

# Chapter 5. Steering

The steering mechanism design is shown on fig. 5-1, 5-2.

Since November, 1998, vehicles are fitted with a telescopic intermediate shaft instead of a cylindrical intermediate shaft 17 (see fig. 5-1) and the steering wheel 19 is fastened by a self-locking nut.

There are two variants of fitting the steering pitman arm roller: on needle or on ball bearing. In the text the figures for both variants are given, thus the sign "" refers to the first embodiment (pitman arm roller is established on a needle bearing).

## Fault diagnosis

Diagnosis	Remedy
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### Excessive free play in the steering wheel

1. Loose steering box fastening bolt	1. Tighten nuts
2. Loose tie-rod ballpin nuts	2. Check and tighten nuts
3. Excessive gap in rod balljoints	3. Renew ball joints or tie rods
4. Excessive clearance in front wheel hub bearings	4. Adjust clearance
5. Excessive clearance in roller-to-worm mesh	5. Adjust clearance
6. Too large clearance between slave arm shaft and bushes	6. Replace bushes or bracket assembly
7. Excessive clearance in worm bearings	7. Adjust clearance
8. Loose bolts fastening intermediate shaft to worm shaft or to upper shaft	8. Tighten bolts

### Stiff steering wheel

1. Deformation of steering drive components	1. Renew deformed components
2. Wrong wheel alignment angle	2. Check wheel alignment angle and adjust
3. Wrong roller-to-worm clearance	3. Adjust clearance
4. Excessive torque applied to slave arm shaft adjusting nut	4. Adjust nut tightening
5. Low pressure in front wheel tyres	5. Ensure normal pressure
6. Damaged balljoint components	6. Inspect and renew damaged parts
7. No oil in steering box	7. Check oil lever and top up. Renew oil seal if necessary
8. Damaged upper shaft bearings	8. Renew bearing

### Noise (rattle) in the steering mechanism

1. Excessive clearance in front wheel hub bearings	1. Adjust clearance
2. Loose nuts on tie-rod ballpins	2. Check and tighten nuts
3. Excessive gap between slave arm shaft and bushes	3. Replace bushes or bracket in assembly
4. Slackened slave arm shaft adjusting nut	4. Adjust nut

Diagnosis	Remedy
5. Wrong clearance in roller-to-worm mesh or in worm bearings	5. Adjust clearance
6. Excessive gap in tie-rod balljoint	6. Renew ball joints or tie rods
7. Loose steering box fastening bolts or slave arm shaft bracket	7. Check and tighten bolt nuts
8. Loose knuckle arm fastening nuts	8. Tighten nuts
9. Loose steering shaft fastening bolts	9. Tighten nuts

### Shimmy

1. Improper tyre pressure	1. Check and ensure normal pressure
2. Wrong front wheel alignment angle	2. Check and adjust wheel alignment angle
3. Excessive clearance in front wheel hub bearings	3. Adjust clearance
4. Wheels out-of-balance	4. Balance wheels
5. Loose tie-rod ballpin nuts	5. Check and tighten nuts
6. Loose fastening bolts on steering box or slave arm shaft bracket	6. Check and tighten bolt nuts
7. Wrong roller-to-worm gap	7. Adjust clearance

### Vehicle wandering

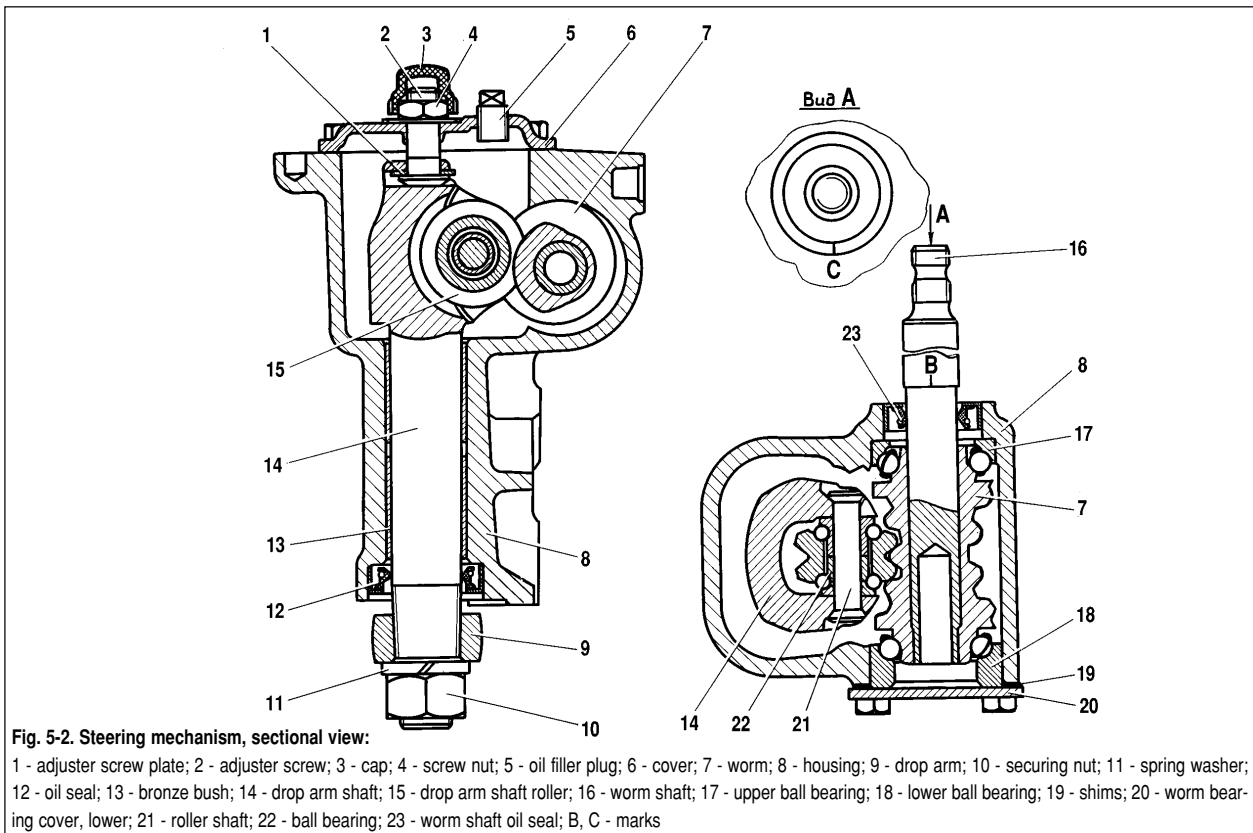
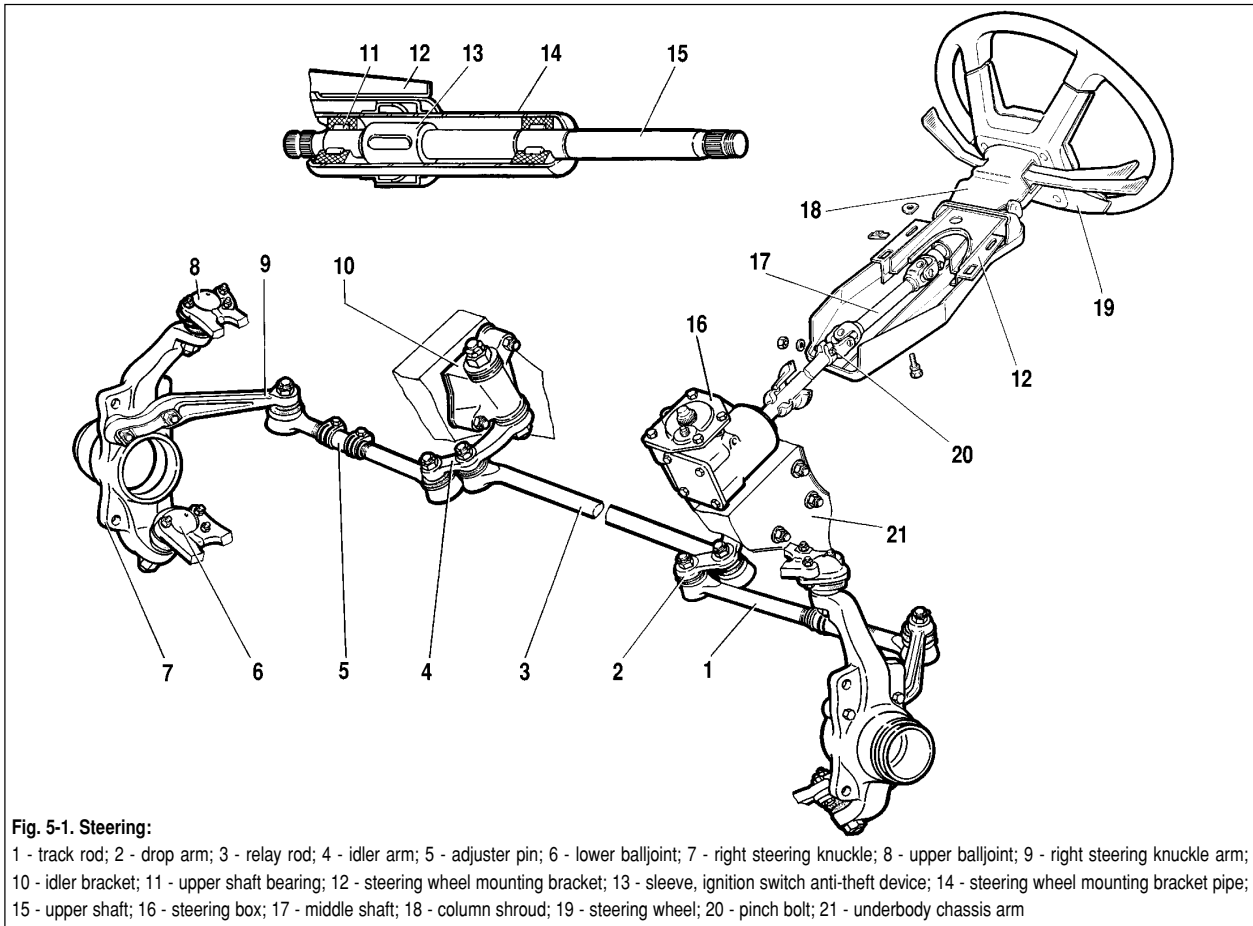
1. Unequal pressure in tyres	1. Check and ensure normal pressure
2. Wrong front wheel alignment angle	2. Check wheel alignment angle and adjust
3. Different tension in front suspension springs	3. Replace bad springs
4. Deformed steering knuckles or suspension arms	4. Inspect knuckles and arms, replaces bad parts
5. Incomplete brake release on one or several wheels	5. Check braking system

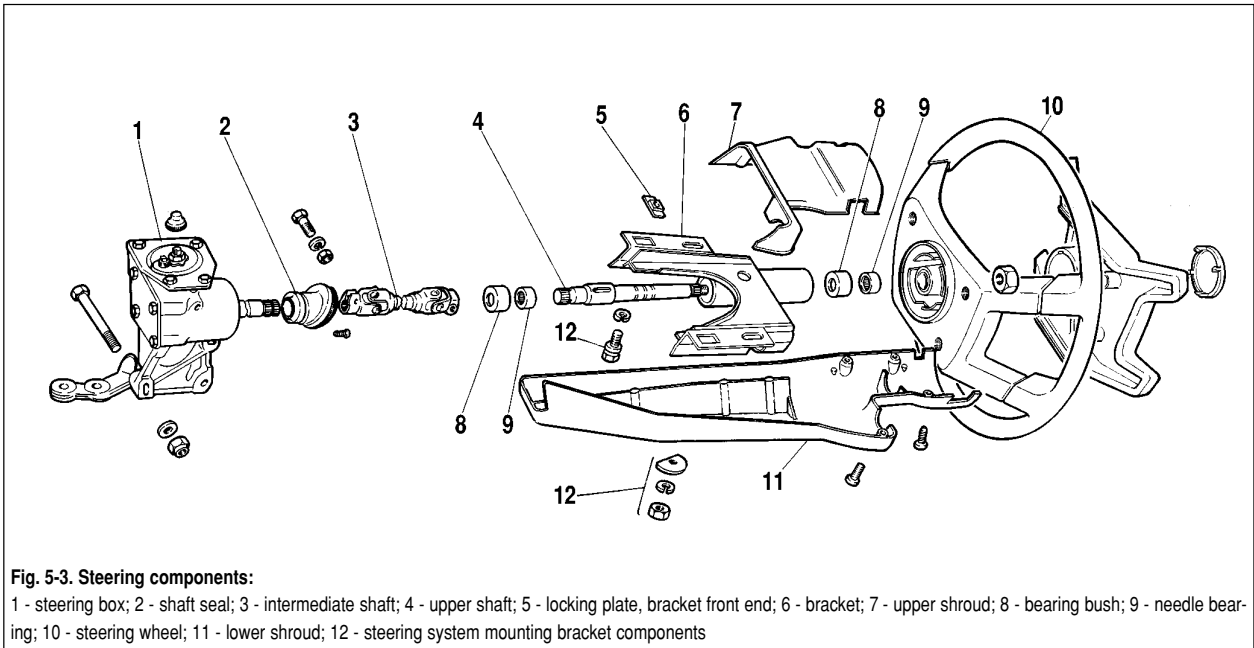
### Vehicle unstable

1. Wrong front wheel alignment angle	1. Check wheel alignment angle and adjust
2. Excessive clearance in front wheel bearings	2. Adjust clearance
3. Loose tie-rod ballpin nuts	3. Check and tighten nuts
4. Excessive clearance in tie-rod balljoint	4. Renew tie rod balljoints
5. Loose fastening bolts on steering box or slave arm shaft bracket	5. Check and tighten bolt nuts
6. Excessive roller-to-worm gap	6. Adjust gap
7. The steering knuckles or suspension arms are deformed	7. Inspect knuckles and arms, replaces bad parts

### Oil leak from the steering box

1. Worn arm shaft sealing or worm	1. Renew oil seal
2. Loose steering box cover fastening bolts	2. Tighten bolts
3. Damaged sealings	3. Renew sealings





## Steering - inspection, check and adjustment

### General inspection

The steering system should be examined at any signs of malfunction (rattle, excessive free play of the steering wheel or, on the contrary, its hard rotation, and so on). The inspection is carried out on the trestles or an inspection pit in the following order.

Clean the components of the steering mechanism and the steering box. Place the wheels in position corresponding to straight movement.

- Turn the steering wheel in both directions, and ensure:
- the steering wheel free play does not exceed  $5^\circ$  (when measured on the wheel rim, no more than 18-20 mm). To perform this operation use tool 67.8720.9501;
  - there is no rattle in joints, connections and steering mechanism;
  - reliable fastening of the steering box and the slave arm bracket (tighten the threaded connections if necessary);
  - there is no free play in the tie-rod balljoint and in the slave arm bracket, and there is no axial displacement of the worm shaft;
  - the steering wheel turns with the effort (with the front wheels standing on smooth surface) not exceeding 196 N (20 kgf),  $245^\circ$  N (25\* kgf).

Check the tie-rod adjuster pins, ensure reliable tightening of the clamps.

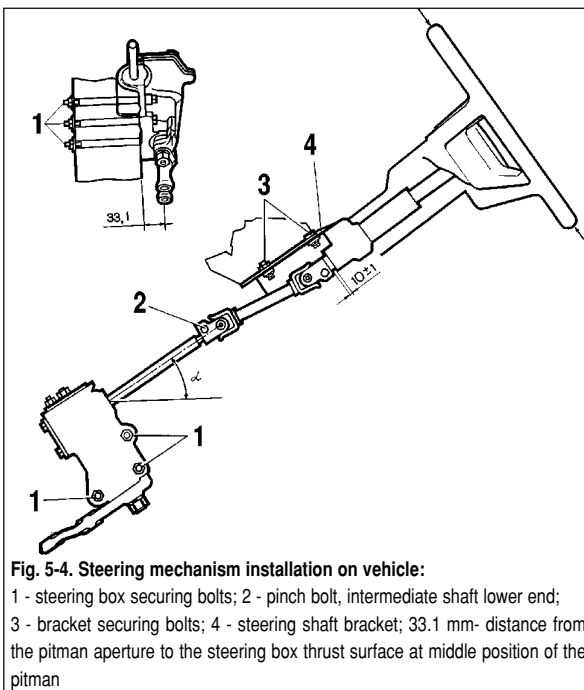
Inspect the balljoint and protective caps, as set forth below.

### Inspection of the tie-rod balljoint

First, check the movement of the tie-rod ends along the pins. For this purpose, move the end parallel to the pin, using a lever and a support.

The axial movement of the end in relation to the pin should be 1-1.5 mm. This will prove that the pin insert is not jammed in the tie-rod end and it moves together with the pin, depressing the spring. Replace the joint with a jammed insert.

Rotate the steering wheel in both directions, by touch ensure there is no free play in the tie-rod joints. If the free play in the ball is detected, replace the tie-rod ends or tie-rod assembly.



Inspect the tie-rod balljoint protective caps.

If the protective caps are in good condition and provide inside cleanness, their service life is practically unlimited. Moisture, dust and other foreign particles inside the joint will result in premature wear of components.

The cap should be replaced in case of cracks, breaks and in case greasing is squeezing out when the joint is pressed with fingers.

### Checking and adjusting the clearance in the steering mechanism worm bearings

Place the front wheels in position corresponding to straight movement, rotate the steering wheel in both directions, and check if the distance between the steering box 8 end face (fig. 5-2) and mark B made on the steering worm shaft will change. This change will indicate a gap in worm bearings.

To adjust the clearance in worm bearings, make 1-1.5 turns of the steering wheel to the left, undo the fastening bolt from the bottom cover 20 and drain oil from the steering box. Remove the bottom cover, remove one shim or replace it with a thinner one.

**Note.** Shims are delivered in spare parts with thickness of 0.10 and 0.15 mm.

Fix the bottom cover, again check for axial shift of worm in bearings. If there is no free play, fill the steering box with 0.215 l. of transmission oil.

Check the effort of turning the steering wheel, having placed the front wheels on smooth metal surface. It should not exceed 196 N (20 kgf), 245\* N (25\* kgf).

### Check and adjustment of the roller-to-worm mesh

Having ensured there is no axial movement of the worm in the bearings, use puller A.47035 to press out the balljoint pins from the apertures in the arm and disconnect the tie-rods from the arm, at the same time keeping the front wheels straight.

Move the arm by the head, check for a gap in the roller-to-worm mesh. Within the 30° turn of the steering wheel in each direction from the neutral position there should be no clearance, that is, no evident free play of the arm.

If the free play of the arm can be felt, remove cap 3 (see fig. 5-2), slacken nut 4 on the adjusting screw and, having raised the washer, tighten the adjusting screw 2 to take up the backlash. Do not tighten the adjusting screw too much. Then, hold the adjusting screw with a screwdriver, and tighten nut 4.

Ensure, that the arm does not move, connect the balljoint pins. Check the effort of turning the steering wheel. If it exceeds 196 N (20 kgf), slacken adjusting screw 2 and refit cap 3.

## Steering mechanism

### Removal and refitting

**Removal.** Disconnect the wires from the battery and take off the horn push-pad trim. Undo the steering wheel fastening nut, remove the steering wheel, and both halves of the steering column shroud.

**Note.** If it is necessary to remove only the steering box, undo the bolt that is fastening the intermediate shaft lower U-joint fork on the worm shaft and the bolts fastening the steering box to the body chassis arm.

Remove the instrument cluster and disconnect the connector plugs of the three-lever switch from the harness connectors.

Disconnect the wires from the ignition switch terminals, undo the fastening screws, push down the switch lock and remove the ignition switch. Loosen the fastening clip of the switch housing incorporating the turn lights, headlights and wipers, and remove.

Undo the bolt that is fastening the intermediate shaft lower U-joint fork to the steering worm shaft.

Undo the bracket 6 fastening bolt (fig. 5-3) and remove the steering shaft with the bracket.

Undo the nuts that are fastening the ballpins on the side and middle tie-rods to the arm, and use puller A.47035 to press out the ballpins from the arm apertures.

Remove the steering box, prior having undone the bolts that are fastening it to the body chassis arm. Take out the steering shaft sealing from the opening in the car front.

**Refitting.** Insert sealing 2 (see fig. 5-3) into the opening in the car front, match the sealing ridges with the grooves in the opening, place the steering box on the chassis arm, but do not tighten completely the nuts on the steering box fastening bolts.

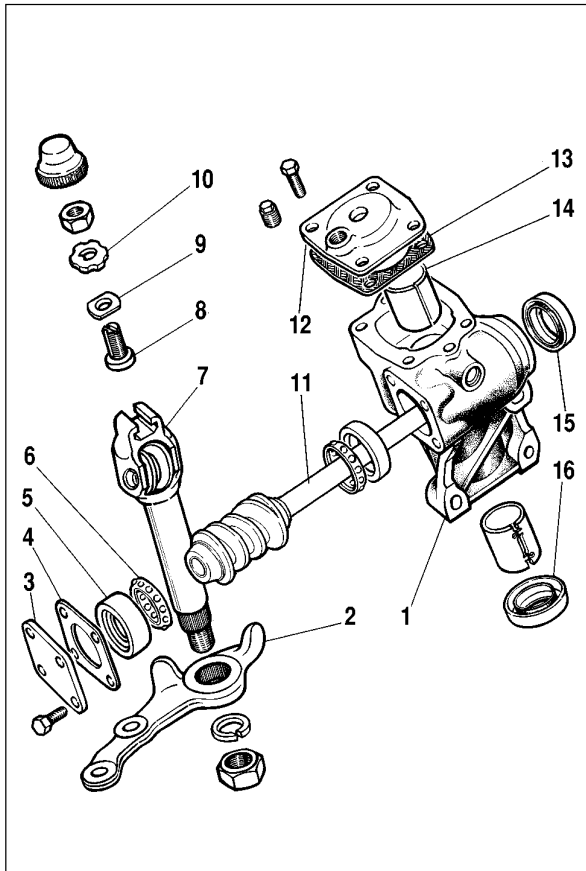
Using a special fixture, situate the steering box so that angle  $\alpha$  (fig. 5-4) does not exceed 32°, and the clearance between the shaft and the brake pedal will be no less than 5 mm. Then completely tighten the steering box fastening nuts.

Place the steering pitman arm in middle position. To do this, match the labels on the steering box and on the worm shaft (see fig. 5-2).

Temporarily refit the steering wheel on the shaft so that the spokes are located horizontally and in this position connect the intermediate shaft U-joint with the worm shaft, paying special attention, that the fastening bolts pass through the worm ring groove. Then attach the steering shaft bracket to the body.

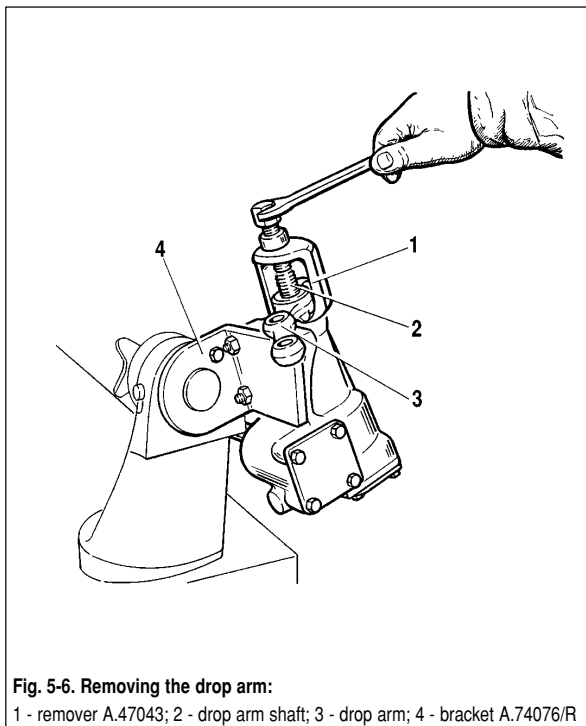
Remove the steering wheel and refit the combination switch (turn lights, headlights and wipers) on the column.

Refit the steering wheel on the shaft so that the spokes are located horizontally. The steering wheel should rotate smoothly and easily in both directions, then tighten the steering wheel fas-



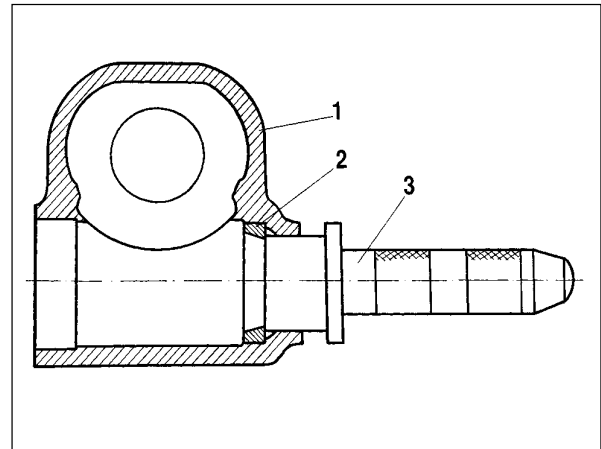
**Fig. 5-5. Steering mechanism, exploded view:**

1 - steering box; 2 - drop arm; 3 - box cover, lower; 4 - shims; 5 - worm shaft bearing ring, outer; 6 - race with balls; 7 - drop arm shaft; 8 - adjusting screw; 9 - adjusting plate; 10 - lockwasher; 11 - worm shaft; 12 - top cover; 13 - gasket; 14 - pitman shaft bush; 15 - worm shaft oil seal; 16 - pitman shaft oil seal



**Fig. 5-6. Removing the drop arm:**

1 - remover A.47043; 2 - drop arm shaft; 3 - drop arm; 4 - bracket A.74076/R



**Fig. 5-7. Removing the outer ring of the worm upper bearing using tool 67.7853.9541:**

1 - steering box; 2 - worm upper bearing ring, outer; 3 - tool 67.7853.9541

tening nut and fix it in three points. Move the combination switch case fully towards the steering wheel, and tighten the switch fastening clip.

Reconnect the wires of the ignition switch and fix the switch on the steering column bracket with screws.

Reconnect the combination switch plugs to the vehicle harness plugs.

Refit both halves of the shaft shroud and fasten them with screws. Apply a thin layer of greasing on the lower contact ring and refit the horn push-pad trim on the steering wheel.

Refit the ballpins of the middle and left tie-rods on the pitman arm and fix them with nuts.

Adjust the front wheels toe-in and check the effort on the steering wheel, which should not exceed 196 N (20 kgf), 245\* N (25\* kgf) (measured on the wheel rim) when tested on a smooth metal plate.

**Note.** It is possible to assemble the steering column (with the combination switch) separately and then to refit the unit on the vehicle.

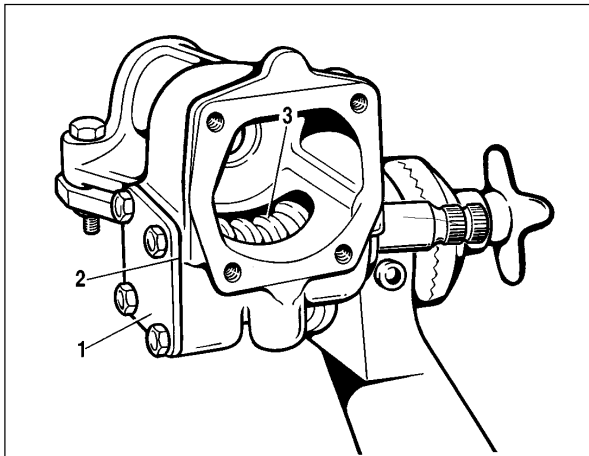
To fix the unit, establish the steering wheel spokes horizontally and connect the worm shaft to the lower end of the intermediate shaft, paying attention, that the lock bolts pass through a ring groove on the worm shaft and the wheel shaft.

Prior to completely fastening the bracket bolts, rotate the steering wheel in both directions several times and only then tighten the bracket fastening bolts.

### Steering mechanism - dismantle and reassembly

**Dismantle.** Drain oil from the steering box. Fix it on bracket A.74076/R with support A.74076/1.

Undo the pitman arm fastening nut 2 (fig. 5-5), take off the spring washer, and using puller A.47043 remove the arm (fig. 5-



**Fig. 5-8. Installing the steering worm**  
1 - bearing cover; 2 - shim; 3 - worm

6). Undo the fastening bolt, take off cover 12 (see fig. 5-5) of the steering box together with cap, adjusting screw 8, adjusting plate 9, lock washer 10 and jam nut. Take out from the steering box 1 the pitman arm shaft 7 in assembly with the roller.

Undo the fastening bolt, remove cover 3 from the worm shaft thrust bearings together with shims 4.

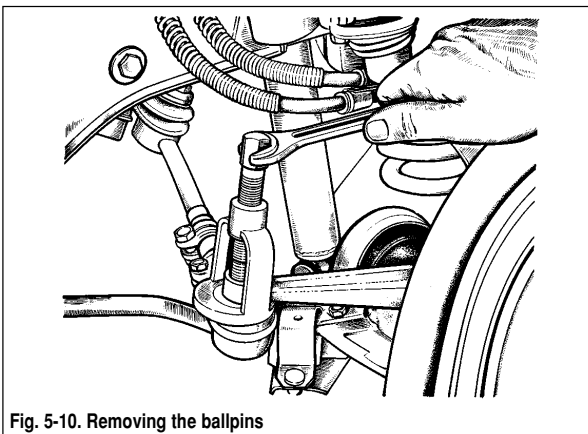
With the worm shaft 11 push out from the box the bearing outer ring 5 and take out the shaft together with bearing cage 6. Remove worm shaft sealing 15 and the pitman arm sealing 16.

Using tool 67.7853.9541 take out the top bearing outer ring (fig. 5-7).

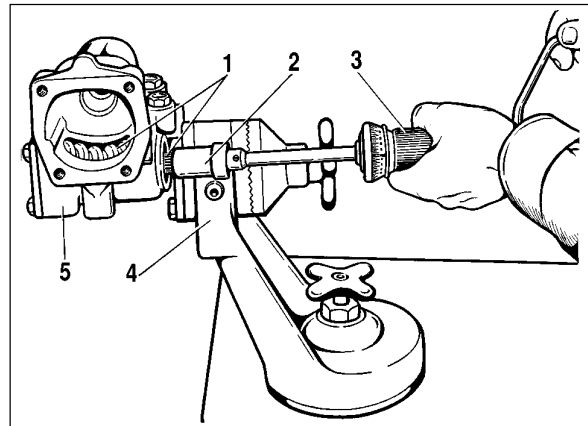
**Reassembly.** The reassembly of the steering mechanism is carried out on bracket A.74076/R in sequence, reverse to dismantle.

The outer ring of the worm upper bearing is press-fitted with tool 67.7853.9541, having rearranged the fixture on the tool handle in reverse order.

Refit the worm in the steering box and fasten the bottom cover (fig. 5-8), use dynamometer 02.7812.9501 and head A.95697/5 (fig. 5-9) to check the worm friction moment; it should be within the limits of 19.6-49 N•cm (2-5 kgf•cm). If the moment



**Fig. 5-10. Removing the ballpins**



**Fig. 5-9. Checking the worm friction moment using a dynamometer:**  
1 - worm; 2 - head A.95697/5; 3 - dynamometer 02.7812.9501; 4 - test-bench bracket; 5 - steering box

will appear less than specified, reduce the thickness of shim 2 (see fig. 5-8), and if more - increase.

After refitting the pitman arm, ensure there is no clearance in the roller-to-worm mesh in position when the worm shaft is turned right and left by 30° from the pitman arm middle position. Take up any possible clearance by adjusting screw 2 (see fig. 5-2) and tighten jam nut 4.

After adjusting the roller-to-worm mesh gap, use a dynamometer to check the worm friction, which should be equal to 68.7-88.3 N•cm (7-9 kgf•cm) when turning the worm shaft by 30° both to the left and to the right from the middle position and should smoothly reduce to 49 N•cm (5 kgf•cm) when turned from the 30° position further to the stop.

After the reassembly, check the angles of pitman rotation from the neutral position, which should make  $32^{\circ}10' \pm 1^{\circ}$  both to the left and to the right until the pitman arm will get pressed against the bolt head; fill the steering box with 0.215 l of transmission oil.

## Check and repair

Carefully examine the working surfaces of the roller and the worm for traces of wear, jamming or risks. Renew worn and damaged components.

Check the size of the clearance between the bushes and the pitman arm shaft, which should not exceed 0.10 mm. If the clearance is more than specified, renew the bushes using tool A.74105.

On the inner surfaces of the pitman arm bushes there are spiral flutes, which come out only from one side. When press-fitting, the bushes should be located so that their end faces with the flutes were inside the aperture of the steering box, and the outputs of the flutes were facing each other. The end faces of the bushes should be deep inside the steering box aperture by 1.5 mm.

New bushes should be greased with transmission oil before press-fitting.

After press-fitting in the steering box, finally process the bushes with a reamer A.90336 up to the size of 28.698-28.720 mm. The mounting gap between the pitman arm shaft and the bushes should be within 0.008-0.051 mm.

Check for easy rotation of the pitman arm roller on the ball bearing. The ball bearings on the worm and the roller should rotate freely, without jamming; there should be no signs of wear or damages on the surface of the rings and balls.

Check the axial clearance between the head of the adjusting screw 8 (see fig. 5-5) and the groove in the pitman arm shaft 7. The gap should not exceed 0.05 mm. If more, replace the adjusting plate 9 with a plate of greater thickness.

**Note.** In the spare parts the adjusting plates are supplied of eleven sizes, with thickness from 1.95 mm up to 2.20 mm, ; the increase in each size makes 0.025 mm.

Inspect locking plates 5 (see fig. 5-3). Renew if they are deformed.

### Steering shaft - dismantle and reassembly

**Dismantle.** Undo the U-joint fork fastening bolt and separate the intermediate and upper shafts of the steering mechanism.

If the upper shaft or its bearings are damaged, flare the places of the bracket pipe punching and take out the pipe from the shaft 15 (see fig. 5-1) in assembly with bearings 11.

If the shaft rotates in the bearings without jamming and there is no radial free play in the bearings (the resilient radial movements of the steering shaft are allowed), it is not recommended to dismantle the upper steering shaft.

Renew the shaft and the bearing in case of wear or damage.

**The reassembly** is carried out in reverse order, paying attention that the U-joint lock bolt passes through the ring groove on the upper shaft. Then punch the bracket pipe in two points from both sides to fix the shaft bearings.

### Tie-rods and balljoints

**Removal and refitting.** Remove the cotter pins and undo the nuts with which the side tie-rod ballpins are fastened to the arms on the steering knuckles.

Using puller 67.7824.9516 (fig. 5-10) take out the ballpins from the cone apertures on the arms.

Remove the cotter pins and undo the nuts fastening the ballpins of the middle and side tie-rods to the pitman arm and to the idler arm. Using puller 67.7824.9516, take out the pins from the corresponding jacks on the arms and remove the tie-rods.

The tie-rods are refitted in reverse order. All ballpin nuts are tightened with a dynamometer with subsequent splinting. If the nut cut does not match the opening for the pin, the nut should be

screwed in to an angle, smaller than 60° to provide for subsequent splinting.

After refitting adjust the front wheel toe-in.

**Check and repair.** Inspect the protective caps 3 (fig. 5-11), as described above (see "Inspection, check and adjustment of steering mechanism"). Renew damaged protective caps.

Inspect the condition of the tie-rod balljoints by their radial and axial clearance. If the free play of pin 1 in case 3 is felt, and also in case of dirt or sand penetration, or corrosion on the ballpin, wear of the support insert - renew the joint with the tie-rod end.

### Idler arm bracket

**Removal and dismantle.** Separate the idler arm from ballpins on the middle and side tie-rods, remove the cotter pins, having previously undone the nuts and taken out the ballpins from the arm using puller 67.7824.9516. Then undo the bolt fastening the bracket to the body chassis arm and remove the bracket.

Fix the bracket in vice, remove the cotter pins and undo nut 4 (fig. 5-12), then remove washers 3 and 6 and the idler arm 1 in assembly with shaft 9, washer 10 and self-locking nut 11, remove sealings 7 and press out bushes 8.

**Inspection.** Inspect the idler arm shaft bushes; in case of out-of-roundness or inadmissible gap between them and the shaft, renew the bushes. Also renew sealings 7.

Check the shaft for out-of-roundness and damages, renew if necessary. Ensure the idler arm has no deformations, otherwise renew.

**Assembly and refitting.** Before reassembly grease the bushes of the idler arm shaft and fill the space between them with ЛИТОЛ-24. The reassembly order of the idler arm bracket is a reverse to dismantle.

If shaft 9 was replaced, the bracket self-locking nut 11 should be tightened with a dynamometer.

Washer 6 is installed with the extrusions facing upwards.

After tightening nut 4 the arm in horizontal position should not rotate under its own weight. It should turn under force of 9.8-19.6 N (1-2 kgf) applied to its end.

If nut 4 was tightened too much, undo it, raise washer 6 and tighten again.

Fix the bracket on the chassis arm with self-locking nuts and flat washers, tighten them with dynamometer.

Connect the tie-rod ballpins to the idler arm.