SECTION J

STEERING

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Section J.1

DESCRIPTION

The steering gear is of the rack and pinion type and is secured above the front frame cross member immediately behind the radiator. Tie-rods, operating the swivel 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 in the steering rack controls the backlash between the pinion and the rack.

Section J.2

MAINTENANCE

Provision has been made to replenish the rack housing with hypoid oil every 12,000 miles (19200 km.). The oil nipple is situated on the left side (right side for L.H.D. vehicles) of the rack housing and is positioned to enable the lubricant to be injected from above. Avoid overfilling the rack housing and keep the clips on the rubber gaiters fully tightened to prevent the oil escaping.

Apply the lubricating gun to the nipple on each tie-rod ball joint every 1,000 miles (1600 km.).

Section J.3

ADJUSTMENTS IN THE VEHICLE

The following adjustments maintain the performance of the steering at its maximum, and consists of aligning the front wheels and taking up backlash in the steering gear. Proceed as detailed below:

(1) Front wheel alignment is governed by four factors—camber, castor, swivel pin inclination and wheel toe-in. The correct camber and swivel pin angles are built into the front suspension and will change only if the suspension is distorted by accidental damage. It is most important that the front wheels should toe-in $\frac{1}{16}$ in. (1·58 mm.) to $\frac{1}{8}$ in. (3 mm.) and this is governed by the length of the tie-rods. Adjustments are provided so that the tie-rods may be lengthened or shortened to maintain the correct alignment.

Should adjustment be necessary, slacken the locknut of 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.

When making adjustments remember that they are double, that is to say, adjustments of the rim in one direction makes a similar increase of the opposite portion of the rim in the other direction.

The track is best adjusted by means of a Dunlop Optical Alignment Gauge, particulars of which can be obtained from the Dunlop Rubber Co. Ltd., Fort Dunlop, Erdington, Birmingham, England.

When adjustment are completed make sure to re-tighten the locknuts and rubber gaiter clips and particularly that the bottom surfaces of the ball joints are in the correct plane.

When the track is correctly adjusted and the wheels are in the straight-ahead position the tie-rods should be adjusted to equal lengths. This can be checked by measuring the distance from the spanner flats to the ball joint locknuts.

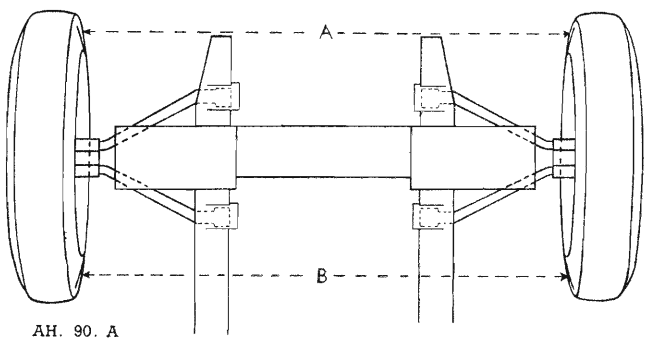


Fig. J.1. The toe-in must be adjusted so that 'A' is $\frac{1}{16}$" to $\frac{1}{8}$" less than 'B.'

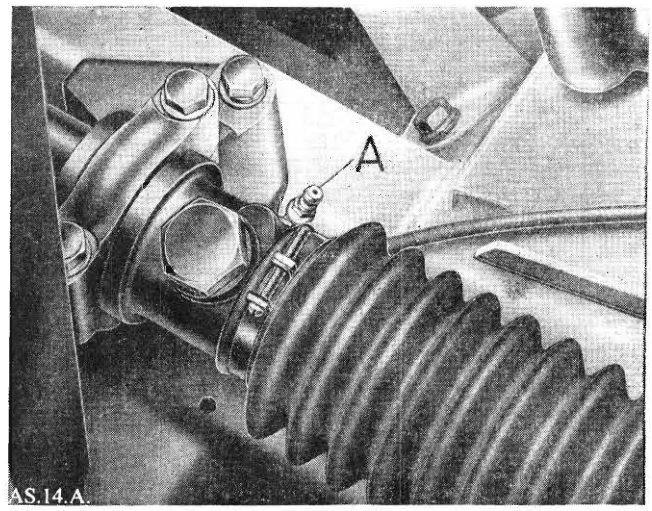


Fig. J.2. Oil nipple provided for lubrication of the steering rack and pinion.

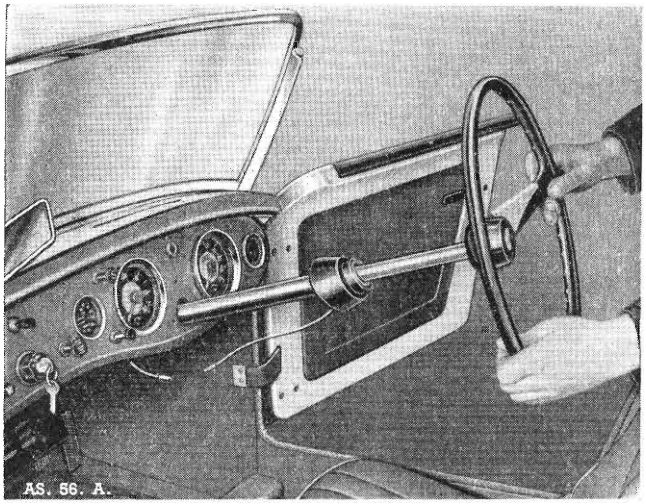


Fig. J.3. Showing the removal of the steering column.

When adjusting the track the following precautions should be observed:

(*a*) The car should have come to rest from a forward movement. This ensures, as far as possible, that the wheels are in their natural running position.

(*b*) It is preferable for alignment to be checked with the car laden and the tyres inflated to the standard pressure of 18 lb./sq. in. (1·27 kg./cm²).

(*c*) With conventional base-bar type alignment gauges measurements in front of and behind the wheel centres should be taken at the same points on the tyres or rim flanges. This is achieved by marking the tyres where the first reading is taken and moving the car forwards approximately half a road wheel revolution before taking the second reading at the same points.
With the Dunlop Optical Gauge two or three readings should be taken with the car moved forwards to different positions—180° road wheel turn for two readings and 120° for three readings. The average figure should then be calculated.
Wheels and tyres vary laterally within their manufacturing tolerances, or as the result of service, and alignment figures obtained without moving the car are unreliable.

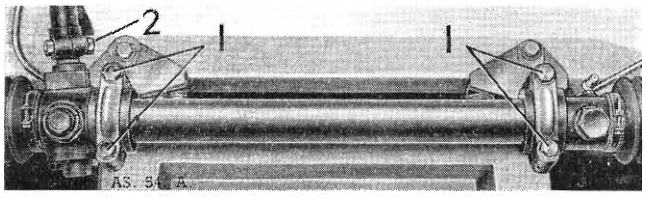


Fig. J.4. Showing the mounting points '1' of the steering rack and '2' being the steering column clamp bolt.

(2) Adjustment is provided between the rack damper cap and the rack body. This is to eliminate back-lash between the pinion and the rack.
To adjust the damper cap proceed as follows:
(*a*) Disconnect the tie-rods from their respective swivel arms in order to free the gear of all loads.
(*b*) Unscrew the steering column clamp bolt and withdraw the column from the pinion shaft splines.
(*c*) Unscrew the damper cap and remove its shims and plunger spring. Position the plunger in the cap and replace the cap. Then screw down the cap until it is just possible to rotate the pinion shaft by drawing the rack through its housing.
(*d*) A feeler gauge is then used to measure the clearance between the hexagon of the damper cap and its seating in the rack housing (Fig. J.5). To this figure must be added a clearance of ·002 to ·005 in. (·05 to ·127 mm.) to arrive at the correct thickness of shims which must be placed beneath the damper cap. The shims are available in thicknesses of ·003 and ·010 in. (·076 and 0·254 mm.).
(*e*) 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.
(*f*) Refit both steering column and swivel arms to the steering rack assembly.

(3) Excessive end play of the pinion is rectified by the fitting of shims of pre-determined thicknesses and is performed in the following manner:
(*a*) Disconnect the tie-rod(s) from the swivel arm(s) to free the gear of all loads.
(*b*) Unscrew the steering column clamp bolt, 2 Fig. J.4, and withdraw the column from the pinion and shaft splines.
(*c*) By means of a dial gauge placed at the splined end of the pinion shaft, check the end play of the shaft which should be between ·002 in. and ·005 in. (·05 and ·13 mm.). If necessary the shims must be adjusted to give this end play.
(*d*) Refit both steering column and swivel arms to the steering rack assembly.

(4) The ball joints linking the tie rods to the rack

must be a reasonably tight sliding fit without play. If by examination this is not correct then the following procedure should be adopted:

(*a*) Disconnect the tie-rod(s) from the swivel arm(s).

(*b*) Place a suitable receptacle under the ball joint concerned and release the gaiter clips from the rack housing and tie-rod(s) and remove the rubber gaiter(s).

(*c*) Tap back the washer locking the ball housing. Unscrew the ball joint caps with Service Tool 18G 313 and remove the lockwasher.

(*d*) Fit a new ball housing lockwasher. Replace the shims and ball seat and, after inserting the ball into its mating socket screw up the ball housing until it is quite tight.

(*e*) 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 ·005, ·008 and ·010 in. (·127, ·20 and ·254 mm.).

(*f*) When correctly adjusted the ball housing must be locked in three places with the flange of the lock washer.

(*g*) Replace the rubber gaiter(s) and clips and replenish the rack housing with hypoid oil. (See Section J.2.)

(*h*) Refit the tie-rod(s) to the swivel arm(s).

Section J.4

STEERING COLUMN ASSEMBLY

To Remove

(1) Remove the connector from the negative battery terminal.

(2) Unscrew and remove the clamp nut bolt from the splined lower end of the steering column.

(3) Disconnect the horn wire (brown with black) at its snap connection beneath the facia.

(4) Remove the steering column surround, situated between the facia panel and the steering wheel, after unscrewing its three securing setscrews located behind the facia.

(5) Slacken the two bolts securing the column bracket beneath the facia panel.

(6) As illustrated in Fig. J.3, the steering column complete may now be withdrawn rearwards from the facia panel.

To Dismantle

The inner and outer columns can be separated once the steering wheel motif, steering wheel securing nut and steering wheel have been removed. To avoid damage to the ebonite horn switch contact, use Service Tool 18G562 to loosen the nut.

To Replace

The installation of the steering column assembly is the reversal of the procedure to remove. Tighten the steering wheel nut to the figure given in **'GENERAL DATA'**, using service Tool 18G562, on successive hexagons so that the cutaway on the socket clears the horn switch contact.

Section J.5

STEERING RACK ASSEMBLY

To Remove

(1) Remove the radiator as described in Section C.3.

(2) Remove the clamp nut and bolt from the splined lower end of the steering column and disengage the column from the splines.

(3) Detach the tie-rod ball joint from the swivel arm

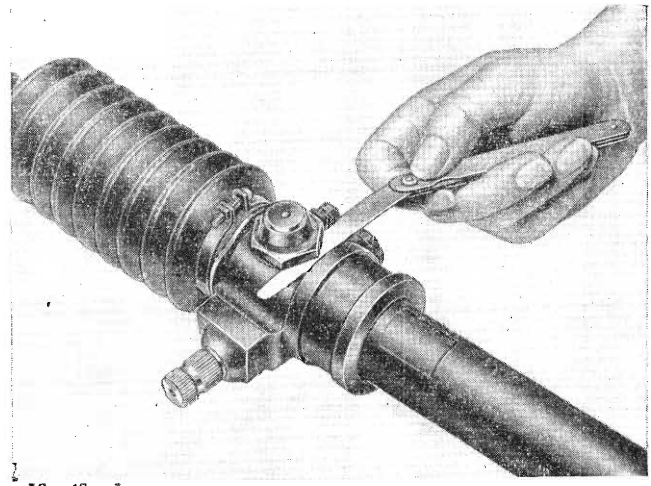


Fig. J.5. Checking the adjustment of the damper cap.

by first removing the split pins and then unscrewing the castellated nuts from the ball pins. Service Tool 18G 313 will facilitate the separation of the tie-rod from the swivel arm.

(4) Extract the four setpins and washers securing the two steering rack clamps to the mounting brackets. The rack assembly complete with tie-rods may now be withdrawn from the car.

To Dismantle

(1) 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.

(2) Slacken the ball joint locknuts and unscrew the ball joint assemblies.

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

(4) 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.

(5) Unscrew the damper pad housing fitted at the pinion end of the rack housing and withdraw it complete with plunger, spring and shims.

(6) 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.

(7) Secure the rack housing 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, Service Tool 18G 313. **Note:** In some cases the latter operation releases the ball seat housing from the ball joint cap, in this case difficulty will be experienced in removing the ball housing from the rack. It is therefore essential that the ball housing is released from the rack before the ball seat housing and joint cap are separated.

(8) Remove the lock washers. The steering rack may be withdrawn from the housing.

(9) Screw the ball seat housing from the ball joint caps using the C-spanner previously mentioned together with the tie-rod pin spanner 18G 312. The shims and ball seats are now free to be removed; ensure that the shims are kept to their respective sides.

(10) 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 grease nipple from the rack housing and the two on the ball joints. Check them by forcing oil through them with the oil gun 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 (4) Section J.3.

The outer ball joint is not adjustable and if worn must be replaced by a new assembly.

To Reassemble

(1) 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.

(2) Adjust the ball joint, if necessary, as detailed in (4) Section J.3.

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

(4) Draw the rack through its housing until the centre tooth (number 12 from either end) is in the centre of the pinion housing.

(5) 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.

(6) 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.

(7) Replace the shims and tail end bearing. Adjust the end play of the pinion as detailed in (3) Section J.3.

(8) Refit the rubber gaiters and clips.

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

(10) Replace and adjust the steering rack damper as described in (2) Section J.3.

(11) Replace the secondary damper, pressure pad, sealing washer and spring.

(12) Fit a new pinion shaft oil seal, and pump 10 fluid ounces (0·28 litre approx.) of hypoid oil into the rack housing through the nipple provided.

To Replace

Replacement of the steering rack is a reversal of the procedure 'to remove' except that the bolts securing the housing to its mounting brackets should not be fully tightened until the steering column assembly (if removed) 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 to finally tighten the rack housing bolts.

Section J.6

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.

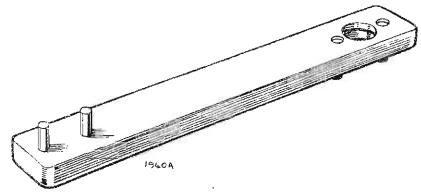


Fig. J.7. Service Tool 18G312.

18G313. Steering Tie-rod C-Spanner

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

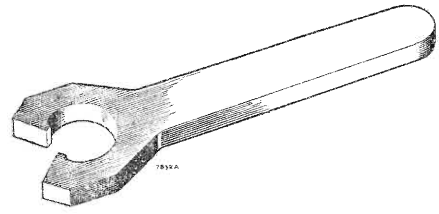


Fig. J.8. Service Tool 18G313.

18G562. Steering Wheel Nut Spanner

Designed to enable the steering wheel nut to be tightened without damage to the ebonite horn switch contact.

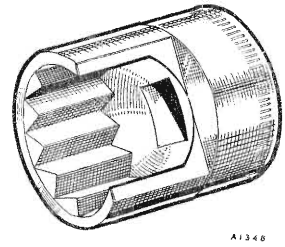


Fig. J.9. Service Tool 18G562.

Section J.7 FAULT DIAGNOSIS

Symptom	No.	Possible Fault
(a) Wheel Wobble	1	Unbalanced wheels and tyres
	2	Slack steering connections
	3	Incorrect steering geometry
	4	Excessive play in steering gear
	5	Broken or weak front springs
	6	Worn hub bearings
	7	Loose or broken shackles

Symptom	No.	Possible Fault
(b) Wander		Check 2, 3 and 4 in (a)
	1	Broken spring clips
	2	Front suspension and rear axle mounting points out of alignment
	3	Uneven tyre pressures
	4	Uneven tyre wear
	5	Weak shock absorbers or springs
(c) Heavy Steering		Check 3 in (a)
	1	Excessively low tyre pressures
	2	Insufficient lubricant in steering rack
	3	'Dry' steering connections
	4	Out of track
	5	Incorrectly adjusted steering gear
	6	Misaligned steering column
(d) Tyre Squeal		Check 3 in (a)
		Check 1 in (c)