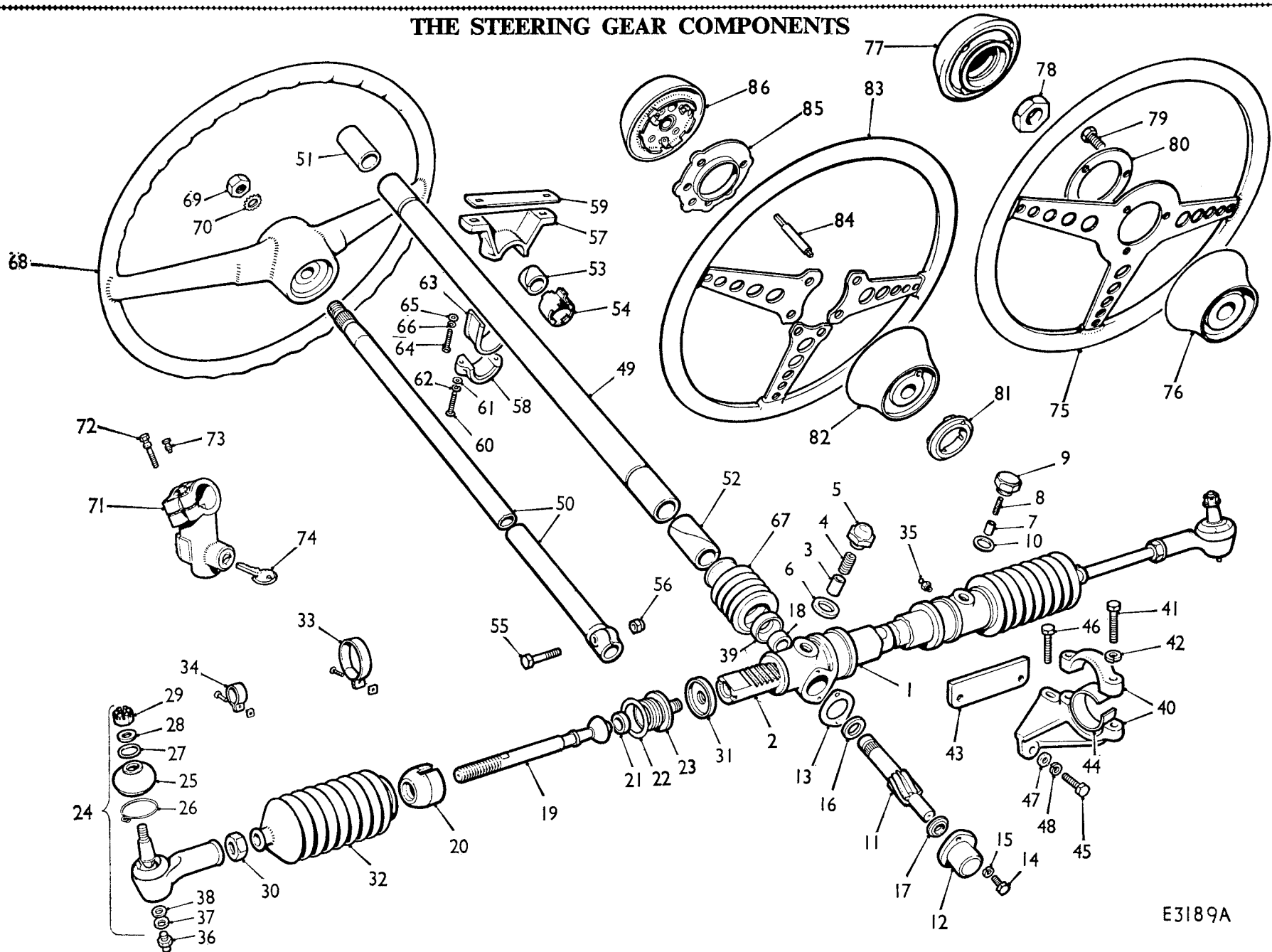
# SECTION J

## THE STEERING GEAR

# THE STEERING GEAR COMPONENTS



## KEY TO THE STEERING GEAR COMPONENTS

| No. | Description |
|---|---|
| 1. | Rack housing. |
| 2. | Rack. |
| 3. | Damper pad. |
| 4. | Damper pad spring. |
| 5. | Damper pad housing. |
| 6. | Shim. |
| 7. | Secondary damper pad. |
| 8. | Secondary damper spring. |
| 9. | Secondary damper housing. |
| 10. | Housing washer. |
| 11. | Pinion. |
| 12. | Pinion tail bearing. |
| 13. | Shim. |
| 14. | Set screw. |
| 15. | Spring washer. |
| 16. | Pinion thrust washer (top). |
| 17. | Pinion thrust washer (bottom). |
| 18. | Pinion seal. |
| 19. | Tie-rod. |
| 20. | Ball housing (female). |
| 21. | Ball seat. |
| 22. | Shim. |
| 23. | Ball housing (male). |
| 24. | Ball socket assembly. |
| 25. | Boot. |
| 26. | Clip. |
| 27. | Ring. |
| 28. | Plain washer. |
| 29. | Nut. |
| 30. | Locknut. |
| 31. | Lock washer. |
| 32. | Seal. |
| 33. | Clip (inner). |
| 34. | Clip (outer). |
| 35. | Lubricator. |
| 36. | Lubricator. |
| 37. | Dished washer. |
| 38. | Fibre washer. |
| 39. | Retainer. |
| 40. | Bracket and cap assembly. |
| 41. | Set screw. |
| 42. | Spring washer. |
| 43. | Seating. |
| 44. | Packing. |
| 45. | Set screw. |
| 46. | Set screw. |
| 47. | Plain washer. |
| 48. | Spring washer. |
| 49. | Outer column. |
| 50. | Inner column tube. |
| 51. | Felt bearing (top). |
| 52. | Felt bearing (bottom). |
| 53. | Felt bearing (bottom). |
| 54. | Clip. |
| 55. | Bolt. |
| 56. | Nut. |
| 57. | Bracket. |
| 58. | Bracket cap. |
| 59. | Shim. |
| 60. | Set screw. |
| 61. | Plain washer. |
| 62. | Spring washer. |
| 63. | Seating. |
| 64. | Set screw. |
| 65. | Plain washer. |
| 66. | Spring washer. |
| 67. | Draught excluder. |
| 68. | Steering-wheel. |
| 69. | Nut. |
| 70. | Shakeproof washer. |
| 71. | Steering-column lock. |
| 72. | Shear bolt. |
| 73. | Locating screw. |
| 74. | Lock key. |
| 75. | Steering-wheel. |
| 76. | Steering-wheel nut. |
| 77. | Motif. |
| 78. | Nut. |
| 79. | Set screw. |
| 80. | Locking ring. |
| 81. | Slip ring. |
| 82. | Steering wheel boss. |
| 83. | Steering wheel. |
| 84. | Horn contact. |
| 85. | Lock ring. |
| 86. | Horn push. |

Nos. 75–80: Midget Mk. III (GAN5). Sprite Mk. IV (HAN10).

Nos. 81–86: From car number Midget Mk. III (GAN5) 89515. Sprite Mk. IV (HAN10) 86303.

### GENERAL 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 bearings. A damper pad inserted in the steering rack controls the backlash between the pinion and the rack.

## Section J.1

### LUBRICATION

(Early cars)

The lubrication nipple provided at the left-hand side of the rack housing (right-hand side on left-hand-drive cars) is accessible when the bonnet is raised. Apply a gun filled with lubricant and give 10 strokes only at regular intervals.

**CAUTION: If the vehicle is hoisted with its front wheels clear of the ground care should be taken to avoid forceful movement of the wheels from lock to lock, as damage may occur within the steering mechanism.**

## Section J.2

### FRONT WHEEL ALIGNMENT

When correctly adjusted the front wheels should toe in 0 to $\frac{1}{8}$ in. (0 to 3 mm.). To carry out the necessary adjustment first check that all tyres are inflated to the recommended pressures (see **'GENERAL DATA'**).

Turn the wheels to the straight-ahead position. [Roll the vehicle backwards and forwards and bounce the suspension to relieve suspension and tyre stresses.] With conventional base-bar-type alignment gauges measurements in front of and behind the wheel centres should be taken at the same points on tyres or rim flanges. This is achieved by marking the tyres where the first reading is taken and moving the car forward approximately half a road wheel revolution before taking the second reading at the same points.

If the wheel alignment is incorrect 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.

**NOTE.—To ensure that the steering-rack is in the central position and that the steering geometry is correct it is important to adjust the tie-rods to exactly equal lengths.**

After adjustment tighten the ball joint locknuts.

## Section J.3

### STEERING-COLUMN ASSEMBLY

**Removing**

Remove the connector from the negative battery terminal. Release and remove the clamp bolt nut from the splined lower end of the steering-column. Disconnect the horn wire at its snap connection beneath the fascia. Remove the steering-column surround situated between the fascia panel and the steering-wheel, after removing its securing set screws located behind the fascia. Release the bolts securing the column bracket beneath the fascia panel. The steering-wheel may now be withdrawn. The inner and outer columns can be separated once the steering-wheel motif, steering-wheel securing nut, and steering-wheel have been removed. (See Section J.6 for later cars.) To avoid damage to the horn switch contact use Service tool 18G 562 to unscrew the nut.

**Refitting**

Refitting of the steering-column assembly is the reverse of the removal procedure. Use Service tool 18G 562 when tightening the steering-wheel nut.

## Section J.4

### STEERING-RACK AND PINION

(Early cars)

**Removing**

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

Remove the split pins and slotted nuts from the ball pins and detach the tie-rod ball joint from the swivel arm, using Service tool 18G 1063.

Remove the set screws securing the steering-rack clamp mounting brackets to the front cross-member. The rack assembly complete with tie-rods and brackets can now be removed.

**Dismantling**

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.

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

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

Extract the 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 housing between suitable clamps in a vice and tap back the washers locking the tie-rod ball housing. Remove the ball joint cap, using 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 to release the ball**

**housing from the rack before the ball seat housing and joint cap are separated.**

Remove the lock washer and withdraw the steering-rack from the housing.

Remove the ball seat housing from the ball joint caps, using Service tool 18G 313 together with 18G 312. The shims and ball seats are now free to be removed: ensure that the shims are kept to their respective sides.

Thoroughly clean and examine all parts of the dismantled assembly for wear, and renew if necessary.

**Reassembly**

Reassemble by reversing the dismantling procedure and pay special attention to the following points.

The ball joints linking the tie-rods to the rack 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 ·002, ·003, ·005, and ·010 in. (·05, ·08, ·13, and ·25 mm.). When correctly adjusted, the ball housing must be locked in three places with the flange of the lock washers.

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.

Ensure also that the centre tooth on the rack is in line with the mark on the splined end of the pinion shaft when replacing the pinion. Excessive end-float of the pinion is rectified by the fitting of shims. By means of a dial

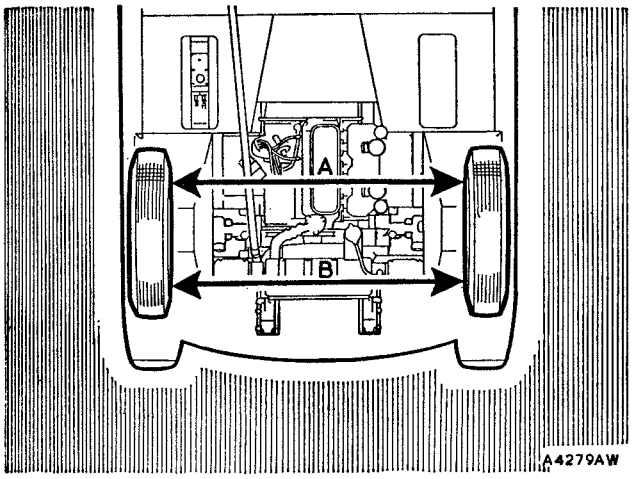



*Fig. J.1*

*The toe-in must be adjusted so that* (A) *is* 0 *to* $\frac{1}{8}$ *in.* (0 *to* 3 *mm.*) *greater than* (B)

gauge placed at the end of the pinion shaft, check the end-float of the shaft, which should be between ·002 and ·005 in. (·05 and ·13 mm.). The shims are available in thicknesses of ·003, ·005, and ·010 in. (·08, ·13, and ·25 mm.). Replace the ball joint locknuts and joint assemblies in approximately their original positions, referring to the figures recorded when the rack was dismantled. To replace and adjust the rack damper, position the plunger in the cap and replace the cap. Screw down the cap until it is just possible to rotate the pinion shaft by drawing the rack through its housing. With a feeler gauge measure the clearance between the hexagon of the damper cap and its seating in the rack housing (Fig. J.2). After obtaining a figure, add ·002 to ·005 in. (·05 to ·13 mm.) to arrive at the correct thickness of shims which must be placed beneath the damper cap. Shims are available in thicknesses of ·003 and ·010 in. (·08 and ·25 mm.). Remove the damper cap and plunger. Fit the spring beneath the plunger and assembly with the required number of shims to give the stated clearance. Fit a new pinion shaft oil seal and pump 10 fl. oz. (·28 litre) approximately of oil into the rack housing through the nipple provided.

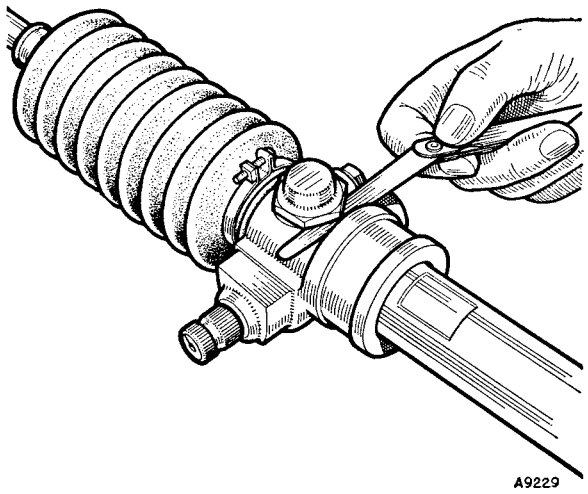



*Fig. J.2*

*Checking the adjustment of the damper cap*

**Refitting**

Refitting is the reverse of the removal procedure, except that the bolts securing the housing to its mounting brackets should not be fully tightened until the assembly has been replaced. This method of assembly will ensure that the steering-rack pinion is in correct alignment with the column. Finally, tighten the rack housing bolts.

## Section J.5

### STEERING LOCK IGNITION SWITCH

Cars exported to certain markets are fitted with a combined ignition/starter switch and steering-column lock mounted on the steering-column.

On cars fitted with the lock a sleeve integral with the inner column is slotted to permit engagement of the lock tongue; the outer column is also slotted to allow the lock tongue to pass through. A hole drilled in the upper surface of the outer column locates the steering lock

bracket. The bracket is secured by two bolts each waisted below the head to permit removal of the heads by shear action during assembly.

To remove the lock, disconnect the battery and the ignition/starter switch connections and turn the lock setting to 'GARAGE' to unlock the steering. Free the steering-column assembly as described in Section J.3 and remove the lock securing bolts with a suitable tool.

## Section J.6

### STEERING-WHEEL AND HUB

**(Midget GAN5, Sprite HAN10)**

**Removing**

(1) Remove the steering-wheel motif assembly; it is a press-fit.

(2) Turn back the lock tabs on the centre boss retainer, and remove bolts, centre boss retainer and the steering-wheel.
NOTE.—From Car No. G-AN5-105501 the lock tabs have been deleted from the centre boss retainer.

**Hub**

(3) Slacken the steering-wheel nut and fit Service tool 18G 1181 to the hub using the special bolts. Mark the hub and column to assist correct re-alignment and pull the hub until it is a loose fit on the steering-column. Remove 18G 1181, the steering-wheel nut and hub.

(4) When refitting the hub, position it on the column splines in the original position. Fit the nut and tighten to the torque wrench setting given in **'GENERAL DATA'.**

## Section J.7

### STEERING COLUMN ASSEMBLY

**(Midget Mk. III from Car No. G-AN5-105501)**

**Removing**

NOTE.—From Car No. G-AN5-114643 a new type of steering rack is fitted; making it unnecessary to carry out operations 2, 3 and 4 when removing the column from the steering rack.

(1) Disconnect the battery.

(2) Turn the steering until the pinch bolt nut is uppermost and remove the nut.

(3) Using a soft drift, push the bolt until the threaded end is flush with the column.

(4) Turn the steering until the bolt head is uppermost, taking care that the bolt does not foul the brake pipe as the steering is turned.

(5) Remove the pinch bolt.

(6) Disconnect the multi-connector block.

(7) Disconnect the wiring from the ignition/steering lock switch.

(8) Turn the steering to the straight-ahead position.

(9) Remove the bolts retaining the steering-column support bracket.

(10) Remove the steering-column complete with steering-wheel and direction indicator switch.

**Refitting**

(11) Check that the steering rack is in the straight-ahead position.

(10) Check that the column is in the straight-ahead position with the pinch bolt split uppermost.

(11) Reverse the removing procedure in (1) to (10).

## Section J.8

### STEERING LOCK IGNITION SWITCH

**(Midget Mk. III from Car No. G-AN5-105501)**

**Removing**

(1) Remove the steering-column (Section J.3).

(2) Remove the steering-wheel and hub (Section J.6).

(3) Remove the direction indicator/headlight flasher/low-high beam switch.

(4) Turn the ingition key to position '1' to ensure that the steering lock is disengaged.

(5) Drill out, or remove with a suitable proprietary tool, the retaining shear bolts.

(6) Unscrew the steering lock locating grub screw.

(7) Remove the steering lock and ignition starter switch.

**Refitting**

(8) Reverse the removing procedure in (1) to (7), using new shear bolts and ensuring that the shear bolts are tightened until the bolt heads shear at the waisted point giving a torque tightness of 12 lbf. ft. (1·66 kgf. m.).

## Section J.9

### LUBRICATION

**(Midget Mk. III from Car No. G-AN5-114643)**

It is recommended that after every 30,000 miles (50000 km.) or 3 years the steering rack is inspected and lubricated.

(1) Clean the bellows and the ends of the rack housing.

(2) Inspect the bellows for cracks, splits, signs of deterioration, or leakage of lubricant. If a bellows is damaged, or there are signs of lubricant leakage, the bellows must be renewed as described in Section J.13.

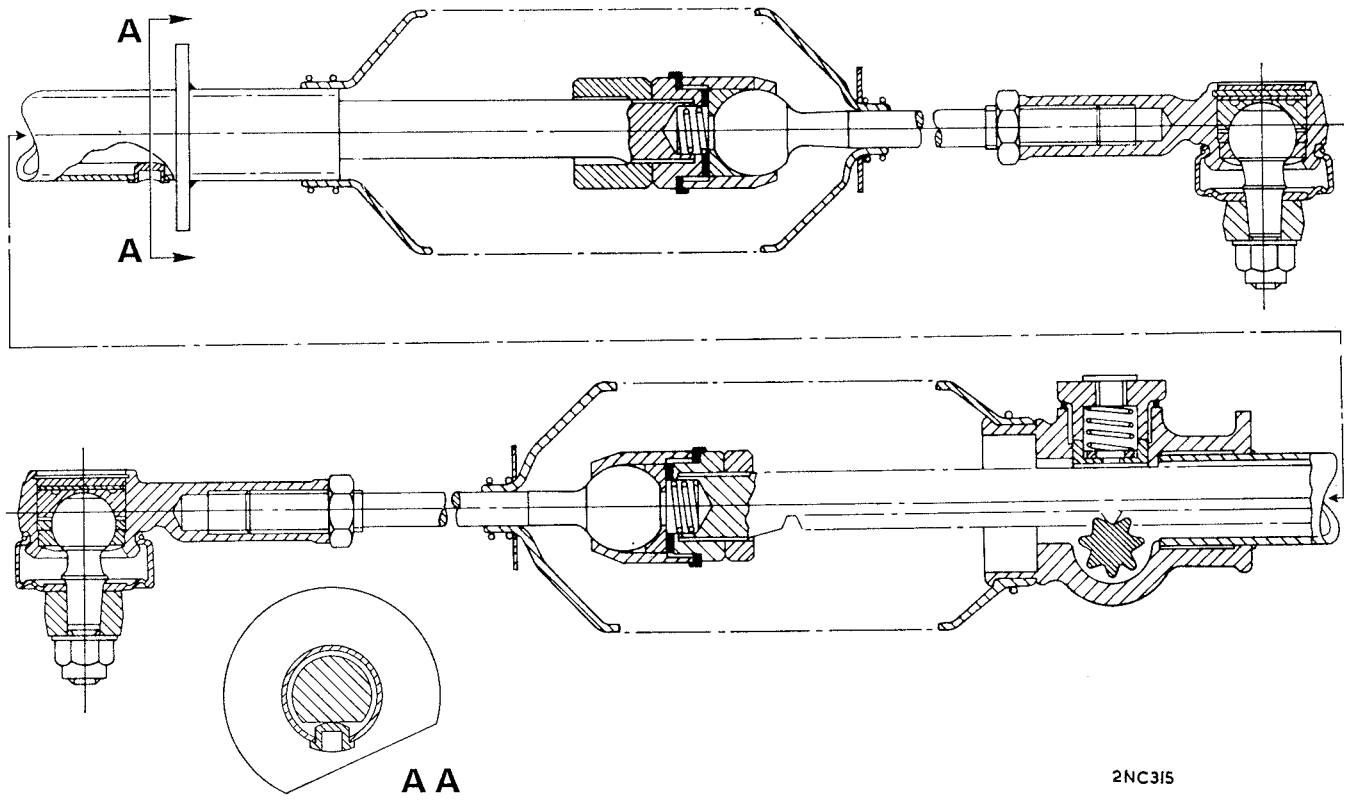



*Fig. J.3*

*A section through the steering rack and tie-rods. Inset AA: the correct position of the flat on the rack in relation to the plug*

(3) Release the bellows fixings from both ends of the rack housing.

(4) Roll the bellows back to expose the rack and inner ball joints.

(5) Examine the existing grease around the inner ball joint and the rack for ingress of water or dirt; if this is evident, the steering rack must be removed for dismantling and inspection of the components as described in Section J.11.

(6) If the inner ball joint and the rack are in a satisfactory condition, apply approximately 2 oz. (57 gm.) of a recommended grease around each inner ball joint and the rack including the teeth.

(7) Unroll the bellows and secure to the rack housing.

**CAUTION: If the vehicle is hoisted with its front wheels clear of the ground, care should be taken to avoid forceful movement of the wheels from lock to lock as damage may occur within the steering mechanism.**

## Section J.10

### STEERING RACK AND PINION

### (Midget Mk. III from Car No. G-AN5-114643)

#### Removing

**CAUTION.**—Should a rubber bellows become damaged, with a subsequent loss of lubricant, it is necessary to remove the steering rack assembly for dismantling and inspection of the components. If a rubber bellows has been damaged in the workshop and dirt has not entered the steering rack assembly, a new bellows may be fitted and the inner ball joint and rack lubricated with a recommended grease (see Section J.9).

(1) Remove the radiator.

(2) Turn the steering to the straight-ahead position.

(3) Remove the road wheels.

(4) Remove the nuts from the tie-rod end assemblies.

(5) Using tool 18G 1063, detach the tie-rod end assemblies from the steering levers.

(6) Remove the steering-column pinch bolt.

(7) Remove the bolts retaining the steering-column support bracket.

(8) Withdraw the steering-column from the pinion.

(9) Mark the steering rack housing in relation to the mounting bracket clamp to assist when refitting.

(10) Remove the clamp bolts and clamps from the mounting brackets.

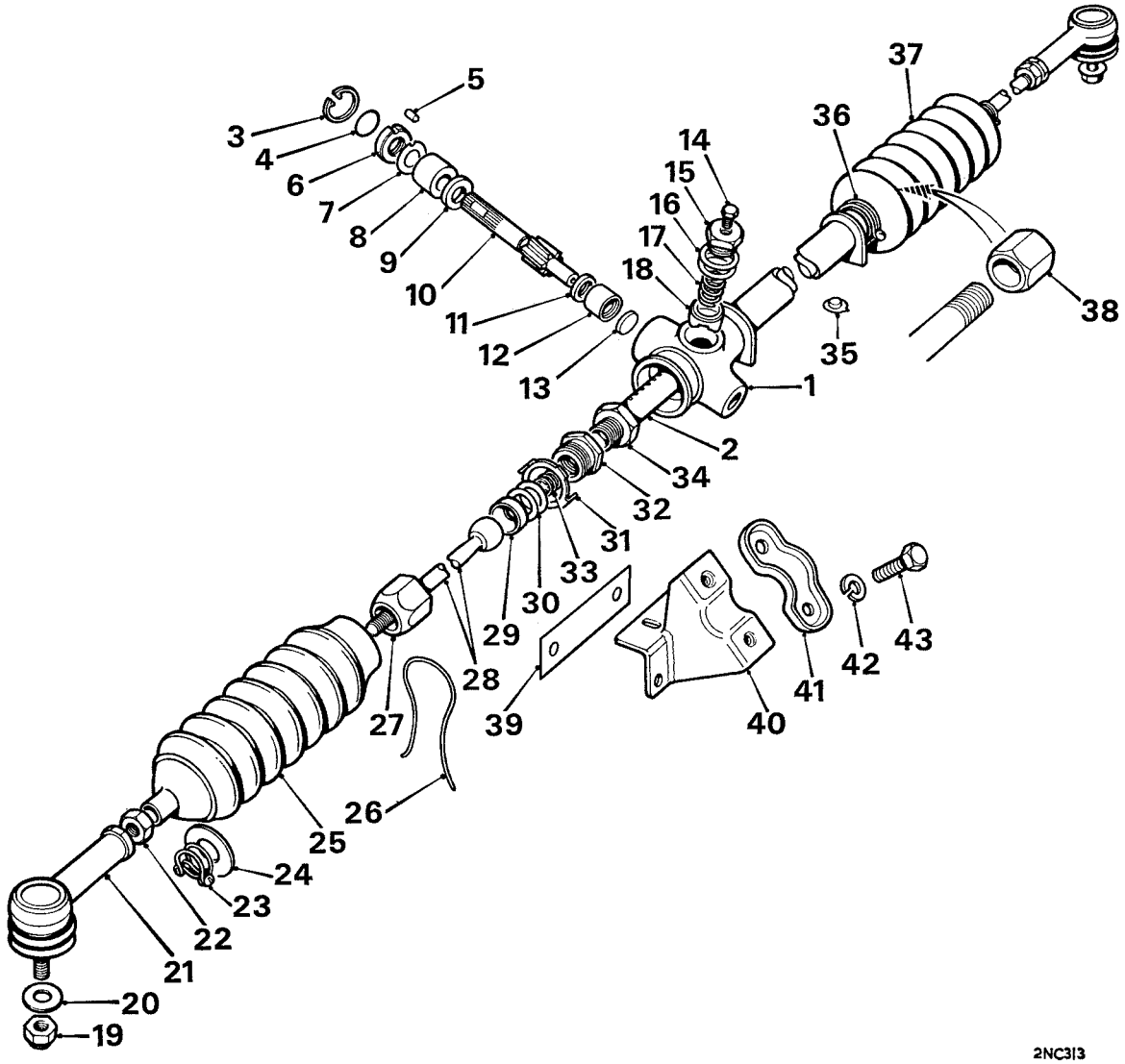
(11) Withdraw the steering rack assembly.

#### Dismantling

(12) Slacken the tie-rod end assembly locknuts and remove the tie-rod end assemblies and locknuts from the tie-rods.

(13) Slacken the bellows retaining clips and remove the bellows wire from the pinion end of the steering rack.

# THE STEERING RACK COMPONENTS
## (Midget Mk. III from Car No. G–AN5–114643)




| *No.* | *Description* |
|---|---|
| 1. | Rack housing. |
| 2. | Rack. |
| 3. | Circlip. |
| 4. | 'O' ring. |
| 5. | Dowel. |
| 6. | Retaining ring. |
| 7. | Shims. |
| 8. | Pinion shaft bush. |
| 9. | Thrust washer. |
| 10. | Pinion. |
| 11. | Thrust washer. |
| 12. | Pinion spigot bush. |
| 13. | End cover. |
| 14. | Grease plug. |
| 15. | Screwed cap. |
| 16. | Shims. |
| 17. | Spring. |
| 18. | Plunger. |
| 19. | Nut. |
| 20. | Washer. |
| 21. | Tie-rod end assembly. |
| 22. | Locknut. |

| *No.* | *Description* | |
|---|---|---|
| 23. | Small retaining clip. | |
| 24. | Protective shield. | |
| 25. | Bellows for rack housing—pinion end. | |
| 26. | Bellows tie-wire. | |
| 27. | Cup nut. | |
| 28. | Tie-rod. | |
| 29. | Cup. | |
| 30. | Shims. | |
| 31. | Tab washer. | |
| 32. | Sleeve nut. | |
| 33. | Spring. | |
| 34. | Locknut for sleeve nut—pinion end. | |
| 35. | Plug. | |
| 36. | Large retaining clip. | |
| 37. | Bellows for rack housing | } Non-pinion end. |
| 38. | Locknut for sleeve nut | |
| 39. | Packing for rack mounting bracket—pinion end. | |
| 40. | Rack mounting bracket. | |
| 41. | Rack mounting clamp. | |
| 42. | Spring washer. | |
| 43. | Setscrew. | |

(14) Remove the bellows together with their protective shields fitted behind the outer retaining clips.

(15) Slacken the locknuts and unscrew the tie-rod inner ball joint assemblies.

(16) Withdraw the coil springs and unscrew the locknuts from each end of the rack.

(17) Remove the bellows retaining clip from the rack housing.

(18) Unlock the tab washer and unscrew the sleeved nut from the cup nut and remove the tab washer, shims and cup to dismantle the tie-rod inner ball joint assembly.

(19) Remove the grease plug from the screwed cap.

(20) Remove the screwed cap and shims.

(21) Withdraw the spring and plunger from the rack housing.

(22) Remove the circlip retaining the pinion assembly.

(23) Withdraw the pinion assembly and dowel.

**CAUTION.**—Take care not to lose the dowel.

(24) Remove the retaining ring, shims and thrust washer from the pinion shaft.

(25) Remove the 'O' ring from the annular groove in the retaining ring.

(26) Withdraw the rack from the pinion end of the housing.

(27) Remove the thrust washer from the pinion housing bore.

(28) Turn the rack housing over and, with the base of the pinion bore uppermost, drift out the lower bush and end plug.

**Inspection**

(29) Thoroughly clean all components.

(30) Inspect the rack and pinion for wear, cracks or damage, with particular attention to the condition of the teeth.

(31) Thoroughly examine the bellows for cracks, splits or signs of deterioration.

(32) Renew all damaged or excessively worn components.

**Reassembling**

(33) Immerse the pinion bushes and the plunger in S.A.E. 20 engine oil, and heat the oil to 100° C. (212° F.) for two hours, then allow the oil to cool before removing the bushes and plunger from the oil and fitting to the rack; this allows the pores of the bushes and plunger to be filled with lubricant.

(34) Fit the bottom bush into the pinion housing as follows:

(*a*) Fit the large bush on the pinion shaft and then stand the splined end of the shaft on the press base-plate.

(*b*) Place the end plug into the recess in the lower bush and position the bush on the pinion spigot.

(*c*) Position the pinion housing over the pinion, and press the housing over the bush, ensuring that the splined pinion shaft is centralized in the pinion housing bore with its bush.

(35) Fit the thrust washer, chamfered bore uppermost, into the pinion housing.

(36) Insert the rack into the housing from the pinion end, noting the following:

(*a*) Liberally smear the rack and its teeth with grease.

(*b*) Insert the rack into the housing with 3½ in. (88·90 mm.) of the teeth end protruding from the 'travel' abutment face of the pinion housing (see dimension 'E' of Fig. J.6).

(*c*) The flat on the rack registers against the locating plug (which must be taped in position), noting that the plug will be retained in position by the mounting bracket when the rack is fitted.

**(See Editor's note at end of Section J.)**

*Pinion end-float*

(37) Assemble the thrust washer, bush and retaining ring to the splined end of the pinion shaft, ensuring that the face of the bush with the lubricating groove butts against the thrust washer.

(38) Insert the pinion assembly into the pinion housing, ensuring that the flat on the pinion is facing towards the plunger boss.

(39) Fit the retaining circlip.

(40) Mount a dial gauge on the rack housing.

(41) Push the pinion down and zero the dial gauge.

(42) Lift the pinion until the retaining ring contacts the circlip and note the dial gauge reading which represents the pinion shaft end-float.

(43) Remove the dial gauge.

(44) Remove the circlip and withdraw the pinion assembly.

(45) Withdraw the retaining ring and fit a new 'O' ring to its annular groove.

(46) From the reading obtained in (42) select shims that will give a maximum of ·010 in. (·25 mm.) end-float.

Shims are available in the following thicknesses:

·005 in. (·13 mm.).

·010 in. (·25 mm.).

(47) Fit the shims and retainer to the pinion shaft.

(48) Insert the pinion assembly into the pinion housing (with the pinch bolt flat towards the plunger boss), ensuring that the cut-away on the shims and retaining ring are aligned with the dowel hole in the pinion housing.

(49) Fit the dowel and retaining circlip, with the points of the circlip opposite the dowel to prevent the circlip becoming dislodged.

*Plunger pre-load*

(50) Fit the plunger and screwed cap to the rack housing, tightening the screwed cap until all end-float has been eliminated.

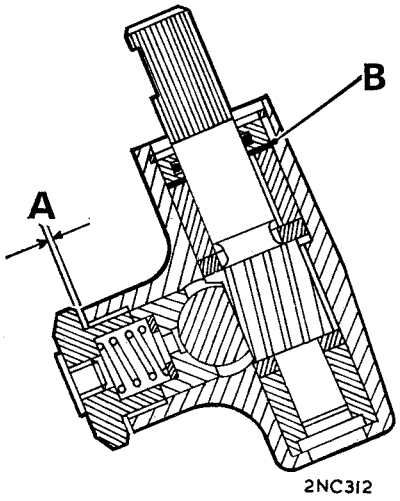



*Fig. J.4*

*A section through the pinion housing*

A. The gap between the screwed cap and the housing when the plunger and screwed cap are fitted and all end-float eliminated.

B. Shims fitted to produce a maximum pinion end-float of ·010 in. (·25 mm.).

(51) Measure the clearance between the screwed cap and the rack housing using a feeler gauge. Ensure that the housing is free from burrs.

(52) Remove the screwed cap and plunger.

(53) Smear the plunger with grease and fit the plunger and spring into the rack housing.

(54) Make up a shim pack equal to that measured in (51) plus and additional ·004 in. (·1 mm.).

**CAUTION:** It is important that at least one ·004 in. (·1 mm.) shim is used.

Shims are available in the following thicknesses:
·002 in. (·05 mm.).
·004 in. (·1 mm.).
·010 in. (·25 mm.).

(55) Assemble the shims to the screwed cap; fit and tighten the cap.

(56) Fit a grease nipple to the screwed cap and inject ½ to ¾ oz. (14 to 21 gm.) of a recommended grease into the unit; remove the grease nipple.

(57) Fit the grease plug to the screwed cap.

(58) Check that the screwed cap is correctly adjusted. If correct a force of 2 lb. (·91 kg.) acting at a radius of 8 in. (20·3 cm.) will rotate the pinion shaft through three-quarters of a turn in either direction of the rack centre tooth position.

Re-adjust if necessary by adding or subtracting shims beneath the screwed cap.

*Tie-rod inner ball joint*

(59) Smear the tie-rod ball with graphite grease.

(60) Slide the cup nut over the tie-rod and position the cup over the tie-rod ball.

(61) Position a new tab washer on the sleeve nut followed by a shim pack of known thickness and screw the sleeve nut into the cup nut.

Shims are available in the following thicknesses:
·002 in. (·05 mm.).
·010 in. (·25 mm.).

(62) Measure the clearance between the tab washer and the cup nut, using a feeler gauge. This dimension plus ·002 in. (·05 mm.) is the amount by which the shim pack must be reduced to give the correct ball end movement.

(63) Dismantle the ball joint and reassemble it with the correct shim pack as determined in (62).

(64) Check the pre-load on the tie-rod ball spheres. When the adjustment is correct the following torque is required on a tie-rod to produce articulation 35 degrees either side of the centre plane.
*Steel cup:* Articulation torque 40 lb. in. (·46 kg. m.).
*Nylon cup:* Articulation torque 15 to 50 lb. in. (·17 to ·57 kg. m.).

**CAUTION.**—If a nylon cup is replacing a steel cup the thrust spring must be discarded.

(65) Lock the tab washer over the cup nut and sleeve nut.

(66) Repeat (59) to (65) for the remaining tie-rod inner ball joint assembly.

(67) Position the bellows retaining clip on the rack housing at the bearing end.

(68) Screw the locknuts on to each end of the rack, ensuring that there is 23·20 in. (589·28 mm.) between their inside faces.

**CAUTION.**—The locknut at the pinion end of the rack is smaller than the locknut at the bearing end of the rack.

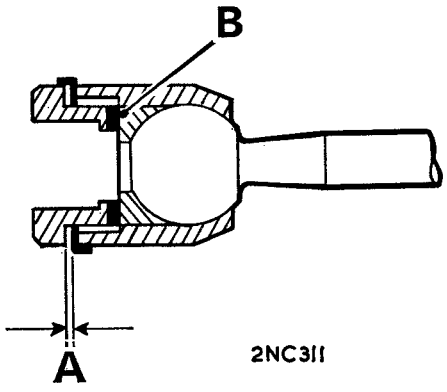



*Fig. J.5*

*A section through the inner ball joint assembly*

A. The gap between the tab washer and cup nut when shims of known thickness are fitted.

B. These shims must be reduced by ·002 in. (·05 mm.) and the width of gap 'A'.

(69) Insert the thrust springs into the ends of the rack if steel cups are used in the inner ball joint assemblies.

(70) Screw each tie-rod assembly as far as possible up to the locknut.

(71) Tighten each locknut to the torque figure given in **'GENERAL DATA'.**

(72) **Push the bellows onto the tie-rods, ensuring that the protective shields are fitted on the outer end of the bellows behind the small clips.**

(73) Lubricate around each inner ball joint and the rack including the teeth with approximately 2 oz. (57 gm.) of a recommended grease.

(74) Secure the bellows to the rack housing and tie-rods with the clips and wire.

(75) Screw the tie-rod end assembly locknuts onto the tie-rods.

(76) Screw the tie-rod end assemblies onto the tie-rods, ensuring there is 42·68 in. (1084·1 mm.) between the ball pin centres.

(77) Tighten the locknuts to the torque figure given in **'GENERAL DATA'.**

**Refitting**

(78) Position the rack into the mounting brackets and fit the clamps but do not tighten the clamp fixing bolts.

(79) Check that the rack is in the straight-ahead position with the pinch bolt flat on the pinion shaft uppermost.

(80) Check that the steering-column is in the straight-ahead position with the slot of the clamp uppermost.

(81) Slide the column over the pinion shaft as far as it will go.

(82) Fit the steering-column support bracket securing bolts.

(83) Turn the steering-wheel one complete turn to the left and back, then one complete turn to the right and back.

(84) Check that the marks made in (9) are aligned, and tighten the clamp bolts to the torque figures given in **'GENERAL DATA'.**

**CAUTION.**—If the marks made in (9) are not aligned or new mounting brackets are being fitted the steering rack must be aligned as described in Section J.11.

(85) Tighten the steering-column pinch bolt to the torque figure given in **'GENERAL DATA'.**

(86) Reverse the removing procedure in (1) to (5), noting:

(*a*) Tighten the tie-rod end assembly ball joint nut to the torque figure given in **'GENERAL DATA'.**

(*b*) Check the front wheel alignment (Section J.2.).

## Section J.11

**(See Editor's note at end of Section J.)**

**STEERING RACK MOUNTING BRACKETS**

**(Midget Mk. III from Car No. G–AN5–114643)**

**Removing**

(1) Remove the radiator (Section C.5).

(2) Remove the steering rack (Section J.10).

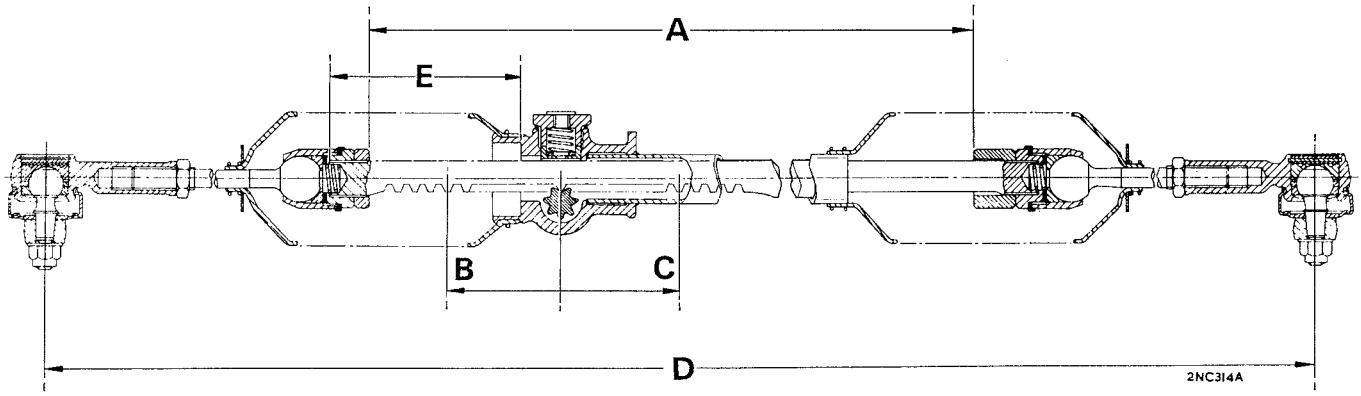



*Fig. J.6*

*Steering rack assembly dimensions*

A. 23·20 in. (589·28 mm.).
B. Rack travel from centre tooth position 2·72 in. (69·09 mm.).
C. Rack travel from centre tooth position 2·72 in. (69·09 mm.).
D. 42·68 in. (1084·1 mm.).
E. 3½ in. (88·90 mm.) fitting dimension – end of rack to 'travel' abutment face of pinion housing.

(3) Remove the securing bolt from each mounting bracket and remove the radiator lower tube assembly.

(4) Remove the front bolts securing the mounting brackets to the cross-member, collecting any packing fitted between the mounting bracket on the pinion end of the rack and the cross-member.

**CAUTION.**—It is important that this packing is retained for refitting the mounting brackets. If they are mislaid or their thicknesses have not been recorded, the steering rack must be realigned as described in Section J.12.

**Refitting**

**CAUTION.**—If new mounting brackets are being fitted or the steering rack is being refitted after an accident damage repair to the front end, the steering rack must be aligned as described in Section J.12.

(5) Reverse the removing procedure in (1) to (4), ensuring that:

(*a*) The thickness of packing removed from between the mounting bracket on the pinion end of the rack and the cross-member are refitted.

(*b*) Each mounting bracket front and top fixing bolts are tightened to the torque figure given in **'GENERAL DATA'.**

## Section J.12

### STEERING RACK ALIGNMENT

**(Midget Mk. III from Car No. G–AN5–114643)**

**When fitting new mounting brackets**

(1) Fit the mounting brackets to the rack assembly, tightening the clamp bolts and then slackening off one full turn.

(2) Fit the rack assembly into the car.

(3) Screw in the two front bolts and the top bolt securing the mounting bracket farthest from the steering pinion to the cross-member, noting:

(*a*) The radiator lower tube assembly is retained in position by the mounting bracket top securing bolt.

(*b*) The mounting bracket securing bolts are not tightened at this stage.

(4) Check that the rack is in the straight-ahead position, with the flat on the pinion shaft uppermost.

(5) Check that the steering-column is in the straight-ahead position, with the slot of the clamp uppermost.

(6) Slide the steering-column sleeve over the pinion shaft as far as it will go.

(7) Fit the steering-column support bracket securing bolts.

(8) Fit and tighten the pinion pinch bolt to the torque figure given in **'GENERAL DATA'.**

(9) Turn the steering-wheel one complete turn to the left and back, then one complete turn to the right and back, noting any movement of the rack assembly in relation to the body cross-member; slowly turn the rack in both directions until the neutral point (i.e. where no movement of the rack assembly is visible) is found.

(10) Measure the gap between the mounting bracket on the pinion end of the rack and the cross-member, fit packing to the thickness of the gap and insert the two front and top fixing bolts, noting:
(*a*) Packing is available in thicknesses of $\frac{1}{32}$ in. (·79 mm.) only.
(*b*) The radiator lower tube assembly is retained in position by the top bolt.

(11) Tighten the mounting bracket top and front securing bolts to the torque figure given in **'GENERAL DATA'.**

(12) Commence at the pinion end and tighten the mounting bracket clamp bolts to the torque figure given in **'GENERAL DATA'.**

(13) Fit the tie-rod end assembly ball joints, tightening the nuts to the torque figure given in **'GENERAL DATA'.**

(14) Fit the road wheels.

(15) Fit the radiator (Section C.5).

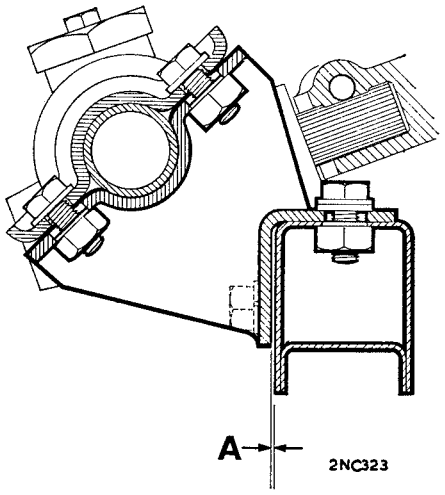



*Fig. J.7*

*The rack mounting bracket on the pinion side showing (A) the face of the bracket to be measured for packing*

## Section J. 13

### STEERING RACK BELLOWS

**(Midget Mk. III from Car No. G–AN5–114643)**

**Removing**

(1) Remove the road wheel.

(2) Mark the position of the tie-rod end assembly locknut, for when refitting.

(3) Slacken the tie-rod end assembly locknut.

(4) Remove the nut securing the tie-rod end assembly to the steering lever.

(5) Using tool 18G 1063, detach the tie-rod end assembly from the steering lever.

(6) Remove the tie-rod end assembly and locknut from the tie-rod.

(7) Slacken the bellows retaining clips/wire.

(8) Detach the large clip from the bellows and allow it to hang on the end of the rack housing. Withdraw the bellows from the rack housing and the tie-rod.

(9) Remove the small clip and protective shield from the bellows.

**Inspection**

(10) Examine the existing grease around the inner ball joint and the rack for ingress of water or dirt; if this is evident, the steering rack must be removed for dismantling and inspection of the components as described in Section J.11.

(11) If the inner ball joint and the rack are in a satisfactory condition, apply around each inner ball joint and the rack including the teeth approximately 2 oz. (57 gm.) of a recommended grease.

**Refitting**

(12) Fit a new bellows.

(13) Secure the bellows to the rack housing with the clip or wire.

(14) Fit the protective shield and small clip to the outer end of the bellows.

(15) Reverse the procedure in (1) to (6).

(16) Check the front wheel alignment as described in Section J.2.

**CAUTION: If the vehicle is hoisted with its front wheels clear of the ground, care should be taken to avoid forceful movement of the wheels from lock to lock as damage may occur within the steering mechanism.**

### EDITOR'S NOTES

**J. The Steering Gear**

*Steering Rack and Pinion–Reassembling*
When the steering rack is in the straight-ahead position, the flat on the pinion must be positioned 30° to either side of the pinion housing's center line on the plunger cap side of the rack housing. Before you reinstall the steering rack assembly, be sure to lubricate it as described in Section J.9.

*Steering Rack Mounting Brackets*
When you remove the front bolts that hold the mounting brackets to the crossmember, make mental note of the positions of the brake pipe clips.

# Section Ja

## THE STEERING GEAR (Energy Absorbing Column)

**The information given in this Section refers specifically to service operations on, or affected by equipment fitted to the Sprite Mk. IV and Midget Mk. III in conformity with local and territorial requirements, and must be used in conjunction with Section J.**

## Section Ja.1

### STEERING-COLUMN

**Removing**

(1) Disconnect the battery.
(2) Remove the pinion pinch bolt
(3) Remove the three toe-plate to column securing bolts, fixing ring, and washer.
(4) Note the location, quantity, and thickness of the packing washers between the column upper fixing flanges and the body brackets, remove the three securing bolts and nuts and collect the packing washers. **If the packing washers are mislaid or their fitting positions are not recorded the steering-column must be aligned as described in Section Ja.3 when refitted.**
(5) Disconnect the steering-column switch wiring at the snap connectors and multi-snap connectors below the fascia.
(6) Withdraw the steering-column assembly complete with steering-wheel and switches from the car.

**Dismantling**

(7) Withdraw the motif disc from the centre of the steering-wheel, unscrew the wheel retaining nut and remove the steering-wheel (See Section J.6).
(8) Unscrew the switch cowl retaining screws and remove the cowl.
(9) Unscrew the two windscreen wiper/washer switch retaining screws and remove the switch assembly complete with wiring.
(10) Unscrew the two direction indicator/horn switch retaining screws and remove the switch assembly complete with wiring.
(11) Unscrew the four ignition switch retaining screws and remove the switch complete with wiring.

**Reassembling**

(12) Reverse the dismantling procedure in (7) to (11).

**Refitting**

**NOTE—If a new steering-column is being fitted it must be aligned as described under the appropriate heading in Section Ja.3.**

(13) Fit the column assembly into the car and enter the pinion into the inner column sleeve.
(14) Fit the packing washers in their original positions between the column fixing flanges and the body brackets; fit the three securing bolts and nuts, tightening them by hand until the packing washers are just pinched.
(15) Fit the sealing washer and fixing ring to the toe-plate, then screw in and tighten the three toe-plate bolts.
(16) Tighten the three upper fixing bolts to the torque figure given in **'GENERAL DATA'.**
(17) Fit and tighten the pinion pinch bolt to the torque figure given in **'GENERAL DATA'.**

## Section Ja.2

### STEERING RACK AND PINION
**(Early cars)**

**Removing**

(1) Remove the radiator (Section C.5).
(2) Remove the split pins and slotted nuts from the ball pins.
(3) Using tool 18G 1063 detach the tie-rod ball joints from the steering levers.
(4) Remove the steering-column pinch bolt.
(5) Remove the six bolts securing the rack assembly to the body cross-member.
(6) Move the rack assembly forward as far as possible collecting any shims fitted between the right-hand mounting bracket and the front of the body cross-member. **It is important that these shims are preserved for refitting the rack assembly, if they are mislaid and their thickness has not been recorded the rack assembly must be realigned as described in Section Ja.3.**
(7) Remove the three toe-plate bolts.
(8) Slacken off the three steering-column upper fixing bolts and pull the column back sufficiently to disengage the column sleeve from the pinion.
(9) Remove the right-hand front road wheel and withdraw the rack assembly complete with mounting brackets.

**Dismantling**

(10) Carry out the operations detailed under **'Dismantling'** in Section J.4.

**Refitting**

**NOTE—If a new rack assembly is being fitted it must be aligned as described under the appropriate heading in Section Ja.3.**

(11) Reverse the removing procedure in (1) to (9) noting the following points.
*(a)* Ensure that thickness of shims removed from between the rack assembly and the cross-member are refitted.
*(b)* When entering the pinion into steering-column sleeve ensure that both the column and the rack are in the dead-ahead position.

## Section Ja.3

### ALIGNMENT

**When fitting new steering-column and steering gear:**

(1) Fit both mounting brackets to the rack assembly and tighten the clamp bolts.
(2) Early cars:
(i) Slacken the clamp bolts on the pinion end bracket half a turn and the clamp bolts on the right-hand bracket one full turn.
(ii) Fit the rack assembly into the car.
(iii) Screw in and tighten the two front pinion end bracket securing bolts, then fit and tighten the top bolt.

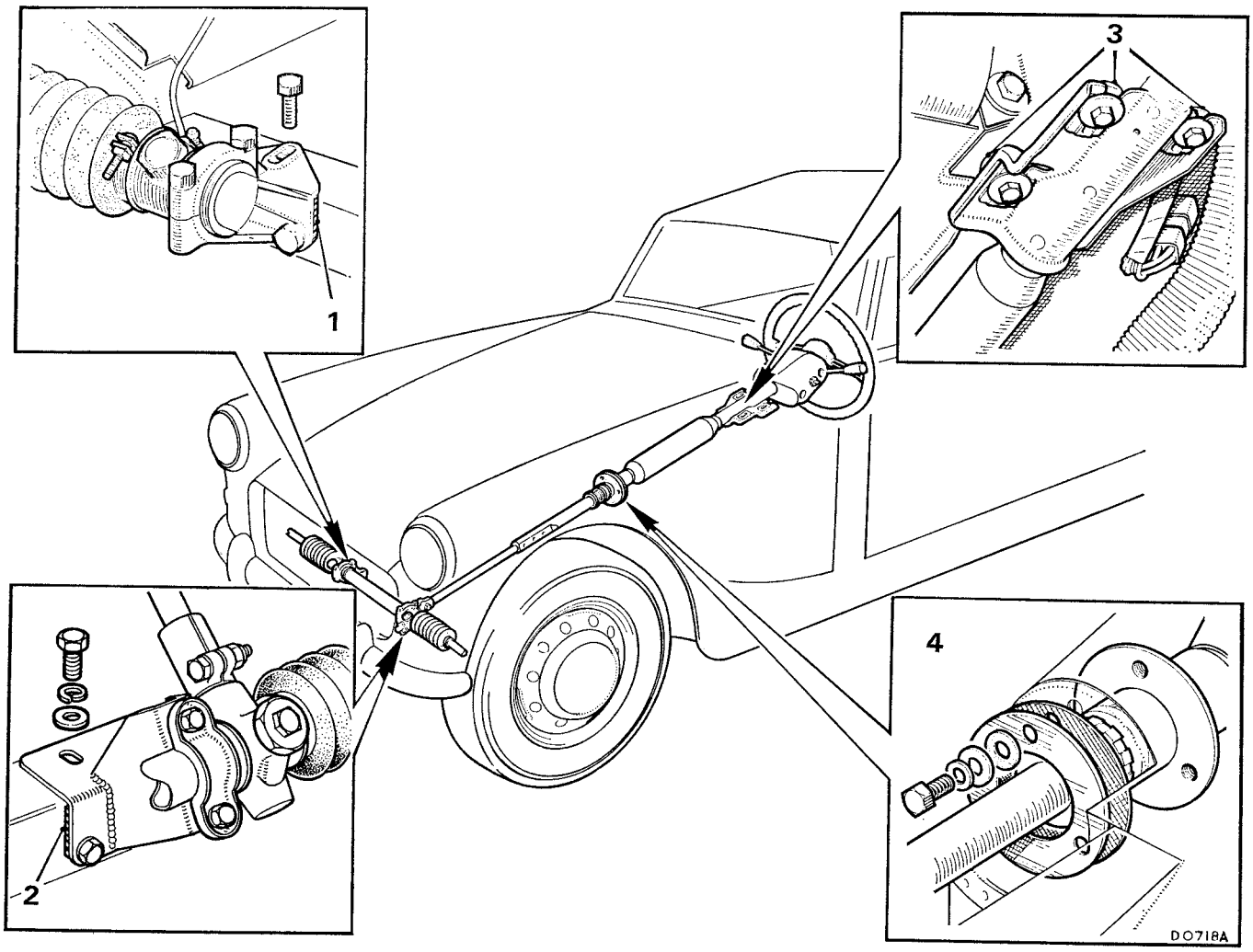



*Fig. Ja.1*

*Steering alignment*

1. Packing fitted behind right-hand mounting bracket—early cars.
2. Packing fitted behind left-hand mounting bracket—Midget Mk. III from Car No. G-AN5-114487.
3. Steering-column sleeve.
4. Packing washers fitted between column top fixing brackets.
5. Toe-plate fixings.

(3) Later Midget Mk. III cars from Car No. G-AN5-114487:
  (i) Slacken the clamp bolts one full turn.
  (ii) Fit the rack assembly into the car.
  (iii) Screw in the two front bolts and the top bolt securing the mounting bracket to the cross-member; do not tighten the mounting bracket securing bolts.

(4) Check that the rack is in the straight-ahead position with the pinch bolt flat on the pinion shaft uppermost.

(5) Fit the steering-column into the car, slide the fixing plate and sealing washer into the column.

(6) Turn the column to the straight-ahead position with the slot of the clamp uppermost.

(7) Slide the steering-column sleeve over the pinion shaft as far as it will go.

(8) Fit the two top bolts and nuts into the upper fixing brackets; tighten them by hand until the weight of the column is just taken and the column fixing flanges and body brackets are parallel to each other with the spaces between them equal at both points; check that the column passes through the toe-plate approximately central of the hole.

(9) Measure the spaces between the column flanges and the brackets.

(10) Remove the two fixing bolts, fit packing washers equal in thickness to the spaces, refit the bolt tightening them by hand until the washers are just pinched.

(11) Fit the fixing ring and sealing washer then screw in and tighten the three toe-plate bolts.

(12) Fit and tighten the pinion pinch bolt.

(13) Turn the steering one complete turn to the left and back, then one complete turn to the right and back, noting any movement of the rack assembly in relation to the body cross-member; slowly turn the steering in both directions until the neutral point (i.e. where no movement of the rack assembly is visible) is found.

(14) Early cars:
  (i) Measure the gap between the right-hand rack mounting bracket and the front face of the body cross-member; fit packing to the thick-

ness of the gap, then insert and tighten the two front fixing bolts.

(ii) Fit and tighten the right-hand rack mounting bracket top fixing bolt.

(15) Midget Mk. III from Car No. G–AN5–114487:

(i) Measure the gap between the left-hand rack mounting bracket and the front face of the body cross-member; fit packing to the thickness of the gap.

(ii) Insert the two front bolts and the top bolt securing the mounting bracket to the cross-member.

(iii) Tighten the mounting brackets top and front securing bolts to the torque figure given in **'GENERAL DATA'.**

(16) Fit and tighten the bracket top fixing bolt.

(17) Tighten the fixing bracket clamp bolts commencing with those on the pinion end bracket.

(18) Measure the gap between the upper column mounting flange and fixing bracket at the third bolt position, fit packing washers to the thickness of the gap then fit and tighten the bolt until the washers are just pinched.

(19) Remove the pinion pinch bolts and the three toe-plate bolts.

(20) Check, by pulling and pushing, that the steering-column slides reasonably freely up and down on the pinion; if the column is tight on the pinion the rack assembly alignment must be re-checked.

(21) If the steering-column alignment check in (17) is satisfactory, refit and tighten the three toe-plate bolts.

(22) Refit the pinion pinch bolt and tighten it to the figure given in **'GENERAL DATA'.**

(23) Tighten the three top fixing bolts to the figure given in **'GENERAL DATA'.**

**When fitting a new rack assembly to an existing column**

(24) Remove the rack assembly as described in Section Ja.2, (1) to (9) or Ja.4, (1) to (11).

(25) Carry out operations (2) and (3).

(26) Push the steering-column forward and enter the pinion into the column sleeve as far as it will go.

(27) Screw in and tighten the three toe-plate bolts.

(28) Tighten the three column upper securing bolts.

(29) Fit and tighten the pinion pinch bolt.

(30) Carry out operations (13) to (17) and (19) to (23).

**When fitting a new column to an existing rack**

(31) Carry out operations (4) to (12) and (19) to (23).

**Steering-wheel**

Refer to the instructions given in Section J.6 for removing and refitting the steering-wheel fitted to Midget Mk. III (GAN 5) cars.

## Section Ja.4

### STEERING RACK AND PINION
### (Midget Mk. III from Car No. G–AN5–114487)

**Removing**

**CAUTION.—Should a rubber bellows become damaged, with a subsequent loss of lubricant, it is necessary** to remove the steering rack assembly for dismantling and inspection of the components as described in Section J.10. If a rubber bellows has been damaged in the workshop and dirt has not entered the steering rack assembly, a new bellows may be fitted and the bellows packed with a recommended grease (see Section J.9).

(1) Remove the radiator (Section C.5).

(2) Turn the steering to the straight-ahead position with the slot of the column clamp uppermost.

(3) Remove the road wheels.

(4) Remove the nuts from the tie-rod end assemblies.

(5) Using tool 18G 1063, detach the tie-rod end assemblies from the steering levers.

(6) Remove the steering-column pinch bolt.

(7) Remove the three toe-plate bolts.

(8) Slacken the three steering-column upper fixing bolts and pull the column back sufficiently to disengage the column sleeve from the pinion.

(9) Mark the steering rack housing in relation to the mounting bracket to assist when refitting.

(10) Remove the clamp bolts and clamps from the mounting brackets.

(11) Withdraw the steering rack assembly.

**Dismantling, inspection, and assembling**

(12) Carry out the operations detailed under **'Dismantling, Inspection,** and **Reassembling'** in Section J.10.

**Refitting**

**CAUTION.—If a new rack assembly or mounting brackets are being fitted the steering rack must be aligned as described under the appropriate heading in Section Ja.3.**

(13) Position the rack into the mounting brackets and fit the clamps but do not tighten the clamp fixing bolts.

(14) Check that the rack is in the straight-ahead position with the pinch bolt flat on the pinion shaft uppermost.

(15) Check that the column is in the straight-ahead position with the slot of the clamp uppermost.

(16) Slide the column over the pinion shaft as far as it will go.

(17) Tighten the steering-column upper fixing bolts.

(18) Fit and tighten the three toe-plate bolts.

(19) Turn the steering-wheel one complete turn to the left and back, then one complete turn to the right and back.

(20) Check that the marks made in (9) are aligned, and tighten the clamp bolts.

**CAUTION.**—If the marks made in (9) are not aligned, the steering rack must be aligned as described under the appropriate heading in Section Ja.3.

(21) Tighten the steering-column pinch bolt to the torque figure given in **'GENERAL DATA'.**

(22) Reverse the removing procedure in (1) to (5) and:

(*a*) Tighten the tie-rod end assembly ball joint nut to the torque figure given in **'GENERAL DATA'.**

(*b*) Check the front wheel alignment (Section J.2).