

Fig. 9-1 Standard Steering Gear—Exploded View

# STEERING

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## STANDARD STEERING GEAR

### GENERAL DESCRIPTION

The standard steering gear (Fig. 9-1) is of the recirculating ball nut type. The ball nut, mounted on the worm, is driven through steel balls which circulate in helical grooves in both the worm and nut. Ball return guides attached to the nut, serve to recirculate the two sets of twenty-seven balls each in the grooves.

As the steering wheel is turned to the right, the nut moves upward. When the wheel is turned to the left the nut moves downward.

The teeth on the sector, which are forged as part of the pitman shaft, and the ball nut are so designed that a tighter fit exists between the two when the front wheels are straight ahead. Proper engagement between the sector and the ball nut is obtained by an adjusting screw which moves the pitman shaft endwise permitting desired engagement of the tapered teeth of the ball nut and sector gear. The worm bearing adjuster can be turned to provide proper preloading of the upper and lower bearings.

### PERIODIC SERVICE RECOMMENDATIONS

Periodic service consists of periodical lubrication as outlined in General Lubrication Section.

### ADJUSTMENTS ON CAR

Correct adjustment of the steering gear is extremely important and can only be obtained by following the correct procedure. Before any adjustments are made to the steering gear in an attempt to correct such conditions as shimmy, hard or loose steering and road shocks, careful check should be made to determine that front end alignment, shock absorbers, wheel balance and tire pressure are correctly adjusted and/or operating satisfactorily.

There are two adjustments on the recirculating ball type steering gear:

1. Worm bearing preload adjustment.
2. Sector and ball nut backlash adjustment.

**CAUTION:** It is very important when adjusting the steering gear, that the adjustment be made in the above sequence. Failure to do so will result in damage to the steering gear.

#### WORM BEARING PRELOAD—ADJUST

1. Disconnect steering connecting rod from pitman arm (Fig. 9-8) by removing cotter pin and plug from connecting rod.
2. Tighten pitman arm nut to 110-125 lb. ft. torque.
3. Loosen steering column bracket to make certain

column is not sprung due to misalignment. If misaligned, shim at steering gear housing to frame bolts and tighten bracket.

4. Loosen pitman shaft adjusting screw lock nut and back off adjusting screw a few turns (Fig. 9-2).

5. With a spring scale at rim of steering wheel, measure pull required to keep wheel in motion when off high point (at least 30° off center) (Fig. 9-3).

6. Pull required should be between  $\frac{3}{8}$  and  $\frac{7}{8}$  pounds. To correct, loosen worm bearing adjuster lock nut with brass drift (Fig. 9-4) and turn adjuster to bring spring scale pull within limits (Fig. 9-5).

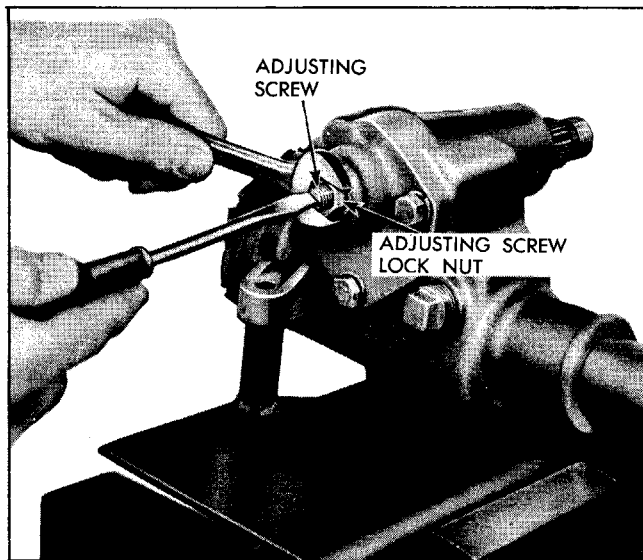


Fig. 9-2 Adjusting Pitman and Ball Nut Backlash

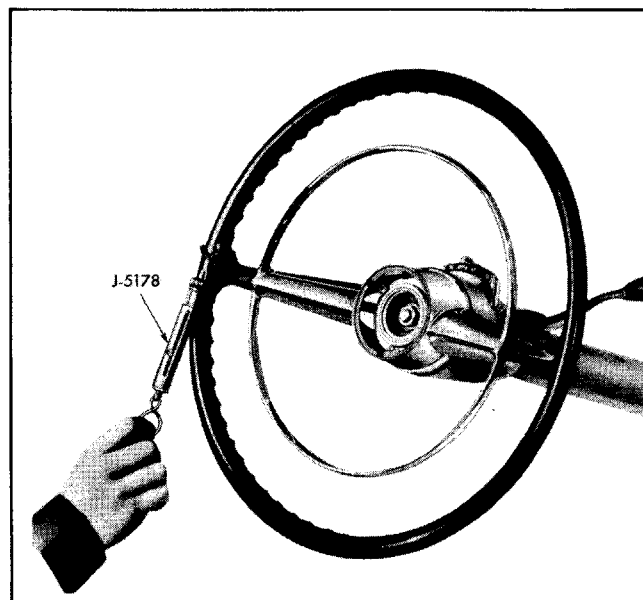


Fig. 9-3 Checking Pull at Wheel Rim

7. Retighten lock nut when adjustment is correct and recheck as in step 6 above.

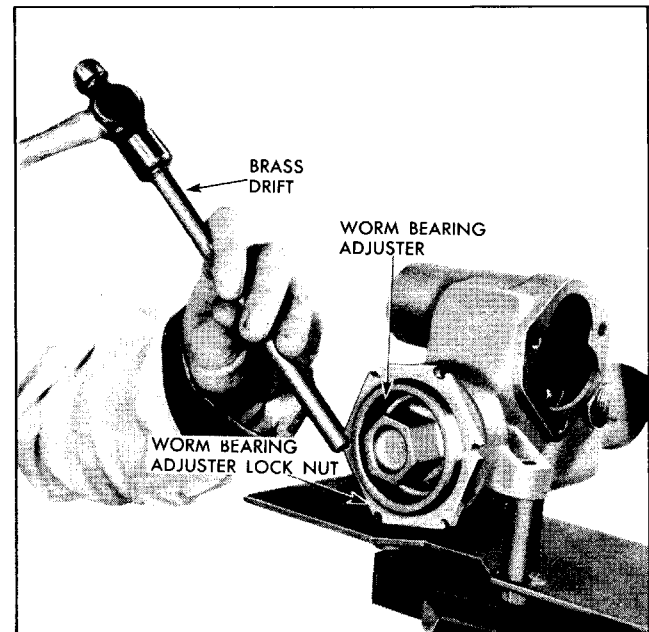


Fig. 9-4 Loosening Worm Bearing Adjuster Lock Nut

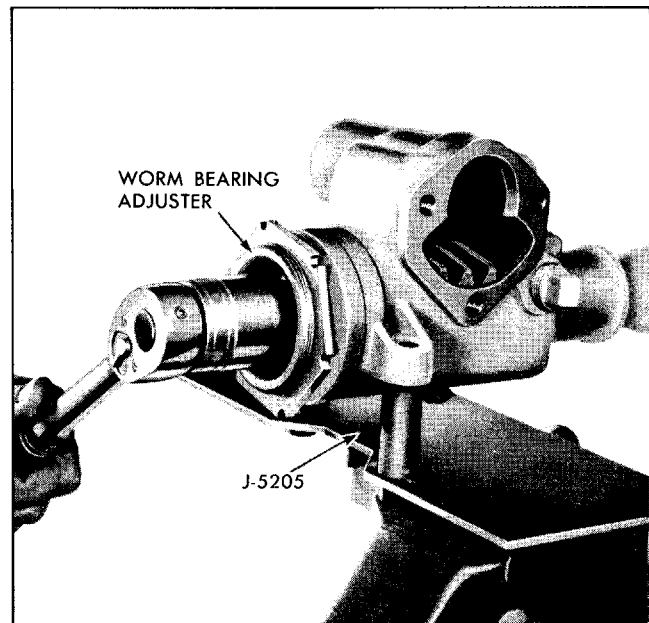


Fig. 9-5 Adjusting Worm Bearing Preload

#### SECTOR AND BALL NUT BACKLASH—ADJUST

1. When worm bearing preload has been adjusted correctly, pitman shaft adjusting screw (Fig. 9-2) should be turned clockwise until a pull of 1 to 2 pounds at the steering wheel rim is required to turn the wheel through center (Fig. 9-3).

2. Tighten pitman shaft adjusting screw lock nut, and recheck adjustment.

3. Reassemble steering connecting rod to pitman arm. Set spokes of steering wheel in straight ahead position (mark on steering shaft up, Fig. 9-7). If road wheels are not straight ahead, adjust steering tie rods as outlined on page 3-0.

## MINOR REPAIRS

### STEERING WHEEL—REPLACE

1. Remove deluxe horn ring button by turning counterclockwise. (Remove standard horn button by pressing down on one side, inserting screwdriver underneath opposite edge of button, and prying upward.)

2. Remove lock nut, nut, washer, horn ring, horn insulator and contact assembly.

3. Remove steering wheel using puller J-3044 (Fig. 9-6).

4. To replace, reverse above procedure. Be sure wheel is in straight ahead position (Fig. 9-7). Tighten steering wheel nut to 25-30 lb. ft. torque. Tighten lock nut finger tight plus  $\frac{1}{4}$  turn.

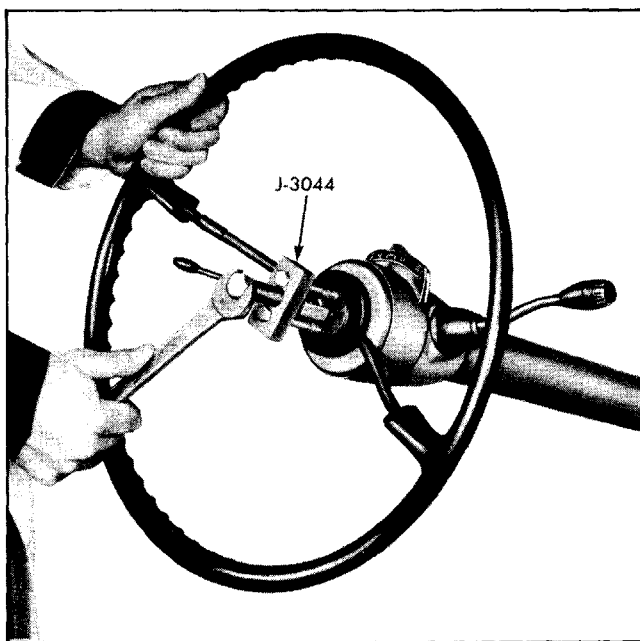


Fig. 9-6 Removing Steering Wheel

### STEERING LINKAGE—REPLACE (FIG. 9-8)

Steering connecting rod may be removed from both tie rods, pitman arm and idler arm by removing both cotter pins and threaded plugs in ends of rod.

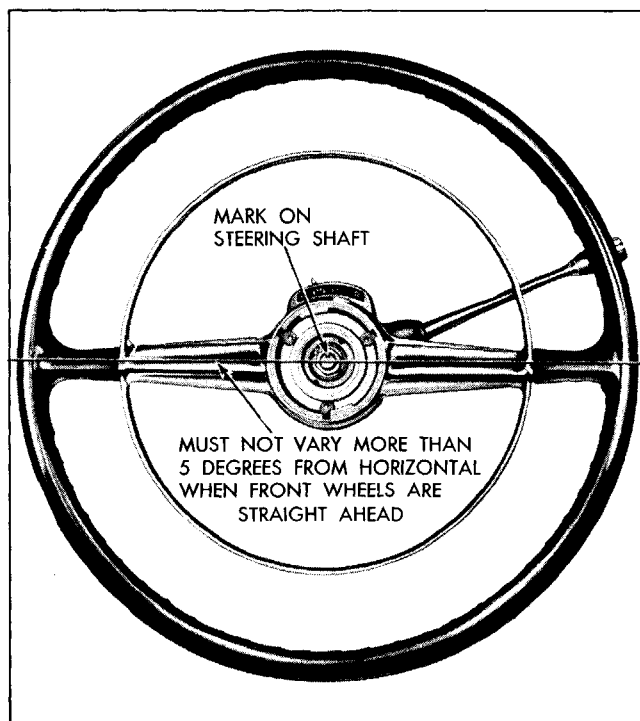


Fig. 9-7 Locating Steering Wheel Position

Connecting rod may be installed by placing tie rod pitman arm and idler lever balls in the rod. Install threaded plugs until tight and back off to nearest cotter pin hole and install new cotter pin. **CAUTION:** If plugs feel tight before head is approximately flush with end of rod, check for improper position of ball sockets.

After steering connecting rod is removed pitman arm may be removed from pitman shaft by removing the nut and lockwasher and by using puller J-5504. To install pitman arm on pitman shaft, replace arm, lockwasher and nut and tighten to 110-125 lb. ft. torque.

After steering connecting rod is removed, idler arm may be removed by removing two bolts which retain idler support to frame. The idler support and idler arm may then be separated, first threading idler support from bushing and then threading the idler arm from bushing. In reassembling, install bushing in idler arm and tighten to 100 lb. ft. torque; next thread idler support and seal into bushing until distance between upper face of lever and shoulder on support is approximately  $\frac{11}{16}$ ". Install assembly on frame with two attaching bolts and tighten to 18-20 lb. ft. torque.

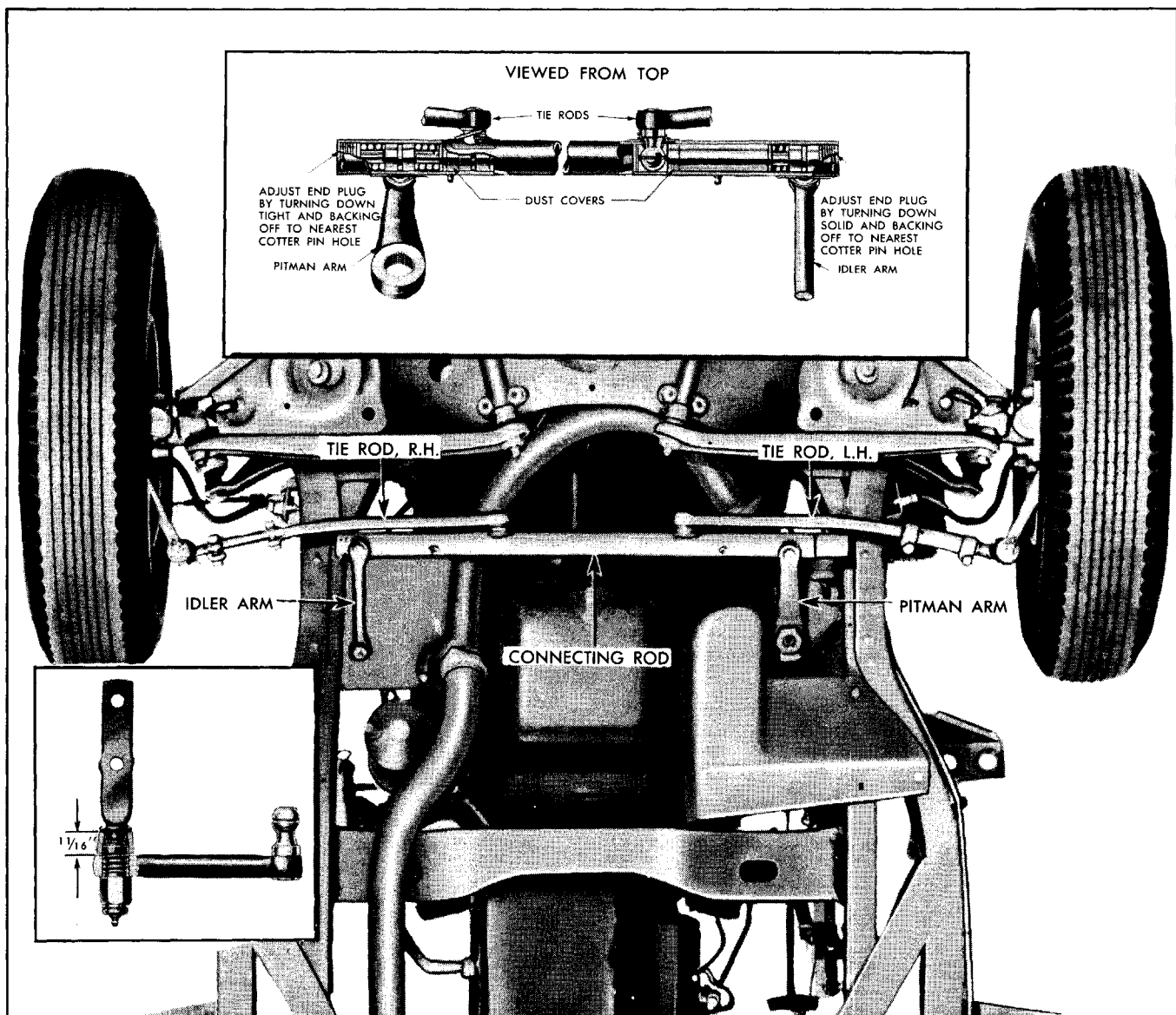


Fig. 9-8 Steering Linkage

Tie rod assembly may be removed from car by removing cotter pin and castellated nut on tie rod ends at steering arms. To separate tie rod and tie rod end, loosen two bolts on tube and clamp assembly, and thread out the part to be replaced. To reassemble, thread new part into tube and clamp assembly to approximate original location, place tie rod end with dust cover in steering arm, tighten castellated nut securely, and install new cotter pin. When new tie rods or tie rod ends are installed it is necessary to check toe-in, page 3-0. Check bolts on tube and clamp assembly for tightness (18-20 lb. ft. torque).

Whenever work is done on steering linkage it should be lubricated as outlined on page 0-3.

## STANDARD STEERING GEAR— REMOVE

**NOTE:** If car is equipped with power brakes, remove power brake unit as outlined on page 5-8.

1. Remove steering wheel (page 9-3).
2. Disconnect direction signal wiring harness at connector under instrument panel. Remove direction signal lever.
3. Remove steering column lower finish plate.
4. Roll back floor mat and remove steering column and pedal plates, felts, and felt retainer plate.

5. Disconnect horn wire and neutralizer switch wire.

6. Remove gearshift lever (see Transmission and Gearshift Control, page 7-1).

7. Disconnect gearshift and selector rods from levers on steering column.

8. Raise car on hoist, if available, otherwise on high car stands under **BOTH LOWER CONTROL ARMS** so as to provide clearance for removing steering gear.

9. Remove engine left side apron.

10. Remove pitman arm from shaft using puller J-5504.

11. Loosen three bolts holding steering gear housing to frame, then remove two bolts leaving the front upper bolt to support steering gear.

12. Remove bolts holding steering column lower bracket to upper bracket on instrument panel.

13. Remove remaining steering gear housing to frame bolt and remove steering gear by bringing it down through floorboard and over steering linkage toward right front wheel. Be sure to save shims found between steering gear housing and frame so these shims can be reinstalled.

## STANDARD STEERING GEAR— OVERHAUL AND ADJUSTMENT

### DISASSEMBLY

1. Remove steering gear assembly from car (page 9-4) and mount on holding fixture J-5205 (Fig. 9-9).

2. Rotate wormshaft with steering wheel, until wheel is in center of travel. Remove three side cover screws and adjusting screw nut (Fig. 9-1).

3. Remove side cover and gasket by turning adjusting screw clockwise through cover (Fig. 9-9).

4. Remove adjusting screw from slot in end of pitman shaft. Make sure shim found on adjusting screw is kept with screw (Fig. 9-10).

5. Remove pitman shaft from housing using care that threads do not damage seal in housing.

6. Loosen worm bearing adjuster lock nut with brass drift and remove adjuster and lower bearing (Fig. 9-4).

7. Push worm and shaft assembly, with ball nut assembly, through bottom of housing and remove upper bearing.

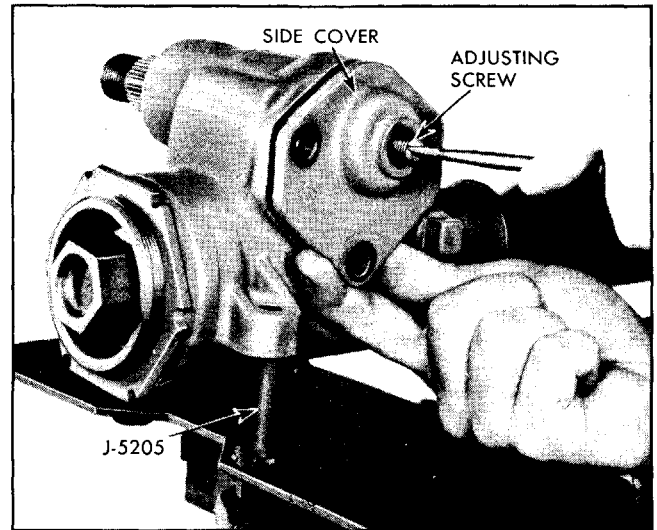


Fig. 9-9 Removing or Replacing Side Cover

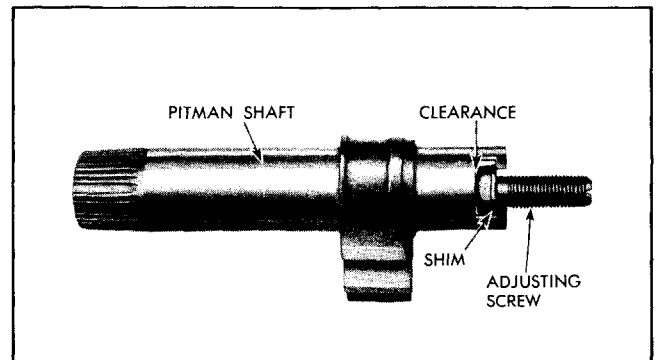


Fig. 9-10 Pitman Shaft and Adjusting Screw

8. Remove ball nut return guide clamp by removing one screw (Fig. 9-11), remove guides, turn ball nut over and remove balls. Rotating shaft slowly from side to side will aid in removing balls.

9. Remove ball nut from worm. **NOTE:** Unless all balls are removed nut cannot be removed.

### CLEANING AND INSPECTION

1. Wash all parts in clean kerosene or other suitable solvent.

2. Inspect all bearings, bearing cups, worm groove, bushings, seals, teeth for scoring, wear, pitting, etc. which would necessitate replacement.

3. Inspect housing and cover for sandholes or cracks.

If pitman shaft bushing, seal, upper and lower bearing cups, steering gear housing or column jacket need replacement see **REPAIRS**.

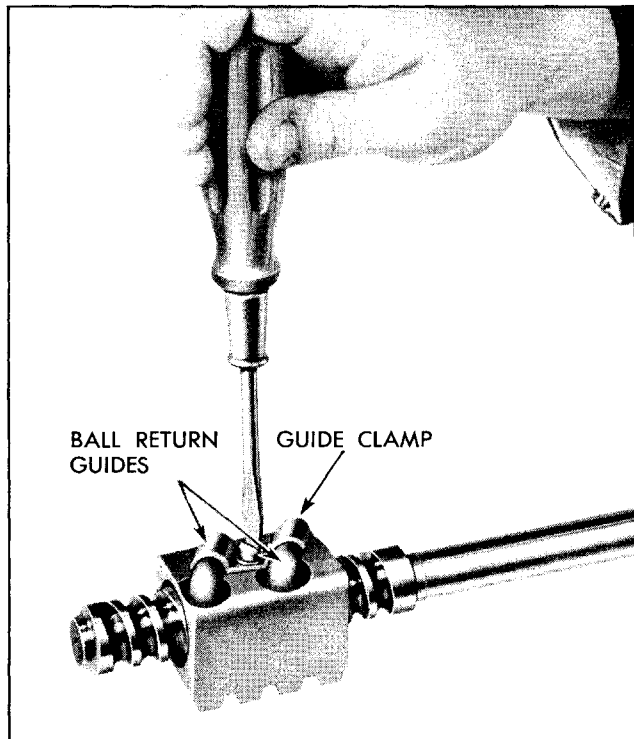


Fig. 9-11 Removing or Replacing Ball Nut Return Guide Clamp

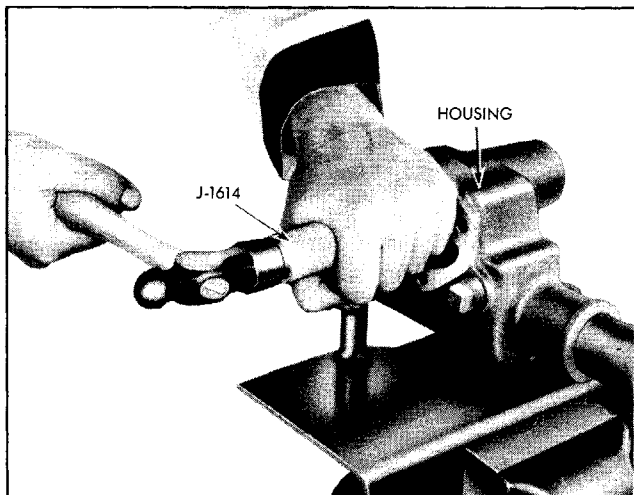


Fig. 9-12 Removing or Replacing Pitman Shaft Bushing

### REPAIRS

#### PITMAN SHAFT SEAL—REPLACE

See step 10, page 9-8 under Assembly.

#### PITMAN SHAFT BUSHING—REPLACE

Drive out bushing with tool J-1614 (Fig. 9-12). Install new bushing with same tool. Inner end of bushing must be flush with inside surface of housing. Seal must be removed before the bushing is removed.

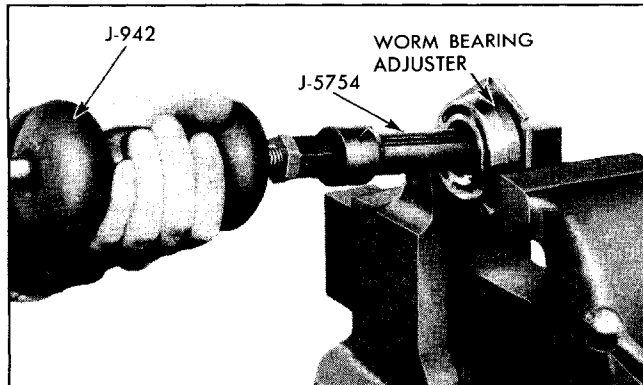


Fig. 9-13 Removing Bearing Cup from Worm Bearing Adjuster

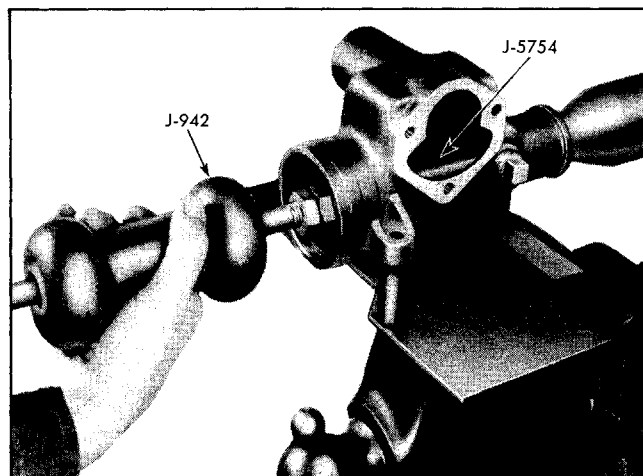


Fig. 9-14 Removing Bearing Cup from Steering Gear Housing

#### UPPER OR LOWER BEARING CUPS—REPLACE

Remove lower cup from worm bearing adjuster (Fig. 9-13) or upper cup from housing (Fig. 9-14) using tool J-5754 and slide hammer. Install bearing cup in housing (Fig. 9-15) and/or worm bearing adjuster (Fig. 9-16) using tool J-5755.

#### STEERING GEAR HOUSING OR STEERING COLUMN JACKET—REPLACE

NOTE: Refer to section 7 for replacement of steering column shift linkage.

Steering column jacket is press fit in steering gear housing. When replacing housing and/or jacket the jacket must be properly aligned to housing so holes in jacket will be correctly positioned. Distance between lower mounting screw hole of housing and top of jacket is shown in Fig. 9-17.

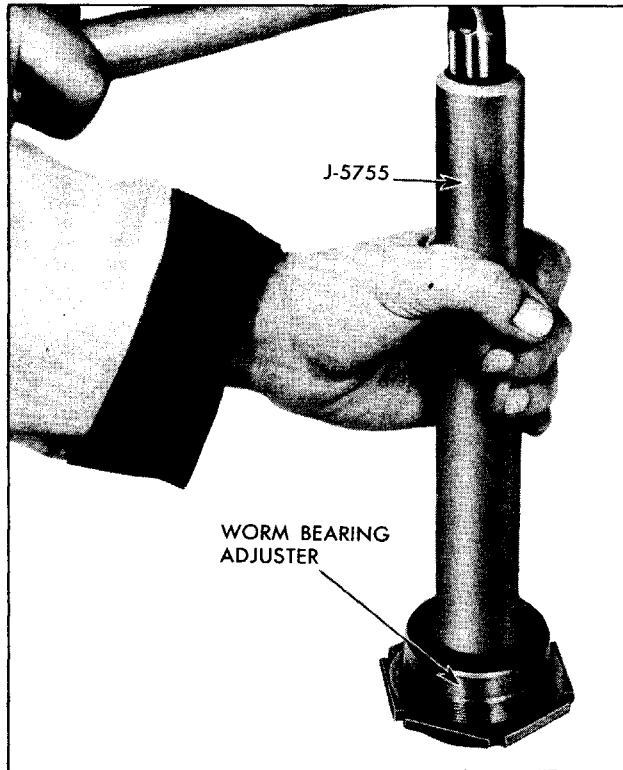


Fig. 9-15 Replacing Bearing Cup in Worm Bearing Adjuster

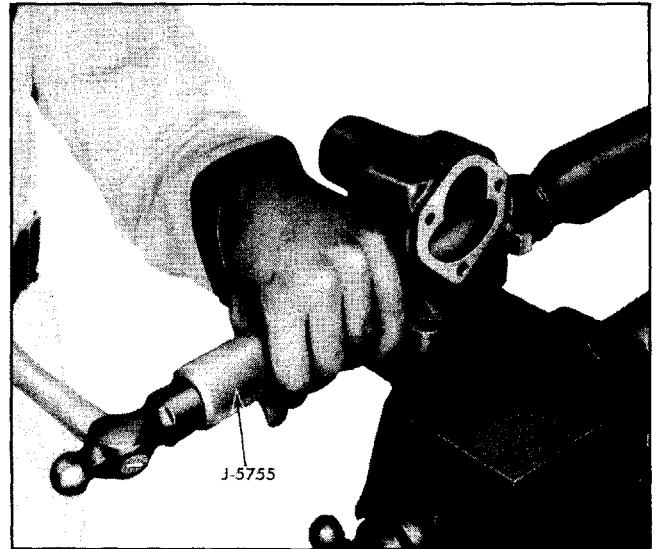


Fig. 9-16 Replacing Bearing Cup in Steering Gear Housing

**ASSEMBLY**

NOTE: All seals, bushings and bearings should be prelubricated before assembly.

1. Position ball nut on shaft so that deep side of teeth are located as shown in Fig. 9-18.

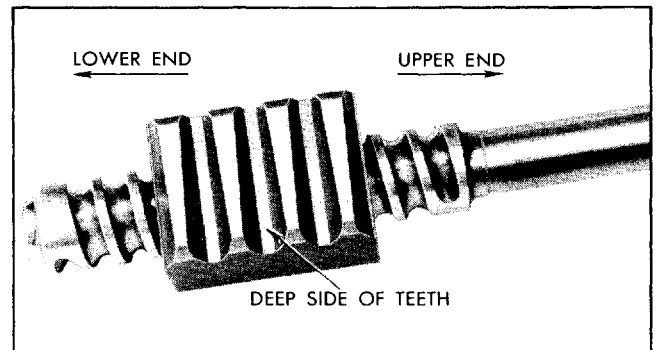


Fig. 9-18 Ball Nut Properly Installed on Shaft

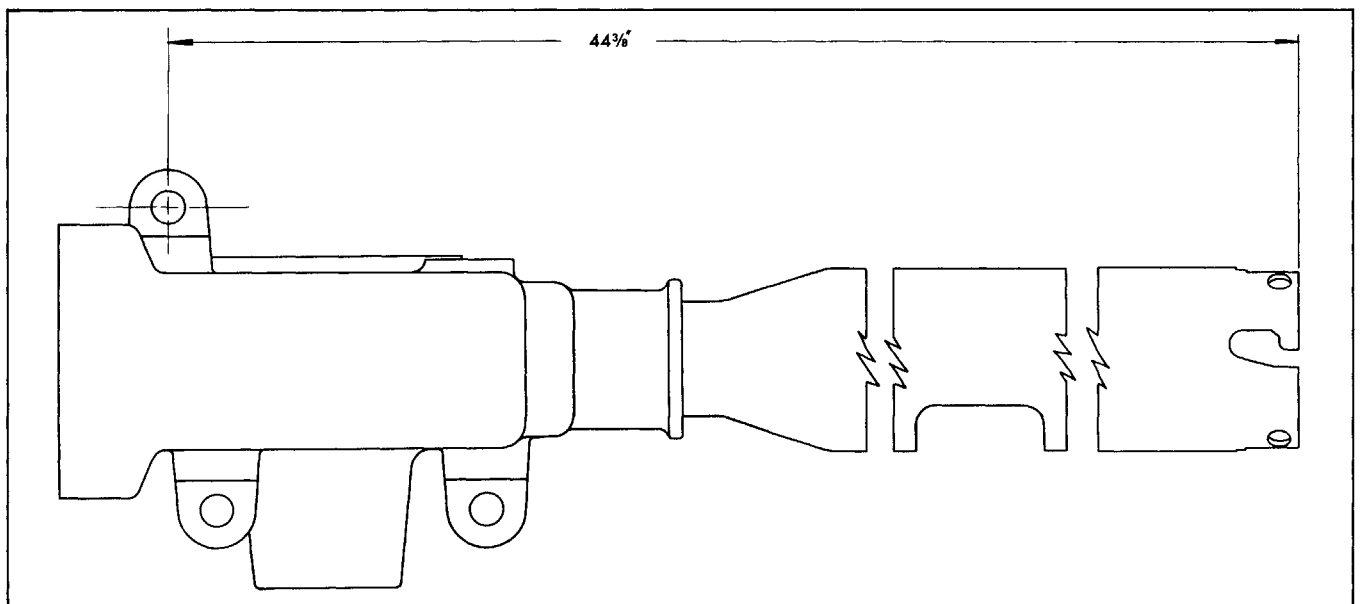


Fig. 9-17 Assembly of Steering Column Housing to Steering Gear Housing



2. Install 18 balls in each circuit of ball nut (rock steering shaft slightly to aid in installing balls) and insert 9 balls in each return guide using petrolatum to hold balls in place. Install return guide clamp and screw (Fig. 9-11). **CAUTION:** Do not rotate shaft while installing balls, since balls may enter crossover passage between circuits. This will cause improper operation of ball nut.

3. Place upper bearing on shaft. Center ball nut on worm, then slide steering shaft, bearing and nut into housing.

4. Place lower bearing in worm adjuster and install adjuster in housing. **NOTE:** Adjuster should be installed just tight enough to hold bearing races in place. Final adjustment will be made later.

5. Install pitman shaft adjusting screw and selective shim in pitman shaft (Fig. 9-10). **NOTE:** Screw must be free to turn, but have no more than .002" end play. If end play of screw in slot is too tight or too loose, select new shim to give proper clearance. Shims are furnished in four thicknesses: .063", .065", .067", and .069".

6. Install pitman shaft and adjusting screw with sector and ball nut teeth positioned as shown in Fig. 9-19.

7. Install side cover and gasket on adjusting screw, turning screw counterclockwise until it projects through cover  $\frac{5}{8}$ " to  $\frac{3}{4}$ ".

8. Install three cover attaching screws.

9. Tighten pitman shaft adjusting screw so that teeth on shaft and ball nut engage but do not bind. Final adjustment will be made later.

10. Position seal protector J-5787 on pitman shaft. Place seal over protector and seat seal using tool J-5813 (Fig. 9-20).

11. Fill steering gear with all-season steering gear lubricant.

12. Place steering wheel on shaft and turn steering gear from one extreme to the opposite to make certain there are no unusual binds. **NOTE:** Never allow ball nut to strike the ends of the ball races in worm due to the possibility of damage to ball guides. Steering gear is now ready for final adjustment of worm bearing preload and sector and ball nut backlash (page 9-1).

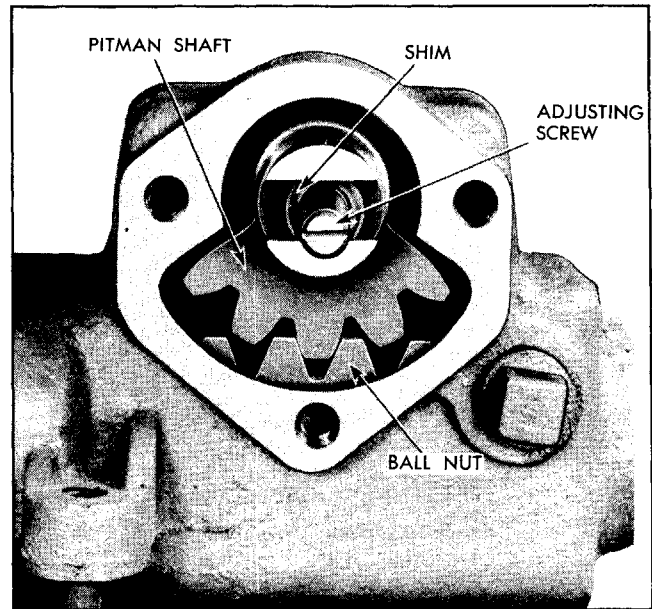


Fig. 9-19 Positioning Pitman Shaft and Ball Nut

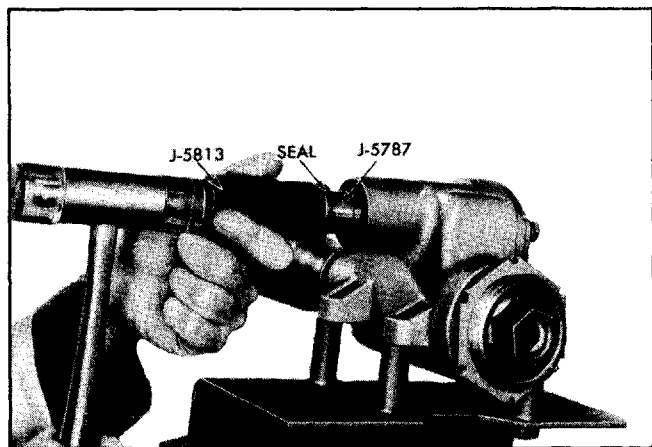


Fig. 9-20 Replacing Pitman Shaft Seal

## STANDARD STEERING GEAR— REPLACE

1. Install steering gear from underneath car following same path used to remove assembly from car.

2. Install top front steering gear housing to frame bolt with lockwasher finger tight. **CAUTION:** Be sure to reinstall shims which were found between steering gear housing and frame on removal of steering gear.

3. Install steering column rubber grommet.

4. Install steering column lower bracket, bolts, and lockwashers on upper bracket at instrument panel. Tighten bolts snugly but not to final tightness.

5. Install two remaining steering gear housing to frame bolts with plain and lockwashers. Tighten all three housing to frame bolts.

6. Check for correct shimming of steering gear housing to frame by seeing if steering column aligns with bracket when bracket bolts are loosened. **NOTE:** If misalignment exists, it will be necessary to change steering gear housing to frame shims to correct alignment.

7. If steering column alignment is satisfactory, tighten steering column bracket bolts.

8. Install pitman arm on pitman shaft. Make sure lockwasher is in good condition and is installed under pitman shaft nut. Tighten pitman shaft nut to 110-125 lb. ft. torque.

9. Install engine left side apron.

10. Car may now be lowered to floor for added accessibility in completing installation.

11. Install gearshift linkage which was removed during removal of steering gear assembly (see Transmission and Gearshift Control, page 7-1).

12. Install steering column and pedal upper and lower plates, felts, and felt retainer plate. **NOTE:** If car is equipped with power brakes refer to installation of power brake unit, page 5-15.

13. Install direction signal lever and connect direction signal and horn wiring under instrument panel.

14. Install steering wheel. See that wheel spokes are in straight ahead position when steering gear is on high point of cam with mark on end of steering shaft up (Fig. 9-7) and wheels are in straight ahead position.

15. Connect wires to neutralizer switch on Hydra-Matic models.

**TROUBLE DIAGNOSIS AND TESTING**

**STANDARD STEERING GEAR**

For information on steering troubles, cause, and remedy, see Trouble Diagnosis and Testing Section—Front End Suspension, page 3-0.

**SPECIFICATIONS**

Type	Saginaw Recirculating Ball Nut
Steering Gear Ratio	25:1
Lubricant	See Lubrication Section Page 0-3
Lubricant Capacity	13 Fluid Ounces

**TORQUE SPECIFICATIONS**

	Lb. Ft. Torque
Steering gear pitman arm nut	110-125
Steering wheel to shaft nut	25-30
Tie rod tube and clamp assembly nuts	18-20
Idler lever nut and bushing	100
Idler support to frame	18-20

**SERVICE CRAFTSMAN NEWS REFERENCE**

News Year	News No.	Page No.	Subject