SUSPENSION, STEERING, WHEELS AND TIRES

GROUP 3

PART 3-1 SUSPENSION, STEERING, WHEELS AND TIRES—GENERAL SERVICE

1 DIAGNOSIS AND TESTING

Table 1 lists various suspension, steering, and wheel and tire trouble symptoms and their possible causes. The possible causes are listed in the table in the order in which they should be checked. For example, refer to the fourth trouble symptom in Table 1, "Hard Turning When Stationary". When checking the possible causes, check item 1 (tire pressure) and item 2 (tire size) before proceeding with items 12, 17, and 21 as indicated.

Refer to Table 2, for Movable Steering Column Trouble Symptoms and Possible Causes.

PRELIMINARY CHECKS

The following preliminary checks should always be made before performing any trouble shooting operations. Also, see Table 1.

AIR BLEEDING

Air in the power steering system (shown by bubbles in the fluid) should be bled. After making sure that the reservoir is filled to specification (the fluid must be at normal operating temperature when the check is made), turn the steering wheel through its full travel three or four times with the windshield wiper in operation. **Do not hold the wheels against their stops.** Recheck the fluid level.

CHECK FLUID LEVEL

Run the engine until the fluid is at normal operating temperature. Then turn the steering wheel all the way to the left and right several times, and shut off the engine.

Check the fluid level in the power steering reservoir. The level must be at the full mark on the dipstick. If the level is low, add enough automatic transmission fluid C1AZ-19582-A to raise the level to the F

TABLE 1—Steering Diagnosis Guide

POWER STEERING FLUID LEVEL LOW OR FLUID LEAKAGE	Jerky steering. Hard steering and/or loss of power assist.	Hard turning when stationary. Steering and suspension noises.
AIR IN POWER STEERING SYSTEM	Jerky steering. Hard steering and/or loss of power assist.	Steering and suspension noises. Shimmy or wheel tramp.
OBSTRUCTION IN POWER STEERING LINES	Hard steering and/or loss of power assist.	Hard turning when stationary. Steering and suspension noises. Jerky steering.

TABLE 1—Steering Diagnosis Guide (Continued)

LOOSE STEERING GEAR MOUNTINGS	Jerky steering. Loose steering.	Steering and suspension noises. Shimmy or wheel tramp. Side-to-side wander.
INSUFFICIENT STEERING PUMP PRESSURE	Hard steering and/or loss of power assist.	Hard turning when stationary. Binding or poor recovery. Steering and suspension noises.
INCORRECT STEERING GEAR ADJUSTMENT	Jerky steering. Loose steering. Hard steering and/or loss of power assist. Steering and suspension noises.	Shimmy or wheel tramp. Side-to-side wander. Body sway or roll. Binding or poor recovery. Abnormal or irregular tire wear.
STEERING GEAR VALVE SPOOL BINDING OR OUT OF ADJUSTMENT	Hard steering and/or loss of power assist.	Binding or poor recovery. Heavier steering in one direction.
OBSTRUCTION WITHIN STEERING GEAR	Hard steering and/or loss of power assist. Hard turning when stationary.	Binding or poor recovery. Jerky steering. Steering and/or suspension noise.

mark on the dip stick. **Do not overfill the reservoir.**

CHECK PUMP BELT

If the pump belt is broken, glazed, or worn, replace it with a new belt. **Use only the specified type of belt.** Refer to Part 3-3 for belt adjustment.

CHECK FOR FLUID LEAKS

With the engine idling, turn the steering wheel from stop to stop several times. Check all possible leakage points. Tighten all loose fittings, and replace any damaged lines or defective seats.

CHECK TURNING EFFORT

With the front wheels properly aligned and tire pressures correct, check the effort required to turn the steering wheel.

1. With the car on dry concrete, set the parking brakes.
2. With the engine warmed up and running at idle speed, turn the steering wheel to the left and right several times to warm the fluid.
3. Attach a pull scale to the rim of the steering wheel. Measure the pull required to turn the wheel one complete revolution in each direction. The effort required to rotate the steering wheel should not exceed 3.5 pounds.

PUMP-FLUID PRESSURE TEST

A fluid pressure test will show whether the pump or some other unit in the power steering system is causing trouble in the system. Steps outlined below should be followed

TABLE 2—Movable Steering Column Trouble Symptoms and Possible Causes

BINDING, ROUGH, OR RASPING COLUMN MOVEMENT	Track to column bracket misalignment. Locking plate out of adjustment rubs pawl.	Shroud interference with instrument panel.
HARD COLUMN MOVEMENT	Slide tension out of adjustment. Track to column bracket misalignment.	Locking plate out of adjustment—rubs pawl.
POSSIBLE SHIFT INTO REVERSE WITH COLUMN AT EXTREME RIGHT	Locking plate out of adjustment.	
POOR SHIFTING INTO OR OUT OF PARK	Left stop out of adjustment.	Lock pawl arm binding in pivot bushing.
LATERAL LOOSENESS IN COLUMN WHEN LOCKED	Locking pawl arm loose in pivot bushing.	Pivot bracket loose at steering gear. Left stop out of adjustment.
VERTICAL LOOSENESS IN COLUMN WHEN LOCKED	Loose track or braces. Pivot bracket loose at steering gear.	Slide tension out of adjustment.
RIGHT SHROUD HITS AIR CONDITIONING UNIT	Right stop bolt (on track) out of adjustment.	

TABLE 3—Trouble Symptoms and Possible Causes

POSSIBLE CAUSES OF TROUBLE / TROUBLE SYMPTOMS	Jerky Steering	Loose Steering	Hard Steering and/or Loss of Power Assist	Hard Turning When Stationary	Steering and Suspension Noises	Shimmy or Wheel Tramp	Pull to One Side	Side-to-Side Wander	Body Sway or Roll	Tire Squeal on Turns	Binding or Poor Recovery	Abnormal or Irregular Tire Wear	Sag at One Wheel	Hard or Rough Ride	Rear Suspension Misalignment (Dog-Tracking)
1. Incorrect Tire Pressure			X	X	X	X	X	X	X	X		X	X	X	
2. Tire Sizes Not Uniform			X	X		X	X	X				X	X		
3. Overloaded or Unevenly Loaded Vehicle								X				X	X	X	
4. Power Steering Fluid Level Low-Leak	X		X	X	X										
5. Sagging or Broken Spring					X	X	X	X	X			X	X	X	
6. Glazed, Loose or Broken Power Steering Pump Belt	X		X	X	X										
7. Rear Spring Tie Bolt Off Center							X					X			X
8. Broken Rear Spring Tie Bolts					X	X	X	X	X			X			X
9. Rear Spring Front Hanger Mislocated							X					X			X
10. Bent Spindle Arm							X	X		X		X			
11. Bent Spindle							X	X		X		X			
12. Lack of Lubrication			X	X	X						X			X	
13. Air in Power Steering System	X		X		X	X									
14. Obstruction in Power Steering Lines			X	X	X										
15. Loose or Weak Shock Absorber					X	X			X			X		X	
16. Loose or Worn Suspension Arm Bushings					X	X						X		X	
17. Binding Front Suspension Ball Joints or Steering Linkage	X		X	X	X						X			X	
18. Loose, Worn, or Damaged Steering Linkage or Connections	X	X			X	X		X		X		X			
19. Loose Steering Gear Mountings	X	X			X	X		X	X						
20. Insufficient Steering Pump Pressure			X	X							X				
21. Incorrect Steering Gear Adjustment	X	X	X	X	X	X		X	X		X	X			
22. Incorrect Brake Adjustment	X				X		X					X			
23. Incorrect Front Wheel Bearing Adjustment	X	X			X	X	X	X				X			
24. Wheel Out of Balance	X				X	X						X		X	
25. Incorrect Front Wheel Alignment			X		X	X	X	X		X	X	X			
26. Out-of-Round Wheel or Brake Drum						X						X		X	
27. Frame of Underbody Out of Alignment							X					X			X
28. Bent Rear Axle Housing					X		X					X			X
29. Excessive Wear of Steering Pump Internal Parts					X										
30. Steering Gear Valve Spool Binding or Out of Adjustment			X	X							X				
31. Obstruction Within Steering Gear			X	X							X				

to determine the cause of the trouble.

1. Measure the pump belt tension.

When adjusting the belt tension on the power pump, do not pry against the pump to obtain the proper belt load.

A half inch cast boss has been incorporated on the front face of the pump cover plate onto which a 9/16" open end wrench can be fitted to pry the pump and obtain the proper belt tension.

2. Disconnect the pressure line hose from the pump outlet, and install a 0-2000 psi pressure gauge (Tool T56L-33610-D) and shut off valve between the end of the hose and the pump outlet.

Be sure that the pressure gauge is between the pump and the shut off valve, all connections are tight, and the shut off valve is fully open.

3. Connect a tachometer to the engine.

4. Start the engine and operate it at idle speed for at least two (2) minutes to warm up the fluid.

5. Cycle the steering wheel from stop-to-stop several times to expel any air from the system; stop the engine. Remove the reservoir filler cap and check the fluid level in the reservoir. If necessary, add lubricant C1A-19582-A to the proper level.

6. With the engine running at **approximately** 500 rpm and no steering effort applied, and the lubricant at normal operating temperature, the pressure gauge should show a pressure of less than **50** psi. If the pressure is higher, inspect the hoses for kinks and obstructions.

7. Increase the engine speed to 1000 rpm, then slowly close the gauge shut-off valve. With the valve fully closed, the pump pressure should be 1000 to 1150 psi.

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

If pressure is more or less than specification, replace the pump assembly. If pressure is as specified and steering efforts are heavy, the gear and/or control valve could be at fault.

8. Remove the tachometer.

FRONT WHEEL ALIGNMENT CHECKS

Do not attempt to check and adjust front wheel alignment without first making a preliminary inspection of the front-end parts. Refer to Section 3.

Check all the factors of front wheel alignment except the turning angle before making any adjustments. The turning angle should be checked only after caster, camber and toe-in have been adjusted to specifications.

The front wheel alignment specifications given in Part 3-5 are correct only when the car is at "Curb Height". Before checking or adjusting the alignment factors, the suspension alignment spacers must be installed to obtain the curb height.

EQUIPMENT INSTALLATION

Equipment used for front wheel alignment inspection must be accurate. Alignment height spacers (Figs. 2 and 3) are used to check caster, camber and toe-in. If the car is operated under abnormal load conditions, the spacers should be omitted when checking toe-in.

1. Drive the car in a straight line far enough to establish the straight-ahead position of the front wheels, and then mark the steering wheel hub and the steering column collar (Fig. 1). **Do not adjust the steering wheel spoke position at this time.** If the front wheels are turned at any time during the inspection, align the marks to bring the wheels back to the straight-ahead position.

2. With the car in position for the front end alignment inspection and adjustment, install the suspension alignment spacers as follows to establish the curb height.

Lift the front of the car and position the suspension alignment spacers between the suspension upper arm and the edge of the frame spring pocket as shown in Fig. 2. The lower end of the alignment spacers should be placed over the head of the ball joint retaining nut. Position the alignment spacers for the rear of the car between the rear axle and the frame side rail as shown in Fig. 3. Lower the rear of the car so that the weight of the body will hold the alignment spacers in place.

3. Install the wheel alignment equipment on the car. Whichever type of equipment is used, follow the installation and inspection instructions provided by the equipment manufacturer.

CASTER

Check the caster angle at each front wheel. Caster is the forward or rearward tilt at the top of the wheel spindle (Fig. 4). If the spindle tilts to the rear, caster is positive. If the spindle tilts to the front, caster is negative. The correct caster angle,

FIG. 1—Typical Straight Ahead Position Marks

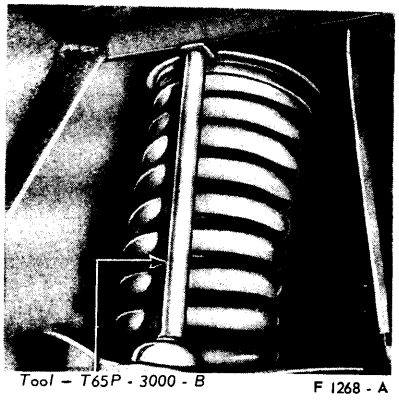

FIG. 2—Alignment Spacer Installation—Front

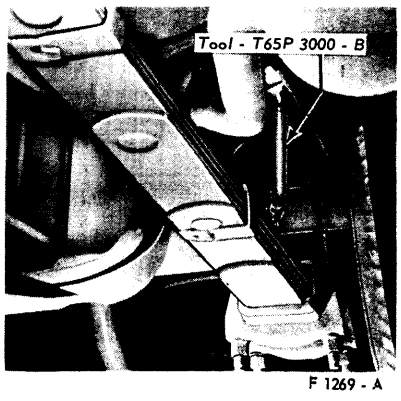

FIG. 3—Alignment Spacer Installation—Rear

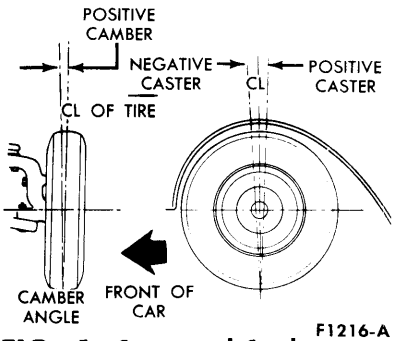

FIG. 4—Caster and Camber Angles

or tilt is specified in Part 3-5.

The maximum difference between both front wheel caster angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

CAMBER

Check the camber angle at each front wheel. The camber angle is the amount the front wheels are tilted at the top (Fig. 4). If a wheel tilts outward, camber is positive. If a wheel tilts inward, camber is negative. The correct camber angle, or outward tilt, is specified in Part 3-5. The maximum difference between both front wheel camber angles should not exceed ½°. However, a difference of not more than ¼° is preferred.

TOE-IN

Alignment height spacers are used on all cars to check and adjust toe-in, except on those operated under abnormal conditions. Toe-in should only be checked and adjusted after the caster and camber has been adjusted to specifications.

Check the toe-in with the front wheels in the straight-ahead position. Measure the distance between the extreme front and also between the extreme rear of both front wheels. The difference between these two distances is the toe-in.

Correct toe-in, or inward pointing of both front wheels at the front, is specified in Part 3-5.

FRONT WHEEL TURNING ANGLE

When the inside wheel is turned 20°, the turning angle of the outside wheel should be as specified in Part 3-5. The turning angle cannot be adjusted directly, because it is a result of the combination of caster, camber, and toe-in adjustments and should, therefore, be measured only after these adjustments have been made. If the turning angle does not measure to specifications, check the spindle or other suspension parts for a bent condition.

2 COMMON ADJUSTMENTS AND REPAIRS

WHEEL ALIGNMENT ADJUSTMENTS

After front wheel alignment factors have been checked, make the necessary adjustments. **Do not attempt to adjust front wheel alignment by bending the suspension or steering parts.**

CAMBER

Adjust the camber by removing or installing shims between the pivot bracket of the front suspension lower arm and the mounting bracket on the underbody in the engine compartment (Fig. 5).

The removal of shims between the mounting and pivot brackets will move the lower ball joints inward. The installation of shims between the mounting and pivot brackets will move the lower ball joint outward. Camber adjusting shims are available in several standard shim thicknesses. A 1/16-inch change of shim thickness will change the camber angle ⅓°. The total shim stack thickness should not exceed 11/16-inch.

CASTER

The caster adjustment is made by repositioning the strut on the lower arm as shown in Fig. 5. Adjust the caster by loosening the rearward washers, nuts and bolts. Lift the strut so that the strut serrations will

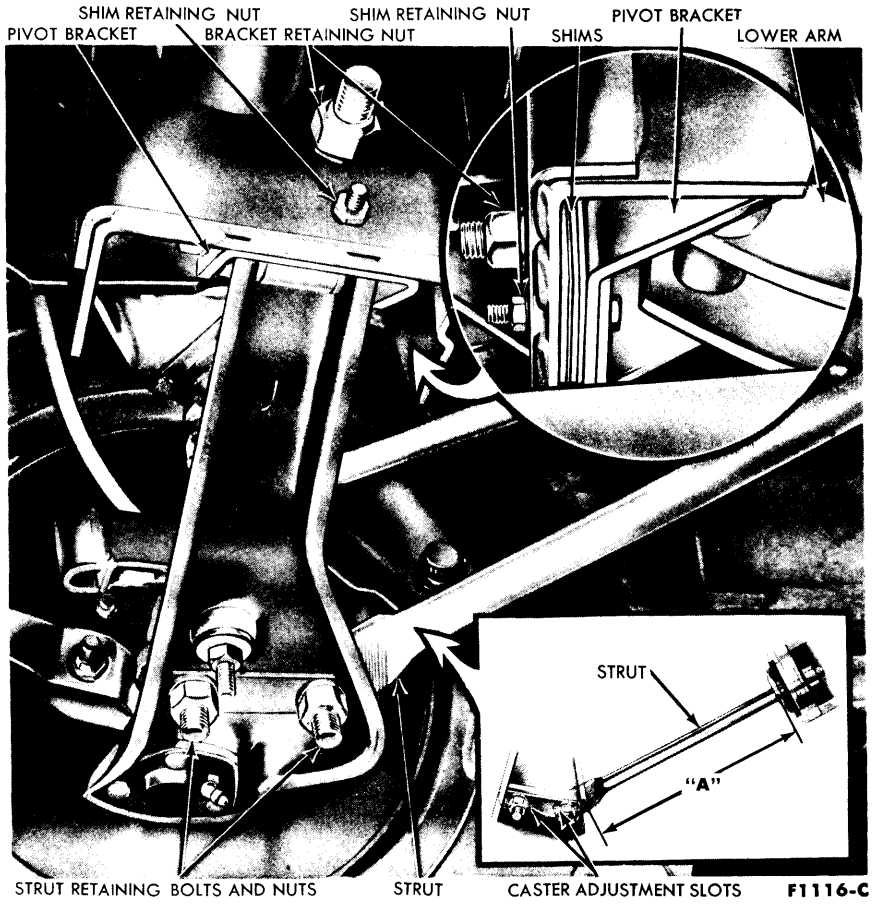

FIG. 5—Caster and Camber Adjustments

be free from the serrations on the lower arm. Lengthen the distance between the strut forward mount and the side of the lower arm (Fig. 5, dimension "A") to decrease the caster angle. Decrease the distance between the strut forward mount and the side of the lower arm (Fig. 5, dimension "A") to increase the caster angle. Tighten the rearward nuts that retain the strut to the lower arm. Check the caster, camber, and toe-in alignment for the correct settings listed in the specifications. Remove the suspension alignment spacers.

TOE-IN AND STEERING WHEEL ALIGNMENT ADJUSTMENTS

Check the steering wheel spoke position when the front wheels are in the straight-ahead position. If the spokes are not in their normal position, they can be properly adjusted while toe-in is being adjusted. The toe-in specification is specified in Part 3-5.

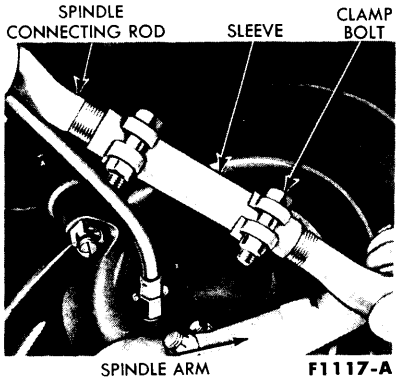

FIG. 6—Spindle Connecting Rod Sleeve

1. Loosen the two clamp bolts on each spindle connecting rod sleeve (Fig. 6).

2. Adjust toe-in. If the steering wheel spokes are in their normal position, lengthen or shorten both rods equally to obtain correct toe-in (Fig. 7). If the steering wheel spokes are not in their normal position, make the necessary rod adjustments to obtain correct toe-in and steering wheel spoke alignment (Fig. 8).

3. Recheck toe-in and steering wheel spoke alignment. If toe-in is correct and the steering wheel spokes are still not in their normal position, turn both connecting rod sleeves upward or downward the same number of turns to move the steering wheel spokes (Fig. 8).

4. When toe-in and steering wheel spoke alignment are both correct, torque the clamp bolts on both connecting rod sleeves to specifications.

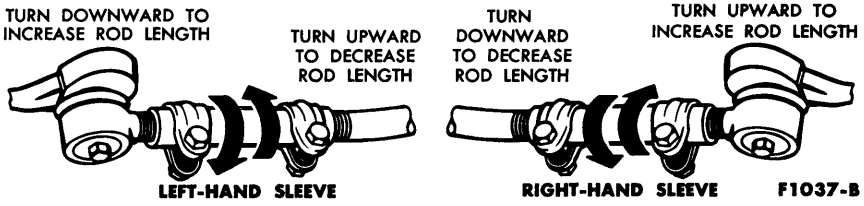

FIG. 7—Spindle Connecting Rod Adjustments

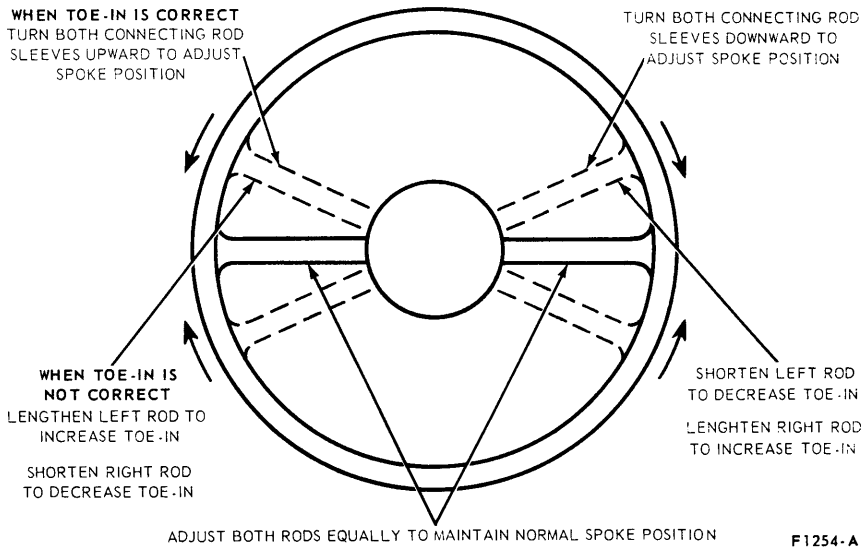

FIG. 8—Toe-In and Steering Wheel Spoke Alignment Adjustments

3 CLEANING AND INSPECTION

FRONT END GENERAL INSPECTION

Do not check and adjust front wheel alignment without first making the following inspection for front-end maladjustment, damage, or wear.

1. Check for specified air pressures in all four tires.

2. Raise the front of the car off the floor. Shake each front wheel grasping the upper and lower surfaces of the tire. Check the front suspension ball joints and mountings for looseness, wear and damage. Check the brake caliper attaching bolts. Torque all loose nuts and bolts to specifications. Replace all worn parts as outlined in Part 3-2.

3. Check the steering gear mountings and all steering linkage connections for looseness. Torque all mountings to specifications. If any of the linkage is worn or bent, replace the parts as outlined in Part 3-3.

4. Check the front wheel bearings. If any in-and-out free play is noticed, adjust the bearings to specification. Replace worn or damaged bearings as outlined in Part 3-4.

5. Spin each front wheel with a wheel spinner, and check and balance each wheel as required.

6. Check the action of the shock absorbers. If the shock absorbers are not in good condition, the car may not settle in a normal, level position, and front wheel alignment may be affected.

WHEEL INSPECTION

Wheel hub nuts should be inspected and tightened to specification at predelivery. Loose wheel hub nuts may cause shimmy and vibration. Elongated stud holes in the wheels may also result from loose hub nuts.

Keep the wheels and hubs clean. Stones wedged between the wheel and rotor or rear drum and lumps of mud or grease can unbalance a wheel and tire.

Check for damage that would affect the runout of the wheels. Wobble or shimmy caused by a damaged wheel will eventually damage the wheel bearings. Inspect the wheel rims for dents that could permit air to leak from the tires.

FLUSHING THE POWER STEERING SYSTEM

Should a power steering pump become inoperative, the shaft and pulley should be checked for freedom of rotation. If the pump shaft does not turn freely (binding), it is an indication that there is wear on the pump internal components and the need for flushing the steering system, when installing a **new** pump.

1. Remove the power steering pump and pulley as outlined in Part 3-3.
2. Install a new pump and connect only the pressure hose to the pump (Part 3-3).
3. Place the oil return line in a suitable container and plug the reservoir return pipe.
4. Fill the reservoir with lubricant C1AZ-19582-A.
5. Disconnect the coil wire to prevent the engine from starting and raise the front wheels off the ground.
6. While approximately two quarts of steering gear lubricant are being poured into the reservoir, turn the engine over using the ignition key, at the same time cycle the steering wheel from stop to stop.
7. As soon as all of the lubricant has been poured in, turn off the ignition key, and attach the coil wire.
8. Remove the plug from the reservoir return pipe, and attach the return hose to the reservoir.
9. Check the reservoir fluid level; if low add fluid C1AZ-19582-A to the proper level. **Do not overfill.**
10. Lower the car.
11. Start the engine and cycle the steering wheel from stop to stop to expel any trapped air from the system.

UPPER BALL JOINT INSPECTION

1. Raise the car on a frame contact hoist or by floor jacks placed beneath the underbody until the wheel falls to the full down position as shown in Figs. 9 and 10. This will unload the upper ball joint.
2. Adjust the wheel bearings as described in Part 3-4.
3. Attach a dial indicator to the upper arm. Position the indicator so that the plunger rests against the underside of the spindle at the upper ball joint stud.
4. Grasp the tire at the front and rear sides and slowly move the tire up and down (Fig 9). If the dial indicator reading (axial play) exceeds specifications (Part 3-5), replace the upper ball joint.
5. With the dial indicator attached to the upper arm, position the indicator so that the plunger rests against the inner side of the wheel rim adjacent to the upper arm ball joint.
6. Grasp the tire at the top and bottom, and slowly move the tire in and out (Fig. 10). Note the reading (radial play) on the dial indicator. If the reading exceeds specifications (Part 3-5), replace the upper ball joint.

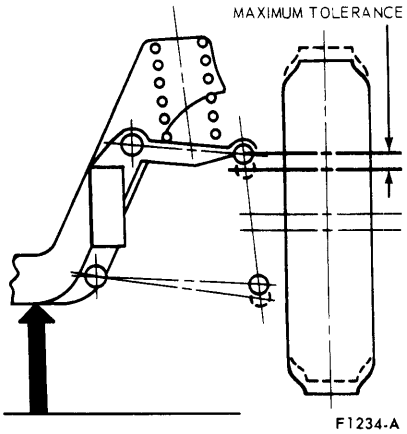

FIG. 9—Measuring Upper Ball Joint Axial Play

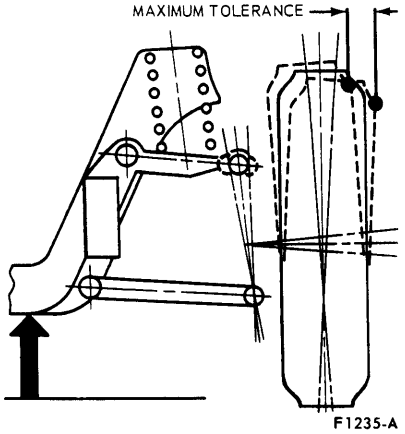

FIG. 10—Measuring Upper Ball Joint Radial Play

LOWER BALL JOINT INSPECTION

To determine if the lower ball joint is excessively worn or loose, perform the following procedure.

1. Raise the car on a frame contact hoist or by floor jacks placed beneath the underbody until the wheel falls to the full down position.
2. Ask an assistant to grasp the lower edge of the tire and move the wheel in and out.
3. As the wheel is being moved in and out, observe the lower end of the spindle and the lower arm.
4. Any movement between the lower end of the spindle and the lower arm indicates ball joint wear and loss of preload. If any such movement is observed, replace the lower arm.

During the foregoing check, the upper ball joint will be unloaded and may move. Disregard all such movement of the upper ball joint. Also, do not mistake loose wheel bearings for a worn ball joint.

PART 3-2 SUSPENSION

1 DESCRIPTION AND OPERATION

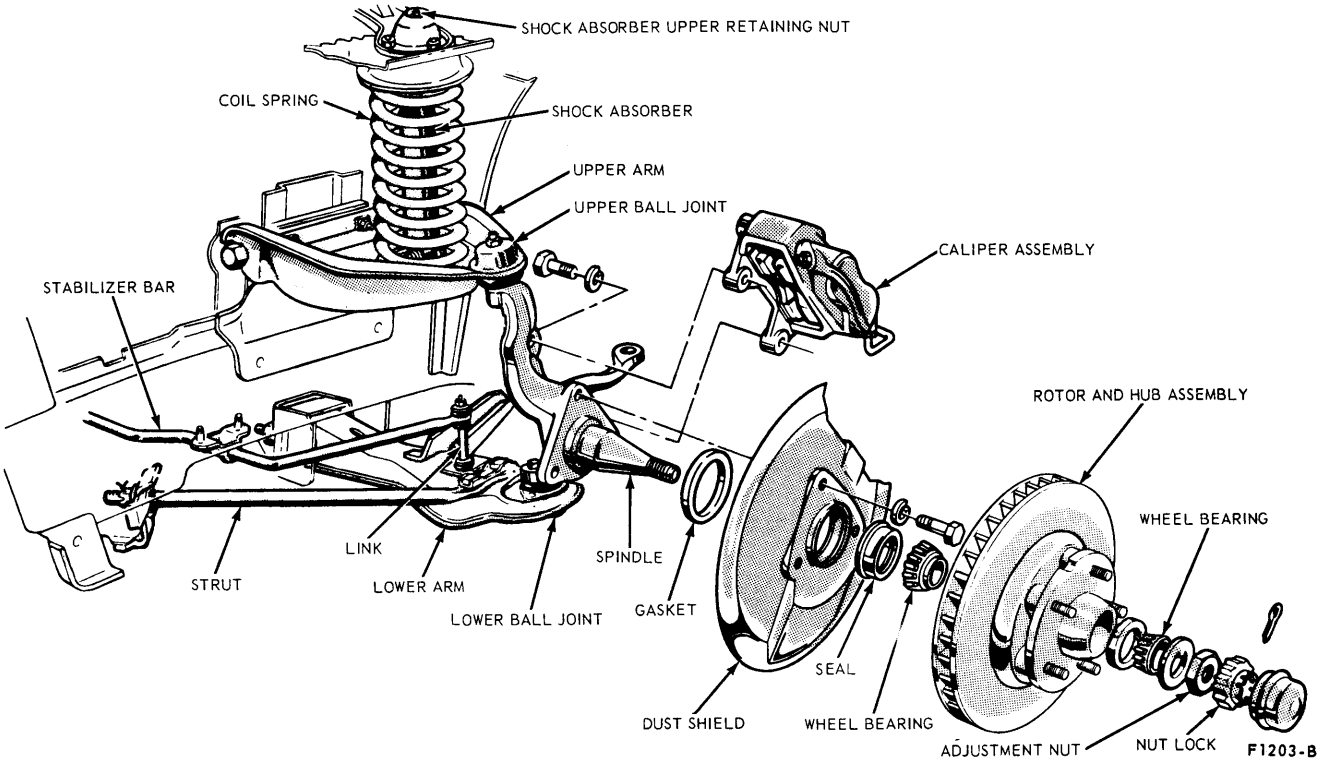

FIG. 1—Front Suspension

FRONT SUSPENSION

Each front wheel rotates on a spindle. The upper and lower ends of the spindle are attached to upper and lower ball joints which are mounted to an upper and lower arm respectively. The upper arm pivots on a bushing and shaft assembly which is bolted to the underbody. The lower arm pivots on a bolt mounted in a bracket which is bolted to the underbody (Fig. 1). A coil spring seats between the upper arm and the top of the spring housing. A double-acting shock absorber is bolted to the upper arm and the top of the spring housing.

The swiveling action of the ball joints allows the wheel and spindle assemblies to move up and down with changes in road surface. The swiveling ball joints also permit the spindles and wheels to be turned to the left or right by the steering gear and linkage.

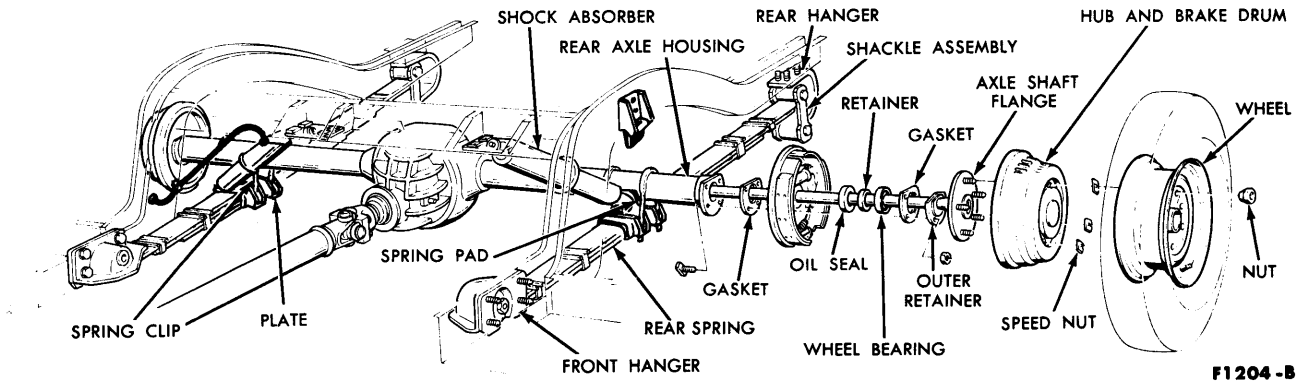

FIG. 2—Rear Suspension

The pivoting action of the suspension arms provides **up and down** movement for the spindles and wheels as required by bumps or depressions in the road surface. The coil springs, shock absorbers, and stabilizer bar control the front suspension up and down movements.

The struts, which are connected between the suspension lower arms and the underbody, prevent the suspension arms from moving forward and backward.

REAR SUSPENSION

Each rear wheel, hub and brake drum assembly is bolted to the rear axle shaft flange. The wheel and axle shaft assembly rotates in the rear axle housing. Two spring pads, integral with the axle housing, rest on two leaf spring assemblies. The axle housing is fastened to the center of the springs by spring clips (U-bolts), spring clip plates, and nuts (Fig. 2). Each spring assembly is suspended from the underbody side rail by hanger and shackle assemblies at the front and rear. The upper end of each shock absorber is mounted to a bracket in the under body; the lower end is mounted to the spring pad at the axle housing.

The springs and shock absorbers provide for up and down movement of the rear axle and wheels as required by changes in the road surface. They also cushion road shocks.

2 IN-CAR ADJUSTMENT AND REPAIRS

UPPER BALL JOINT REPLACEMENT— ARM IN CAR

1. Raise the front of the car and position safety stands under the chassis.
2. Remove the wheel and tire assembly.
3. Loosen the upper stud (ball joint-to-arm) nut.
4. Remove the cotter pin and loosen the upper ball joint stud nut. Place a box wrench over the lower end of tool T57P-3006-A, and position the tool as shown in Fig. 3.

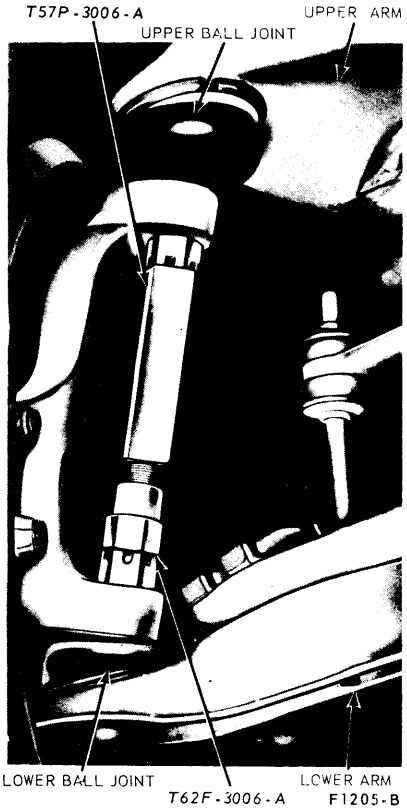

FIG. 3—Loosening Ball Joint Stud

The tool should seat firmly against the ends of both studs, and not against the lower stud nut. It may be necessary to remove the cotter

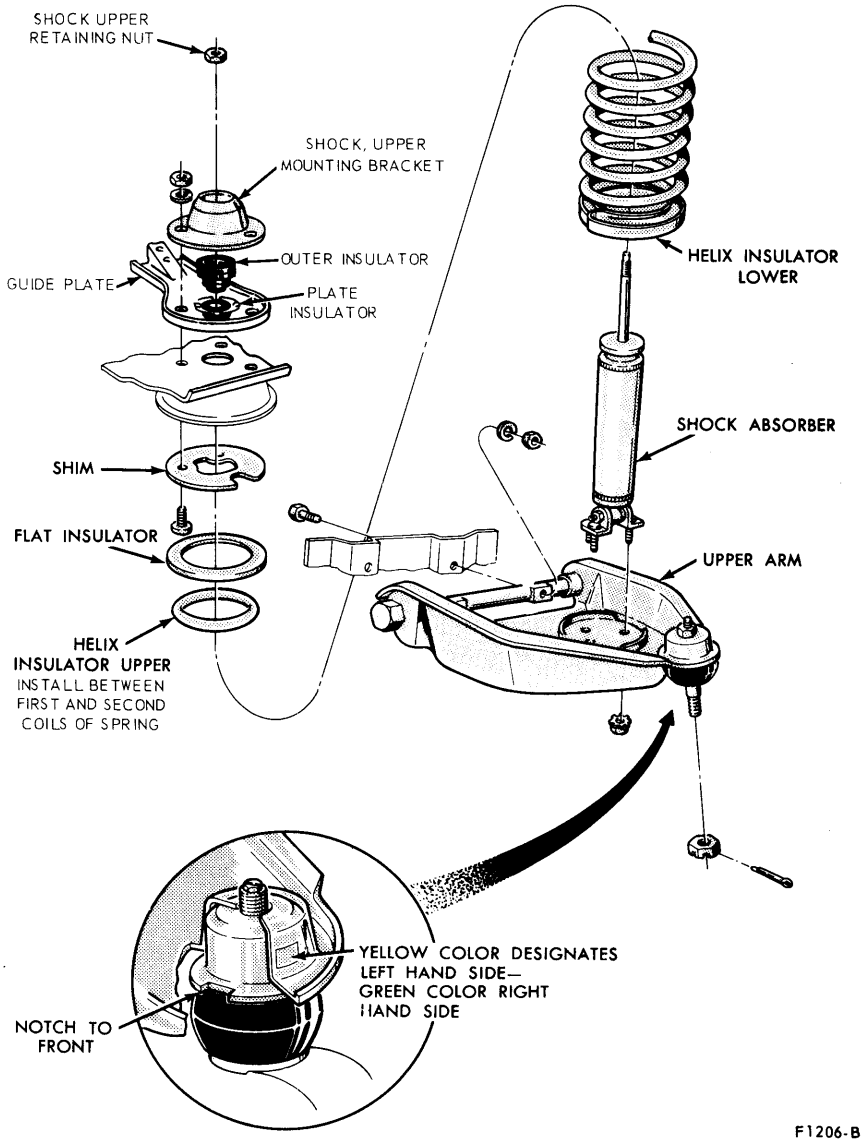

FIG. 4—Upper Arm, Shock Absorber and Spring Connections

pin from the lower ball joint stud if the cotter pin prevents the tool from seaitng on the lower stud.

5. Turn the wrench until both studs are under tension, then loosen the stud from the spindle by tapping the spindle near the upper stud with a hammer. **Do not loosen the stud with tool pressure alone.** Remove the ball joint stud nut.

6. Slide the ball joint stud out of the spindle upper bore. Remove the upper retaining nut, and drive the ball joint out of the suspension arm.

8. Position the replacement ball joint in its recess in the upper arm so that the ball joint notch faces the front of the car (Fig. 4-B). Install the retaining nut on the upper stud and draw the ball joint into place by tightening the nut.

9. Position the ball joint stud in the spindle bore, install the stud nut, and torque to specifications. Install a new cotter pin. Tighten the nut, if necessary, to align the cotter pin hole.

10. Install the wheel and tire assembly.

11. Remove the safety stands, lower the car, and check camber, caster and toe-in.

STABILIZER REPAIR

To replace the end bushings on each stabilizer link, use the following procedure.

1. Raise the car on a hoist.

2. Remove the link-to-stabilizer bar retaining nut, washers, and insulators, and disconnect the link from the bar (Fig. 1).

3. Remove the link-to-lower arm retaining nut, washers, and insulators, and remove the link from the arm.

4. Assemble the link and new washers and insulators to the lower arm, then install the link-to-lower arm retaining nut.

5. Connect the link to the bar with new washers and insulators and secure with the retaining nut.

6. Lower the car.

3 REMOVAL AND INSTALLATION

Be sure the car is centered on the hoist before servicing any front end components to avoid bending or damaging the rotor splash shields on full right or left wheel turns.

FRONT WHEEL SPINDLE

REMOVAL

1. Raise the front of the car and position safety stands under the chassis.

2. Remove the wheel cover and remove the wheel and tire from the hub.

3. Remove 2 bolts and washers retaining the caliper to the spindle (Fig. 1). Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

4. Remove the hub and rotor from the spindle.

5. Remove 3 bolts and remove the splash shield and gasket from the spindle.

6. Remove the cotter pin and retaining nut, then disconnect the spindle connecting rod end from the spindle arm with Tool 3290-C.

7. Remove the cotter pins and loosen the ball joint stud nuts.

8. Position a box wrench over the lower end of the tool T57P-3006-A and position the tool as shown in Fig. 3. **The tool should seat firmly against the ends of both studs, not against the stud nuts.**

9. Turn the wrench until the tool places the studs under tension, then loosen the studs in the spindle by tapping the spindle near the studs with a hammer. **Do not loosen the studs in the spindle with tool pressure alone.**

10. Remove the stud nuts and the spindle from both studs.

INSTALLATION

1. Position the new spindle to the upper and lower ball joint studs, install the stud nuts, and tighten the nuts to specifications. Continue to tighten both nuts until the cotter pin holes line up with slots, then install new cotter pins.

2. Connect the spindle connecting rod end to the spindle arm, and install the retaining nut. Tighten the nut to specifications, align slot and install cotter pin.

3. Install the gasket and splash shield on the spindle. Tighten the retaining bolts to specifications.

4. Install the hub and rotor on the spindle and adjust the wheel bearings.

5. Position the caliper over the rotor and install the retaining bolts. Tighten the bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

6. Install the wheel and tire on the hub.

7. Lubricate the steering stop on the lower arm and the mating flat on the spindle with specified lubricant.

8. Remove the safety stands, lower the car, and check camber, caster, and toe-in.

FRONT SHOCK ABSORBER

REMOVAL

1. Raise the front of the car and position a safety stand under the lower suspension arm; then, lower the car slightly.

2. Disconnect the shock absorber lower mounting bracket from the upper arm by removing the three retaining nuts and washers (Fig. 4).

3. Open the hood; then, remove the three retaining nuts and the shock absorber upper mounting bracket. Remove the two bolts that attach the guide plate to the dash panel brace. Remove the shock absorber, guide plate, and lower bracket as an assembly.

INSTALLATION

1. Position the shock absorber and guide plate assembly through the top of the spring housing so that the three lower mounting studs enter the holes in the suspension upper arm. Install the lower retaining nuts on the studs.

2. Install the two bolts that attach the guide plate to the dash panel brace. Install the upper mounting bracket and the three retaining nuts.

3. Remove the safety stands, and lower the car.

REPLACEMENT

1. Remove the front shock absorber as outlined under "Removal."

2. Remove the shock absorber upper retaining nut and insulator, then

separate the shock absorber from the guide plate (Fig. 4).

3. Remove the retaining nut and bolt, and transfer the lower mounting bracket to the replacement shock absorber (Fig. 5).

4. Pry loose the insulator retaining tabs and remove the insulator from the guide plate (Fig. 4).

5. Install a new insulator in the guide plate and secure by crimping the retaining tabs.

6. Assemble the guide plate, then the outer insulator and retaining nut to the shock absorber shaft.

7. Install the shock absorber as outlined under "Installation."

FRONT SPRING

REMOVAL

1. Raise the front of the car, position safety stands under the suspension lower arms; then, lower the car slightly.

2. Remove the wheel and tire assembly. Remove the front shock absorber as described in steps 2 and 3 under "Removal" in the foregoing procedure.

3. Raise the car slightly in order to lower the suspension upper arm. Install spring tool T63P-5310-A. Slide the tool bearing and upper plate over the shaft screw against the shaft nut. Insert the tool assembly through the upper opening in the spring housing so that the shaft screw goes through the top of the coil spring with the tool upper plate holes going over the studs as shown in Fig. 6.

4. From under the car, place the tool lower plate under the fourth coil from the bottom. Secure the plate to the coil by installing the tool retainer in the groove in the shaft screw (Fig. 7).

5. Insert a ½-inch square drive flex-handle wrench in the drive hole in the lower plate to prevent the tool with spring from turning (Fig. 7). While holding the tool, compress the spring by turning the tool shaft nut clockwise (Fig. 6).

6. Remove the two nuts and lock washers that retain the upper arm inner shaft to the chassis, and swing the arm out of the way. The arm pivots on the ball joint.

7. Remove the bolt that retains the clip and brake line to the chassis, then move the brake line out of the way (Fig. 7).

8. Disconnect the stabilizer bar from the link at both left and right hand suspension lower arms by removing the bar-to-link retaining nuts and upper bushings (Fig. 1). Position the bar out of the way.

9. Fully release the spring tension by turning the tool shaft nut counterclockwise (Fig. 6). **Be sure to hold the lower plate of the tool with the ½-inch square drive flex-handle wrench so that the tool will not turn or snap loose during spring release (Fig. 7).**

10. Remove the spring tool, then remove the spring from the car.

INSTALLATION

1. On cars equipped with air conditioning, install the tapered shim in the top of the spring housing with the thick portion of the shim toward the centerline of the car. Retain the shim in the housing with tape.

2. Insert one helix-type insulator between the two top coils of the spring and attach the other to the bottom coil (Fig. 8). Secure both insulators with tape.

3. Place the flat rubber insulator over the top of the spring (Fig. 4), and secure it with tape in three places.

4. Assemble the upper components of tool T63P-5310A by sliding the tool bearing and the upper plate over the shaft screw against the shaft nut. Position the spring from under the car so that its upper end is seated in the spring housing. Insert the tool assembly through the upper opening in the spring housing so that the shaft screw goes through the top of the coil spring with the tool upper plate holes going over the studs as shown in Fig. 6.

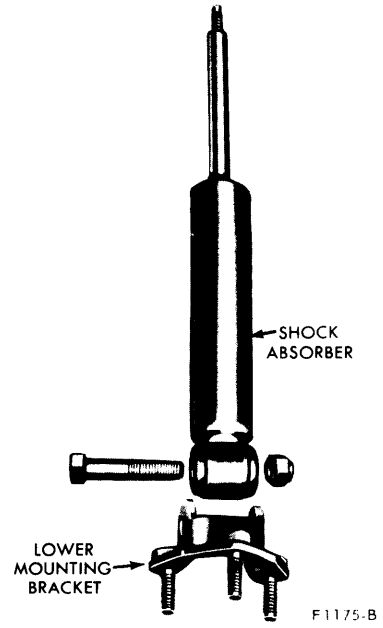

FIG. 5—Front Shock Absorber and Mounting Bracket

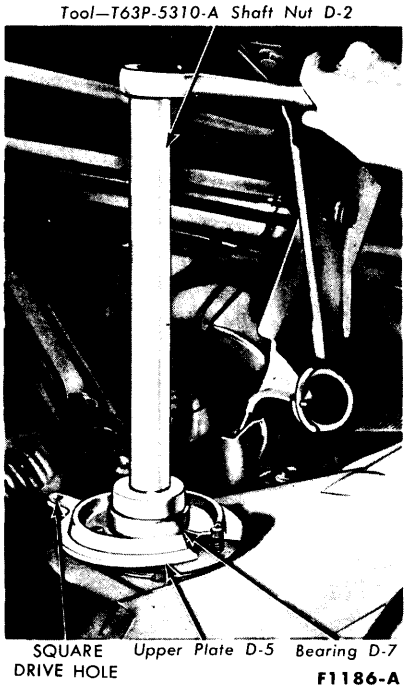

FIG. 6—Compressing or Releasing Spring—Upper View

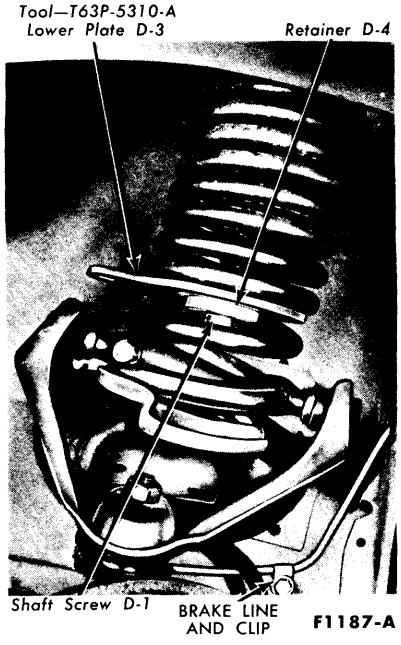

FIG. 7—Compressing or Releasing Spring—Lower View

5. From under the car, place the tool lower plate under the fourth coil from the bottom. Secure the plate to the coil by installing the tool retainer to the groove in the tool shaft screw.

6. Compress the spring by turning the tool shaft nut clockwise (Fig. 6). Hold the tool lower plate from turning during spring compression. Use the ½-inch square drive flex-handle wrench.

7. Position the stabilizer bar on the left and right-hand links and install the rubber bushings and nuts (Fig. 1).

8. Position the brake line and clip on the chassis and install the retaining bolt.

9. Swing the upper arm into position and install the arm inner shaft-to-chassis retaining nuts. **Do not tighten.**

10. **Partially** release the spring tension by turning the shaft nut of tool T63P-5310-A counterclockwise (Fig. 6). As the spring is being released, pry the lower coil so that it will seat in the groove of the upper arm. **Hold the tool lower plate with the square drive wrench.**

11. Tighten the upper arm inner shaft-to-chassis retaining nuts to specifications. Release the spring completely, then remove the tool. **Hold the tool lower plate from turning during spring release. Use the ½-inch square drive flex-handle wrench.**

12. With the safety stands placed under the suspension lower arms, lower the car enough to compress the spring slightly.

13. Position the shock absorber and upper mounting plate assembly through the top of the spring housing so that the three lower mounting studs enter the holes in the suspension upper arm. Install the lower retaining nuts on the studs.

14. Install the two bolts that attach the mounting plate to the dash panel brace. Install the three mounting plate retaining nuts.

15. Install the wheel and tire assembly. Remove the safety stands. Check caster, camber and toe-in.

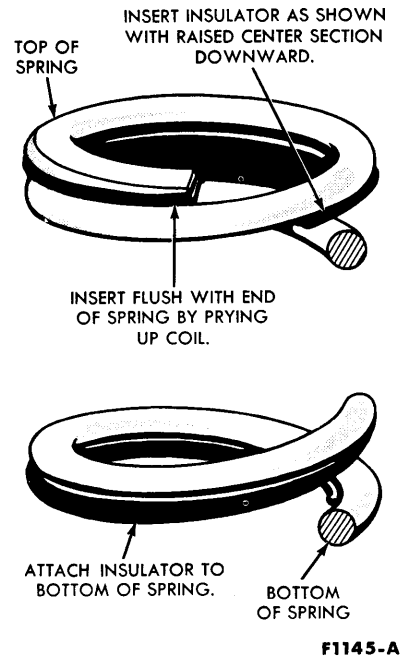

FIG. 8—Front Spring Insulator Installation

UPPER ARM

REMOVAL

1. Remove the shock absorber and coil spring assemblies, and disconnect the arm inner shaft from the chassis as outlined in the "Front Spring" procedure under "Removal."

2. Remove the cotter pin and loosen the upper ball joint stud nut. Place a box wrench over lower end of tool T57P-3006-A as shown in Fig. 3. **The tool should seat firmly against the ends of both studs and not against the lower stud nut.** It may be necessary to remove the cotter pin from the lower ball joint stud if the cotter pin prevents the tool from seating on the lower stud.

3. Turn the wrench until both studs are under tension, then loosen the upper stud from the spindle by tapping the spindle near the upper stud with a hammer. **Do not loosen the stud with tool pressure alone.** Remove the upper stud nut, and disengage the upper ball joint and stud from the spindle. Remove the upper arm from the car.

INSTALLATION

1. Position the arm on the car by inserting the upper ball joint stud

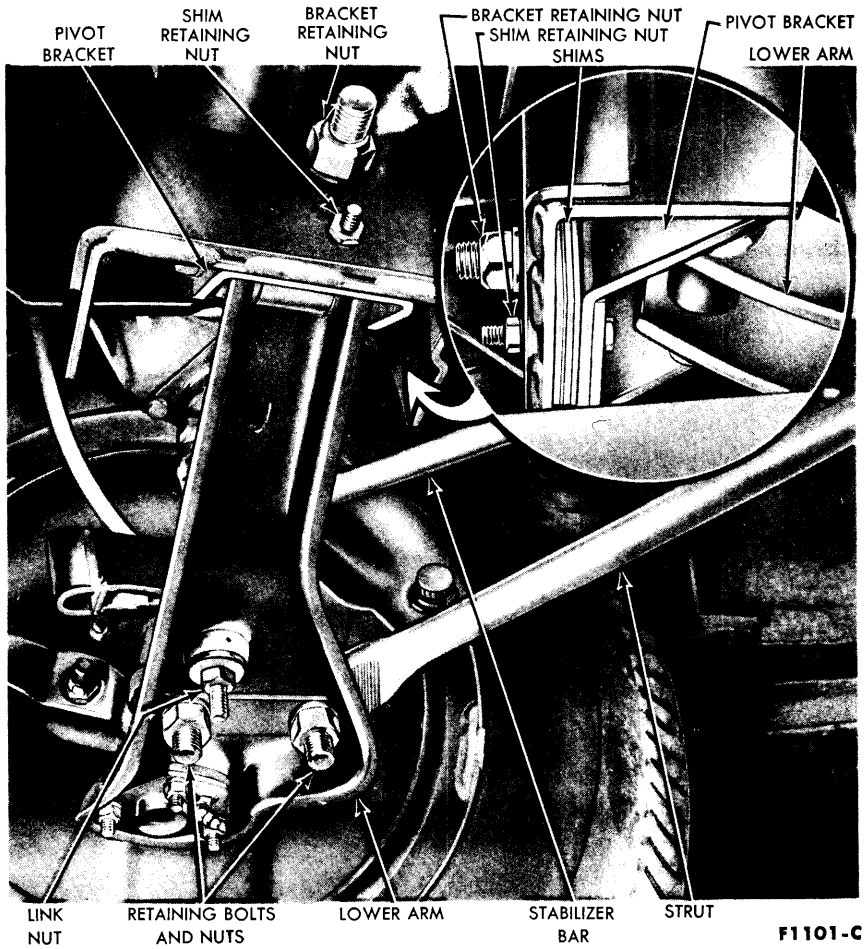

FIG. 9—Suspension Lower Arm Installed

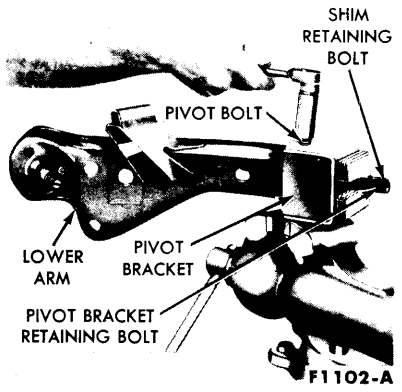

FIG. 10–Lower Suspension Arm Assembly

in the spindle upper bore. Install the stud nut. Tighten the nut to specifications, then continue to tighten until the cotter pin holes are aligned with the slots. Install a new cotter pin.

2. Install the coil spring, connect the upper arm inner shaft to the chassis, and install the shock absorber. Follow the steps in the "Front Spring" procedure under "Installation."

LOWER ARM

REMOVAL

1. Raise the front of the car, and install safety stands.

2. Remove the wheel and tire from the hub.

3. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

4. Remove the hub and rotor from the spindle.

5. Remove the splash shield and gasket from the spindle.

6. Remove the link nut underneath the arm (Fig. 9), and disconnect the stabilizer link from the arm.

7. Remove the retaining nuts, bolts, washers and plates, and disconnect the strut from the lower arm (Fig. 9).

8. Remove the cotter pin and loosen the lower ball joint stud nut. Place a box wrench over the end of tool T57P-3006-A, and position the tool 180° from the position shown in Fig. 3 (wrench at the top). The tool should seat firmly against the ends of both studs, not against the upper stud nut. It may be necessary to remove the cotter pin from the upper ball joint stud if the cotter pin prevents the tool from seating on the upper stud.

9. Turn the wrench until both studs are under tension, then loosen the stud from the spindle by tapping the spindle near the lower stud with a hammer. **Do not loosen the stud with tool pressure alone.** Disengage the lower ball joint and stud from the spindle.

10. Remove the pivot bracket retaining nut and the shim retaining nut (Fig. 9), then remove the bracket and lower arm assembly from the car.

11. Place the assembly in a vise and remove the nut from the pivot bolt (Fig. 10). Remove the pivot bolt, and separate the pivot bracket from the lower arm.

INSTALLATION

1. Assemble the pivot bracket to the new lower arm with the pivot bolt, place the assembly in a vise, and install the pivot bolt nut (Fig. 10). Tighten the nut snug. Do not torque it until the lower arm assembly is installed in the car.

2. Slide the shims over the retaining bolts against the pivot bracket (Fig. 10), then mount the lower arm and pivot bracket assembly to the chassis mounting bracket (Fig. 9). Install the pivot bracket and shim retaining nuts.

3. Insert the lower ball-joint stud in the lower bore of the wheel spindle, and install the stud nut. Tighten the nut to specifications, then continue to tighten until the cotter pin

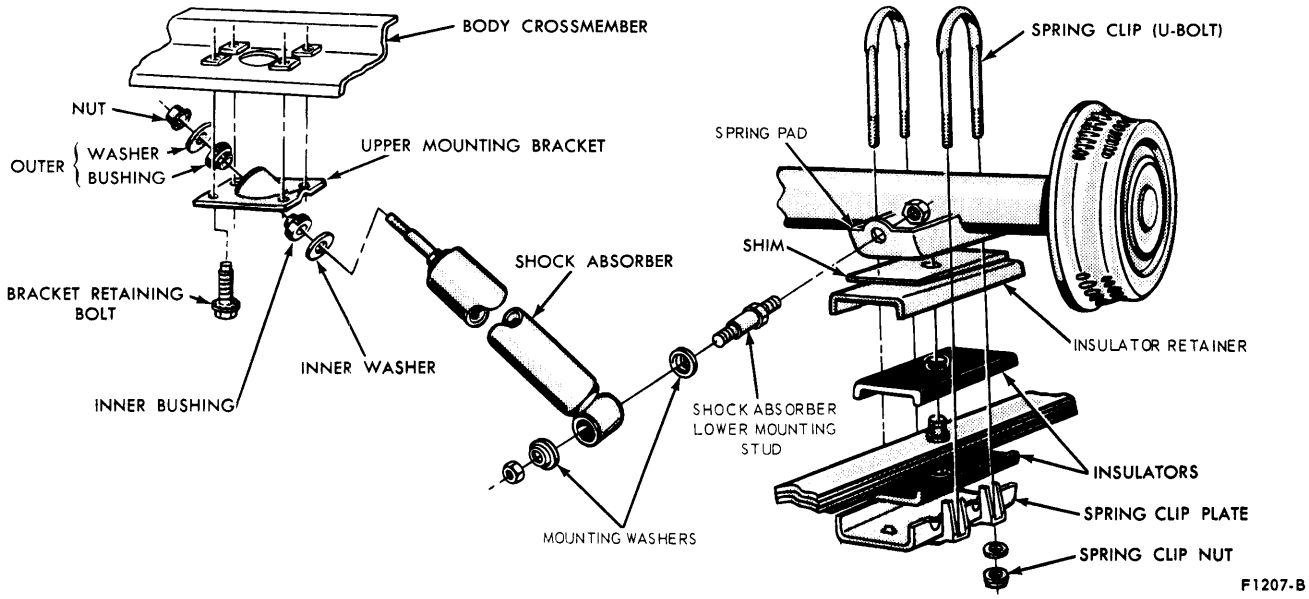

FIG. 11–Rear Shock Absorber and Spring Center Mounting

holes are aligned with the slots. Install a new cotter pin.

4. Position and connect the lower arm strut to the lower suspension arm with retaining plates, bolts, washers, and nuts (Fig. 9). Torque the nuts.

5. Connect the stabilizer bar link to the lower suspension arm, and install the washers, bushings and link retaining nut. Tighten the nut to specifications.

6. Tighten the pivot bolt and nut at the lower arm pivot bracket to specifications.

7. Lubricate the steering stop on the lower arm and the mating flat on the spindle. Refer to Group 19 for specified lubricant.

8. Install the gasket and splash shield on the spindle. Tighten the retaining bolts to specifications.

9. Install the hub and rotor on the spindle and adjust the wheel bearings.

10. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

11. Install the wheel and tire on the hub.

12. Remove the safety stands, lower the car, and check the camber, caster, and toe-in.

REAR SHOCK ABSORBER

REMOVAL

1. Raise the rear end of the car. Remove the bolts that retain the shock absorber mounting bracket to the underbody (Fig. 11).

2. Remove the retaining nut and outer washer from the shock absorber lower mounting stud at the spring pad on the axle housing. Disconnect the shock absorber from the stud. Compress the shock absorber and remove it from the car.

3. Remove the nut, outer washer and bushing that retain the shock absorber to the mounting bracket, and remove the bracket.

4. If the shock absorber is serviceable and requires new bushings, remove the inner bushing and washer from the shock absorber upper mounting stud.

INSTALLATION

1. Place the inner washer and bushing on the shock absorber upper mounting stud.

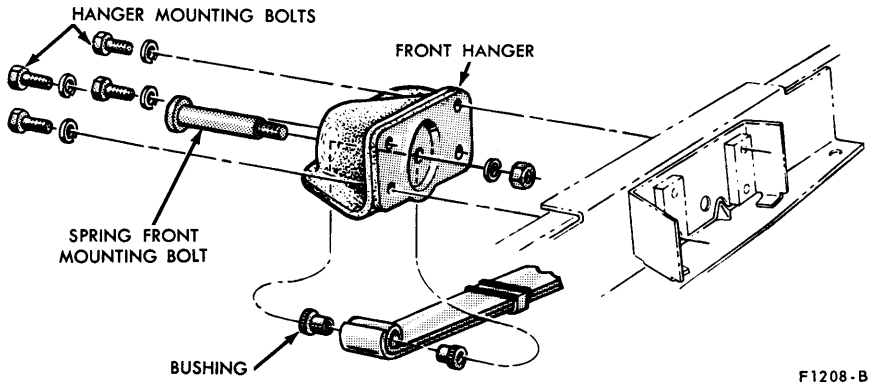

FIG. 12—Rear Spring and Front Hanger Mounting

2. Connect the upper stud to the mounting bracket, and install the bushing, washer, and nut on the stud. Torque the nut to specifications.

3. Connect the mounting bracket and shock absorber to the underbody (Fig. 11). Torque the bolts to specifications.

4. Connect the lower eye of the shock absorber to the mounting stud on the spring pad with inner and outer washers and retaining nut. Torque the nut to specifications.

REAR SPRING

REMOVAL

1. Raise the car until the rear wheels clear the floor, and place supports beneath the underbody.

2. Remove the anti-rattle coil-type spring that retains the parking brake cable to the rear spring. Remove the hook-type retainer from the brake cable and spring clip (U-bolt).

3. Place a jack and a block of wood underneath the spring clip plate, then raise the center of the spring to reduce the tension.

4. Remove the spring clip (U-bolt) nuts (Fig. 11), then lower the jack enough to remove the spring clips.

5. Remove the spring front hanger-to-underbody mounting bolts and lock washers (Fig. 12).

6. Remove the rear shackle nuts and shackle bar, then remove the shackle assembly from the rear hanger and spring (Fig. 13).

7. Lower the jack until the spring and front hanger assembly is free of the car.

8. Lift the shim (if used), upper insulator retainer, and insulator from the top of the spring.

9. Remove the spring and front hanger as an assembly from the jack, and separate the spring clip plate and the lower insulator from the spring.

INSTALLATION

1. Position the lower insulator and spring clip plate on the center of the spring. Place the entire assembly on a wood block and jack, then raise the jack until the spring is in mounting position.

2. Position the rear eye of the pring on the rear hanger and install the shackle assembly to the spring and hanger (Fig. 13). The rear eye is at the long end of the spring from the center tie bolt. Install the shackle bar and retaining nuts. **Do not tighten the nuts at this time.**

3. Position the spring and front hanger assembly on the underbody, and install the hanger mounting bolts (Fig. 12). Do not tighten the bolts at this time.

4. Install the upper insulator and retainer on the spring (Fig. 11). Install the axle shim if one was used.

5. Raise the jack until the center of the spring, the insulators, the

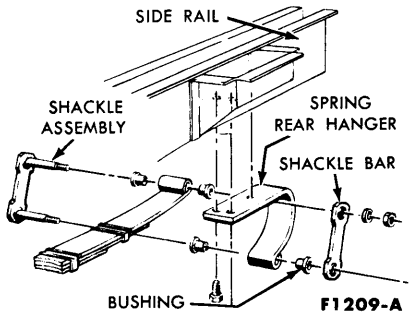

FIG. 13—Rear Spring and Rear Hanger Mounting

retainer, and the spring clip plate are all properly aligned and positioned against the spring pad on the axle housing (Fig. 11).

6. Install the spring clips over the axle housing and through the holes in the spring clip plate. Install the spring clip nuts, but do not tighten at this time.

7. Torque the rear shackle nuts and the front hanger mounting bolts to specification.

8. Torque the spring clip nuts evenly to specification. Make sure that the lower insulator retainer contacts the upper retainer. Remove the jack and wood block.

9. Install the hook-type retainer to the parking brake cable and the spring clip. Secure the parking brake cable to the top of the spring with the small anti-rattle, coil-type spring. Remove the supports and lower the car.

4 MAJOR REPAIR OPERATIONS

UPPER ARM OVERHAUL– ARM REMOVED

INSPECTION

Inspect the upper arm and the inner shaft for cracks, bends or other damage. Replace the parts as required.

Replacement arms come with the bushings, inner shaft, and ball joint installed. If the original arm is to be used, these components should be replaced on the bench.

BUSHING AND INNER SHAFT REPLACEMENT

Always replace both upper arm bushings, if either bushing is worn or damaged. Install only new bushings when replacing the inner shaft.

1. Position the upper arm inner shaft in a vise, then unscrew the bushings from the shaft and arm. Remove the assembly from the vise, and separate the inner shaft from the arm.

2. Position the shaft in the arm, apply grease to the new bushings, and install the bushings loose on the shaft and arm. **Turn the bushings so that the shaft is exactly centered in the arm.** The shaft will be properly centered when located at the dimension shown in Fig. 14.

3. Fabricate a 9¼-inch spacer from a section of ¾-inch diameter pipe or metal of comparable size and strength.

4. Position the arm and inner shaft assembly in a vise. Position the spacer parallel with the inner shaft, and force the spacer between the flanges of the upper arm.

If the spacer can not be forced between the arm flanges due to excessive distortion, replace the upper arm assembly.

5. With the spacer positioned in the arm, torque the bushings to specification. Pivot the arm on the shaft to be sure that no binding exists, then remove the spacer.

BALL JOINT REPLACEMENT

1. Remove the ball joint-to-arm retaining nut and remove the ball joint from the upper arm (Fig. 14).

2. Install the replacement ball joint in its recess in the upper arm so that the ball joint notch faces the front of the car (Fig. 4).

3. Install the retaining nut and torque to specifications (Fig. 14).

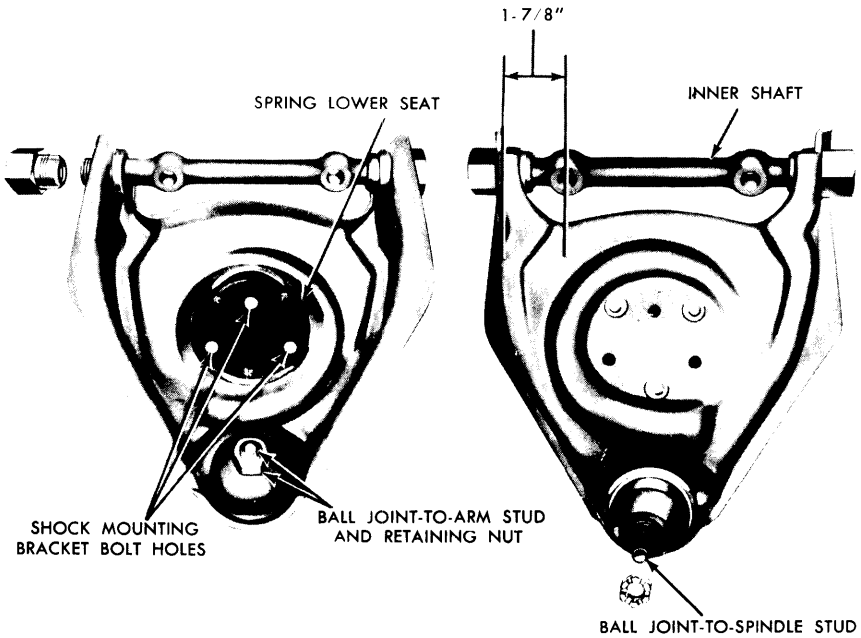

FIG. 14–Upper Suspension Arm

LOWER ARM OVERHAUL– ARM REMOVED

INSPECTION

Inspect the lower arm, the inner bushings, and the pivot bolt for cracks, bends, wear or other damage, and replace the arm if necessary.

Replacement arms come with the ball joint installed. If the original arm is to be used, the ball joint should be replaced on the bench.

BALL JOINT REPLACEMENT

The lower ball joint cannot be repaired and must be replaced if it is worn or damaged.

1. Remove the lower arm as outlined in the "Lower Arm" procedure under "Removal."

2. Remove the ball joint from the arm. If the ball joint is riveted to the arm, drill a ⅛-inch pilot hole completely through each rivet, and then drill off the rivet head through

the pilot hole with a 3/8-inch drill. Drive all rivets out of the holes.

3. Clean the end of the arm, and remove all burrs from the hole edges. Check for cracks in the metal at the holes, and replace the arm if it is cracked.

4. Install a new ball joint on the arm. **Use only the specified bolts, nuts, and washers. Do not attempt to rivet the new ball joint to the arm.**

5. Torque the ball joint retaining nuts and bolts to specifications.

6. Install the lower arm as outlined in the "Lower Arm" procedure under "Installation."

REAR SPRING OVERHAUL—SPRING REMOVED

FRONT HANGER ASSEMBLY

If the front hanger or bushings are to be replaced, proceed as follows:

1. Remove the nut and lock washer from the spring front mounting bolt (Fig. 12).

2. Tap the spring mounting bolt out of the bushings and hanger, then separate the hanger from the spring. Remove the bushings.

3. Position the bushings in the front eye of the spring. Assemble the front hanger to the spring eye and install the spring mounting bolt through the hanger, bushings, and spring eye as shown in Fig. 12.

4. Install the lock washer and nut on the mounting bolt and tighten to the specified torque.

REAR SHACKLE AND HANGER ASSEMBLY

Inspect the rear shackle bushings, and studs for wear or damage. Replace parts where necessary (Fig. 13).

If the rear shackle bushings are to be replaced, it will be necessary to remove the rear hanger assembly. Torque the hanger attaching bolts to specification when reinstalled.

SPRING LEAVES AND TIE BOLT

Check for broken spring leaves. Inspect the anti-squeak inserts between the leaves, and replace them if they are worn. **The spring leaves must be dry and free of oil and dirt before new inserts are installed.**

Inspect the spring clips for worn or damaged threads (Fig. 11). Check the spring clip plate and insulator retainers for distortion.

If the spring center tie bolt requires replacement, clamp the spring in a vise to keep the spring compressed during bolt removal and installation.

PART 3-3 STEERING

1 DESCRIPTION AND OPERATION

DESCRIPTION

The power steering unit is a torsion-bar type of hydraulic assisted system. This system furnishes power to reduce the amount of turning effort required at the steering wheel. It also reduces road shock and vibrations.

The torsion bar power steering unit includes a worm and one piece rack piston, which is meshed to the gear teeth on the steering sector shaft. The unit also includes a hydraulic valve, valve actuator, and torsion bar assembly which are mounted on the end of the worm shaft and operated by the twisting action of the torsion bar.

The torsion-bar type of power steering gear is designed with the one piece rack-piston, worm and sector shaft in one housing and the valve spool in an attaching housing (Fig. 1). This makes possible internal fluid passages between the valve and cylinder, thus eliminating all external lines and hoses, except the pressure and return hoses between the pump and gear assembly.

The power cylinder is an integral part of the gear housing. The piston is double acting, in that fluid pressure may be applied to either side of the piston.

A selective metal shim, located in the valve housing of the gear is for the purpose of tailoring steering gear efforts. If efforts are not within specifications they can be changed by increasing or decreasing shim thickness as follows:

Efforts heavy to the left—Increase shim thickness

Efforts light to the left—Decrease shim thickness

A change of one shim size will increase or decrease steering efforts approximately 1½ in.-lbs.

Shims are available in the following thicknesses:

0.0057-0.0063 inch
0.0077-0.0083 inch
0.0097-0.0103 inch
0.0117-0.0123 inch
0.0137-0.0143 inch

Do not use more than one shim.

The operation of the hydraulic control valve spool is governed by the twisting of a torsion bar. All effort applied to the steering wheel is transmitted directly through the input shaft and torsion bar to the worm assembly and integral piston. Any resistance to the turning of the front wheels results in twisting of the bar. The twisting of the bar increases as the front wheel turning effort increases. The control valve spool actuated by the twisting of the torsion bar, directs fluid to the side of the piston where hydraulic assist is required.

The upper end of the torsion bar is drilled and pinned to the input shaft. The lower end of the torsion bar is inserted into the worm, then drilled and pinned to the lower end of the worm, after the valve spool has been centered. The actuator is attached to the upper end of the worm by three helical splines. The valve spool is held on the actuator by a snap ring. The actuator is coarsely splined to the outside diameter of the input shaft. The coarse spline fit between the actuator and input shaft is sufficiently loose to allow upward and downward movement of the actuator and valve spool. As the torsion bar twists, its radial motion is transferred into axial mo-

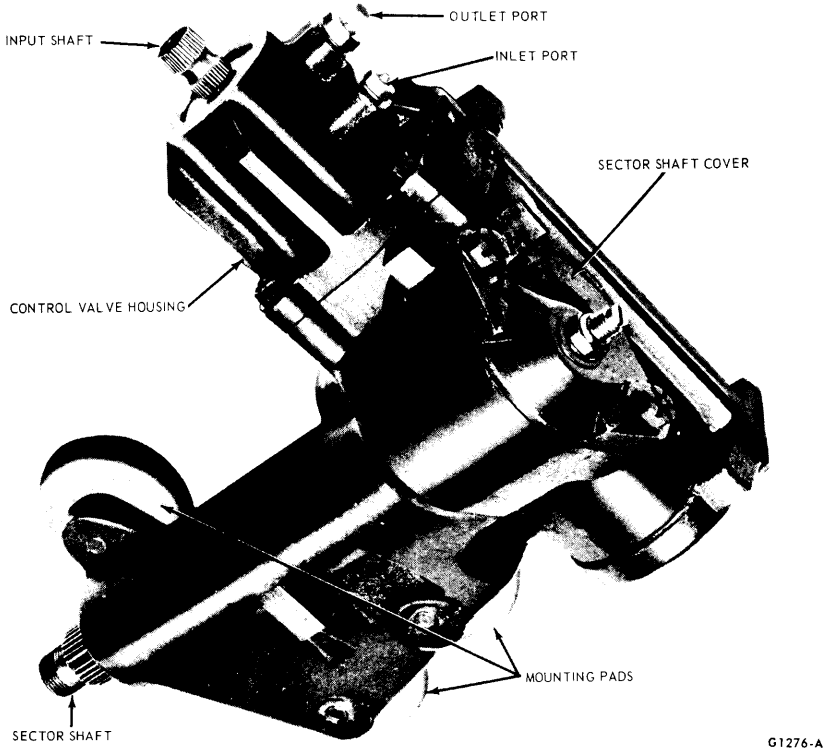

FIG. 1—Steering Gear

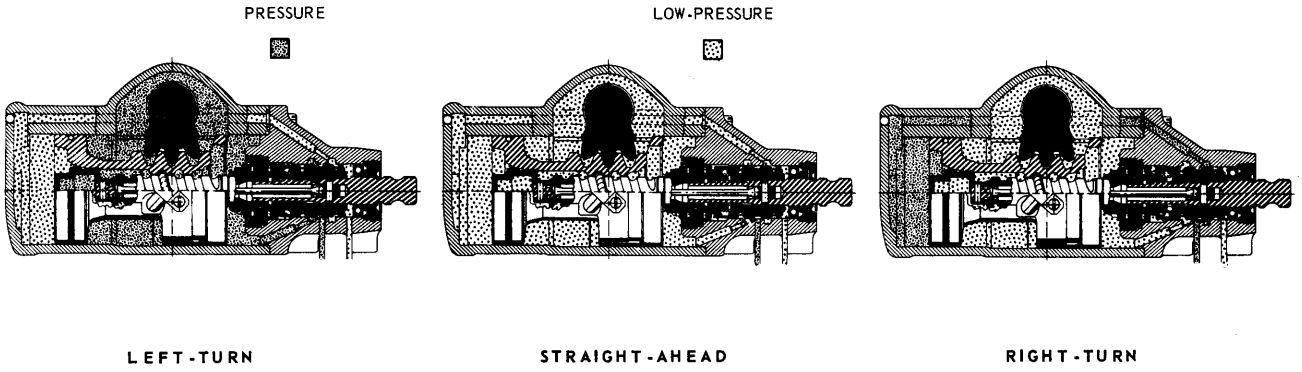

FIG. 2—Power Flows

tion by the three helical threads. Thus, the valve is moved off center, and fluid is directed to one side of the piston or the other.

The resistance of the torsion bar gives the driver a feel of the road, and at the same time the driver is receiving full power assist in steering.

OPERATION

STRAIGHT-AHEAD POSITION (NEUTRAL)

When the power unit is not assisting in the steering effort, the valve spool is in the neutral (straight-ahead) position. The fluid flows from the pump through the inlet port of the steering gear to the center groove and over the lands of the valve, exhausting through holes in the outer grooves to the center of the valve and out the exhaust port to the pump (Fig. 2). Therefore, no area of the valve spool or steering gear is under high pressure in this position. The amount of pressure in neutral position is approximately 150 psi at normal operating temperatures.

RIGHT TURN

When the steering wheel is turned to the right, the piston on the worm resists being turned due to load on the sector shaft from the front end weight of the car. Thus, the torsion bar will start to twist.

For a right turn the valve spool moves up, allowing fluid from the pump to enter against the lower side of the power piston (Fig. 2). The fluid on the upper side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the lower side of the piston, pushing it upward and providing assist in turning of the sector shaft.

LEFT TURN

If the steering wheel is turned to the left, it will cause a similar action but in the opposite direction. The torsion bar twists to the left moving the valve spool downward, allowing fluid from the pump to enter against the upper side of the power piston (Fig. 2). The fluid on the lower side of the piston is free to return through the valve to the pump. Therefore, the power assist is to the upper side of the piston, pushing it downward. The instant the driver stops applying steering effort to the steering wheel the valve spool is returned to its neutral position by the unwinding of the torsion bar.

POWER STEERING PUMP

The power steering pump is a belt driven slipper type pump which is integral with the reservoir. It is constructed so that the reservoir is attached to the rear side of the pump housing front plate and the pump body is incased within the reservoir.

The pump rotor has 8 slippers and

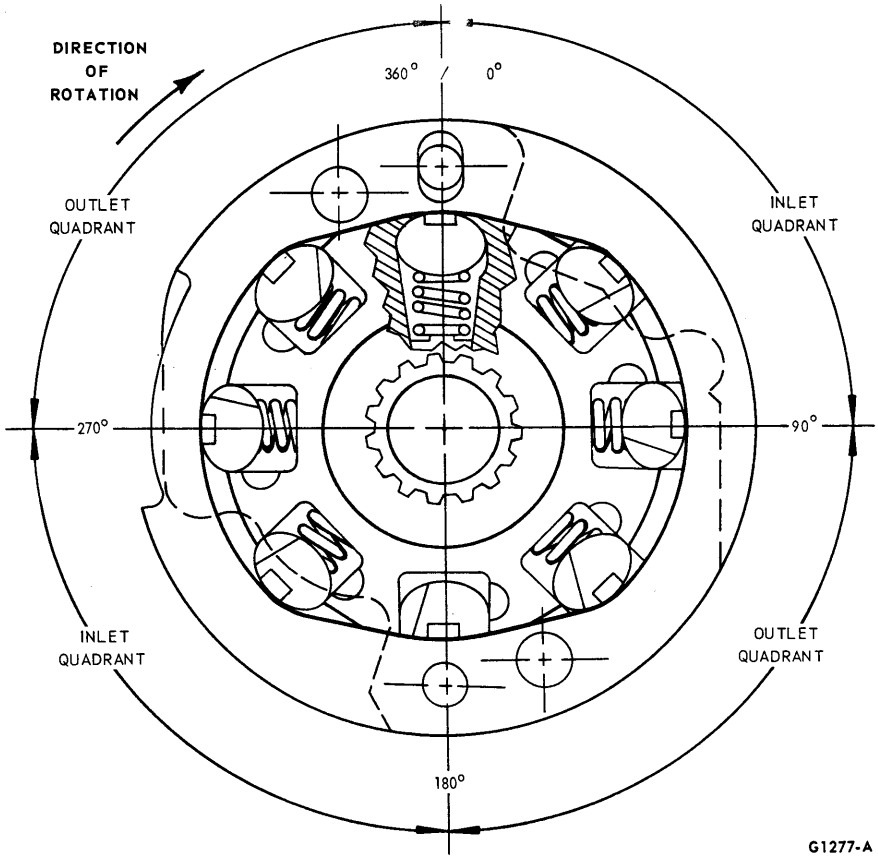

FIG. 3—Power Steering Pump Cycle

springs which rotate inside a cam insert containing two lobes 180° from each other. The cam insert and the pump port plates provide a sealed chamber within which the rotor and slippers rotate between the two lobes for pump operation.

As the rotor turns, the slippers are forced outward against the inner surface of the cam insert by a combination of centrifugal force, slipper spring force and fluid pressure acting on the under side of the slipper. A pair of adjacent slippers, along with the surfaces of the rotor, cam and pressure plates, form a sealed chamber within the crescent-shaped void. As this sealed chamber moves through the crescent shaped void its volume changes, resulting in a pumping action.

As the rotor rotates 90° (Fig. 3), the slipper slides outward in its slot, riding on the cam and the volume of the sealed chamber increases. This creates a vacuum and sets up a suction area. With the inlet port placed in this area, the chamber will fill with fluid. As the rotor rotates 90° to 180°, the volume of the sealed chamber decreases, thus creating a pressure area. The pressure or outlet port is located in this area. While this pumping action is going on between 0° and 180°, the same condition is occurring between 180° and 360°. This combination creates what is known as a balanced rotor pump. The two pressure and suction quadrants are diametrically opposite each other.

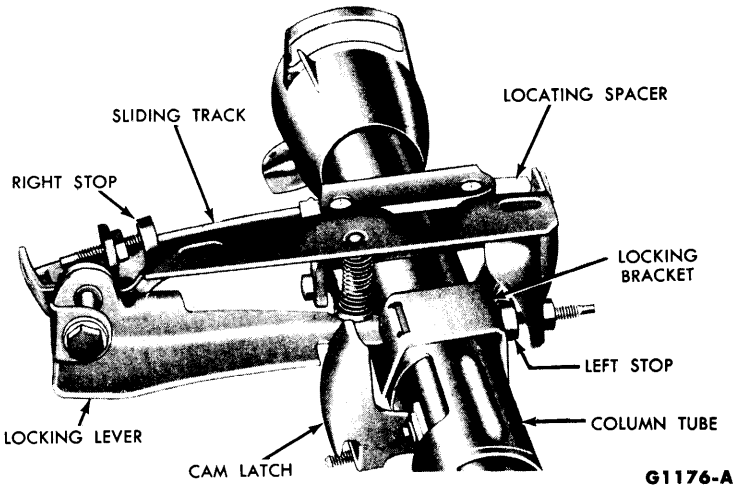

FIG. 5—Movable Steering Column Mechanism

Flow Control Valve. Since the pump is a constant displacement pump, the internal flow will vary directly with the pump speed. However, a power steering gear requires a relatively high constant rate of flow in the parking zone and up to approximately 2800 rpm and thereafter a lower rate of flow. This is accomplished by means of a variable orifice mechanism shown in Fig. 4.

All of the internal pump flow is ported from the pumping mechanism (rotor, slippers, and cam insert) through passage "A" into the flow control zone. All of the flow goes through the orifice and out into the line until the bypass port is cracked open. This is the regulation point. The oil drops in pressure in moving through the orifice. The lower pressure is then sensed through a hole drilled in the cover communicating to the rear of the spool valve. The differential in pressure thus created on the spool valve increases steadily and proportionately with increasing RPM and this moves the valve progressively back into its bore, thus increasing the opening of the bypass port.

The metering pin (Fig. 4) travels with the spool valve decreasing the net area of the orifice at higher speeds. This action reduces flow to the steering gear.

Pressure Relief Valve. When the steering wheel is turned completely to the "stop position" in the right or left turn direction, or in the case of a road load of sufficient magnitude, the steering gear will not accept any flow from the pump, except for a very limited volume of oil due to leakage past valve seals. Because of this resistance, excessive hydraulic pressure would be developed, if it were not limited by the pressure relief valve.

When relief pressure is reached, the pressure relief ball is forced off its seat, allowing oil to pass through

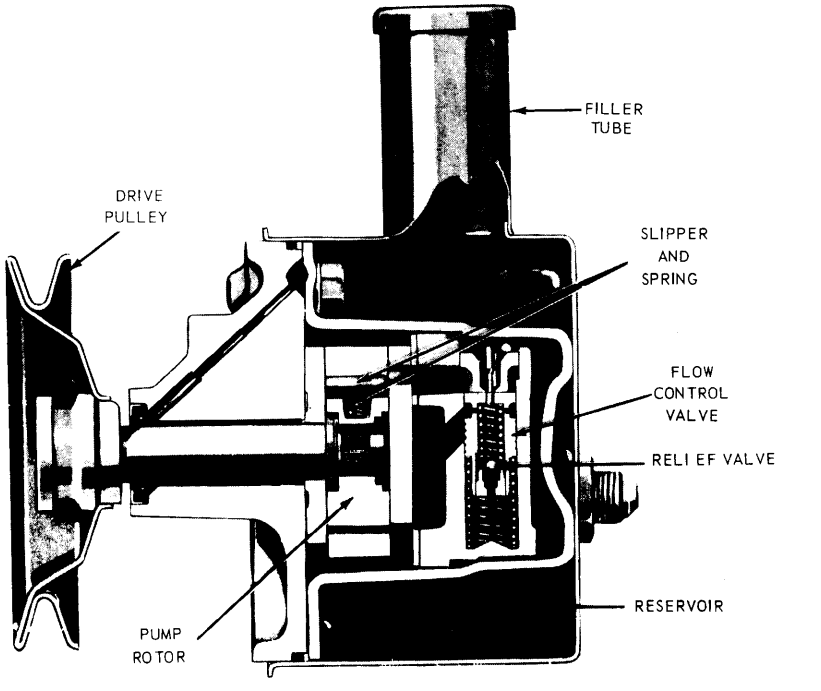

FIG. 4—Flow Control Valve and Pressure Relief Ball

the spool valve and dump into the bypass port (Fig. 4). The relief valve will continue to limit oil pressure to the relief setting for the duration of the overload condition.

MOVABLE STEERING COLUMN

The movable column combines a lateral-movement mechanism (Fig. 5) at the instrument panel with a flexible coupling that attaches to the steering gear input shaft. The steering column lower end pivots on a bracket that is fastened to the dash panel.

With the column in the straight-ahead position and the gear shift lever at any position other than P, the column is locked to the brake pedal support assembly. It is locked by a locking lever controlled by the selector tube. A coil spring provides positive engagement of the locking bracket when the shift lever is at any position other than P.

When the selector lever is moved to park position, a cam latch (fastened to the selector tube) disengages the locking lever from the locking bracket. The steering column assembly may then be moved about 8 inches to the right. Whenever the locking lever is disengaged, and the column is moved over, the transmission cannot be shifted. As the column is moved back to its extreme left (or straight-ahead) position, the locking lever engages the bracket, locking the column and the transmission can be shifted by the selector lever.

2 IN-CAR ADJUSTMENTS AND REPAIRS

VALVE SPOOL CENTERING CHECK

1. Install a 0-2000 psi pressure gauge tool T56L-33610-D in the pressure line between the power steering pump outlet port and the integral steering gear inlet port.

2. **Make sure that the valve on the gauge is in the fully open position.**

3. Check the fluid level in the reservoir and fill it to the proper level with the specified fluid.

4. Start the engine and cycle the steering wheel from stop-to-stop, to bring the steering lubricant up to normal operating temperature. Stop the engine and recheck the reservoir. Add fluid if necessary.

5. With the engine running at approximately 1000 rpm and the steering wheel centered, attach an inch-pound torque wrench to the steering wheel retaining nut. Apply sufficient torque to the torque wrench in each direction, either side of center, to get a gauge reading of 250 psi.

6. The torque reading should be the same in both directions when 250 psi is reached. If the difference between the readings exceed 4 in-lbs, the steering gear must be removed and the valve centering shim removed from the valve housing and a thicker or thinner shim installed. Only one shim to be used.

The **"out of car"** procedure for valve centering check is the same as for "in car" except the torque and simultaneous pressure reading must be made at the right and left stops instead of either side of center.

STEERING GEAR ADJUSTMENTS

During the breaking-in period of the car, it is probable that some of the factory adjustments will change. These changes in adjustment do not necessarily affect the satisfactory operation of the steering gear assembly, and therefore ordinarily do not require readjustment unless there is excessive lash or other malfunctioning.

ADJUSTMENT IN CAR

Preload (thrust bearing adjustment) and worm to rack preload cannot be changed in service. (The only adjustment which can be performed is the total over center position load, to eliminate excessive lash between the sector and rack teeth.)

1. Disconnect the pitman arm from the sector shaft.

2. Disconnect the fluid return line at the reservoir, at the same time cap the reservoir return line pipe.

3. Place the end of the return line in a clean container and cycle the steering wheel in both directions as required, to discharge the fluid from the gear.

4. Remove the ornamental cover from the steering wheel hub and turn the steering wheel to 45° from the left stop.

5. Using an inch-pound torque wrench on the steering wheel nut, determine the torque required to rotate the shaft slowly through an approximately ⅛ turn from the 45° position.

6. Turn the steering gear back to center, then determine the torque required to rotate the shaft back and forth across the center position. Loosen the adjuster nut, and turn the adjuster screw (Fig. 6) in until a reading of 11-12 in. lbs. greater than the torque 45° from the stop is obtained.

Retighten the lock nut while holding the screw in place.

7. Recheck the readings and replace pitman arm and steering wheel hub cover.

8. Connect the fluid return line to the reservoir and fill the reservoir with specified lubricant to the proper level.

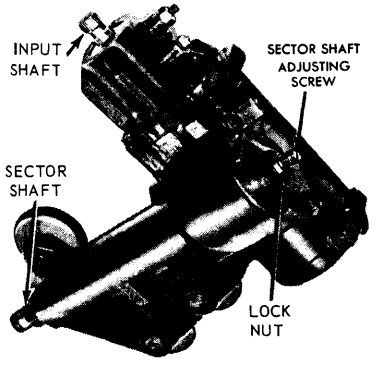

FIG. 6—Adjusting Mesh Load

PUMP BELT TENSION ADJUSTMENT

Pump drive belt tension cannot be checked accurately using the thumb pressure or belt deflection methods. Correct belt adjustment is assured only with the use of a belt tension gauge.

1. Check the belt tension with a belt tension gauge tool T63L-8620-A. With a new belt, or one that has been run for less than 15 minutes, the tension should be within 120-150 lbs. With a belt that has been run for more than 15 minutes, the tension should be within 90-120 lbs.

2. To adjust the belt, loosen the mounting bolts incorporated on the

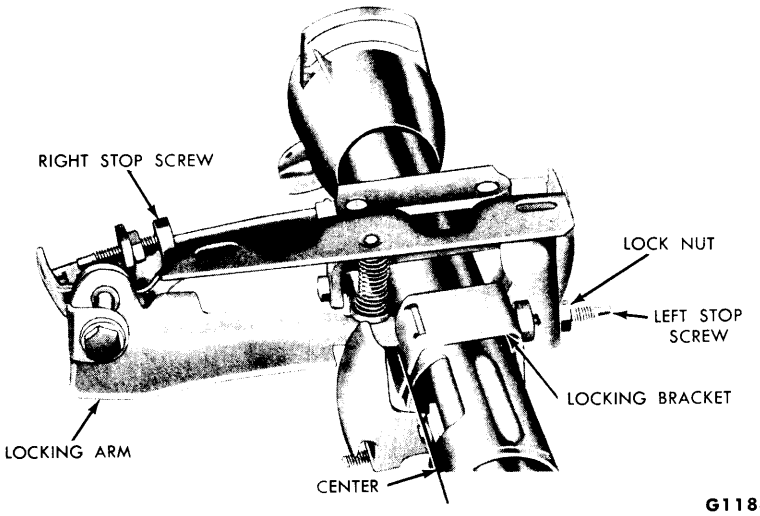

FIG. 7–Steering Column Stop Adjustments

front face of the pump cover plate (hub side) and one nut at the rear. Fix a 9/16" open end wrench on the projecting ½" boss on the cover plate and pry upward to correct tension.

Do not pry against the reservoir to obtain proper belt load as it can be deformed and cause a leak.

3. Recheck the belt tension. When the tension has been correctly adjusted, tighten the bolts and the nut to 30-40 ft-lbs torque.

MOVABLE COLUMN

STOP ADJUSTMENTS

1. Remove the instrument panel extension and the radio access panel.
2. Loosen the left stop screw lock nut.
3. Adjust the stop screw as required to center the locking arm on the locking bracket (Fig. 7).
4. Tighten the stop screw lock nut.
5. Move the column to the extreme right and observe for interference at the instrument panel, or air conditioner if so equipped.
6. If an interference is noted, loosen the lock nut on the stop screw at the right side of the track. Thread the screw inward as required to shorten the travel and eliminate the interference. Tighten the stop screw lock nut.

LOCK MECHANISM

1. Place the selector lever in the P (Park) position. Note the position of the locking arm.
2. If interference is noted, loosen the cam latch screw lock nut (Fig. 8).
3. Turn the screw (Fig. 8) in or out as required to provide clearance between the locking arm and bracket and also at the cam latch.
4. Tighten the cam latch screw lock nut.
5. If adjusting the cam latch screw does not correct the trouble, fabricate a gauge as shown in Fig. 9 and remove the column from the car and adjust the cam latch as shown in (Fig. 10).

SLIDE FRICTION

1. Remove the two column-to-sliding track attaching bolts.
2. Connect a pull scale to the track and check the sliding effort as shown in Fig. 11.
3. To adjust the sliding effort, loosen the two lock nuts shown in Fig. 11. Tighten or loosen the two Allen head adjustment bolts as required to obtain a 10 lb. pull.
4. Tighten the two lock nuts. Recheck the pull effort.
5. Install the spacer shown in Fig. 18. Secure the column to the track with the two attaching bolts. Be careful when tightening the two column attaching bolts so as not to create a bind in the track.
6. Remove the nylon locating spacer from the track.

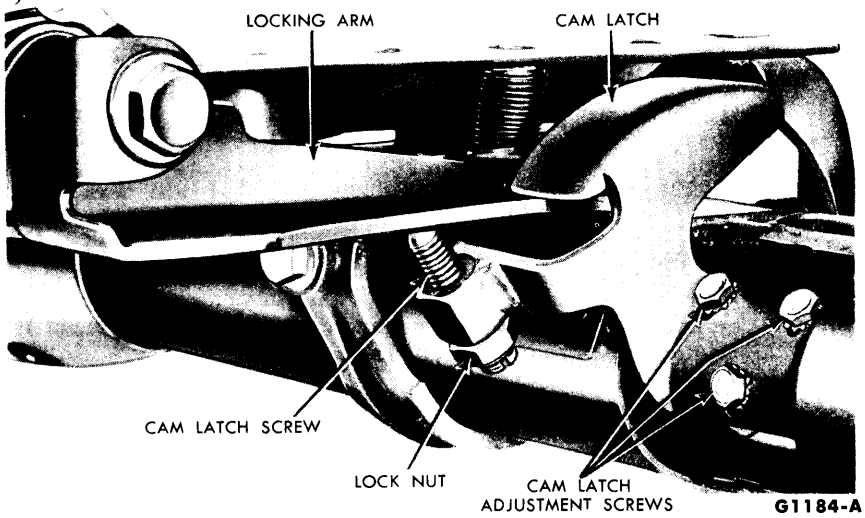

FIG. 8–Steering Column Locking Mechanism

3 REMOVAL AND INSTALLATION

STEERING GEAR REPLACEMENT

REMOVAL

1. Disconnect the pressure and the return line from the steering gear. Cap each line and plug each port in the gear to prevent the entry of dirt.
2. Remove the bolt that secures the flex joint to the steering gear. Loosen the bolt that attaches the flex joint to the steering shaft.

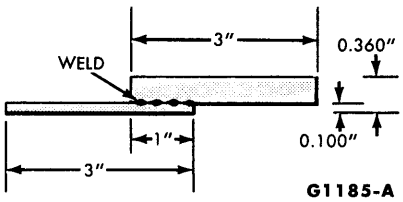

FIG. 9—Cam Latch Guage (Fabricated)

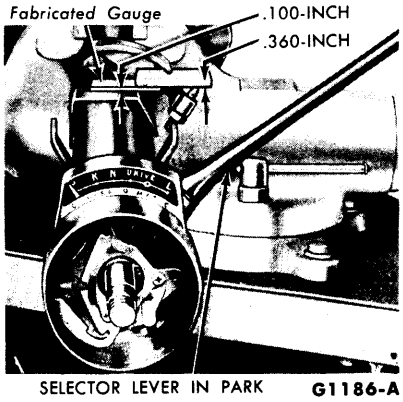

FIG. 10—Adjusting Cam Latch

3. With a pry bar, carefully loosen the flex joint from the steering shaft.

4. Remove the two bolts that secure the left strut to the underside of the car and remove the strut.

5. Remove the nut and lock washer that secures the Pitman arm to the sector shaft. Remove the Pitman arms as shown in Fig. 12.

6. Remove the three bolts that attach the steering gear to the side rail and remove the gear.

7. Remove the three mounting pads from the gear as shown in Fig. 13.

INSTALLATION

1. Install the three mounting pads on the steering gear as shown in Fig. 13 and torque them to specifications.

2. Position the flex joint on the gear.

3. Align the flat spot on the flex joint with the one on the steering shaft then slide the gear into place on the side rail. Install the three gear to side rail attaching bolts and tighten to specifications.

4. Position the Pitman arm on the sector shaft and secure it with nut and lock washer. Tighten the nut to specifications.

5. Hold the left strut in position and install the two attaching bolts. Torque the bolts to specifications.

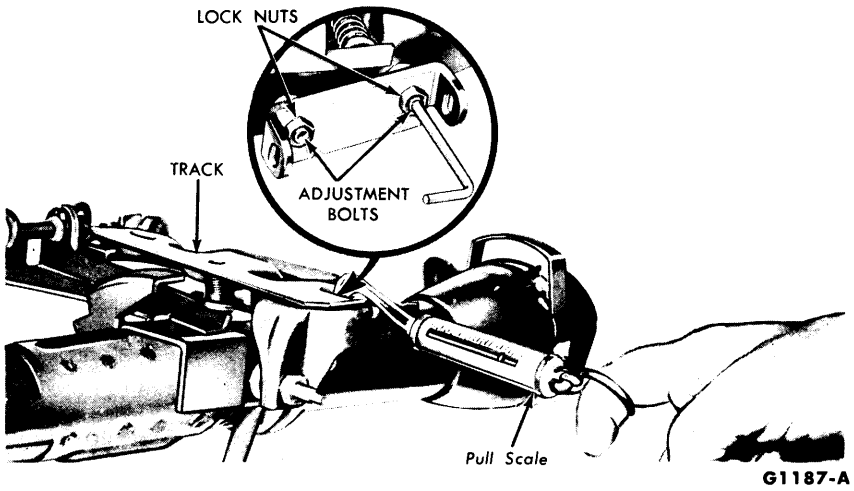

FIG. 11—Checking Track Sliding Effort

6. Install the flex joint-to-steering shaft attaching bolt. Tighten both flex joint attaching bolts to specification.

7. Remove the plugs from the gear ports and the caps from the lines. Connect the pressure line and the return line to the steering gear.

8. Fill the reservoir to the proper level with the specified fluid.

9. Start the engine and cycle the system to bleed the system.

10. Recheck the fluid level and fill the system as required.

POWER STEERING PUMP

1. Remove the power steering fluid from the pump reservoir by disconnecting the fluid return line at the reservoir, and allow the fluid to drain into a suitable container.

2. Disconnect the pressure line from the pump.

3. Remove 1 nut and 3 bolts attaching the pump to the mounting bracket; disconnect the belt from the pulley and remove the pump from the car.

4. Position the pump to the mounting bracket and install the 3 bolts and 1 nut.

5. Place the belt on the pulley and adjust the belt tension (Section 2) with Tool T63L-8620-A and tighten the bolts and nut to specifications.

6. Connect the pressure line to the pump fitting and tighten the retaining nut.

7. Place a new clamp on the return hose and connect the hose to the pump. Then, tighten the clamp.

8. Fill the power steering pump reservoir with transmission fluid C1AZ-19582-A and cycle the system to remove air from the steering gear, wiper motor, and lines.

9. Check for leaks and again check the fluid level. Add fluid as necessary.

STEERING WHEEL REPLACEMENT

1. Remove the hub cap from the steering wheel.

2. Remove the steering wheel nut, and then remove the steering wheel with a puller as shown in Fig. 14.

3. Transfer all serviceable parts to the new steering wheel.

4. Position the steering wheel on the shaft so that the alignment mark on the hub of the wheel is adjacent to the one on the shaft. Install and torque the nut to specification. Stake the nut securely.

5. Install the hub cap.

UPPER STEERING SHAFT BEARING REPLACEMENT

1. Remove the steering wheel and the upper bearing spring.

2. Remove the turn signal lever from the switch.

3. Remove the three turn signal clamp attaching screws.

4. Remove the three bearing retainer attaching screws and remove the retainer (Fig. 15).

5. Carefully lift the turn signal switch from the column. Use care to move the attaching wires only enough for the switch to clear the shaft.

6. Working from the engine compartment, disconnect the upper steer-

FIG. 12–Removing Pitman Arm

ing shaft from the flexible coupling.

7. Lift the upper shaft and bearing from the column.

8. Remove the C ring from the upper end of the shaft and press the bearing off the shaft. Remove the rubber insulator from the bearing.

9. Slide a new bearing onto the upper end of the shaft until it contacts the C-ring. Install a new C-ring above the bearing.

Install the rubber insulator on the bearing outer race.

10. Install the shaft and bearing in the column making sure that the lower end of the shaft enters the flexible coupling in the engine compartment and that the bearing is seated in the bore.

11. Secure the upper shaft to the flexible coupling.

12. Position the turn signal switch and the bearing retainer in the column and install the three attaching screws.

13. Pull the turn signal wires from the lower end of the column just enough to remove all slack. Install the thru wire retaining clips.

14. Install the turn signal lever.

15. Install the upper bearing spring and the steering wheel.

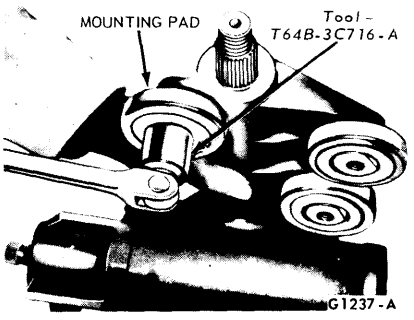

FIG. 13–Removing or Installing Steering Gear Mounting Pads

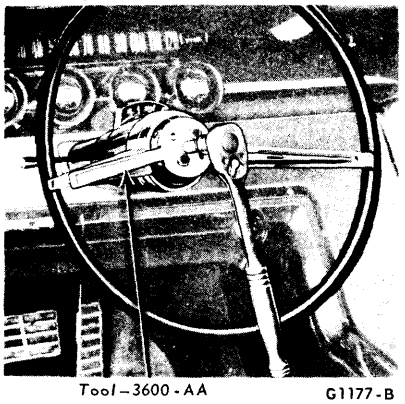

FIG. 14–Removing Steering Wheel

SHIFT TUBE AND LEVER REPLACEMENT

REMOVAL

1. Disconnect the ground cable from the battery.

2. Working from under the hood, remove the two steering column tube bracket attaching bolts (Fig. 16).

3. Disconnect the shift rod from the selector lever at the lower end of the steering column.

4. Remove the bolt that secures the steering shaft to the flexible coupling.

5. Remove the steering wheel, the turn signal switch retainer, and the turn signal lever.

6. Carefully lift the turn signal switch off the steering column.

7. Pull the steering shaft assembly out of the steering column.

8. Remove the moulding cap, finish panel extension, console rear panel, rear panel moulding, left side moulding and the two lower edge mouldings (Fig. 16) from the left side of the console.

9. Remove the lower edge moulding retainers.

10. Remove the radio access cover.

11. Remove the headlamp switch and bezel from the instrument panel.

12. Remove the instrument panel moulding cover attaching screws and cover from the panel.

13. Remove the instrument panel finish panel attaching screws and remove the finish panel.

14. Remove the dust boot retainer-to-dash attaching bolts.

15. Disconnect the turn signal wires at the connector.

16. Disconnect the two wires and the two vacuum hoses from the neutral safety switch.

17. Remove the two steering column-to-track attaching bolts.

18. Remove the lower half of the cover at the column by pulling down and remove the two screws that attach the clamp retaining the doors to the column.

19. Remove the clip that secures the two door actuating levers to the pivot bracket (Fig. 16). Carefully remove the doors from the column.

20. Remove the two bolts that secure the pivot bracket to the instrument panel and remove the bracket.

21. Remove the three screws that secure the locking cam to the selector lever tube (Fig. 17) and remove the cam.

22. Remove the two neutral switch attaching screws and remove the switch.

23. Lift the column part way out of the instrument panel and remove

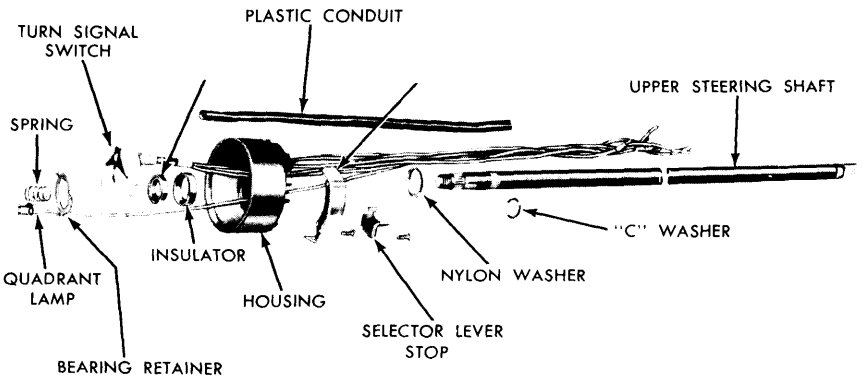

FIG. 15–Upper Steering Shaft Disassembled

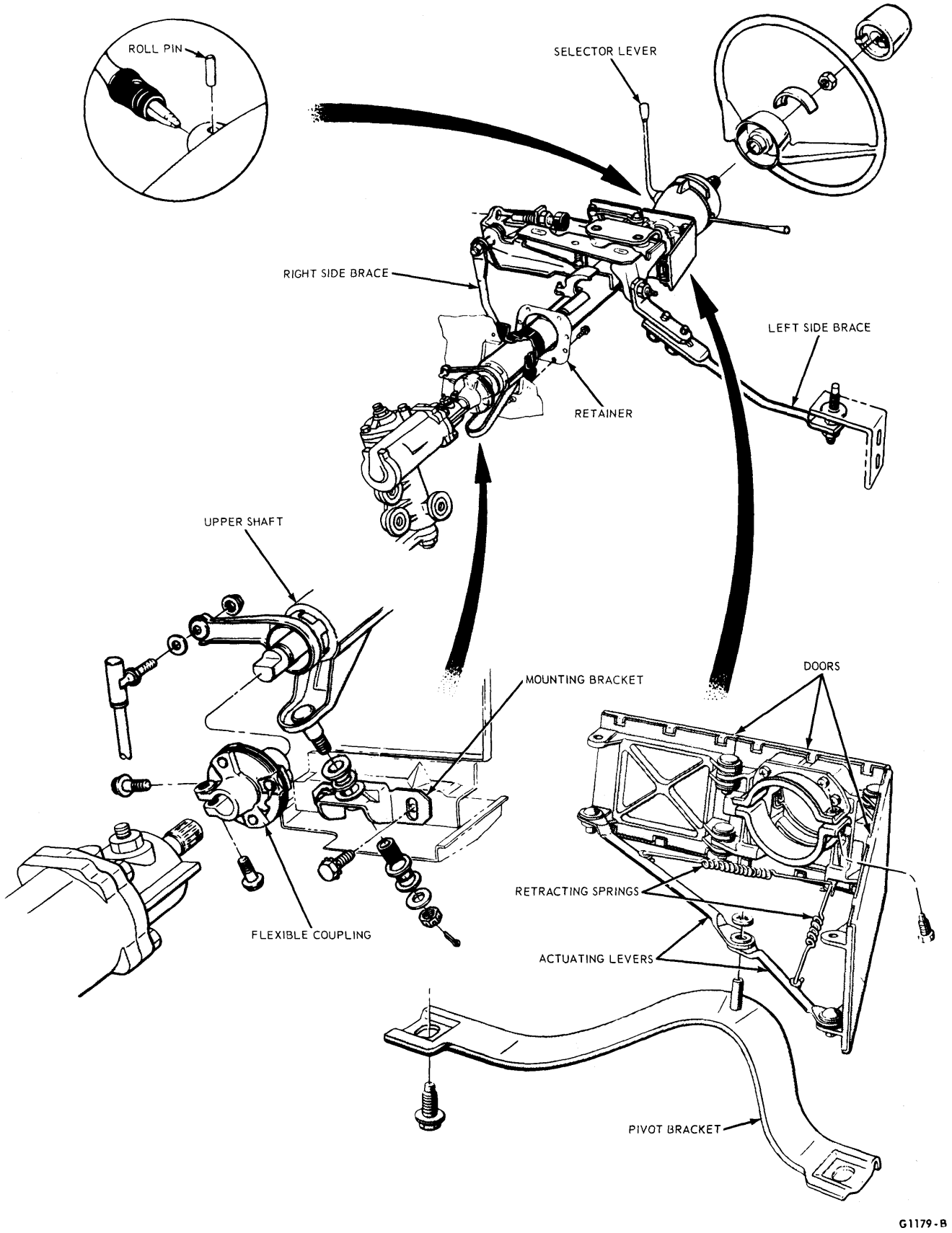

FIG. 16—Movable Steering Column Installation

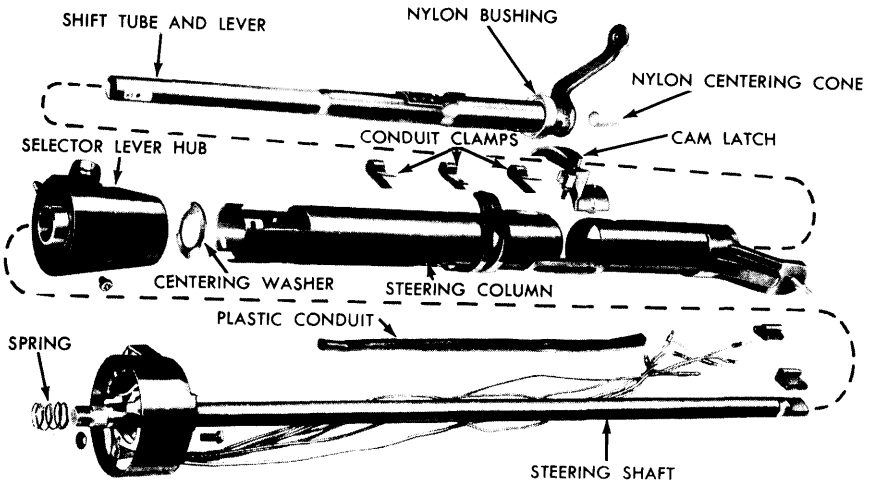

FIG. 17—Steering Column Disassembled

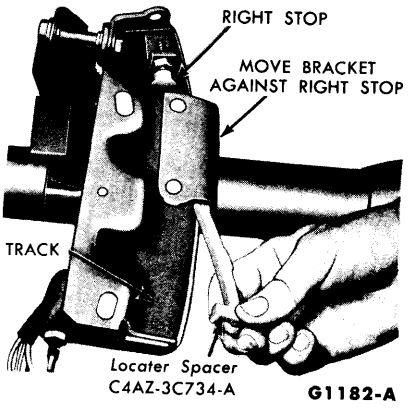

FIG. 18—Removing or Installing Locater Spacer

the dust boot retainer from the lower end of the column. Remove the column from the instrument panel.

24. Remove the selector lever roll pin, then remove the lever.

25. Remove the neutral switch stop attaching screws and remove the stop from the shift tube.

26. Remove the screw that attaches the shift lever tube to the hub.

27. Slip the shift tube and lever from the lower end of the column.

28. Spread the nylon bushing enough to clear the neutral switch mounting pad then remove it from the tube. Pull the nylon centering cone from the lower end of the tube with pliers.

INSTALLATION

1. Work the plastic centering cone into the lower end of the shift lever tube making sure that the taper is toward the bottom of the tube.

2. Slide the nylon bushing to the lower end of the tube spreading only enough to provide clearance at the neutral safety switch mounting pad.

3. Slide the shift tube and lever into the lower end of the column until the upper end enters the selector lever hub and the molded stop is in the slot in the tube.

4. Secure the shift tube to the selector lever hub with the attaching screw (Fig. 17).

5. Secure the neutral switch stop to the shift tube with the attaching screws.

6. Position the selector lever in the hub and secure it with a roll pin. Install the nylon locating spacer on the track (Fig. 18).

7. Enter the lower end of the column in the instrument panel opening and install the dust boot retainer on the column. Continue to lower the steering column until the mounting bracket is on the engine compartment side of the dash panel.

8. Install, but do not tighten the bracket attaching bolts.

9. Secure the column to the track with the two attaching bolts. Tighten the bracket-to-dash attaching bolts at this time.

10. Secure the cam latch to the shift tube with the attaching screws.

11. Secure the neutral safety switch to the shift tube. Connect the neutral safety switch wires and the two vacuum hoses to the switch.

12. Connect the turn signal wires at the connector.

13. Secure the dust boot and retainer to the dash with the attaching bolts.

14. Secure the column door pivot bracket to the lower end of the instrument panel.

15. Position the doors on the steering column tube and install the clamp, but do not tighten the screws. Install the lower cover at the column.

16. Secure the two door actuating levers to the pivot bracket with the pin, washers and the retainer.

17. Slide the doors to approximately 3/16 inch from the instrument panel. Move the column to the side slowly and observe the operation of the door. It should be moved as close as possible to the instrument panel and still have clearance through the full movement. Tighten the two screws and install the two retracting springs (Fig. 16). The pivot bracket can be adjusted from side to side and fore and aft to make the doors parallel with the instrument panel.

18. Install the instrument panel finish panel.

19. Install the instrument panel moulding cover.

20. Install the headlamp switch on the instrument panel.

21. Install the radio access cover on the left side of the console and instrument panel.

22. Install the lower edge moulding retainers.

23. Install the two lower edge mouldings, left side moulding, rear panel moulding, console rear panel finish panel extension and the moulding cap.

24. Place the steering shaft assembly in the steering column making sure that the lower end enters the flexible coupling.

25. Place the turn signal switch over the shaft and secure it with the retainer and attaching screws.

26. Install the steering wheel.

27. Install the flexible coupling-to-steering shaft attaching bolt.

28. Connect the transmission shift rod to the shift lever.

29. Connect the battery ground cable to the battery.

30. Adjust the steering column and the neutral safety switch as required.

4 MAJOR REPAIR OPERATIONS

STEERING GEAR

DISASSEMBLY

In most cases, complete disassembly of the power steering unit will not be necessary. It is suggested that only those assemblies that are faulty be disassembled. Disassembly and reassembly of the unit and the subassemblies must be made on a clean workbench. As in repairing any hydraulically operated unit, cleanliness is of utmost importance. Therefore, the bench, tools, and parts must be kept clean at all times. Thoroughly clean the exterior of the unit with a suitable solvent and, when necessary, drain as much of the hydraulic oil as possible. Handle all parts very carefully to avoid nicks, burrs, scratches and dirt, which could make the parts unfit for use.

1. Remove the three mounting pads from the housing (Fig. 13).
2. Hold the steering gear over a drain pan in an inverted position and cycle the input shaft six times to drain the remaining fluid from the gear.
3. Mount the gear in a soft jawed vise.
4. Remove the teflon lock nut and the brass washer from the adjusting screw.

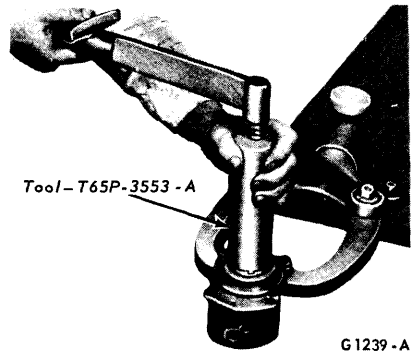

FIG. 20—Removing or Installing Lock Nut

5. Turn the input shaft to either stop then, turn it back approximately 1¾ turns to center the gear.
6. Remove the two sector shaft cover attaching screws and the identification tag.
7. Tap the lower end of the sector shaft with a soft-faced hammer to loosen it then, lift the cover and shaft from the housing as an assembly. Discard the O - ring.
8. Turn the sector shaft cover counterclockwise off the adjuster screw.
9. Remove the four valve housing attaching bolts. Lift the valve housing from the steering gear housing while holding the piston to prevent it from rotating off the worm shaft. Remove the valve housing and the lube passage O-rings and discard them.
10. Stand the valve body and piston on end with the piston end down. Rotate the input shaft counterclockwise out of the piston allowing the ball bearings to drop into the piston.
11. Place a cloth over the open end of the piston and turn it upside down to remove the balls.
12. Remove the two screws that attach the ball guide clamp (Fig. 19) to the ball nut and remove the clamp and the guides.
13. Install valve body assembly in holding fixture (do not clamp in vise) and remove the lock nut and the retaining nut as shown in Fig. 20.
14. Carefully slide the worm and valve assembly out of the valve housing.
15. Remove the shim from the valve housing bore.

PARTS REPAIR OR REPLACEMENT

Valve Housing.

1. Remove the dust seal (Fig. 21) from the rear of the valve housing

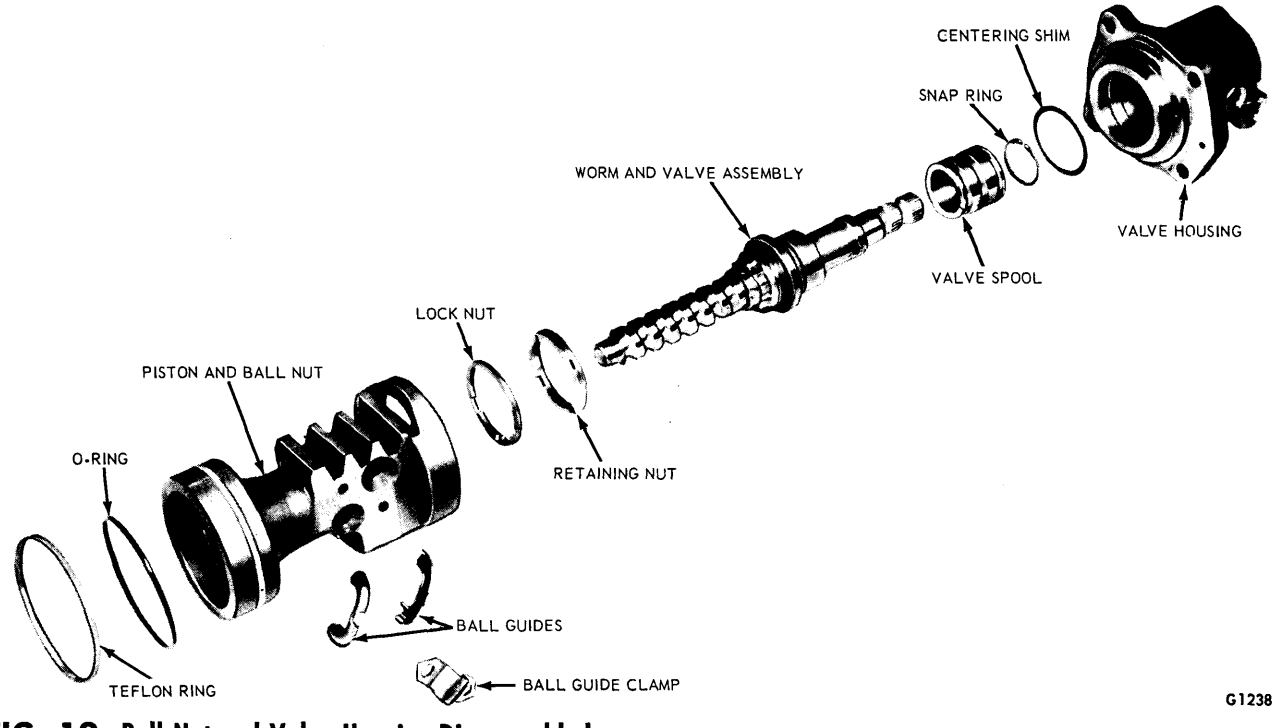

FIG. 19—Ball Nut and Valve Housing Diasssembled

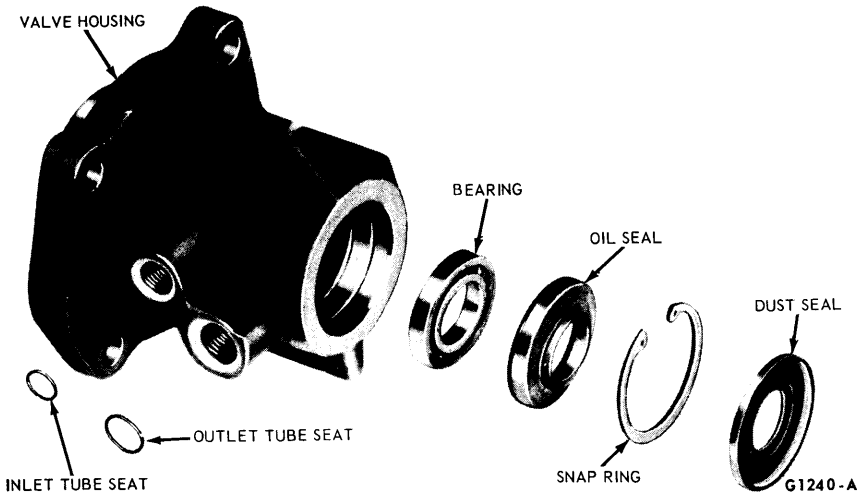

FIG. 21—Valve Housing Disassembled

with Tool T59L-100-B and T58L-101-A.

2. Remove the snap ring from the valve housing.

3. Turn the fixture to place the valve housing in an inverted position.

4. Insert special tool in the valve body assembly, opposite the seal end and gently tap the bearing and seal out of the housing as shown in Fig. 22. Discard the seal. Caution must be exercised when inserting and removing the tool to prevent damage to the valve bore in the housing.

5. Remove the oil inlet and outlet tube seats with an EZ-out if they are damaged.

6. Coat the oil inlet and outlet tube seats with vaseline and position them in the housing. Install and tighten the tube nuts to press the seats to the proper location.

7. Coat the bearing and seal surface of the housing with a film of vaseline.

8. Position the bearing in the valve housing. Seat the bearing in the housing with the tool shown in Fig. 23.

9. Dip the new oil seal in gear lubricant then place it in the housing with the metal side of the seal facing outward. Drive the seal into the housing until the outer edge of seal does not quite clear the snap ring groove (Fig. 24).

10. Place the snap ring in the housing, then drive on the ring with the tool shown in Fig. 24 until the snap ring seats in its groove to properly locate the seal.

11. Place the dust seal in the housing with the dished side (rubber side) facing out. Drive the dust seal into place with the tool shown in Fig. 24. The seal must be located behind the undercut in the input shaft when it is installed.

Worm and Valve.

1. Remove the snap ring from the end of the actuator.

2. Slide the control valve spool (Fig. 19) off the actuator.

3. Install valve spool evenly and slowly with a slight oscillating motion into flanged end of valve housing with valve identification groove between the valve spool lands outward, checking for freedom of valve movement within housing working area. Valve spool should enter housing bore freely and fall by its own weight.

4. If valve spool is not free, check for burrs at the outward edges of the working lands in the housing and remove with a hard stone.

5. Check valve for burrs and if burrs are found, stone valve in a **radial direction only.** Check for freedom of valve again.

6. Remove valve spool from housing.

7. Slide the spool onto the actuator making sure that the groove in the spool annulus is toward the worm.

8. Install the snap ring to retain the spool.

9. Check the clearance between the spool and the snap ring. The clearance should be between 0.002-0.005 inch. If the clearance is not within these limits, select a snap ring that will allow a clearance of 0.003 inch.

Piston and Ball Nut.

1. Remove the teflon ring and the O-ring (Fig. 19) from the piston and ball nut.

2. Dip a new O-ring in gear lubricant and install it on the piston and ball nut.

3. Install a new teflon ring on the piston and ball nut being careful not to stretch it any more than necessary.

STEERING GEAR HOUSING DISASSEMBLY

1. Remove the snap ring and the spacer washer (Fig. 25) from the

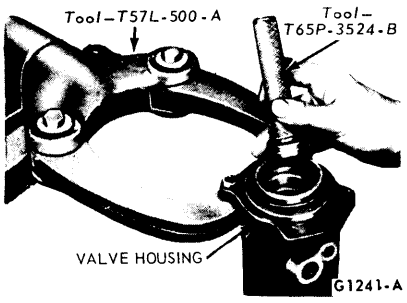

FIG. 22—Removing Bearing and Oil Seal

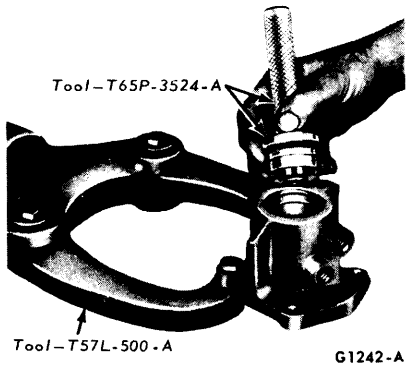

FIG. 23—Installing Valve Housing Bearing

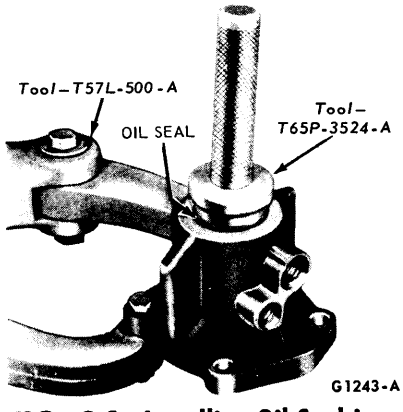

FIG. 24—Installing Oil Seal in Valve Housing

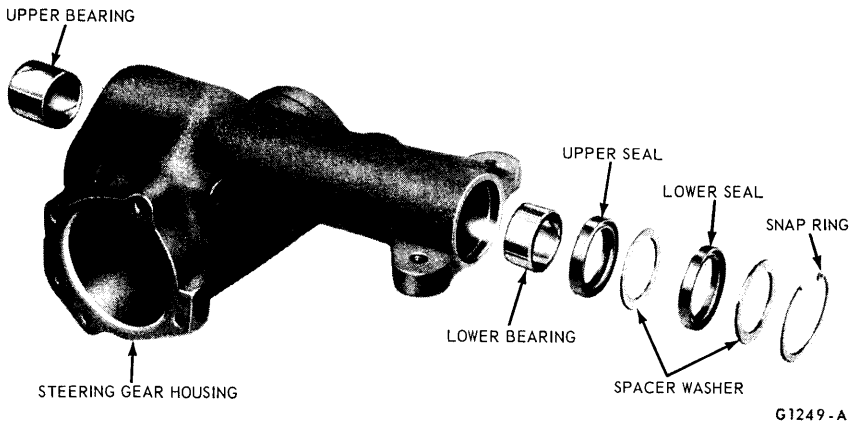

FIG. 25—Steering Gear Housing Disassembled

lower end of the steering gear housing.

2. Remove the outer seal from the housing as shown in Fig. 26. Lift the spacer washer from the housing.

3. Remove the upper seal in the same manner as the lower seal.

4. Place the steering gear housing on blocks in a press as shown in Fig. 27 and press the upper and the lower bushing from the housing if worn or defective. Make sure that the blocks are positioned to clear the tool as it passes through the housing.

5. Press the upper bushing into place with the tools shown in Fig. 28.

6. Press the lower bushing into place with the tools shown in Fig. 29.

7. Dip both sector shaft seals in gear lubricant.

8. Position the sector shaft inner seal (widest seal) into the housing with the lip facing inward. Place a spacer washer (Fig. 25) on top of it. Press the seal into place with the tool shown in Fig. 30.

9. Place the outer seal in the housing with the lip facing inward. Place a spacer washer on top of it and press it into place as shown in Fig. 31.

10. Position the snap ring in the housing. Press the snap ring into the housing with the tool shown in Fig. 30 to properly locate the seals and engage the snap ring in the groove.

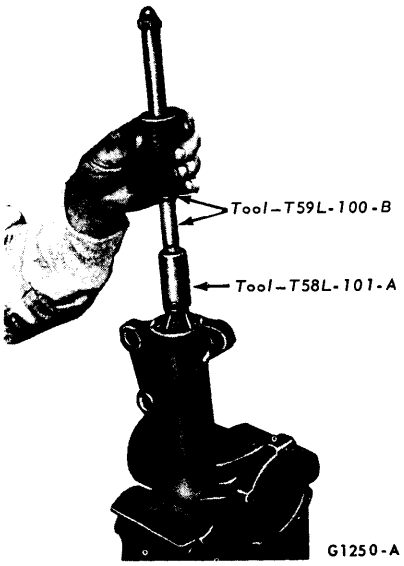

FIG. 26—Removing Outer Seal

ASSEMBLY

1. Mount the valve housing in the holding fixture with the flanged end up.

2. Place the required thickness valve spool centering shim (Fig. 19) in the housing. **Use one shim only.**

3. Carefully install the worm and valve in the housing.

4. Install the retaining nut in the housing and torque it to 55-65 ft. lbs. (Fig. 20).

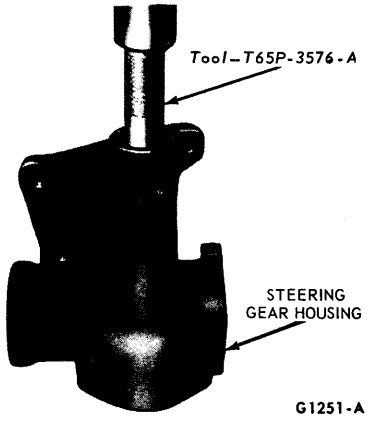

FIG. 27—Removing Steering Gear Housing Upper and Lower Bushings

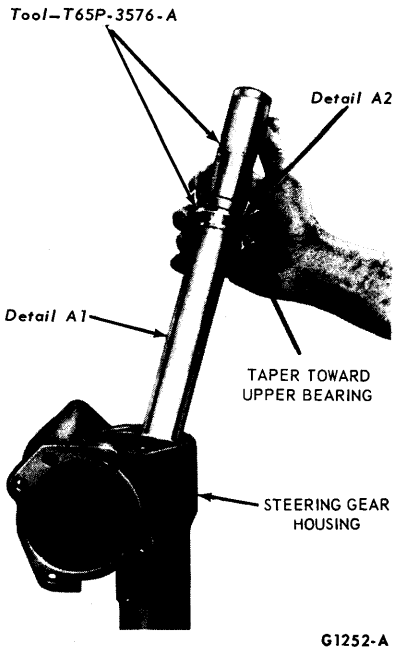

FIG. 28—Installing Upper Bushing In Steering Gear Housing

5. Install the lock nut and tighten it to 20-30 ft. lbs. torque.

6. Place the piston on the bench with the ball guide holes facing up. Insert the worm shaft into the piston so that the first groove is in alignment with the hole nearest to the center of the piston (Fig. 32).

7. Place the ball guide in the piston. Place the 27 balls in the ball

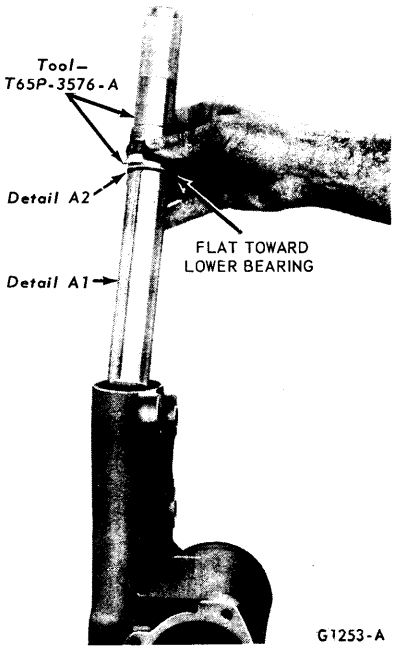

FIG. 29—Installing Lower Bushing In Steering Gear Housing

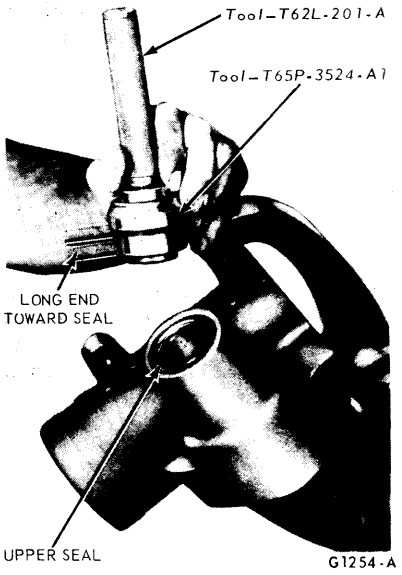

FIG. 30—Installing Sector Shaft Inner Seal

guide (Fig. 32) turning the worm in a clockwise direction as viewed from the input end of the shaft. If all of the balls have not been fed into the guide upon reaching the right stop, rotate the input shaft in one direction and then in the other while installing the balls. After the balls have been installed, do not rotate the input shaft or the piston more than 3½ turns off the right stop to prevent the balls from falling out of the circuit.

8. Secure the guides in the ball nut with the clamp (Fig. 19).

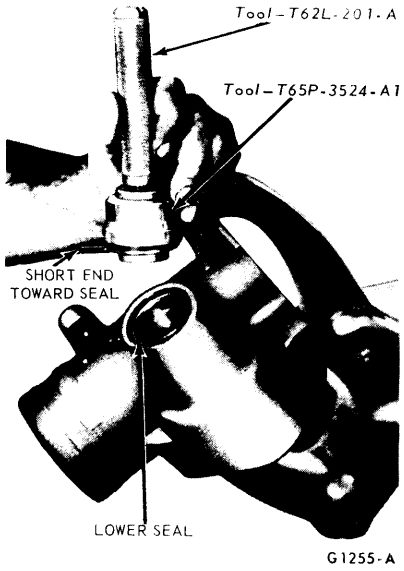

FIG. 31—Installing Sector Shaft Outer Seal

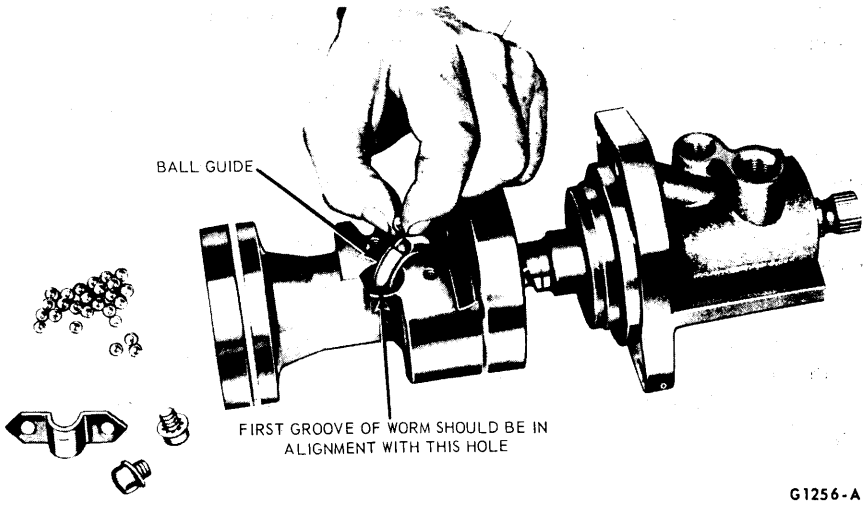

FIG. 32—Assembling Piston on Worm Shaft

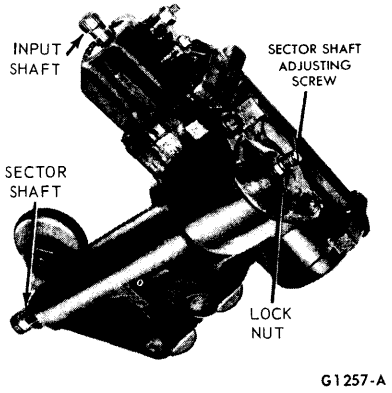

FIG. 33—Adjusting Mesh Load

9. Position a new lube passage O-ring in the counterbore of the gear housing.

10. Apply vaseline to the teflon seal on the piston.

11. Place a new O-ring on the valve housing.

12. Slide the piston and valve into the gear housing being careful not to damage the teflon seal.

13. Align the lube passage in the valve housing with the one in the gear housing, and install but do not tighten the attaching bolts.

14. Rotate the ball nut so that the teeth are in the same plane as the sector teeth. Tighten the four valve housing attaching bolts to specifications.

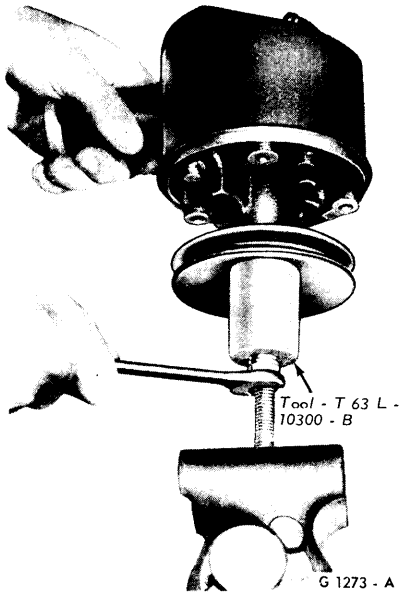

FIG. 34—Removing Power Steering Pump Pulley

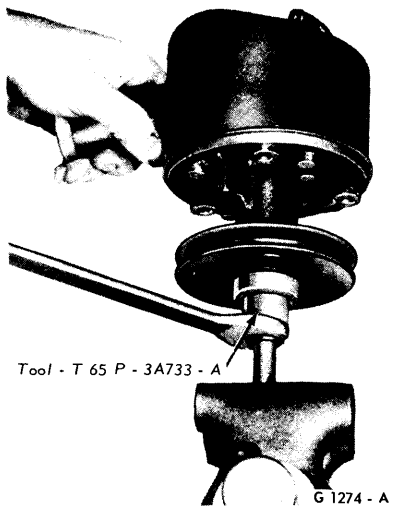

FIG. 35—Installing Power Steering Pump Pulley

15. Position the sector shaft cover O-ring in the steering gear housing. Turn the input shaft as required to center the piston.

16. Position the sector shaft and cover assembly in the gear housing. Install the steering identification tag and the two sector shaft cover attaching bolts. Torque the bolts to specifications.

17. Attach an in-lb torque wrench to the input shaft. Adjust the mesh load to specifications as shown in Fig. 33.

POWER STEERING PUMP PULLEY

REMOVAL

Other than pulley removal, pump should not be disassembled for any repairs but replaced as a unit.

1. Drain as much of the fluid as possible from the pump through filler pipe.

2. Install the pulley remover tool, T63L-10300-B on pulley hub, and place the tool and pump in a vise as shown in Fig. 6.

3. Hold the pump and rotate the tool nut counterclockwise to remove the pulley (Fig. 34). **The pulley must be removed without in and out pressure on the pump shaft to prevent damage to internal thrust areas.**

INSTALLATION

1. Position the pulley to the pump shaft and install Tool T65P-3A733-A as shown in Fig. 35.

2. Hold the pump and rotate the tool nut clockwise to install the pulley on the shaft. The pulley face will be flush with end of pump shaft. **Install the pulley without in and out pressure on the shaft to prevent damage to internal thrust areas.**

3. Remove the tool.

PART 3-4 WHEELS AND TIRES

1 DESCRIPTION AND OPERATION

FRONT WHEEL

Each front wheel and tire assembly is bolted to its respective front hub and rotor assembly. Two opposed tapered roller bearings are installed in each hub. A grease retainer is installed at the inner end of the hub to prevent lubricant from leaking on the rotor. The entire assembly is retained to its spindle by the adjusting nut, nut lock and cotter pin (Fig. 1). The front wheel assemblies rotate freely on their respective spindles and are driven by the motion of the car.

REAR WHEEL

The rear wheel hub and brake drum assembly is retained on studs on the rear axle shaft flange by three speed nuts (Part 3-2, Fig. 2). The wheel and tire assembly mounts on the same rear axle shaft flange studs and is held against the hub and drum by the wheel nuts. The rear wheel bearing is pressed onto the axle shaft just inside the shaft flange, and the entire assembly is retained on the rear axle housing by the bearing retainer plate which is bolted to the housing flange.

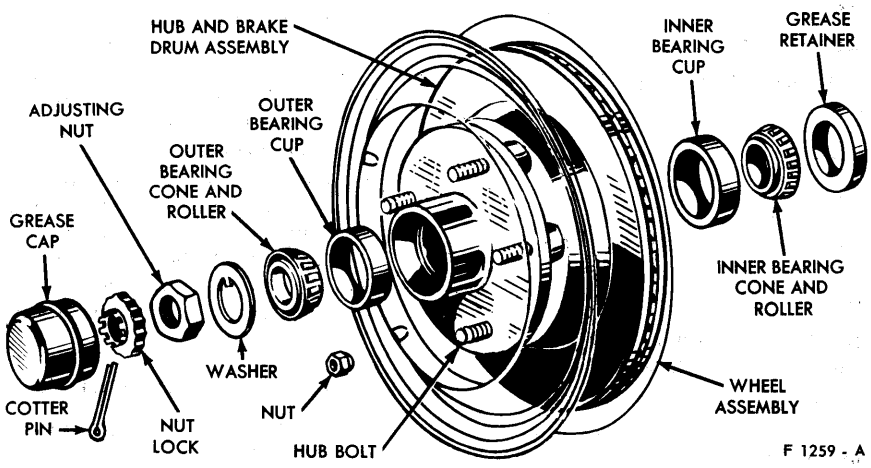

FIG. 1—Front Hub and Rotor, Bearings, and Grease Retainer

2 IN-CAR ADJUSTMENTS AND REPAIRS

FRONT WHEEL BEARING ADJUSTMENT

The front wheel bearings should be adjusted if the wheel is loose on the spindle or if the wheel does not rotate freely. **Front wheel bearing end play is critical and must be within specification.** The following procedure will bring the end play to specification.

1. Raise the car until the wheel and tire clear the floor.
2. Pry off the wheel cover and remove the grease cap (Fig. 1) from the hub.
3. Wipe the excess grease from the end of the spindle, and remove the adjusting nut cotter pin and nut lock.
4. While rotating the wheel, hub, and rotor assembly, torque the adjusting nut to 17-25 ft-lbs to seat the bearings (Fig. 2).
5. Locate the nut lock on the adjusting nut so that the castellations on the lock are aligned with the cotter pin hole in the spindle.
6. Using a 1⅛-inch box wrench, back off both the adjusting nut and the nut lock together until the next castellation on the nut lock aligns with the cotter pin hole in the spindle.
7. Install a new cotter pin, and bend the ends of the cotter pin around the castellated flange of the nut lock.
8. Check the front wheel rotation.

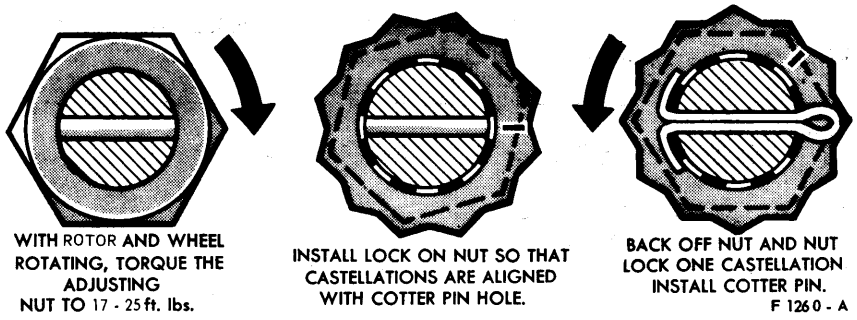

FIG. 2—Front Wheel Bearing Adjustment

If the wheel rotates properly, install the grease cap and the hub cap or wheel cover. If the wheel still rotates roughly or noisily, clean or replace the bearings and cups as required.

3 REMOVAL AND INSTALLATION

Exercise care not to interfere with and damage the caliper splash shield, the bleeder screw fitting or the transfer tube during removal and installation of a wheel and tire assembly.

WHEEL AND TIRE ASSEMBLY

REMOVAL

1. Pry off the wheel hub cap or cover. Loosen but do not remove the wheel hub nuts.
2. Raise the car until the wheel and tire clear the floor.
3. Remove the wheel hub nuts from the bolts, and pull the wheel and tire assembly from the hub and rotor.

REMOVING THE TIRE FROM THE WHEEL

The tire can be demounted on a mounting machine. **Be sure that the outer side of the wheel is positioned downward.** If tire irons are used, follow the procedure given here.

1. Remove the valve cap and core, and deflate the tire completely.
2. With a bead loosening tool, break loose the tire side walls from the wheel (Fig. 3).
3. **Position the outer side of the wheel downward,** and insert two tire irons about 8 inches apart between the tire inner bead and the back side of the wheel rim. **Use only tire irons with rounded edges or irons designed for demounting tubeless tires.**
4. Leave one tire iron in position, and pry the rest of the bead over the rim with the other iron. Take small "bites" with the iron around the tire in order to avoid damaging the sealing surface of the tire bead.
5. Stand the wheel and tire upright with the tire outer bead in the drop center well at the bottom of the wheel. Insert the tire iron between the bead and the edge of the wheel rim, and pry the wheel out of the tire.

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FIG. 3—Bead Loosening Tool

MOUNTING TIRE TO WHEEL

1. If a used tire is being installed remove all dirt from the tire.

If a tire is being mounted on the original wheel, clean the rim with emery cloth or fine steel wool. Check the rim for dents.

If a new wheel is being installed, coat a new valve with RUGLYDE lubricant (B6A-19583-A) or similar rubber lubricant and position the valve in the new wheel. Use a rubber hammer or a valve replacing tool to seat the valve firmly against the inside of the rim.

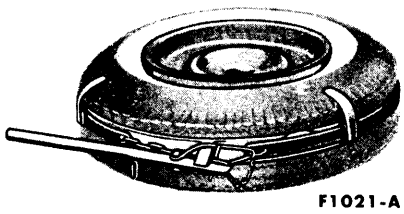

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FIG. 4—Tubeless Tire Mounting Band

2. Apply RUGLYDE or a similar rubber lubricant to the sealing surface on both tire beads. With the outer side of the wheel down, pry the beads over the wheel rim with two tire irons. **Do not use a hammer or mallet to force the beads over the rim.**
3. Align the balance mark on the tire with the valve on the wheel.
4. Hold the beads against the rim flanges by positioning a tire mounting band over the tire (Fig. 4). If a mounting band is not available, tie a tourniquet of heavy cord around the circumference of the tire. Tighten the cord with a tire iron. Center the tire on the wheel with a rubber mallet.
5. Give the tire a few quick bursts of air to seat the beads properly, then inflate the tire to 40 pounds pressure. Check to see that the bead positioning rings (outer rings near the side walls) are evenly visible just above the rim flanges all the way around the tire. If the rings are not even, deflate the tire completely and inflate it again.
6. When the rings are properly positioned, deflate the tire to the recommended pressure.

INSTALLATION

1. Clean all dirt from the hub and drum.
2. Position the wheel and tire assembly on the hub and drum. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and drum.
3. Lower the car to the floor, and torque the hub nuts to specification.
4. Install the hub cap or wheel cover taking care to center the valve stem in the hole provided.

4 MAJOR REPAIR OPERATIONS

FRONT WHEEL GREASE SEAL AND BEARING REPLACEMENT AND/OR REPACKING

If bearing adjustment will not eliminate looseness or rough and noisy operation, the hub and bearings should be cleaned, inspected, and repacked. If the bearing cups or the cone and roller assemblies are worn or damaged, they should be replaced.

1. Raise the car until the wheel and tire clear the floor.
2. Remove the wheel cover or hub cap from the wheel.
3. Remove the wheel and tire from the hub and rotor.

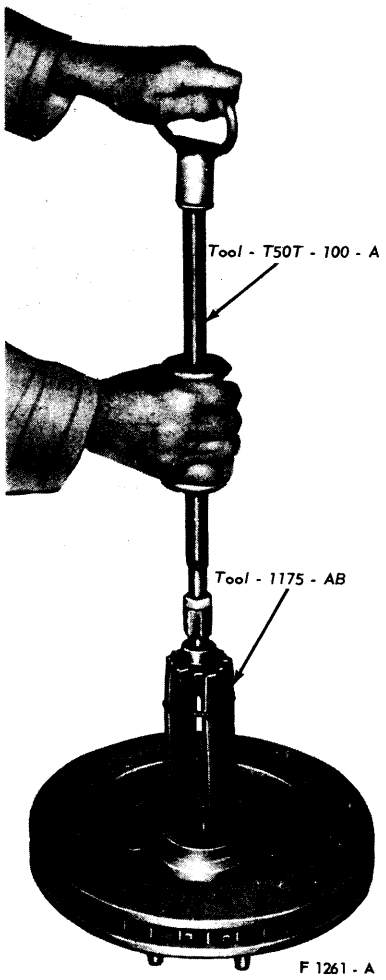

FIG. 5—Removing Grease Retainer

4. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.

5. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle. Remove the outer bearing cone and roller assembly (Fig. 1).

6. Pull the hub and rotor assembly off the wheel spindle.

7. Remove the grease retainer. (Fig. 5) and the inner bearing cone and roller assembly from the hub.

8. Clean the lubricant off the inner and outer bearing cups with solvent and inspect the cups for scratches, pits, excessive wear, and other damage. If the cups are worn or damaged, remove them with a drift.

9. Thoroughly clean the inner and outer bearing cones and rollers with solvent, and dry them thoroughly. Do not spin the bearings dry with compressed air.

Inspect the cones and rollers for wear or damage, and replace them if necessary. The cone and roller assemblies and the bearing cups should be replaced as a set if damage to either is encountered.

10. Thoroughly clean the spindle and the inside of the hub with solvent to remove all old lubricant.

Cover the spindle with a clean cloth, and brush all loose dust and dirt from the dust shield. **To prevent getting dirt on the spindle carefully remove the cloth from the spindle.**

11. If the inner and/or outer bearing cup(s) were removed, install the replacement cup(s) in the hub with the tools shown in Fig. 6. **Be sure to seat the cups properly in the hub.**

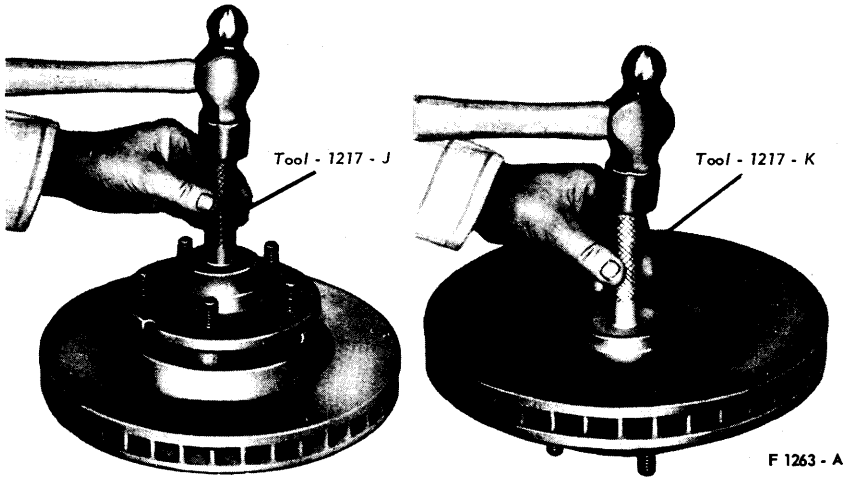

FIG. 6—Installing Front Wheel Bearing Cup

12. Pack the inside of the hub with the specified wheel bearing grease. Add lubricant to the hub only until the grease is flush with the inside diameter of both bearing cups. **All old grease should be completely cleaned from the bearings before repacking with new grease.**

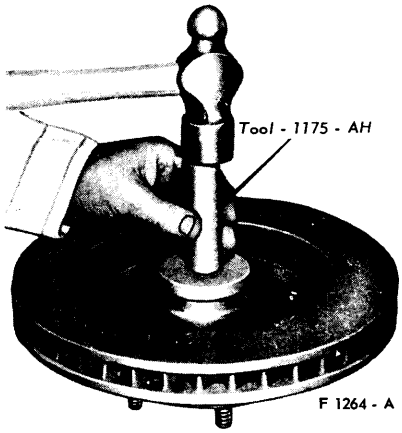

FIG. 7—Installing Grease Retainer

13. Pack the bearing cone and roller assemblies with wheel bearing grease. A bearing packer is desirable for this operation. If a packer is not available, work as much lubricant as possible between the rollers and cages. Lubricate the cone surfaces with grease.

14. **Place the inner bearing** cone and roller assembly in the inner cup. Apply a light film of grease to the grease retainer and install the new grease retainer with the tool shown in Fig. 7. **Be sure the retainer is properly seated.**

15. Install the hub and rotor assembly on the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer or the spindle threads.**

16. Install the outer bearing cone and roller assembly and the flat washer on the spindle, then install the adjusting nut.

17. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.

18. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).

19. Install the wheel and tire on the hub.

20. Install the wheel cover.

FRONT HUB AND ROTOR ASSEMBLY REPLACEMENT

When the hub and rotor assembly is replaced, new bearings, cups, and grease retainer must be installed in the new assembly.

1. Raise the car until the wheel and tire clear the floor. Pry off the hub cap or wheel cover, and remove the wheel and tire assembly from the hub and rotor assembly.
2. Remove 2 bolts and washers retaining the caliper to the spindle. Remove the caliper from the rotor and wire it to the underbody to prevent damage to the brake hose.
3. Remove the grease cap from the hub. Remove the cotter pin, nut lock, adjusting nut, and flat washer from the spindle, then, remove the outer bearing cone and roller assembly (Fig. 1).
4. Pull the hub and rotor off the spindle.
5. Remove the protective coating from the new hub and rotor with carburetor degreaser. Install new inner and outer bearing cups in the new hub with the tool shown in Fig. 6. **Be sure to seat the cups properly in the hub.**
6. Grease and install the inner bearing cone and roller assembly in the inner bearing cup. Apply a light film of grease on the grease retainer and install the grease retainer.
7. Install the new hub and rotor assembly to the wheel spindle. **Keep the hub centered on the spindle to prevent damage to the grease retainer.**
8. Install the outer bearing cone and roller assembly and the flat washer on the spindle; then, install the adjusting nut.
9. Install the caliper to the spindle and tighten the retaining bolts to specifications. Check for the correct flexible hose routing (Part 2-2).
10. Position the wheel and tire on the new hub and rotor. Install the wheel hub nuts and tighten them alternately in order to draw the wheel evenly against the hub and rotor.
11. Adjust the wheel bearings as outlined in Section 2, and install a new cotter pin. Bend the ends of the cotter pin around the castellations of the nut lock to prevent interference with the radio static collector in the grease cap. Install the grease cap.
12. Install the hub cap or wheel cover.

PART 3-5 SPECIFICATIONS

FRONT SUSPENSION

Wheel Alignment	Checking Specifications			Optimum Re-Setting Specifications
	Min.	Max.	Maximum Variation Between Wheels	Desired Alignment
Caster	−1¼°	−3¼°	½°	−1½°
Camber	¾°	+1°	½°	+½°
Toe-In	1/32 inch	9/32 inch	—	5/32 inch
King Pin Angle	—	—	—	7°
Turning Angle of Outside Wheel with Inside Wheel Turned 20°	—	—	—	19½°

BALL JOINTS

	Axial Play (Inches) Max. Allowable	Radial Play (Inches) Max. Allowable
Upper Ball Joint	0.060	0.250
Lower Ball Joint	Replace if Perceptibly Loose	

TREAD WIDTH AND WHEELBASE

Front Tread Width	61 inches
Rear Tread Width	60 inches
Wheelbase	113 inches

REAR LEAF SPRINGS

Body Style	Number of Leaves	Capacity at Normal Load Height	Spring Length at Normal Load	Load	Rate
Hardtop	5	880-920 pounds	60 Inches	1020 ± 23	121 ± 6
Convertible	5	980-1020 pounds	60 Inches	1135 ± 24	134 ± 6

FRONT SUSPENSION—TORQUE LIMITS

Description	Ft — Lbs
Brace-Front—Suspension No. 2 Crossmember to Side Rails	40 — 55
Crossmember—½ x 2.00 Lateral to Siderails	40 — 55
Joint Assy.—Front Suspension Upper Arm Ball Joint to Front Spindle	60 — 80
Joint Assy.—Front Suspension Lower Arm Ball Joint to Front Spindle	60 — 80
Arm & Inner Shaft Assy—Upper Suspension Arm Shaft to Crossmember	50 — 76
Lower Arm Bracket Lower Suspension Arm Pivot Bracket to Crossmember	85 — 115
Arm & Bushing Assy.—Front Suspension Lower Arm To Pivot Bracket	60 — 80
Strut to Body Mounting Bracket	70 — 90
Strut to Lower Arm	120 — 165
Front Shock Absorber to Bracket Assembly	95 — 120
Front Shock Absorber to Spring Tower	20 — 28
Spring Tower Plate to Spring Tower	24 — 34
Bracket Assy.—Front Shock Absorber to Upper Arm	22 — 28
Stud Stabilizer Bar Link to Stabilizer Bar & Lower Arm	5 — 10
Front Stabilizer Bar Frame Mounting Bracket to Frame	11 — 18
Front Splash Shield—to Spindle Flange	10 — 20
Caliper to Spindle	75 — 100

STEERING—TORQUE LIMITS

Description	Ft — Lbs
Steering Pitman Arm Assy. to Rod Assy.—Pitman Arm to Idler Arm	35 — 47
Steering Idler Arm Assy. to Rod Assy.—Pitman Arm to Idler Arm	35 — 47
Steering Spindle Arm Connecting Rod and End Assy. to Rod Assy.—Pitman Arm to Idler Arm	40 — 55
Steering Spindle Arm Connecting Rod and End Assy. to Steering Spindle Arm	40 — 55
Steering Idler Arm Mounting Bracket to Frame Assembly	20 — 30
Steering Spindle Connecting Rod Clamp to Adjusting Sleeve	8 — 13
Steering Idler Arm Bushing Assy. to Idler Arm Mounting Bracket	60 — 80
Steering Wheel to Steering Gear Assembly	25 — 35
Steering Pitman Arm to Sector Shaft Assembly	150 — 200
Steering Gear Assy. to Frame Assy	35 — 50
Power Steering Drive Pulley and Crankshaft Pulley to Crankshaft	35 — 65
Power Steering Drive Pulley to Crankshaft Pulley	20 — 25
Pump Adjusting Bracket to Water Pump Housing	30 — 40
Power Steering Pump Support Bracket to Pump	30 — 40
Power Steering Pump Support Bracket to Cylinder Head	30 — 40
Upper Coupling Flange to Steering Column Shaft (Movable Column)	25 — 35
Lower Coupling Flange to Steering Gear Assy. (Movable Column)	25 — 35
Steering Column Track Assy. to Brake Pedal Support (Movable Column)	22 — 28
Steering Column Pivot Stud (Movable Column)	3 — 6
Insulator to Steering Gear	35 — 50
Track L.H. Stop Screw to Track Inner Brace (Movable Column)	10 — 13
Track Inner to Outer Brace (Movable Column)	10 — 13
Selector Assy. to Track Assy. (Movable Column)	6 — 9
Movable Column Door Pivot Bracket to Body	10 — 13
Track Rear Brace to Track & Floor Bracket	10 — 13
Rear Track Brace Floor Bracket to Floor Pan	34 — 42
Pressure Hose to Steering Gear Assembly	14 — 18
Outlet Tube Assy. to Power Steering Pump Assembly	18 — 25
Outlet Tube Assy. to Pressure Hose	18 — 25
Turn Signal Handle Assy.	15-20 In-Lbs
Track Outer Brace to Instrument Panel Support (Movable Column)	10 — 13

REAR SUSPENSION—TORQUE LIMITS

Description	Ft — Lbs
Rear Spring Rear Shackle Hanger to Underbody	14 — 26
Rear Spring Rear Shackle Assy. to Rear Spring Assy.	34 — 59
Rear Spring Shackle Assy. to Hanger	34 — 59
Rear Spring Assy. to Rear Axle	45 — 65
Rear Shock Absorber to Upper Mounting Bracket	15 — 25
Rear Shock Absorber Upper Mounting Bracket to Underbody	20 — 28
Rear Shock Absorber Assy. to Lower Attaching Stud	30 — 40
Rear Shock Absorber Attaching Stud to Rear Axle Spring Seat	120 — 156
Rear Axle Bumper Bracket to Underbody	20 — 28
Rear Spring Front Eye Stud & Washer Assy. to Rear Spring Front Hanger Bracket	86 — 110
Rear Spring Center Bolt	15 — 30
Rear Spring Front Hanger to Underbody	70 — 100

STEERING

Steering Gear Type	Recirculating Ball-Torsion Bar
Gear Ratio	17.0:1
Turns of wheel for full left to right turn (within gear)	3.6
Torsion Bar Diameter	0.188 inch
Hydraulic Fluid	CIAZ-19582-A
Hydraulic Fluid Capacity	1.6 pints (Approx.)
Phosphorescent dye additive (for leak detection)	4 oz. per quart of fluid

Adjustment Gear	Specification
Sector shaft mesh load—total over mechanical center position must be 9-13 lbs. in. greater than the off center torque of 2 to 7 lbs. in.	17 in lbs max.
Worm bearing preload—with the input shaft in place and 45° off of the left stop, check input torque through an approx. ⅛ turn from the 45° position	2-7 in lbs
Clearance between valve spool and retaining ring	0.002-0.005 in. Preferably 0.003"
Pressure variation between right and left turns (at 250 lbs. pressure) Steering gear in car—check efforts each side of center	4 in lbs max variation
Steering gear out of car—check efforts at right & left stops	4 in lbs max variation
Clearance between inner sector seal and housing	0.025 inch

WHEELS AND TIRES

Tire Size and Ply Rating		8.15 x 15
Inflation Pressure (psi)	Front	24
	Rear	24

GEAR TORQUE LIMITS

Description	Ft Lbs	In Lbs
Gear Cover to Gear Housing	50-60	
Valve Housing to Gear Housing	35-45	
Race Retaining Inner Nut	55-65	
Race Lock Nut	20-30	
Piston End Cap	50-75	
Guide Clamp Retaining Screw and Washer		42-70
Mesh Load Adjusting Screw Lock Nut	25-35	

TORQUE LIMITS

Description	Ft — Lbs
Wheel Assembly to Front Wheel Hub and Rotor Assembly	75 — 110
Front Wheel, Hub & Rotor Assembly to Front Wheel Spindle (Torque with Rotor Turning)	17 — 25
Wheel Assembly to Rear Axle Shaft to Drum Assembly	75 — 110

SERVICE TOOLS

Ford Tool No.	Former No.	Description
T50T-100-A	—	Slide Hammer—Long
T62L-201-A	—	Handle Adapter
TOOL-1175-AB	1175-AE	Seal Remover
TOOL-1175-AH	1175-AH	Seal Replacer
TOOL-1217-J	1217-J	Front Hub Outer Bearing Cup Replacer
TOOL-1217-K	1217-K	Front Hub Inner Bearing Cup Replacer
T65P-3000-B	—	Front Suspension Alignment Spacer
T57P-3006-A	3006-B	Ball Joint Remover Press
TOOL-3290-C	3290-C	Tie Rod Ball Ends and Control Valve Ball Stud Remover
T65P-3524-A	—	Remover and Installer—Input Shaft Bearing and Seals
T65P-3553-A	—	Wrench-Worm Bearing Nut and Locknut
T65P-3576-A	—	Remover-Replacer—Sector Shaft Bushings
T65P-3576-B	—	Replacer—Sector Shaft Seals
TOOL-3590-FCA	3590-FC	Steering Arm Remover
TOOL-3600-AA	3600-AA 3826	Steering Wheel Remover —Bolt On Type
T64B-3C716-A	—	Insulator Remover and Replacer Socket
T65P-3A733-A	—	Pulley Installer
T63P-5310-A	5310-B	Front Coil Spring Compressor
T63L-10300-B	—	Pulley Remover
T56L-33610-D	3500-E	Pressure Testing Gauge Assembly