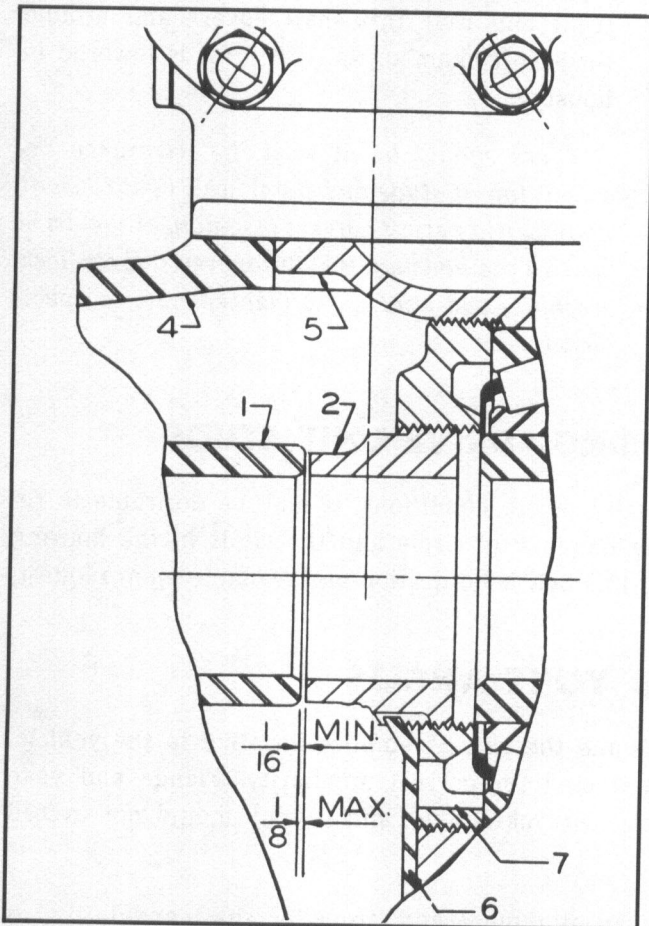


Figure 1

- A. Screw the adjusting extension nut 2, Fig. 1, into the differential bearing adjusting nut 7, Fig. 1.

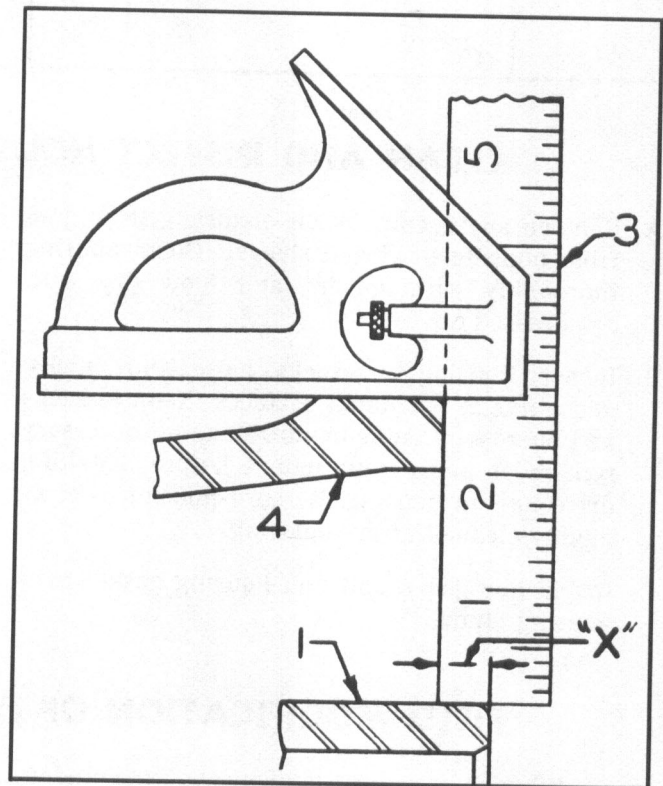


Figure 2

- B. Hold a machinist square firmly against the axle housing flange 4, Fig. 2, directly over the sleeve 1, Fig. 2. Adjust the scale of the square so it will almost contact the top of sleeve. Measure the distance "X", Fig. 2, and record it.
- C. Adjust the scale of the square as shown in Fig. 3. Hold square firmly against drive unit flange, 5, as illustrated. Measure the distance "Y", and record it.

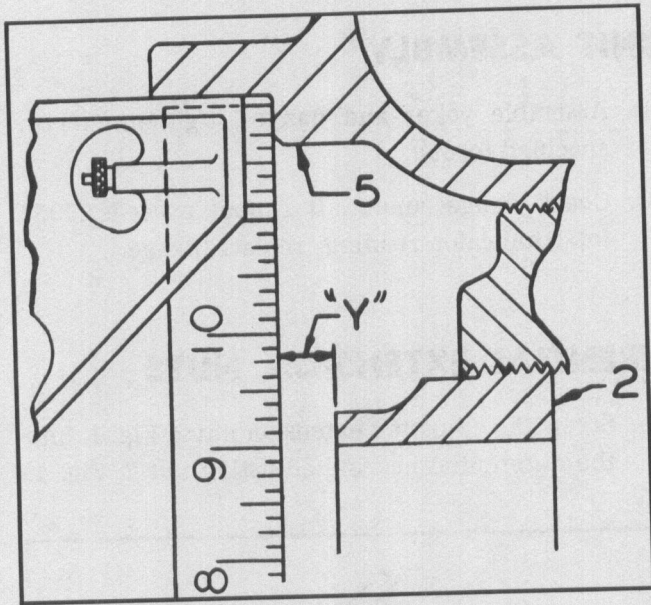


Figure 3

CLEAN AND INSPECT HOUSING, ASSEMBLE DRIVE UNIT

- Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.
- 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. Be sure housing is thoroughly cleaned after repairing.
- Install new drive unit and housing gasket over housing studs.

- The distance "Y" should be $\frac{1}{16}$ " to $\frac{1}{8}$ " greater than the distance "X" when nut is correctly adjusted and drive unit installed in the axle housing. This operation must be completed at each side of the drive unit prior to installation in the axle housing.

For example: Suppose distance "X" equals $\frac{9}{16}$ ". The extension nut should be screwed into adjusting nut until the distance "Y" is $\frac{5}{8}$ " to $\frac{11}{16}$ ".

- Carefully assemble drive unit in housing, installing lock washers and nuts on studs under front and rear thru-shaft covers and around thru-shaft chamber as drive unit is lowered in housing.

There should be at least $\frac{3}{16}$ " clearance between top of studs and outer wall of thru-shaft chamber to permit correct assembly of the drive unit in the housing. Install tapered dowels, lock washers, and stud nuts. Tighten nuts to specified torque.

FIELD MODIFICATION OF HOUSING—DRIVE UNIT STUDS

When heavy duty tandems operate under unusually severe conditions, it may be desirable to replace the $\frac{1}{2}$ " studs in the housing—drive unit mounting flange stud circle and the studs in the housing shelf with larger studs. Detailed instructions for making this field modification are available upon request.

CHECK FLANGE AND YOKE ANGLES

After the drive units are secured to the housings and the axle assemblies installed in the vehicle, the thru-shaft universal flanges and yokes should be inspected for correct angularity. Flange and yoke angles must be within 1° of the main transmission flange or yoke angle, and runout should not exceed .005" total indicator reading.

Further details giving optimum standards of flange alignment and propeller shaft angularity, as well as details of field methods of checking and correcting flange angles, are available upon request.

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.

NEW AND RECONDITIONED AXLE SERVICE

The original rear axle lubricant should be drained at the end of the driveaway prior to putting the vehicle in regular service, or before the maximum of 3,000 miles. 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. Put an

additional 2 U. S. pints of specified lubricant in the inter-axle differential housing.

REGULAR AXLE SERVICE

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

Some newer model axles have a 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.

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.

TIRES

Measure the rolling radii of all tires. The tires of all wheels must be matched to within $\frac{1}{8}$ " of the same rolling radius ($\frac{3}{4}$ " of the same rolling circumference). The 4 largest tires should not be installed on one driving axle and the four smallest tires on the other driving axle of thru-drive type tandems. Such tire mounting will cause 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.

HOW TO MATCH TANDEM TIRES

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.

- A. Inflate all tires to the same pressure.
- B. Carefully measure the rolling circumference of each tire with a steel tape.
- C. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
- D. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
- E. Mount the four other tires on the other axle in the same manner.
- F. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
- G. Vary tire air pressure within the tire manufacturer's recommended range, so the lubricant temperatures of both axles are 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.

Refer to Field Maintenance Manual No. 11, "Tandem Hook-ups," for additional information which applies to tandem assemblies.

TABULATION OF TORQUE LIMITS

CAP SCREWS									
LOCATION	DIAM-ETER	NO. THREADS	TORQUE—LB. FT.		NO. THREADS	TORQUE—LB. FT.		DIAM-ETER	NO. THREADS
			MIN.	MAX.		MIN.	MAX.		
Differential Bearing Adjusting Nut Lock	5/16"	18	4	6	18	39	42	5/16"	18
Cross Shaft Bearing Lock	3/8"	24	39	42	20	102	105	1/2"	13
Inter-Axle Differential Shift Unit Housing	3/8"	24	39	42	20	102	105	7/16"	14
Pinion, Thru-Shaft and Cross Shaft Bearing Cages and Covers and Inter-Axle Differential Housings	7/16"	20	61	66	20	80	85	1/2"	14
Carrier to Housing	1/2"	20	92	102	20	102	105	7/16"	14
Axle Differential Case Bolt	1/2"	20	92	102	20	102	105	3/8"	16
Inter-Axle Differential Shift Shaft Nut	1/2"	20	92	102	20	102	105	1/2"	16
Inter-Axle Differential Case Bolt Nut	1/2"	20	92	102	20	102	105	5/8"	18
Inter-Axle Differential Shift Housing	7/16"	20	61	66	20	80	85	3/4"	18
Shift Fork Adjusting Screw Lock Nut	1/2"	20	40	55	20	1100	1100	1/2"	18
Shift Fork Set Screw Lock Nut	3/8"	24	30	33	24	1100	1100	3/8"	24
Pinion Shaft, Thru-Shaft and Inter-Axle Differential Case Shaft	1"	20	300	400	20	1200	1200	1"	20
Pinion Bearing Adjusting and Lock Nut	1 1/4"	18	700	900	18	1100	1100	1 1/4"	18
	1 1/2"	18	800	1100	18	1100	1100	1 1/2"	18
	1 1/2"	12	800	1100	12	1100	1100	1 1/2"	12
	1 3/4"	12	800	1100	12	1100	1100	1 3/4"	12
	3 3/8"	12	1000	1200	12	1200	1200	3 3/8"	12

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

(Later Axle Models Employing Hardened Washers)

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

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.