

STEERING

TABLE OF CONTENTS

Note Name	Note No.	Page No.	Note-Name	Note No.	Page No.
Preliminary Operations Before Steering Gear Adjustments	1	7-5	Assembly of Tank and Pump	14	7-11
Steering Gear Adjustments (Manual Steering Gear)	2	7-5	Installation of Tank and Pump Assembly	15	7-13
Worm Bearing Adjustment (Off Center)	2a	7-5	Removal of Manual Steering Gear	16	7-13
Pitman Shaft End-Play Adjustment (Through Center)	2b	7-5	Disassembly of Manual Steering Gear	17	7-13
Steering Gear Adjustments (Power Steering)	3	7-5	Assembly of Manual Steering Gear	18	7-13
Off-Center Preload Check	3a	7-5	Installation of Manual Steering Gear	19	7-15
Pitman Shaft End Play Adjustment (Through Center)	3b	7-6	Removal of Power Steering Gear Assembly	20	7-15
Power Rack Guide Adjustment	3c	7-6	Disassembly of Power Steering Gear Assembly	21	7-15
Checking and Bleeding Hydraulic System	4	7-6	Removal of Valve Body from Gear Assembly	21a	7-15
Checking Fluid Level	4a	7-6	Disassembly of Valve Body	21b	7-16
Bleeding the System	4b	7-7	Removal of Cylinder Assembly from Gear Housing	21c	7-16
Pump Belt Tension Adjustment	5	7-7	Disassembly of Cylinder	21d	7-16
Checking Pump Pressure	6	7-7	Disassembly of Gear Housing	21e	7-17
Drag Link Height Adjustment	7	7-7	Assembly of Power Steering Gear Assembly	22	7-17
Removal of Steering Wheel	8	7-8	Assembly of Gear Housing	22a	7-17
Installation of Steering Wheel	9	7-8	Assembly of Valve Body	22b	7-18
Removal and Disassembly of Steering Linkage	10	7-9	Installation of Valve Body	22c	7-18
Removal	10a	7-9	Assembly of Power Cylinder	22d	7-19
Disassembly	10b	7-9	Installation of Cylinder Assembly on Gear Housing	22e	7-19
Assembly and Installation of Steering Linkage	11	7-9	Installation of Steering Gear	23	7-20
Assembly	11a	7-9	Diagnosis		7-21
Installation	11b	7-10	Specifications		7-22
Removal of Tank and Pump	12	7-10	Torque Tightness		7-22
Disassembly of Tank and Pump	13	7-10	Special Tools		7-22

GENERAL DESCRIPTION

A hydraulically operated power steering gear, Fig. 7-1, which combines the recirculating ball type gear with a hydraulic booster mechanism, is used on all 1954 series 62, 60S, and 75 cars, and is available as optional equipment on the 86 series when the chassis is ordered at the factory. The hydraulic booster is linked to the pitman shaft through a separate power rack and is controlled by a valve assembly on the steering shaft. The gear ratio of the power steering gear is 19.2 to 1. The overall ratio is 21.5 to 1.

The manual steering gear assembly is used as standard equipment on the 1954 series 86 cars only, and is of the recirculating ball type, which provides rolling contact of the gear with the worm to reduce friction and attain ease of handling. Details of construction are shown in Fig. 7-2. The gear ratio of this manual gear is 23.6 to 1, with an overall steering ratio of 27.1 to 1.

The power steering gear, Fig. 7-1, is so designed that it will reduce steering effort, especially during parking, yet not remove the so-called "feel" of steering. In addition, the hydraulic system resists road shock or kick-back. All steering is accomplished in an effort range of from zero to eight pounds pull at the rim of the steering wheel, which is proportional to the force necessary to turn the front wheels. The hydraulic booster system does not assist in steering until an effort of over three pounds is exerted at the rim of the steering wheel. Although there is a great reduction in steering effort, the hydraulic system accomplishes no steering effort, except through the guidance of the driver.

The principal working parts of the hydraulic gear are the steering worm, ball nut, pitman shaft gear, control valve, hydraulic cylinder and power rack. The hydraulic supply system consists of an oil reservoir, hydraulic pump, and a combination pres-

STEERING

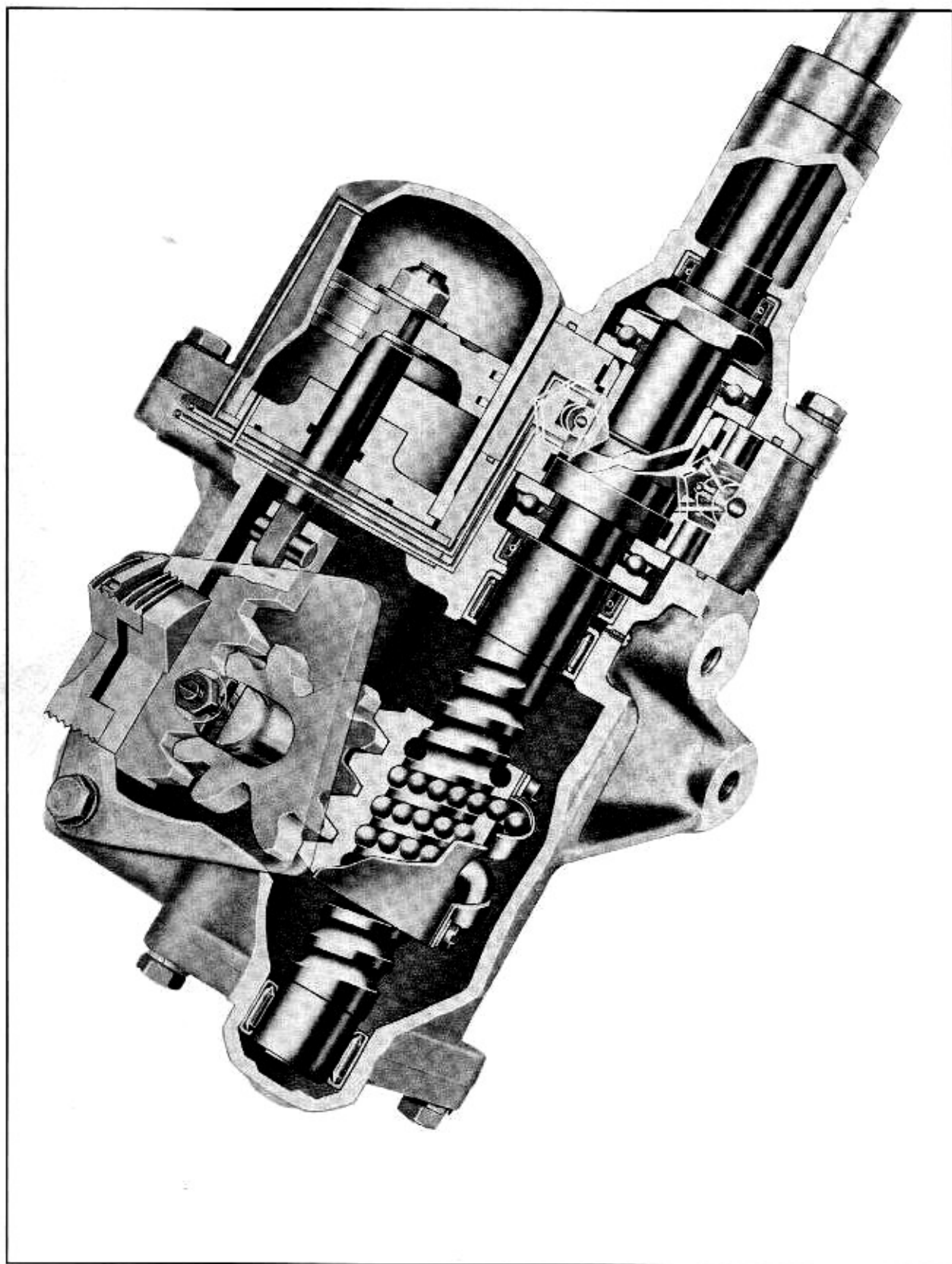


Fig. 7-1 Power Steering Gear Detail

STEERING

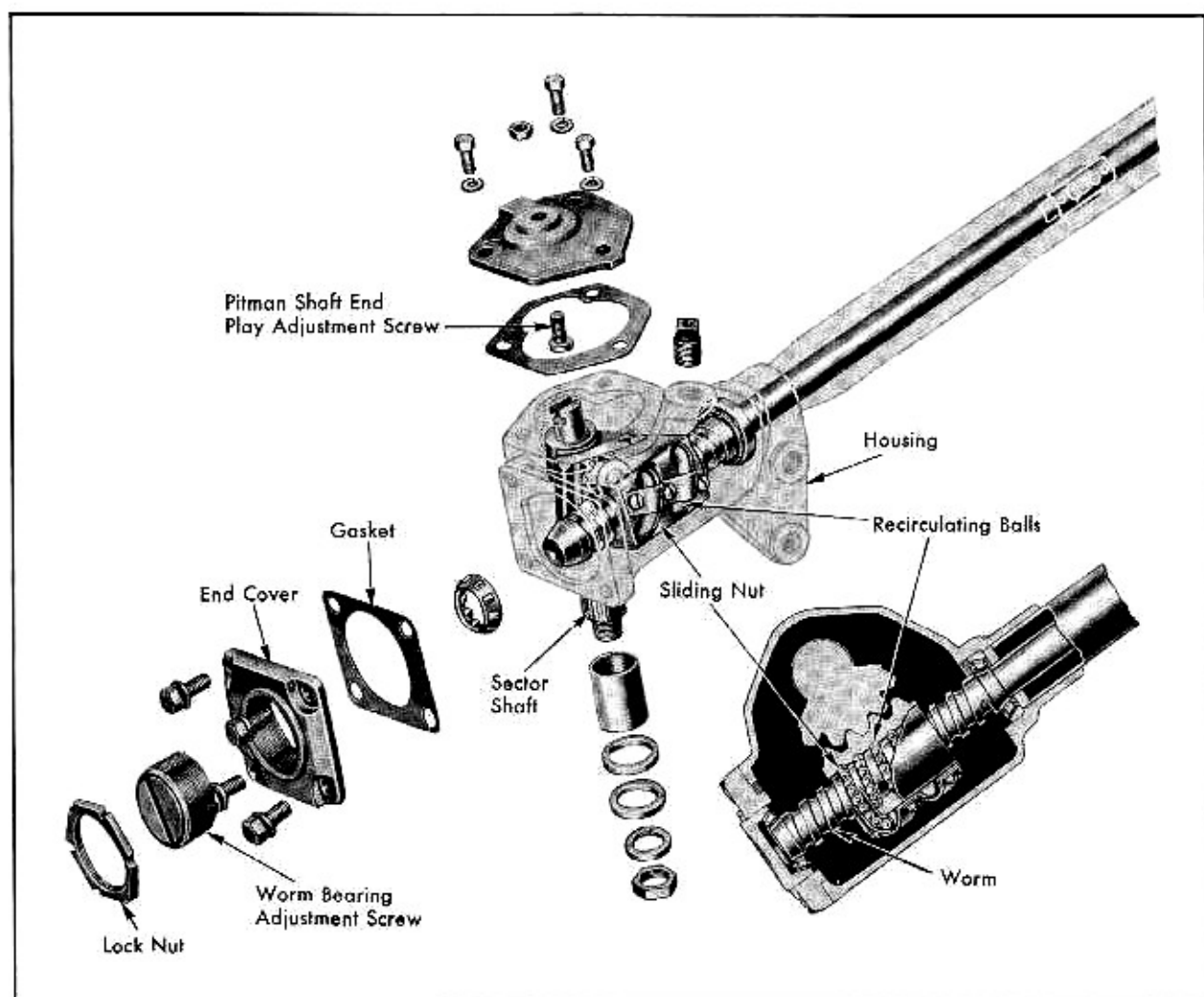


Fig. 7-2 Manual Steering Gear Detail

sure relief and flow control valve. Oil from the pump is directed to the valve body on the gear housing through a high pressure hose.

The hydraulic cylinder assembly is mounted on the steering gear housing and is linked to the pitman shaft gear through a power rack attached to the end of the piston rod. The power rack is guided by an adjustable plate. The control valve body assembly, which directs the flow of oil to the power cylinder, is mounted on the steering gear housing and is concentric with the steering shaft. The control valve body is positively aligned to the housing and cover by machined counterbores in the housing and cover. The valve body assembly consists of a valve spool, valve spool sleeve, ten plungers, five preload springs, a check valve, and the valve body. The valve spool has two annular grooves which connect three annular passages inside the valve body. A valve spool centering sleeve, which is slightly (.005" - .0015") longer than the valve spool, is

located between the steering shaft and the valve spool. This sleeve is maintained in a position concentric with the steering shaft by a rubber "O" ring located in a groove in the shaft, Fig. 7-3.

The sleeve is held in position on the shaft by upper and lower thrust bearings, a spring type cone washer and a stake type nut. The sleeve and valve spool are centered laterally in the valve body by five sets of plungers which bear against both the cover and the thrust bearing on the upper end and the gear housing and the thrust bearing at the lower end. The plungers are held against these parts by the action of five springs. It is therefore necessary to overcome the preload of the five springs before the sleeve and the valve spool can be moved either up or down. When there is sufficient resistance to rotation of the pitman shaft developed at the road wheels, continued turning of the steering wheel will result in an axial movement of the worm and shaft to overcome the preload of the plunger

STEERING

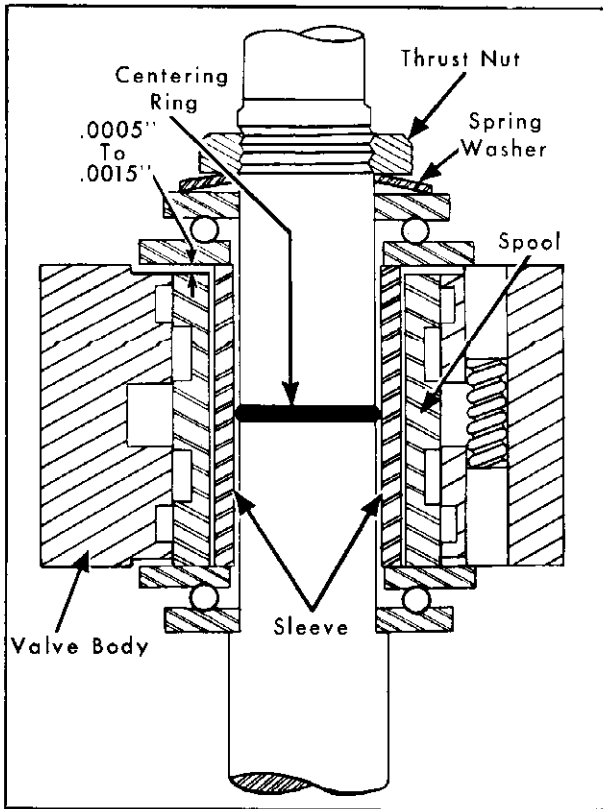


Fig. 7-3 Centering Sleeve Position

springs. This axial movement is due to the lead on the steering worm and the direction of movement is dependent on the direction of rotation of the steering wheel.

With this design, any side load imposed on the thrust bearings, when the shaft is turned, will not be transmitted to the valve spool to cause binding of the spool in the valve body. The valve spool will, however, move upward or downward with the thrust bearings to direct the oil into the proper passages.

When the valve spool is in the neutral or centered position, Fig. 7-4, the oil from the pump flows from

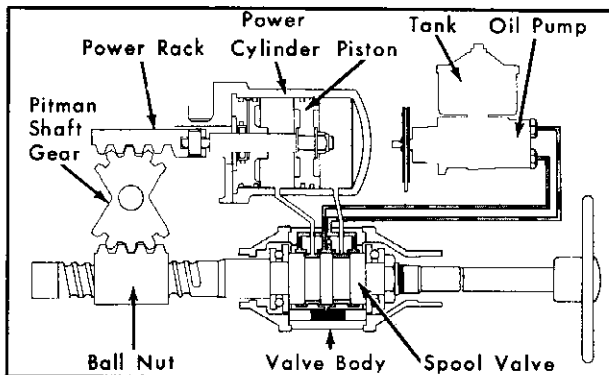


Fig. 7-4 Hydraulic Circuit - Neutral

the center passage of the valve body, through the two annular grooves in the valve spool, to the annular passages at the ends of the valve body and returns to the pump.

As the steering wheel is turned, resistance at the road wheels will cause the shaft and the valve spool to move either up or down depending on the direction in which the wheel is turned. This movement of the valve spool interrupts the direct circuit of the pump by shutting off both direct return passages. Fig. 7-5. The oil is then forced to travel to one end of the hydraulic cylinder, through drilled passages in the

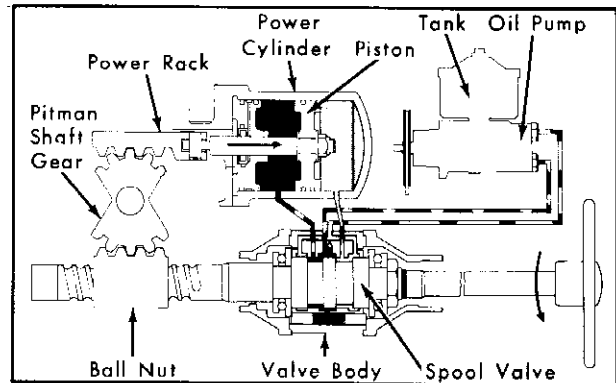


Fig. 7-5 Hydraulic Circuit - Left Turn

housing and cylinder, to move the piston. The opposite end of the cylinder is open to the pump return line, and oil on this side of the piston is permitted to return to the pump.

The hydraulic pump is of the constant displacement type with a flow control valve and builds up only enough pressure to overcome the resistance to the rotation of the pitman shaft. The oil pressure which operates the piston is also diverted to the plungers, on the spring side, to assist in building up a preload which must be overcome by slightly increased effort at the steering wheel. This feature of increasing the centering action of the plungers permits the driver to retain the "feel" of driving the car as was previously mentioned.

A check valve in the return line passage of the valve body permits circulation of oil in the power system in the event of pump failure or if steering is done when the engine is shut off.

The steering linkage consists of the steering knuckle arms, each of which is connected to a tie rod which in turn is connected to the steering connecting rod (drag link). The left end of the drag link is connected to the steering gear pitman arm, and the right end is connected to an idler arm mounted on the right frame side bar. Road harshness at the steering wheel is reduced by means of springs in the drag link, between the tie rod ball sockets and the pitman arm and idler arm ball sockets.

STEERING

SERVICE INFORMATION

(1) Preliminary Operations Before Steering Gear Adjustments

Often, conditions such as hard or loose steering, road shock, vibration and the like, are not due to the steering gear, but to other related factors, such as: wheel balance, tire pressure, shock absorbers, front end alignment, etc. Therefore, before any adjustment of the steering gear is made, these related factors should be checked and adjusted if necessary.

Other factors in the Power Steering assembly which will affect the operation of this unit are: improper oil level, drive belt tension, dirt or sludge in reservoir, oil leakage at gaskets or fittings. These conditions are discussed in the following notes and should also be checked before any adjustment of the steering gear is made.

(2) Steering Gear Adjustments (Manual Steering Gear)

The recirculating ball type steering gear has two adjustments: The worm bearing adjustment and the pitman shaft end-play adjustment.

a. Worm Bearing Adjustment (Off Center)

1. Disconnect steering connecting rod at pitman arm.

2. Check alignment of steering tube as follows:

a. Loosen three mounting screws holding steering gear to frame side bar.

b. Tighten front screw only.

c. Check space between gear housing and frame side bar, and install proper thickness shims to fill gap at two rear mounting screws, Fig. 7-6. If there is no space at the rear, loosen the front screw and tighten two rear mounting screws. Check space at front of gear, and add spacers to fill gap at this point. If shims are required in the gear housing alignment adjustment, noted above, the straight ahead position of the front wheels, in relation to the steering gear high spot position and toe-in, should be rechecked.

d. Tighten three mounting screws to 40-45 ft. lbs. torque.

3. Turn steering wheel to either stop, then check pull required to turn steering wheel back to 90° from the straight ahead position, using Spring Scale, Tool No. 4-544-A. This off-center pull should be between 1 and 1-1/4 pounds.

NOTE: In order to avoid damage to ball mechanism, do not turn steering wheel hard against stops.

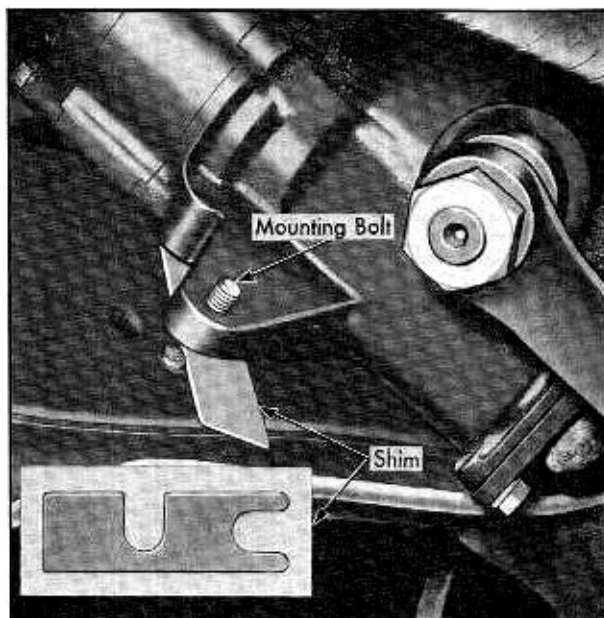


Fig. 7-6 Aligning Steering Gear

4. Loosen locknut, using a 2-1/2" open end wrench, and turn worm bearing adjustment screw as required.

5. Tighten lock nut, when adjustment is correct, and recheck as described in Step 3 above.

b. Pitman Shaft End-Play Adjustment (Through Center)

1. Turn steering wheel about 90° each way through center. The pull through center should be between 1-1/2 and 2 pounds. New cars driven less than 1000 miles require a pull of not less than 2 pounds nor more than 2-1/2 pounds.

2. Loosen lock nut and turn pitman shaft adjusting screw clockwise to increase the pull through center -- counter-clockwise to decrease the pull through center.

3. Tighten lock nut when adjustment is correct, and recheck pull through center.

4. Reassemble steering connecting rod. The end nut at the pitman arm ball end must be turned up tight and backed off 1/2 to 5/8 turn.

(3) Steering Gear Adjustments (Power Steering Gear)**a. Off-Center Preload Check**

1. Disconnect drag link at pitman arm.

2. Check alignment of steering shaft as outlined in Note 2a, and add shims as necessary.

STEERING

3. Back off power rack and pitman shaft adjusting screws at least $1/2$ turn.

4. Using Spring Scale, Tool No. J-544A, check the "off-center" pull through at the rim of the steering wheel. This should be between $3/8$ and $3/4$ lbs.

NOTE: If the pull off-center is greater or less than specified above, it will be necessary to remove the gear from the car. Check thrust bearing lock nut torque (30 ft. lbs.). See Note 22. Also check for binding or rough bearings in upper and lower thrust bearing retainers. Do not attempt to compensate for any variance from off-center pull specifications by adjusting the pitman shaft end play screw or the power rack screw.

b. Pitman Shaft End Play Adjustment

1. Adjust pitman shaft end play screw until pull through center is $1/2$ to 1 lb. greater than pull at one full turn off center, Fig. 7-7.

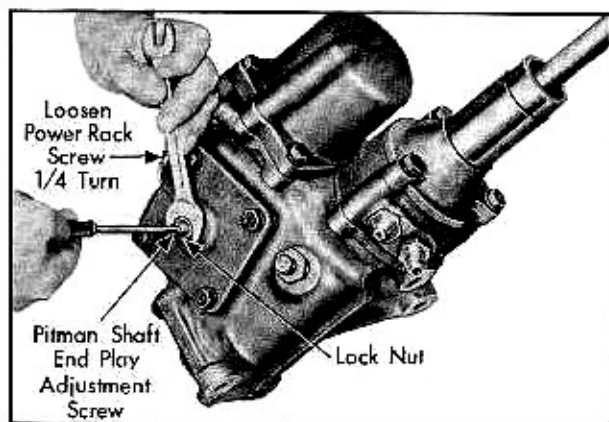


Fig. 7-7 Adjusting Pitman Shaft End Play

2. Tighten adjusting screw lock nut, and recheck pull through center.

c. Power Rack Guide Adjustment

After the pitman shaft end play has been adjusted, the clearance between the power rack gear and the ball nut must be adjusted to prevent binding or excessive lash at this point.

1. Using Special Tool, No. J-5648, tighten the power rack adjusting screw so that the over center pull through is $1/8$ to $1/4$ lb. greater than that obtained in the pitman shaft end play adjustment, Fig. 7-8 (Note 3b above). This should be measured at the rim of the wheel through an arc not exceeding 3° .

2. Tighten power rack adjusting screw lock nut, and recheck adjustment.

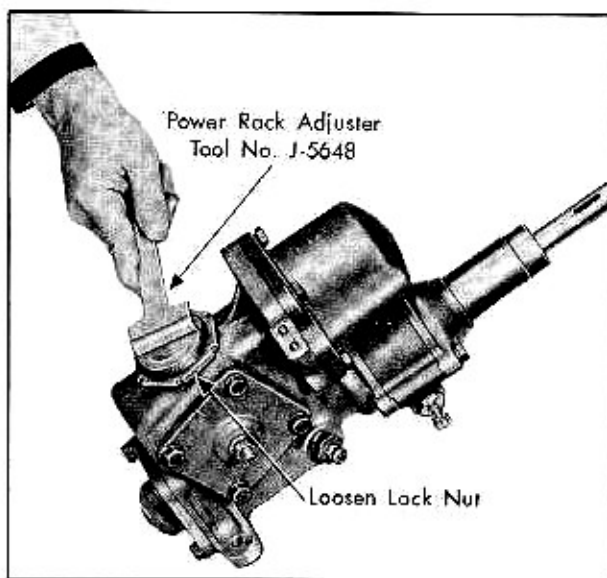


Fig. 7-8 Adjusting Power Rack

3. Connect drag link at pitman arm.

(4) Checking and Bleeding Hydraulic System

a. Checking Fluid Level

1. With engine shut off, remove tank cover hold-down screw, and remove cover and gasket.

2. Level of fluid should be $1/2$ " below top edge at oil level mark as indicated on outside of tank, Fig. 7-9.

3. Fill to level with Hydra-Matic transmission fluid.

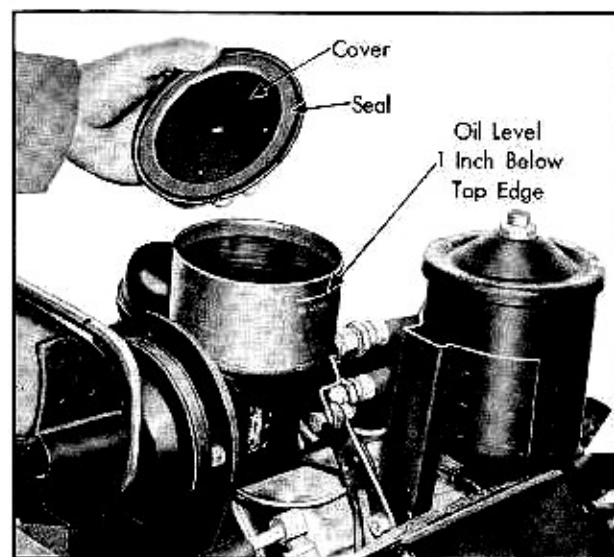


Fig. 7-9 Checking Pump Fluid Level

STEERING

4. Install gasket, cover, and hold-down screw. Tighten screw to 10-15 ft. lbs. torque.

b. Bleeding the System

If there is air in the hydraulic circuit, the following procedure should be used to bleed the system:

1. Fill oil tank to proper level, and let oil remain undisturbed for about two minutes.

2. Crank engine (coil wire disconnected) and maintain fluid level in tank. Turn wheels (off ground) at the same time to eliminate air pockets in power cylinder.

3. Start engine and run at idle for two minutes. Recheck fluid level, and inspect gear, pump, hoses, and connections for leaks.

4. Increase engine speed to 1500 R.P.M. and continue running at this speed until air bubbles cease to appear. Turn wheels (off ground) from right to left. Do not hit stops.

5. Lower car and turn wheels on ground. Recheck for leaks.

6. Check oil level and refill as required.

(5) Pump Belt Tension Adjustment

1. Loosen pump to mounting bracket screws.

2. Move pump outward until belt is tight.

3. Tighten bracket to pump mounting screws.

4. With shift lever in "N", race engine while turning steering wheel. If belt squeals, it is too loose and must be retightened.

(6) Checking Pump Pressure

1. Disconnect hose at lower union marked "PR" on pump.

2. Install Checking Gauge, Tool No. J-5176, on union at pump, with gauge valve closed, Fig. 7-10.

3. Connect hose to fitting on valve side of gauge.

4. Open gauge valve and run engine at idle.

5. Turn wheels (on ground) against stops. Pressure should not be less than 900 psi.

6. If pressure is less than 900 psi, slowly close gauge valve, observing gauge for pressure increase. Pressure will increase as valve is closed, if pump

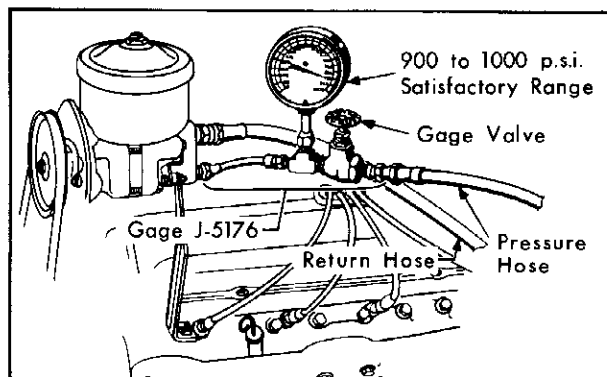


Fig. 7-10 Checking Pump Pressure

is operating properly. If pressure increases (950 psi, when valve is closed) the trouble is in the gear.

CAUTION: Do not leave valve closed for more than fifteen seconds.

7. If pressure does not increase when valve is closed, difficulty is in the pump.

8. If pressure (valve closed) is greater than system pressure, but less than 900 psi, both units require attention.

9. Shut engine off, remove gauge and valve, and reconnect hose to pump.

(7) Drag Link Height Adjustment

The distance between the lower edge of the drag link and the flat spot on the frame side bar, directly above the drag link at each end, should be checked in cases of steering wander and instability after normal corrective adjustments have been made. The procedure outlined below may be used to measure these distances:

1. Place a straight bar across two adjustable jacks, directly below the drag link. Fig. 7-11.

2. Adjust the height of the jacks so that distance "A" (from top of bar to flat spot on frame) is equal on both sides.

NOTE: Adjusting jacks so that distance "A" is an even number of inches will simplify this measurement.

3. Measure distance "B" (from top of bar to bottom of drag link) on both sides.

4. Distance "A" minus "B" should be 4-7/8" and equal at both ends of the drag link within 1/8" (DRAG LINK MUST BE PARALLEL TO FRAME WITHIN 1/8"). A tool to check drag link to frame

STEERING

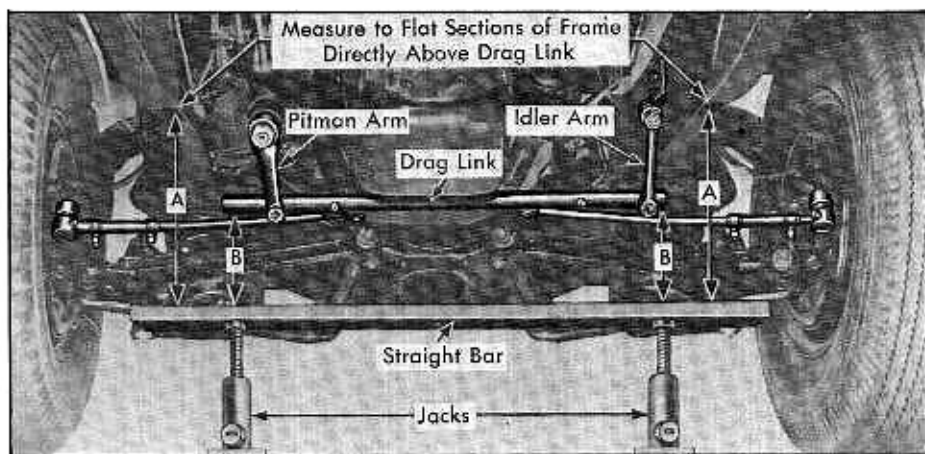


Fig. 7-11 Checking Drag Link to Frame Parallelism

parallelism quickly may be made from any rigid material to the dimensions shown in Fig. 7-12. Place the tool on the top of the drag link at the end, and check the distance between the tip of the tool and the flat spot on the frame with a 1/4" drill as shown in Fig. 7-12. If the tool plus the drill shank does not touch the frame the drag link is too low, and if the tip of the tool will not fit in position, the drag link is too high. Check both ends to see that the clearance between the tool and frame is within the 1/8" allowed for parallelism to frame.

5. If the idler arm end of the drag link is not within limits, remove the idler arm support mounting screws on the frame side bar, and screw the idler arm in or out of bushing until correct height is obtained.

CAUTION: When turning the idler arm into the bushing to raise the drag link, be sure that the idler arm is at least 1/2 turn off of base to prevent interference on turns. When turning idler arm out of bushing, do not unscrew more than 2-1/2 turns from base or excessive play

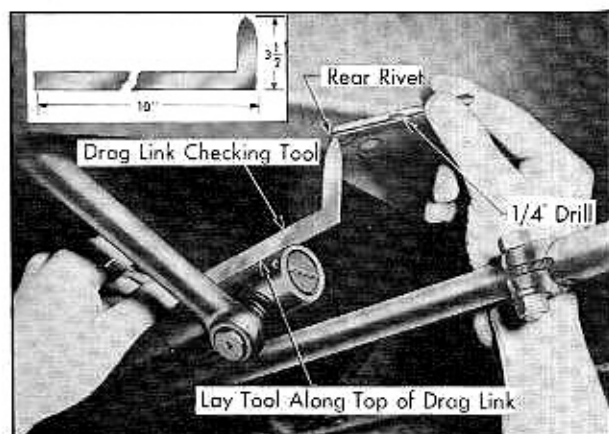


Fig. 7-12 Checking Drag Link Height With Tool

will result. If proper height cannot be obtained with this adjustment, it indicates a bent idler arm which should be replaced.

6. If the pitman arm end of drag link is not within limits, the pitman arm must be removed and bent as required.

CAUTION: The bending operation on the pitman arm must be done very carefully to avoid internal stresses and must be performed cold, with a tool placed midway between the ball stud and the splined hole in the steering gear end. Do not bend unless drag link distance to frame at pitman arm end is not within limits. All adjustments for parallelism should be made at the idler arm end if possible.

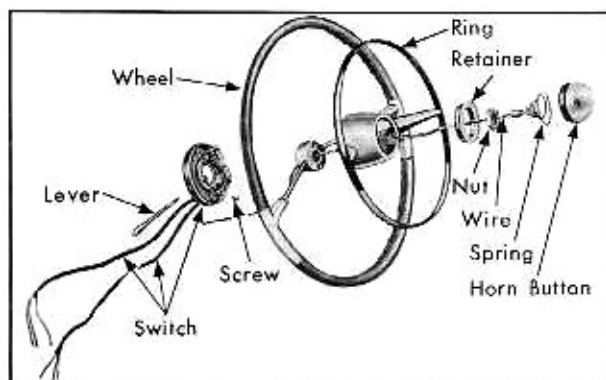
(8) Removal of Steering Wheel

1. Disconnect horn wire from terminal at lower end of steering column on both manual and hydraulic steering gears.
2. Depress horn button, turn in either direction until locking ears are released and remove button.
3. Remove horn button spring.
4. Remove steering wheel hub nut, Fig. 7-13.
5. Remove horn ring retainer, cushion, and horn ring.
6. Remove steering wheel using Special Puller, Tool No. J-1859, Fig. 7-14.

(9) Installation of Steering Wheel

1. Install steering wheel over splines on steering shaft so that punch marks line up.
2. Install horn ring, cushion, and retainer in

STEERING



• Fig. 7-13 Steering Wheel Assembly

position on steering wheel.

3. Install steering wheel hub nut and tighten to 45-50 ft. lbs. torque.

4. Stake nut to steering shaft.

5. Install spring and horn button, being sure emblem is in proper position.

6. Connect horn wire to terminal on steering column.

(10) Removal and Disassembly of Steering Linkage

a. Removal

1. Disconnect tie rod ends from steering arms

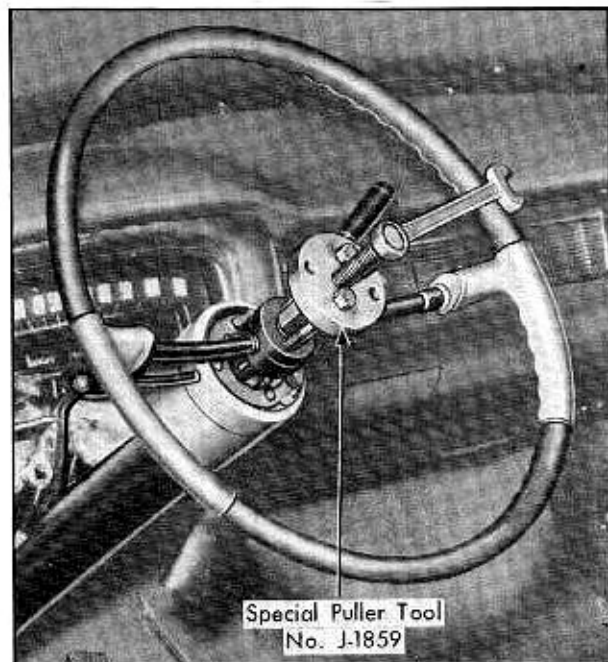


Fig. 7-14 Removing Steering Wheel

at wheels.

2. Remove idler arm support screws from frame side member.

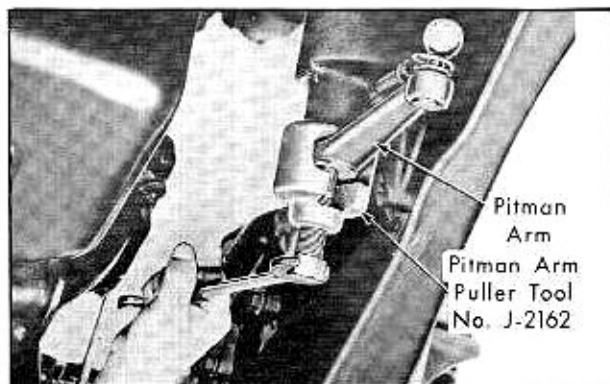
3. Remove pitman arm from pitman shaft, using Special Puller, Tool No. J-2162, Fig. 7-15.

4. Remove steering connecting link with tie rods, idler arm support, idler arm, and pitman arm attached.

b. Disassembly

1. Remove cotter pin, adjusting plug, stop plug, spring, and ball seat from left end of steering connecting link to remove pitman arm from connecting link, Fig. 7-16.

2. Remove inside ball seat, spring, stop plug, spacer, and tie rod outer ball seat to remove left tie rod.



• Fig. 7-15 Removing Pitman Arm

3. Remove cotter pin, plug, and outer ball seat from right end of steering connecting link to remove idler arm from connecting link.

4. Remove inner ball seat, spring, stop plug, long spacer, cover, and ball seat, to remove right tie rod.

5. Tie rod ends may be removed from tie rod by loosening clamp screws and unscrewing tie rod or tie rod end from clamp.

6. Remove idler arm support from idler arm bushing by unscrewing support.

7. Remove bushing from idler arm.

(11) Assembly and Installation of Steering Linkage

a. Assembly

1. Assemble all parts in the reverse order of disassembly, being sure all spacers, springs, and stops

STEERING

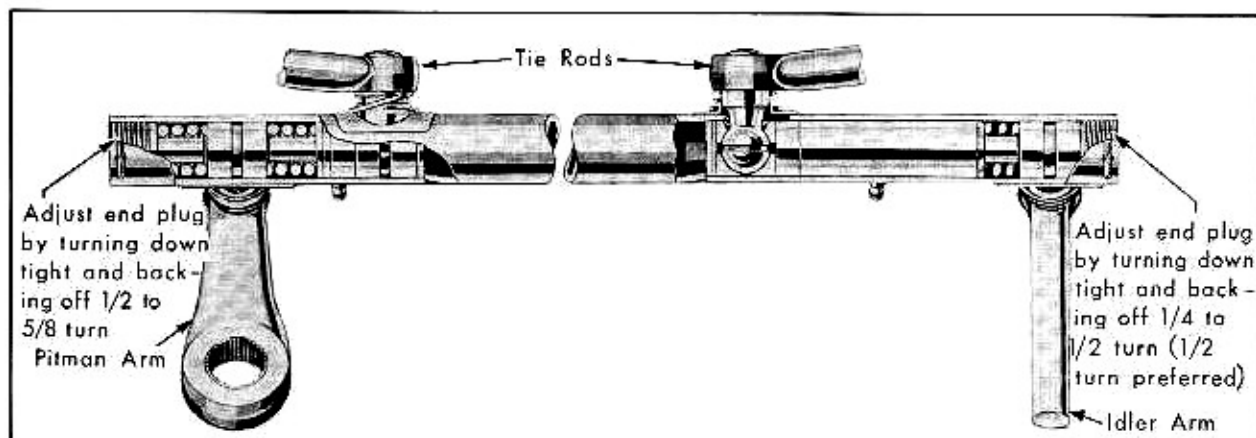


Fig. 7-16 Steering Connector Link

are in correct position.

2. Install end plug in pitman arm end of drag link and adjust by turning down tight and backing plug off 1/2 to 5/8 turn and install cotter pin.

3. Install right end plug and adjust by turning down tight and backing off 1/4 to 1/2 turn.

4. Install bushing in idler arm and tighten to 110-115 ft. lbs.

5. Turn idler arm support with seal into idler arm bushing until it bottoms, and then back off 1/2 to 1-1/2 turns depending on position of bushing in idler arm.

b. Installation

1. Install pitman arm on pitman shaft and tighten nut to 125-150 ft. lbs. torque.

2. Install idler arm support on frame side bar and tighten mounting screws to 30 ft. lbs. torque.

3. Connect tie rod ends to steering arms and tighten nuts to 50-55 ft. lbs. torque.

4. Check drag link height and parallelism to

frame. See Note 7.

5. Adjust toe-in.

NOTE: When toe-in adjustment is completed be sure that open side of clamps are over open side of tie rod adjuster before tightening clamp nuts. Fig. 7-17.

(12) Removal of Tank and Pump

1. Disconnect hoses at unions on pump. When hoses are disconnected, secure ends of hoses in a raised position to prevent drainage of oil.

2. Install two caps at pump unions to prevent drainage of oil from pump.

3. Remove drive pulley attaching nut.

4. Loosen bracket to pump mounting screws.

5. Remove pump belt.

6. Slide pulley from shaft and remove key.

7. Remove mounting bracket to pump screws.

8. Remove tank and pump assembly.

(13) Disassembly of Tank and Pump

1. Remove tank cover screw, washers, and tank cover with gaskets. Fig. 7-18.

2. Remove gasket from tank cover and discard gasket.

3. Pour out oil and remove four tank to pump mounting screws.

4. Remove tank and cork gaskets from pump

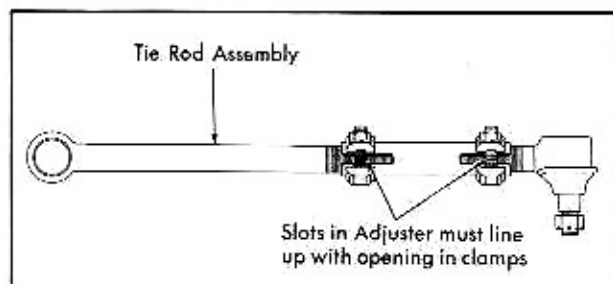


Fig. 7-17 Tie Rod Clamp Position

STEERING

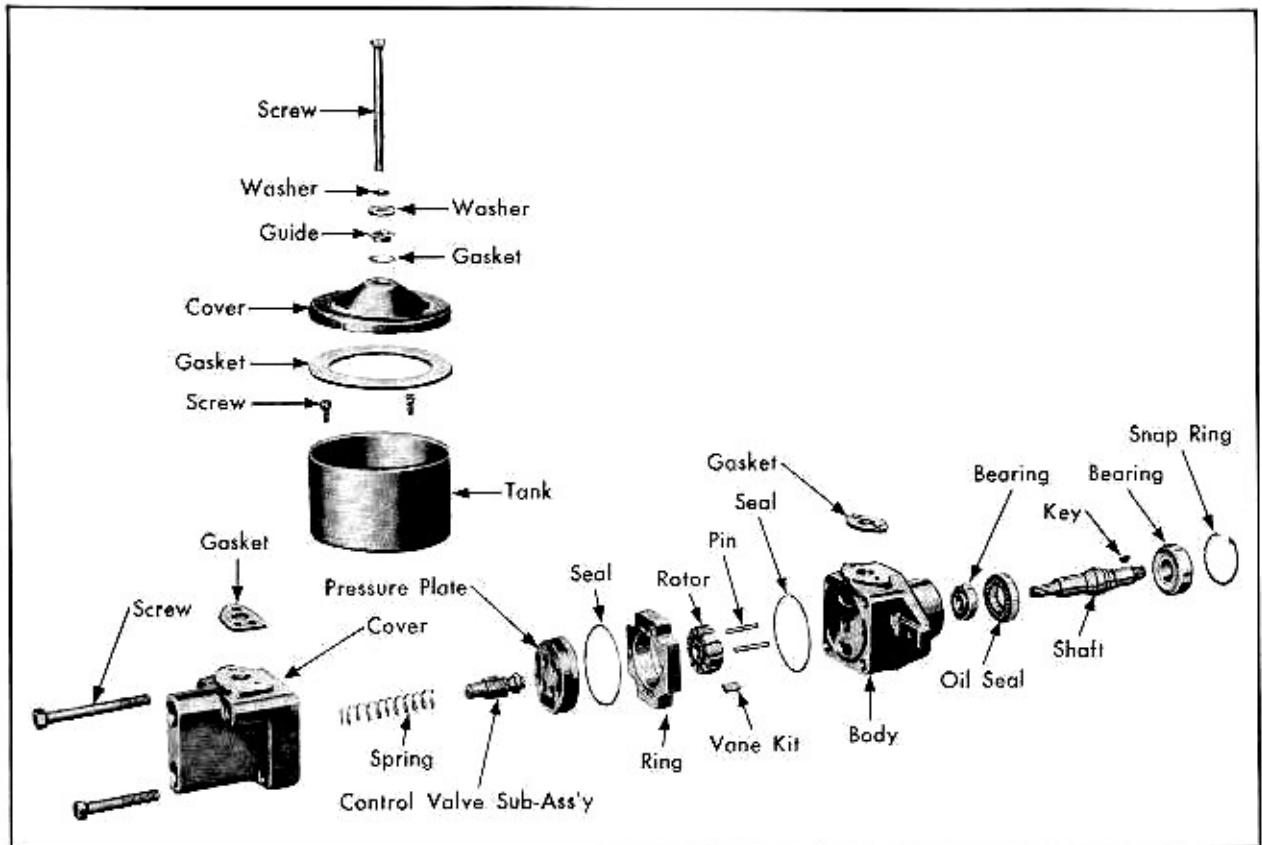


Fig. 7-18 Steering Pump - Disassembled

assembly. Discard gaskets.

5. Remove four pump cover to pump body attaching screws with rear pump mounting bracket.

6. Lift cover assembly from pump assembly.

7. Discard "O" ring seal which fits in front face of pump cover.

8. Remove flow control valve assembly and spring from front face of pump cover.

9. Mark position of pressure plate, and remove plate from dowel pins located in pump body.

10. Mark position of pump cam ring in relation to pump body, and remove ring from dowel pins located in pump.

NOTE: Arrows on outer edges of cam ring point in direction of pump rotation.

11. Remove rotor with vanes from pump shaft.

12. Remove and discard "O" ring from groove in pump body.

13. Remove dowel pins from pump body.

14. Remove shaft bearing retainer snap ring from front face of pump body.

15. Remove drive shaft with large sealed bearing from pump body.

16. Remove oil seal from pump body with a long punch inserted through large holes in machined face of pump body, and discard seal. Fig. 7-19.

17. If necessary to remove small bearing for replacement, remove bearing from pump body by lightly tapping around inner race of bearing with pin punch inserted through center hole in body. Fig. 7-20.

18. Press large sealed bearing off shaft.

(14) Assembly of Tank and Pump

1. Press large sealed bearing over threaded end of shaft with stamped face of inner race toward front of pump.

2. Press small bearing into pump body.

3. Install new oil seal into pump body with the numbered side of seal against seat.

STEERING

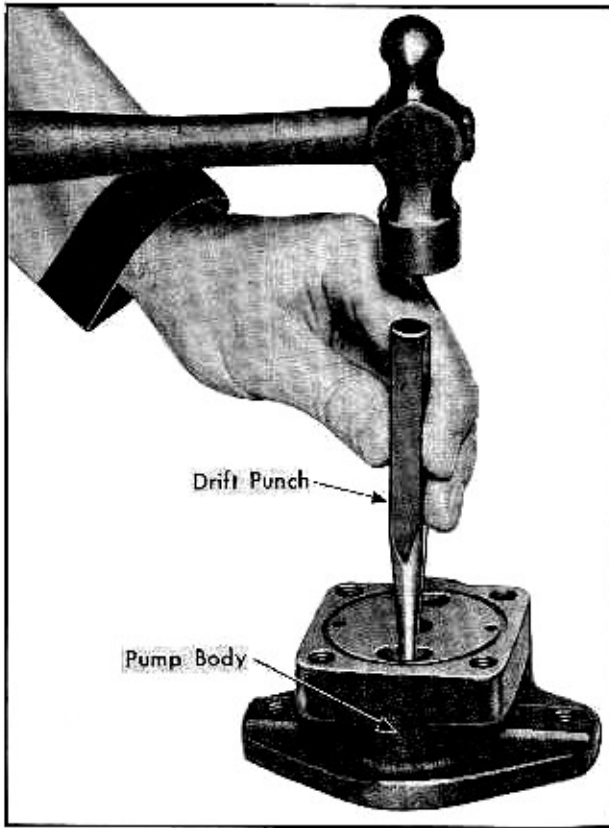


Fig. 7-19 Removing Pump Shaft Oil Seal



Fig. 7-20 Removing Shaft Bearing

4. Install drive shaft and large sealed bearing assembly into pump body.

5. Install shaft bearing snap ring retainer.

6. Install new "O" ring in groove of pump body.

7. Install dowel pins, chamfered end first, into dowel holes in the pump body.

8. Install rotor, with vanes, on pump body over splined end of drive shaft. Assemble vanes in rotor with radius edges toward outside of rotor.

9. Install cam ring on dowel pins and over rotor and vanes. Position correctly according to scribed marks. Fig. 7-21.

NOTE: Arrow on outer edge of cam ring points in direction of pump rotation.

10. Install pressure plate on dowel pins which extend through cam ring, with small arrow on pressure plate at the top.

11. Install control valve and spring in front face of cover.

12. Install new "O" ring which fits in front face of pump cover.

13. Position pump cover assembly over pressure plate and against cam ring.

14. Install four cover to body attaching screws with rear pump mounting bracket.

15. Install new gaskets on pump and tank cover mounting flanges.

16. Position tank on pump assembly, with holes in reservoir lined up with holes in pump assembly.

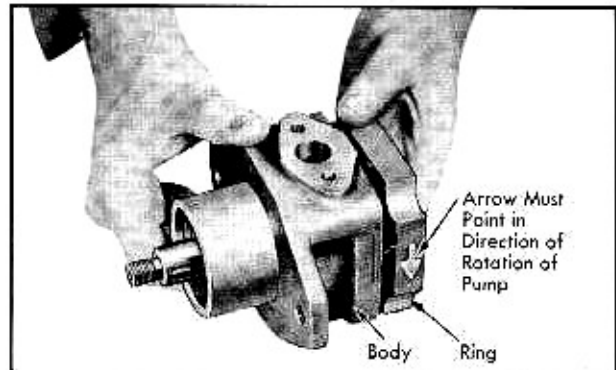


Fig. 7-21 Installing Cam Ring

STEERING

and install four screws.

17. Install tank cover, with new gasket, cover screw, large washer, and lock washer.

(15) Installation of Tank and Pump

1. Position tank and pump assembly on mounting brackets with holes lined up and install screws loosely.

2. Install key in slot on shaft and slide pulley on shaft.

3. Install drive pulley attaching nut finger tight against pulley.

4. Install pump belt over pulley.

5. Move pump outward until belt is tight; then tighten mounting screws.

6. Tighten pulley nut to 35-45 ft. lbs. torque.

7. Connect and tighten hose fittings.

8. Fill and bleed system.

(16) Removal of Manual Steering Gear

1. Raise front end of car until front wheels are approximately 6 inches above floor.

2. Remove steering wheel as described in Note 8.

3. Remove horn wire from terminal at lower end of steering column.

4. Remove horn contact from steering jacket after removing neutral safety switch mounting screw.

5. Loosen clamp holding lower steering jacket to upper steering jacket, and tap clamp down onto lower jacket.

6. Disconnect steering connecting rod at pitman arm.

7. Remove three bolts holding steering gear to frame side bar.

NOTE: Remove any shims found at upper or lower housing mounting bolts.

8. Strike steering gear housing firmly a few times with a lead hammer to drive the lower jacket down out of the upper jacket.

9. Remove steering gear, lower jacket and steering shaft from bottom of car.

(17) Disassembly of Manual Steering Gear

1. Rotate steering worm until nut is in center of travel.

2. Remove pitman shaft nut.

3. Remove pitman arm from pitman shaft using Special Puller, Tool No. J-2162, Fig. 7-15.

4. Remove three side cover screws, and remove side cover and pitman shaft from housing.

5. To remove side cover from pitman shaft, turn adjuster screw in end of pitman shaft down through cover.

6. Remove four screws and take out end cover with worm bearing, outer race, and thrust washer.

7. To remove lower worm bearing, outer race and thrust washer from cover, loosen worm bearing adjuster screw lock nut and turn screw in through cover.

8. Slide steering shaft and nut assembly out of steering housing.

9. Remove pitman shaft seal from gear housing.

(18) Assembly of Manual Steering Gear

1. Install new pitman shaft seal in gear housing.

2. Install steering shaft and nut assembly in gear housing, keeping the ball nut away from stops on worm.

3. Install worm bearing adjusting screw with lower worm bearing, outer race, and thrust washer in end cover.

4. Install end cover and attaching parts on gear housing making sure bearings seat properly.

5. Tighten worm bearing adjusting screw until a slight drag is felt on bearings. Do not tighten lock nut.

6. Install pitman shaft and adjuster screw inside cover.

7. Rotate steering column until ball nut is in center of travel so that center tooth on pitman shaft will enter center space in nut.

8. Install side cover and pitman shaft in gear housing.

STEERING

9. Add 2/3 of a tube (13 oz.) of Cadillac Steering Gear Lubricant or equivalent. Adjust gear as outlined in Note 2.

(19) Installation of Manual Steering Gear

1. Make sure that upper end of lower steering jacket is smooth and free from burrs and that lower end of upper jacket is smooth on the inside.

2. Slide steering gear assembly up inside of upper jacket.

3. Use a lead hammer to drive gear housing up until bolt holes in steering gear housing line up with holes in frame side bar.

4. Install three mounting bolts and tighten lower bolt.

5. Slide steering jacket clamp up onto upper jacket and tighten clamp bolt.

6. Align steering gear by use of shims as described in Note 2a.

7. Tighten the three mounting bolts to 40-45 ft. lbs. torque.

8. Connect pitman arm to steering connecting rod, turning end nut up tight and backing it off 1/2 to 5/8 turn.

9. Install horn contact and neutral safety switch.

10. Install horn wire on horn control terminal.

11. Install steering wheel as explained in Note 9.

12. Check drag link height, Note 7.

(20) Removal of Power Steering Gear Assembly

1. Raise front of car and place stands near outer ends of lower suspension arm.

2. Remove steering wheel assembly.

3. Remove screw holding neutral safety switch and horn contact bracket and loosen lower jacket clamp bolt.

4. Disconnect hydraulic steering pump to valve body hoses at pump and valve body. Install caps on pump to prevent loss of oil.

5. Remove fitting from valve body on side closest to frame.

6. Disconnect drag link at pitman arm.

7. Disconnect left exhaust pipe from exhaust manifold and disconnect intermediate hanger. Pull exhaust pipe down from manifold and move in toward engine.

8. Remove three bolts holding steering gear to frame side bar.

9. Carefully slide steering gear down out of upper jacket, and remove complete assembly from car.

NOTE: If gear will not clear lower front suspension arms, it may be necessary to add weight to compress the front springs so that gear may be removed without bending the steering shaft.

(21) Disassembly of Power Steering Gear

a. Removal of Valve Body from Gear Assembly

1. Using a soldering iron, remove the upper tip on the horn contact wire, and remove the plastic insulator.

2. Pull the wire down through the tube and out of opening at horn contact bushing. Fig. 7-22.

3. Remove bushing with wire from steering tube.

4. Remove three valve cover to gear housing screws, and remove valve cover with "O" ring seal. Discard "O" ring. Fig. 7-23.

5. Remove worm bearing lock nut, spring washer, upper and lower races, and bearing.

6. Remove valve body with spool valve and sleeve as an assembly.

7. Remove sleeve centering "O" ring from shaft

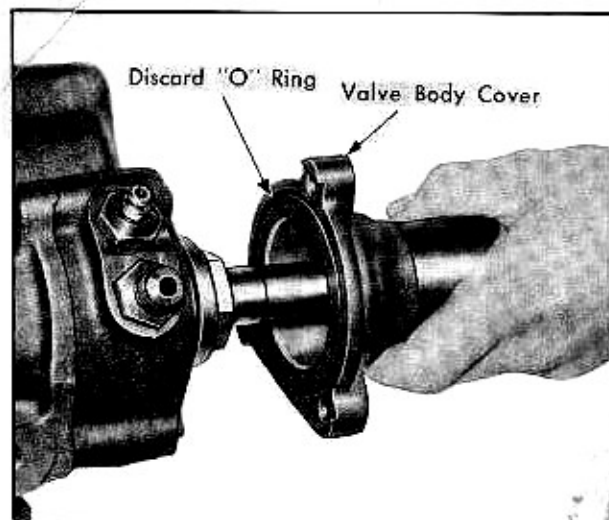


Fig. 7-23 Removing Valve Body Cover

STEERING

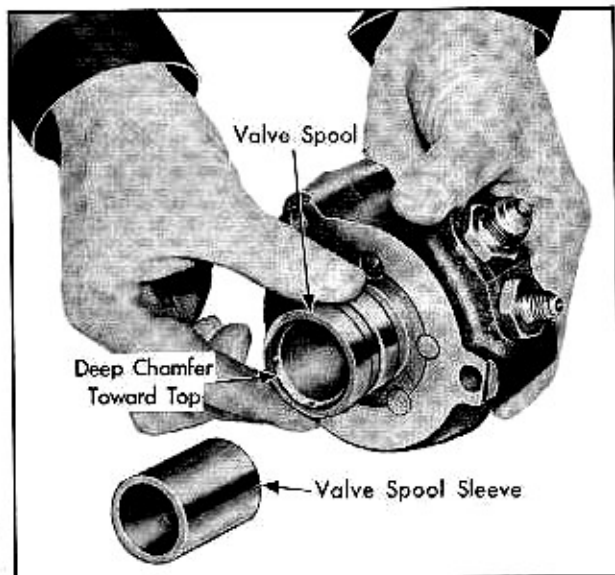


Fig. 7-24 Removing Valve Spool and Sleeve

and discard "O" ring.

8. Remove lower bearing with races.

9. Remove and discard "O" ring seal from gear housing upper flange.

b. Disassembly of Valve Body

1. Slide spool and sleeve out of valve body carefully. Note that top of spool is counterbored. Fig. 7-24.

2. Remove ten plungers and springs, being careful not to nick or score plungers.

3. Remove inlet fitting from valve body, and remove the check valve through return port with a screwdriver. Fig. 7-25.

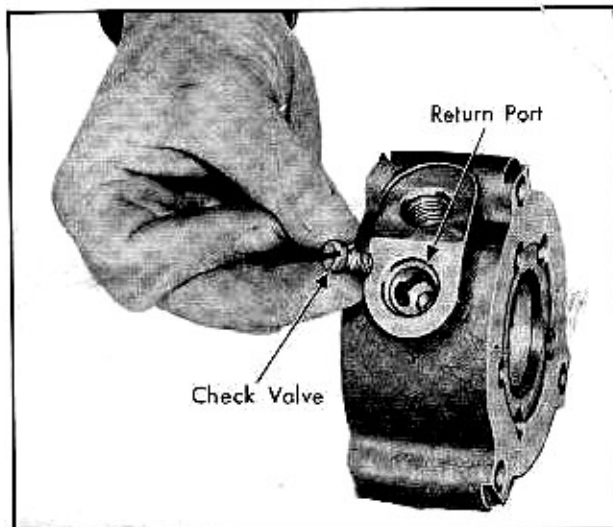


Fig. 7-25 Removing Check Valve

c. Removal of Cylinder Assembly from Gear Housing

1. Remove power rack adjusting screw lock nut.

2. Remove power rack adjusting screw.

3. Remove power rack guide.

4. Remove side cover screws and pitman shaft adjusting screw lock nut. Turn adjusting screw down through cover to remove side cover from housing. Remove cover and gasket.

5. Mark pitman gear tooth, ball nut, and power rack, as shown in Fig. 7-26, to insure proper positioning of parts when reassembling gear.

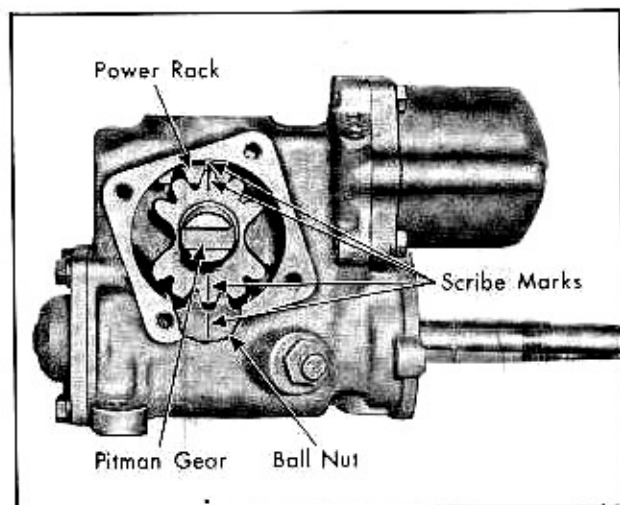


Fig. 7-26 Gear Teeth Locating Marks

6. Remove pitman shaft from gear housing.

7. Remove cylinder to gear housing screws, and remove power cylinder, guiding power rack through opening in housing.

8. Remove large and small "O" ring seals between cylinder and gear housing.

9. Remove small oil ring around oil passage in gear housing.

d. Disassembly of Cylinder

1. Remove adapter and piston assembly from cylinder.

2. Place rack in a vise with jaws against sides of rack.

3. Remove piston rod retaining nut, thrust washers, piston with rings, and adapter assembly.

4. Remove two piston rings from piston assembly.

STEERING

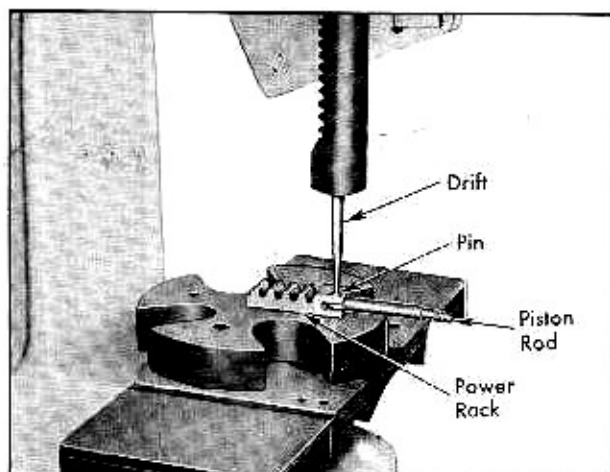


Fig. 7-27 Removing Power Rack Pin

5. Remove "O" ring seal from inner diameter of adapter assembly.

6. Press out power rack to piston rod pin with an arbor press. (Do not nick or score machined surfaces on the power rack). Fig. 7-27.

e. Disassembly of Gear Housing

1. Remove four lower end cover attaching screws, and remove cover with roller bearing and gasket.

2. Using Puller, Tool No. J-5190, remove roller bearing from end cover. Fig. 7-28.

3. Slide steering tube and worm nut, as an assembly, out of gear housing.

4. Remove oil seal from upper end of housing.

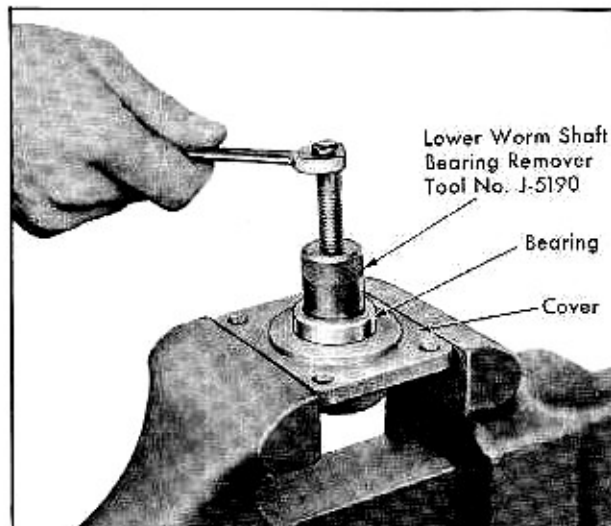


Fig. 7-28 Removing End Cover Roller Bearing

5. Remove pitman shaft bushing from housing.

6. If steering shaft upper roller bearing is defective, it will be necessary to replace the gear housing and roller bearing as an assembly. Removal of the bearing from the housing is not recommended.

(22) Assembly of Power Steering Gear

a. Assembly of Gear Housing

1. Install pitman shaft bushing in its bore in gear housing.

2. Install pitman shaft seal in housing.

3. Install oil seal in upper housing flange, using Tool No. J-5189. Fig. 7-29.

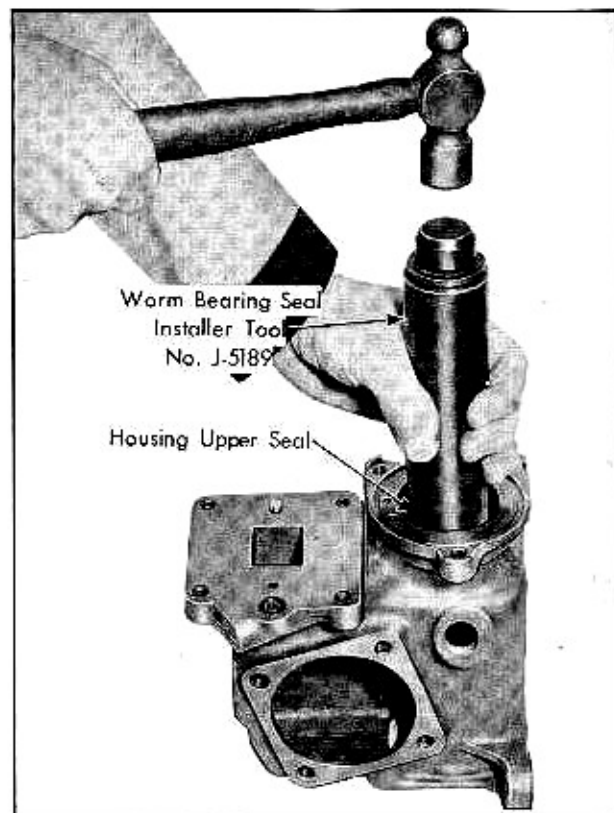


Fig. 7-29 Installing Oil Seal in Housing

4. Slide steering shaft and worm up into housing. Guide upper end of tube carefully through seal at top of housing to avoid damage to lip of seal.

5. Press bearing into end cover using Tool No. J-5191. See Fig. 7-30.

6. Install lower end cover, with bearing and gasket, on housing and tighten screws.

STEERING

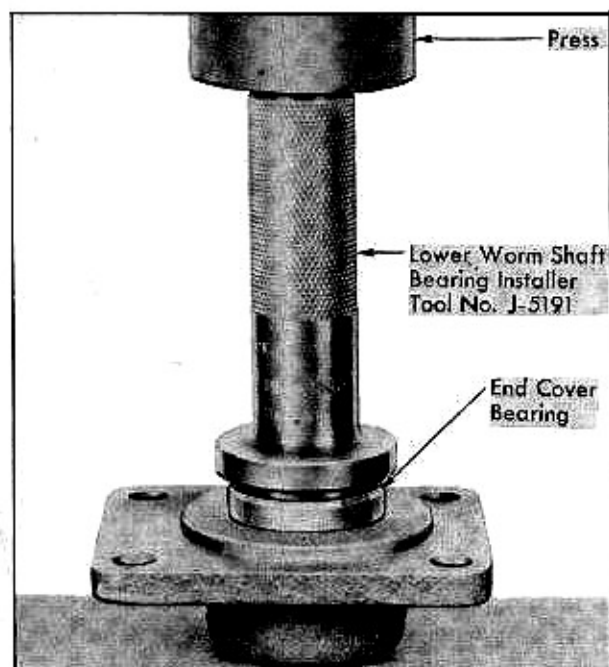


Fig. 7-30 Installing End Cover Bearing

b. Assembly of Valve Body

NOTE: Extreme care must be exercised, when assembling the valve body and power cylinder, to be certain that all parts are clean as any foreign material may affect their proper operation.

1. Install check valve through return fitting port in valve body.

2. Install preload springs and plungers in valve body.

3. Install valve spool in valve body with counter-bored end of spool toward top of valve body. Fig. 7-24.

4. Install sleeve in valve spool.

NOTE: Inject clean Hydra-Matic fluid through inlet and return fittings to lubricate parts.

c. Installation of Valve Body

1. Install lower small thrust washer, bearing with retainer, and large thrust washer over steering tube.

2. Install a new valve spool sleeve centering "O" ring on steering shaft. (Lubricate with Hydra-Matic fluid).

3. Install a new "O" ring seal in groove in gear housing flange. Slide valve body assembly over

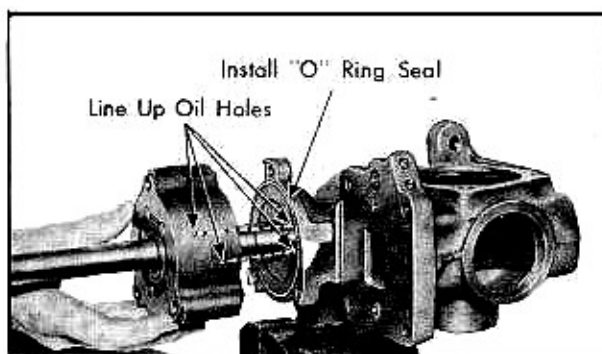


Fig. 7-31 Installing Valve Body

steering tube. Oil holes in lower face of valve body must line up with oil holes in housing flange. Fig. 7-31.

4. Install large thrust washer, bearing with retainer, and small thrust washer above valve body.

5. Install a new spring washer, cup side down, and new staking nut.

NOTE: Be sure new nut turns freely on shaft threads.

6. Temporarily install steering wheel on shaft so that shaft may be held stationary while tightening nut to prevent damage to ball nut mechanism.

7. Tighten nut to 30 ft. lbs. torque, while holding shaft stationary with steering wheel, Fig. 7-32, then back nut off 1/4 turn. Stake nut in place at keyway.

8. Install a new "O" ring seal between the valve body and valve cover.

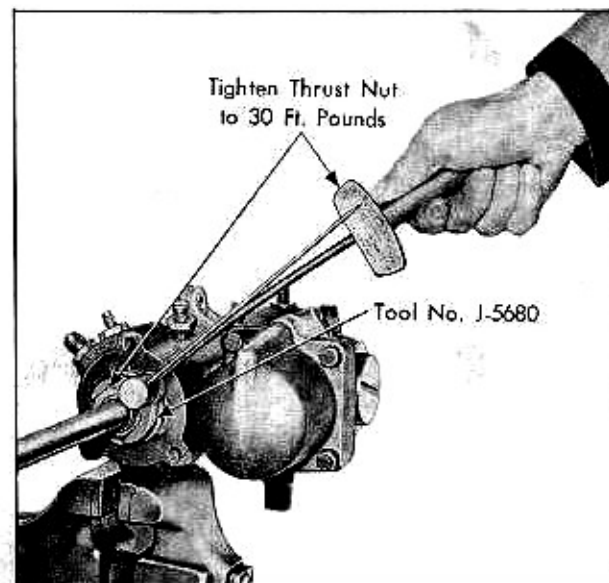


Fig. 7-32 Tightening Thrust Bearing Nut

STEERING

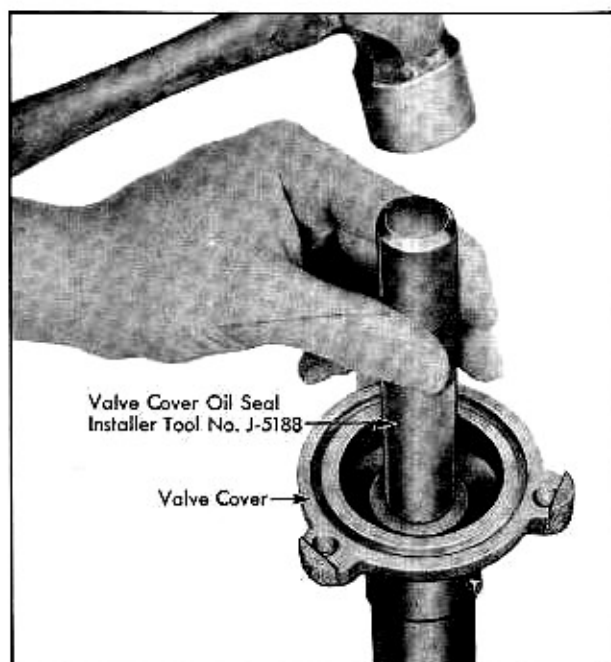


Fig. 7-33 Installing Seal In Cover

9. Install a new inner seal in valve body cover using Seal Installer, Tool No. J-5188, Fig. 7-33.

10. Install valve cover and long attaching screws.

11. Install Inlet line fitting, with new "O" ring seal, in valve body.

12. Check off-center pull at rim of steering wheel. This should be $3/8$ to $3/4$ lbs.

d. Assembly of Power Cylinder

1. Press piston rod pin into power rack and piston rod. Peen around pin, exercising care not to raise burrs on machined surface of power rack.

2. Install a new "O" ring seal in groove in inner

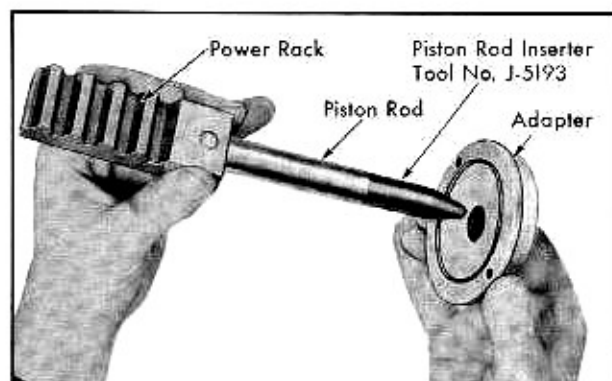


Fig. 7-34 Installing Adapter on Piston Rod

diameter of adapter.

3. Install Special Thimble, Tool No. J-5193, over threaded end of piston rod and slide adapter over Thimble onto piston rod. Fig. 7-34.

4. Install piston rings on piston.

5. Remove Thimble and install piston, with thrust washers on both sides, over piston rod and

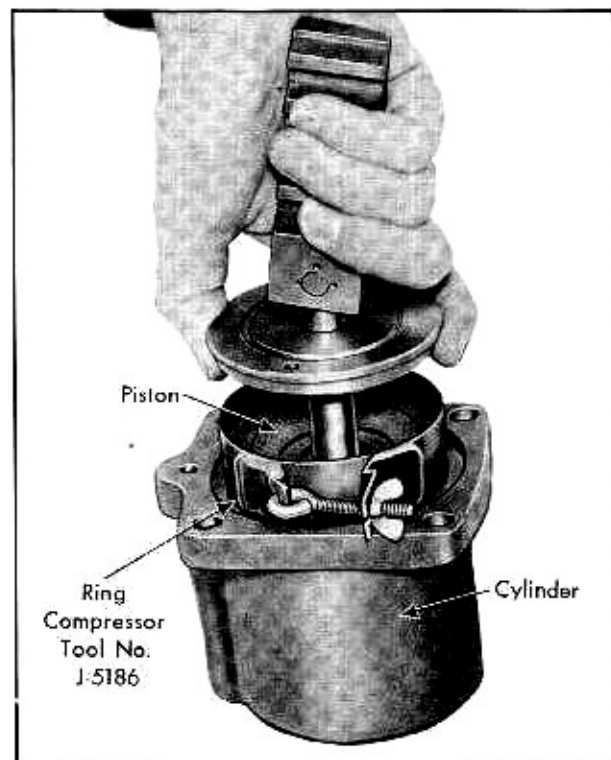


Fig. 7-35 Installing Piston in Cylinder

install piston rod nut. Cupped side of piston must be toward adapter.

6. Install piston in cylinder, using Ring Compressor, Tool No. J-5186, to compress piston rings. Fig. 7-35.

7. Slide adapter into cylinder, and install a new "O" ring seal in groove between adapter and cylinder.

8. Install a new "O" ring seal on face of adapter and a small seal around oil passage in gear housing. Fig. 7-36.

e. Installation of Cylinder Assembly on Gear Housing

1. Guide power rack through opening in gear housing and position cylinder assembly on gear

STEERING

housing, with dowel hole in adapter over dowel pin in housing. Be certain that "O" ring seals are in position, Fig. 7-36.

2. Install cylinder to housing mounting screws.

3. Install pitman shaft in housing, engaging teeth of gear with power rack and worm gear ball nut. Be sure that scribed marks on pitman gear ball nut and power rack are aligned. (Proper alignment of gear teeth will permit at least 4-1/2 complete turns of steering wheel).

4. Install power rack guide with notch parallel to piston rod.

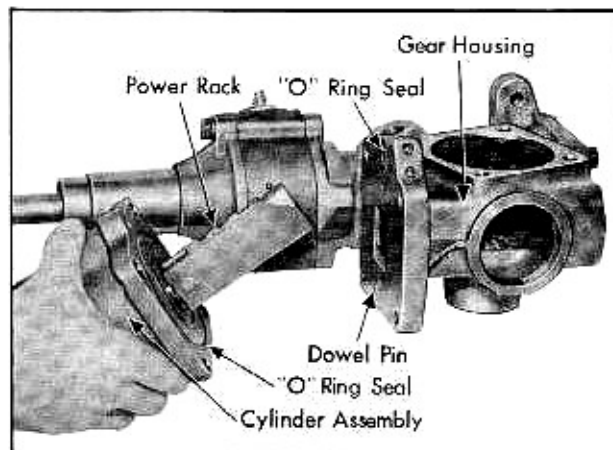


Fig. 7-36 Installing Cylinder Assembly

5. Install power rack guide adjusting screw and lock nut loosely.

6. Install adjusting screw and spacer washer in slot in pitman shaft.

7. Place side cover and gasket over adjusting screw, and turn screw out through cover until cover is positioned on steering gear housing.

8. Install side cover and lock washers.

9. Install adjusting screw loosely.

10. Adjust pitman shaft and power rack as explained in Note 3c.

11. Press new horn contact bushing into place on steering shaft, thread wire through shaft, install plastic insulator, and solder contact on end of wire.

(23) Installation of Power Steering Gear

1. Install steering worm shaft Seal Protector Tool No. J-5159, on upper end of steering shaft.

2. Carefully insert upper end of shaft into shifter tube, and slide assembly up into position until holes in steering gear housing line up with holes in frame side bar.

3. Install screws through frame into steering gear loosely.

4. Align steering gear by use of shims as described in Note 2.

5. Remove seal protector from steering shaft.

6. Install steering wheel and horn ring with button. See Note 9.

7. Measure gap between bottom edge of horn ring and upper edge of directional signal switch carrier. This should be 3/16" with the horn ring in a released position. Slide steering jacket up or down as required to obtain specified clearance.

8. Slide clamp up onto lower jacket and tighten clamp screws.

9. Install horn contact and neutral safety switch assembly in position on lower steering jacket. Adjust safety switch.

10. Connect pitman arm to steering connecting rod, turning end nut up tight and backing it off 1/2 to 5/8 turn.

11. Install exhaust pipe on exhaust manifold studs and connect intermediate hanger to pipe.

12. Check drag link height. See Note 7.

13. Install return line fitting, with "O" ring, in valve body.

14. Remove caps and connect hoses at valve body and pump.

15. Bleed hydraulic system as explained in Note 4b.

STEERING

TROUBLE DIAGNOSIS CHART

Condition	Cause	Remedy
1. Hard steering	Steering tube misaligned or bent Steering adjustment tight Tight upper bearing (at steering wheel)	Check alignment Check adjustments Replace bearing
2. Low oil pressure when tested with gage	Belt slips Low oil Pump mechanical trouble Pump pressure relief valve spring weak Pump pressure relief valve stuck open Flow control valve stuck open	Adjust belt tension Fill reservoir Overhaul or replace Replace flow control valve assembly Free up valve Free up valve
3. Chatter when turning	Loose thrust bearing nut adjustment	Check adjustment
4. Excessive wheel kickback or or loose steering	Lash in linkage, gear, or rack Air in system	Adjust or replace affected unit Bleed and refill
5. Gear noise	Loose power rack adjustment Loose through center adjustment Loose thrust bearing adjustment Loose piston-to-power rack pin	Adjust Adjust Adjust Replace as required
6. Pump noise	Low oil Belt squeal Hose grounded Pump mechanical trouble Clogged intake line Pump shaft seal leaking air Sticky pump vanes	Fill as required Adjust belt tension Reroute hose Overhaul or replace pump Clean out or replace Replace seal Check vanes
7. External oil leaks	Loose connections Loose tank to pump body screws Worn hose "O" ring seals at connections "O" ring seals on either side of valve body	Tighten Tighten screws; replace gasket Replace Replace Replace
8. Internal oil leaks	Upper or lower shaft seal Cylinder adapter seal	Replace Replace
9. Poor centering of steering gear	Incorrect caster or toe-in in front wheels Sticky or faulty spool valve Tight steering linkage Steering gear misalignment Tight power rack adjustment Tight upper bearing (at steering wheel)	Adjust Free up or replace valve body Lubricate Re-shim at frame Readjust power rack Replace bearing

STEERING

TORQUE TIGHTNESS

Application	Size	Ft. Lbs. Min.	Ft. Lbs. Max.
Steering gear to frame	7/16-14	40	45
Tie rod pivots to steering arms	1/2-20	50	55
Tie rod adjuster clamp nuts	5/16-24	20	25
Idler arm threaded bushings	Special	110	115
Pitman arm nut	7/8-16	100	125
Steering wheel nut	Special	45	50
Idler arm support to frame	3/8-24	30	35
Lower end cover	3/8-16	25	29
Side cover plate	3/8-16	25	29
Valve cover to housing	3/8-16	15	20
Power cylinder to housing	3/8-16	25	29
Pump tank cover	3/8-16	25	29
Pump cover to body	3/8-16	25	29

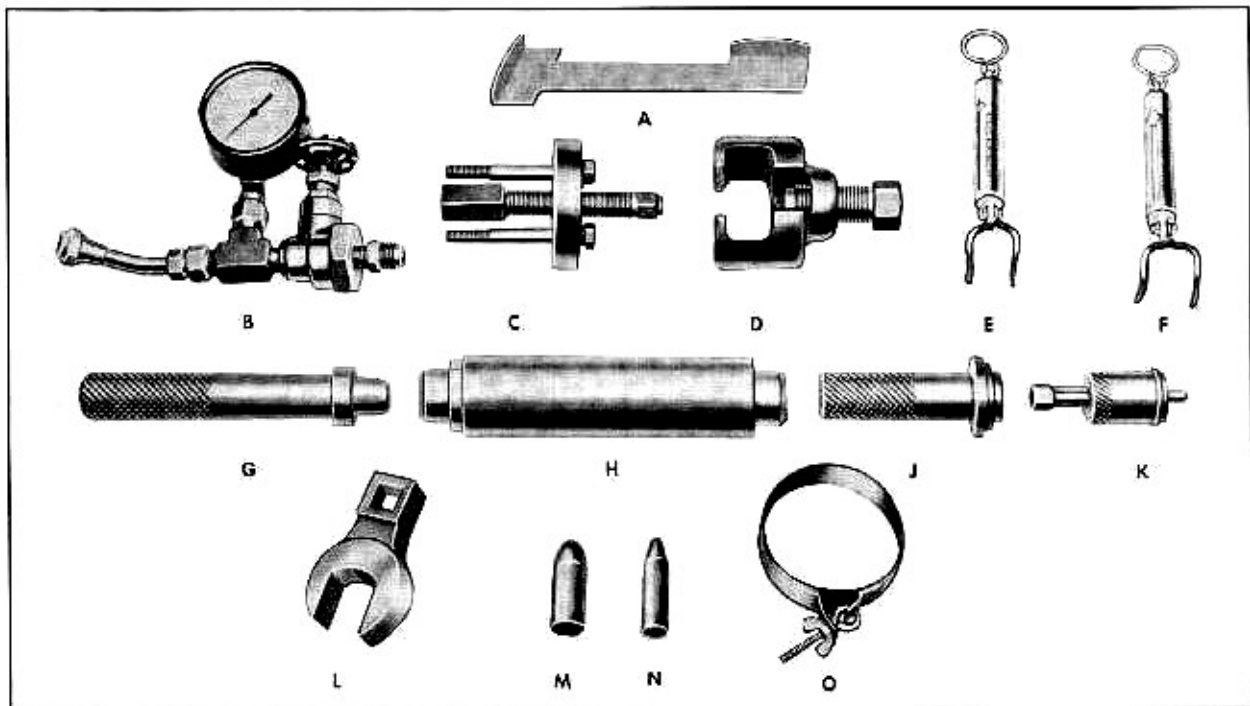


Fig. 7-37 Steering Gear Special Tools

Key	Tool No.	Name	SPECIFICATIONS		
			Steering Ratio	Gear	Overall
A	J-5648	Power Rack Adjusting Wrench			
B	J-5176	Pressure Testing Gauge			
C	J-1859	Steering Wheel Puller	Power	19.1 to 1	21.5 to 1
D	J-2162	Pitman Arm Puller	Manual	23.6 to 1	27.1 to 1
E	J-544A	4# Scale	Tread	62, 60S, 75	86 Comm.
F	J-5178	15# Scale	Front	60"	60"
G	J-5188	Seal Installer	Rear	63.10"	65.12"
H	J-5189	Bearing and Seal Installer			
J	J-5191	Bearing Installer	Hydraulic pump pressure	Min.	Max.
K	J-5190	Bearing Puller			
L	J-5680	Bearing Adjusting Wrench	With steering wheel held against stops	900 psi	1000 psi.
M	J-5159	Bushing Protector			
N	J-5193	Piston Rod Inserter	Pressure relief valve to remain closed against	900 psi.	
O	J-5186	Piston Ring Compressor			