SECTION 9

STEERING

CONTENTS OF THIS SECTION

STANDARD STEERING

INDEX

GENERAL DESCRIPTION

The steering gear is of the recirculating ball type. This gear ovides for ease of handling by transmitting forces from the ormshaft to the pitman shaft through the use of ball earings.

The steering column is connected to the steering gear by a exible coupling. This coupling (identical with the 1970 10-30 series truck coupling) incorporates a capturing strap hich is designed to prevent column-to-coupling deflection om exceeding the length of the coupling alignment pins.

The steering column is new for Chevy Van but is basically the same as the 1970 C10-30 series truck column. The one-piece steering shaft is flanged at the lower end for attachment to the new flexible coupling.

The 1971 Chevy Van incorporates "Forward Steering" whereas the steering linkage is located forward of the front crossmember. Steering effort is transmitted to left and right hand adjustable tie rods through a relay rod. The relay rod is connected to an idler arm on the right and to the pitman arm on the left.

MAINTENANCE AND ADJUSTMENTS

UBRICATION

eering Linkage

Every 6000 miles or four months, whichever occurs first, steering linkage should be lubricated with water resistant chassis lubricant which meets General Motors Specification l 6031M or its equivalent.

eering Gear

The steering gear is factory-filled with steering gear ricant. Seasonal change of this lubricant should not be formed and the housing should not be drained—no lubrica- is required for the life of the steering gear.

Every 36,000 miles, the gear should be inspected for seal kage (actual solid grease—not just oily film). If a seal is replaced or the gear is overhauled, the gear housing should be refilled with No. 1051052 (13 oz. container) Steering Gear Lubricant which meets GM Specification GM 4673M, or its equivalent.

NOTE: Do not use EP Chassis Lube, which meets GM Specification GM 6031M, to lubricate the gear. DO NOT OVER-FILL the gear housing.

ADJUSTMENTS

Steering Gear

Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, loose or hard steering and road shocks, a careful check should be made of

front end alignment, shock absorbers, wheel balance and tire pressure for possible cause.

Correct adjustment of steering gear is very important. While there are but two adjustments to be made, the following procedure must be followed step-by-step in the order given.

1. Disconnect the battery ground cable.
2. Remove the pitman arm to pitman shaft nut. Mark the relationship of the arm to the shaft and then remove the pitman arm using Tool J-6632 or J-5504 (fig. 1).
3. Remove the horn button cap.
4. Turn the steering wheel gently from stop to stop, carefully counting the total number of turns. Then turn the wheel back exactly half-way, to center position.

CAUTION: Do not turn the steering wheel hard against the stops with the pitman arm disconnected as damage to the ball guides may result.

5. Loosen the pitman shaft lash adjuster screw locknut and turn the adjuster screw a few turns in a counter-clockwise direction (fig. 2). This relieves the load imposed on the worm bearings by the close meshing of the ball nut and sector teeth.
6. Using an Inch Pound Torque Wrench and Socket on the steering wheel nut, measure the torque required to keep the wheel in motion. If the torque does not lie within the limits given in the Specifications Section, worm bearing preload adjustment is necessary.
7. To adjust the worm bearings, loosen the worm bearing adjuster locknut and turn the worm bearing adjuster (fig. 2) until there is no perceptible end play in the worm. Check the torque at the steering wheel, readjusting if necessary. Tighten the locknut and recheck the torque.

NOTE: If the gear feels "lumpy" after adjusting the worm bearings, there is probable bearing damage due to severe impact or improper adjustment—the gear must be disassembled for replacement of damaged parts.

8. After proper adjustment of worm bearing preload has been obtained, sector lash adjustment must be made.
   a. Check that all steering gear and side cover bolts are properly torqued.
   b. Turn the steering wheel from stop to stop, carefully counting the total number of turns. Turn the wheel back exactly half-way to center postion.
   c. Turn the lash adjuster screw clockwise to take out all lash in the steering gear ball nut and sector teeth, tighten the lock nut.
   d. Check the torque at the steering wheel, taking the highest reading as the wheel is turned through center position. Readjust if necessary to obtain proper torque (see Specifications Section at rear of this manual).

NOTE: If maximum specification is exceeded, turn lash adjuster screw counter-clockwise, then come up on adjustment by turning the adjuster in a clockwise motion.

9. Reassemble the pitman arm to pitman shaft, lining up the marks made at disassembly; torque the nut to specifications.

NOTE: The pitman arm to pitman shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

10. Install the horn button cap and connect the battery ground cable.

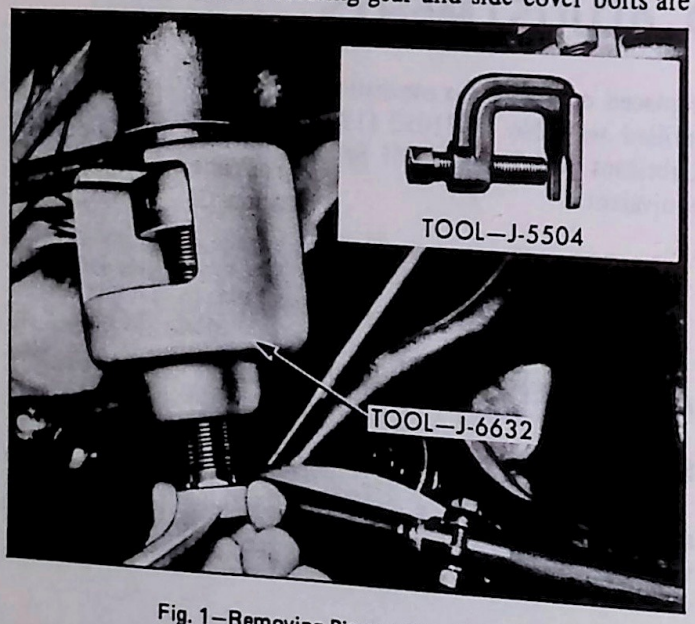

Fig. 1—Removing Pitman Arm (Typical)

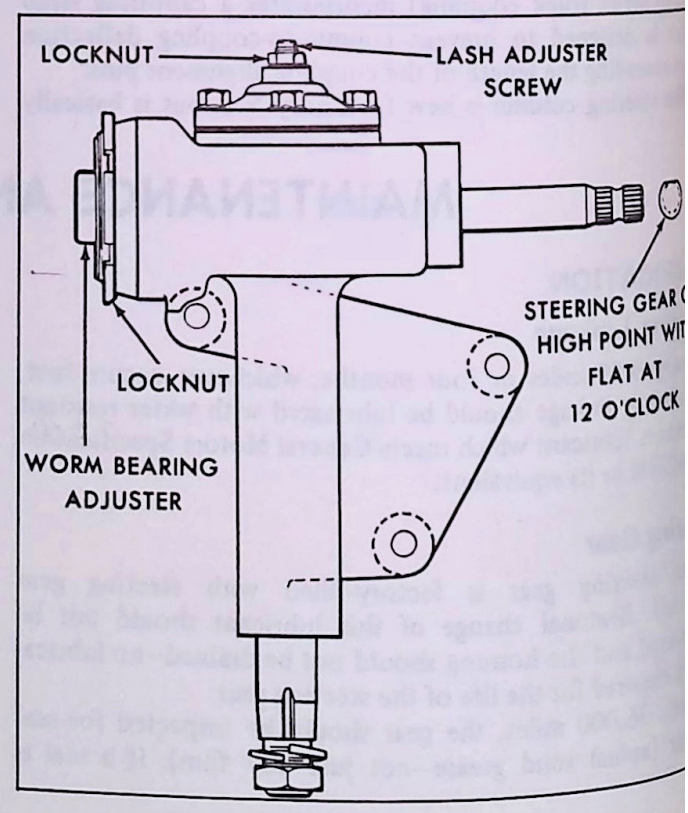

Fig. 2—Steering Gear Adjustment Points (Typical)

Steering Gear High Point Centering

1. Set front wheels in straight ahead position. This can be checked by driving vehicle a short distance on a flat surface to determine steering wheel position at which vehicle follows a straight path.
2. With front wheels set straight ahead, check position of the flat on the worm shaft and flexible coupling. This flat should be at the top side of the shaft at the 12 o'clock position and lined up with the flat in the coupling lower clamp.
2. If the gear has been moved off high point when setting wheels in straight ahead position, loosen adjusting sleeve clamps on both left and right hand tie rods, then turn both sleeves an equal number of turns in the same direction to bring gear back on high point.

CAUTION: Turning the sleeves an unequal number of turns or in different directions will disturb the toe-in setting of the wheels. The tie rod sleeve clamps must be positioned between the locating protrusions at each end of the sleeve. The clamp and sleeve openings must be aligned and facing forward (fig. 14).

NOTE: The tie rod adjusting sleeve clamp fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

4. Readjust toe-in as outlined in Section 3 (if necessary).

teering Wheel Alignment

NOTE: Check steering gear for high point centering before checking steering wheel alignment.

1. Set wheels in a straight ahead position by driving the vehicle a short distance.
2. Check the steering wheel position; if off more than one inch from horizontal (fig. 3), remove the steering wheel (see "Steering Wheel-Removal") and reposition.

NOTE: The steering wheel to steering shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

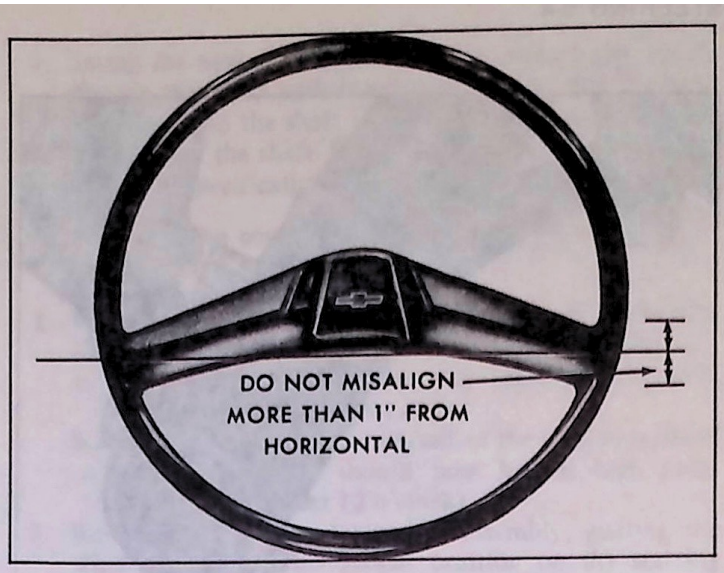

Fig. 3—Steering Wheel Alignment

Steering Column Lower Bearing Adjustment

1. Loosen clamp on steering shaft.
2. Adjust clamp to allow steering shaft end play indicated in Figure 4.
3. Tighten clamp bolt to specified torque.

Shifter Tube Adjustment

3-Speed Transmission

1. Loosen adjusting ring attaching screws and clamp bolt.
2. Rotate adjusting ring to give .005" end play between adjusting ring and first and reverse shifter lever (fig. 5).
3. Tighten attaching screws and clamp bolt.

Automatic Transmission

1. Place the shift tube lever in "neutral."
2. Loosen adjusting ring clamp screws and rotate the shift tube adjusting ring to obtain .33" to .36" clearance between the shift tube lever and adjusting ring (fig. 6).
3. Tighten the adjusting ring clamp screws to 70 in. lbs.

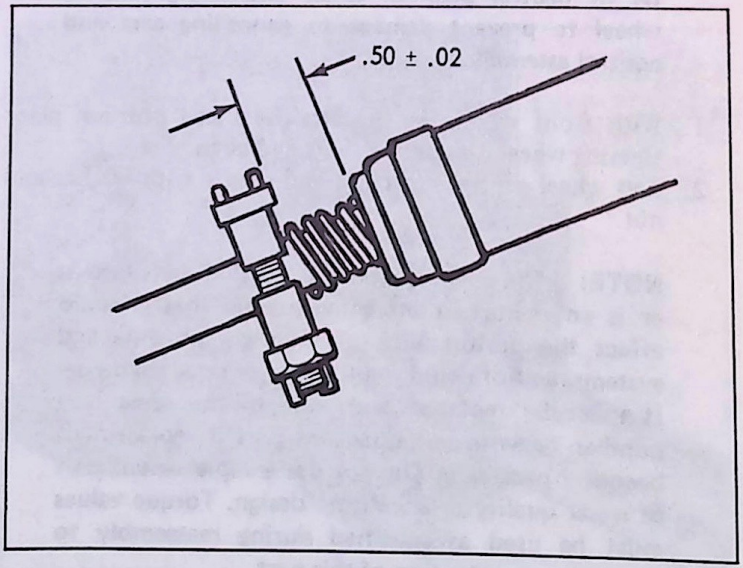

Fig. 4—Steering Column Lower Bearing Adjustment

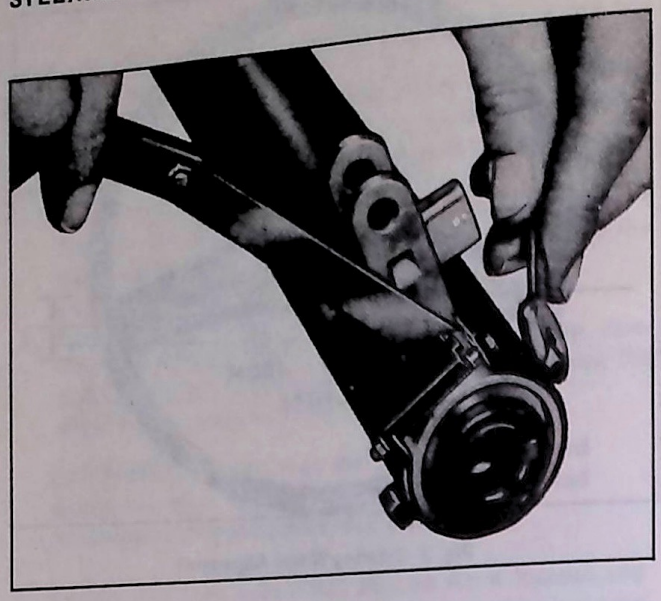

Fig. 5–Shift Tube Adjustment – 3-Speed Transmission

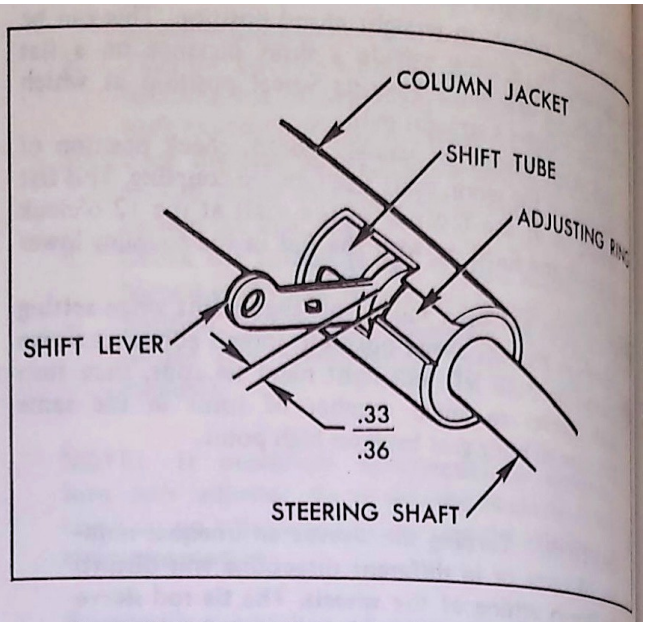

Fig. 6–Shift Tube Adjustment – Automatic Transmission

COMPONENT REPLACEMENT AND REPAIRS

STEERING WHEEL

Removal

1. Disconnect battery ground cable.
2. Remove horn button, receiving cup, belleville spring and bushing and mark steering wheel to steering shaft relationship.
3. Remove steering shaft nut and washer.
4. Use Tool J-2927 to remove wheel (fig. 7). It may be necessary to tap lightly on the bolt head of the tool with a hammer as it is turned down, to loosen tight steering wheels.

Installation

NOTE: Directional signal control assembly must be in neutral position when assembling steering wheel to prevent damage to cancelling cam and control assembly.

1. With front wheels in the straight ahead position place steering wheel on steering shaft and align.
2. Tap wheel gently into place and secure with washer and nut.

NOTE: The steering wheel to steering shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

3. Install belleville spring, receiving cup, bushings and attaching screws.
4. Install horn button assembly.
5. Connect battery ground cable.

STEERING COLUMN UPPER BEARING

Removal

1. Remove steering wheel as outlined in this section.
2. Remove directional signal cancelling cam.
3. Pry out upper bearing.

Installation

1. Replace all component parts in reverse order of removal making sure that directional signal switch is in neutral position before installing steering wheel.

NOTE: The steering wheel to steering shaft fastener is an important attaching part in that it could

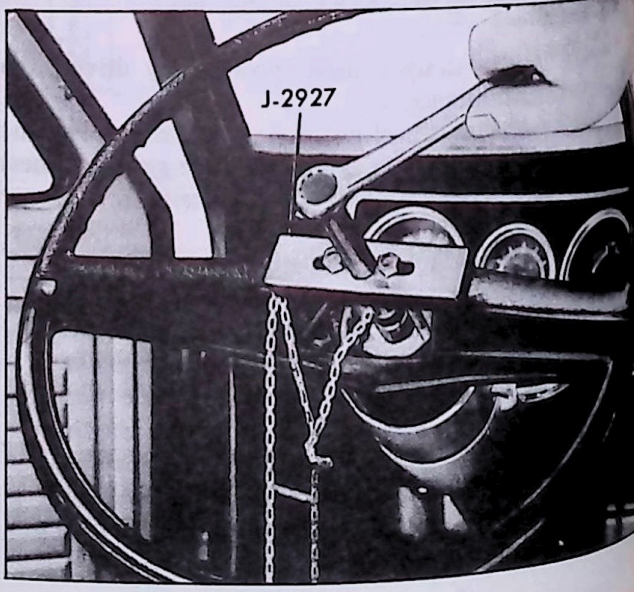

Fig. 7–Steering Wheel Removal

affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

STEERING GEAR AND/OR FLEXIBLE COUPLING

Removal

1. Disconnect the battery ground cable.
2. Set the wheels in a straight ahead position (wormshaft flat will be at 12 o'clock).
3. Remove the steering shaft flange to flexible coupling bolts.
4. Remove the pitman arm to pitman shaft nut. Mark the relationship of the arm to the shaft and then remove the arm from the shaft using Tool J-6632 or J-5504 (fig. 1).
5. Remove the steering gear to frame mounting bolts and remove the steering gear and flexible coupling as an assembly.
6. Remove the flexible coupling clamp bolt and remove the coupling from the wormshaft. It may be necessary to tap the coupling with a soft mallet to remove it from the splined wormshaft.

Installation

NOTE: The pitman arm to pitman shaft nut, steering gear to frame bolts and steering coupling to steering shaft and wormshaft fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

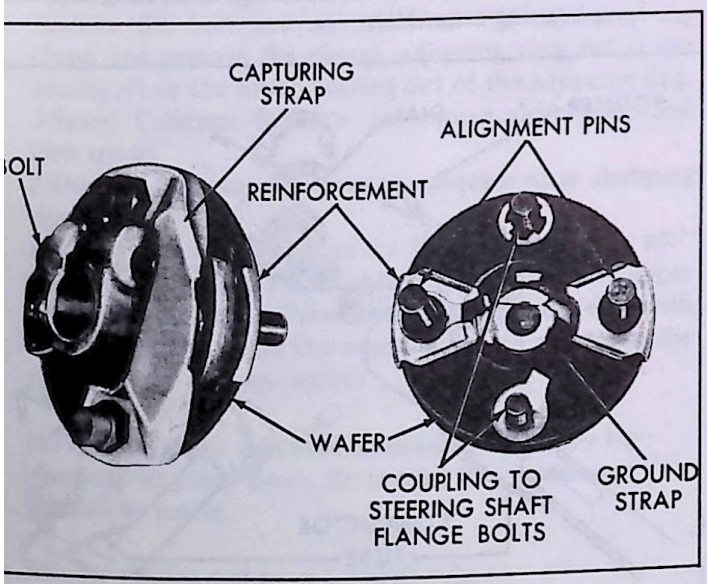

Fig. 8—Flexible Type Steering Coupling

1. Install the new coupling onto the wormshaft, aligning the flat on the shaft with the flat in the coupling. Push the coupling onto the shaft until the coupling reinforcement bottoms on the shaft. Install the coupling clamp bolt and torque to specifications (fig. 8).

   NOTE: The coupling bolt must pass through the shaft undercut.

2. When reinstalling the steering gear assembly, determine the correct mid-position of the wormshaft as follows:
   a. Turn the shaft all the way through its travel, counting the number of turns.
   b. Turn the shaft back one-half of the total number of turns. The gear should now be on high point (wormshaft flat at 12 o'clock).
3. Reinstall the gear and coupling assembly, guiding the alignment pins to the proper position on the steering shaft flange (large pin to large opening—small pin to small opening).

   NOTE: A new coupling incorporates plastic spacers on the alignment pins which aid in centering the pins in the flange openings and also serve to maintain the correct coupling to flange dimension (fig. 9). Be sure the spacers are fully installed on the pins.

4. Install the gear to frame bolts and torque to specifications.
5. Install the steering shaft flange to coupling bolts and torque to specifications.
6. Fashion a hook of heavy gauge wire and pull the plastic spacers away from the locking pins (fig. 9).

   CAUTION: Under no circumstances should the vehicle be driven until the plastic spacers have been removed from the alignment pins.

   NOTE: If plastic alignment pin spacers were not used, check that the flexible coupling to steering shaft flange dimension of .250" to .375" has been maintained. The coupling pins should be centered in the flange slots.

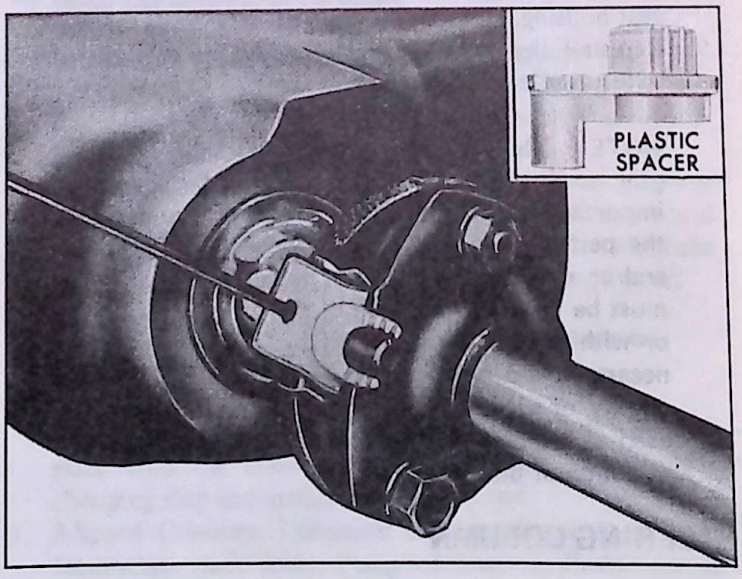

Fig. 9—Removal of Alignment Pin Spacers

7. Reassemble the pitman arm to the pitman shaft, lining up the marks made at disassembly; torque the nut to specifications.
8. Connect the battery ground cable.

PITMAN SHAFT SEAL

If pitman shaft seal leakage occurs, the steering gear must be completely removed from the vehicle to perform the replacement procedure.

Replacement

1. Remove the steering gear as outlined under "Steering Gear-Removal".
2. Loosen the lash adjuster locknut and turn the lash adjuster a few turns counter-clockwise.
3. Pull side cover and pitman shaft from gear housing as a unit. Do not separate side cover from pitman shaft.
4. Pry the pitman shaft seal from gear housing using a screw driver being careful not to damage housing bore.

CAUTION: Inspect the lubricant in the gear for contamination. If the lubricant is contaminated in any way, the gear must be completely overhauled as outlined in the 1970 Overhaul Manual–Section 9.

5. Coat the new seal with gear lubricant and install in the housing using a suitable size socket.
6. Pack as much new Steering Gear Lubricant (meeting GM Specification GM4673M) into the ends of the housing as it will hold without falling out the pitman shaft opening.
7. Place a piece of tape over the splined end of the pitman shaft and then lower the pitman shaft and side cover into the housing.

NOTE: Before the pitman shaft is all the way into the housing, more lubricant can be added in the center cavity. DO NOT OVER-FILL the gear housing.

8. Install a new side cover gasket, align the side cover on the gear housing, install and torque the side cover screws.
9. Reinstall the steering gear assembly as outlined under "Steering Gear–Installation".

NOTE: The pitman arm to pitman shaft, steering gear to frame and flexible coupling fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

STEERING COLUMN

Removal

1. Disconnect the battery ground cable.
2. Disconnect the transmission shifter rods at the column shift levers.
3. Remove the steering shaft flange to flexible coupling bolts.
4. From inside the vehicle, remove the screws from the toe pan seal and slide the seal up the column.
5. Remove the steering wheel as outlined under "Steering Wheel-Removal," and reinstall the shaft nut and washer.
6. **All Columns**–Disconnect the directional signal wiring harness.
   Automatic Columns–Disconnect the conductor tube (for transmission indicator) at the instrument panel (fig. 10).
7. Remove the cap screws from the column support bracket at the dash panel.
8. Carefully lower and then withdraw the column assembly, rotating so that the shift levers clear the toe pan opening.

Disassembly (Fig. 11)

1. Remove the steering wheel nut and flat washer and then slide the steering shaft assembly from the lower end of the column.
2. Remove the lower bearing preload spring and clamp from the steering shaft.
3. Drive out the shift lever pivot pin and remove the shift lever.
4. Remove the directional signal cancelling cam. Remove the directional signal switch lever.
5. Remove the column wiring harness cover.
6. Remove the directional signal switch screws.
7. Rotate the directional signal switch housing counter-clockwise and remove the housing from the column.

NOTE: The housing and switch cannot be fully removed from the column until the shift lever housing is removed.

8. Remove the plastic thrust washer assembly and then remove the shift lever housing from the column.
9. Separate the directional signal switch, switch control support assembly, directional signal housing and shift lever housing assemblies.

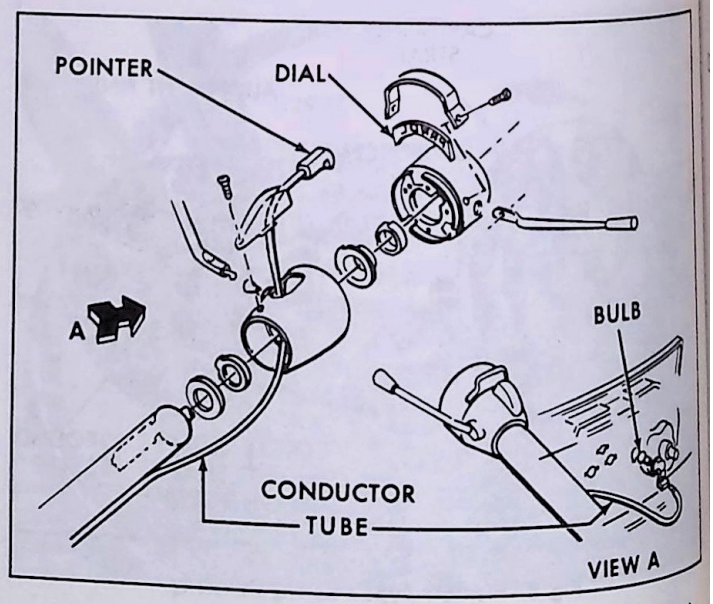

Fig. 10–Conductor Tube (Automatic Transmission Indicator Light)

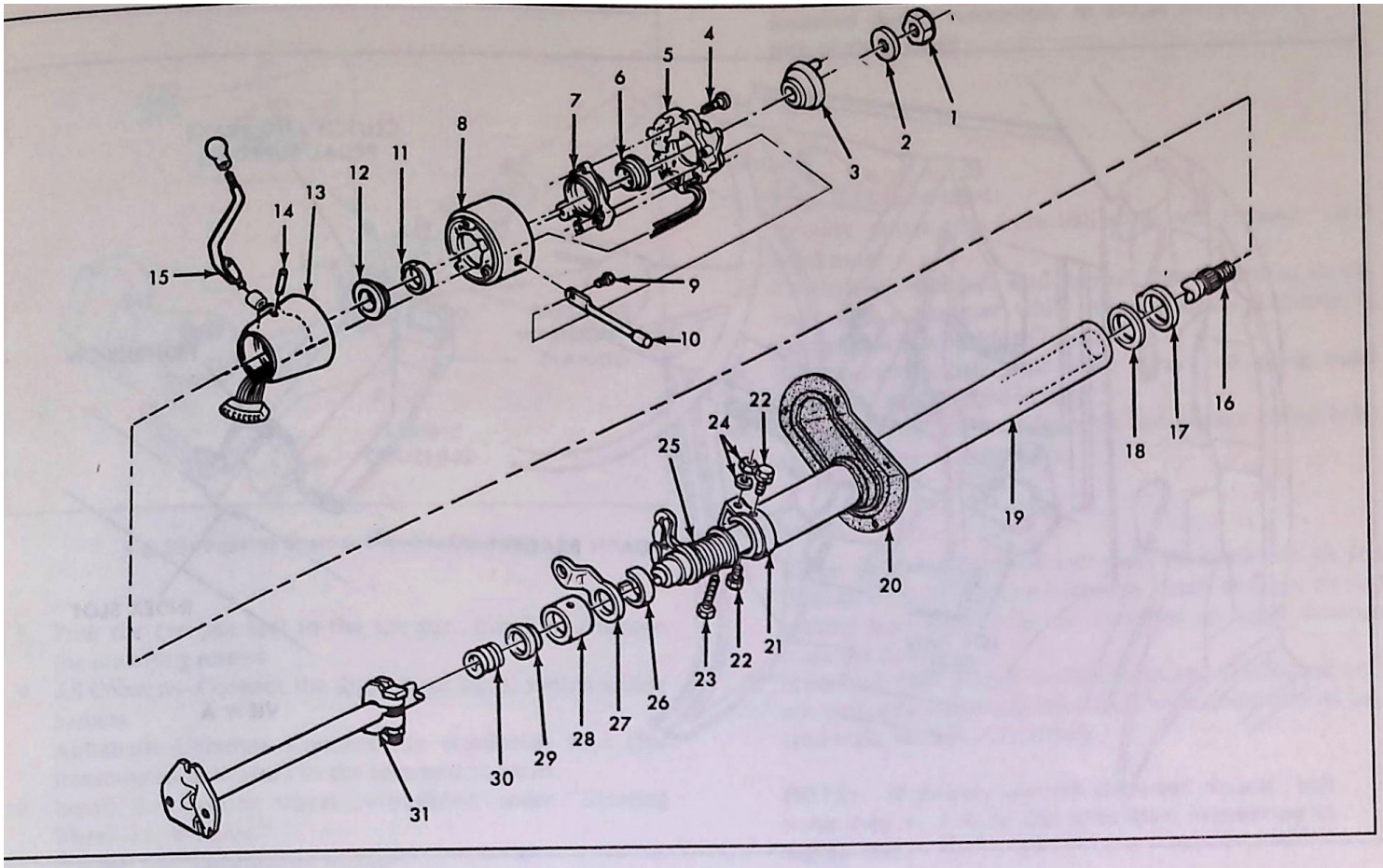

Fig. 11—Steering Column (3-Speed Transmission)—Explode

. Steering Shaft Nut
2. Flat Washer
3. Turn Signal Cancelling Cam
4. Turn Signal Switch Screw
5. Turn Signal Switch
6. Steering Shaft Upper Bearing
7. Switch Contact Support
8. Turn Signal Housing
9. Turn Signal Switch Lever Screw
10. Turn Signal Switch Lever
11. Rubber Ring
12. Plastic Thrust Washer
13. Shift Lever Housing
14. Shift Lever Pin
15. Shift Lever
16. Steering Shaft
17. Shift Lever Housing Bushing
18. Bushing Seat
19. Steering Column Jacket
20. Toe Pan Seal
21. Adjusting Ring Clamp
22. Adjusting Ring Clamp Screws
23. Adjusting Ring Clamp Bolt
24. Nut and Lockwasher
25. Shift Tube Assembly
26. Shift Lever Spacer
27. 1st-Reverse Shift Lever
28. Adjusting Ring
29. Shaft Lower Bearing
30. Lower Bearing Preload Spring
31. Preload Spring Clamp

0. Press the steering shaft upper bearing out of the switch contact support.
1. Remove the shift lever housing seat and bushing from the upper end of the column.
2. Remove the bolt and screws from the adjusting ring clamp and remove the clamp, adjusting ring and lower bearing. Press the lower bearing out of the adjusting ring.
3. **3-Speed Columns**–Remove 1st-reverse shift lever and lever spacer.
   Automatic Columns–Remove the selector plate clamping ring screws.
4. Place the column upright on the floor, supporting it with two pieces of wood. Place a block of wood on the upper end of the shift tube. Press down on the shift lever with foot while tapping on the wood block to withdraw the tube from the column jacket.

NOTE: In some tolerance stack-up cases it may be necessary to use a press. Be careful not to damage the tube or jacket.

5. Remove the felt seal from the shift tube.
6. Remove the toe pan seal from the column jacket.

Assembly

NOTE: In the following assembly sequence, use a general purpose lithium soap grease for lubricating those components so indicated.

1. Install the toe pan seal onto the column jacket.
2. Lubricate all bearing surfaces on the shift tube.
3. Place the felt seal onto the shift tube (next to spring) and then place the shift tube in the jacket.
4. **3–Speed Columns**–Temporarily install spacer, 1st-reverse shift lever and lower adjusting ring. Place a block of wood on top of the adjusting ring and tap until the shift tube bottoms. Remove adjusting ring, shift lever and spacer.

NOTE: The shift tube spring retainer must be bottomed against the jacket stops.

Automatic Columns–Align the three holes in the selector plate with the three holes in the jacket, position the clamping ring and install the three screws.

5. **3-Speed Columns**–Lubricate and install the spacer and 1st-reverse shift lever (tang of lever towards top of column).

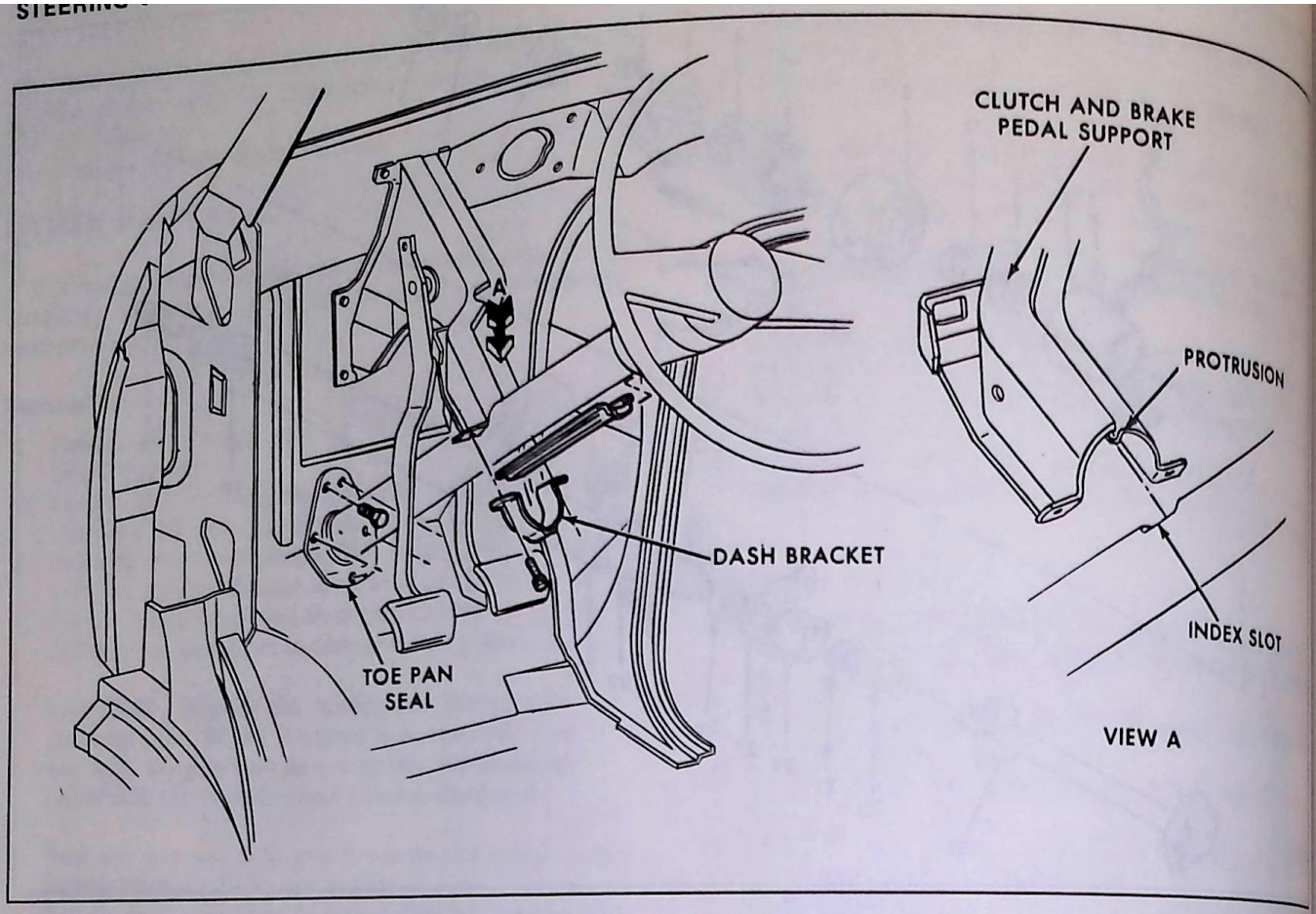

Fig. 12–Steering Column Mounting

6. Install lower bearing in the adjusting ring and then install the adjusting ring, clamp and screws.
7. Install the shift lever housing seat and bushing to upper end of housing.
8. Thread directional signal switch wiring harness through the switch and shift lever housings, lubricate the inner diameter of the shift housing, and then place the shift lever housing onto the upper end of the column.
9. Install the switch housing plastic washer assembly. Press the upper bearing into the switch contact support.
10. Install the directional signal switch housing, contact support, bearing and switch and torque the switch screws to 25 in. lbs.
11. Install the column wiring harness cover.
12. Install the directional signal and gearshift levers.
13. Adjust the shift tube as outlined under "Shifter Tube Adjustment."
14. Loosely install the lower bearing preload spring and clamp onto the steering shaft.
15. Slide the steering shaft assembly up through the column assembly. Install the directional signal cancelling cam, steering shaft nut and flat washer.

Installation–Mandatory Sequence

1. Adjust the column lower bearing preload by positioning the spring and clamp to maintain the dimension as shown in Figure 4.
2. Install the plastic spacers onto the flexible coupling alignment pins.
3. From inside the vehicle, carefully insert the lower end of the column through the toe pan opening, guiding the steering shaft flange onto the flexible coupling. Install and torque the flange to coupling bolts.

NOTE: The steering coupling to steering shaft fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

4. Locate the index slot in the column jacket with the protrusion on the clutch and brake pedal support (fig. 12).
5. Loosely install the column dash bracket and screws.
6. Push the column down until the steering shaft flange bottoms on the plastic spacers on the flexible coupling and then torque the dash bracket screws.
7. Remove the plastic spacers from the alignment pins using a wire hook (fig. 9). Check the rag joint to steering shaft flange clearance (fig. 13); if not within specifications, the dash bracket screws must be loosened and the column raised or lowered as required. Retorque the bracket screws.

CAUTION: The alignment pin plastic spacers must be removed before the vehicle can be driven.

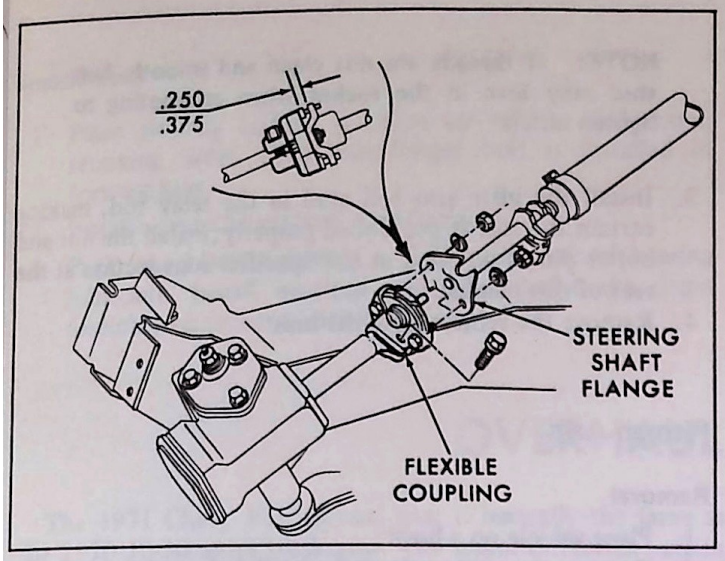

Fig. 13–Steering Shaft to Flexible Coupling

8. Push the toe pan seal to the toe pan, install and torque the mounting screws.
9. **All Columns**–Connect the directional signal switch wiring harness.
   Automatic Columns–Connect the conductor tube (for transmission indicator) to the instrument panel.
10. Install the steering wheel as outlined under "Steering Wheel–Installation."
11. Connect the transmission linkage.
12. Connect the battery ground cable.

STEERING LINKAGE (Fig. 14)

NOTE: All steering linkage fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

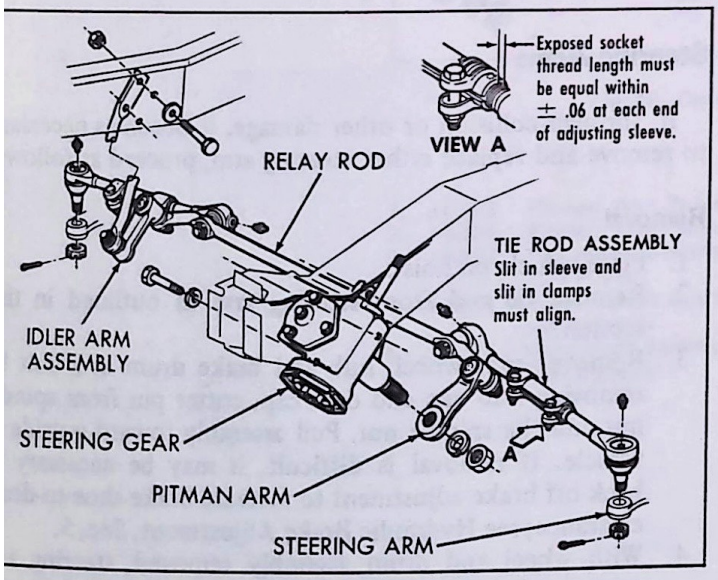

Fig. 14–Steering Linkage

Tie Rod

Removal

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts.
3. To remove outer ball stud, tap on steering arm at tie rod end with a hammer while using a heavy hammer or similar tool as a backing (fig. 15).
4. Remove inner ball stud from relay rod using same procedure as described in Step 3.
5. To remove tie rod ends from tie rod, loosen clamp bolts and unscrew end assemblies.

Installation

1. If the tie rod ends were removed, lubricate the tie rod threads with EP Chassis lube and install ends on tie rod making sure both ends are threaded an equal distance from the tie rod.
2. Make sure that threads on ball studs and in ball stud nuts are perfectly clean and smooth. Check condition of ball stud seals; replace if necessary.

   NOTE: If threads are not clean and smooth, ball studs may turn in tie rod ends when attempting to tighten nut.

3. Install ball studs in steering arms and relay rod.
4. Install ball stud nut, tighten and install new cotter pins; see Specifications Section at rear of manual. Lubricate tie rod ends.
5. Remove vehicle from hoist.
6. Adjust toe-in as described in Section 3.

   NOTE: Before locking clamp bolts on the rods, make sure that tie rod ends are in alignment with their ball studs (each ball joint is in the center of its travel). If the tie rod is not in alignment with the

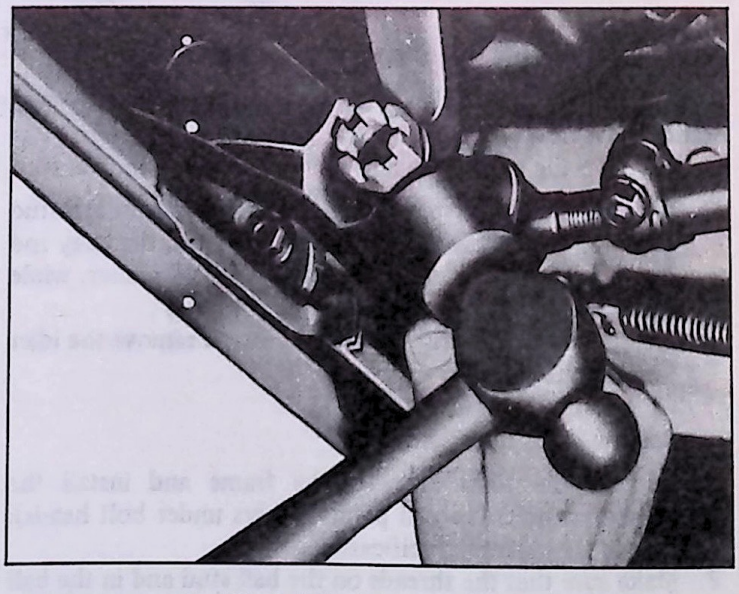

Fig. 15–Ball Stud Removal (Typical)

studs, binding will result. The slit in the tie rod must be in alignment with the slot in the clamp. The sleeve clamps must be positioned between the locating protrusions at each end of the sleeve.

Relay Rod

Removal

1. Place vehicle on hoist.
2. Remove inner ends of the tie rods from relay rod as described under "Tie Rod–Removal."
3. Remove the cotter pins from the pitman and idler arm ball studs at the relay rod. Remove the castellated nuts.
4. Remove the relay rod from the pitman and idler arms by tapping on the relay rod ball stud bosses with a hammer, while using a heavy hammer as a backing (fig. 15).
5. Remove the relay rod from the vehicle.

Installation

1. Make sure that threads on the ball studs and in the ball stud nuts are perfectly clean and smooth. Check condition of ball stud seals; replace if necessary.

   NOTE: If threads are not clean and smooth, ball studs may turn in sockets when attempting to tighten nut.

2. Install the relay rod to the idler arm and pitman arm ball studs, making certain the seals are in place. Install and torque the nut and then install the cotter pin (see Specifications Section for specific instructions).
3. Install the tie rods to the relay rod as previously described under "Tie Rod–Installation." Lubricate the tie rod ends.
4. Remove the vehicle from the hoist.
5. Adjust toe-in (see Section 3) and align steering wheel as described previously in this section under Steer-Wheel Alignment and High Point Centering.

Idler Arm

Removal

1. Place vehicle on a hoist.
2. Remove the cotter pin and castellated nut from ball stud at the relay rod. Remove the ball stud from the relay rod by tapping on the relay rod boss with a hammer, while using a heavy hammer as a backing (fig. 15).
3. Remove the idler arm to frame bolt and remove the idler arm assembly.

Installation

1. Postion the idler arm on the frame and install the mounting bolts (special plain washers under bolt heads); torque the nuts to specifications.
2. Make sure that the threads on the ball stud and in the ball stud nut are perfectly clean and smooth. Check condition of ball stud seal; replace if necessary.

   NOTE: If threads are not clean and smooth, ball stud may turn in the socket when attempting to tighten nut.

3. Install the idler arm ball stud in the relay rod, making certain the seal is positioned properly; install the nut and cotter pin as outlined in the Specifications section at the rear of this manual.
4. Remove the vehicle from the hoist.

Pitman Arm

Removal

1. Place vehicle on a hoist.
2. Remove the cotter pin and castellated nut from ball stud at the relay rod. Remove the ball stud from the relay rod by tapping on the relay rod boss with a hammer, while using a heavy hammer as a backing (fig. 15).
3. Remove the pitman arm to pitman shaft nut. Mark relationship of the arm to the shaft and then remove the pitman arm using Tool J-6632 or J-5504 (fig. 1).

Installation

1. Install the pitman arm on the pitman shaft, lining up the marks made upon removal. Install and torque the nut.
2. Make sure that the threads on the ball stud and in the ball stud nut are perfectly clean and smooth. Check condition of ball stud seal; replace if necessary.

   NOTE: If threads are not clean and smooth, ball stud may turn in the socket when attempting to tighten nut.

3. Install the pitman arm ball stud to the relay rod, making certain the seal is positioned properly; install the nut and cotter pin as outlined in the Specifications Section at the rear of this manual.
4. Remove the vehicle from the hoist.

Steering Arms

If, through collision or other damage, it becomes necessary to remove and replace either steering arm, proceed as follows:

Removal

1. Place vehicle on hoist.
2. Remove tie rod from steering arm as outlined in this section.
3. Remove front wheel, hub and brake drum as a unit by removing hub cap and dust cap, cotter pin from spindle nut and the spindle nut. Pull assembly toward outside of vehicle. If removal is difficult, it may be necessary to back off brake adjustment to increase brake shoe-to-drum clearance; see Hydraulic Brake Adjustment, Sec. 5.
4. With wheel and drum assembly removed, steering arm retaining bolt heads are accessible and removal of steering arm from vehicle may be accomplished by removing retaining nuts.

Installation

1. Place steering arm in position on vehicle and install retaining bolts. Note that longer bolt is installed in forward hole.
2. Install nuts and torque to specifications.
3. Pack wheel bearings using a high quality wheel bearing lubricant. Install bearings and wheel-hub-brake drum assembly removed previously.
4. Install keyed washer and spindle nut. Proceed as outlined under "Front Wheel Bearings—Adjust" in Section 3.
5. Install tie rod stud in steering arm. Be sure that the dust cover is in place on ball stud.
6. Install castellated nut on ball stud, tighten to specifications and install cotter pin (see Specifications Section).
7. Remove vehicle from hoist.
8. Following directions given in Section 3 to check cornering wheel relationship and toe-in; correct as required.

OVERHAUL OPERATIONS

The 1971 Chevy Van manual gear is basically the same as the 1970 10-30 series truck gear. The major differences are in the outside configuration of the gear housing, a longer wormshaft, a longer pitman shaft and the use of two (2) bushings to support the longer pitman shaft.

To overhaul the 1971 Chevy Van gear, refer to the procedures outlined for the 10-30 series truck in the 1970 Chevrolet Overhaul Manual, Section 9, Pages 9-1 thru 9-8. The two pitman shaft bushings are replaced as outlined for Corvette on Page 9-4 of the same manual.

SPECIAL TOOLS

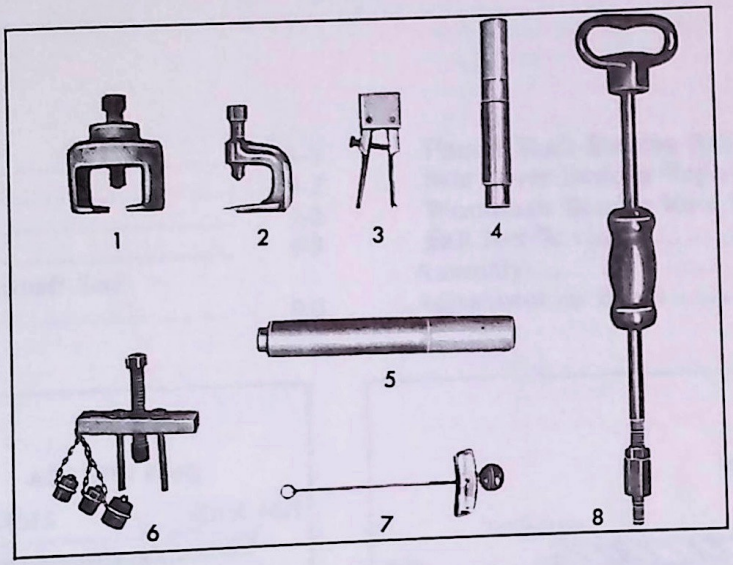

Fig. 16—Chevy Van Special Tools

1.	J-6632	Pitman Arm Puller	6.	J-2927	Steering Wheel Puller
2.	J-5504	Pitman Arm Puller	7.		In. Lb. Torque Wrench Ft. Lb. Torque Wrench
3.	J-5822	Wormshaft Bearing Cup Puller	8.	J-2619	Slide Hammer
4.	J-1614	Sector Shaft Bushing Remover			
5.	J-5755	Wormshaft Bearing Cup Installer			

SECTION 9

STEERING

CONTENTS OF THIS SECTION

MANUAL STEERING GEARS

INDEX

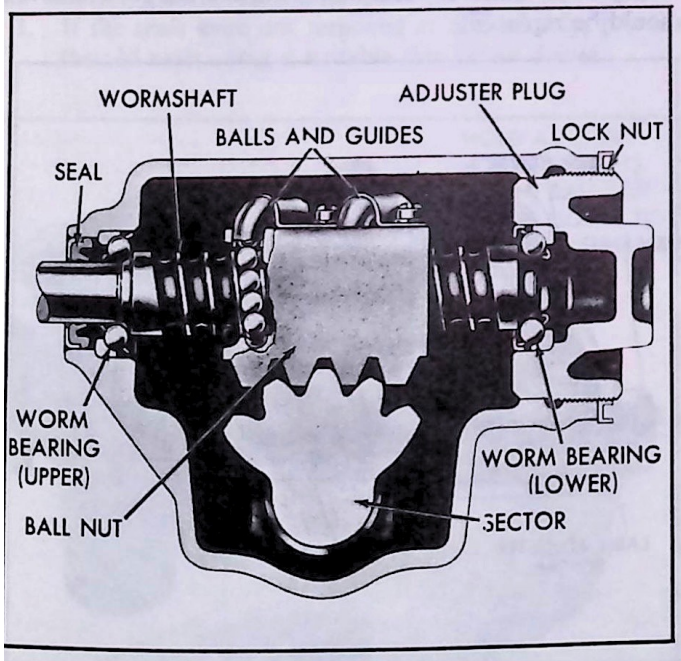

Fig. 1--Steering Gear (Except Corvette)

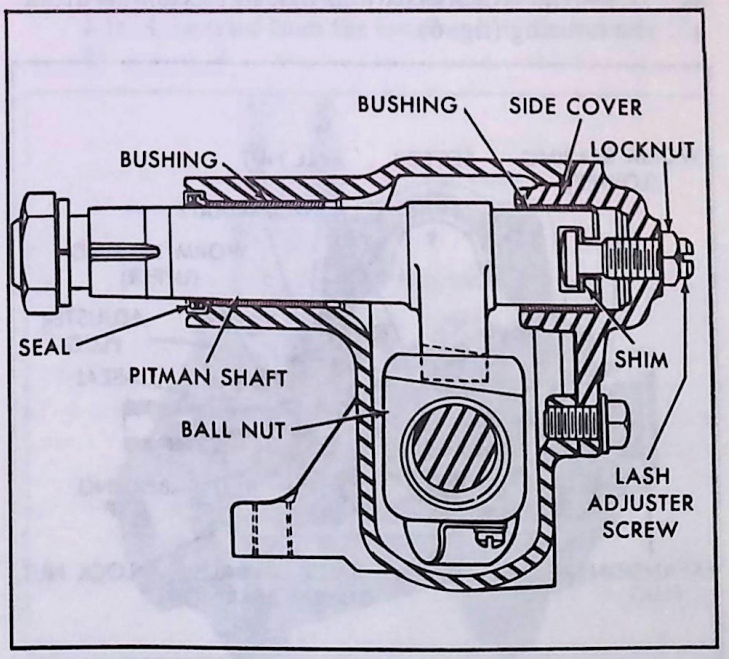

Fig. 2--Steering Gear (Except Corvette and G10-30 Series Trucks)

OVERHAUL OPERATIONS

Disassembly (Figs. 1 through 4)

As with any ball bearing unit the steering gear parts must be kept free of dirt. Clean paper or rags should be spread on the workbench before starting disassembly of the steering gear.

1. Place the steering gear in a vise, clamping onto one of the mounting tabs. The wormshaft should be in a horizontal position.
2. Rotate the wormshaft from stop to stop, counting the total number of turns. Then turn back exactly half way, placing the gear on center (the wormshaft flat should be at the 12 o'clock position).
3. Place a pan under the assembly to catch the lubricant and remove the three self locking bolts attaching the side cover to the housing.
4. Tap lightly on the end of the pitman shaft with a plastic hammer and lift the side cover and pitman shaft assembly from the gear housing (fig. 5).

NOTE: If the pitman shaft sector does not clear the opening in the housing easily, turn the wormshaft by hand until the sector will pass through the opening in the housing.

5. Remove the adjuster plug and locknut assembly (incorporates the lower wormshaft bearing and race on all except Corvette - upper wormshaft bearing race on Corvette).
6. Draw the wormshaft and ball nut assembly from the housing (fig. 6).

CAUTION: Use care that the ball nut does not run down to either end of the worm. Damage will be done to the ends of the ball guides if the nut is allowed to rotate until stopped at the end of the worm.

7. **All Except Corvette**–Remove the upper bearing from the wormshaft.
   Corvette– Remove lower bearing from inside the gear housing.
8. **All except Corvette**–Using a suitable size screw driver, pry the lower bearing retainer from the adjuster plug housing and remove the bearing (fig. 7).
9. Remove the locknut from the lash adjuster screw in the side cover. Remove the lash adjuster screw from the side cover by turning the screw clockwise. Slide the adjuster screw and shim out of the slot in the end of the pitman shaft.
10. Pry out and discard both the pitman shaft and wormshaft seals.

Inspection

With the steering gear completely disassembled, wash all parts in cleaning solvent. Dry them thoroughly with air. With a magnifying glass inspect the bearings and bearing races for signs of indentation. Also check for any signs of chipping or breakdown of the surface. Any parts that show signs of damage should be replaced

Inspect all seals. Any seal that is worn or has been removed should be replaced.

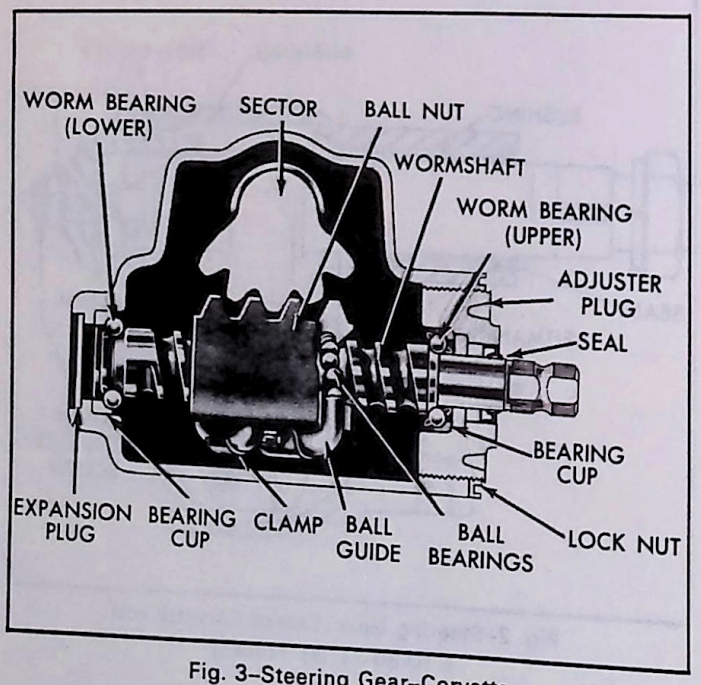

Fig. 3–Steering Gear–Corvette

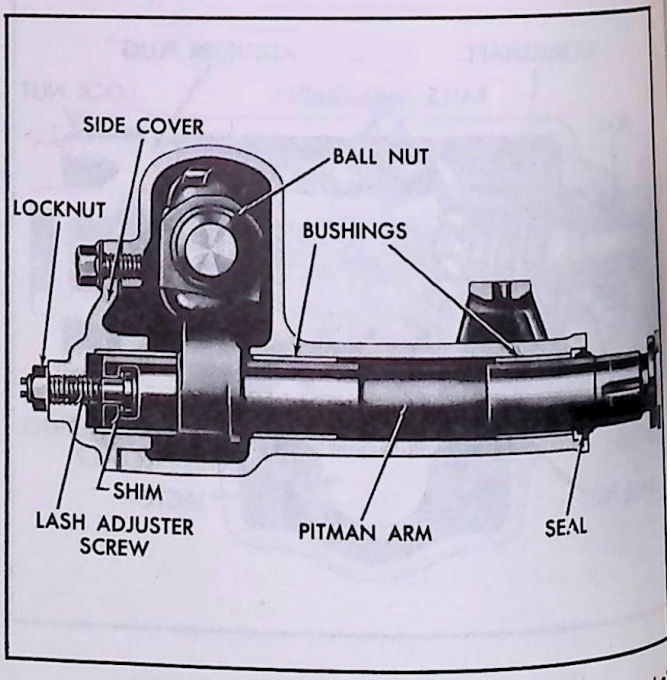

Fig. 4–Steering Gear (Corvette and G10-30 Series Trucks

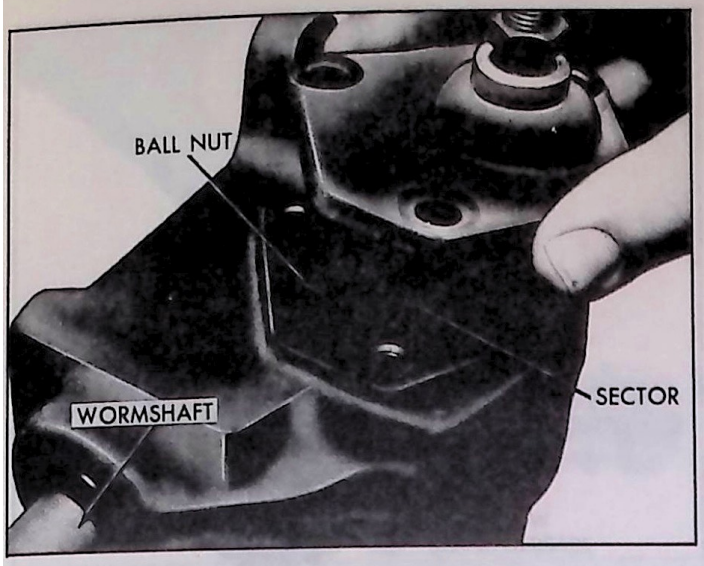

Fig. 5–Removing Pitman Shaft Assembly–Typical

Inspect the fit of the pitman shaft in its bushing in the side cover. If this bushing is worn, a new side cover and bushing assembly should be installed.

Check steering gear wormshaft assembly for being bent or damaged in any way. Never attempt to salvage steering parts by welding or straightening.

Repairs

Pitman Shaft and/or Wormshaft Seal Replacement

The double lipped pitman shaft and wormshaft seals should be replaced each time a defective seal is indicated or the steering gear is disassembled.

1. If the seals were not removed at disassembly, pry out the old seals using a suitable size screw driver.

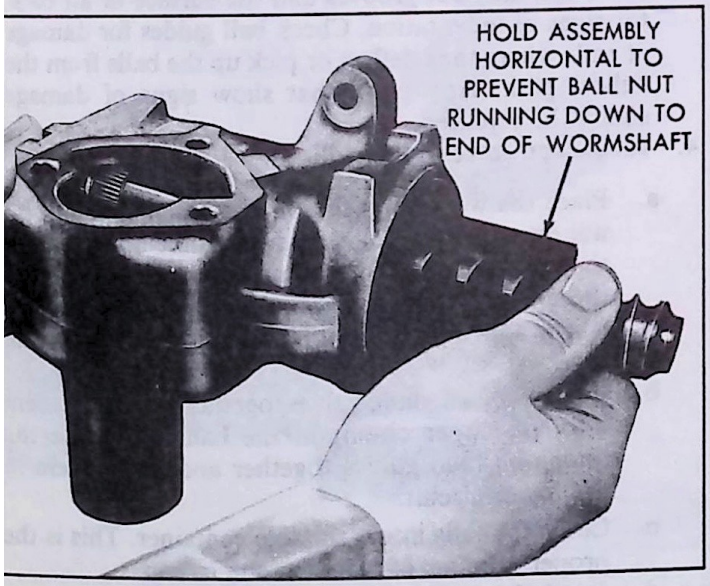

Fig. 6–Removing the Wormshaft and Ball Nut–Typical

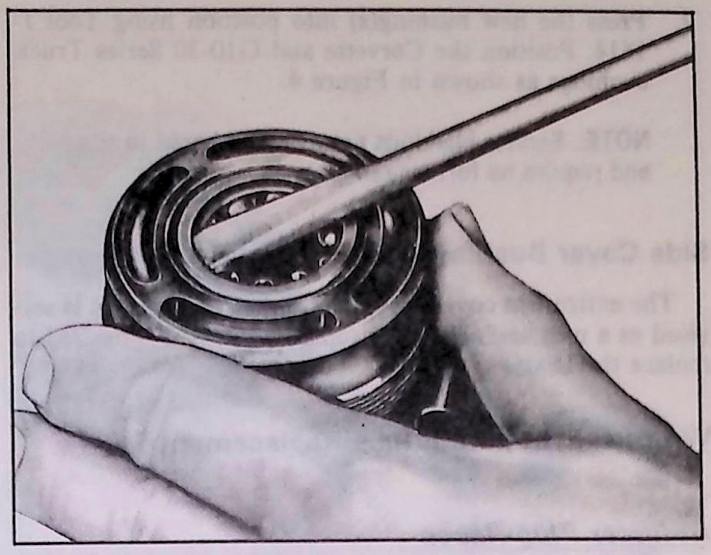

Fig. 7–Removing Lower Bearing Retainer–Except Corvette

CAUTION: Before installing new seals, check the condition of the pitman shaft bushing(s) and the upper wormshaft bearing race.

2. A suitable size socket, pressing on the outer diameter of the seal, may be used to install new seals.

NOTE: Care should be taken to insure that the new seals are not assembled in a cocked position.

Pitman Shaft Bushing Replacement

1. Support the steering gear housing in an arbor press and press the pitman shaft bushing (2 bushings on Corvette and G10-30 Series Trucks) from the housing using Tool J-1614, inserted from the lower end of the housing (fig. 8).

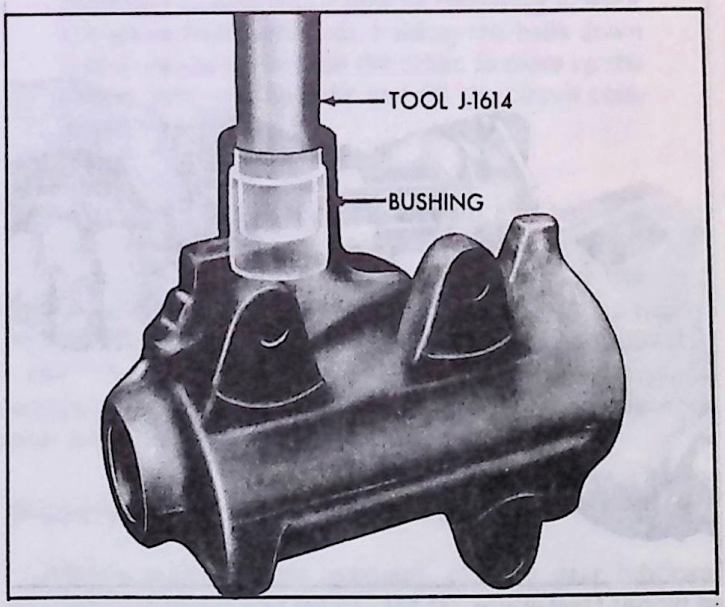

Fig. 8–Removing Pitman Shaft Bushing Using Tool J-1614–Typical

2. Press the new bushing(s) into position using Tool J-1614. Position the Corvette and G10-30 Series Truck bushings as shown in Figure 4.

NOTE: Service bushings are diamond bored to size and require no further reaming.

Side Cover Bushing Replacement

The entire side cover assembly, including bushing, is serviced as a unit and should be replaced when it is desired to replace the bushing.

Wormshaft Bearing Race Replacement

Adjuster Plug Races

1. **All Except Corvette-** Remove the wormshaft bearing race using Tool J-5822 and Slide Hammer J-2619 as shown in Figure 9.

   Corvette- Using a hammer and punch, drive the bearing race out of the adjuster plug.
2. Press the new bearing race into position using Tool J-5755.

Housing Races

1. **Corvette only-** Using a drift or punch (inserted into the housing from the adjuster plug end) drive the sheet metal expansion plug out of the lower end of the housing.
2. Using a drift or punch, drive the bearing race out of the housing.
3. Press the new bearing race into position using Tool J-5755 (fig. 10).
4. **Corvette only-** Install a new expansion plug into the lower end of the housing. Press on the center of the plug to deform it inward and secure it in the housing. Make sure the plug is tight or lubricant leakage could result.

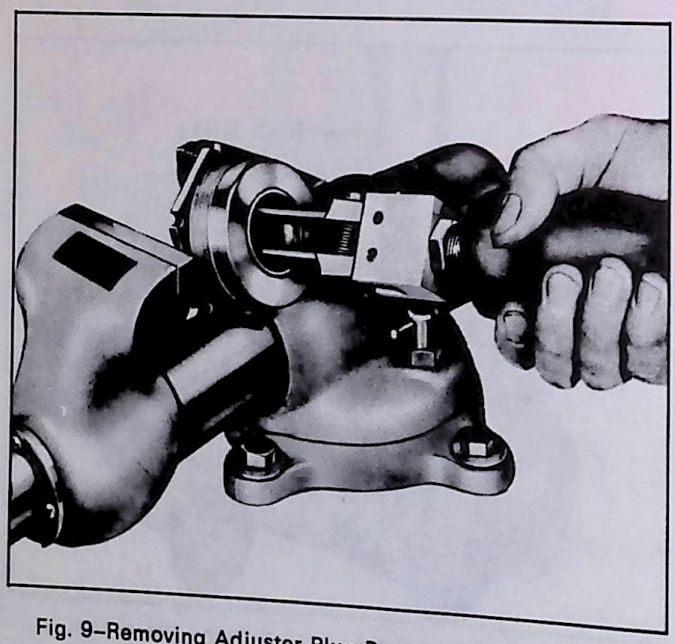

Fig. 9–Removing Adjuster Plug Bearing Race Using Tools J-5822 and J-2619

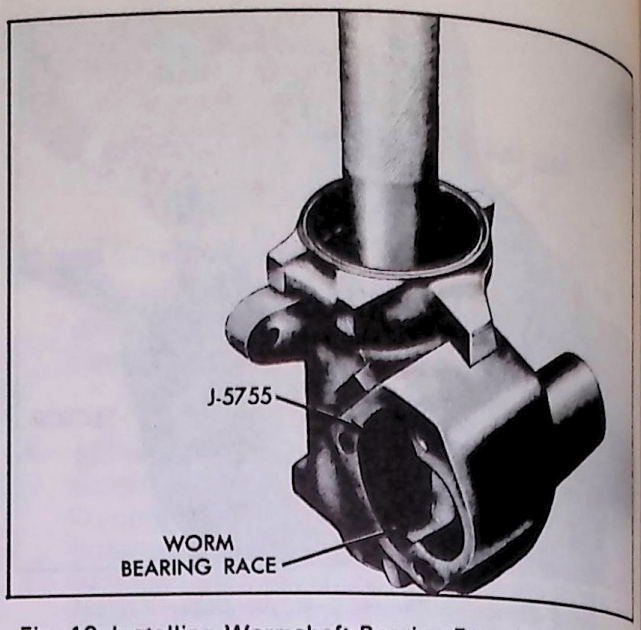

Fig. 10–Installing Wormshaft Bearing Race in Housing Using Tool J-5755–Typical

Ball Nut Servicing

As a rule, disassembly of the ball bearing nut will not be necessary if it is perfectly free with no indication of binding or tightness when rotated on the worm. However, if there is any indication of binding or tightness, the unit should be disassembled, cleaned and inspected as follows:

1. Remove screws and clamp retaining the ball guides in nut. Draw guides out of nut.
2. Turn the nut upside down and rotate the wormshaft back and forth until all the balls have dropped out of the nut into a clean pan. With the balls removed, the nut can be pulled endwise off the worm.
3. Wash all parts in cleaning solvent and dry them thoroughly with air. Using a magnifying glass inspect the worm and nut grooves and the surface of all balls for signs of indentation. Check ball guides for damage at ends where they deflect or pick up the balls from the helical path. Any parts that show signs of damage should be replaced.
4. **All Except Corvette (fig. 11):**

   a. Place the wormshaft flat on the bench and slip the nut over the worm with the ball guide holes up and the shallow end of the ball nut teeth to the left from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.

   b. Place two ball guide halves together and insert them into the upper circuit in the ball nut. Place the remaining two guides together and insert them in the lower circuit.

   c. Count 24 balls into a suitable container. This is the proper number of balls for one circuit.

   d. Load the balls into one of the guide holes while turning the wormshaft gradually away from that

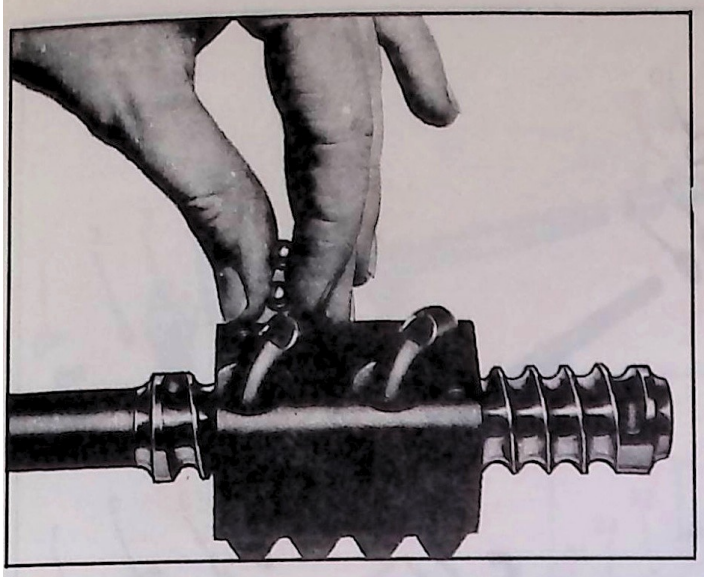

Fig. 11–Filling Ball Circuits–Except Corvette

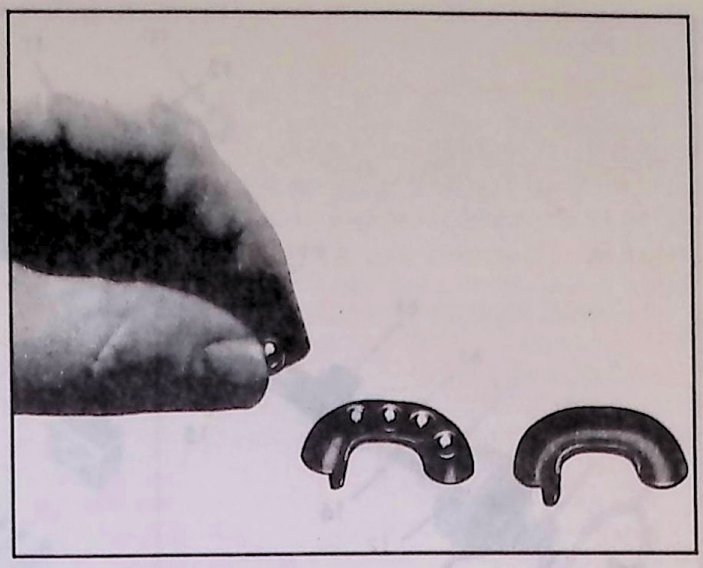

Fig. 13–Filling Ball Guides–Corvette

hole. When all of the balls have been installed, the circuit is complete.

e. Fill the remaining ball circuit in the same manner as described for the first circuit in Steps c and d above.

5. **Corvette only (figs. 12 and 13):**

a. Place the wormshaft flat on the bench and slip the nut over the worm with the ball guide holes up and the shallow end of the rack teeth to the left from the steering wheel position. Align the grooves in the worm and nut by sighting through the ball guide holes.

b. Count 27 balls into a suitable container. This is the proper number of balls for half the circuit. Place these balls into one of the guide holes while turning the worm gradually away from that hole.

c. Lay one-half of the ball guide, groove up, on the bench and place the remaining balls from the count container in it.

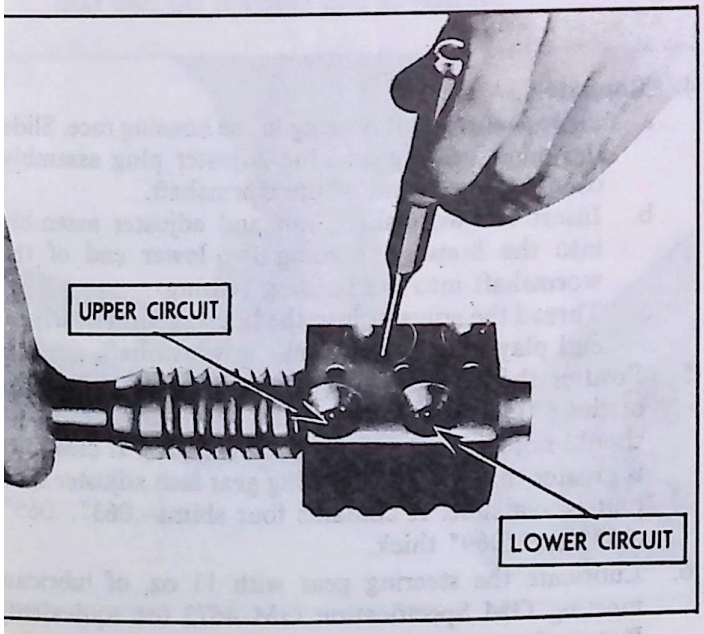

Fig. 12–Filling Ball Circuits–Corvette

d. Close this half of guide with the other half. Hold the two halves together and plug each open end with petroleum jelly so that balls will not drop out while installing the guide.

e. Push the guide into the guide holes of the nut. This completes one circuit of balls. If the guide does not push all the way down easily, tap it lightly into place with the wooden handle of a screw driver.

f. Fill the second ball circuit in the same manner. Continue until the ball circuit is full from the bottom of one guide hole to the bottom of the other or until stopped by reaching the end of the worm.

NOTE: In cases where the balls are stopped by the end of the worm, hold down those balls already dropped into the nut with the blunt end of a clean rod or punch (fig. 12) and turn the worm in the reverse direction a few turns. The filling of the circuit can then be continued. It may be necessary to work the worm back and forth, holding the balls down first in one hole and then the other, to close up the spaces between the balls and fill the circuit completely and solidly.

6. Assemble the ball guide clamp to the ball nut and tighten the screws to specified torque.

Check the assembly by rotating the nut on the worm to see that it moves freely. Do not rotate the nut to the end of the worm threads as this may damage the ball guides. If there is any "stickiness" in the motion of the nut, some slight damage to the ends of the ball guides or to other gear components may have been overlooked.

Assembly (Fig. 14 and 15)

After a major service overhaul, steering gear lubricant meeting GM Standard GM 4673M (or equivalent) should be applied to the pitman shaft and bearings, wormshaft and bearings and the ball nut teeth.

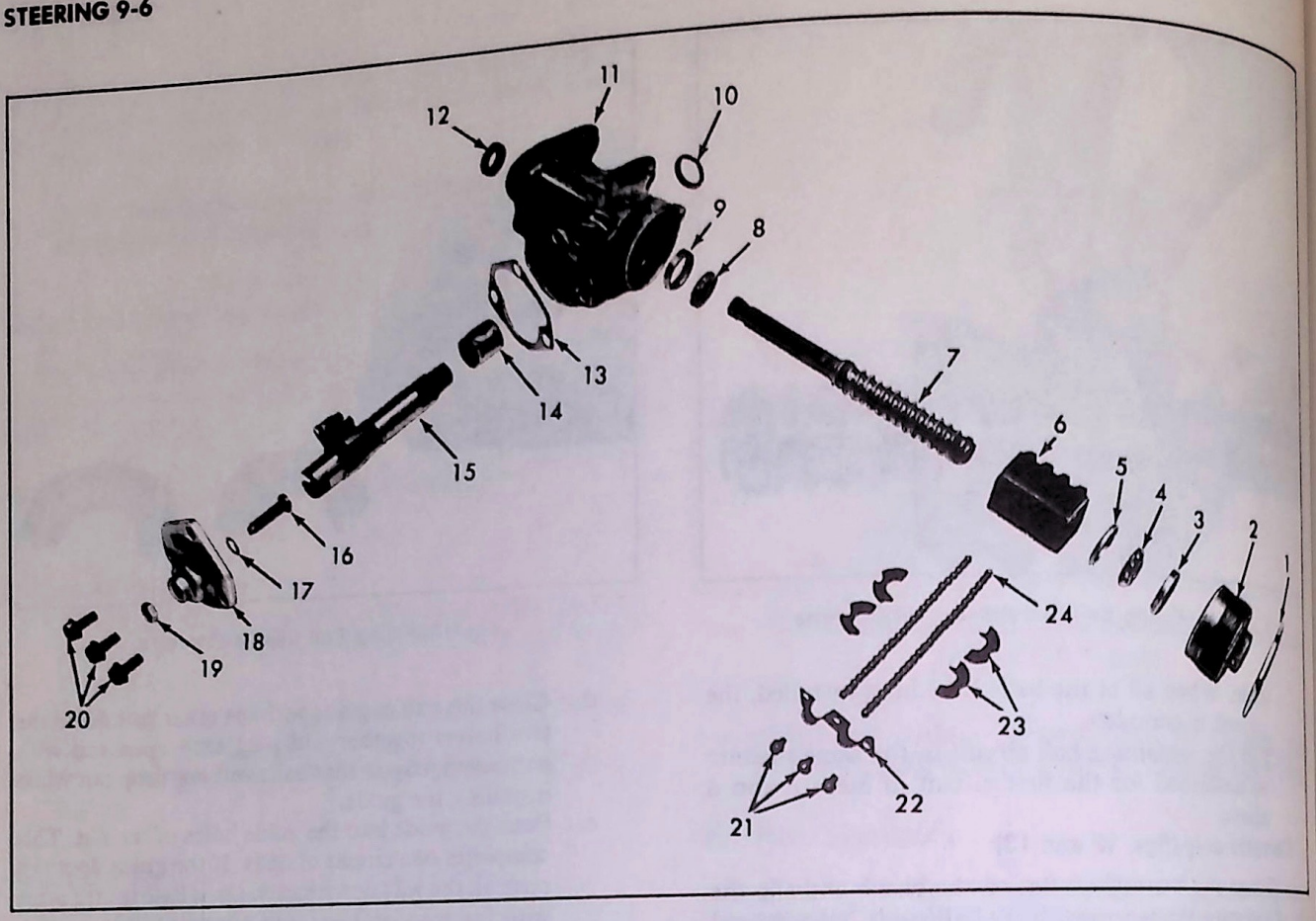

Fig. 14–Steering Gear–Except Corvette

1. Worm Bearing Adjuster Locknut
2. Worm Bearing Adjuster
3. Lower Worm Bearing Race
4. Lower Ball Bearing
5. Lower Bearing Retainer
6. Ball Nut
7. Wormshaft
8. Upper Ball Bearing
9. Upper Worm Bearing Race
10. Pitman Shaft Seal
11. Housing
12. Wormshaft Seal
13. Side Cover Gasket
14. Pitman Shaft Bushing (2 Bushings on G10-30 Series Trucks)
15. Pitman Shaft
16. Lash Adjuster
17. Lash Adjuster Shim
18. Housing Side Cover and Bushing Assembly
19. Lash Adjuster Locknut
20. Side Cover Bolts
21. Ball Guide Clamp Screws
22. Ball Guide Clamp
23. Ball Guides
24. Balls

1. Place the steering gear housing in a vise with the wormshaft bore horizontal and the side cover opening up.
2. With the pitman shaft and wormshaft seals, pitman shaft bushings and wormshaft bearing races installed, and the ball nut installed on the wormshaft, proceed to Step 3 or 4.
3. **All Except Corvette–**
   a. Slip the upper ball bearing over the wormshaft and insert the wormshaft and nut assembly into the housing, feeding the end of the shaft through the upper ball bearing race and seal.
   b. Place a ball bearing in the adjuster race and press the stamped retainer into place with a suitable socket.
   c. Install the adjuster and locknut into the lower end of the housing (being careful to guide the end of the wormshaft into the bearing) until nearly all end play has been removed from the wormshaft.
4. **Corvette–**
   a. Place a wormshaft bearing in the housing race. Slide the other bearing and the adjuster plug assembly over the upper end of the wormshaft.
   b. Insert the wormshaft, nut and adjuster assembly into the housing, guiding the lower end of the wormshaft into the housing bearing.
   c. Thread the adjuster into the housing until nearly all end play is removed from the wormshaft.
5. Position the lash adjuster (with shim) in the slotted end of the pitman shaft. Check the end clearance, which should not be greater than .002″ (fig. 16). If clearance is greater than .002″, a steering gear lash adjuster shim unit is available. It contains four shims--.063″, .065″, .067″ and .069″ thick,
6. Lubricate the steering gear with 11 oz. of lubricant meeting GM Specification GM 4673 (or equivalent). Rotate the wormsahft until the ball nut is at the end o

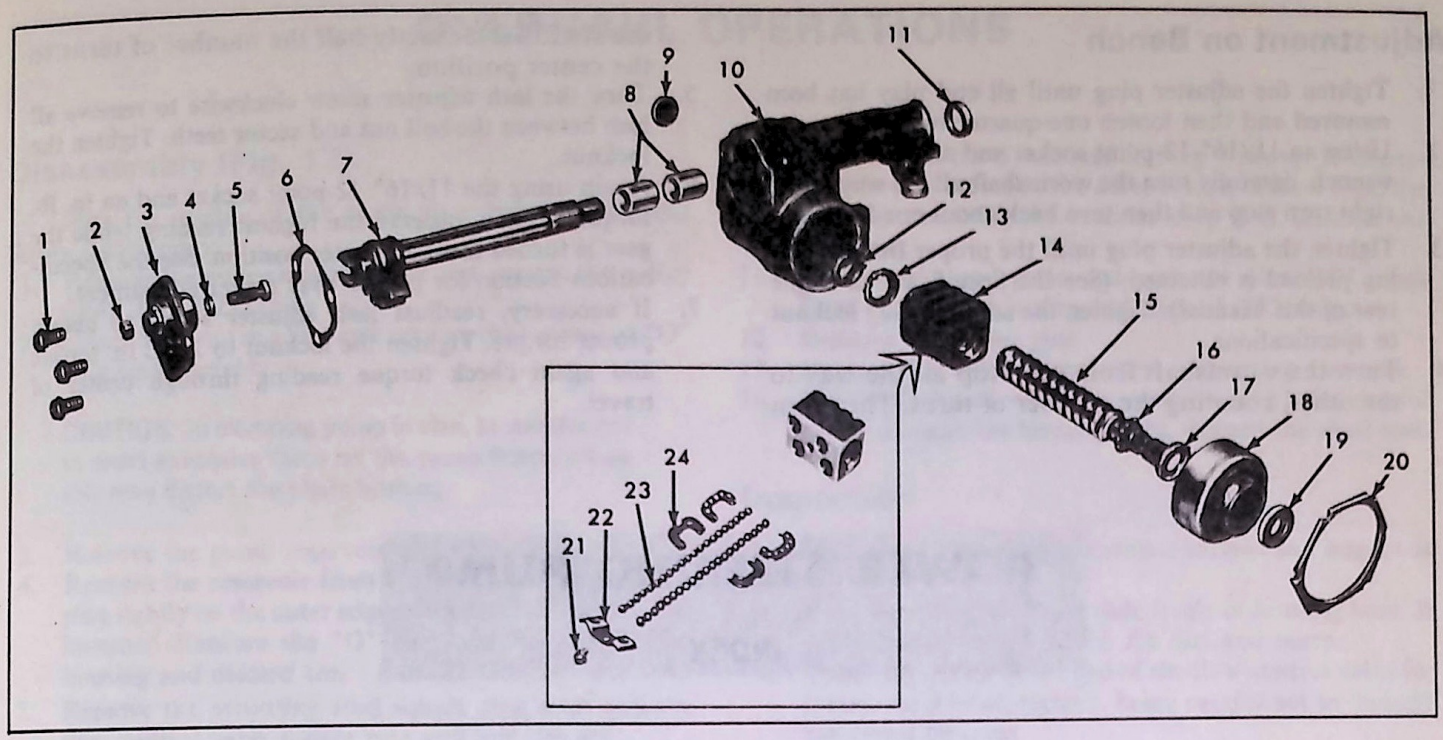

Fig. 15–Steering Gear–Corvette

1. Side Cover Screws
2. Lash Adjuster Locknut
3. Side Cover and Bushing
4. Lash Adjuster Shim
5. Lash Adjuster Screw
6. Side Cover Gasket
7. Pitman Shaft
8. Pitman Shaft Bushings
9. Expansion Plug
10. Steering Gear Housing
11. Pitman Shaft Seal
12. Worm Bearing Race–Lower
13. Worm Bearing–Lower
14. Ball Nut
15. Wormshaft
16. Worm Bearing–Upper
17. Worm Bearing Race–Upper
18. Adjuster Plug
19. Wormshaft Seal
20. Adjuster Plug Locknut
21. Clamp Screw
22. Ball Guide Clamp
23. Balls
24. Ball Guides

its travel and then pack as much new lubricant into the housing as possible without losing it out the pitman shaft opening. Rotate the wormshaft until the ball nut is at the other end of its travel and pack as much lubricant into the opposite end as possible.

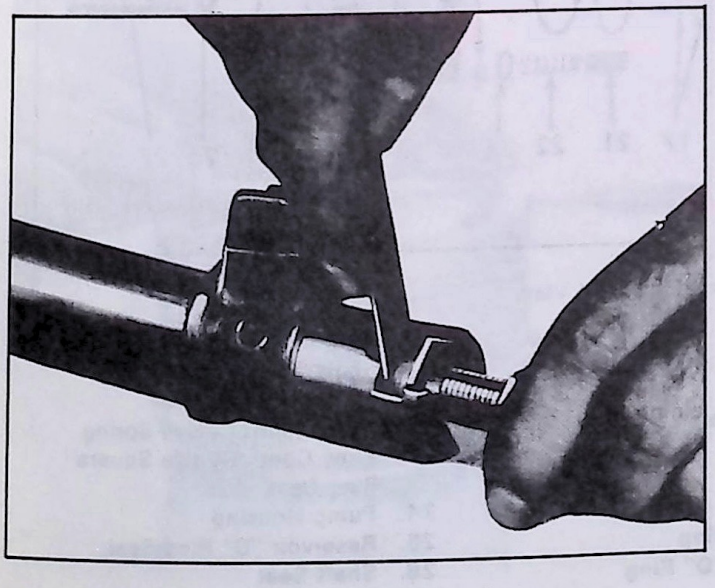

Fig. 16–Checking Lash Adjuster End Clearance

7. Rotate the wormshaft until the ball nut is about in the center of travel. This is to make sure that the pitman shaft sector and ball nut will engage properly, with the center tooth of the sector entering the center tooth space in the ball nut.
8. Insert the pitman shaft assembly (with lash adjuster screw and shim but without side cover) into the housing as that the center tooth of the pitman shaft sector enters the center tooth space of the ball nut.
9. Pack the remaining portion of lubricant into the housing.
10. Place the side cover gasket on the housing.
11. Install the side cover onto the pitman shaft by reaching through the side cover with a screwdriver and turning the lash adjuster screw counterclockwise until the screw bottoms; back the screw off one half turn. Loosely install a new locknut onto the adjuster screw.
12. Install and tighten the side cover bolts to specifications.

NOTE: If new side cover bolts are used at installation, be sure to use specified bolts which are self locking.

Adjustment on Bench

1. Tighten the adjuster plug until all end play has been removed and then loosen one-quarter turn.
2. Using an 11/16" 12-point socket and an in. lb. torque wrench, carefully turn the wormshaft all the way to the right turn stop and then turn back about one-half turn.
3. Tighten the adjuster plug until the proper thrust bearing preload is obtained; (See the Specifications at the rear of this Manual). Tighten the adjuster plug locknut to specifications.
4. Turn the wormshaft from one stop all the way to the other, counting the number of turns. Then turn the shaft back exactly half the number of turns to the center position.
5. Turn the lash adjuster screw clockwise to remove all lash between the ball nut and sector teeth. Tighten the locknut.
6. Again using the 11/16" 12-point socket and an in. lb. torque wrench, observe the highest reading while the gear is turned through center position. See the Specifications Section for proper over center adjustment.
7. If necessary, readjust lash adjuster screw to obtain proper torque. Tighten the locknut to 23 ft. lb. torque and again check torque reading through center of travel.

POWER STEERING PUMP

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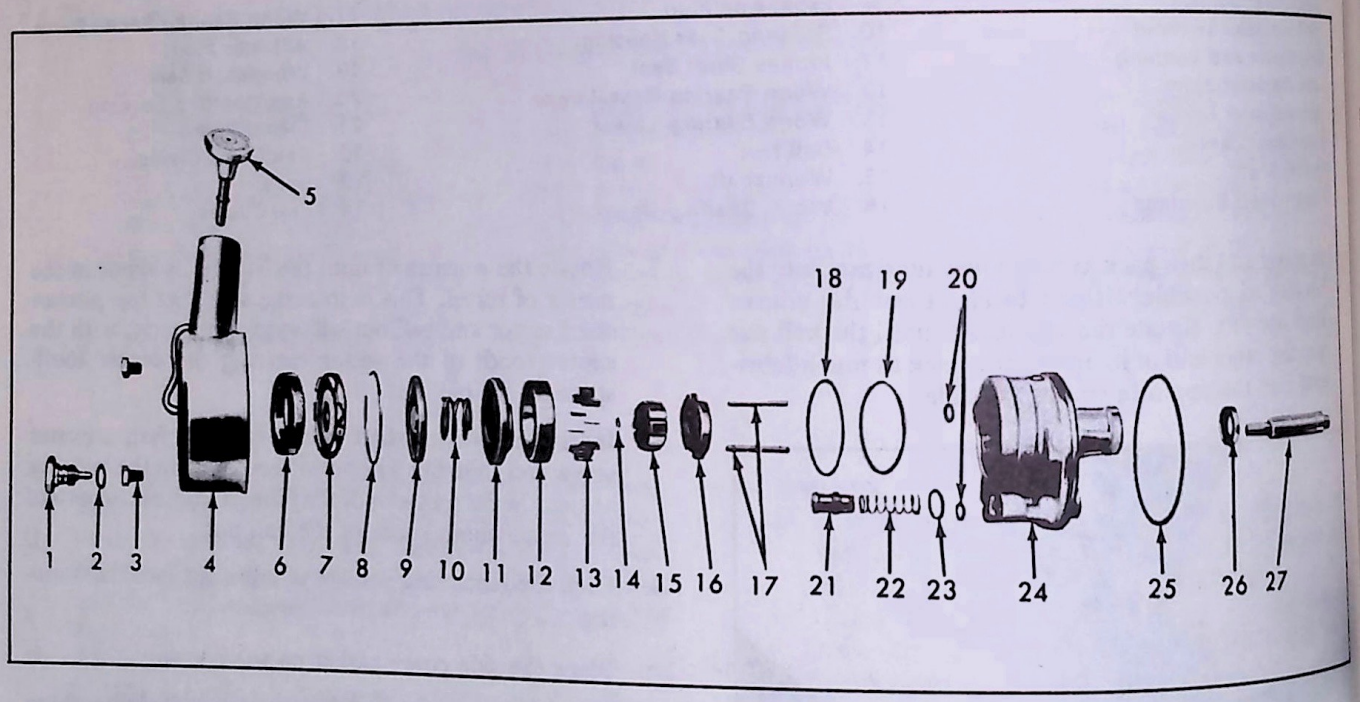


Fig. 17–Power Steering Pump–Exploded View

1. Union
2. Union "O" Ring Seal
3. Mounting Studs
4. Reservoir
5. Dip Stick and Cover
6. Element (Corvette only)
7. Filter Assembly (Corvette only)
8. End Plate Retaining Ring
9. End Plate
10. Spring
11. Pressure Plate
12. Pump Ring
13. Vanes
14. Drive Shaft Retaining Ring
15. Rotor
16. Thrust Plate
17. Dowel Pins
18. End Plate "O" Ring
19. Pressure Plate "O" Ring
20. Mounting Stud Square Ring Seals
21. Flow Control Valve
22. Flow Control Valve Spring
23. Flow Control Valve Square Ring Seal
24. Pump Housing
25. Reservoir "O" Ring Seal
26. Shaft Seal
27. Shaft

OVERHAUL OPERATIONS

Disassembly (Fig. 17)

Clean the outside of the pump in a Nontoxic Solvent before disassembly.

1. Remove the pulley retaining nut and remove the pulley using Tool J-21239-1.
2. Place the pump in a vise and remove the union and "O" ring seal assembly.

CAUTION: In clamping pump in vise, be careful not to exert excessive force on the pump front hub as this may distort the shaft bushing.

3. Remove the pump reservoir retaining studs.
4. Remove the reservoir from the pump housing by tapping lightly on the outer edge of the reservoir with a soft hammer. Remove the "O" ring seal from the pump housing and discard seal.
5. Remove the mounting stud square ring seals and the flow control valve square ring seal and discard.
6. On Corvette, remove filter and filter cage; discard filter element.
7. Remove the end plate retaining ring. Compress the end plate retaining ring by inserting a small punch in the 1/8" diameter hole in the pump housing. When the ring is in compressed position, remove with a screw driver as shown in Figure 18.
8. Remove the end plate. The end plate is spring loaded and will generally sit above the housing level. If sticking should occur, a slight rocking action or light tapping with a soft hammer will free the plate. Remove the end plate spring.
9. With the pump still in a vise, remove the shaft woodruff key and tap end of shaft gently with a soft hammer until the shaft, pressure plate, pump ring, rotor assembly and thrust plate can be removed as a unit (fig. 19).
10. Separate the parts removed in Step 9 above. If inspection shows the shaft to be defective, separate it from the rotor by removing the retainer snap ring. Discard the snap ring.
11. Remove the end plate and pressure plate "O" rings from the pump housing and discard "O" rings.
12. Remove the dowel pins.
13. Remove the flow control valve and spring assembly.
14. Pry the shaft seal out of the pump housing being careful not to damage the housing bore, discard the shaft seal.

Inspection

Clean all metal parts in a nontoxic solvent and inspect as follows:

1. Flow control valve must slide freely in housing bore. If sticking is observed, check for dirt and burrs.
2. Check cap screw in the end of the flow control valve for looseness; if loose, tighten, being careful not to damage machined surfaces.
3. Be sure that pressure plate and pump plate surfaces are flat and parallel with pump ring. Check all of these parts for cracks and scoring.

NOTE: A high polish is always present on rotor pressure plate and thrust plate as a result of normal wear. Do not confuse this with scoring.

4. Make certain vanes were installed with rounded edge toward pump ring and see that they move freely in rotor slots.
5. If the flow control plunger is determined to be faulty, install a new part. This part is serviced as a unit only and is factory calibrated.
6. Check drive shaft for worn splines, breaks, bushing material pickup, etc.

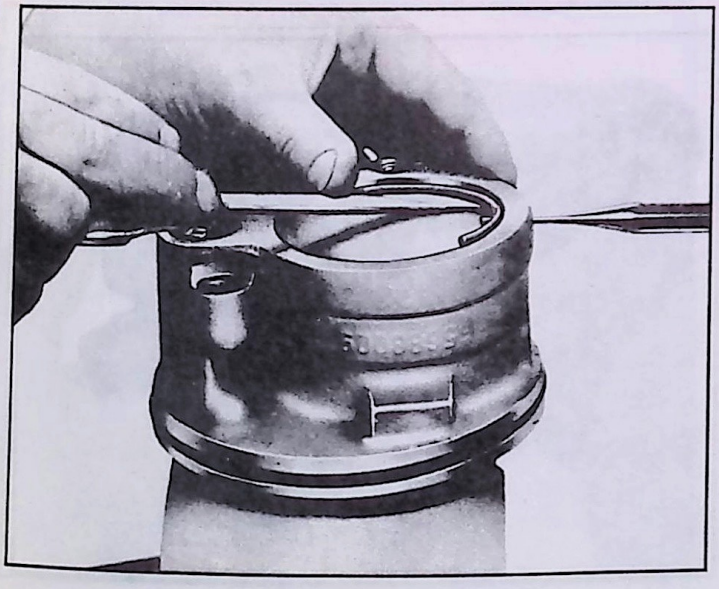


Fig. 18–Removing End Plate Ring

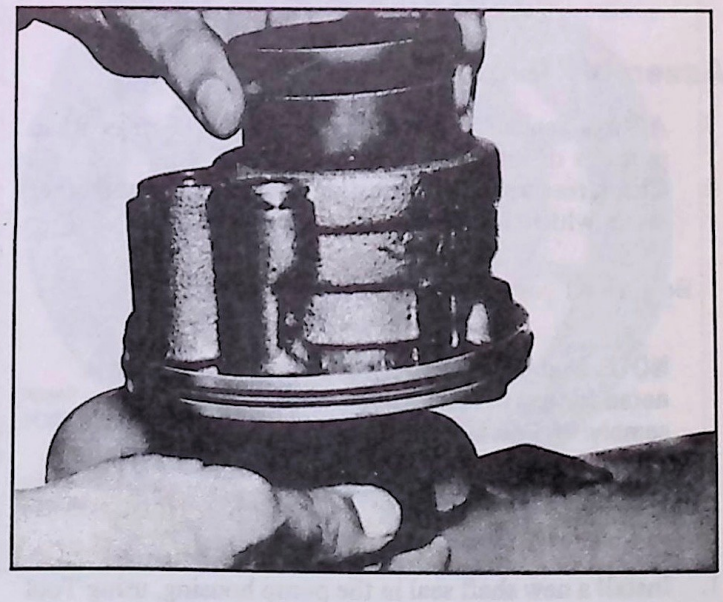


Fig. 19–Impeller Unit Removal

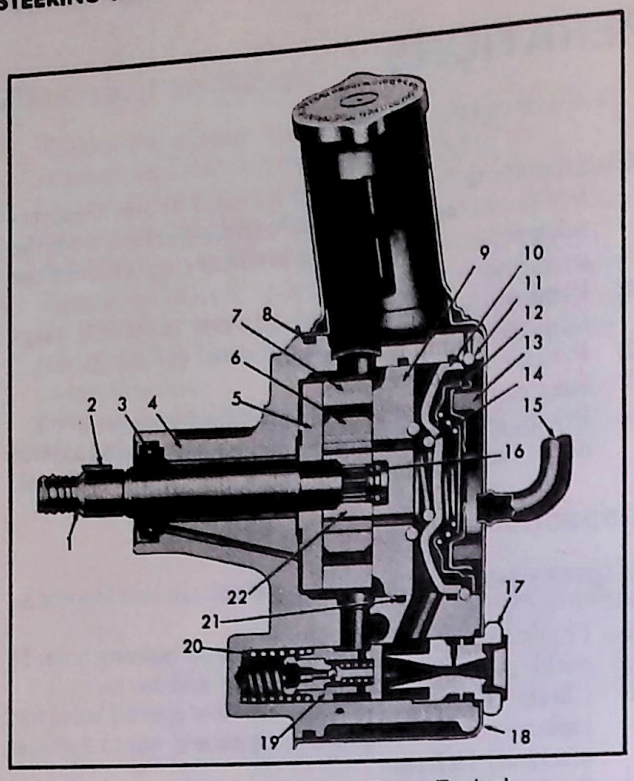


Fig. 20–Power Steering Pump–Typical

1. Shaft
2. Woodruff Key
3. Shaft Seal
4. Pump Housing
5. Thrust Plate
6. Vanes
7. Pump Ring
8. Reservoir "O" Ring Seal
9. Pressure Plate
10. End Plate
11. End Plate Retaining Ring
12. Cage Assembly (Corvette Only)
13. Filter (Corvette Only)
14. Pressure Plate Spring
15. Pump Inlet Tube
16. Rotor-to-Drive Shaft Retaining Ring
17. Pump Outlet Union
18. Reservoir
19. Flow Control Valve
20. Flow Control Valve Spring
21. Pressure Plate "O" Ring
22. Rotor

Assembly (Fig. 20)

7. Always replace all rubber seals and "O" rings when pump is dismantled.
8. Check reservoir, studs, casting, etc. for burrs and other faults which would impair proper operation.

Be sure all parts are clean during reassembly.

NOTE: In the following text, Power Steering Fluid is noted for use in lubricating components upon reassembly. If Power Steering Fluid is not available, Transmission Fluid bearing the mark Dexron may be used as a substitute.

1. Install a new shaft seal in the pump housing, using Tool J- 22670 as shown in Figure 21.

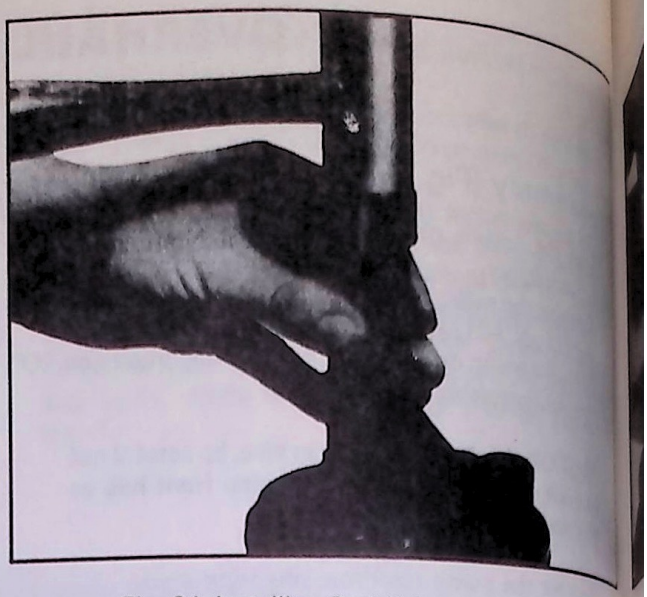


Fig. 21–Installing Seal Using Tool J-22670

2. Install both dowel pins in the pump housing and install a new pressure plate "O" ring lubricated with Power Steering Fluid.
3. Install the thrust plate on the shaft with the ported face towards the splined end of the shaft (fig. 22).
4. Install the rotor, which must be free on the shaft splines, with the countersunk side towards the thrust plate.
5. Install a new shaft retaining ring by placing the ring on the end of the shaft and using first a drift and then a 3/8" socket to tap the NEW ring into place (fig. 23).

CAUTION: Do not use a "C" ring to replace the full diameter ring. Be sure the retaining ring is firmly seated in the shaft groove before proceeding.

6. Place pump housing in a vise and install shaft, thrust plate and rotor assembly into housing, aligning the holes in the thrust plate with the dowel pins as shown in Figure 24.

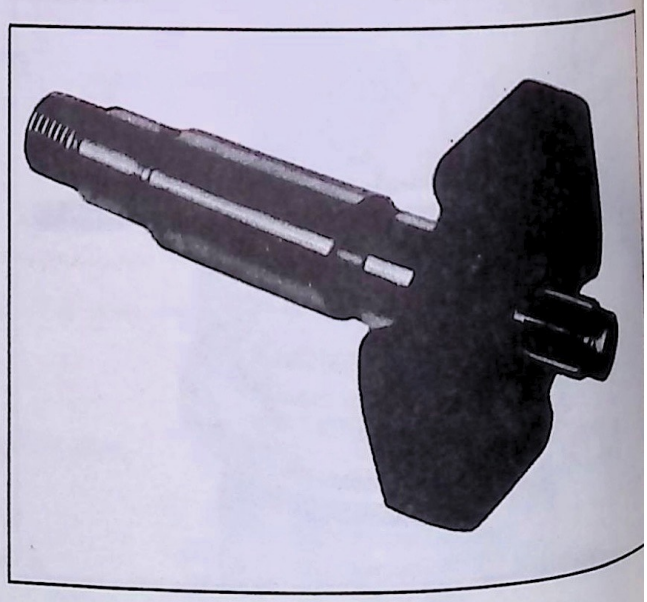


Fig. 22–Installing Thrust Plate

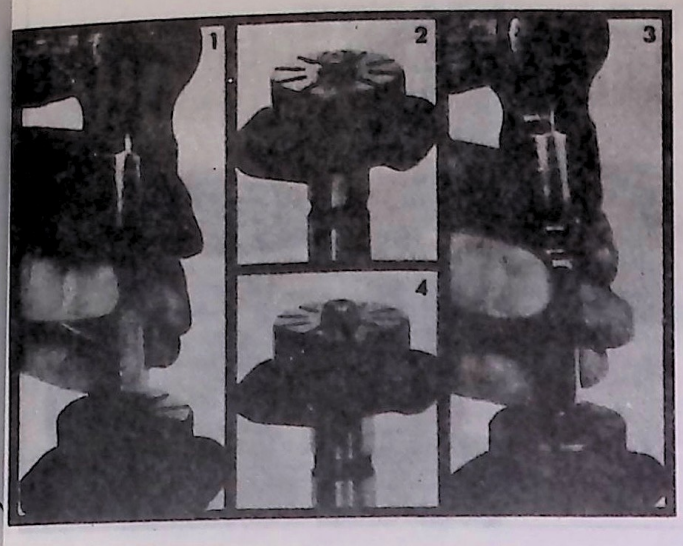


Fig. 23–Installing Shaft Snap Ring

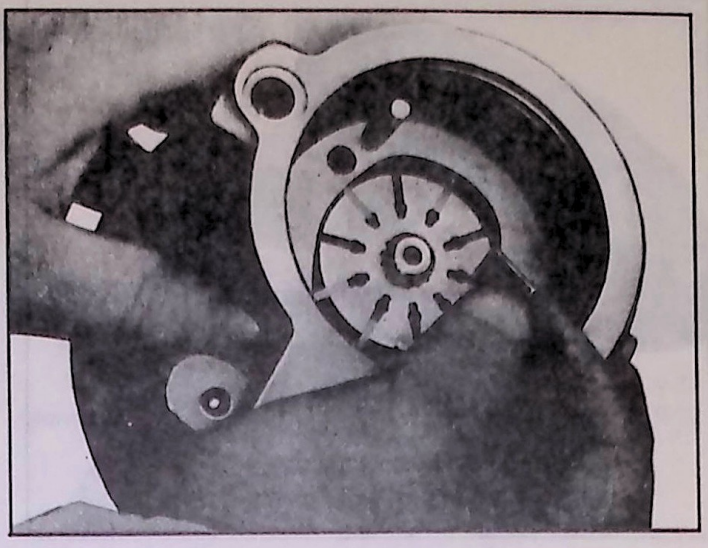


Fig. 26–Installing Vanes

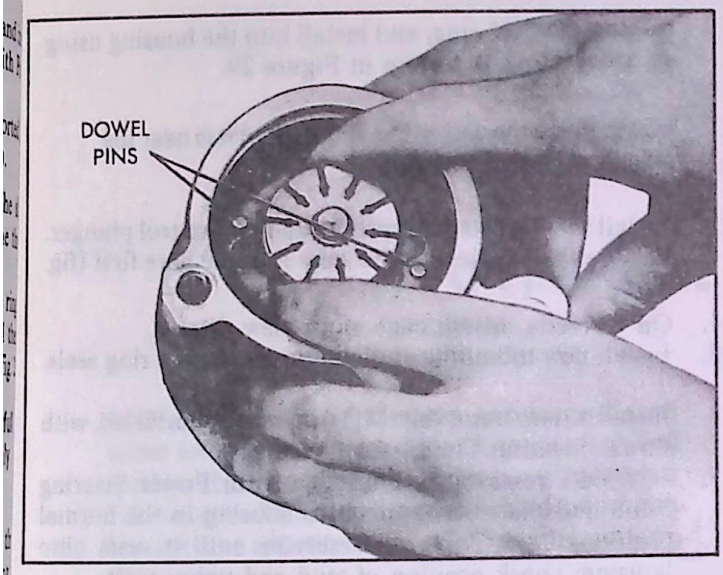


Fig. 24–Installing Shaft, Thrust Plate, and Rotor Assembly

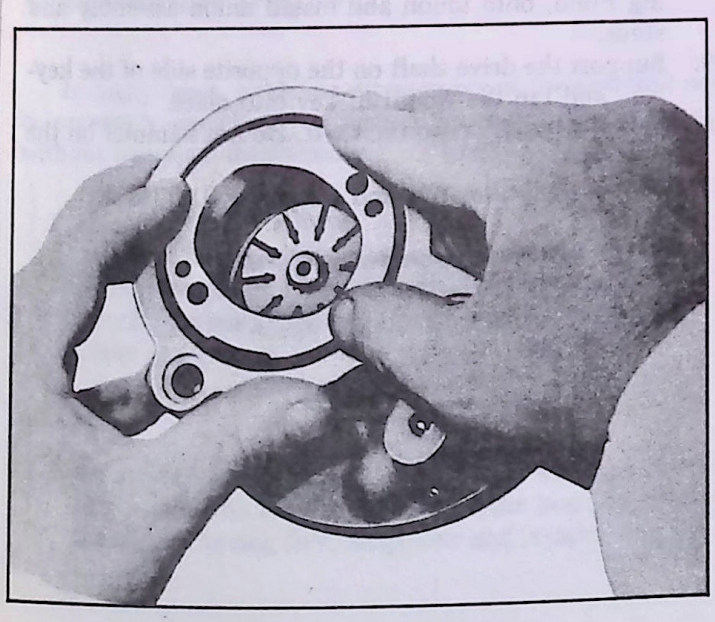


Fig. 25–Installing Pump Ring

7. Install the pump ring onto the dowel pins with the direction of rotation arrow to the rear of the housing (fig. 25). Rotation is clockwise as viewed from the pulley end of the shaft.
8. Install the vanes into the rotor slots with the radius edge towards the pump ring and the square edge towards the rotor as shown in Figures 26 and 27.
9. Lubricate the outside diameter and chamfer of the pressure plate with Power Steering Fluid, to ensure against damaging the pressure plate "O" ring, and install the pressure plate onto the dowel pins with the ported face towards the pump ring. Seat the pressure plate by placing a large socket on top of the plate and pressing down

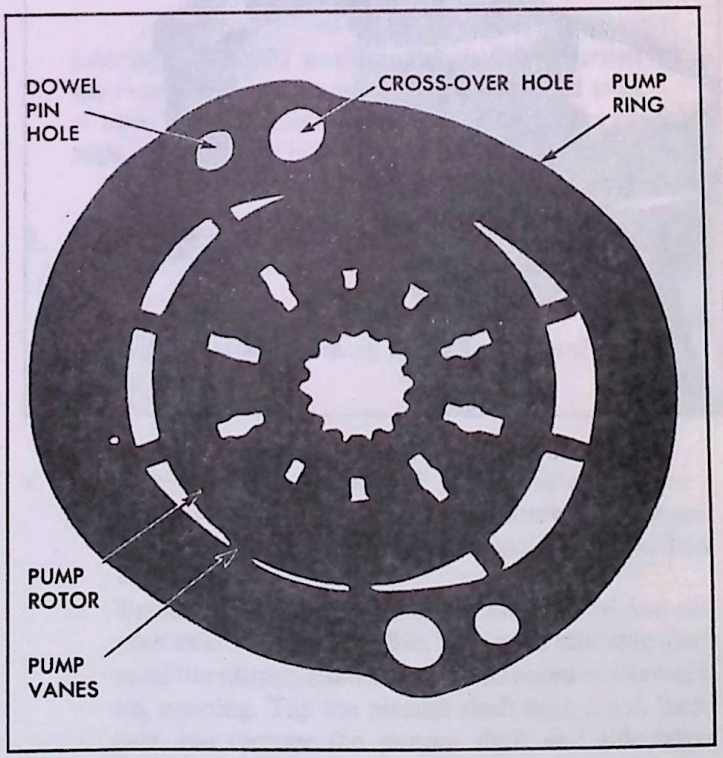


Fig. 27–Correct Vane Assembly

Fig. 28–Installing Pressure Plate Spring

by hand (pressure plate will travel approximately 1/16" to seat).

10. Install the pressure plate spring in the center groove of the pressure plate (fig. 28).
11. Lubricate a new end plate "O" ring with Power Steering Fluid and install in housing groove.
12. Lubricate the outside diameter and chamfer of the end plate with Power Steering Fluid, to ensure against damaging the "O" ring, and install into the housing using an arbor press as shown in Figure 29.

Fig. 29–Installing End Plate Retaining Ring

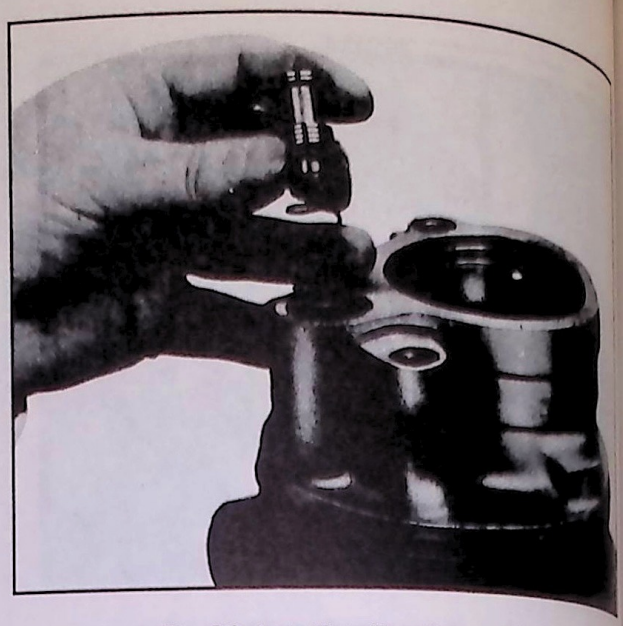


Fig. 30–Installing Flow Control Valve

NOTE: Place the end of the ring so that it is near the valve bore in the housing.

13. Install the flow control spring and flow control plunger. Be sure the hex head screw goes into the bore first (fig. 30).
14. On Corvette, install cage and a new filter.
15. Install new mounting stud and union square ring seals.
16. Install a new reservoir "O" ring seal, lubricated with Power Steering Fluid, onto housing.
17. Lubricate reservoir sealing edge with Power Steering Fluid and place reservoir onto housing in the normal position. Press down on reservoir until it seats onto housing; check position of stud and union seals.
18. Place a new "O" ring seal, lubricated with Power Steering Fluid, onto union and install union assembly and studs.
19. Support the drive shaft on the opposite side of the keyway and tap the woodruff key into place.
20. Slide the pulley onto the shaft. Do not hammer on the pulley.
21. Install the pulley nut and torque to 60 ft. lbs.

NOTE: Always use a new pulley nut.

INTEGRAL POWER STEERING GEAR

INDEX

OVERHAUL OPERATIONS

NOTE: In the following text, Power Steering Fluid is noted for use in lubricating components upon reassembly. If Power Steering Fluid is not available, Transmission Fluid bearing the mark DEXRON may be used as a substitute.

Disassembly (Fig. 31)

In many cases, complete disassembly of the gear will not be necessary since most of the components can be removed without complete disassembly.

NOTE: Disassembly of the major components within the gear must be performed on a clean workbench. The work area, tools and parts must be kept clean at all times.

1. Rotate end cover retainer ring so that one end of the ring is over the hole in the side of the housing. Force the end of the ring from its groove and remove ring (fig. 32).

2. Turn the stub shaft counter-clockwise until the rack-piston just forces end cover out of housing. Remove cover and discard "O" ring.

CAUTION: DO NOT turn the stub shaft any further than absolutely necessary to remove the end plug, or balls from rack-piston and worm circuit may escape and lay loose inside the rack-piston chamber.

3. Remove the rack-piston end plug as shown in Figure 33.

NOTE: To aid in loosening end plug, tap end plug with a brass drift.

4. Remove the pitman shaft and side cover as follows:
   a. Loosen the over-center adjusting screw locknut and remove the 4 side cover attaching bolts and lock washers.
   b. Rotate the side cover until the rack-piston and pitman shaft teeth are visible, then turn the stub shaft until the pitman shaft teeth are centered in the housing opening. Tap the pitman shaft with a soft hammer and remove the pitman shaft and side cover from the housing. Remove the side cover "O" ring and discard.

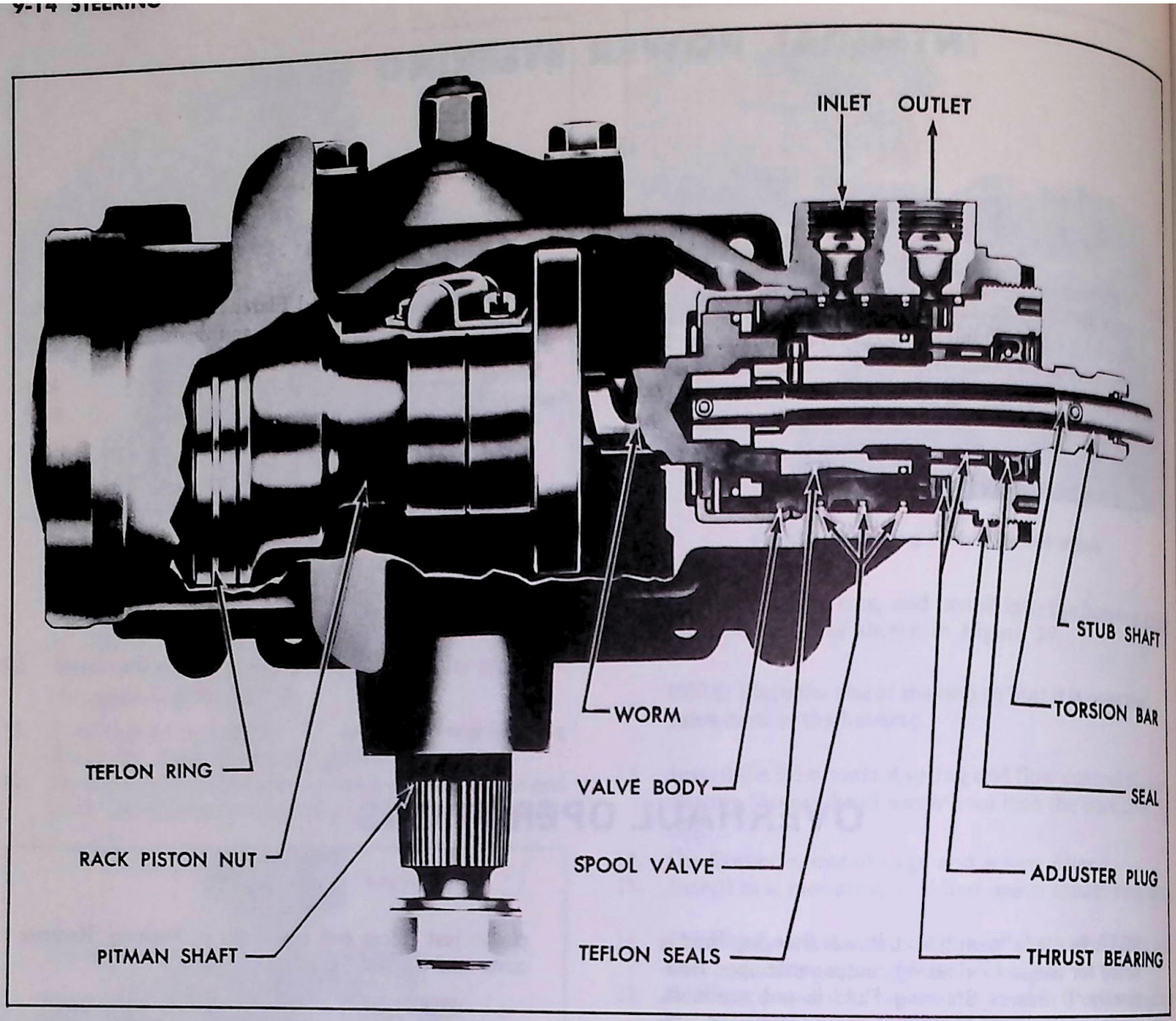


Fig. 31–Power Steering Gear–Typical

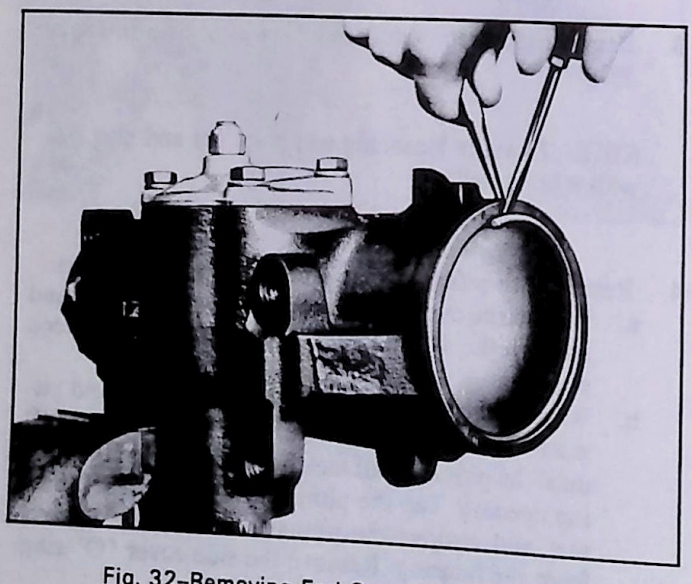


Fig. 32–Removing End Cover Retaining Ring

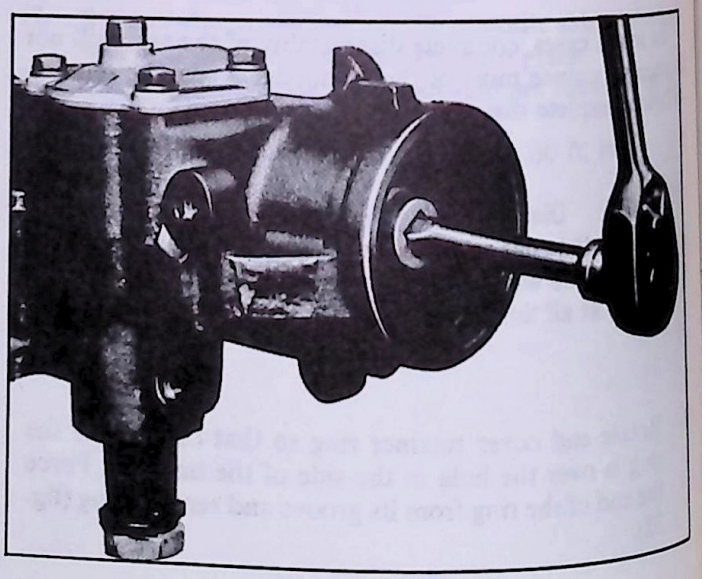


Fig. 33–Removing End Plug

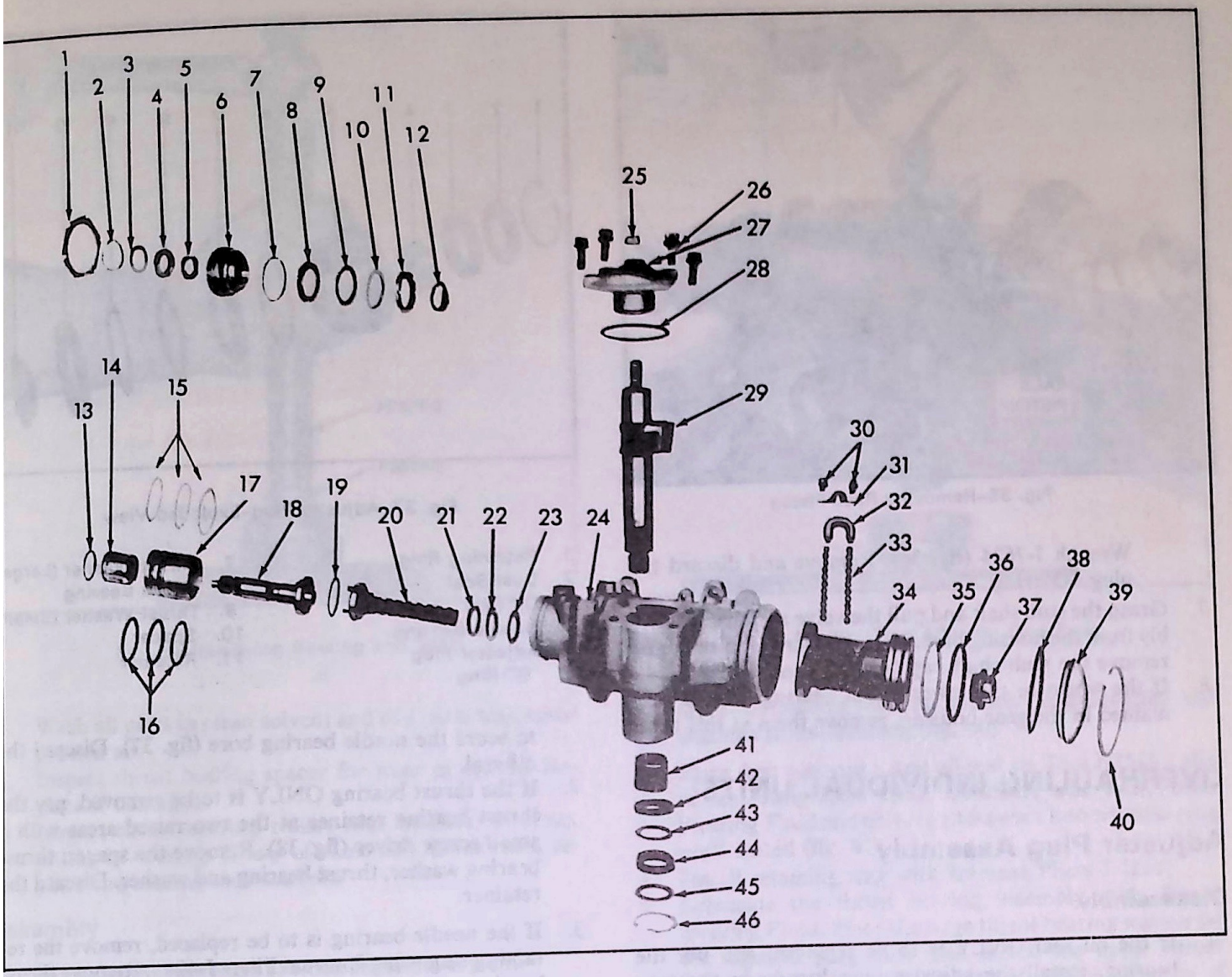


Fig. 34–Power Steering Gear–Exploded View

1. Locknut
2. Retaining Ring
3. Dust Seal
4. Oil Seal
5. Bearing
6. Adjuster Plug
7. "O" Ring
8. Thrust Washer (Large)
9. Thrust Bearing
10. Thrust Washer (Small)
11. Spacer
12. Retainer
13. "O" Ring
14. Spool Valve
15. Teflon Oil Rings
16. "O" Rings
17. Valve Body
18. Stub Shaft
19. "O" Ring
20. Wormshaft
21. Thrust Washer
22. Thrust Bearing
23. Thrust Washer
24. Housing
25. Locknut
26. Attaching Bolts and Washers
27. Side Cover
28. "O" Ring
29. Pitman Shaft
30. Screws and Lock Washers
31. Clamp
32. Ball Return Guide
33. Balls
34. Rack-Piston
35. Teflon Oil Seal
36. "O" Ring
37. Plug
38. "O" Ring
39. Housing End Cover
40. Retainer Ring
41. Needle Bearing
42. Oil Seal
43. Back Up Washer
44. Oil Seal
45. Back Up Washer
46. Retaining Ring

5. Remove the rack-piston as follows:
   a. Insert Ball Retainer Tool J-7539 into the rack-piston bore with pilot of tool seated in the end of the worm (fig. 35). Turn the stub shaft counter-clockwise while holding tool tightly against worm. The rack-piston will be forced onto the tool.
   b. Remove the rack-piston with Ball Retainer Tool J-7539 from gear housing.

6. Remove the adjuster plug as follows:
   a. Loosen the adjuster plug locknut and remove.
   b. Remove adjuster plug assembly with Spanner

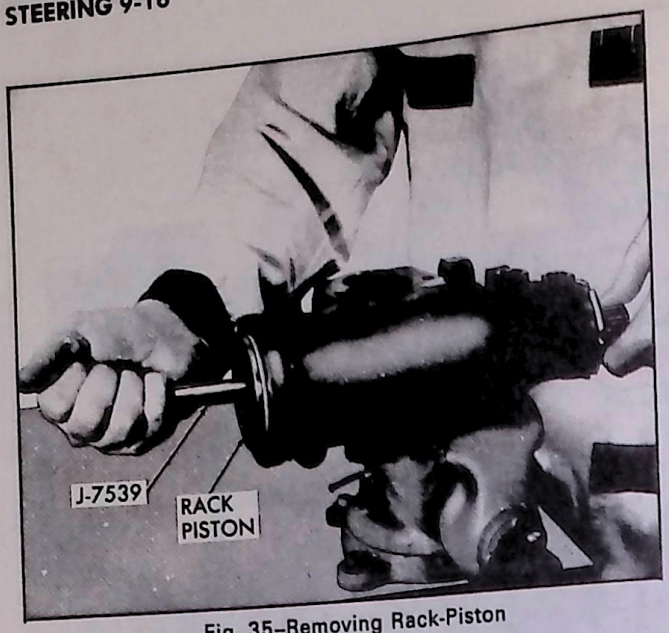


Fig. 35–Removing Rack-Piston

Wrench J-7624 (fig. 36). Remove and discard the plug "O" ring.

7. Grasp the stub shaft and pull the valve and shaft assembly from the housing bore. Separate worm and shaft and remove the stub shaft cap "O" ring and discard.
8. If the worm or the lower thrust bearing and race remained in the gear housing, remove them at this time.

OVERHAULING INDIVIDUAL UNITS

Adjuster Plug Assembly

Disassembly

1. If the oil seal ONLY is to be replaced, and not the bearing, install the adjuster plug loosely in the gear housing. Remove the retaining ring with Internal Pliers J-4245. With a screw driver, pry the dust seal and oil seal from the bore of the adjuster plug being careful not to score the needle bearing bore (fig. 37). Discard the oil seal.

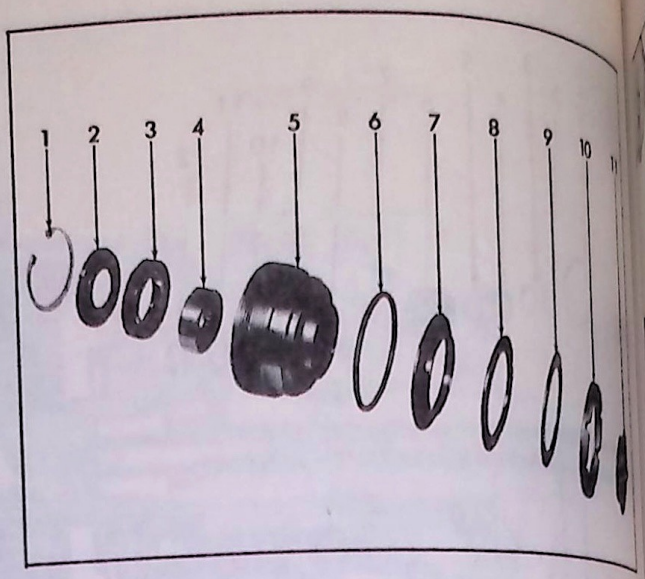


Fig. 37–Adjuster Plug–Exploded View

1. Retaining Ring
2. Dust Seal
3. Oil Seal
4. Needle Bearing
5. Adjuster Plug
6. "O" Ring
7. Thrust Washer (Large)
8. Thrust Bearing
9. Thrust Washer (Small)
10. Spacer
11. Retainer

2. If the thrust bearing ONLY is to be removed, pry the thrust bearing retainer at the two raised areas with a small screw driver (fig. 38). Remove the spacer, thrust bearing washer, thrust bearing and washer. Discard the retainer.
3. If the needle bearing is to be replaced, remove the retaining ring using Internal Pliers J-4245. Remove thrust bearing as outlined in Step 2 above. Drive needle bearing, dust seal and oil seal from adjuster plug using Bearing Remover J-8524-2 and Driver J-7079-2 as shown in Figure 39. Discard the oil seal.

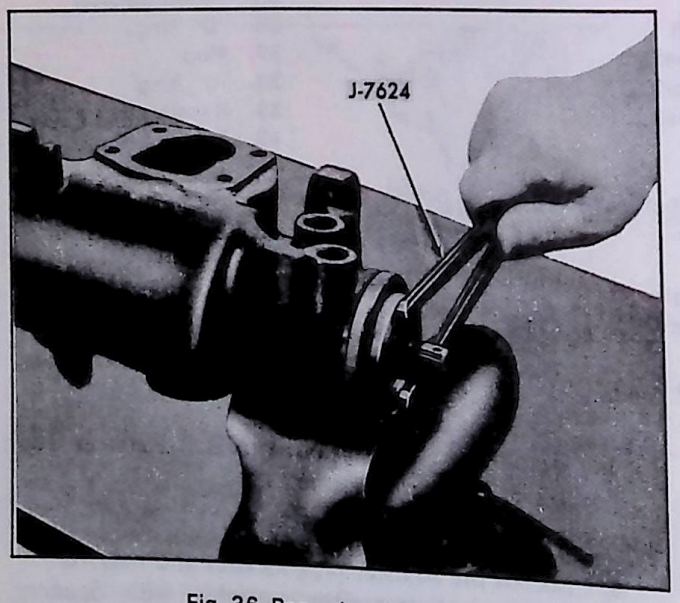


Fig. 36–Removing Adjuster Plug

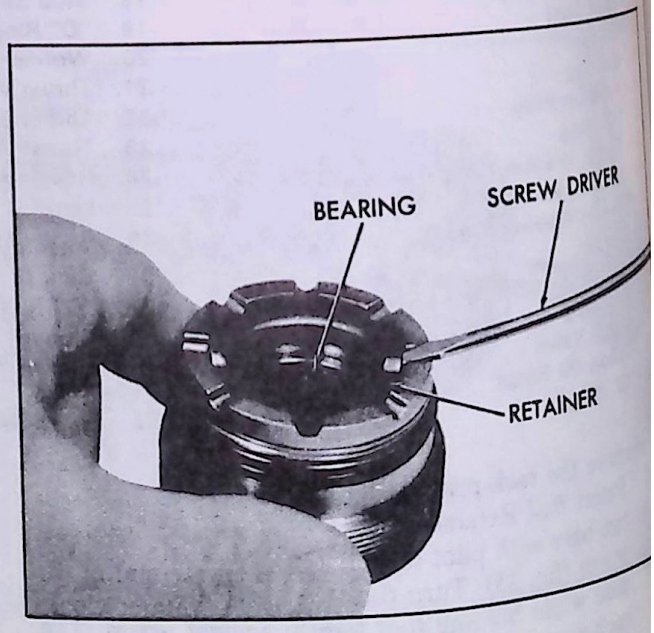


Fig. 38–Removing Retainer

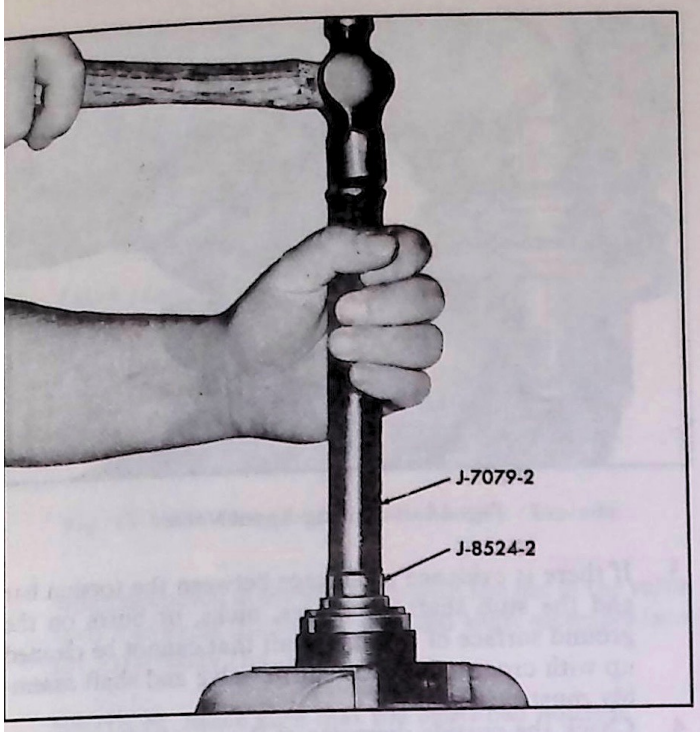


Fig. 39–Removing Bearing and Seal

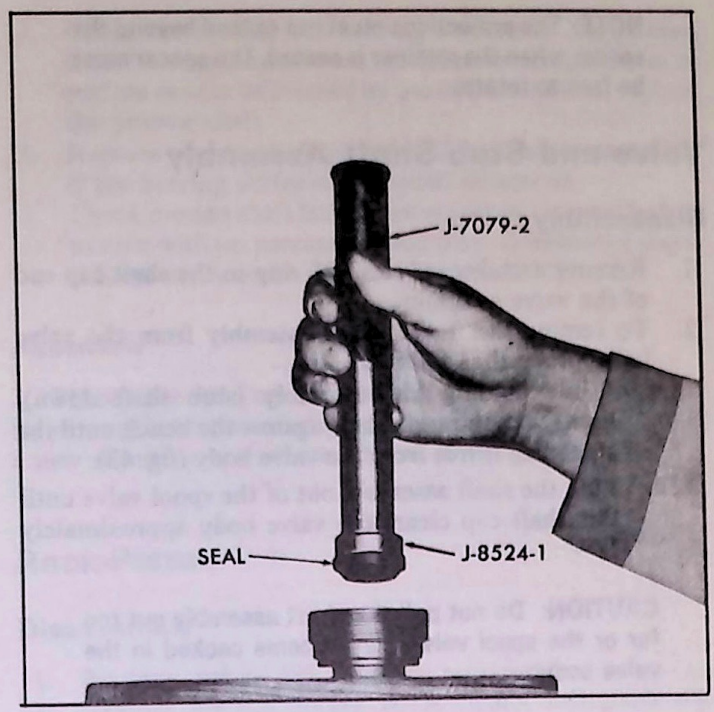


Fig. 41–Installing Adjuster Plug Seal

4. Wash all parts in clean solvent and dry parts with compressed air.
5. Inspect thrust bearing spacer for wear or cracks. Replace if damaged.
6. Inspect thrust bearing rollers and washers for wear, pitting or scoring. If any of these conditions exist, replace the bearing and washers.

Assembly

CAUTION: Place a block of wood under the adjuster plug to protect the thrust bearing surface.

1. If the needle bearing was removed, place new needle bearing over Tool J-8524-1 and J-7079-2, with the bearing manufacturer's identification toward the tool, and drive the bearing into the adjuster plug until the tool bottoms in the housing (fig. 40).
2. Place dust seal and a new oil seal on Tool J-8524-1 (lip of seal away from tool). Lubricate seal with Power Steering Fluid and drive or press seals into adjuster plug until seated (fig. 41).
3. Install retaining ring with Internal Pliers J-4245.
4. Lubricate the thrust bearing assembly with Power Steering Fluid. Place the large thrust bearing washer on the adjuster plug hub, then install the upper thrust bearing, small bearing washer and spacer (grooves of spacer away from bearing washer).
5. Install a new bearing retainer on the adjuster plug by carefully tapping on the flat surface of the retainer (fig. 42).

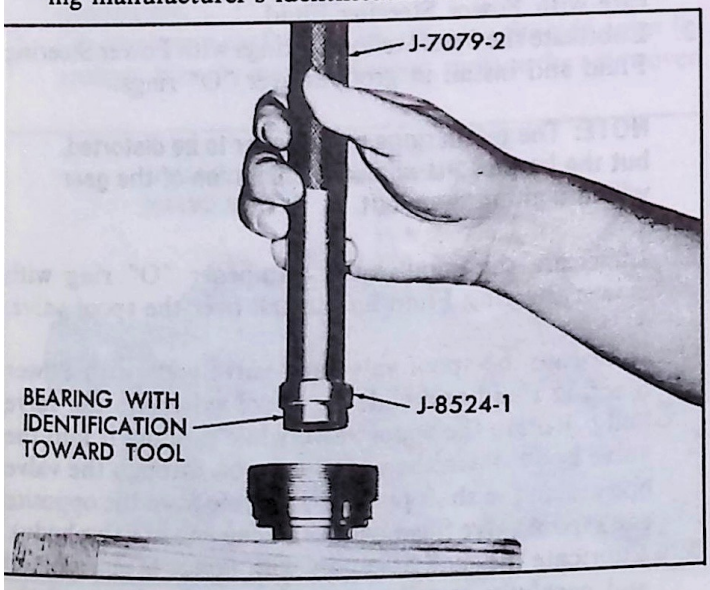


Fig. 40–Installing Bearing

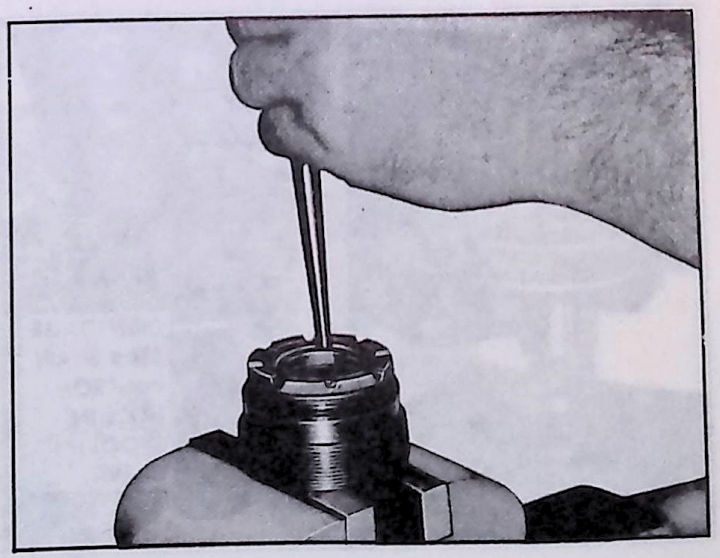


Fig. 42–Installing Retainer

NOTE: The projections must not extend beyond the spacer when the retainer is seated. The spacer must be free to rotate.

Valve and Stub Shaft Assembly

Disassembly

1. Remove and discard the "O" ring in the shaft cap end of the valve assembly.
2. To remove the lower shaft assembly from the valve body, proceed as follows:
   a. While holding the assembly (stub shaft down), lightly tap the stub shaft against the bench until the shaft cap is free from the valve body (fig. 43).
   b. Pull the shaft assembly out of the spool valve until the shaft cap clears the valve body approximately 1/4".

   CAUTION: Do not pull the shaft assembly out too far or the spool valve may become cocked in the valve body.

   c. Carefully disengage the shaft pin from the valve spool and remove the shaft assembly (fig. 43).
3. Push the spool valve out of the flush end of the valve body until the dampener "O" ring is exposed, then carefully pull the spool from the valve body, while rotating the valve (fig. 44). If the spool valve becomes cocked, carefully realign the spool valve, then remove.
4. Remove the dampener "O" ring from the spool valve and discard.
5. If the teflon oil rings are to be replaced, cut the 3 teflon oil rings and "O" rings from the valve body and discard.

Cleaning and Inspection

1. Wash all parts in clean solvent and blow out all oil holes with compressed air.
2. If the drive pin in the stub shaft or valve body is cracked, excessively worn or broken, replace the complete valve and shaft assembly.

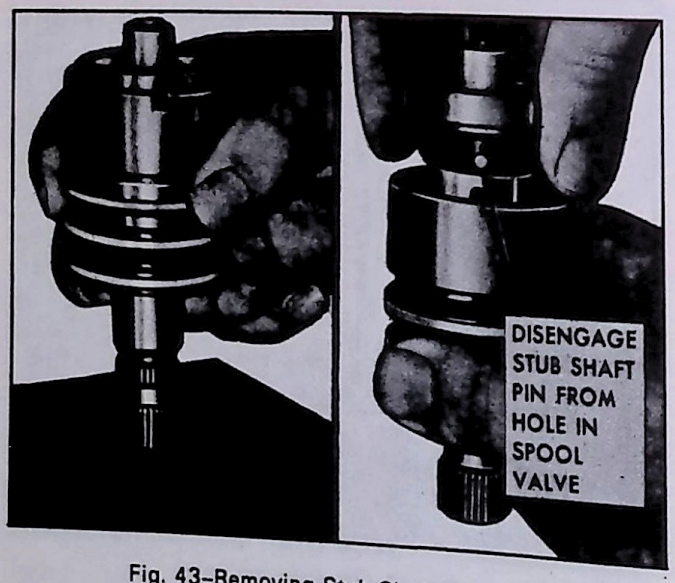


Fig. 43–Removing Stub Shaft Assembly

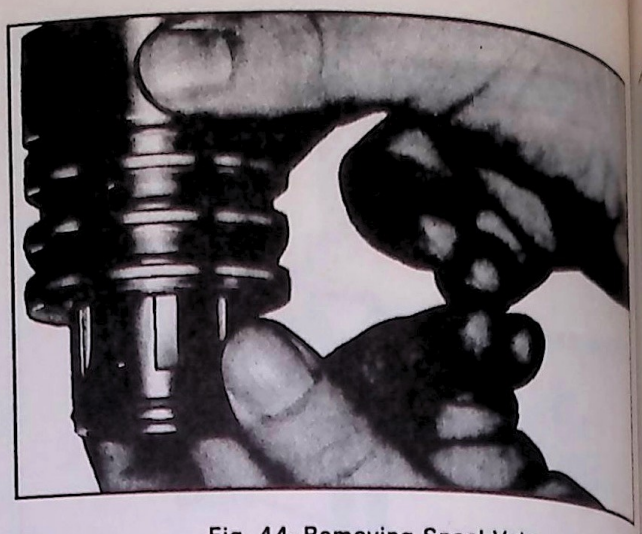


Fig. 44–Removing Spool Valve

3. If there is evidence of leakage between the torsion bar and the stub shaft, or scores, nicks, or burrs on the ground surface of the stub shaft that cannot be cleaned up with crocus cloth, the entire valve and shaft assembly must be replaced.
4. Check the outside diameter of the spool valve and the inside diameter of the valve body for nicks, burrs, or bad wear spots. If the irregularities cannot be cleaned up by the use of crocus cloth, the complete valve and shaft assembly will have to be replaced.
5. If the small notch in the skirt of the valve body is excessively worn, the complete valve and shaft assembly will have to be replaced.
6. Lubricate the spool valve with Power Steering Fluid and check the fit of the spool valve in the valve body (with the spool valve dampener "O" ring removed). If the valve does not rotate freely without binding, the complete valve and shaft assembly will have to be replaced.

Assembly (Fig. 45)

1. If valve body "O" rings and teflon rings were removed, install new "O" rings in the oil ring grooves and lubricate with Power Steering Fluid.
2. Lubricate the 3 new teflon oil rings with Power Steering Fluid and install in grooves over "O" rings.

   NOTE: The teflon rings may appear to be distorted, but the heat of the oil during operation of the gear will straighten them out.

3. Lubricate the spool valve dampener "O" ring with Power Steering Fluid and install over the spool valve.
4. Lubricate the spool valve and valve body with Power Steering Fluid and slide the spool valve into the valve body. Rotate the spool valve while pushing it into the valve body. Push the spool valve on through the valve body until the shaft pin hole is visible from the opposite end (spool valve flush with shaft cap end of valve body).
5. Lubricate the shaft assembly with Power Steering Fluid and carefully install it into the spool valve until the shaft pin can be placed into the hole in the spool valve

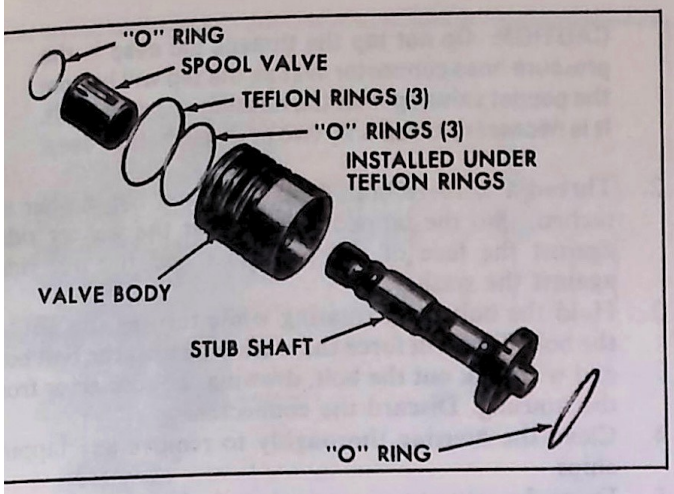


Fig. 45–Valve Body and Shaft Assembly - Explode

. Align the notch in the shaft cap with the pin in the valve body and press the spool valve and shaft assembly into the valve body (fig. 46).

CAUTION: Make sure that the shaft cap notch is mated with the valve body pin before installing valve body into the gear assembly.

. Lubricate a new "O" ring with Power Steering Fluid and install it in the shaft cap end of the valve body assembly.

itman Shaft and Side Cover

isassembly

Remove the locknut and unscrew the side cover from the justing screw. Do not attempt to disassemble pitman shaft. scard locknut.

eaning and Inspection

. Wash all parts in clean solvent and dry parts with compressed air.

. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.

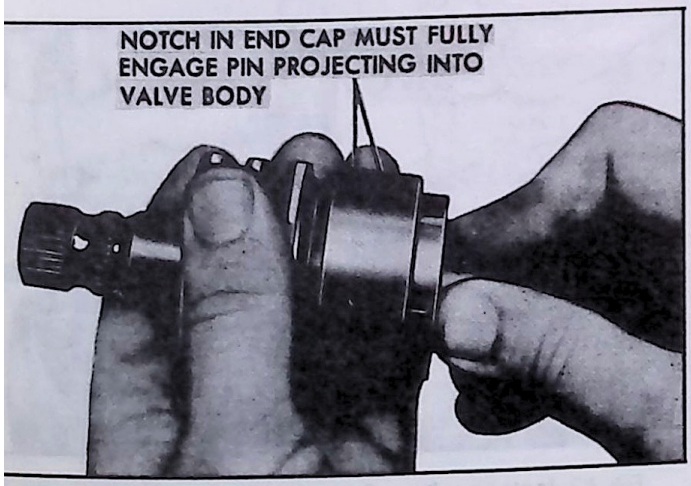


Fig. 46--Installing Stub Shaft Assembly

3. Check the sealing and bearing surfaces of the pitman shaft for roughness, nicks, etc. If minor irregularities in surface cannot be cleaned by use of crocus cloth, replace the pitman shaft.
4. Replace pitman shaft assembly if teeth are damaged or if the bearing surfaces are pitted or scored.
5. Check pitman shaft lash adjusting screw. It must be free to turn with no perceptible end play. If adjusting screw is loose replace the pitman shaft assembly.

Assembly

Thread the side cover onto the pitman shaft adjusting screw until it bottoms and then turn in one-half turn. Install a new adjusting screw locknut, but do not tighten.

Rack-Piston

Disassembly

1. Remove tool J-7539 from the rack-piston.
2. Remove the ball return guide clamp, ball guide and balls.
3. If necessary to replace the teflon oil seal and "O" ring, remove at this time.

Cleaning and Inspection

1. Wash all parts in clean solvent and dry with compressed air.
2. Inspect the worm and rack-piston grooves and all the balls for scoring. If either the worm or rack-piston needs replacing, both must be replaced as a matched assembly.
3. Inspect ball return guide halves, making sure that the ends where the balls enter and leave the guides are not damaged.
4. Inspect lower thrust bearing and washers for scores or excessive wear. If any of these conditions are found, replace the thrust bearing and washers.
5. Inspect rack-piston teeth for scoring or excessive wear. Inspect the external ground surfaces for wear, scoring or burrs.

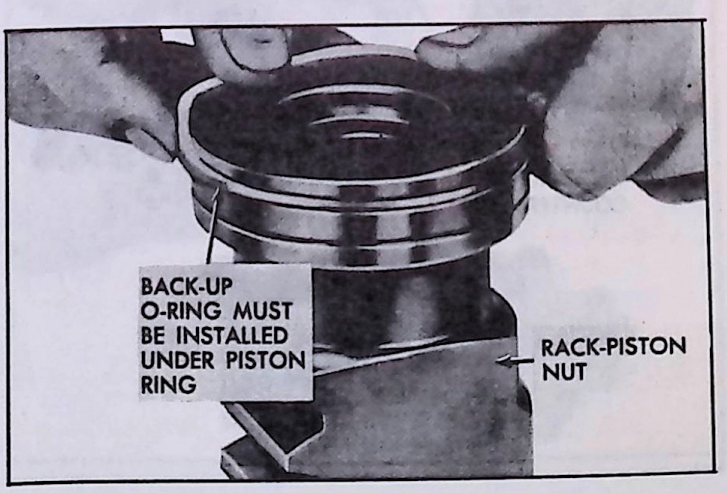


Fig. 47–Installing Ring on Rack-Piston

Assembly

1. If the teflon oil seal and "O" ring were removed, lubricate a new "O" ring and seal with Power Steering Fluid and install in groove on rack-piston. The teflon ring may be slightly loose after assembly, but will tighten up when subjected to the hot oil in the system (fig. 47).
2. Slide the worm all the way into the rack-piston. It is not necessary to have the thrust bearing assembly on the worm at this time.
3. Turn the worm until the worm groove is aligned with the lower ball return guide hole (fig. 48).
4. Lubricate the balls with Power Steering Fluid, then feed 17 balls into the rack-piston, while slowly rotating the worm counter- clockwise.

IMPORTANT: The black balls are .0005" smaller than the silver balls. The black and silver balls must be installed alternately into the rack- piston and return guide.

5. Alternately install 7 balls into the return guide and retain with chassis lubricant at each end of guide. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the 2 clamp screws to 10 ft. lbs.
6. Insert Bearing Retainer Tool J-7539 into the rack-piston, then while holding tool tightly against end of worm, thread worm out of the rack-piston.

Hose Connector Inverted Flares

If the brass inverted flare connectors show need of replacement, proceed as follows:

1. Tap threads into the center hole of the connector with a 5/16-18 tap.

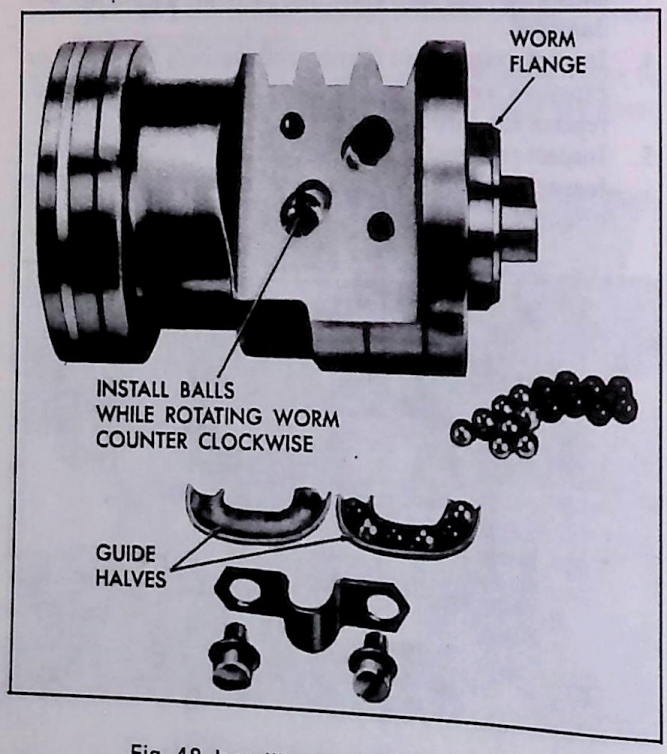


Fig. 48–Installing Balls in Rack-Piston

CAUTION: Do not tap the threads too deep in the pressure hose connector seat as the tap will bottom the poppet valve against the housing and damage it. It is necessary to tap only two or three threads deep.

2. Thread a 5/16-18 bolt, with a nut and flat washer attached, into the tapped hole so that the washer rides against the face of the port boss and the nut rides against the washer.
3. Hold the bolt from rotating while turning the nut on the bolt. This will force the washer against the bolt boss and will back out the bolt, drawing the connector from the housing. Discard the connector.
4. Clean the housing thoroughly to remove any tapping chips.
5. Drive the new connector against the housing seat using Tool J-6217, being careful not to damage either the connector or housing seat (fig. 49).

Pitman Shaft Needle Bearing and Seals

Removal

1. If pitman shaft seals ONLY are to be replaced, remove the seal retaining ring with Internal Pliers J-4245 and remove outer steel washer. Pry out the outer seal. Remove the inner steel washer, then pry out the inner seal (fig. 50). Discard seals.

CAUTION: When prying out seals, be extremely careful not to score the housing bore.

2. If pitman shaft needle bearing replacement is necessary, remove with Tool J-6278. Since this bearing is shouldered, it must be pressed out the pitman shaft end of the housing.

Installation

1. If the pitman shaft needle bearing was removed, place bearing Installer Tool J-22407 onto Handle J-8092. Place needle bearing (shouldered end first) on to Tool J-22407. Press bearing into gear housing until Tool bottoms on housing. The bearing is now correctly positioned (fig. 51).

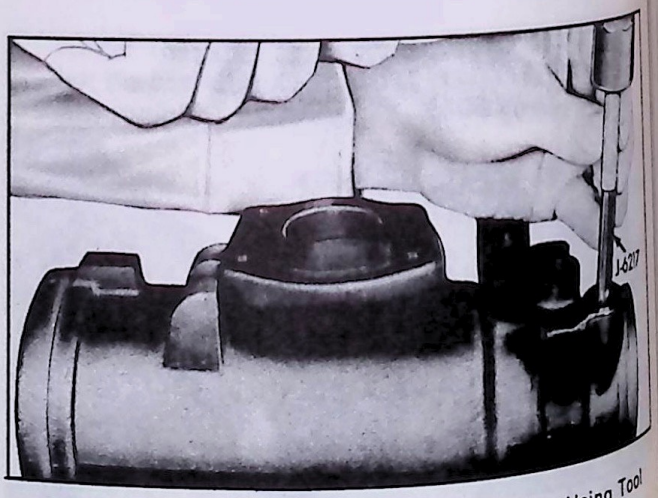


Fig 49–Installing New Connector in Housing Using Tool J-6217

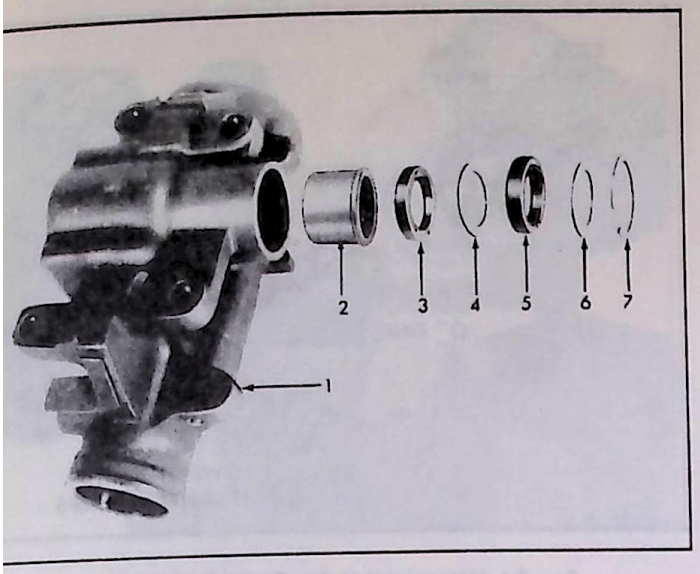


Fig. 50–Pitman Shaft Bearing and Seals

1. Housing
2. Bearing
3. Oil Seal
4. Steel Washer
5. Oil Seal (Double Lip)
6. Steel Washer
7. Retaining Ring

CAUTION: Do not drive the bearing further into the housing after removing Tool J-22407, since damage to the bearing would result.

2. Lubricate the lips of the oil seals with Power Steering Fluid.
3. Install the pitman shaft oil seals as follows:
   a. Place Adapter J-6278-2 over Tool J-6278, then install the outer seal (double lip), inner steel washer, and inner seal with the lips of the seals facing away from the adapter.
   b. Drive the seals into the housing until the top of Adapter J-6278-2 is flush with the housing (fig. 52).

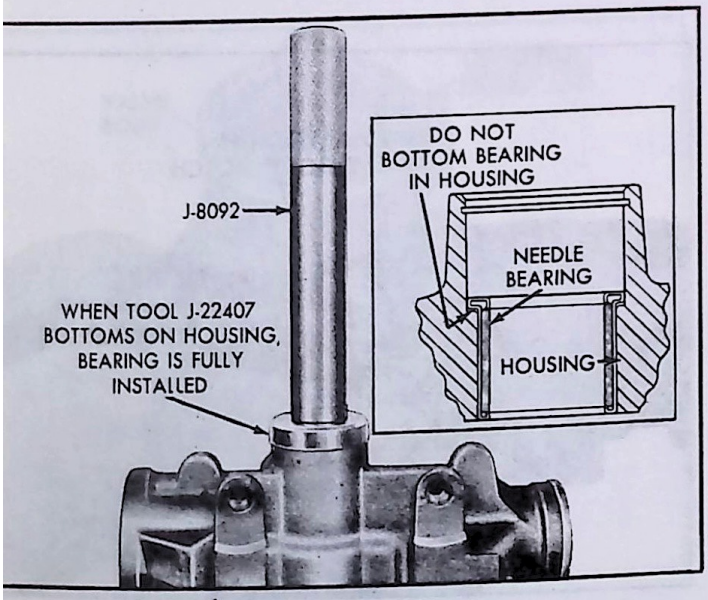


Fig. 51–Installing Pitman Shaft Bearing

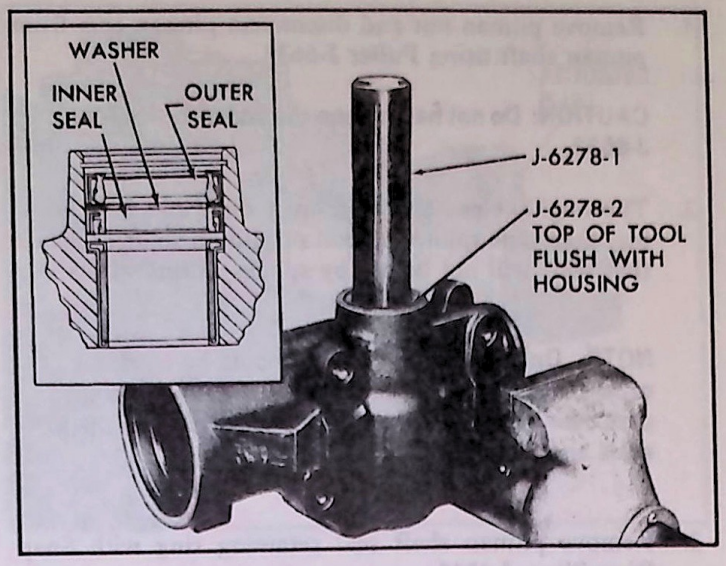


Fig. 52–Installing Pitman Shaft Seals (Bench Overhaul)

   c. Remove the tool and adapter, then install the outer steel washer and seal retaining ring. The retaining ring will not seat in the groove at this time.
   d. Reinsert Tool J-6278 with Adaper J-6278-2 and continue driving the seals until the retaining ring seats in its groove (Refer to Inset, Figure 52), then remove the tool and adapter.

Removal and Installation of Pitman Shaft Seals with Steering Gear in Vehicle (fig. 53)

If upon inspection of the gear, it is found that oil leakage exists at the pitman shaft seals, the seals may often be replaced without removing the gear assembly from the vehicle as follows:

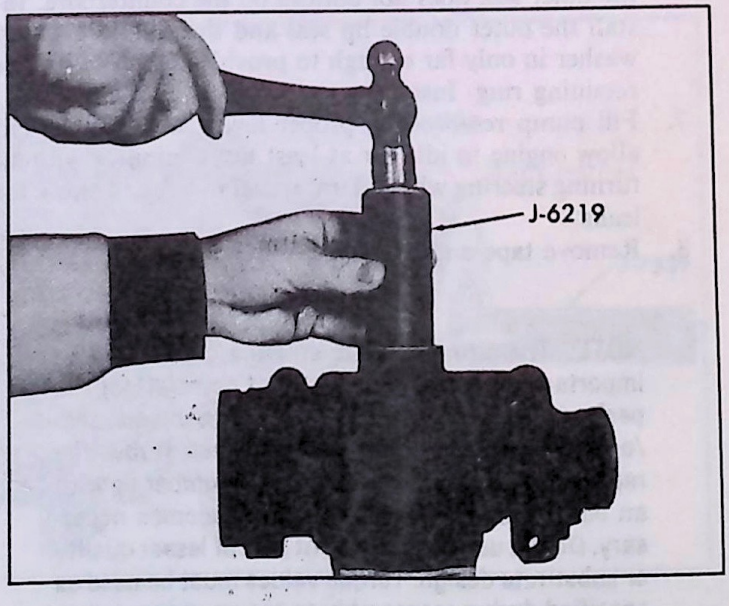


Fig. 53–Installing Pitman Shaft Seals

1. Remove pitman nut and disconnect pitman arm from pitman shaft using Puller J-6632.

   CAUTION: Do not hammer on the end of Puller Tool J-6632.

2. Thoroughly clean end of pitman shaft and gear housing, then tape splines on end of pitman shaft to insure that seals will not be cut by splines during assembly.

   NOTE: Only one layer of tape should be used; an excessive amount of tape will not allow the seals to pass over it, due to the close tolerance between the seals and the pitman shaft.

3. Remove pitman shaft seal retaining ring with Snap Ring Pliers J-4245.
4. Start engine and turn steering wheel fully to the left so that oil pressure in the housing can force out pitman shaft seals. Turn off engine.

   NOTE: Use suitable container to catch oil forced out of gear. This method of removing the pitman shaft seals is recommended, as it eliminates the possibility of scoring the housing while attempting to pry seals out. If pressure of oil does not remove seals, turn off engine, remove the steering gear and remove the seals as outlined previously in this section.

5. Clean the end of housing thoroughly so that dirt will not enter housing with the installation of the new seals.
6. Lubricate the seals thoroughly with Power Steering Fluid to install seals with Installer J-6219. Install the inner single lip seal first, then a back-up washer. Drive seal in far enough to provide clearance for the outer seal, back-up washer and retaining ring. Make sure that the inner seal does not bottom on the counterbore. Install the outer double lip seal and the second back-up washer in only far enough to provide clearance for the retaining ring. Install retaining ring.
7. Fill pump reservoir to proper level. Start engine and allow engine to idle for at least three minutes without turning steering wheel. Turn wheel to left and check for leaks.
8. Remove tape and reconnect pitman arm.

   NOTE: The pitman arm to steering gear nut is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

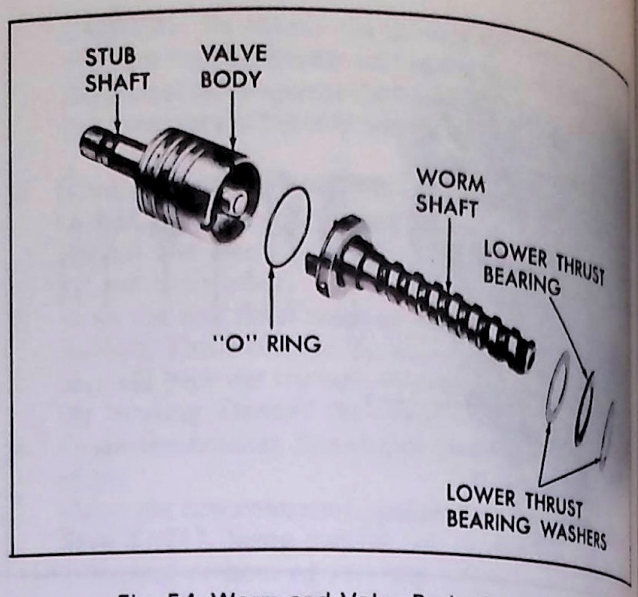


Fig. 54--Worm and Valve Body--Exploded View

GEAR ASSEMBLY

1. Lubricate the worm, lower thrust bearing and the two thrust washers with Power Steering Fluid, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm (fig. 54).

2. Lubricate the valve body teflon rings and a new stub shaft cap "O" ring with Power Steering Fluid. Install the stub shaft cap "O" ring in the valve body so it is seated against the stub shaft cap. Align the NARROW NOTCH in the valve body with the pin in the worm, then install the valve and stub shaft assembly in the gear housing (fig. 55). Apply pressure to the VALVE BODY when installing. If pressure is applied to the stub shaft during installation, the stub shaft may be forced out of the valve body (fig. 56).

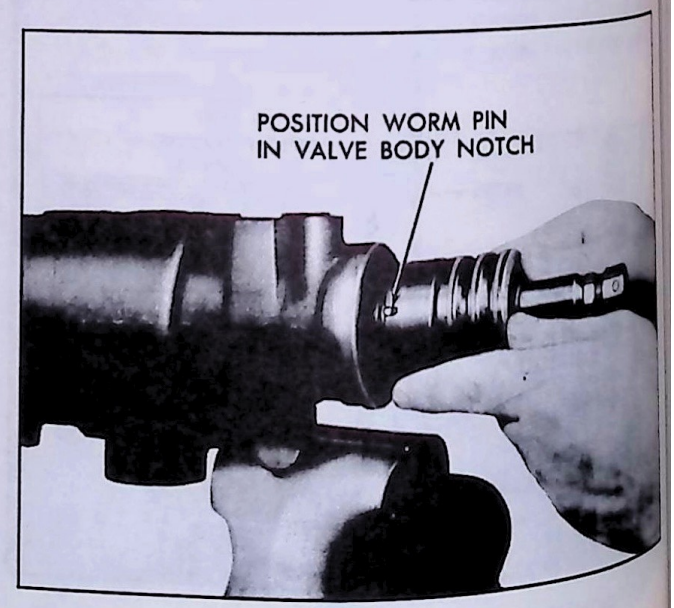


Fig. 55--Valve to Worm Alignment

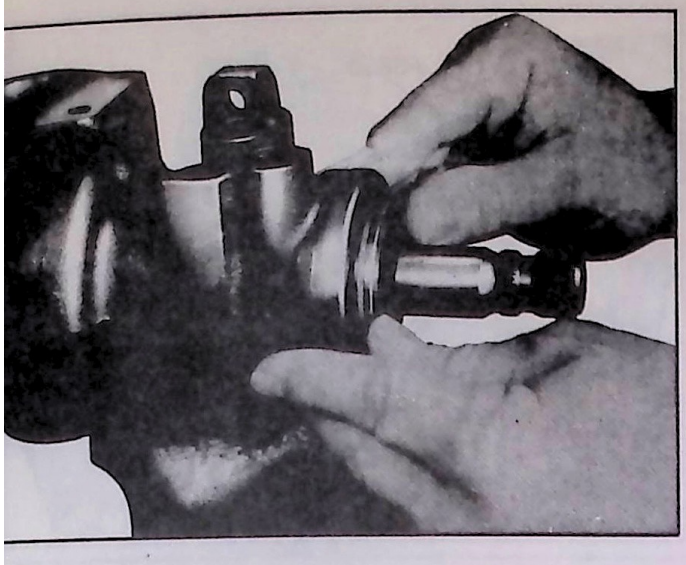


Fig. 56–Installing Valve Body

NOTE: The valve body is properly seated when the oil return hole in the housing is entirely uncovered (fig. 57).

3. Lubricate a new adjuster plug "O" ring with Power Steering Fluid and install in groove on adjuster plug. Place Seal Protector J-6222 over the stub shaft, then install the adjuster plug assembly in the housing until it seats against the valve body (fig. 58). Remove Seal Protector. Do not adjust the thrust bearing preload at this time.

4. Install the rack-piston as follows:
   a. Lubricate the rack-piston teflon seal with Power Steering Fluid.
   b. Position Seal Compressor J-8947 (Passenger Cars) J-7576 (Trucks) against the shoulder in the housing.

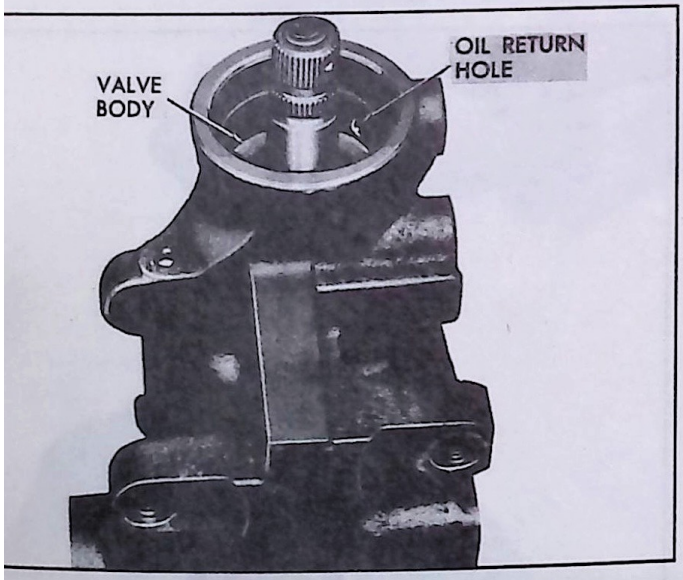


Fig. 57–Valve Body Position in Housing

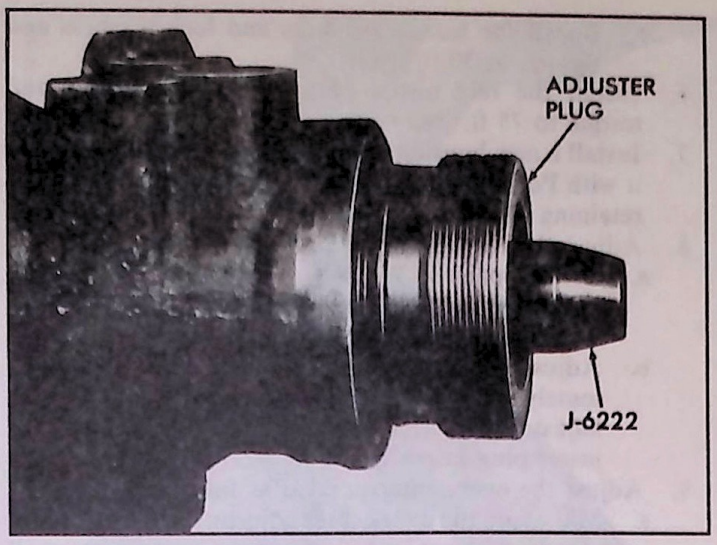


Fig. 58–Installing Adjuster Plug

   c. With Ball Retainer J-7539 in place in the rack-piston, push the rack-piston (with teeth toward pitman shaft opening), into the housing until Tool J-7539 contacts the center of worm (fig. 59).
   d. Turn the stub shaft clockwise with a 3/4" twelve point socket or box end wrench to thread the rack-piston onto the worm while holding Tool J-7539 against the end of the worm.
   e. When the rack-piston is completely threaded on the worm, remove Ball Retainer J-7539 and Seal Compressor J-8947 (Cars) or J-7576 (Trucks).

5. Install the pitman shaft and side cover as follows:
   a. Install a new "O" ring in the pitman shaft side cover and retain with chassis lubricant.
   b. Turn the stub shaft until the rack-piston teeth are centered in the pitman shaft opening, then install the pitman shaft and side cover so that the center tooth of the pitman shaft engages the center groove of the rack-piston.

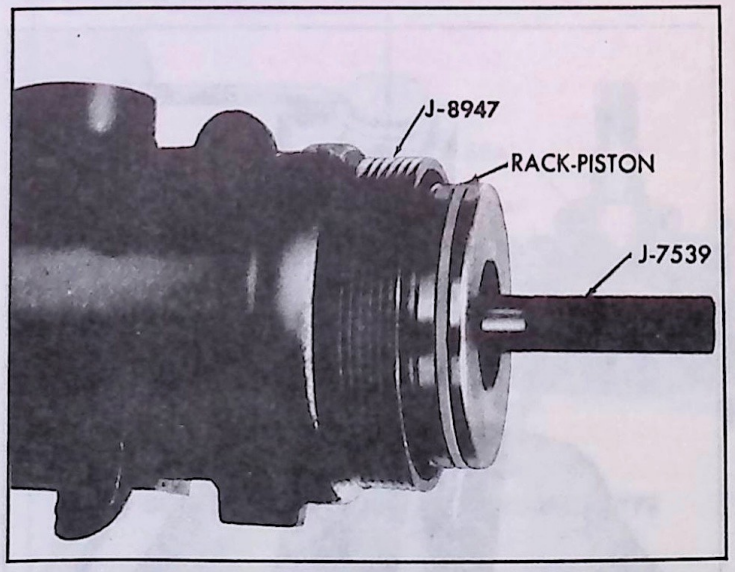


Fig. 59–Installing Rack-Piston

c. Install the side cover bolts and lock washers and tighten to 30 ft. lbs.

6. Install the rack-piston plug in the rack-piston and torque to 75 ft. lbs.
7. Install a new housing end cover "O" ring and lubricate it with Power Steering Fluid. Install the end cover and retaining ring.
8. Adjust the thrust bearing preload as follows:
   a. Using Spanner Wrench J-7624, tighten adjuster plug up snug (clockwise). Back adjuster plug off 1/8 turn and measure valve drag.
   b. Adjust thrust bearing preload to obtain approximately 2 in. lbs. in excess of seal drag. Tighten adjuster plug locknut securely while holding adjuster plug in position with Tool J-7624.
9. Adjust the over-center preload as follows:
   a. Make sure the over-center adjusting screw is backed all the way out and then turned back in one-half turn.
   b. Install an inch-lb. torque wrench with a 3/4", 12-point socket on the stub shaft splines.
   c. Rotate the stub shaft from one stop to the other. Count the number of turns and locate the center of travel, then check the combined seal drag and thrust bearing preload by rotating the torque wrench through the center of travel. Note the highest reading.

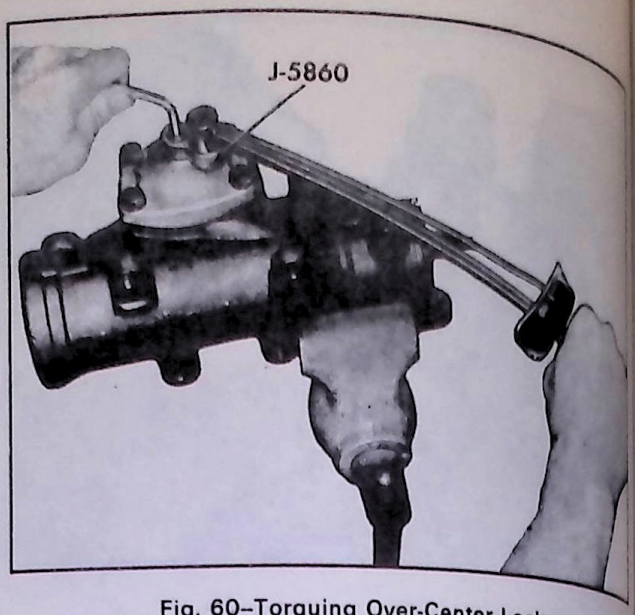


Fig. 60–Torquing Over-Center Locknut

   d. Tighten the pitman shaft over-center adjusting screw until the torque wrench reads 3-6 in. lbs. higher than the reading noted in Step c. The total reading should not exceed 14 in. lb.
   e. While holding the adjusting screw, tighten the locknut to 25 ft. lbs. using using Adapter J-5860 (fig. 60) and recheck the adjustment.

CONTROL VALVE CORVETTE

INDEX

OVERHAUL OPERATIONS

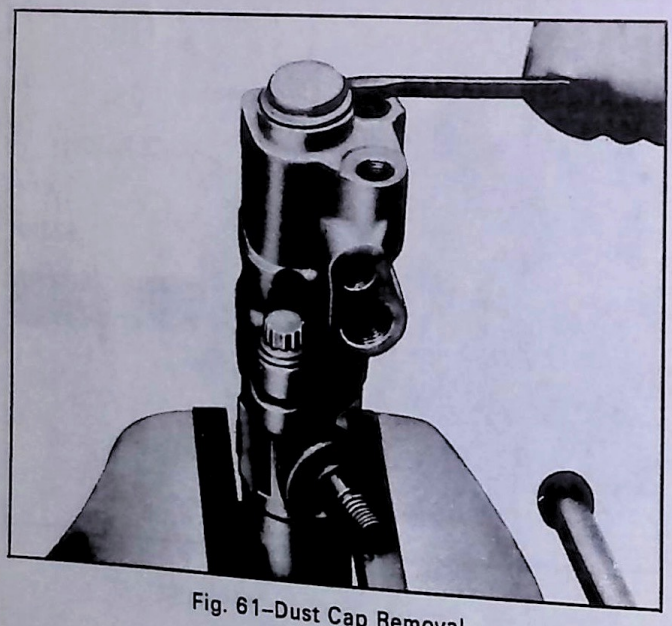


Fig. 61–Dust Cap Removal

Fig. 62–Removing Adjusting Nut

Fig. 63--Removing Spool from Housing

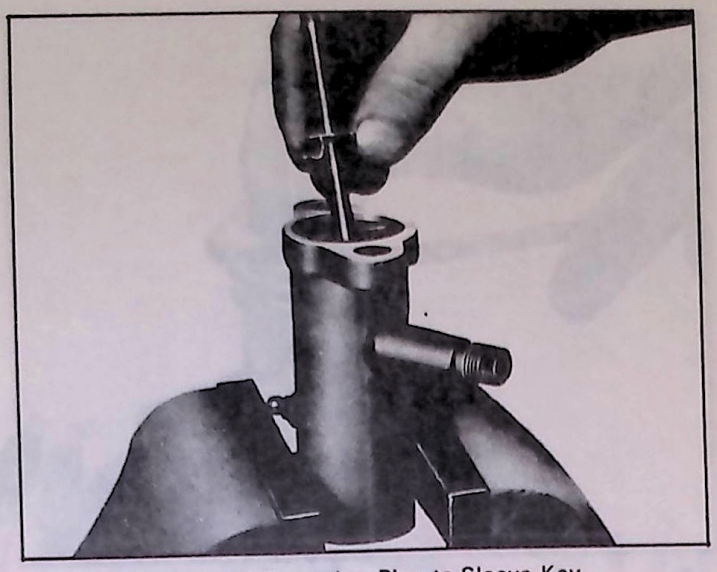


Fig. 65--Removing Plug-to-Sleeve Key

Disassembly

1. Place the valve in a vise as shown and remove dust cover (fig. 61).
2. Remove adjusting nut (fig. 62).
3. Remove valve to adapter bolts and remove valve housing and spool from adapter.
4. Remove spool from the housing (fig. 63).
5. Remove spring, reaction spool, washer reaction spring, spring retainer, and seal (fig. 64). "O" ring may now be removed from the reaction spool.
6. Remove the annulus spacer valve shaft washer and plug to sleeve key (See Figure 65).
7. Remove clamp by removing nut, bolt and spacer or, if crimped type clamp is used, straighten clamp end and pull clamp and seal off end of stud (fig. 66).
8. Carefully, so as not to nick the top surface, turn adjuster plug out of sleeve (fig. 67).
9. Remove the adapter from the vise and invert, permitting the spring and one of the two ball seats to fall free.
10. Remove the ball stud and the other ball seat and the sleeve will fall free.

Inspection

1. Wash all metal parts in nontoxic solvent and blow dry with compressed air.
2. Inspect all parts for scratches, burrs, distortion, evidence of wear and replace all worn or damaged parts, including mating parts when necessary.
3. Replace all seals, gaskets, covers with approved service parts.

Repairs

NOTE: The Corvette valve incorporates a 55 lb. centering spring. The Corvette valve incorporating this spring is identified by an "X" stamped on the dust cover.

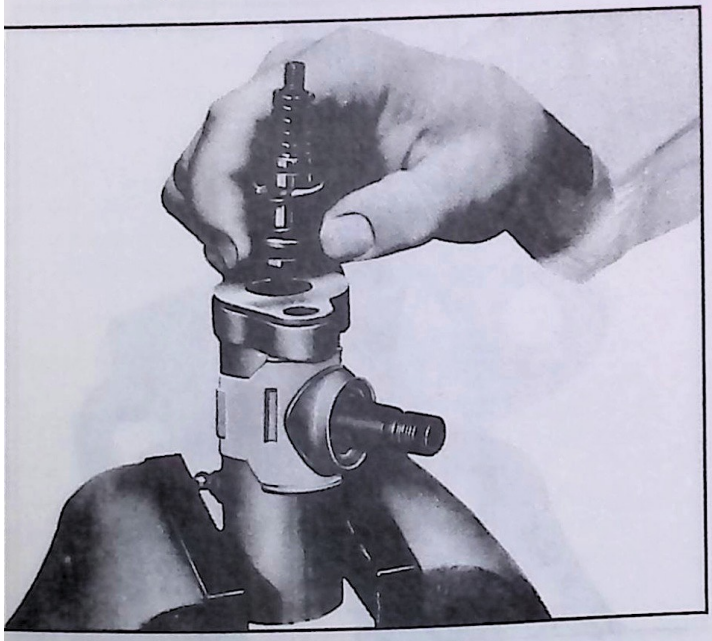


Fig. 64--Removing Valve Parts from Shaft

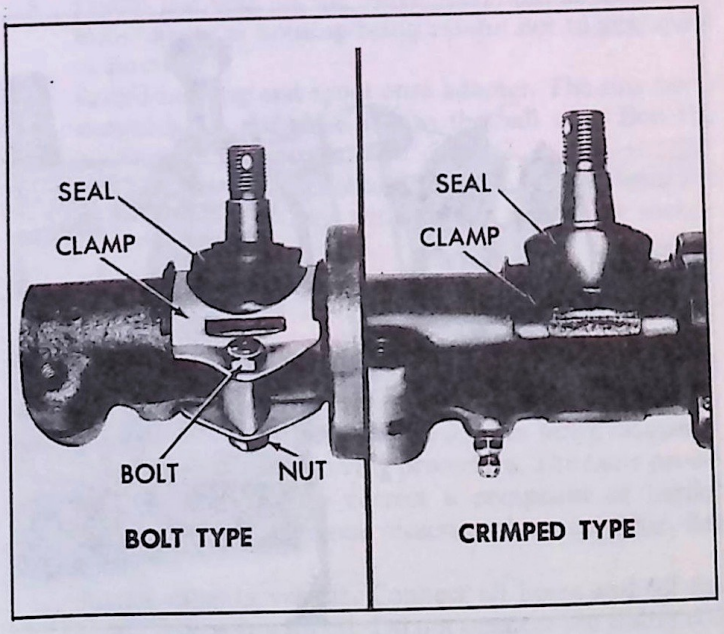


Fig. 66--Seal with Clamp Attachment

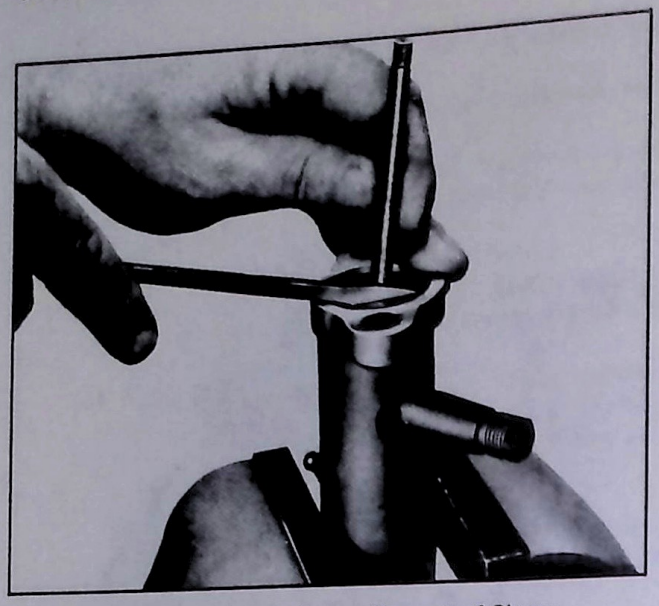


Fig. 67–Turning Adjuster Plug out of Sleeve

In case a connector seat becomes damaged, proceed as follows:

To remove connector seat, tap threads in center hole using a 5/16- 18 tap. Thread a bolt with nut and flat washer attached into tapped hole so that the washer rides against the face of the port boss and the nut rides against the washer. Hold the bolt from rotating while turning the nut off the bolt. This will force the washer against the port boss face and will back out the bolt thus drawing the connector seat from the top cover housing (fig. 68). Discard the connector seat. Clean the housing out thoroughly to remove any tapping chips.

Drive new connector seat against housing seat, using Tool J 6217, being careful not to damage either the connector seat or the housing seat (fig. 69).

Assembly (Fig. 71)

1. Replace the sleeve and ball seat in the adapter, then the ball stud, and finally the other ball seat and the spring, small coil down.

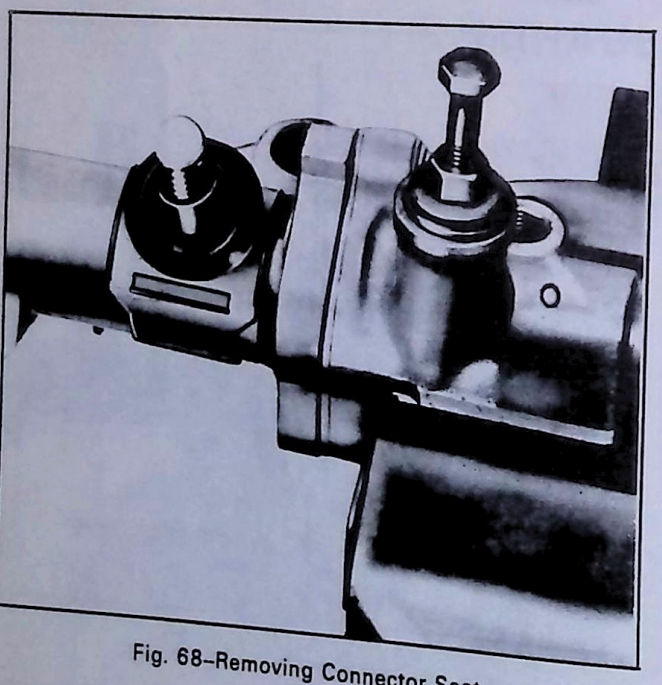


Fig. 68–Removing Connector Seat

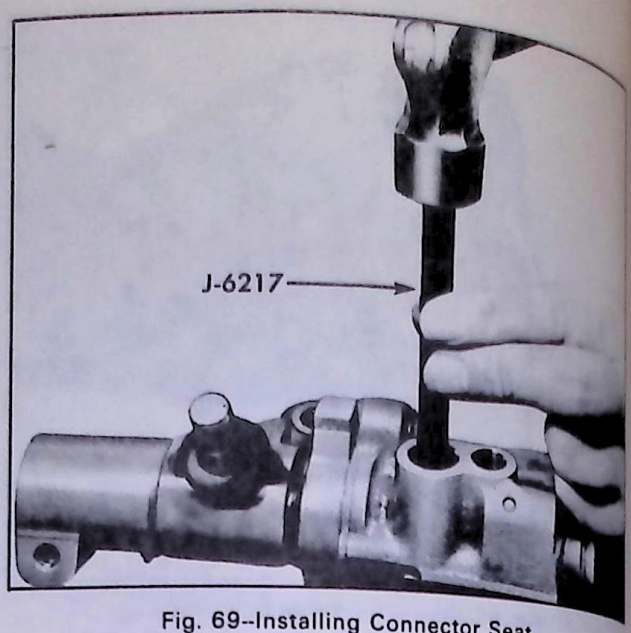


Fig. 69–Installing Connector Seat

2. Clamp the adapter in vise, put the shaft through the seat in the adjuster plug and screw adjuster plug in sleeve (fig. 70).
3. Turn the plug in until it is tight, then back it off until the slot lines up with notches in the sleeve.
4. Install new seal and clamp over stud so lips on seal mate with clamp. (A nut and bolt attachment type clamp replaces the crimped type for service fig. 66).
5. Center the ball stud, seal and clamp at opening in adapter housing, then install spacer, bolt and nut.
6. Insert the key, making sure that the small tangs on the ends of the key fit into the notches in the sleeve (fig. 72).
7. Install the valve shaft washer, annulus spacer, and the reaction seal (lip up), spring retainer, reaction spring and spool, washer and adjustment spring. (Install "O" ring seal on reaction spool before installing spool on shaft.) Install the washer with the chamfer "up".

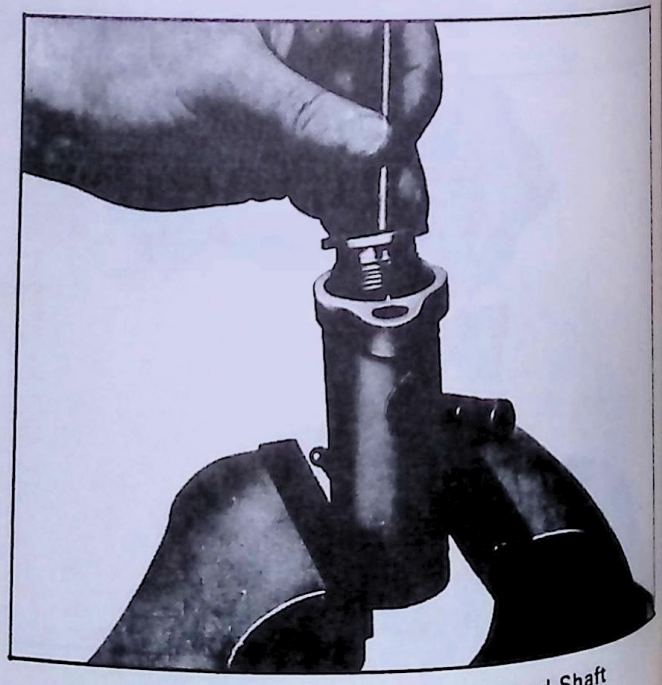


Fig. 70–Replacing Adjuster Plug and Shaft

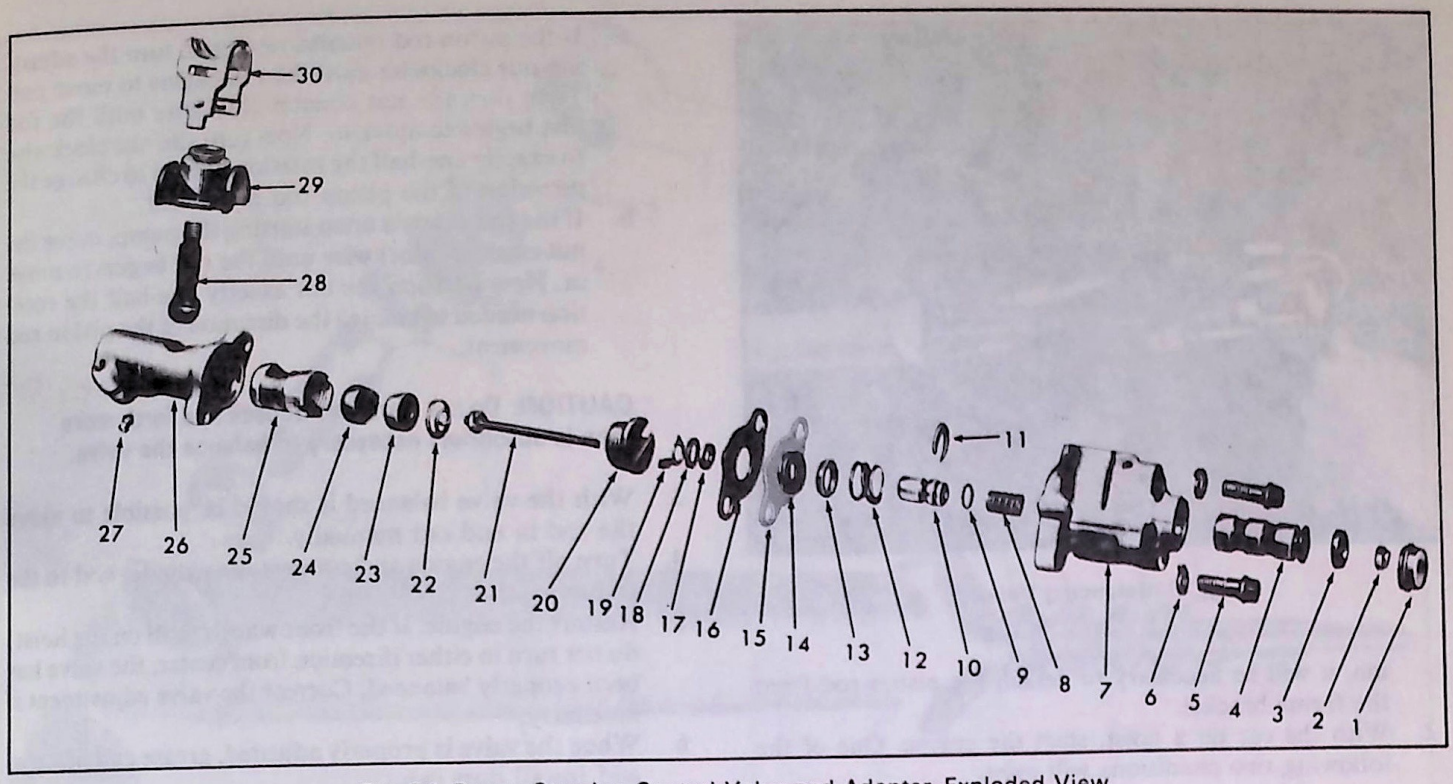


Fig. 71–Power Steering Control Valve and Adapter–Exploded View

1. Dust Cover
2. Adjusting Nut
3. Vee Block Seal
4. Valve Spool
5. Valve Mounting Bolts
6. Lock Washer
7. Valve Housing
8. Valve Adjustment Spring
9. "O" Ring Seal
10. Valve Reaction Spool
11. Spring Thrust Washer
12. Valve Spring
13. Spring Retainer
14. Annulus Seal
15. Annulus Spacer
16. Gasket
17. Valve Shaft Washer
18. "O" Ring Seal
19. Plug to Sleeve Key
20. Ball Adjuster Nut
21. Valve Shaft
22. Ball Seat Spring
23. Ball Seat
24. Ball Seat
25. Sleeve Bearing
26. Adapter Housing
27. Lubrication Fitting
28. Ball Stud
29. Seal
30. Clamp

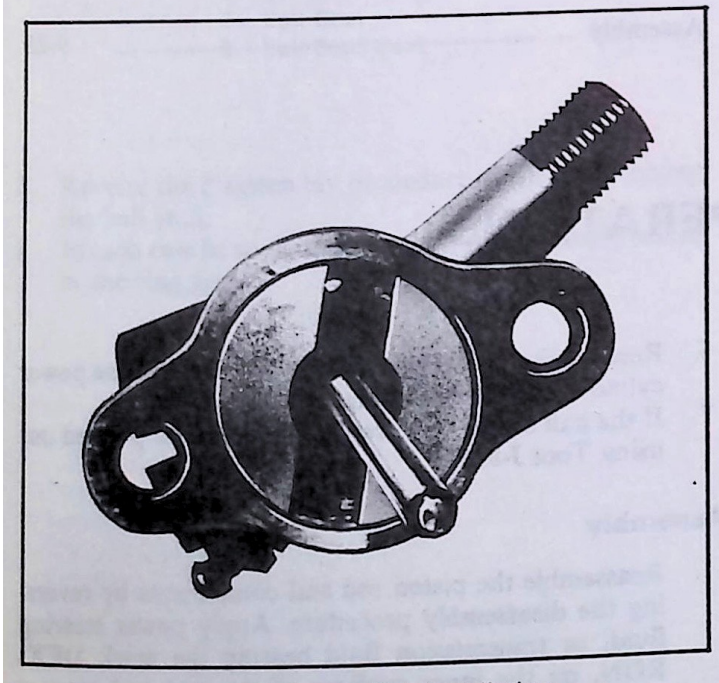


Fig. 72–Proper Key Installation

8. Install the seal on the valve spool (lip down), then install spool in housing being careful not to jam spool in housing.
9. Install housing and spool onto adapter. The side ports should be on the same side as the ball stud. Bolt the housing to the adapter.
10. Depress the valve spool and turn the locknut onto the shaft about four turns with a clean wrench or socket.

NOTE: Always use a new nut.

Valve Balancing (Fig. 73)

The control valve must be adjusted, after being disassembled, as outlined in the following procedure. The same procedure may be followed to correct a complaint of harder steering effort required in one direction than the other. See Figure 73.

1. Install valve in vehicle. Connect all hoses and fill the pump reservoir with oil. Do not connect the piston rod to the frame bracket. If the vehicle is already in operat-

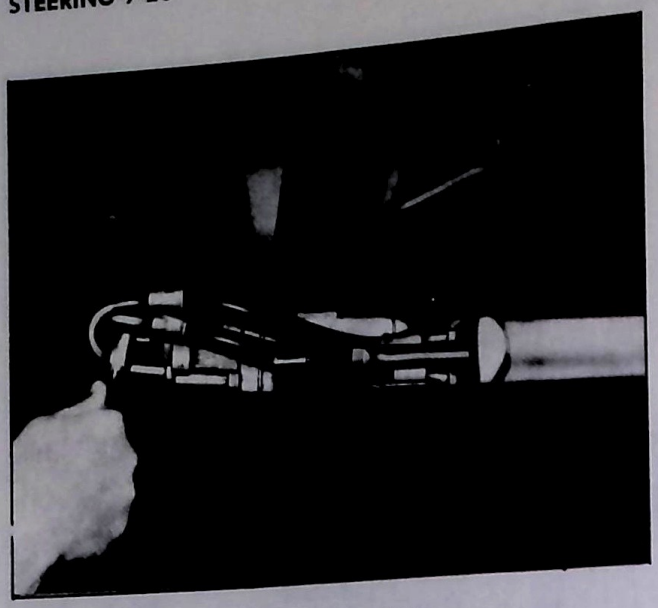


Fig. 73–Balancing Valve

ion, it will be necessary to detach the piston rod from the frame bracket.

2. With the car on a hoist, start the engine. One of the following two conditions will exist.

   a. If the piston rod remains retracted, turn the adjusting nut clockwise until the rod begins to move out. Then turn the nut counter-clockwise until the rod just begins to move in. Now turn the nut clockwise to exactly one-half the rotation needed to change the direction of the piston rod movement.
   b. If the rod extends upon starting the pump, move the nut counter- clockwise until the rod begins to move in. Now position the nut exactly one-half the rotation needed to change the direction of the piston rod movement.

CAUTION: Do not turn the nut back and forth more than is absolutely necessary to balance the valve.

3. With the valve balanced it should be possible to move the rod in and out manually.
4. Turn off the engine and connect the cylinder rod to the frame bracket.
5. Restart the engine. If the front wheels (still on the hoist) do not turn in either direction from center, the valve has been properly balanced. Correct the valve adjustment if necessary.
6. When the valve is properly adjusted, grease end of valve and install dust cap.

POWER CYLINDER-- CORVETTE

INDEX

OVERHAUL OPERATIONS

Disassembly (Fig. 74)

1. To remove the piston rod seal, remove the snap ring; then pull out on rod, being careful not to spray oil.
2. Remove the piston rod scraper and scraper element, back up washer and piston rod seal from the rod.
3. At the ball stud end of the cylinder, remove the ball stud seal.
4. Remove the snap ring retaining the end plug and lube fitting.
5. Push on the end of the ball stud and remove the end plug, spring, spring seat and ball stud.
6. Remove the "O" ring seal from the top lip of the power cylinder ball stud opening.
7. If the ball seat is to be replaced, it must be pressed out using Tool J-8937.

Assembly

1. Reassemble the piston rod seal components by reversing the disassembly procedure. Apply power steering fluid, or transmission fluid bearing the mark DEXRON, on the inner surfaces of the seal and scraper before assembly.

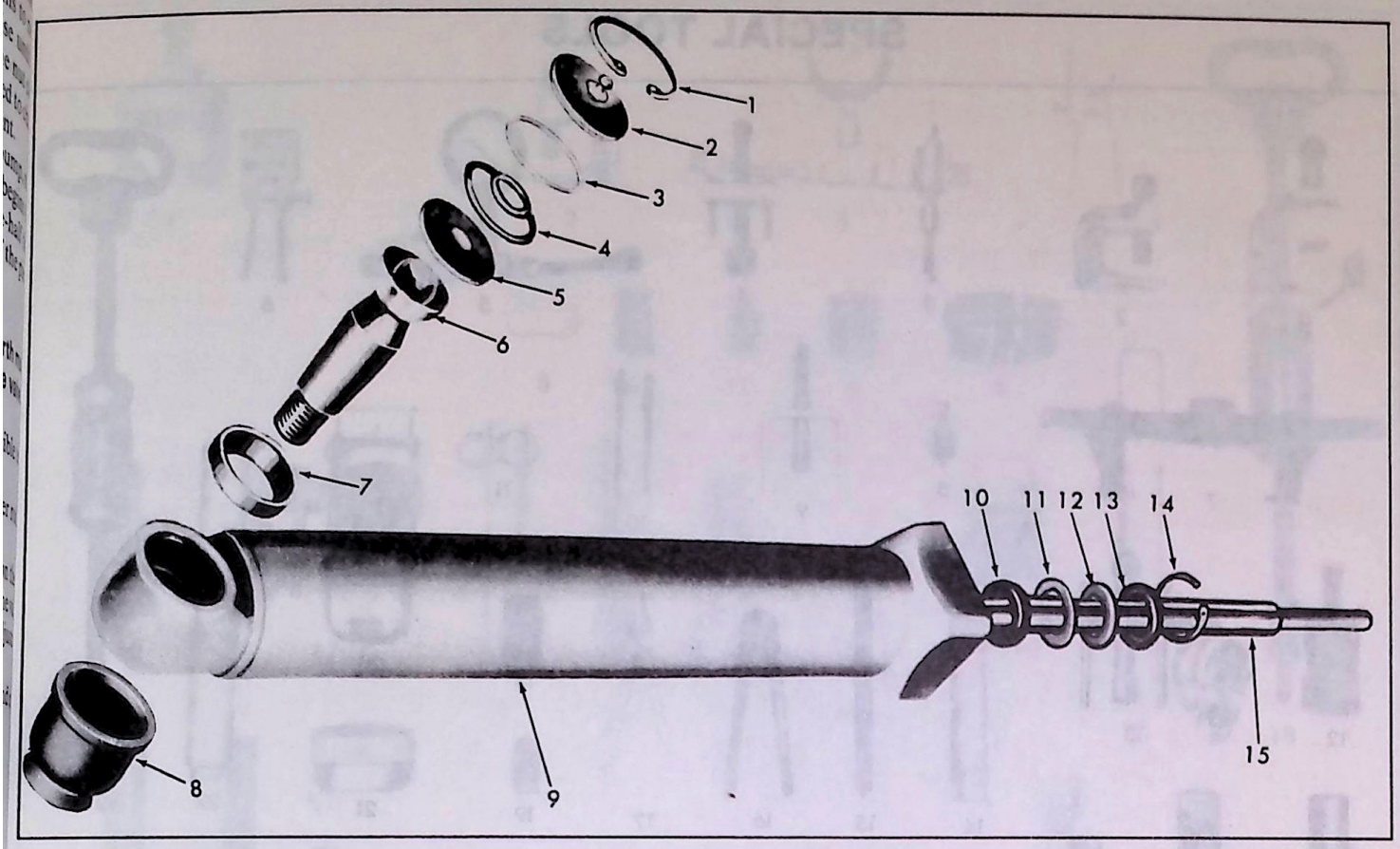


Fig. 74–Power Steering Power Cylinder Components

1. Snap Ring
2. End Plug and Lube Fitting
3. "O" Ring
4. Spring
5. Spring Seat
6. Ball Stud
7. Ball Seat
8. Ball Stud Seal
9. Piston Body
10. Piston Rod Seal
11. Backup Washer
12. Scraper Element
13. Piston Rod Scraper
14. Snap Ring
15. Piston Rod

2. Reverse the disassembly procedure when reassembling the ball stud.
3. In each case be sure that the snap ring is securely seated in the ring groove.

NOTE: Be sure to use new seals and "O" rings when re-assembling cylinder.

SPECIAL TOOLS

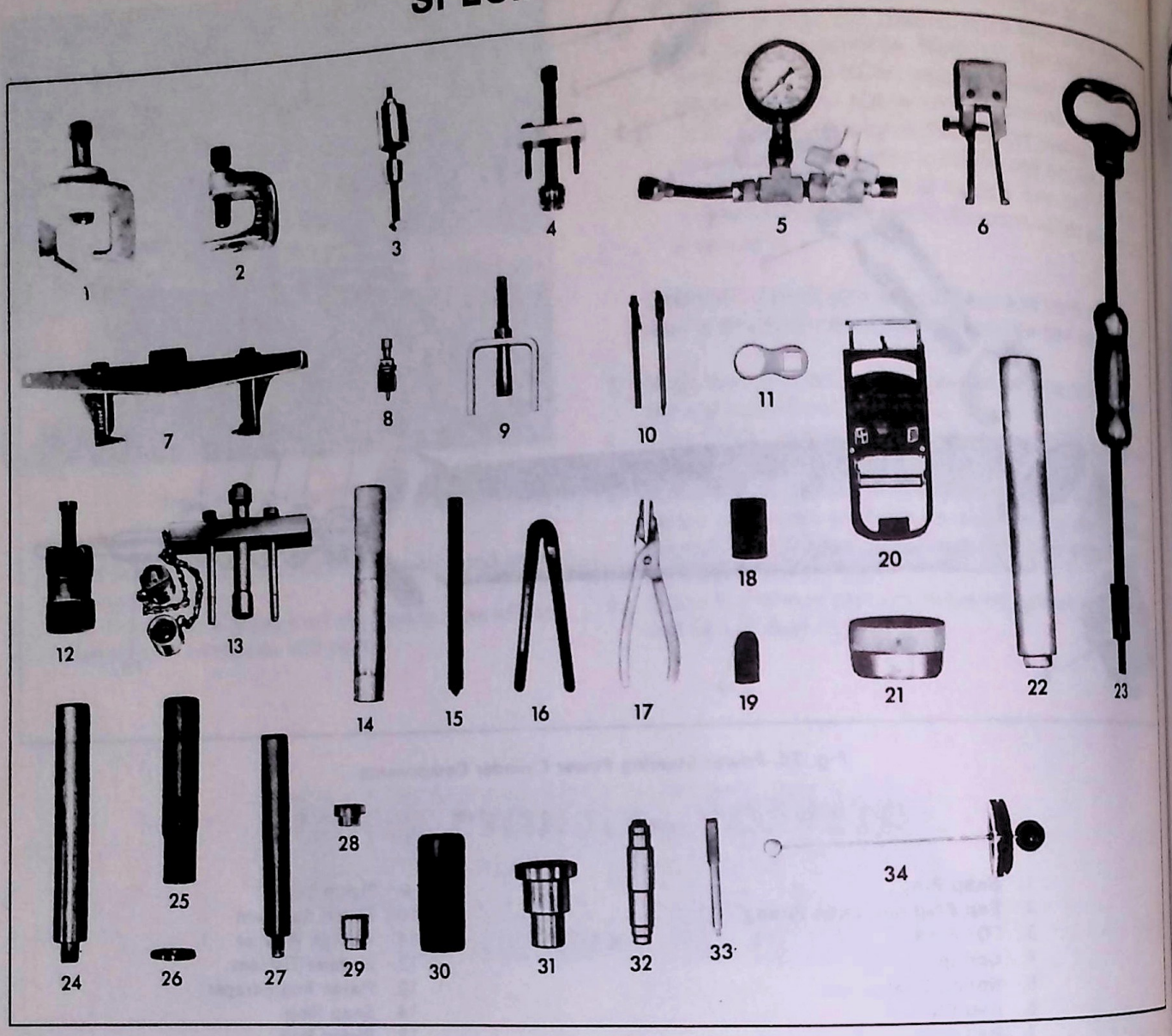


Fig. 75–Manual and Power Steering Special Tools–Passenger Car

1.	J-6632	Pitman Arm Puller
2.	J-5504	Pitman Arm Puller
3.	J-23073	Shift Tube Installer
4.	J-23072	Shift Tube Remover
5.	J-5176	Oil Pressure Gauge
6.	J-5822	Wormshaft Bearing Race Remover
7.	J-8433	Pump Pulley Remover (Cast Pulley)
8.	J-21854	Column Pivot Pin Remover
9.	J-23653	Lock Plate Compressor
10.	J-5421	Thermometer
11.	J-5860	Torque Wrench Adapter
12.	J-21239	Pump Pulley Remover (Stamped Pulley)
13.	J-2927	Steering Wheel Puller
14.	J-1614	Pitman Shaft Bushing Remover
15.	J-7539	Ball Retainer
16.	J-7624	Spanner Wrench
17.	J-4245	No. 23 Internal Pliers
18.	J-22670	Pump Shaft Seal Installer
19.	J-6222	Shaft Seal Protector
20.	J-23600	Belt Tension Gauge
21.	J-8947	Rack-Piston Seal Compressor
22.	J-5755	Wormshaft Bearing Race Installer
23.	J-2619	Slide Hammer
24.	J-8092	Handle
25.	J-6278	Pitman Shaft Bearing Remover
26.	J-6278-2	Pitman Shaft Seal Installer
27.	J-7079-2	Handle
28.	J-8524-1	Adjuster Plug Bearing Installer
29.	J-8524-2	Adjuster Plug Bearing Remover
30.	J-6219	Pitman Shaft Seal Installer
31.	J-22407	Pitman Shaft Bearing Installer
32.	J-8937	Ball Seat Remover
33.	J-6217	Connector Seat Installer
34.		Torque Wrenches

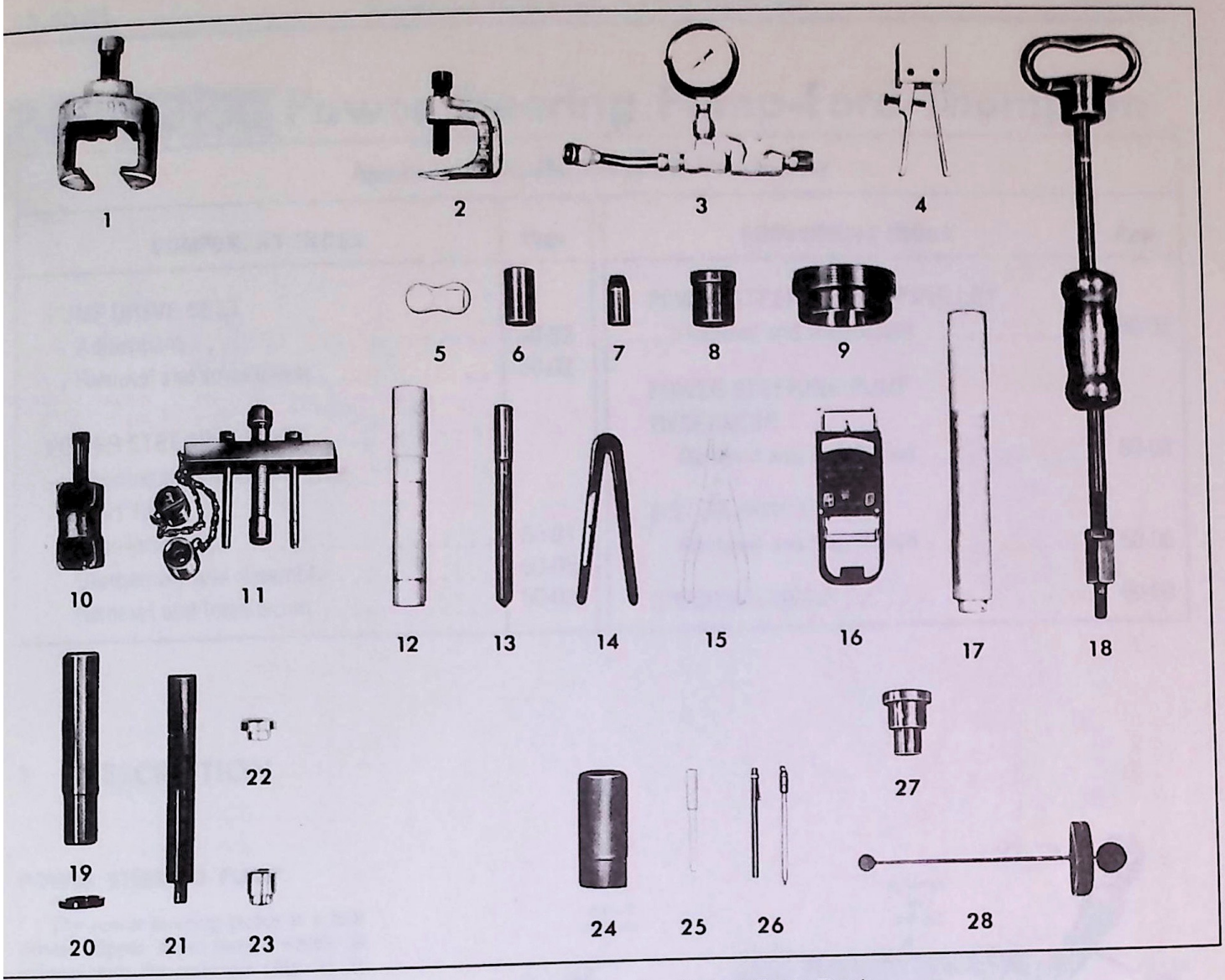


Fig. 76--Manual and Power Steering Special Tools--Truck

1.	J-6632	Pitman Arm Puller
2.	J-5504	Pitman Arm Puller
3.	J-5176	Pressure Gauge
4.	J-5822	Wormshaft Bearing Race Puller
5.	J-5860	Torque Wrench Adapter
6.	J-22670	Pump Shaft Seal Installer
7.	J-6222	Shaft Seal Protector
8.	J-9226	Pitman Shaft Bushing Replacer
9.	J-7576	Rack-Piston Seal Compressor
10.	J-21239	Pump Pulley Remover
11.	J-2927	Steering Wheel Puller
12.	J-1614	Pitman Shaft Bushing Remover
13.	J-7539	Ball Retainer
14.	J-7624	Spanner Wrench
15.	J-4245	No. 23 Internal Pliers
16.	J-23600	Belt Tension Gauge
17.	J-5755	Wormshaft Bearing Race Installer
18.	J-2619	Slide Hammer
19.	J-6278	Pitman Shaft Bearing Remover
20.	J-6278-2	Pitman Shaft Seal Installer
21.	J-7079-2	Drive Handle
22.	J-8524-1	Adjuster Plug Bearing Installer
23.	J-8524-2	Adjuster Plug Bearing Remover
24.	J-6219	Pitman Shaft Seal Installer
25.	J-6217	Connector Seat Installer
26.	J-5421	Thermometer
27.	J-22407	Pitman Shaft Bearing Installer
28.		In. Lb. Torque Wrench

PART 13-50 Power Steering Pump-Ford-Thompson

Applies To F-100, 250, 350 (4 x 2) Vehicles Only

1 DESCRIPTION

POWER STEERING PUMP

The power steering pump is a belt driven slipper type pump which is integral with the reservoir (Fig. 1). It is constructed so that the reservoir is attached to the rear side of the pump housing front plate and the pump body is encased within the reservoir (Fig. 2).

An identification tag is located behind the outlet fitting nut which will disclose the pump builder. Figure 3 shows typical tags. The F in the second line indicates a Ford-built pump while the letter W in the bottom line means the pump was built by TRW or Thompson.

Pumps built by Ford will have internal components similar to those of prior model pumps. However, pumps built by TRW have several internal components which are slightly different than those in Ford pump . Therefore, some of the parts are not interchangeable between the two pumps and proper identification is imperative when requesting service parts.

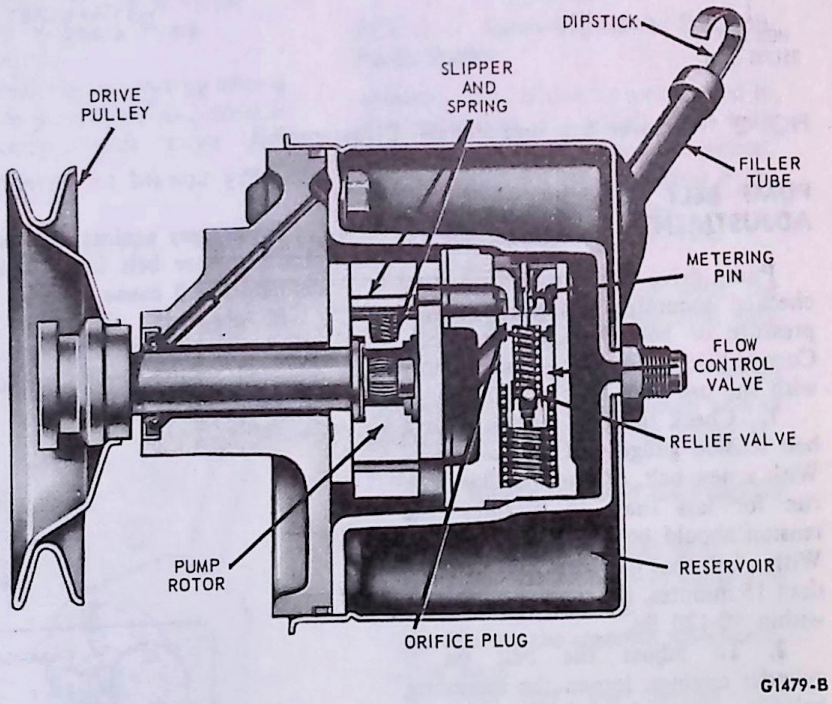


FIG. 1 Power Steering Pump— Sectional View

3 ADJUSTMENTS

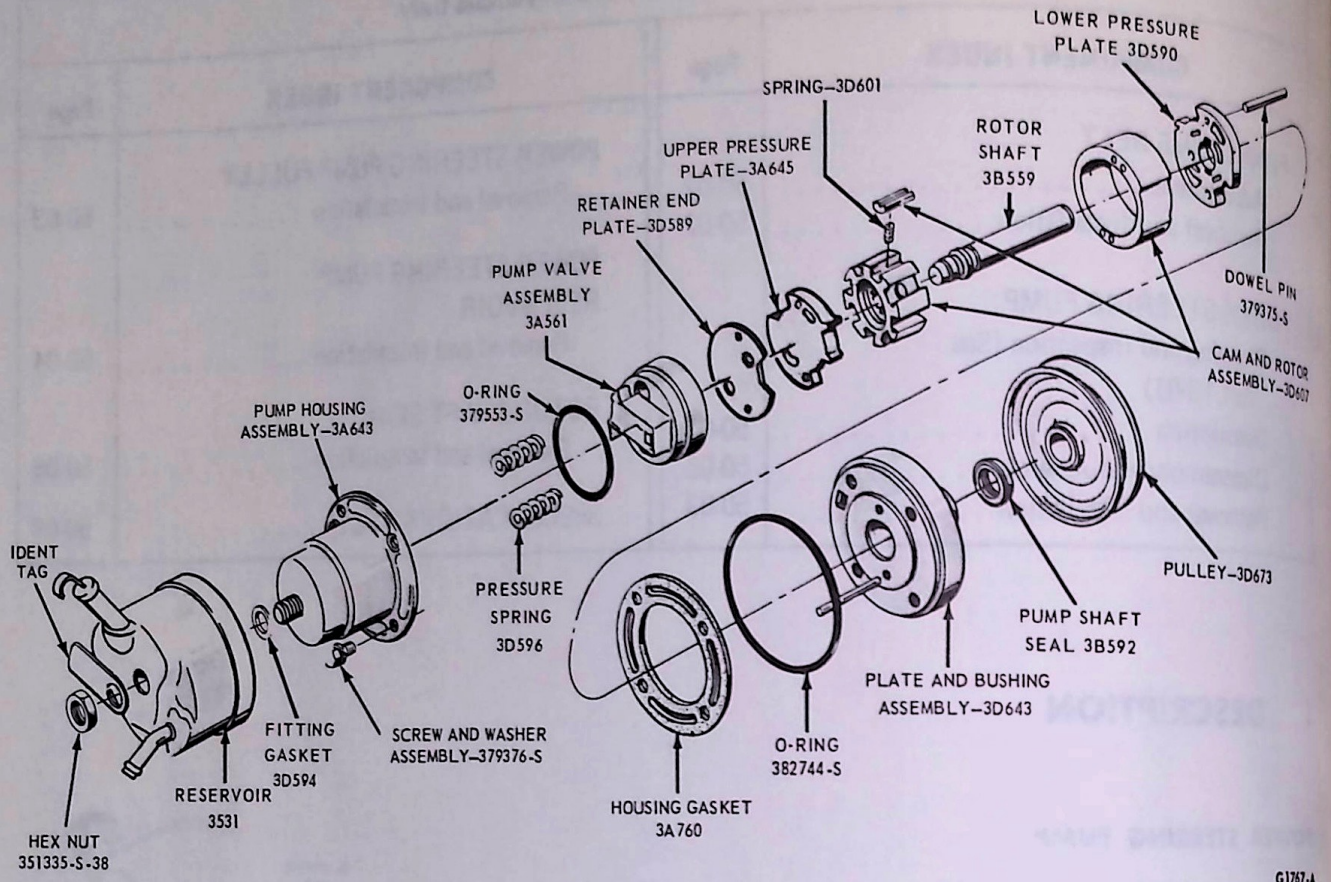


FIG. 2 Power Steering Pump—Disassembled

PUMP BELT TENSION ADJUSTMENT

Pump drive belt tension cannot be checked accurately using the thumb pressure or belt deflection methods. Correct belt adjustment is assured only with the use of a belt tension gauge.

1. Check the belt tension with a belt tension gauge tool T63L-8620-A. With a new belt, or one that has been run for less than 15 minutes, the tension should be within 120-150 lbs. With a belt that has been run for more than 15 minutes, the tension should be within 90-120 lbs.

2. To adjust the belt on 6 cylinder engines, loosen the mounting bolts incorporated on the front face of the pump cover plate (hub side) and one nut at the rear of the reservoir (on 8 cylinder engines, loosen the mounting belt in the adjusting slot and the nut directly above the adjusting slot). On all vehicles equipped with power steering, fit Tool T70P-3D643-A over the boss on the pump housing. Now use a 1/2 inch drive ratchet which will fit into the 8-point hole in the special tool. Pry upward to correct the belt tension.

Do not pry against the reservoir to obtain proper belt load as it can be deformed and cause a leak.

3. Recheck the belt tension. When the tension has been correctly adjusted, tighten the bolts and the nut to specification.

POWER STEERING PUMP DRIVE BELT REPLACEMENT

1. Loosen the idler pulley attaching bolts and remove the compressor drive belt if equipped with an air conditioner.

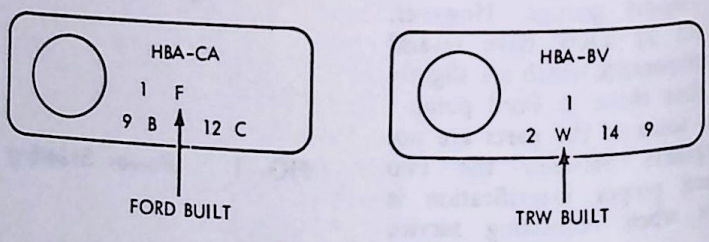


FIG. 3 Pump Identification Tags

2. Loosen 3 bolts and one nut attaching the power steering pump to the pump bracket, and remove the pump drive belt.
3. **Position the power steering pump drive belt on the pulleys.**
4. Adjust the drive belt tension as outlined in this section to specification and tighten the pump attaching bolts and one nut to specification.
5. Install the compressor drive belt if equipped with an air conditioner and adjust to specification (Group 36).

4 REMOVAL AND INSTALLATION

POWER STEERING PUMP

Removal

1. Loosen the pivot bolt (top) and the two adjustment bolts (lower) (Fig. 4) and remove the drive belt.
2. Disconnect the pressure and the fluid return hose from the rear of the pump.
3. Remove the pivot bolt and the two adjustment bolts that secure the pump to the bracket and remove the pump.

Installation

1. Position the pump to the bracket and install but do not tighten the two adjustment bolts and one pivot bolt (Fig. 4).
2. Connect the pressure hose and the fluid return hose to the fittings at the rear of the pump.
3. Place the drive belt on the crankshaft pulley and the pump pulley.
4. Place a wrench on the adjustment web and apply leverage to obtain the specified belt tension using Tool T63L-8620-A and tighten the adjustment bolts and pivot bolt to specification.
5. Fill the system with the proper fluid to the fill mark on the dipstick.
6. Start the engine and turn the wheels from stop-to-stop to bleed air from the system and check for fluid leaks. **Do not hold the wheels against the stops.** Check the fluid level in the reservoir and add fluid C1AZ-19582-A if necessary.

Start-Up Procedure (After Power Steering Pump Overhaul)

Upon initial engine start-up after a power steering pump overhaul, there is very frequently . much noise and aeration. This is due to air trapped in the overhauled unit which mixes with the surging fluid and causes aeration. The problem can be minimized if the following procedure is used.

1. Disconnect the coil wire.
2. Fill the reservoir.
3. Crank the engine with the starter and continue adding fluid until the level remains constant.
4. Rotate the steering wheel approximately 30 degrees each side of center while continuing to crank the engine.
5. Recheck the fluid level and fill as required.
6. Reconnect the coil wire.
7. Start the engine and allow it to run for several minutes.
8. Rotate the steering wheel from stop to stop.
9. Shut off the engine and recheck the fluid level—add as required.

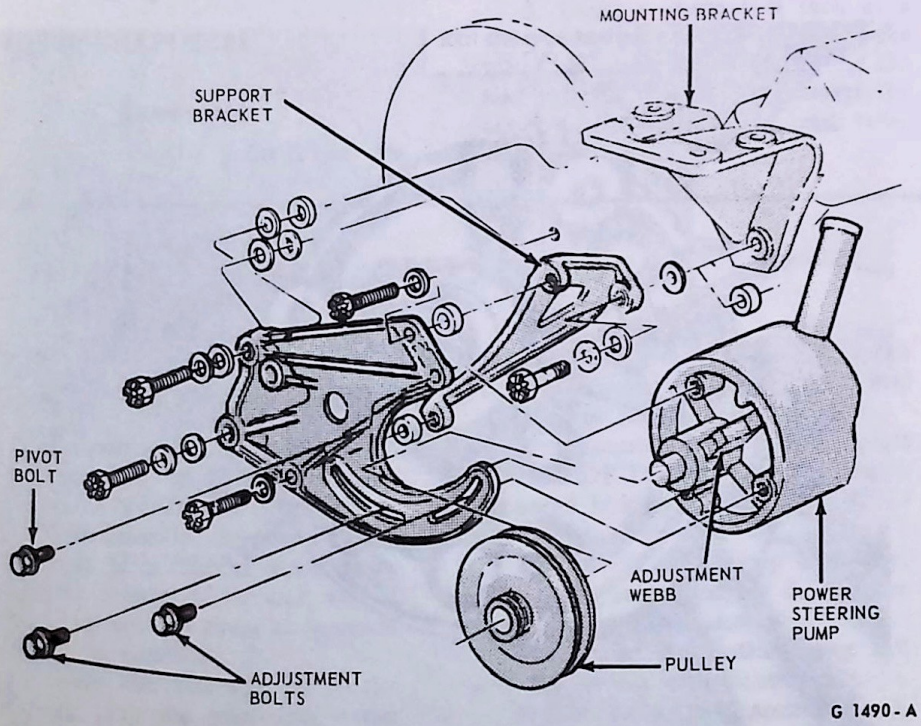


FIG. 4 Power Steering Pump Installed—Ford-Thompson

FIG. 5 Removing Power Steering Pump Pulley

POWER STEERING PUMP PULLEY

Removal

1. Drain as much of the fluid as possible from the pump through filler pipe.

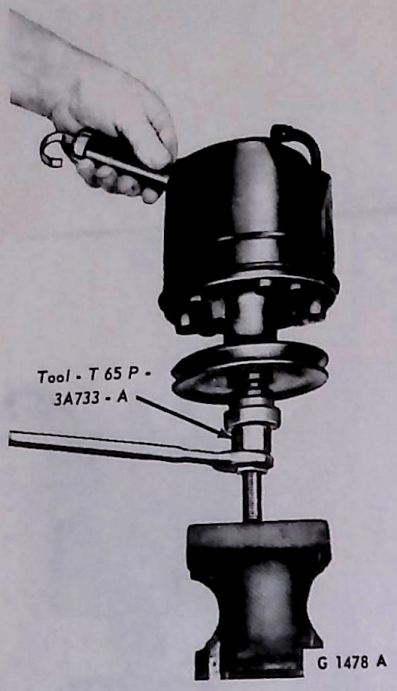


FIG. 6 Installing Power Steering Pump Pulley

2. Install a 3/8-16 capscrew in the end of the pump shaft to prevent damage to the shaft end by the tool screw.

3. Install the pulley remover tool, T63L-10300-B on the pulley hub, and place the tool and pump in a vise as shown in Fig. 5.

4. Hold the pump and rotate the tool nut counterclockwise to remove the pulley (Fig. 5). **The pulley must be removed without in and out pressure on the pump shaft to prevent damage to internal thrust areas.**

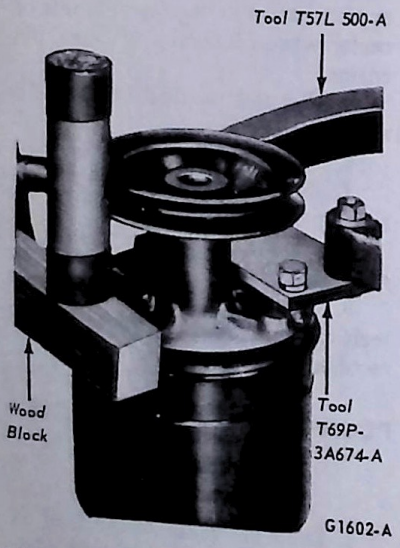


FIG. 7 Removing Pump Reservoir

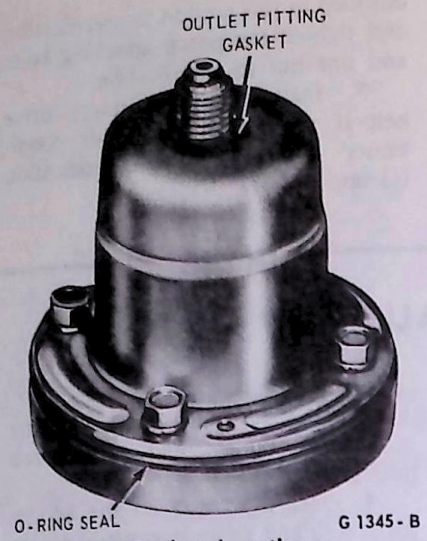


FIG. 8 Gasket Locations

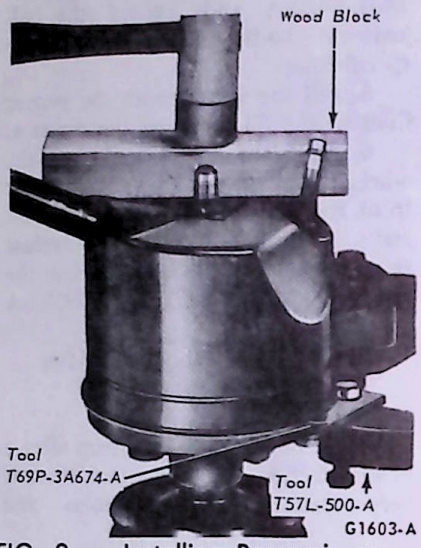


FIG. 9 Installing Reservoir on Pump

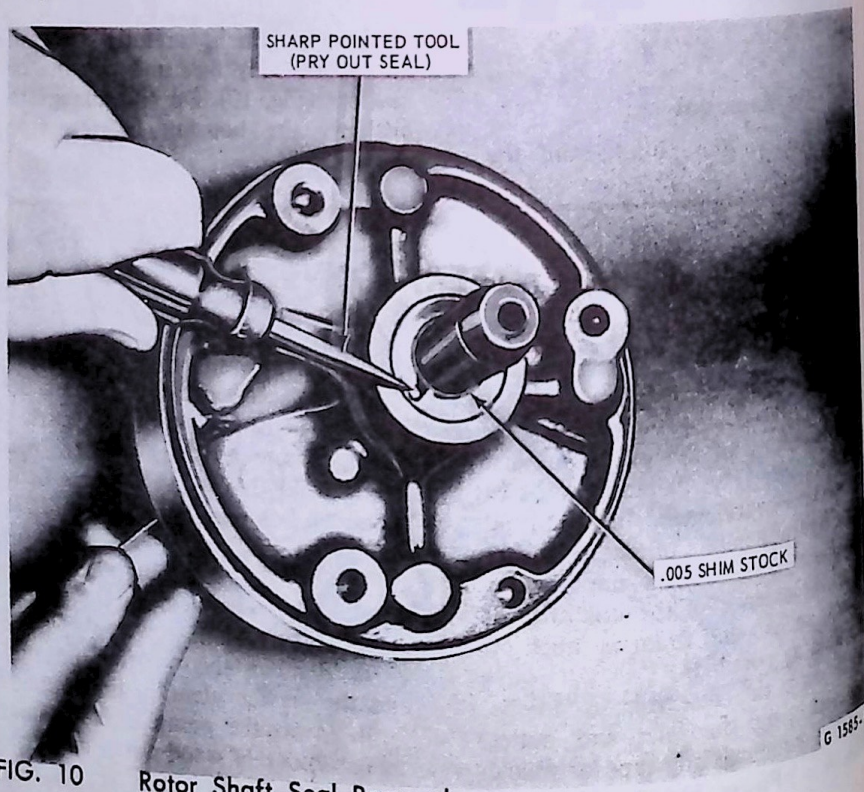


FIG. 10 Rotor Shaft Seal Removal

Installation

1. Position the pulley to the pump shaft and install Tool T65P-3A733-A as shown in Fig. 6.

2. Hold the pump and rotate the tool nut clockwise to install the pulley on the shaft. The pulley face will be flush with the end of pump shaft. Install the pulley without in and out pressure on the shaft to prevent damage to internal thrust areas.

3. Remove the tool.

POWER STEERING PUMP RESERVOIR

Reservoir replacement must be done on a clean workbench. Cleanliness of work area and tools is extremely important when repairing any hydraulic unit. Thoroughly clean the exterior of the pump with a suitable cleaning solvent. **Do not clean, wash or soak the shaft oil seal in solvent. Plug the inlet and outlet openings with plugs or masking tape before cleaning the pump exterior or removing the reservoir.**

Removal

1. Assemble the adapter plate (Tool T69P-3A674-A) to the bench mounted fixture tool (T57L-500-A). Position the pump and pulley on the adapter plate, pulley facing down.

2. Remove the outlet fitting hex nut and the service identification tag.

3. Invert the pump so the pulley side is facing up and remove the reservoir by tapping around the flange with a wood block (Fig. 7).

4. Remove the reservoir O-ring seal, and the outlet fitting gasket from the pump.

Installation

1. Install a new gasket on the outlet fitting and a new reservoir O-ring seal on the pump housing plate (Fig. 8). **The old gasket and seal should never be re-used.**

2. Apply vaseline to the reservoir O-ring seal and to the inside edge of the new reservoir flange. **Do not twist the O-ring seal.**

3. Position the reservoir over the pump and, on all models except those to be used with electric power pac installations, align the notch in the reservoir flange with the notch in the outer diameter of the plate and bushing assembly.

On pumps released for electric power pac installation, the notch in the reservoir flange must be rotated 12 to 14 degrees to the left of the center line of the notch in the OD of the plate and bushing assembly.

4. Install the reservoir on the pump and O-ring seal with a plastic or rubber hammer and a block of wood as shown in Fig. 9. **Tap at the rear of the reservoir and on the outer edges only.**

5. Inspect the assembly to be sure the reservoir is evenly seated on the pump housing plate.

6. Position the service identification tag on the outlet fitting and install the outlet fitting hex nut. Torque the nut to specification (at the end of this Part). Do not exceed specification.

ROTOR SHAFT SEAL

Removal

1. Remove the pulley from the rotor shaft as described under Power Steering Pump Pulley Removal.

2. Position the pump assembly in the bench mounted holding fixture, T57L-500-A, pulley end of the shaft up.

3. Clean any rust or road dirt from the pulley end of the rotor shaft.

4. To prevent scoring of the shaft, wrap .005 shim stock (free of burrs) around the rotor shaft and push it into the ID of the seal until it is against the bushing.

5. Using a sharp tool such as a sheet metal punch, carefully pierce the metal seal body face and pry the old seal out (Fig. 10). **Do not damage the bushing, the housing or the rotor shaft.**

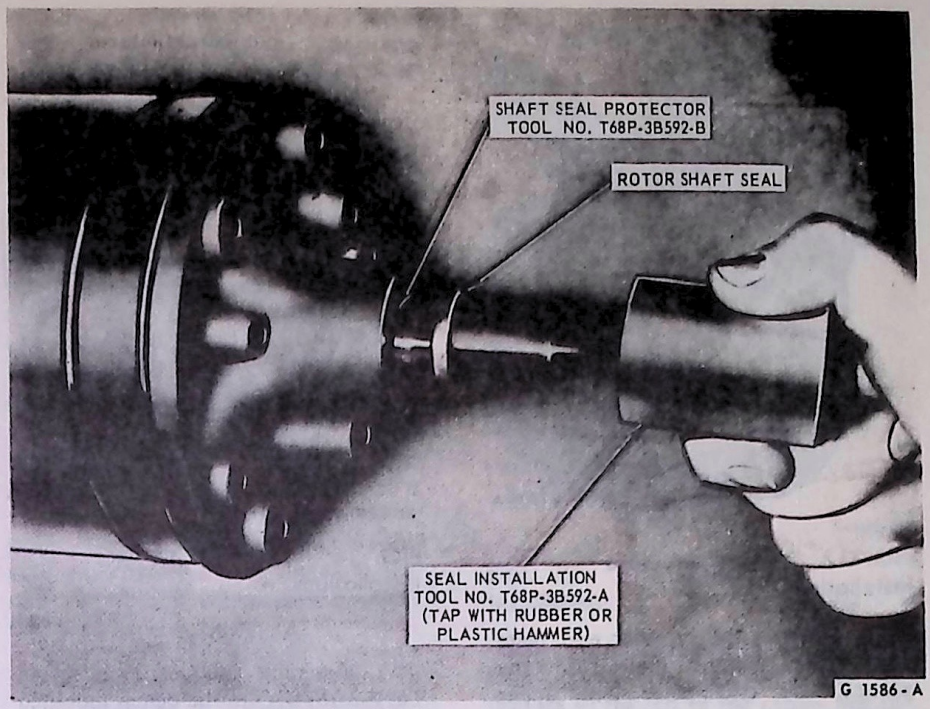


FIG. 11 Rotor Shaft Seal Installation

Installation

1. Remove the shim stock.

2. Position the new rotor shaft seal on the shaft seal protector, Tool T68P-3B592-B.

3. Insert the seal protector tool and the rotor shaft seal onto the shaft (Fig. 11).

4. Using the seal installation Tool T68P-3B592-A and a rubber or plastic hammer, tap gently on the end of the tool until the seal is completely installed (flush with the end of the seal bore).

5. Remove the tools.

6. Install the pulley on the rotor shaft as described under Power Steering Pump Pulley Installation.

5 MAJOR REPAIR OPERATIONS

POWER STEERING PUMP

Disassembly of the pump and its sub-assemblies (Fig. 2) must be made on a clean workbench. In repairing any hydraulically operated unit, cleanliness is of utmost importance. Clean the exterior of the unit with a suitable solvent and drain as much of the fluid as possible.

If only the reservoir is to be removed, plug the inlet and outlet openings with masking tape or plugs. Do not immerse the shaft oil seal in solvent. If only the rotor shaft seal is to be replaced, see Rotor Shaft Seal outlined in Section 4 of this part.

1. Assemble the adapter plate (Tool T69P-3A674-A) to the bench mounted holding fixture Tool T57L-500-A (Fig. 12).

2. Position the pump assembly, with pulley assembled, on the adapter plate, pulley facing down.

3. Remove the outlet fitting nut and the service identification tag.

4. Invert the pump assembly and, using a block of wood and a rubber or plastic hammer, remove the pump reservoir and seal by tapping around the flange of the reservoir and on the underside of the filler neck.

5. Again invert the pump assembly, loosen and remove the pump housing retention bolts and remove the pump housing.

6. If necessary, remove the following components from the pump housing: the housing cover, the O-ring seal and the pressure springs. These components normally will remain in the pump housing when it is removed.

7. Remove and discard the pump cover gasket.

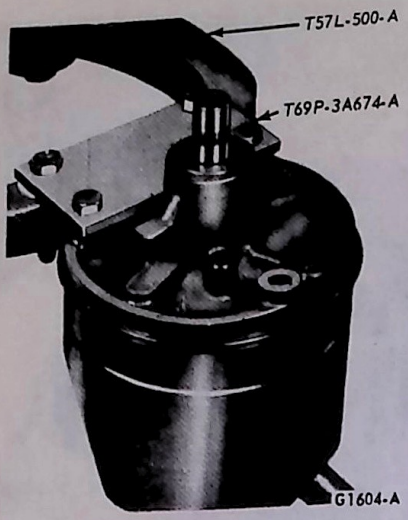


FIG. 12 Adapter Plate Installation

8. Remove the retainer end plate and upper pressure plate (in some pumps, the end plate and upper pressure plate are integral).

9. Remove the loose fitting dowel pin. Be careful not to bend the fixed dowel pin which remains in the housing plate assembly.

10. Remove the rotor assembly, being careful to prevent the springs and slippers from falling out and becoming lost. Do not disassemble further unless the lower pressure plate, housing plate, rotor shaft and/or seal is to be replaced.

11. Invert the pump assembly and using Tool T63L-10300-B, remove the pulley.

12. Clean any rust, road dirt, burrs, scoring, etc. from the pulley end of the rotor shaft prior to removal of the shaft from the housing plate. The shaft must come out without restrictions to prevent scoring or damage to the bushing. Remove the pump rotor shaft.

13. Remove the lower pressure plate.

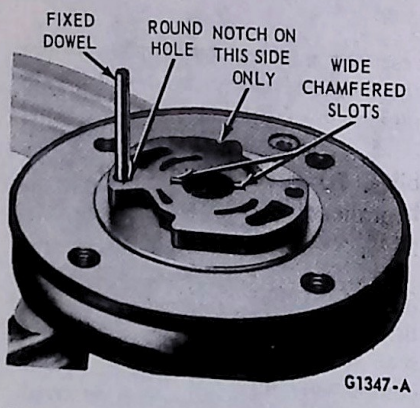


FIG. 13 Lower Pressure Plate Installed

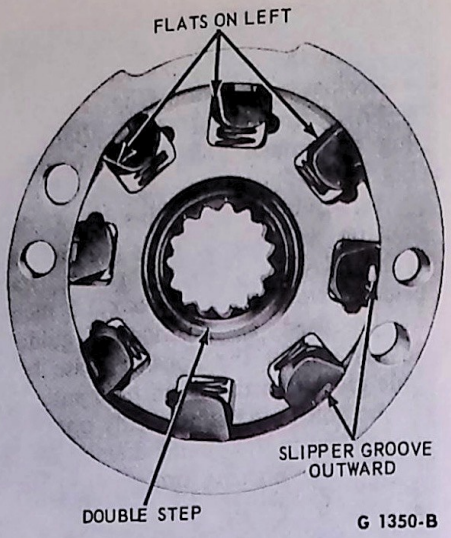


FIG. 14 Correct Slipper Installation

Assembly

1. Assemble adapter plate (Tool T69P-3A674-A) to the bench mounted holding fixture Tool T57L-500-A. Position the pump assembly on the adapter plate, pulley side facing down. (If the lower pressure plate and rotor shaft have not been disassembled, omit steps 2 and 3.)

2. Insert the lower pressure plate on the anchor pin with the wide chamfered slots at the center hole facing up (Fig. 13).

3. Dip the rotor shaft in specified steering gear lubricant (C1AZ19582A); then insert the rotor shaft through the lower pressure plate and housing plate.

4. If the rotor assembly is disassembled, hold the cam insert with the notch on the OD of the cam at the top and the arrow or the open end of the vendor letter mark on the OD of the cam pointing downward.

5. Insert the rotor in the cam with the double step in the ID of the rotor facing upward.

6. With the rotor extended upward approximately one half way out of the cam, insert a spring into a rotor spring pocket working in the rotor cavity directly beneath the cam notch.

7. Use one of the slippers to compress the spring and install the slipper with the groove in the slipper facing upward (toward the cam notch). The flats on the side of the slipper should be on the left (Fig. 14).

8. Hold the cam stationary and turn the rotor either to the right or left, one space at a time. Repeat Step 7 until all the rotor cavities have been filled. Be careful when turning the rotor that the springs and slippers already inserted do not fall out.

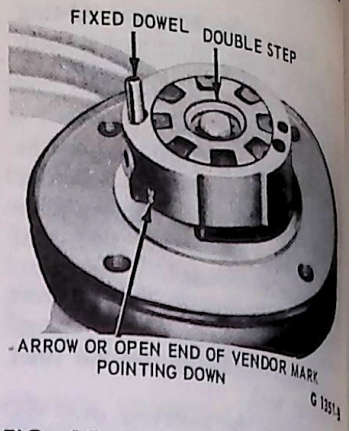


FIG. 15 Cam and Rotor Installation

9. Install the cam and rotor assembly onto the pump housing plate with the fixed dowel passing through the first hole to the left of the cam notch when the arrow on the cam OD is pointing toward the lower pressure plate (Fig. 15). If the cam and rotor assembly will not seat, turn the rotor shaft slightly until the spline teeth mesh, allowing the cam and rotor to drop down into position.

10. Insert the loose fitting dowel through the cam insert and lower plate into the hole in the housing plate assembly. When the loose dowel is properly installed the heights of the two dowels must be equal. Squirt the rotor, springs, slippers and cam insert with C1AZ-19582-A lubricant.

11. Place the upper pressure plate with the face having the tapered notch down against the cam insert. The fixed dowel should pass through the round dowel hole and the loose dowel through the elongated hole. The slot between the ears on the pressure plate OD should match the notch on the cam insert OD (Fig. 16).

12. Install the retainer end plate (unless integral with the pressure plate) so the slot on the end plate OD matches the corresponding notches on the upper pressure plate and cam (Fig. 17).

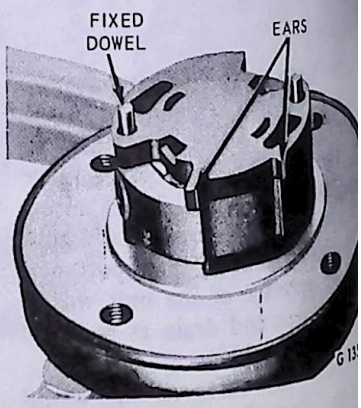


FIG. 16 Upper Pressure Plate Installation

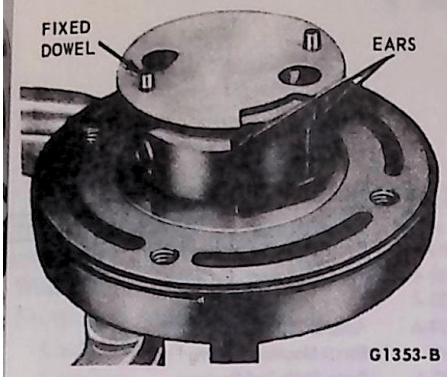


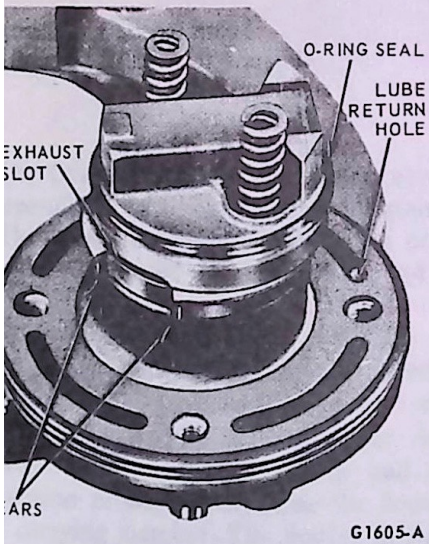
FIG. 17 Retainer End Plate Installation

13. Install the pump valve assembly O-ring seal onto the pump valve assembly being careful not to twist the seal (Fig. 18).

14. Place the pump valve assembly on top of the retainer end plate with the large exhaust slot on the pump valve in line with the OD notches of the previously assembled parts. The stack of parts must be fully seated. If the pump valve has been installed correctly, the relief valve stem will be in line with the lube return hole in the pump housing plate (Fig. 18).

15. Place small amounts of vaseline on the pump housing plate to hold the cover gasket in place. Install the gasket on the pump housing plate.

16. Insert the pressure plate springs into the pockets in the pump valve assembly. Vaseline may be placed in the spring pockets to hold the springs in position (Fig. 18).



IG. 18 Valve and Pressure pring Installation

17. Using Tool T69P-3B586 A, plug the intake hole in the housing (Fig. 19).

18. Lubricate the inside of the housing and the housing cover seal with C1AZ-19582-A lubricant. Fabricate two studs (3/8-16 x 1.5 inch) to be used as positioning guides. Install one in the housing plate bolt hole closest to the drain hole and one in the bolt hole diametrically opposite.

19. Align the small diameter lube hole in the housing rim with the lube hole in the housing plate.

20. Install the housing, applying an even, downward pressure. The pressure plate springs must not be jarred and moved out of position. Remove the guide studs.

21. Install the housing retaining bolts finger tight.

22. Remove Tool T69P-3B586-A.

23. Torque the retaining bolts to specification ft-lbs until the housing flange contacts the gasket.

24. Install a 3/8 x 16 hex head screw, finger tight, into the end of the rotor shaft. Using a torque wrench, check the input torque of the shaft (Fig. 20). The torque should not exceed 15 in-lbs. If it does, loosen the retaining bolts slightly, rotate the rotor shaft, re-torque the bolts evenly and again check the shaft torque. The pump must not be used if the shaft torque exceeds 15 in-lbs.

25. Release the pin in the bench holding fixture and agitate the pump assembly back and forth. If there is a rattle, the pressure plate springs have fallen out of their seats and must be reinstalled.

26. Install the reservoir O-ring on the housing plate being careful not to twist the O-ring. Apply vaseline to the seal and to the ID of the reservoir flange.

27. Install the reservoir and, on all pumps except those to be used with electric power pac installations, align the notch in the reservoir flange with the notch in the OD of the pump housing plate and bushing assembly. On pumps released for electric power pac installation, when facing the front

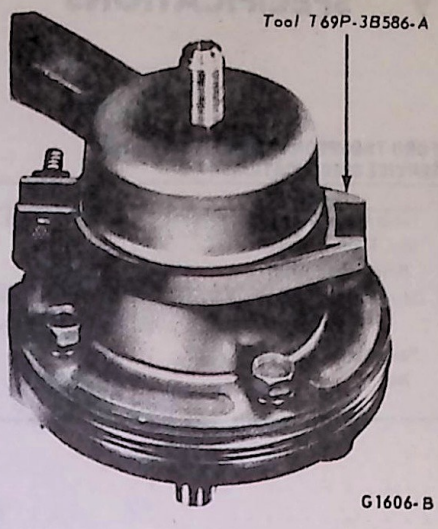


FIG. 19 Pump Housing Installation

of the pump, the notch in the reservoir flange must be rotated 12 to 14 degrees to the left of the center line of the notch in the OD of the plate and bushing assembly. Using only a plastic or rubber hammer, tap at the rear on the outer corners of the reservoir to avoid damage.

28. Inspect the assembly to determine if the reservoir is seated on the housing plate.

29. Install the service identification tag on the outlet valve fitting.

30. Install the outlet valve fitting nut and torque to 43-47 ft-lbs.

31. Invert the pump assembly.

32. If the pulley was removed, install the correct pulley using Tool T65P-3A733-A.

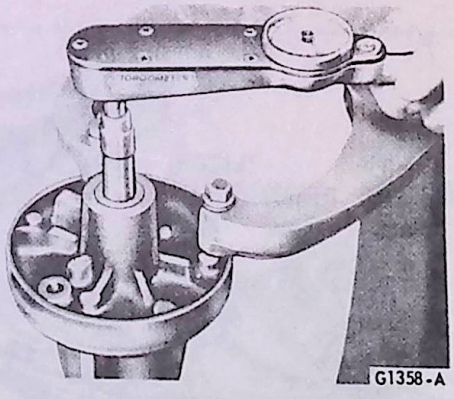


FIG. 20 Checking Pump Rotational Torque

9 SPECIFICATIONS

FORD-THOMPSON POWER STEERING PUMP SERVICE SPECIFICATIONS

Description	Specification		
Pump Rotor Shaft End Play	0.017 In. Max. – 0.003 In. Min.		
Max. Torque Allowed to Rotate Rotor Shaft	15 In-Lb		
Stamped Housing to Plate	Screw and Washer Assy.	28–32 Ft-Lb	Alternate
	Bolt Hex-Washer Hd.	38–47 Ft-Lb	Alternate
Reservoir to Stamped Housing Nut	43–47 Ft-Lb		

SPECIAL SERVICE TOOLS

Tool No.	Description
T63L-8620-A	Belt Tension Gauge
T64L-10300-A	Pulley Remover
T65P-3A733-A	Pulley Installer
T64P-3A674-A	Adapter Plate
T57L-500-A	Bench Mounted Holding Fixture
T68P-38592-A	Pump Shaft Seal Replacer
T68P-38592-B	Pump Shaft Seal Protector
T69P-38586-A	Pump Housing Hole Plugging Tool

SECTION 3

FRONT SUSPENSION

INDEX

GENERAL DESCRIPTION

The Chevrolet Chevy Van and Sportvan line incorporates an independent coil front suspension system. (fig. 1).

The unequal length control arm coil spring independent suspension is used on all 10, 20 and 30 series Vans. This suspension system consists of upper and lower control arms pivoting on steel threaded bushings on upper and lower control arm shafts which are attached to the crossmember with U-bolts. These control arms are connected to the steering knuckle through pivoting ball joints. A coil spring is located between the lower control arm and a formed seat in the suspension crossmember, thus the lower control arm is the load carrying member. The double acting shock absorbers are also attached to the lower control arms and connect with the frame to the rear on the upper end. The front wheel bearings are tapered roller type on the above models.

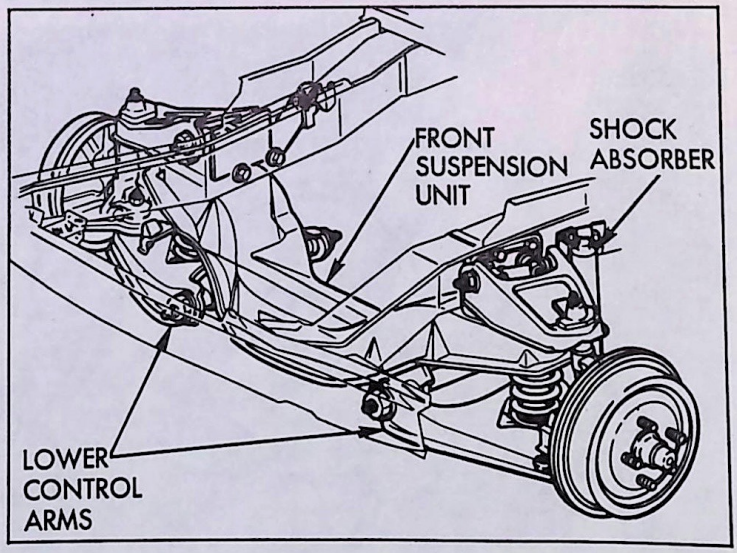


Fig. 1—Independent Front Suspension

MAINTENANCE AND ADJUSTMENTS

NOTE: All front suspension attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

WHEEL BEARINGS–ADJUST

1. Jack up front end of vehicle and remove wheel and tire assembly. Remove dust cap from end of hub and withdraw spindle cotter pin.
2. Tighten adjusting nut to 15 lb. ft. while rotating hub in both directions.
3. Back off nut one flat (1/6 turn) and insert new cotter pin. If nut and spindle hole do not line up, back off slightly (1/6 turn) to align cotter pin. This adjustment provides for .001" to .008" bearing end clearance.
4. Spin hub to make sure it turns freely. Lock cotter pin by spreading the end and bending it inboard. Install dust cap, and wheel and tire assembly.
5. Lower vehicle.

FRONT END ALIGNMENT

Correct alignment of the front suspension must be maintained to insure efficient steering and satisfactory tire life. Check alignment at regular intervals and particularly after front suspension has been subjected to extremely heavy service or severe impact loads.

Before checking and adjusting alignment, such compon... as wheel bearings, spring height, tie rods, steering gear, sh... absorbers and tire inflation should be inspected and corre... where necessary.

Caster and Camber—Figure 2

Positive caster is the amount in degrees of the backward ... of the knuckle. Positive camber is the amount in degrees ... the front wheels are tilted outward at the top from a ver... position. Both angle adjustments are necessary for ste... stability and safe vehicle handling.

Caster and camber adjustments are made by means of ... located between the upper control arm shaft and the mou... bracket attached to the suspension crossmember.

Measure caster and camber as follows (refer to Figure 3):

Caster

1. Using a bubble protrator measure frame angle "B" ... location shown in Figure 3.
2. Check caster angle on alignment machine.
3. Add angle "B" and caster angle to determine fra... corrected angle.
4. Measure dimension "A."
5. Using dimension "A" and the caster-camber chart (fig. ... for the appropriate vehicle, shown below, find the reco... mended caster angle.
6. The frame corrected angle, Step 3 above, should cor... spond to the recommended angle on the chart wit... ±1/4°. Make changes as necessary to bring caster an... within limits.

Camber

1. Determine vehicle camber angle on alignment machine.
2. Measure dimension "A."
3. Using dimension "A" and the caster-camber chart for ... appropriate vehicle, shown below, find the recommend... camber angle.

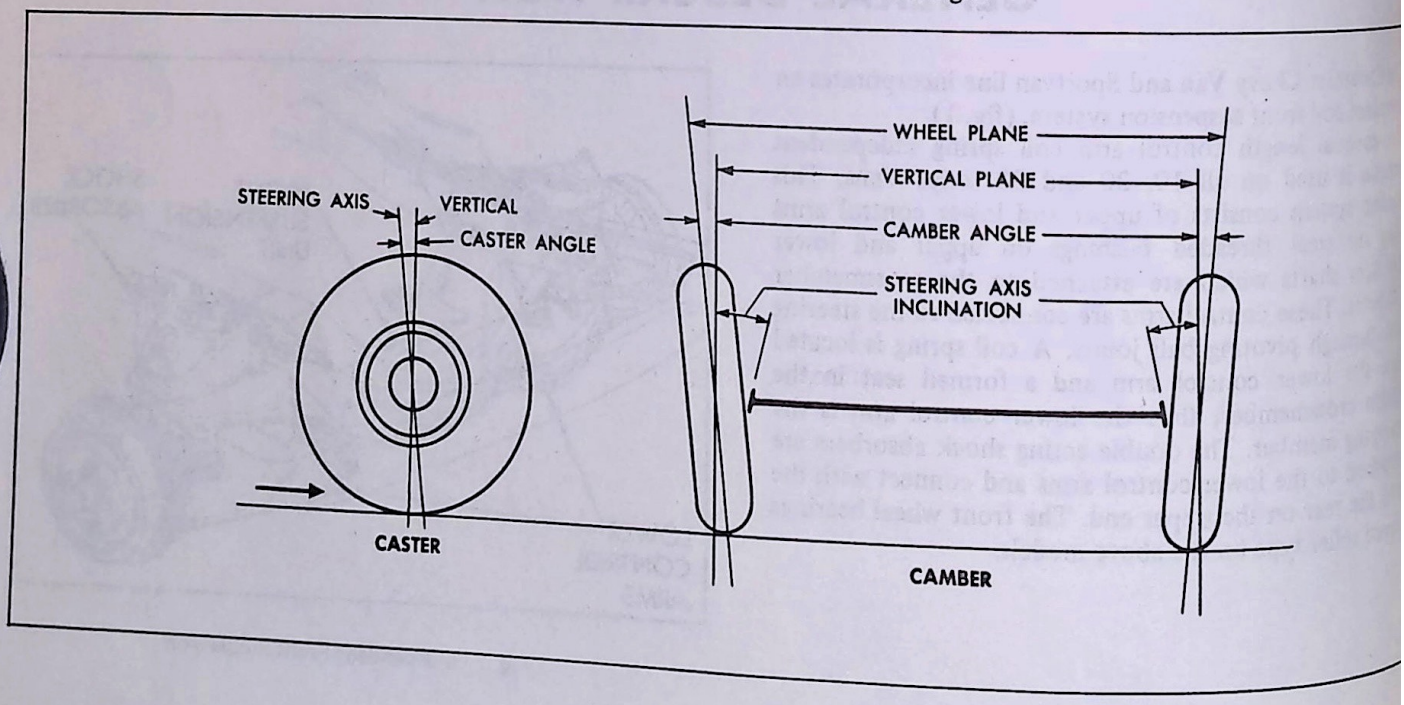


Fig. 2–Front End Alignment

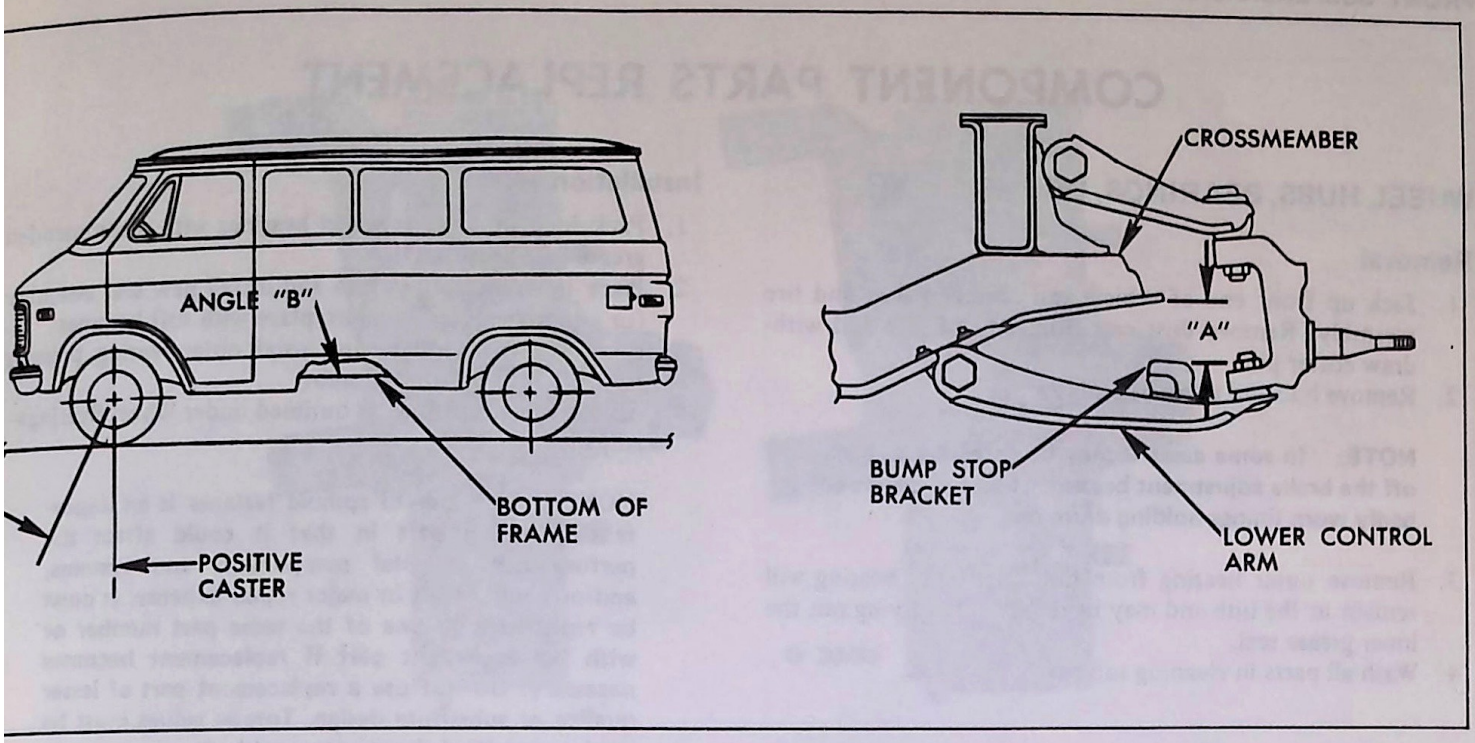


Fig. 3-Caster-Camber Adjustment

. If the angle in Step 1 does not correspond to the recommended angle on the chart within ± 1/4°, make necessary changes.

Shims may be changed at either front or rear to vary caster, at both points equally to vary camber (fig. 5).

e-In

Toe-in is the amount in fractions of an inch that wheels are ser together in front than at rear. Check steering gear high int adjustment and place wheels in straight ahead position fore checking toe-in. Adjustments are made by loosening mp bolts at each end of tie rod, then turning tie rod tube til wheels have proper toe-in. Tighten clamp bolts securely er proper adjustment is made.

rnering Wheel Relationship

Cornering wheel relationship, or toe-out on turns is determined by the angle of the steering arms. If, when checking this angle, toe-out does not fall within specified limits, it will be necessary to replace defective steering arm as outlined under Steering Knuckle/Steering Arm later in this section.

Steering Axis Inclination

"Camber" is the outward tilt of the wheel and "steering axis inclination" is the inward tilt of the knuckle. Camber cannot be changed without changing steering axis inclination. Correct specifications will be found at the end of this manual. If, with the camber correctly adjusted, the steering axis inclination does not fall within the specified limits the knuckle is bent and should be replaced.

If a new knuckle is installed, caster, camber and toe-in must be readjusted.

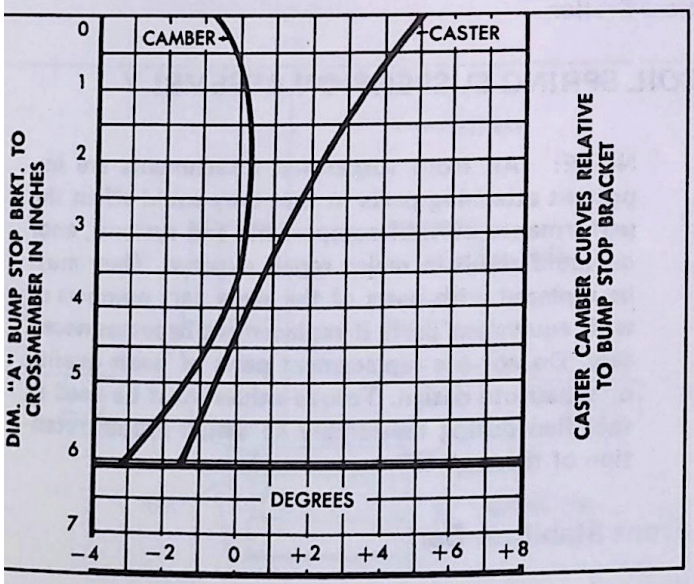


Fig. 4—Caster-Camber Chart

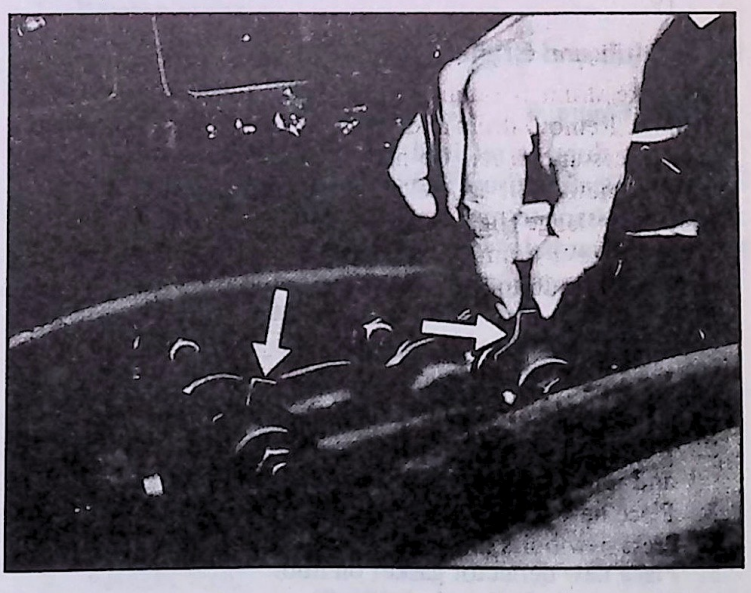


Fig. 5—Caster-Camber Shims (Typical)

COMPONENT PARTS REPLACEMENT

WHEEL HUBS, BEARINGS, DRUMS

Removal

1. Jack up front end of vehicle and remove wheel and tire assembly. Remove dust cap from end of hub and withdraw cotter pin.
2. Remove hub and drum assembly.

NOTE: In some cases it may be necessary to back off the brake adjustment because of scored drums or badly worn linings holding drum on.

3. Remove outer bearing from hub. The inner bearing will remain in the hub and may be removed by prying out the inner grease seal.
4. Wash all parts in cleaning solvent.

Inspection

1. Check all bearings for cracked bearing cages, worn or pitted rollers.
2. Check bearing races for cracks or scoring, check brake drums for out-of-round or scored condition and check bearing outer races for looseness in hubs.

Repairs

Replacement of Bearing Cups

1. Using steel bar stock 3/8" x 3/8" in cross section, make press-out tools shown in Figure 7.
2. Place appropriate tool behind bearing cup, indexing tool in provided notches, and press out cup with arbor press.
3. Install inner and outer cups using driver handle J-7079-2 or J-8092 (fig. 8) and suitable cup installers for different vehicle series as listed in Special Tools illustration, Figure 19.

Wheel Hub and Brake Drum

G10-20—Figure 6

1. Brake drum is retained to hub by hub bolts and wheel nuts. Remove drum and discard gasket (if present).
2. If necessary to replace hub bolts, press out old bolts and press new bolts in making sure bolt heads seat squarely on hub flange (fig. 9).
3. Place brake drum and a new gasket over hub bolts when installing hub to wheel spindle.

G30

1. Remove two flat head screws securing drum to wheel hub and remove drum and gasket. Discard gasket.
2. If necessary to replace hub bolts, press bolts out of hub and remove deflector and deflector gasket.
3. Place new deflector gasket on hub.
4. Press new bolts into hub (fig. 9).
5. Place brake drum on hub, retain with the two flat head screws.

Installation

1. Pack inner and outer wheel bearings with recommended grease (see Section O).
2. Place inner bearing in hub and install new seal assembly (or assemblies), tapping into place with soft hammer.
3. Position hub on spindle and install outer bearing, pressing it firmly into position in hub.
4. Adjust wheel bearings as outlined under Wheel Bearing Adjust.

NOTE: This hub to spindle fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

SHOCK ABSORBERS—Figure 10

Removal

1. Remove nuts and eye bolts securing upper and lower shock absorber eyes.

NOTE: Remove burr formed by lock washers on control arm and on frame.

2. Withdraw shock absorber and inspect rubber eye bushings. If defective, replace shock absorber assembly.

Installation

Place shock absorber into position in mounting brackets. Install eye bolts and nuts and torque as shown in Specifications Section.

COIL SPRING SUSPENSION ASSEMBLY

NOTE: All front suspension attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Front Stabilizer Bar

Removal

1. Place vehicle on hoist and remove nuts and bolts attaching stabilizer brackets and bushings at frame locations

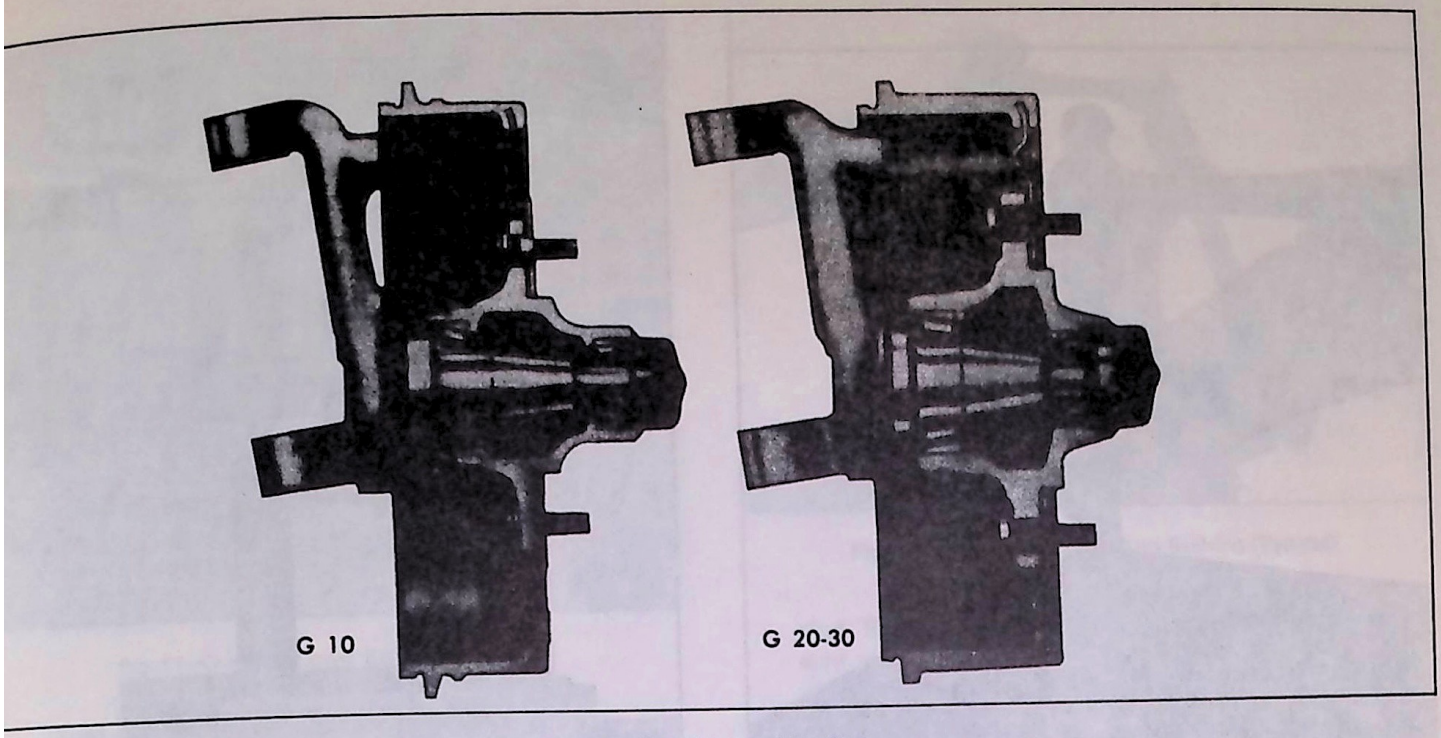


Fig. 6—Wheel Hub and Bearings

2. Remove brackets and bushings at lower control arms and remove stabilizer from vehicle.

Inspection

Inspect rubber bushings for excessive wear or aging—replace where necessary. Use rubber lubricant when installing bushings over stabilizer bar.

Installation

1. Place stabilizer in position on frame and install frame brackets over bushings. Install nuts and bolts loosely.
2. Install brackets over bushings at lower control arm location. Be sure brackets are positioned properly over bushings. Tighten all nuts and bolts securely.
3. Remove vehicle from hoist.

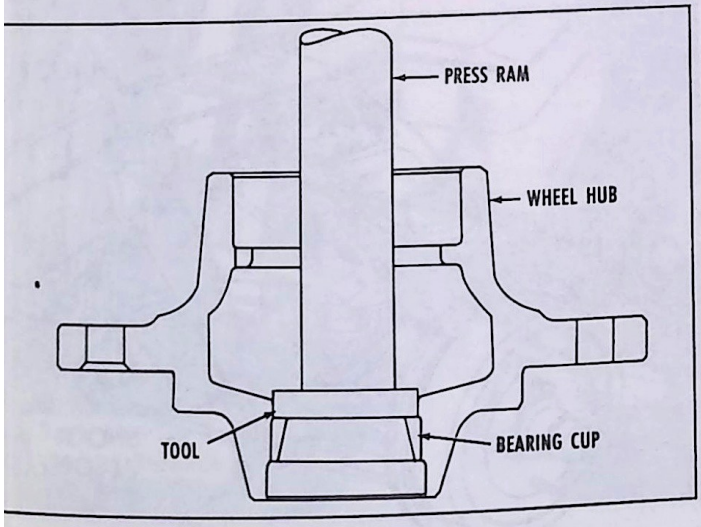


Fig. 7—Wheel Hub Bearing Cup Removal

Spring

Removal

1. Place vehicle on hoist and place jack stands under frame, allowing control arms to hang free.
2. Disconnect shock absorber at lower end.
3. Bolt Tool J-23028 to a suitable jack.
4. Place tool under cross-shaft so that the cross-shaft seats in the grooves of the tool Adapter J-23028 (fig. 20). As a safety precaution install a chain through the spring and lower control arm.
5. Raise the jack to remove tension on the lower control arm cross-shaft and remove the two "U" bolts securing the cross-shaft to crossmember.
6. Lower control arm by slowly releasing the jack until spring can be removed.
7. Remove spring.

Installation

1. Properly position spring on the control arm, and lift control arm.
2. Position control arm cross-shaft to crossmember and install "U" bolts and attaching nuts.

   NOTE: Make certain front indexing hole in cross-shaft is lined up with crossmember attaching saddle stud.

3. Torque nut to specifications.
4. Install shock absorber to lower control arm and install stabilizer bar if so equipped.
5. Remove tool.
6. Remove vehicle from hoist.

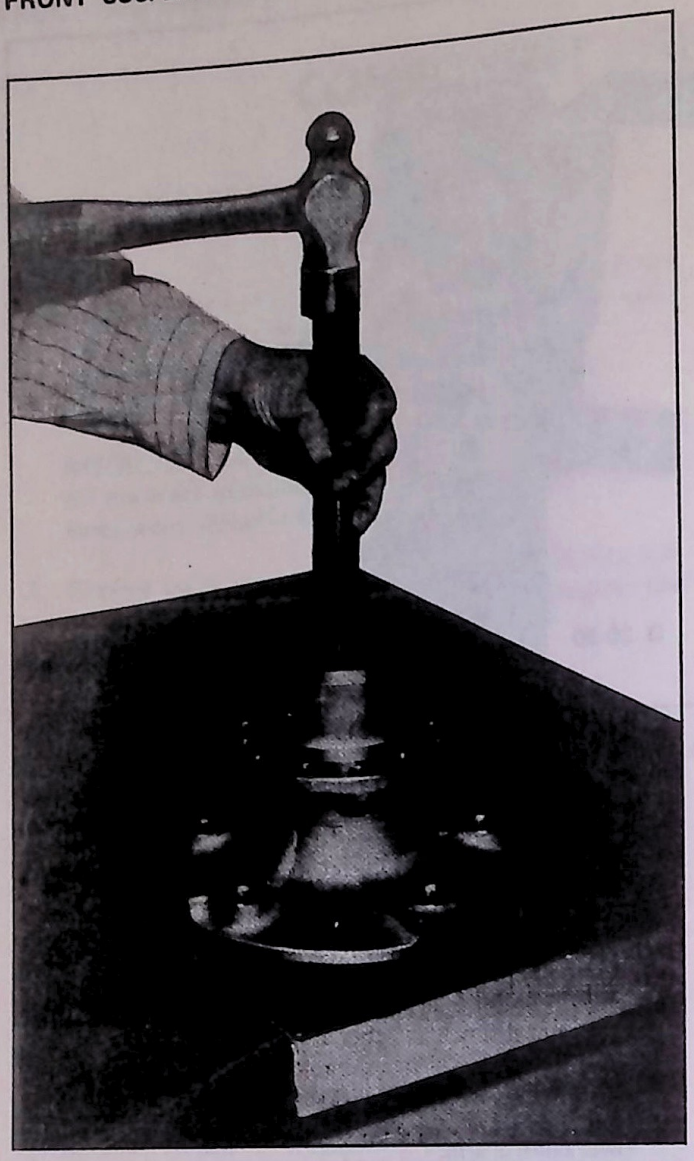


Fig. 8—Installing Bearing Cup (Typical)

Ball Joint—Inspection

Upper

1. Place vehicle on hoist and support on frame to allow control arms to hang free. Remove wheel and tire assembly.
2. Support lower control arm with adjustable jackstand and disconnect upper ball stud from steering knuckle.
3. Reinstall nut on ball stud and measure torque required to rotate stud with torque wrench. Limits are 1-10 lb. ft. If torque is not within these limits, replace ball joint.
4. If ball joint inspection shows no defect, assemble upper stud to steering knuckle and torque. See Specifications.

Lower

Lower ball joints are a loose fit when not connected to the steering knuckle. Wear may be checked without disassembling the ball stud, as follows:

1. Support weight of control arms at wheel hub and drum.

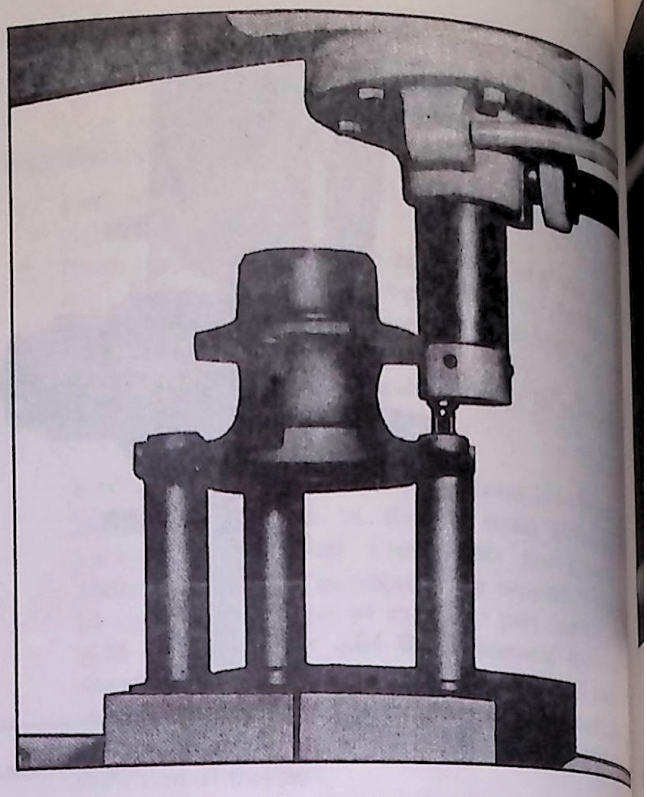


Fig. 9—Pressing Hub Bolt (Typical)

2. Measure distance between tip of ball stud and tip of grease fitting below ball joint (fig. 11).
3. Move support to control arm to allow wheel hub and drum to hang free. Measure distance as in Step 2. If the difference in measurements exceeds .094" (3/32") for 4 models, ball joint is worn and should be replaced.
4. Remove vehicle from hoist.

LOWER CONTROL ARM ASSEMBLY

NOTE: All control arm attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or

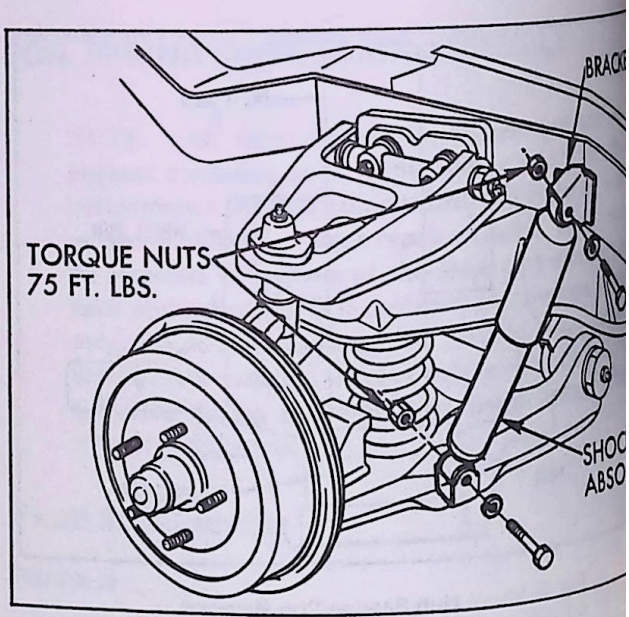


Fig. 10—Shock Absorber

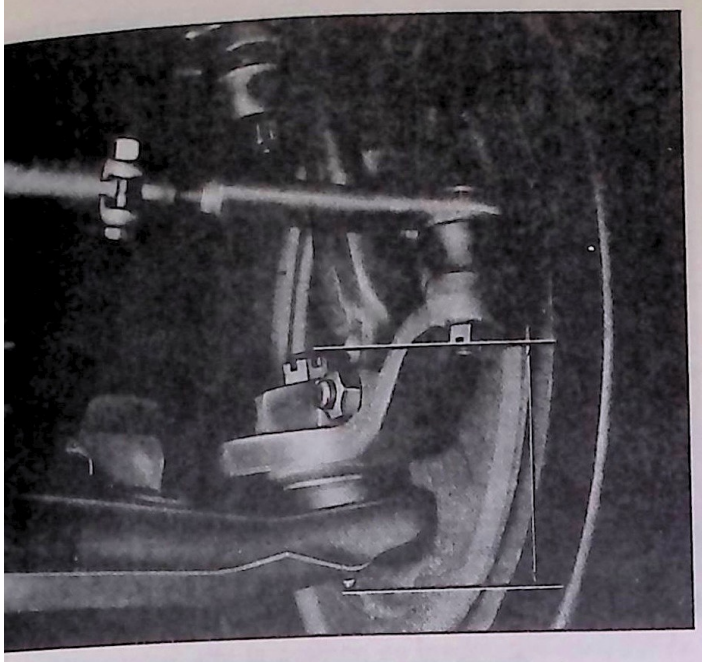


Fig. 11—Checking Lower Ball Joint (Typical)

could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

Removal

1. Place vehicle on hoist and remove spring as outlined under spring removal.
2. Remove cotter pin from lower ball stud and loosen stud nut until top of nut is slightly above top of the stud.
3. Install Ball Stud Remover J-8806 (fig. 12), positioning large cup end of the tool over the upper ball stud nut and piloting the threaded end of tool on end of the lower ball stud. Extend bolt from Tool J-8806 to loosen lower ball stud in steering knuckle. When stud is loosened, remove tool and nut from lower stud.
4. Remove control arm.

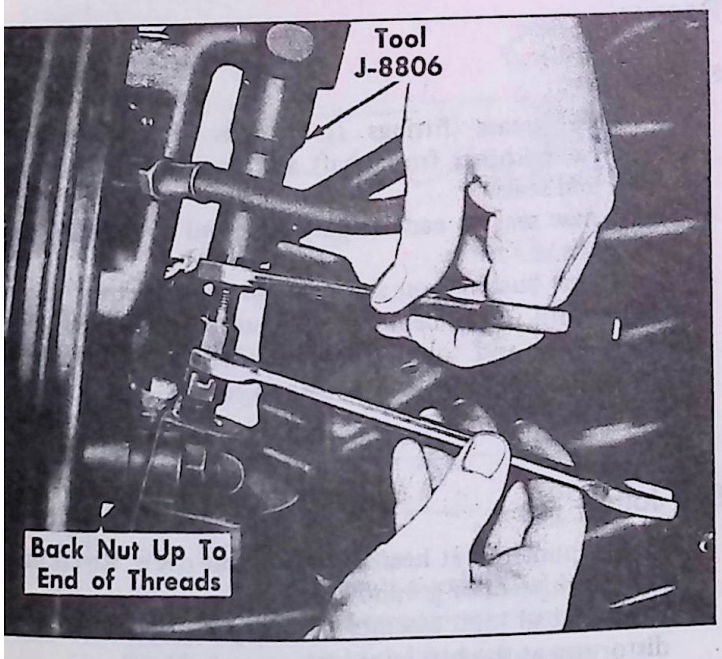


Fig. 12—Loosening Lower Ball Joint Stud (Typical)

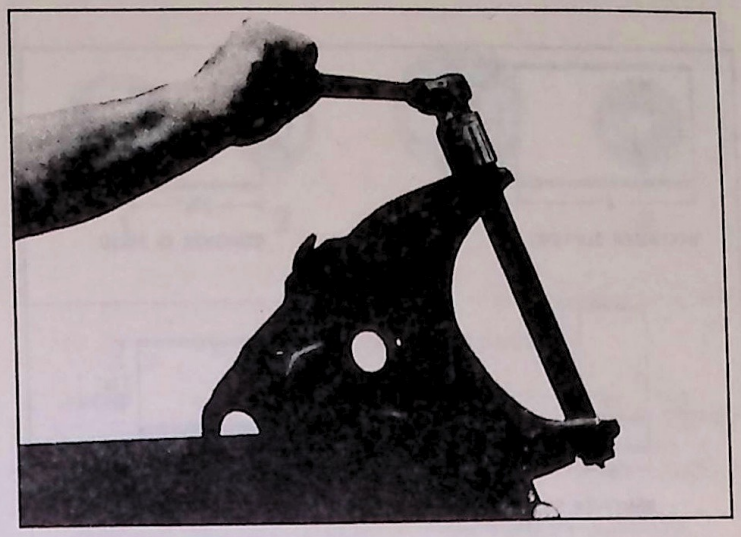


Fig. 13—Removing Control Arm Bushing (Typical)

Repairs

Bushings

1. Remove grease fittings from bushing outer ends and unscrew bushings from control arm and shaft (fig. 13).
2. Slide new seal on each end of shaft and insert shaft into control arm.

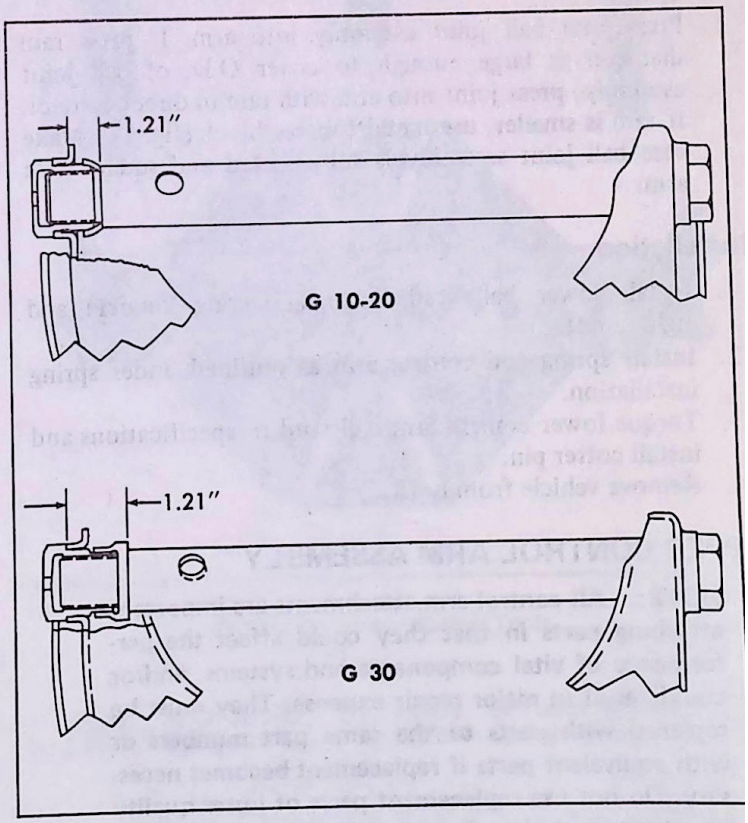


Fig. 14—Positioning Lower Control Arm Shaft

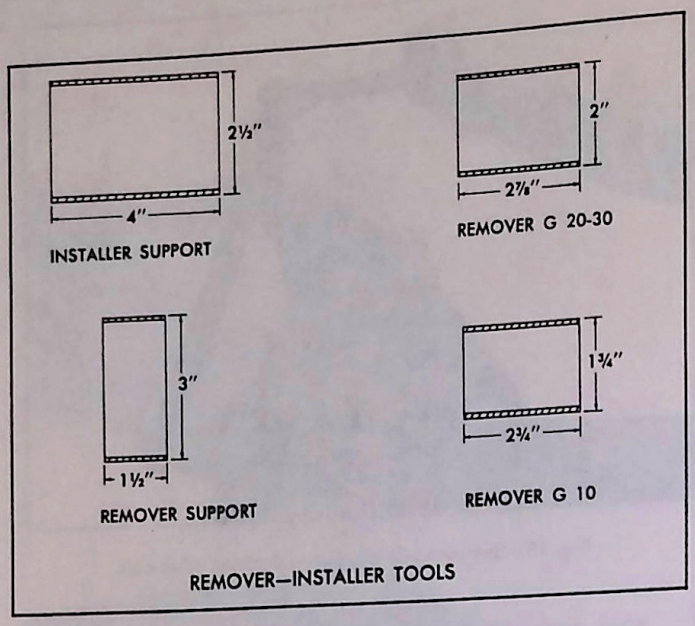


Fig. 15—Ball Joint Tools

3. Start new bushings on shaft and into control arm. Adjust shaft until it is centered in control arm, then turn bushings in and torque to specifications. Figure 14 shows correct final positioning of shaft. Check shaft for free rotation and install grease fittings.

Ball Joint

1. Using heavy wall steel tubing or pipe, make remover/installer tools to the dimensions shown in Figure 15.
2. Place control arm over remover support and, with appropriate remover, press out ball joint (fig. 16).
3. Invert arm and place on installer support at ball joint area.
4. Press new ball joint assembly into arm. If press ram diameter is large enough to cover O.D. of ball joint assembly, press joint into arm with ram in direct contact. If ram is smaller, use metal tube or block (fig. 17). Make sure ball joint assembly is fully seated and square with arm.

Installation

1. Install lower ball stud through steering knuckle and tighten nut.
2. Install spring and control arm as outlined under spring installation.
3. Torque lower control arm ball stud to specifications and install cotter pin.
4. Remove vehicle from hoist.

UPPER CONTROL ARM ASSEMBLY

NOTE: All control arm attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

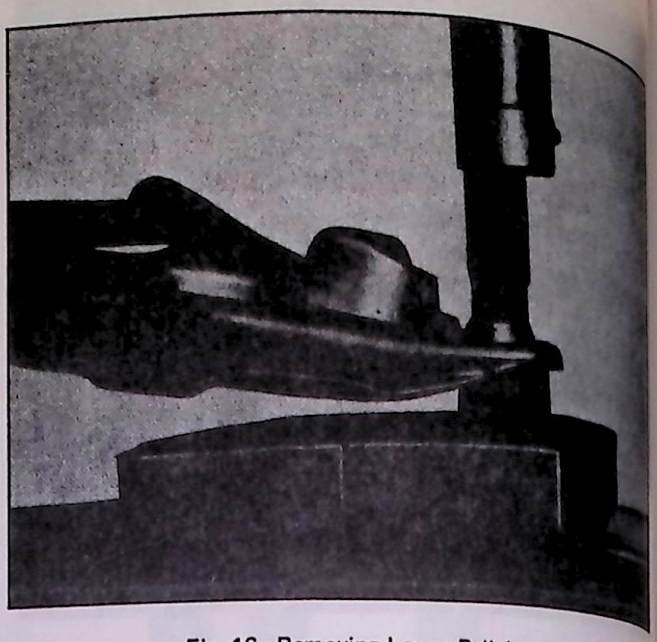


Fig. 16—Removing Lower Ball Joint

Removal

1. Place vehicle on hoist, remove wheel and tire assembly and support lower control arm assembly with adjustable jackstand.
2. Remove cotter pin from upper control arm ball stud and loosen stud nut until bottom surface of nut is slightly below end of stud.
3. Loosen upper control arm ball stud in steering knuckle, using Tool J-8806 position as shown in Figure 12. Remove the nut from the ball stud and raise upper arm to clear steering knuckle.
4. Remove nuts securing control arm shaft studs to crossmember bracket. Withdraw control arm assembly.

NOTE: Tape shims and spacers together and tag for proper relocation when control arm is reinstalled.

Repairs

Bushings

1. Remove grease fittings from ends of bushings and unscrew bushings from shaft and control arm. Remove shaft and seals.
2. Slide new seal on each end of shaft and insert shaft into control arm.
3. Start new bushings on shaft and into control arm. Adjust shaft until it is centered in control arm, then turn bushings in and torque. See Specifications. Check shaft for free rotation. Figure 18 shows correct final positioning of shaft.

Ball Joint

1. Center punch rivet heads and drill out rivets. Rivets may also be chiseled or ground off.
2. Remove ball joint assembly and inspect arm for cracks or distortion at the ball joint seat.
3. Install service ball joint assembly in arm using special hardened bolts only, torquing bolts 45 lb. ft.

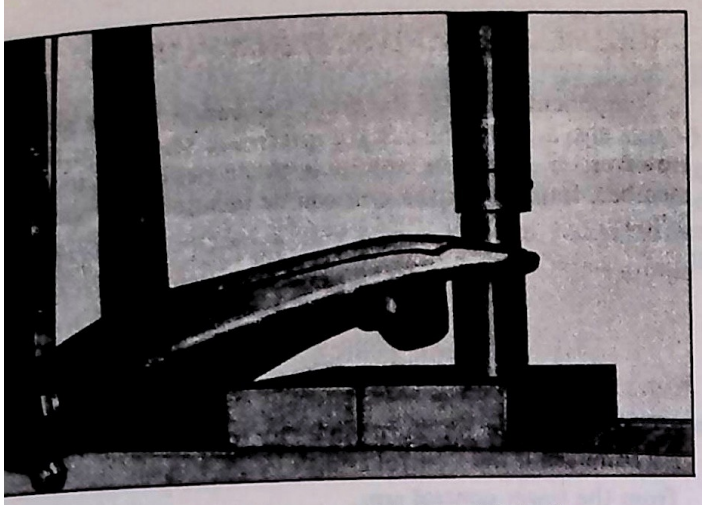


Fig. 17—Installing Lower Ball Joint (Typical)

nstallation

1. Place control arm in position on bracket and install nuts. Before tightening nuts, insert caster and camber shims in the same order as when removed.
2. Insert ball joint stud into steering knuckle and install nut. See specifications for torque values.
3. Remove adjustable support from under control arm. Install wheel and tire assembly.
4. Lower vehicle and check front end alignment and adjust where necessary.
5. Remove vehicle from hoist.

TEERING KNUCKLE/STEERING ARM

NOTE: It is recommended that vehicle be raised and supported on a twin-post hoist so that the front coil spring remains compressed, yet the wheel and steering knuckle assembly remain accessible. If a frame hoist is used, support lower control arm with an adjustable jackstand to safely retain spring in its curb height position.

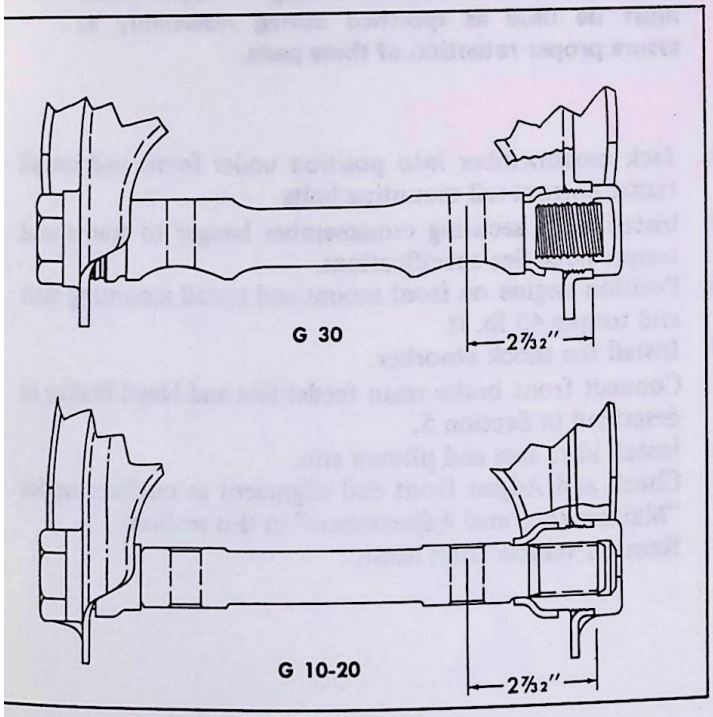


Fig. 18—Positioning Upper Control Arm Shaft

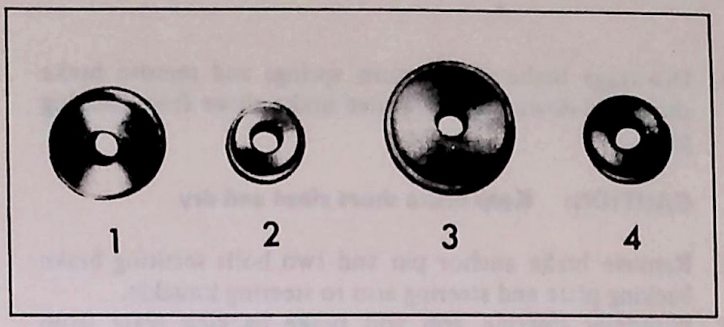


Fig. 19—Wheel Bearing Cup Installers

1.	J-8458	Inner Cup Installer—G10	3.	J-9276-2	Inner Cup Installer—G20-30
2.	J-8849	Outer Cup Installer—G10	4.	J-8457	Outer Cup Installer—G20-30

Removal

1. Place vehicle on hoist and support lower control arm as noted above.
2. Remove hub cap, wheel hub dust cover, cotter pin adjusting nut and washer, withdraw wheel and tire, brake drum, and wheel hub and bearing assembly from steering knuckle spindle.

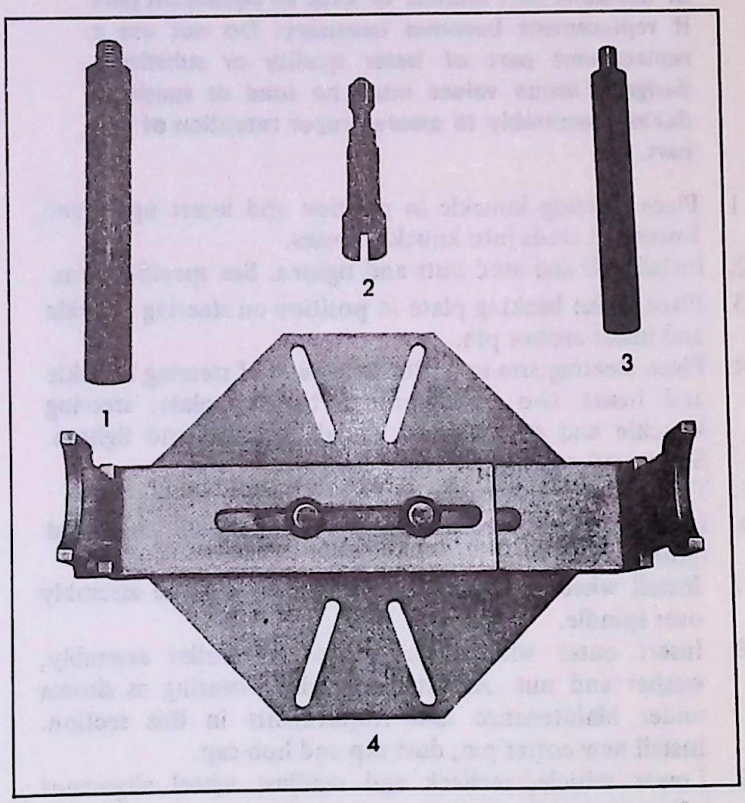


Fig. 20—Additional Special Tools

1.	J-8092	Driver Handle	3.	J-8806	Ball Joint Stud Remover
2.	J-7079	Driver Handle	4.	J-23028	Spring Remover

3. Disengage brake shoe return springs and remove brake shoe hold-down cups. Remove brake shoes from backing plate.

CAUTION: Keep brake shoes clean and dry.

4. Remove brake anchor pin and two bolts securing brake backing plate and steering arm to steering knuckle.
5. Withdraw steering arm and brake backing plate from steering knuckle. Wire backing plate to frame. Do not disconnect brake line.

NOTE: Refer to Section 9—Steering, for further steering arm service operations.

6. Remove upper and lower ball stud cotter pins and remove ball stud nuts. Free steering knuckle from ball studs by rapping steering knuckle bosses. Withdraw steering knuckle.

Installation

NOTE: All steering knuckle/steering arm attachments, including anchor pin, are important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Place steering knuckle in position and insert upper and lower ball studs into knuckle bosses.
2. Install ball and stud nuts and tighten. See specifications.
3. Place brake backing plate in position on steering knuckle and insert anchor pin.
4. Place steering arm in position on back of steering knuckle and insert two bolts through backing plate, steering knuckle and steering arm. Install locknuts and tighten. See specifications.
5. Torque brake anchor pin to 145 ft. lbs.
6. Install brake shoes, brake shoe hold-down cups and return springs.
7. Install wheel hub, brake drum, wheel and tire assembly over spindle.
8. Insert outer wheel bearing race and roller assembly, washer and nut. Adjust front wheel bearing as shown under Maintenance and Adjustments in this section. Install new cotter pin, dust cap and hub cap.
9. Lower vehicle, recheck and readjust wheel alignment where necessary.
10. Remove vehicle from hoist.

CROSSMEMBER AND SUSPENSION UNIT

Component parts of the front suspension may be serviced separately as outlined in the preceding service operations. However, if extensive service is to be performed to crossmember, frame, etc., the unit can be removed and installed as follows:

Removal

1. Place vehicle on hoist and remove the shock absorber from the lower control arm.
2. Remove idler arm and pitman arm.
3. Support engine and remove front engine mount center bolts.
4. Separate main brake feeder line from crossmember tee.
5. Remove bolts retaining crossmember hangers to frame side rails.
6. Remove bolts securing crossmember to frame bottom rail and lower the assembly from vehicle.

Installation

NOTE: All crossmember to frame attachments are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with parts of the same part numbers or with equivalent parts if replacement becomes necessary. Do not use replacement parts of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

1. Jack crossmember into position under frame and install frame bottom rail mounting bolts.
2. Install bolts securing crossmember hanger to frame and torque nuts. See specifications.
3. Position engine on front mount and install mounting bolt and torque 45 lb. ft.
4. Install the shock absorber.
5. Connect front brake main feeder line and bleed brakes as described in Section 5.
6. Install idler arm and pitman arm.
7. Check and Adjust front end alignment as outlined under "Maintenance and Adjustments" in this section.
8. Remove vehicle from hoist.