1 Begin by removing the steering tie-rod outer balljoint as described in the previous Section.
2 Mark the position of the locknut on the tie-rod so that it can be refitted in the same place and then unscrew it from the tie-rod.
3 Place a suitable container beneath the rubber gaiter to catch any oil that may spill from the rack (early models only).
4 Now undo and remove the two retaining clips or cut off the wire clips and then slide the gaiter off the rack housing and tie-rod.
5 Refitting the rubber gaiter is the reverse sequence to removal. With the gaiter in position refill the rack with the appropriate lubricant as described in Section 31 before refitting the retaining clips or wire.

29 Rack-and-pinion steering gear – removal and refitting

Note: *The rack-and-pinion steering gear is secured to the front floor of the car by U-bolts and locknuts. To enable the steering gear to be removed, it will be necessary to lower the rear of the front subframe by approximately 3 in (76 mm) to provide the necessary working clearances.*
1 Working in the engine compartment, remove the air cleaner assembly, referring to Chapter 3 if necessary.
2 Undo and remove the nuts and bolts securing the exhaust pipe-to-manifold clamp. Lift off the clamp. On Cooper S models, remove the complete exhaust system as described in Chapter 3.
3 Undo and remove the bolt securing the engine tie-rod to the side of the cylinder block.
4 Detach the clutch operating lever return spring, and then undo and remove the two bolts securing the clutch slave cylinder to the flywheel housing. Tie the slave cylinder out of the way from a convenient place on the bulkhead.
5 Undo and remove the two bolts (or nuts) each side securing the subframe towers to the bulkhead crossmember. On later models undo and remove the large hexagon-headed plug used in place of the bolts or nuts.
6 Working inside the car undo and remove the securing screws and lift off the two halves of the steering column shroud.
7 Undo and remove the nut and bolt securing the inner column clamp to the steering gear pinion shaft.
8 Slacken the upper column clamp bolt at the parcel shelf bracket. To do this cut a slot in the shear bolt head and unscrew it with a screwdriver.
9 Lift the complete steering column upwards until the inner column clamp is disengaged from the pinion shaft.
10 Lift up the carpets and then undo and remove the four steering rack U-bolt locknuts.
11 Jack up the front of the car and support it on axle stands positioned under the body side sills. Remove both front roadwheels.
12 From underneath the car, undo and remove the nut and bolt securing the exhaust pipe support to the bracket on the side of the gearbox.
13 On manual transmission models fitted with a remote control gearchange, undo and remove the bolts securing the rear of the remote control housing to the floor. On automatic transmission models it should be possible to lower the subframe sufficiently for removal of the steering gear without disconnecting the gear selector cable. However, if during subsequent operations the cable appears to be under tension, disconnect it from the transmission as described in Chapter 6, Section 24.
14 On models fitted with rubber cone suspension, disconnect the front shock absorbers from the upper suspension arms.
15 Undo and remove the locknuts securing the steering outer balljoint shanks to the steering arms on the swivel hubs. Release the tapers using a universal balljoint separator or shock them free by striking the steering arms with a medium hammer.
16 Support the subframe securely on jacks and then undo and remove the nuts and bolts securing the subframe to the rear mountings or to the floor.
17 Slacken the bolt securing the front of the subframe or subframe mountings to the body.
18 Carefully lower the jacks, allowing the subframe to drop by approximately 3 in (76 mm) at the rear.
19 Lift off the rack-and-pinion retaining U-bolts and clamp pads and then manoeuvre the rack assembly out from between the subframe and body on the driver's side.
20 Refitting the steering gear is the reverse sequence to removal bearing in mind the following points.

(a) Do not tighten the U-bolt locknuts until the upper column is fitted and secure
(b) When refitting the upper column to the pinion shaft and mountings, refer to the procedure described in Section 25

30 Rack-and-pinion steering gear – dismantling and reassembly

Note: *It is not possible to make any adjustments to the rack-and-pinion steering gear unless it is removed from the car. With it removed, it is as well to dismantle and examine the whole unit before making any adjustments. This will save having to remove the unit again later because of initial non-detection of wear. If wear is very bad it is advisable to fit an exchange reconditioned unit. It must be pointed out that dismantling and reassembly of the steering gear is rather involved and may be beyond the scope of the average DIY enthusiast. Read through the complete Section first to familiarise yourself with the procedure and ensure that the necessary tools and equipment are available before proceeding.*
1 Mark the position of the locknuts on the tie-rods so that the toe-out is approximately correct on reassembly.
2 Slacken the locknuts and, gripping the tie-rods firmly with a self-gripping wrench, unscrew the tie-rod balljoints. Now unscrew the locknuts also.
3 If the steering gear is fitted with black rubber gaiters, it will be filled with oil. If it is fitted with transparent rubber gaiters it will be filled with grease. If working on the oil-filled type ensure that a container is available before proceeding further.
4 Unscrew the clips or cut the wires that secure the rubber gaiters to the rack housing and tie-rods. Carefully remove the gaiters, and on oil-filled types, drain the oil from the housing.
5 On inspection it will be seen that the ball housing at the inner end of each tie-rod is secured to the rack by a locking collar. The locking collar is then peened into a groove in the ball housing on early models, or retained by a grooved pin on later types.
6 On early models punch or prise up the peening and then unlock the ball housing and collar using BL special tool No 18G1278. Alternatively, use two small Stilson wrenches, but take care not to damage the housing and collar faces.
7 On later models, it is first necessary to drill out the grooved pin. To do this use a 0.156 in (3.97 mm) drill, and drill to a depth of 1.6 in (4 mm). Now unlock the ball housing and collar using the procedure described in the previous paragraph.
8 Unscrew the ball housing and then lift off the tie-rod, ball seat and spring from the end of the rack. The locking collar can now be removed.
9 Repeat this procedure for the other tie-rod, noting that if these components are to be re-used they must be refitted to the same side of the rack from which they were removed.
10 At the base of the pinion housing, undo and remove the two rack damper cover bolts and spring washers. Lift off the damper cover together with its shims, and then withdrw the thrust spring, yoke, and O-ring seal from the rack housing.
11 Undo and remove the two bolts and lift off the pinion end cover together with its gasket and shims.
12 Carefully push out the pinion and lower bearing.
13 Withdraw the rack from the pinion end of the housing. **Note:** *If the rack is withdrawn from the plain end of the housing the rack teeth will damage the support bush.*
14 Extract the pinion upper bearing from the rack housing, followed by the oil seal.
15 From the plain end of the rack housing, undo and remove the small retaining screw and then withdraw the rack support bush. **Note:** *On some models a rivet is used instead of a screw and this must be carefully drilled out.*
16 Thoroughly clean all the parts with paraffin. Carefully inspect the teeth on the rack and the pinion for chipping, roughness, uneven wear, hollows, or fractures. Renew both components if either is badly worn.
17 Carefully inspect the component parts of the inner balljoints for wear or ridging, and renew as necessary.
18 The outer tie-rod joints cannot be dismantled, and if worn must be renewed as a complete assembly. Examine the component parts of the damper and renew any that show signs of wear. Pay particular attention to the oil seals; as a precautionary measure it is always best to renew them.

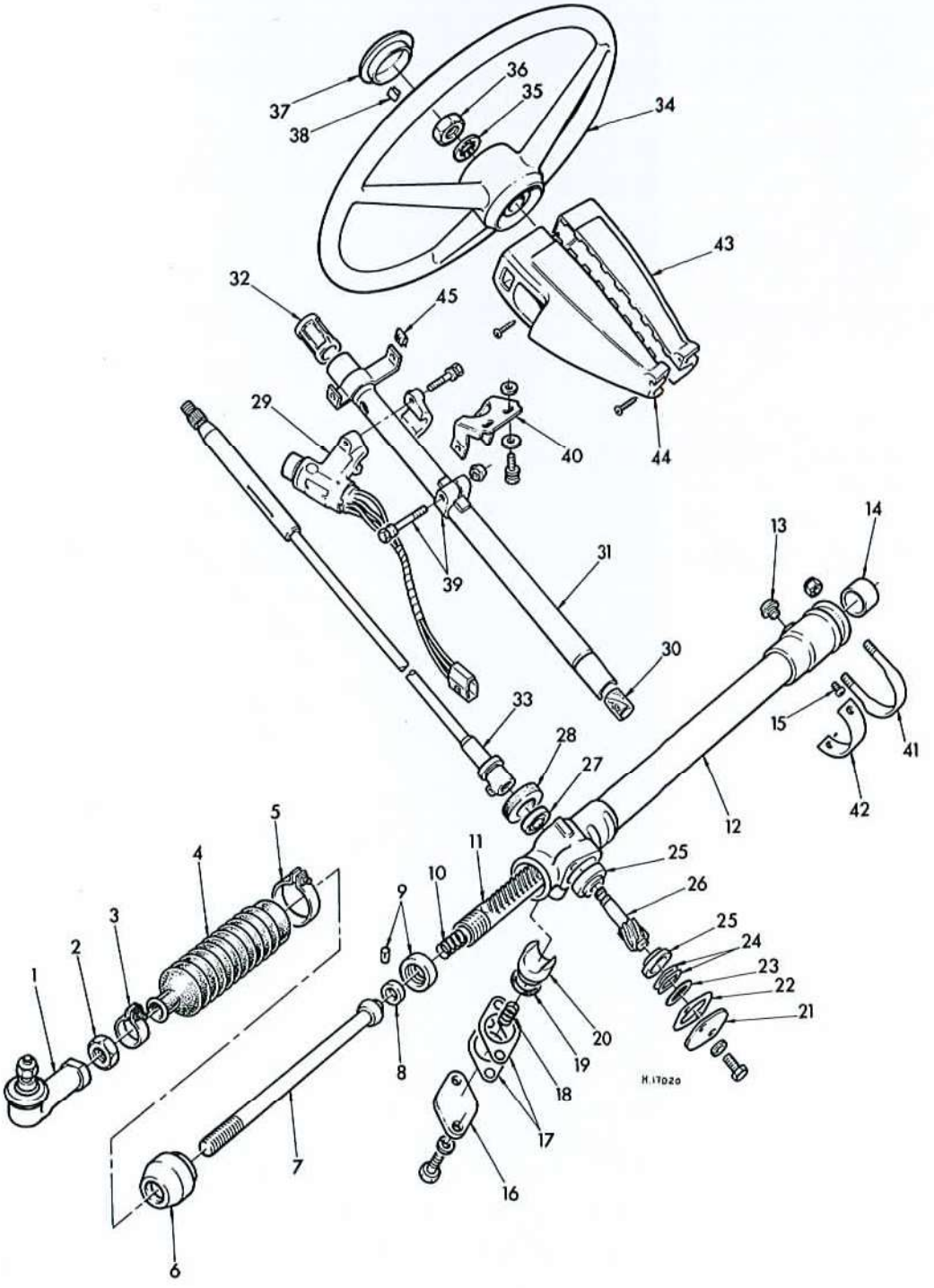

Fig. 11.17 Exploded view of the steering gear (Sec 30)

1 *Balljoint*
2 *Locking nut*
3 *Retaining clip*
4 *Rubber gaiter*
5 *Retaining clip*
6 *Ball housing*
7 *Tie-rod*
8 *Ball-seat*
9 *Locknut and grooved pin*
10 *Thrust spring*
11 *Rack*
12 *Rack housing*
13 *Rack centring hole plug*
14 *Rack bearing*
15 *Bearing retaining screw*
16 *Damper cover plate*
17 *Shims*
18 *Thrust spring*
19 *O-ring seal*
20 *Rack support yoke*
21 *Pinion end cover*
22 *Gasket*
23 *Shim – standard*
24 *Shims*
25 *Pinion bearings*
26 *Pinion*
27 *Pinion seal*
28 *Sealing washer*
29 *Ignition switch and steering lock with shear bolts*
30 *Lower felt bush*
31 *Steering column – outer*
32 *Upper bush*
33 *Steering column – inner*
34 *Steering wheel*
35 *Locking washer*
36 *Nut*
37 *Hub cover*
38 *Retaining clip*
39 *Column clip and shear bolt*
40 *Clamp plate*
41 *U-bolt*
42 *Anti-friction strip*
43 *Left-hand shroud*
44 *Right-hand shroud*
45 *Spring nut*

19 The rubber gaiters are particularly prone to damage and it is advisable to renew them as a matter of course.
20 Begin reassembly by refitting the rack support bush to the plain end of the rack housing. If the original bush is being refitted, align the screw holes in the bush and rack housing.
21 If a new rack support bush is being fitted, drill a 0.109 in (2.7 mm) hole, into the bush, through the retaining screw hole, to a depth of 0.142 in (10.5 mm).
22 Apply jointing compound to the threads of the support bush retaining screw. Refit and tighten the screw, then check that the bush bore has not distorted. Make sure that the screw does not break right through the bush into the bore.
23 Lubricate the upper pinion bearing and fit it into place in the housing. Use the pinion to push the bearing fully into position.
24 Insert the rack into the housing from the pinion end and then refit the pinion, splined end first.
25 Lubricate the lower pinion bearing and place it in position on the lower end of the pinion shaft.

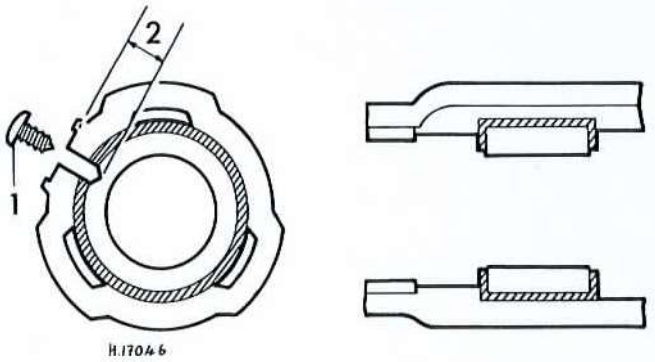

Fig. 11.18 Refitting the rack support bush (Sec 30)

1 Retaining screw 2 Drill to a depth of 0.142 in (10.5 mm)

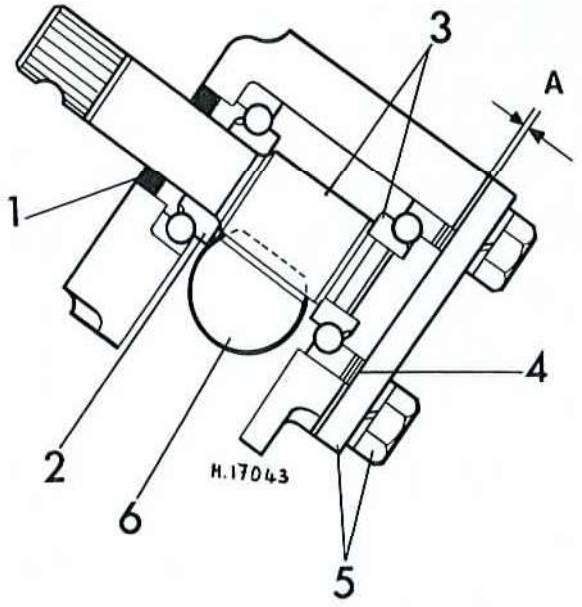

Fig. 11.19 Reassembly of the pinion housing (Sec 30)

1 Oil seal
2 Upper pinion bearing
3 Pinion and lower bearing
4 Preload shims
5 End cover and retaining bolt
6 Rack
A = 0.011 to 0.013 in (0.28 to 0.33 mm)

26 Refit the preload shims, using additional shims if necessary, until the shim pack stands proud of the pinion housing.
27 Refit the end cover and retaining bolts and tighten the bolts lightly and evenly until all pinion endfloat is taken up.
28 Using feeler gauges, measure the gap between the end cover and the pinion housing. Now take off the end cover and remove the appropriate number of shims until a gap of 0.011 to 0.013 in (0.28 to 0.33 mm) still remains.
29 With the correct shims in position, refit the end cover using a new gasket, and with the bolt threads lightly coated in jointing compound, tighten them fully.
30 Place a new oil seal over the pinion and insert it into the housing. The seal must be fitted with the seal lips toward the pinion bearing and with its top face flush with the end of the housing.
31 Lubricate the rack damper yoke and slide it into the housing. Refit the cover plate and retaining bolts, but do not fit the spring at this stage.
32 Tighten the cover plate bolts evenly until the rack is lightly clamped by the yoke. Turn the pinion two or three turns in either direction and check that the rack is not binding in any position. If necessary, slacken the cover plate bolts slightly to achieve this.
33 Take a feeler gauge measurement of the gap between the damper cover plate and the housing and then remove the cover plate.
34 Fit a new O-ring seal to the damper yoke and place the spring in position. Add shims equal to the gap measured between the cover plate and housing plus 0.002 to 0.005 in (0.05 to 0.13 mm). Refit the cover plate and tighten down the bolts. Turn the pinion through 180° in each direction from the centre and make sure there is no tightness or binding.
35 Screw one of the tie-rod ball housing locking collars onto the rack as far as it will go. If the original components are being re-used, make sure that the collar is being refitted to the end of the rack from which it was removed.
36 Lubricate the thrust spring and ball seat and then locate them in the end of the rack. Lubricate the tie-rod balljoint and the ball housing and refit these components.
37 Tighten the ball housing until the tie-rod ball is clamped and will not move without binding.
38 Now slacken the ball housing slightly (approximately $\frac{1}{8}$ of a turn) until the tie-rod is just free to move. **Note:** *The tie-rod will still feel stiff to move because of the tension of the thrust spring, but there should be no trace of binding or endfloat.*
39 Hold the ball housing in this position and screw the locking collar into contact with it. Tighten the locking collar using the same procedure used for removal, making sure that the position of the ball

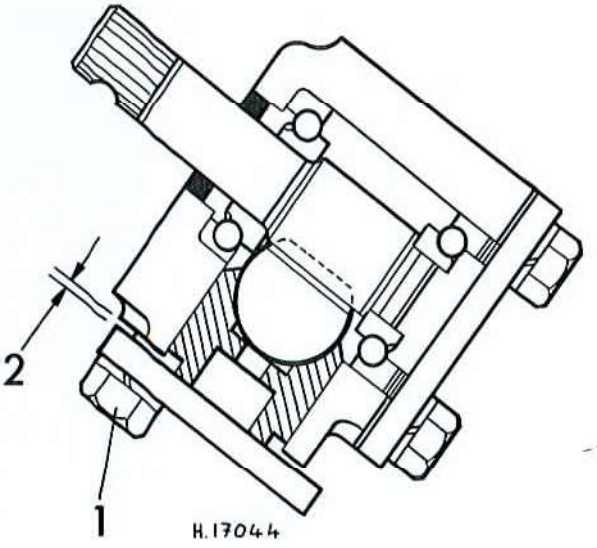

Fig. 11.20 Reassembly of the rack damper (Sec 30)

1 Damper cover plate retaining bolts
2 Measured gap plus 0.002 to 0.005 in (0.05 to 0.13 mm) – see text

housing does not alter.
40 If working on early type racks, peen the edge of the locking collar into the groove of the ball housing using a small punch.
41 On later type racks, protect the rack housing from swarf and drill a 0.156 in (3.97 mm) diameter hole, 0.312 in (8.0 mm) deep, between the locking collar and ball housing. The hole must be drilled on the side facing away from the rack teeth and at least 90° away from any previous hole. **Note:** *The rack may be drilled a maximum of three times only. With the hole drilled, drive in a new grooved pin and retain it by peening over the edge of the hole.*
42 Repeat the above procedure for the other tie-rod and ball housing.
43 Refit the rubber gaiter and retaining clips or wire to the plain end of the rack assembly.
44 Stand the assembly upright and fill it through the pinion end of the housing with the correct quantity and type of lubricant as shown in the Specifications.
45 Refit the remaining rubber gaiter and its retaining clips or wire.
46 If the original tie-rods have been refitted, screw on the tie-rod outer balljoint locknuts to the positions marked during dismantling. Now screw on the balljoints and tighten the locknuts.
47 If new tie-rods have been fitted, screw on the locknuts and then screw on the balljoints, by an equal amount each side, until the dimension between their centres is as shown in the Specifications. Tighten the locknuts.
48 The steering gear can now be refitted to the car as described in Section 29. It will be necessary to have the front wheel alignment checked and reset as described in Section 32 after refitting.

31 Rack-and-pinion steering gear – lubrication

1 The steering gear is filled with lubricant during manufacture and then sealed. Additional lubricant will only be required in service if a leak develops, either from the rubber gaiters or from any of the joints, or if the steering gear has been dismantled.
2 The steering gear fitted to early models, identified by black rubber gaiters, is filled with oil. The equipment fitted to later models, identified by transparent rubber gaiters is filled with grease. The grade and quantity of lubricant for both types is given in the Specifications.
3 Should it be necessary to refill the rack, proceed as follows.
4 Jack up the driver's side of the car, suitably support it on stands, and remove the front roadwheel.
5 Centralise the steering gear so that the wheels are in the straight-ahead position.
6 Slacken the retaining clips or remove the wire securing the rubber gaiter to the rack housing and tie-rod. Slide the rubber gaiter down the tie-rod sufficiently to provide access.
7 Using an oil can or grease gun filled with the specified grade and quantity of lubricant, fill the rack housing.
8 Refit the rubber gaiter and secure it with the retaining clips or soft iron wire.
9 Turn the steering from lock to lock to distribute the lubricant, refit the roadwheel and lower the car to the ground.

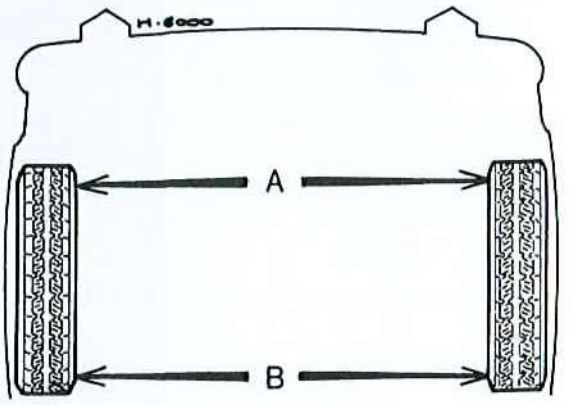

Fig. 11.21 Front wheel alignment (Sec 32)
Dimension A must be 0.0625 in (1.6 mm) greater than B

32 Front wheel alignment

1 The front wheels are correctly aligned when they turn out at the front (toe-out) by the specified amount with the vehicle unladen. Adjustment is carried out by loosening the locknut securing each tie-rod balljoint, and the outer clips on the gaiters, then turning both tie-rods equally until the adjustment is correct.
2 Accurate adjustment and setting of the front wheel alignment involves the use of optical aligning equipment or scuff plates, and it is strongly recommended that this work be entrusted to your local dealer.
3 If the front wheels are not in alignment, tyre wear will be heavy and uneven, and the steering will be unresponsive.