

C O N T E N T S

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GENERAL DESCRIPTION

The Henry J steering wheel is mounted on the upper end of the steering column which extends down into the steering gear housing. A tubular jacket encloses the steering column and provides a mounting for the gearshift mechanism. The upper end of the jacket contains a bearing that centers and supports the steering column inside the jacket. A worm gear is pressed onto the lower end of the steering column inside the steering gear housing (Fig. 190). The machined end surfaces of the worm rest on two opposed roller bearings. The lower bearing is adjustable toward the upper bearing by use of shims between the housing and end cover plate.

A shaft and roller assembly is mounted in two bushings in the housing, perpendicular to the worm, with the gear teeth of the roller meshing with the worm teeth. Turning of the steering column and worm rotates the roller shaft, and moves the pitman arm which is installed on the bottom end of the roller shaft.

Gear lash between the worm and roller is adjustable by means of a screw, threaded through the shaft

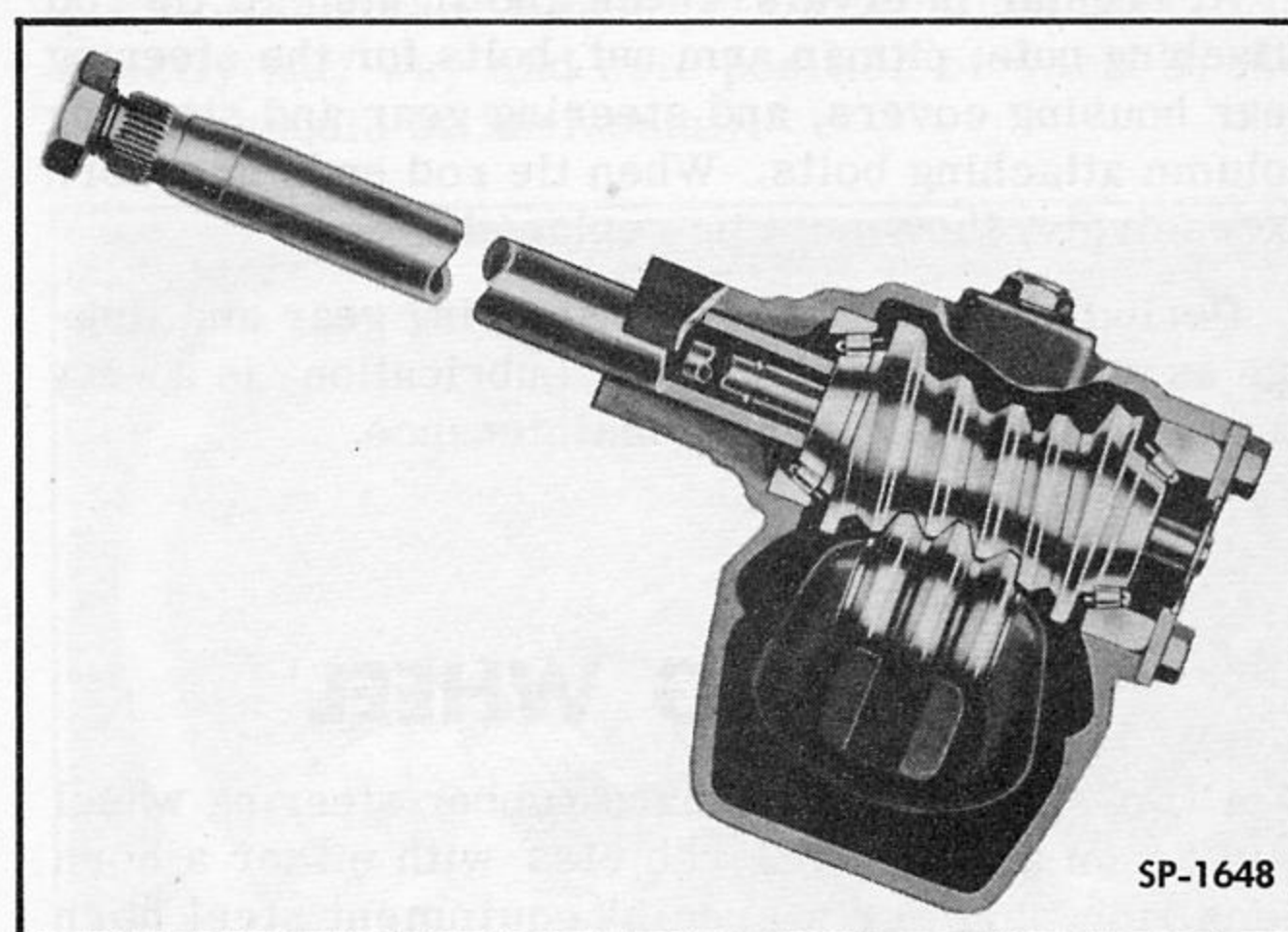


Fig. 190—Steering Gear—Sectional View

and roller cover and engaged in a slot in the shaft to provide endwise movement of the shaft and roller. An oil seal, pressed into the housing, is used to prevent lubricant leakage around the lower end of the roller shaft.

The pitman arm is connected directly to the right

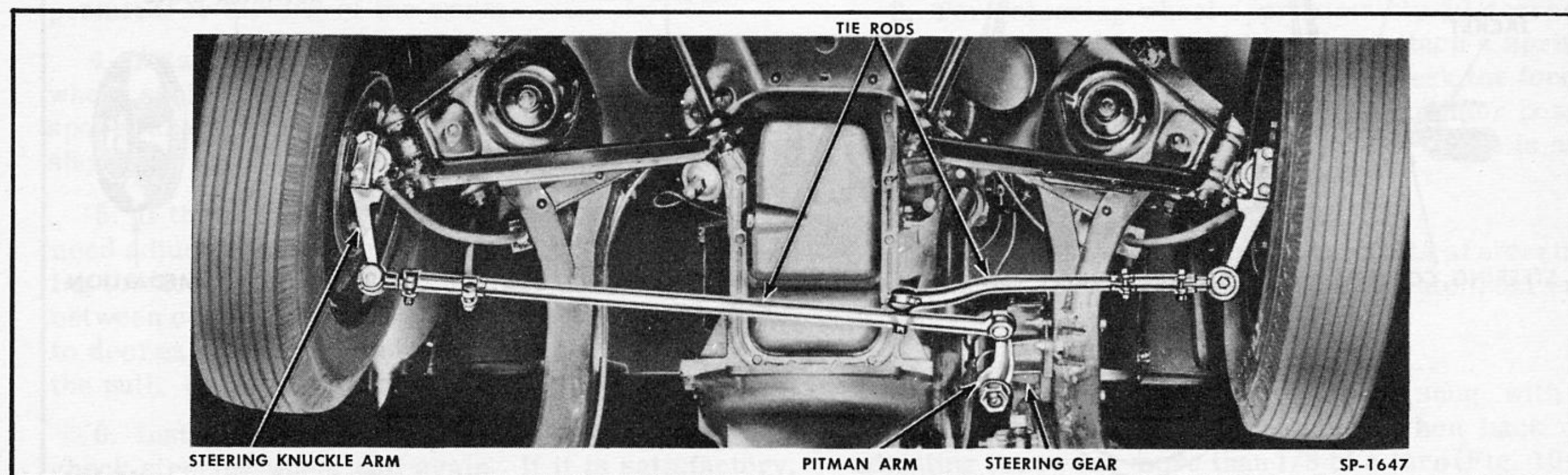


Fig. 191—Steering Gear Linkage

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(long) tie rod. The left (short) tie rod also attaches to the right tie rod (Fig. 191).

The tie rods extend to the front wheel steering knuckle arms. Both tie rods are adjustable for length to establish proper toe-in of the front wheels. The right tie rod also affects the centering of the steering wheel.

MAINTENANCE

At regular intervals, check and tighten all tie rod attaching nuts, pitman arm nut, bolts for the steering gear housing covers, and steering gear and steering column attaching bolts. When tie rod ends are worn excessively, they must be replaced.

Periodic lubrication of the steering gear and linkage as specified in Section 17, "Lubrication" is a very important part of steering maintenance.

STEERING WHEEL

A two-spoke steel and hard rubber steering wheel is used on all Henry J vehicles with either a horn medallion bezel or a special equipment steel horn ring mounted beneath the steering wheel medallion (Fig. 192).

STEERING WHEEL REPLACEMENT

The steering wheel can be replaced as follows:

1. Carefully pry medallion out of horn ring or horn bezel.
2. Turn contact plate 1/3 of a turn and lift it out of spacer.
3. Disconnect horn cable assembly from inside engine compartment.
4. Pull cable assembly out through top end of steering column.
5. Remove steering wheel nut from top end of steering column and remove ground cup.
6. Lift horn bezel or horn ring from steering wheel and remove rubber cushion ring.
7. Pull steering wheel off with Steering Wheel Puller C-232.
8. To install steering wheel, reverse the removal procedure, using care to have steering wheel line up correctly when front wheels are straight ahead.

STEERING GEAR

The steering gear has provisions for adjustments to eliminate looseness and end-play within the mechanism and still keep the unit free and easy to operate. Before any repairs are made to the steering gear, all of the adjustments described below should be made. If this does not remedy the trouble, the steering gear can then be overhauled.

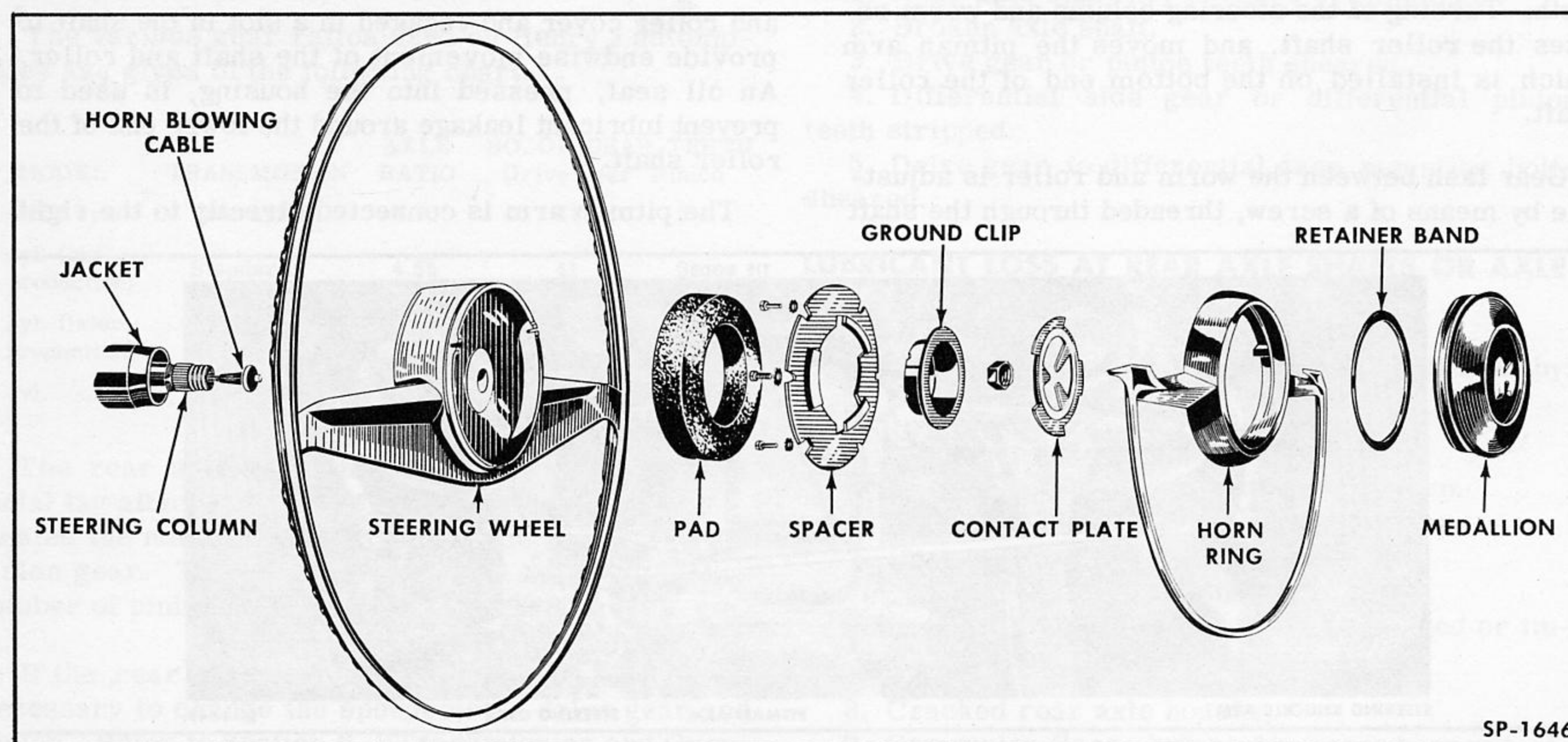


Fig. 192—Steering Wheel Installation

STEERING GEAR ADJUSTMENTS

The following adjustments can be made on the steering gear while the steering gear assembly is in the vehicle. The steering linkage should be checked before steering gear adjustments are attempted to determine that the linkage is not the source of trouble.

a. Steering Column Alignment

Before any adjustment of the steering gear is attempted, the steering column must be aligned to prevent a bind. Align the column as follows:

1. Body bolts must be tight and body must be properly located on frame.
2. Tighten steering column mounting bolts at instrument panel.
3. Loosen steering gear to frame side rail bolts to permit steering gear to move in relation to the frame.
4. If necessary, use shims between steering gear housing and frame to locate gear in the aligned position, then tighten mounting bolts.
5. Loosen bolts which attach the steering column to instrument panel. If the column shifts its position in relation to the support, the support must be shimmed or relocated so the column will be supported in its free position with support bolts tightened.

b. Worm Bearing Adjustment

If the steering wheel has a bind or has excessive end-play or looseness, the bearings that support the steering gear worm should be adjusted as follows:

1. Check and align steering column if necessary as described above.
2. Disconnect tie rod from pitman arm.
3. Turn steering wheel all the way to one side, then back about $1/8$ of a turn. At this position there is full back lash between worm and roller teeth to permit free turning of the worm.
4. Attach a spring scale to outer end of steering wheel spoke and, pulling at a 90 degree angle to the spoke, check force required to turn wheel. The pull should be from $1/4$ to $3/4$ pounds (Fig. 193).
5. If the pull is not as specified, worm bearings need adjustment. Remove housing end cover, draining lubricant from housing, and add or remove shims between cover and housing as necessary. Add shims to decrease the pull and remove shims to increase the pull. Shims are available in various thicknesses.
6. Install end cover, tighten cover bolts and check steering wheel pull again. If it is satisfactory, fill steering gear housing with lubricant as specified in Section 17, "Lubrication."

c. Shaft and Roller Adjustment

This adjustment is for proper mesh of the roller and worm to eliminate lost motion or play in the steering gear at the mid-point of movement. Never check or make this adjustment until steering column alignment and worm bearing adjustment have been checked and corrected. In the steering gear housing, the position of the roller contact with the worm is offset from the centerline of the worm; therefore, when the adjusting screw is tightened the roller is moved into closer contact with the worm. Proceed as follows:

1. With pitman lever arm still disconnected, turn steering wheel all the way from right to left extreme positions counting number of turns. Turn wheel back exactly half way and note position of wheel spokes (which should be horizontal).

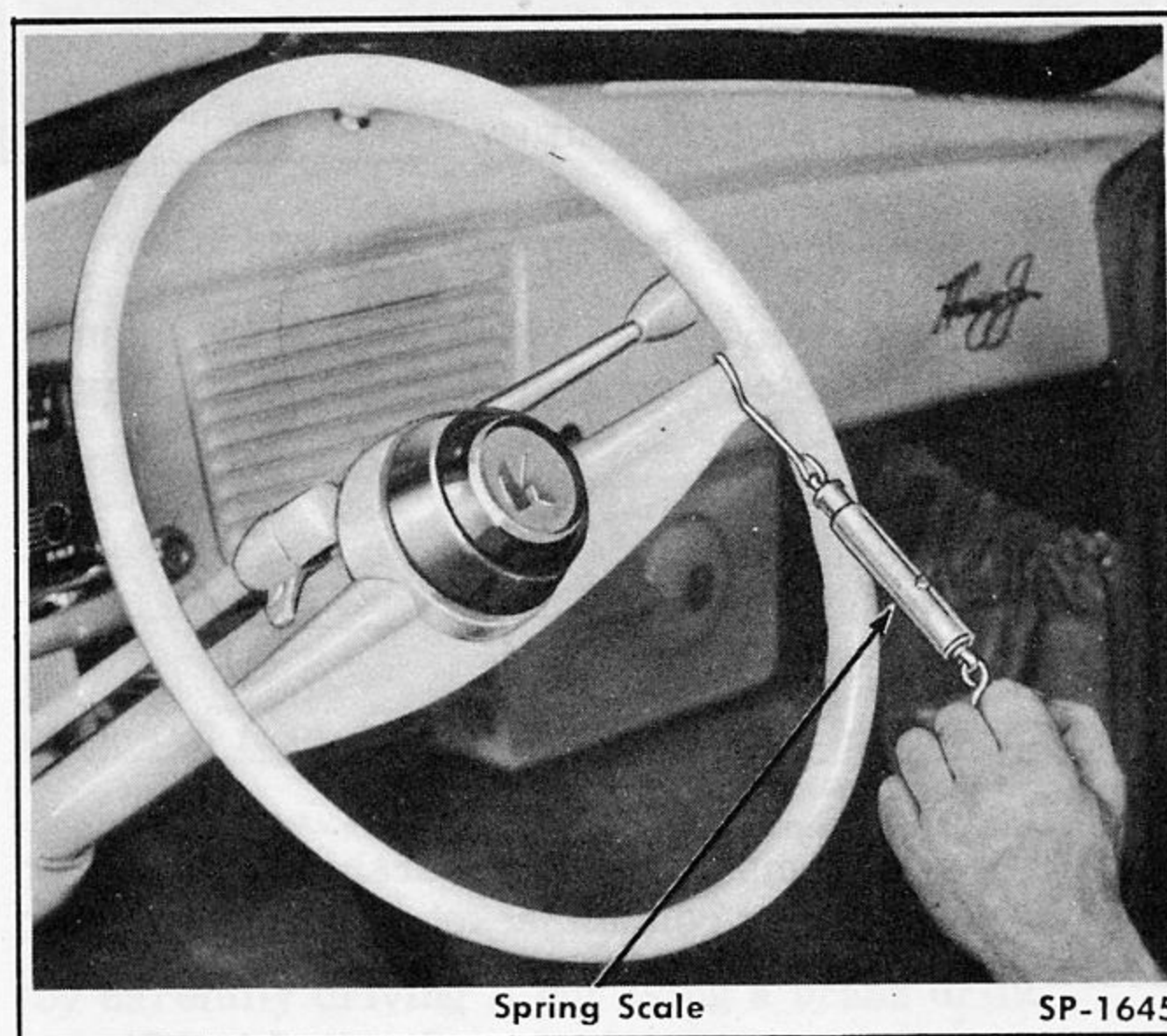


Fig. 193—Checking Steering Wheel Pull

2. Turn steering wheel approximately 30 degrees either way from center position. Then attach a spring scale to outer end of wheel spoke and check the force required to turn steering wheel through center position. The force should be 1 to 2 pounds. If pull is not as specified, adjustment is required.

3. Tighten shaft and roller cover bolts at steering gear housing. Remove locknut and lockplate from end of adjusting screw.

4. Tighten adjusting screw down snug with a screwdriver, turning it clockwise. Then back off adjusting screw not more than $1/8$ of a turn (Fig. 194). Install the lock plate and the nut on the adjusting screw.

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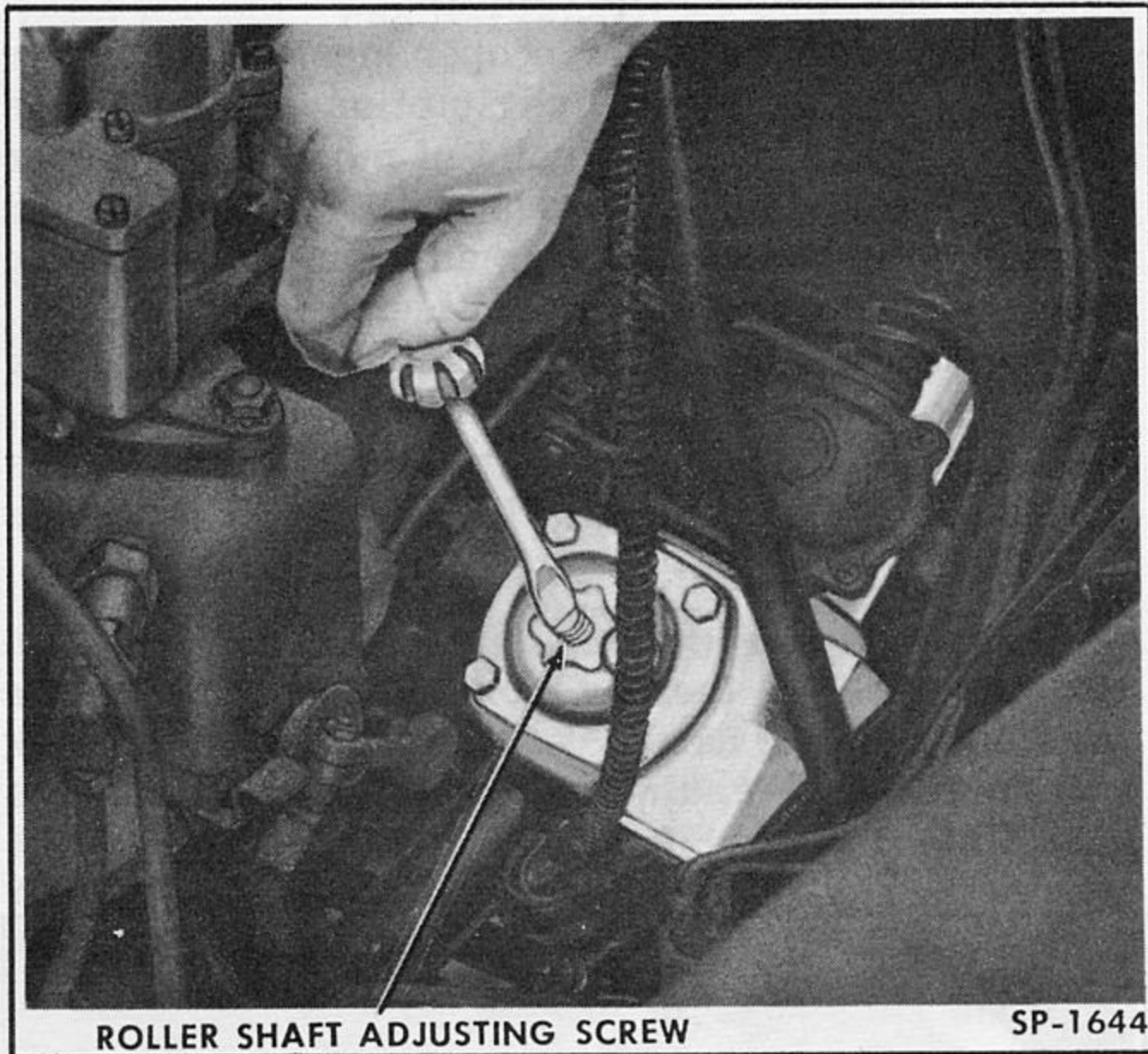


Fig. 194—Adjusting Steering Gear Shaft and Roller

5. Check steering wheel pull again. If the adjustment was satisfactory, connect tie rod to pitman arm.

STEERING GEAR REMOVAL

The complete steering gear assembly can be removed from the vehicle as follows:

1. Disconnect shifting rods from lower shifting levers mounted on steering column jacket in engine compartment.
2. Loosen clamp that holds gearshift lower lever housing and steering column jacket onto steering gear housing. Do not remove screws.
3. Remove steering wheel as detailed in "Steering Wheel Replacement" in this section.
4. Pull back front floor mat and remove floor plates and seals which fit around foot pedals and steering column.
5. Remove steering column support bracket clamp and attaching bolts which support column at instrument panel.
6. Remove spring and bearing spacer from upper end of steering column jacket. Leave bearing in steering column jacket.
7. Work lower end of steering column jacket loose from steering gear housing, with gearshift mechanism still attached. Remove jacket from steering column by pulling upward, inside the body.
8. The shifting levers must be carefully worked through opening in floor pan as jacket is pulled upward.

9. Disconnect tie-rod from pitman arm and remove pitman arm nut and lockwasher. Using Pitman Arm Puller KF-119, remove the arm from steering gear shaft (Fig. 195).

NOTE: Pitman arm can be left on steering gear and removed on bench, if desired.

10. Remove steering gear to frame mounting bolts and shims if used between housing flange and frame. At this point, remove filler plug and turn steering gear over allowing lubricant to drain out.

11. Remove steering gear by moving it forward and upward to clear adjacent units in engine compartment.

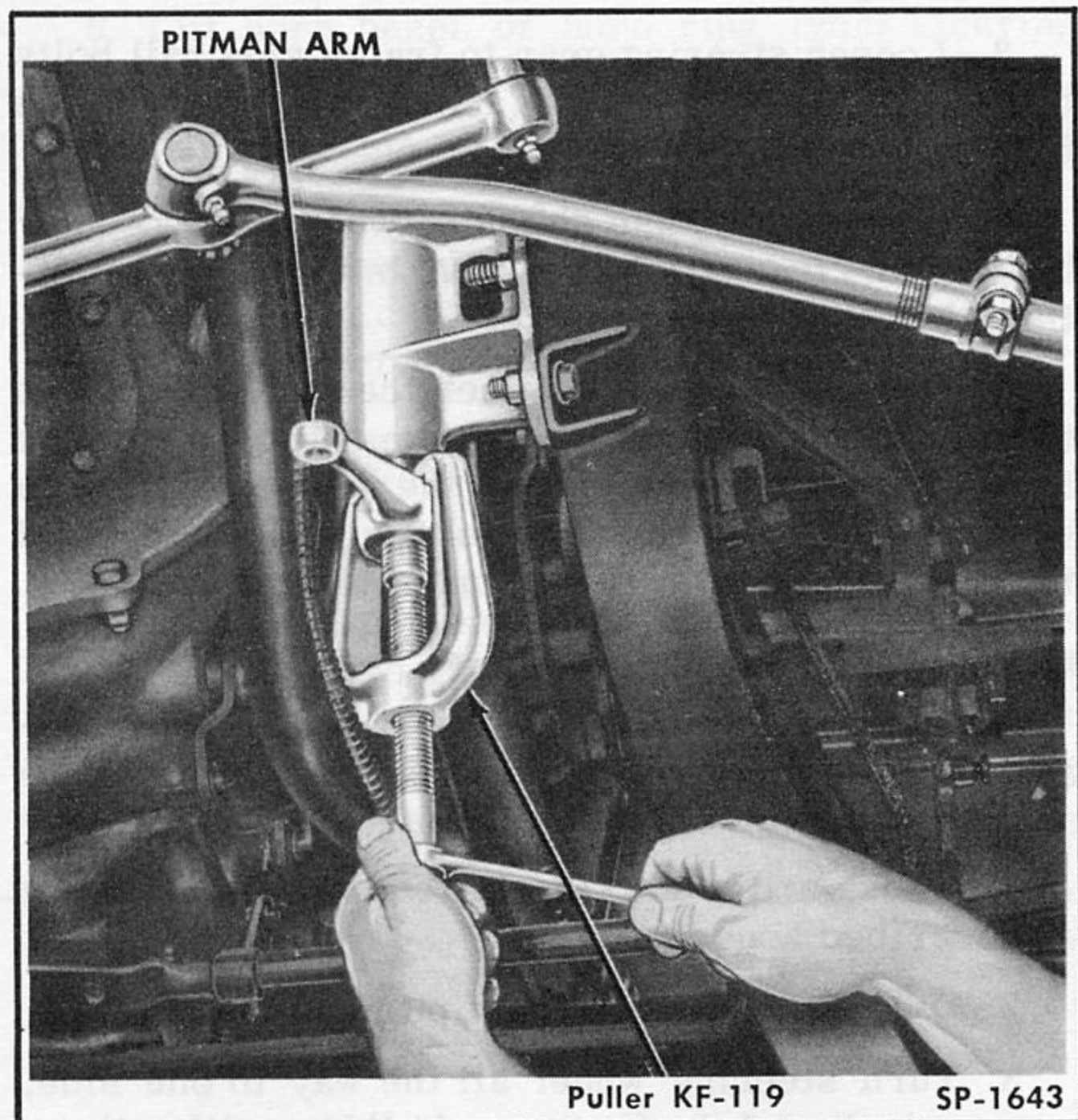


Fig. 195—Removing Pitman Arm

STEERING GEAR REPAIR

The steering gear can be disassembled, inspected and various parts replaced if necessary by following the procedures below. Clean the outside surfaces of the steering gear assembly to remove all dirt before starting to repair the unit.

a. Disassemble Steering Gear

Disassemble the steering gear after it has been removed from the vehicle as follows:

1. Remove shaft and roller adjusting screw locknut and lockplate and remove shaft and roller cover plate screws.
2. Turn adjusting screw clockwise a few turns,

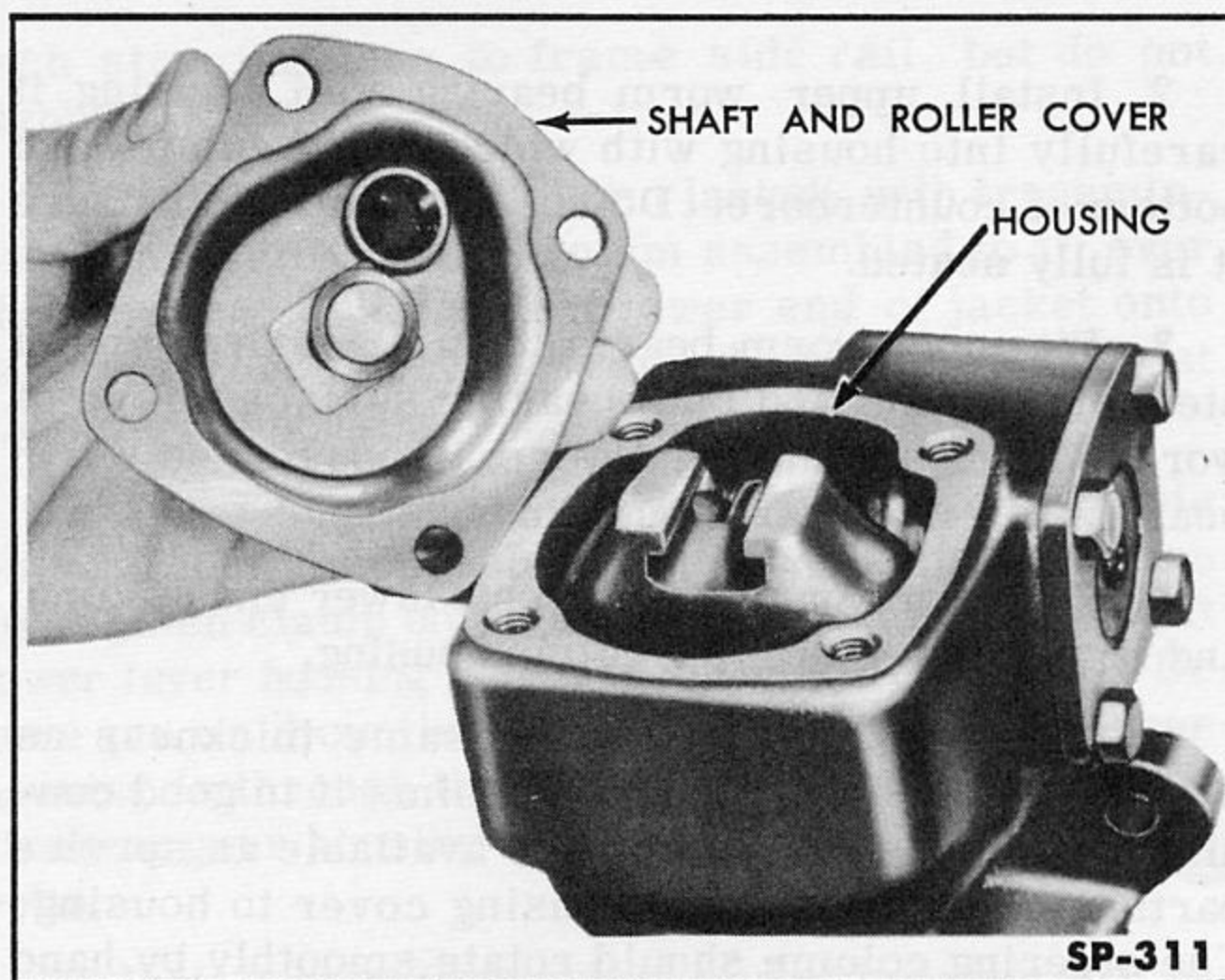


Fig. 196—Removing Shaft and Roller Cover

then remove cover plate and adjusting screw by sliding sideways to disengage shaft and roller (Fig. 196).

3. Remove shaft and roller assembly from the housing by pushing on end of shaft (Fig. 197). Do not attempt to disassemble roller from shaft as these parts are replaceable only as an assembly.



Fig. 197—Removing Shaft and Roller Assembly

4. Remove housing end cover attaching bolts, housing cover, and shims used to establish worm bearing adjustment (Fig. 198). Check total thickness of shims with a micrometer so it will be possible to use the same thickness when assembling steering gear.

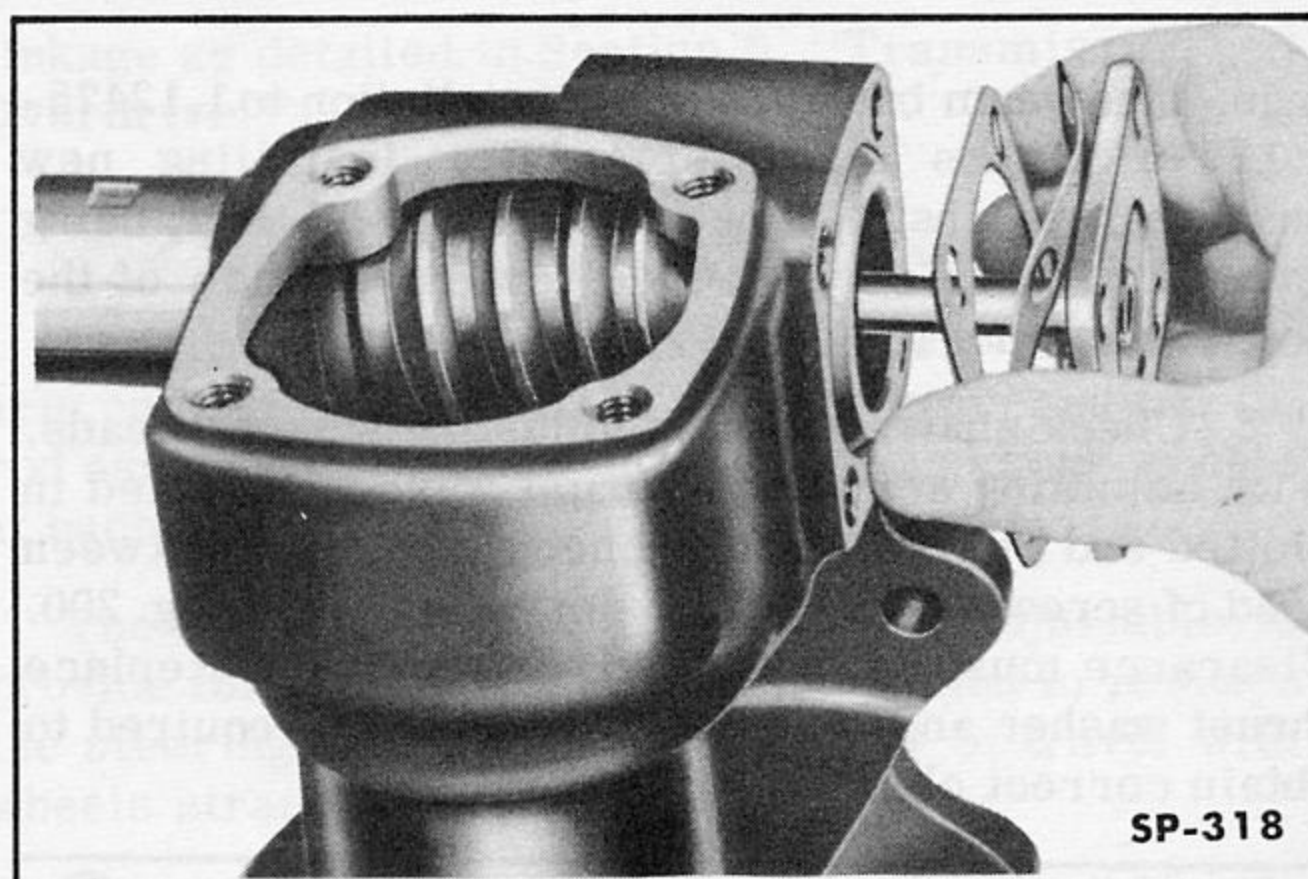


Fig. 198—Removing Housing End Cover

5. Remove lower worm bearing cup, lower bearing, the worm and steering column assembly, and upper bearing (Fig. 199). The lower bearing cup can be loosened, if necessary, by tapping lightly on end of the steering column with a soft hammer.

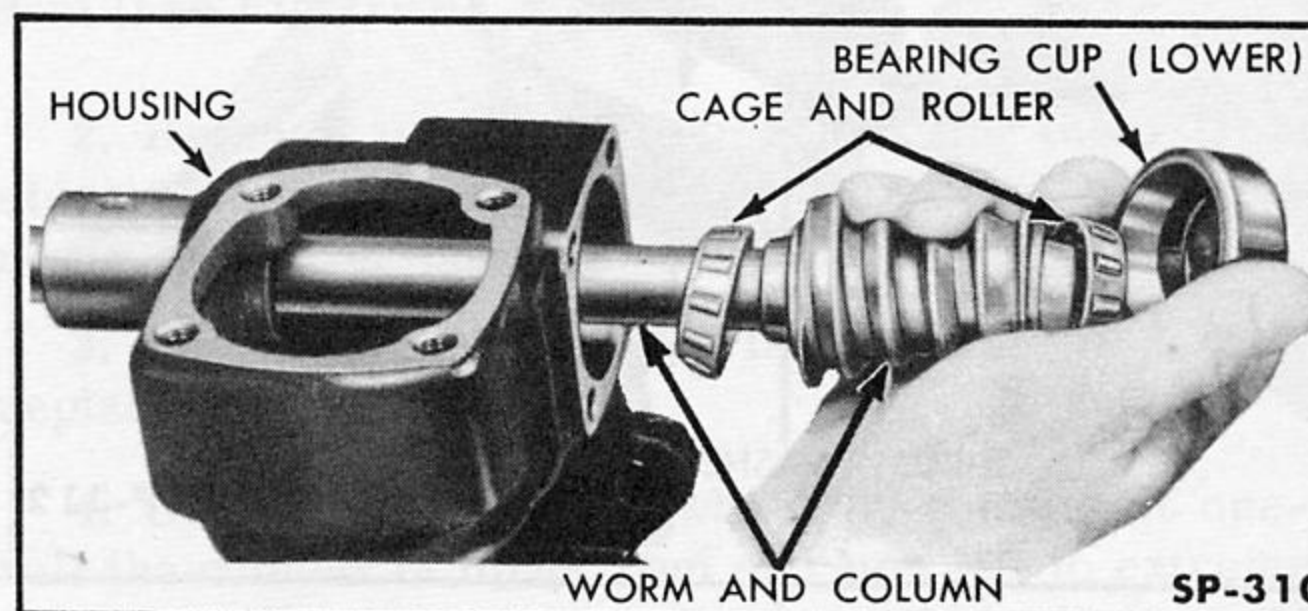


Fig. 199—Removing Steering Column and Worm

6. Remove upper worm bearing cup from housing by carefully driving it out using a brass drift.

7. Remove roller shaft oil seal from housing if it is worn or if roller shaft bushings are to be replaced.

b. Inspect Steering Gear Parts

After the steering gear is disassembled, clean all of the parts.

1. Inspect worm and roller teeth for wear, pitting, chipping or scoring. Check the bearing surfaces on worm — they must not be worn, pitted, chipped or otherwise damaged. Examine bearing cups for the same conditions. Check worm bearings carefully for damaged rollers. Replace parts as necessary if any of these conditions are discovered. The worm and steering column must be replaced as a unit.

2. Check fit of roller shaft in housing bushings. If shaft does not fit properly, examine it for wear or roughness and replace if necessary. If bushings are worn, press them out of housing and install new bush-

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ings. Line ream bushings after installation to 1.12475-1.12575 inches diameter. After installing new bushings, also install a new roller shaft oil seal, being careful to keep correct side toward outside of the housing and not to cock it in housing.

3. Check shaft and roller adjusting screw threads. With adjusting screw and thrust washer inserted in slotted end of roller shaft, check clearance between head of screw and bottom of slot as shown in Fig. 200. Clearance must be .002 of an inch or less. Replace thrust washer and/or adjusting screw as required to obtain correct clearance.

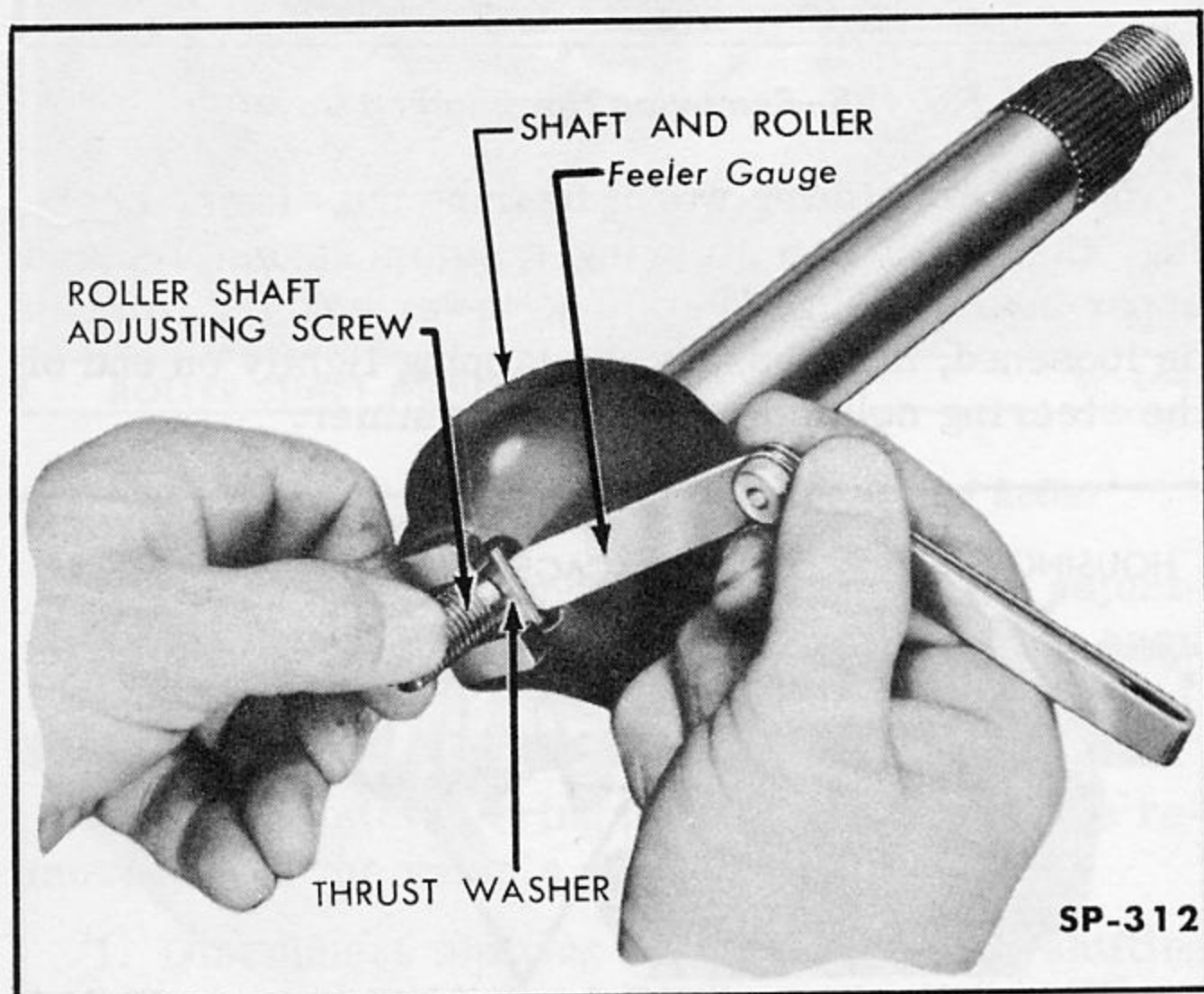


Fig. 200—Checking Roller Shaft Adjusting Screw Clearance

4. The roller of the shaft and roller assembly is mounted on bearings and must rotate freely. If rotation is rough, if roller is loose or if there is end-play, the roller and shaft assembly should be replaced as a unit. Be sure there is no indication of twisting or other distortion in the roller shaft. Check splines and threads to be sure they are in good condition.

5. Check steering column for bending or distortion. Column run-out at upper end should not exceed .250 of an inch total indicator reading.

6. Check condition of bearing in upper end of steering column jacket. If it is rough, remove bearing with a suitable puller and install a new bearing, pressing it into place in the jacket. Pack the bearing with wheel bearing grease before installing it.

c. Assemble Steering Gear

After the various steering gear parts have been inspected, they can be assembled as follows:

1. Dip all parts with wearing surfaces into steering gear lubricant.

2. Install upper worm bearing cup, driving it carefully into housing with wide face of cup toward bottom of counterbore. Do not cock cup and be sure it is fully seated.

3. Fit upper worm bearing into place over end of steering column and onto bearing surface at end of worm. Install column and worm in housing so worm bearing fits into bearing cup in housing.

4. Fit lower worm bearing onto lower end of worm and install lower bearing cup in housing.

5. Select shims totaling the same thickness as previously removed, or use old shims if in good condition. Various size shims are available as service parts. Install shims and housing cover to housing. The steering column should rotate smoothly by hand without binding, but there should be no end-play. Worm bearing adjustment should be checked and readjusted if necessary after steering gear is completely assembled.

6. Install roller shaft assembly in steering gear housing. Be careful not to damage oil seal when passing serrated end of shaft through seal. Turn steering column by hand to mesh teeth of worm and roller at center of worm.

7. Assemble thrust washer on roller shaft adjusting screw and turn screw into roller shaft cover. Install this assembly and cover gasket on steering gear housing, fitting head of adjusting screw and thrust washer into slot in roller shaft. Turn screw counterclockwise to seat cover against housing. Install cover bolts and tighten securely.

8. Rotate steering column as far as possible one way and then in the opposite direction counting total number of turns. Then rotate the column back exactly halfway to center of steering gear travel. Tighten roller shaft adjusting screw down snug, turning it clockwise, then back off adjusting screw $1/8$ of a turn. Install lock plate and nut on adjusting screw.

9. Temporarily install the steering wheel on the steering column so the spring scale can be used and check the worm bearing adjustment and the shaft and roller adjustment as described under "Steering Gear Adjustments" in this section. **DO NOT FILL STEERING GEAR HOUSING WITH LUBRICANT UNTIL AFTER THE STEERING GEAR IS INSTALLED IN THE VEHICLE.**

STEERING GEAR INSTALLATION

After the steering gear has been overhauled, it can be installed to the vehicle as follows:

1. Place steering gear assembly in engine compartment and direct steering column up into body through opening in floor pan. Install bolts which at-

tach steering gear to frame side rail, but do not tighten.

2. Install steering column jacket, with transmission gear shifting mechanism assembled to it, over the steering column. Fit lower end of jacket onto steering gear housing sleeve, bottoming it against shoulder on housing.

NOTE: The slot in the jacket must align with hole on surface of housing sleeve. Place clamp in position and tighten clamp bolts to fasten jacket and gearshift lower lever housing on the steering gear housing. Be sure pin on mounting face of gearshift lower lever housing is through the slot in jacket and into hole in steering gear housing sleeve before tightening clamp bolts.

3. Install steering column jacket bearing spacer and spring over upper end of steering column, fitting spacer into place between bearing and steering column.

4. Install steering column support bracket clamp at instrument panel and install support bolts loosely.

5. Install steering wheel to column as described in "Steering Wheel Replacement" in this section.

6. Align steering column and check worm bearing adjustment and roller and shaft adjustment. Refer to "Steering Gear Adjustments" in this section.

7. Install floor plates and seals to floor pan around foot pedals and steering column.

8. With front wheels in the straight ahead position and steering wheel turned to the center of its travel, install pitman arm on roller shaft.

9. Connect transmission shifting rods to their respective shift levers on steering column in engine compartment. Check and adjust shifting mechanism

linkage as detailed in Section 6, "Transmission and Overdrive."

STEERING LINKAGE

The direct steering linkage consists of a pitman arm on the lower end of the steering gear, and two tie rod assemblies mounted on fixed ball and stud sockets at each end (Fig. 201).

The steering linkage is completely adjustable to provide for proper front wheel toe-in and to position the steering gear in its exact center of travel with wheels straight ahead.

STEERING LINKAGE REPLACEMENT

Whenever the steering linkage is bent, broken or worn, it should be replaced as follows:

1. Disconnect tie rod from pitman arm by removing cotter pin and nut and dropping socket stud out of arm. Remove pitman arm from steering gear roller shaft, using Pitman Arm Puller KF-119 to remove arm (see Fig. 195).

2. Remove tie rods by disconnecting them from steering knuckle arms. Tie rods can be separated by removing cotter pin and nut from socket joint.

3. Carefully inspect all parts for damage or wear, replacing as necessary.

4. Center the steering wheel by rotating it one-half the number of turns from extreme left to extreme right (spokes of steering wheel should be horizontal in this position if steering wheel is properly installed). Install pitman arm to steering gear roller shaft with arm parallel to steering column. Tighten lockwasher and nut.

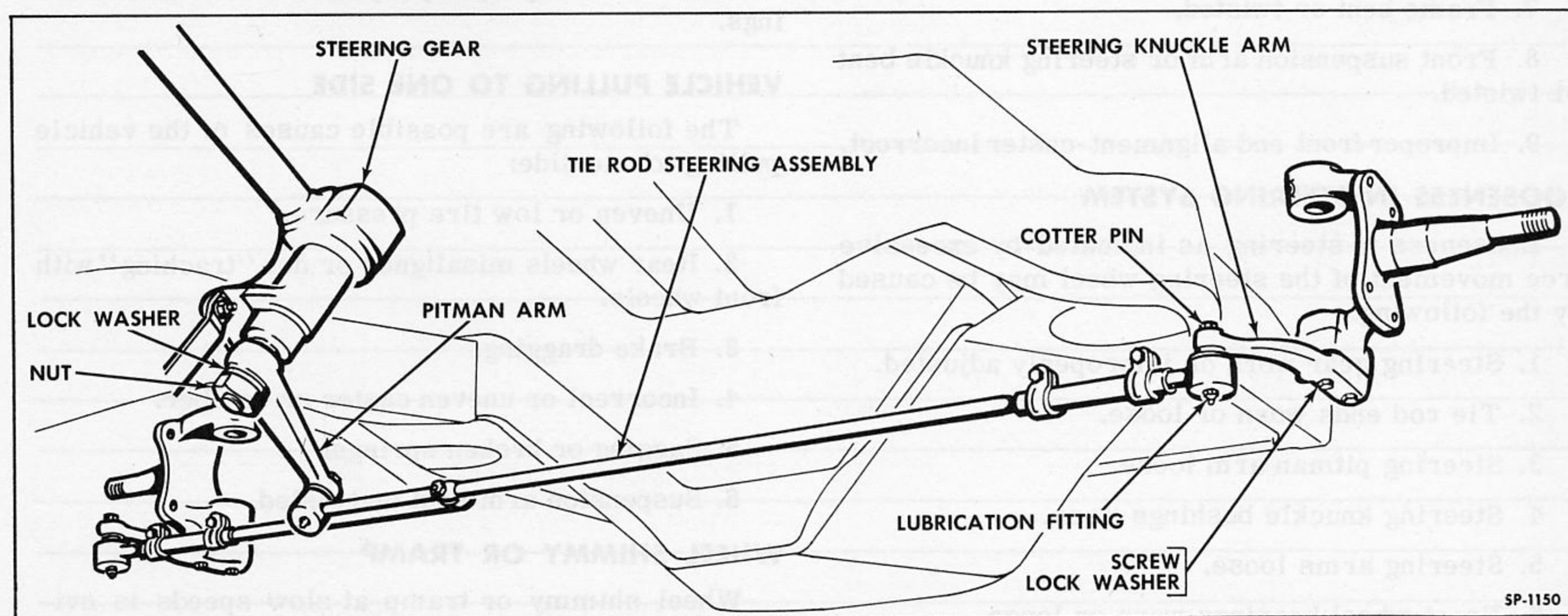


Fig. 201—Steering Linkage

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5. Install right (long) tie rod to right front wheel steering arm and to pitman arm.

6. Install left (short) tie rod to left front wheel steering arm and to right tie rod at center of vehicle.

7. Loosen tie rod clamps and adjust tie rods so both front wheels are approximately straight ahead with steering wheel still in centered position located in Step 4. Proceed with toe-in adjustment of front wheels as detailed in Section 8, "Chassis Suspension".

SERVICE DIAGNOSIS

Whenever a diagnosis of steering difficulties is made, it must be remembered that other factors such as front end alignment, front suspension, tire inflation, wheel and tire mounting, wheel bearings, frame alignment or brakes can also reflect as a steering problem. Various symptoms are given in the following paragraphs and the possible causes, both in the steering system and from other sources, are listed.

HARD STEERING

Possible causes of hard steering as indicated by tightness or stiffness in the steering mechanism are as follows:

1. Improper steering gear worm bearing or roller shaft adjustment.
2. Tie rod ends binding due to misalignment.
3. Under-inflation of front tires.
4. Lack of lubrication.
5. Steering gear linkage bent.
6. Steering column misalignment.
7. Frame bent or twisted.
8. Front suspension arm or steering knuckle bent or twisted.
9. Improper front end alignment-caster incorrect.

LOOSENESS IN STEERING SYSTEM

Looseness in steering as indicated by excessive free movement of the steering wheel may be caused by the following:

1. Steering gear worn or improperly adjusted.
2. Tie rod ends worn or loose.
3. Steering pitman arm loose.
4. Steering knuckle bushings worn.
5. Steering arms loose.
6. Front wheel bearings worn or loose.
7. Steering gear mounting loose.

LACK OF STEERING CONTROL

Lack of steering control as indicated by steering wander or road weave may be caused by the following:

1. Low or uneven tire pressure.
2. Steering gear worn or adjustments either too loose or too tight (the latter causing over-steering).
3. Tie rod ends worn or loose.
4. Improper front end alignment-incorrect or unequal caster, camber or toe-out with loose steering linkage.
5. Front suspension arm or steering knuckle bent or twisted.
6. Frame misaligned or rear axle shifted.
7. Sway eliminator bar defective.
8. Sagging front or rear springs.
9. Steering knuckle bushings worn.
10. Type of road surface and cross winds.
11. Defective shock absorbers.

ROAD SHOCK TO STEERING WHEEL

The following are possible causes of the condition which is indicated by a sharp and sudden reaction of the steering wheel as a result of the front wheels hitting a bump or hole in the road:

1. Excessive tire pressure.
2. Improper adjustment of steering gear worm bearings or roller shaft.
3. Steering knuckle bent or bushings worn.
4. Worn or improperly adjusted front wheel bearings.

VEHICLE PULLING TO ONE SIDE

The following are possible causes of the vehicle pulling to one side:

1. Uneven or low tire pressure.
2. Rear wheels misaligned or not "tracking" with front wheels.
3. Brake dragging.
4. Incorrect or uneven caster or camber.
5. Sagging or broken springs.
6. Suspension arm bent or twisted.

WHEEL SHIMMY OR TRAMP

Wheel shimmy or tramp at slow speeds is evidenced by a shaking movement of the steering wheel. At high speeds the condition is indicated when the

vehicle seems to gallop, as might be the case if the wheels were oval shaped instead of round. Possible causes are:

1. Wheels, tires or brake drums out-of-balance.
2. Uneven or under-inflation of front tires.
3. Wheel or tire not mounted properly.
4. Worn or loose steering gear or linkage.
5. Improper front end alignment — toe-in, caster or camber incorrect.

6. Wheel bearings worn or loose.
7. Propeller shaft operating out-of-balance.
8. Shock absorbers not functioning properly.
9. Front springs weak or sagging.

UNEQUAL RIGHT AND LEFT TURNING RADII

If the vehicle can be turned more sharply one way than the other, the steering linkage is bent or striking other parts of the vehicle, limiting the travel.

SERVICE BULLETIN REFERENCE

GENERAL INFORMATION

1. The purpose of this document is to provide a comprehensive overview of the project's objectives, scope, and timeline. It is intended for use by all stakeholders involved in the project, including the project manager, team members, and sponsors.

2. The project is a complex endeavor that requires careful planning and execution. The primary goal is to deliver a high-quality product that meets the needs of the customer and the organization. The project is divided into several phases, each with its own set of tasks and deliverables.

3. The project manager is responsible for overseeing the project from start to finish. This includes defining the project's scope, identifying the resources needed, and managing the project's budget and schedule. The project manager will also be responsible for communicating the project's progress to the sponsor and other stakeholders.

4. The project team consists of individuals with diverse skills and expertise. Each team member has a specific role to play in the project's success. The project manager will assign tasks to team members based on their strengths and availability. Regular communication and collaboration are essential for the project's success.

5. The project's timeline is a critical factor in its success. The project manager will develop a detailed project schedule that outlines the start and end dates for each task. This schedule will be used to track the project's progress and identify any potential delays or risks.

6. The project's budget is another key consideration. The project manager will develop a detailed budget that outlines the costs of all project activities. This budget will be used to track the project's financial performance and ensure that the project is completed within the allocated budget.

7. The project's success is ultimately measured by the satisfaction of the customer and the organization. The project manager will monitor the project's progress and make adjustments as needed to ensure that the project meets its goals and objectives.

8. The project is a dynamic environment that requires flexibility and adaptability. The project manager will be responsible for identifying and managing any risks that may arise during the project's execution. This includes identifying potential risks, assessing their impact, and developing strategies to mitigate them.

9. The project is a team effort that requires the commitment and support of all stakeholders. The project manager will foster a collaborative environment where team members feel valued and motivated to contribute to the project's success.

10. The project is a journey that requires patience and persistence. The project manager will ensure that the project is completed on time, within budget, and to the satisfaction of all stakeholders.

SERVICE BULLETIN REFERENCE

1. **Check for proper tire pressure and tread depth.**

2. **Inspect the front suspension, including the shocks, struts, and springs.**

3. **Check the steering system, including the power steering fluid level and the steering rack and pinion.**

4. **Inspect the rear suspension, including the shocks, struts, and springs.**

5. **Check the brake system, including the brake pads, shoes, and rotors.**

6. **Inspect the chassis, including the frame, crossmembers, and control arms.**

7. **Check the alignment, including the camber, toe, and caster.**

8. **Inspect the exhaust system, including the muffler, catalytic converter, and tailpipe.**

9. **Check the fuel system, including the fuel filter, fuel pump, and fuel injectors.**

10. **Inspect the engine, including the oil level, oil filter, and timing belt.**

11. **Check the battery, including the battery level, battery terminals, and battery cables.**

12. **Inspect the lights, including the headlights, taillights, and turn signals.**

13. **Check the horn, including the horn button and the horn itself.**

14. **Inspect the windshield, including the windshield wipers and the windshield itself.**

15. **Check the interior, including the seats, floor mats, and door panels.**

16. **Inspect the exterior, including the body panels, paint, and chrome trim.**

17. **Check the odometer, including the odometer reading and the odometer itself.**

18. **Inspect the vehicle identification number (VIN), including the VIN location and the VIN itself.**

19. **Check the title and registration, including the title and registration fees.**

20. **Inspect the vehicle's overall condition, including the engine, transmission, and chassis.**