Description of the ZF single-peg steering mechanism

General

The movements of the steering wheel are transmitted through the steering column and the flexible joint to the steering worm, which is mounted in adjustable taper ball bearings in the steering box. The steering peg, which is mounted in roller bearings on the drop arm shaft (rocker shaft), rolls along the flanks of the worm. It transmits the movement of the worm to the drop arm, and hence through the two tie rods to the steering arms on the stub axles and in this way to the front wheels.

Lubrication

High-grade SAE 90 gear oil should be used for the lubrication of the steering gear. The steering box has a capacity of about 1/4 US/quarts (0.25 liters). The oil level should be checked at regular intervals as specified in the Lubrication Chart.

Maintenance

Only in its central position, with the wheels in straight-ahead position, there is no play in the steering gear. If the steering gear is correctly adjusted and the vehicle is jacked up, this position will be indicated by a slight resistance at the steering wheel – known as the "pressure point". When adjustments are made to the steering peg, it is essential that the steering gear should be at this pressure point, as described in the following sections. A certain amount of play in the steering when the vehicle is stationary and the front wheels are turned from the straight-ahead position is quite normal. When the vehicle is on the road and is rounding a curve, this play is compensated for by caster action of the front wheels, acting through the tie rods and the drop arm, which forces the steering peg against one flank of the steering worm.
The toe-in must be checked with great care at regular intervals. It is prerequisite that the instructions given in the section **"adjusting toe-in"** are complied with when this is done.
Axial play of the steering worm can be reduced by removing some of the shims located between the steering box and the end plate.

Please note:

New steering boxes, and also those that have been overhauled by the manufacturers, are sealed to prevent tampering by a third party. Since the manufacturers will not accept any claims under the guarantee in respect of steering boxes with a damaged seal, we recommend that a few factory-reconditioned steering boxes should be kept in stock for exchange purposes, and that repairs be as far as possible entrusted to the manufacturers.

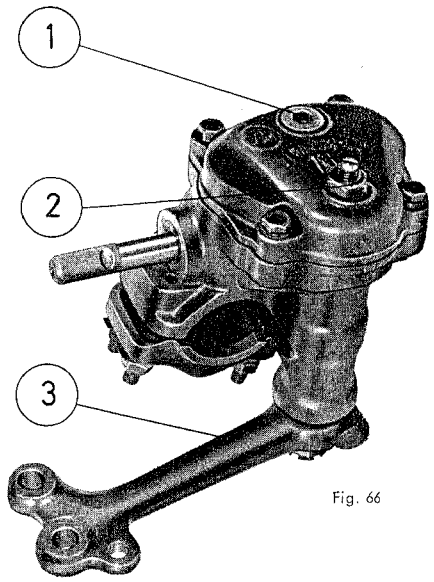

Fig. 66

Steering Gear

① Oil filler plug
② Adjusting screw and lock nut
③ Steering drop arm

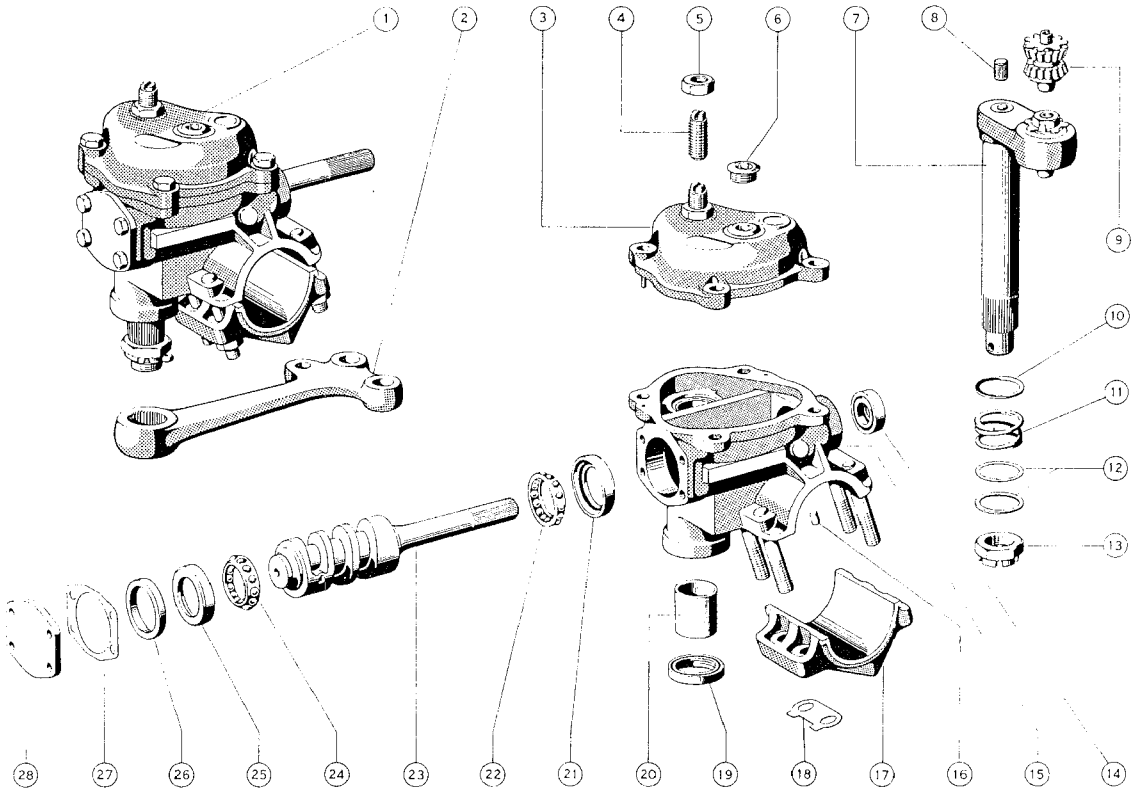

Fig. 67

① Steering box, complete
② Steering drop arm
③ Steering box cover
④ Adjusting screw
⑤ Lock nut for adjusting screw
⑥ Oil filler plug
⑦ Rocker shaft
⑧ Thrust pin
⑨ Steering peg roller bearing
⑩ Thrust washer
⑪ Compression spring
⑫ Thrust washers
⑬ Castle nut
⑭ Radial oil seal
⑮ Steering box
⑯ Dowel pin
⑰ Clamp
⑱ Lock plate
⑲ Seal
⑳ Bearing bushing
㉑ Ball race, top
㉒ Ball cage
㉓ Steering worm
㉔ Ball cage
㉕ Ball race, bottom
㉖ Spacer
㉗ Adjusting washer
㉘ End plate

Removing and Installing Tie Rods

20 ST

Special tool: VW 266 f Tie rod end remover

Removal

1. Jack up car and remove front wheels

2. Unlock and unscrew tie-rod end nuts

3. Press out tie rod ends with remover VW 266 f

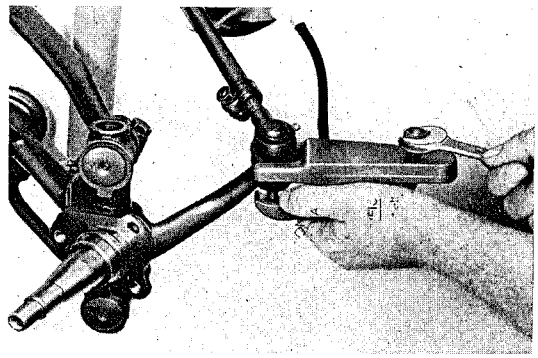

Fig. 68

4. Take off tie rods

Installation

When installing, proceed in reverse order, observing the following points:

1. Check tie rods for damage and deformation. Bent or damaged tie rods must always be replaced

2. Check tie rod ends for wear and, if necessary, replace separate tie rod ends or complete new tie rods. Only tie rod ends with undamaged ball stud threads should be re-used

3. Damaged, clogged or missing grease nipples should be replaced. Angle grease nipples should be fitted to the inner tie rod ends

4. Install short tie rod. Make sure that the bend contacts the drop arm of the steering gear

5. Tighten and lock tie rod end castle nuts and check toe-in

6. Grease tie rod ends

Removing and Installing Steering Damper

21 ST

Removal

1. Jack up car and remove front wheels

2. Unlock and unscrew castle nut on drop arm and on retaining clip

3. Lift out steering damper

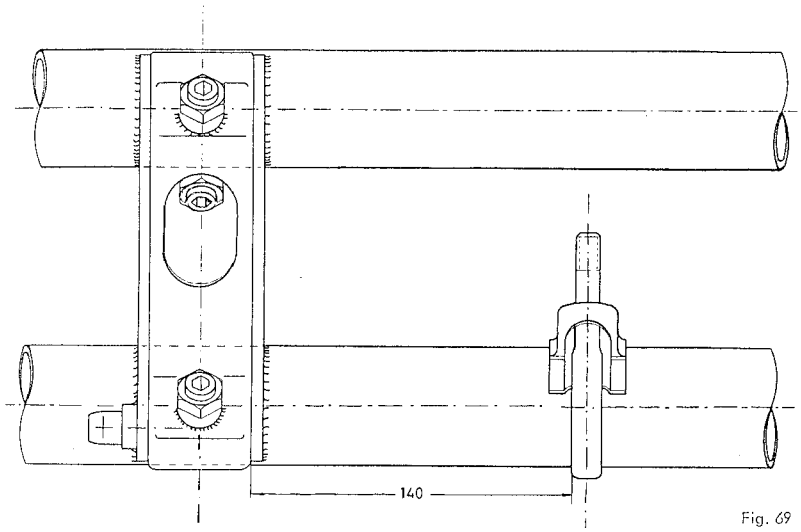

Fig. 69

Installation

When installing, proceed in reverse order, observing the following points.

1. Check steering damper, if necessary replace

2. Check rubber bushing on steering damper for wear, if necessary replace

3. Check retaining clips and nuts

4. Make sure that the dimension shown in fig. 69 is adhered to when assembling the retaining clip.
5. Tighten castle nuts until they rest on the rubber bushings, otherwise premature wear and rattling will result
6. Lock castle nuts

22 ST

Removing and Installing Steering Wheel

Removal

1. Disconnect battery
2. Remove horn button. Turn at outer ring with three lugs counterclockwise, applying some force, and remove horn button (see fig. 70)

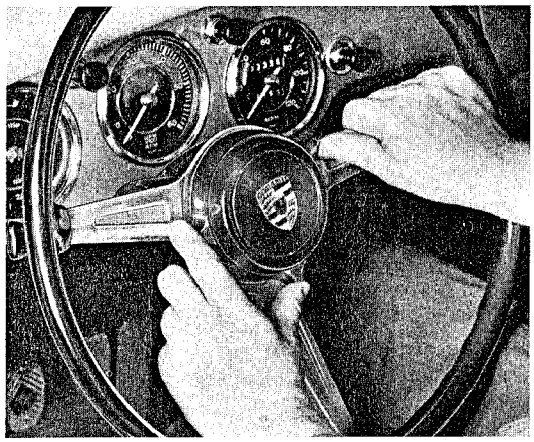

Fig. 70

3. Remove contact pin
4. Remove nut on steering wheel with socket wrench (27 mm opening) and remove steering wheel. When doing this, take care of pressure spring and retaining ring for steering shaft bearing.

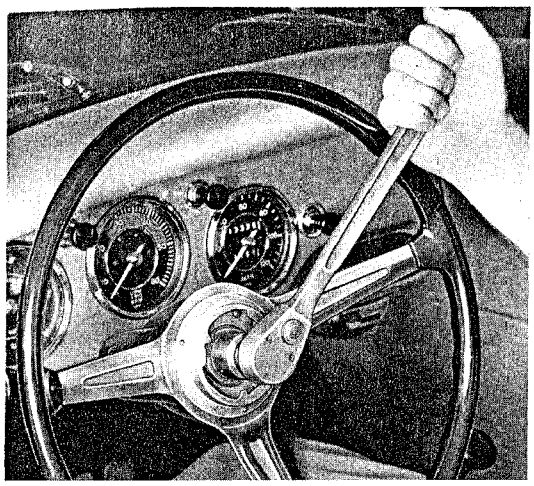

Fig. 71

Installation

Install by proceeding in reverse order, paying attention to the following points:

1. Attach pressure spring and retaining ring to steering wheel hub. (see fig. 72). Fit steering wheel with the wheels in straight-ahead position, and make sure that central spoke points downward. Lock steering wheel nut by a lock washer.

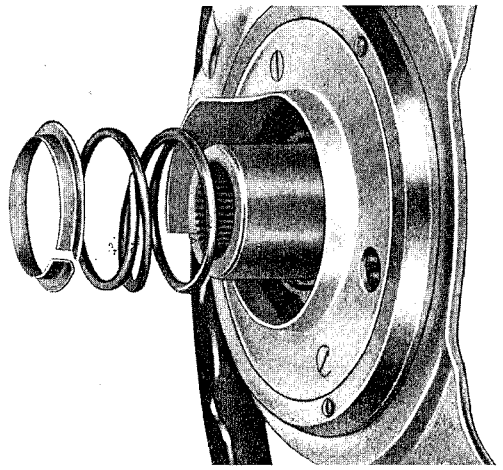

Fig. 72

2. Check whether return mechanism of flashlight switch is working correctly.

3. Insert contact pin and turn horn button clockwise until it engages.

Removing and Installing Steering Column

23 ST

Removal

1. Disconnect battery
2. Remove cover to steering box (fig. 73)

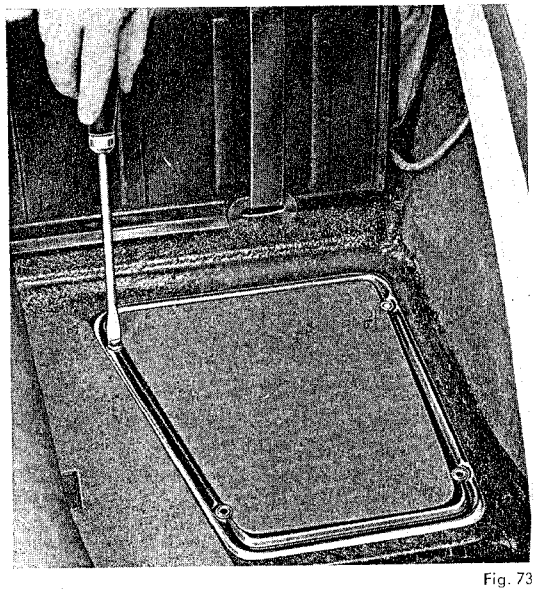

Fig. 73

3. Disconnect steering column at steering coupling (Unlock hex. hd. screw, unscrew and detach clamp from steering column (see fig. 74)

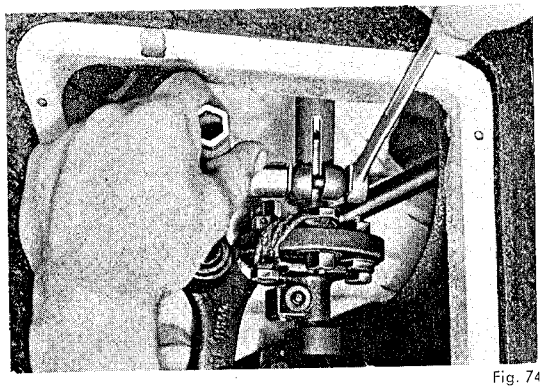

Fig. 74

4. Loosen steering wheel nut (21 St)
5. Pull out steering column with steering wheel of tubular jacket; to do this, turn steering wheel until steering column has disengaged from steering coupling, then remove steering wheel.

Installation

When installing, proceed in reverse order, observing the following points:

1. Check steering column for out-of true. Permissible out-of-true .0787" (2 mm)
2. Check whether steering shaft bearing in tubular jacket moves easily.

Note:

The steering shaft bearing is filled with special grease and therefore free of maintenance. If a replacement should become necessary, it can be pushed out of the lower end of the tubular jacket towards top.

3. Install clamp on steering column with a new lock plate, tighten hex. hd. screw and lock.

24 ST

Removing and Installing Steering Column Tube

Removal

1. Remove steering wheel (21 St)

2. Disconnect cables from sockets

3. Unscrew nuts at mounting studs below instrument panel

4. Turn steering column tube slightly to remove it from the rubber cushion in the dashboard

Installation

Installation is done in reverse order, observing the following points:

1. Check ease of movement of steering shaft bearing in tube.

Note:

The steering shaft bearing is filled with special grease and therefore free of maintenance. If a replacement should become necessary, it can be pushed out from the lower end of the tube towards top.

2. Check rubber cushion in dashboard, if necessary replace.

3. Insert tube until the steering column projects .925" + .0197" (23,5 + 0,5 mm) beyond the upper edge of the steering shaft bearing installed in the tube (see fig. 75)

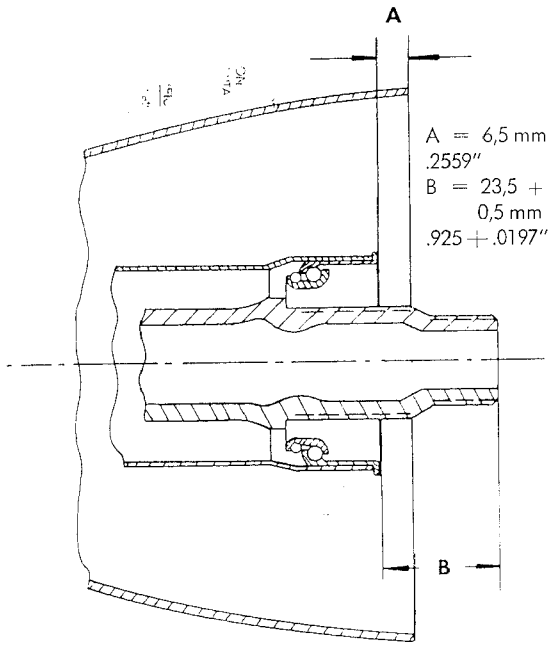

Fig. 75

4. When connecting the cables, take care to join only cables of matching colour.

Removing and Installing Steering Gear

Special tool: VW 266 f Tie rod end remover

25 ST

Removal

1. Jack up car, remove left front wheel
2. Open front hood and remove steering box cover and front cover. Disconnect battery.
3. Loosen steering damper at drop arm
4. Push out tie rod ends on drop arm, using tool VW 266 f (19 St) or some other commercial drift.
5. Remove horn button (21 St) and take out contact pin
6. Turn steering towards right or turn drop arm completely counterclockwise. Loosen steering column from steering coupling (22 St)
7. Remove clamp on steering gear after unlocking and removing hexagon nuts.
8. Remove steering gear from front axle and pull out towards front.

Installation

Installation is done in reverse order, observing the following points:

1. Check and adjust steering gear. If necessary, disassemble and replace damaged or worn out parts, or install a steering gear which has been reconditioned by factory experts.
2. Attach steering gear to axle tube, remember dowel pin.
3. Lock retaining nuts on clamp with new lock plates. Tightening torque 22 ft lb (3 mkg).
4. Check oil level, if required, top up to lower rim of oil filler opening with gear oil of the prescribed specification (capacity 1/4 US/quarts, 0,25 l).
5. Check and if necessary readjust toe-in.

Important!

After every removal and reinstallation of the steering gear check and if necessary adjust toe-in. The instructions on "adjusting toe-in" in section "W: Alignment of Wheels" must be strictly observed.

Disassembly and Assembly of Steering Gear

26 ST

Disassembly:

1. Pull off steering coupling (Unlock screw and unscrew)
2. Unlock and unscrew retaining nut for drop arm
3. Pull off drop arm with special tool P 72

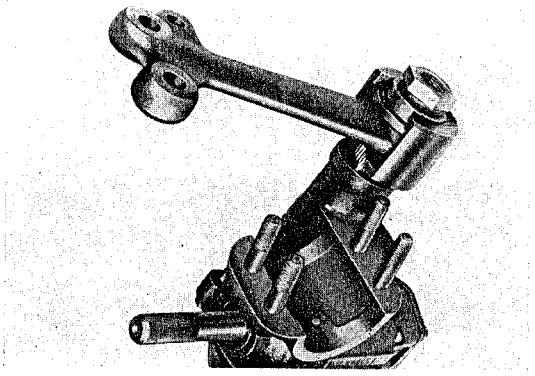

Fig. 76

4. Loosen the 4 retaining screws on steering box cover and take off cover
5. Pull out rocker shaft

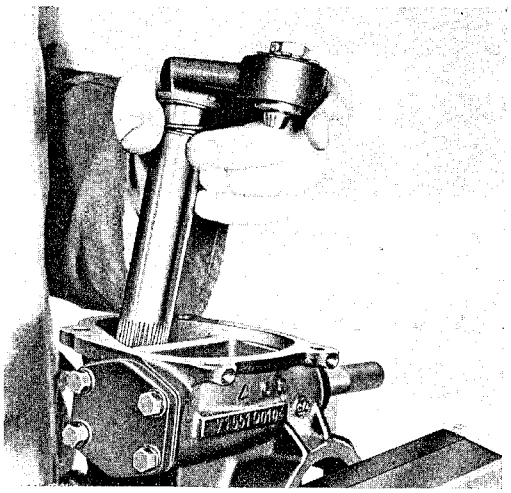

Fig. 77

6. Pull washers and compression spring from rocker shaft
7. Unscrew retaining screws on end plate, remove end plate

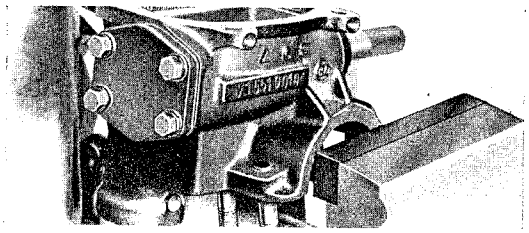

Fig. 78

8. Take out shims and collect at a safe place
9. Take out spacer ring

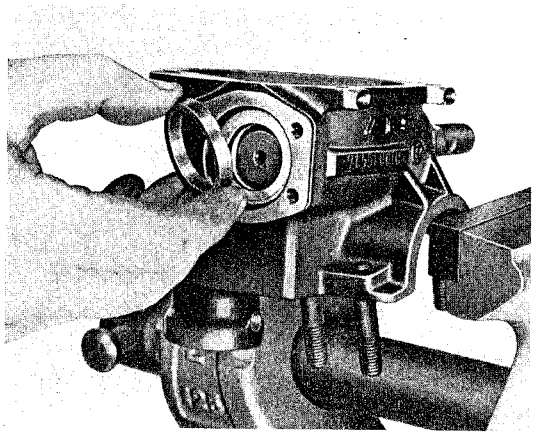

Fig. 79

10. Pull out steering worm downward, if necessary by using a composition hammer.

Important!

Do not mix up bearing cage und bearing race, all parts of the taper roller bearing must be refitted to the same side of the steering worm.

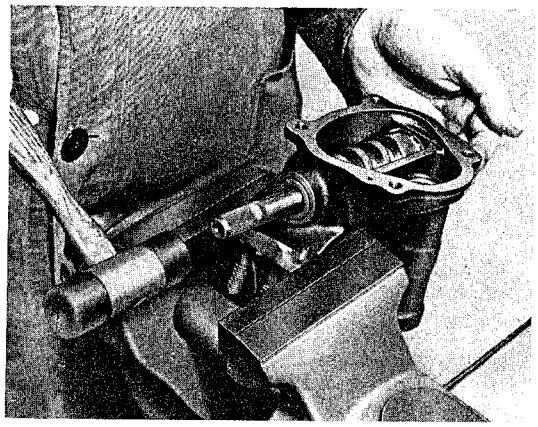

Fig. 80

11. Remove oil seal for rocker shaft and steering worm

Assembly

The steering gear is re-assembled in reverse order, observing the following points:

1. Thoroughly clean the steering box and all components
2. Check the worm and the peg for wear, renewing them, if necessary. When doing this, the following points should be kept in mind:
   a) if the worm is renewed, both taper bearings must also be replaced
   b) if the peg is renewed, a new locking plate must also be fitted. See procedures (28 St)
3. Fit new oil seals
4. Insert worm, together with upper bearing, which should be packed with grease, through the lower opening

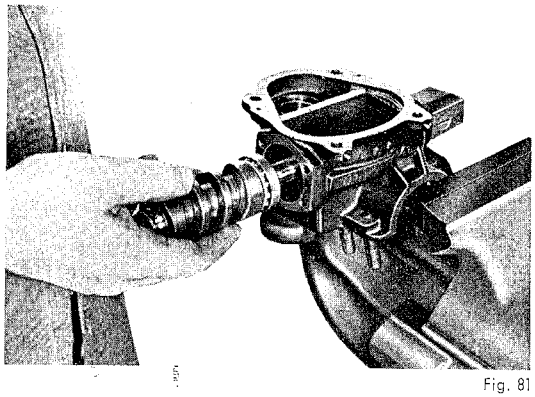

Fig. 81

5. Pack the lower bearing with grease and fit in place. Then fit outer race.

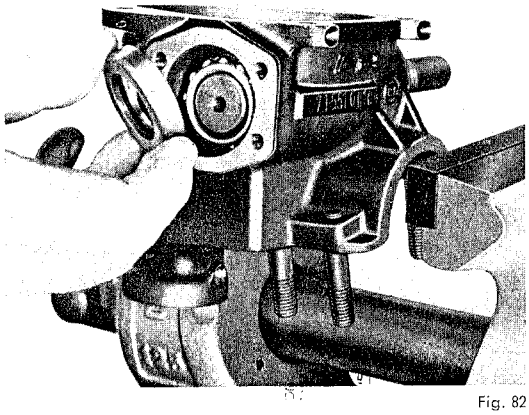

Fig. 82

6. If a new steering worm is fitted, place sufficient shims between the steering gear and the end plate to ensure that the worm turns freely but has no play. Do not use any paper gaskets for making this adjustment.

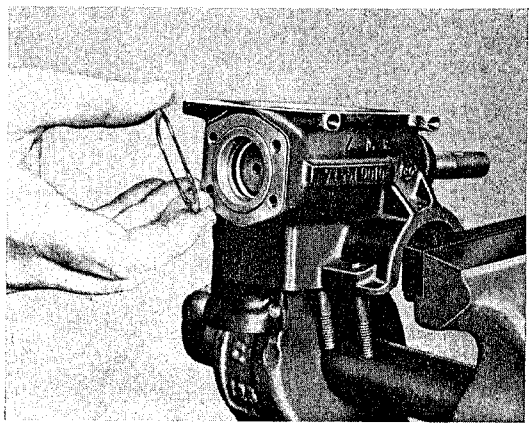

Fig. 83

7. For adjustment, turn steering so that it is at "Pressure Point". (Lines marked on worm and steering box must coincide).

8. Fill steering box with 0.25 liters of SAE 90 hypoid gear oil.

9. Make sure that the marks on the drop arm and the rocker shaft coincide (see fig. 84).

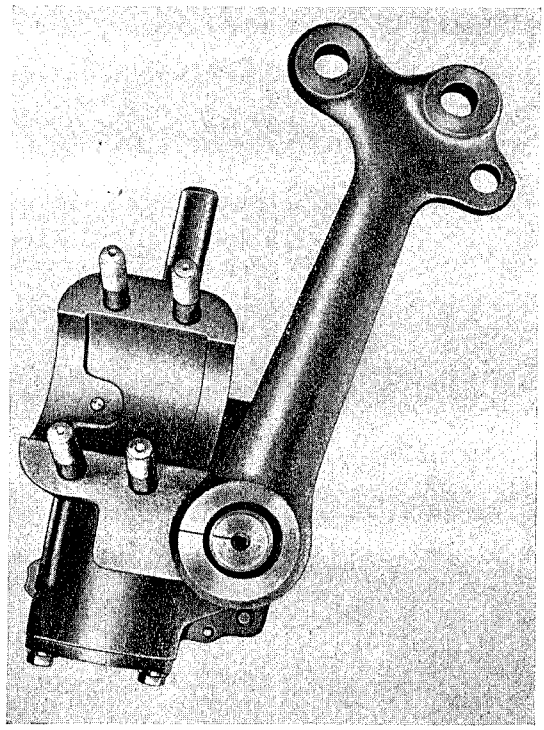

Fig. 84

10. Screw up castle nut and insert cotter pin. Tightening torque 112 ft lb. (15 mkg).

Please note:

It is advisable not to disassemble the steering gear except in an emergency, since the manufacturers refuse any claims under the guarantee, if the seal on the bolts securing the cover plate is broken. See also note in section on "Maintenance" on page S 33.

Adjustment

The pressure point is adjusted by the manufacturers. Only in exceptional cases any attempt should be made to correct this adjustment. In general, it is advisable to have the pressure point a little loose rather than too tight. Maximum play of the steering wheel in the central position should be .3937" (10 mm).

The play can be adjusted by means of the adjusting screw and lock nut.

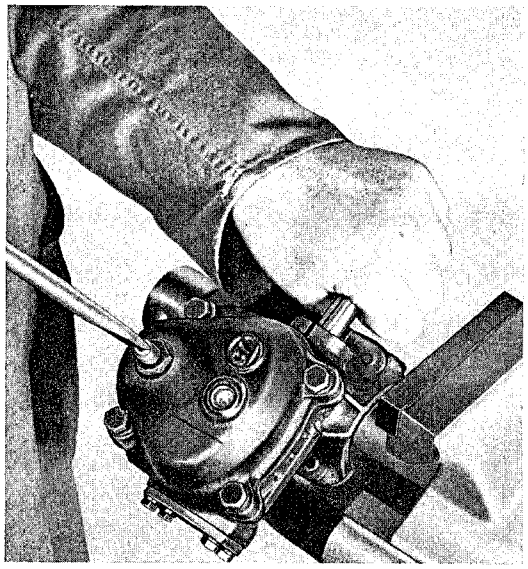

Fig. 85

Take care: Unlike the worm steering gear formerly employed, the single-peg gear is designed in such a way that only in the centre of its range, with front wheel deflections between ± 2°, there is no play. If the wheels are turned more than 3° in either direction there must be play in the steering mechanism.

This design makes it possible to adjust the steering gear accurately and to take up any wear without any danger of the peg binding at some other point on its travel. When checking the play in the steering, the front wheels must be placed accurately in the straight-ahead position. The central position of the steering gear is indicated by notches on the steering box.

27 ST

Position of Pressure Point

The pressure point is located midway between full left and full right lock, and is indicated by a line on the spindle of the steering worm and a notch on the steering box (fig. 85). It is possible to bring these two marks into alignment at points other than the pressure point. To avoid this error, turn the steering wheel to full lock (in either direction). Then turn the wheel back approx. one full revolution and align the marks.

The accurate adjustment of the pressure point is effected by means of a torque measuring device. This can be supplied on special order.

28 ST

Adjustment of Pressure Point

1. Disconnect tie rods and steering damper from drop arm.
2. Unscrew lock nut on steering gear
3. Tighten adjusting screw (right hand thread) until a slight resistance is felt when turning the steering wheel through its central position.
4. Tighten lock nut
5. Fasten tie rod and steering damper.

The pressure point should not be noticeable when the car is being driven. Under no circumstances try to eliminate steering shocks by increasing the pressure point. (If measuring device is available, set the pressure point to 4.34–6.08 in. lbs. (5–7 cmkg).

Note: It is essential that the instructions regarding the adjustment of the toe-in given in the group "Alignment of wheels" are observed.

Removing and Installing Steering Peg (mounted in roller bearings)

29 ST

Removal

1. Fix the cylindrical shoulder on the steering peg adjacent to the tapered portion in a vise (use jaw protectors).

2. Straighten the bent-up lug on the locking plate and unscrew the nut.

3. Take the rocker shaft out of the vise, and strike the threaded end of the peg with a composition hammer until the peg and rollers fall out and the adjusting cone can be removed.

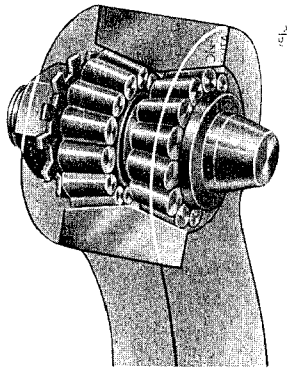

Fig. 86

Installation

The steering peg is fitted in reverse order, attention being paid to the following points:

1. Wash all components and check for wear. The normal play between the rocker shaft and the bore (bushing) is .00078" to .00197" (0.017 to 0.05 mm). Wear tolerance is .00236" (0.06 mm).

2. Coat tapered section of peg and adjusting cone with a .0591" (1.5 mm) thick layer of ball bearing grease or vaseline.

3. Place rollers on peg and on adjusting cone. Take care that the larger diameter ends of the rollers are placed on the larger diameters of the tapered bearing surface, so that both tapers increase together.

4. Carefully place adjusting cone with its rollers in the appropriate taper bore on the rocker shaft.

5. Push the peg with its rollers in its bore in the rocker shaft and carefully press in, using a pair of pliers, if necessary.

6. Fit a new locking plate.

Important!

Where possible, the rollers should be fitted to the same taper as that on which they were originally. It is absolutely essential that the full number of rollers is fitted in each of the two roller bearings. If a roller is missing, destruction of the bearing cannot be avoided.

Adjusting steering peg

1. Fix the cylindrical shoulder of the peg in a vise with the threaded end facing upward.

2. Slightly bend up lugs of the locking plate.

3. Tighten the nut gently until a slight resistance is felt when the peg is turned. This resistance should be slightly greater when a new bearing is fitted than when the bearing has been in use previously.

4. Check the adjustment once more and then bend up two diametrically opposed lugs on the locking plate that are at right angles to one of the plates on the nut.

Note: When locking plate is taken off, remove the lugs which had been bent up; they must never be used a second time for locking the nut. Take in any case a new locking plate.