STEERING (MANUAL, POWER AND PUMPS)

CONTENTS

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
MANUAL STEERING GEAR		
HARD STEERING	(a) Low or uneven tire pressure.	(a) Inflate tires to recommended pressures.
	(b) Insufficient lubricant in the steering gear housing or in steering linkage.	(b) Lubricate as necessary.
	(c) Steering gear shaft adjusted too tight.	(c) Adjust according to instructions.
	(d) Front wheels out of line	(d) Align the wheels. See "Front Suspension".
	(e) Steering column misaligned.	(e) See "Steering Column—Manual Transmission".
PULL TO ONE SIDE (Tendency of the Vehicle to veer in one direction only)	(a) Incorrect tire pressure.	(a) Inflate tires to recommended pressures.
	(b) Wheel bearings improperly adjusted.	(b) See "Front Wheel Bearing Adjustment".
	(c) Dragging brakes.	(c) Inspect for weak, or broken brake shoe spring, binding pedal.
	(d) Improper caster and camber.	(d) See "Front Wheel Alignment".
	(e) Incorrect toe-in.	(e) See "Front Wheel Alignment".
	(f) Grease, dirt oil or brake fluid on brake linings.	(f) Inspect, replace and adjust as necessary.
	(g) Front and rear wheels out of alignment.	(g) Align the front wheels. See "Front Suspension".
	(h) Broken or sagging rear springs.	(h) Replace rear springs.
	(i) Bent suspension parts.	(i) Replace parts necessary.
WHEEL TRAMP (Excessive Vertical Motion of Wheels)	(a) Incorrect tire pressure.	(a) Inflate tires to recommended pressures.
	(b) Improper balance of wheels, tires and brake drums.	(b) Balance as necessary. See "Wheels and Tires."
	(c) Loose tie rod ends or steering connections.	(c) Inspect and repair as necessary.
	(d) Worn or inoperative shock absorbers.	(d) Replace shock absorbers as necessary.
EXCESSIVE PLAY OR LOOSENESS IN THE STEERING WHEEL	(a) Steering gear shaft adjusted too loose or badly worn.	(a) Replace worn parts and adjust according to instructions.
	(b) Steering linkage loose or worn.	(b) Replace worn parts. See "Front Wheel Alignment."
	(c) Front wheel bearings improperly adjusted.	(c) Adjust according to instructions.
	(d) Steering arm loose on steering gear shaft.	(d) Inspect for damage to the gear shaft and steering arm, replace parts as necessary.
	(e) Steering gear housing attaching bolts loose.	(e) Tighten attaching bolts to specifications.
	(f) Steering arms loose at steering knuckles.	(f) Tighten according to torque specifications.
	(g) Worn ball joints.	(g) Replace the ball joints as necessary. See "Front Suspension".
POWER STEERING GEAR		
HARD STEERING	(a) Tires not properly inflated.	(a) Inflate tires to recommended pressures.
	(b) Low oil level in pump reservoir (usually accompanied by pump noise).	(b) See "Fluid Level", Power Steering Pump.

Condition	Possible Cause	Correction
POWER STEERING Continued		
	(c) Loose pump belt.	(c) See "Belt Adjustment Engine Cooling—Group 7".
	(d) Improper caster and camber.	(d) See "Front Wheel Alignment". Front Suspension.
	(e) Power steering output low.	(e) Perform the "Pump Pressure and Flow Tests". NOTE: When the power steering pump fails to give proper steering, assist, the trouble is usually caused by fouling of the flow control valve causing it to stick in the open or "by pass" position. This fouling can be caused by gum deposits, pieces of broken slipped springs, burrs, or foreign material (pieces or rubber, dirt or machine chips). If no fouling is evident, or if the flow control valve contains pieces of coiled wire (broken slipper spring), the pump should be disassembled for possible slipper spring replacement.
	(f) Steering column shaft or bearing binding.	(f) Repair as necessary.
	(g) Steering linkage binding.	(g) Repair and lubricate as necessary.
	(h) Steering gear malfunctions.	(h) Adjust or repair as follows:
	1. Gear shaft adjustment too tight.	1. See "Gear Shaft Adjustment",
	2. Damaged valve lever.	2. Remove steering gear, repair as necessary.
	3. External leakage.	3. Inspect for leakage at the lower sector shaft oil seal; the sector shaft cover "O" ring.
	4. Excessive internal leakage.	4. Remove steering gear and repair as necessary.
POOR RECOVERY FROM TURNS	(a) Tires not properly inflated.	(a) Inflate tires to recommended pressures.
	(b) Steering linkage binding.	(b) Repair and lubricate as necessary.
	(c) Improper wheel alignment.	(c) See "Front Wheel Alignment", Front Suspension.
	(d) Damaged or worn steering tube bearing.	(d) Remove jacket tube and replace bearings.
	(e) Steering wheel column jacket and steering nut improperly aligned.	(e) See "Gear Installation".
	(f) Steering gear malfunctions.	(f) Adjust or repair as follows:
	1. Improper gear shaft adjustment.	1. See "Gear Shaft Adjustment",
	2. Column support spanner nut loose.	2. Remove steering gear, disassemble, inspect and reassemble as outlined in this section.
	3. Damaged valve lever.	3. Remove steering gear and repair as necessary.
	4. Improper worm thrust bearing adjustment.	4. Remove steering gear, disassemble, inspect and reassemble. "Gear Reconditioning"
	5. Damaged cylinder head worm seal ring or faulty worm piston ring.	5. See"Steering Gear Removal, Disassembly and Inspection", replace parts as necessary. See "Gear Reconditioning".
	6. Burrs or nicks in the reaction ring grooves in the cylinder head or column support.	6. Remove steering gear and repair as necessary.
	7. Dirt or chips in the steering gear unit.	7. Remove the steering gear, disassemble completely, clean in a clean solvent, inspect and make repairs as necessary.
	8. Rough or catchy worm in the piston assembly.	8. Replace the worm and piston assembly. See "Gear Reconditioning."
LEADS TO EITHER SIDE	(a) Tires not properly inflated.	(a) Inflate tires to recommended pressures; See "Wheels and Tires".

Condition	Possible Cause	Correction
POWER STEERING (Continued)	(b) Improper wheel alignment.	(b) See "Front Suspension, Front Wheel Alignment".
	(c) Valve body out of adjustment.	(c) If vehicle leads to the left, move the steering valve housing **down** on the steering housing. If vehicle leads to the right, move the steering valve housing **up** on the steering housing.
	(d) Valve lever damaged.	(d) Remove the steering gear and replace or repair as necessary.
	(e) Column support spanner nut loose.	(e) Remove steering gear and repair as necessary.
EXCESSIVE STEERING WHEEL FREE-PLAY	(a) Improper gear shaft adjustment.	(a) See "Gear Shaft Adjustment".
	(b) Column support spanner nut loose.	(b) Remove steering gear, disassemble, inspect and reassemble.
	(c) Improper worm thrust bearing adjustment.	(c) Remove steering gear, disassemble, inspect and reassemble.
	(d) Coupling loose on the worm shaft.	(d) Inspect the wormshaft splines for wear.
LACK OF ASSIST (One Direction)	(a) Oil leaking past worm shaft oil seal ring.	(a) Remove steering gear, disassemble, inspect and replace the parts as necessary.
	(b) Broken or worn ring on worm piston.	(b) See "Gear Reconditioning"
	(c) Piston end plug loose.	(c) Replace the worm and piston assembly.
	(d) Reaction seal missing.	(d) Remove the steering gear and repair as necessary
LACK OF ASSIST (Both Directions)	(a) Pump belt slipping.	(a) See "Belt Adjustment—Cooling—Group 7".
	(b) Pump output low.	(b) Perform the "Pump Pressure and Flow Tests", also refer to correction (e) in Diagnosis under "Hard Steering".
	(c) Broken or worn ring on worm piston.	(c) See "Gear Reconditioning".
	(d) Piston end plug loose.	(d) Replace the worm and piston assembly.
	(e) Internal leakage in the steering gear valve body.	(e) Replace the steering gear valve body assembly.
TEMPORARY INCREASE IN FRONT WHEN TURNING STEERING WHEEL TO THE RIGHT OR LEFT	(a) Oil level low in pump reservoir.	(a) See "Fluid Level", Power Steering Pump.
	(b) Loose pump belts.	(b) See "Belt Adjustment—Cooling—Group 7".
	(c) Oil on pump belt.	(c) Replace the belt and adjust.
	(d) Binding steering linkage.	(d) Lubricate and repair as necessary.
	(e) Engine idle too slow.	(e) See "Fuel Specifications".
	(f) Air in the system.	(f) Work steering wheel from right to left until the air is expelled.
	(g) Power steering pump output low.	(g) See Diagnosis "Hard Steering" correction (e).
	(h) Gear malfunction.	(h) Adjust and repair as outlined under "Hard Steering"—condition and correction (g).
NOISES	(a) Buzzing noise in neutral and stops when the steering wheel is turned.	(a) Noisy pump, make pressure test and repair as necessary. Damaged hydraulic lines or interference of hoses with components attached to fender shield. Air in system; work steering wheel from right to left until the air is expelled.
	(b) Chuckling noise. Causes as follows: 1. Improper gear shaft adjustment. 2. Improper worm shaft thrust bearing adjustment.	(b) Correct as follows: 1. See "Gear Shaft Adjustment". 2. Remove steering gear, disassemble, inspect and reassemble. See "Worm Bearing Pre-Load".

Condition	Possible Cause	Correction
POWER STEERING (Continued)	3. Coupling loose on the worm shaft.	3. Inspect worm shaft splines for wear. Inspect bolt.
NOISES	4. Worn worm and piston assembly.	4. Replace worm and piston assembly.
	(c) Metallic clatter or tapping noise.	(c) Replace the back pressure valve cushion.
	(d) Knocking condition at the bracket stop when the engine is running.	(d) Rubber stop worn or missing from pump bracket.
	(e) Loose pump belt.	(e) Belt not properly adjusted or worn to the extent that belt tension cannot be properly adjusted.
	POWER STEERING PUMP	
LOW OIL PUMP PRESSURE	(a) Pump belt loose.	(a) See "Engine Cooling—Group 7."
	(b) Pump pulley loose.	(b) Replace the pulley, measure the pump diameters as follows: Shaft diameter .8120-.8125 Pulley inside diameter .8095-.8105. If shaft is damaged, replace pump.
	(c) Oil level low in pump reservoir.	(c) See "Fluid Level."
	(d) Pressure relief valve spring weak, or relief valve stuck in open position.	(d) Replace the relief valve and perform "Pump Pressure Test."
	(e) Flow control valve stuck.	(e) Repair as necessary. Refer to "Flow Control Valve Removal and Installation and Correction under Diagnosis "Hard Steering."
	(f) Worn pump rotor, slippers, or broken and distorted springs.	(f) Repair as necessary. See Diagnosis "Hard Steering" Correction (e).
HIGH PUMP PRESSURE	(a) Wrong relief valve.	(a) Replace relief valve and perform "Pump Pressure Test."
	(b) Relief valve clogged with foreign matter (dirt, metal chips, etc.)	(b) Replace relief valve and perform "Pump Pressure Test."
LEAKS	(a) Reservoir over-filled. NOTE: Operating the steering gear manually when the engine is not running will cause the steering gear to displace the fluid from the steering gear housing which will then be forced out of the pump filler cap vent, giving a false indication of fluid leakage.	(a) See "Fluid Level."
	(b) Pressure and return hose connections and fittings.	(b) Tighten all fittings, check hose for deterioration: replace any faulty hoses. If the discharge fitting is leaking; See "Discharge Fitting Ferrule Replacement."
	(c) Reservoir to-pump-body "O" ring or mounting screws.	(c) Replace the reservoir mounting screws.
	(d) Pump shaft oil seal.	(d) Replace oil seal.

MANUAL STEERING GEAR

AC-1, AND AC-2 MODELS

Description

The manual steering gear (Fig. 1) is designed to provide easy steering with a minimum of friction in the steering gear. A ball nut travels up or down on the wormshaft, riding on recirculating balls acting as a screw thread.

The wormshaft and ball nut assembly is supported in the gear housing by an adjustable ball thrust type upper and lower bearing. The lower bearing cup is pressed into the gear housing, and the upper bearing cup is pressed into the wormshaft bearing adjuster.

SERVICE PROCEDURES

Adjustments

Two adjustments are provided in the steering gear (Fig. 2). The worm-bearing pre-load adjustmen, and the ball nut rack sector gear mesh adjustment.

Before correct adjustment can be made at ball nut rack and sector gear, it must be determined that worm bearing pre-load is properly adjusted.

The worm-bearing pre-load adjustment is controlled by the worm thrust bearing adjuster which threads into the housing at the upper end of the wormshaft.

The cross shaft is integral with the sector gear and the sector gear meshes with the rack teeth on the recirculating ball nut. Adjustment at this point is controlled by the cross shaft adjusting screw which extends through the housing cover.

Worm Bearing Pre-load

(1) Disconnect the steering gear arm from the cross shaft with Tool C-3646 (Fig. 3).

(2) Remove the horn button or horn ring.

(3) Loosen the cross shaft adjusting screw lock nut, and back out the adjusting screw approximately two turns. This will relieve any friction load which may be present at the closely meshed ball nut rack and sector gear teeth.

(4) Turn the steering wheel two complete turns from the straight ahead position, and place the torque wrench Tool C-3380 on the steering shaft nut.

(5) Rotate the steering shaft at least one turn toward the straight ahead position, while testing the rotating torque with the torque wrench.

The torque required to keep the wheel moving should be between 1½ and 4½ inch-pounds. If the reading is not within these limits, the adjustment can be made in or out of the vehicle as follows:

(a) Loosen the adjuster lock nut.

(b) Use the adjuster wrench from Tool C-3884 set and turn the adjuster clockwise to increase the pre-load, or counterclockwise to decrease the pre-load.

(c) While holding the adjuster from turning, tighten lock nut securely. Retest worm bearing pre-load.

Ball Nut Rack and Sector Mesh

The cross shaft adjusting screw, located in the housing cover, raises or lowers the shaft to provide the proper mesh load between the tapered teeth of the sector gear and the tapered teeth of the ball nut.

NOTE: This adjustment can be accurately made only after the proper worm bearing pre-load has been established.

(1) Turn the steering wheel gently from one stop all the way to the other, carefully counting the number of turns. Turn the steering wheel back exactly half way, to the center position.

(2) Turn the cross shaft adjusting screw clockwise to take out all lash between the ball nut rack and sector gear teeth, then tighten the adjusting screw lock nut to 35 foot-pounds.

(3) Turn the steering wheel about ¼ turn away from the center or "high spot" position. Then, using torque wrench Tool C-3380, at the steering wheel nut, measure the torque required to rotate the steering wheel through the high spot at the center position.

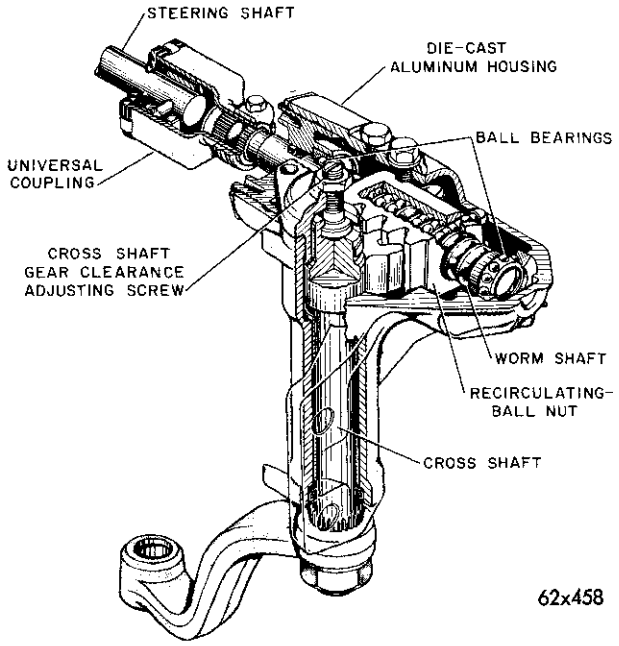


Fig. 1—Steering Gear Cross Section

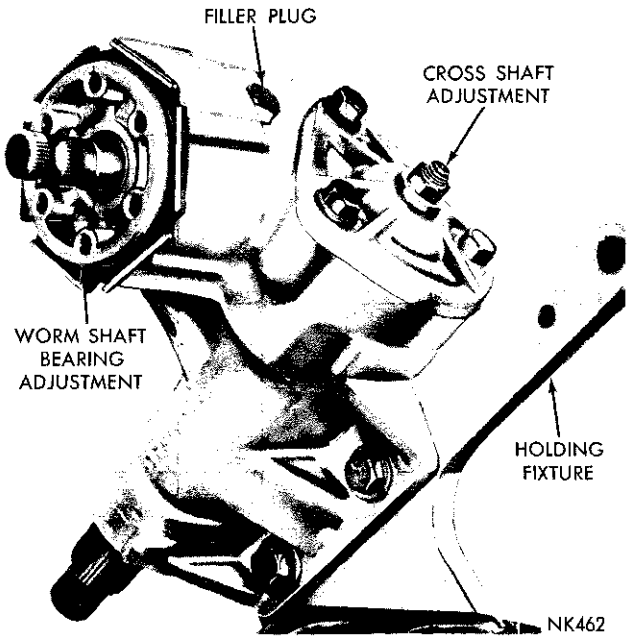


Fig. 2—Gear Adjustment Locations

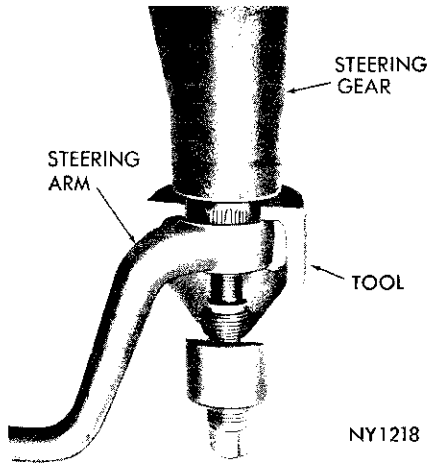


Fig. 3—Removing the Steering Gear Arm

The reading should be between 8¼ and 11¼ inch-pounds. This represents the total of the worm shaft bearing pre-load and the ball nut rack and sector gear mesh load. Readjust the cross shaft adjustment screw if necessary, to obtain the proper torque reading.

(4) After the adjustments have been completed, place the front wheels in a straight ahead position, and with the steering gear and steering wheel centered, install the steering arm on the cross shaft.

(5) Tighten the steering arm retaining nut to 120 foot-pounds.

Gear Removal

NOTE: The manual steering gear can be removed without removing the steering column assembly.

(1) Remove the steering arm retaining nut. Remove the arm with Tool C-3646 (Fig. 3).

(2) Remove the bolt from the coupling clamp at the upper end of the steering gear wormshaft.

(3) To provide sufficient clearance at the coupling, loosen the column jacket to instrument panel clamp bolts sufficient to disengage the tab on the clamp from the slot in the column jacket. Slide the column assembly up far enough to disengage the coupling from the wormshaft.

CAUTION: Care is required to avoid scratching the column jacket when sliding it up and down in the clamp assemblies.

It is not necessary to disconnect the shift linkage on models equipped with manual transmission, or to remove the floor plate to floor pan bolts when removing the steering gear. If the floor plate bolts are loosened, it will be necessary to realign the steering column when reinstalling the gear.

(4) Remove three steering gear housing mounting bolts and remove steering gear from under vehicle.

Gear Reconditioning

Thoroughly clean the entire outside surface of the steering gear before disassembly to avoid contaminating the wormshaft and ball nut assembly with dirt or grit.

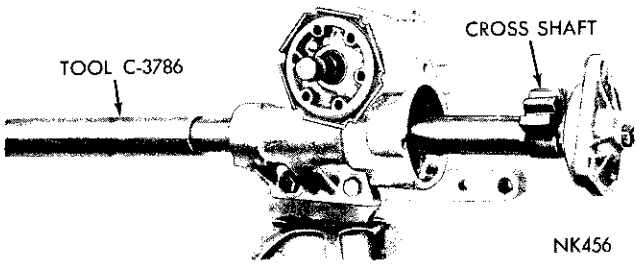


Fig. 4—Removing Cross Shaft

(1) Attach the steering gear to holding fixture, Tool C-3323 and install holding fixture in a vise (Fig. 2).

(2) Loosen the cross shaft adjusting screw lock nut, and back out the screw about two turns to relieve the load caused by close mesh between the ball nut rack and sector gear teeth.

NOTE: Remove the cross shaft seal as outlined in "Cross Shaft Oil Seal Replacement."

(3) Position the steering wormshaft in the straight-ahead position.

(4) Remove the bolts from the cross shaft cover, then slowly remove the cross shaft while sliding the arbor Tool C-3786 into the housing (Fig. 4).

(5) Remove the lock nut from the cross shaft adjusting screw and remove the screw from the cover by turning the screw clockwise.

(6) Slide the adjustment screw and shim out of the slot in the end of the cross shaft.

(7) Loosen the wormshaft bearing adjuster lock nut with a soft drift and remove the lock nut. Hold the wormshaft from turning while unscrewing the adjuster, using wrench from Tool Set C-3884. (Fig. 5).

(8) Slide the worm shaft adjuster off the shaft.

CAUTION: The adjuster must be handled carefully to avoid damage to the aluminum threads.

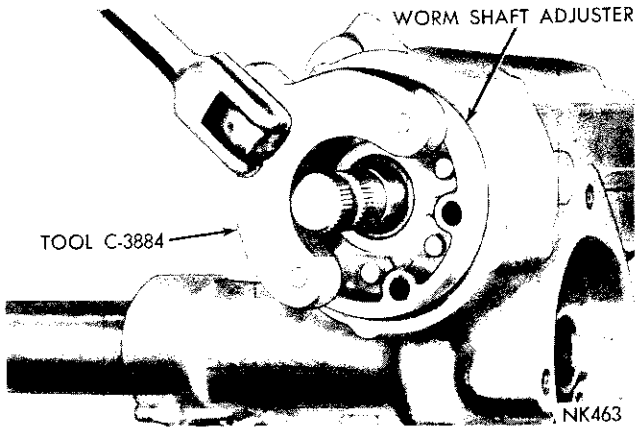


Fig. 5—Removing Worm Shaft Adjuster

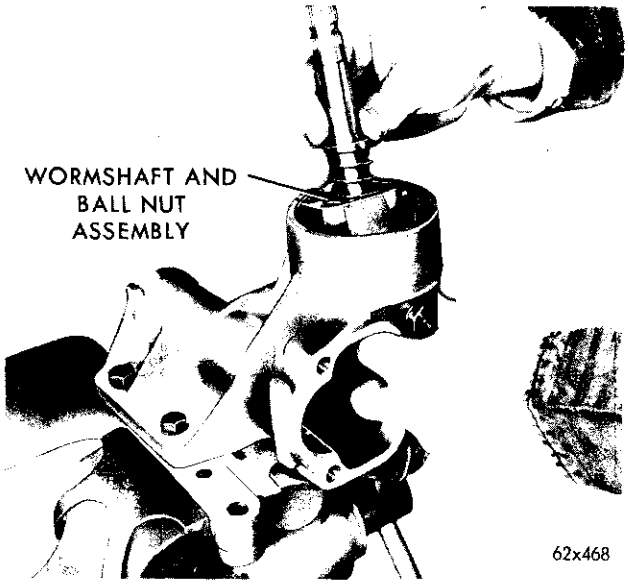


Fig. 6—Removing Worm Shaft and Ball Nut Assembly

NOTE: Be careful that the ball nut does not run down to either end of the wormshaft as the ball guide ends can be damaged if the ball nut is allowed to rotate until stopped at the end of the worm.

(9) Carefully remove worm and ball nut assembly (Fig. 6).

The ball nut and wormshaft are serviced as an assembly only, and are not to be disassembled. Do not remove or disturb the ball return guides.

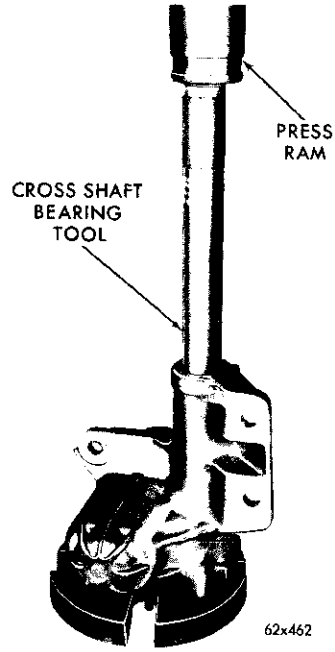


Fig. 7—Removing Cross Shaft Inner and Outer Bearings

CAUTION: Place the ball nut and wormshaft assembly in a clean place, and cover it to keep it clean.

(10) Remove the cross shaft needle bearing by placing the steering gear housing in an arbor press; insert Tool C-3786 in lower end of housing (Fig. 7) and press both bearings through the housing.

NOTE: The cross shaft cover assembly, including a needle bearing or bushing, is serviced as an assembly.

(11) Remove the wormshaft oil seal from the wormshaft bearing adjuster, by inserting a blunt punch behind the seal and tap alternately on each side of the seal until the seal is driven out of the adjuster.

(12) Remove the wormshaft spacer and upper bearing cup in the same manner. However, this must be done carefully to avoid cocking the bearing cup and distorting the adjuster counterbore.

(13) Remove the lower cup if replacement is necessary by positioning the locking puller head jaws of puller Tool C-3868 (Fig. 8) behind the bearing cup and expanding the puller head by pressing down on the center plunger of tool. Withdraw the bearing cup by turning the puller screw nut in a clockwise direction while holding the center screw.

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

(15) Test the operation of the ball nut assembly on the wormshaft. If the ball nut does not travel smoothly and freely on the wormshaft and there is roughness or binding, the assembly must be replaced.

(16) Extreme care is necessary when handling the aluminum worm bearing adjuster to avoid damaging the threads. It is equally important to avoid damaging

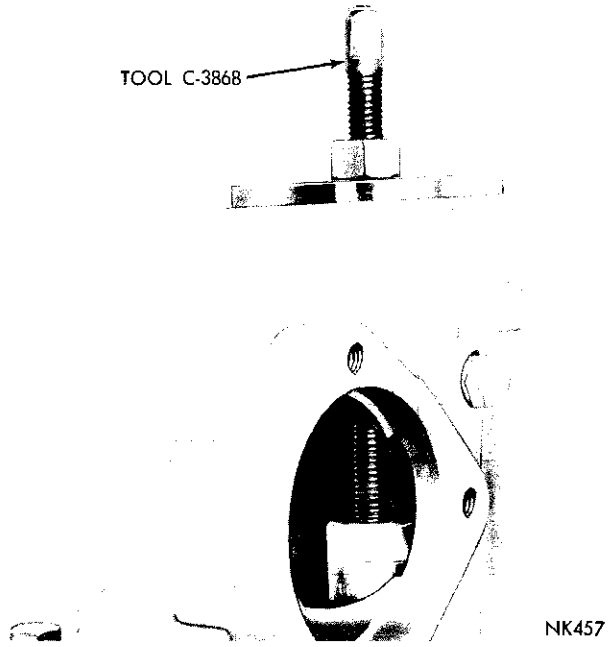


Fig. 8—Removing Lower Bearing Cup

the mating threads in the gear housing. The wormshaft adjuster must **Never** be screwed into the housing without lubrication, or when threads are dirty or damaged. These precautions **must** be taken to avoid "picking up" the threads and ruining the housing and/or the wormshaft bearing adjuster.

(17) Inspect the cross shaft for wear and check fit of the shaft in the housing bearings. Inspect the fit of the shaft pilot in its housing bearing in the cover. Make sure the wormshaft has not been bent or otherwise damaged.

(18) The cross shaft and wormshaft oil seals should be replaced when the unit is reconditioned.

(19) Install the cross shaft outer needle bearing by placing the bearing on end of Tool C-3333 with the adapter ring. Press the bearing into the housing to ½ inch below the end of the bore to provide space for the oil seal.

(20) Install the inner needle bearing by placing bearing on Tool C-3333 (Fig. 9). Press the bearing into the inside end of the housing bore flush with the inside end of the bore surface.

(21) Install the wormshaft bearing cups, position the bearing cup and spacer into the adjuster nut, and press them in place with Tool C-3865 (Figs. 10 and 11).

(22) Install the wormshaft oil seal by positioning the seal in the wormshaft adjuster with the lip of seal up. Drive the seal into place with a suitable sleeve so it is slightly below the end of the bore in the adjuster.

(23) Apply a coating of steering gear lubricant to all moving parts during assembly, also place lubricant on and around oil seal lips.

(24) Clamp the holding fixture and housing in a vise with the bearing adjuster opening upward.

(25) Place a thrust bearing in the lower cup in the housing.

(26) Hold the ball nut from turning (Fig. 6), and insert the wormshaft and ball nut assembly into the housing with the end of the worm resting in the thrust bearing.

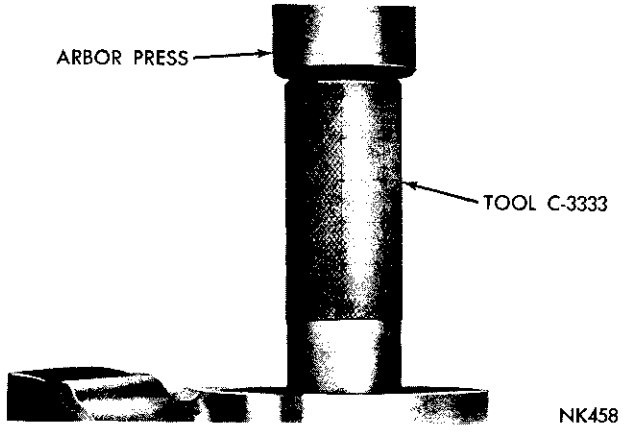


Fig. 9—Pressing Inner Bearing Into Housing

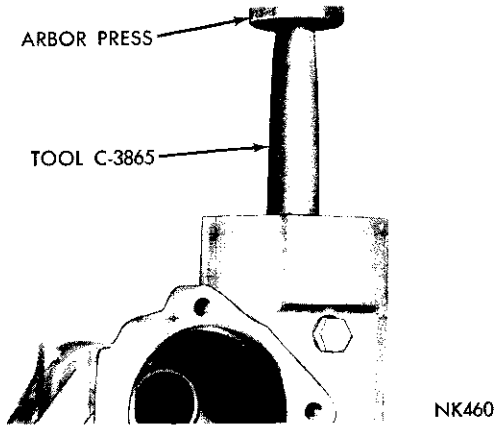


Fig. 10—Installing Wormshaft Lower Bearing Cup

(27) Place the upper thrust bearing on the wormshaft.

Thoroughly lubricate the threads on the adjuster and the threads in the housing.

(28) Place a protective sleeve of plastic tape over the wormshaft splines so that the splines do not damage seal and slide adjuster assembly over shaft.

(29) Thread the adjuster into the steering housing, and with Tool wrench C-3884 and splined nut set, tighten the adjuster to 50 foot-pounds while rotating the wormshaft. This is done to effectively seat the bearings.

(30) Loosen the adjuster so no bearing preload exists. Then, using torque wrench Tool C-3380, adjust the wormshaft bearing preload from 1⅛ to 4½ inch-pounds.

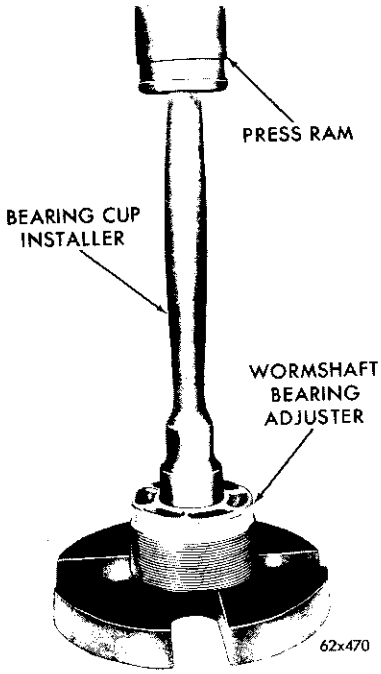


Fig. 11—Installing Wormshaft Upper Bearing Cup

(31) After adjusting the preload, tighten the bearing adjuster lock nut, and then retest to be sure the preload remains between 1⅛ and 4½ inch-pounds.

(32) Before installing the cross shaft, pack the wormshaft cavities in the housing above and below the ball nut with steering gear lubricant. Use steering gear lubricant whenever possible, but if not available, a good grade of multi-purpose lubricant may be used. Do not use gear oil. When the gear is properly packed with steering gear lubricant it will contain eleven fluid ounces of lubricant, and the level of the lubricant will be at the top of the worm.

(33) Slide the cross shaft adjusting screw and shim into the slot in the end of the shaft.

(34) Test the end clearance (Fig. 12). The screw must be free to turn with no perceptible end play to .004 inch loose. Three different thickness shims are available to obtain the specified clearance.

(35) Start the cross shaft and adjuster screw into bearing in the housing cover. Then, using a screw driver through the hole in the cover, turn the screw counterclockwise to pull the shaft into the cover.

(36) Install the adjusting screw lock nut, but do not tighten at this time.

(37) Rotate wormshaft to centralize ball nut.

(38) Place a new cover gasket on housing cover.

(39) Carefully install the cross shaft and cover assembly into the steering gear housing (Fig. 4).

The cross shaft and sector teeth should be coated with the steering gear lubricant before installing the cross shaft in the housing.

(40) Make certain some lash exists between the cross shaft sector teeth and the ball nut rack then install and tighten the cover bolts to 25 foot-pounds.

Gear Installation

(1) Slide the steering column assembly upward to where the column coupling will clear the end of the wormshaft and permit installation of the steering gear. Also make sure the clamp is in place on the steering shaft coupling.

(2) Position the steering gear in position from underneath the vehicle and install the three mounting bolts.

(3) Tighten mounting bolts to 80 foot-pounds.

(4) With the master serration on the wormshaft, aligned with the notch mark on the coupling housing, slide the steering column assembly down far enough to engage the column coupling with the wormshaft.

(5) Align the groove on the steering column coupling with the groove in the wormshaft and install the coupling bolt, washer and nut.

(6) Tighten the nut to 33 foot-pounds.

(7) While the jacket clamp bolts are loose, position the jacket assembly so the steering shaft coupling is centered at the midpoint of its travel.

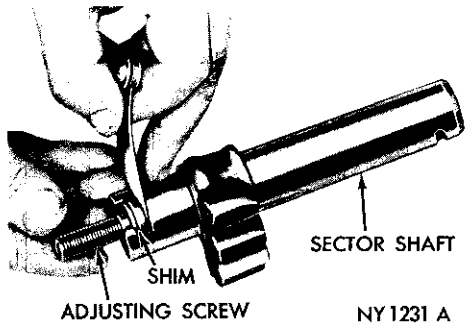


Fig. 12—Measuring Cross Shaft Adjusting Screw End Clearance

The coupling travel midpoint can be determined by a $^{3}/_{16}$" diameter gauge hole which is provided in the steering shaft.

When the bottom edge of the gauge hole is tangent to the top edge of the seal, the coupling is centered in its travel.

(8) After centering the coupling, tighten the column jacket to instrument panel clamp bolts to 95 inch-pounds.

NOTE: On vehicles equipped with manual transmission and concentric shift linkage, it will be necessary to readjust the length of the 1st and reverse shift rod and the 2nd and 3rd shift rod after the steering column assembly has been secured in position. See "Manual Transmission Linkage Adjustments."

(9) Turn the steering gear and steering wheel to the midpoint of its travel.

(10) Place the front wheels in the straight ahead position so the master serrations in the steering gear arm align with those on the steering cross shaft.

(11) Install the steering gear arm, lock washer and nut on the cross shaft and tighten the nut to 120 foot-pounds.

(12) After the steering gear has been completely installed, test the steering wheel to be sure it is centered in the straight ahead position. If it is found to be off center with the wheels straight ahead, adjust

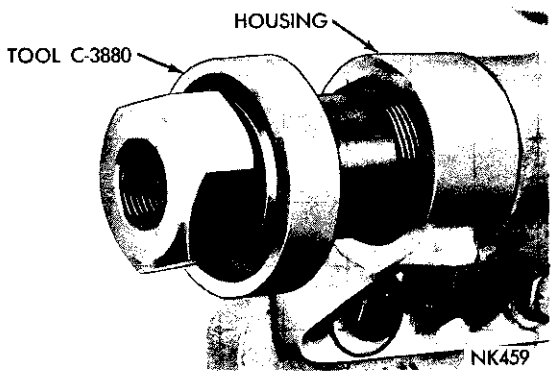


Fig. 13—Removing Cross Shaft Oil Seal

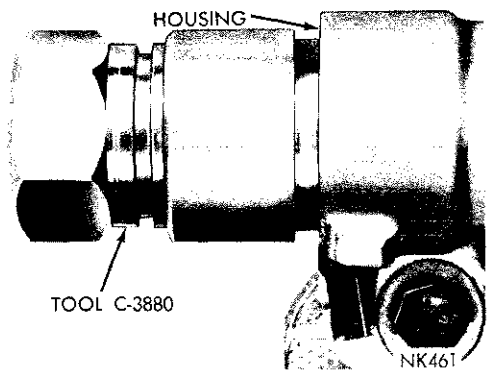


Fig. 14—Installing Cross Shaft Oil Seal

the tie rods to center the wheel. See Group 2, "Front Suspension."

Cross Shaft Oil Seal Replacement

The cross shaft oil seal may be replaced by this procedure either on the bench, or without removing the steering gear from the vehicle.

CAUTION: When replacing the oil seal in the vehicle, clean the exposed portion of the cross shaft to help prolong oil seal life.

Use Tool C-3880 to service the cross shaft seal. The tool consists of adapter SP-3056; half rings SP-1932 and nut SP-3610.

(1) Slide the threaded adapter over the end of the cross shaft and install the nut portion of the tool on the shaft (Fig. 13). Maintain pressure on the adapter with the tool nut while screwing the adapter into the seal until it grips the oil seal firmly. Place the two half rings and retainer over both portions of the tool. Turn the tool nut counterclockwise to withdraw the seal from the housing.

(2) Place the seal onto the splines on the cross shaft with the lip of the seal facing the gear housing.

(3) Place the installing adapter SP-3052 from Tool C-3880 against the seal. Press the seal in until a gap of ¼ inch exists between the adapter and the housings (Fig. 14).

(4) Place the nut down from Tool Set C-3880 on the cross shaft, and turn it down against the adapter, pressing the seal into the housing until the step on the adapter contacts the end of the housing.

POWER STEERING GEAR

Description

The power steering gear consists of a gear housing (Fig. 1) containing a gear shaft with sector gear, a power piston with gear teeth milled into the side of the piston is in constant mesh with the gear shaft sector and a wormshaft connects the steering wheel to the power piston. The wormshaft is geared to the piston through a recirculating ball contact (Fig. 2).

SERVICE PROCEDURES

GEAR SHAFT ADJUSTMENT IN THE VEHICLE

(1) With the gear shaft on center, loosen the gear shaft adjusting screw lock nut ½ turn and tighten the adjusting screw until backlash just disappears. Tighten the screw 1¼ turns from this position and while holding adjusting screw in this position, tighten lock nut.

NOTE: This is a temporary adjustment to insure that the piston rack and sector teeth are in full alignment (Fig. 2).

(2) Operate the unit manually for a minimum of 180 degrees from the center in each direction, measured at the wormshaft.

(3) Start the engine and run at idle speed. With hydraulic power to the steering gear unit and with the gear shaft on center plus or minus 2 degrees, readjust the gear shaft backlash. This will require loosening the adjusting screw until the backlash is evident. Retighten the adjusting screw until the backlash just disappears. Continue to tighten ⅜ to ½ turn from this position and tighten the lock nut 50 foot-pounds torque to maintain this setting.

GEAR REMOVAL

Imperial Models AY-1

(1) Disconnect the battery ground cable.

(2) Loosen the jacket tube clamp at the steering gear housing.

(3) Remove the cotter key and nut at the center link and disconnect the link from the arm.

(4) Remove the arm nut and washer at the steering gear shaft.

(5) Slide Tool C-3646 up on the arm and place the shoe of the puller behind the steering arm. Tightening the tool center screw against the gear shaft, will pull the steering arm from the gear shaft.

CAUTION: Do not remove the steering arm by prying with a lever or striking with a hammer as serious steering gear internal damage will result.

(6) Remove the four nuts and washers connecting the master cylinder to the brake booster and move the master cylinder towards the engine.

NOTE: Use a wire to attach the cylinder so that the brake tube will not be damaged.

(7) Disconnect the pressure and return hoses at the steering gear. Fasten the ends of the hoses above the oil level in the reservoir. Cap the ends of the hoses. Cap the fittings on the steering gear.

(8) Remove the coupling clamp bolt and slide the jacket tube up and off the steering gear from inside the vehicle by pulling up on the steering wheel (about 2 inches).

(9) Remove the gear housing to frame mounting bolts, washers and alignment wedge.

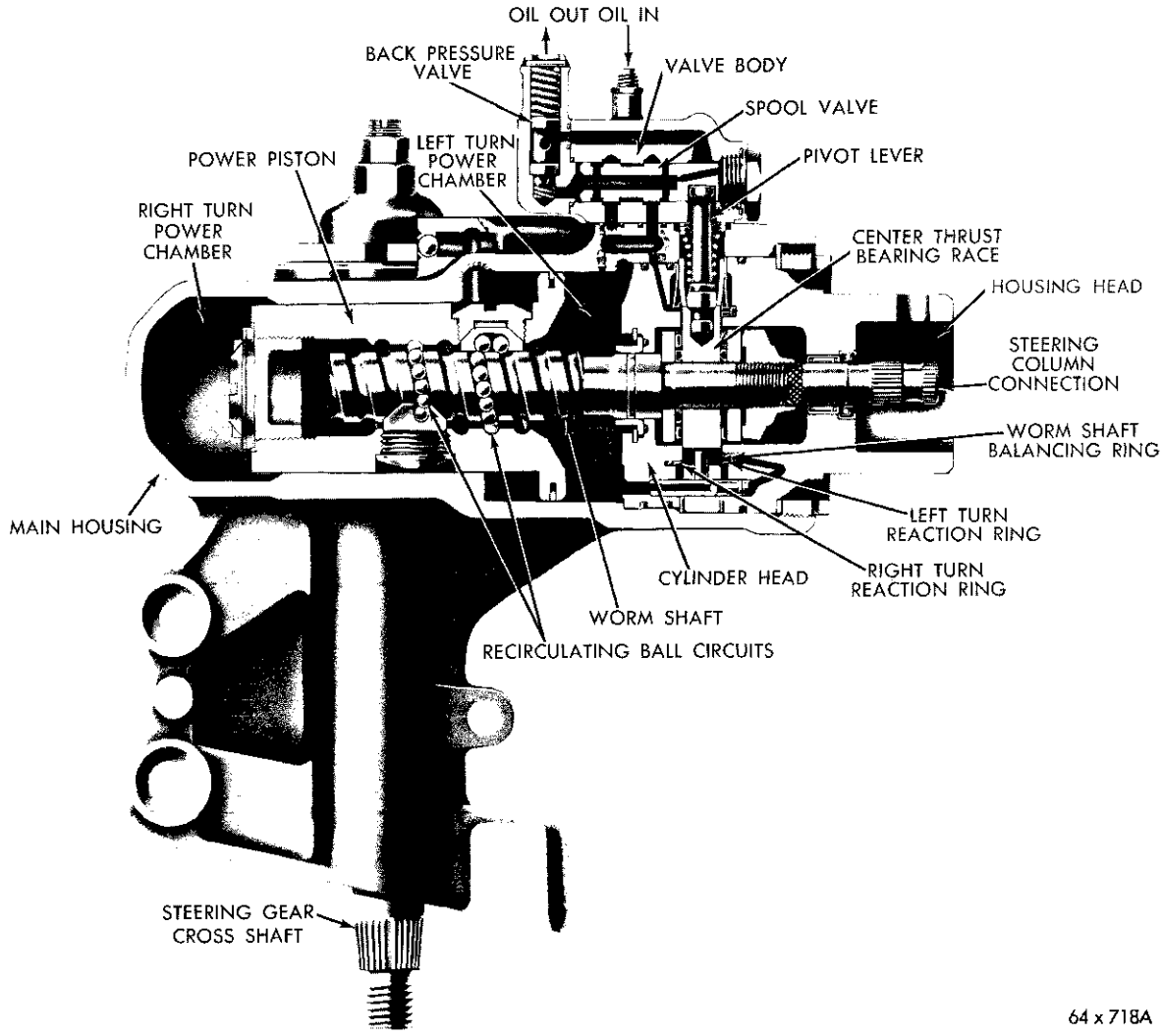


Fig. 1—Steering Gear (Sectional View)

(10) Remove the steering gear from under the vehicle.

Chrysler Models AC-1, AC-2, AC-3

(1) Disconnect the battery ground terminal.

(2) Disconnect the hoses at the gear control valve. Fasten the ends of the hoses above the oil level in the reservoir.

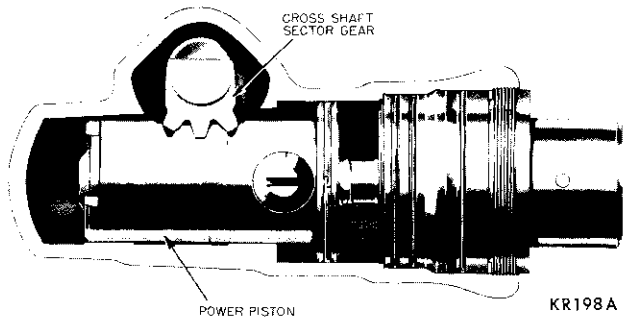


Fig. 2—Steering Gear Housing (Sectional View)

(3) Loosen the wormshaft to steering shaft coupling clamp bolt.

(4) From inside the vehicle loosen the steering column to instrument panel bracket and pull up on the column assembly until the coupling is clear of the steering gear wormshaft (about 2 inches).

(5) Raise the vehicle.

(6) Remove the cotter key and nut from the steering arm at the center link.

(7) Remove the center link from the steering arm using puller Tool C-3894.

(8) Remove the three bolts that mount the steering gear to the crossmember and remove the gear from under the vehicle.

GEAR RECONDITIONING

NOTE: Prior to disassembly, clean the gear assembly thoroughly in a suitable solvent and install the unit in the holding fixture Tool C-3323.

(1) When disassembling, each part should be placed in a suitable solvent, washed, then dried by

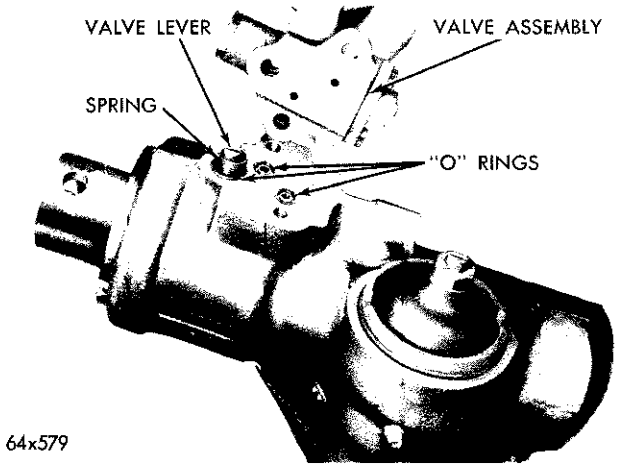


Fig. 3—Removing Valve Body Assembly

dry compressed air. Careful handling of the parts must be exercised to avoid the occurrence of nicks and burrs. Crocus cloth may be used to remove small nicks or burrs provided it is used carefully. When used on the steering gear valve, use extreme care not to round off the sharp edge portions of the two lands located between the valve drilled holes. The sharp edge portion of these two lands is vitally important to this type of valve.

(2) Drain the steering gear through the pressure and return connections by turning the wormshaft from one extreme of travel to the other.

(3) Remove the valve body housing attaching screws.

(4) Remove the valve body and the three "O" rings (Fig. 3).

(5) Remove the spring and valve lever. Pry under the spherical head with a screwdriver.

NOTE: Use care not to collapse the slotted end of the valve lever as this will destroy the bearing tolerances of the spherical head.

(6) Remove the gear shaft oil seal inner and outer as outlined in "Gear Shaft Oil Seal Replacement."

(7) Loosen the gear shaft adjusting screw locknut

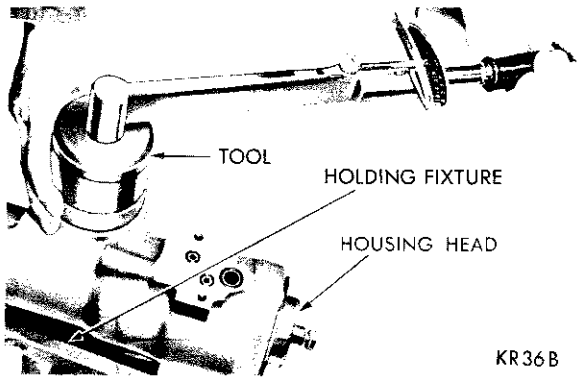


Fig. 4—Removing Gear Shaft Cover Nut

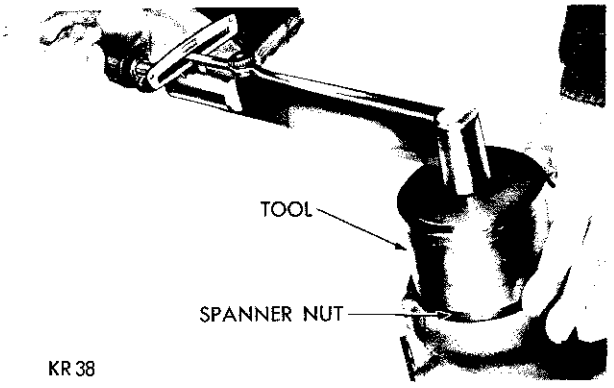


Fig. 5—Removing Steering Column Support Nut

to facilitate removal and remove the gear shaft cover nut with Tool C-3633 (Fig. 4).

CAUTION: Oil will be expelled when the gear shaft and cover are withdrawn from the housing.

(8) Rotate the worm shaft to the full right turn position, then return the worm shaft to the center of travel. This will place the piston in the center position (Fig. 2). Place Tool C-3786 on the threaded end of the gear shaft, then slowly withdraw the gear shaft until the sector teeth clear the housing. Rotate the shaft 180 degrees and allow the ends of the teeth to rest on the housing. The tool will prevent the needle bearings from falling out of their cages when the gear shaft is removed.

(9) Turn the wormshaft to the full right turn position to compress the power train parts and remove the housing head nut with Tool C-3634 (Fig. 5).

NOTE: By this procedure, the worm will be all the way into the position and the power train parts will be resting against the piston flange. It is imperative that the cylinder head, center race and spacer assembly and the housing head be maintained in close contact with each other. This will prohibit the teflon sealing ring on the wormshaft from becom-

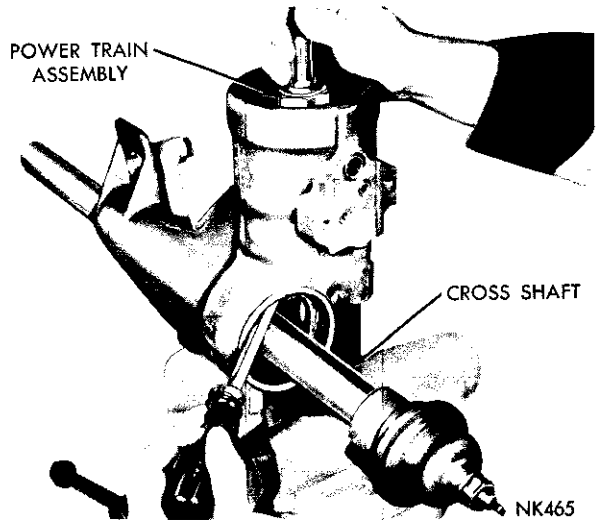


Fig. 6—Removing the Power Train

ing disengaged from its mating sleeve retained in the cylinder head. It will also eliminate the possibility of the reaction rings becoming disengaged from their grooves in both the cylinder head and the housing head.

(10) While holding the worm shaft in the fully compressed position, pry up on the piston teeth with a screwdriver using the gear shaft as a fulcrum and remove the power train (Fig. 6).

NOTE: By this procedure, the worm will be all the way into the piston and the power train parts will be resting against the piston flange. It is imperative that the cylinder head, center race and spacer assembly and the housing head be maintained in close contact with each other. This will prohibit the teflon sealing ring on the worm shaft from becoming disengaged from its mating sleeve retained in the cylinder head. It will also eliminate the possibility of the reaction rings becoming disengaged from their grooves in both the cylinder head and housing head.

(11) Remove the column jacket housing head tang washer.

NOTE: The needle bearing in the support consists of 33 needles originally retained in the support by heavy lubricant to facilitate assembly. This lubricant, however, will have become dissolved in the hot hydraulic fluid with the unit in operation.

(12) To make sure the bearing needles do not drop out when removing the housing head, place the arbor, Tool C-3929 on the wormshaft and slide the support and bearing kup on the arbor tool (Fig. 7).

(13) Place the power train in a vise equipped with soft jaws to avoid damaging the piston assembly.

CAUTION: Do not turn the worm more than one-half turn during disassembly.

(14) Hold the wormshaft from turning, then turn the thrust bearing nut with sufficient force to release the staked portions from the knurled section and remove the nut.

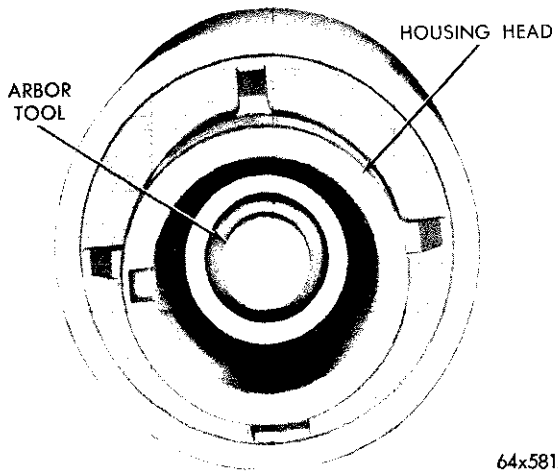


Fig. 7—Retaining the Bearing Rollers With Arbor Tool

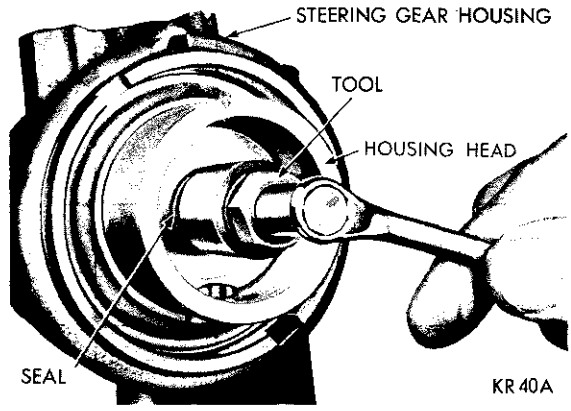


Fig. 8—Removing Wormshaft Upper Seal

NOTE: Wire brush the knurled section to remove the chips, then blow out the nut and wormshaft to remove any metal particles.

(15) Remove the upper thrust bearing race (thin).

(16) Remove the upper thrust bearing.

(17) Remove the center bearing race.

(18) Remove the lower thrust bearing.

(19) Remove the lower thrust bearing race (thick).

(20) Remove the lower reaction ring and the reaction spring.

(21) Remove the cylinder head assembly.

(22) Test the operation of the wormshaft. The torque required to rotate the wormshaft throughout its travel in or out of the piston must not exceed 2 inch-pounds.

NOTE: The worm and piston assembly is serviced as a complete assembly only and should not be disassembled.

(23) Remove the wormshaft upper seal with puller Tool C-3638 (Fig. 8).

CAUTION: Do not interchange the Imperial wormshaft support, reaction rings and seals with that of any other models. The machining on the AY1 model support is different, resulting in a difference of reaction feel.

(24) Remove the large "O" ring from the groove in the support.

(25) Remove the reaction seal from the groove in the face of the housing head with air pressure directed into the ferrule chamber (Fig. 9).

(26) Inspect all the grooves for burrs. Make sure the passage from the ferrule chamber to the upper reaction chamber is unobstructed.

(27) Install the wormshaft upper oil seal using Tool C-3650 (Fig. 10) (with the lip of the seal toward the bearing).

(28) Lubricate and install the reaction seal in the groove in the face of the housing head with the flat side of the seal out (Fig. 11).

(29) Remove the two "O" rings in the two outer grooves in the cylinder head.

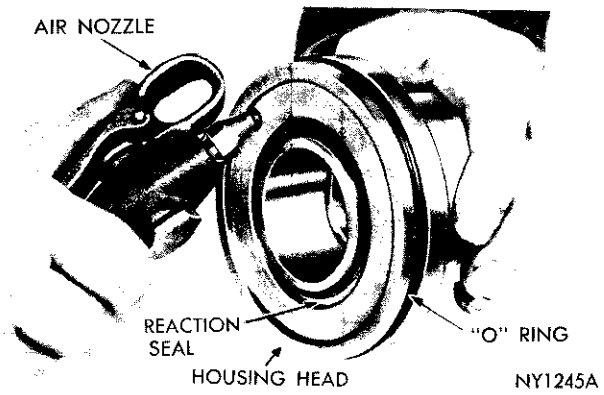


Fig. 9—Removing Reaction Seal From Housing Head

(30) Remove the lower reaction "O" ring in the groove in the face of the cylinder head. Apply air pressure into the oil hole located in the groove between the two "O" ring grooves (Fig. 12).

(31) Inspect the wormshaft seal in the cylinder head counterbore for possible damage; replace the cylinder head seal if necessary (Fig. 13).

(32) Inspect the oil passage in the ferrule for obstruction and cylinder head lands for burrs, then lubricate the two large "O" rings and install in the grooves on the cylinder head.

(33) Install the cylinder head oil seal, back-up ring and retainer (if removed). Make sure the retainer is seated in the groove.

(34) Install the lower reaction seal in the cylinder head groove.

NOTE: The small "O" ring for the ferrule groove should be installed after the worm shaft bearing preload has been established; otherwise, the small "O" ring will be damaged by the reaction springs and the center bearing spacer.

(35) Remove the gear shaft adjusting screw lock nut and remove the small "O" ring from the top of the cover and large "O" ring from the base of the cover (Fig. 26).

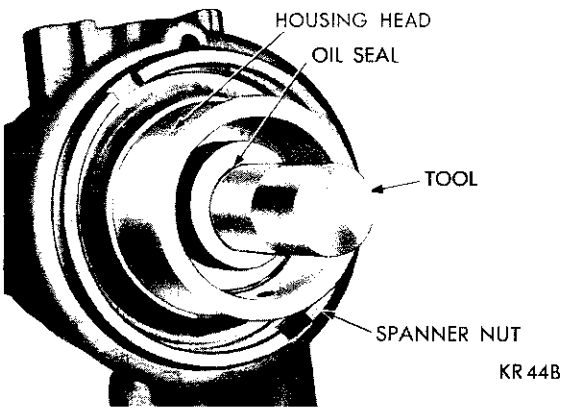


Fig. 10—Installing Wormshaft Upper Seal

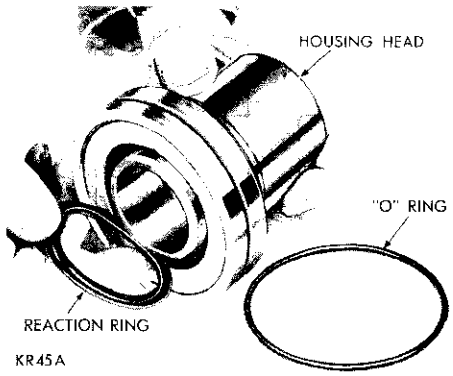


Fig. 11—Installing Reaction Seal Into Housing Head

CAUTION: The needle bearing in the cover consists of 51 needles originally retained in the cover by heavy lubricant to facilitate assembly. This lubricant, however, will have become dissolved in the hot hydraulic fluid with the unit in operation.

NOTE: If for some reason, the cover assembly must be removed from the gear shaft, the 51 needles will fall out of the cover. If any needles (51) become lost, it will be necessary to replace the cover and bearing as an assembly. Use wheel bearing lubricant to retain the needle rollers in the cover when reassembling.

(36) Lubricate a new small "O" ring and install it over the adjusting screw into position at the top of the gear shaft cover.

(37) Lubricate an "O" ring and gear shaft cover with petrolatum and install the "O" ring in the cover groove.

(38) Install the adjusting screw lock nut, but do not tighten.

(39) Attach the steering gear housing in the hold-

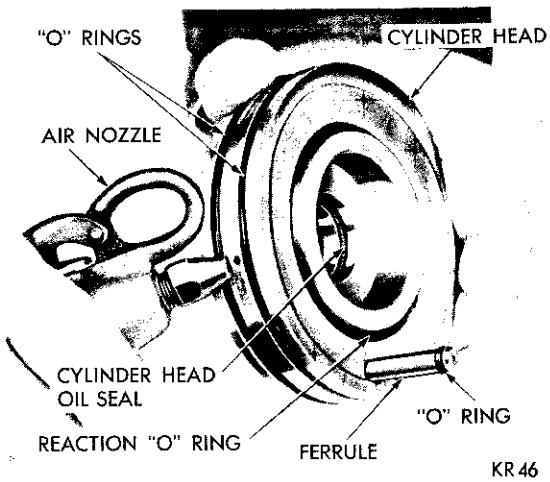


Fig. 12—Removing Reaction Ring Seal From Cylinder Head

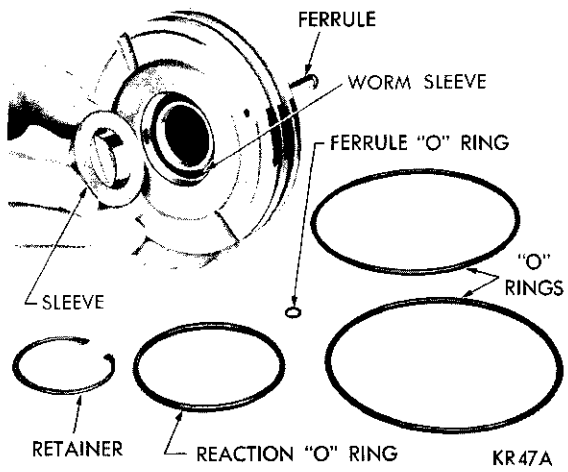


Fig. 13—Removing Cylinder Head Seal

ing fixture Tool C-3323 and place the holding fixture in a vise.

(40) If necessary to remove the housing bearings, use puller, Tool C-3332 with adapter SP-3062 (Fig. 14) as follows:

(a) Engage the jaws behind the bearing, hold the center screw while turning the puller nut to pull the lower (outer) needle bearing out of the housing.

(b) Use puller, Tool C-3332, to remove the upper (inner) needle bearing.

(41) Install gear shaft bearings into the housing with installer, Tool C-3333 (lettered end of the bearings against the installer tool). Press the bearings to ⅛ inch below the edge of the counterbore.

(42) If the power piston ring (Figs. 15 and 16) was removed at disassembly, inspect the condition of the rubber sealing ring and install a new cast iron ring with Tool C-3676, Piston Ring Remover and Installer, as follows:

(a) Position Tool C-3676 in the vise (Fig. 17).

(b) Slide a new piston ring into place in the piston groove.

(c) Place the piston and ring assembly in Tool C-3676 with the lower part of the piston and the ring resting on the land of tool.

(d) Press down on the piston to bottom the piston ring in the piston groove, forcing the open ends of the ring out for ease of locking the ring. The ring should be positioned with ring hooks in line with the ball guide plug.

(43) Place the piston assembly in a vertical position (worm shaft up) in a vise equipped with soft jaws.

(44) Slide the cylinder head assembly (ferrule up) on the wormshaft, inspect the wormshaft seal ring making sure gap is closed to avoid damaging ring as cylinder head moves against piston flange.

(45) Lubricate with Power Steering Fluid Part No. 2084329 and install the following parts in order:

(a) Lower thrust bearing race (thick).

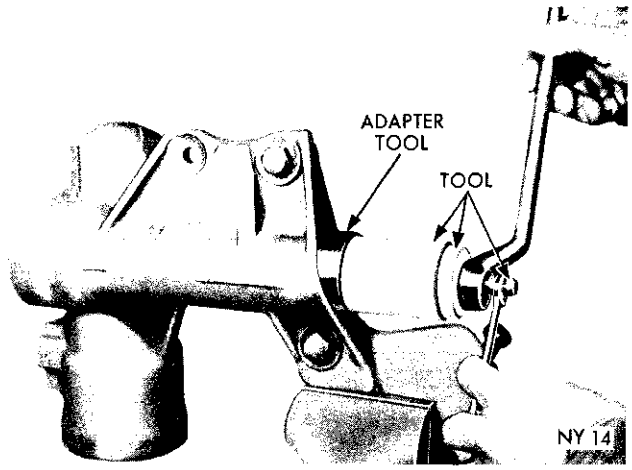


Fig. 14—Removing Housing Lower Bearing

(b) Lower thrust bearing.

(c) Lower reaction spring (with smallhole over the ferrule).

(d) Lower reaction ring (flange up so the ring protrudes through the reaction spring and contacts the reaction "O" ring in the cylinder head).

(e) Center bearing race.

(f) Upper thrust bearing.

(g) Upper thrust bearing race (thin).

(h) Start the wormshaft thrust bearing nut (do not tighten).

(46) Turn the wormshaft counterclockwise one-half turn. Hold the wormshaft in this position while tightening the nut to 50 foot-pounds to prestretch the wormshaft threads.

CAUTION: If the wormshaft is turned more than one-half turn, the cylinder head sleeve will clear the oil seal ring on the wormshaft. Always position the wormshaft oil seal ring before bottoming the cylinder head against the piston top flange to avoid damaging the oil seal ring.

(47) Loosen the adjusting nut. Place several rounds of cord around the center bearing race (Fig. 18). Make a loop in one end of the cord and hook the loop of a distributor breaker arm spring scale Tool MTU-36 in the cord loop. Pulling the cord will cause the bearing race to rotate. Retighten the worm bearing adjusting nut while pulling on the cord with the scale. If the adjusting nut is tightened properly, reading on the scale should be 16 to 24 ounces (20 ounces preferred) while the bearing race is turning.

CAUTION: Place a support under the adjusting nut during the staking operation to avoid brinelling the piston and the worm bearings.

(48) Stake the upper part of the wormshaft adjusting nut into the knurled area of the shaft as follows:

(a) Hold a ¼ inch flat end punch on the center line of the wormshaft and perpendicular to the wormshaft and at a slight angle to the nut flange (Fig. 19).

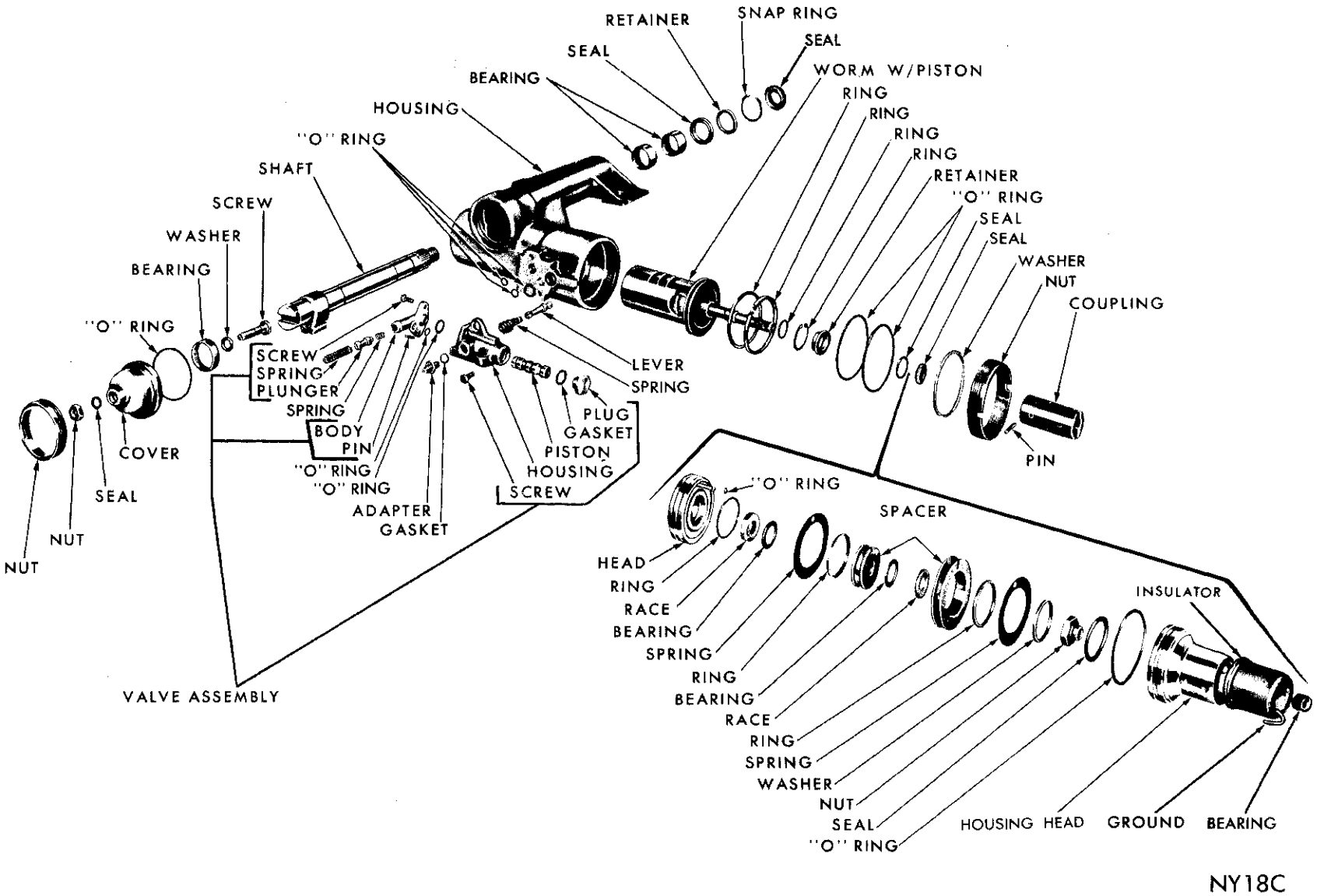


Fig. 15—Steering Gear (Disassembled View) Models AC-1, AC-2 and AC-3

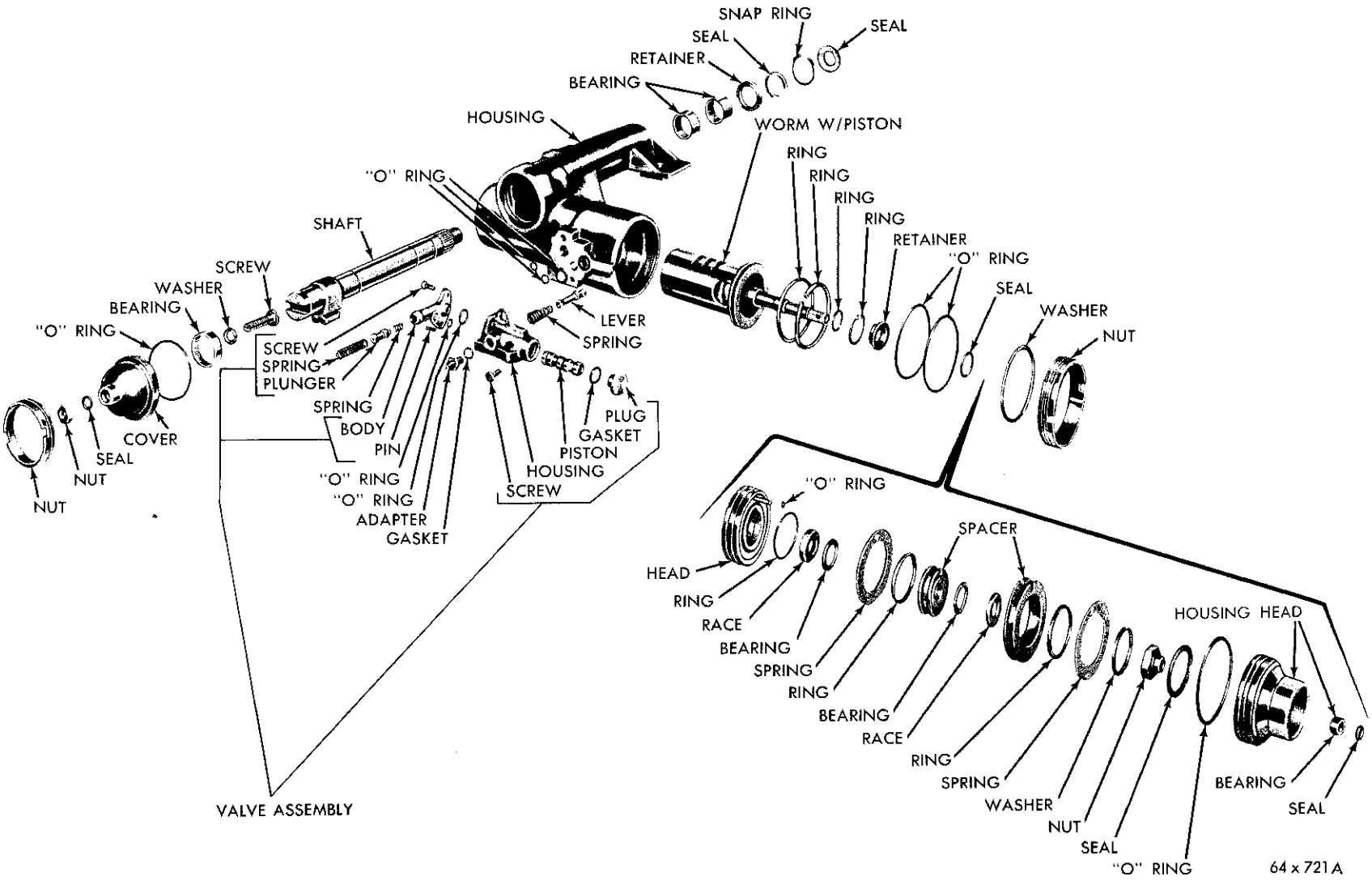


Fig. 16—Steering Gear (Disassembled View) Models AY-1

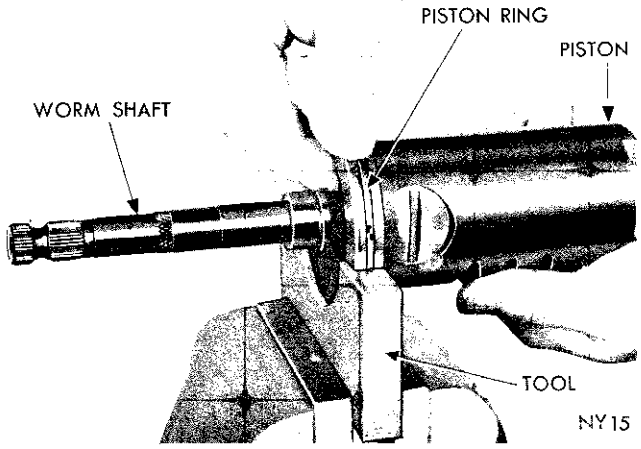


Fig. 17—Installing the Piston Ring

(b) Strike the punch a sharp blow with a hammer and recheck the preload.

NOTE: If the adjusting nut moved during the staking operation, it can be corrected by striking the nut a glancing blow in the direction required to regain proper preload.

(c) After the proper preload, stake the nut at three more locations 90 degrees apart around the upper part of the nut.

(d) To test the total staking, tighten the nut to 28 foot-pounds torque in either direction. If the nut does not move, the staking operation is satisfactory.

IMPORTANT: Retest the preload adjustment, the torque of 16 to 24 inch ounces must remain after the adjusting nut is securely locked.

(49) Install the center bearing spacer assembly over the center bearing race and engage the dowel-pin of the spacer in the slot of the race and the slot of the spacer entered over the cylinder head ferrule.

NOTE: This will align the valve lever hole in the center bearing race with the valve lever hole in the center bearing spacer assembly.

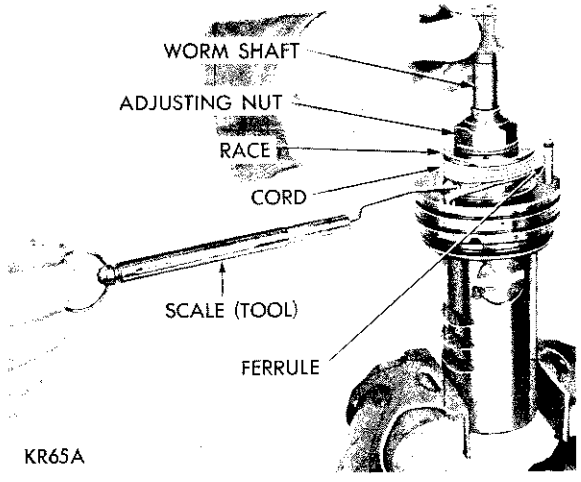


Fig. 18—Adjusting Center Bearing Pace Preload

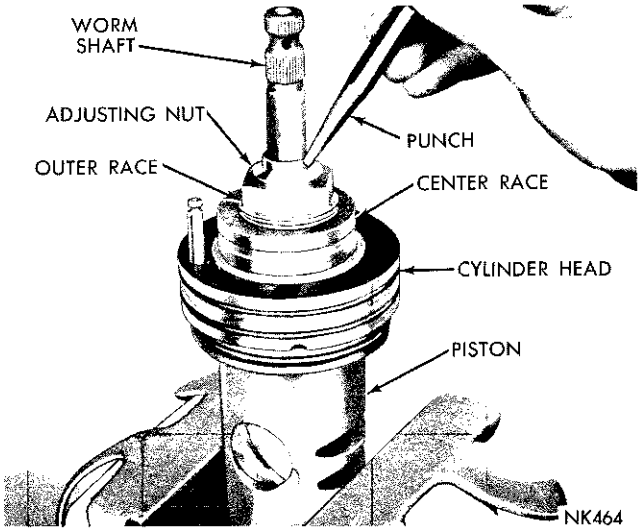


Fig. 19—Staking Wormshaft Bearing Adjusting Nut

(50) Install the upper reaction ring on the center bearing spacer with the flange down against the spacer.

(51) Install the upper reaction pressure spring over the reaction ring with the cylinder head ferrule through the hole in the reaction spring.

(52) Install the reaction ring (without flange) inside the upper reaction ring.

(53) Lubricate the ferrule "O" ring with petrolatum and install it in the groove on the cylinder ferrule.

(54) Carefully install the housing head over the wormshaft, engaging the cylinder head ferrule and the "O" ring and making sure the reaction rings enter the circular groove in the housing head.

CAUTION: Form a .0015 inch feeler gauge into a coil and insert with the housing head to protect the lip of the seal when installing over the wormshaft serrations.

(55) Align the parts on the power train so that the valve lever hole in the center bearing spacer assembly is 90 degrees counterclockwise from the piston rack teeth and hold all the parts together.

(56) With the steering gear housing in the holding fixture Tool C-3323 in approximate vehicle installed position; lubricate the bore of the housing with petrolatum and carefully install the power train assembly with the center bearing spacer valve lever hole in "UP" position (Fig. 1) to line up with the control valve lever clearance hole in the steering gear housing.

CAUTION: Place a feeler stock, .0015 inch, to cover the aligning notch in the steering gear housing to protect the "O" ring seals when installing the gear train.

Make sure the cylinder head is bottomed on the housing shoulder (Fig. 1). Do not release pressure

on the power train (Fig. 6) until all the parts are positioned in the steering gear housing.

(57) Align the valve lever hole in the center bearing spacer exactly with the clearance hole in the housing, with aligning Tool C-3649.

NOTE: Aligning tool should not be removed until the spanner nut is securely tightened.

(58) Install the housing head spanner nut and tighten the nut 110 to 200 foot-pounds with Tool C-3634 (Fig. 5).

(59) Set the piston at the center of travel and install the gear shaft and cover assembly so that the sector teeth index with the piston rack teeth. Make sure the "O" ring is properly positioned in the face of the cover (Fig. 26).

(60) Install the cover spanner nut and tighten the nut 110 to 200 foot-pounds with Tool C-3633 (Fig. 4).

(61) Install the valve lever (double bearing end first) into the center bearing spacer through the hole in the steering housing so that the slots in the valve lever are parallel to the wormshaft in order to engage the anti-rotation pin in the center bearing race.

NOTE: Turn the worm until the piston bottoms in both directions and observe the action of the lever. It must return easily to its center position when the worm torque is relieved.

(62) Install the spherical spring over the valve lever, large end of the spring up.

(63) Install the valve body on the housing making sure that the valve lever enters the hole in the piston (Fig. 1). Be sure that the "O" ring seals are in place. Tighten valve mounting screws to 30 inch-pounds.

(64) Install a new inner oil seal, back-up washer, retainer, and new outer seal as outlined in "Gear Shaft Oil Seal Replacement."

FINAL TEST AND ADJUSTMENTS

(1) Remove the oil reservoir cover and fill the reservoir to the bottom of the filler neck opening.

(2) Connect the test hoses, Tool C-3211 and Tool C-3318, with the proper adapters to the hydraulic pump on the vehicle with pressure gauge Tool C-3309B installed between the pump and the steering gear to register the pressures.

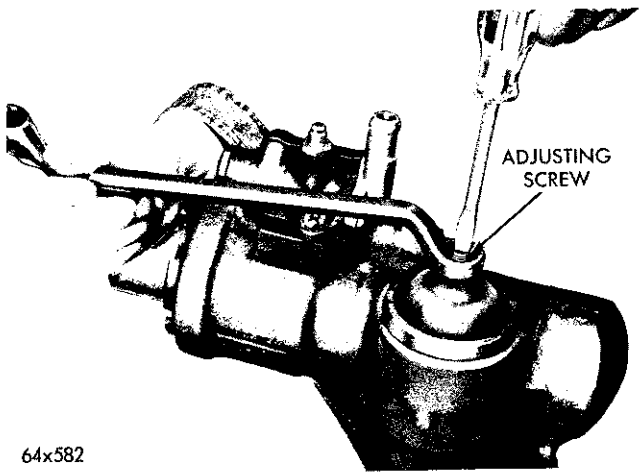


Fig. 20—Steering Gear Shaft Adjustment

(3) Start the engine and operate at idle to bring the steering gear to normal operating temperature.

(4) Expel all the air from the unit by turning the wormshaft several times to the right and then to the left.

(5) Refill the reservoir before proceeding with the following test and adjustments on the bench:

(a) Tighten the steering valve body attaching screws to 7 foot-pounds.

(b) Install a steering gear shaft arm on the steering gear shaft.

(c) With the gear shaft on center, tighten the gear shaft adjusting screw until the backlash just disappears. Tighten 1¼ turns from this position and while holding the adjusting screw in this position, tighten the lock nut (Fig. 20).

NOTE: This will bring the piston rack and the sector teeth in full alignment.

(d) Turn off the hydraulic power to the unit. Operate the unit manually from a minimum of 180 degrees from center in each direction, measured at the wormshaft.

(e) With the hydraulic power applied to the unit and with the gear shaft on center plus or minus 2 degrees, readjust the gear shaft backlash. This will require loosening the adjusting screw until the backlash just disappears. Continue to tighten ⅜ to ½ turn from this position and tighten the lock nut to 50 foot-pounds to maintain this setting.

(f) Starting from a point at least one full turn of the wormshaft either side of center, the torque at the gear shaft required to turn the unit through center at 2 rpm in each direction shall not exceed 25 foot-pounds from left to right. Perform this operation carefully to prevent a lockup in the steering gear.

(g) Adjust the torque evenly by moving the steering valve assembly by tapping gently on the back pressure valve body attaching screws to move the valve body up on the steering housing and tap on the end plug to move the valve body down on the housing.

NOTE: If the torque is greater to the right, move the control valve body "Down." If the torque is greater to the left, move the valve body "Up." After positioning the valve to obtain equal torque, tighten the valve body attaching screws to 15 foot-pounds to maintain this setting.

(h) With the unit at or near the full turn in either direction, attempt to return the unit to the center by applying a torque wrench at the steering gear cross shaft. Hold the wormshaft until the cross shaft torque builds up to 50 foot-pounds. Release the wormshaft and maintain a constant steady pull on the cross

shaft (turning cross shaft slowly). If the cross shaft torque does not drop to 25 foot-pounds maximum as the piston passes through the center, check for too much interior drag; binding valve lever, binding valve spool, or cross shaft adjustment is too tight.

(i) With the unit under power, but without any load, the torque required to rotate the wormshaft through an included angle of 180 degrees (90 degrees either side of center) shall be 6 to 9 inch-pounds.

(j) If the steering gear tests are satisfactory, disconnect the test equipment.

GEAR INSTALLATION

Imperial:

(1) Enter the steering gear from under the vehicle and install the spherical, flat and lockwashers and nuts, but do not tighten.

(2) Install the Steering Gear Housing Aligning Tool C-3949 in place of the vehicle steering column and jacket tube and align the steering gear as follows:

(a) Slide the lower end of the aligning tool into position on the steering gear wormshaft support and the upper end at the instrument panel clamp.

(b) Install the jacket tube support bracket clamp at the instrument panel. Tighten the instrument support bracket clamp bolts to 95 inch-pounds.

(c) Tighten the two forward steering gear mounting bolts to 50 foot-pounds torque (Fig. 21).

(d) Install the serrated wedge over the rear mounting bolt between the steering housing and the frame parallel to the axis of the steering gear wormshaft so that the tapered surfaces match, then tap the wedge gently but firmly into the space.

(e) Tighten the rear mounting bolt to 50 foot-pounds. This locks the gear in place and maintains steering gear alignment.

(f) Remove the jacket tube support bracket clamp at the instrument panel and remove the Steering Gear Housing Aligning Tool C-3949.

(3) Install the steering column and jacket assembly through the floor panel from the driver's side and start the coupling on the steering gear wormshaft, making certain the master serration on the coupling indexes with the missing serration on the wormshaft.

NOTE: The steering column assembly should be moved down onto the wormshaft until the wormshaft lightly bottoms on the locating pin pre-assembled into the coupling.

(4) Install the coupling clamp bolt and tighten to 33 foot-pounds.

(5) Align the jacket tube at the instrument panel and install the jacket tube clamp and attaching screws. Tighten the screws finger tight.

CAUTION: While the steering column is not rigidly attached to the instrument panel use extreme care to prevent any misalignment of the column from the true column position which would result in damage to the flexible coupling disc and horn ground.

(6) After positioning the steering column assembly so that the flexible coupling disc assumes an unstressed axial position, and the top of the steering column is correctly aligned with the instrument panel bracket clamp, tighten the clamp bolts to 95 inch-pounds.

(7) Slide the floor pan support plate into position, centering it around the column jacket, install the attaching bolts. Tighten bolts to 95 inch-pounds.

(8) Move the jacket "O" ring down the jacket into position and bolt the "O" ring retaining plate to the toe board support plate. Tighten bolts to 95 inch-pounds.

(9) Install the lower column plate to the instrument panel.

(10) Connect the pressure and return hoses at the steering gear.

(11) With the steering gear centered in its travel and the steering wheel and front wheels in the straight ahead position, connect the steering gear arm to the steering gear cross shaft. Install the washer and nut. Tighten nut to 120 foot-pounds.

(12) Install the steering center link, tighten to 30 foot-pounds and install cotter pin.

(13) Refill the reservoir. Expel all the air from the system by turning the steering wheel several times to the right and left.

(14) Connect the battery ground cable.

Chrysler:

(1) From under the vehicle position the gear on the crossmember and install the three mounting bolts. Tighten the bolts to 50 foot-pounds.

(2) Position the steering gear in the center of the high spot (worm master spline should be at 12 o'clock) and install the steering arm, washer and nut. Tighten nut to 120 foot-pounds.

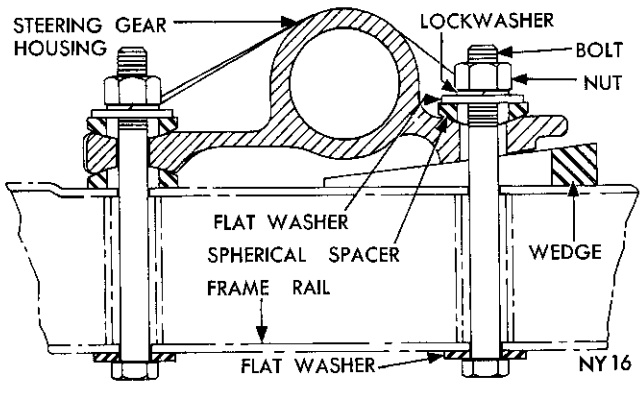


Fig. 21—Steering Gear Mounting—Models AY-1

(3) Connect the hoses to the gear steering valve assembly.

(4) From inside the vehicle push down on the steering wheel until the steering shaft coupling engages the worm with the master spline on the wormshaft and the notch on the body of the coupling aligned. Position the clamp on the coupling, install the bolt and tighten to 33 foot-pounds.

(5) With the wheels straight ahead position the center link on the steering arm and install the washer and nut. Tighten the nut to 120 foot-pounds.

(6) Lower the vehicle.

(7) Connect the battery ground cable.

(8) Fill the reservoir.

(9) Start the engine and operate the steering wheel from left to right several times to expel the air from the system.

(10) Refill the reservoir to the proper level.

CONTROL VALVE RECONDITIONING

(1) Remove the two screws attaching the pressure control valve body to the steering valve body and remove the back pressure control valve assembly (Fig. 22).

(2) Compress the pressure control valve spring and remove the retainer pin, spring, pressure control valve piston and back pressure valve cushion spring.

(3) Carefully shake out the steering valve piston. Inspect the valve for nicks, burrs and scores.

NOTE: If the steering valve or valve housing is damaged, replace the valve and housing assembly.

Do not remove the valve end plug unless inspection indicates a leak at the seal.

Small burrs and nicks may be removed with crocus cloth, if extreme care is used not to round off the sharp edge portion of the valve. The sharp edge portion is vitally important to the operation of this valve.

(4) Clean the valve bodies and valve pistons thoroughly in clean solvent. Blow out all passages and blow parts dry with dry compressed air. Lubricate the pistons and bores with Power Steering Fluid Part No. 2084329.

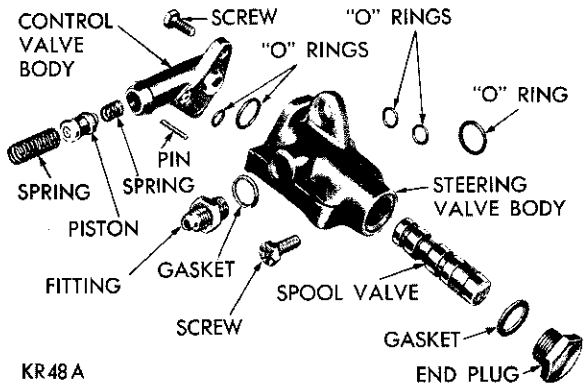


Fig. 22—Steering Valve (Disassembled View)

(5) Install the steering spool valve into the valve housing so that the valve lever hole is aligned with the lever opening in the valve body. The valve must be perfectly free in the valve body without sticking or binding.

(6) Install a new seal and end plug (if removed). Tighten the plug to 25 foot-pounds.

(7) Install the back pressure valve cushion spring in the back pressure valve body. Lubricate the back pressure valve piston and insert the nose end of the piston into the body bore. Test for smooth operation. Be sure the lower spring is not cocked.

(8) Install the pressure control valve spring on top of the valve piston. Compress the spring and install the retaining pin.

(9) Install the two "O" rings and assemble the back pressure valve assembly to the control valve body. Tighten the two attaching screws to 10 foot-pounds.

(10) If the pressure inlet fitting has been removed, replace the copper gasket and retighten the fitting to 30 foot-pounds.

GEAR SHAFT OIL SEAL REPLACEMENT

NOTE: The gear shaft oil seal may be replaced in the vehicle or on the work bench. To clearly show the tool application the illustrations show the seal replacement operations on the work bench.

(1) Raise the vehicle.

(2) Remove the cotter key and nut connecting the steering gear arm to the center link.

(3) Remove the tie rod end with Tool C-3894. (See "Tie Rod End Replacement.")

(4) Remove the steering gear arm nut and washer.

(5) Slide Tool C-3646 upon the arm and place the shoe of the puller behind the steering arm (Fig. 23). Tightening the tool center screw against the gear shaft will pull the steering gear arm from the gear shaft.

CAUTION: Do not remove the steering arm by prying with a lever or striking with a hammer as serious steering gear internal damage will result.

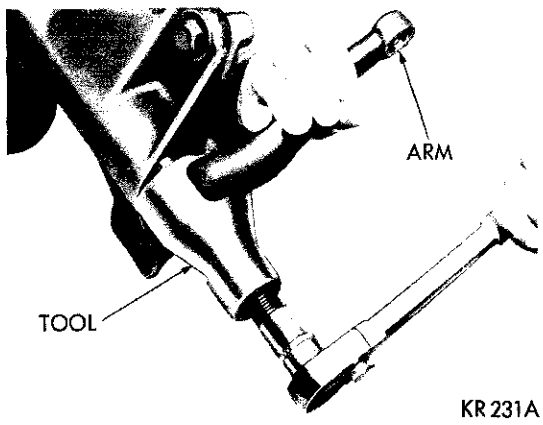


Fig. 23—Removing Steering Gear Arm

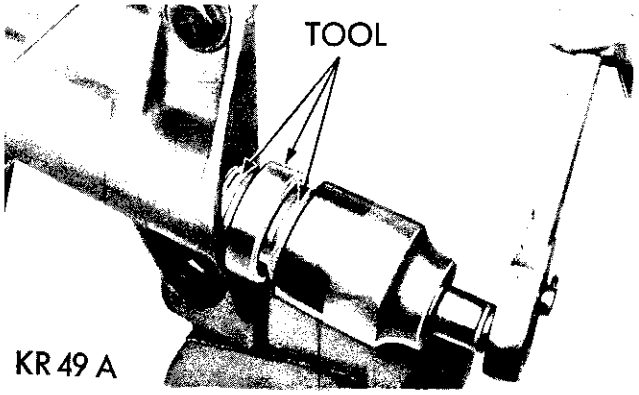


Fig. 24—Removing Gear Shaft Oil Seal

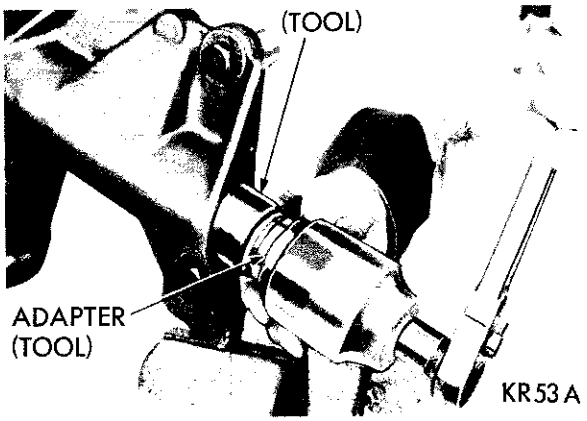


Fig. 25—Installing Gear Shaft Oil Seal

(6) Remove the gear shaft, grease retainer with adapter SP-3056 and Tool C-3350 (Fig. 24) as follows:

(a) Slide the threaded position of the adapter SP-3056 over the end of the gear shaft.

(b) Install the nut section of Tool C-3350 on the gear shaft.

(c) Maintain pressure on the adapter SP-3056 with the nut section of Tool C-3350 while turning adapter SP-3056 into the seal until it has bottomed in the seal.

(d) Install the two half-rings and ring retainer of Tool C-3350 over adapter and nut section of tool.

(e) Turn the nut section counterclockwise; as the hexagon nut is removed from the gear shaft, the oil seal will be pulled from the housing.

(7) Remove the oil seal snap ring with pliers Tool C-3229 and remove the oil seal back-up washer and repeat operation a, b, c, d, to remove the inner seal.

(8) Install the gear shaft inner oil seal into the steering gear housing (lip of seal toward the needle bearings) with the adapter SP-3052 and Tool C-3350 as follows:

(a) Place long lip of adapter SP-3052 against seal.

(b) Thread the tool nut on the threaded end of the gear shaft (Fig. 25).

(c) Turn the tool nut on the gear shaft until the shoulder of the adapter tool contacts the housing.

(d) Remove the tools and install the oil seal back-up washer and retainer ring.

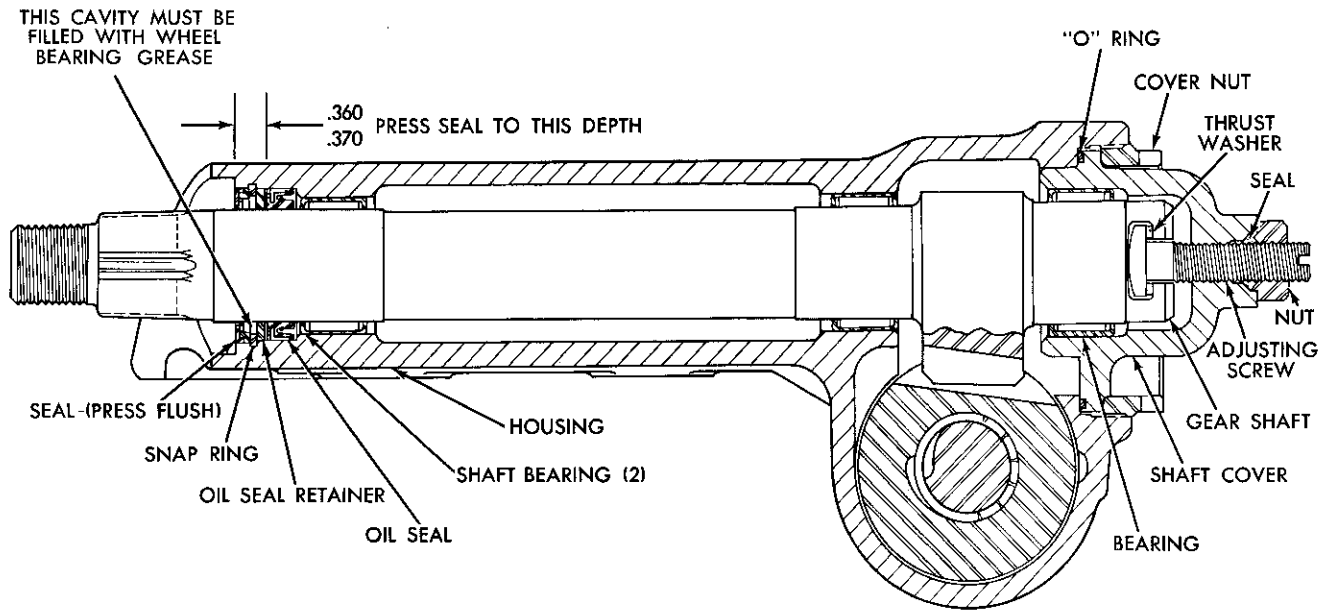


Fig. 26—Steering Gear Housing (Sectional View)

CAUTION: Make sure the snap ring is properly seated in the housing groove (Fig. 26).

(e) Fill the cavity of the housing base to within 3/16 inch of the end of the bore with wheel bearing grease. Any surplus grease will squeeze out around inner edge of seal when the seal is installed.

(f) Position the gear shaft grease retainer with lip of seal towards the needle bearings and with the hub of the adapter SP-3052 against the seal, install the seal.

POWER STEERING PUMP

Description

The power steering pump is a belt-driven constant displacement pump.

In operation (Fig. 1) the spring loaded slippers in the pump rotor are in contact with the eccentric, inside diameter of the housing. As a rotor revolves, the slippers force the oil from the inlet side of the pump to the flow control valve. Orifices in the metering insert permit a flow of approximately two gallons per minute to the gear before the valve moves to the right to allow the excess to flow back to the inlet side of the pump. Maximum pressure in the system is limited by the pressure relief valve. The valve opens into the reservoir when the pressure exceeds the maximum pressure specified.

SERVICE PROCEDURES

FLUID LEVEL

(1) Start the engine, turn the steering wheel back and forth several times to expel the air from the system, then shut off the engine.

(2) Wipe the reservoir filler cap free of dirt then remove the cap and visually inspect the oil level in the reservoir.

Engine Cold—Oil level should be at the bottom of filler neck.

Engine Hot—Oil level should be one-half way up in fill neck.

If necessary, add only Power Steering Fluid Part No. 2084329 to the required level. Do not overfill.

PRESSURE TEST

(1) Measure the pump belt tension. See "Cooling System," Group 7.

(2) Disconnect the pump to the steering gear pressure hose at the power steering pump. Connect the test hose Tool C-3388 with the proper adapter between the power steering pump and pressure gauge Tool C-3309B with a shut-off valve between the pressure gauge and the pressure hose that you disconnected from the pump (Fig. 2).

NOTE: Make sure all connections are tight and that the shut-off valve is fully opened. The pressure gauge must be installed between the pump and the shut-off valve, all connections must be tight and the shut-off valve fully open.

(3) Remove the oil reservoir filler cap.

(4) Connect one lead of the tachometer to the distributor terminal of coil and the other to a good ground, start the engine and operate at 500 rpm and fill the pump reservoir to the proper level.

(5) Expel all the air from the unit by turning the steering wheel to the full right turn and back to the full left turn several times and recheck oil level.

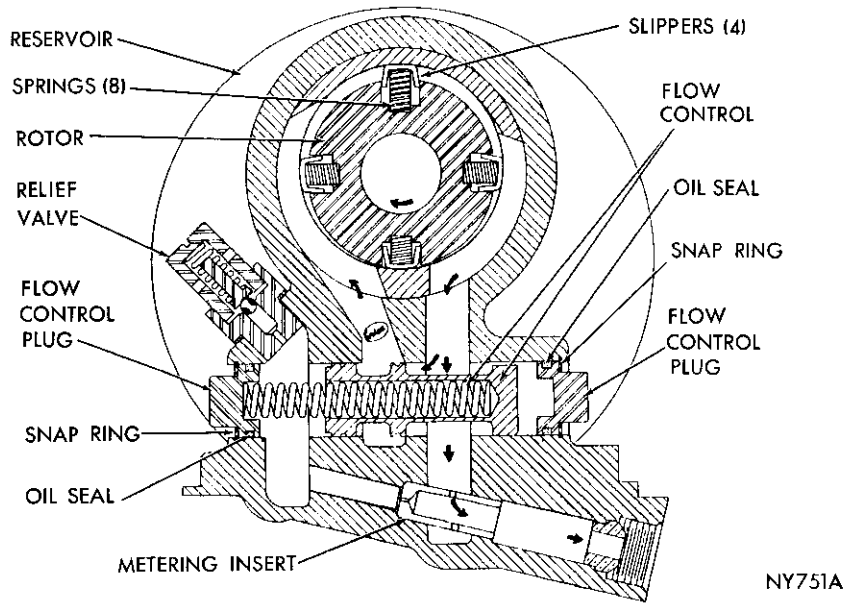


Fig. 1—Power Steering Pump—Oil Flow

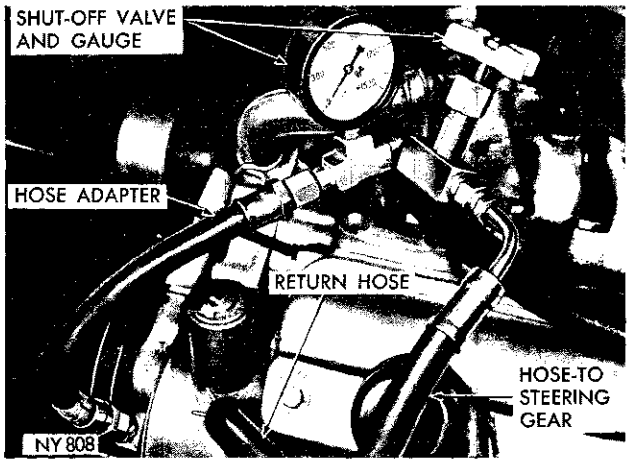


Fig. 2—Pressure Test

NOTE: To assist in heating the pump oil; slowly turn the pressure gauge valve towards the closed position until the gauge reads 400 psi and open the valve fully when the oil temperature reaches 150 degrees F.

(6) With the engine operating at 500 rpm and no steering effort applied, the oil temperature should be between 150 and 170 degrees F. (measure with a thermometer in the reservoir); the pressure gauge should show a pressure of less than 1000 psi. If the pressure is higher, inspect the hoses and connections for kinks and obstructions, or restrictions in the steering gear.

(7) Increase the engine speed to 1000 rpm, then slowly close the gauge shut-off valve. With the gauge shut-off valve fully closed the pump pressure should be as follows:

950 to 1000 psi for Chrysler Models with .96 displacement pump. 1000 to 1100 psi for Chrysler Models with 1.2 displacement pump. 1200 to 1300 psi for Imperial Models.

NOTE: For identification the 1.2 displacement pump has a milled slot for a machined hex in the end of the pulley shaft. The .96 displacement pump does not have the milled slot.

CAUTION: Do not close the valve for more than a few seconds, as this would abnormally increase the oil temperature and cause undue oil pump wear.

a. If the pressure increases to more than that indicated above, the relief valve is faulty or the pump is equipped with the wrong relief valve.

b. If the pressure is less than that indicated above, the relief valve is faulty. Replace the relief valve with the correct relief valve known to be in working order and repeat the test in step (7). If the pressures are still below specifications, disassemble the pump and inspect the flow control valve for evidence of fouling or slipper spring breakage.

c. With the gauge shut-off valve fully open, operate the steering unit through another cycle, this time holding the unit at the extreme travel in each direction while watching the oil pressure gauge. The gauge reading should be equal in each direction. If not, it indicates excessive internal leakage in the steering gear unit.

NOTE: Do not hold the steering wheel at either extreme position for more than a few seconds.

d. If the pressures are within the ranges specified; make a flow test as outlined in "Pump Flow Test."

PUMP FLOW TEST

(1) Inspect the pump belt tension. See "Cooling System" Group 7.

(2) Disconnect the pump pressure hose at the power steering pump and connect the test hose adapter tube and pressure gauge Tool C-3309B with the proper adapters between the power steering pump and the hose disconnected from the pump (Fig. 3).

NOTE: The pressure gauge must be installed between the pump and the shut-off valve; all connections must be tight and the shut-off valve fully open.

(3) Disconnect the return hose at the power steering pump. Use care to avoid damaging the return hose screen. Remove the return hose screen and examine for rips or creases. If the screen is damaged replace with a new screen, inspect the reservoir for any loose pieces of screen. Make certain that the screen is clean and properly reinstalled after completion of the pump flow test.

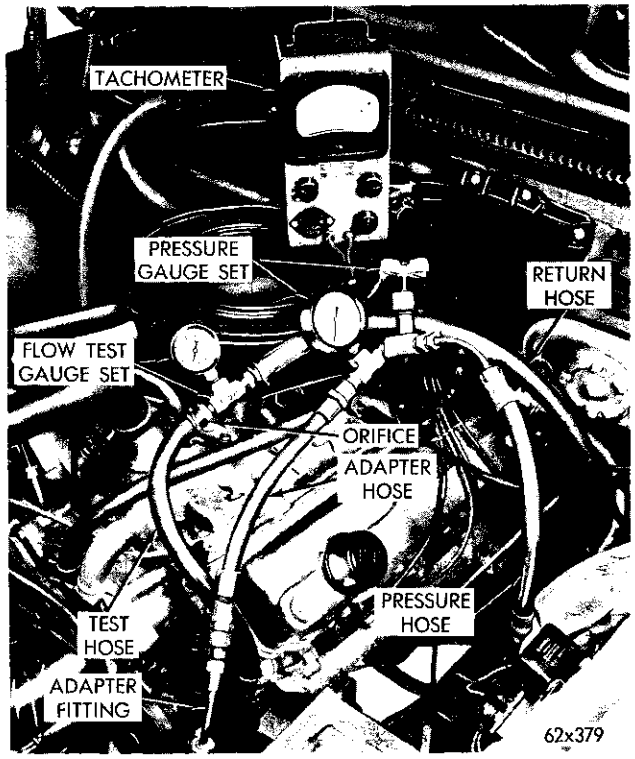


Fig. 3—Flow Test Connections

(4) Install the flow checking gauge set Tool C-3885 with the special hose between the power steering pump and the return hose disconnected from the pump (Fig. 3).

NOTE: The fitting that has the restriction, and the arrow on the "tee" connector (Fig. 3) must be towards the power steering pump. Use orifice SP-3825.

(5) Remove the oil reservoir cover and fill the reservoir to the proper level.

(6) Start the engine and operate at 500 engine rpm.

(7) Expel all the air from the unit by turning the steering wheel to the full right turn and back to the full left turn several times and recheck oil level.

(8) Increase the engine speed 1000 to 1200 rpm and no steering effort applied, oil temperature between 150 and 170 degrees F. (Check the thermometer in the reservoir); the flow pressure gauge in the pump return line should read between 14 and 25 psi. If correct measuring orifice is used for test, and flow pressure gauge registers less than 14 psi inspect to see if the restrictor is installed properly, if O.K., dirt may be restricting control valve movement or blocking the orifice or flow valve spring may be weak. If the return pressure is greater than 25 psi, the flow valve may be stuck in the closed position.

(9) Decrease the engine speed to 500 rpm, then slowly turn the pressure gauge shut-off valve towards the closed position to obtain 850 psi on the pressure gauge at the pump discharge without fully closing the shut-off valve.

CAUTION: Do not close the valve completely.

With 850 psi registered on the pressure gauge, the flow measuring gauge should show a minimum pressure of 10 psi.

If the flow pressure reading is less than 10 psi; inspect the flow valve operation for sticking; if the valve is operating satisfactorily the pump is worn and should be replaced.

If flow pressure reading is 10 psi or greater, and relief valve is operating properly; the pump is good.

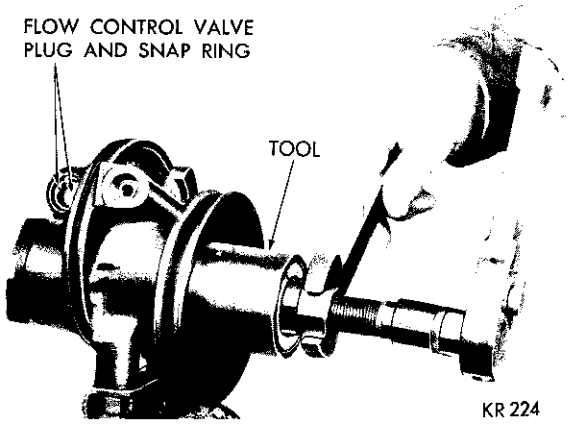


Fig. 4—Removing Pump Pulley

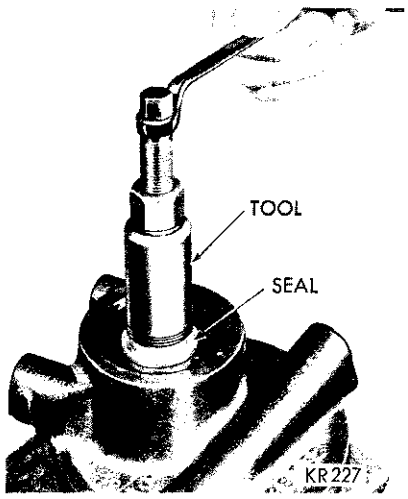


Fig. 5—Removing Pump Oil Seal

When removing the test equipment, make sure the pressure and return hoses are reinstalled properly. There should be no interference of the hoses with the components attached to the fender shield or the dash panel.

NOTE: The return hose screen should be clean and reinstalled in the end of the return hose at the pump before reinstalling the return hose.

PUMP REMOVAL

(1) Loosen the pump lower mounting bolt and remove the belt from the pulley.

(2) Place a container under the pump and disconnect both hoses at the pump. Cap ends of the hoses and secure the hoses high enough to prevent loss of fluid.

(3) Remove the bolts attaching the pump bracket to the engine and remove the pump and bracket assembly.

OIL SEAL REPLACEMENT

(1) Clean the exterior of the pump before disassembly.

(2) Remove the filler cap and drain the reservoir.

(3) Remove the brackets, reservoir screws, gasket and "O" ring.

(4) Using spacer washers between the bracket and the pump, reinstall the pump bracket for use as a holding fixture. Clamp the bracket in a vise (Fig. 4).

(5) Remove the pulley with Tool C-3615 or C-3934 as follows:

a. Engage one half-collar under the flange of the pulley hub.

b. Position the screw shaft and nut with the flange section inside the half-collar.

c. Engage the other half-collar under the pulley hub and over the flange of the screw shaft nut and install the retainer sleeve over both half-collars.

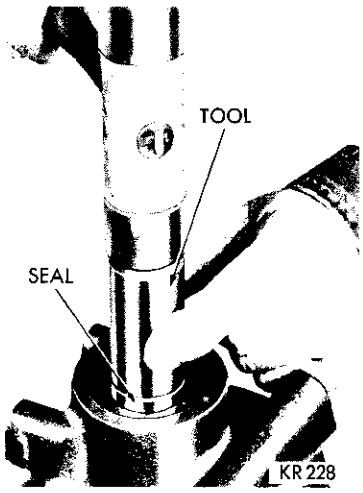


Fig. 6—Installing Pump Oil Seal

d. Hold the nut from turning and turn the screw inward to remove the pulley.

(6) If there has been evidence of a leak, remove pump shaft oil seal by threading Tool C-3783 for 1.2 pumps (C-3642 for .46 pumps) far enough into seal to engage the metal portion of the seal (Fig. 5).

Turning the puller center screw while holding the tool body will force the seal assembly from the pump.

CAUTION: The pulley end of the shaft should be examined for sharp burrs or corners and smoothed with a stone or fine emery cloth. This will prevent seal damage when the new seal is installed. Do not stone or emery the area on the shaft that the seal lip contacts.

(7) Install new seal with lip of seal toward pump. Use Tool C-3782 for 1.2 pumps (C-3643 for .96 pumps) to drive seal flush with insert (Fig. 6).

(8) Support the pump body on the holding fixture, Tool C-3643, with the tool dowel pins in the pump bolt holes so that the pressure will be absorbed by the lower end of the pump shaft (Fig. 7).

CAUTION: The pump must be supported in a manner in which all pressing force will be applied to the shaft only: otherwise, the pump body and rotor will be damaged.

(9) Install the pulley with a heavy duty arbor press. Press on the pulley hub only until the hub is flush with the end of the pump shaft.

(10) Lubricate and install a new pump body "O" ring and a new reservoir gasket on the pump body.

(11) Tighten the reservoir and the pump brackets. Tighten the screws to 16 foot-pounds.

(12) Install the pump and test belt adjustment as outlined under "Cooling System" Group 7.

DISCHARGE FITTING FERRULE REPLACEMENT

(1) Wipe away all dirt around the discharge fitting and tighten the high pressure hose tube nut to 24 foot-pounds.

(2) Start the engine and steer the vehicle from stop to stop to build-up pressure.

If the discharge fitting is leaking, disconnect the high pressure hose at the pump and examine the tubing flare for nicks, scratches, or other damage. If the tubing flare or nut is damaged, replace the high pressure hose.

(3) Examine the pump housing in the discharge area to be sure that the housing has not been damaged by cross-threading or over-tightening the flare nut. If the housing is cracked or if the threads are damaged; the pump must be replaced.

(4) Examine the brass ferrule in the pump discharge fitting for nicks and scratches. The hose tubing flare should make an indentation in the ferrule which is concentric with the center hole and of approximate uniform depth all the way around. If the ferrule is damaged or nut improperly seated, replace the ferrule.

(5) Remove the pump from the vehicle.

(6) Clamp the pump in a vise with the discharge opening in the down position, this will prevent any chips from falling into the pump.

(7) Use a No. 4 screw-extractor (E-Z Out). Turn the extractor into the ferrule (Fig. 8), then rock the extractor slightly to remove the ferrule. Perform this operation carefully so as not to damage the threads on the housing.

(8) Clean out the discharge bore of any foreign material (brass chips, dirt, etc.).

(9) Center the new ferrule with the tapered end up in the housing bore. The ferrule is pressed into place by reinstalling the high pressure hose and tightening the flare nut to 24 foot-pounds. Figure 9 is a cutaway view to show the ferrule properly seated in the housing.

CAUTION: Be sure that the ferrule is centered in the housing bore before installing the high pressure hose flare nut.

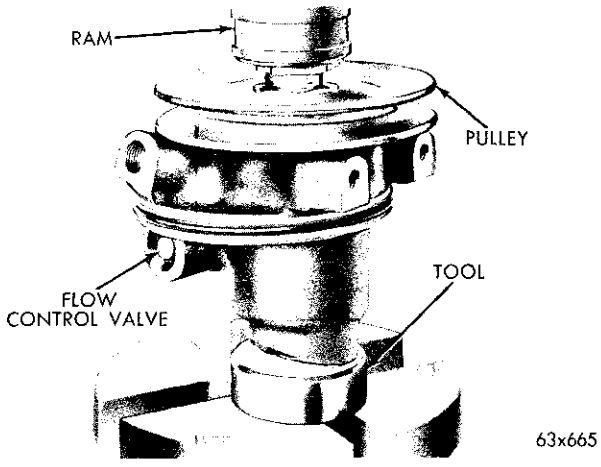


Fig. 7—Installing Pump Pulley

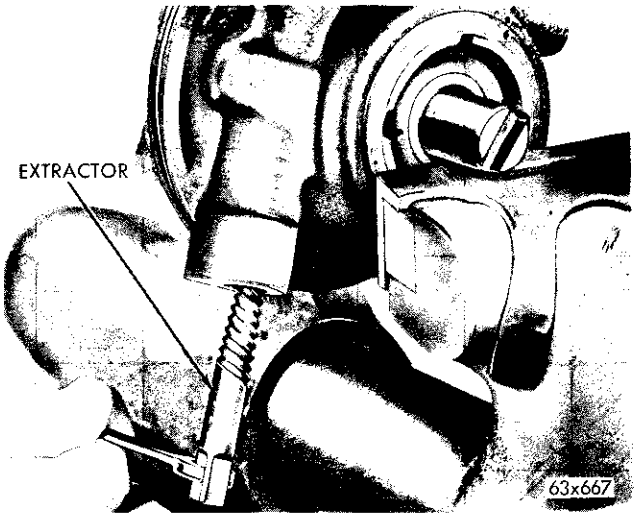


Fig. 8—Removing Brass Ferrule

Flow Control Valve

(1) With the pump reservoir removed, remove the flow control valve end plug retaining ring and end plug that is nearest the discharge fitting on the pump (Fig. 10).

(2) Depress the control valve against spring pressre and allow it to spring back. If the spring is not broken, the valve should pop out of the bore to a point where it can be removed. If the valve should stick, **do not force it,** but repeat the spring back procedure several times.

NOTE: Gum deposits will cause the control valve to stick in one position and it will be necessary to break the valve free by light tapping and repeat Step 2.

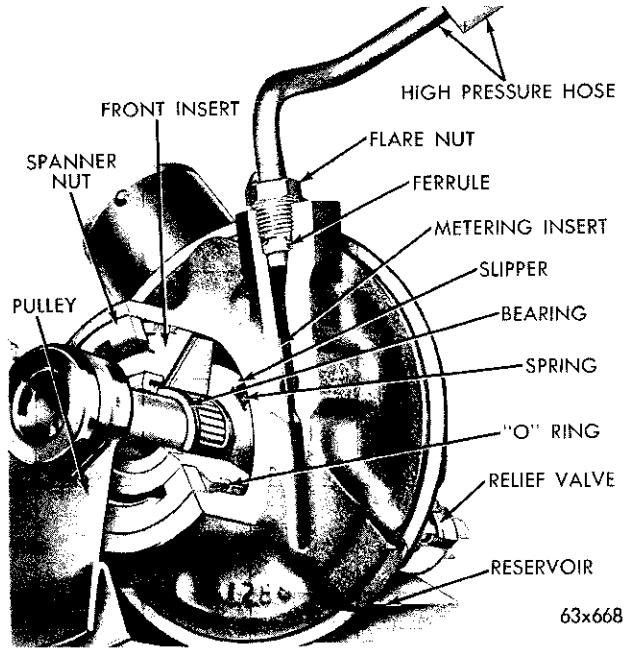


Fig. 9—Pump Cross Section Showing Ferrule Installed

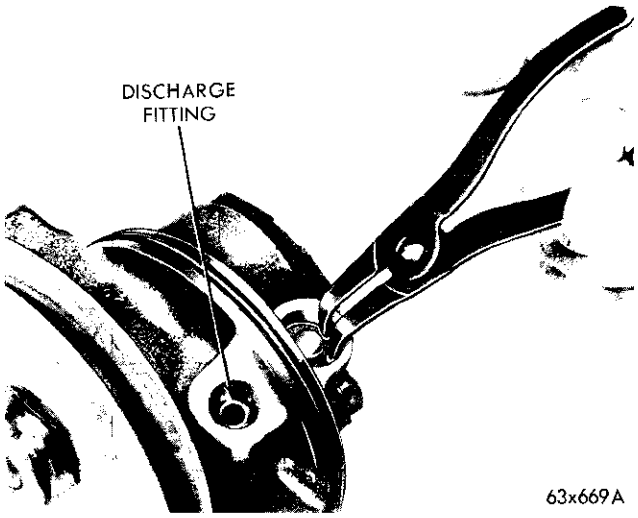


Fig. 10—Removing Flow Control Valve Retaining Ring

If the control valve and bore were fouled by gumming, foreign material, or burrs, the valve and valve bore should be thoroughly cleaned and flushed and reassembled.

NOTE: Inspect the flow control valve and valve bore. If the valve or valve bore in pump body are badly scored, replace the pump assembly less pulley and reservoir.

(3) Install the control valve spring, seating the spring in the spring socket.

(4) Remove any burrs with a fine hone or crocus cloth but **Do Not** round the valve land corners.

(5) Lubricate with 2084329 power steering fluid and install the control valve over the control valve spring and into the bore. When all valve lands have cleared the retaining ring groove area, work the control valve back and forth against spring pressure until the valve operates smooth and freely.

(6) Install a new "O" ring on the end plug.

(7) Lubricate the end plug and "O" ring and install the end plug with the machined projection **out.**

(8) Install the plug retainer ring with the sharp edge of ring **up.**

(9) Install the relief valve if removed.

(10) Install pulley (Fig. 7).

(11) Install a new pump body "O" ring, new reservoir gasket and reservoir and brackets.

SLIPPER SPRING REPLACEMENT

(1) Remove the pump and bracket from the vehicle.

(2) Remove the bracket and reservoir from the pump.

(3) Remove the pump pulley (Fig. 4).

(4) Use a center punch to mark the position of the spanner nut and front insert in the pump housing (Fig. 11) to insure that the front insert and spanner nut are returned to the exact same position at reassembly.

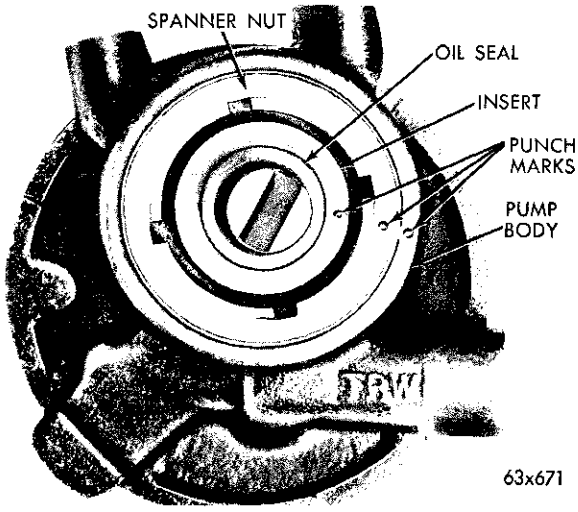


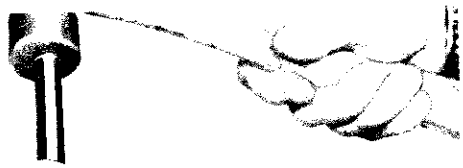
Fig. 11—Center Punch Marks on Pump Body Spanner Nut and Front Insert

(5) Use a ¼ inch drift to loosen and remove the spanner nut (Fig. 12).

(6) Support the pump housing so that the front insert is clear and use a smooth ½ inch diameter bar (Fig. 13), press the shaft, rotor and front insert out of the pump housing.

CAUTION: Be careful not to damage the pump rear bearing.

(7) Examine the parts for broken edges or deep scoring, especially on the rotor and slippers. If either of these conditions are present, then the pump assembly less relief valve, pulley, and reservoir must be replaced. Small nicks or burrs may be smoothed with a fine hone.



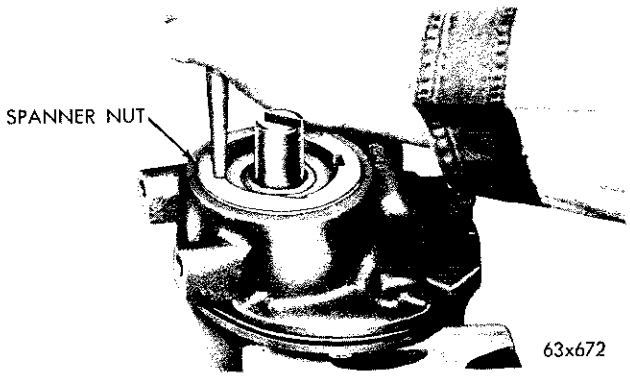


Fig. 12—Removing Spanner Nut

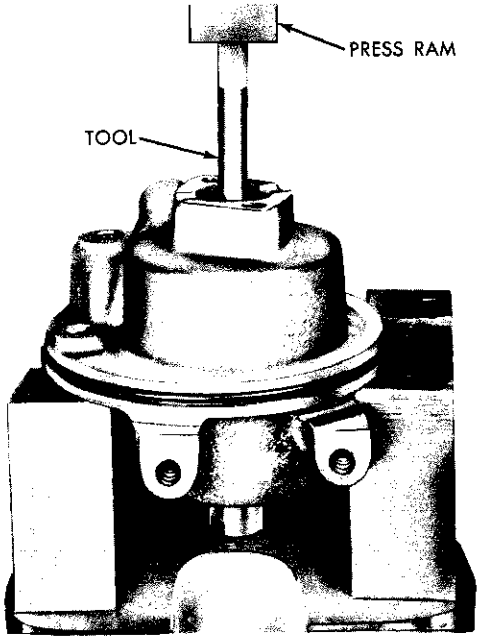


Fig. 13—Removing Shaft

NOTE: The cam insert has two machined notches (one large and one small) on the inside surface; these are not to be interpreted as deep scoring.

(8) Smooth off burrs or corners on the pulley end of the pump shaft, this will prevent shaft oil seal damage when a new seal is installed.

CAUTION: Do not stone or emery the area on the shaft the seal lip contacts.

(9) If all parts are in a serviceable condition. Discard all eight slipper springs.

(10) Thoroughly flush and clean all parts with clean solvent.

NOTE: It is essential that cleanliness be observed throughout the pump assembly.

(11) Using a piece of soft steel wire 25 inches long, make three turns around the center of the rotor and fasten the wire, Fig. 14. Bend ends of wire toward pulley end of shaft. Do not make wire coils too tight or wire will be difficult to remove.

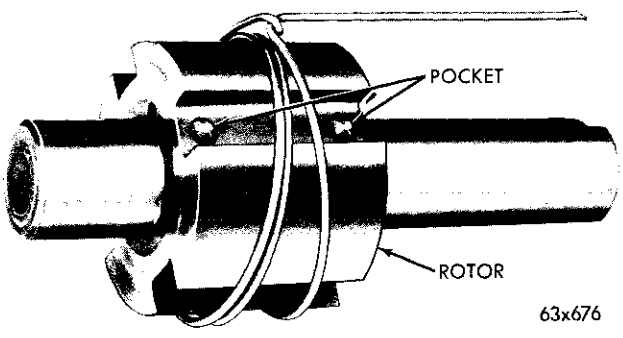


Fig. 14—Slipper Retainer Wire Tool Installed on Rotor

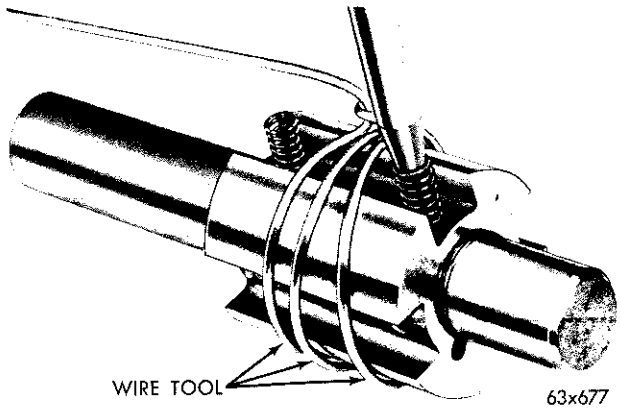


Fig. 15—Installing Slipper Springs

CAUTION: Use care when handling the rotor and shaft since the corners of the rotor are extremely sharp and must remain sharp for good pump operation. The oil seal and bearing surfaces of the shaft must remain free of any nicks or burrs.

(12) Use an ordinary wood pencil with the point broken to install the new springs. Enter the blunt tapered end of the pencil in the spring and snap the springs into the pockets in the rotor by turning the pencil clockwise (Fig. 15). Install the springs and slippers in one rotor slot at a time. Remove the pencil from the spring with a counter-clockwise rotation. Either end of the spring may be inserted into the rotor pocket.

NOTE: Make sure the proper springs are installed. The springs for the .96 pump (small) are not interchangeable with the springs for the 1.2 pump (large).

(13) Install each slipper by sliding the slipper between the two springs and the wire tool so that the ends are flush with the rotor. The notched portion of the slipper must be installed, (Fig. 16).

NOTE: Inspect the springs to make sure they are in the pockets and in an upright position under the slipper (Fig. 17).

(14) Using a washer of the dimensions shown in Figure 18 drop it over the pulley end of the shaft.

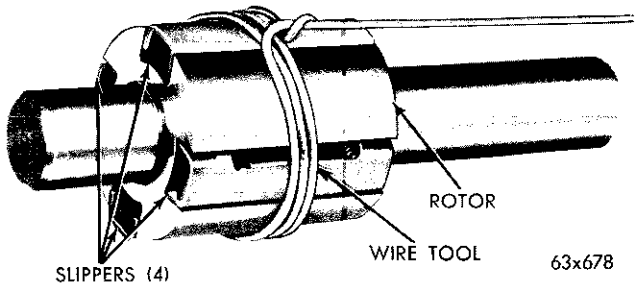


Fig. 16—Slippers Properly Installed in Pump Rotor

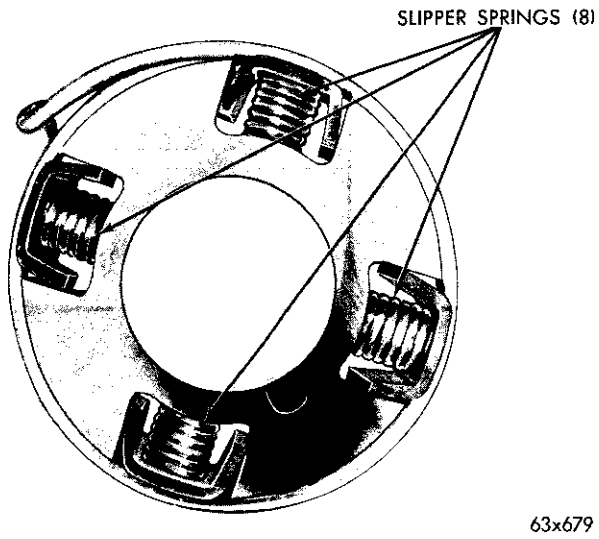


Fig. 17—Slippers and Springs Properly Installed

This washer is used to keep the slippers flush with the end of the rotor.

NOTE: It is important that the slippers remain flush with the end of the rotor throughout the assembly operation.

(15) Insert the shaft and rotor assembly with the flat washer tool and slipper retaining wire tool into the pump cam insert so that the slippers and rotor are inside the cam with the end of the shaft resting against the back face in the housing (Fig. 19).

CAUTION: Do Not attempt to insert the pump shaft into the bearing at this time.

(16) Hold the washer against the rotor with a screw driver while removing the wire retaining tool, making sure that the slippers remain flush with the end of the rotor.

(17) Line the pump shaft with the lower bearing and push the shaft, rotor and slippers all the way into

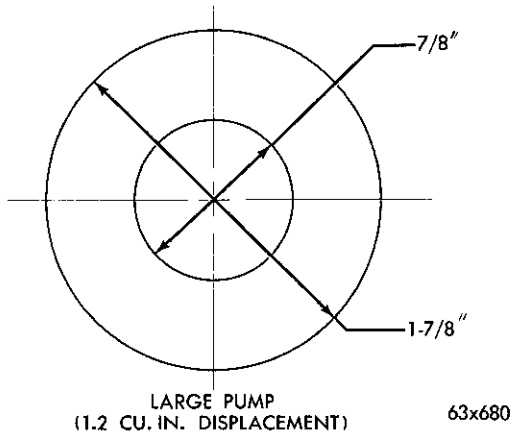


Fig. 18—Slipper Retaining Washer Tool Dimensions

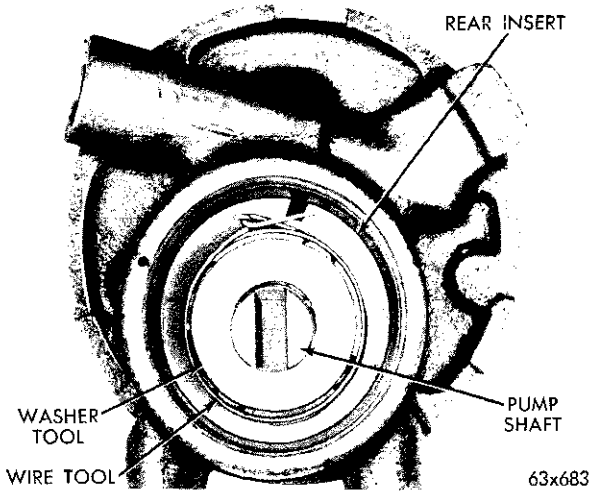


Fig. 19—Installing Rotor, Shaft and Slippers Assembly

the housing until the rotor is flush with the end of the cam insert.

NOTE: The slipper ends may hang up on the center openings in the cam insert. If this should occur, rotate the shaft while installing will overcome this condition.

(18) Remove the special flat washer tool. Make sure that the springs are in place by rotating the pump shaft and looking through the notch in each slipper.

(19) Lubricate the rotor and slippers with clean power steering fluid and rotate the shaft to make sure the slippers do not bind.

(20) Replace the shaft seal and "O" ring seal on the front insert. Lubricate the shaft seal, "O" ring and shaft with power steering fluid.

(21) After making sure the inner face on the front insert is smooth and free of burrs, place the insert assembly on the shaft with care so that the shaft seal is not damaged by the end of the shaft.

(22) Support the pump housing in an arbor press, align the center punch marks on the front insert and the pump body, and using a 1¼ inch socket with ½ inch drive, press the insert into the pump housing (Fig. 20).

(23) Install the spanner nut and tighten to the exact

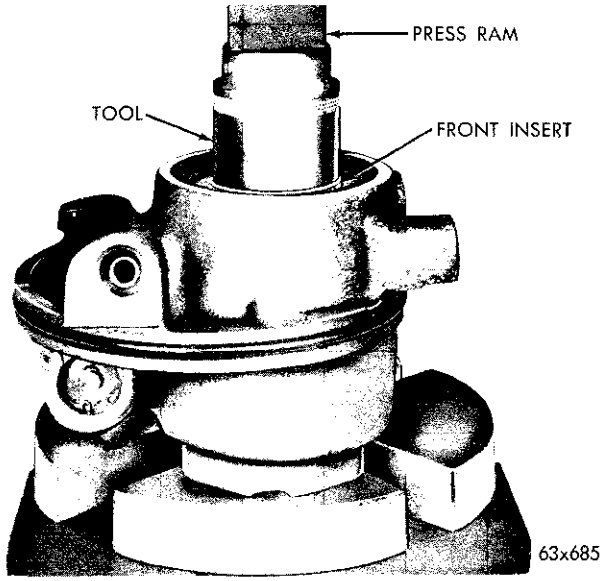


Fig. 20—Installing Front Insert Into Pump Housing

original position in the housing as indicated by the pin punch marks placed on the pump body and spanner nut at disassembly.

(24) Install the flow control valve as outlined under "Flow Control Valve Installation."

(25) Install the pump pulley (Fig. 7).

(26) Install a new "O" ring on the pump body and install the reservoir and pump brackets.

PUMP INSTALLATION

(1) Position the pump on the engine and install the attaching bolts.

(2) Install the drive belts and adjust. Refer to "Engine Cooling—Group 7" for proper adjustment.

(3) Connect the pressure and return hoses.

(4) Fill the pump reservoir with power steering fluid Part No. 2084329.

(5) Start the engine, turn the steering wheel all the way to the left and back all the way to the right several times to expel the air from the system, then turn off the ignition switch to stop the engine and recheck the fluid in the reservoir.