STEERING

STEERING COLUMNS

GENERAL

All models are equipped with an anti-theft, energy-absorbing steering column. The column is designed to compress during a front end collision.

The ignition switch and lock cylinder are mounted on the column. When the lock cylinder is engaged in the LOCK position, the ignition switch and steering mechanism cannot be operated. On vehicles equipped with automatic transmission, the lock mechanism also prevents operation of the gearshift linkage.

An Adjust-O-Tilt steering column is optionally available on all models. This column also has the energy-absorbing and anti-theft features.

A center slip-type (telescoping) intermediate shaft is used on all models. It is attached to the steering gear with a flexible-type coupling and to the steering column with a universal joint.

STEERING COLUMN ALIGNMENT

(1) Loosen two-piece toeboard seal cover and remove lower clamp bracket.

(2) Remove instrument panel lower trim.

(3) Loosen column mounting bracket-to-instrument-panel attaching bolts.

(4) Pull steering column upward. Maintain upward pressure and tighten instrument panel-to-column mounting bracket bolts to 20 foot-pounds torque.

(5) Install lower clamp bracket and tighten bolts to 15 foot-pounds torque.

(6) Tighten toeboard seal cover bolts to 10 foot-pounds torque.

(7) Install instrument panel lower trim.

(8) On vehicles with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.

STEERING WHEEL REMOVAL

CJ Models

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove rubber boot and horn button from steering wheel. Rotate button until lock tabs on button align with notches in contact cup and pull upward to remove.

(4) Remove steering wheel nut and washer.

NOTE: *If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.*

(5) Remove plastic horn contact cup retainer and remove horn contact cup and contact plate from steering wheel.

(6) Remove horn contact pin and bushing from steering wheel.

(7) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

(8) Remove steering wheel using Puller J-25115 (fig. 11-1).

Cherokee-Wagoneer-Truck Models

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

SERVICE DIAGNOSIS—ALL COLUMNS

Lock System

Condition	Possible Cause	Correction
WILL NOT UNLOCK	(1) Sector stripped.	(1) Replace sector.
	(2) Lock bolt damaged.	(2) Replace lock bolt.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Damaged housing.	(4) Replace housing.
	(5) Damaged sector.	(5) Replace sector.
	(6) Damaged rack.	(6) Replace rack.
	(7) Shear flange on sector shaft collapsed (tilt column).	(7) Replace sector.
WILL NOT LOCK	(1) Lockbolt spring broken or defective.	(1) Replace lock bolt spring.
	(2) Damaged sector tooth.	(2) Replace sector.
	(3) Defective lock cylinder.	(3) Replace lock cylinder.
	(4) Burr on lock bolt or housing.	(4) Remove burr.
	(5) Damaged housing.	(5) Replace housing.
	(6) Damaged rack.	(6) Replace rack.
	(7) Ignition switch stuck.	(7) Replace ignition switch.
	(8) Actuator rod restricted.	(8) Remove restriction.
	(9) Transmission gearshift linkage adjustment incorrect.	(9) Adjust linkage.
	(10) Sector installed incorrectly.	(10) Install correctly.
	(11) Interference between bowl (shroud) and remote rod (tilt column).	(11) Replace bowl (shroud) or remote rod as required.
HIGH EFFORT	(1) Lock cylinder defective.	(1) Replace lock cylinder.
	(2) Ignition switch defective.	(2) Replace ignition switch.
	(3) Rack preload spring broken or deformed.	(3) Replace preload spring.
	(4) Burrs on sector, rack, housing, support or actuator rod coupling.	(4) Remove burr.

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Lock System (Continued)

Condition	Possible Cause	Correction
HIGH EFFORT (Continued)	(5) Bent sector shaft.	(5) Replace shaft.
	(6) Defective rack.	(6) Replace rack.
	(7) Remote rod restricted.	(7) Remove restriction.
	(8) Bent remote rod.	(8) Straighten or replace.
	(9) Ignition switch mounting bracket bent.	(9) Straighten or replace.
	(10) Extreme misalignment of housing to cover (tilt column).	(10) Replace either or both.
	(11) Distorted coupling slot in rack (tilt column).	(11) Replace rack.
WILL STICK IN "START"	(1) Remote rod deformed.	(1) Straighten or replace.
	(2) Any high effort condition.	(2) Check items under high effort.
KEY CANNOT BE REMOVED IN "OFF-LOCK"	(1) Ignition switch is not set correctly.	(1) Readjust.
	(2) Defective lock cylinder.	(2) Replace lock cylinder.
LOCK CYLINDER CAN BE REMOVED WITHOUT DEPRESSING RETAINER	(1) Lock cylinder with defective retainer.	(1) Replace lock cylinder.
	(2) Lock cylinder retainer missing.	(2) Replace lock cylinder.
	(3) Burr over retainer slot in housing cover.	(3) Remove burr.
HIGH EFFORT ON LOCK CYLINDER BETWEEN "OFF" AND "OFF-LOCK"	(1) Distorted rack.	(1) Replace rack.
	(2) Burr on tang of shift gate (automatic column).	(2) Remove burr.
	(3) Linkage not adjusted.	(3) Adjust linkage.
LOCK BOLT HITS SHAFT LOCK IN "OFF" POSITION	(1) Ignition switch is not adjusted correctly (all except tilt column).	(1) Adjust ignition switch.

Ignition System

Condition	Possible Cause	Correction
ELECTRICAL SYSTEM WILL NOT FUNCTION	(1) Poor battery connection.	(1) Connect securely.
	(2) Connector body loose or defective.	(2) Tighten or replace.
	(3) Defective wiring.	(3) Repair or replace.
	(4) Defective ignition switch.	(4) Replace ignition switch.
	(5) Ignition switch not adjusted properly.	(5) Adjust switch.
SWITCH WILL NOT ACTUATE MECHANICALLY	(1) Defective ignition switch.	(1) Replace switch.
SWITCH CANNOT BE ADJUSTED CORRECTLY	(1) Switch remote rod deformed.	(1) Repair, straighten or replace.
	(2) Sector to rack engaged in wrong tooth.	(2) Engage correctly.

Column

Condition	Possible Cause	Correction
NOISE IN COLUMN	(1) Coupling bolts not tightened.	(1) Tighten pinch bolts to 30 ft.-lbs. torque.
	(2) Column not correctly aligned.	(2) Align column.
	(3) Coupling pulled apart.	(3) Align column and replace coupling.
	(4) Broken lower joint.	(4) Repair or replace joint and align column.
	(5) Horn contact ring not lubricated.	(5) Lubricate with multi-purpose grease.
	(6) Lack of grease on bearings or bearing surfaces.	(6) Lubricate with multi-purpose grease.
	(7) Lower shaft bearing worn or broken.	(7) Replace bearing. Check shaft and replace if scored.
	(8) Upper shaft bearing worn or broken.	(8) Replace bearing assembly.
	(9) Shaft lock plate cover loose.	(9) Tighten three screws to 15 in.-lbs. torque, or if missing, replace. CAUTION: Use specified screws only.

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Column (Continued)

Condition	Possible Cause	Correction
NOISE IN COLUMN (Continued)	(10) Shaft lock retaining ring not seated.	(10) Replace snap ring. Check for proper seating in groove.
	(11) One click when in "off-lock" position and the steering wheel is moved (all except automatic column).	(11) Normal—lock bolt is seating.
	(12) Loose sight shields (all except automatic column).	(12) Bend to eliminate rattle.
HIGH STEERING SHAFT EFFORT	(1) Column misaligned.	(1) Align column.
	(2) Defective upper or lower bearing.	(2) Replace as required.
	(3) Tight steering universal joint (tilt column only).	(3) Repair or replace.
	(4) Flash on I.D. of shift tube at plastic joint (tilt column only).	(4) Replace shift tube.
	(5) Frozen upper or lower bearings (all except manual column).	(5) Replace bearings.
MISCELLANEOUS	(1) Shroud loose on shift bowl. Housing loose on jacket—will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	(1) Bends on shroud over lugs on bowl. Tighten four mounting screws to 60 in.-lbs. torque.
LASH IN MOUNTED COLUMN ASSEMBLY	(1) Instrument panel bracket mounting bolts loose.	(1) Tighten to 20 ft.-lbs. torque.
	(2) Broken weld nuts on jacket.	(2) Replace jacket assembly.
	(3) Column bracket capsule sheared.	(3) Replace bracket assembly.
	(4) Column bracket to jacket mounting bolts loose.	(4) Tighten to 20 ft.-lbs. torque.
	(5) Loose lock shoes in housing (tilt column only).	(5) Replace shoes.
	(6) Loose tilt head pivot pins (tilt column only).	(6) Replace pivot pins.
	(7) Loose lock shoe pin in support (tilt column only).	(7) Replace pin.
	(8) Loose support screws (tilt column only).	(8) Tighten to 60 in.-lbs. torque.

Column (Continued)

Condition	Possible Cause	Correction
STEERING WHEEL UPPER HOUSING LOOSE (TILT COLUMN ONLY)	(1) Excessive clearance between holes in support or housing and pivot pin diameters.	(1) Replace either or both pivot pins.
	(2) Defective or missing anti-lash spring in centering spheres.	(2) Add spring or replace both spheres.
	(3) Upper bearing not seating in housing.	(3) Replace bearing and housing.
	(4) Upper bearing inner race seat missing.	(4) Install seat.
	(5) Loose support screws.	(5) Tighten to 60 in.-lbs. torque.
	(6) Bearing preload spring missing or broken.	(6) Replace preload spring.
STEERING WHEEL LOOSE—EVERY OTHER TILT POSITION (TILT COLUMN ONLY)	(1) Loose fit between lock shoe and shoe pivot pin.	(1) Replace lock shoes and pivot pin.
STEERING COLUMN NOT LOCKING IN ANY TILT POSITION (TILT COLUMN ONLY)	(1) Shoe seized on its pivot pin.	(1) Replace both.
	(2) Shoe grooves may have burrs or dirt.	(2) Replace shoe.
	(3) Shoe lock spring weak or broken.	(3) Replace lock spring.
STEERING WHEEL FAILS TO RETURN TO TOP TILT POSITION (TILT COLUMN ONLY)	(1) Pivot pins are bound up.	(1) Replace pivot pins.
	(2) Wheel tilt spring is defective.	(2) Replace tilt spring.
	(3) Turn signal switch wires too tight (improperly routed).	(3) Adjust position of wires.
NOISE WHEN TILTING COLUMN (TILT COLUMN ONLY)	(1) Upper tilt bumpers worn.	(1) Replace tilt bumper.
	(2) Tilt spring rubbing in housing.	(2) Lubricate with multi-purpose grease.
ONE CLICK WHEN IN "OFF-LOCK" POSITION AND THE STEERING WHEEL IS MOVED	(1) Seating of lock bolt.	(1) None. Click is normal characteristic sound produced by lock bolt as it seats.

Column (Continued)

Condition	Possible Cause	Correction
HIGH SHIFT EFFORT (AUTOMATIC AND TILT COLUMN ONLY)	(1) Column not aligned correctly in car.	(1) Align.
	(2) Lower bowl bearing not aligned correctly.	(2) Assemble correctly.
	(3) Lack of grease on seal or bearing areas.	(3) Lubricate.
IMPROPER TRANSMISSION SHIFTING (AFTER ANY NECESSARY CORRECTIONS, THE NEUTRAL START SWITCH IS TO BE CHECKED AND ADJUSTED AS REQUIRED) (AUTOMATIC AND TILT COLUMN ONLY)	(1) Sheared shift tube joint.	(1) Replace shift tube assembly.
	(2) Improper transmission gearshift	(2) Adjust linkage.
	(3) Loose lower shift lever.	(3) Replace shift tube assembly.
	(4) Improper shift gate.	(4) Replace with correct part.
TURN SIGNAL WILL NOT CANCEL	(1) Loose switch mounting screws.	(1) Tighten to specified torque (25 in.-lbs.).
	(2) Switch or anchor bosses broken.	(2) Replace switch.
	(3) Broken, missing or out of position detent, return or cancelling spring.	(3) Reposition springs or replace switch as required.
	(4) Uneven or incorrect cancelling cam to cancelling spring interference (.120 in/side).	(4) Adjust switch position. (a) If interference is correct and switch will still not cancel, replace switch. (b) If interference cannot be corrected by switch adjustment, replace cancelling cam or switch.

Turn Signal

Condition	Possible Cause	Correction
TURN SIGNAL DIFFICULT TO OPERATE	(1) Turn signal lever loose.	(1) Tighten mounting screw (12 in.-lbs.).
	(2) Yoke broken or distorted.	(2) Replace switch.
	(3) Loose or misplaced springs.	(3) Reposition springs or replace switch.
	(4) Foreign parts and/or materials.	(4) Remove foreign parts and/or material.
	(5) Switch mounted loosely.	(5) Tighten mounting screws (25 in.-lbs.).

Turn Signal (Continued)

Condition	Possible Cause	Correction
TURN SIGNAL WILL NOT INDICATE LANE CHANGE	(1) Broken lane change pressure pad or spring hanger.	(1) Replace switch.
	(2) Broken, missing or misplaced lane change spring.	(2) Replace or reposition as required.
	(3) Jammed base or wires.	(3) Loosen mounting screws, reposition base or wires and retighten screws (25 in.-lbs).
TURN SIGNAL WILL NOT STAY IN TURN POSITION	(1) Foreign material or loose parts impeding movement of yoke.	(1) Remove material and/or parts.
	(2) Broken or missing detent or cancelling springs.	(2) Replace switch.
	(3) None of the above.	(3) Replace switch.
HAZARD SWITCH CANNOT BE TURNED OFF	(1) Foreign material between hazard support cancelling leg and yoke.	(1) Remove foreign material. (a) No foreign material impeding function of hazard switch—replace turn signal switch.
HAZARD SWITCH WILL NOT STAY ON OR DIFFICULT TO TURN OFF	(1) Loose switch mounting screws.	(1) Tighten mounting screws (25 in.-lbs.).
	(2) Interference with other components.	(2) Remove interference.
	(3) Foreign material.	(3) Remove foreign material.
	(4) None of the above.	(4) Replace switch.
NO TURN SIGNAL LIGHTS	(1) Defective or blown fuse.	(1) Replace fuse.
	(2) Inoperative turn signal flasher.	(2) Replace turn signal flasher.
	(3) Loose chassis to column connector.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand. If vehicle lights now operate normally, signal switch is inoperative.	(4) Replace signal switch.
	(5) If vehicle lights do not operate check chassis wiring for opens, grounds, etc.	(5) Repair chassis wiring as required.

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Turn Signal (Continued)

TURN INDICATOR LIGHTS (ON INSTRUMENT PANEL) ON, BUT NOT FLASHING	(1) Inoperative turn flasher.	(1) Replace turn flasher. Note: There are two flashers in the system. Consult manual for location.
	(2) Loose chassis to column connection.	(2) Connect securely.
	(3) Burned out or damaged front or rear turn signal bulb.	(3) Replace bulb.
	(4) Inoperative turn signal switch.	(4) Replace turn signal switch.
	(5) To determine if turn signal switch is defective, substitute new switch into circuit and operate switch by hand. If the vehicle's lights operate normally, signal switch in inoperative.	(5) Replace signal switch.
	(6) If the vehicle's lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc.	(6) Repair chassis wiring as required using manual as guide.
FRONT OR REAR TURN SIGNAL LIGHTS NOT FLASHING	(1) Burned out or damaged turn signal bulb.	(1) Replace bulb.
	(2) High resistance connection to ground at bulb socket.	(2) Remove or repair defective connection.
	(3) Loose chassis to column connector.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system and operate switch by hand. If turn signal lights are now on and flash, turn signal switch is inoperative.	(4) Replace turn signal switch.
	(5) If vehicle lights do not operate, check chassis wiring harness to light sockets for opens, grounds, etc.	(5) Repair chassis wiring as required using manual as guide.

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Turn Signal (Continued)

Condition	Possible Cause	Correction
STOP LIGHT NOT ON WHEN TURN INDICATED	(1) Loose column to chassis connection.	(1) Connect securely.
	(2) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If brake lights work with switch in the turn position, signal switch is defective.	(2) Replace signal switch.
	(3) If brake lights do not work check connector to stop light sockets for grounds, opens, etc.	(3) Repair connector to stop light circuits using service manual as guide.
TURN INDICATOR PANEL LIGHTS NOT FLASHING	(1) Burned out bulbs.	(1) Replace bulbs.
	(2) High resistance to ground at bulb socket.	(2) Replace socket.
	(3) Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights.	(3) Locate and repair as required. Use service manual as guide.
TURN SIGNAL LIGHTS FLASH VERY SLOWLY	(1) Inoperative turn signal flasher.	(1) Replace turn signal flasher.
	(2) System charging voltage low.	(2) Increase voltage to specified. Use service manual.
	(3) High resistance ground at light sockets.	(3) Repair high resistance grounds at light sockets.
	(4) Loose chassis to column connection.	(4) Connect securely.
	(5) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If flashing occurs at normal rate, the signal switch is defective.	(5) Replace signal switch.
	(6) If the flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for grounds, high resistance points, etc.	(6) Locate and repair as required. Use service manual as guide.

Turn Signal (Continued)

Condition	Possible Cause	Correction
HAZARD SIGNAL LIGHTS WILL NOT FLASH—TURN SIGNAL FUNCTIONS NORMALLY	(1) Blown fuse.	(1) Replace fuse.
	(2) Inoperative hazard warning flasher.	(2) Replace hazard warning flasher in fuse panel.
	(3) Loose chassis to column connection.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system without removing old. Depress the hazard warning lights. If they now work normally, the turn signal switch is defective.	(4) Replace the turn signal switch.
	(5) If the lights do not flash, check wiring harness "K" lead for open between hazard flasher and connector. If open, fuse block is defective.	(5) Repair or replace brown wire or connector as required.

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(3) Remove horn cover attaching screws from underside of steering wheel and remove horn cover.

NOTE: *If equipped with sport style wheel, remove button, nut and washer, button retaining ring, and horn contact ring.*

(4) Disconnect horn wire from switch in steering wheel cavity. Gently pull and wiggle connector to remove.

(5) Remove steering wheel nut and connector.

(6) Paint or scribe alignment marks on steering wheel and steering shaft for assembly reference.

(7) Remove steering wheel using Puller J-25115 (fig. 11-1).

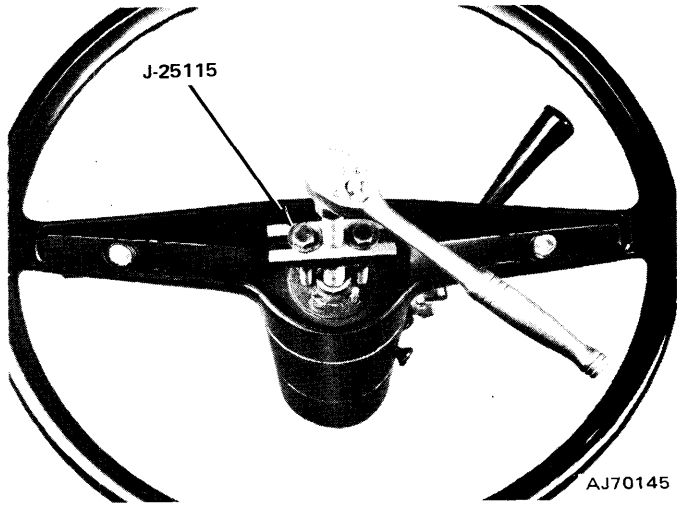


Fig. 11-1 Steering Wheel Removal

STEERING WHEEL INSTALLATION

CJ Models

(1) Align paint or scribe marks on steering wheel and steering shaft and install steering wheel.

(2) Install horn contact pin and bushing in steering wheel. Be sure bushing is seated fully.

(3) Assemble contact plate, horn contact cup, and plastic horn contact cup retainer. Install assembled parts in steering wheel and install attaching screws.

(4) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(5) Install rubber boot and horn button on steering wheel.

(6) Connect battery negative cable.

Cherokee-Wagoneer-Truck Models

(1) Align paint or scribe marks on steering shaft and steering wheel and install steering wheel.

(2) Install steering wheel washer and nut. Tighten nut to 20 foot-pounds torque.

(3) Connect horn wire to switch in steering wheel.

(4) Install steering wheel horn cover.

NOTE: *If equipped with the sport style wheel, install the horn contact ring, button retaining ring, washer and nut, and horn button.*

(5) Connect battery negative cable.

STEERING COLUMN REMOVAL

CAUTION: *Handle the steering column with special care after it is removed from the vehicle. Sharp blows on the end of the steering shaft or shift levers, leaning on the column assembly, or dropping the assembly could shear or loosen the plastic fasteners that maintain column rigidity.*

(1) Disconnect battery negative cable.

(2) On vehicles with automatic transmission, disconnect transmission shift rod at steering column shift lever.

NOTE: *On Wagoneer and Cherokee models with power brakes, the gearshift linkage must first be placed in the "1" range detent position in order to gain access to the shift rod-to-shift lever retaining clip.*

(3) Remove steering column-to-intermediate shaft U-joint pinch bolt.

CAUTION: *Do not attempt to separate the intermediate shaft and steering column at this time. If separated, the plastic connector injected into the intermediate shaft could be damaged.*

(4) On Wagoneer and Cherokee models with air conditioning, remove left duct extension.

(5) Remove steering column-to-instrument panel bezel.

NOTE: *On Wagoneer, Cherokee, and Truck models, the screws that attach the two halves of the bezel are located behind the lower bezel half.*

(6) Remove bolts attaching steering column mounting bracket to instrument panel.

(7) Remove bolts attaching steering column mounting bracket to steering column and remove bracket.

CAUTION: *To avoid damaging the mounting bracket breakaway capsules, store the bracket in a safe place until service operations are completed.*

(8) Remove upper and lower toe plates.

(9) On vehicles with automatic transmission, disconnect wiring terminal at neutral safety switch.

(10) Disconnect wiring harness connectors at ignition switch. Disconnect black connector first. Release connectors by pressing lock tab on each connector.

(11) Disconnect Cruise Command terminal connector if equipped.

(12) Separate steering column from intermediate shaft and remove steering column.

STEERING COLUMN INSTALLATION

WARNING: *Use only the specified screws, bolts, and nuts when servicing the column. Do not use any substitute fasteners. Tighten all fasteners to the specified torque only to maintain the energy-absorbing (compression) action of the column. Bolts and screws longer than specified must not be used as they may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must be tightened to the proper torque so that the bracket will break away under impact.*

(1) Install steering column in vehicle and connect column to intermediate shaft.

(2) Install intermediate shaft-to-column U-joint pinch bolt. Tighten bolt to 30 foot-pounds torque.

(3) Connect Cruise Command wiring terminal if equipped.

(4) Connect wiring harness connectors to ignition switch. Install white connector first—black connector last.

(5) On vehicles with automatic transmission, connect wiring harness connector to neutral safety switch.

(6) Install upper and lower toe plates but do not tighten attaching bolts completely.

(7) Install mounting bracket on steering column and tighten bracket attaching bolts to 15 foot-pounds torque.

(8) Align steering column and instrument panel and install mounting bracket-to-instrument panel bolts. Do not tighten bolts completely.

(9) Pull steering column upward and tighten mounting bracket-to-instrument panel bolts to 20 foot-pounds torque. Be sure to maintain upward pressure on column when tightening bolts.

(10) Tighten toe plate bolts to 15 foot-pounds torque.

(11) Install both halves of steering column-to-instrument panel bezel.

(12) On Wagoneer, Cherokee, and Truck models with air conditioning, install left duct extension.

(13) Connect transmission shift rod to steering column shift lever.

(14) Connect battery negative cable.

(15) On vehicles with automatic transmission, check operation of gearshift linkage and adjust linkage if necessary.

(16) Install toeboard parts.

(17) Connect all electrical components and check for proper operation.

(18) Install instrument panel trim, steering column bezel, and left side air conditioning duct (if equipped).

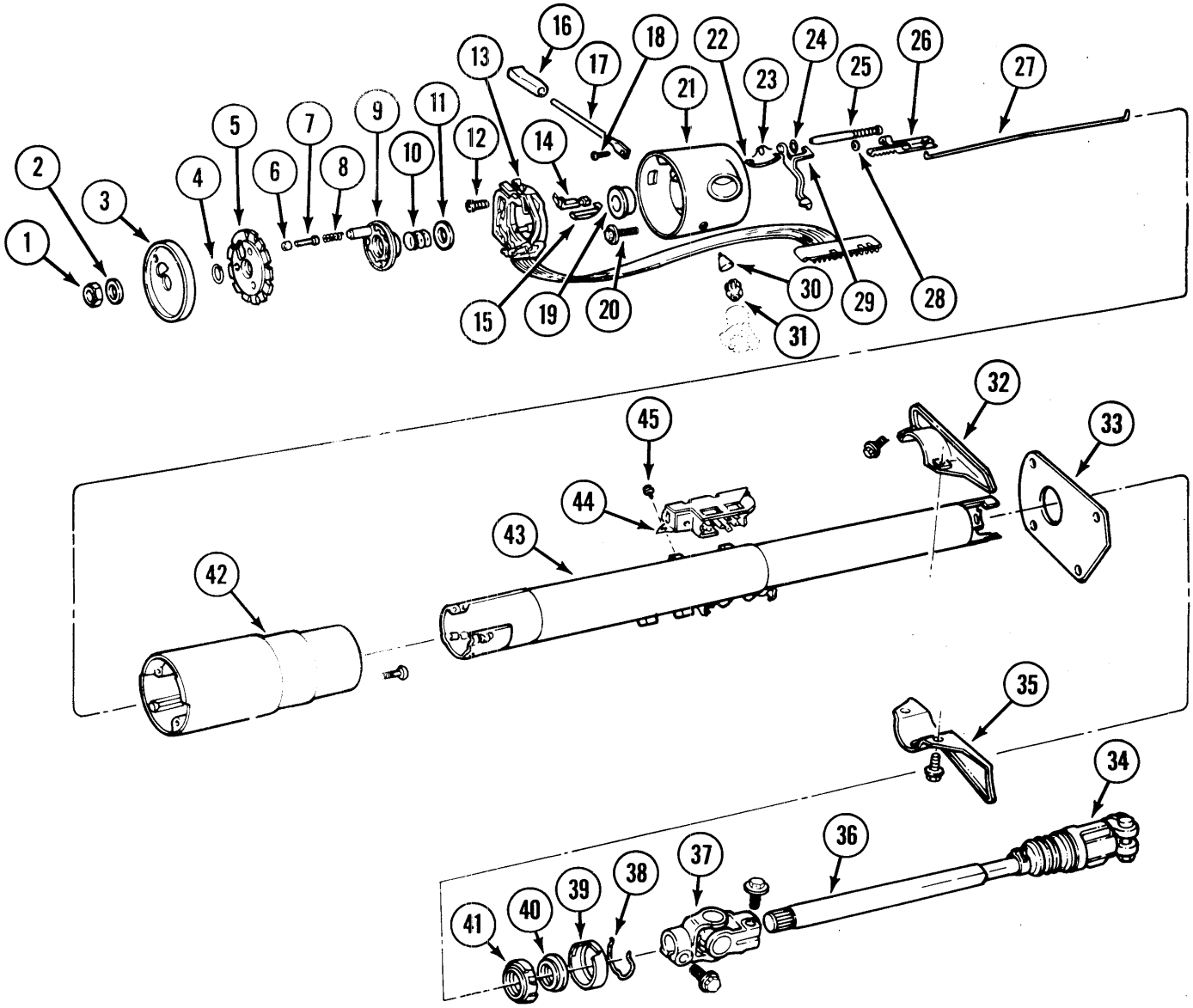
(19) On vehicle with automatic transmission, check gearshift manual linkage for proper operation. Refer to Automatic Transmission section.

(20) Connect battery negative cable.

STEERING COLUMN—MANUAL TRANSMISSION

Column Disassembly

NOTE: *Steering column removal is not necessary if only the anti-theft cover, lock plate and snap ring, canceling cam, turn signal switch, upper bearing preload spring, or lock cylinder are to be serviced (fig. 11-2).*



1. STEERING WHEEL NUT
2. WASHER
3. ANTI-THEFT COVER
4. STEERING SHAFT SNAP RING
5. LOCKPLATE
6. BUSHING
7. HORN CONTACT PIN
8. SPRING
9. CANCELLING CAM
10. UPPER BEARING PRELOAD SPRING
11. THRUST WASHER
12. TURN SIGNAL SWITCH SCREW (3)
13. TURN SIGNAL SWITCH
14. BUZZER SWITCH
15. BUZZER SWITCH SPRING
16. TURN SIGNAL LEVER KNOB
17. TURN SIGNAL LEVER
18. TURN SIGNAL LEVER SCREW
19. UPPER BEARING
20. HOUSING RETAINING SCREW (4)
21. HOUSING
22. RACK PRELOAD SPRING
23. KEY RELEASE LEVER SPRING
24. WAVE WASHER
25. LOCK BOLT
26. LOCK RACK
27. REMOTE ROD
28. SPRING WASHER
29. KEY RELEASE LEVER
30. HAZARD WARNING SWITCH KNOB
31. SECTOR
32. TOE PLATE (UPPER HALF)
33. SEAL
34. INTERMEDIATE SHAFT COUPLING
35. TOE PLATE (LOWER HALF)
36. INTERMEDIATE SHAFT
37. INTERMEDIATE SHAFT-TO-STEERING SHAFT U-JOINT
38. SNAP RING
39. RETAINER
40. LOWER BEARING
41. LOWER BEARING ADAPTER
42. SHROUD
43. JACKET
44. IGNITION SWITCH
45. IGNITION SWITCH SCREW (2)

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Fig. 11-2 Steering Column—Manual Transmission

However, the column must be removed in order to service any of the remaining components. If the column is removed, remove the column-to-instrument panel mounting bracket and install Support Fixture J-23074 (fig. 11-3). Mount the column in a vise by clamping the support fixture flange in the vise.

(1) Place front wheels in straight-ahead position.
(2) Disconnect battery negative cable.
(3) Cover painted areas of column.
(4) Remove steering wheel.
(5) Remove anti-theft cover. Use two screwdrivers to pry cover off of lock plate and out of column.

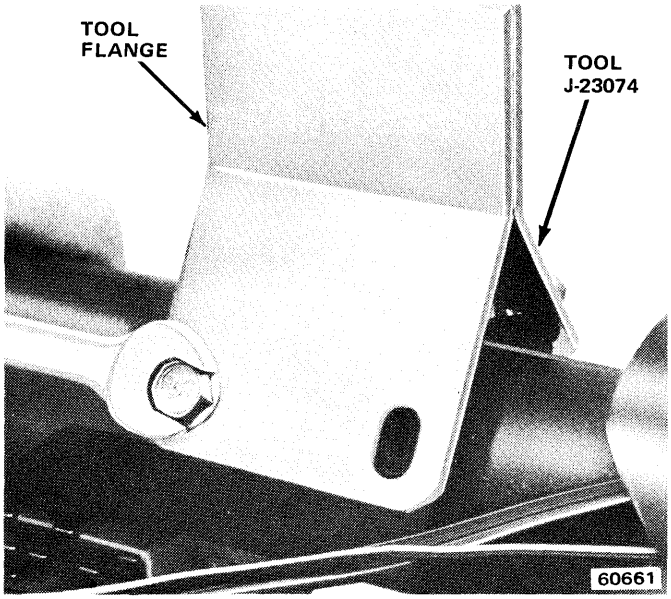

Fig. 11-3 Attaching Support Fixture

(6) Compress lock plate using Lock Plate Compressor Tool J-23653 and unseat wire snap ring from steering shaft groove (fig. 11-4). Discard snap ring, do not reuse.

WARNING: *The lock plate is under strong spring tension.*

(7) Remove lock plate compressor tool.

(8) Remove snap ring, lock plate, turn signal canceling cam, upper bearing preload spring, and thrust washer from steering shaft.

CAUTION: *When the steering shaft snap ring is removed, the shaft is free in the column. During bench overhaul, remove the shaft by pulling it out from the lower end of column. Do not allow the shaft to fall out whenever the column is removed from the vehicle.*

(9) Remove hazard warning switch knob. Press knob inward and unthread knob from column.

(10) On vehicles without Cruise Command, remove turn signal lever attaching screw and remove lever.

(11) On vehicles with Cruise Command, disconnect two of four wires at switch connector. Fold wires back along harness. Tape wires to harness and tape length of string to harness to aid removal.

(12) Unhook turn signal switch wire harness connector from bracket at lower end of steering column.

(13) Disconnect instrument panel harness connector from turn signal switch harness connector by lifting plastic lock tab on connector and separating connectors (fig. 11-5).

(14) Wrap tape around turn signal switch harness connector to prevent snagging during removal.

(15) Remove turn signal switch attaching screws and remove switch. Pull switch and harness straight up and out of housing (fig. 11-6).

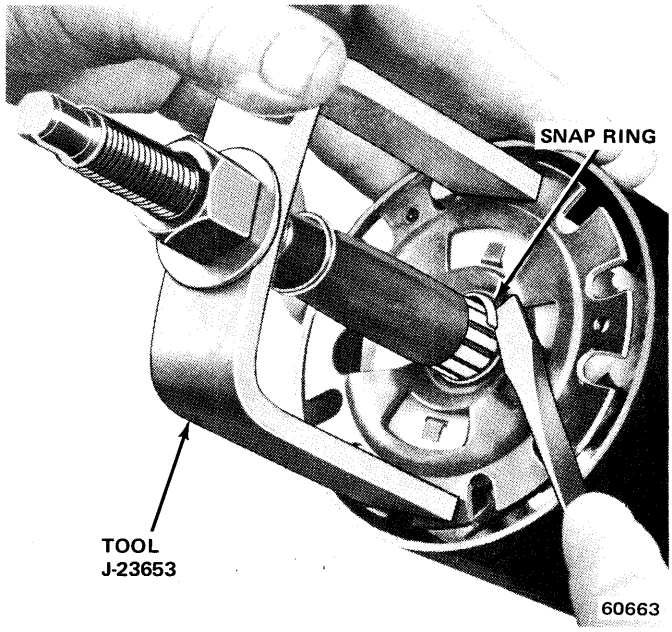

Fig. 11-4 Removing Lock Plate Snap Ring

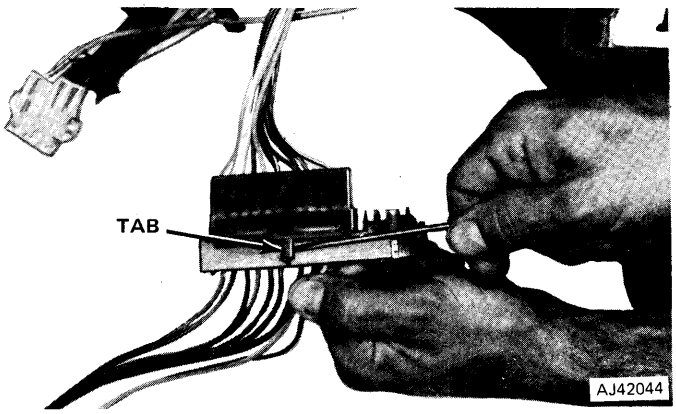

Fig. 11-5 Disconnecting Turn Signal Switch Harness Connectors

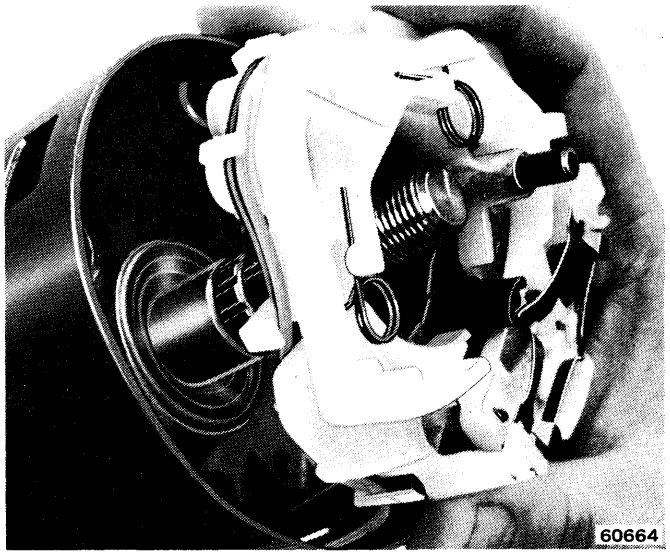

Fig. 11-6 Removing—Installing Turn Signal Switch

(16) On vehicles with Cruise Command, remove turn signal lever and switch and remove switch harness using string previously taped in place.

(17) Place ignition lock cylinder in RUN position.

(18) Compress lock cylinder retaining tab using thin-bladed screwdriver and remove lock cylinder from column.

NOTE: *The lock cylinder retaining tab is accessible through the slot adjacent to the turn signal switch mounting boss (fig. 11-7). If the retaining tab is not visible through the slot, scrape or knock any casting flash out of the slot to provide access.*

(19) Remove ignition switch from lower end of column (fig. 11-8).

(20) Remove screws attaching housing and shroud to column jacket (fig. 11-9) and remove housing and shroud.

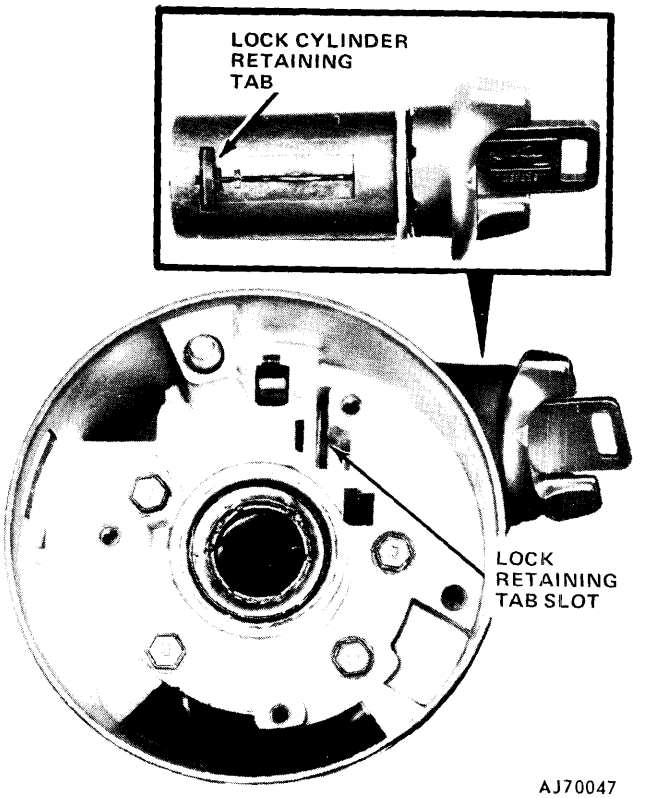

Fig. 11-7 Lock Cylinder Retaining Tab Location

(21) Disengage remote rod from lock rack.

(22) Remove screws attaching shroud to housing (fig. 11-10) and separate shroud and housing.

(23) Remove wave washer from key-release lever pivot and remove key-release lever and spring (fig. 11-11).

(24) Remove lock rack and lock bolt assembly (fig. 11-12).

(25) Remove rack preload spring (fig. 11-13).

(26) Remove sector through lock cylinder hole in housing. Push on block tooth of sector with blunt punch to remove (fig. 11-14).

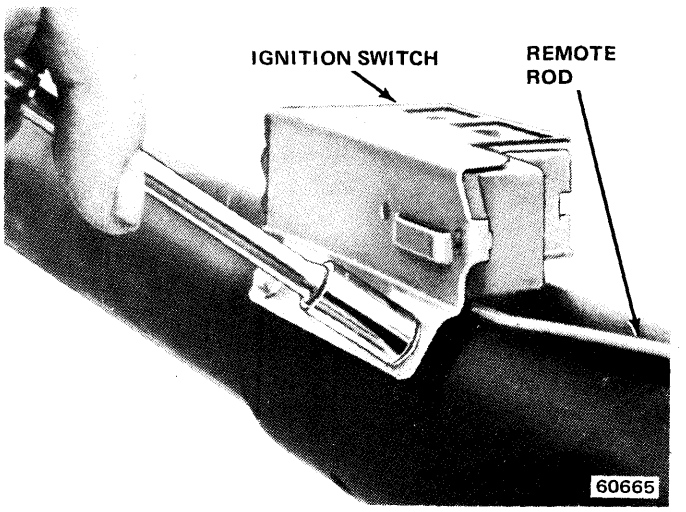

Fig. 11-8 Removing—Installing Ignition Switch

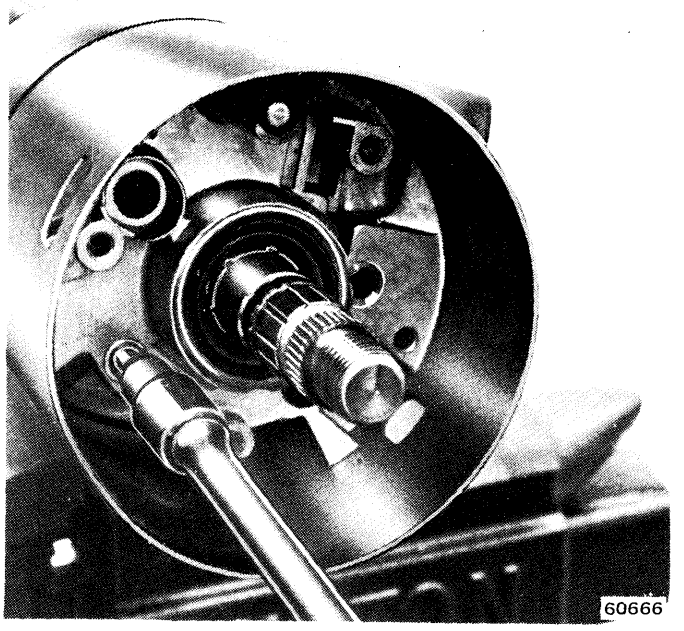

Fig. 11-9 Removing—Installing Housing and Shroud

NOTE: *Although the preceeding steps can be performed with the column mounted in the vehicle, the following steps can be performed only after the column has been removed.*

(27) Remove column from vehicle, if necessary, and mount column in vise using Support Fixture Tool J-23074 (fig. 11-3).

(28) Remove steering shaft.

(29) Remove snap ring from lower bearing retainer and remove retainer, bearing, and adapter.

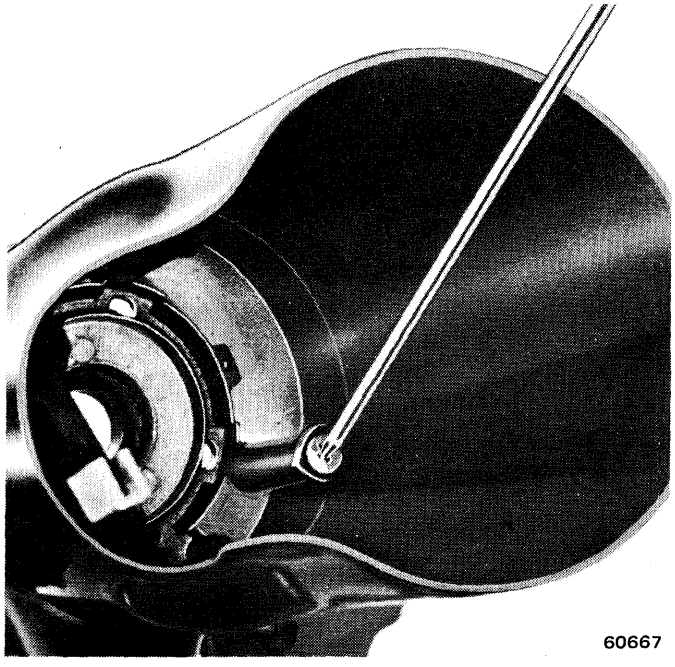

Fig. 11-10 Removing Shroud From Housing

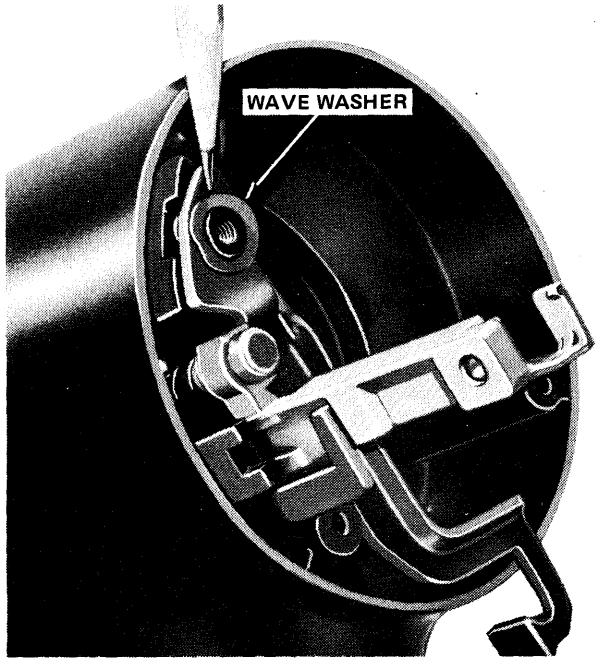

Fig. 11-11 Wave Washer Position

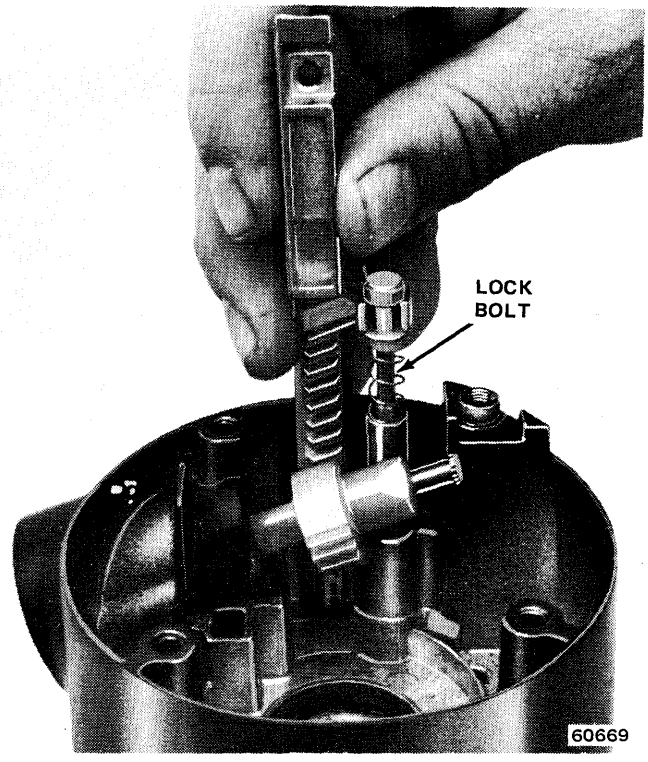

Fig. 11-12 Removing Lock Rack and Lock Bolt

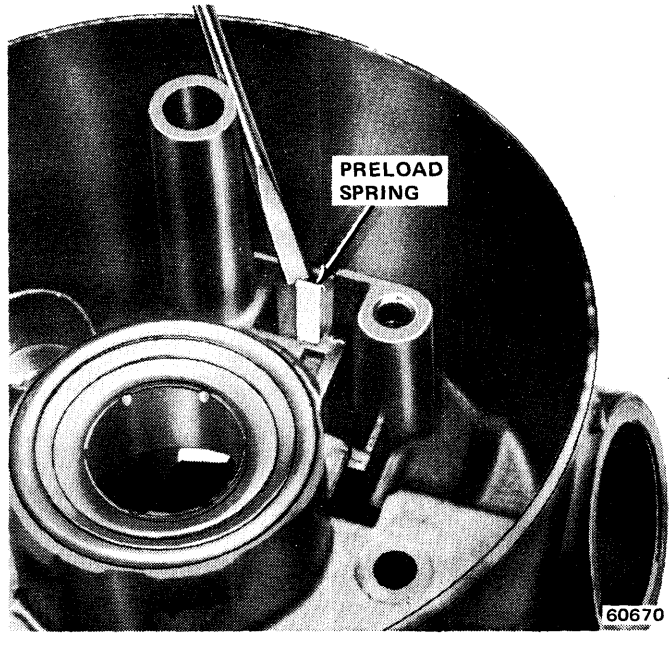

Fig. 11-13 Removing—Installing Rack Preload Spring

Column Assembly

WARNING: *Use only specified screws, bolts, and nuts when servicing the column, and tighten all fasteners to the specified torque only to maintain the energy-absorbing (compressing) action of the steering column. Incorrect length screws or bolts may prevent the column from compressing under impact. The bolts or nuts securing the column mounting bracket to the instrument panel must also be tightened to the proper torque so that the bracket will break away under impact.*

(1) Coat all friction and bearing surfaces with multi-purpose grease before assembly.

(2) Install sector on sector shaft. Install sector through lock cylinder hole in housing (fig. 11-15). Use blunt tool to press sector onto shaft. Be sure sector turns freely after installation.

(3) Install rack preload spring (fig. 11-13). Bowed side of spring must bear against lock rack when rack is installed.

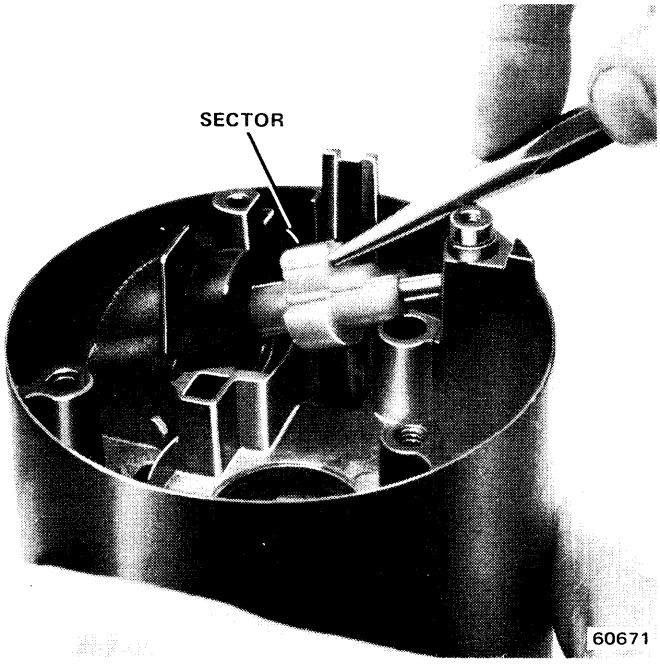

Fig. 11-14 Removing Sector

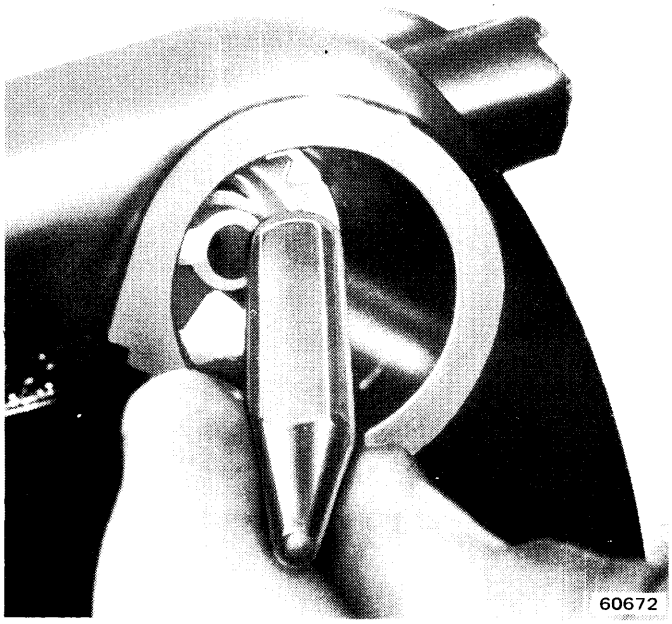

Fig. 11-15 Installing Sector

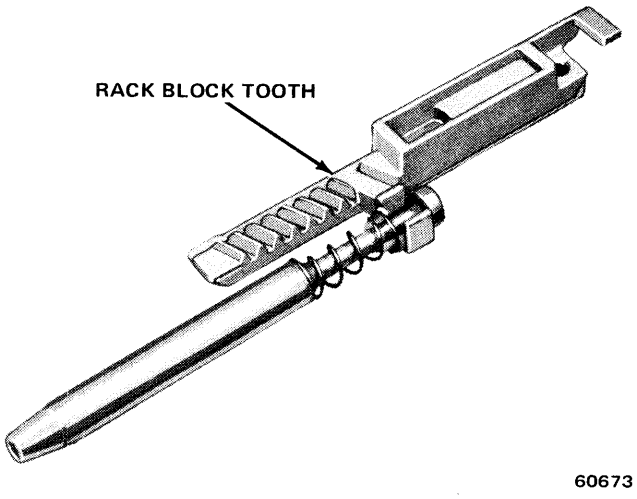

Fig. 11-16 Assembling Lock Bolt and Lock Rack

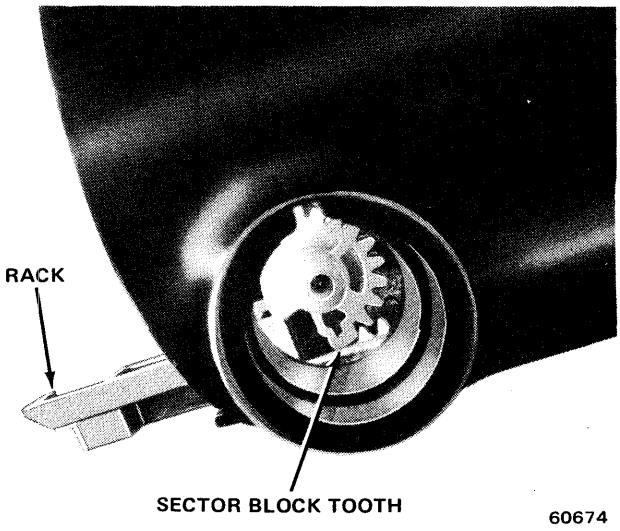

Fig. 11-17 Installing Lock Bolt and Lock Rack

(4) Assemble lock bolt and lock rack (fig. 11-16).

(5) Install assembled lock bolt and lock rack in housing (fig. 11-16). Mate block tooth of lock rack with block tooth of sector (fig. 11-17).

(6) Install key-release lever return spring over post in housing (fig. 11-18). Insert release lever finger in lock rack slot and position hole in lever over threaded hole in housing post (fig. 11-19). Be sure inner end of spring contacts release lever.

(7) Raise key-release lever slightly and install end of release lever spring between lever and housing boss (fig. 11-20).

(8) Coat wave washer with multi-purpose grease and install washer on post and over release lever (fig. 11-11).

(9) Position shroud on housing and install attaching screws. Tighten screws to 18 inch-pounds torque. Do not displace release lever wave washer when assembling shroud and housing.

(10) Install remote rod on lock rack. Insert short hooked end of rod in lock rack.

(11) Install assembled shroud and housing on column and install attaching screws (fig. 11-9). Tighten screws to 60 inch-pounds torque.

(12) Install lock cylinder in housing. Insert key in lock, hold cylinder sleeve, and rotate key clockwise until key stops (this retracts actuator).

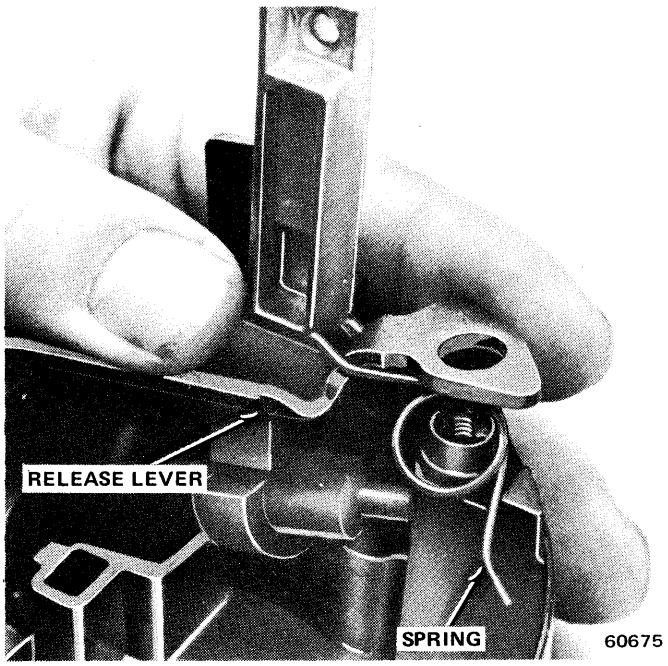

Fig. 11-18 Installing Key-Release Lever and Spring

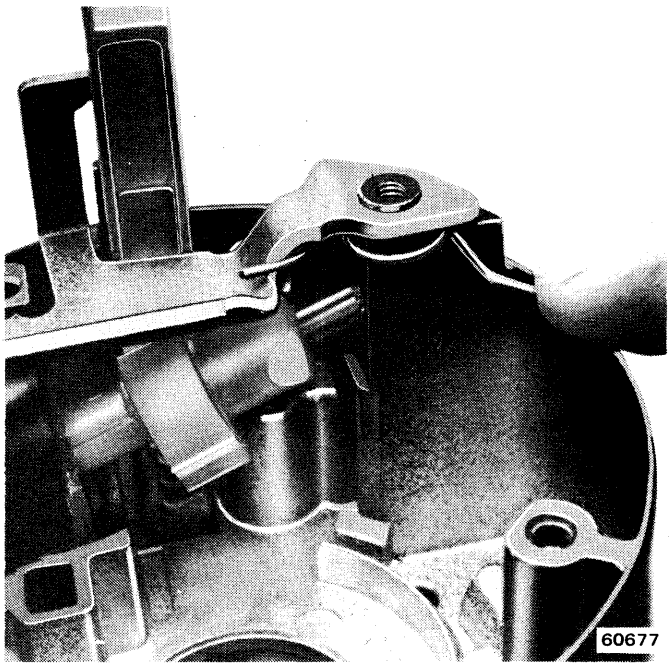

Fig. 11-20 Securing Key-Release Lever Spring

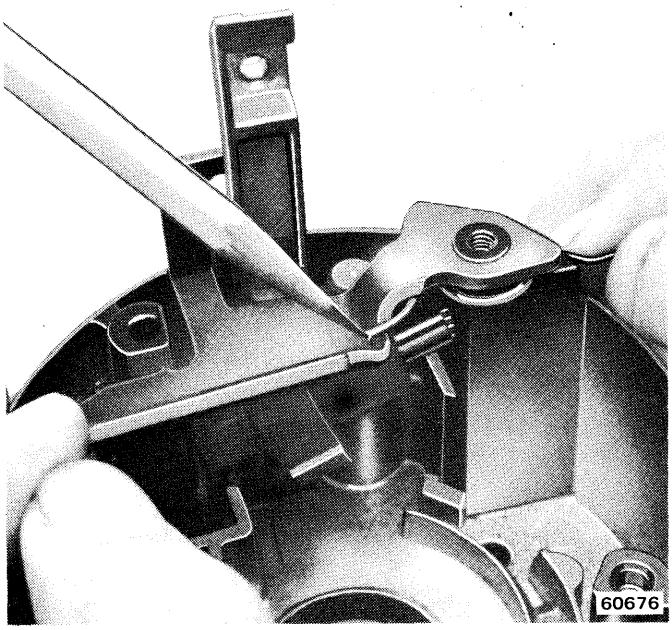

Fig. 11-19 Positioning Key-Release Lever Spring

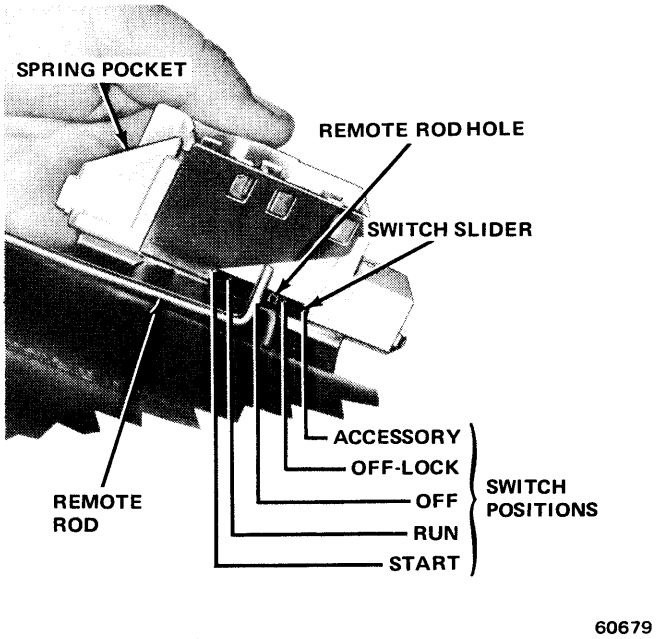

Fig. 11-21 Positioning Ignition Switch

(13) Insert lock cylinder in housing bore with cylinder tab aligned with keyway in housing. Push cylinder inward until it bottoms. Rotate key counterclockwise until drive section of cylinder mates with sector. Push cylinder in fully until tab engages in housing groove.

(14) Turn lock cylinder clockwise to stop, then counterclockwise to stop at Off-Unlock position.

(15) Place ignition switch in Off-Unlock position as follows:

(a) Position switch on jacket (fig. 11-21).

(b) Move switch slider to extreme left to Accessory position.

(c) Move slider two positions to right from Accessory position to Off-Unlock position.

(d) Insert remote rod into hole in switch slider.

(e) Position switch on column and install attaching screws. Tighten screws to 35 inch-pounds torque.

(16) Install lower bearing, bearing adapter, retainer, and snap ring in lower end of column.

(17) Install steering shaft through lower end of column and into upper bearing in housing.

(18) Install turn signal switch and wire harness. Bend wires against connector and feed connector through housing and shroud.

(19) Align turn signal switch in housing and install switch attaching screws. Tighten screws to 35 inch-pounds torque.

(20) On vehicles without Cruise Command, install turn signal lever. Tighten lever attaching screw to 35 inch-pounds torque.

(21) On vehicles with Cruise Command, install lever and switch assembly. Use string previously taped in place to guide wires into housing. Remove string and tape. Connect wires to switch terminal and install lever attaching screw. Tighten screw to 35 inch-pounds torque.

(22) Install thrust washer, upper bearing preload spring, and canceling cam on steering shaft. Position canceling cam as shown in figure 11-22.

(23) Place turn signal switch in neutral position and install hazard warning switch knob.

(24) Position lock plate on steering shaft.

(25) Install snap ring on sleeve of Compressor Tool J-23653 and thread tool sleeve onto end of steering shaft (fig. 11-23).

(26) Compress lock plate and install snap ring in steering shaft groove (fig. 11-23).

(27) Install anti-theft cover.

(28) Remove Support Fixture Tool J-23074 and install column mounting bracket. Tighten bracket attaching bolts to 22 foot-pounds torque.

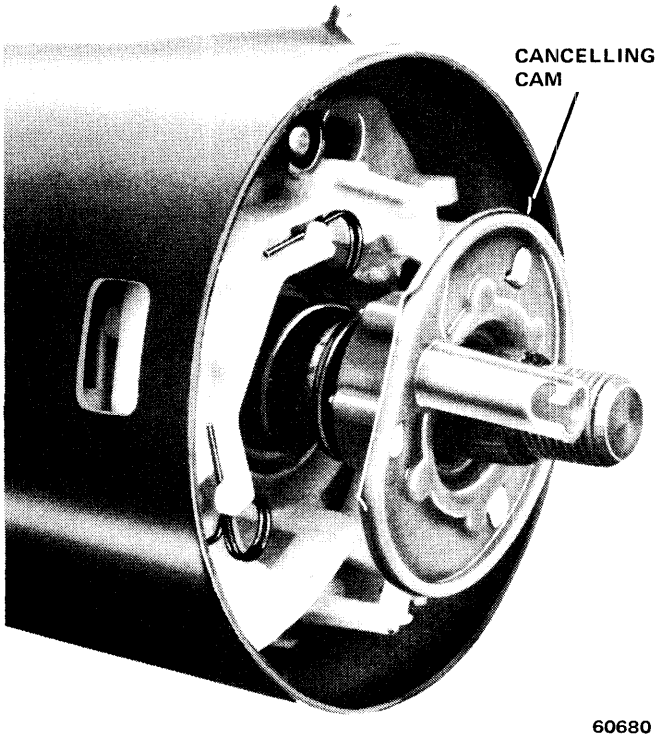

Fig. 11-22 Positioning Turn Signal Switch Cancelling Cam

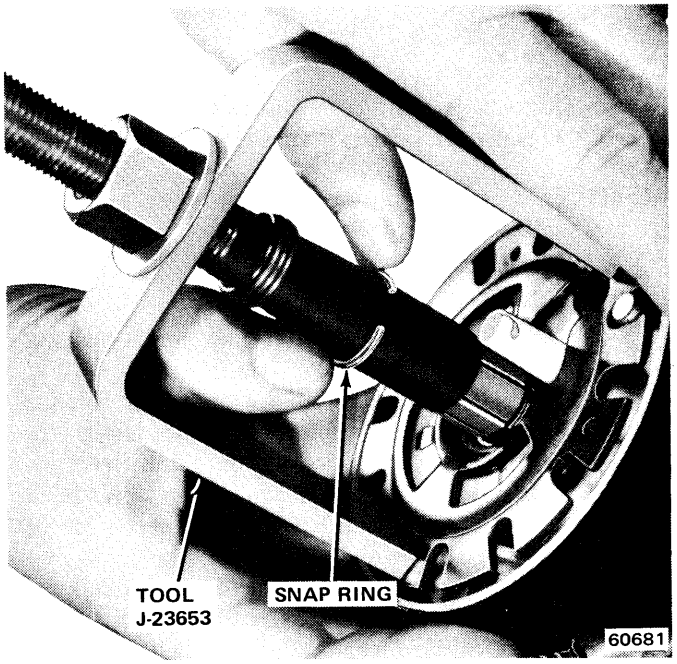

Fig. 11-23 Installing Lock Plate and Snap Ring

(29) Hook turn signal switch wire harness connector on column mounting lugs.

(30) Install steering wheel.

(31) Install steering wheel nut and tighten nut to 30 foot-pounds torque.

(32) Install steering column in vehicle if removed.

(33) Connect battery negative cable.

STEERING COLUMN—AUTOMATIC TRANSMISSION

Column Disassembly

NOTE: *Steering column removal is not necessary if only the anti-theft cover, lock plate and snap ring, upper bearing preload spring, canceling cam, turn signal switch, or lock cylinder are to be serviced. However, the column must be removed in order to service any of the remaining components. If the column must be removed, remove the column mounting bracket and install Support Fixture J-23074 (fig. 11-3). Mount the column in a vise by clamping the support fixture flange in the vise.*

(1) Disconnect battery negative cable.

(2) Place front wheels in straight-ahead position.

(3) Remove column-to-instrument panel bezel and left air conditioning duct (if equipped).

(4) Cover painted areas of column.

(5) Remove steering wheel (fig. 11-1).

(6) Remove anti-theft cover. Use two screwdrivers to pry cover off lock plate and out of housing.

(7) Compress lock plate using Compressor Tool J-23653 and unseat snap ring from steering shaft groove (fig. 11-4).

WARNING: *The lock plate is under strong spring tension.*

(8) Remove lock plate compressor tool and remove snap ring. Discard snap ring, do not reuse.

CAUTION: *When the snap ring is removed, the steering shaft is free in the column. If the column is removed for bench overhaul, do not let the shaft fall out when the column is removed.*

(9) Remove lock plate, canceling cam, upper bearing preload spring, and thrust washer (fig. 11-24).

(10) On vehicles without Cruise Command, remove turn signal lever attaching screw and remove lever.

(11) On vehicles with Cruise Command, remove wires from switch terminal. Fold two of four wires back along harness. Tape wires in place and tape length of string to harness to aid removal.

(12) Push inward on hazard warning switch knob and unthread knob in counterclockwise direction.

(13) Place gearshift lever in Park position. Remove lever retaining pin using punch and remove lever.

(14) Unhook turn signal switch wire harness connector from column.

(15) Disconnect turn signal switch harness connector from instrument panel harness connector (fig. 11-5). Lift connector lock tab to separate connectors.

(16) Using stiff wire or paper clip, compress lock tab retaining shift quadrant light wire in connnector block and disconnect wire.

(17) Remove column lower bracket and plastic harness protector.

(18) Remove column-to-instrument panel mounting bracket if turn signal switch is to be removed with column mounted in vehicle.

(19) Wrap tape around turn signal switch harness connector to prevent snagging (fig. 11-25).

(20) Remove turn signal switch attaching screws and remove switch and harness. Pull switch straight up and out of column.

(21) On vehicles with Cruise Command, remove turn signal lever attaching screw and remove lever and switch as assembly. Guide switch harness out of column using string previously taped to harness.

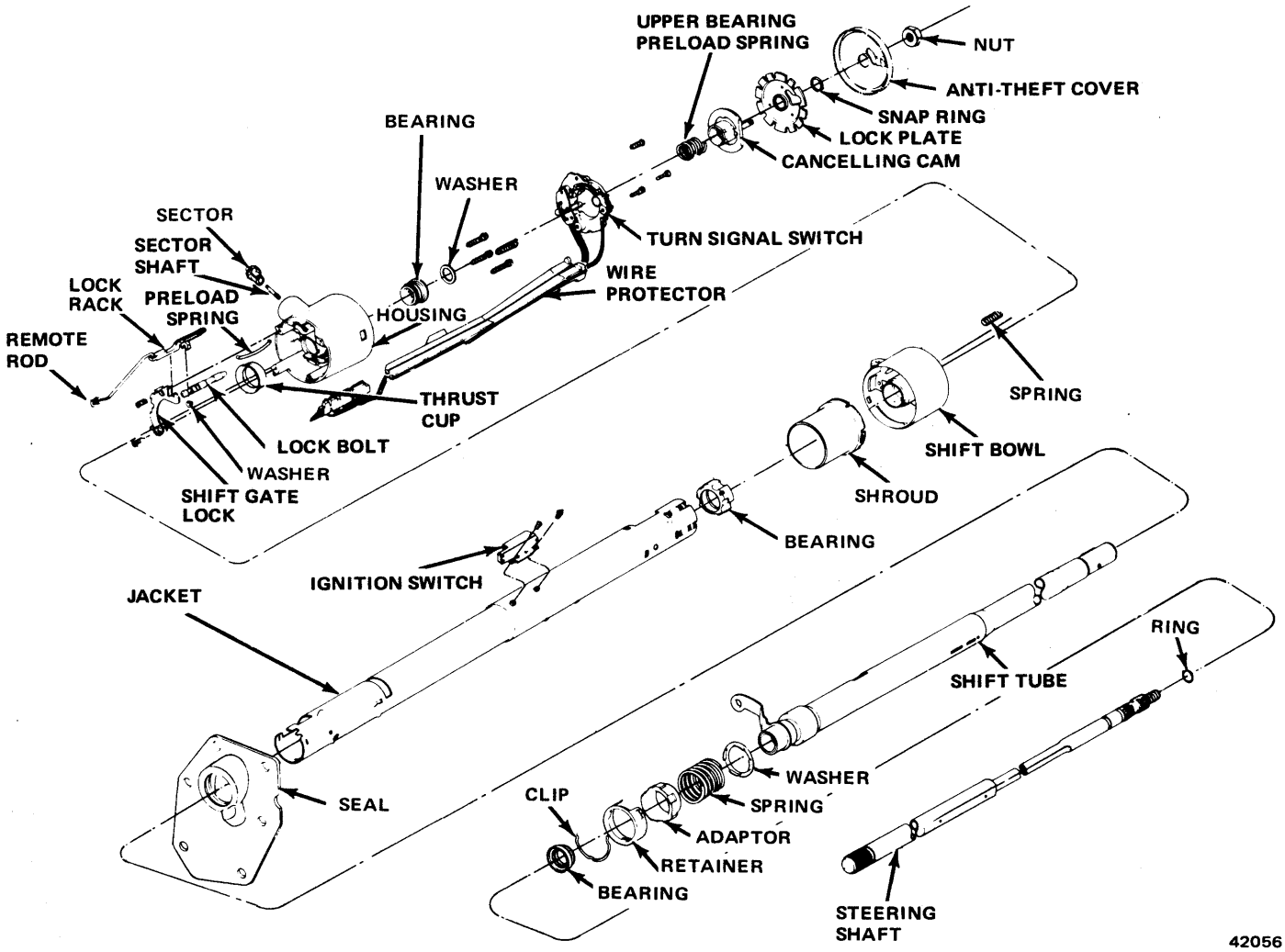

Fig. 11-24 Steering Column—Automatic Transmission

Fig. 11-25 Removing Turn Signal Switch Harness

(22) Place lock cylinder in LOCK position. Compress lock cylinder retaining tab and remove lock cylinder (fig. 11-7).

NOTE: *The retaining tab is accessible through the tab slot in the housing (fig. 11-7). If the tab is not visible through the slot, scrape or knock all casting flash from the slot.*

(23) Remove ignition switch from lower end of column.

(24) Remove upper housing attaching screws and remove upper housing.

NOTE: *The remote rod and shift quadrant light wire (if equipped) will be removed as an assembly along with the upper housing.*

(25) Remove thrust cup from upper housing (fig. 11-26).

(26) Remove lock bolt and lock rack and remove rack preload spring (fig. 11-27).

(27) Remove sector from sector shaft using blunt punch (fig. 11-17). Note position of sector for assembly reference. Remove sector through lock cylinder hole in housing.

(28) Remove shift gate lock from upper housing. Examine shift gate lock detents for wear. Replace lock if excessively worn.

(29) Remove shift quadrant. Quadrant is retained by two clips which must be pried out with small punch (fig. 11-28).

(30) Remove shift quadrant light cover. Remove screw retaining socket assembly and remove assembly.

(31) Remove shift bowl from column jacket.

(32) Remove nylon lower bowl bearing from upper end of column tube (fig. 11-29).

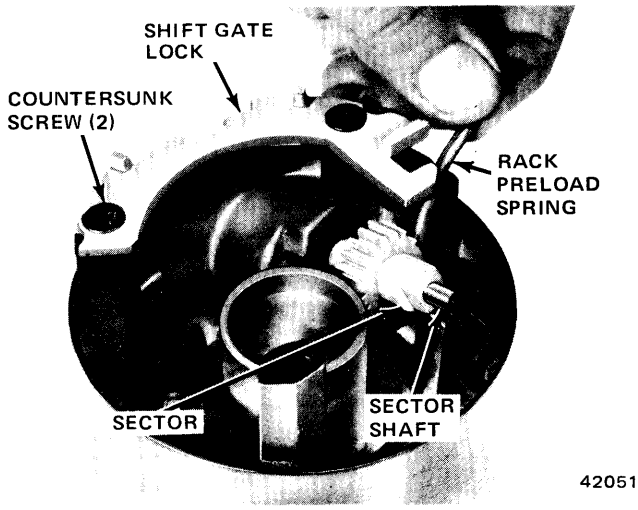

Fig. 11-27 Housing Components

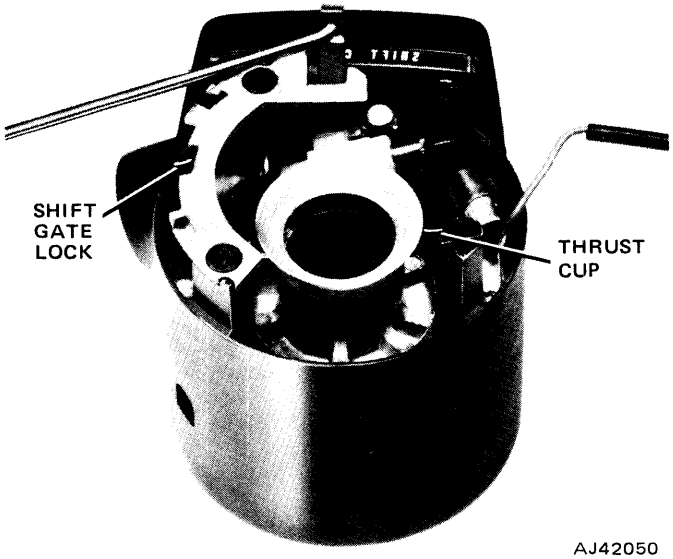

Fig. 11-26 Thrust Cup Position

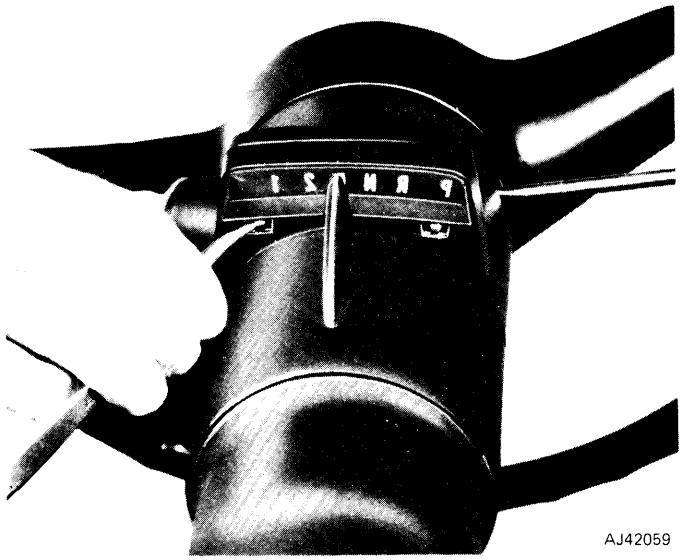

Fig. 11-28 Shift Quadrant Retainer Clip Removal

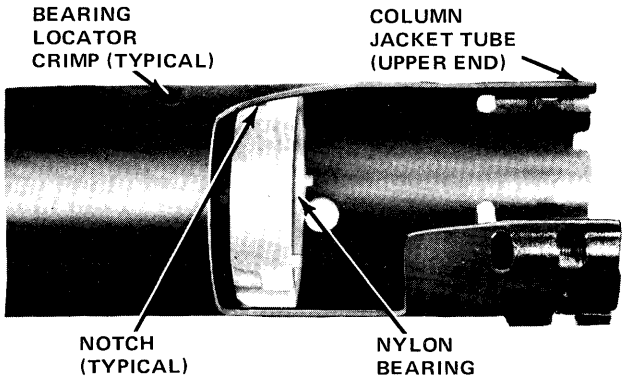

Fig. 11-29 Shift Bowl Lower Bearing Position

NOTE: *Although the proceeding steps are performed with the column mounted in the car, the following steps can be performed only after the column has been removed.*

(33) Remove column from vehicle. Refer to Steering Column Removal.

(34) Remove steering shaft from lower end of column.

(35) Remove lower bearing retainer, retainer ring, lower bearing preload spring, and nylon washer (fig. 11-30).

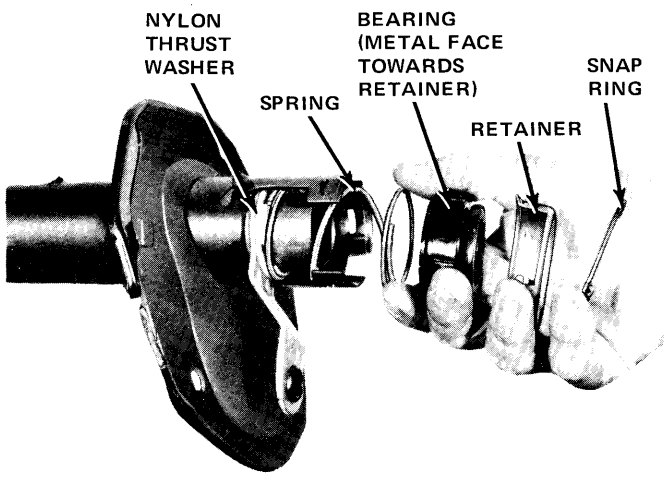

Fig. 30 Lower Bearing Assembly

(36) Remove neutral safety and backup lamp switch.

(37) Remove shift tube bearing retaining screws.

(38) Remove shift tube.

(39) Remove nylon shift tube bearing from tube.

Column Assembly

(1) Apply multi-purpose grease to all friction and bearing surfaces.

(2) Install shift tube.

(3) Install nylon thrust washer in lower end of shift tube with flat side of bearing facing upper end of tube (fig. 11-30).

(4) Install preload spring, lower bearing (with metal face toward retainer), bearing retainer, and retainer ring.

(5) Install neutral safety and backup lamp switch.

(6) Install nylon lower bowl bearing in upper end of jacket.

NOTE: *The bearing must be installed with the smaller inside diameter facing the lower end of the jacket, and with the bearing notches engaged in the three locator crimps in the column (fig. 11-29).*

(7) Align shift bowl with shift tube spline and install bowl.

(8) Install rack preload spring in upper housing (fig. 11-27).

(9) Position large end of sector on sector shaft and press sector in place using blunt punch (fig. 11-15).

(10) Install shift gate lock and install two countersunk attaching screws (fig. 11-26). Tighten screws to 45 inch-pounds torque.

(11) Install shift quadrant lamp and install lamp cover.

(12) Install shift quadrant indicator and press retainer clips into place with flat side toward bowl.

(13) Assemble lock bolt and lock rack (fig. 11-16).

(14) Install assembled lock bolt and lock rack in shift bowl (fig. 11-31).

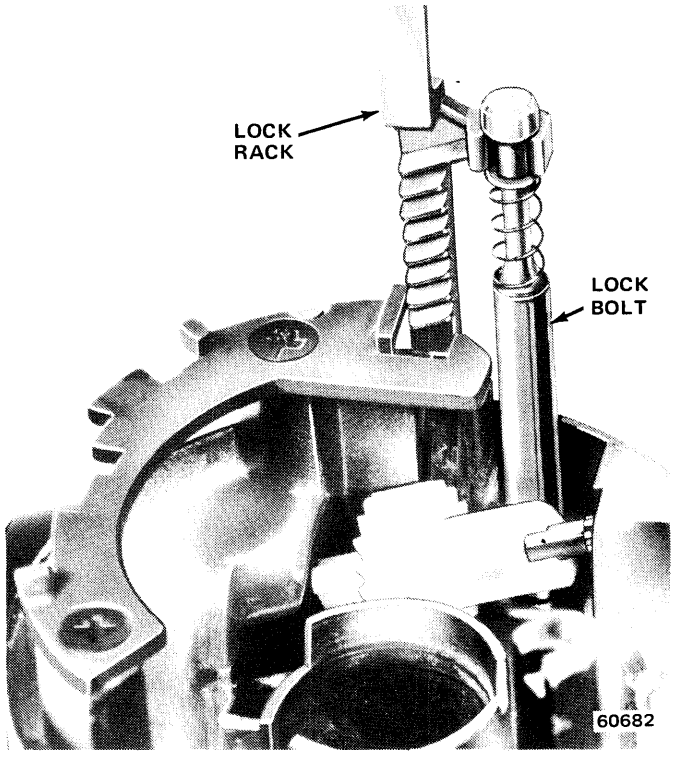

Fig. 11-31 Installing Lock Rack and Lock Bolt

NOTE: *Block tooth of lock rack must engage block tooth of sector (fig. 11-17).*

(15) Install nylon thrust cup in upper housing with flared end of cup facing outward (fig. 11-26).

(16) Rotate shift bowl counterclockwise to stop and install upper housing. Tighten housing attaching screws to 60 inch-pounds torque.

NOTE: *The shift bowl must be in the Park position and the rack pulled downward before installing the upper housing.*

(17) Guide shift quadrant lamp wire and remote lock rod into position between shift bowl and column jacket.

(18) Install turn signal switch and harness assembly in column.

(19) Remove tape from turn signal switch wire harness connector and position harness in protector and protector-to-column jacket.

(20) Install turn signal switch retaining screws. Be sure switch actuating lever pivot is correctly aligned and seated in upper housing pivot boss before installing screws.

(21) On vehicles without Cruise Command, install turn signal lever and lever attaching screw. Tighten screw to 35 inch-pounds torque.

(22) On vehicles with Cruise Command, install turn signal lever and switch assembly. Guide wires into housing using string previously taped in place. Remove string and tape. Connect wires to switch terminals. Install lever attaching screw and tighten screw to 35 inch-pounds torque.

(23) Install steering shaft if removed. Install shaft through lower end of column and into upper bearing.

(24) Install thrust washer, upper bearing preload spring, and canceling cam on upper end of steering shaft.

(25) Align lock plate splines with steering shaft splines and install lock plate. Be sure cancelling cam shaft protrudes through dogleg opening in lock plate (fig. 11-32).

(26) Install replacement steering shaft snap ring on sleeve of Lock Plate Compressor Tool J-23653 and thread tool onto steering shaft (fig. 11-23).

(27) Compress lock plate and seat snap ring in steering shaft groove.

(28) Remove compressor tool.

(29) Install anti-theft cover.

(30) Align canceling cam and index marks on steering shaft and steering wheel and install steering wheel. Tighten steering wheel nut to 20 foot-pounds torque.

(31) Install hazard warning light switch knob and steering wheel trim cover.

(32) Install gearshift lever.

(33) Install lock cylinder in cover.

(34) Install ignition switch on column.

(35) Place shift bowl in any position except Park and rotate bowl counterclockwise until lock rack bottoms against lower surface of bowl.

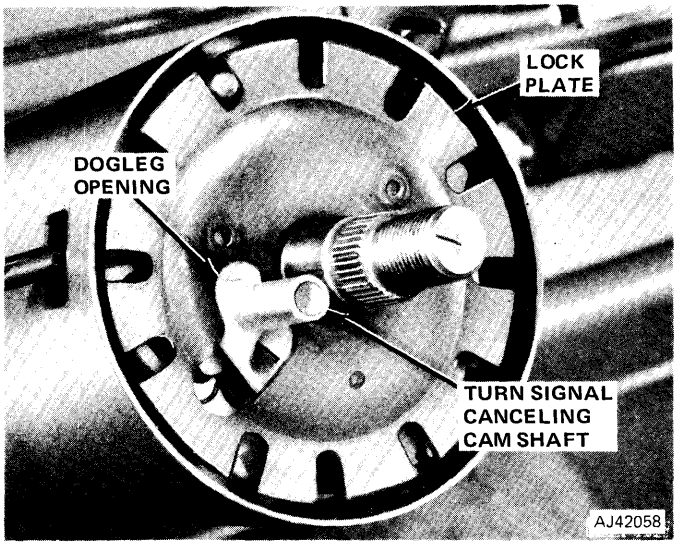

Fig. 11-32 Cancelling Cam and Lock Plate Position

(36) Place ignition switch in Off-Unlocked position as follows (fig. 11-33):

(a) Move switch slider toward left to Accessory position.

(b) Move slider two positions toward right to Off-Unlock position.

(c) Insert remote rod into slider hole and attach ignition switch to column. Tighten switch attaching screws to 35 inch-pounds torque.

(d) Move switch slider out of Off-Unlock position after attaching switch to column.

(37) Install column if removed. Refer to Steering Column Installation.

(38) Adjust neutral safety and backup lamp switch.

(39) Install lower finish panel, air conditioning duct if equipped, and column-to-instrument panel bezel.

(40) Remove protective wrapping from painted areas of column.

(41) Connect battery negative cable.

ADJUST-O-TILT STEERING COLUMN

Column Disassembly

NOTE: *Although it is possible to disassemble the steering column down to the upper housing with the column mounted in the vehicle, the column must be removed if disassembly is to be more extensive. If the column is removed, use Steering Column Support Fixture J-23074 to mount the column assembly in a vise (fig. 11-3).*

(1) Disconnect battery negative cable.

(2) Cover painted areas of column.

(3) Remove steering wheel.

(4) Remove gearshift lever retaining pin and remove gearshift lever.

(5) Remove anti-theft cover. Use two screwdrivers to pry cover off lock plate and out of housing.

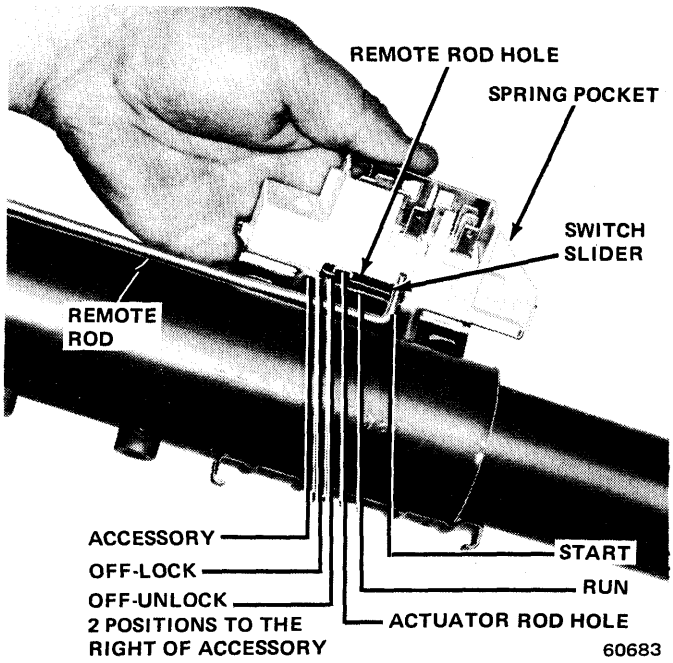

Fig. 11-33 Positioning Ignition Switch

(6) Compress lock plate using Lock Plate Compressor Tool J-23653, and unseat round wire snap ring from steering shaft groove (fig. 11-4).

WARNING: *The lock plate is under strong spring pressure.*

(7) Remove lock plate compressor tool and remove snap ring. Discard snap ring, do not reuse.

(8) Remove lock plate, canceling cam, upper bearing preload spring, and upper bearing and bearing race.

(9) On vehicles without Cruise Command, remove turn signal lever attaching screw and remove lever.

(10) On vehicles with Cruise Command, remove wires from switch terminal in lever. Fold two of four switch wires back, along harness and tape wires in place. Tape length of string to harness to aid removal.

(11) Press hazard warning light switch knob inward and remove knob by turning counterclockwise.

(12) Unhook turn signal switch wire harness connector from mounting bracket on lower right side of column jacket.

(13) Loosen toeboard bolts.

(14) Remove bolts attaching mounting bracket to steering column.

(15) Remove nuts attaching mounting bracket to instrument panel and remove mounting bracket.

(16) Remove wire harness plastic protector from column jacket.

(17) Wrap tape around harness connector to prevent snagging (fig. 11-25).

(18) Remove turn signal switch retaining screws and remove switch and wire harness. Pull switch straight up and out of column.

(19) On vehicles with Cruise Command, remove turn signal lever attaching screw and remove lever and switch. Guide switch wire harness out of column using string previously taped to harness.

(20) Insert ignition key in lock cylinder and place cylinder in LOCK position.

(21) Compress lock cylinder retaining tab and remove lock cylinder (fig. 11-7).

NOTE: *The retaining tab is accessible through the tab slot in the housing (fig. 11-7). If the tab is not visible through the slot, remove all casting flash from the slot.*

(22) Remove spring clips retaining shift quadrant using punch or long needlenose pliers and remove quadrant (fig. 11-28).

(23) Remove shift quadrant mounting bracket and light socket.

(24) Remove tilt release handle.

(25) Remove cover retaining screws and remove cover from column.

(26) Remove lock sector tension spring retaining screw. Unhook spring from lock sector shaft and remove spring.

(27) Remove snap ring from lock sector shaft and remove sector, shaft, and lockpin.

(28) Install tilt release handle and place upper housing in full upward tilt position.

(29) Insert screwdriver in tilt spring retainer slot and compress retainer approximately 3/16 inch. Rotate retainer 1/8-turn counterclockwise and remove retainer and spring.

WARNING: *Tilt spring is under strong spring tension.*

(30) Place housing in center (non-tilt) position.

(31) Remove housing pivot pins using Tool J-21854-1 (fig. 11-34).

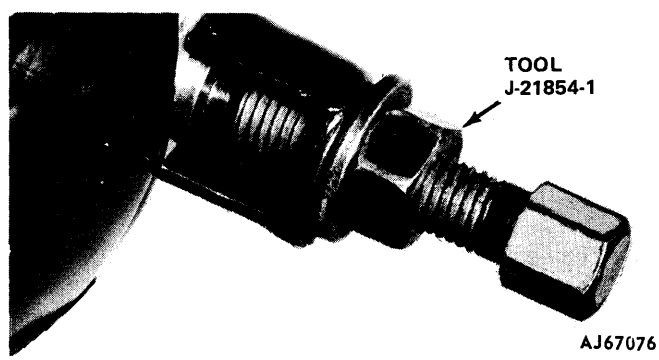

Fig. 11-34 Pivot Pin Removal

(32) Lift tilt release handle to disengage lock shoes and remove housing. Remove two ball bearing assemblies from housing if bearings are to be serviced.

(33) Remove tilt release lever.

(34) Remove release lever pin from housing using pin punch or Tool J-22635 (fig. 11-35).

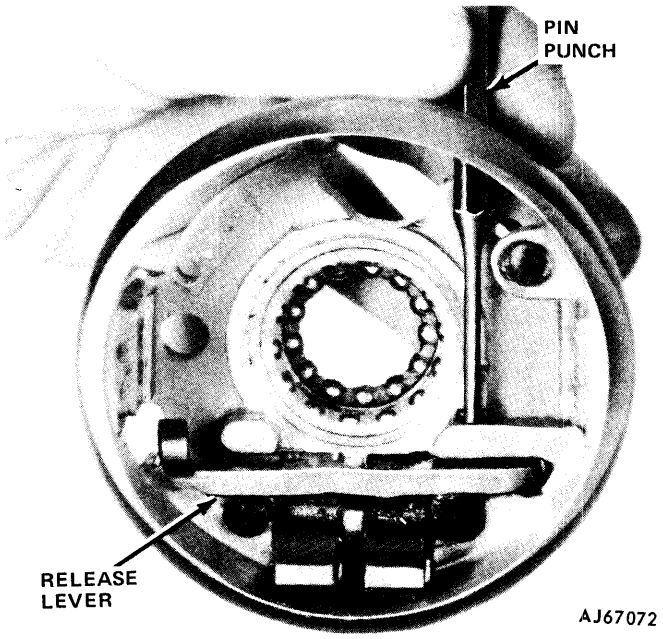

Fig. 11-35 Removing Release Lever Pin

NOTE: *When removing the release lever pin, compress the lock shoe springs to relieve spring tension on the pin.*

(35) Remove lock shoe pin from housing using pin punch or Tool J-22635 (fig. 11-36) and remove lock shoes and lock shoe springs.

NOTE: *When removing the lock shoe pin, compress the lock shoe springs to relieve spring tension on the pin (fig. 11-36).*

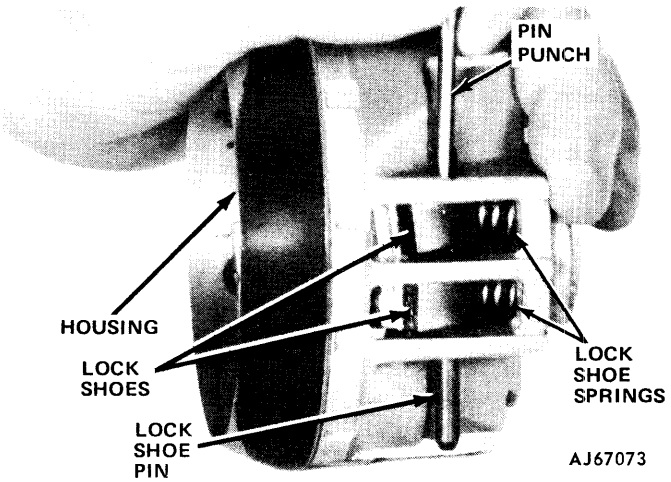

Fig. 11-36 Removing Lock Shoe Pin

(36) Disconnect steering shaft at intermediate shaft coupling. Remove steering shaft through upper end of column.

(37) Disassemble steering shaft by folding shaft at 90° and separating upper and lower halves of shaft at flexible joint (fig. 11-37).

(38) Remove ignition switch.

(39) Remove neutral safety and backup lamp switch.

(40) Remove lock rack and remote rod.

(41) Remove lower bearing retainer snap ring and remove retainer, bearing, and adapter.

(42) Remove screws attaching support to shift bowl and remove support.

(43) Remove shift gate pin and remove shift gate from support.

(44) Remove shift tube retaining ring and thrust washer.

(45) Remove shift tube from column jacket using Shift Tube Remover Tool J-23072 (fig. 11-38).

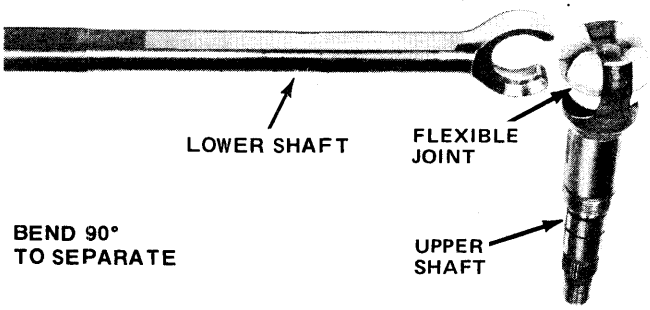

Fig. 11-37 Steering Shaft Assembly

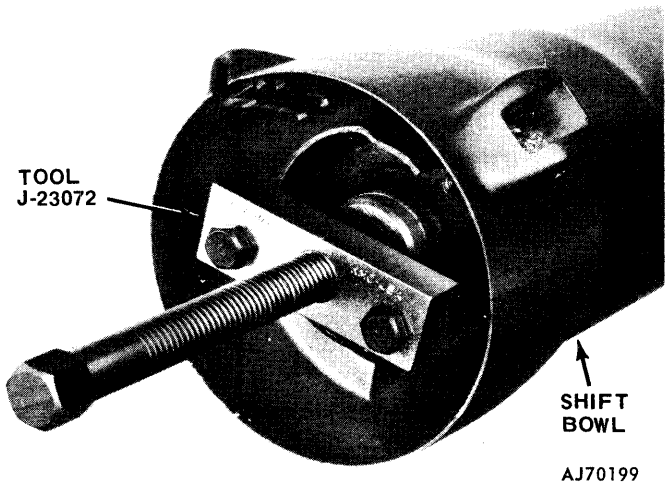

Fig. 11-38 Removing Shift Tube

(46) Remove retainer plate by rotating shift bowl clockwise, sliding plate out of jacket notches, tipping it down toward shift bowl hub at 12 o'clock position and removing plate-bottom side first (fig. 11-39).

(47) Remove wave washer and shift tube spring.

(48) Remove shift bowl from column jacket.

(49) Remove lower bearing retainer spring clip (fig. 11-40).

(50) Remove lower bearing retainer, lower bearing, and bearing adaptor.

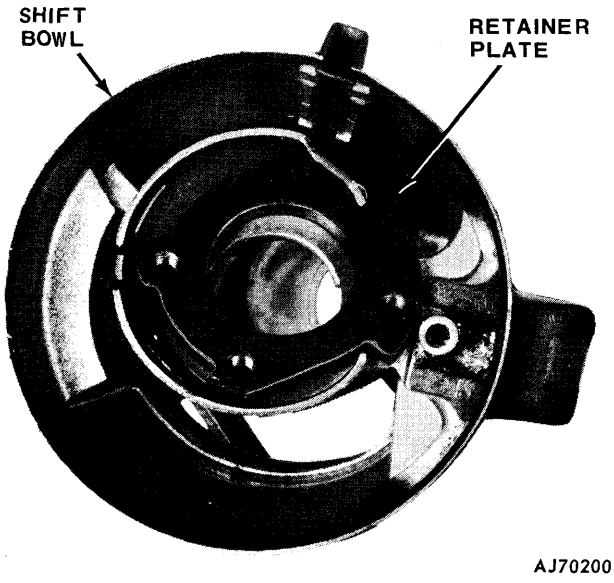

Fig. 11-39 Removing Retainer Plate

Column Assembly

(1) Coat all bearing and friction surfaces with multi-purpose grease.

(2) Mount shift bowl on column jacket.

(3) Install shift tube spring, wave washer, and retainer plate in shift bowl.

(4) Install shift tube through lower end of column jacket and align tube spline with shift bowl keyway.

(5) Insert Installer Tools J-23073-2 and -4 in shift tube (fig. 11-41). Spring-loaded lower foot of tool must engage shift tube inner shoulder and tool guide must be seated in shift tube.

(6) Tighten tool spring tension nut to snug fit.

(7) Place Receiver Tools J-23073-3 and -4 over puller stud and tighten Tool Nut J-23073-2 to pull tube into shift bowl (fig. 11-42).

(8) Remove shift tube installer tools.

(9) Install shift tube thrust washer and retainer plate snap ring.

(10) Install lower bearing adaptor with notched end of adaptor facing lower end of column.

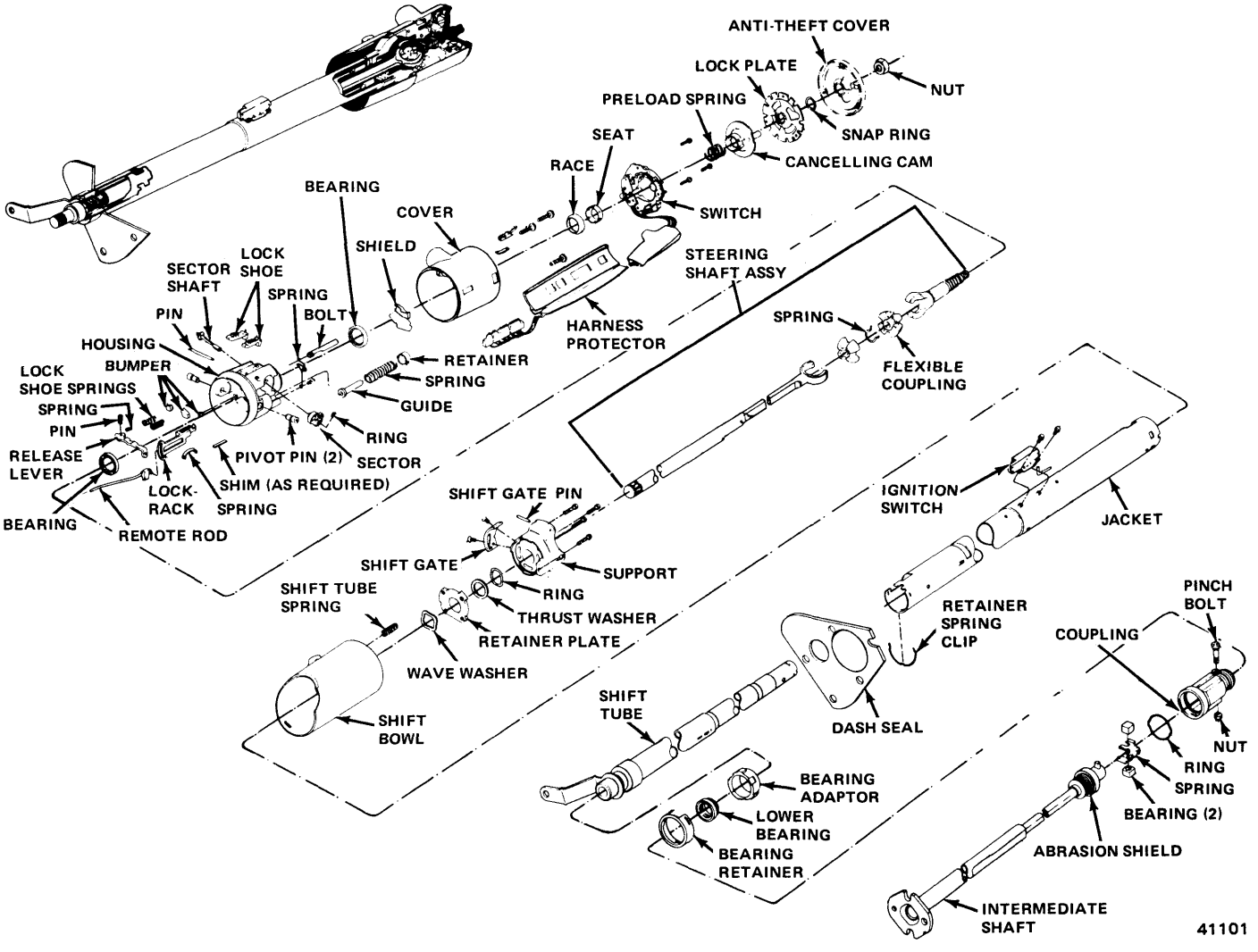

Fig. 11-40 Adjust-O-Tilt Steering Column

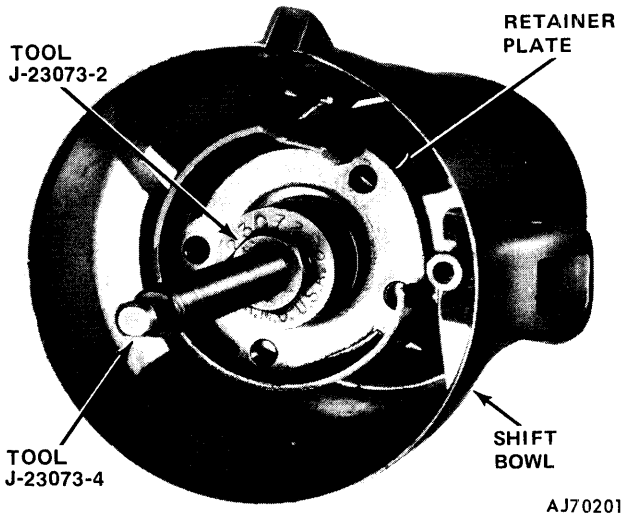

Fig. 11-41 Positioning Shift Tube Installer Tools

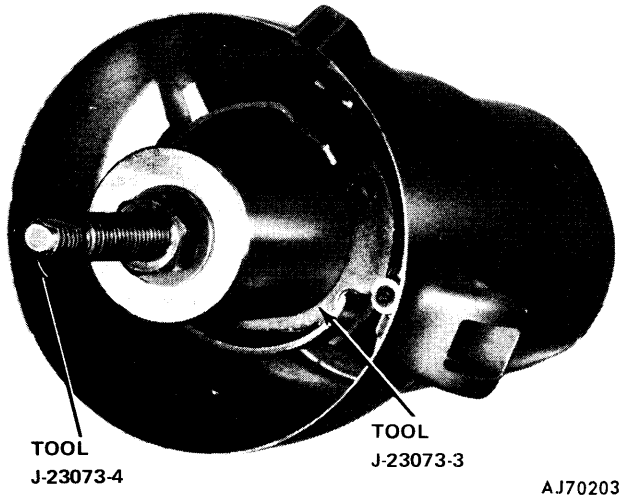

Fig. 11-42 Pulling Shift Tube into Shift Bowl

(11) Install lower bearing in column with metal face of bearing toward lower end of column.

(12) Install lower bearing retainer and retainer spring clip (fig. 11-40).

(13) Install pin and shift gate in support.

(14) Install support in shift bowl. Align V-notch in support with notch in column jacket (located at 9 o'clock position).

(15) Install support-to-shift bowl attaching screws.

(16) Assemble steering shaft.

(17) Install steering shaft through upper end of column.

(18) Install ball bearings in housing if removed. Be sure there are 14 balls in each bearing.

(19) Install tilt release handle.

(20) Insert ignition switch remote rod between shift bowl and column jacket, and into guide channel in left side of support.

(21) Place lock rack on remote rod (fig. 11-43).

(22) Guide housing over steering shaft and lock rack and align lock shoes with teeth in support.

(23) Align housing and support pivot pin holes and install pivot pins using fiber mallet or brass drift.

(24) Install lock shoes, lock shoe springs, tilt bumpers, and lockpin in housing.

(25) Install lock sector and sector shaft. Large tooth on sector must engage large slot in lock rack.

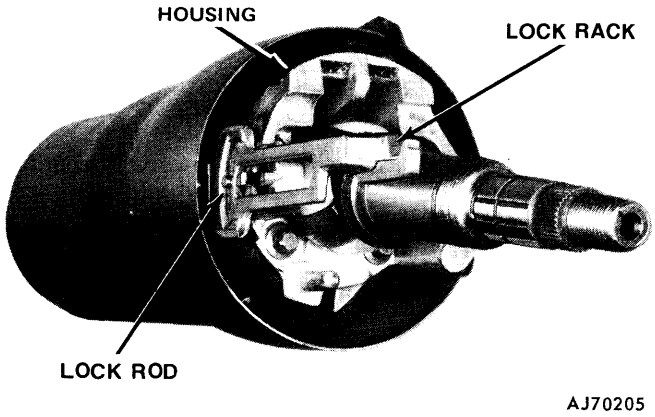

Fig. 11-43 Lock Rack and Remote Rod Position

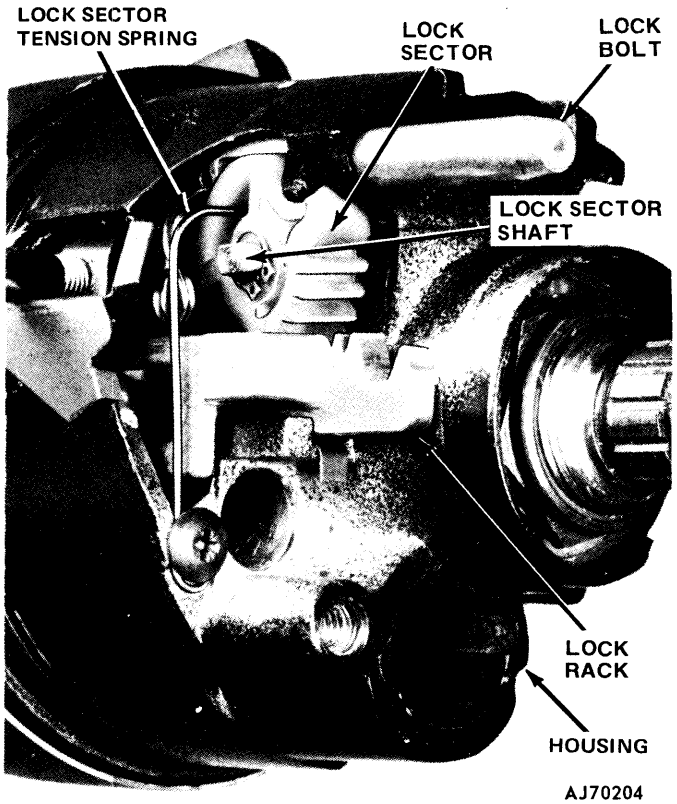

Fig. 11-44 Lock Sector and Tension Spring Position

(26) Install sector shaft retaining snap ring.

(27) Hook lock sector tension spring on lockpin. Engage sector and install spring retaining screw (fig. 11-44).

(28) Place housing in full upward tilt position and install tilt spring and seat.

(29) Press tilt spring retainer into housing approximately 3/16 inch and rotate retainer approximately 1/8-turn clockwise to secure spring.

(30) Place housing in center tilt position and remove tilt release handle.

(31) Install cover on housing and install cover attaching screws.

(32) Guide shift quadrant light wire upward through housing and downward between shift bowl and column jacket.

(33) Install shift quadrant mounting bracket and attach light socket.

(34) Hook base of shift quadrant over tabs on left side of retainer and place in position.

(35) Install shift quadrant pointer in shift bowl and engage pointer in quadrant.

(36) Install quadrant retainer clip with flat side of clip facing downward.

(37) Install tilt release handle.

(38) Install turn signal switch and switch harness in column. Guide switch wire harness between cover and column jacket.

(39) On vehicles without Cruise Command, install turn signal lever and lever attaching screw. Tighten screw to 35 inch-pounds torque.

(40) On vehicles with Cruise Command, install turn signal lever and switch assembly. Guide switch wire harnesss into cover using string previously taped to harness. Remove tape from harness and connect wires to switch terminal. Install lever attaching screw and tighten screw to 35 inch-pounds torque.

(41) Remove tape from turn signal switch harness connector and position wires in column harness protector.

(42) Align turn signal switch in cover and install switch attaching screws. Tighten screws to 35 inch-pounds torque.

NOTE: *Be sure the switch actuating lever pivot is correctly aligned and seated in the housing pivot boss before installing the switch attaching screws.*

(43) Install mounting bracket on steering column. Tighten bracket-to-column bolts to 15 foot-pounds torque.

(44) Position column mounting bracket on instrument panel and install bracket-to-instrument panel attaching nuts. Tighten nuts to 20 foot-pounds torque.

(45) Tighten toeboard bolts to 10 foot-pounds torque.

(46) Install bearing race, bearing race seat, preload spring, and canceling cam on steering shaft.

(47) Align lock plate splines with steering shaft splines and install lock plate. Canceling cam shaft must protrude through opening in lock plate (fig. 11-32).

(48) Install replacement steering shaft snap ring on Lock Plate Compressor Tool J-23653 and install tool on steering shaft (fig. 11-23).

(49) Compress lock plate and push snap ring into steering shaft groove (fig. 11-23).

(50) Connect steering shaft to intermediate shaft coupling.

(51) Install gearshift lever in shift bowl. Guide lever over lock sector tension spring and into bowl. Align lever retaining pin holes with pin punch and install lever retaining pin using fiber mallet or brass drift.

(52) Install lock cylinder as follows:

(a) Insert ignition key in lock cylinder.

(b) Hold lock cylinder and turn key clockwise to stop.

(c) Align cylinder locking lug with keyway in cover and insert cylinder in cover.

(d) Push lock cylinder against lock sector. Rotate cylinder counterclockwise until cylinder engages sector and push cylinder inward until cylinder retainer tab snaps into place.

(53) Install steering wheel.

(54) Adjust gearshift linkage and neutral safety and backup lamp switch.

(55) Install lower finish panel and air conditioning duct (if equipped). Install steering column-to-instrument panel bezel.

(56) Remove protection from painted column areas.

(57) Connect battery negative cable.

MANUAL STEERING GEAR

GENERAL

Two different design manual steering gear units are used in Jeep vehicles. Left-hand drive models use a recirculating ball, worm and nut-type gear (fig. 11-45). Right-hand drive models use a worm and roller-type gear (fig. 11-46).

In the recirculating ball-type gear, the wormshaft and ball nut are in line with the steering shaft in the column. The ball nut is mounted on the wormshaft and is driven through steel ball bearings which circulate in spiral grooves machined in the wormshaft and ball nut. The bearings act as a rolling thread between the wormshaft and ball nut. The ball nut is directly engaged by the the pitman shaft teeth.

In the worm and roller-type gear, only the wormshaft is in line with the steering shaft in the column. The roller gear and shaft assembly are mounted in a fixed position in the steering gear. The three-tooth roller gear is attached to the roller shaft by a steel pin. The steering arm is attached directly to the splined end of the roller shaft.

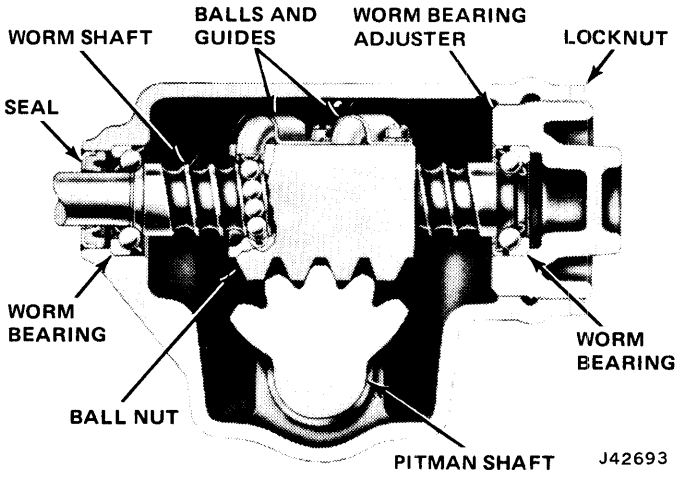

Fig. 11-45 Recirculating Ball Gear—Left-Hand Drive Vehicles

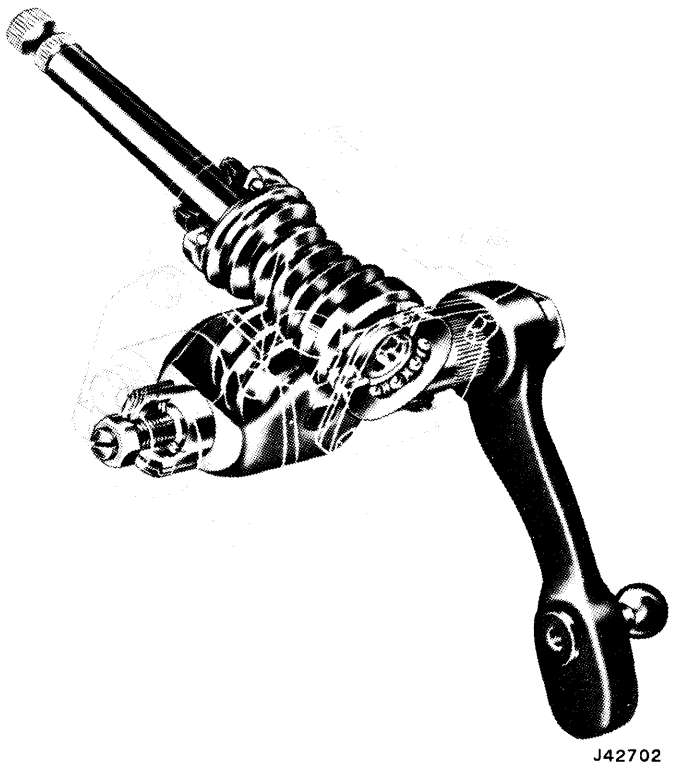

Fig. 11-46 Worm and Roller Gear—Right-Hand Drive Vehicles

STEERING GEAR—LEFT-HAND DRIVE VEHICLES

Removal

(1) Remove intermediate shaft-to-wormshaft coupling clamp bolt and disconnect intermediate shaft.

(2) Remove pitman arm nut and lockwasher.

(3) Remove pitman arm from pitman shaft using Puller Tool J-6632.

(4) On Wagoneer, Cherokee, and Truck models, remove bolts attaching steering gear to frame and remove gear.

(5) On CJ models:

(a) Raise left side of vehicle slightly to relieve tension on left front spring and place support stand under frame.

(b) Remove bolts attaching steering gear lower bracket to frame.

(c) Remove bolts attaching steering gear upper bracket to crossmember and remove gear. Use a nine-inch extension and Tool J-25359-21 to remove the upper bracket bolts.

(d) Remove bolts that attach upper bracket to tie plate and lower bracket to steering gear and remove brackets.

Service Diagnosis

Condition	Possible Cause	Correction
HARD STEERING	(1) Incorrect tire pressure.	(1) Adjust.
	(2) Lack of lubrication.	(2) Lubricate steering linkage.
	(3) Tie rod ends worn.	(3) Replace.
	(4) Drag link ball joints tight.	(4) Adjust.
	(5) Steering gear parts worn.	(5) Replace.
	(6) Frozen steering shaft bearings.	(6) Replace bearings.
	(7) Lower coupling flange rubbing against steering shaft.	(7) Loosen bolt and assemble properly.
	(8) Steering gear adjusted incorrectly.	(8) Check adjustment. Disconnect pitman arm from gear or disconnect linkage from pitman arm and adjust gear if necessary.
	(9) Front spring sag.	(9) Check front end jounce height. It should be approximately the same at both wheels. Replace front springs if sagged.
	(10) Frame bent or broken.	(10) Repair frame as necessary.
	(11) Steering knuckle bent.	(11) Install new knuckle.
	(12) Ball joint galled or too tight.	(12) Replace ball joint.
	(13) Steering knuckle ball studs binding.	(13) Reseat studs.
	(14) Steering gear or connections binding.	(14) Test steering system with wheels off floor. Adjust and lubricate.
LOOSE STEERING	(1) Tie rod ends worn.	(1) Replace.
	(2) Tie rod ball sockets worn.	(2) Replace.
	(3) Steering gear parts worn.	(3) Replace.
	(4) Steering gear improperly adjusted.	(4) Adjust.
EXCESSIVE ROAD SHOCK	(1) Axle clip loose.	(1) Repair as necessary.
	(2) Wheel bearings loose.	(2) Repair as necessary.
	(3) Shock absorbers worn.	(3) Replace.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
TURNING RADIUS SHORT ONE SIDE	(1) Center bolt in spring sheared off.	(1) Repair as necessary.
	(2) Axle shifted.	(2) Repair as necessary.
	(3) Steering arm bent.	(3) Replace.

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Installation

NOTE: *Proper retention of the steering gear is important. Some of the following steps in gear installation require the application of Locktite or similar material to attaching bolt threads. Wherever indicated, use Locktite 271 Adhesive/Sealant, Jeep Part Number 8129800, or equivalent. Before applying this material, first clean all bolt threads thoroughly to remove dirt and grease and apply the material to the bolt threads no more than five minutes before installation.*

(1) On Wagoneer, Cherokee, and Truck models:

(a) Apply Loctite or equivalent to steering gear-to-frame mounting bolts.

(b) Align and engage intermediate shaft coupling with splines on steering gear wormshaft.

(c) Position gear on frame and install gear attaching bolts. Tighten bolts to 70 foot-pounds torque.

(d) Install intermediate shaft coupling pinch bolt and nut. Tighten nut to 45 foot-pounds torque.

(2) On CJ models:

(a) Apply Loctite or equivalent to all steering gear mounting bracket attaching bolts.

(b) Position tie plate and upper and lower mounting brackets on steering gear and install mounting bracket-to-gear attaching bolts. Tighten bracket-to-gear bolts to 70 foot-pounds torque and tighten bracket-to-tie plate bolt to 55 foot-pounds torque.

(c) Apply Loctite or equivalent to all steering gear-to-frame and crossmember mounting bolts.

(d) Align and engage intermediate shaft coupling with steering gear wormshaft splines.

(e) Position steering gear on frame and install gear mounting bolts. Tighten mounting bolts to 55 foot-pounds torque.

(3) Install intermediate shaft coupling clamp bolt and nut. Tighten nut to 45 foot-pounds torque.

(4) Install pitman arm on pitman shaft and install lockwasher and pitman arm nut. Tighten nut to 185 foot-pounds torque.

(5) On CJ models, remove support stand and hydraulic jack.

NOTE: *After the steering gear is installed, it may produce a slightly rough feel. To eliminate this roughness, turn the gear full left and right for 10 to 15 complete cycles.*

Disassembly

(1) Rotate wormshaft until shaft is at center of travel. When centered, shaft index mark located beneath double spline, should be centered between upper and lower end of shaft when viewed from cover side of gear (fig. 11-45).

(2) Remove pitman shaft adjuster screw locknut (fig. 11-47).

(3) Remove side cover attaching bolts and lockwashers.

(4) Turn pitman shaft adjuster screw clockwise to force side cover from housing. Remove side cover and gasket.

(5) Remove adjuster screw and shim from T-slot in pitman shaft (fig. 11-47). Retain shim with screw.

(6) Remove pitman shaft from housing. If necessary, tap shaft lightly to remove. Do not damage pitman shaft bushing when removing shaft.

(7) Remove worm bearing adjuster locknut.

(8) Remove worm bearing adjuster.

(9) Remove bearing retainer and wormshaft lower bearing from worm bearing adjuster. Use screwdriver to pry retainer out of adjuster and remove bearing.

(10) Remove wormshaft and ball nut from housing (fig. 11-48).

CAUTION: *Do not allow the ball nut to rotate freely and bottom at either end of the wormshaft. This could result in damage to the ends of the ball return guides.*

(11) Remove wormshaft upper bearing from wormshaft.

(12) Remove pitman shaft and wormshaft seals. Use screwdriver to pry seals out of housing.

(13) Remove ball guide clamp attaching screws and remove clamp and ball guides from ball nut.

(14) Place clean shop cloth on workbench and position wormshaft and ball nut over cloth.

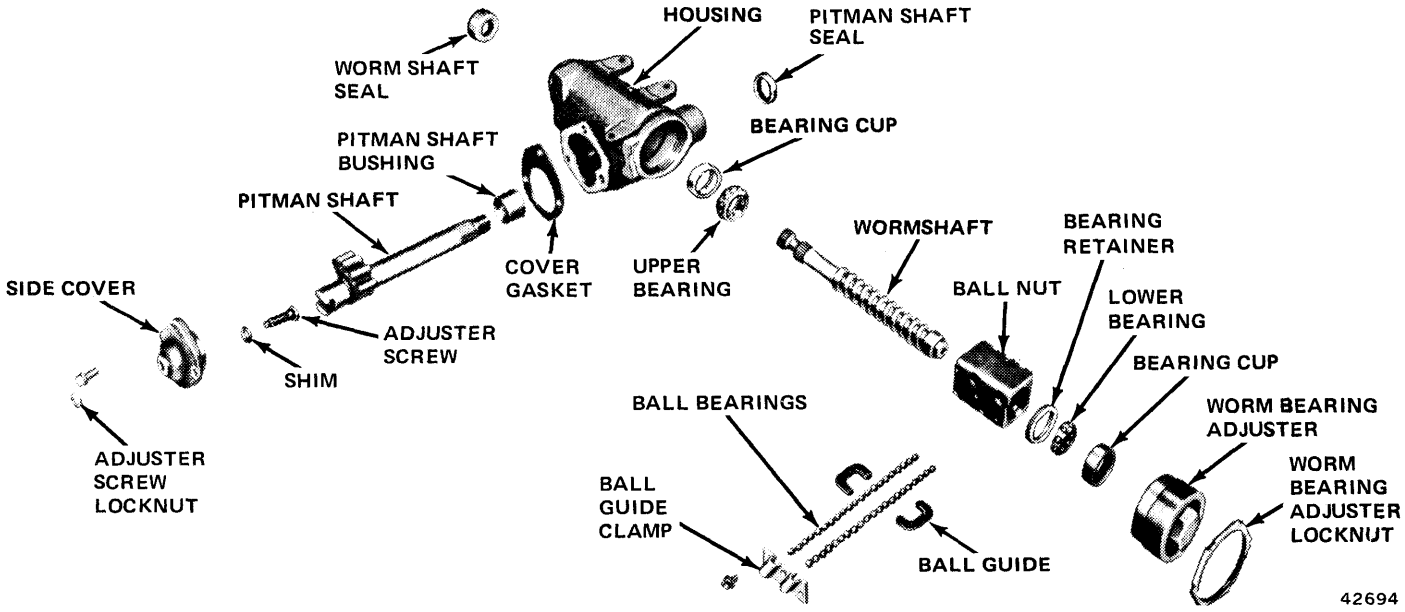


Fig. 11-47 Steering Gear—Left-Hand Drive Vehicles

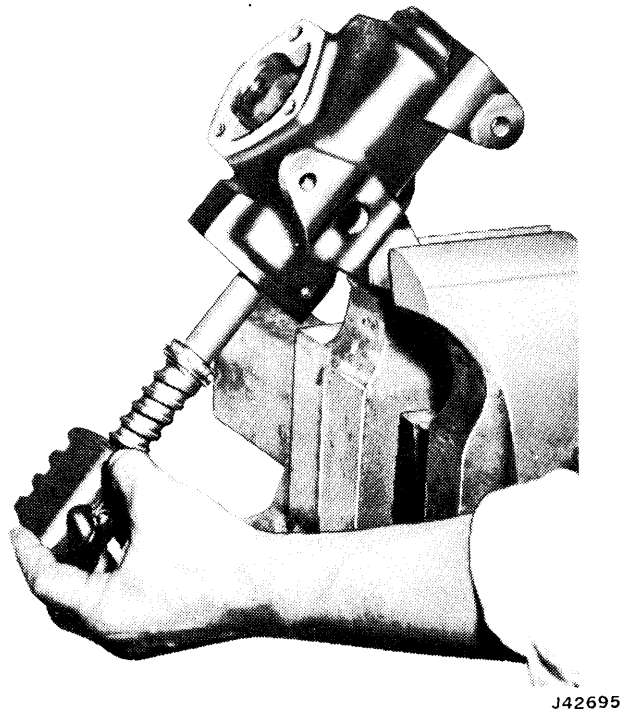


Fig. 11-48 Removing—Installing Wormshaft and Ball Nut

(15) Turn ball nut over and rotate wormshaft back and forth until ball bearings remaining in ball nut drop out onto cloth.

NOTE: *There are a total of 50 ball bearings in the ball nut (25 in each circuit).*

(16) Remove ball nut from wormshaft.

Cleaning and Inspection

Wash all parts in clean solvent and wipe dry with a clean cloth.

Inspect the wormshaft lower bearing and bearing cup for scoring or excessive wear. If either the bearing or cup is damaged, replace both parts. Remove the bearing cup from the worm bearing adjuster using Puller Tool J-5754 and Slide Hammer J-2619 (fig. 11-49).

Inspect the wormshaft upper bearing and bearing cup for scoring or excessive wear. If either the bearing or cup is damaged, replace both parts. Remove the bearing cup from the housing using Puller Tool J-5754 and Slide Hammer J-2619.

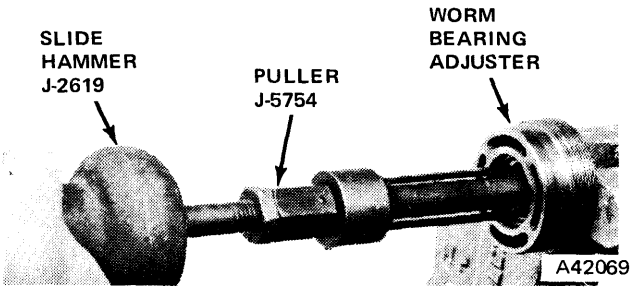


Fig. 11-49 Removing Wormshaft Lower Bearing Cup

Inspect the wormshaft and ball nut for pitting, scoring, grooving, or other damage. Replace either part if damaged.

Inspect the pitman shaft bushings for damage or wear. If the bushing in the housing is damaged, remove it and install a replacement bushing using Remover—Installer Tool J-1614 (fig. 11-50).

If the pitman shaft bushing in the side cover is damaged, replace the side cover and bushing as an assembly.

Inspect the ball nut and pitman shaft teeth for pitting and heavy scoring. Replace the ball nut or pitman shaft if pitted or scored.

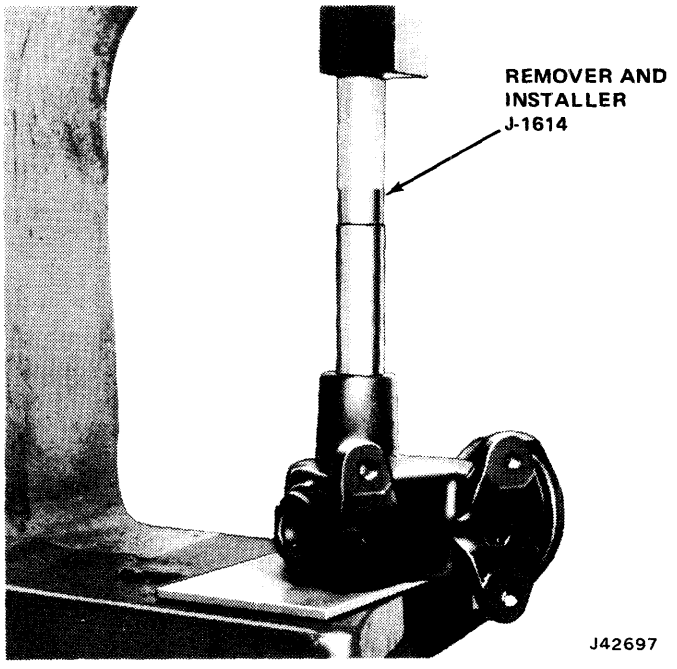


Fig. 11-50 Removing—Installing Pitman Shaft Bushing

Inspect the ball guides, ball bearings, and ball guide clamp for damage. If any of these components are damaged, install a new ball kit.

Check the fit of the pitman shaft adjuster screw and end play shim in the pitman shaft T-slot (fig. 11-51). The adjuster screw must turn freely and end play must not exceed 0.002 inch. If end play exceeds this limit, change the shim thickness to obtain the correct end play. An adjuster screw shim kit is available for this purpose.

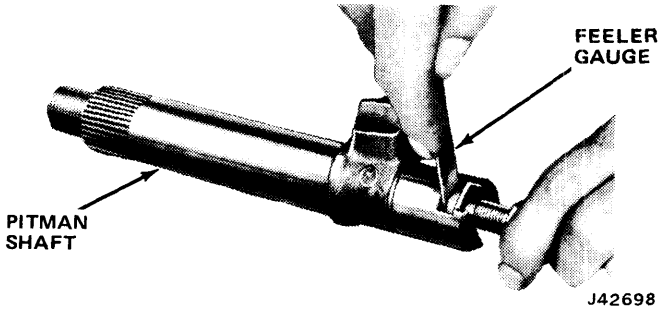


Fig. 11-51 Measuring Pitman Shaft Adjuster Screw End Play

Assembly

(1) Lubricate all gear components with Jeep lubricant part no. 940657, or equivalent.

(2) Position ball nut on wormshaft so deep side of ball nut teeth face side cover when wormshaft is installed in housing.

(3) Install 20 ball bearings in each ball nut circuit. Turn wormshaft back and forth to ease installation (fig. 11-52).

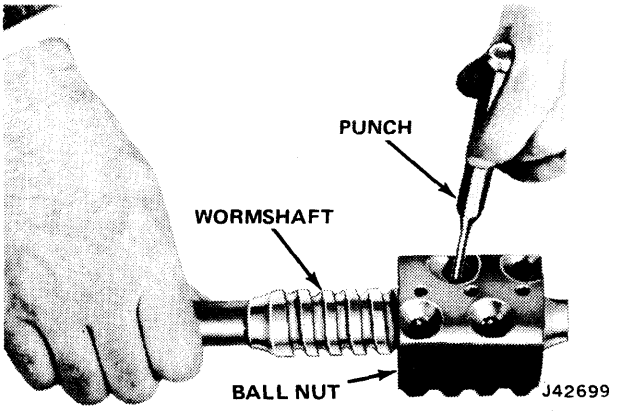


Fig. 11-52 Installing Ball Bearings In Ball Nut

(4) Insert ball guides into ball nut (fig. 11-53). Hold guides in place and install 5 additional ball bearings in each ball nut circuit through hole in top of each ball guide.

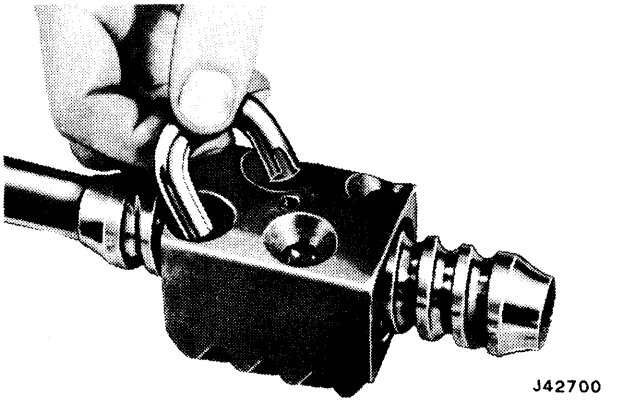


Fig. 11-53 Installing Ball Guides

(5) Install ball guide clamp over ball guides and install clamp attaching screws and washers.

(6) Rotate wormshaft through complete travel several times to be sure ball bearings in ball nut are installed correctly and that wormshaft rotates freely.

CAUTION: *Do not allow the ball nut to bottom at either end of the wormshaft. This could result in damage to the ends of the ball guides.*

(7) Install replacement wormshaft bearing cups in worm bearing adjuster and housing, if removed, using Bearing Cup Installer J-5755 and arbor press (fig. 11-54).

(8) Install upper bearing on wormshaft and center ball nut on wormshaft.

(9) Install assembled wormshaft and ball nut in housing (fig. 11-48). Be sure wormshaft upper bearing is properly seated in bearing cup.

(10) Install worm bearing adjuster in housing. Be sure wormshaft is seated in lower bearing cup.

(11) Install worm bearing adjuster locknut but do not tighten the nut competely.

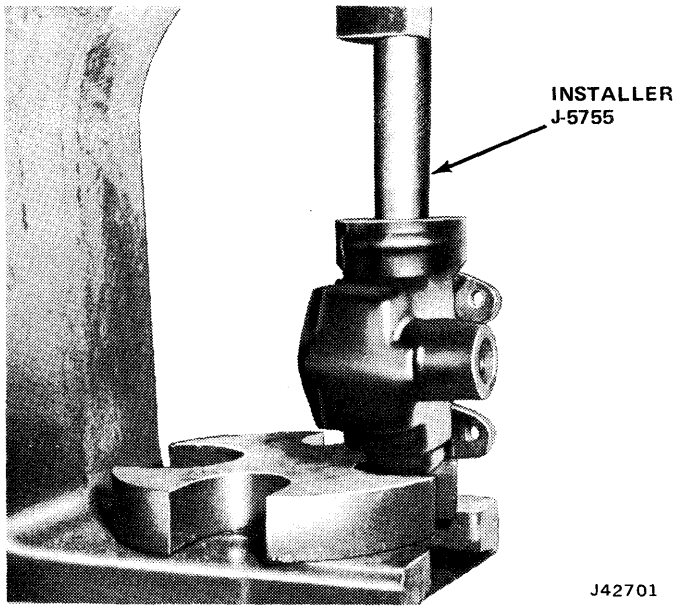


Fig. 11-54 Installing Wormshaft Bearing Cups

(12) Rotate wormshaft until center tooth space of ball nut is centered in side cover opening.

(13) Install adjuster screw and correct thickness end play shim in pitman shaft T-slot.

(14) Install pitman shaft in housing and mesh center tooth of sector gear on pitman shaft with center tooth space in ball nut.

(15) Install gasket and side cover on housing. Thread pitman shaft adjuster screw into side cover but do not tighten completely.

(16) Install side cover attaching bolts and lockwashers. Tighten bolts to 30 foot-pounds torque.

(17) Install locknut on pitman shaft adjuster screw but do not tighten nut completely.

(18) Install pitman shaft seal using Seal Protector Tool J-5787 and Seal Installer Tool J-7171.

(19) Install wormshaft seal using Seal Installer Tool J-7017.

(20) Fill steering gear with 11 ounces of Jeep lubricant part number 940657 or equivalent.

(21) Adjust steering gear as outlined under adjustment.

Adjustment

The recirculating ball-type gear requires two adjustments which are, worm bearing preload and pitman shaft overcenter drag torque.

Worm bearing preload is controlled by the amount of compression force exerted on the wormshaft bearings by the worm bearing adjuster.

Pitman shaft overcenter drag torque is controlled by the pitman shaft adjuster screw which determines the clearance between the ball nut and pitman shaft sector teeth.

CAUTION: *The following adjustment procedures must be performed exactly as described and in the sequence outlined. Failure to do so can result in damage to the gear internal components and improper steering response. Always adjust worm bearing preload first and pitman shaft overcenter drag torque last.*

Worm Bearing Preload

(1) Install socket and Torque Wrench J-7754 on splined end of wormshaft.

(2) Rotate wormshaft fully to either left or right turn position but do not contact stops.

(3) Tighten worm bearing adjuster until torque required to rotate wormshaft is 8 inch-pounds.

CAUTION: *The preload adjustment must be made with the wormshaft no more than 1/2-turn from either full-right or full-left turn position.*

(4) Tighten worm bearing adjuster locknut to 90 foot-pounds torque. Recheck wormshaft rotating torque and adjust if necessary. Record torque reading.

Pitman Shaft Overcenter Drag Torque

(1) Turn steering gear from full left turn position to full right turn position and count total number of turns.

(2) Turn gear back one-half total number of turns. This places steering gear on high point or straight-ahead position (total number of turns should be 6.14).

(3) Install socket and Torque Wrench J-7754 on pitman shaft splines.

(4) Tighten pitman shaft adjuster screw until torque required to rotate pitman shaft is 4 to 10 inch-pounds in excess of worm bearing preload.

CAUTION: *The total amount of adjustment torque (worm bearing preload plus overcenter drag torque) must not exceed 16 inch-pounds as measured through the center of gear travel. Total torque must not exceed this value in the overcenter range.*

(5) Tighten adjuster screw locknut to 23 foot-pounds torque.

(6) Recheck overcenter drag torque and adjust if necessary.

STEERING GEAR—RIGHT-HAND DRIVE VEHICLES

Removal

(1) Remove gear-to-column flexible coupling allen-head clamping screw.

(2) Disconnect steering connecting rod at steering arm.

(3) Remove bolts attaching steering gear to frame.

(4) Remove gear by sliding gear slightly forward and to right and lifting gear out of engine compartment.

Installation

(1) Position gear on frame and install gear mounting bolts.

(2) Attach steering connecting rod to steering arm.

(3) Align and engage steering gear wormshaft with steering column and install flexible coupling clamp bolt.

Disassembly

(1) Clean exterior of steering gear with solvent.

(2) Remove fill plug from housing (fig. 11-55) and drain lubricant from gear.

(3) Paint assembly alignment reference marks on steering arm and roller gear and shaft assembly.

(4) Remove nut and lockwasher from roller gear shaft (fig. 11-55).

(5) Remove steering arm from roller gear shaft using pitman arm puller.

CAUTION: *Do not use a hammer or wedge to remove the steering arm from the roller gear shaft. This will damage the gear and shaft assembly.*

(6) Remove nicks or burrs from exposed portions of roller gear and shaft assembly and from worm gear and shaft assembly using fine-tooth file or emery cloth.

(7) Remove side cover attaching bolts.

(8) Remove side cover, cover gasket, and roller gear and shaft from housing as an assembly.

(9) Remove locknut from roller shaft adjustment screw.

(10) Turn roller shaft adjustment screw clockwise until screw is completely unthreaded from side cover and separate roller gear and shaft assembly from cover.

(11) Remove end cover attaching bolts and remove end cover and shims from housing.

(12) Remove worm gear and shaft assembly.

(13) Remove upper and lower bearing cups and bearings from worm gear and shaft.

(14) Remove worm gear shaft and roller gear shaft oil seals from housing. Discard both seals.

Cleaning and Inspection

Clean all parts with solvent and wipe them dry.

Inspect the steering gear housing for cracks, porosity, or other damage. Replace the housing if damaged.

Inspect the roller gear and shaft assembly for wear, scoring, or pitting. Remove slight burrs or scratches using fine emery cloth. Be sure the roller gear moves freely on its shaft and does not have excessive end play. Replace the gear and shaft assembly if worn or damaged.

Measure the roller gear shaft adjustment screw end play. End play must not exceed 0.015 inch. If end play is excessive, replace the retaining ring, thrust washer, and adjustment screw.

Inspect the roller gear and shaft assembly needle bearings. Replace the bearings if worn or damaged. Insert the roller gear shaft through each bearing and check the shaft-to-bearing clearance. If clearance exceeds 0.010 inch, replace the bearings. Remove the bearings using a piloted mandrel. Install replacement bearing using the piloted mandrel. Press the bearings into the side cover and gear housing until the face of each bearing is flush with the bearing boss of the cover or housing.

Inspect the worm gear and shaft assembly for wear, scoring, or pitting. Remove light corrosion or scratches using a fine abrasive cloth. Replace the assembly if it is excessively worn or damaged.

Inspect the upper and lower worm shaft bearings and bearing cups for wear and damage. Replace the bearings and cups as assemblies if worn or damaged.

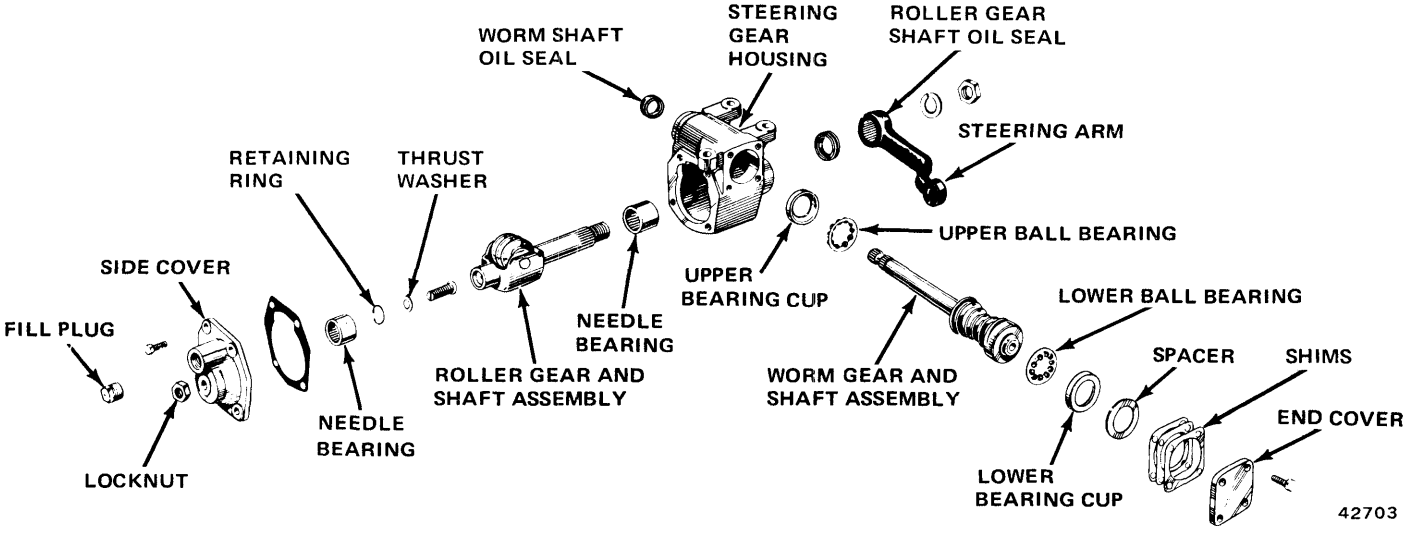


Fig. 11-55 Steering Gear—Right-Hand Drive Vehicles

NOTE: *The bearing balls must be replaced as a full set in each bearing.*

Assembly

(1) Position replacement worm and roller shaft oil seals on seal bores in gear housing. Longest lip of each seal must face into housing.

(2) Press each seal into housing seal bore using suitable diameter tool that will contact seal bore of housing around entire perimeter of bore.

(3) Lubricate worm gear and shaft assembly and upper bearing and bearing cup with Gear Lubricant MIL-L2105B, Grade SAE 80 or equivalent.

(4) Install upper bearing and bearing cup on worm gear shaft.

(5) Install worm gear and shaft shaft assembly in gear housing. Do not damage oil seal when installing shaft.

(6) Lubricate lower end of worm gear and shaft assembly and lower bearing and bearing cup with Gear Lubricant MIL-L-2105B, Grade SAE 80 or equivalent.

(7) Install lower bearing, bearing cup, and spacer on lower end of worm gear shaft.

(8) Install shims and end cover on steering gear housing and install cover attaching bolts. Do not tighten bolts completely at this time.

(9) Position side cover on roller gear shaft adjustment screw.

(10) Thread screw counterclockwise into cover until end of roller gear shaft just touches inner face of cover.

(11) Install locknut on adjustment screw hand-tight only.

(12) Install gasket on side cover.

(13) Lubricate roller gear and shaft assembly with Gear Lubricant MIL-L-2105B, Grade SAE 80 or equivalent.

(14) Install roller gear and shaft assembly in housing. Do not damage roller gear shaft oil seal when installing assembly.

(15) Mesh roller gear and worm gear.

(16) Install side cover attaching bolts. Tighten bolts to 20 foot-pounds torque.

(17) Clamp exposed portion of roller gear and shaft assembly in vise equipped with protective jaws.

(18) Align assembly reference marks on roller gear shaft and steering arm and install steering arm on splined end of shaft.

(19) Install lockwasher and nut on roller gear shaft and tighten nut to pull arm onto splined end of shaft.

(20) Fill steering gear housing with Gear Lubricant MIL-L-2105B, Grade SAE 80 or equivalent.

(21) Adjust gear as outlined under Adjustment.

Worm Bearing Preload

This adjustment controls the preload applied to the upper and lower worm bearings. Adjustment is accomplished by adding or subtracting shims from between the steering gear housing and end cover (fig. 11-55).

(1) Loosen end cover attaching bolts if necessary.
(2) Tighten bolts alternately, and only a few turns at a time, while rotating worm gear shaft.
(3) Tighten bolts to 20 foot-pounds torque.
(4) Install socket and inch-pound torque wrench on splined end of worm gear shaft.
(5) Turn worm gear shaft using torque wrench and record torque required to rotate shaft. Rotating torque must be 2 to 5 inch-pounds.
(6) If adjustment is necessary, remove end cover and add or subtract shims to obtain correct preload torque.

NOTE: *Adding shims will decrease preload torque. Subtracting shims will increase preload torque.*

(7) Recheck preload and adjust if necessary.

Worm and Roller Gear Clearance

This adjustment controls the clearance between the worm and roller gears. Adjustment is accomplished by turning the roller gear shaft adjusting screw inward or outward to control worm-to-roller clearance.

(1) Loosen adjuster screw locknut and turn adjuster screw counterclockwise until worm gear shaft turns freely when rotated to full right and left-turn positions.
(2) Count total number of turns required to rotate worm gear shaft through entire range of travel.
(3) Center gear by turning shaft back one-half total number of turns.
(4) Rotate worm gear shaft back and forth through center of travel and tighten adjustment screw until slight bind occurs at center of shaft travel.
(5) Loosen or tighten adjusting screw until rolling torque of 7 to 12 inch-pounds is obtained.
(6) Hold adjustment screw in position and tighten adjustment screw locknut to 18 foot-pounds torque.
(7) Recheck torque required to rotate worm gear shaft through center of travel and adjust if necessary.

STEERING LINKAGE

GENERAL

The steering linkage consists of a pitman arm attached to the steering gear assembly, a connecting rod, a tie rod, a steering damper, and a steering knuckle arm (integral with the steering knuckle). Ball-studs and adjusting tubes are used on the tie rod and connecting rod for the adjustments and steering wheel centering (fig. 11-56).

The connecting rod is attached to the pitman arm at one end and to the tie rod at the opposite end. The tie-rod ends are connected to the steering knuckle arms. The steering damper is attached to the tie rod on one end and to a bracket on the left spring tie-plate at the opposite end.

On Wagoneer, Cherokee, and Truck models, the tie rod (fig. 11-57) consists of a solid rod that is threaded on one end, and has an integral ball-stud end assembly at the opposite end. An adjusting tube and removable ball-stud end complete the tie rod assembly. The threaded end of the tie rod has right-hand threads which accept the turnbuckle. On CJ models, the tie rod has ball-studs and adjusting tubes at both ends. The ball-stud tie rod end is threaded into the adjusting tube. A large boss is located on the tie rod about eight inches from the unthreaded right-hand end. A tapered hole machined into the boss accepts the steering connecting rod end. The steering damper is connected to a stud which is attached to a bracket that is clamped to the center of the tie rod.

The connecting rod (fig. 11-58) consists of a rod threaded at the left end, with an integral ball-stud end assembly at the right end. An adjusting tube and removable ball-stud end complete the connecting rod assembly. On Wagoneer, Cherokee, and Truck models, the end having the integral ball-stud end assembly attaches to the tie rod. On CJ models, it is attached to the right side steering arm. The threaded end, with the adjusting tube and removable ball-stud end assembly, is attached to the pitman arm. However, the ball-stud end assembly can be replaced separately.

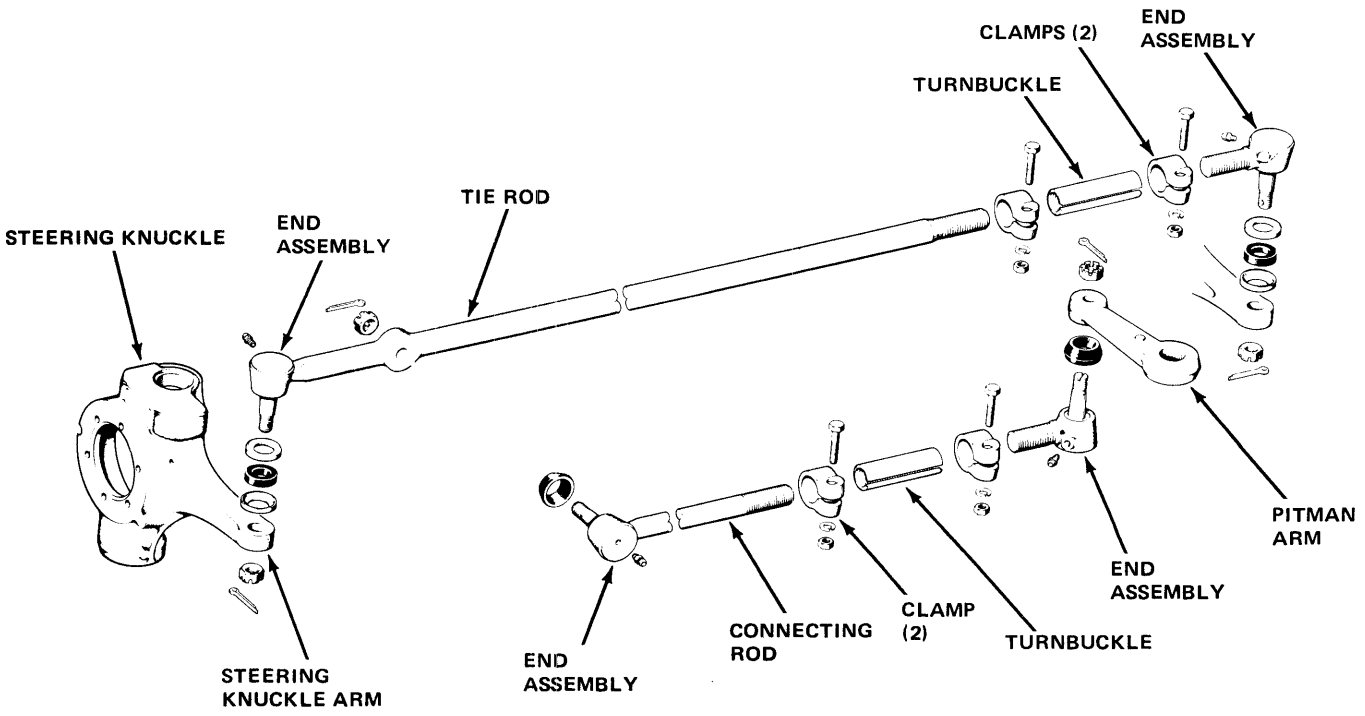


Fig. 11-56 Steering Linkage—Wagoneer-Cherokee-Truck

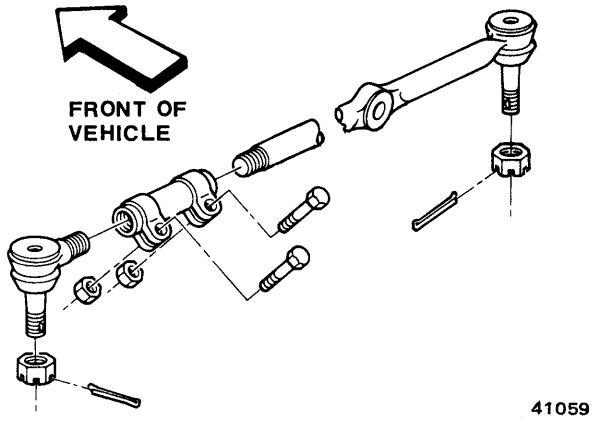


Fig. 11-57 Tie Rod Assembly

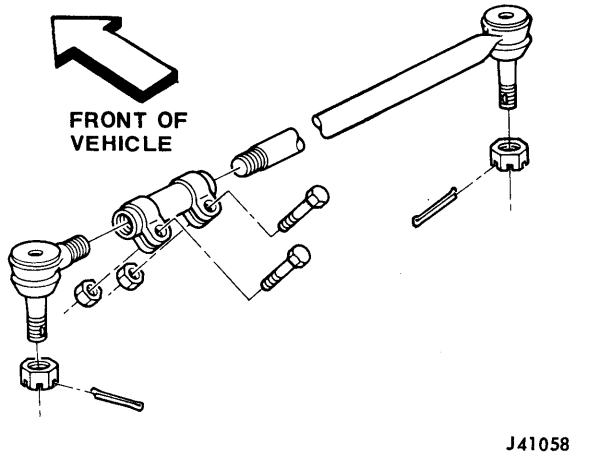


Fig. 11-58 Connecting Rod Assembly

Tie Rod

Removal

(1) Remove cotter pins and retaining nuts at both ends of tie rod and from end of connecting rod where it attaches to tie rod.

(2) Remove nut attaching steering damper push rod to tie rod bracket and move damper aside.

(3) Remove tie rod ends from steering arms and connecting rod using puller.

NOTE: *After removal, the tie rod ends can be removed from the tie rod by loosening the adjusting tube clamp bolts and unthreading the ends.*

Installation

(1) Attach tie rod ends to steering arms. Tighten nuts to 50 foot-pounds torque and use new cotter pins to secure nuts.

(2) Attach connecting rod to tie rod. Tighten nut to 60 foot-pounds torque on CJ models and 70 foot-pounds torque on Wagoneer, Cherokee, and Truck models and install replacement cotter pin in retaining nut.

(3) Attach steering damper to tie rod bracket.

(4) Adjust toe-in as necessary.

Connecting Rod

The steering connecting rod can be removed by removing the cotter pins and nuts from both ball stud ends, and then removing the rod. The steering connecting rod ball stud ends cannot be disassembled for service.

When installing the steering connecting rod, place the wheels in the straight-ahead position and place the steering arm parallel to the centerline of the vehicle. Have the steering gear steering arm properly indexed, with line marks on the steering arm and gear shaft and the steering gear on center of high point. With the steering arm so positioned, install the connecting rod.

Steering Damper

The steering damper (fig. 11-59) has eyelets at each end for mounting on studs. The body end of the damper attaches to a stud on a bracket mounted between the left axle spring and the axle spring pad. The push rod end is attached to a bracket that is clamped to the tie rod.

The steering damper is serviced as an assembly. If damaged or leaking, replace with a new assembly. The rubber bushings used in the damper eyelets can be replaced individually if required.

Removal

(1) Place front wheels in straight-ahead position.

(2) Remove locknut that attaches damper to bracket on tie plate and lift damper off stud (fig. 11-59).

(3) Remove locknut that attaches push rod end to tie rod bracket and remove damper assembly.

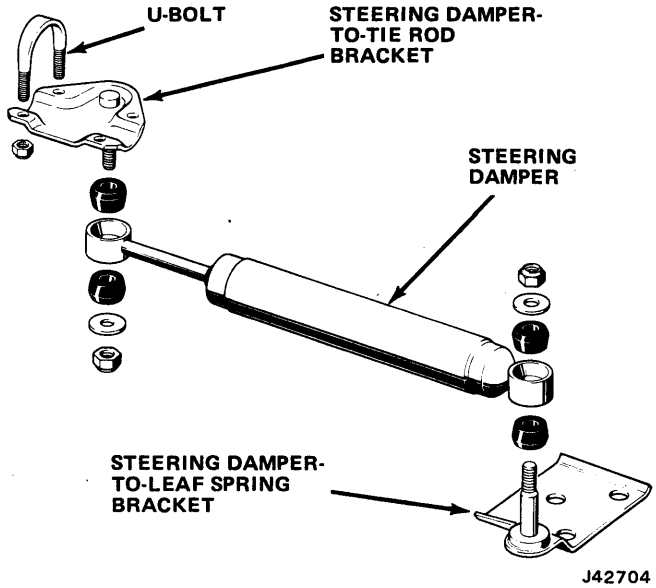


Fig. 11-59 Steering Damper

Installation

(1) Insert rubber bushings in damper eyelets.
(2) Mount eyelet at push rod end on tie rod bracket stud and install attaching parts.
(3) Extend push rod by pulling back on damper body until eyelet can be located on, and secured to, damper bracket stud on spring pad.
(4) Tighten all locknuts securely.

FRONT WHEEL ALIGNMENT

Alignment should be checked and adjusted using an alignment rack. To ensure correct alignment, the following inspection is recommended.
(1) Equalize tire pressures and place vehicle on level surface.
(2) Check steering gear-to-steering column alignment.
(3) Inspect steering knuckle pivots, spindle, and wheel bearings for looseness.
(4) Check for spring sag.
(5) Check brakes and shock absorbers for proper operation.
(6) Check steering gear adjustment.
(7) Check caster.
(8) Check toe-in.
(9) Check camber.
(10) Check tracking of front and rear wheels.
(11) Check for broken spring center bolts.

NOTE: *Be sure all front suspension and steering system nuts and bolts are tight before checking wheel alignment.*

Toe-In

Refer to figure 11-60. The use of an alignment rack to measure toe-in is recommended. To measure toe-in, without an alignment rack, raise the front of the vehicle and turn the front wheels to the straight-ahead position. Using chalk, draw a 1/2-inch wide strip around the circumference of each tire at the center of each tire tread while turning the wheels by hand. Using a steady rest, scribe a pencil line in the chalk strip at the exact center of each tire tread.

Measure the distance between the scribed pencil lines at the front and rear of the wheels. Be sure that both measurements are made at an equal distance from the floor. The distance between the lines should be greater at the rear than at the front by 3/64 inch to 3/32 inch. To adjust toe-in, loosen the clamp bolts and turn the tie rod with a small pipe wrench. The tie rod is threaded with right- and left-hand threads to provide equal adjustment at both wheels. After adjustment, tighten the clamp bolts to specified torque.

NOTE: *It is common practice to measure between the wheel rims, which is a satisfactory method providing the wheels run true. However, by scribing a line on the tire tread, measurement is taken between the actual road contact points.*

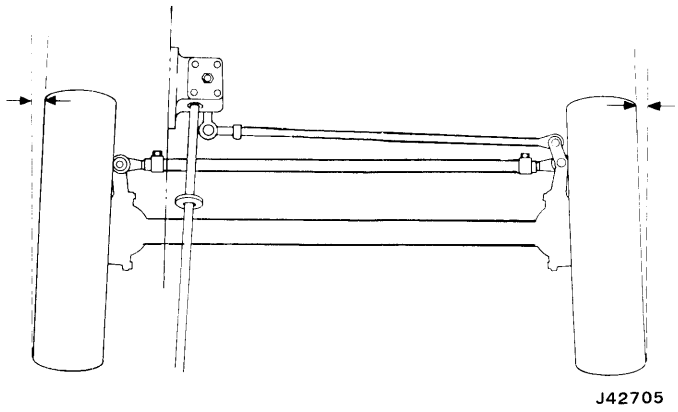


Fig. 11-60 Front Wheel Toe-In (Top View)—Typical

Camber

Refer to figure 11-61. Correct wheel camber of 1-1/2° is preset in the solid front axle at the time of manufacture and cannot be altered by adjustment. It is important that the camber is the same on both front wheels. Camber angle should be checked using wheel alignment equipment.

CAUTION: *Do not attempt to adjust the camber angle by heating or bending the axle or any suspension components. If camber is incorrect, the component(s) causing the camber angle to be incorrect should be replaced.*

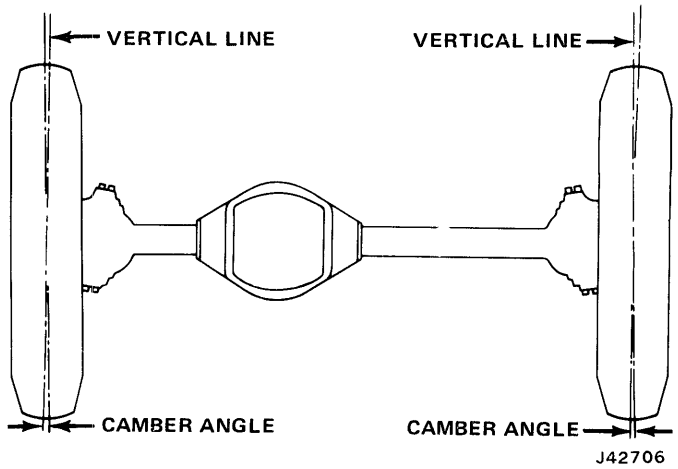


Fig. 11-61 Front Wheel Camber (Front View)

Caster

Refer to figure 11-62. Axle caster is preset at 3° for CJ models and 4° for Cherokee, Wagoneer, and Truck. Caster should be checked using wheel alignment equipment. If caster is incorrect, adjustment may be made by

installing new parts or installing caster shims between the axle pad and the springs.

If the camber and toe-in are correct and it is known that the axle is not twisted, a satisfactory check may be made by road-testing the vehicle. Before road-testing, make sure all tires are properly inflated, being particularly careful that both front tires are inflated to exactly the same pressure.

If the vehicle turns easily to either side but does not return to the straight-ahead position unassisted, incorrect caster is indicated.

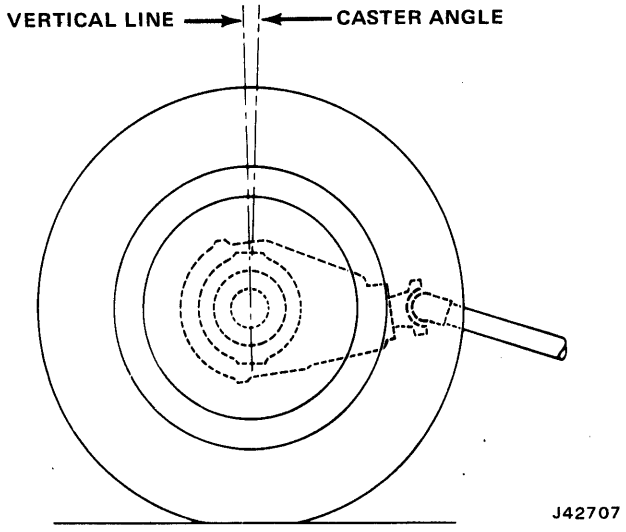


Fig. 11-62 Axle Caster (Side View)

STEERING WHEEL SPOKE ALIGNMENT

After checking and adjusting front wheel alignment, align the steering wheel spokes as follows.

(1) Center steering wheel by aligning spokes with steering gear in straight-ahead position and clamp wheel in position.

(2) Loosen connecting rod adjusting tube clamp and turn tube until front wheels are in straight-ahead position.

(3) Tighten adjusting tube clamps.

(4) Road-test to check spoke alignment adjustment.

FRONT END SHIMMY

Front end shimmy may be caused by one or more of the following conditions:

- Incorrectly adjusted front wheel bearings
- Worn or out-of-balance or out-of-round front tires
- Loose steering damper to tie rod bracket (CJ, Cherokee, Wagoneer, Truck)
- Steering damper malfunction
- Worn (loose) tie rod ends
- Worn (loose) steering knuckle ball studs
- Incorrect tire pressures

The following procedure outlines a method for determining and correcting the causes of wheel shimmy.

(1) Raise and support front of vehicle.

(2) Inspect condition of front tires. Check and correct tire inflation pressure. Check for evidence of tire imbalance such as flat spots, scalloping, cupping or bald spots. Balance or replace tires as necessary.

(3) Check and correct front wheel bearing adjustment if necessary. Refer to adjustment procedure outlined in Section 9.

(4) Check for loose steering damper tie rod bracket on vehicles so equipped. If bracket is loose, center bracket on tie rod and tighten attaching bolts.

(5) Disconnect steering damper at tie rod bracket and check operation as follows:

(a) Alternately compress and extend damper. Damper should provide equal resistance throughout length of each stroke.

(b) Replace damper if lack of resistance is evident.

(6) Inspect all tie rod ends. If excessive play is observed in any tie rod end when checked, replace it.

(7) Inspect steering knuckle ball studs. Insert pry bar between knuckle and yoke, adjacent to ball stud, and pry against each ball stud. If none of the studs move or appear to be loose in their sockets, proceed to next step. If any stud moves or appears to be loose in its socket, reseat both studs on that side of the axle as follows:

(a) Remove wheels and tires. Remove axle shafts.

(b) Remove cotter pin and slotted nut from upper ball stud and loosen lower ball stud jamnut.

(c) Unseat upper and lower ball studs by striking upper ball stud with rawhide or lead hammer. Remove upper ball stud split ring seat using Tool J-25158. Discard split ring seat.

(d) Remove lower ball stud jamnut and remove steering knuckle. Discard lower ball stud jamnut.

(e) Clean upper ball stud split ring seat threads and lower ball stud taper in steering knuckle. Clean threads and tapered surfaces of both ball studs. Clean threads in upper ball stud retaining nut.

(f) Install steering knuckle. Support knuckle by hand and install new lower ball stud jamnut. Tighten jamnut finger-tight only. Install upper ball stud nut. Tighten nut until lower ball stud is drawn into tapered hole in axle yoke. Do not install split ring seat at this time.

(g) Tighten upper ball stud jamnut to 80 foot-pounds torque. Remove upper ball stud nut and install new upper ball stud split ring seat. Tighten split ring seat to 50 foot-pounds torque using Tool J-25158. Tighten lower ball stud jamnut to 100 foot-pounds torque and install cotter pin.

(h) Install axle shafts and steering spindles, and repeat step (7).

(i) Install wheels and tires.

(8) On CJ models not equipped with steering damper, if steering components inspected are O.K., install steering damper kit.

(9) Remove supports and lower vehicle.

(10) Road-test vehicle to verify repair.

POWER STEERING SYSTEM

GENERAL

The power steering system consists of a power steering gear, connecting hoses, and a hydraulic pump. The engine-driven pump supplies oil from an integral reservoir through the pressure and return hoses which connect the gear and pump.

If for any reason the power system should malfunction, the steering gear will operate manually, giving the driver continued control of the vehicle. The steering gear, in this condition, operates as a typical recirculating ball-type manual steering gear. Hydraulic fluid is bypassed through the valve so that it does not restrict manual operation.

DESCRIPTION AND OPERATION

Steering Gear

All models use a recirculating ball-type power steering gear. Steel balls act as a rolling thread between the steering gear wormshaft and the rack-piston.

Wormshaft fore and aft movement is controlled by a bearing and two races at the lower end, and a bearing assembly in the adjuster plug at the upper end. The lower bearing races are conical and exert a constant pressure on the wormshaft to prevent loss of thrust bearing preload. The adjuster plug controls worm bearing preload adjustment when servicing the gear.

In the right-turn position, the rack-piston moves upward. In the left-turn position, the rack-piston moves downward.

The rack-piston teeth are meshed with the pitman shaft sector teeth. Turning the wormshaft turns the pitman shaft which, through mechanical linkage, turns the wheels.

Power Steering Pump

A vane-type, constant-displacement pump is used to develop the system oil pressure which is applied to the rack-piston (fig. 11-63). The integral pump reservoir provides a reserve supply of oil for the hydraulic system.

The pump reservoir cap is vented to maintain atmospheric pressure within the reservoir and to allow air trapped in the system to escape.

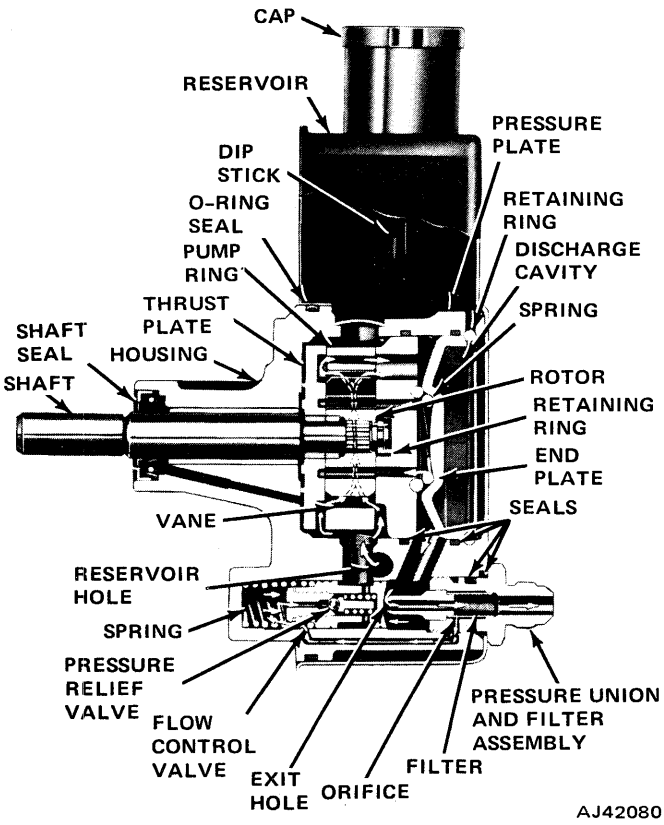
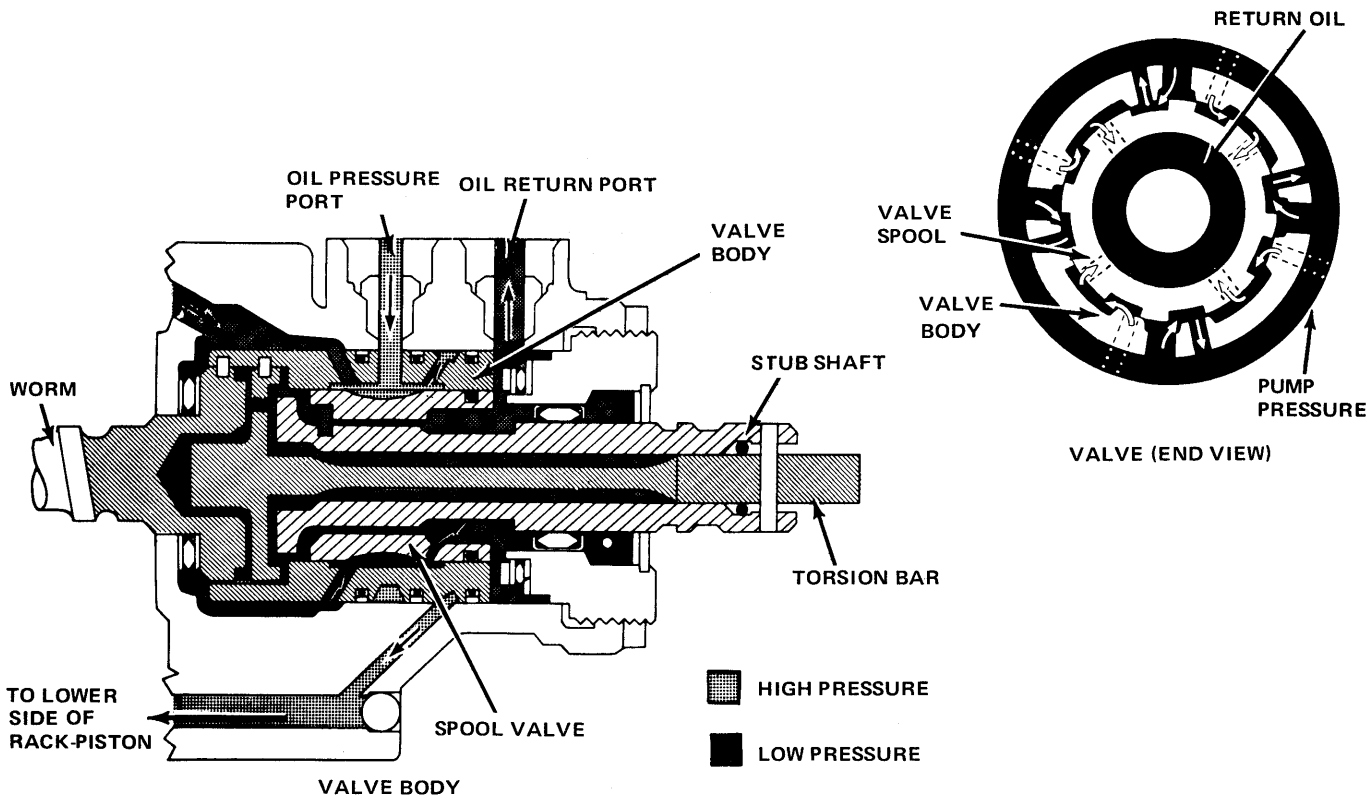


Fig. 11-63 Power Steering Pump

A flow control valve within the pump is used to control and maintain system operating pressure. A pressure relief valve is incorporated into the flow control valve. The flow control valve can be serviced without removing the pump.

Hydraulic Assist

The power steering gear has an open center, three-way, rotary valve to control hydraulic assist. Pump-supplied oil is applied to the pressure hole in the gear housing and then routed by the valve through the gear oil passages (fig. 11-64 and 11-65).



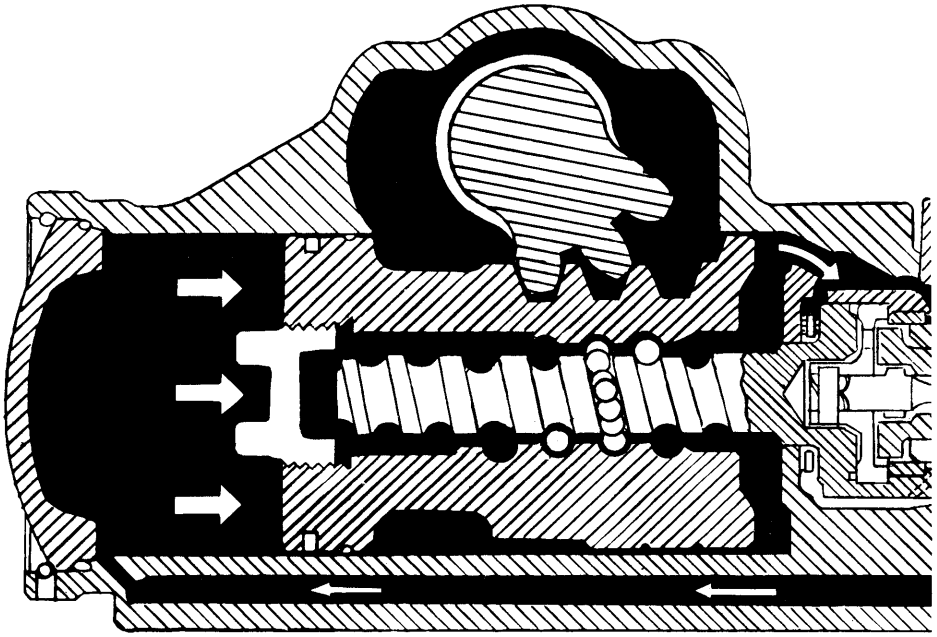


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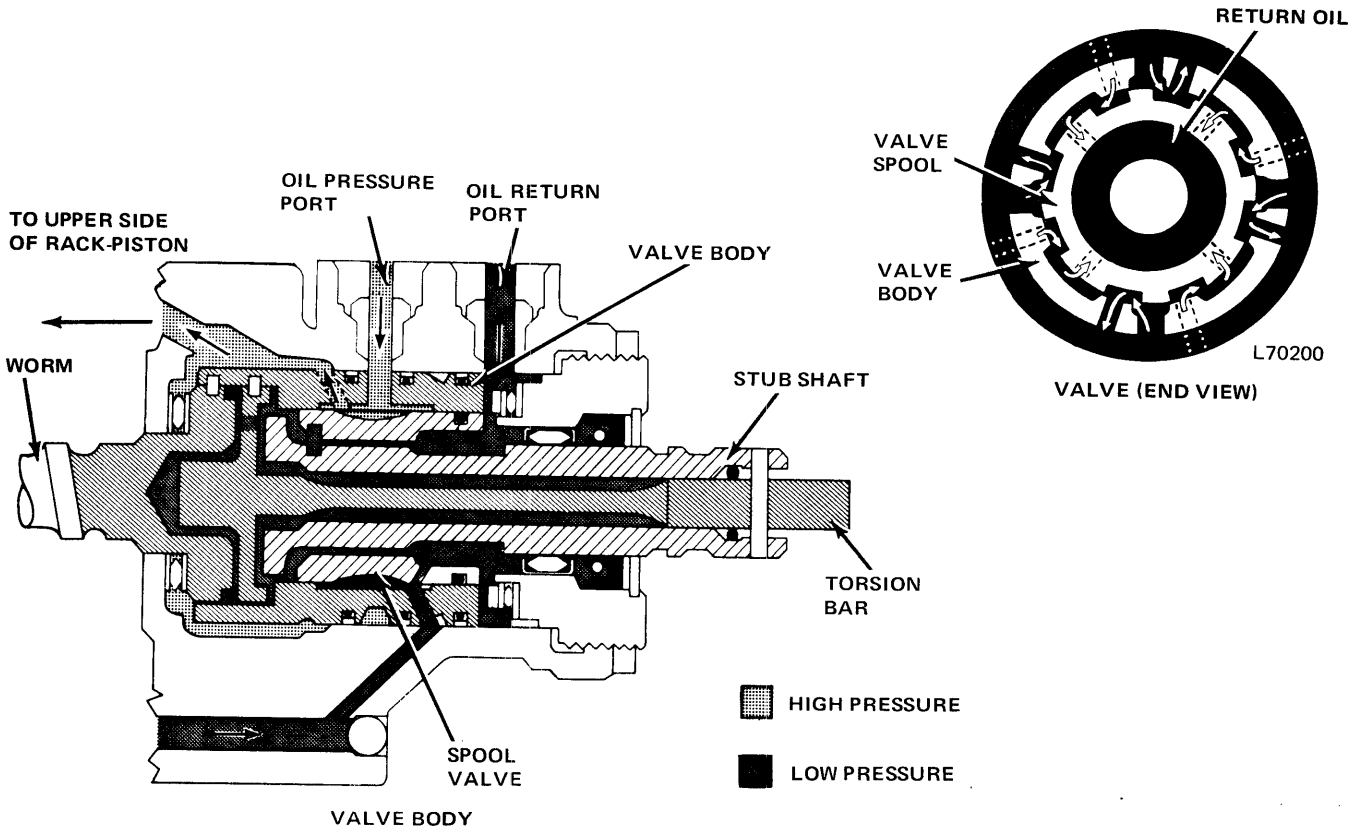
Fig. 11-64 Valve Oil Flow—Right Turn Position



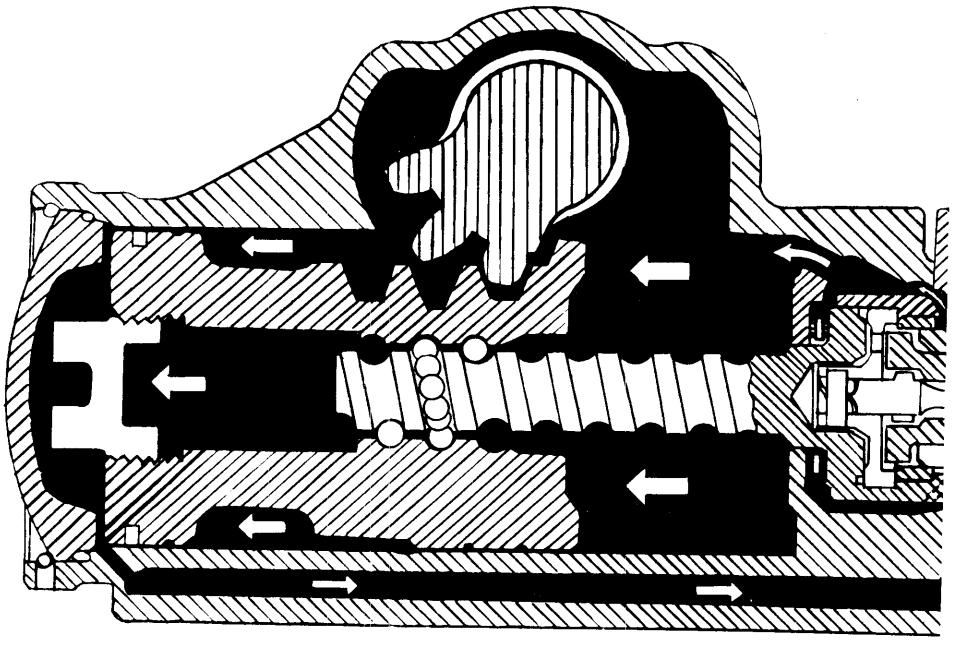


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Fig. 11-65 Valve Oil Flow—Left Turn Position

The valve body, spool valve, torsion bar, and stub shaft which is pinned to the torsion bar, are, in effect, attached to the front wheels through mechanical connections. Due to the pressure exerted on the front wheels by the weight of the vehicle, the wheels and, consequently, the valve body, tend to resist any turning effort that is applied. As resistance to turning by the wheels and valve body increases, the torsion bar deflects, permitting the stub shaft to rotate within the valve body. Since the spool valve is connected to the stub shaft by a locating pin, the spool valve also rotates within the valve body. As the spool valve rotates, the fluid directional passages machined into the spool valve are brought into alignment with machined passages in the valve body. When these passages are aligned, high pressure fluid from the pump is directed through the aligned passages and against either side of the rack-piston nut.

Variable Ratio Power Steering

A variable ratio power steering gear is included in the optional power steering package offered on Wagoneer, Cherokee, and Truck models. CJ models are equipped with a constant ratio steering gear.

The ratio of a steering system is the relationship of steering wheel movement to that of the front wheels, in terms of the number of degrees that the steering wheel must be moved to turn the front wheels one degree.

Variable ratio steering is accomplished by a pitman shaft sector incoporating a short tooth on either side of a long center tooth, rather than a sector with three teeth of equal length, as in the constant ratio gear. Companion changes are also made in the rack-piston teeth (fig. 11-70).

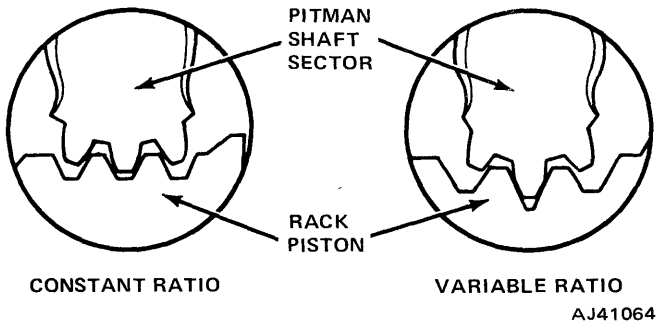


Fig. 11-66 Rack and Sector Comparison

Since the sector is basically a series of levers, any movement of the rack will cause the sector to swing the pitman arm in the same ratio; that is, it will turn the pitman arm the same number of degrees with each tooth in the sector.

To increase or decrease the ratio, it is only necessary to change the length of the sector teeth. A low ratio, or smaller radius sector with shorter teeth, produces greater pitman arm movement than the high ratio sector with its longer teeth and greater leverage.

On this basis, the variable ratio sector is in reality one long, high-ratio lever at the center, flanked by two lower-ratio levers for left and right turns.

Since only the tip of the long center tooth is in contact with the rack when the front wheels are straight, initial movement of the rack in either direction causes a relatively small response of the sector and pitman arm because of the high ratio that results from this long lever relationship.

As a result, the steering ratio remains a nearly constant 16.0:1 for the first 40 degrees of steering wheel movement in either direction from center.

Turning the steering wheel further reduces the length of the lever. The point of contact now rolls down the side of the center tooth, to act as a shorter radius, providing a steering ratio of 13.0:1 at full lock.

NOTE: *Service procedures for constant and variable ratio steering are the same.*

PERIODIC MAINTENANCE

Fluid Level

The power steering fluid level should be inspected periodically and maintained at the level indicated on the dipstick.

Check and correct the fluid level, if necessary, as outlined under Fluid Level and Initial Operation. In addition, always check the system for external leaks and check the fluid for evidence of foaming. Foaming usually indicates an overfill condition or the presence of air in the system.

NOTE: *Air bubbles circulating through the pump and gear will result in noise. Refer to Fluid Level and Initial Operation at the end of this section for hydraulic system bleeding procedure.*

Pump Drive Belt Tension

Adjust the belt so that tension is as specified when measured with Belt Tension Gauge J-23600. When using a belt tension gauge, make sure the gauge is placed in the center of the longest belt span. When checking notched belts, make sure the middle finger of the gauge is in the notched groove of the belt.

POWER STEERING GEAR SERVICE

Removal

(1) Disconnect hoses from return port and pressure port. Raise hoses above pump to prevent oil from draining and cap hoses to prevent entry of dirt.

Service Diagnosis—Steering Gear and Pump

Condition	Possible Cause	Correction
HISSING NOISE IN STEERING GEAR	(1) There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.	(1) Slight hiss is normal and in no way affects steering.
RATTLE OR CHUCKLE NOISE IN STEERING GEAR	(1) Gear loose on frame.	(1) Check gear-to-frame mounting screws. Tighten screws to 65 foot-pounds torque.
	(2) Steering linkage looseness.	(2) Check linkage pivot points for wear. Replace if necessary.
	(3) Pressure hose touching other parts of car.	(3) Adjust hose position. Do not bend tubing by hand.
	(4) Loose pitman shaft over center adjustment. **NOTE**: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.	(4) Adjust to specifications.
	(5) Loose pitman arm.	(5) Tighten pitman arm nut to specifications.
SQUAWK NOISE IN STEERING GEAR WHEN TURNING OR RECOVERING FROM A TURN	(1) Damper O-ring on valve spool cut.	(1) Replace damper O-ring.
CHIRP NOISE IN STEERING PUMP	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.
BELT SQUEAL (PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND STAND STILL PARKING)	(1) Loose or damaged belt.	(1) Adjust belt tension or replace belt.

60702A

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
GROWL NOISE IN STEERING PUMP	(1) Excessive back pressure in hoses or steering gear caused by restriction.	(1) Locate restriction and correct. Replace part if necessary.
GROWL NOISE IN STEERING PUMP (PARTICULARLY NOTICEABLE AT STAND STILL PARKING)	(1) Scored pressure plates, thrust plate or rotor.	(1) Replace parts and flush system.
	(2) Extreme wear of cam ring.	(2) Replace parts.
GROAN NOISE IN STEERING PUMP	(1) Low oil level.	(1) Fill reservoir to proper level.
	(2) Air in the oil. Poor pressure hose connection.	(2) Tighten connector to specified torque. Bleed system by operating steering from right to left-full turn.
RATTLE NOISE IN STEERING PUMP	(1) Vanes not installed properly.	(1) Install properly.
	(2) Vanes sticking in rotor slots.	(2) Free up by removing burrs, varnish, or dirt.
WHINE NOISE IN STEERING PUMP	(1) Pump shaft bearing scored.	(1) Replace housing and shaft. Flush system.
POOR RETURN OF STEERING WHEEL TO CENTER	(1) Tires not properly inflated.	(1) Inflate to specified pressure.
	(2) Lack of lubrication in linkage and ball studs.	(2) Lube linkage and ball studs.
	(3) Lower coupling flange rubbing against steering gear adjuster plug.	(3) Loosen pinch bolt and assemble properly.
	(4) Improper front wheel alignment	(4) Check and adjust as necessary. With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or ball studs are binding.
	(5) Steering linkage binding.	(5) Replace pivots.
	(6) Ball studs binding.	(6) Replace ball studs.
	(7) Tight or frozen steering shaft bearings.	(7) Replace bearings.

60702B

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
POOR RETURN OF STEERING WHEEL TO CENTER (Continued)	(8) Sticky or plugged spool valve.	(8) Remove and clean or replace valve.
	(9) Steering gear adjustments over specifications.	(9) Check adjustment with gear out of vehicle. Adjust as required.
	(10) Steering gear poppet valve installed incorrectly.	(10) Inspect and install valve correctly.
CAR LEADS TO ONE SIDE OR THE OTHER (KEEP IN MIND ROAD CONDITION AND WIND. TEST CAR IN BOTH DIRECTIONS ON FLAT ROAD)	(1) Incorrect tire pressure.	(1) Check and adjust.
	(2) Front end misaligned.	(2) Adjust to specifications.
	(3) Unbalanced steering gear valve.	(3) Replace valve.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump.	(1) Add power steering fluid as required.
	(2) Pump belt slipping.	(2) Tighten or replace belt.
	(3) High internal leakage.	(3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level.	(1) Fill as required.
	(2) Loose pump belt.	(2) Adjust tension to specification.
	(3) Insufficient pump pressure.	(3) Check pump pressure. (See pressure test). Replace relief valve if defective.
	(4) Sticky flow control valve.	(4) Inspect for varnish or damage, replace if necessary.
LOOSE STEERING	(1) Steering gear loose on frame.	(1) Tighten attaching screws to specified torque.
	(2) Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose.	(2) Tighten flange pinch bolts to 30 foot-pounds, if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque.
	(3) Steering linkage joints worn enough to be loose.	(3) Replace loose pivots.
	(4) Worn poppet valve (Gear).	(4) Replace poppet valve.
	(5) Loose thrust bearing preload adjustment (Gear).	(5) Adjust to specification with gear out of vehicle.
	(6) Excessive overcenter lash in gear.	(6) Adjust to specification with gear out of vehicle.

60702C

Service Diagnosis—Steering Gear and Pump (Continued)

Condition	Possible Cause	Correction
HARD STEERING OR LACK OF ASSIST	(1) Loose pump belt.	(1) Adjust belt tension to specification.
	(2) Low oil level in reservoir. NOTE: Low oil level will also result in excessive pump noise.	(2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors.
	(3) Tires not properly inflated.	(3) Inflate to recommended pressure.
NOTE: If checks (1) through (3) do not reveal cause of hard steering, refer to pressure test.	Further possible causes could be: (4) Sticky flow control valve. (5) Insufficient pump pressure output. (6) Excessive internal pump leakage. (7) Excessive internal gear leakage.	In order to diagnose conditions such as listed in (4), (5), (6), (7) a test of the entire power steering system using gauge tool J 21567 is required.
FOAMING AERATED POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	(1) Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
LOW PRESSURE DUE TO STEERING PUMP	(1) Flow control valve stuck or inoperative.	(1) Remove burrs or dirt or replace. Flush system.
	(2) Pressure plate not flat against cam ring.	(2) Correct.
	(3) Extreme wear of cam ring.	(3) Replace parts. Flush system.
	(4) Scored pressure plate, thrust plate, or rotor.	(4) Replace parts. Flush system.
	(5) Vanes not installed properly.	(5) Install properly.
	(6) Vanes sticking in rotor slots.	(6) Freeup by removing burrs, varnish, or dirt.
	(7) Cracked or broken thrust or pressure plate.	(7) Replace part.
LOW PRESSURE DUE TO STEERING GEAR	(1) Pressure loss in cylinder due to worn piston ring or badly worn housing bore.	(1) Remove gear from vehicle for disassembly and inspection of ring and housing bore.
	(2) Leakage at valve rings, valve body-to-worm seal.	(2) Remove gear from car for disassembly and replace seals.

(2) On Wagoneer, Cherokee, and Truck models, remove clamp bolt and nut attaching flexible coupling to steering gear stub shaft and disengage coupling from stub shaft.

(3) On CJ models, remove clamp bolt and nut attaching intermediate shaft coupling to steering gear stub shaft and disconnect intermediate shaft.

(4) Remove pitman arm nut, lockwasher, and remove pitman arm using Tool J-6632.

(5) On Wagoneer, Cherokee, and Truck models, remove steering gear-to-frame mounting bolts and remove gear.

(6) On CJ models:

(a) Raise left side of vehicle slightly to relieve tension on left front spring and place support stand under frame.

(b) Remove three lower steering gear mounting bracket-to-frame bolts.

(c) Remove two upper steering gear mounting bracket-to-crossmember bolts and remove steering gear and mounting brackets as assembly.

(d) Remove mounting bracket-to-gear attaching bolts and remove upper and lower mounting brackets from steering gear.

Installation

NOTE: *Proper retention of the steering gear is important. Some of the following procedural steps in gear installation require the application of Locktite or equivalent material to attaching bolt threads. Wherever indicated, use Locktite 271 Adhesive/Sealant (Jeep part number 8129800) or equivalent. When applying this material, clean all bolt threads thoroughly to remove dirt and grease and apply the material liberally to the bolt threads no more than five minutes before installation.*

(1) On Wagoneer, Cherokee, and Truck models:

(a) Align and install flexible coupling on steering gear stub shaft and install clamp bolt. Tighten clamp bolt to 30 foot-pounds torque.

(b) Apply Loctite or equivalent material to steering gear-to-frame mounting bolts.

(c) Position steering gear on frame and install gear mounting bolts. Tighten mounting bolts to 70 foot-pounds torque.

(2) On CJ models:

(a) Apply Loctite or equivalent material to all steering gear mounting bracket attaching bolts.

(b) Position upper and lower mounting brackets on steering gear and install bracket attaching bolts. Tighten bolts to 70 foot-pounds torque.

(c) Apply Loctite or equivalent material to steering gear mounting bracket-to-frame and crossmember attaching bolts.

(d) Align and connect intermediate shaft coupling to steering gear stub shaft

(e) Position assembled steering gear and mounting brackets on frame and crossmember and install attaching bolts. Tighten all attaching bolts to 55 foot-pounds torque.

(f) Remove support stands and lower vehicle.

(3) On CJ models, install intermediate shaft coupling-to-steering gear stub shaft clamp bolt and nut. Tighten nut to 45 foot-pounds torque.

(4) Install pitman arm on pitman shaft and install lockwasher and nut. Tighten pitman arm nut to 185 foot-pounds torque.

(5) Connect pressure and return hoses to steering gear. Tighten hose fittings to 25 foot-pounds torque.

(6) Check and correct fluid level as outlined under Fluid Level and Initial Operation.

Steering Gear Disassembly

NOTE: *In most cases, complete disassembly of the power steering gear will not be necessary. Only those subassemblies that have malfunctioned should be disassembled. Steering gear repair operations must always be performed on a clean work bench. Cleanliness is of utmost importance in avoiding a problem recurrence after assembling the gear. The work bench, tools, and steering gear component parts must be kept clean at all times. Thoroughly clean the exterior of the unit with a suitable solvent before disassembly. Refer to Figure 11-67 for parts nomenclature and assembly sequence during service operations.*

(1) Drain fluid from steering gear.

(2) Cap all openings in steering gear. Clean exterior of gear thoroughly and wipe dry.

(3) Mount steering gear in vise with pitman shaft pointing downward. Clamp unmachined housing boss portion of gear in vise (fig. 11-68).

(4) Rotate end plug retaining ring until one end of ring is aligned with hole in side of housing. Unseat ring using punch inserted through hole in housing and remove ring using screwdriver (fig. 11-69).

(5) Install 12-point deep socket and ratchet handle on stub shaft. Slowly rotate shaft counterclockwise until rack piston forces housing end plug out of housing and remove end plug.

CAUTION: *Do not rotate the stub shaft any farther than necessary or the ball bearings will drop out of the rack-piston circuits. This will cause the rack piston and pitman shaft sector teeth to disengage. If disengagement should occur, remove the side cover and pitman shaft and engage the teeth.*

(6) Remove and discard O-ring seal from housing end plug.

(7) Turn stub shaft one-half turn clockwise.

(8) Unseat rack piston end plug by striking it with plastic mallet.

(9) Remove rack piston end plug using square drive lug of 1/2-drive ratchet handle.

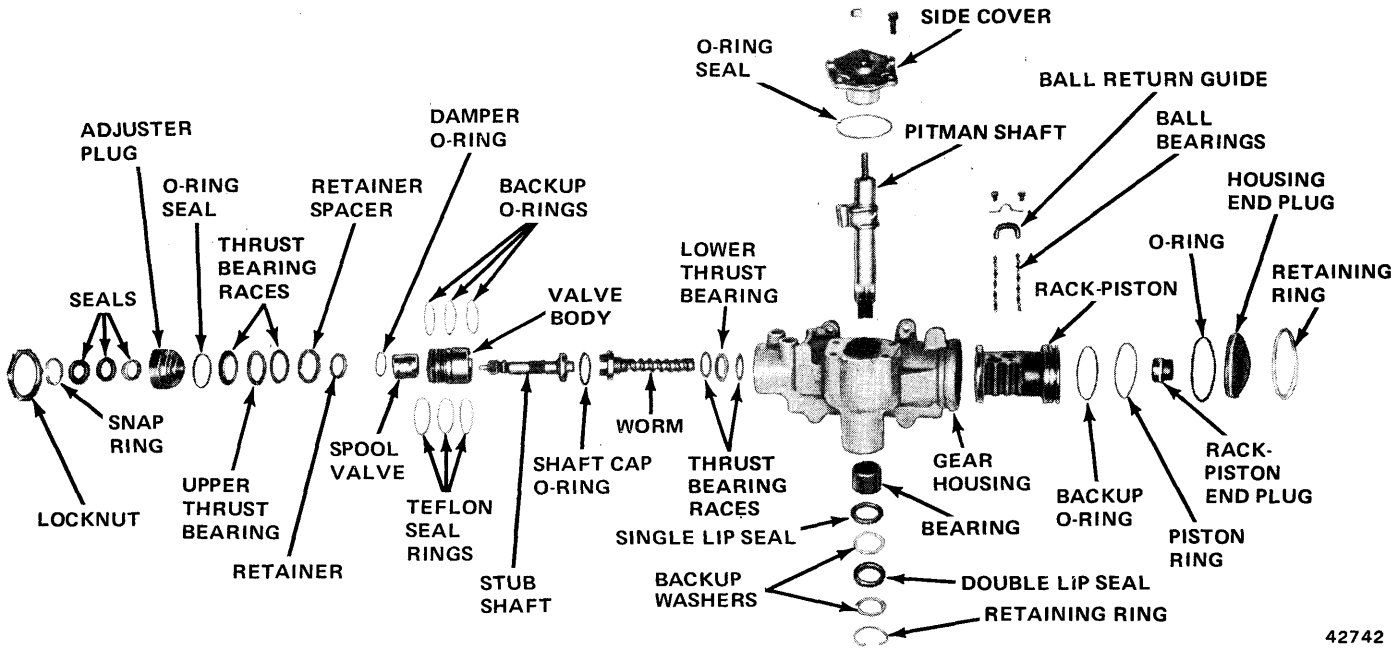


Fig. 11-67 Power Steering Gear

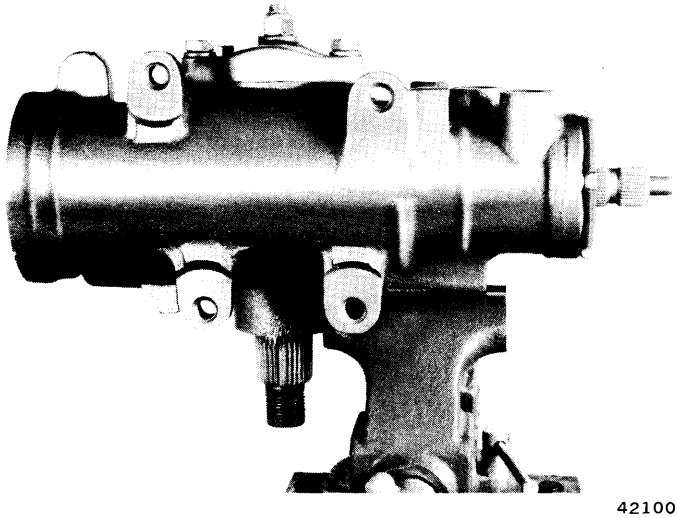


Fig. 11-68 Steering Gear Mounted In Vise

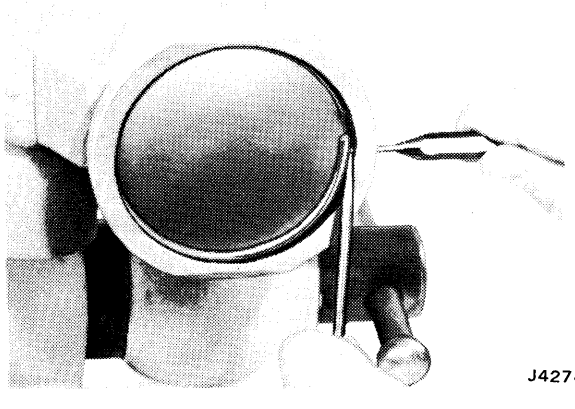


Fig. 11-69 Removing End Plug Retaining Ring

CAUTION: *Do not attempt to remove the rack piston end plug until it has been unseated as the plug could be broken.*

(10) Remove and discard pitman shaft adjuster screw locknut. Use Allen wrench to prevent adjuster screw from turning when removing locknut (fig. 11-70).

(11) Remove side cover attaching bolts and lockwashers.

(12) Unthread side cover from adjuster screw by turning screw clockwise into pitman shaft.

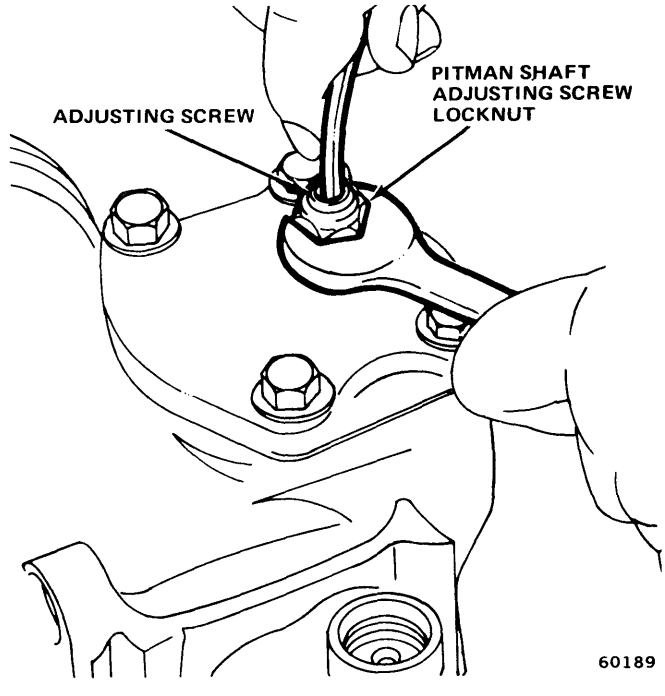


Fig. 11-70 Removing—Installing Adjuster Screw Locknut

(13) Turn stub shaft until pitman shaft sector teeth are centered in housing.

(14) Remove pitman shaft from housing by tapping shaft with plastic mallet.

NOTE: *Do not remove or disassemble any of the pitman shaft component parts. The shaft and component parts are serviced as an assembly only.*

(15) Remove rack piston from housing as follows:

(a) Insert rack piston Arbor Tool J7539-01 or J-21552 into rack piston until it contacts end of wormshaft.

(b) Hold arbor tool tightly against wormshaft and turn stub shaft counterclockwise to force rack piston onto arbor tool.

(c) Remove rack piston and arbor tool from housing as an assembly (fig. 11-71).

(16) Remove adjuster plug locknut using brass drift.

(17) Remove adjuster plug using Tool J-7624 (fig. 11-72).

(18) Remove valve body from housing. Grasp stub shaft and pull upward and outward to remove.

(19) Remove wormshaft lower thrust bearing and races from upper end of housing if not removed previously.

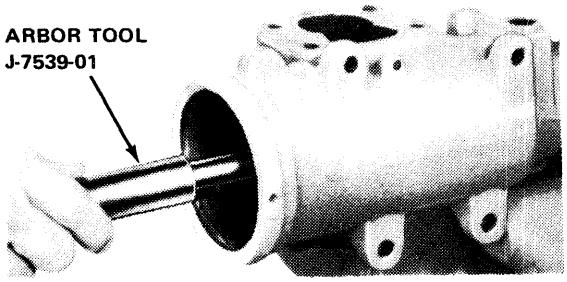


Fig. 11-71 Removing Rack Piston

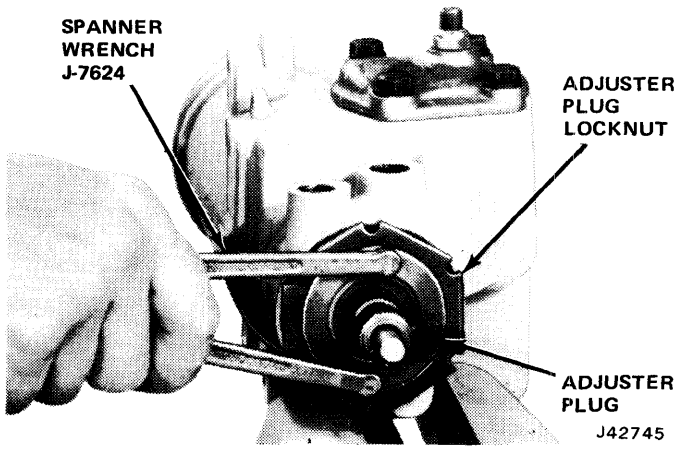


Fig. 11-72 Removing Adjuster Plug

Disassembly—Subassembly Components

Pitman Shaft Bearings and Seals

(1) Remove pitman shaft seal retaining ring using Snap Ring Pliers J-4245.

(2) Remove pitman shaft outer backup washer and double lip seal (fig. 11-73). Discard seal. Use screwdriver to pry out washer and seal.

(3) Remove pitman shaft inner backup washer and single lip seal (fig. 11-73). Discard seal. Use screwdriver to pry out washer and seal. Do not damage housing seal bore when removing washers and seals.

(4) Remove pitman shaft needle bearing from housing using Tool J-6657 and discard bearing.

NOTE: *When removing the bearing, drive the bearing out of the housing—not through the housing.*

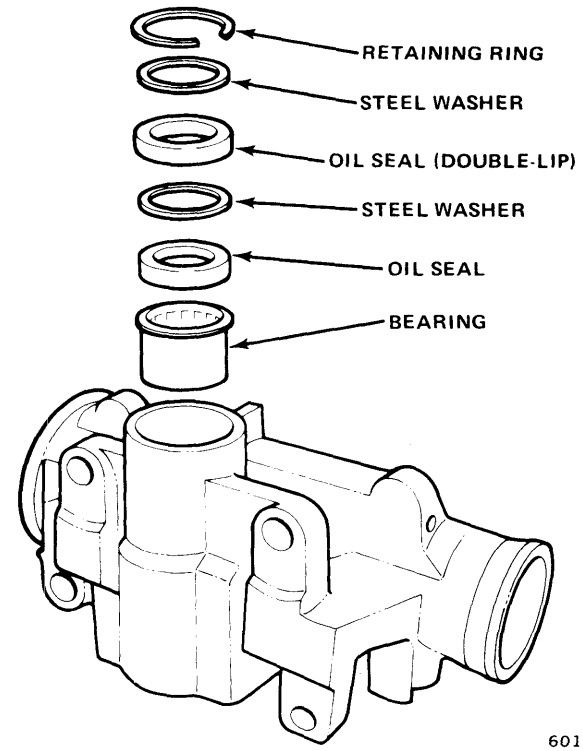


Fig. 11-73 Pitman Shaft Bearing and Seals

Adjuster Plug

(1) Remove thrust bearing retainer using screwdriver (fig. 11-74) and discard retainer. Do not damage needle bearing bore when removing retainer.

(2) Remove thrust bearing spacer, thrust bearing, and thrust bearing races (fig. 11-75).

(3) Remove and discard adjuster plug O-ring seal.

(4) Remove stub shaft seal retainer ring and remove and discard stub shaft dust seal. Use screwdriver to pry retainer and seal out of adjuster plug.

(5) Remove needle bearings using Tool J-6221 and discard bearings.

Fig. 11-74 Removing Thrust Bearing Retainer

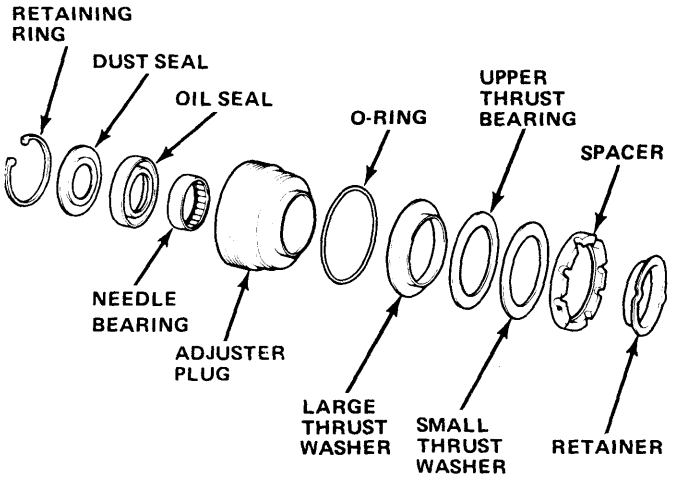


Fig. 11-75 Adjuster Plug Components

Valve Body

CAUTION: *The valve body assembly is a precision unit with select-fit parts that are hydraulically balanced during manufacture. It is uncommon to make service repairs of the valve assembly with the possible exception of the valve spool damper O-ring. Do not disassemble the valve unless absolutely necessary . This could result in damaging the assembly. If the spool valve damper O-ring requires replacement, remove the valve spool, replace the O-ring, and reinstall the spool valve immediately. If the valve spool or valve body requires replacement, replace the complete valve body as an assembly only. Do not attempt to interchange parts. If disassembly of the valve body assembly is absolutely necessary, proceed as outlined in the following steps.*

(1) Remove and discard stub shaft cap-to-valve body O-ring seal.

(2) Hold valve body assembly in both hands with stub shaft pointing downward and tap end of stub shaft lightly against workbench until shaft cap is free of valve body (fig. 11-76).

(3) Pull stub shaft outward until shaft cap clears valve body by approximately 1/4 inch.

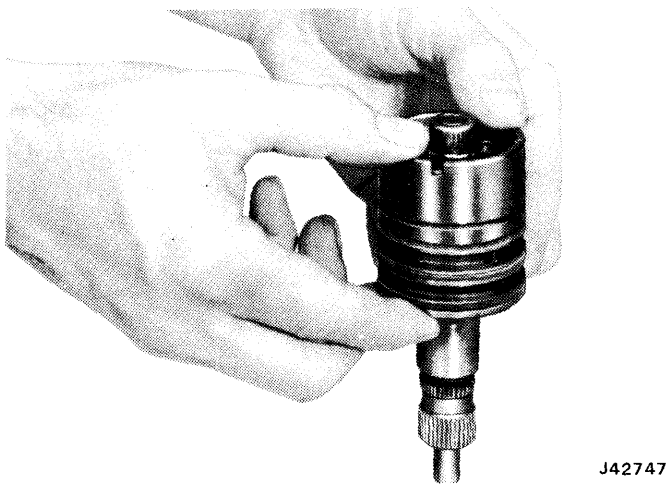


Fig. 11-76 Removing Stub Shaft From Valve Body

CAUTION: *Do not pull the stub shaft out of the valve body any farther than 1/4 inch as the spool valve may become cocked in the valve body.*

(4) Disengage stub shaft pin from spool valve and remove stub shaft.

(5) Remove spool valve from valve body using a push and turn motion. If spool valve becomes cocked, carefully realign valve before further attempts at removal.

(6) Remove and discard spool valve damper O-ring. Discard O-ring.

(7) Cut and remove valve body seal rings and backup O-rings (fig. 11-77).

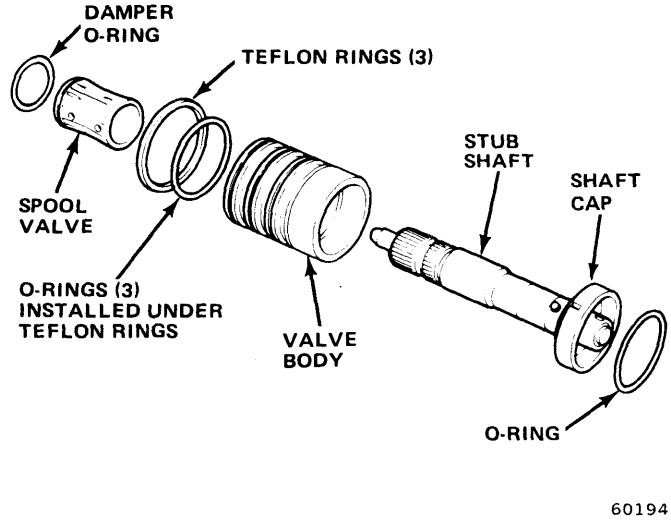


Fig. 11-77 Valve Body Components

NOTE: *Remove and discard the seal rings and O-rings only if they exhibit excessive wear. The seal rings are made of filled teflon and it is unusual for replacement to be required.*

Rack Piston and Wormshaft

(1) Remove wormshaft, lower thrust bearing, and races.

(2) Cut and remove piston ring and backup O-ring from rack piston. Discard piston ring and O-ring.

(3) Remove ball return guide clamp attaching screws and remove return guide clamp.

(4) Place rack piston on clean cloth and remove ball return guides, arbor tool, and ball bearings.

Inspection and Repair

Gear Housing

Inspect the gear housing bores. If severly scored or worn, replace the housing.

Check the hose connectors. If damaged, scored, or brinelled, remove the connectors as follows:

(1) Tap connector using 5/16-18 tap (fig. 11-78).

(2) Thread 5/16-18 bolt with nut and flat washer attached into connectors.

(3) Hold bolt and rotate nut from bolt to remove connectors (fig. 11-79).

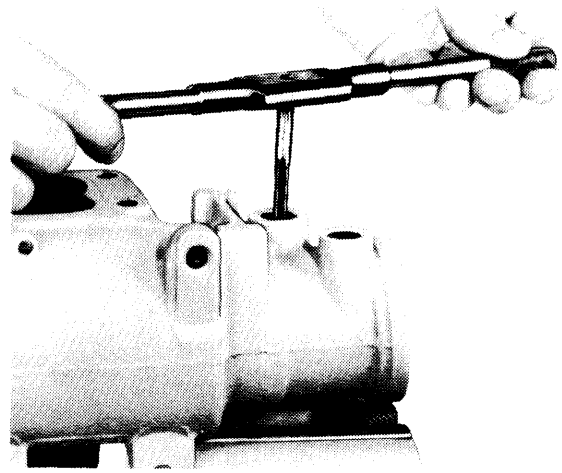


Fig. 11-78 Threading Hose Connector Seat

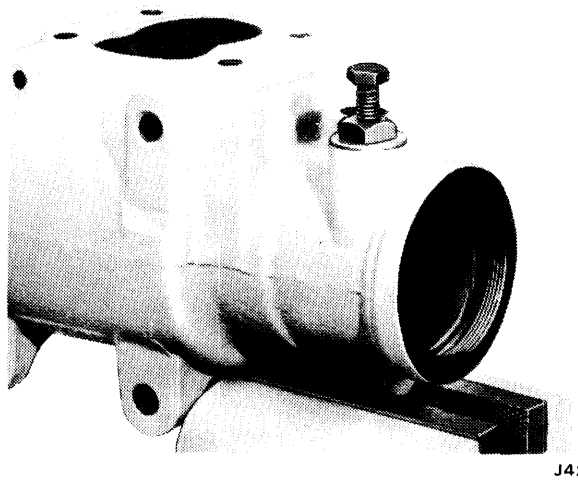


Fig. 11-79 Removing Hose Connector Seat

(4) If necessary, remove poppet valve from pressure port using No. 5 screw extractor.

(5) Install replacement connector into connector port using Tool J-6217 (fig. 11-80).

NOTE: *After installing the connector, check poppet valve operation. Press the poppet valve downward using a pencil. If the valve is correctly installed, the valve will spring back when the pencil is removed.*

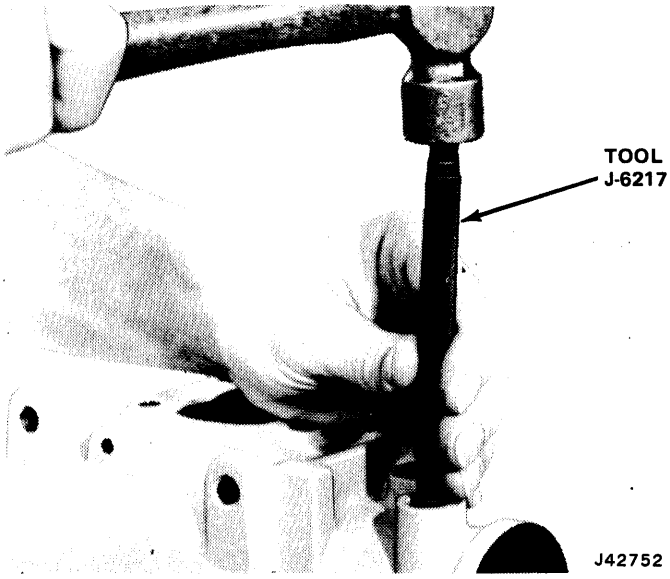


Fig. 11-80 Installing Hose Connector Seat

Inspect all of the housing seal surfaces and retaining ring grooves for damage. Replace the housing if damaged.

Inspect the housing ball plug (fig. 11-81). If prior leakage was noted around the plug or if the ball is raised above the housing surface, tap the ball into the housing until it is flush with or 1/16 inch below the housing surface. Secure the ball by staking the housing around it.

NOTE: *If the gear is installed and fluid leaks past the ball after it has been seated and staked in place, replace the steering gear housing.*

Rack-Piston and Wormshaft

Inspect the wormshaft for wear, scoring, pitting, distortion, nicked threads, or cracks. Replace the wormshaft if it exhibits any of these conditions. Inspect the rack piston for scored, pitted, or nicked ball bearing grooves. Replace the rack piston if damaged.

Inspect the exterior diameter of the ball nut for wear or scoring and be sure the seal seats are clean and free from burrs.

Inspect the rack piston teeth for chips, cracks, dents, or scoring. If either the wormshaft or rack piston are damaged, replace both parts as a matched set only.

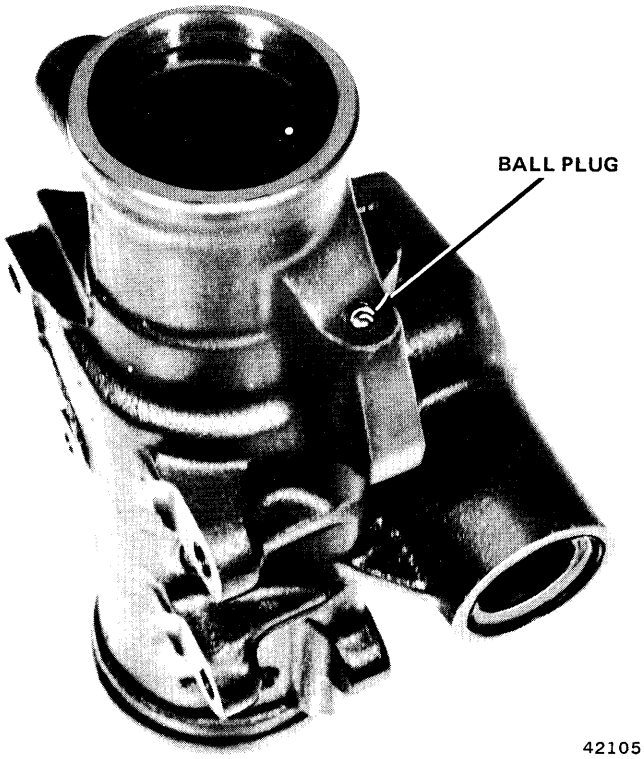


Fig. 11-81 Ball Plug Location

Inspect each of the ball bearings for dents, nicks, excessive wear, flaking, or flat spots and replace as necessary. Inspect the ball return guides. Be sure the guide ends, where the bearings enter and leave the guides, are free of burrs or distortion.

Inspect the lower thrust bearing and bearing races for wear or scoring. Replace any parts that are damaged or worn.

Valve Body

If fluid was leaking from between the torsion bar and stub shaft before the gear was disassembled, replace the valve body as an assembly.

Inspect the stub shaft-to-valve body pin. If the pin is worn or damaged replace the entire valve body assembly.

Inspect the wormshaft pin grooves in the valve body. If the grooves are damaged, replace the entire valve body assembly.

Inspect the spool valve drive pin in the stub shaft. If cracked, broken, or excessively worn, replace the entire valve body assembly.

Examine the valve body and outside diameter of the spool valve for nicks and burrs. Remove minor nicks or burrs using a very fine hone stone, but do not remove any stock from the valve body surfaces. A slight polishing is normal on the valve body and spool valve surfaces.

Pitman Shaft and Side Cover

Inspect the pitman shaft bushing in the side cover for excessive wear or scoring. If the bushing is worn or scored, replace side cover and bushing as an assembly only.

Inspect the pitman shaft sector teeth and the shaft bearing and seal surfaces. If any one of these surfaces is worn, pitted, or scored, replace the pitman shaft.

Inspect the pitman shaft needle bearings for flat spots, roughness, pitting, or excessive wear. Replace the bearings if they exhibit any of these conditions.

Assembly—Subassembly Components

Rack Piston and Wormshaft

(1) Lubricate all components with power steering fluid.

(2) Install backup O-ring in rack piston ring groove.

(3) Install teflon seal ring on top of backup O-ring (fig. 11-82).

NOTE: *The seal ring may appear to be slightly loose after installation, however, this is normal. The seal ring will tighten when exposed to system fluid at operating temperature.*

(4) Install wormshaft in rack piston (fig. 11-83).

(5) Align ball return guide holes with wormshaft grooves.

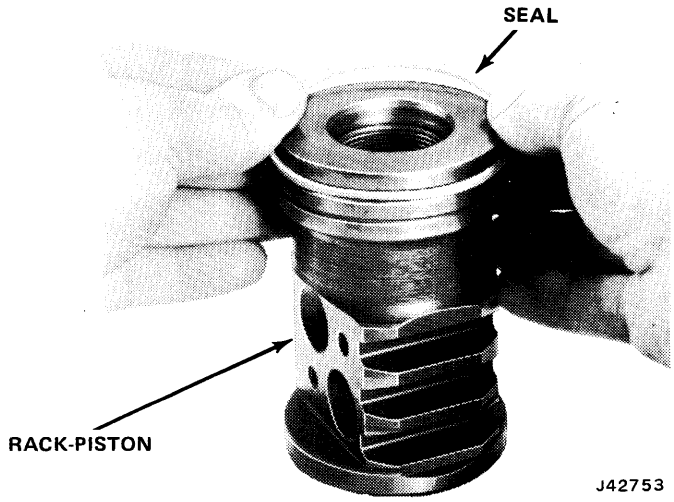


Fig. 11-82 Installing Rack Piston Seal Ring

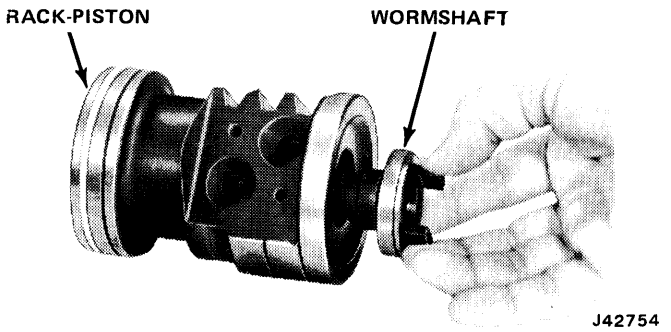
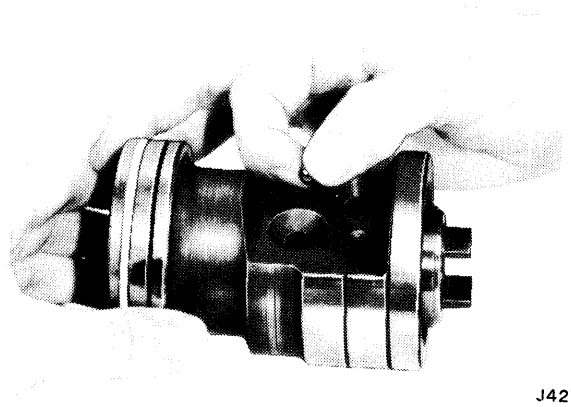


Fig. 11-83 Installing Wormshaft In Rack Piston

(6) Install 18 ball bearings in rack piston ball guide hole nearest piston ring. Rotate wormshaft slowly in a counterclockwise direction when installing ball bearings (fig. 11-84).

NOTE: *Install the ball bearings alternately. Install a black ball bearing followed by a silver ball bearing.*



J42755

Fig. 11-84 Installing Ball Bearings

(7) Fill one ball return guide half with petroleum jelly and install remaining ball bearings in guide.

(8) Assemble both ball return guide halves and insert guides in rack piston (fig. 11-85). Guides should fit loosely.

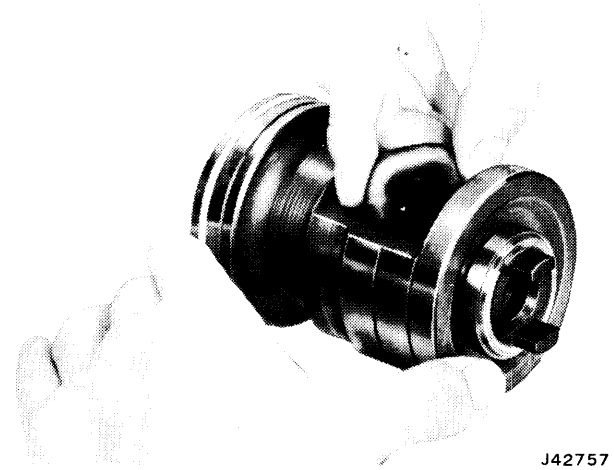


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Fig. 11-85 Installing Ball Return Guides

(9) Place ball return guide clamp over guides and install clamp attaching bolts and washers. Tighten bolts to 10 foot-pounds torque.

NOTE: *Do not allow the arbor tool to separate from the the wormshaft until the rack piston is fully installed on the arbor tool.*

Valve Body

(1) Lubricate all valve body components with power steering fluid.

(2) Install backup O-rings in valve body ring grooves.

(3) Install valve seal rings over backup O-rings (fig. 11-86). Seal rings may appear loose or twisted in grooves, this is normal. Rings will tighten when exposed to system oil at operating temperature.

J42758

Fig. 11-86 Installing Valve Body Seal Rings

(4) Install spool valve damper O-ring in spool valve groove.

(5) Install spool valve in valve body. Push valve spool through valve body until stub shaft pin hole is visible from opposite end and spool valve is flush with stub shaft cap end of valve body.

(6) Install stub shaft in spool valve until stub shaft pin can be inserted into spool valve.

(7) Align notch in stub shaft cap with pin in valve body and press spool valve and stub shaft into valve body.

CAUTION: *Be sure that the stub shaft cap notch is mated with the valve body pin before installing the valve body in the housing.*

(8) Install stub shaft cap-to-wormshaft O-ring in valve body.

CAUTION: *Do not allow the stub shaft to disengage from the valve body pin. If this occurs, the spool valve will extend too far into the valve body. This condition will cause the damper O-ring to expand into the valve body oil grooves and prevent withdrawal of the valve spool. If disengagement occurs, attempt to withdraw the spool valve using a pull and turn motion. If this fails to free the spool valve, proceed as follows: First, be sure the spool valve is free to rotate, then place the valve body on a flat surface with the notched end facing upward. Tap the spool valve with a wooden or plastic rod until the O-ring is cut and remove the valve. Replace the damper O-ring and reassemble the valve body. Make sure all the cut pieces of the O-ring are removed.*

Pitman Shaft Bearings and Seals

(1) Install needle bearing using Tool J-6657. Install bearing from inside of housing. Be sure bearing identification end faces inside of gear and that tool is placed against identification end of bearing during installation. Press bearing into housing until it clears shoulder in gear housing by 0.030 inch.

(2) Install single lip seal and backup washer using Tool J-6219. Install seal and washer far enough into housing to provide clearance for double lip seal and backup washer (Fig. 11-87). Be sure seal does not bottom in counterbore and that seal lip faces interior of housing.

(3) Install double lip seal and backup washer using Tool J-6219. Be sure seal is installed with lip facing interior of housing.

(4) Install retaining ring.

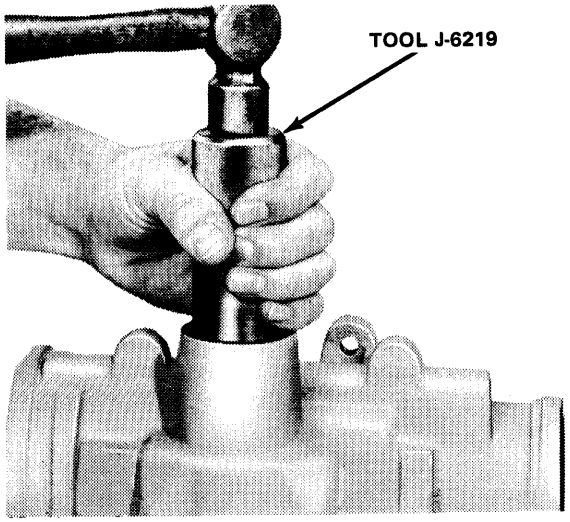

Fig. 11-87 Installing Pitman Shaft Seals

(5) Install wormshaft lower thrust bearing and races on end of wormshaft. Installation sequence is: race—bearing—race. Coned ends of races must face rack piston when installed.

(6) Install assembled valve body and wormshaft in housing. Align valve body drive pin in wormshaft with narrow pin slot in valve body before inserting valve body in housing (fig. 11-88).

CAUTION: *Do not push against the stub shaft to install the valve body. This may cause the stub shaft to disengage from the valve body allowing the spool valve O-ring to slip into the valve body oil grooves. Install the valve body by pressing directly on the valve body with the fingertips only (figs. 11-88 and 11-89). Before installing the adjuster plug, be sure the valve body is properly seated. Most of the oil return hole in the gear housing should be fully visible when the valve body is fully seated. If not, the valve body and wormshaft are misaligned or the thrust bearing and races are improperly installed.*

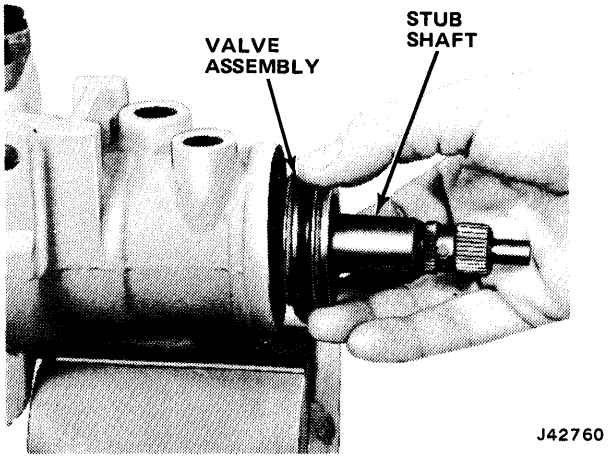

Fig. 11-88 Installing Valve Body

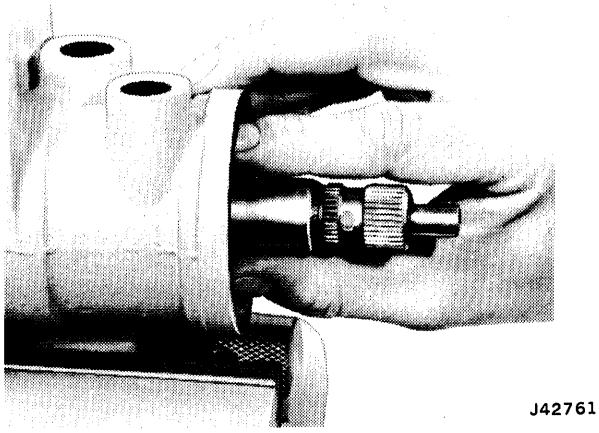

Fig. 11-89 Seating Valve Body

Adjuster Plug

(1) Lubricate all adjuster plug components with power steering fluid.

(2) Install needle bearing using Tool J-6621 (fig. 11-90). End of bearing must be flush with lower surface of stub shaft seal bore in adjuster plug.

(3) Install stub shaft oil seal using Tool J-5188 (fig. 11-91). Install seal far enough to provide clearance for dust seal and retaining ring.

(4) Install dust seal so rubber seal surface faces outward.

(5) Install retaining ring. Be sure ring is properly seated.

(6) Lubricate adjuster plug O-ring with petroleum jelly and install O-ring on adjuster plug.

(7) Assemble and install large O.D. thrust bearing race, wormshaft upper thrust bearing, small O.D. thrust bearing race, and thrust bearing retainer on adjuster plug. Do not flatten retainer dimples. Retainer must rotate freely after assembly. Radial location of dimples is not important.

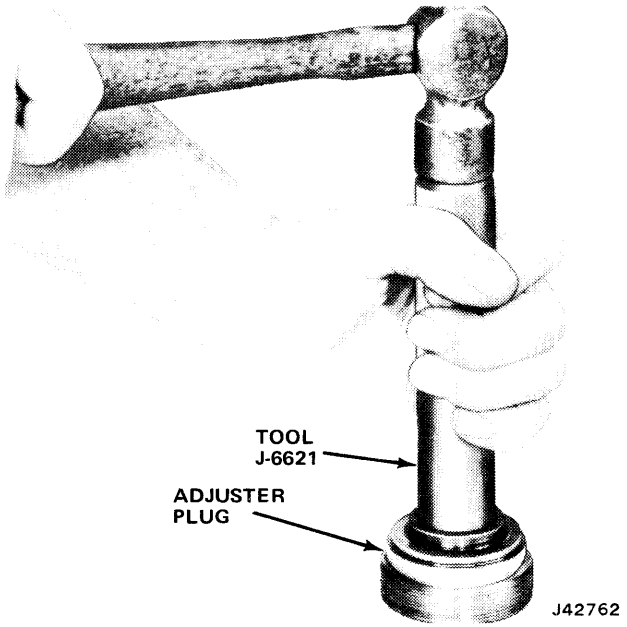

Fig. 11-90 Installing Needle Bearing in Adjuster Plug

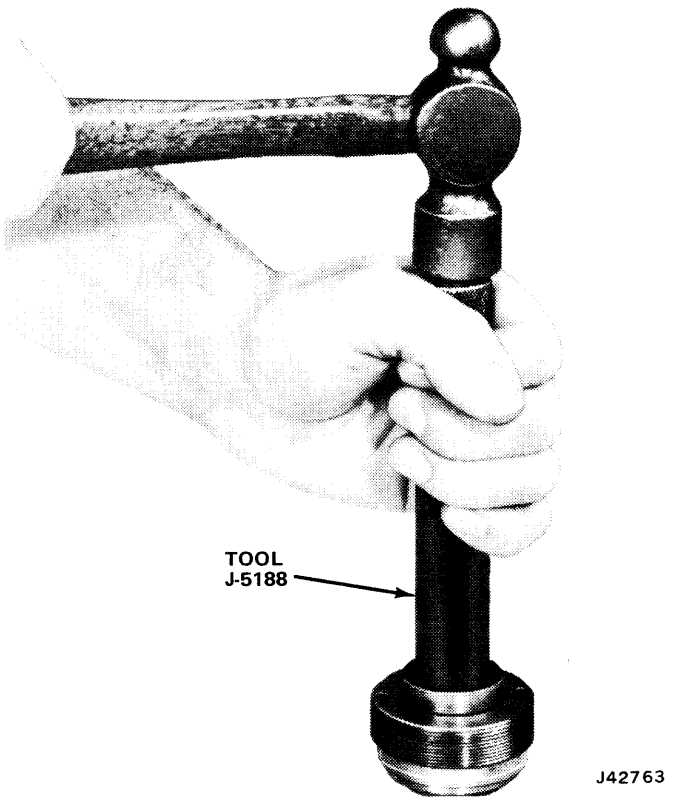

Fig. 11-91 Installing Stub Shaft Seal

Assembly—Steering Gear Housing Components

(1) Lubricate all components with power steering fluid.

(2) Place Seal Protector Tool J-6222 over end of stub shaft and install adjuster plug in housing. Tighten adjuster plug to 20 foot-pounds torque.

(3) Remove seal protector tool from stub shaft.

(4) Install rack piston in housing. Be sure wormshaft engages stub shaft. Do not damage rack piston seal ring during installation.

(5) Turn stub shaft clockwise to draw rack piston into housing. Remove arbor tool when rack piston seal ring is inside housing.

(6) Turn stub shaft until center groove in rack piston is aligned with center of pitman shaft needle bearing bore.

(7) Install side cover gasket on side cover. Be sure rubber seal in gasket is seated in cover groove.

(8) Install side cover on pitman shaft. Thread cover onto pitman shaft adjuster screw until cover bottoms against shaft.

(9) Install pitman shaft. Mesh center tooth of shaft with center groove in rack piston.

(10) Position side cover on housing and install cover attaching bolts. Tighten bolts to 45 foot-pounds torque. Be sure cover gasket is properly seated before installing cover bolts.

(11) Install replacement adjuster screw locknut on pitman shaft adjuster screw. Thread locknut half-way onto screw. Use hex wrench to prevent adjuster screw from turning while installing screw.

(12) Install end plug in rack piston. Tighten plug to 50 foot-pounds torque.

(13) Lubricate housing end plug O-ring with petroleum jelly and install O-ring in housing.

(14) Install housing end plug and seat plug against O-ring. If necessary, tap end plug lightly with plastic mallet to seat it against O-ring.

(15) Install housing end plug retainer ring. Ring end gap must not be aligned with hole in side of housing. Tap end plug lightly to be sure plug and retainer ring are seated.

(16) Adjust wormshaft bearing preload and pitman shaft overcenter drag torque as outlined under Steering Gear Adjustment.

Steering Gear Adjustment

The steering gear requires two adjustments which are: wormshaft bearing preload and pitman shaft over center drag torque.

Wormshaft bearing preload is controlled by the amount of compression force exerted on the conical wormshaft thrust bearing races by the adjuster plug.

Pitman shaft overcenter drag torque is controlled by the pitman shaft adjuster screw which determines the clearance between the rack piston and pitman shaft sector teeth.

CAUTION: *The following adjustment procedures must be performed exactly as described and in the sequence outlined. Failure to do so can result in damage to the gear internal components and poor steering response. Always adjust wormshaft bearing preload first; then adjust pitman shaft overcenter drag torque last.*

Wormshaft Bearing Preload

(1) Seat adjuster plug in housing using spanner wrench. Approximately 20 foot-pounds torque is required to seat plug.

(2) Place index mark on gear housing opposite one of the holes in adjuster plug (fig. 11-92).

(3) Measure back (counterclockwise) 3/16 to 1/4 inch from first index mark and remark housing (fig. 11-93).

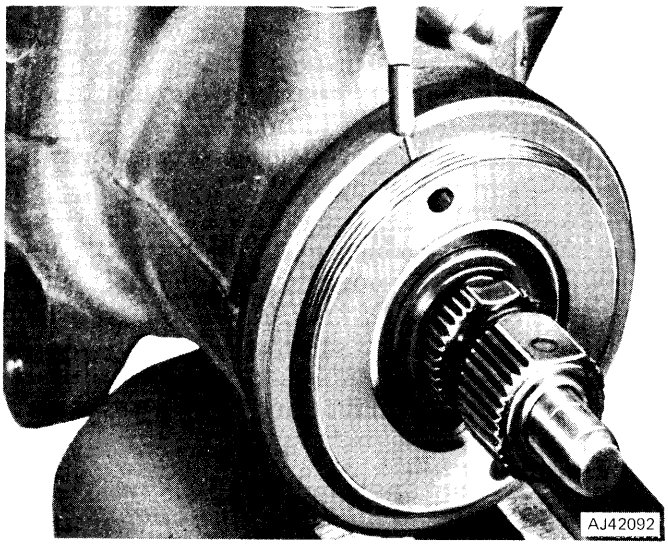

Fig. 11-92 Marking Housing

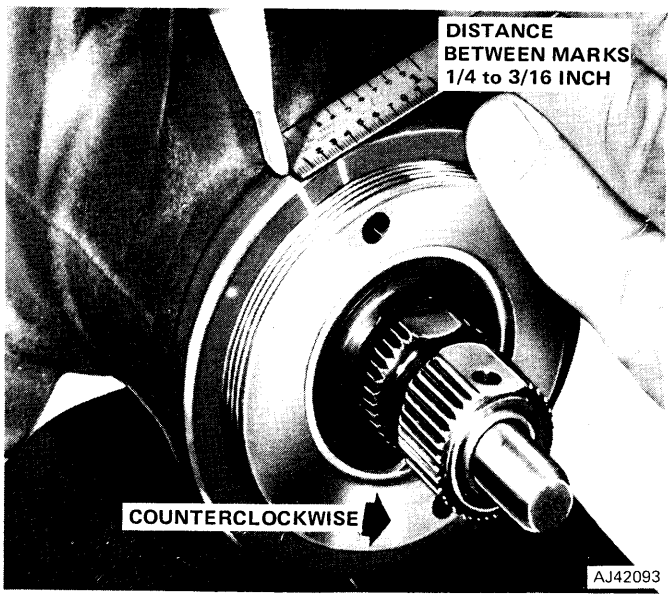

Fig. 11-93 Remarking Housing

(4) Turn adjuster plug counterclockwise until hole in plug is aligned with second mark.

(5) Install and tighten adjuster plug locknut to 85 foot-pounds torque using Tool J-25194. Do not allow the adjuster plug to turn while tightening locknut.

(6) Turn stub shaft clockwise to stop, then turn stub shaft back one-quarter turn.

(7) Assemble and install torque wrench with maximum capacity of 50 inch-pounds and 12-point deep socket on splined end of stub shaft (fig. 11-94).

(8) Measure torque required to turn stub shaft. Take reading with beam of wrench at or near vertical position while turning stub shaft at an even rate (fig. 11-94).

(9) Record reading. Torque required to turn stub shaft should be 4-to-10 inch-pounds torque.

NOTE: *If the measured torque reading is above or below the specified limits, the adjuster plug may have turned when the locknut was tightened, or the gear may be incorrectly assembled, or the wormshaft thrust bearings and races may be defective. Repair as required and remeasure preload.*

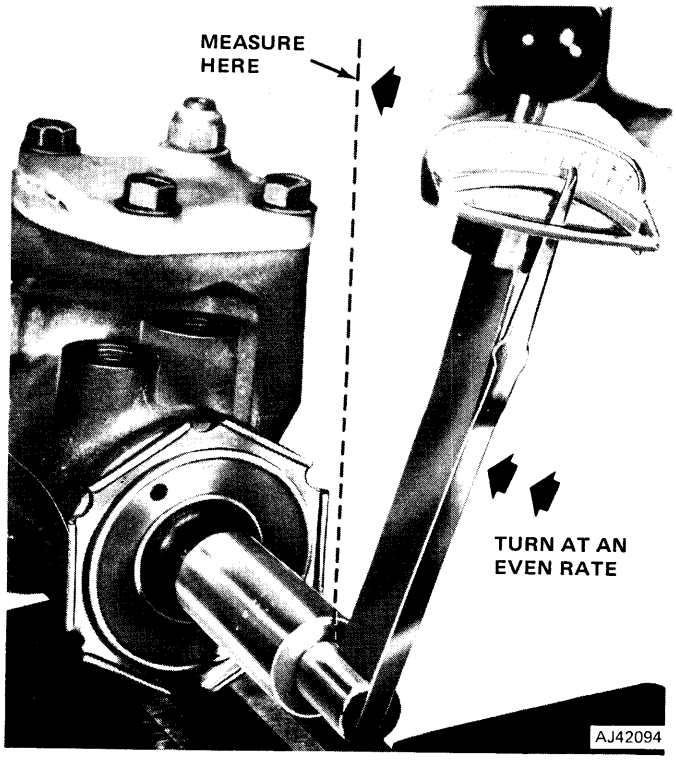

Fig. 11-94 Measuring Wormshaft Bearing Preload

Pitman Shaft Overcenter Drag Torque

(1) Turn pitman shaft adjuster screw counterclockwise until screw is fully extended, then turn screw back 1/2 turn clockwise.

(2) Rotate stub shaft from stop-to-stop and count total number of turns.

(3) Starting from either stop, turn stub shaft back 1/2 total number of turns. This is gear center.

NOTE: *When the gear is centered, the flat on the stub shaft should face upward and be parallel with the side cover. In addition, the master spline on the pitman shaft should be in line with the adjuster screw.*

(4) Install 50 inch-pound torque wrench and deep socket on stub shaft. Place wrench in vertical position to take reading (fig. 11-95).

(5) Rotate torque wrench 45 degrees each side of center and record highest drag torque measured on or near center (fig. 11-95).

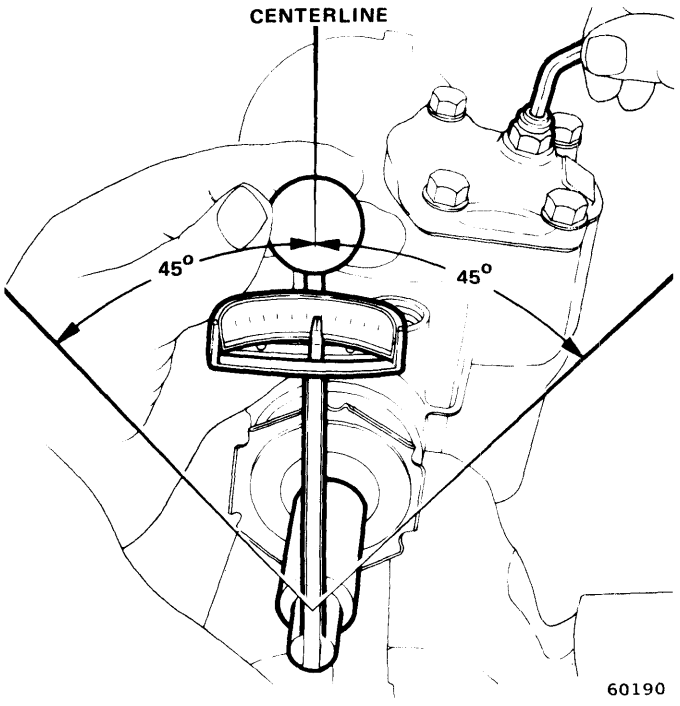

Fig. 11-95 Measuring Pitman Shaft Overcenter Drag Torque

(6) Adjust drag torque by turning pitman shaft adjuster screw clockwise until desired drag torque is obtained. Adjust drag torque to following limits:

On new gears, add 4 to 8 inch-pounds torque to previously measured wormshaft bearing preload **but do not exceed a combined total of 14 inch-pounds drag torque.**

On used gears (400 or more miles), add 4 to 5 inch-pounds torque to previously measured wormshaft bearing preload **but do not exceed a combined total of 14 inch-pounds drag torque.**

(7) Tighten pitman shaft adjuster screw locknut after adjusting overcenter drag torque. Tighten locknut to 35 foot-pounds torque. Use hex wrench to prevent adjuster from turning while tightening adjuster screw.

(8) Install steering gear and fill power steering pump reservoir with Jeep power steering fluid or equivalent.

(9) Bleed air from power steering system as outlined under Fluid Level and Initial Operation.

POWER STEERING PUMP SERVICE

Removal

NOTE: *It is not necessary to remove the pump to service the flow control valve or pump union. The flow control valve is retained in the pump housing by the pump union.*

(10) Remove pump drive belt and air pump belt (if equipped).

(11) Disconnect return and pressure hoses from pump. Cover all openings in pump to prevent dirt entry.

(12) On vehicles with eight-cylinder engine, remove pump front mounting bracket from engine.

(13) Remove bolts and nuts attaching pump front mounting bracket to pump and remove bracket from pump.

Pump Shaft Seal Replacement—Pump Assembled

(1) Remove pump drive belt from pulley.

(2) Remove pulley using Tool J-25034 (fig. 11-96). Do not hammer pulley from shaft.

(3) Wrap length of 0.005-inch shim stock, approximately 2-1/2 inches long, around pump shaft and push it past seal until it bottoms in pump housing (fig. 11-97).

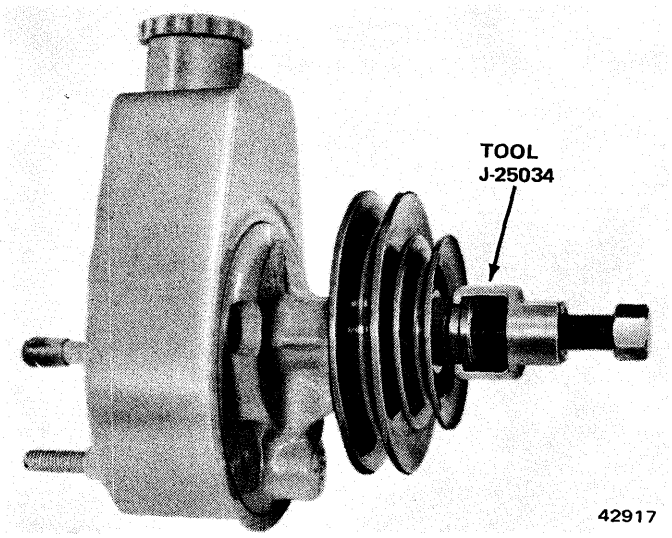

Fig. 11-96 Removing Pump Pulley

(4) Cut metal body of seal using sharp tool and pry seal out using screwdriver (fig. 11-97). Do not damage shaft or pump housing.

(5) Lubricate replacement seal with power steering fluid and install seal in pump housing, spring side first.

(6) Seat seal using Tool J-7728 (fig. 11-98). Do not use excessive force to install seal.

(7) Install pulley using Tool J-25033 (fig. 11-99).

(8) Install drive belt and air pump belt (if equipped).

(9) Adjust belt tension to specification.

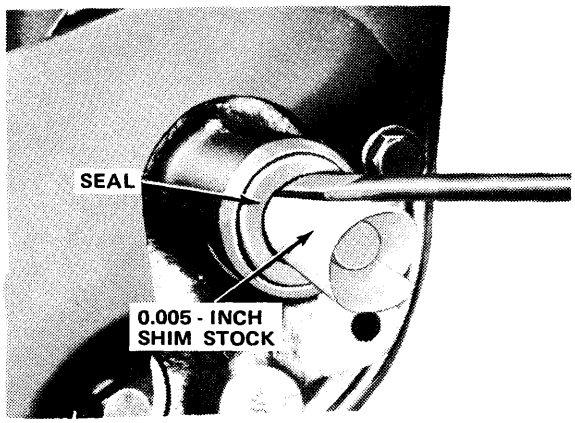

Fig. 11-97 Removing Oil Seal

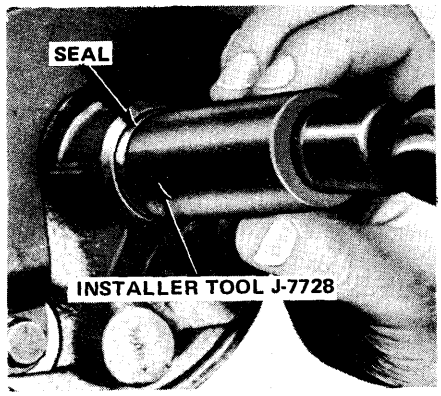

Fig. 11-98 Installing Pump Shaft Seal

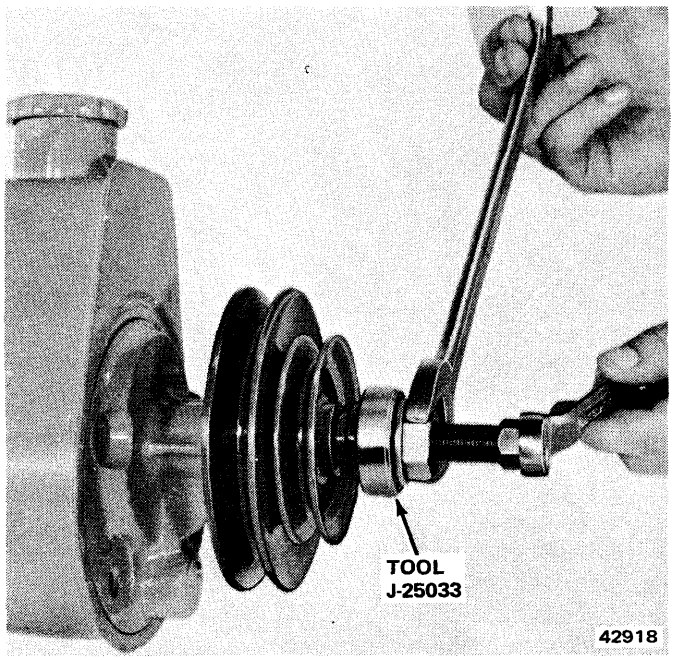

Fig. 11-99 Installing Pump Pulley

(10) Fill pump reservoir to proper level with power steering fluid and bleed air from pump as outlined in Fluid Level and Initial Operation.

Pump Disassembly

(1) Cover all pump openings and clean exterior of pump.

(2) Remove pump pulley using Tool J-25034 (fig. 11-96).

(3) Remove reservoir cap and drain oil from pump reservoir.

(4) Mount pump in vise with pump shaft pointing downward.

CAUTION: *Do not overtighten the vise when mounting the pump. This will distort the pump bushing.*

(5) Remove reservoir-to-pump housing studs and O-rings. Discard O-rings.

(6) Remove pump union. Remove O-ring from union and discard O-ring.

(7) Remove flow control valve and spring.

(8) Remove reservoir from pump by rocking reservoir back and forth and pulling upward.

(9) Remove reservoir O-ring seal from housing and discard O-ring.

(10) Remove small reservoir-to-housing O-ring seal from counterbore in housing and discard O-ring.

(11) Rotate end plate retaining ring until one end of ring is over hole in housing. Unseat ring using 1/8-inch punch and remove ring using screwdriver (fig. 11-100).

(12) Remove pump from vise. Invert pump and remove end plate, pressure plate spring, flow control valve and spring. If end plate should stick in housing, tap it lightly to remove it.

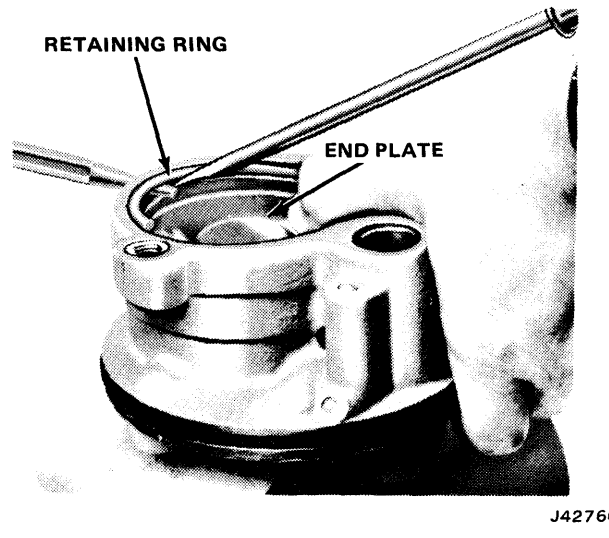

Fig. 11-100 Removing End Plate Retaining Ring

NOTE: *Do not attempt to disassemble the flow control valve. The valve is serviced as an assembly only.*

(13) Remove and discard end plate O-ring seal.

(14) Place end of shaft on bench and press down on housing to force pump shaft out.

(15) Turn housing over and remove shaft and rotor assembly. Do not drop parts. If two dowel pins did not

come out with assembly, remove dowel pins from housing.

(16) If shaft and rotor assembly must be disassembled, use screwdriver to remove retainer ring and separate parts (fig. 11-101).

(17) Remove and discard pressure plate O-ring seal.

(18) Remove shaft seal by prying out with small screwdriver.

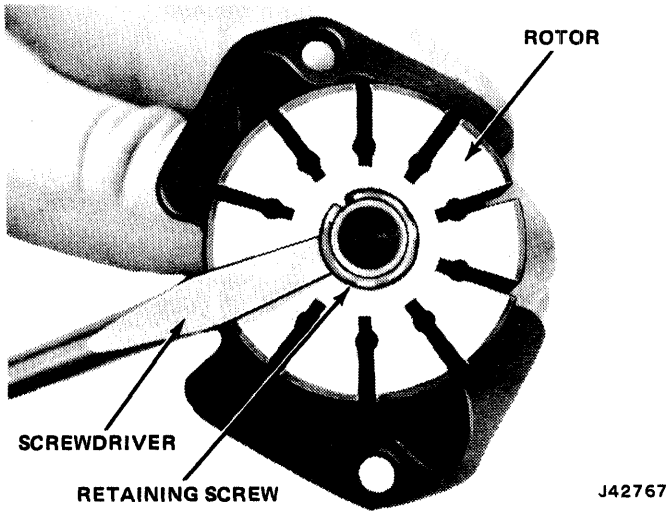

Fig. 11-101 Removing Rotor Retaining Ring

Cleaning and Inspection

Wash all parts thoroughly in clean solvent and dry using a clean, lint-free cloth.

Inspect the pump shaft for wear or scoring. Replace the shaft if it exhibits any type of damage.

Check the fit of the rotor vanes in the rotor slots. The vanes must slide freely but fit snugly in the slots. Replace the vanes if worn or damaged. Burrs or irregularities on the vanes may be removed using an oil stone. Replace the rotor if the vanes are excessively loose in the rotor slots, or if worn or scored. Light scoring on the rotor can be repaired by carefully lapping the rotor surface with crocus cloth. Clean the rotor thoroughly after lapping.

Inspect all of the machined and ground surfaces on the rotor ring for roughness or irregular wear. Slight irregularities may be removed with an oil stone. Replace the ring if the inside cam surface is badly scored or worn.

Inspect the surfaces of the pressure plate and thrust plate for wear or scoring. Light scoring can be repaired by carefully lapping the plate with crocus cloth until the surface is smooth and flat. Clean the plate thoroughly after lapping.

Inspect the flow control valve bore in the housing for scoring, burrs or other damage. Hairline scratches are normal. Replace the valve as an assembly if badly scored or if it is the cause of low pump pressure. Check the screw in the end of the valve. If loose, tighten it but do not damage the machined surfaces. Clean the filter in the end of the screw with solvent and dry with compressed air.

Check orifice in union to be sure it is not plugged.

Pump Assembly

(1) Lubricate all pump components with power steering fluid (fig. 11-102).

(2) Install pump shaft seal using Tool J-7017. Install seal so spring side of seal faces housing (fig. 11-103). Bottom seal in housing.

(3) Mount housing in vise with shaft end facing downward.

(4) Install pressure plate O-ring seal in groove in housing bore.

(5) Insert pump shaft in housing. Press downward on splined end of shaft with thumb to seat shaft. Do not damage shaft seal during installation.

(6) Install two dowel pins in housing and install thrust plate on pins with ported face of plate facing rear of housing.

(7) Install pump ring with small holes in ring on dowel pins and with arrow on outer edge of ring pointing to rear of housing.

(8) Install rotor on pump shaft with spline side of rotor facing rear of housing. Rotor must be rotate freely on shaft splines.

(9) Install shaft retaining ring on pump shaft.

(10) Install ten vanes in rotor slots. Rounded edge of vanes must face pump ring and flat edge must face center of rotor.

(11) Lubricate outside diameter and chamfer of pressure plate with petroleum jelly.

(12) Install plate on dowel pins with ported face toward rotor. Dowel pins fit into slots in plate that are nearest outside diameter of plate. Use plastic or wooden rod and tap lightly around outside diameter of pressure plate to seat it. Pressure plate will travel approximately 1/16 inch to seat.

CAUTION: *Never press or hammer on the center of the pressure plate. This will cause permanent distortion and result in pump failure.*

(13) Install end plate O-ring seal in groove in bore of housing. Do not install seal in end plate retaining ring groove which is first groove from rear of housing (fig. 11-104).

(14) Install pressure plate spring.

(15) Lubricate outside diameter and chamfer of end plate with petroleum jelly and insert plate in housing.

(16) Place end plate retaining ring on top of end plate.

(17) Using arbor press, press end plate into housing until housing ring groove is evenly exposed and install ring. Be sure ring is completely seated in housing groove and that end plate is properly aligned before installing end plate.

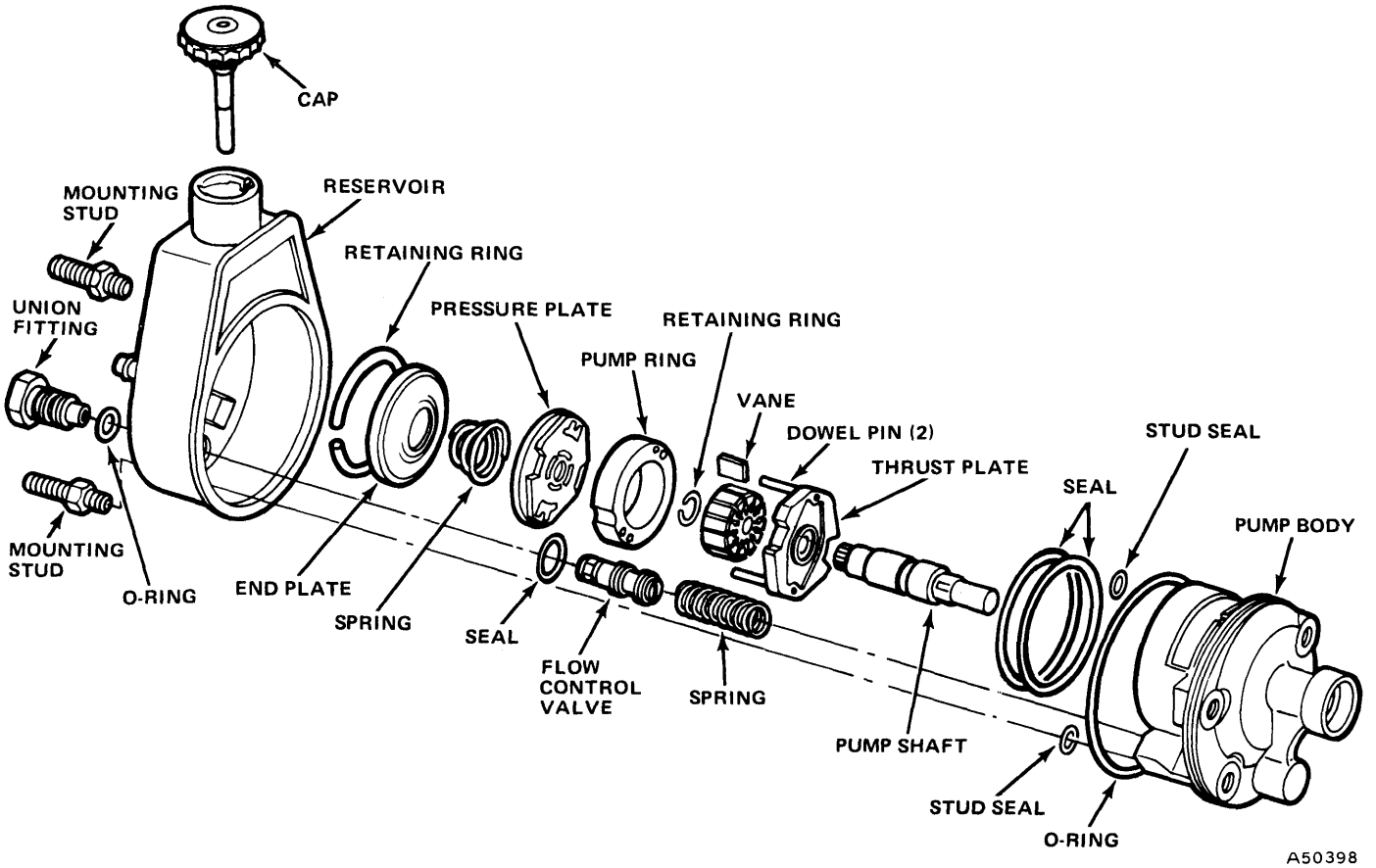

Fig. 11-102 Power Steering Pump

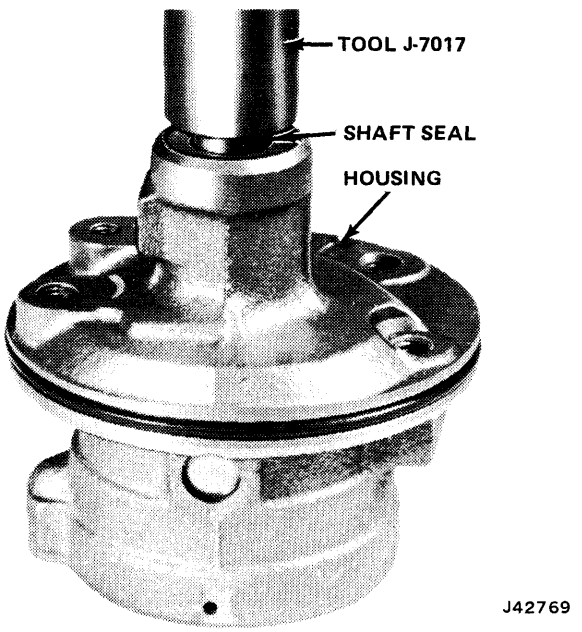

Fig. 11-103 Installing Pump Shaft Seal

CAUTION: *Press the end plate into the housing only far enough to install the retaining ring in the groove.*

(18) Install reservoir O-ring seal on housing.

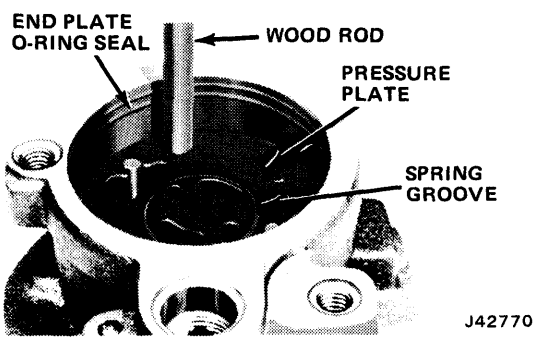

Fig. 11-104 Seating Pressure Plate in Housing

(19) Install pressure union and mounting stud O-ring seals in proper counterbores at rear of housing.

(20) Install reservoir on housing and align stud holes. Tap reservoir with plastic mallet to seat it on housing. Install reservoir-to-housing studs with short end of stud installed in housing. Tighten studs to 35 foot-pounds torque.

(21) Install flow control valve spring in housing, and install flow control valve with hex head of valve facing into housing. Check for free movement of valve in housing.

(22) Install O-ring in groove nearest outlet end of pump union. Install union in pump and tighten to 35 foot-pounds torque.

CAUTION: *If the O-ring is installed in the groove on the pump union that contains the flow orifice, the pump will not develop any pressure.*

(23) Remove pump from vise and install pulley using Tool J-25033 (fig. 11-99).

(24) Rotate pump shaft and check for bind. Shaft must rotate freely by hand.

Power Steering Pump Installation

(1) Position pump in mounting bracket and install attaching bolts.

(2) On vehicles with eight-cylinder engine, install front mounting bracket.

(3) Connect hydraulic hoses.

(4) Fill reservoir with power steering fluid.

(5) Bleed air from pump by turning pulley counterclockwise (viewed from front of pump) until bubbles cease to appear in fluid.

(6) Install drive belt.

(7) Using 1-5/8-inch open-end wrench on pump housing boss, pull outward on pump to adjust belt tension, and tighten pump attaching nuts.

(8) Check and adjust belt tension using Gauge J-23600. Refer to Specifications for desired belt tension.

(9) Tighten all pump mounting bolts and nuts to 30 foot-pounds torque.

(10) Install and adjust air pump belt.

NOTE: *If the pump or steering gear has been disassembled, refer to Fluid Level and Initial Operation.*

Fluid Level and Initial Operation

(1) Fill reservoir with power steering fluid.

(2) Operate engine until power steering fluid reaches normal operating temperature of approximately 170°F then stop engine.

(3) Remove reservoir filler cap and check fluid level. If fluid level is low, add power steering fluid as required and replace filler cap.

(4) Turn wheels to full left turn position and add power steering fluid to COLD mark on dipstick.

(5) Start engine, set engine at fast idle speed, and recheck fluid level. Add fluid if necessary to COLD mark on dipstick.

(6) Bleed air from system by turning wheels from side to side without hitting stops. Maintain fluid level just above pump housing. Fluid with air in it will have a light tan or red appearance. Air must be eliminated from fluid before normal steering action can be obtained.

(7) Return wheels to straight-ahead position, continue to operate engine for two or three minutes, then stop engine.

(8) Recheck fluid level as described in steps (2) and (3). Be sure fluid level is at HOT mark on dipstick after system has stabilized at normal operating temperature.

(9) Road-test car to be sure steering functions normally and is free from noise.

Oil Pump Pressure Test

NOTE: *The combination of any type tester and fittings is acceptable for this test and connection may be made to the pump body or gear housing, whichever is most convenient. However, the gauge must, at all times, be connected between the pump and test gauge valve in the pressure line circuit.*

(1) Check belt tension and adjust if necessary.

(2) Position drip pan beneath engine.

(3) Disconnect power steering pump pressure hose. Keep hose end raised to prevent excess fluid loss.

(4) Connect pressure hose to Power Steering Pressure Test Gauge J-21567.

(5) Connect test gauge hose to power steering pump.

(6) Open test gauge valve fully counterclockwise.

(7) Fill pump reservoir.

(8) Operate engine until it reaches normal operating temperature.

(9) Record initial pressure shown on gauge with valve open. Initial pressure should be 80 to 125 psi. If pressure is in excess of 200 psi, stop test and check hoses for restrictions or check poppet valve in steering gear for proper assembly. If pressure is OK, proceed to next step.

(10) Close test gauge valve completely for 2 to 3 seconds, record highest pressure reading, and reopen valve. Perform this operation three times.

CAUTION: *Do not hold the valve closed for more than five seconds at a time as the pump could be damaged.*

(11) Three pressure readings (made with test gauge valve closed) must not vary by more than 50 psi.

(12) Pressures should be in 1050-1100 psi range for CJ models and in 1350-1400 psi range for Wagoneer, Cherokee, and Truck models.

(13) If recorded pressures do not vary by more than 50 psi and are within specifications, pump is functioning properly.

EXAMPLE: On CJ models, if pressures recorded were 1050-1100-1075 psi, pump is operating properly.
If pressures recorded were high, but did not repeat within 50 psi, flow control valve is sticking. Remove and clean valve and remove any burrs with crocus cloth or fine hone. If system contains some dirt, flush the system.

CAUTION: *The power steering hydraulic system is a closed circuit. Contamination of fluid in either the pump or gear will be transferred. If the system is exceptionally dirty, the pump and gear must be disassembled and cleaned.*

(14) If pump performance is within specifications, with valve open, turn (or have assistant turn) steering wheel to both left and right stops and record highest pressures. Compare recorded pressures with specifications.

CAUTION: *Do not hold the steering wheel against either stop for more than five seconds as the pump could be damaged.*

(15) If pump pressures are below specifications at one or both sides of gear, gear is leaking internally and must be disassembled and repaired.

(16) Stop engine and remove test gauge.

(17) Connect pressure hose to pump.

(18) Make necessary repairs or replenish fluid level.

(19) Remove drain pan.

SPECIFICATIONS

Power Steering Gear

Type	Recirculating Ball, Worm and Nut
Ratio	CJ - 17.5:1 Constant Ratio
	All Others 13/16:1 Variable Ratio
Bearings:	
Worm - Upper	Ball
Lower	Ball
Pitman Shaft	Bushing
Torque:	
Pitman Arm to Pitman Shaft	160-210 ft-lbs
Adjuster Plug Locknut	50-110 ft-lbs
Pitman Shaft Lash-Adjuster Locknut	27-37 ft-lbs
Pressure and Return Hose Fittings	25-35 ft-lbs
Rack-Piston Plug	50-100 ft-lbs
Return Guide Clamp Screws	3-6 ft-lbs
Side Cover Bolts	30-45 ft-lbs
Steering System Oil Capacity (Dry)	1 1/4 qts

Power Steering Pump

Capacity at 465 rpm	1.25 gpm
Flow Control Range	1.25-2.15 gpm
Relief Valve Setting:	
CJ Models	1100-1200 psi
Cherokee, Wagoneer, Truck	1400-1500 psi

Engine Drive Belt Tension

	New Belt*	Used Belt
Air Conditioner, Six-Cylinder	125-155	90-115
Air Conditioner, V-8	125-155	105-130
Air Pump (All except Six-Cylinder w/AC)	125-155	90-115
Air Pump Six-Cylinder w/AC (3/8 Inch Belt)	65-75	60-70
Fan	125-155	90-115
Idler Pulley	125-155	90-115
Power Steering Pump	125-155	90-115

***New belt specifications apply only to replacement belts. Once a belt has been tensioned and run, it is considered a used belt and should be adjusted to used belt specifications.**

Manual Steering Gear

Left-Hand Drive Vehicles:	
Type	Recirculating Ball
Ratio	24:1
Bearings - Upper	Ball
Lower	Ball
Pitman Shaft	Bushing
Torque:	
Worm Bearing Adjuster Nut	8 in-lbs
Pitman Shaft Adjuster Screw	18 in-lbs
Cover Bolts	25-35 ft-lbs
Pitman Shaft Lash-Adjustment Locknut	18-27 ft-lbs
Worm Thrust-Adjustment Locknut	70-110 ft-lbs
Right-Hand Drive Vehicles:	
Type	Worm and Roller
Ratio	24:1
Bearings - Upper	Ball
Lower	Ball
Lever Shaft	Roller and Bushing
Torque:	
Worm Bearing Preload	2-5 in-lbs
Input Torque Over Center (Maximum)	7-12 in-lbs
Cover to Housing Cap Screws	18-20 ft-lbs
Flexible Coupling to Flange	15-20 ft-lbs
Worm Gear Shaft Locknut	16-20 ft-lbs

Wheel Alignment

Steering Axis Inclination	8-1/2°
Caster	
CJ	3°(+1°)
Cherokee, Wagoneer, and Truck	4°(+1°)
Camber	1 1/2°(+1/2°)
Toe-In	3/64 to 3/32 inch
Turning Angle	
CJ	28° to 29°
Cherokee, Wagoneer, and Truck	37° to 38°

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Torque Specifications

Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Service In-Use Recheck Torque
Clamp Bolt, Flexible Coupling, Intermediate Shaft to Power Steering Gear 3/8-24	25-35
Clamp, Intermediate Shaft to Steering Gear	40-50
Clamp, Shaft U-Joint, Upper Shaft Assembly to Lower Shaft Assembly	45-55
Column Capsule Bracket to Column Bolt	12-17
Column Capsule Bracket to Instrument Panel Nut to Support Rod	15-25
Connecting Rod 5/8-18 (To Castellated Nut Slot)	70 min
Connecting Rod Clamp Bolts (Cherokee-Wagoneer-Truck)	25-35
Connecting Rod Stud Nuts 9/16-18 (Cherokee-Wagoneer-Truck)(To Castellated Nut Slot)	60 min
Intermediate Shaft to Steering Gear Coupling (Power Steering) 3/8-24, 5/16-24	15-25
Pitman Arm to Pitman Shaft	160-210
Steering Bracket to Frame 3/8-16 Bolt (CJ)	35-45
Steering Bracket to Frame Bolt and Nut 7/16-20 (CJ)	60-70
Steering Bracket to Frame 7/16-20 (Cherokee-Wagoneer-Truck)	60-80

	Service In-Use Recheck Torques
Steering Gear to Bracket - All Models	60-80
Steering Wheel Nut (CJ)	32-38
Steering Wheel Nut (Cherokee-Wagoneer-Truck)	15-25
Tie-Rod Clamp Bolt 5/16-24 (CJ)	10-15
Tie-Rod Clamp Bolt 3/8-24 (CJ)	20-30
Tie-Rod Clamp Bolt 7/16-14 (Cherokee-Wagoneer-Truck)	25-35
Tie-Rod Stud Nuts 1/2-20 (CJ) (To Castellated Nut Slot)	40 min
Tie-Rod Stud Nuts (To Castellated Nut Slot)	60 min
Wheel to Hub Nuts (CJ)	90-115
Wheel to Hub Nuts (Cherokee-Wagoneer-Truck Models 25 and 45)	65-80
Wheel to Hub Nuts (Model 46 Truck)	100-150

All torque values given in foot-pounds with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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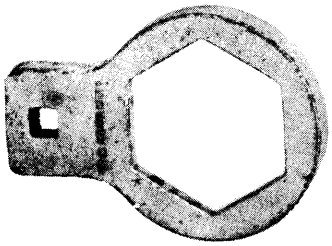
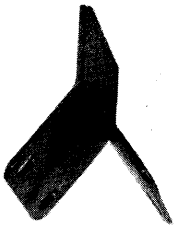
TECHNICAL BULLETIN REFERENCE

Date	TB No.	Subject	Changes Information on Page No.

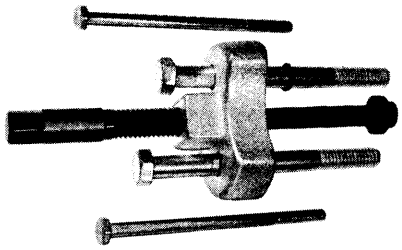
Special Tools



J-25194 ADJUSTER PLUG LOCKNUT WRENCH (2-3/4" x 3-1/4")



J-23074 STEERING COLUMN HOLDING FIXTURE



J-25115 STEERING WHEEL PULLER

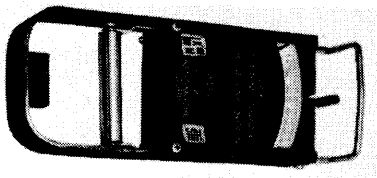
J-5754 PITMAN SHAFT BUSHING AND BEARING CUP PULLER

J-7754 TORQUE WRENCH (0 - 25 INCH POUNDS)

J-7624 ADJUSTER PLUG SPANNER WRENCH

J-6217 HOSE CONNECTOR TOOL (POWER STEERING)

J-1614 PITMAN SHAFT BUSHING REMOVER AND INSTALLER



J-23600 BELT TENSION GAUGE

J-7539-01 RACK PISTON ARBOR (POWER STEERING)

J-5188 ADJUSTER PLUG OIL SEAL INSTALLER

J-7171 PITMAN SHAFT OIL SEAL INSTALLER

J-5787 PITMAN SHAFT OIL SEAL PROTECTOR

J-4245 SNAP RING PLIERS (INTERNAL)

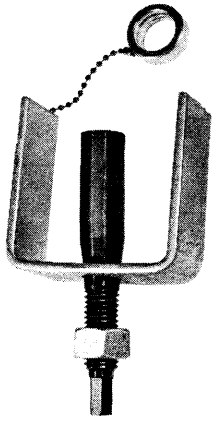
J-7017 WORM SHAFT UPPER OIL SEAL INSTALLER

J-6657 PITMAN SHAFT NEEDLE BEARING REMOVER AND INSTALLER

J-6219 PITMAN SHAFT OIL SEAL INSTALLER

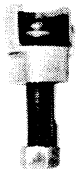
J-6222 ADJUSTER PLUG OIL SEAL PROTECTOR

J-1586-01 PUMP SHAFT OIL SEAL PROTECTOR

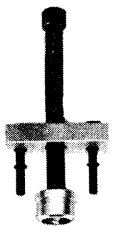


J-23653 LOCK PLATE COMPRESSOR AND SNAP RING INSTALLER

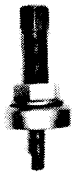
J-23073 SHIFT TUBE INSTALLER



J-25034 REMOVER



J-23072 SHIFT TUBE REMOVER



J-25033 INSTALLER

J-21854-1 PIVOT PIN PULLER

42771