



GMC
INTEGRAL GEAR
POWER STEERING

USED ON GMC MODELS
C.K.P. 1500, 2500, 3500

Service Training Department
GMC Truck & Coach Division



POWER STEERING PUMP

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OVERHAUL OPERATIONS

Disassembly (Fig. 17)

Clean outside of pump in a Nontoxic Solvent before disassembly.

1. Remove pulley using Tool J-21239-1 for stamped pulleys and Tool J-8433-1 with J-8433-2 adapter for cast pulleys.
2. Remove union and seal.

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

3. Remove pump reservoir retaining studs.
4. Remove reservoir from housing.
5. Remove mounting bolt "O" rings and union "O" rings.

Remove end plate retaining ring. Compress end plate retaining ring by inserting small punch in $\frac{1}{8}$ diameter hole in pump housing. When ring is in compressed position, remove with screw driver as shown (fig. 18).

Remove end plate. 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 hammer will free the plate.

With pump in vise, remove shaft woodruff key and tap end of shaft gently with soft hammer until pressure plate, pump ring, rotor assembly and thrust plate may be removed as a unit (fig. 19).

Remove end plate "O" ring.

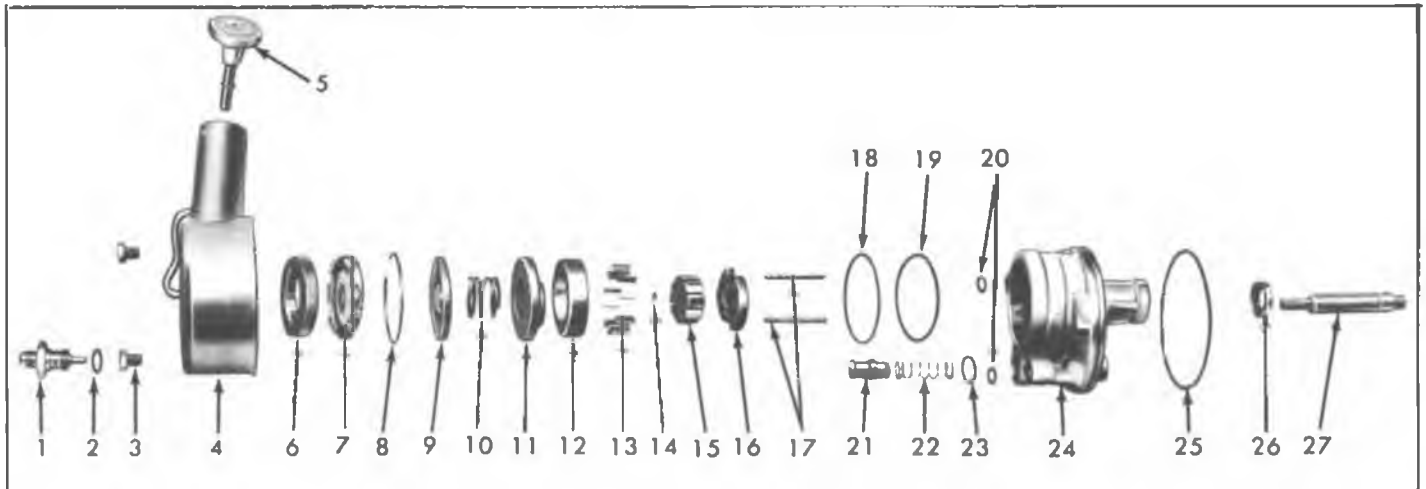


Fig. 17—Power Steering Pump

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



Fig. 18—Removing End Plate Ring

11. Separate the parts removed in Step 8. If inspection shows shaft to be defective, separate it from rotor by removing retainer snap ring.

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.



Fig. 19—Impeller Unit Removal

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 suspected of being 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.
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.

Assembly (Fig. 20)

Be sure all parts are clean during re-assembly.

1. Install new shaft seal, using Tool J-22670 as shown in Figure 21 and insert shaft at hub end of housing, spline end entering mounting face side (fig. 22).
2. Install thrust plate on dowel pins with ported face to rear of pump housing (fig. 23).

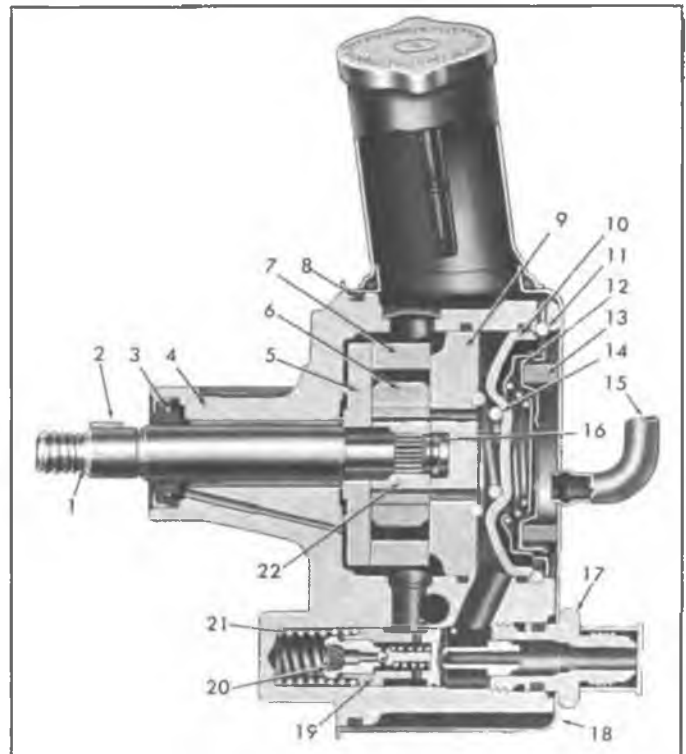


Fig. 20—Power Steering Pump

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

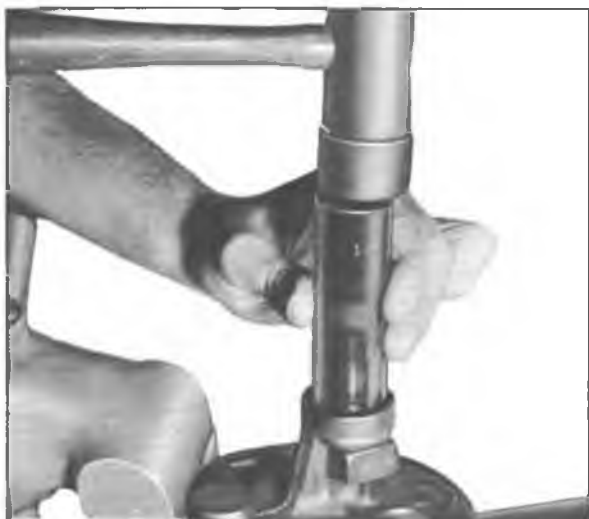


Fig. 21 – Installing Seal Using Tool J-22670

3. Install rotor, which must be free on splines, on pump shaft over splined end.

NOTE: Assemble rotor with countersunk side toward shaft.

4. Using suitable tool, install shaft retaining ring (fig. 24).
5. Install pump ring on dowel pins with direction of rotation arrow to the rear of the pump housing (fig. 25). Rotation is clockwise as viewed from pulley.
6. Install vanes in rotor slots with radius edge towards outside as shown in Figures 26 and 27.
7. Lubricate outside diameter and chamfer of pressure plate with petroleum jelly to insure against damaging "O" ring and install on dowel pins with ported face toward the pump ring. Seat pressure plate by placing large socket on top of plate and pushing down with hand. (Pressure plate will travel about $\frac{1}{16}$ " to seat).

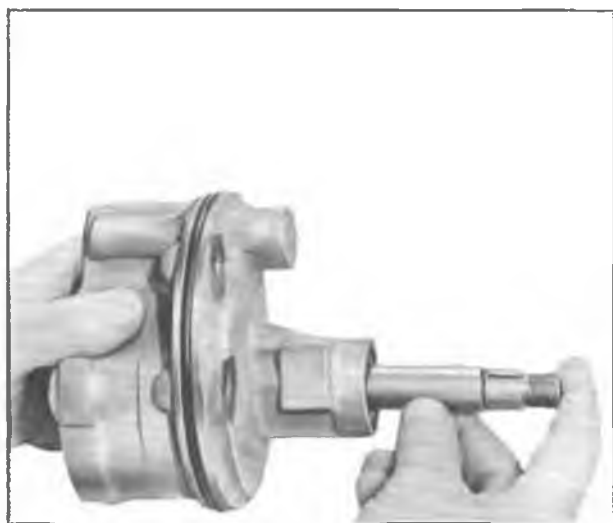


Fig. 22 – Shaft Installation



Fig. 23 – Installing Thrust Plate

8. Install pressure plate spring in center groove of pressure plate (fig. 28).
9. Install end plate "O" ring.
10. Lubricate outside diameter and chamfer of end plate with petroleum jelly to insure against damaging "O" ring and install in housing using an arbor press as shown in Figure 29.
11. Install end plate retaining ring while pump is in arbor press. Be sure it is completely seated in the groove of the housing and that ring gap is in position shown in Figure 29.
12. Install flow control spring and flow control plunger. Be sure hex head screw goes into bore first (fig. 30).
13. Install stud seals and union seal.
14. Place reservoir in normal position and press down until reservoir seats on housing; check position of stud seals and union seal.

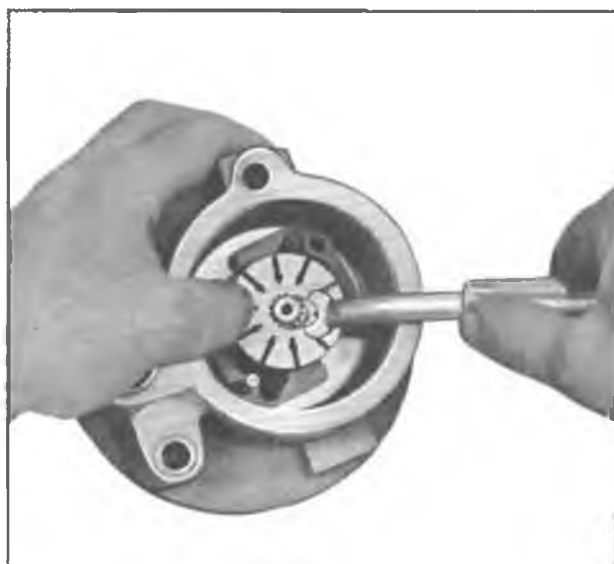


Fig. 24 – Installing Shaft Snap Ring



Fig. 25 - Installing Pump Ring

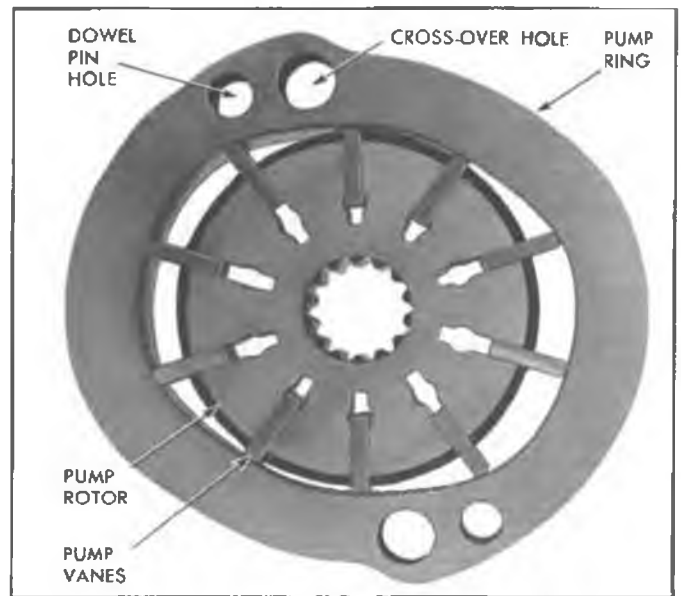


Fig. 27 - Correct Vane Assembly

16. Install studs, union, and drive shaft woodruff key. Support the shaft on the opposite side of key when tapping key into place.
17. Slide pulley on shaft. Do not hammer pulley.
18. Install pulley nut and torque to 60 ft. lbs.

NOTE: Always use a new pulley nut.



Fig. 26 - Installing Vanes



Fig. 28 - Installing Pressure Plate Spring



Fig. 29—Installing End Plate Retaining Ring



Fig. 30—Installing Flow Control Valve

POWER STEERING GEAR

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OVERHAUL OPERATIONS

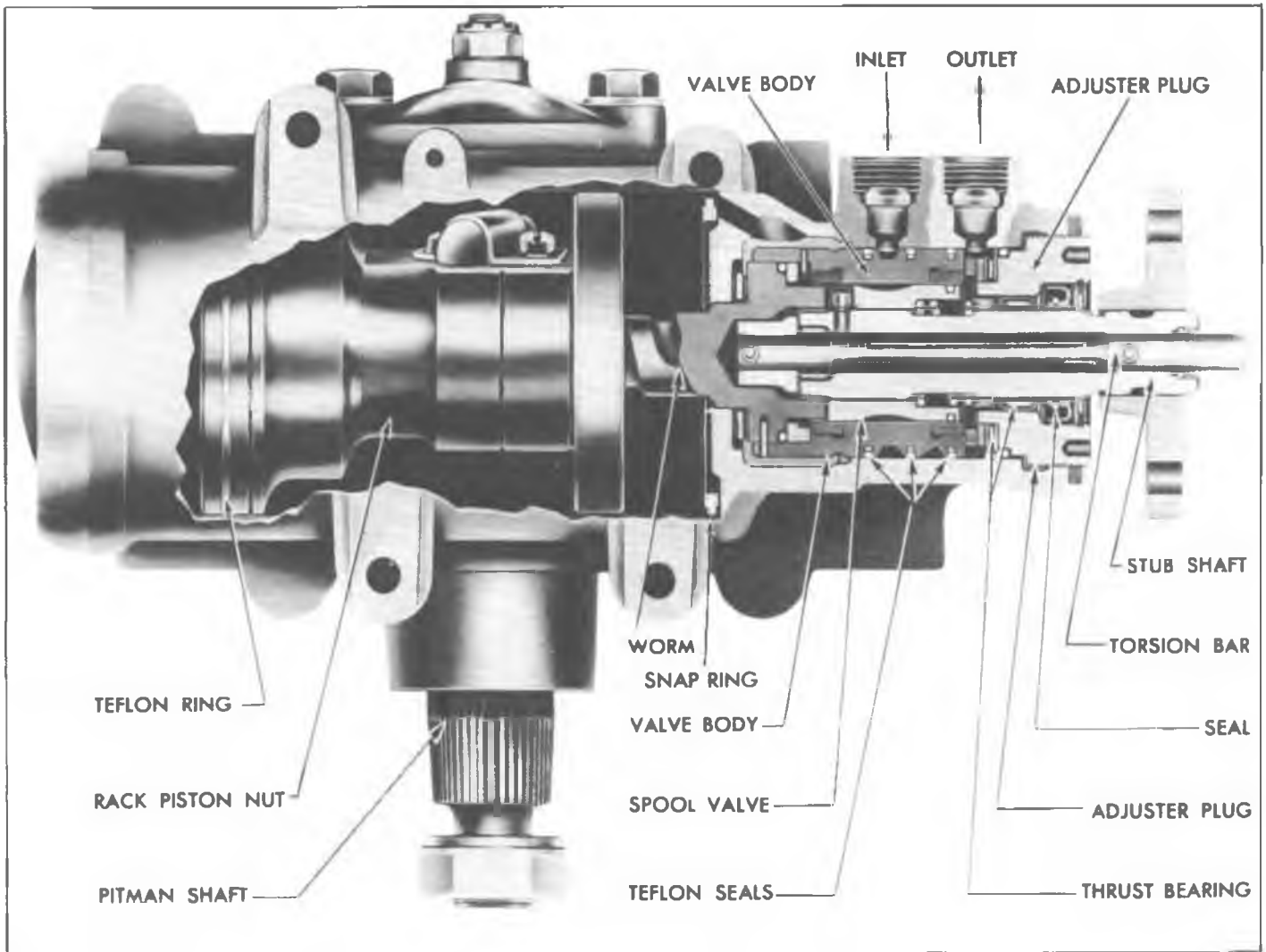


Fig. 31 - Power Steering Gear

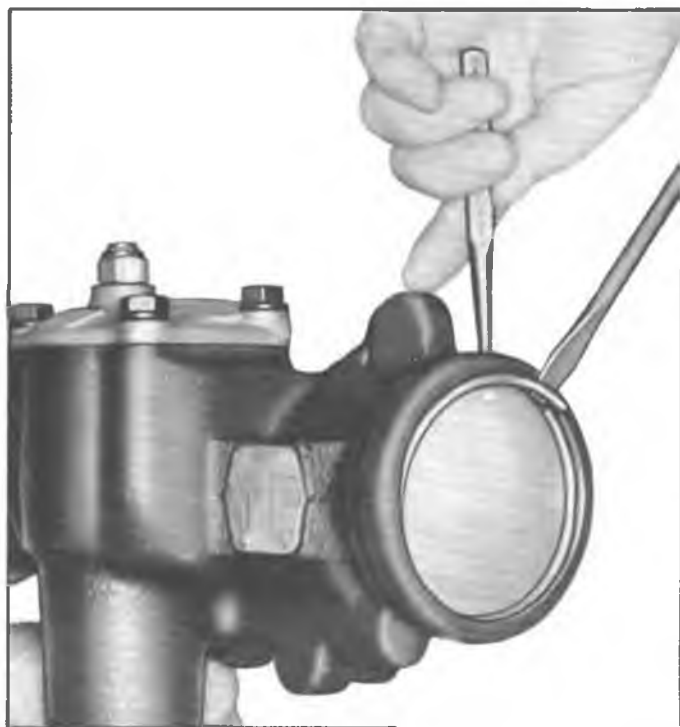


Fig. 32—Removing End Cover Retaining Ring

Disassembly

1. Rotate end cover retainer ring so that one end of the ring is over hole in side of housing then force end of ring from its groove and remove ring (fig. 32).
2. Turn the coupling flange counter-clockwise until rack-piston just forces end cover out of housing; otherwise, the worm may thread out of the rack-piston and the balls will fall out of their circuit. Remove cover and discard "O" ring.
3. Remove the rack-piston end plug as shown in Figure 33.
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 side cover until the rack-piston and pitman shaft teeth are visible, then turn the coupling flange until the pitman shaft teeth are centered in the housing opening. Tap 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.
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 coupling flange 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. Remove coupling flange attaching bolt and flange.
 - b. Loosen the adjuster plug locknut with Spanner Wrench J-972.
 - c. Remove adjuster plug assembly with Spanner Wrench J-7624 (fig. 36). Remove and discard the plug "O" ring.
7. Grasp the lower shaft and pull the valve and shaft assembly from the housing bore. Separate worm and shaft and remove the lower shaft cap "O" ring and discard.

8. If the worm or 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 seal **ONLY** is to be replaced and not the bearing, remove the retaining ring with the Internal Pliers J-5403, then remove the dust seal. Pry the seal from the bore of the adjuster plug (fig. 37).
2. Remove the thrust bearing retainer by prying at the two raised areas with a small screw driver, remove the spacer, thrust bearing washer, thrust bearing and washer (fig. 38).
3. If the needle bearing is to be replaced, remove the retaining ring using Internal Pliers J-5403, then drive the dust seal, seal and bearing from the adjuster plug with Tool J-8524-2 and Drive J-7079-2 (fig. 39).
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 scores. If any of these conditions exist, replace the bearing and washers.

Assembly

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 away from the tool and drive bearing into plug until the tool bottoms in the housing (fig. 40).

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

2. Temporarily install the adjuster plug in the gear housing and place dust seal and a new oil seal on Tool J-8524-1

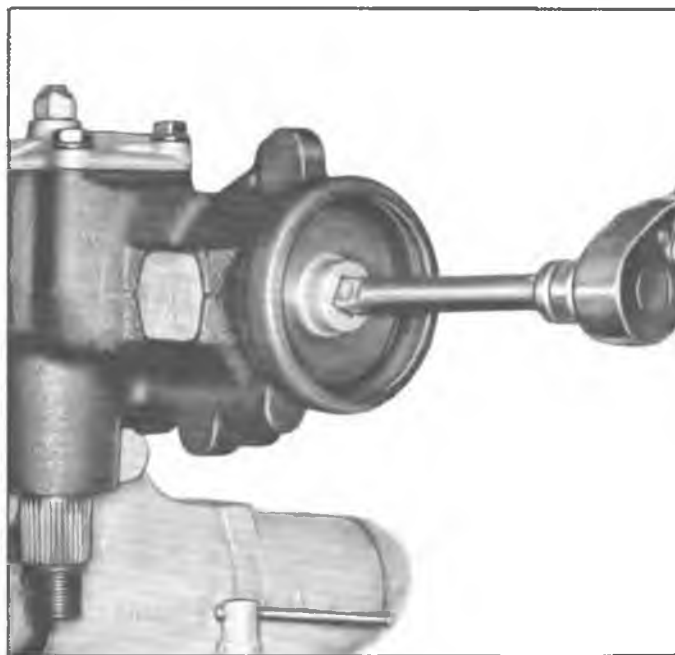


Fig. 33—Removing End Plug

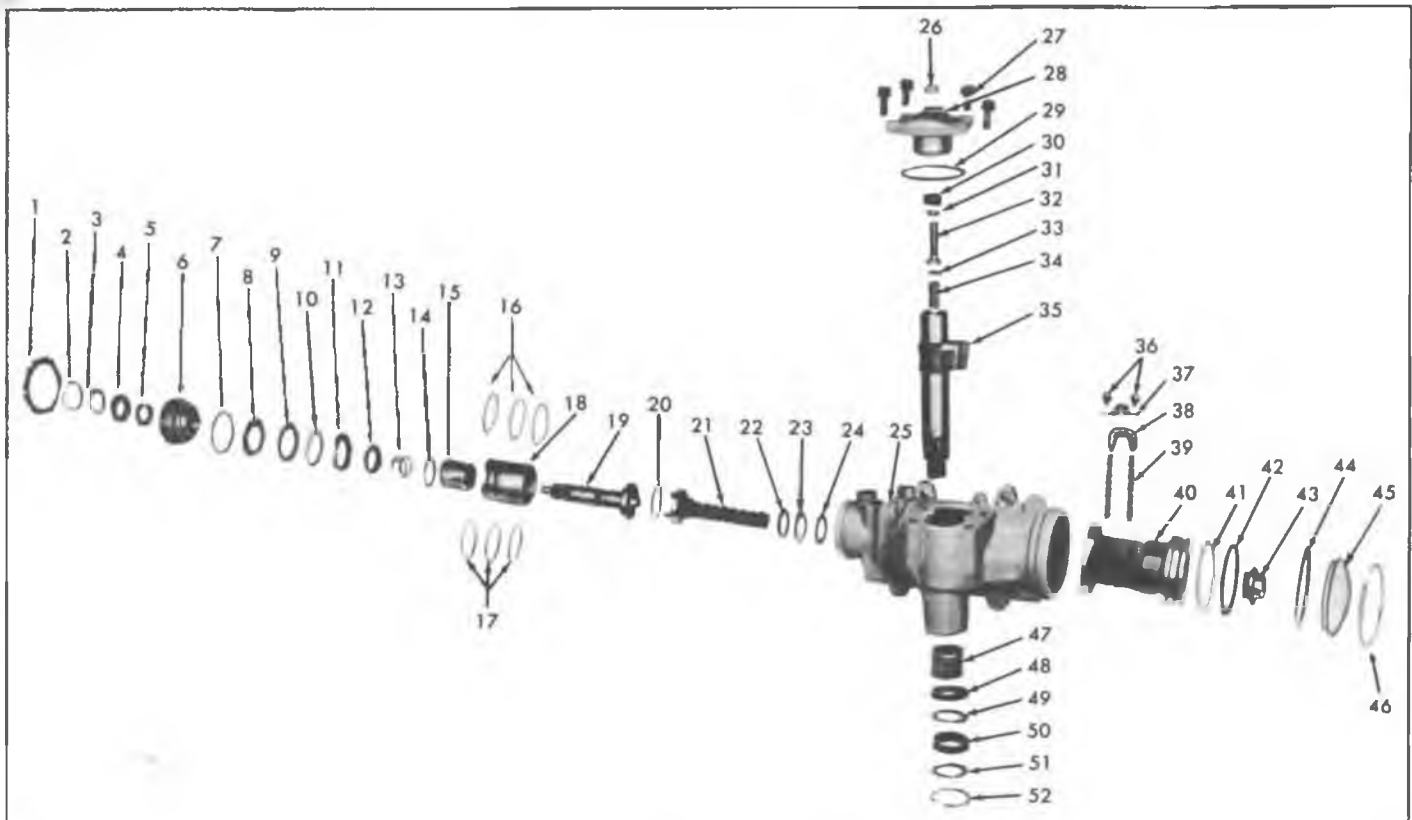


Fig. 34—Power Steering Gear—Exploded View

- | | | | | |
|---------------------------|------------------------|---------------------------------|-----------------------------|-----------------------|
| 1. Locknut | 11. Spacer | 22. Thrust Washer | 32. Adjuster Screw | 42. "O" Ring |
| 2. Retaining Ring | 12. Retainer | 23. Thrust Bearing | 33. Thrust Washer | 43. Plug |
| 3. Dust Seal | 13. Spool Valve Spring | 24. Thrust Washer | 34. Spring | 44. "O" Ring |
| 4. Oil Seal | 14. "O" Ring | 25. Housing | 35. Pitman Shaft | 45. Housing End Cover |
| 5. Bearing | 15. Spool Valve | 26. Locknut | 36. Screws and Lock Washers | 46. Retainer Ring |
| 6. Adjuster Plug | 16. Teflon Oil Rings | 27. Attaching Bolts and Washers | 37. Clamp | 47. Needle Bearing |
| 7. "O" Ring | 17. "O" Rings | 28. Side Cover | 38. Ball Return Guide | 48. Oil Seal |
| 8. Thrust Washer (Large) | 18. Valve Body | 29. "O" Ring | 39. Balls | 49. Back Up Washer |
| 9. Thrust Bearing | 19. Stud Shaft | 30. Adjuster Retainer | 40. Rack-Piston | 50. Oil Seal |
| 10. Thrust Washer (Small) | 20. "O" Ring | 31. Shim | 41. Teflon Oil Seal | 51. Back Up Washer |
| | | | | 52. Retaining Ring |

(lip of seal away from tool). Lubricate seal with Type "A" Transmission Fluid and drive or press seal into adjuster plug until seated (fig. 41).

3. Install retaining ring with Internal Pliers J-5403. Then remove the adjuster plug from the housing.
4. Lubricate the thrust bearing assembly with Type "A" Transmission 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).

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

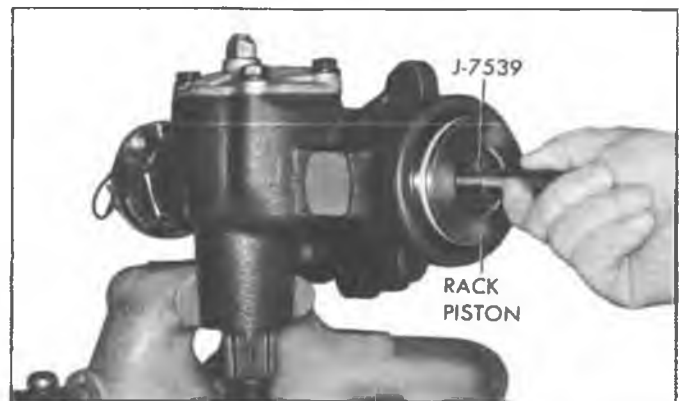


Fig. 35—Removing Rack Piston



Fig. 36 - Removing Adjuster Plug

Valve and Lower Shaft Assembly

Disassembly

1. Remove the spool valve spring by carefully prying top coil out of groove in the lower shaft, then slide the spring from the shaft. Be careful not to distort spring.
2. To remove the lower shaft assembly from the valve body, proceed as follows:

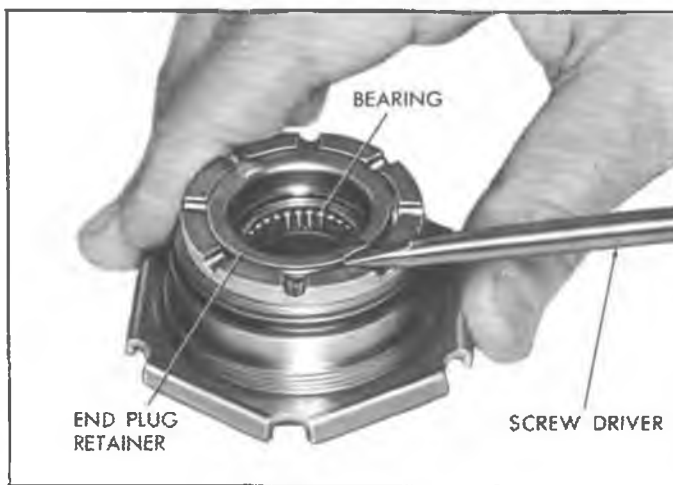


Fig. 38 - Removing Retainer

- a. While holding the assembly (lower shaft down), lightly tap the stub shaft against the bench until the shaft cap is free from the valve body (fig. 43). The spool valve should be held in the valve body while tapping the shaft.
- b. Carefully remove the lower shaft assembly so as not to cock the spool valve in the valve body.
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.

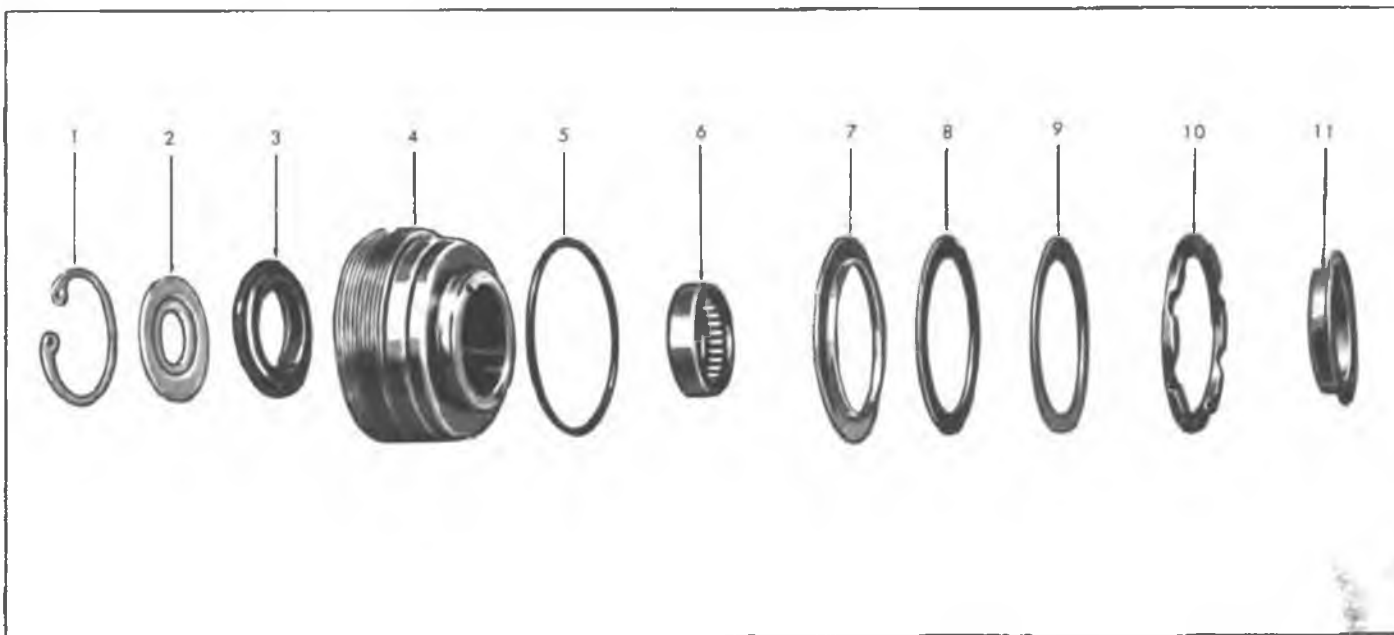


Fig. 37 - Adjuster Plug - Exploded View

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



Fig. 39—Removing Bearing and Seal

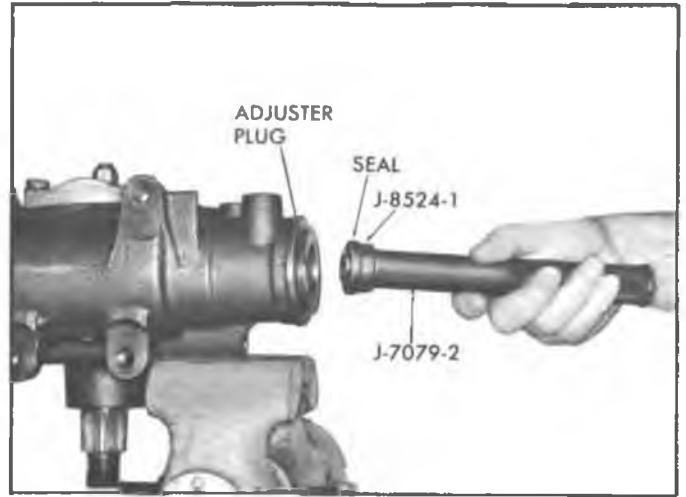


Fig. 41—Installing Seal

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 lower shaft or valve body is cracked, excessively worn or broken, replace the complete valve and shaft assembly.
3. If there is evidence of leakage between the torsion bar and the lower shaft, or scores, nicks, or burrs on the ground surface of the lower 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 exces-

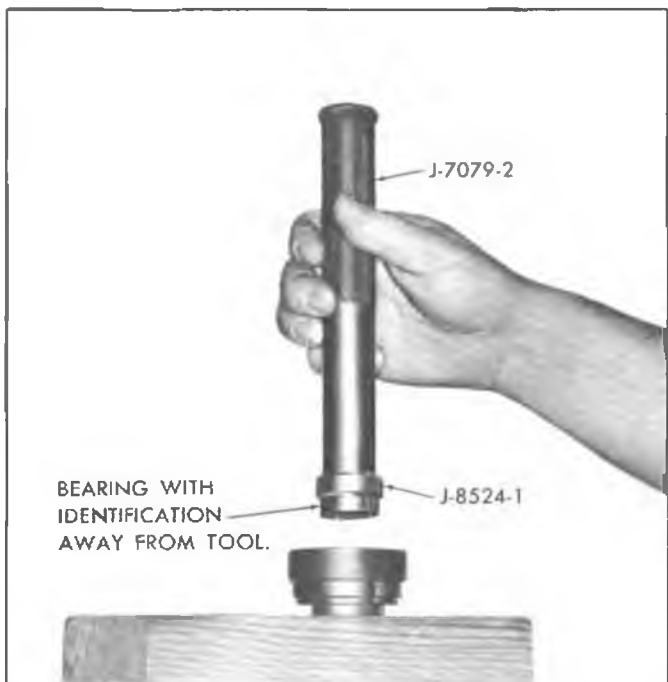


Fig. 40—Installing Bearing



Fig. 42—Installing Retainer



Fig. 43 - Removing Stub Shaft

sively worn, the complete valve and shaft assembly will have to be replaced.

6. Lubricate the spool valve with Type "A" Transmission 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.
7. Check the overall length of the spool valve spring. The spring should be approximately .860". If it is less than .830", replace the spring.

Assembly

1. If valve body "O" rings and teflon rings were removed, install "O" rings in the oil ring grooves and lubricate with Type "A" Transmission Fluid.



Fig. 44 - Removing Spool Valve

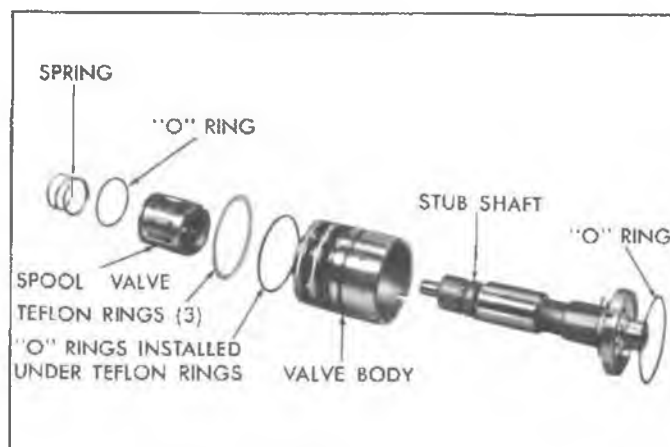


Fig. 45 - Valve Body and Shaft Assembly

2. Lubricate the 3 teflon oil rings with petroleum 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. Assemble the lower shaft assembly in the valve body so the notch in the lower shaft cap engages with the pin in the valve body and is seated (fig. 45).
4. Install the spool valve as follows:
 - a. Lubricate the spool valve dampener "O" ring with petrolatum and install over spool valve.
 - b. Lubricate the spool valve with Type "A" Transmission fluid and slide the valve over the lower shaft. (Notch in spool towards the valve body). Rotate the spool valve while pushing valve into valve body to align notch in spool with the pin in the lower shaft (fig. 45).
 - c. Carefully press spool valve into body, engaging notch on pin. Extreme care must be taken not to cut "O" ring. The spool valve is properly seated when it is flush with the top of valve body.
5. Place a piece of shim stock over the shaft to protect the seal surface from spring ends.
6. Slide the valve spring over the lower shaft and down into the spool valve until the top coil of the spring is in the shaft groove (fig. 46)

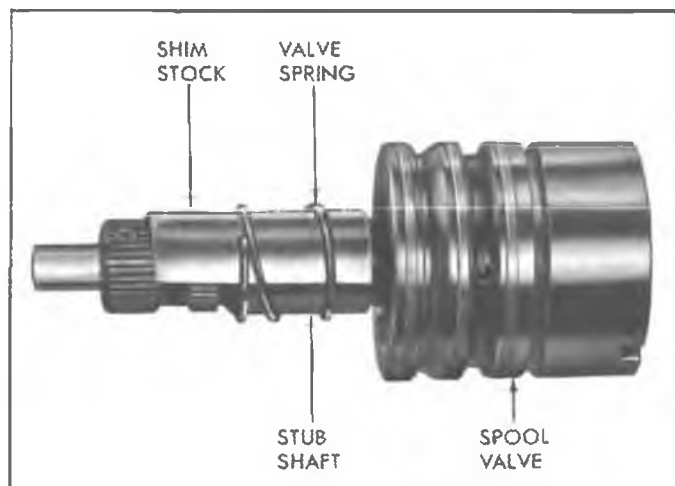


Fig. 46 - Installing Valve Spring

Pitman Shaft and Side Cover

Disassembly

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

Cleaning and Inspection

1. Wash all parts in clean solvent and dry parts with compressed air.
2. Check pitman shaft bearing surface in the side cover for scoring. If badly worn or scored, replace the side cover.
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 adjusting screw lash. 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. Install a new adjusting screw locknut, but do not tighten.

Rack-Piston

Disassembly

1. Check the worm to ball drag as follows:
 - a. Lightly clamp the rack-piston assembly in a brass jawed vise with Tool J-7539 still in place.
 - b. Thread worm into rack-piston while holding Tool J-7539 tightly against worm so the balls will not fall out of the rack-piston. When the worm is in place, remove Tool J-7539.
 - c. Clamp rack-piston (flanged end of worm up) in vise, then install the valve and lower shaft assembly so that the small notch in the valve body engages the drive pin in the worm. Locate the over-center position of the worm by slowly turning the worm and noting the area where the turning effort is highest. **DO NOT THREAD THE WORM OUT TOO FAR SINCE THIS MAY CAUSE SOME OF THE BALLS TO DROP OUT OF THE RACK-PISTON.**
 - d. Using a torque wrench and a $\frac{3}{4}$ " 12 point socket, check the drag while rotating the torque wrench in a 120° arc. The reading should not exceed 3 in. lbs. (fig. 47).
If a drag can be felt while rotating worm by hand, but it cannot be measured on a torque wrench, it will be acceptable.
 - e. If the drag is not within limits, a new set of balls must be installed upon reassembly. Note the ball size stamped on the rack-piston and install the next size larger balls to increase the drag or the next size smaller balls to decrease the drag; black balls need not be replaced unless they are defective. A change of one ball size will change the drag approximately 1 in. lb.

NOTE: If no number is apparent, the ball size is number 7.

- f. Remove the torque wrench and valve and shaft assembly.
2. Thread the worm out of the rack-piston, remove 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 scores or excessive wear. Inspect the external ground surfaces for wear, scoring or burrs.

Assembly

1. If the teflon oil seal and "O" ring was removed, install a new "O" ring and seal lubricated with Type "A" Transmission Fluid in the groove of the rack-piston.
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.

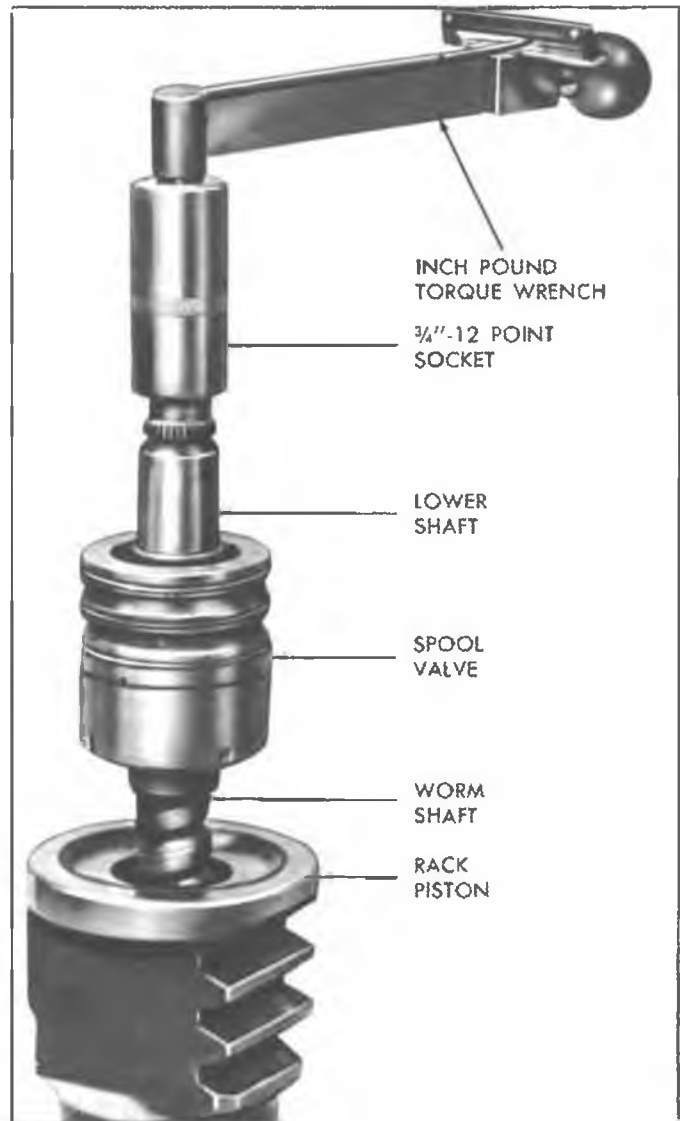


Fig. 47—Checking Ball Drag

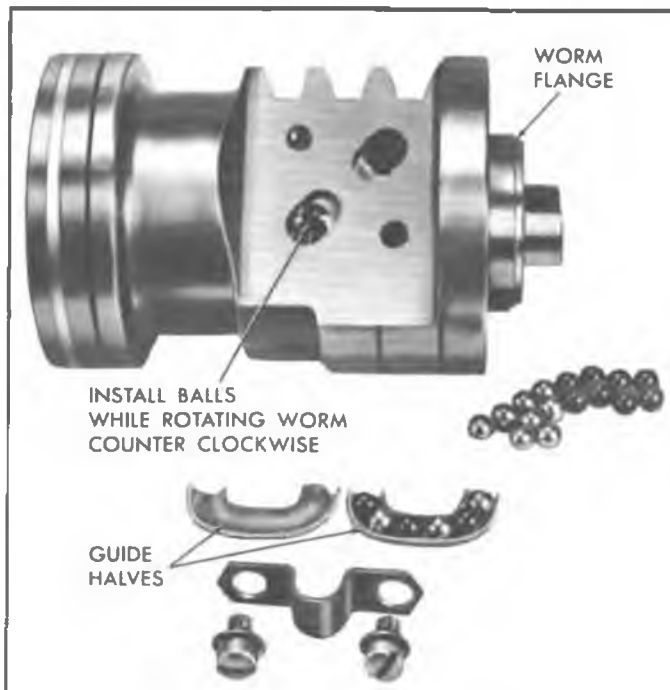


Fig. 48—Installing Balls in Rack-Piston

3. Turn the worm until the worm groove is aligned with the lower ball return guide hole (fig. 48).
4. Lubricate the balls with Type "A" Transmission Fluid, then feed 16 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.

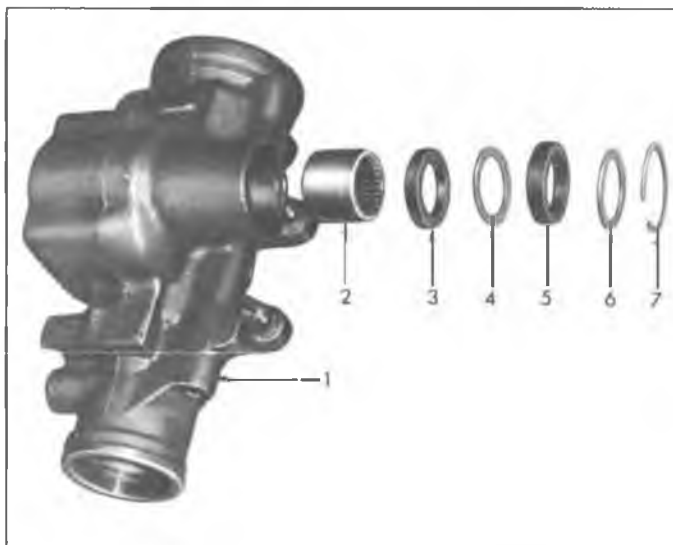


Fig. 49—Pitman Shaft Seals

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

5. Alternately install 6 balls into the return guide and retain with petrolatum. Install balance of balls into piston alternating black and silver. It will be necessary to rotate worm while installing balls. Install the return guide assembly onto the rack-piston. Install the return guide clamp and tighten the 2 clamp screws 10 ft. lbs.
6. Check the ball drag if a new set of balls were installed. Refer to RACK-PISTON - DISASSEMBLY, Step 1c.
7. 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.

Pitman Shaft Needle Bearing and Seals

Removal

1. If pitman shaft seals ONLY are to be replaced, remove the seal retaining ring and outer steel washer, then pry out the outer seal. Remove the inner steel washer, then pry out the inner seal (fig. 49).
2. If pitman shaft needle bearing replacement is necessary, remove with Tool J-6278.

Installation

1. If the pitman shaft needle bearing was removed, place Adapter J-6278-2 over Tool J-6278; slide the new needle bearing on the tool with the bearing manufacturer's identification against the adapter and drive the bearing into the housing until adapter bottoms in housing (fig. 50).
2. Lubricate the lips of the oil seals with Type "A" Transmission 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. 51).
 - 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 Adapter J-6278-2 and continue driving the seals until the retaining ring seats in its groove (Refer to Inset, Figure 51), then remove the tool adapter.

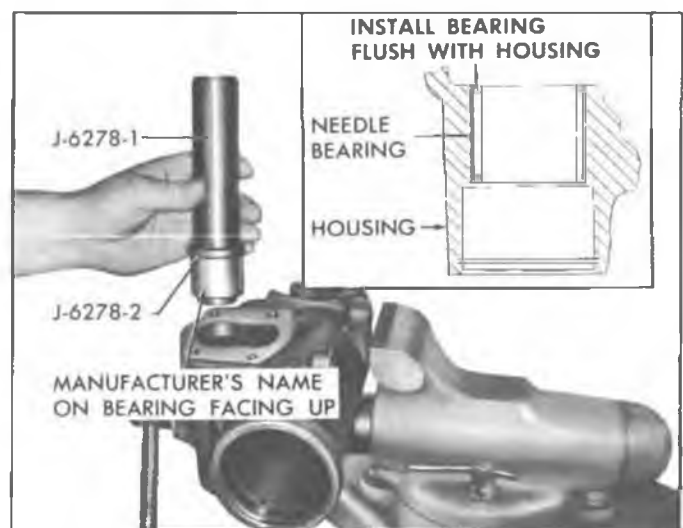


Fig. 50—Installing Pitman Shaft Bearing

Removal and Installation of Pitman Shaft Seals

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 gear assembly from car as follows:

1. Remove pitman nut and disconnect pitman arm from pitman shaft using puller J-6632 (See Fig. 2).
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-5403.
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 pitman shaft assembly and remove seals in normal manner being careful not to score seal bore in housing.

5. Inspect seals for damage to rubber covering on O.D. If O.D. appears scored, inspect housing for burrs and remove before attempting new seal installation.
6. Clean the end of housing thoroughly so that dirt will not enter housing with the installation of the new seals.
7. Lubricate the seals thoroughly with petroleum jelly 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

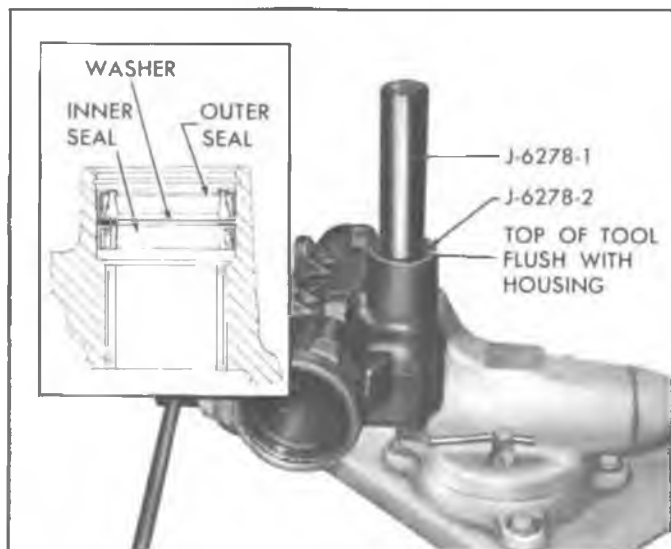


Fig. 51 – Installing Pitman Shaft Seals

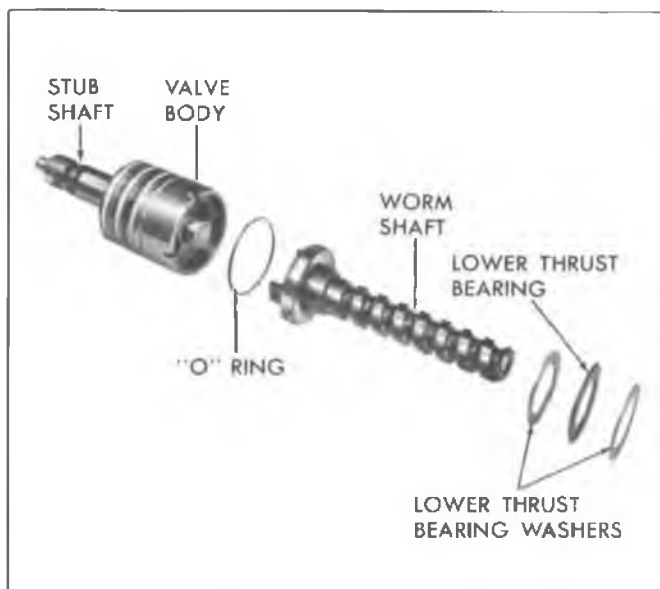


Fig. 52 – Worm and Valve Body – Exploded View

enough to provide clearance for the retaining ring. Install retaining ring.

8. 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.
9. Remove tape and reconnect pitman arm.

Assembly

1. Lubricate the worm, lower thrust bearing and the two thrust washers with Type "A" Transmission Fluid, then install one thrust washer, the bearing, and the other thrust washer over the end of the worm (fig. 52).
2. Lubricate the valve body teflon rings and a new lower shaft cap "O" ring with petrolatum. Install the lower shaft cap "O" ring in the valve body so it is seated against the lower shaft cap. Align the NARROW NOTCH in the valve body with the pin in the worm, then install the valve and shaft assembly in the gear housing (fig. 53). Apply pressure to the VALVE BODY when installing. If pressure is applied to the lower shaft during installation, the shaft may be forced out of the valve body (fig. 55).

NOTE: The valve body is properly seated when the oil return hole in the housing is entirely uncovered (fig. 56).



Fig. 53 – Valve to Worm Alignment

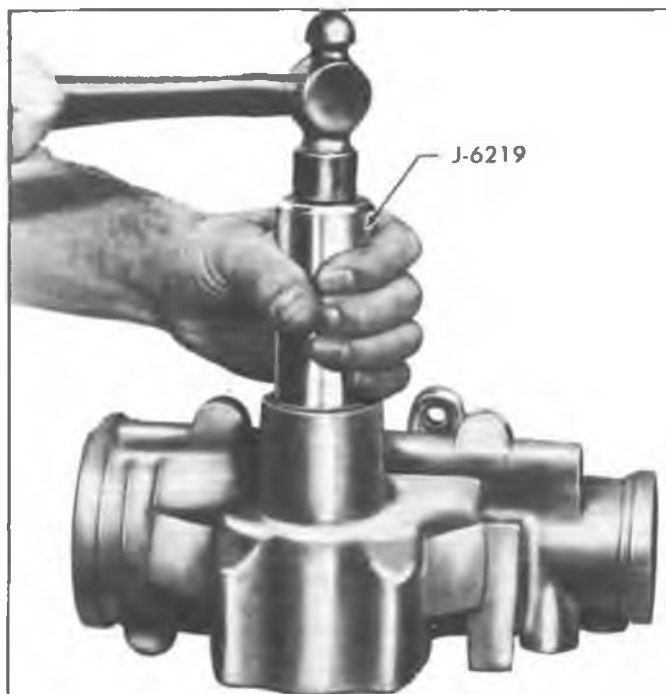


Fig. 54—Installing Pitman Shaft Seals Using Tool J-6219

3. Lubricate a new adjuster plug "O" ring with petrolatum and install in groove on adjuster plug. Place Seal Protector J-6222 over lower shaft, then install the adjuster plug assembly in the housing until it seats against the valve body (fig. 56). 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 petrolatum, and install on rack-piston (fig. 58).
 - b. Position Seal Compressor J-8947 against the shoulder in the housing.



Fig. 55—Installing Valve Body

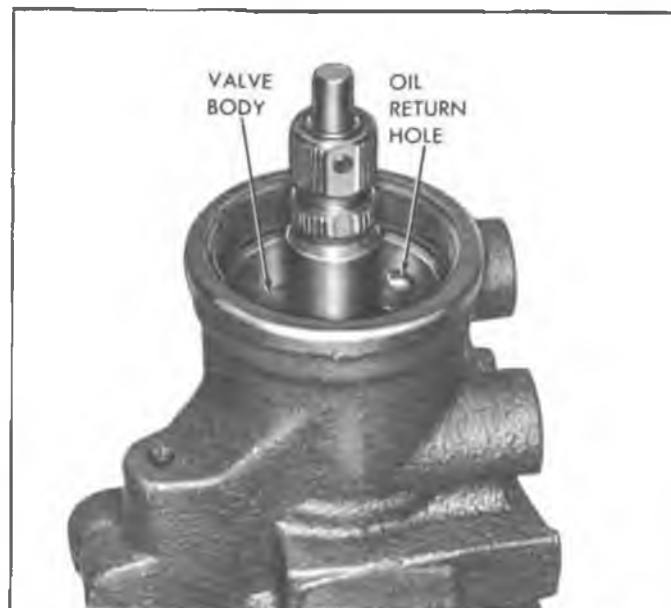


Fig. 56—Valve Body Position in Housing

- 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 lower shaft clockwise with a $\frac{3}{4}$ " 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.
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 petrolatum.
 - b. Turn the lower 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.
 - c. Install the side cover bolts and lock washers and tighten 30 ft. lbs.



Fig. 57—Installing Adjuster Plug



Fig. 58—Installing Ring on Rack-Piston

6. Install the rack-piston plug in the rack-piston.
7. Install a new housing end cover "O" ring and lubricate it with petrolatum, then 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 $\frac{1}{4}$ turn and measure valve drag.
 - b. Adjust thrust bearing preload to obtain $\frac{1}{2}$ to 2 in. lbs. in excess of valve assembly drag. Tighten adjuster plug locknut 80 ft. lbs. using Spanner Wrench J-972 while holding adjuster plug in position with Tool J-7624 (fig. 60).

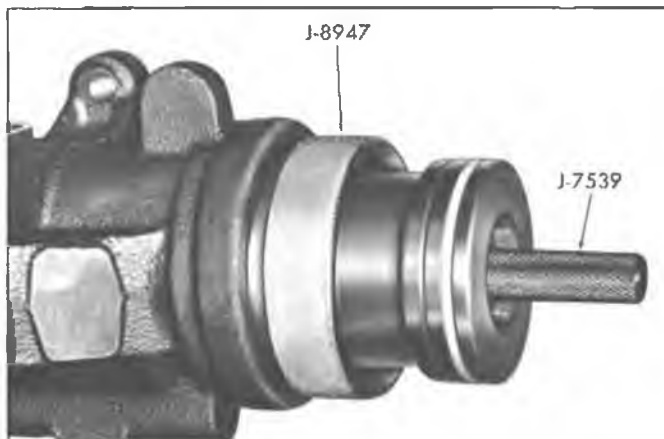


Fig. 59—Installing Rack-Piston

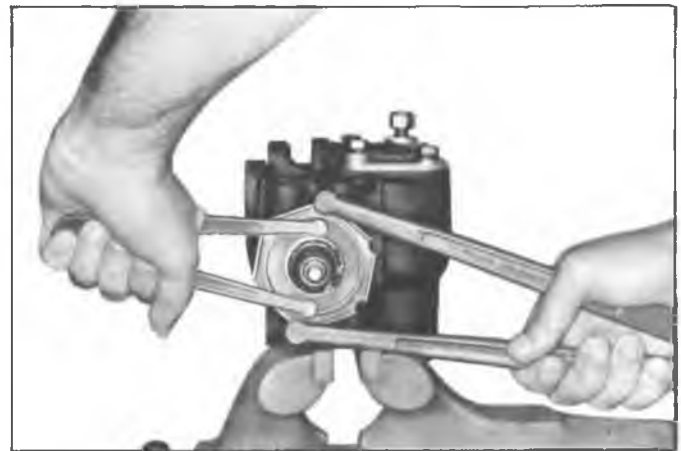


Fig. 60—Locking Preload Adjustment

9. Adjust the over-center preload as follows:
 - a. Make sure the over-center adjusting screw is backed all the way out.
 - b. Install an inch-pound torque wrench with a $\frac{3}{8}$ " 12 point socket on the lower shaft splines.
 - c. Rotate the lower shaft from one stop to the other. Count the number of turns and locate the center of travel, then check the combined ball and thrust bearing preload by rotating the torque wrench through the center of travel. Note the highest reading.
 - 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 lb. in.
 - e. While holding the adjusting screw, tighten the locknut 25 ft. lbs. using Adapter J-5860 (fig. 61) and recheck the adjustment.
10. Position the coupling flange onto the lower shaft, then install the flange attaching bolt and lock washer. Tighten the coupling flange attaching bolt 30 ft. lbs.

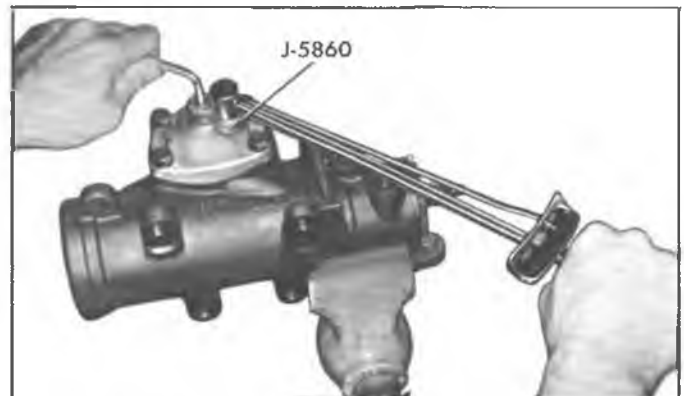


Fig. 61—Torquing over Center Locknut

Special Tools

J-972	Spanner Wrench
J-4245	Snap Ring Pliers #3
J-5188	Adjuster Plug Seal Installer
J-5403	Internal Pliers
J-5860	Center Rocknut Adapter
J-6217	Valve Connector Seat Installer
J-6219	Pitman Shaft Seal Installer
J-6221	Adjuster Plug Bearing Remover and Installer
J-6222	Adjuster Plug Seal Protector
J-6278-1	Pitman Shaft Bearing Installer
J-6278-2	Pitman Shaft Bearing Installer Adapter
J-6632	Pitman Arm Remover
J-6657	Pitman Shaft Bearing Remover
J-7079-2	Adjuster Plug Dust Seal and Bearing Remover Drive
J-7539	Rack-Piston Arbor
J-7624	Spanner Wrench
J-7576	Rack-Piston Installer
J-8433-1	Pulley Remover (cast)
J-8433-2	Pulley Remover (cast) Adapter
J-8524-2	Adjuster Plug Dust Seal and Bearing Remover
J-8947	Rack-Piston Seal Compressor
J-21000	Pump Shaft Seal Protector
J-21001	Pump Shaft Seal Installer
J-21239-1	Pulley Remover (Stamped)
J-22616	Pump Shaft Seal Protector
J-22670	Power Steering Seal Installer

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