

# Disassembly and Assembly of Steering

Job No.

L 4

## A. DB-Steering Type L 0; Part Nos. 120 460 31 01, 120 460 25 01 and 120 460 24 01

Models 220, 219, 220a, 220S

Description of grease seals on the various types of steering, see Page L 4/7.

### Disassembly:

1. Remove the steering (see Job No. L 1, paragraphs 1 to 6).
2. Remove the split pin of the castle nut on the steering gear arm, unscrew the castle nut and use Bell-shaped Puller 186 589 04 33 to pull off the steering gear arm.
3. Unscrew the hexagon nut (7) and the set screw (6) in the housing cover to the point where the pressure sleeve (4) is no longer under stress (see Fig. L 4/6).
4. Remove the four housing cover fixing screws and remove the cover and gasket. Take out the pressure sleeve (1) together with the compression spring (Fig. L 4/1).

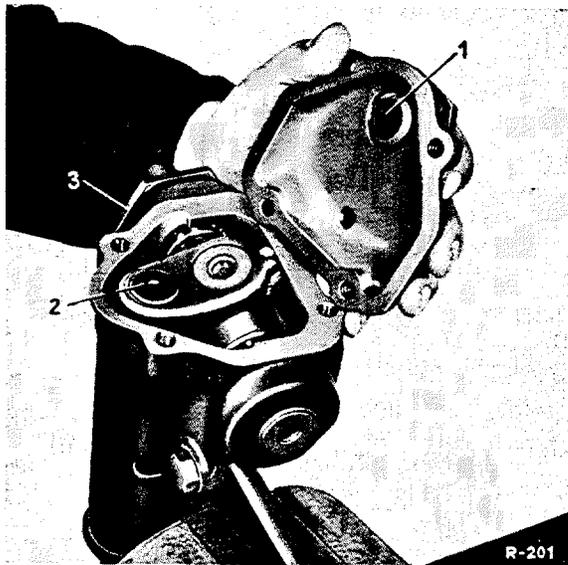


Fig. L 4/1

- 1 Pressure sleeve
- 2 Steering shaft
- 3 Hexagon nut for adjusting ring

5. Empty the oil by tilting the steering gear.
6. Pull out the steering shaft (2) upward (Fig. L 4/1).

7. Use Wrench 180 589 00 01 to unscrew the hexagon nut (3) which fixes the adjusting ring and use Pin Wrench 000 589 00 05 to screw out the adjusting ring (Fig. L 4/2).

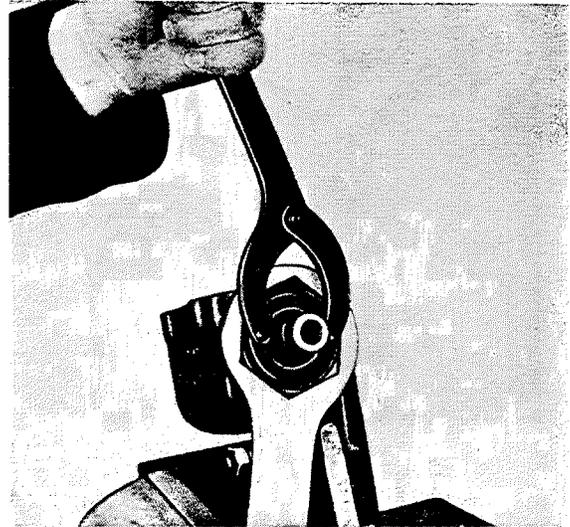


Fig. L 4/2

8. Disengage the cable guide tube from the housing (Fig. L 4/3).

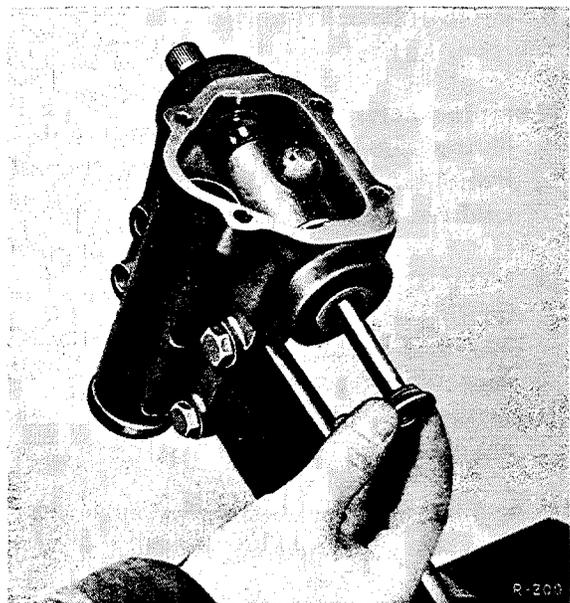


Fig. L 4/3

- Use a suitable drift to tap the steering worm upward far enough to allow the upper outer race and the ball retainer to be removed.

Then remove the steering worm and the steering nut from the housing. When doing this, incline the steering worm upward at an angle (Fig. L 4/4).



Fig. L 4/4

**Note:** As long as the inner races of the taper-roller bearings are pressed on the steering worm, the steering worm must not be turned so far that the inner races foul the ball guide tubes, as this will cause them to be dented.

- Remove the ball retainer of the lower taper-roller bearing from the housing.

**Note:** The outer races and the ball retainers must not be inadvertently interchanged. To avoid this, place them or mark them so that confusion is impossible.

- If replacement of the lower taper-roller bearing is necessary, use Internal Extractor 000 589 27 33 to pull out the lower outer race. When doing this, use a 25×60×10 mm washer to support the extractor at the housing at the top.

**Note:** If the extractor is not available, a suitably bent screw driver can be used to pry out the outer race. The screw driver should be applied between the housing and the bearing race.

- Use a suitable puller to pull the inner races of the upper and lower taper-roller bearings off the steering worm.

**Note:** If the taper-roller bearings are to be reinstalled, the inner races should be marked to avoid confusion.

- If necessary, disengage the steering worm from the steering nut.

Keep the steering worm horizontal and be careful with the balls.

**Note:** Normally there are in all 62 balls in the steering nut. Because of the permissible tolerances there can in some cases be as few as 60 or as many as 64 balls in the steering nut.

The ball guide tubes (9) (see Fig. L4/5) must not be screwed off. If a ball guide tube is bent, the steering nut, complete with steering worm and balls, must be replaced.

Only the complete assembly with steering nut, balls, steering worm and taper-roller bearings is supplied as a replacement part.

- Remove the sealing ring (8) for the cable guide tube from the steering worm.

- Then tap out the grease seal (6) from the adjusting ring (4) (Fig. L 4/5) and the grease seal (10) for the steering shaft (1) (see Fig. L 4/6) from the steering housing.

- Thoroughly clean all parts.

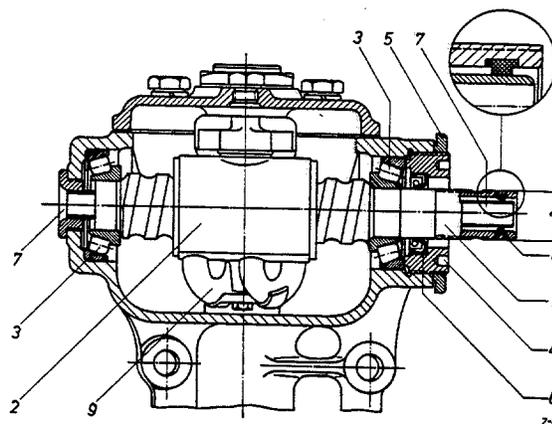


Fig. L 4/5

- a Diameter at the serration = 19.6 mm
- 1 Steering worm
- 2 Steering nut
- 3 Taper-roller bearing
- 4 Adjusting ring

- 5 Hexagon nut for adjusting ring
- 6 Grease seal in adjusting ring
- 7 Cable guide tube
- 8 Cable guide tube sealing ring
- 9 Ball guide tube

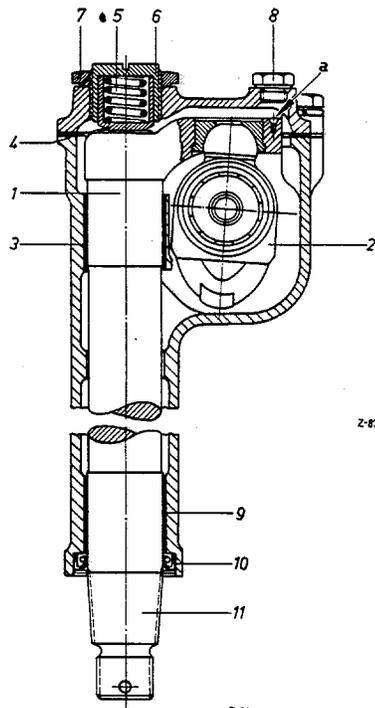


Fig. L 4/6

- |   |                         |
|---|-------------------------|
| a Centering bore for steering shaft center position | 5 Compression spring    |
| 1 Steering shaft                                    | 6 Set screw             |
| 2 Steering nut                                      | 7 Hexagon nut           |
| 3 Upper bearing bushing                             | 8 Screw plug            |
| 4 Pressure sleeve                                   | 9 Lower bearing bushing |
|   | 10 Grease seal          |

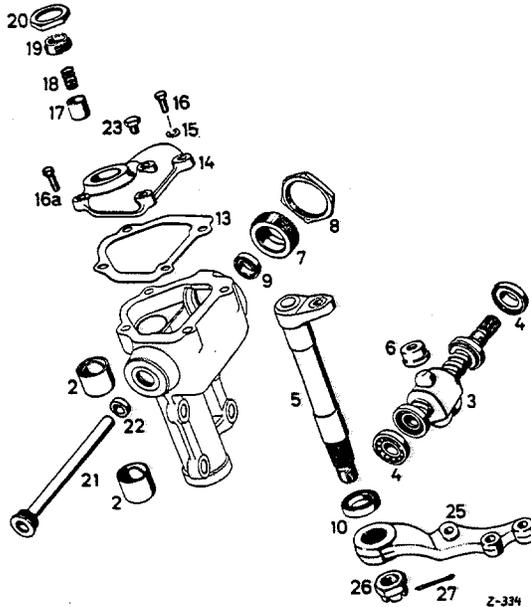


Fig. L 4/7

- |  |                            |
|--|----------------------------|
| 2 Upper and lower bearing bushing                  | 15 Lock washer B 8         |
| 3 Steering worm with nut and taper-roller bearing  | 16 Hexagon screw M 8 × 20  |
| 5 Steering shaft with ball-cup                     | 16a Hexagon screw M 8 × 25 |
| 6 Ball-cup   | 17 Pressure sleeve         |
| 7 Adjusting ring                                   | 18 Compression spring      |
| 8 Hexagon nut                                      | 19 Set screw               |
| 9 Sealing ring B 20 × 32 × 7 for the steering worm | 20 Hexagon nut             |
| 10 Grease seal for the steering shaft              | 21 Cable guide tube        |
| 13 Gasket  | 22 Sealing ring            |
| 14 Steering housing cover                          | 23 Screw plug              |
|  | 25 Steering gear arm       |
|  | 26 Castle nut M 22 × 1.5   |
|  | 27 Cotter-pin 5 × 40       |

### Assembly:

- If the steering nut was screwed out during the disassembly operation, install the steering nut by screwing it onto the steering worm, whilst holding the latter vertical.
- Now fill the upper ball-race with balls. When doing this, turn the steering worm back and forth and use a suitable bent, blunt wire to insert the balls in the ball guidetube (Fig. L 4/8).



Fig. L 4/8

- Turn over the steering worm together with the nut and screw in the steering worm until the lower opening of the ball-race is exposed. Then fill the lower ball-race in the same manner.

**Note:** When inserting the balls it is not necessary to count them.

Normally 31 balls are needed in each ball-race. In individual cases, however, it is possible that in one ball-race, one ball less, i. e. necessary.

**As a check, insert as many balls as will go in without forcing. The balls must on no account be forced in.**

Now the steering worm can be turned through. When doing this, it must be pos-

sible to turn the steering worm easily and without binding. If the steering worm binds at any point, one ball too many has been inserted in one ball-race. If this is the case, the balls no longer roll in the race as they should but instead, they skid.

**On no account use force when turning the steering worm.**

**If binding spots are felt when turning the steering worm, even after the balls have been fitted in the prescribed manner, the steering worm must be replaced complete with balls and steering nut.**

**Similarly, if one or more balls are lost, the complete steering worm assembly must be replaced.**

20. Now press the inner races of the taper-roller bearings onto the steering worm. The inner races must lie snugly against the shoulder of the steering worm. When pressing in the races, care must be taken to ensure that the inner races are not installed under excessive pressure, as the danger exists that the steering worm may be damaged at the end of the ball-race.

**Note:** If the inner races of the taper-roller bearings are pressed onto the steering worm, the steering worm must not be turned in so far that the inner races foul the ball guide tubes, as this will dent them.

If the old taper-roller bearings are reinstalled, the inner races must not be inadvertently interchanged; each one must be installed again on the side on which the taper-roller bearing in question was located before removal.

21. Insert a new sealing ring (8) for the cable guide tube in the steering worm (see Fig. L 4/5).
22. Then use Forcing Sleeve 180 589 0239 to press the outer race of the lower taper-roller bearing into the housing (Fig. L 4/9).
23. Press a new grease seal (320 × 32 × 7 DIN 6504) into the adjusting ring. Before doing this, smear the circumference of the grease seal with sealing compound.

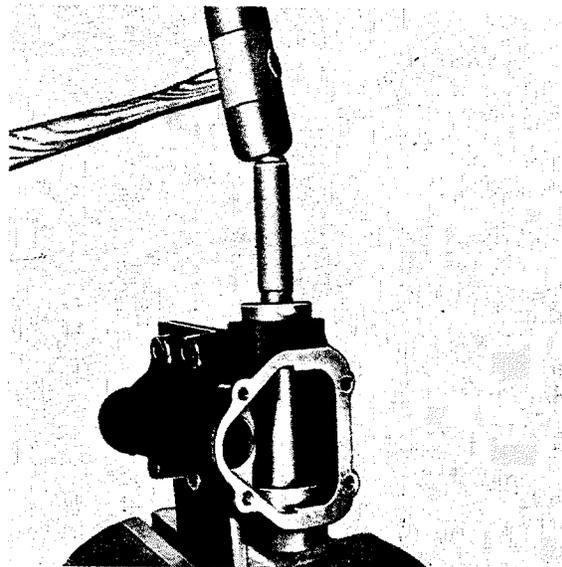


Fig. L 4/9

24. Now install the lower ball retainer and slide the steering worm together with the steering nut into the housing from above; incline the steering worm at an angle when sliding it into the housing (Fig. L 4/10).
25. Install the upper ball retainer and use Forcing Sleeve 180 589 0239 to press in the outer race of the upper taper-roller bearing.

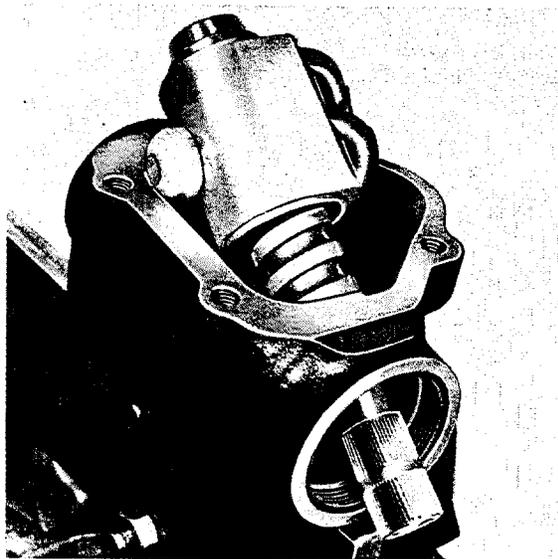


Fig. L 4/10

26. Smear sealing compound on the lower threads of the adjusting ring (2) and screw the adjusting ring into the housing; when doing this, press Guide Sleeve (1) 180 589 0061 onto the steering worm (Fig. L 4/11).

**Note:** It is absolutely essential to use the guide sleeve (1) as otherwise the grease seal which is pressed into the adjusting ring will be damaged by the serrations on the steering worm.

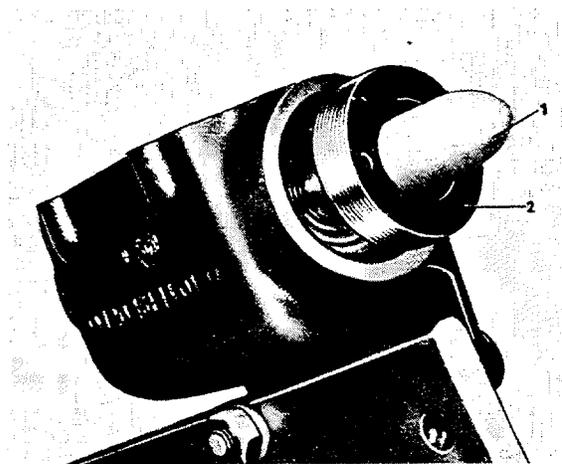


Fig. L 4/11

- 1 Guide sleeve
- 2 Adjusting ring

27. Screw the hexagon nut onto the adjusting ring by hand.

28. Then use Pin Wrench 000 589 0005 to tighten the adjusting ring so that the steering worm has an end play of from 0.00 mm to 0.01 mm.

**It must still be possible to turn the steering worm easily (Fig. L 4/12).**

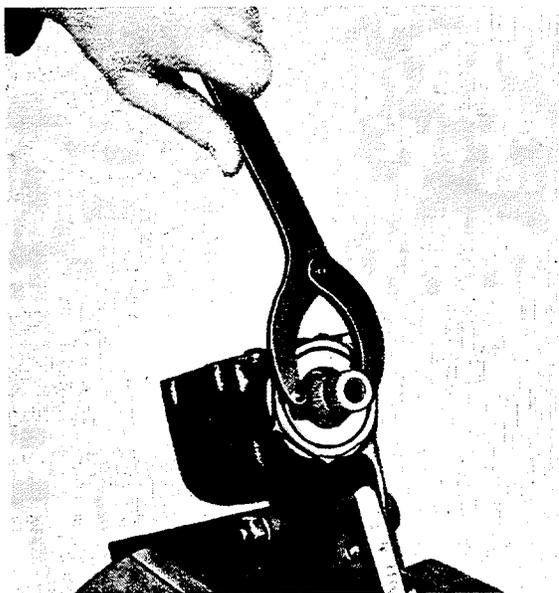


Fig. L 4/12

29. Use Pin Wrench 000 589 0005 to hold steady the adjusting ring and use Wrench 180 589 0001 to tighten the hexagon nut which holds the adjusting ring in position (Fig. L 4/13).

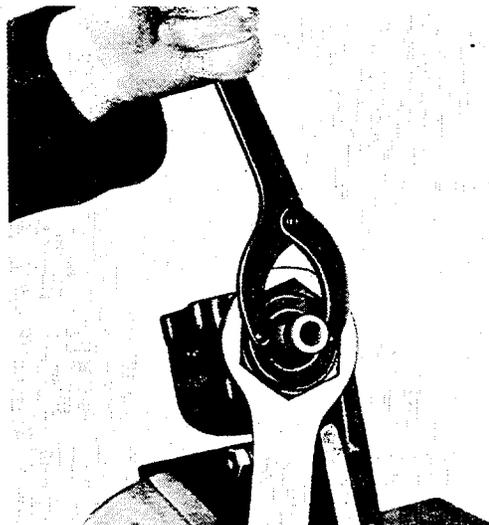


Fig. L 4/13

After tightening the hexagon nut, re-check the end play.

30. Apply SAE 90 hypoid oil liberally to the bearing surfaces of the steering shaft. Apply Molykote-Paste G to the steering nut ball head. Then insert the steering shaft in the housing.

31. Screw in the steering worm to the point where the stop face (a) of the steering shaft arm rests against the stop face (b) of the housing (Fig. L 4/14).

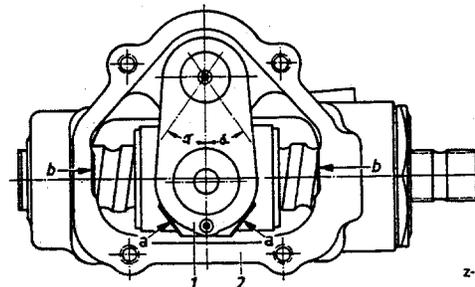


Fig. L 4/14

- 1 Steering shaft arm
- 2 Steering housing
- a Stop faces at the steering shaft arm
- b Stop faces at the housing
- Angle of lock  $\alpha = 35^{\circ} 30'$

**Note:** The stop face (a) of the steering shaft arm must rest against the stop face (b) of the housing before the steering nut can touch the taper-roller bearings.

**The steering nut must on no account press on the taper-roller bearings, as this might result in the destruction of the taper-roller bearings or cause the end of the thread (ball-race), cut on the steering worm, to break away.**

**If the faces (b) in the housing are worn, the housing must be replaced.**

32. Fill up the steering housing with 0.3 liters of SAE 90 hypoid oil.
33. Place the cover, together with the gasket, on the steering housing and fix it with the four hexagon screws and lock washers. The two longer hexagon screws (25 mm long) should be installed on the left, seen in the direction of travel.
34. Insert the pressure sleeve (4) together with the compression spring (5) in the cover of the steering housing (with grease) (see Fig. L 4/6).  
Now screw in the set screw (6) and install the hexagon nut (7) by hand.
35. Back out the screw plug (8) in the housing cover (see Fig. L 4/6) and turn the steering worm so that the center point marked on the steering shaft arm is in the center of the bore in the screw plug.
36. Use a screwdriver to screw the set screw in until the compression spring is bunched solid.  
Now slacken the set screw a little, bearing in mind the following:  
On steering assemblies with inclined steering shaft arms the set screw should be backed out 2 mm and on steering assemblies with horizontal steering shaft arms, the set screw should be backed out 3—4 mm (in both cases measured around the circumference of the set screw). Then lock the set screw with the hexagon nut. When doing this, use a screwdriver to hold the set screw steady (Fig. L 4/15).
37. Check the steering worm for ease of movement.

**Note:** The steering shaft must on no account jam at the center position when it is turned.

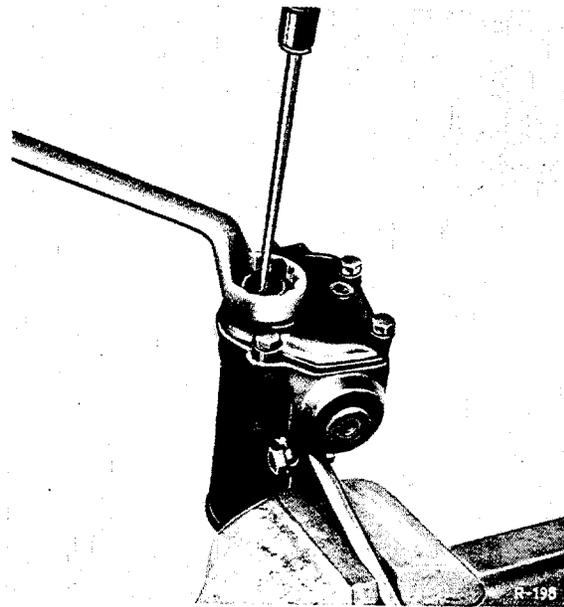


Fig. L 4/15

The adjustment should be so made that when the steering shaft is at the center point on steerings with inclined steering shaft arms, a slight pressure should be noticeable when the steering shaft is turned completely. On steerings with horizontal steering shaft arms, the steering shaft does not reach its highest point when in the center position but at approx. the 15° position in both right and left locks. Thus, when the steering shaft is turned completely, there are two spots at which a slight pressure is felt.

It, however, the steering worm jams when turned, the set screw must be slackened off slightly.

38. Reinstall and tighten up the screw plug and sealing ring.
39. Smear sealing compound on the thread of the cable guide (1) and place Guide Pin (2) 1805890761 on the cable guide and slide the sealing ring (10) onto the cable guide (Fig. L 4/16 and Fig. L 4/19). Then slide the cable guide tube into the housing and screw into place.

**Note:** It is necessary to use the guide pin in order to avoid damage to the sealing ring in the steering worm when sliding in the cable guide tube.

Then check that the upper end of the cable guide tube is not flared and has no sharp edges.

**Description of grease seals on the various types of steering, see pages L 4/7 and L 4/8.**

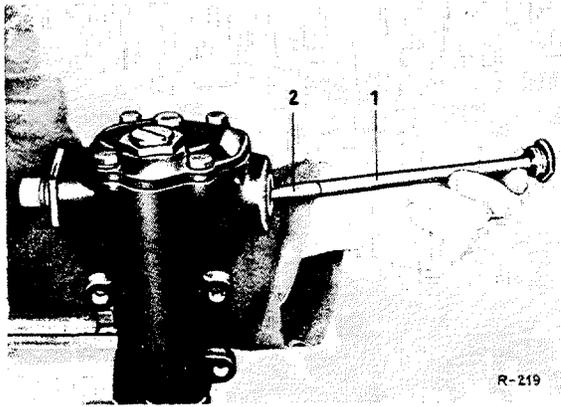


Fig. L 4/16

- 1 Cable guide tube
- 2 Guide pin

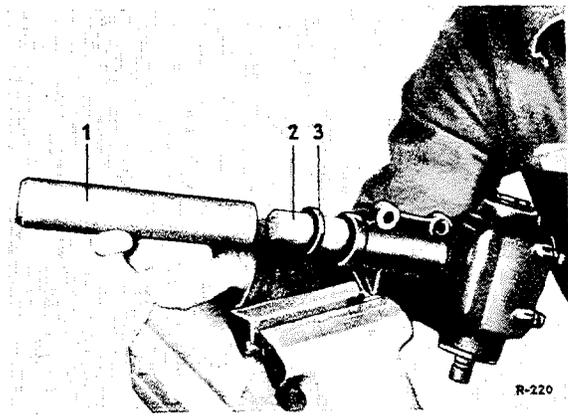


Fig. L 4/17

- 1 Fitting Sleeve 120 589 06 61
- 2 Guide Sleeve 120 589 05 61
- 3 Grease seal

40. Push Guide Sleeve (2) 120 589 05 61 onto the steering shaft (Fig. L 4/17). Then smear sealing compound along the outer circumference of a new grease seal and use Fitting Sleeve (1) 120 589 06 61 to drive it into the housing (Fig. L 4/17).
41. Press the steering gear arm onto the serrated part of the steering shaft so that the

markings on the steering gear arm coincide with those on the steering shaft.

42. Screw the castle nut onto the steering shaft and tighten firmly.
43. Cotter the castle nut.
44. Install the steering assembly (see Job No. L 1, paragraphs 8 to 16).

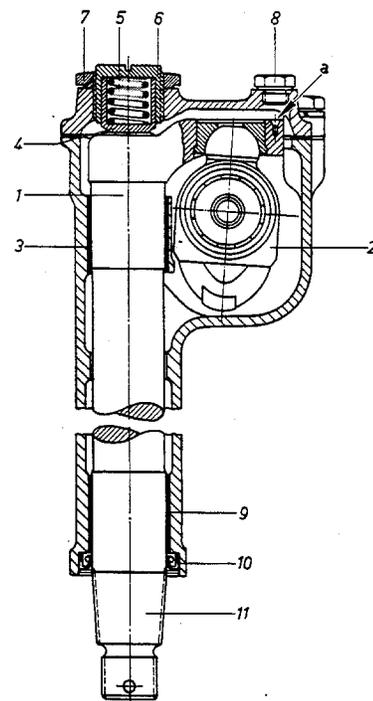
### Description of Grease Seals on the various Types of Steering

#### a) Grease Seal on the Steering Shaft

On all types of steering assembly, the steering shaft is sealed with a grease seal (10) at the bottom (Fig. L 4/18).

Fig. L 4/18

- |   |                         |
|---|-------------------------|
| a Centering bore for steering shaft arm center position | 6 Set screw             |
| 1 Steering shaft  | 7 Hexagon nut           |
| 2 Steering nut  | 8 Screw plug            |
| 3 Upper bearing bushing                                 | 9 Lower bearing bushing |
| 4 Pressure sleeve                                       | 10 Grease seal          |
| 5 Compression spring                                    |                         |



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## b) Grease Seals on the Steering Worm

Steering, Type L 0, Part Nos. 120 460 24 01 and 120 460 25 01.

These steering assemblies are sealed with the sealing ring (10) at the bottom on the cable guide and the grease seal (6) in the adjusting ring (Fig. L 4/19).

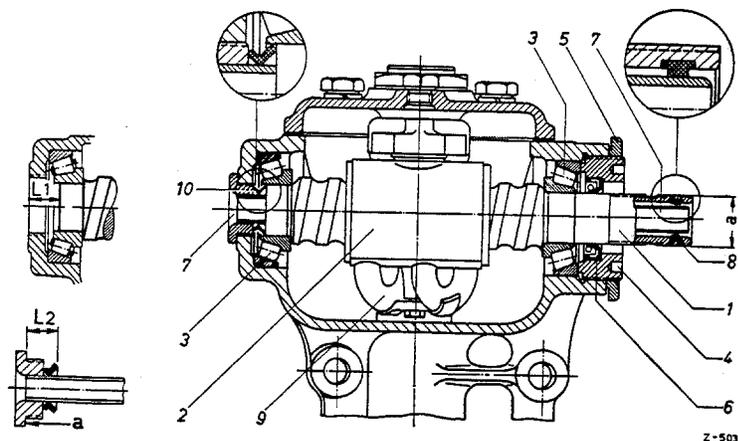


Fig. L 4/19

- |  |  |
|--|--|
| a Diameter at the serrations = 19.6 mm | 5 Hexagon nut for adjusting ring           |
| b Contact force of cable guide tube    | 6 Grease seal in adjusting ring            |
| 1 Steering worm                        | 7 Cable guide tube                         |
| 2 Steering nut                         | 8 Upper sealing ring for cable guide tube  |
| 3 Taper-roller bearing                 | 9 Ball guide tube                          |
| 4 Adjusting ring                       | 10 Lower sealing ring for cable guide tube |

Steering, Type L 0, Part No. 120 460 31 01

These steering assemblies have the grease seal (6) in the adjusting ring and the sealing ring (8) between steering worm and cable guide tube (see Fig. L 4/19), up to Steering No. 65 15 848. As of Steering No. 65 15 849, the sealing ring (10) has been added at the bottom of the cable guide tube.

**When repairs are being carried out, this sealing ring (10) should be subsequently installed up to steering No. 65 15 848.**

**Note:** When the sealing ring (10) is being installed, care should always be taken to ensure that sufficient pressure is used to push the sealing ring right home. The distance  $L_2 - L_1$  must be 0.5—0.6 mm, i.e., when the cable guide tube is installed the sealing ring must be compressed approx. 0.5—0.6 mm. If this difference in measurement is not obtained, the cable guide tube must be remachined accordingly at its contact surface (b) (see Fig. L 4/19). When the steering is reassembled, the sealing ring (10) should be pressed on before the cable guide tube is installed, in accordance with Paragraph 39 of the installation instructions.

## B. DB Steering Type L 1; Part No. 186 4601201

Model 220

### Disassembly:

1. Remove the steering (see Job No. L 1, paragraphs 1 to 6).
2. Remove the split pin of the castle nut on the steering gear arm, unscrew the castle nut and use Bell-shaped Puller 186 589 04 33 to pull off the steering gear arm.
3. Unscrew the hexagon nut (1) and the set screw (2) in the housing cover to the point where the pressure sleeve (7) is no longer under stress (see Fig. L 4/21).
4. Remove the four housing cover fixing screws and remove the cover and gasket. Take out the pressure sleeve (1) together with the compression spring (Fig. L 4/20).

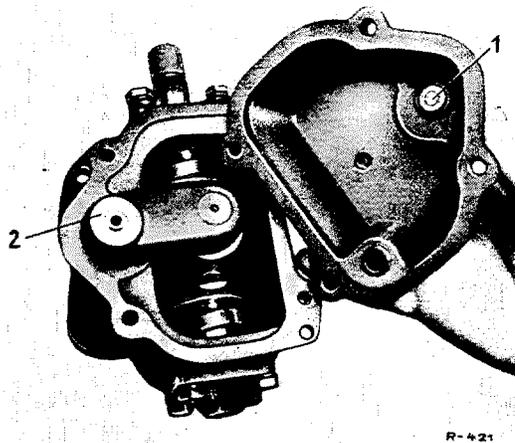


Fig. L 4/20

1 Pressure sleeve  
2 Steering shaft

5. Empty the oil by tilting the steering gear.
6. Pull out the steering shaft (2) upward (Fig. L 4/20).
7. Slacken the 4 fixing screws for the lower bearing cover and remove the cover with the cable guide tube (1), the ball race (2), the ball retainer (3), the shim (4) and the seal (Fig. L 4/21).
8. Slacken the 4 fixing screws for the lower bearing cover. Then use a suitable drift to

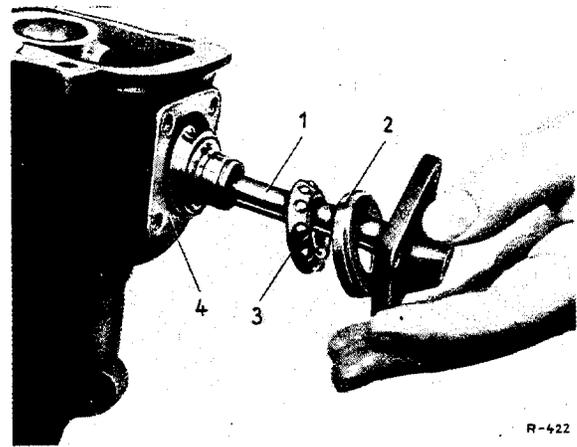


Fig. L 4/21

1 Bearing cover with cable  
guide tube  
2 Ball race  
3 Ball retainer  
4 Shim

knock the steering worm upward until the cover, together with the ball race, ball retainer and sealing ring, can be taken off.

9. Remove the steering worm with the steering nut obliquely upward from the housing (Fig. L 4/22).

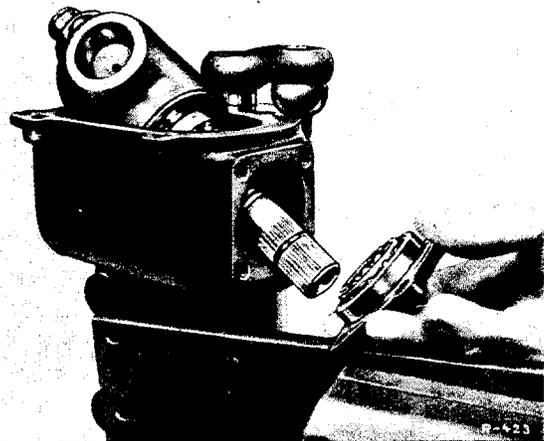


Fig. L 4/22

10. If it is necessary to replace the ball race in the upper bearing cover, use a suitable puller to pull it off.

**Note: The ball races and the ball retainers must not be inadvertently interchanged. To avoid this, place them or mark them so that confusion is impossible.**

11. If necessary, disengage the steering worm from the steering nut. Keep the steering worm horizontal and be careful with the balls.

**Note:** Normally there are in all 82 balls in the steering nut. Because of the permissible tolerances there can in some cases be as few as 80 or as many as 84 balls in the steering nut.

**The ball guide tubes must not be screwed off. If a ball guide tube is bent, the steering nut, complete with steering worm and balls, must be replaced.**

**Only the complete assembly with steering nut, balls, steering worm and taper-roller bearings is supplied as a replacement part.**

12. Remove the sealing ring for the cable guide tube from the lower bearing cover.

13. Then tap out the grease seal from the adjusting ring and the grease seal for the steering shaft from the steering housing.

14. Thoroughly clean all parts.

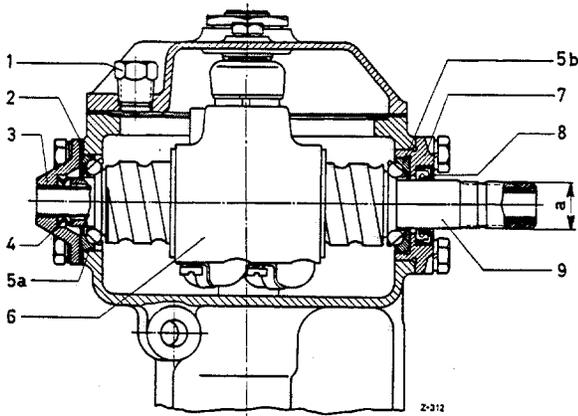


Fig. L 4/23

- a = 21.5mm diameter at the serrations
- 1 Taper plug for oil filler hole
  - 2 Shim
  - 3 Lower bearing cover with cable guide tube
  - 4 Cable guide tube sealing ring
  - 5a Ball race with ball retainer, lower
  - 5b Ball race with ball retainer, upper
  - 6 Steering nut
  - 7 Upper bearing cover
  - 8 Grease seal in adjusting ring
  - 9 Steering worm

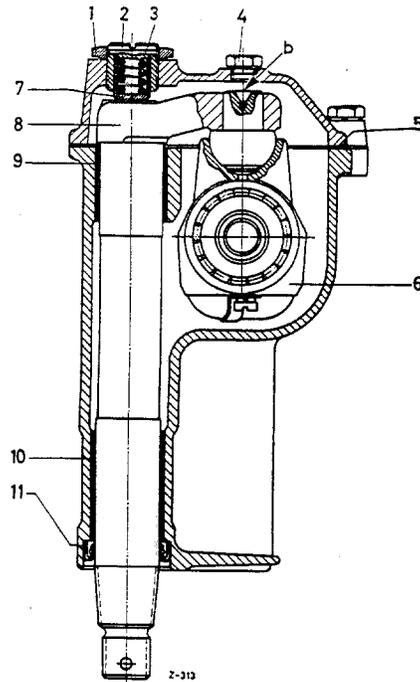


Fig. L 4/24

- a Centering bore for steering shaft arm center position
- 1 Hexagon nut
- 2 Set screw
- 3 Compression spring
- 4 Screw plug
- 5 Gasket
- 6 Steering nut
- 7 Pressure sleeve
- 8 Steering shaft
- 9 Upper bearing bushing
- 10 Lower bearing bushing
- 11 Grease seal

**Assembly:**

15. If the steering nut was screwed out during the disassembly operation, install the steering nut by screwing it onto the steering worm, whilst holding the latter vertical.

16. Now fill the upper ball-race with balls. When doing this, turn the steering worm back and forth and use a suitable bent, blunt wire to insert the balls in the ball guide tube (Fig. L 4/25).

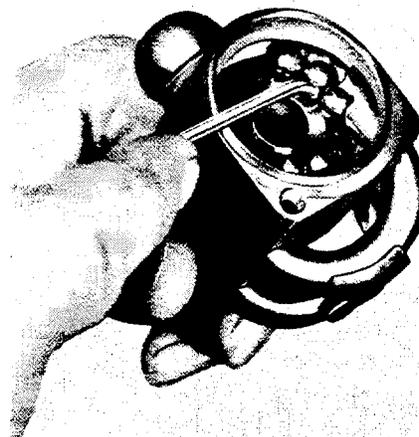


Fig. L 4/25

17. Then fill the lower ball-race in the same manner.

**Note:** When inserting the balls it is not necessary to count them.

Normally 41 balls are needed in each ball-race. In individual cases, however, it is possible that in one ball-race, one ball less, i. e. 40 balls, or one ball more, i. e. 42 balls, are necessary.

**As a check, insert as many balls as will go in Without forcing. The balls must on no account be forced in.**

Now the steering worm can be turned through. When doing this, it must be possible to turn the steering worm easily and without binding. If the steering worm binds at any point, one ball too many has been inserted in one ball-race. If this is the case, the balls no longer roll in the race as they should but instead, they skid.

**On no account use force when turning the steering worm. If binding spots are felt when turning the steering worm, even after the balls have been fitted in the prescribed manner, the steering worm must be replaced complete with balls and steering nut.**

**Similarly, if one or more balls are lost, the complete steering worm assembly must be replaced.**

18. Put the steering worm into the housing obliquely from the top (see Fig. L 4/22).
19. Slide a new sealing ring (4) onto the cable guide tube (see Fig. L 4/23).
20. Put in the lower bearing cover with cable guide tube, sealing ring, outer race, ball retainer and shim and attach it, **loosely** in the first place, to the housing with the 4 hexagon screws.

**Note:** The initial tension on the sealing ring (4) must be approx. 0.5—0.6 mm in order to provide a definite seal against the possibility of oil penetration.

21. Slide the upper bearing cover with the pressed-in sealing ring (8) and the ball race,

together with the ball retainer, over the steering worm shaft and press it into the housing. Attach the cover with the 4 hexagon screws.

**Note:** When sliding on the sealing ring, the serrations of the steering worm should be bound with insulating tape in order to avoid damage to the seal. The outer surface of the insulating tape may be smeared with a little grease.

22. Check the steering worm for end play. To do this, tighten up the 4 fixing screws of the lower bearing cover. The end play of the steering worm should be 0.00 to 0.01 mm.

The shims between the lower bearing cover and the housing are available in 4 thicknesses for correcting the end play. These thicknesses are 0.1 mm, 0.15 mm, 0.2 mm and 0.5 mm. If the specified end play cannot be obtained with the aid of the compensating shims, the upper bearing cover (7) must be correspondingly remachined on the face side (see Fig. L 4/23).

23. Apply SAE 90 hypoid oil liberally to the bearing surfaces of the steering shaft.

Apply Molykote-Paste G to the steering arm ball head. Then insert the steering shaft in the housing.

24. Fill up the steering housing with 0.4 liters of SAE 90 hypoid oil.
25. Place the cover, together with the gasket, on the steering housing and fix it with the four hexagon screws and lock washers.
26. Insert the pressure sleeve (7) together with the compression spring (3) in the cover of the steering housing (with grease) (see Fig. L 4/24). Now screw in the set screw (2) and install the hexagon nut (7) by hand.
27. Back out the screw plug (4) in the housing cover (see Fig. L 4/24) and turn the steering worm so that the center point marked on the steering shaft arm is in the center of the bore in the screw plug.

28. Use a screwdriver to screw the set screw in until the compression spring is bunched solid.

Then back out the set screw approx. 2 mm (measured at its circumference) and lock the set screw with the hexagonal nut. When doing this, use a screwdriver to hold the set screw steady (Fig. L 4/26).

29. Check the steering worm for ease of movement.

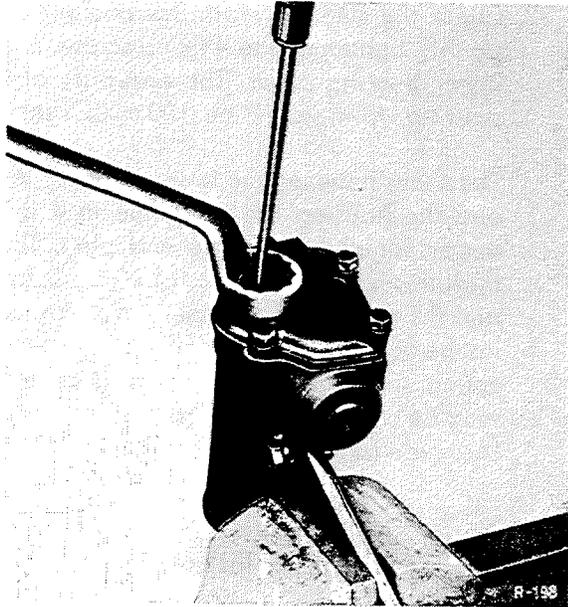


Fig. L 4/26

**Note:** The steering shaft must on no account jam at the center position when it is turned. The adjustment should be so made that a slight pressure is noticeable at the center point when the steering shaft is turned completely.

30. Reinstall the screw plug with sealing ring and tighten up.
31. Bind the serrations of the steering shaft with insulating tape and smear lightly with grease.  
  
Then smear sealing compound along the outer circumference of a new grease seal and use a fitting sleeve to drive it into the housing.
32. Press the steering gear arm onto the serrated part of the steering shaft so that the markings on the steering gear arm coincide with those on the steering shaft.
33. Screw the castle nut onto the steering shaft and tighten firmly.
34. Cotter the castle nut.
35. Install the steering assembly (see Job No. L 1, paragraphs 7 — 14).