

SECTION JJ

THE STEERING GEAR

(RACK AND PINION)

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GENERAL DESCRIPTION

The rack and pinion type steering gear is secured to the engine bulkhead immediately above the clutch housing. Tie-rods, operating the steering arms, are attached to each end of the steering rack by ball joints enclosed in rubber gaiters.

The steering column engages the splined end of a helical-toothed pinion to which it is secured by a clamp bolt.

End-play of the pinion is eliminated by adjustment of the shims fitted beneath the pinion tail end bearing. A damper pad inserted beneath the steering rack controls the backlash between the pinion and rack.

Section JJ.1

MAINTENANCE

A lubricating nipple provided at the left-hand end of the rack housing is accessible from under the bonnet, below the engine bulkhead. This nipple should be used to replenish the rack housing with Hypoid oil to Ref. B (page P.2) every 12,000 miles (19200 km.). Avoid over-filling the steering gearbox and keep the clips on the rubber gaiters fully tightened to prevent the oil escaping. No more than 10 strokes of the hand-type lubricating gun may be given.

Apply a lubricating gun filled to Ref. C (page P.2) to the nipple on each tie-rod ball joint every 1000 miles (1600 km.).

Section JJ.2

REMOVAL AND REPLACEMENT OF THE STEERING WHEEL

Disconnect the battery at the negative terminal. Remove the screw from the side of the steering wheel hub and withdraw the horn-push.

Remove the steering wheel retaining nut, using a $\frac{7}{8}$ in. (22.22 mm.) box spanner. The steering wheel can then be withdrawn from the splined end of the steering column.

Reassembly is a reversal of the above procedure, but ensure that the steering wheel nut is tightened to the recommended torque figure given in 'GENERAL DATA'.

Section JJ.3

REMOVAL AND REPLACEMENT OF THE STEERING COLUMN ASSEMBLY

Remove the connector from the negative battery terminal.

Disconnect the horn and trafficator switch wires from the snap connectors below the instrument panel.

Remove the clamp nut and bolt from the splined lower end of the steering column and remove the two countersunk-headed screws securing the column support bracket beneath the fascia panel.

Disengage the column assembly from the pinion shaft splines and lift from the car.

The method of replacing the steering column assembly is a reversal of the above instructions but it is essential that the splines on the steering column and the pinion are in correct engagement. The slot in the steering column splined clamp must coincide with the mark on the end of the pinion. The mark is at bottom dead centre when the wheels are in the straight-ahead position.

Section JJ.4

REMOVAL AND REPLACEMENT OF THE STEERING RACK ASSEMBLY

Remove the steering column assembly as described in Section JJ.3.

Remove the split pins and slacken the slotted nut on each tie-rod ball joint. **Do not remove the nut but unscrew it until it is flush with the end of the pin thread.** Tap the circumference of the steering arm eye sharply and then place a support above the arm and drive the taper pin from the seating. The securing nut may now be removed and the tie-rod lifted from the arm. Note the position of the rubber sealing washer.

To allow the steering rack to be manoeuvred forward and above the clutch bell housing the rear of the engine must be lowered two or three inches.

Mark the flanges to assist correct reassembly, disconnect the propeller shaft from the rear axle flange,

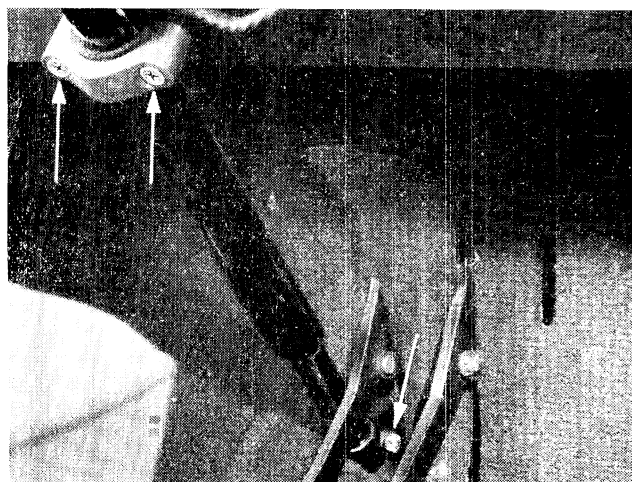


Fig. JJ.1

The two steering column bracket support screws and the clamp nut and bolt on the splined lower end are indicated by the arrows

and place a support beneath it. Support the gearbox rear end and remove the rear engine cross-member (see Section AA.5). The rear of the engine may now be lowered a few inches only.

Extract the four bolts and spring and plain washers securing the steering rack housing to the brackets on the body. Withdraw the housing from the front wheel aperture on the steering wheel side.

Replacement of the steering rack is a reversal of the above instructions except that the bolts securing the housing to the body brackets should not be finally tightened until the steering column assembly has been fitted and secured to the column support bracket. This method of assembly will ensure that the steering rack pinion is in correct alignment with the column. Do not forget finally to tighten the rack housing bolts.

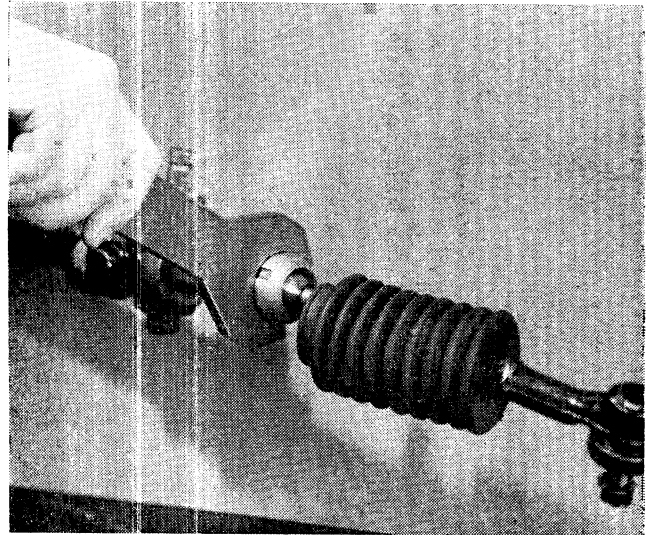


Fig. JJ.3

Use the special tie-rod C-spanner 18G313 to slacken or tighten the ball joint caps

pad, spring, and shims. Care must be taken not to lose any of the shims.

Extract the two bolts securing the pinion shaft tail bearing and remove the bearing and shims. Withdraw the pinion complete with the bottom thrust washer. The top thrust washer (the thickest one) is trapped behind the rack teeth and may be removed after the rack is withdrawn.

Secure the rack between suitable clamps in a vice and tap back the washers locking the tie-rod ball housings. Unscrew the ball joint caps with the special tie-rod C-spanner (special tool 18G313) and remove the lock washers.

The steering rack may now be withdrawn from the housing.

Screw the ball seat housing from the ball joint caps, using the special C-spanner previously mentioned together with the special tie-rod pin spanner 18G312.

The shims and ball seats are now free to be removed; ensure that they are kept to their respective sides.

Section JJ.6

EXAMINING PARTS FOR WEAR

Thoroughly clean and examine for wear all parts of the pinion housing, shaft, and teeth. If badly worn the pinion or housing, or both, should be renewed.

Fractures or hollows, or any roughness on the surface of the teeth will render the rack or pinion unserviceable.

Clean off and examine the rubber gaiters. If they are damaged new ones **must** be fitted. Remove the oil

Section JJ.5

DISMANTLING THE STEERING RACK

Measure and record the distance from the spanner flats on the tie-rods to each of the ball joint locknuts: this will be of great assistance when reassembling.

Slacken the ball joint locknuts and unscrew the ball joint assemblies.

Position the rack housing over a receptacle to catch the oil, release the gaiter clips from the rack housing and tie-rods, and remove the rubber gaiters.

Unscrew the hexagonal cap which is adjacent to the oil nipple on the housing and withdraw it complete with sealing washer, pressure pad, and spring.

Unscrew the damper pad housing fitted at the pinion end of the rack housing and withdraw it complete with

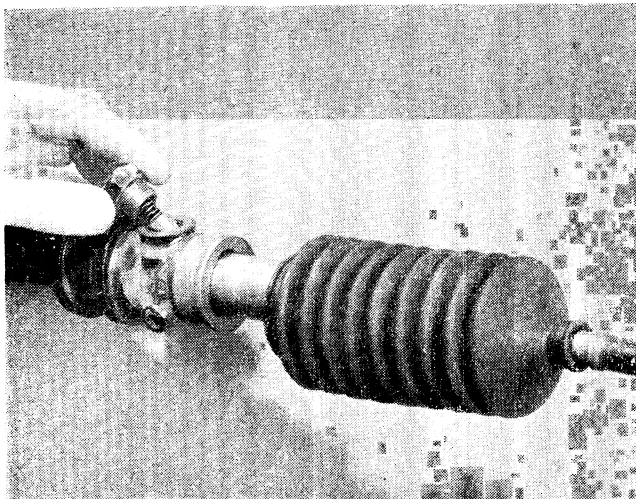
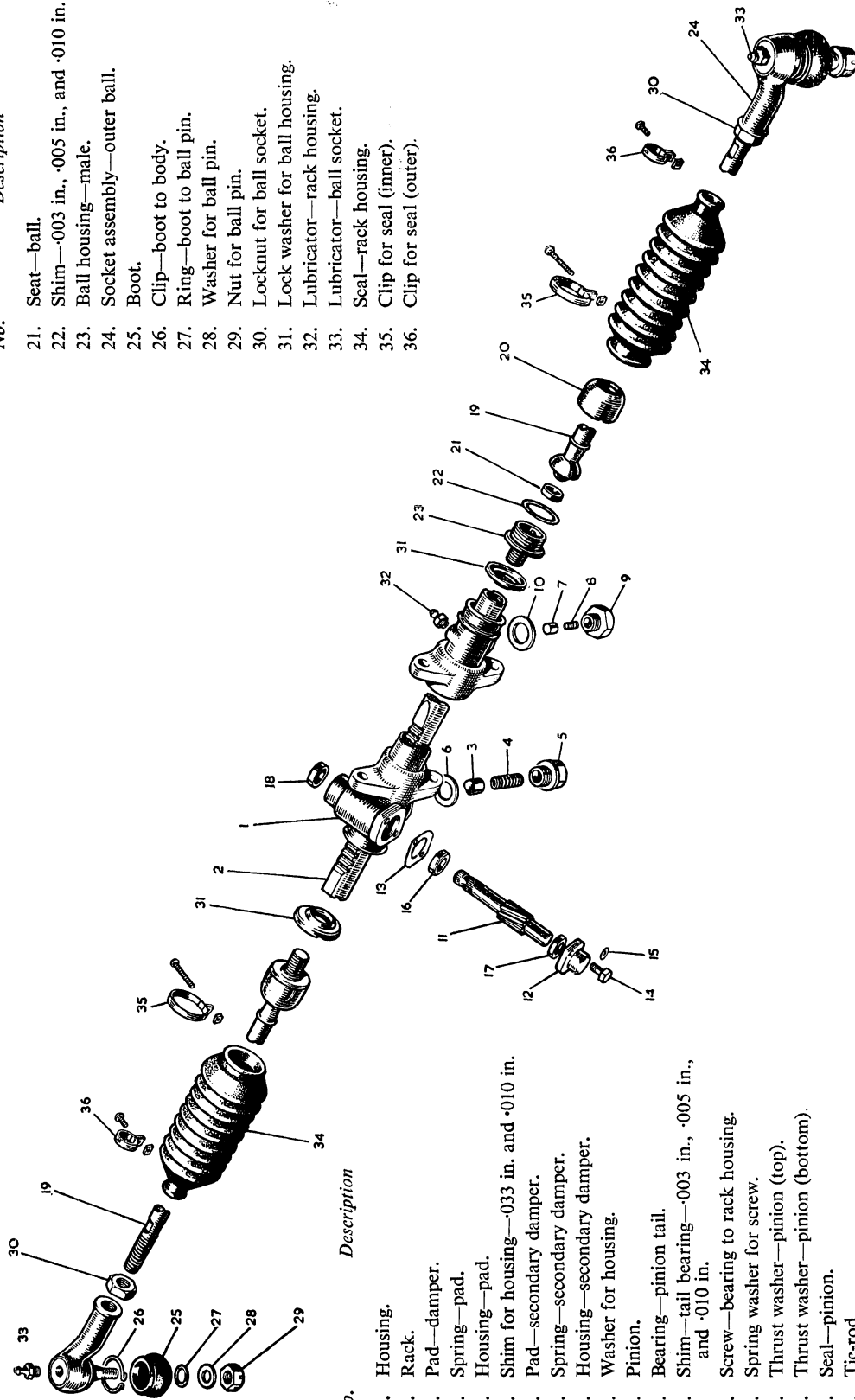


Fig. JJ.2

When removing the rack damper ensure that all the shims are removed with it to avoid possible loss

THE STEERING GEAR COMPONENTS



- | No. | Description |
|-----|---------------------------------------|
| 21. | Seat—ball. |
| 22. | Shim—.003 in., .005 in., and .010 in. |
| 23. | Ball housing—male. |
| 24. | Socket assembly—outer ball. |
| 25. | Boot. |
| 26. | Clip—boot to body. |
| 27. | Ring—boot to ball pin. |
| 28. | Washer for ball pin. |
| 29. | Nut for ball pin. |
| 30. | Locknut for ball socket. |
| 31. | Lock washer for ball housing. |
| 32. | Lubricator—rack housing. |
| 33. | Lubricator—ball socket. |
| 34. | Seal—rack housing. |
| 35. | Clip for seal (inner). |
| 36. | Clip for seal (outer). |

- | No. | Description |
|-----|----------------------------------------------------|
| 1. | Housing. |
| 2. | Rack. |
| 3. | Pad—damper. |
| 4. | Spring—pad. |
| 5. | Housing—pad. |
| 6. | Shim for housing—.033 in. and .010 in. |
| 7. | Pad—secondary damper. |
| 8. | Spring—secondary damper. |
| 9. | Housing—secondary damper. |
| 10. | Washer for housing. |
| 11. | Pinion. |
| 12. | Bearing—pinion tail. |
| 13. | Shim—tail bearing—.003 in., .005 in., and .010 in. |
| 14. | Screw—bearing to rack housing. |
| 15. | Spring washer for screw. |
| 16. | Thrust washer—pinion (top). |
| 17. | Thrust washer—pinion (bottom). |
| 18. | Seal—pinion. |
| 19. | Tie-rod. |
| 20. | Ball housing—female. |

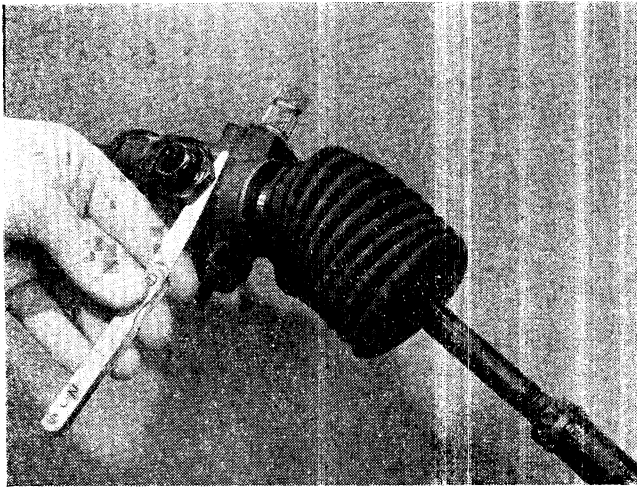


Fig. JJ.4

Measure with a feeler gauge the clearance between the damper cap and the rack body, having first removed the shims and plunger spring

nipple from the rack housing and the two nipples on the ball joints. Check them by forcing lubricant through them to ensure that they are not blocked.

If the tie-rod inner ball housings or seats are badly worn they must be renewed and then adjusted as detailed in Section JJ.7. The outer ball joint is not adjustable, and if worn must be replaced by a new assembly.

Section JJ.7

REASSEMBLING THE STEERING RACK

Fit a new lock washer to one end of the steering rack, then replace and tighten the ball seat housing. Replace the shims and ball seat and, after inserting the ball end of the tie-rod, screw up the ball housing until it is quite tight. The ball must be a reasonably tight sliding fit without play. Any adjustment required is carried out by varying the thickness of shims fitted beneath the ball joint cap seating. The shims are available in thicknesses of $\cdot005$, $\cdot008$, and $\cdot010$ in. ($\cdot127$, $\cdot20$, and $\cdot254$ mm.). When correctly adjusted the ball housing must be locked in three places with the flange of the lock washer.

Insert the rack in the housing and refit and adjust the other ball seat in a similar manner.

Draw the rack through its housing until the centre tooth (No. 12 from either end) is in the centre of the pinion housing.

Place the thickest of the pinion thrust washers in position in the rack housing with its chamfered edge towards the rack. Replace the smaller thrust washer on the plain end of the pinion shaft with the chamfered edge towards the pinion teeth.

Replace the pinion, ensuring that the centre tooth on the rack is in line with the mark on the splined end of the pinion shaft. Correct engagement of the rack and pinion is essential if the steering wheel position is not to be affected.

Replace the shims and pinion tail bearing. Bolt the bearing into position and check the end-play of the pinion shaft, which should be between $\cdot002$ and $\cdot005$ in. ($\cdot05$ and $\cdot127$ mm.). If necessary, the shims must be adjusted to give this degree of clearance. Shims are available in thicknesses of $\cdot003$, $\cdot005$, and $\cdot010$ in. ($\cdot076$, $\cdot127$, and $\cdot254$ mm.).

Refit the rubber gaiters and clips.

Replace the ball joint locknuts and joint assemblies in approximately their original positions, referring to the figures recorded when the rack was dismantled.

The adjustment of the rack damper must be checked, and to do this the plunger must be replaced in the cap and the cap screwed into position without the plunger spring and shims until it is just possible to rotate the pinion shaft by drawing the rack through its housing. A feeler gauge is then used to measure the clearance between the hexagon of the plunger cap and its seating on the rack housing (see Fig. JJ.4). To this figure must be added an additional clearance of $\cdot002$ to $\cdot005$ in. ($\cdot05$ to $\cdot127$ mm.) to arrive at the correct thickness of shims which must be placed beneath the damper cap. The shims are available in thicknesses of $\cdot003$ and $\cdot010$ in. ($\cdot076$ and $\cdot254$ mm.).

Remove the damper cap and plunger. Insert the spring beneath the plunger and replace and tighten the assembly with the requisite number of shims fitted as defined in the previous paragraph.

Fit a new pinion shaft oil seal, and pump 10 fluid ounces ($\cdot28$ litre approx.) of hypoid oil to Ref. B (page P.2) into the rack housing through the nipple provided.

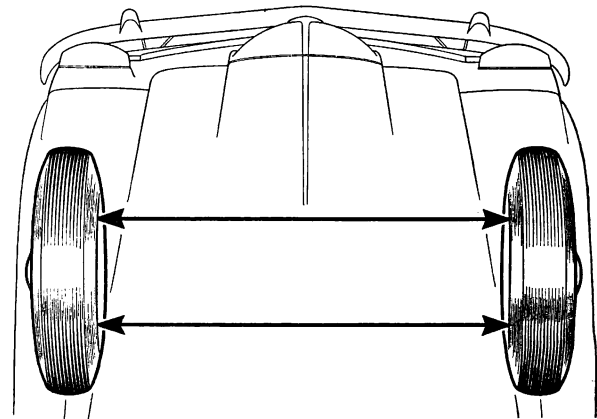


Fig. JJ.5

In this illustration of the front wheels the measurements between the positions indicated by the arrows must be identical

Section JJ.8

CHECKING AND SETTING FRONT WHEEL ALIGNMENT

When correctly adjusted the front wheels must be parallel to each other with the car in an unladen condition. To carry out any necessary adjustment first check that all tyres are inflated to the recommended pressures (see 'GENERAL DATA').

Turn the wheels to the straight-ahead position and position the pointers of a set of alignment trammels to the height of a wheel centre, or make use of an alignment fixture if one is available.

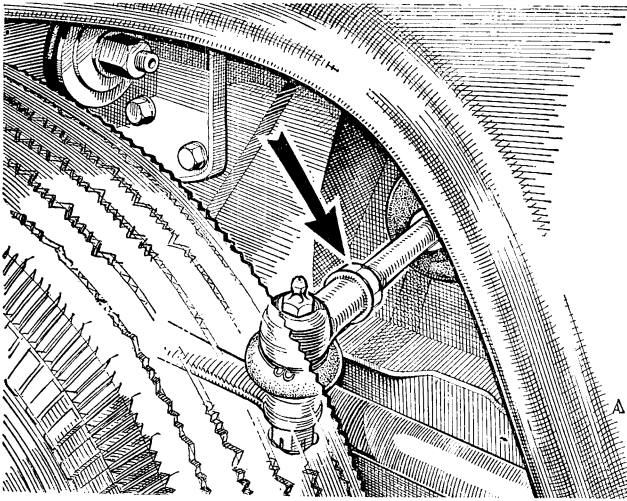


Fig. JJ.6

The locknut for the tie-rod ball joint on the left-hand side is indicated by the arrow

Place the trammel at the front of the wheels and adjust it longitudinally so that both pointers register against the inside of each wheel. Mark the position of the pointers on each wheel rim with chalk, withdraw the trammel, and push the car forward so that the wheels make exactly half a revolution.

Move the trammel to the rear of the front wheels so that both pointers register with the chalk marks on each wheel. For the alignment to be correct both pointers should just touch each wheel rim.

Should they not do so, adjust the track by slackening the locknut for each tie-rod ball joint and the clips securing the rubber gaiters to the tie-rods, then rotate each tie-rod equally in the necessary direction. Both tie-rods have right-hand threads and should be rotated with a spanner applied to the flats provided.

NOTE.—To ensure that the steering rack is in the central position and that the steering geometry is correct it is important that the tie-rods are adjusted to exactly equal lengths. This can be ascertained by measuring from the end of the spanner flats to the locknuts.

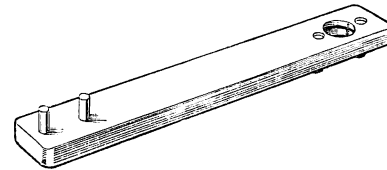
After adjustment tighten the ball joint locknuts and rubber gaiter clips.

Section JJ.9

SPECIAL TOOLS

18G312. Steering Tie-rod Pin Spanner

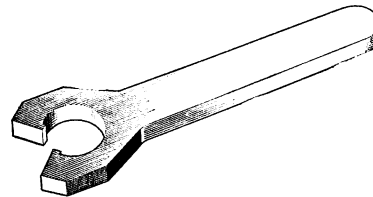
This tool is designed for use with the special C-spanner 18G313 for dismantling the steering tie-rod ball housing. In use it is clamped in a vice and the pins of the spanner are engaged with the holes in the housing. Use the spanner 18G313 to unscrew the housing cap.



18G312

18G313. Steering Tie-rod C-Spanner

Designed to engage the shallow splines of the steering rack ball housing cap and remove it without damage.



18G313