

Disassembly and Assembly of Steering

Job No.

46 — 4

Disassembly:

1. Remove the steering (see Job No. 46—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. 46—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. 46 — 4/1).
5. Empty the oil by tilting the steering gear.
6. Pull out the steering shaft (2) upward (Fig. 46 — 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. 46 — 4/2).

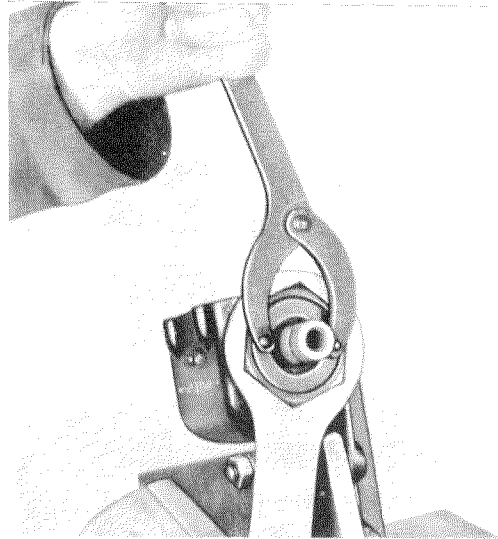


Fig. 46 — 4/2

8. Disengage the cable guide tube from the housing (Fig. 46 — 4/3).

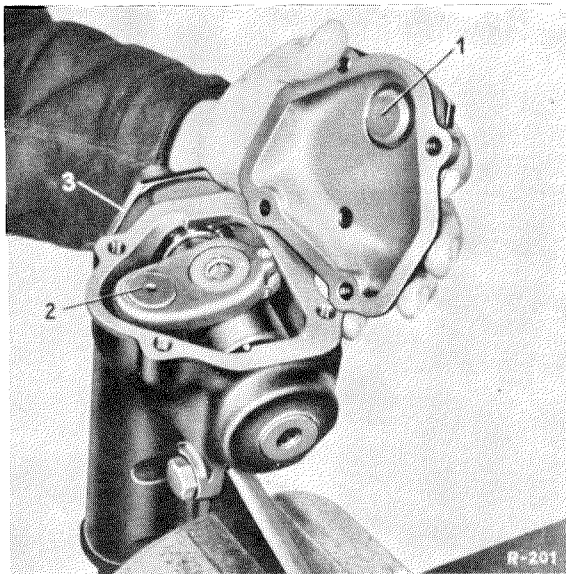


Fig. 46 — 4/1

- 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. 46 — 4/1).

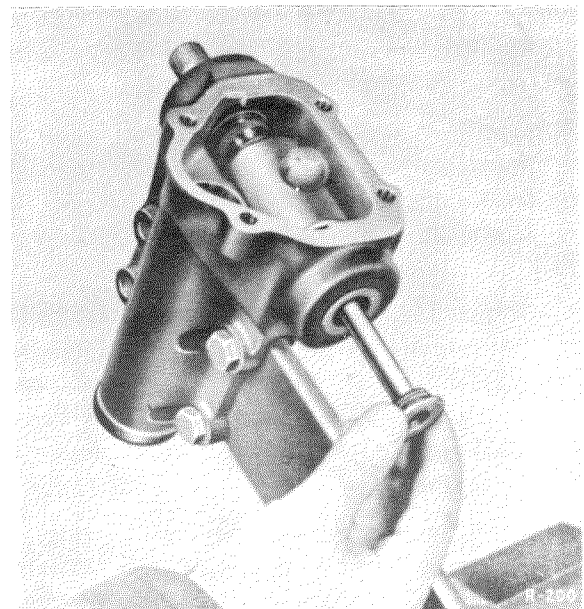


Fig. 46 — 4/3

9. 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. 46 — 4/4).

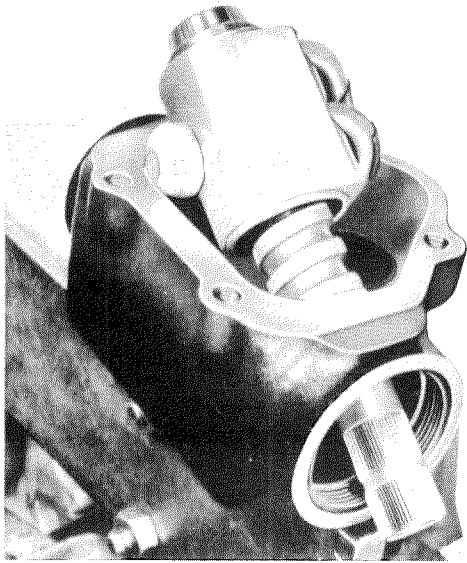


Fig. 46 — 4/4

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.

10. 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.

11. 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.

12. 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.

13. 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. 46 — 4/5) 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.

14. Remove the sealing ring (8) for the cable guide tube from the steering worm.
15. Then tap out the grease seal (6) from the adjusting ring (4) (Fig. 46 — 4/5) and the grease seal (10) for the steering shaft (1) (see Fig. 46 — 4/6) from the steering housing.
16. Thoroughly clean all parts.

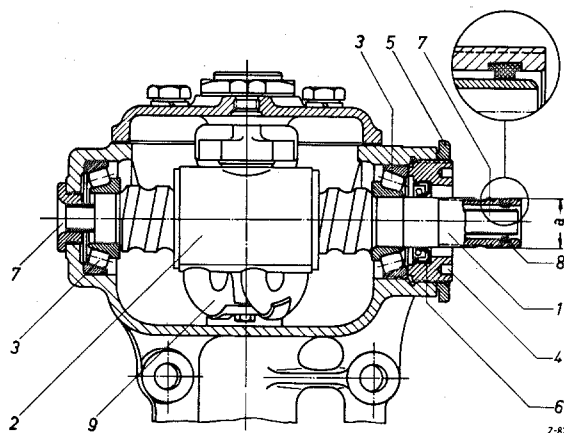


Fig. 46 — 4/5

- | | |
|---------------------------------------|----------------------------------|
| a Diameter at the serration = 19.6 mm | 5 Hexagon nut for adjusting ring |
| 1 Steering worm | 6 Grease seal in adjusting ring |
| 2 Steering nut | 7 Cable guide tube |
| 3 Taper-roller bearing | 8 Cable guide tube sealing ring |
| 4 Adjusting ring | 9 Ball guide tube |

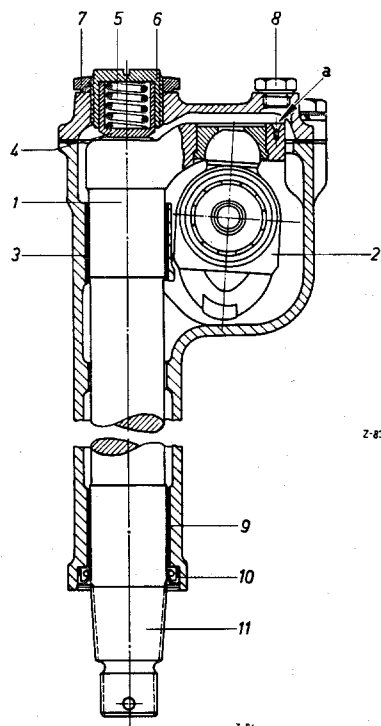


Fig. 46 — 4/6

- | | |
|---|-------------------------|
| a Centering bore for steering shaft arm 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 |

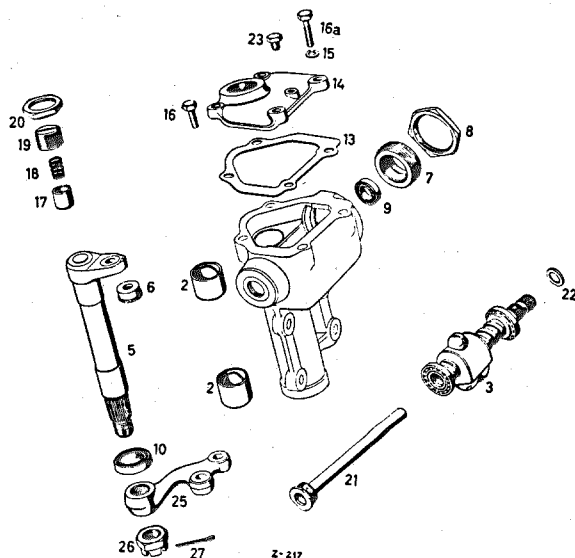


Fig. 46 — 4/7

- | | |
|--|----------------------------|
| 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 guide tube (Fig. 46 — 4/8).

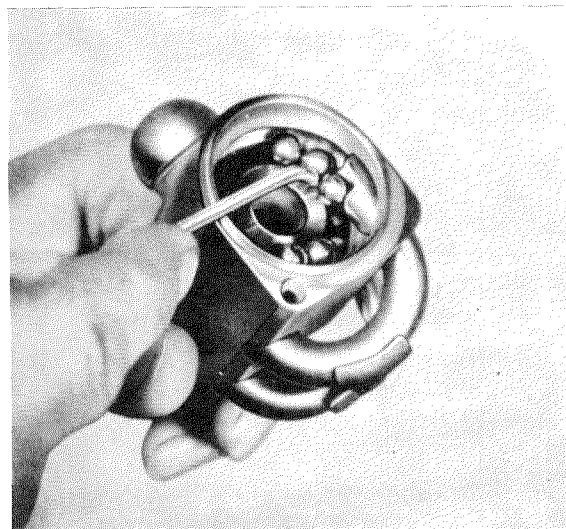


Fig. 46 — 4/8

- 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. 30 balls, or one ball more, i. e. 32 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.

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. 46—4/5).
22. Then use Forcing Sleeve 180 589 02 39 to press the outer race of the lower taper-roller bearing into the housing (Fig. 46—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.

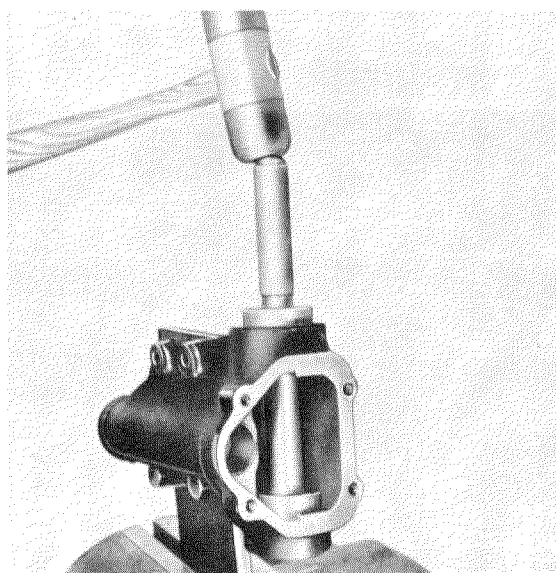


Fig. 46—4/9

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. 46—4/10).
25. Install the upper ball retainer and use Forcing Sleeve 180 589 02 39 to press in the outer race of the upper taper-roller bearing.

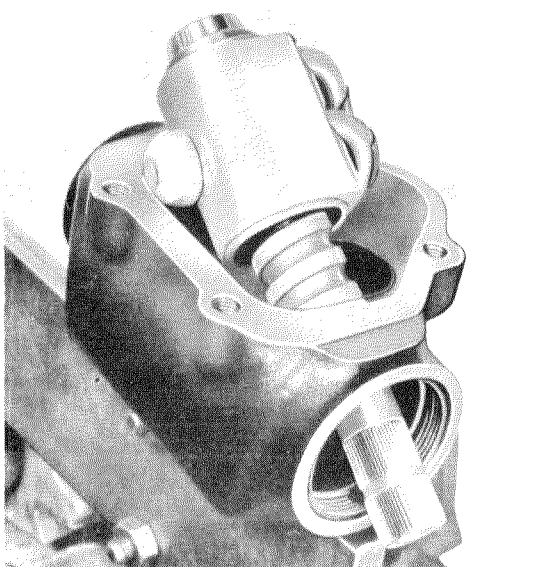


Fig. 46—4/10

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 00 61 onto the steering worm (Fig. 46—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

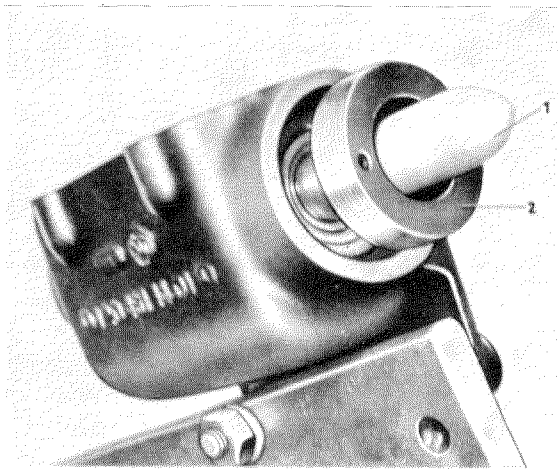


Fig. 46 — 4/11

1 Guide sleeve
2 Adjusting ring

27. Screw the hexagon nut onto the adjusting ring by hand.
28. Then use Pin Wrench 000 589 00 05 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. 46 — 4/12).

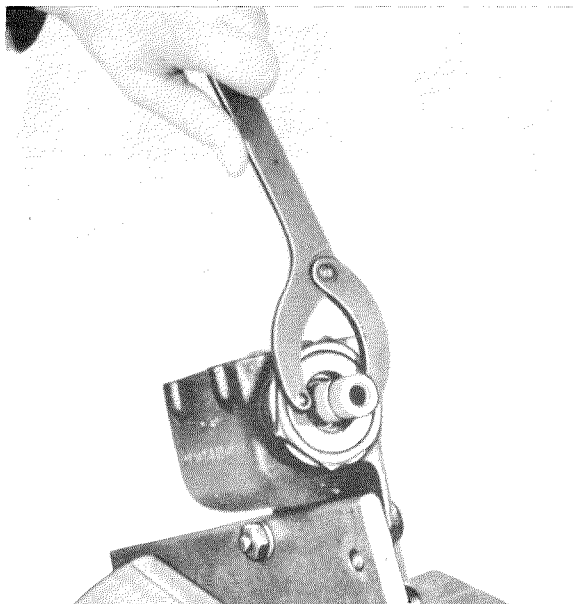


Fig. 46 — 4/12

29. Use Pin Wrench 000 589 00 05 to hold steady the adjusting ring and use Wrench 180 589 00 01 to tighten the hexagon nut which holds the adjusting ring in position (Fig. 46—4/13).

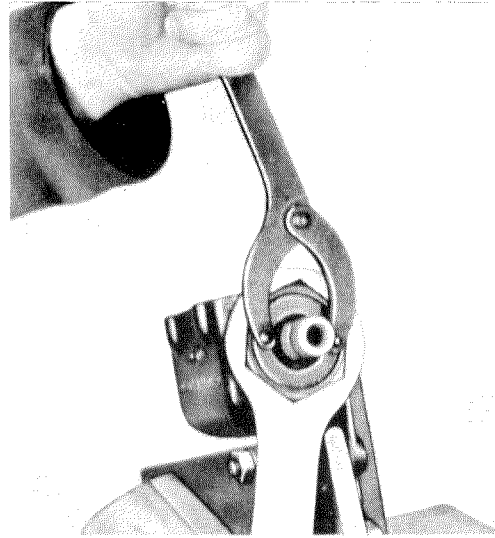


Fig. 46 — 4/13

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. 46 — 4/14).

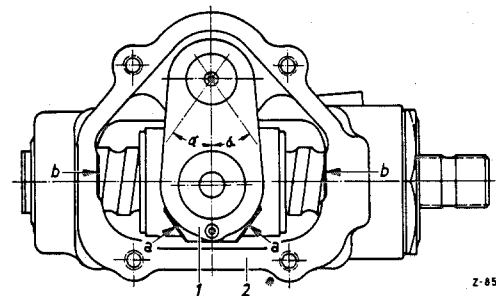


Fig. 46 — 4/14

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

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. 46 — 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. 46 — 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 screw driver to screw the set screw in until the compression spring is bunched solid.

Then back out the set screw approx. 3—4 mm (measured at its circumference) and lock the set screw with the hexagon nut. When doing this, use a screw driver to hold the set screw steady (Fig. 46 — 4/15).

37. Check the steering worm for ease of movement.

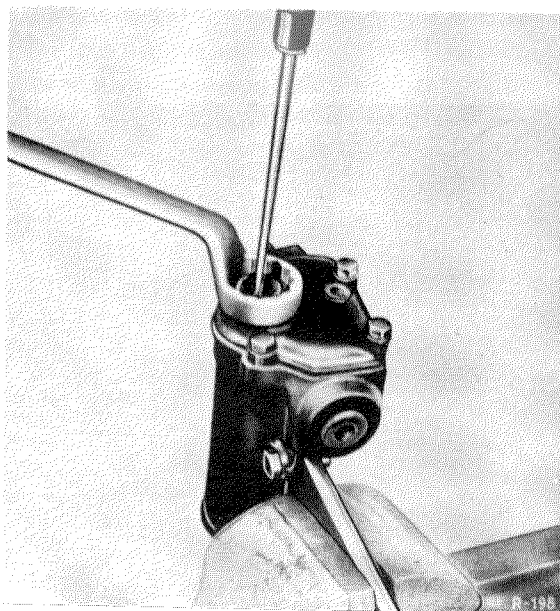


Fig. 46 — 4/15

Note: The steering shaft must on no account jam at the center position when it is turned. Since the steering shaft arm is inclined so that the steering nut is inclined slightly outward, when in the center position, the steering shaft does not reach its highest point when in the center position but at approximately the 15° position in both right and left locks. Thus, when the steering worm is turned completely, the steering shaft reaches its highest point twice.

When it is turned, there are thus two spots at which a slight pressure is felt.

If, 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 tube (1) and place Guide Pin (2) 180 589 07 61 on the cable guide tube (Fig. 46 — 4/16). Then slide the cable guide tube into the housing and screw in 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.

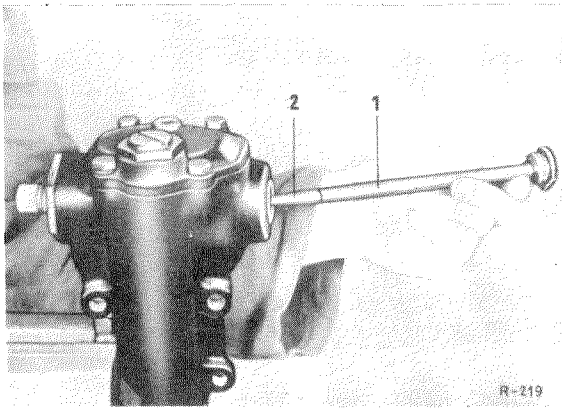


Fig. 46—4/16

- 1 Cable guide tube
- 2 Guide pin

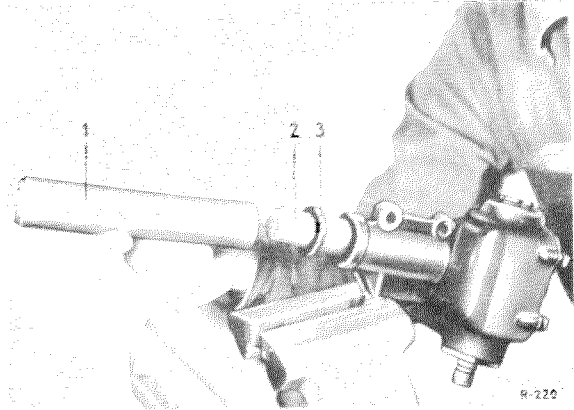


Fig. 46—4/17

- 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. 46—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. 46—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. 46—1, Paragraphs 8 to 16).

Additional Grease Seal and Modified Ball-Cup

a) Additional grease seal

In order to obtain improved sealing, as of Steering No. 3764/56, a second grease seal (10), Part No. 120 997 10 40, has been installed between the steering worm and the cable guide tube (Fig. 46—4/18).

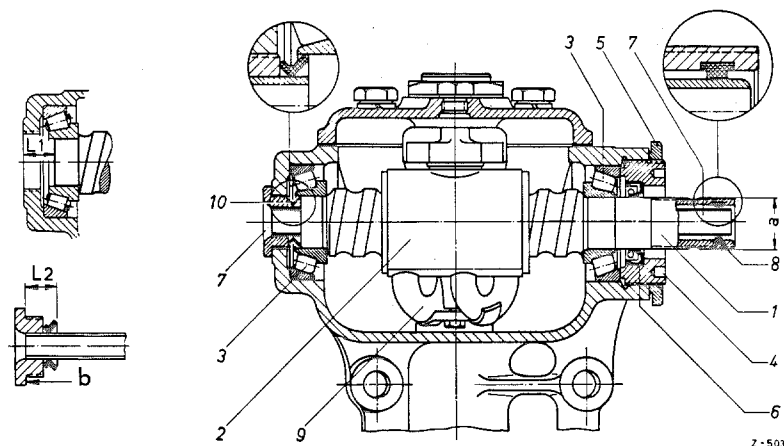


Fig. 46—4/18

- a Diameter at the serrations = 19.6 mm
- b Contact face of cable guide tube
- 1 Steering gear arm
- 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 Upper sealing ring for cable guide tube
- 9 Ball guide tube
- 10 Lower sealing ring for cable guide tube

When repairs are being carried out, this sealing ring (10) should be subsequently installed whenever necessary. In doing this, care should be taken to ensure that sufficient pressure is used to bring the sealing ring to rest against the steering worm and cable guide tube. The distance $L_1 - L_2$ must be 0.5—0.6 mm, i. e. when the cable guide tube is installed, the sealing ring must be compressed approximately 0.5—0.6 mm. If this difference in measurements is not obtained, the cable guide tube must be remachined accordingly at its contact surface (b). When the steering is reassembled, the sealing ring (10) should be pressed on before the cable guide tube is inserted, in accordance with Paragraph 39 of the installation instructions (see Fig. 46 — 4/18).

b) Modified Ball-Cup

For production reasons, in current models the steering shaft arm has a ball-cup with no shoulder. The new ball-cup (2 b) is locked with a snap ring (3) to prevent displacement (Fig. 46 — 4/19).

If repairs are being carried out, the old steering shaft, Part No. 186 460 01 11, can be replaced by the new steering shaft, Part No. 186 460 02 11.

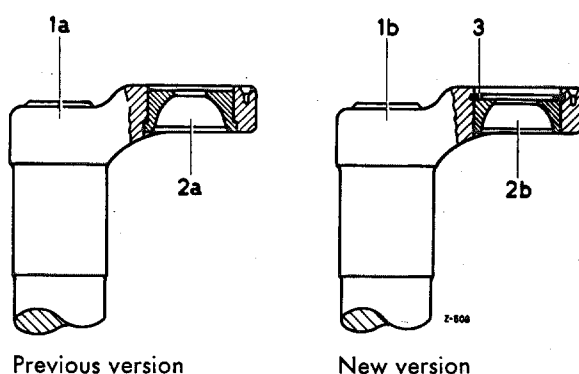


Fig. 46 — 4/19

- 1a Steering shaft with ball-cup with shoulder
- 1b Steering shaft with ball-cup without shoulder
- 2a Ball-cup with shoulder
- 2b Ball-cup without shoulder
- 3 Snap ring