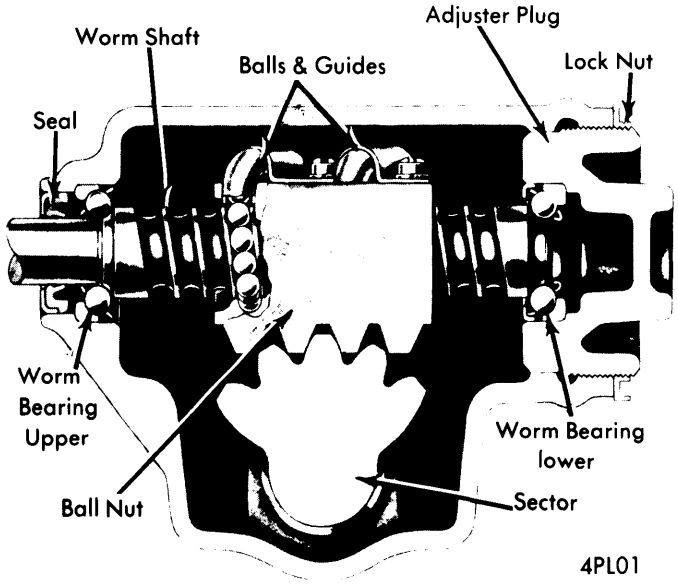
CHRYSLER CORP. (SAGINAW) RECIRCULATING BALL

Dodge (1965-74)
Plymouth (1974)

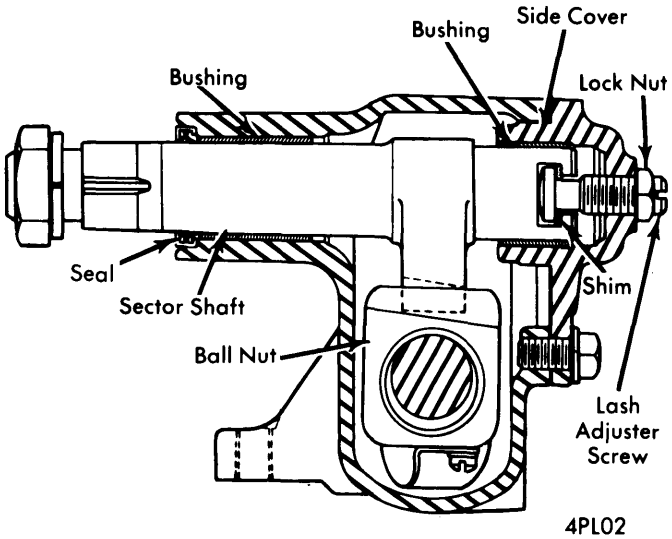
NOTE — Some models use other units. See Chrysler Corp. (Gemmer/Ross) Worm & Roller.

DESCRIPTION & OPERATION

Steering gear is a worm and recirculating ball type. Main components consists of worm shaft, ball nut, balls, sector shaft, housing and bearing. Worm shaft is supported at each end by bearings which are under a preload. Ball nut bearings form a thread between grooves in ball nut and worm shaft. As worm is turned, ball nut moves along on balls as it would on a screw thread. Sector shaft gear meshes with helical grooves on ball nut, and rotates in steel backed bronze bushings in housing and cover.



STEERING GEAR WORM SHAFT CROSS SECTION



STEERING BEAR SECTOR SHAFT CROSS SECTION

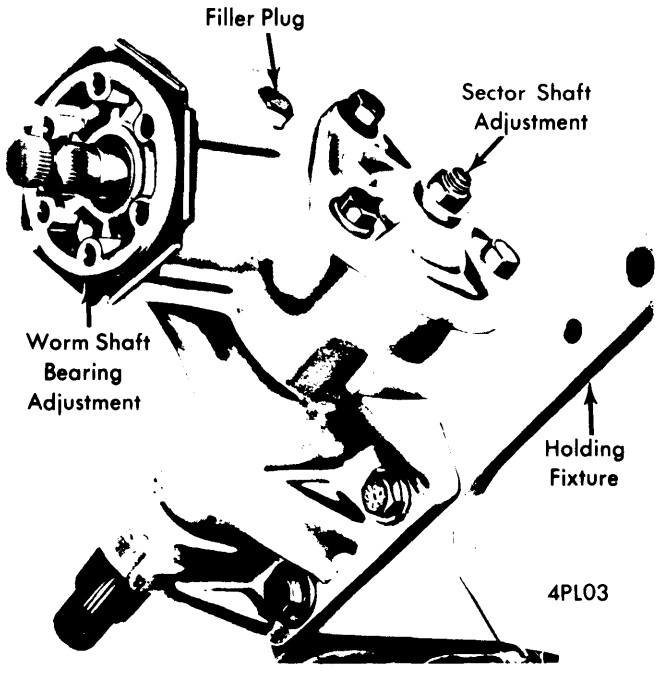
ADJUSTMENT

NOTE — Two adjustments can be made on steering gear and adjustments must be made carefully and in order given. Steering gear adjustment can be checked without removing gear from vehicle. Check for misalignment of steering column which might result in column bind and erroneous torque readings before performing steering gear adjustments.

WORM BEARING PRELOAD

1) Remove pitman arm from sector shaft and remove horn button and spring. Use a suitable torque wrench (50 INCH Lbs. max.) and socket on steering wheel nut to check worm preload. *NOTE — Column drag is negligible as long as column is properly aligned.* Turn steering wheel two turns off-center and check torque required to pull steering wheel through mid-point of gear travel. *CAUTION — Do not turn steering wheel hard against stops with pitman arm removed as damage to internal parts may result.* If worm bearing preload (off-center measurement) and over-center preload (on-center measurement) torque readings are within specifications, gear adjustment is satisfactory.

2) To adjust worm preload, loosen sector shaft adjuster screw lock nut, and back out adjuster screw about two turns. This relieves load from ball nut and sector gear mesh. Turn steering wheel two complete turns from straight ahead position and measure torque required to keep wheel moving toward straight ahead position. Loosen adjuster lock nut and turn adjuster clockwise to increase preload, or counterclockwise to decrease preload. Retighten locknut and recheck preload. Preload MUST be within limits after lock nut is tightened. Continue to next adjustment.



STEERING GEAR "B" & "PB" MODELS

CHRYSLER CORP. (SAGINAW) RECIRCULATING BALL (Cont.)

OVER-CENTER PRELOAD

1) Sector shaft adjuster screw raises or lowers shaft to provide proper mesh load between tapered teeth of sector gear and ball nut. This adjustment is made only after proper worm bearing preload is obtained. With pitman arm removed, gently turn worm shaft, or steering wheel from lock to lock counting total number of turns, then turn back exactly half way to center position. Turn sector shaft adjuster screw clockwise to remove all lash between gear teeth, then tighten adjuster screw lock nut to specification.

2) Turn steering wheel about ¼ turn away from center or gear high spot. With torque wrench on steering wheel nut, measure torque required to rotate steering wheel through high spot at center position. The reading should be as specified. This represents total of worm bearing preload, and ball and sector gear mesh load. Readjust sector shaft adjustment screw, if necesary, to obtain proper torque reading. With adjustments complete, place front wheels straight ahead and center steering wheel, then install pitman arm and tighten nut.

Worm Bearing Preload

Application	① INCH Lbs.
1970-74 "B" & 1974 "PB" Models	1.5-4.5
All Others	5-9

① – Measure with torque wrench on steering wheel nut or worm shaft.

Over-Center Preload

Application	① INCH Lbs.
1970-74 "B" & 1974 "PB" Models	8.25-11.25
All Others	14-18

① – Measure with torque wrench on steering wheel nut or worm shaft.

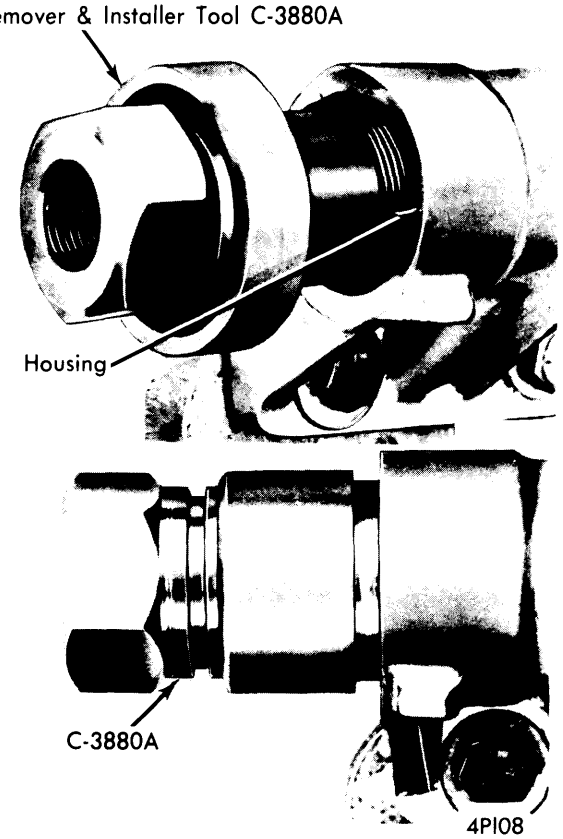
REMOVAL & INSTALLATION

NOTE – Steering component fasteners are made of special quality materials. Replacement fasteners must be of same part number or equivalent. Torque all fasteners as specified.

STEERING GEAR

1970-74 "B" & 1974 "PB" Models – Remove drag link from pitman arm. Disconnect battery ground. Lift windshield washer reservoir and disconnect wires from pump motor. Hose need not be disconnected; place reservoir out of way. Remove steering column. Remove two gear-to-frame bolts and one gear-to-frame nut. Remove splash shield lower two bolts from under left wheel housing and force bottom of shield out from frame about ½" to allow steering gear to be lifted up off mounting stud. Lift gear out through hood opening. To install, reverse removal procedure and note following: Place front wheels straight ahead and set gear worm shaft and sector on high point.

1965-74 All Models (Exc. "B" & "PB" Models) – Remove pitman arm from steering gear sector shaft using suitable puller (C-3646). Remove steering gear-to-frame bolts. Remove bolt from coupling clamp at upper end of gear worm shaft. While supporting gear, tap coupling upward with a mallet until it is free from worm shaft splines, then lift steering gear from vehicle. To install, reverse removal procedure and note following: Place wheels in a straight ahead position and center steering wheel so gear sector shaft is on high point.



SECTOR SHAFT OIL SEAL REPLACEMENT ("B" & "PB" MODELS)

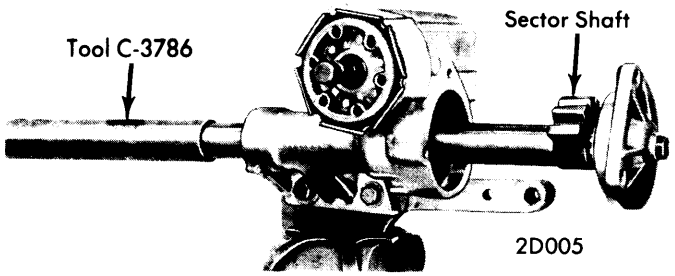
SECTOR SHAFT OIL SEAL

1970-74 "B" & 1974 "PB" Models – 1) Sector shaft seal can be replaced without removing steering gear from vehicle using following procedure: Clean exposed portion of sector shaft before replacing seal. Remove pitman arm using suitable puller (C-4150). Use suitable tool (C-3880) to service sector shaft seal. Tool consists of adapter SP-3056, half rings SP-1932 and nut SP-3610.

2) Slide threaded adapter over end of sector shaft and install nut portion of tool (see illustration). Apply pressure on adapter with nut while screwing adapter into seal until it grips seal firmly. Place two half rings and retainer over both portions of tool. Turn nut counterclockwise to withdraw seal from housing.

3) To install seal, place seal on shaft with seal lip facing gear housing. Place installing adapter against seal. Press seal in until a gap of ¼" exists between adapter and housing. Place nut from tool set on sector shaft and turn it down against adapter, pressing seal into housing until step on adapter contacts end of housing. Remove tool, install pitman arm and tighten nut to specifications.

CHRYSLER CORP. (SAGINAW) RECIRCULATING BALL (Cont.)



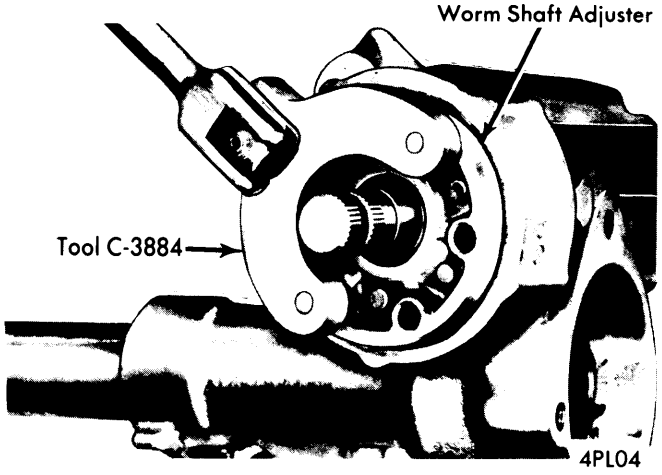
REMOVING SECTOR SHAFT "B" & "PB" MODELS

OVERHAUL

NOTE — Clean entire outside surface of steering gear before disassembly to avoid contamination of worm shaft and ball nut.

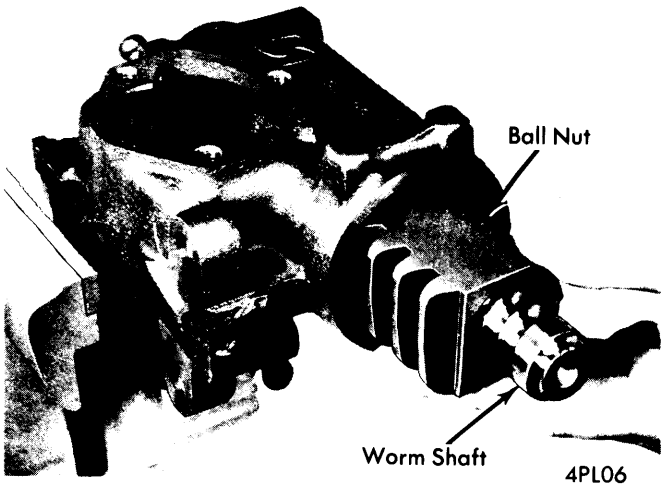
DISASSEMBLY

1970-74 "B" & 1974 "PB" Models — Support gear in a suitable holding fixture or vise, clamping onto gear mounting lug. Loosen sector adjusting screw lock nut about two turns. Remove sector shaft seal as previously outlined. Center steering worm shaft and remove bolts from sector shaft cover. Slowly remove sector shaft while sliding suitable arbor (C-3786) into housing. Remove lock nut from sector adjusting screw and turn screw clockwise to remove from cover. Loosen worm shaft bearing adjuster lock nut and remove nut. Hold worm from turning while unscrewing adjuster using suitable tool (C-3884). Slide worm adjuster off shaft. *CAUTION — Handle aluminum adjuster carefully to avoid damage to threads. Worm shaft should be horizontal when removing worm shaft and ball nut assembly. Do not allow ball nut to run down to either end of worm or damage to ball guide ends may result.* Carefully remove worm and ball nut assembly, unit is serviced only as an assembly and should not be disassembled. Remove housing bearings, bearing races, seals and bushings as necessary. Sector shaft cover assembly, including bearing or bushing, is serviced as an assembly.



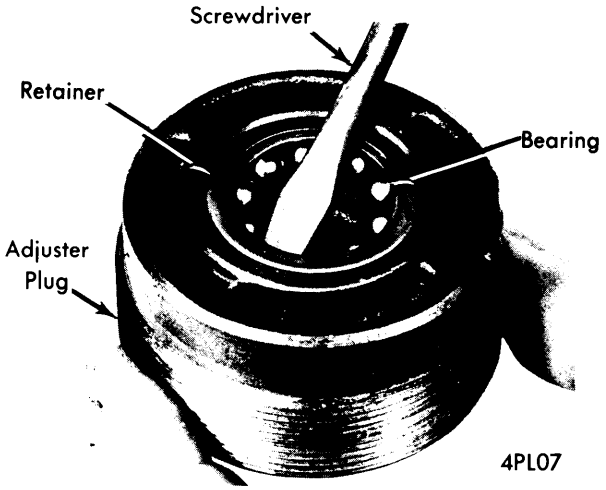
REMOVING WORM SHAFT ADJUSTER "B" & "PB" MODELS

1965-74 All Models (Exc. "B" & "PB" Models) — 1) Mount gear in a suitable holding fixture or vise, clamping onto gear mounting lug. Center worm shaft ball nut and sector in mid range of travel. Loosen sector shaft adjuster screw lock nut and remove housing cover bolts. Lift side cover and sector assembly from housing. Use a mallet on sector end to aid removal. Loosen worm shaft bearing adjuster lock nut and remove worm shaft bearing adjuster assembly with one bearing and race. *CAUTION — Worm shaft should be horizontal when removing adjuster, worm shaft and ball nut assembly. Do not allow ball nut to run down to either end of worm or damage to ball guide ends may result.* Remove worm and ball nut from housing.



REMOVING BALL NUT & WORM SHAFT

2) Remove remaining worm shaft bearing from inside housing. Use a screwdriver to pry lower bearing retainer from adjuster plug and remove bearing. Remove lock nut from sector shaft adjusting screw and remove screw from cover. Remove worm shaft and sector shaft seals. Check sector shaft bushing side cover, if wear is excessive, replace entire side cover assembly. Remove sector shaft bushing in housing with arbor press using suitable tool (C-4171 & adapter C-4173) inserted from lower end of housing. Remove worm shaft bearing adjuster raceand housing race if necessary.



REMOVING LOWER BEARING RETAINER (EXC. "B" & "PB" MODELS)

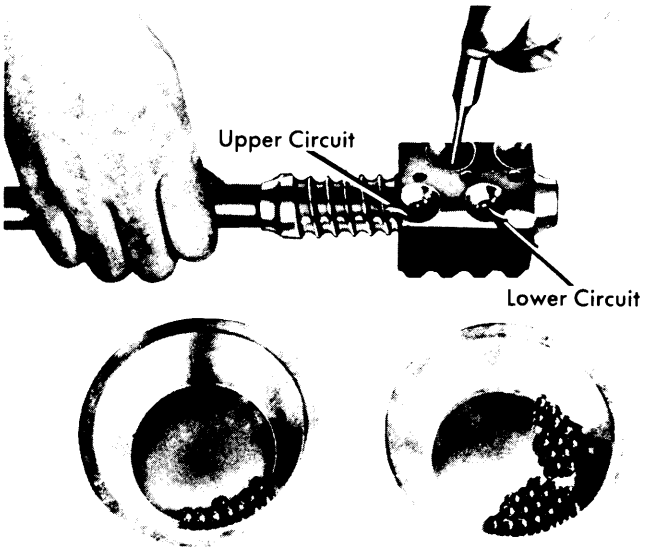
CHRYSLER CORP. (SAGINAW) RECIRCULATING BALL (Cont.)

CLEANING & INSPECTION

All Models – Wash parts with clean solvent and blow dry with compressed air. Inspect bearings, races, bushings and shafts for signs of wear. Check ball nut and worm shaft assembly for binding or roughness when turning worm shaft.

BALL NUT SERVICE

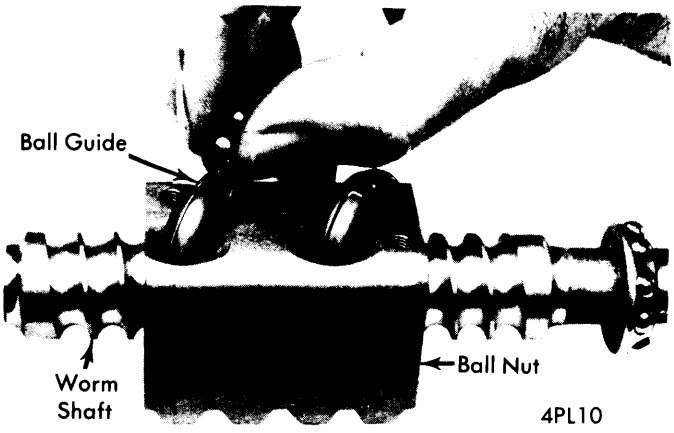
Side Loading Guides – Remove guides from nut over a clean pan to catch balls. Invert nut and rotate worm to permit balls to drop from nut. Remove worm shaft from nut. Wash parts and use a magnifying glass to inspect parts for defects. Check ball guide ends for damage. To reassemble, hold ball nut level and insert worm shaft having shallow side of rack teeth toward left as viewed from steering wheel end. Count 27 balls, number required for one circuit, into a clean container. Place 20 of these balls into one of the guide holes pushing them down with a punch if necessary. *CAUTION – Do not rotate worm while installing balls, or until both circuits are filled.* Place remaining seven balls in guide half, cover with mating half and plug ends with grease to keep balls from falling out. Push guide into nut and tap lightly with a screwdriver handle if binding results when installing guide. Use same procedure to fill second ball guide and nut circuit.



4PL09

FILLING BALL NUT (SIDE LOADING GUIDES)

Top Loading Guides – Disassembly, inspection and cleaning procedures are same as side loading type guide ball nut. To assembly top loading type, slip ball nut over worm with guide holes up and shallow end of ball nut teeth to left as viewed from steering wheel end. Align grooves in worm by sighting through ball holes. Place ball guide halves together and insert in ball nut. Count 25 balls into suitable container for one circuit. Load balls into one of guide holes while turning worm gradually away from hole. With 25 balls install, circuit is complete. Repeat procedure with other circuit.



4PL10

FILLING BALL NUT (TOP LOADING GUIDES)

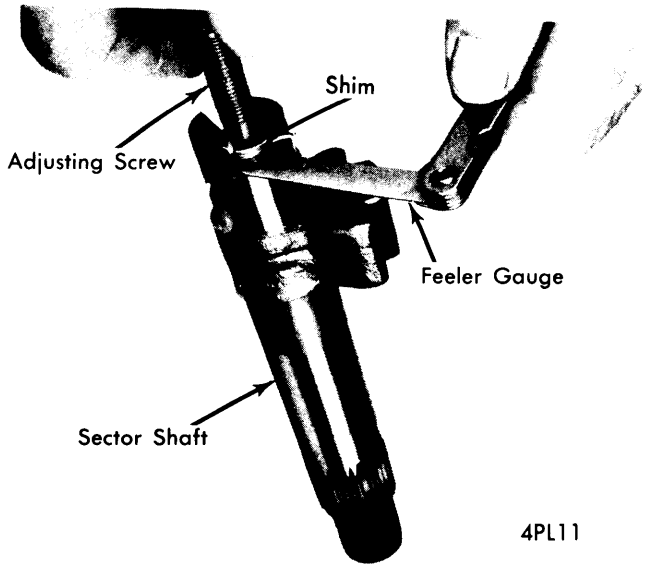
REASSEMBLY

1970-74 "B" & 1974 "PB" Models – 1) Install sector lower needle bearing on end of suitable tool (C-3786) with adapter ring. Press bearing into housing to ½" below end of bore to provide space for oil seal. *CAUTION – Adapter ring must be use with remover and installer arbor tool C-3875 and C-3786 or bearings will be crushed.* Install upper needle bearing by placing bearing on tool C-3786 and press bearing inside end of housing bore flush with inside end of bore surface. Install worm bearing cup and spacer into adjuster nut and press into place with suitable tool C-3865. Install worm oil seal in worm adjuster with seal metal retainer up. Drive seal into place slightly below end of bore in adjuster.

2) Apply steering gear lubricant to all moving parts during reassembly and also place lubricant on seal lips. Clamp gear in a vise with bearing adjuster opening upward. Install thrust bearing in lower cup in housing. Hold ball nut from turning on worm shaft and install assembly in housing. Place upper thrust bearing on worm shaft. Lubricate threads on adjuster and in housing. Wrap tape over worm splines to protect seal. Slide adjuster over shaft. Thread adjuster into steering gear housing and with splined nut set, tighten adjuster to 50 ft. lbs. while rotating worm shaft to effectively seat bearings. Loosen adjuster so no bearing pre-load exists, then readjust worm bearing pre-load as previously outlined in Adjustments.

3) Before installing sector shaft, apply suitable steering gear lubricant in housing and worm shaft cavities. *NOTE – Do not use gear oil in steering gear for lubricant.* When gear is properly filled, it should hold 11 ounces of lubricant. Install sector shaft adjusting screw and shim in shaft. Test end clearance of screw, it must be free to turn with zero to .004" end play. Three different thickness shims are available to obtain specified clearance. Start sector shaft and screw into housing cover using a screwdriver in cover hole to turn adjuster screw, and install lock nut, but do not tighten. Rotate worm shaft to center ball nut, install new gasket on housing cover, and carefully install sector and cover assembly into housing. Leave some lash between sector teeth and ball nut rack, then tighten cover bolts as specified. Install sector shaft seal and perform over-center adjustment as previously outlined.

CHRYSLER CORP. (SAGINAW) RECIRCULATING BALL (Cont.)



CHECKING LASH ADJUSTER END CLEARANCE

1965-74 All Models (Exc. "B" & "PB" Models) – 1) During reassembly, apply a light coat of non-hardening oil resistant sealer to threads of worm shaft adjuster, side cover bolts and sector shaft lash adjuster bolt. This will aid in prevention of lubricant leakage from steering gear assembly. Apply steering gear lubricant to all moving parts during reassembly and also on seal lips. Install new sector shaft bushings, and worm shaft bearing races in housing as required. Install new sector shaft and worm shaft seals.

2) Mount steering gear in a vise so worm shaft bore is in a horizontal positon with side cover opening up. With upper ball bearing on worm shaft, install worm and ball nut assembly in housing positioning worm shaft through upper ball bearing race and seal. Install ball bearing and seal in adjuster plug, and place retainer into position. Install adjuster plug and lock nut in gear housing guiding worm shaft into bearing. Tighten adjuster until only a small amount of worm shaft end play remains.

3) Install sector shaft lash adjuster screw and shim in slotted end of shaft. Check end clearance of screw in sector shaft, clearance should be .002" or less (see illustration). Shims are available in thickness of .063", .065", .067" and .069". Turn worm shaft until ball nut is at end of travel. Place as much lubricant into housing as possible without losing it out sector opening. Turn worm and ball nut to other extreme and apply more lubricant. Center ball nut on worm shaft travel.

4) Install sector shaft assembly into housing engaging center tooth of sector with center tooth space of ball nut. Apply more lubricant to housing and ensure that side cover bushing bore is lubricated. Install side cover gasket and cover. Turn lash adjuster screw until screw bottoms, then turn screw back one-half turn. Start lock nut and tighten hand tight. Tighten side cover bolts as specified. Adjust steering gear as specified in Adjustments.

TIGHTENING SPECIFICATIONS

Application	Ft. LBs.
Worm Preload Adjuster Lock Nut	
All Models (Exc. "B" & "PB" Models)	85
Sector Shaft Adjuster Screw Lock Nut	
"B" & "PB" Models	35
All Others	24
Pitman Arm-To-Sector Shaft Nut	
"B" & "PB" Models	175
All Others	
7/8-14	95-145
1-14	145-245
Clamp Bolt	30
Housing Cover Bolts	
"B" & "PB" Models	25
All Others	22-28
Gear-To-Frame Nuts	
"B" & "PB" Models	100
All Others	
7/16-20	40-70
1/2-20	65-105
9/16-18	90-140