

GROUP 19

STEERING

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MANUAL STEERING GEAR

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SPECIFICATIONS

MANUAL STEERING	
Type.....	Recirculating Ball Nut
Ratio.....	24 to 1
Cross Shaft Bearings (Plymouth).....	3-Needle Bearings
Cross Shaft Bearings (Valiant).....	3-Bronze Bushings
Worm Shaft Bearings.....	2-Caged Ball Bearings
Cross Shaft Adjusting Screw End Play.....	.000-.004 inch
Worm Bearing Pre-Load (in car).....	2½ to 6 in. lbs. to Keep Wheel Moving
Worm Bearing Pre-Load (out of car).....	1½ to 6 in. lbs. to Keep Wheel Moving
Sector Mesh Adjustment Pre-Load Torque— Includes worm bearing Pre-Load (in car).....	11 to 15 in. lbs. Pull through high spot
Sector Mesh Adjustment Pre-Load Torque— Includes worm bearing Pre-Load (out of car).....	10 to 15 in. lbs. Pull through high spot
Column Bearing.....	1 Ball Bearing
Wheel Turns—Steering Arm Removed.....	5¾
Wheel Turns—Steering Arm and Linkage Attached.....	5⅜ Approx.
Steering Shaft to Wormshaft Coupling.....	Sealed U-Joint Type

TORQUE REFERENCE

	Foot-Pounds
Cross Shaft Cover Bolt.....	25
Steering Arm Nut.....	85
Gear Assembly to Frame Bolt.....	50
Steering Wheel Nut.....	40
Cross Shaft Adjusting Screw Lock Nut.....	35

TOOL LIST

MANUAL STEERING GEAR

C-612.....	Puller—Steering Wheel
C-3323.....	Fixture—Steering Gear Holding
C-3646.....	Puller—Steering Arm
C-3865.....	Installer—Thrust Bearing Cup in Manual Steering Gear Housing and Adjuster
C-3868.....	Puller—Thrust Bearing Cup from Manual Steering Gear Housing
C-3875.....	Remover—Installer and Arbor—Cross Shaft Needle Bearings
C-3879.....	Installer—Steering Column Shaft Bearing
C-3880.....	Remover and Installer—Cross Shaft Oil Seal
C-3884.....	Wrench and Nut—Worm Shaft Adjusting
C-3891.....	Puller—Steering Column Shaft Bearing

SERVICE DIAGNOSIS

CONDITIONS—POSSIBLE CAUSES

1. EXCESSIVE PLAY OR LOOSENESS IN THE STEERING WHEEL

Possible Causes:

- (1) Steering gear shaft adjusted too loose or badly worn.
- (2) Steering linkage loose or worn.
- (3) Front wheel bearings improperly adjusted.
- (4) Steering arm loose on steering gear shaft. Inspect for damage to shaft and steering arm.
- (5) Steering gear housing attaching bolts loose.
- (6) Steering arms loose at steering knuckles.

2. HARD STEERING

Possible Causes:

- (1) Low or uneven tire pressure.
- (2) Insufficient lubricant in the steering gear housing or in steering linkage.
- (3) Steering gear shaft adjusted too light.

- (4) Front wheels out of line.
- (5) Steering column misaligned.
- (6) Interference between steering shaft and jacket tube caused by misalignment.

3. PULL TO ONE SIDE

Possible Causes:

- (Tendency of the car to veer in one direction only)
- (1) Incorrect tire pressure.
 - (2) Wheel bearings improperly adjusted.
 - (3) Dragging brakes.
 - (4) Improper caster and camber.
 - (5) Incorrect toe-in.
 - (6) Grease, dirt, oil or brake fluid on brake linings.
 - (7) Front and rear wheels out of alignment.
 - (8) Broken or sagging rear springs.
 - (9) Bent suspension parts.

4. WHEEL TRAMP

Possible Causes:

- (Excessive Vertical Motion of Wheels)
- (1) Incorrect tire pressure.
 - (2) Improper balance of wheels, tires and brake drums.
 - (3) Loose tie rod ends of steering connections.
 - (4) Worn or inoperative shock absorbers.

5. ROAD WANDER

Possible Causes:

- (1) Low tire pressure.
- (2) Improper ball nut rack and cross shaft sector mesh.
- (3) Faulty front wheel bearings.
- (4) Worn tie rod ends.

MANUAL STEERING GEAR

DESCRIPTION

The manual steering gear (Fig. 1) built by the Chrysler Corporation 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.

The cross shaft is integral with the sector gear.

The sector gear meshes with the rackteeth on the re-circulating ball nut. Adjustment at this point is

controlled by the cross shaft adjusting screw which extends through the housing cover.

1. ADJUSTMENTS

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

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

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

2. TESTING WORM BEARING PRE-LOAD (In Vehicle)

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

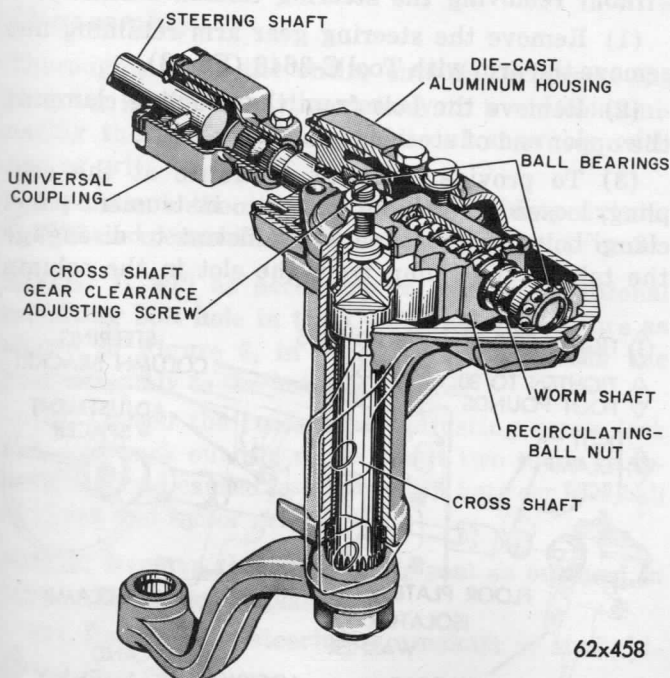


Fig. 1—Steering Gear Cross Section

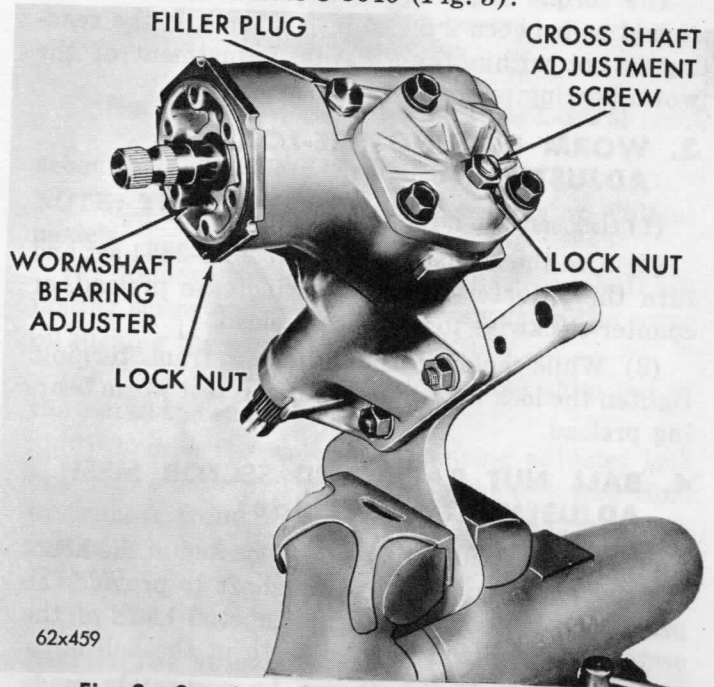


Fig. 2—Steering Gear Adjustment Locations



Fig. 3—Removing Steering Gear Arm (Typical)
(Tool C-3646)

(2) Remove the horn button or horn ring (so equipped).

(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 torque wrench C-3380 on the steering shaft nut.

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

The torque required to keep the wheel moving should be between 2 and 6 inch pounds. If the reading is not within these limits, adjustment of the worm bearing preload is necessary.

3. WORM BEARING PRE-LOAD ADJUSTMENT

(1) Loosen the adjuster lock nut.

(2) Use the adjuster wrench from C-3884 set and turn the adjuster-clockwise to increase preload, or counter-clockwise to decrease preload.

(3) While holding the adjuster from turning, tighten the lock nut securely, then retest worm bearing preload.

4. BALL NUT RACK AND SECTOR MESH ADJUSTMENT (In Vehicle)

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 proper worm bearing preload 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 40 foot-pounds torque.

(3) Turn the steering wheel about $\frac{1}{4}$ turn away from the center or "high spot" position. Then, using torque wrench C-3380, at the steering wheel nut, check the torque required to rotate the steering wheel through the high spot at the center position. The reading should be between 11 and 15 inch pounds. This represents the total of the worm shaft bearing preload 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 85 foot-pounds torque.

5. REMOVAL FROM VEHICLE

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

(1) Remove the steering gear 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 steering gear wormshaft.

(3) To provide sufficient clearance at the coupling, loosen the column jacket to instrument panel clamp bolts (Figs 4 and 5), sufficient to disengage the tab on the clamp from the slot in the column

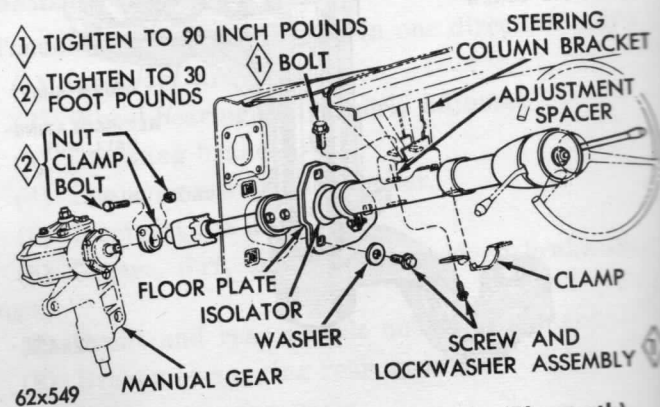


Fig. 4—Steering Column Assembly (Plymouth)

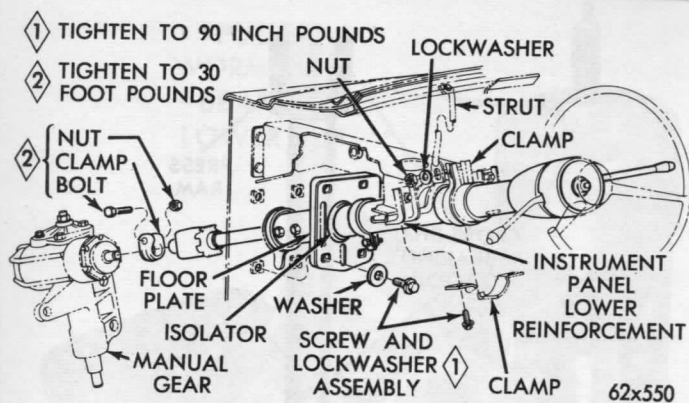


Fig. 5—Steering Column Assembly (Valiant)

jacket. Slide the column assembly up far enough to disengage the coupling from the wormshaft.

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

NOTE: It is not necessary to disconnect the shift linkage on models equipped with manual transmission, or to remove the floor plate to toe board 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 the three steering gear housing mounting bolts and remove the steering gear from the vehicle.

6. RECONDITIONING STEERING GEAR

Disassembly

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.

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

NOTE: It will be necessary to drill an additional mounting bolt hole in the C-3323 holding fixture as shown in Figure 6, in order to firmly attach the gear assembly to the holding fixture.

(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 Seal Replacement".

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

(4) Remove the bolts from the cross shaft cover, then slowly remove the cross shaft while sliding the

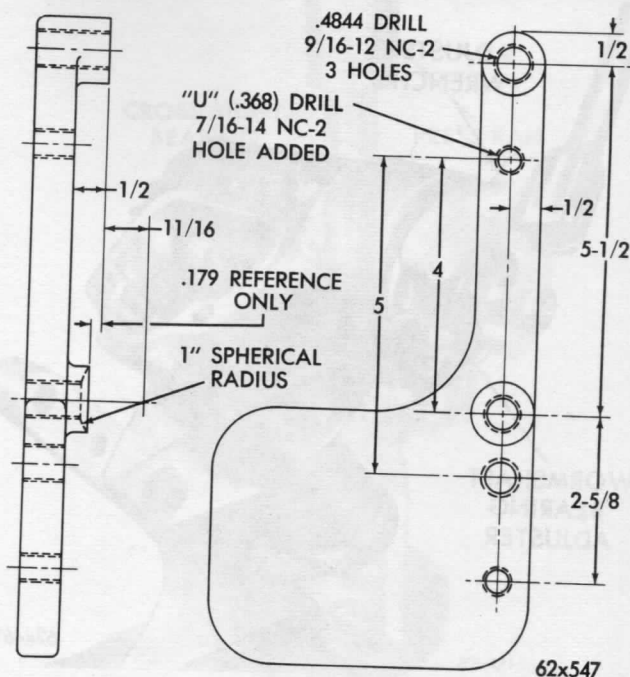


Fig. 6—Steering Gear Holding Fixture—Machining Reference (Tool C-3323)

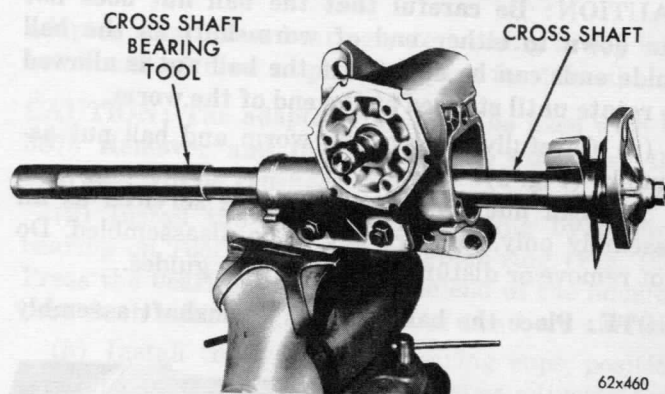


Fig. 7—Removing Cross Shaft (Tool C-3875)

arbor Tool C-3875 into the housing (Fig. 7).

NOTE: The arbor tool is not necessary on Valiant models.

(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 cross shaft.

(7) Loosen the wormshaft bearing adjuster lock nut with a soft drift and remove the lock nut. Hold wormshaft from turning while unscrewing the adjuster, using tool wrench from Tool Set C-3884. (Fig. 8).

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

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

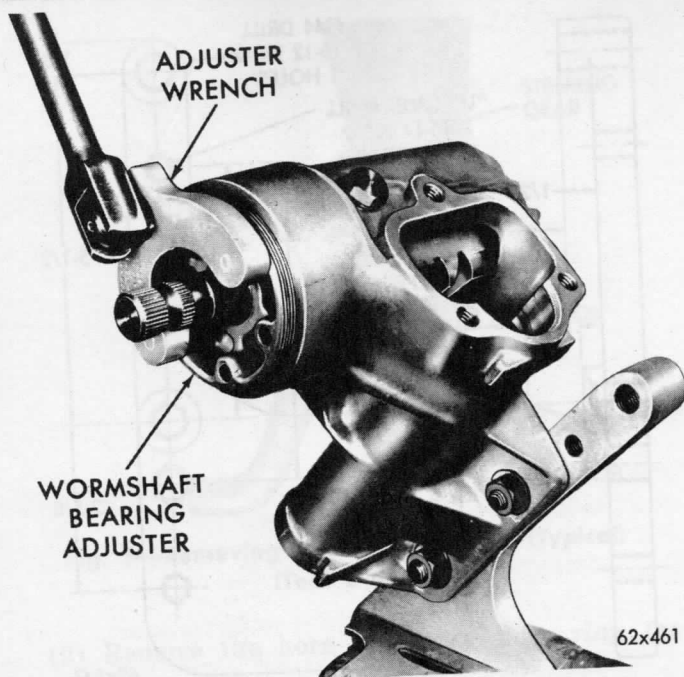


Fig. 8—Removing Wormshaft Adjuster

CAUTION: Be careful that the ball nut does not run down to either end of 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 the worm and ball nut assembly (Fig. 9).

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.

NOTE: Place the ball nut and wormshaft assembly

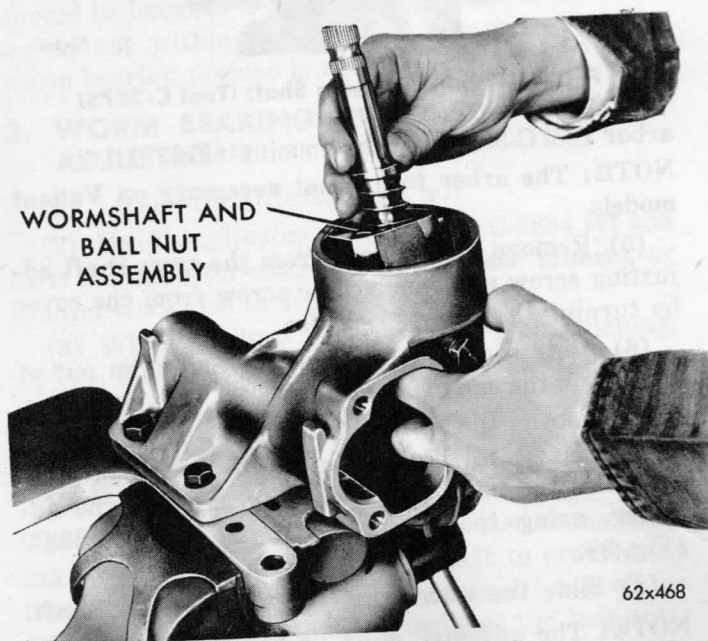


Fig. 9—Removing Wormshaft and Ball Nut Assembly

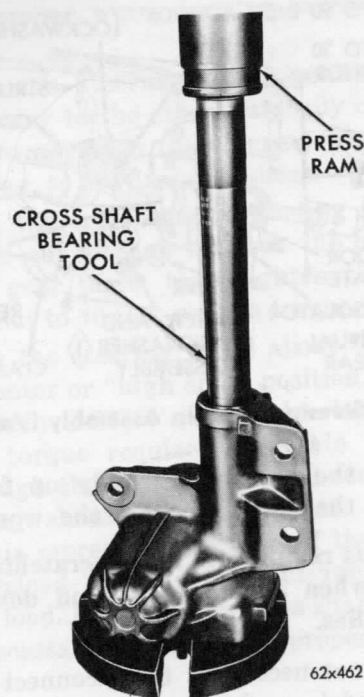


Fig. 10—Removing Cross Shaft Inner and Outer Bearings (Tool C-3875)

in a clean place, and cover it to keep it clean.

(10) Remove the cross shaft needle bearing (if so equipped) by placing the steering gear housing in an arbor press; insert C-3875 tool with adapter ring in lower end of housing (Fig. 10) and press both bearings through the housing.

CAUTION: The adapter ring must be used with C-3875 remover and installer Arbor, otherwise the bearings will be crushed.

NOTE: Housing equipped with sector shaft bushing are serviced in assembly only.

NOTE: The cross shaft cover assembly, including 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 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 C-3868 (Fig. 11) behind the bearing cup and expanding the puller head by pressing down on center plunger of tool. Withdraw the bearing

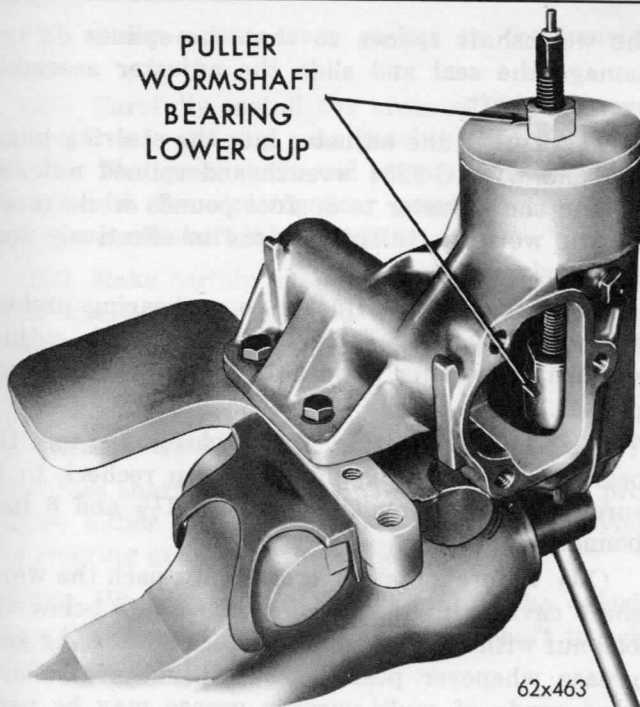


Fig. 11—Removing Lower Bearing Cup (Tool C-3868)

cup by turning the puller screw nut in a clockwise direction while holding the center screw.

Cleaning and Inspection

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

Check 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.

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

Inspect the cross shaft for wear and check fit of the shaft in the housing bearings. Check fit of the shaft pilot in its housing bearing in the cover. Check to be sure the wormshaft has not been bent or otherwise damaged.

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

Assembly

(1) Install the cross shaft outer needle bearing by placing the bearing on end of Tool C-3875 with

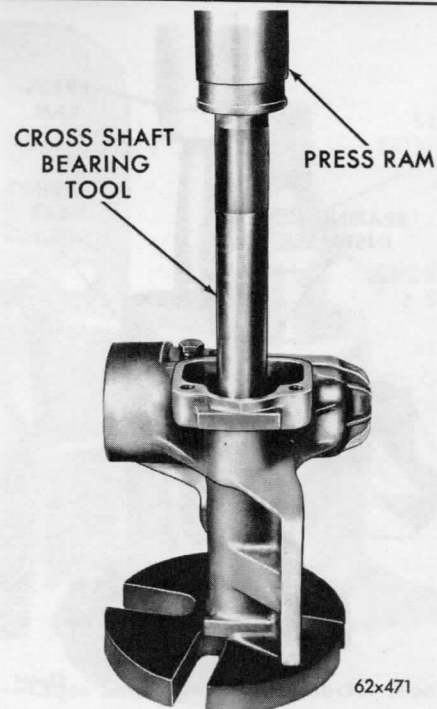


Fig. 12—Pressing Inner Bearing into Housing (Tool C-3875)

adapter ring. Press bearing into housing to $\frac{5}{16}$ inch below end of bore to provide space for the oil seal.

CAUTION: The adapter ring must be used with C-3875 Remover and Installer Arbor, otherwise the bearings will be crushed.

(2) Install the inner needle bearing by placing bearing on Tool C-3875 with adapter ring (Fig. 12). Press the bearing into the inside end of the housing bore flush with the inside end of the bore surface.

(3) Install the wormshaft bearing cups, position the cups in the housing and bearing adjuster nut. Then press them in place with Tool C-3865 (Figs. 13 and 14).

(4) Install the wormshaft oil seal by positioning the seal in the wormshaft adjuster with 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.

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

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

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

(8) Hold the ball nut from turning (Fig. 9), and insert the wormshaft and ball nut assembly into housing with end of worm resting in the thrust bearing.

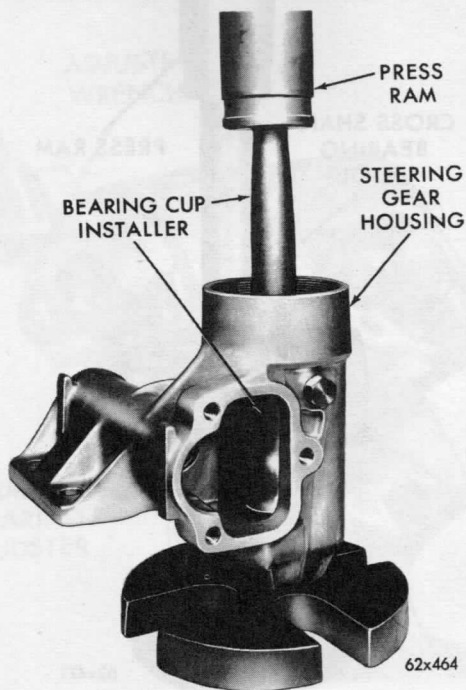


Fig. 13—Installing Lower Wormshaft Bearing Cup
(Tool C-3865)

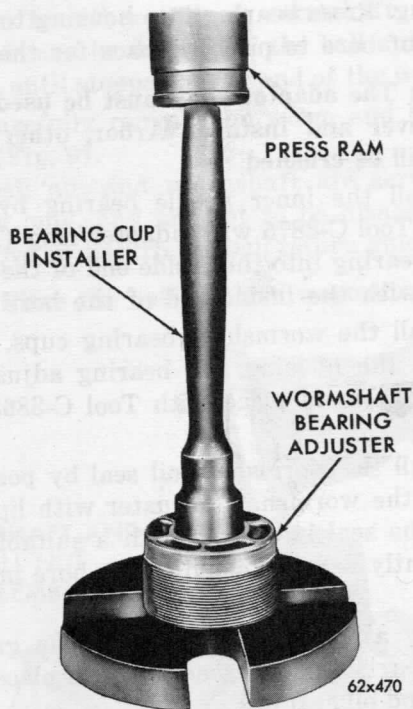


Fig. 14—Installing Upper Wormshaft Bearing Cup
(Tool C-3865)

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

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

(10) Place a protective sleeve of plastic tape over

the wormshaft splines so that the splines do not damage the seal and slide the adjuster assembly over the shaft.

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

(12) Loosen the adjuster so no bearing preload exists. Then, using C-3880 torque wrench, adjust wormshaft bearing preload to from 1½ to 6 inch pounds.

(13) After adjusting the preload, tighten the bearing adjuster lock nut, and then recheck to be sure the preload remains between 1½ and 6 inch pounds.

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

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

(16) Check the end clearance shown in Figure 15. The screw must be free to turn with no perceptible end play to .004 inch lose. Three different thickness shims are available to obtain the specified clearance.

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

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

(19) Rotate the wormshaft to centralize the ball nut.

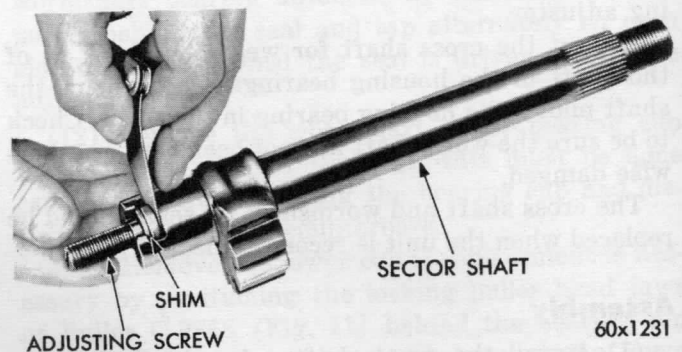


Fig. 15—Checking Cross Shaft Adjusting Screw End

(20) Place a new cover gasket on the housing cover.

(21) Carefully install the cross shaft and cover assembly into steering gear housing (Fig. 7).

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

(22) 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 torque.

7. 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.

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

Removal

(1) Slide the threaded adapter of Tool C-3880 over the end of the cross shaft and install the nut portion of the tool on the shaft (Fig. 16). 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 tool nut counter-clockwise to withdraw the seal from the housing.

Installation

(1) Place the cross shaft seal on the seal protec-

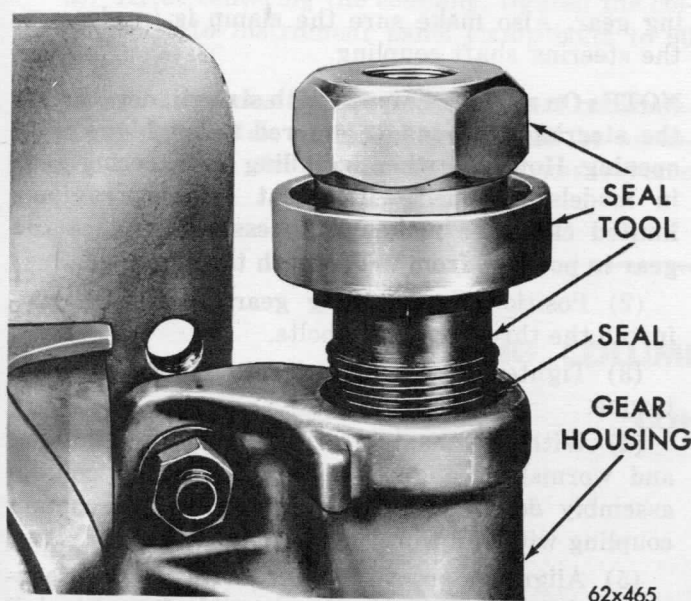


Fig. 16—Removing Cross Shaft Oil Seal (Tool C-3880)

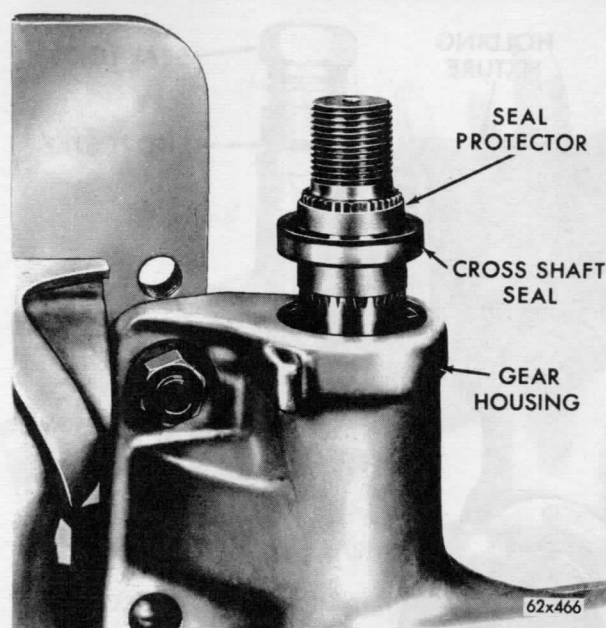


Fig. 17—Cross Shaft Oil Seal Protector (Tool C-3880)

tor sleeve from Tool Set C-3880 by carefully sliding the seal over the tapered end of the sleeve so the lip of the seal faces the tapered end of the sleeve.

(2) Place the seal and protector sleeve assembly onto the splines on the cross shaft with the lip of the seal facing the gear housing (Fig. 17).

(3) Slide the seal down off the protector sleeve onto the cross shaft and remove the sleeve.

NOTE: A piece of tape can be wrapped around the end of the sleeve, opposite the tapered end, to provide a better grip when removing the sleeve.

(4) Place the installing adapter from C-3880 against the seal with the short step end toward the seal (Fig. 18).

(5) 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.

8. BALL NUT RACK AND SECTOR MESH ADJUSTMENT (Out of Vehicle)

The ball nut rack and sector mesh adjustment can be accurately made only after proper worm bearing preload has been established.

(1) Turn the wormshaft to the midpoint of its travel. When the gear is exactly centered, the master spline on the wormshaft will be at the 12 o'clock position when viewed with the gear positioned as it would be when installed in the vehicle.

(2) Turn the cross shaft adjusting screw clockwise to take out all lash between the ball nut rack

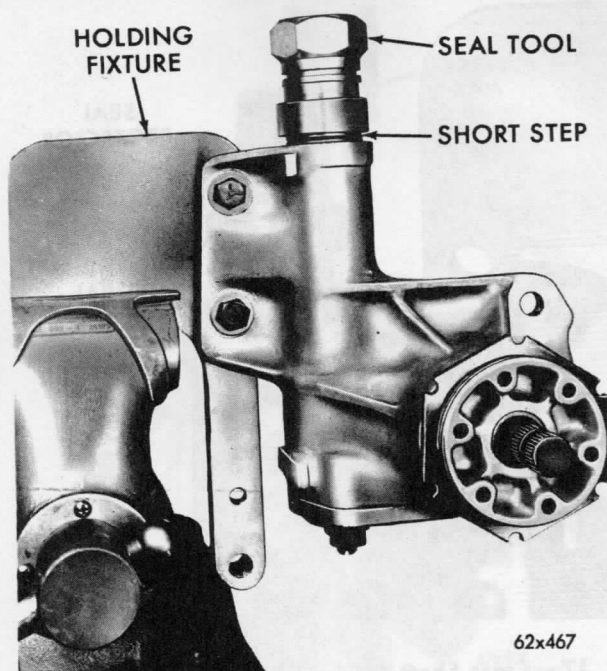


Fig. 18—Installing Cross Shaft Oil Seal (Tool C-3880)

and sector gear teeth, then tighten the adjusting screw lock nut (Fig. 19).

(3) Turn the worm shaft about $\frac{1}{4}$ turn away from the center or "high spot" position. Again using splined adapter from Tool Set C-3884 and C-3380 torque wrench (Fig. 20) rotate the wormshaft through the center or "high spot" position, observing the rotating torque required to turn the gear through the high spot. The reading should be between 10 and 15 inch pounds. This represents the

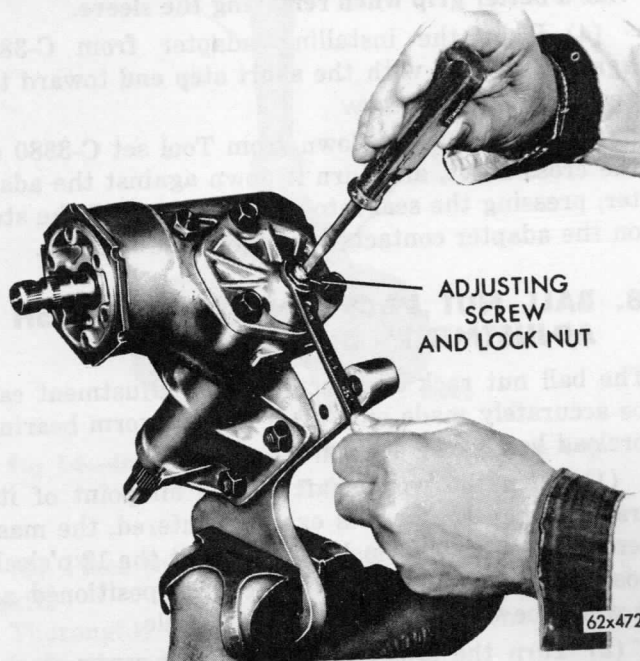


Fig. 19—Cross Shaft Adjustment

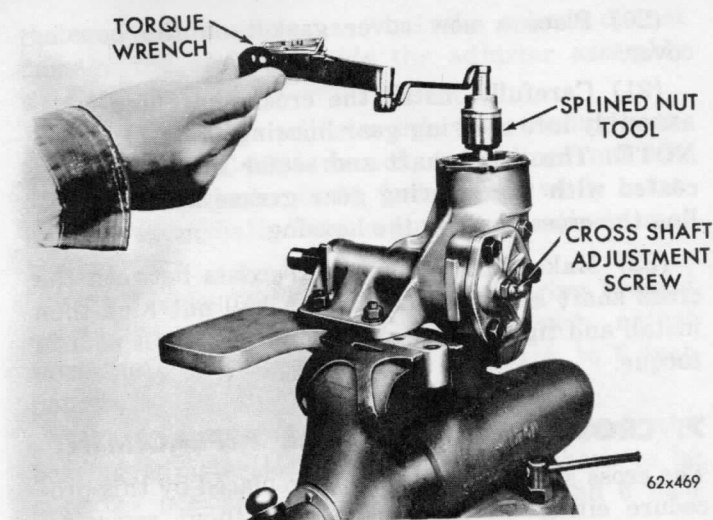


Fig. 20—Testing Ball Nut Rack and Cross Shaft Sector Mesh

total of the worm bearing preload and the sector gear mesh load.

(4) Readjust the cross shaft adjustment screw if necessary to obtain the proper torque reading. Be sure the adjusting screw lock nut is tight whenever a preload torque reading is taken.

(5) With the steering gear positioned in a vise at its operating angle, fill the gear mounting with approved steering gear grease so level of grease covers top of worm.

9. INSTALLATION IN VEHICLE

(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.

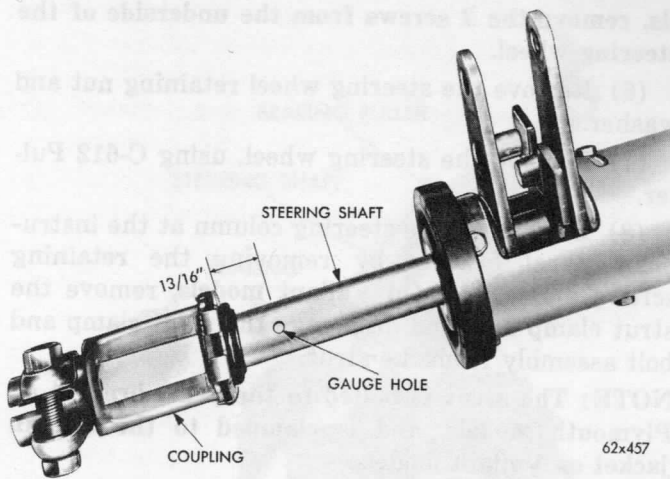
NOTE: On models equipped with six cylinder engines the steering gear can be entered through the hood opening. However, when installing the steering gear in models equipped with eight cylinder engines, limited clearance makes it necessary to place the gear in position from underneath the car.

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

(3) Tighten mounting bolts to 50 foot pounds torque.

(4) With the master serrations in the coupling and wormshaft aligned, slide the steering column assembly down far enough to engage the column coupling with the wormshaft.

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



**Fig. 21—Positioning Steering Shaft Coupling
(Manual Steering)**

(6) Tighten the nut to 30 foot pounds torque.

(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.

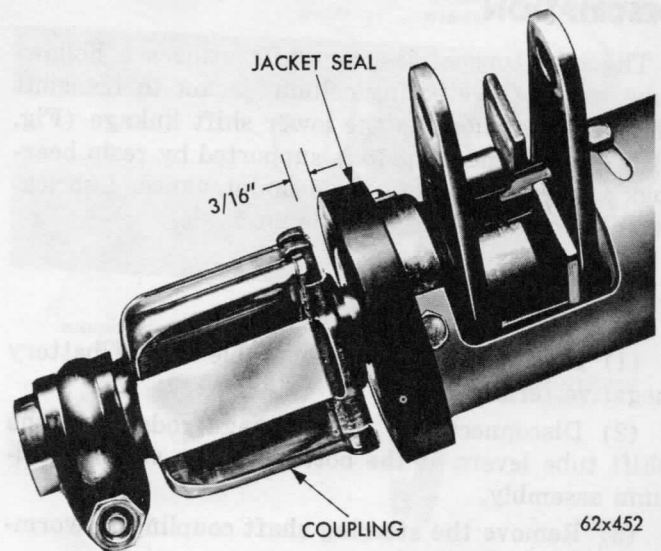
The coupling travel midpoint can be determined by a $\frac{3}{16}$ " diameter gauge hole which is provided in the steering shaft (Fig. 21).

When the dimension from the top of the coupling to the center of the gauge hole is $1\frac{3}{16}$ inch the coupling is centered in its travel (Plymouth models).

NOTE: On Valiant models with both power steering and standard transmission, the column jacket should be positioned so the dimension between the top of the coupling and the column jacket seal is $\frac{3}{16}$ inch (Fig. 22).

(8) After centering the coupling, tighten the column jacket to instrument panel clamp bolts to 90 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



**Fig. 22—Positioning Steering Shaft Coupling
(Power Steering)**

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 85 foot pounds.

(12) After steering gear has been completely installed, check the steering wheel to be sure it is centered in the straight ahead position. If it is found to be off center with wheels straight ahead, adjust the tie rods to center the wheel. Refer to "Front Suspension" Group 2.

STEERING COLUMN WITH GEAR SHIFT

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