

# HUDSON



## POWER STEERING SERVICE

(1954 Model 7D)



# POWER STEERING

(Models 7D)

## CONSTRUCTION

The power steering mechanism available as an option on the 1954 Hornet models consists of two principal units, a hydraulic pump, belt driven by the engine and a hydraulic linkage booster connected by suitable oil delivery and return hoses, Figure 1. The booster unit connects the steering gear to the center steering arm through the medium of a drag link and a steering arm ball housing. One end of the drag link is attached to the power cylinder valve shaft the other end to steering gear pitman arm. The steering arm ball housing, part of the hydraulic booster connects the center steering arm to the hydraulic booster.

## OPERATION

The power steering unit operates through movement of the pitman arm and a drag link, which in turn actuates a flow director valve attached integrally to the power cylinder.

The cylinder piston shaft is fixed by a bracket to a frame cross member. The opposite end of the booster assembly is mounted to the steering arm by the steering arm ball housing, Figure 2. Pitman arm travel in either direction causes a corresponding movement in the flow director valve, Figure 4, thereby directing pressurized oil supplied by the hydraulic pump into the proper side of the cylinder resulting in a longitudinal travel of the booster assembly along the piston shaft. The booster unit applies this force to the steering arm and replaces most of the work previously done by the driver.

The advantage of this type of power steering is threefold in that it not only reduces parking effort but also reduces driving fatigue to a great extent due to

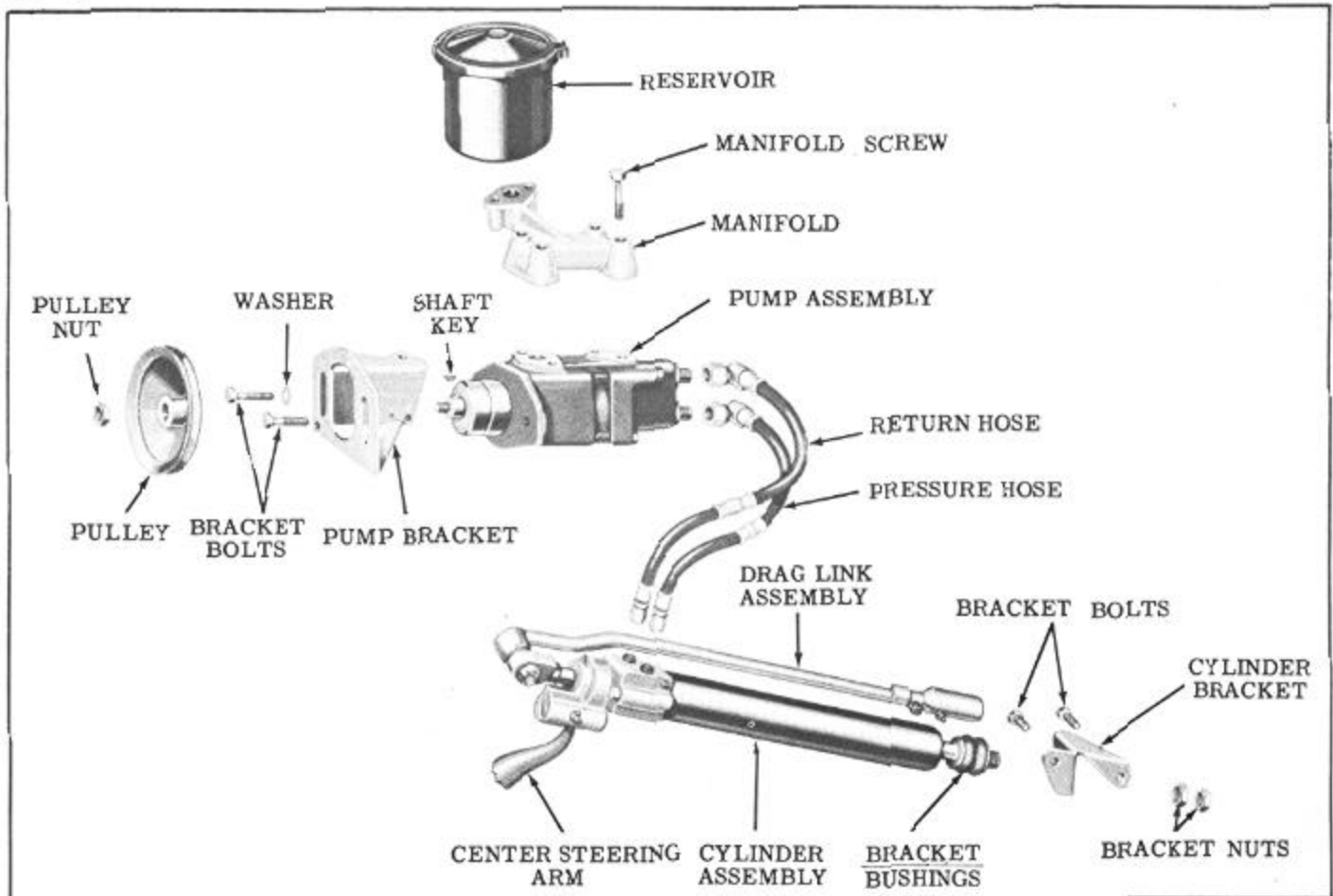


FIGURE 1

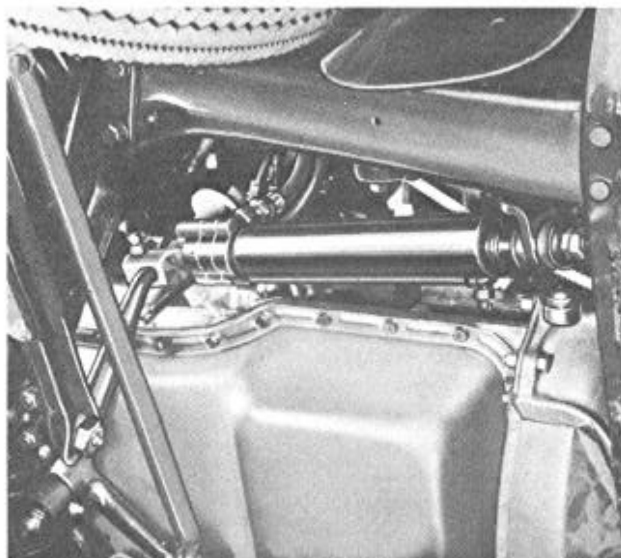


FIGURE 2

the small effort required to control the car on all types of road conditions and has the additional feature of shock free steering. The oil loaded cylinder absorbs a large percentage of road shock due to bumps and unevenness in the highway and prevents this shock from being relayed to the steering wheel.

Complete "road feel" is designed into the booster as well as effortless steering. A 3 to 8 pound initial load on the steering wheel will set the booster in operation, hence the driver constantly controls the actuation of this unit. No power steering is accomplished without driver guidance.

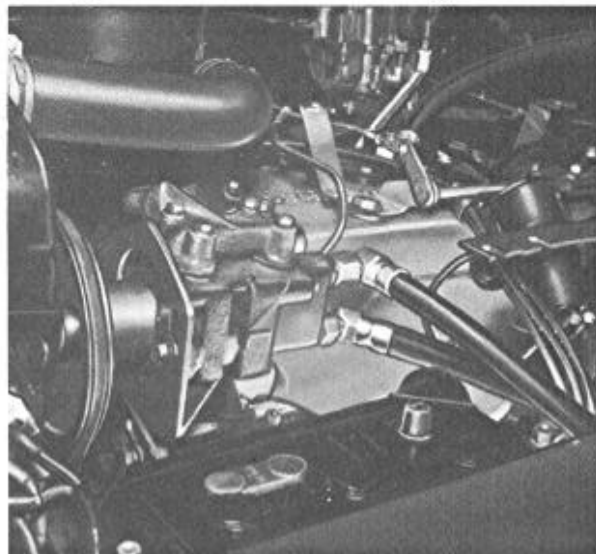


FIGURE 3

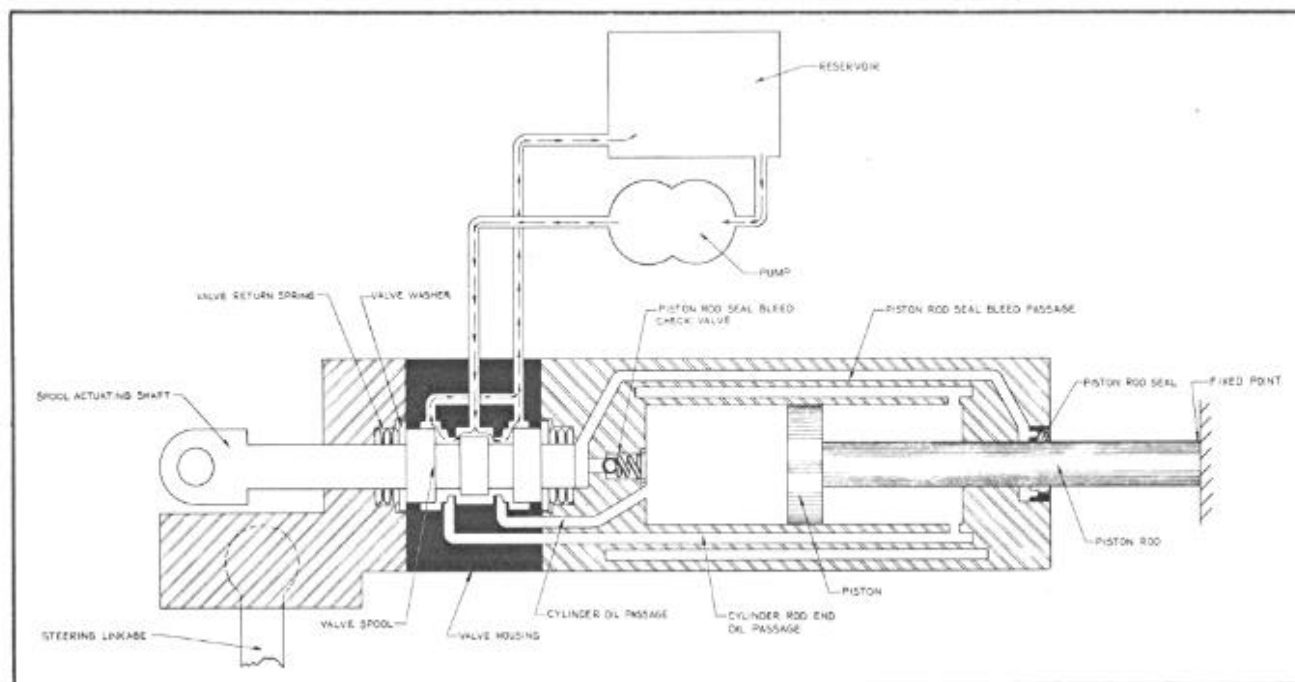


FIGURE 4

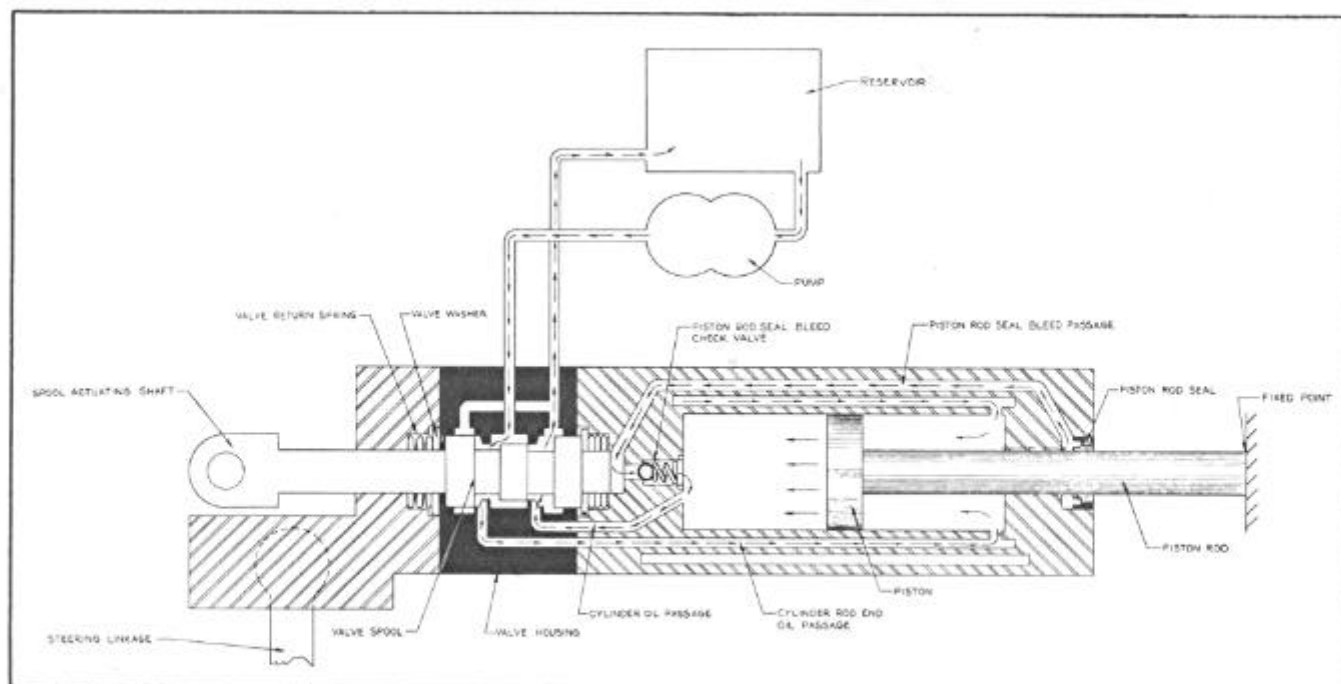


FIGURE 5

The hydraulic supply system consists of a belt-driven hydraulic pump, Figure 3, incorporating a flow and pressure control valve and an oil reservoir and cover assembly. Suitable hoses connect the source of power to the booster proper.

The principal working parts of the hydraulic linkage booster are the control valve assembly and the power cylinder assembly.

The control valve consists of two spools, each having an annular groove which connect three annular passages inside the valve housing, Figure 4. The valve spools are centered and restrained from actuation on the valve shaft by two pre-loaded springs, one at each end of the housing. It is therefore necessary to overcome the pre-load of one spring (this is the 3 to 8 pound effort on the steering wheel mentioned previously) before the valve spools can be moved in either direction. When there is sufficient resistance to rotation of the steering arm developed at the front wheels, continued turning of the steering wheel will result in an axial movement of the valve shaft, thus overcoming the pre-load of the springs. This axial movement is due to the hookup from the pitman arm to

the valve shaft through the drag link and the direction is dependent upon the direction of the travel of the pitman arm.

When the valve spools are in the centered position (no effort on steering wheel), the oil from the hydraulic pump flows through the center passage of the valve body, through the annular grooves in the spools to the annular passages in the housing at both ends and then back to the pump, Figure 4.

When axial movement of the spools occurs with a three pound effort on steering wheel, the direct circuit of the pump is interrupted by shutting off both of the direct return passages, Figure 5. The oil is then forced to travel to one end of the hydraulic cylinder to move the cylinder axially on the piston shaft. At the same time the opposite end of the cylinder is open to the pump return line and permits oil at this end to return through the valve to the pump reservoir.

The hydraulic pump, Figure 6, is of the constant displacement type and builds up only the pressure required to overcome the resistance to the turning of the front wheels. This oil pressure, which pushes against the piston, is also used in building up a pre-load

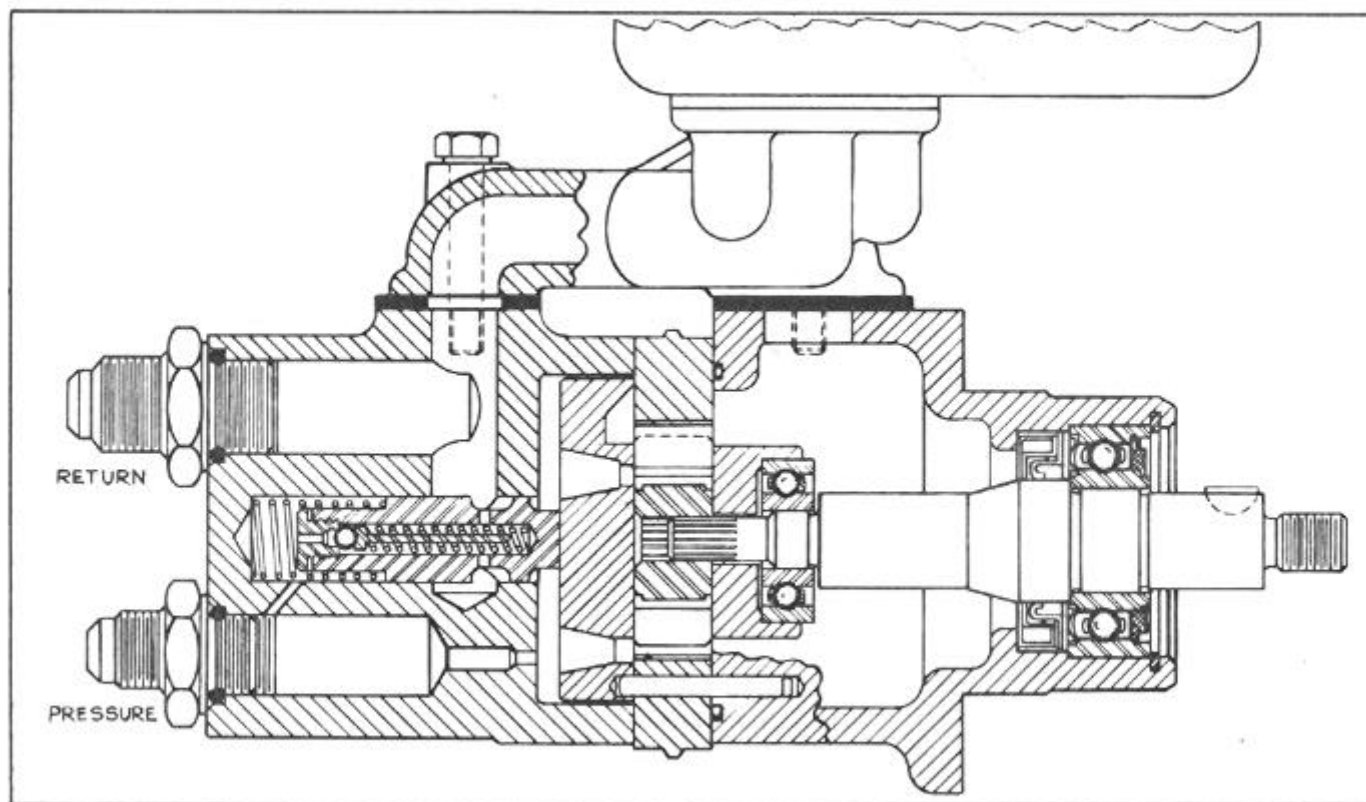


FIGURE 6

on the spools (hence the different diameters) which must be overcome by slightly increasing the effort on the steering wheel. This feature of the added load plus the original spring pre-load produces a reaction so that the driver is conscious of an increased steering effort (3 to 8 pounds) when more power is required to steer the car, thus permitting the driver to retain the "road feel" of operating the car as formerly mentioned.

The engine drives the hydraulic pump through a "V" belt. When the engine is stopped or the booster unit is inoperative due to lack of oil or some other malfunction, the steering becomes entirely manual and will handle the car just as safely and efficiently as a manual steering system.

## SERVICE PROCEDURE

### RESERVOIR AND PUMP ASSEMBLY

#### Removal

1. Raise hood and drain radiator by opening drain cock at lower right side of radiator.
  2. Remove upper radiator hose.
  3. Disconnect hydraulic hoses at unions on pump.
- NOTE: SECURE ENDS OF HOSES IN A RAISED POSITION AT PUMP UNIONS TO PREVENT OIL DRAINAGE.
4. Remove pump drive pulley attaching nut, lock washer and flat washer (3/4" hexagon nut).
  5. Loosen the two pump to bracket screws (9/16" cap screws).
  6. Slide pump towards engine and remove pulley belt.
  7. Remove pump pulley by tapping lightly on back face with a soft hammer.
  8. Remove the two screws attaching the pump to bracket (9/16" cap screws).
  9. Remove the reservoir and pump assembly to the bench for draining and repair.





## Disassembly

1. Remove reservoir cover center screw (1), Figure 8, lockwasher (2), flat washer (3), guide (4), gasket (5), cover (6) and gasket (7).
2. Drain oil from reservoir.
3. Remove the two screws (8) attaching the reservoir to pump manifold (7/16" cap screws) and remove reservoir.
4. Remove the reservoir base gasket (10) and spacer.
5. Remove the four screws (11) attaching the pump manifold (12) to the body and cover (9/16" cap screws).
6. Mark pump cover (33), rotor ring (21) and pump body (18) lightly with a prick punch to insure proper alignment on assembly, Figure 7.

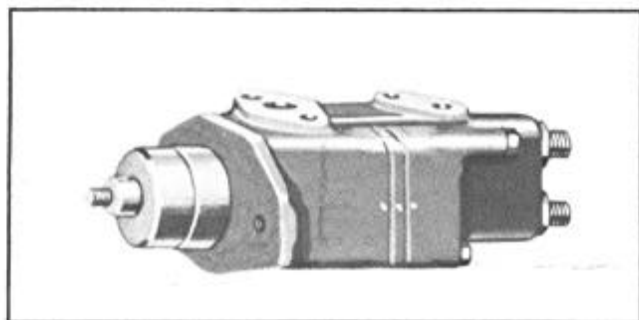


FIGURE 7

7. Remove the four screws (35), Figure 8, attaching pump cover (33) to pump body (18) (9/16" cap screws).
8. Remove the pump cover (33) (with oil line fittings).
9. Remove the "O" ring seal (30) from face of pump cover (discard).
10. Remove the pressure plate (22) and the two aligning pins (19). Mark position of pressure plate.
11. Remove the control valve (31) and valve spring (32).
12. Remove rotor ring (21) (square casting).
13. Remove the pump rotor (20) with twelve vanes (29).
14. Remove the "O" ring (28) from the pump body (discard).
15. Remove shaft bearing retainer snap ring (25) (Tru-Arc) from front face of pump body (18).
16. Remove the pump pulley Woodruff key (15).
17. Remove the pump shaft and bearing as an assembly (26) by tapping lightly on splined end with a brass drift.

18. Remove the oil seal (27) from front of pump body.

CAUTION: DO NOT DAMAGE THE INNER BEARING (16) WHEN REMOVING THE OIL SEAL.

19. Remove outer bearing (large) (14) from pump shaft (26).

## Assembly

1. Clean all parts thoroughly in a good clean solvent and blow parts dry.
2. Install large bearing (14) on pump shaft (26) over threaded end with stamped face of inner race toward threaded end of shaft.
3. Install small inner bearing (16) into pump body (18).
4. Install oil seal (27) into pump body so that the chamfered side with the two 1/16" holes is facing outward towards pulley end of shaft. Use a piece of tubing approximately 1-11/16" outside diameter and apply pressure to outside of seal only.

NOTE: THESE SEALS ARE SHIPPED WITH A PROTECTIVE SLEEVE INSERTED IN THE INNER PERIPHERY OF THE SEAL. THIS SLEEVE IS INSTALLED AT THE FACTORY TO PREVENT THE ACTION OF THE SPRING FROM PUSHING THE RUBBER ELEMENT OUT OF THE CASE AND SHOULD BE LEFT IN PLACE UNTIL THE SEAL IS ASSEMBLED INTO THE PUMP.

5. Install pump shaft (26) with large bearing (14) into the pump body entering shaft through the oil seal (27) and inner bearing (16).

NOTE: THE SHAFT IS A LIGHT PRESS FIT IN THE INNER BEARING AND CARE SHOULD BE USED WHEN INSTALLING THE SHAFT. APPLY A SMALL AMOUNT OF HYDRA-MATIC FLUID TO THE LIP OF SEAL.

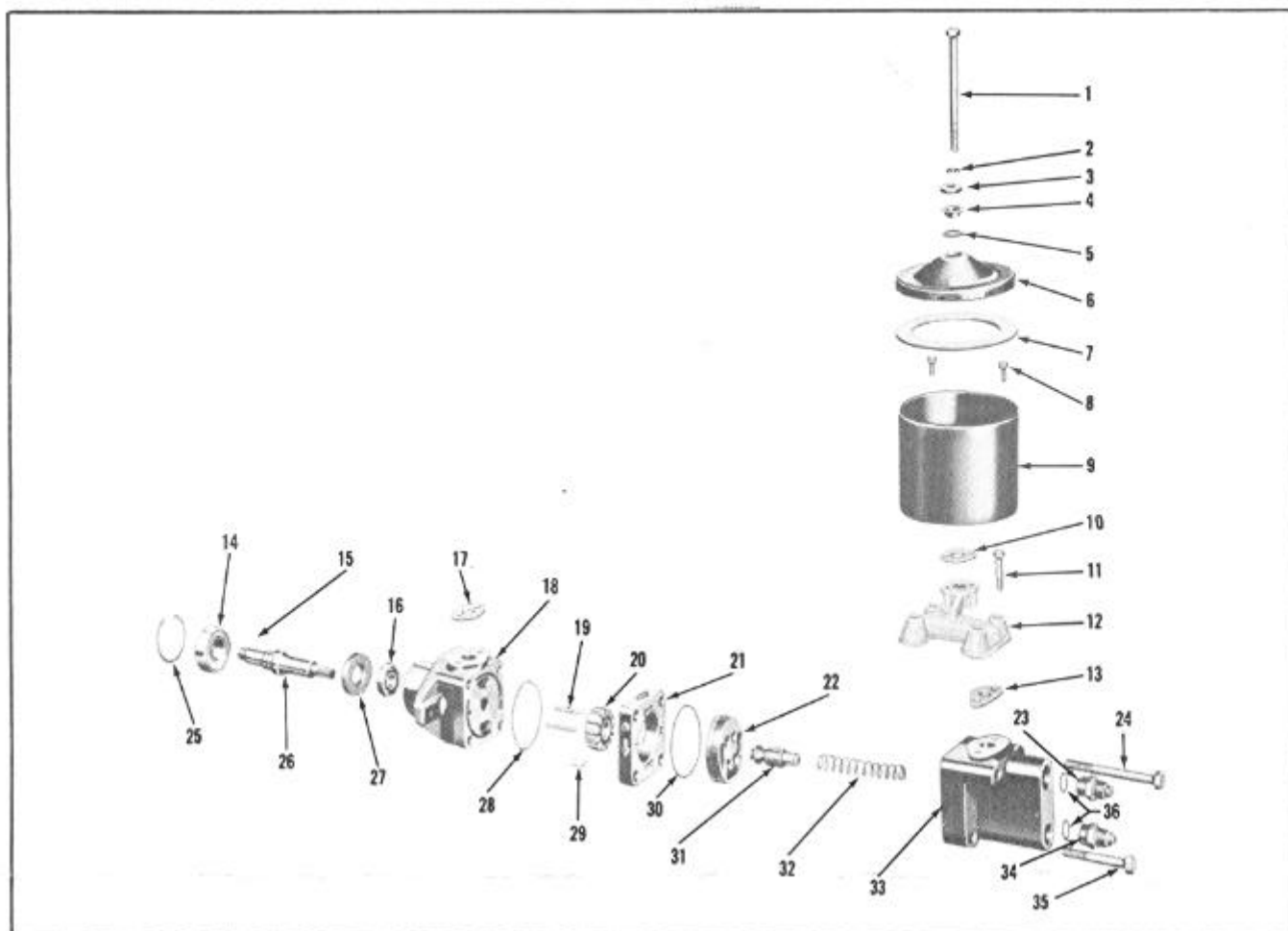
6. Install the bearing retaining (Tru-Arc) snap ring (25)
7. Install the Woodruff key (15) in slot on shaft (26).
8. Install a NEW "O" ring (28) in groove of pump body.
9. Install the two dowel pins (19) in the dowel holes in pump body.
10. Install the rotor (20) with twelve vanes (29).

NOTE: THE RADIUS EDGES ARE TOWARD THE OUTER EDGE OF THE ROTOR.

11. Install rotor ring (21) onto the dowel pins and over the rotor.

NOTE: ARROWS ON ROTOR RING (21) MUST POINT TO DIRECTION OF PUMP ROTATION. CHECK ALIGNING MARKS MADE AT DISASSEMBLY, FIGURE 7.





EXPLOSION — HYDRAULIC PUMP  
FIGURE 8

- |  |  |
|--|--|
| 1. Reservoir cover screw                   | 19. Pressure plate guide pins              |
| 2. Reservoir cover screw lockwasher        | 20. Pump rotor                             |
| 3. Reservoir cover flat washer             | 21. Rotor ring                             |
| 4. Reservoir cover screw guide             | 22. Pressure plate                         |
| 5. Reservoir cover screw gasket            | 23. Return fitting                         |
| 6. Reservoir cover                         | 24. Pump cover attaching screw             |
| 7. Reservoir cover gasket                  | 25. Pump shaft outer bearing retainer ring |
| 8. Reservoir attaching screws              | 26. Pump shaft                             |
| 9. Reservoir tank                          | 27. Oil seal                               |
| 10. Reservoir to manifold gasket           | 28. "O" ring seal                          |
| 11. Pump manifold to cover attaching screw | 29. Rotor vanes                            |
| 12. Pump manifold                          | 30. "O" ring seal                          |
| 13. Manifold to pump cover gasket          | 31. Control valve assembly                 |
| 14. Pump shaft outer bearing               | 32. Control valve spring                   |
| 15. Pump shaft key                         | 33. Pump cover                             |
| 16. Pump body inner bearing                | 34. Pressure fitting                       |
| 17. Manifold to pump body gasket           | 35. Pump cover attaching screw             |
| 18. Pump body                              | 36. Fitting gaskets                        |

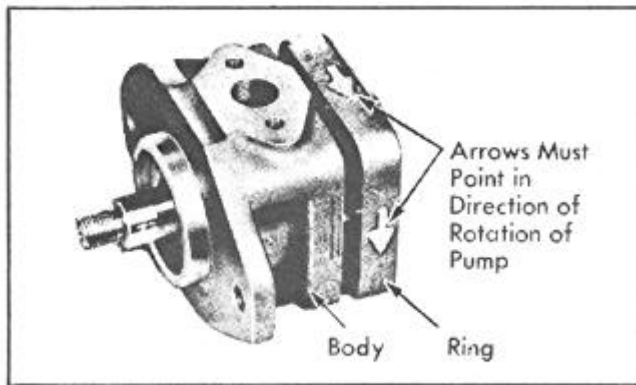


FIGURE 9

12. Install the pressure plate (22) on the dowel pins extending through rotor ring (21). (Small arrow on pressure plate should be at the top).
13. Install the "O" ring (30) in pump cover (33).
14. Install the control valve (31) and control valve spring (32) in front face of pump cover (33), Figures 6 and 8.
15. Install pump cover assembly over the pressure plate (22) and install the pump cover to pump body attaching screws (24) (9/16" cap screws). Tighten all screws evenly finger tight and then torque to 25-30 foot pounds.
16. Install new pump to manifold gaskets and spacers (17) and (13).
17. Install manifold to pump attaching screws (11) (7/16" cap screws) tighten to 12-15 foot pounds.
18. Install oil reservoir to manifold gasket (10).
19. Install oil reservoir (9) on pump manifold and attach two screw and lockwashers (8) (7/16" cap screws).

## RESERVOIR AND PUMP ASSEMBLY

### Installation

1. Position oil pump with reservoir on mounting bracket and install attaching screws, (9/16" cap screws). DO NOT TIGHTEN SCREWS.
2. Install drive pulley (convex side toward pump and key on shaft in line with keyway in pulley).
3. Install flat washer, lockwasher and pulley attaching nut. DO NOT TIGHTEN NUT AT THIS TIME.
4. Install pump drive belt.
5. Raise pump assembly to adjust belt;

- with belt properly adjusted tighten the two pump to bracket screws to 25 to 30 foot pounds (9/16" cap screws).
6. Install the upper radiator hose, tighten hose clamps securely, check for clearance between the oil reservoir and radiator hose.
7. Tighten pulley hub nut to 35-45 foot pounds.
8. Loosen the hose connections at the booster cylinder valve, with the hoses disconnected at the pump, fill the hoses with A.Q.F.A.T. Type "A" Fluid until the fluid runs out at the hose connections at the booster cylinder free of air bubbles then tighten the connections at the booster cylinder while keeping the hoses full of fluid.
9. Install hose connections at oil pump and tighten securely.
10. Fill oil pump reservoir to Mark with A.Q.F.A.T. Type "A" fluid.
11. Fill cooling system.
12. Start engine and run at idle speed for approximately 10 minutes to allow the hydraulic system to clear itself of air that may be trapped in the system.

CAUTION: DO NOT TURN THE STEERING WHEEL DURING THIS 10 MINUTE PERIOD.

13. Recheck oil level.
  14. Install the oil reservoir gasket, cover, cover attaching screw, flat washer and lockwasher (Use new gasket)
  15. Check all hose connections for leaks.
- NOTE: IF THE OIL PUMP IS NOISY AND FLUID LEVEL IS UP TO MARK IN THE RESERVOIR AND ALL CONNECTIONS ARE TIGHT, PLACE CAR IN SERVICE. NOISE WILL DISAPPEAR AFTER 3 OR 4 DAYS USAGE. THE PUMP NOISE IS CAUSED BY AIR FORCED INTO THE OIL WHICH WILL BE GRADUALLY DISSIPATED DURING USAGE. IF CARE IS TAKEN WHEN FILLING AND CONNECTING HOSES THIS CONDITION SHOULD NOT OCCUR.

## VALVE AND POWER CYLINDER

### Removal

1. Turn front wheels a full left turn.
2. Remove the cotter pin from the drag link ball stud at the valve shaft and remove the ball stud nut (7/8" castle nut).
3. Remove the drag link ball stud from the valve shaft using Tool J-2781.
4. Remove the cotter pin, end plug, safety plug, spring and ball seat and discon,

nect the valve and cylinder assembly from the center steering arm.

5. Raise car and place car on stand jacks.
6. Disconnect piston rod at support bracket at No. 3 crossmember by removing lock nut, and retaining nut ( $3/4$ " nut) and pushing the piston rod through the bracket and remove the piston shaft washers, rubber bushings and retaining washers.
7. Disconnect hoses at oil pump and lift valve and power cylinder assembly up through engine compartment, Figure 10.

NOTE: USE SCREW CAPS TO PLUG BOTH HOSES AND BOTH PUMP FITTINGS TO KEEP THE OIL FROM DRAINING OUT.

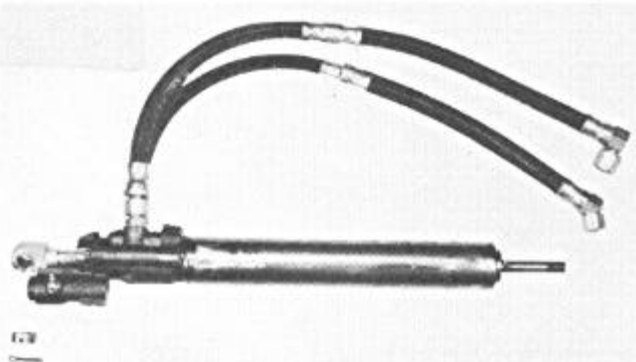


FIGURE 10

### Disassembly

1. Clean outside of valve and cylinder assembly thoroughly.
2. Remove both hoses from valve body and inspect hoses for wear or cracks. Replace if necessary, ( $1-13/16$ " fitting,  $1-7/8$ " fitting).
3. Remove the two screws attaching the steering arm ball housing and the valve and spool assembly to the hydraulic cylinder assembly ( $7/16$ " cap screws), Figure 11.

NOTE: THIS IS A SPRING LOADED ASSEMBLY; AND

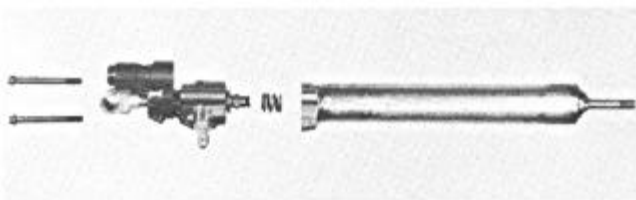


FIGURE 11

SHOULD BE LOOSENED AN EQUAL AMOUNT UNTIL SPRING PRESSURE IS RELIEVED.

4. Remove hydraulic cylinder assembly,

NOTE: THE HYDRAULIC CYLINDER IS SERVICED ONLY AS AN ASSEMBLY AND ONLY THE FOLLOWING PARTS OF THE CYLINDER ARE FURNISHED SEPARATELY:

- a. Retaining lock ring.
- b. Scraper back-up ring.
- c. Scraper.
- d. Seal back-up ring.
- e. Piston rod seal.

NOTE: THE PISTON ROD SEAL SHOULD NOT BE REMOVED UNLESS THERE ARE SIGNS OF LEAKAGE ALONG THE PISTON SHAFT AT THE SHAFT SEAL. TO REPLACE THE SEAL PROCEED AS FOLLOWS:

- A. Use a hook tool and remove the retainer lock ring, Figure 12.

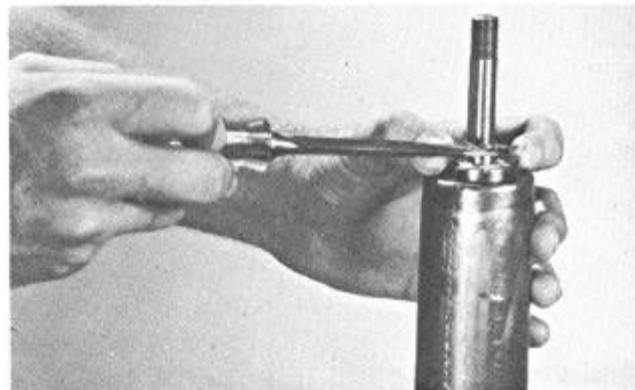


FIGURE 12

- B. Remove the scraper back up ring (24), Figure 19.
- C. Remove the scraper (25).
- D. Remove the seal back up ring (36).
- E. Remove the piston rod seal (37).

CAUTION: WHEN REMOVING SEAL DO NOT DAMAGE THE PISTON ROD.

TO INSTALL NEW SEAL REVERSE PROCEDURE OF REMOVAL USING A NEW OIL SEAL.

5. Remove the valve centering spring (4), Figure 19.
6. Remove "O" ring (8) from pilot locknut (6).
7. While holding the spool shaft nut (7), remove pilot locknut ( $11/16$ " wrench).
8. Remove spool shaft nut (7), ( $11/16$ " wrench).
9. Remove control valve assembly (10) with spools from valve shaft (16).
10. Remove valve washer (9) from valve shaft.

11. Remove "O" ring seals (8) and (29A) from each end of valve body.

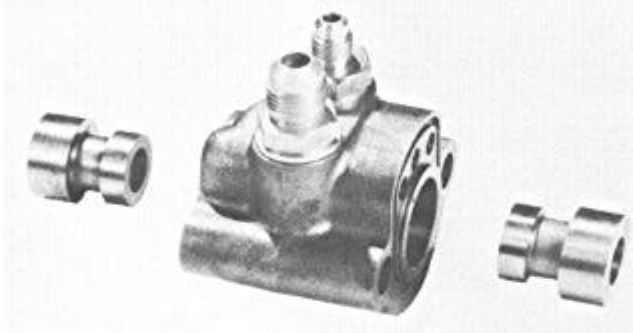


FIGURE 13

12. Slide spools out of valve housing, Figure 13, being careful not to scratch or drop either the spools or the housing.

NOTE: CHECK SPOOLS AND HOUSING BORE FOR EXCESSIVE WEAR.

13. Remove pressure fitting (27), Figure 19, return fitting (2), seals (3) and (28) from valve housing. DO NOT place housing in a vise.
14. Remove valve washer (11).
15. Remove valve return spring (12).



FIGURE 14

16. Push the valve shaft (16) through the steering arm ball housing (14) so that the valve shaft "O" ring seal (29) may be accessible, Figures 14 and 19.
17. Remove shaft retaining ring (13), and seal (29) and remove the valve shaft (16) from the steering arm ball stud housing (14).
18. Clean all parts in a clean solvent and blow dry with an air hose.

### Assembly

1. Clamp head of valve shaft (16), Figure 15, in a vise so that the shaft is in a vertical position and install the steering arm ball housing (14) over the valve shaft (16).
2. Install a new valve shaft "O" ring (29) and spiral retaining ring (13). Figures 14 and 19.

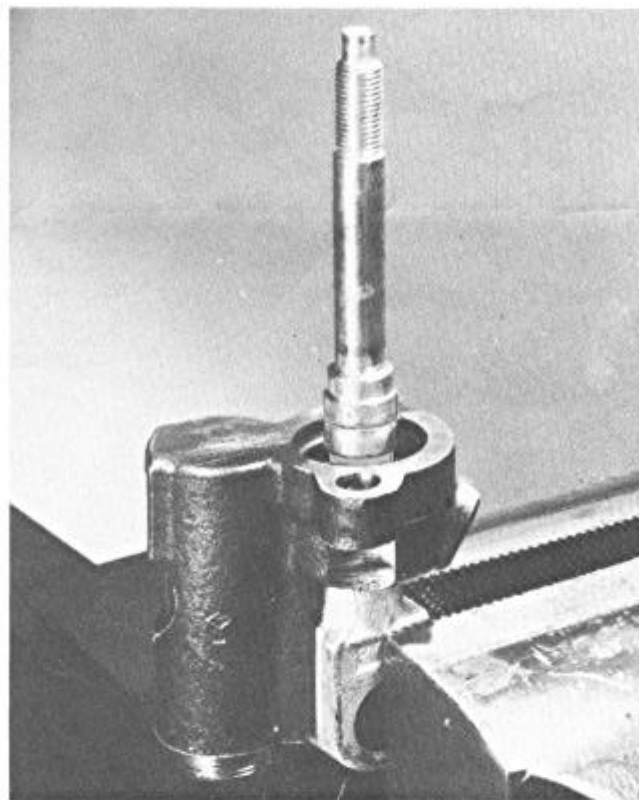


FIGURE 15

3. Place valve return spring (12), and (16) valve washer (11) over the valve shaft and into the steering arm ball housing (14), Figure 16.

NOTE: VALVE WASHER MUST BE ASSEMBLED CONCENTRIC WITH THE VALVE SHAFT AND NOT TILTED.

4. Assemble the valve spools into the valve housing. Insert the largest dia-



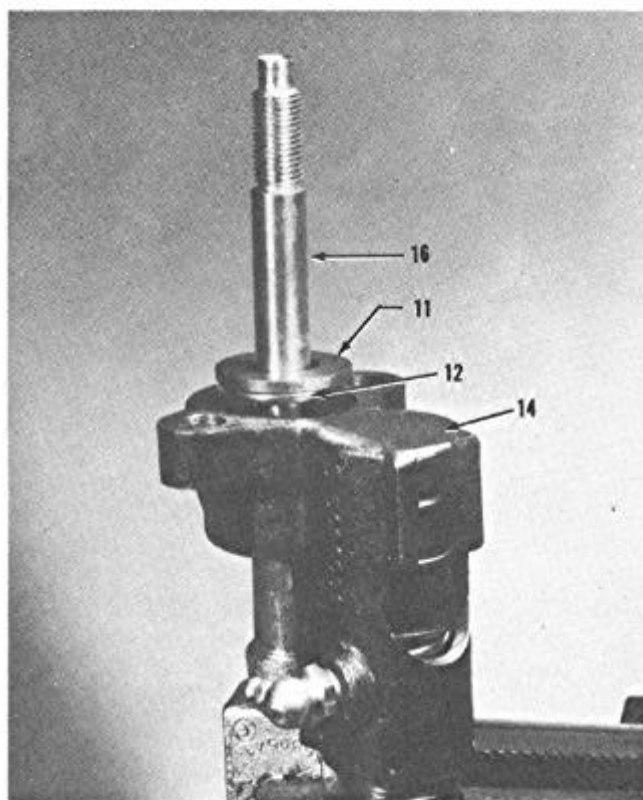


FIGURE 16

meter spool in the end of the housing having the 3 small holes, Figure 13.  
CAUTION: USE CARE TO PREVENT SCRATCHING OR NICKING THE SPOOLS OR BORE IN HOUSING.

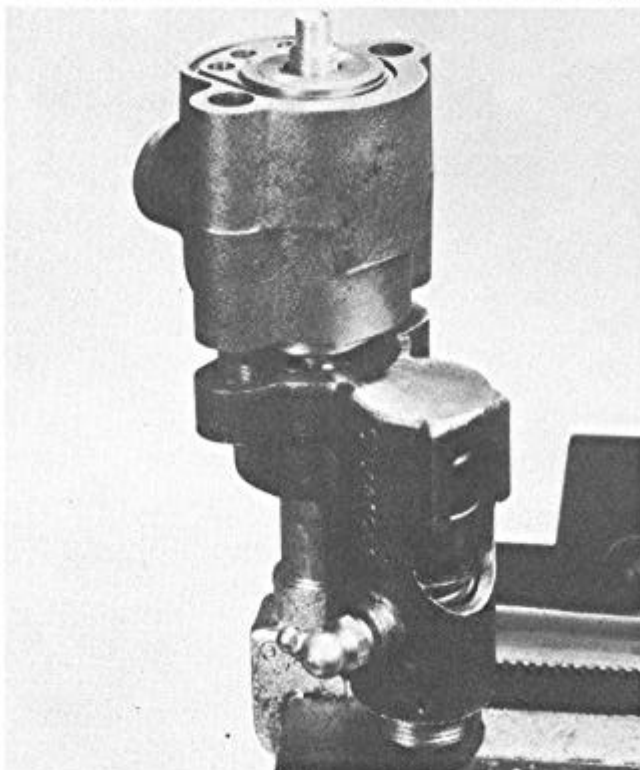


FIGURE 17

5. Install "O" seal (29A), Figure 19, in circular housing groove.
6. Slide valve housing and spool assembly carefully over the valve shaft. The three holes in the valve housing pointing up toward threaded end of valve shaft. Figure 17.

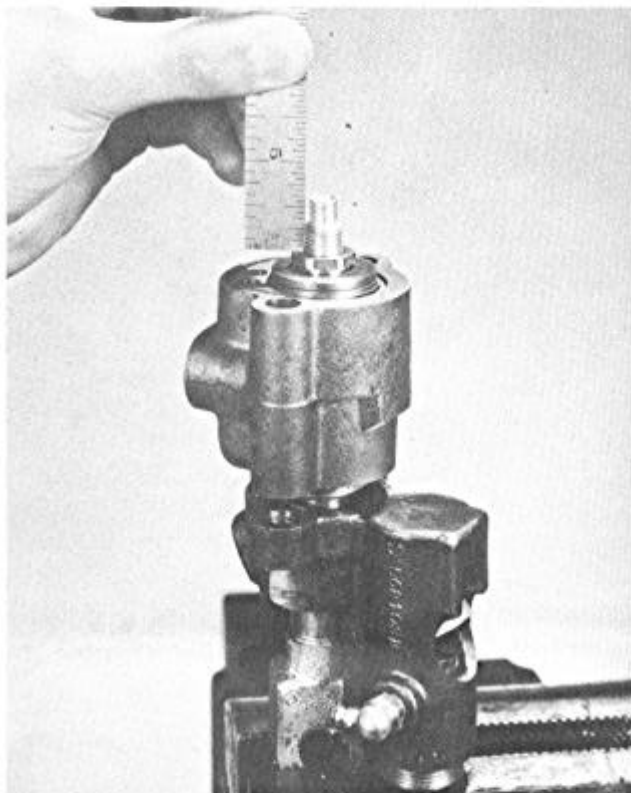


FIGURE 18

7. Install valve washer (9), Figure 19, over valve shaft.
8. Apply Lubri-Plate to valve shaft threads.
9. Install shaft nut (7), Figure 19, until a definite resistance is met. Back off nut 1/2 turn. A minimum a 5/16" of thread should be showing beyond the outside nut, Figure 18.

NOTE: If there is less than 5/16" thread, the inner valve washer (11), has caught on the spool shoulder and is not centralized on the valve shaft.

10. After determining that the 5/16" dimension is correct, screw on pilot lock-nut (6) by hand.
11. Using the two valve body to cylinder attaching screws, and two 7/16" nuts assemble the valve body and shaft assembly together. (Tighten to 12-15 foot pounds).

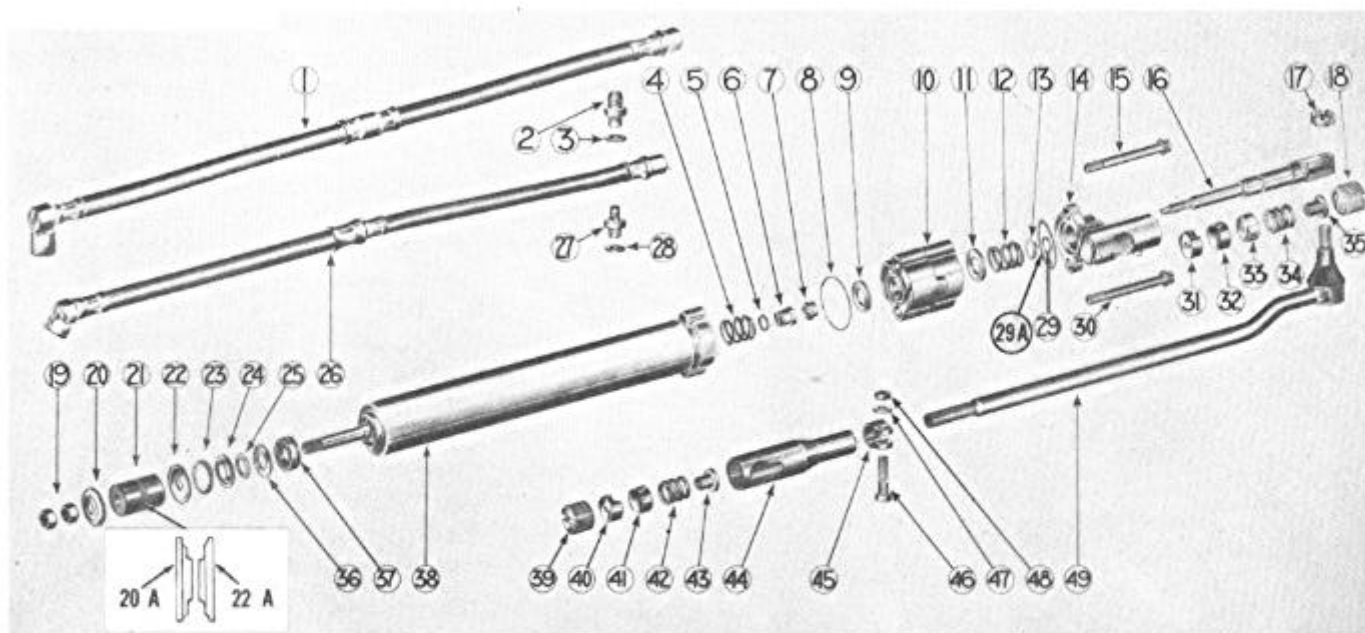


FIGURE 19  
EXPLOSION — LINKAGE BOOSTER

- |                         |                            |                          |
|-------------------------|----------------------------|--------------------------|
| 1. Return Hose          | 18. End Plug               | 32. Ball Seat            |
| 2. Return Fitting       | 19. Piston Shaft Locknut   | 33. Dust Seal            |
| 3. Fitting Seal         | 20. Piston Shaft Washer    | 34. Spring               |
| 4. Valve Spring         | 20A. Rubber Bshg. Retainer | 35. Safety Plug          |
| 5. Pilot Locknut Seal   | 21. Rubber Bushing         | 36. Seal Back-Up Ring    |
| 6. Pilot Locknut        | 22. Piston Shaft Washer    | 37. Piston Rod Seal      |
| 7. Shaft Nut            | 22A. Rubber Bshg. Retainer | 38. Hydraulic Cyl. Assy. |
| 8. Valve Housing Seal   | 23. Retainer Ring          | 39. End Plug             |
| 9. Valve Washer         | 24. Scraper Back-Up Ring   | 40. Ball Seat            |
| 10. Valve & Spool Assy. | 25. Scraper                | 41. Ball Seat            |
| 11. Valve Washer        | 26. Pressure Hose          | 42. Spring               |
| 12. Valve Spring        | 27. Pressure Fitting       | 43. Safety Plug          |
| 13. Retaining Ring      | 28. Fitting Seal           | 44. Pitman Arm Ball Hsg. |
| 14. Strg. Arm Ball Hsg. | 29. Shaft Seal             | 45. Clamp                |
| 15. Valve Bolt          | 29A. Valve Housing Seal    | 46. Clamp Bolt           |
| 16. Valve Shaft         | 30. Valve Bolt             | 47. Lockwasher           |
| 17. Ball Nut            | 31. Ball Seat              | 48. Nut                  |
|                         |                            | 49. Drag Link Assy.      |

12. Tighten the valve shaft nut to 9-11 foot pounds.
13. Release the tension and retighten to 3-5 foot pounds.
14. While holding the valve shaft nut against turning, tighten pilot locknut to 5-10 pounds. After final tightening use a fine punch and working through one of the small holes in the pilot locknut make a punch mark to stake locknut to valve shaft.
15. Install the "O" ring seal (5) on pilot locknut (6), Figure 19.

16. Remove the two cap screws and nuts used in operation (11).
17. Install valve spring (4), Figure 19.
18. Insert housing seal (8) in the contoured ring groove in the valve housing (10).
19. Place power cylinder on the valve assembly and install the attaching screws (Dip threads in sealer).

CAUTION: Do not gauge or slice pilot locknut seal when assembling cylinder to the valve assembly.

20. Tighten valve housing attaching screws to 12-15 foot pounds, Figure 20.



FIGURE 20

21. Install valve fittings (2) and (27) and seals (3) and (28) in their proper places, Figure 19. Assemble pressure and return hose to their proper fittings on valve body assembly.

## POWER CYLINDER AND VALVE

### Installation in Car

1. Enter complete assembly through hood opening.
2. Attach piston rod to the bracket at No. 3 crossmember, assemble one piston shaft washer, one rubber bushing and one rubber bushing retainer on each side of the bracket, Figure 21. Cupped portions of washers should be toward rubber bushings.

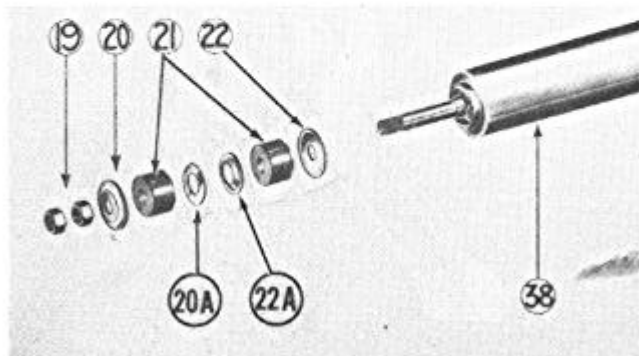


FIGURE 21

3. Install one attaching nut. Tighten securely. Install second nut and tighten securely. Second nut must be flush with end of shaft.
4. Attach steering arm ball stud housing to center steering arm. Install ball seat (31), Figure 19, on side of center steering arm, enter steering arm ball, ball seat (32), dust seal (33), spring (34), safety plug (35) and end plug (18).
5. Adjust end plug (18) by tightening plug to end of travel and back off to nearest cotter pin hole.
6. Install and secure cotter pin.
7. Install drag link, nut and cotter pin to valve shaft, Figure 22.
8. Fill valve and hoses as outlined in steps 8 thru 15, Page 7.

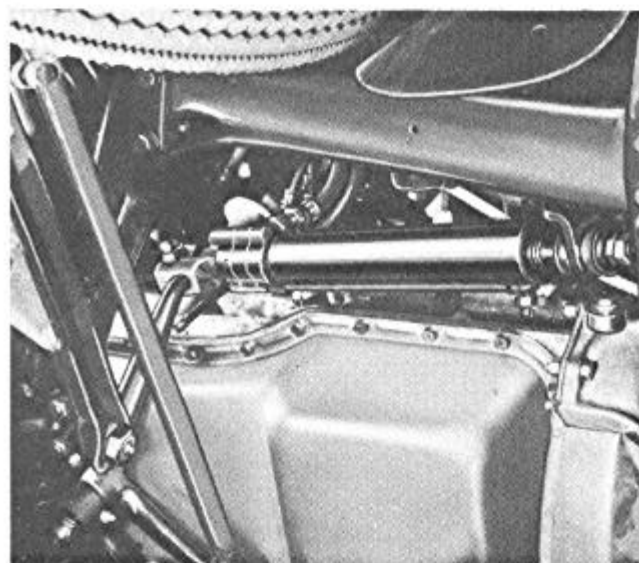


FIGURE 22



