Section V
STEERING GEAR

The design of the steering gear is shown in Figs 5-1, 5-2.

The roller of the pitman arm shaft may be installed either on a needle bearing or a ball bearing. The figures in the text are given for both versions, the asterisk (*) referring to the version with the needle bearing.

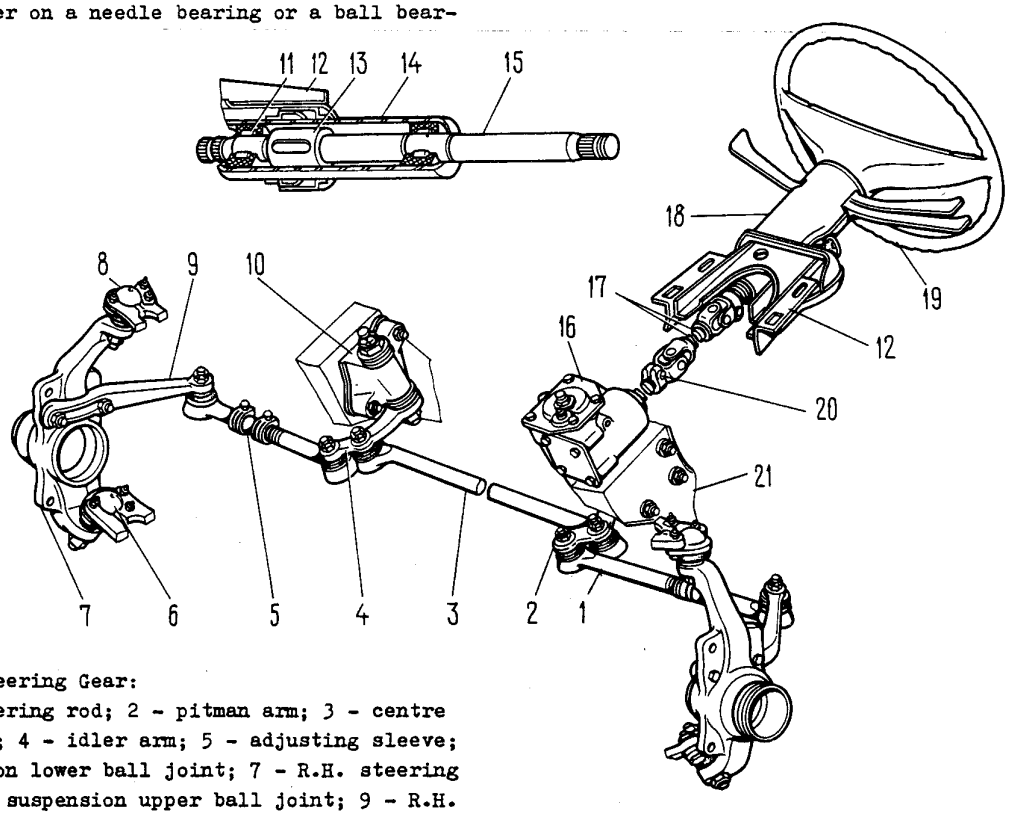

Fig. 5-1. Steering Gear:
1 - side steering rod; 2 - pitman arm; 3 - centre steering rod; 4 - idler arm; 5 - adjusting sleeve; 6 - suspension lower ball joint; 7 - R.H. steering knuckle; 8 - suspension upper ball joint; 9 - R.H. knuckle arm; 10 - idler arm bracket; 11 - upper shaft bearing; 12 - steering shaft bracket; 13 - lock bushing; 14 - steering shaft bracket pipe; 15 - upper steering shaft; 16 - steering gear case; 17 - intermediate steering shaft; 18 - steering shaft casing; 19 - steering wheel; 20 - universal joint tie-bolt; 21 - car body sidemember

TROUBLE SHOOTING

Cause	Remedy
Excessive Steering Wheel Play	
1. Loosening of steering gear case bolts	1. Draw up nuts
2. Loosening of steering rod ball pin nuts	2. Examine and tighten nuts
3. Excessive play in steering rod ball joints	3. Replace steering rods or their heads
4. Excessive clearance in front wheel hub bearings	4. Adjust
5. Excessive roller-to-worm backlash	5. Adjust

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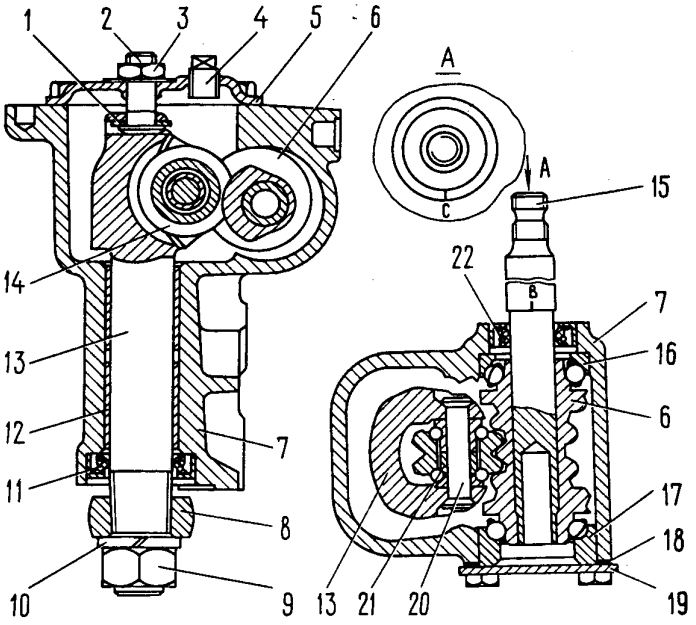

Fig. 5-2. Steering Mechanism, Sectionalized: 1 - adjusting screw plate; 2 - pitman arm shaft adjusting screw; 3 - adjusting screw nut; 4 - oil filler plug; 5 - cover; 6 - worm; 7 - steering gear case; 8 - pitman arm; 9 - pitman arm-to-shaft nut; 10 - spring washer; 11 - gland; 12 - bronze bushing; 13 - pitman arm shaft; 14 - pitman arm shaft roller; 15 - worm shaft; 16 - upper ball bearing; 17 - lower ball bearing; 18 - adjusting shims; 19 - worm bearing lower cover; 20 - roller shaft; 21 - needle bearing; 22 - worm shaft gland; B, C - marks

Cont'd

Cause	Remedy
6. Excessive clearance between idler arm shaft and bushings	6. Replace bushings or bracket assembly
7. Excessive clearance in worm bearings	7. Adjust
8. Loosening of bolts which fasten steering intermediate shaft to worm shaft or upper steering shaft	8. Tighten bolts

Difficult Rotation of Steering Wheel

1. Deformation of steering linkage parts	1. Replace distorted parts
2. Wrong front wheel alignment angles	2. Check and adjust wheel alignment
3. Wrong roller-to-worm backlash	3. Adjust
4. Overtightening of idler arm shaft adjusting nut	4. Adjust

Cont'd

Cause	Remedy
5. Underinflation of front wheel tyres	5. Inflate to normal pressure
6. Ball joint parts damaged	6. Examine and replace faulty parts
7. No oil in steering gear case	7. Check and top up. Replace gland, if necessary
8. Damaged bearings of upper steering shaft	8. Replace bearings

Knocking in Steering Gear

1. Excessive clearance in front wheel hub bearings	1. Adjust
2. Loosening of steering rod ball pin nuts	2. Check and tighten nuts
3. Excessive clearance between idler arm shaft and bushings	3. Replace bushings or bracket assembly
4. Loosening of idler arm shaft adjusting nut	4. Adjust
5. Wrong roller-to-worm backlash or clearance in worm bearings	5. Adjust
6. Excessive clearance in steering rod ball joints	6. Replace steering rods or their heads
7. Loose fastening bolts of steering gear case or idler arm bracket	7. Check and tighten bolt nuts
8. Loosening of knuckle arm nuts	8. Tighten nuts
9. Loose bolts of intermediate steering shaft	9. Tighten bolt nuts

Front Wheel Shimmy

1. Wrong tyre pressure	1. Check and adjust tyre pressure
2. Wrong front wheel alignment angles	2. Check and adjust
3. Excessive clearance in front wheel hub bearings	3. Adjust
4. Wheels out of balance	4. Balance wheels
5. Loosening of steering rod ball pin nuts	5. Check and tighten nuts
6. Loose bolts of steering gear case or idler arm bracket	6. Check and tighten bolt nuts
7. Wrong roller-to-worm backlash	7. Adjust

Car Pulls Aside

1. Non-uniform tyre pressure	1. Check and adjust tyre pressure
2. Wrong front wheel alignment angles	2. Check and adjust

Cont'd

Cause	Remedy
3. Different sagging of front suspension springs	3. Replace faulty springs
4. Distorted steering knuckles or wishbones	4. Examine knuckles and wishbones and replace faulty parts
5. Incomplete release of one or more wheel brakes	5. Inspect brake system

Poor Road Stability

1. Wrong front wheel alignment angles	1. Check and adjust
2. Excessive clearance in front wheel bearings	2. Adjust
3. Loosening of steering rod ball pin nuts	3. Check and adjust nuts
4. Excessive clearance in steering rod ball joints	4. Replace steering rods or their heads

Cont'd

Cause	Remedy
5. Loose bolts of steering gear case or idler arm bracket	5. Check and tighten bolt nuts
6. Excessive roller-to--worm backlash	6. Adjust
7. Distortion of steering knuckles or wishbones	7. Check steering knuckles and wishbones; replace distorted parts

Oil Leaks from Steering Gear Case

1. Gland of pitman arm shaft or of worm seriously worn	1. Replace gland
2. Loose bolts of steering gear case covers	2. Tighten bolts
3. Sealing gaskets damaged	3. Replace gaskets

INSPECTION, CHECKS AND ADJUSTMENT

GENERAL INSPECTION

If the steering gear becomes in any way defective (knocking, excessive play or, on the contrary, difficult rotation of the steering wheel, etc.) examine the parts on a trestle or inspection pit in the following order.

Clean the steering linkage and gear case of dirt. Set the wheels in the straight-ahead position.

Turning the steering wheel back and forth make sure that:

- the steering wheel play is not over 5° (or 18-20 mm measured on the wheel rim); make this check with gauging mandrel 67.8720.9501;
- there is no knocking in the steering linkage joints and in the steering mechanism;
- the steering gear case and idler arm bracket are reliably fastened (tighten the screw joints, if necessary);
- there is no play in the steering rod ball joints and in the idler arm bracket and no end play of the worm shaft;
- the turning force applied to the steering wheel (with the front wheels resting on a smooth plate) is not over 196 N (20 kgf), 245 N* (25 kgf)*.

Turning the adjusting sleeves of both side rods make sure that their clamps are securely tightened.

Examine the ball joints and rubber boots as described below.

CHECKING STEERING ROD BALL JOINTS

The first thing is to check the travel of the rod heads along the pin axis. For this purpose the head should be moved parallel to the pin axis with the aid of a lever and a support.

Axial travel of the rod head relative to the pin should be from 1 to 1.5 mm. This amount of travel indicates that the pin seat is not jammed in the rod head socket and can move together with the pin compressing the spring. If the seat is jammed, replace the entire ball joint.

Turning the steering wheel back and forth, hand-feel the steering rod joints for play. If the ball joint is felt to be loose, replace the steering rod as a whole, or its head alone.

Examine the boots of the steering rod ball joints.

If the boots are intact and ensure adequate cleanliness inside the joints, the service life of the latter is practically unlimited. Moisture, dust, etc. getting into the joint cause premature wear of its parts.

The boot should be replaced if it is cracked, fractured or when the lubricant oozes outside on squeezing the boot with fingers.

CHECKS AND ADJUSTMENT OF STEERING WORM BEARINGS

Set the front wheels in the straight-ahead position and, moving the steering wheel back and forth, check to see that the distance between the face of steering gear case 7 (Fig. 5-2) and mark "B" on the steering worm shaft does not change.

If it does, this is an evidence of play in the worm bearings.

To adjust the clearance in the worm bearings turn the steering wheel 1 - 1.5 of a revolution to the left, unscrew the bolts of lower cover 19 and drain oil from the steering gear case. Remove the lower cover, take out one of adjusting shims 18 or replace it by a thinner one.

Note. The spare adjusting shims are available in the thickness of 0.10 and 0.15 mm.

Secure the lower cover and check again for the axial play of the worm in its bearings. If there is no play, fill the steering gear case with 0.215 l of ТАД-17И transmission oil.

Check the force required for turning the steering wheel, placing the front wheels on a smooth plate. The force should not exceed 196 N (20 kgf), 245 N* (25 kgf)*.

CHECKS AND ADJUSTMENT OF ROLLER-TO-WORM MESH

Having ascertained that there is no end play of the worm in the bearings, press out the ball joint pins with remover tool A.47035 from the holes in the pitman arm and disconnect the steering rods from the latter, keeping the front wheels in the straight-ahead position.

Rocking the pitman arm head check for the backlash in the roller-to-worm mesh. There should be no perceptible free travel of the pitman arm, with the steering wheel turned through 30° from the neutral position in either direction.

If, however, free travel of the pitman arm is noticed, loosen nut 3 (Fig. 5-2) of the adjusting screw, lift the lockwasher and turn in adjusting screw 2 until the clearance is taken up. Do not overtighten the adjusting screw. Then, holding the adjusting screw with a screwdriver, tighten nut 3.

Once it has been learned that the pitman arm has no free travel, connect the ball joint pins to it. Check the force required for turning the steering wheel. If it exceeds 196 N (20 kgf), 245 N* (25 kgf)*, loosen adjusting screw 2.

STEERING MECHANISM

REMOVAL AND INSTALLATION

Removal. Disconnect the wires from the storage battery and remove the horn switch, turning off its screws.

Remove the steering wheel. Take off both halves of the steering shaft casing.

Note. If the steering gear case along has to be removed, unscrew the bolt which fastens the lower end of the intermediate steering shaft on the worm shaft and the case-to-body-sidemember bolts.

Remove the instrument panel and disconnect the connector plugs of the three-lever switch from their mating sockets of the wire harness.

Disconnect the wires from the ignition switch terminals; turn off the fastening screws and, forcing in the lock retainer, remove the ignition switch. Loosen the clamp of the direction indicator, headlight and windshield wiper switch body and remove the latter.

Unscrew the bolt which holds the lower end of the intermediate shaft to the steering worm shaft.

Unscrew the bolts of bracket 6 (Fig. 5-3) and take off the steering shaft complete with the bracket.

Unscrew the nuts which fasten the ball pins of the side and central steering rods to the pitman arm and then, using remover A.47035, drive the ball pins out of their holes in the pitman arm.

Take off the steering gear case, first unscrewing the bolts fastening it to the body sidemember. Turn off the screws of the steering shaft seal and remove it.

Installation. Secure seal 2 (Fig. 5-3) on the dash panel, install the steering gear case on the body sidemember, without screwing home the nuts of the case bolts.

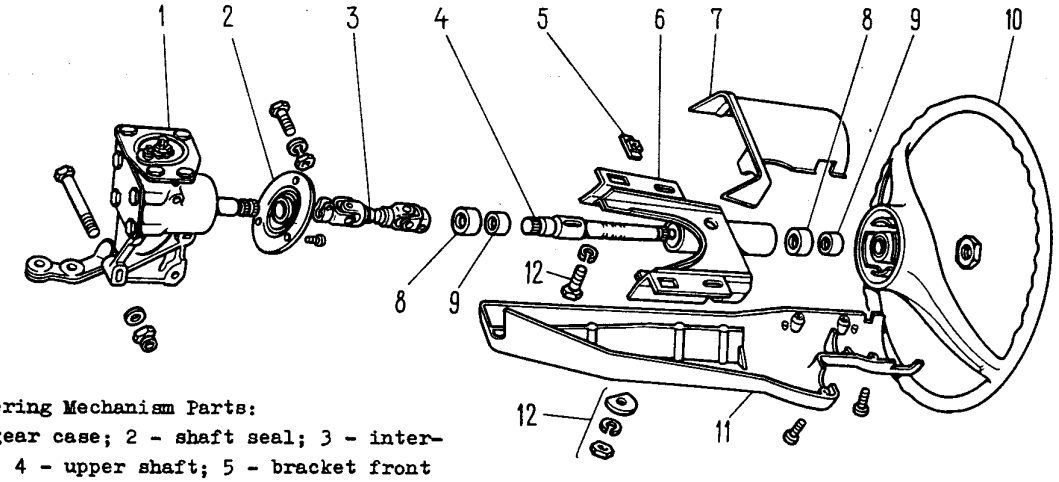

Fig. 5-3. Steering Mechanism Parts:
1 - steering gear case; 2 - shaft seal; 3 - intermediate shaft; 4 - upper shaft; 5 - bracket front part fixing plate; 6 - bracket; 7 - casing upper part; 8 - bearing bushing; 9 - needle bearing; 10 - steering wheel; 11 - casing lower part; 12 - steering gear shaft bracket attachment parts

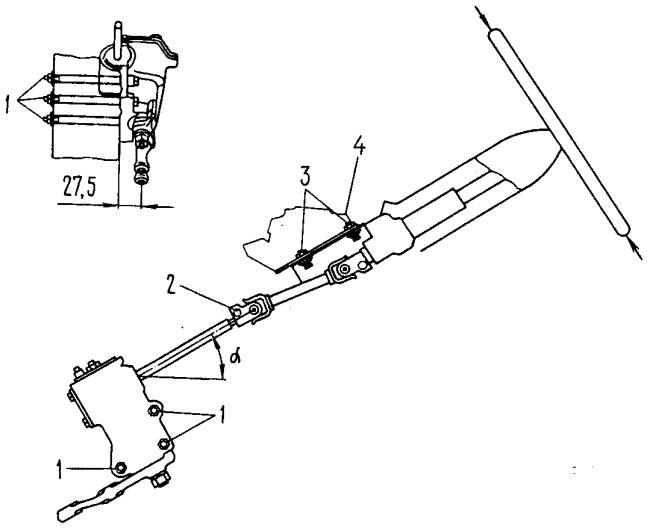

Fig. 5-4. Mounting Steering Mechanism on Car: 1 - steering gear case bolts; 2 - intermediate shaft lower end tie-bolt; 3 - bracket bolts; - steering shaft bracket; 27.5 mm - distance from centre of pitman arm hole to steering gear case mounting surface with pitman arm in neutral

Using a special device, position the gear case so that angle α (Fig. 5-4) is not over 32° and the clearance between the shaft and the brake pedal is not under 5 mm. Then tighten home the nuts of the steering gear case bolts.

Set the pitman arm in the middle position by aligning the marks on the gear case and on the worm shaft (Fig. 5-2).

Put the steering wheel temporarily on the shaft with the wheel arms horizontal and in this position connect the universal joint yoke of the intermediate steering shaft to the worm shaft, then fasten the steering shaft bracket to the car body, without tightening the fastening bolts home.

Remove the steering wheel and put the direction indicator, headlight and windshield wiper switch on the steering shaft.

Put the steering wheel in the initial position on the shaft and, pressing the wheel as shown by arrows in Fig.5-4, check for absence of shaft radial play. If such play exists, shift bracket 4 a little upward along the shaft axis until the radial clearance is taken up. If this fails to eliminate the radial clearance, replace the upper steering shaft or its bearings.

Check the steering wheel for smooth and easy rotation in both directions, then tighten its nut and lock-punch it at three points. Shift the body of the direction indicator, headlight and windshield wiper switch all the way towards the steering wheel and tighten the switch clamp.

Connect the wires to the ignition switch terminals and secure the switch with screws on the steering shaft bracket.

Connect the plugs of the direction indicator, headlight and windshield wiper switch to the wire harness sockets.

Put two halves of the shaft casing on the shaft and fasten them together with screws. Install the horn switch on the steering wheel.

Install the ball pins of the centre and L.H. side steering rods on the pitman arm and secure them with nuts.

Adjust the toe-in of the front wheels and check the force required for turning the steering wheel. With the front wheels placed on a smooth plate this force should not be over 196 N (20 kgf), 245 N* (25 kgf)*, measured on the wheel rim.

Note. As an alternative, the steering shaft can be assembled separately with the direction indicator, headlight and windshield wiper switch and the steering wheel; then the assembled unit as a whole can be installed on the car.

To secure this unit, set the steering wheel arms horizontally and connect the worm shaft with the lower end of the steering intermediate shaft.

Screw in the bracket bolts preliminarily, turn the steering wheel a few times back and forth and tighten home the bracket bolts.

DISASSEMBLY AND ASSEMBLY OF STEERING GEAR CASE

Disassembly. Drain oil from the steering gear case.

Fasten the case on bracket A.74076/R with support A.74076/1.

Unscrew the nut of pitman arm 2 (Fig. 5-5), take off the spring washer and, using remover tool A.47043, remove the pitman arm (Fig. 5-6). Turn off the fastening bolts, remove cover 12 (Fig. 5-5) of the steering gear case complete with adjusting screw 8, adjusting plate 9, lockwasher 10 and the locknut. Lift pitman arm shaft 7 complete with the roller out of steering gear case 1.

Turn out the fastening bolts, remove cover 3 of the worm shaft thrust bearing complete with adjusting shims 4.

Push bearing outer race 5 by worm shaft 11 out of the case and pull out the shaft complete with bearing cages 6. Remove glands 15 and 16 of the worm shaft and pitman arm shaft.

Using mandrel 67.7853.9541, take out the outer race of the upper bearing (Fig. 5-7).

Assembly. Assemble the steering mechanism on bracket A.74076/R by reversing the disassembly operations.

Press on the outer race of the worm upper bearing with mandrel 67.7853.9541 having fitted the attachment on the mandrel handle with the other side.

Having installed the worm into the steering

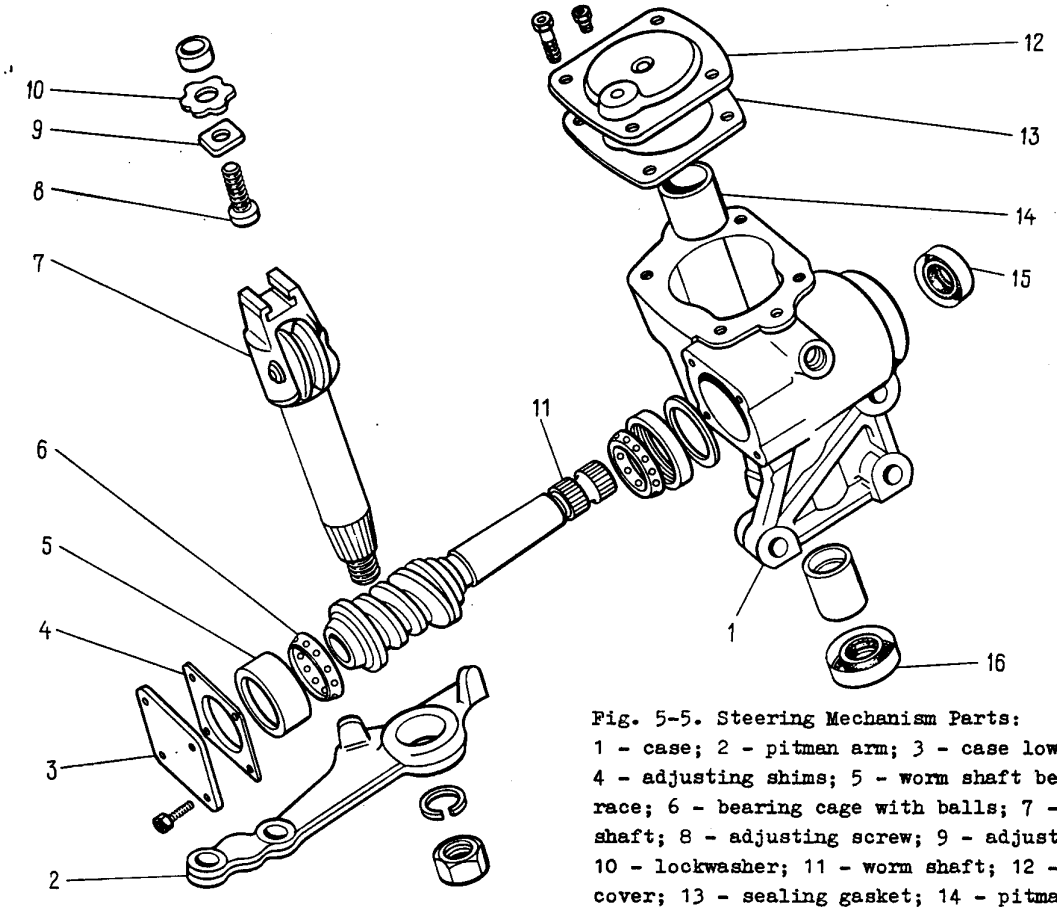

Fig. 5-5. Steering Mechanism Parts:
1 - case; 2 - pitman arm; 3 - case lower cover; 4 - adjusting shims; 5 - worm shaft bearing outer race; 6 - bearing cage with balls; 7 - pitman arm shaft; 8 - adjusting screw; 9 - adjusting plate; 10 - lockwasher; 11 - worm shaft; 12 - case upper cover; 13 - sealing gasket; 14 - pitman arm shaft bushing; 15 - worm shaft gland; 16 - pitman arm shaft gland

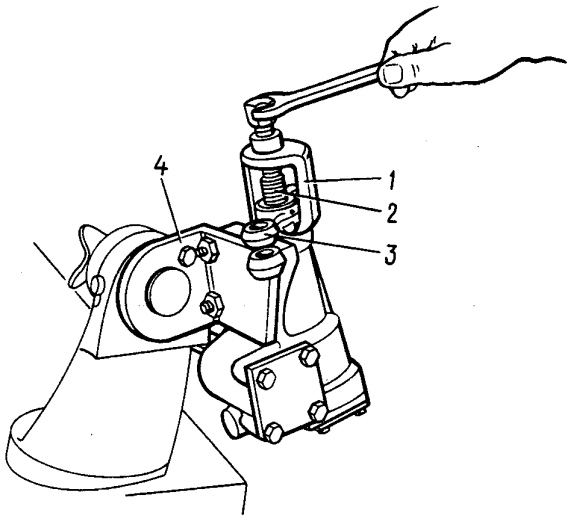

Fig. 5-6. Removing Pitman Arm:
1 - remover tool A.47043; 2 - pitman arm shaft; 3 - pitman arm; 4 - bracket A.74076/R

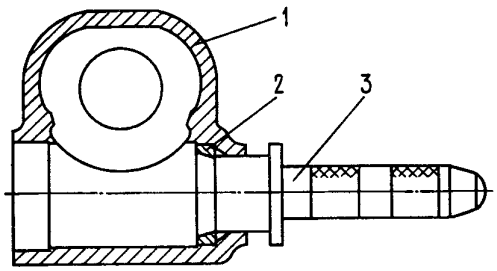

Fig. 5-7. Removing Worm Upper Bearing Outer Race with Mandrel 67.7853.9541:
1 - steering gear case; 2 - worm upper bearing outer race; 3 - mandrel 67.7853.9541

gear case and fastened the lower cover (Fig. 5-8), check friction torque of the worm shaft using dynamometer 02.7812.9501 and head A.95697/5 (Fig. 5-9); the friction torque should range from 19.6 to 49 N.cm (2 - 5 kgf.cm). If the torque is lower or higher, reduce or increase the thickness of adjusting shims 2 (Fig. 5-8), respectively.

After installation of the pitman arm shaft check for absence of backlash in the roller-to-worm mesh with the worm shaft turned 30° right and left from the neutral position of the pitman arm. Eliminate possible backlash by adjusting screw 2 (Fig. 5-2) and tighten locknut 3.

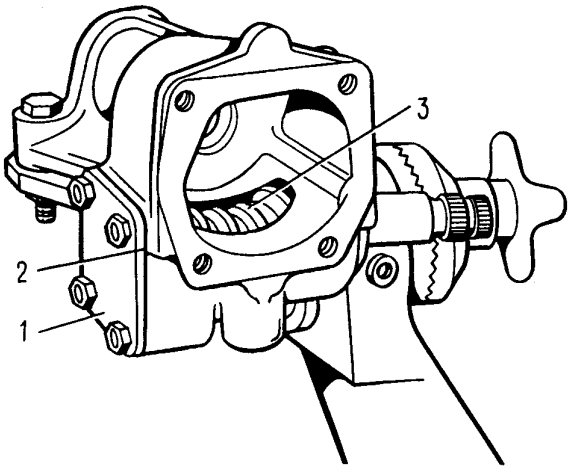

Fig. 5-8. Installing Steering Worm:
1 - bearing cover; 2 - adjusting shim; 3 - worm

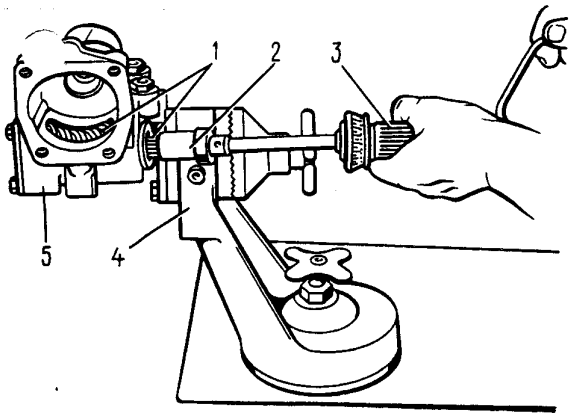

Fig. 5-9. Worm Friction Torque Dynamometer Check:
1 - worm; 2 - head A.95697/5; 3 - dynamometer 02.7812.9501; 4 - repair stand bracket; 5 - steering gear case

After adjustment of the roller-to-worm mesh, check the friction torque of the worm shaft with a dynamometer; on turning the worm shaft 30° left and right from the neutral position it should be 68.6 - 88.2 N.cm (7-9 kgf.cm) or 88.2 - 117.5 N.cm* and should diminish smoothly to 49 N.cm (5 kgf.cm) or 68.6 N.cm* when the shaft is turned from the 30° position all the way to stop.

On completion of assembly check the pitman arm turning angles from the neutral position until the pitman arm comes to bear against the bolt heads; these angles should be 32°10' ±1° both to the right and left. Then fill the steering gear case with 0.215 l of transmission oil ТАД-17И.

CHECKS AND REPAIRS

Examine the roller and worm carefully for wear, notches or signs of jamming on the working surfaces. Replace any worn and damaged parts.

Measure the clearance between the pitman arm shaft and bushings; it should not be over 0.10 mm; if it is larger, replace the bushings with the aid of driver A.74105.

The internal surface of the pitman arm shaft bushings has spiral grooves which open on one side of the bushings only. While pressing in the bushings, arrange them so that their faces with groove outlets are inside the hole in the case and the outlets are located opposite each other. The bushing faces should sink 1.5 mm into the hole of the steering gear case.

Before press-fitting the new bushings, coat them with transmission oil.

The bushings pressed into the case should be finally machined with reamer A.90336 to a diameter of 28.698 - 28.720 mm. The assembly clearance between the pitman arm shaft and bushings should be from 0.008 to 0.051 mm.

Check the pitman arm shaft roller for ease of rotation on the ball (or needle) bearing.

The ball bearings of the steering worm and roller should rotate freely, without binding; the surfaces of the races and balls must bear no signs of wear and damage.

Check the axial clearance between the head of adjusting screw 8 (Fig. 5-5) and the slot of pitman arm shaft 7. This clearance should not be over 0.05 mm. If it is larger, replace adjusting plate 9 by a thicker one.

Note. The spare adjusting plates are available in eleven sizes, varying in thickness from 1.95 mm to 2.20 mm in 0.025 mm steps.

Examine fixing plates 5 (Fig. 5-3) and replace them, if distorted.

DISASSEMBLY AND ASSEMBLY OF STEERING SHAFT

Disassembly. Unscrew the tie bolt of the universal joint yoke and disconnect the intermediate and upper steering shafts.

If the upper shaft or its bearings are damaged, unstake the bracket pipe and take shaft 15 (Fig. 5-1) complete with bearings 11 out of the pipe.

If the shaft turns in the bearings without binding and there is no axial and radial play in the bearings, do not disassemble the upper steering shaft.

If the shaft or its bearings are damaged, replace them by new ones.

For reassembly reverse the disassembly operations. Then stop-punch the bracket pipe in two points at both sides to fix the shaft bearings.

REMOVAL AND INSTALLATION

Undo and unscrew the nuts which fasten the ball pins of the side steering rods to the knuckle arms.

Remove the ball pins from the tapered sockets on the arms with remover tool 67.7824.9516 (Fig. 5-10).

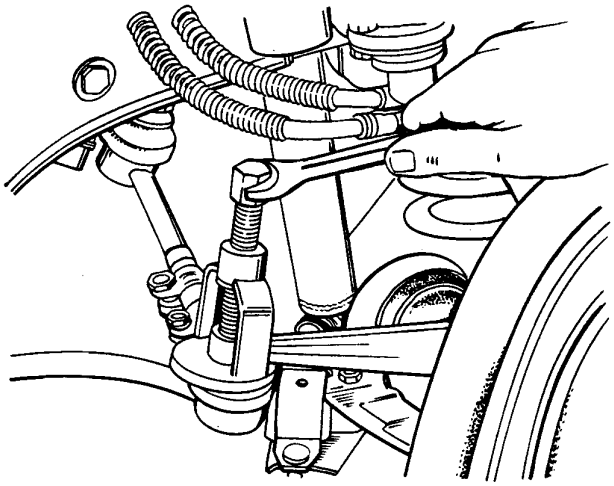

Fig. 5-10. Removing Steering Rod Ball Pins

Undo and unscrew the nuts which fasten the ball pins of the centre and side steering rods to the pitman arm and idler arm; using remover tool 67.7824.9516, take the ball pins from the arm sockets and remove the rods.

To install the steering rods, reverse the removal operations. All the nuts of the ball pins must be tightened with a torque-indicating wrench and cottered. If the slot of the nut does not coincide with the hole for the cotter pin, turn on the nut to an angle smaller than 60° to permit cottering.

After installation adjust the toe-in of the front wheels.

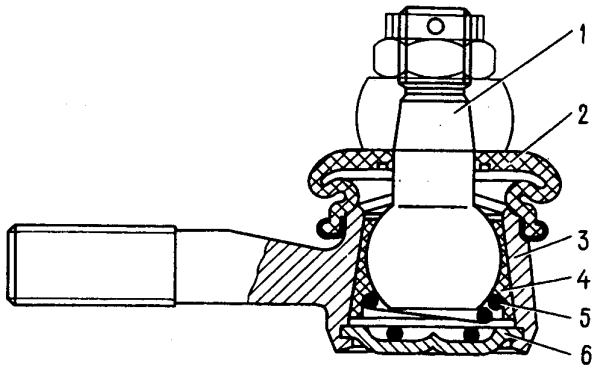

Fig. 5-11. Steering Rod Ball Joint, Sectionalized: 1 - ball pin; 2 - boot; 3 - joint body; 4 - seat; 5 - spring; 6 - plug

CHECKS AND REPAIRS

Examine rubber boots 2 (Fig. 5-11) as described above (see "Inspection, Checks and Adjustments"). Replace any damaged boots.

Measure the radial and axial clearance to assess the condition of the steering rod ball joints. If play of pin 1 in body 3 is felt, also when dirt or sand gets in or the ball pin is corroded and all travel of the ball seat is completely used up, replace the joint complete with the rod head.

IDLER ARM BRACKET

REMOVAL AND DISASSEMBLY

Detach the idler arm from the ball pins of the centre and R.H. steering rods, first uncottering and unscrewing the nuts and taking the ball pins from the arm sockets with remover tool 67.7824.9516. Then unscrew the bracket-to-sidemember bolts and remove the bracket.

Clamp the bracket in a vice, uncotter and unscrew nut 4 (Fig. 5-12), remove washers 3 and 6

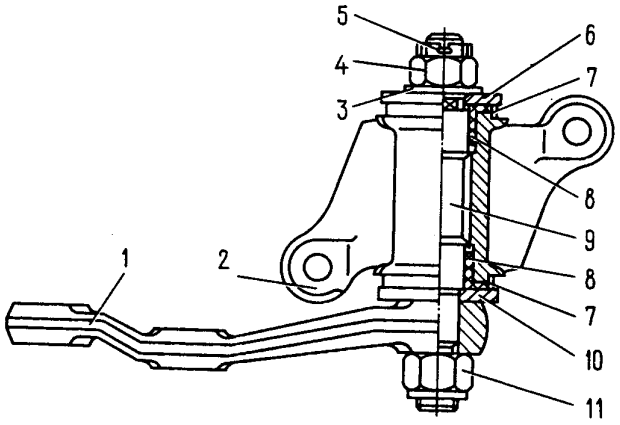

Fig. 5-12. Idler Arm Bracket, Sectionalized: 1 - idler arm; 2 - bracket body; 3 - washer; 4 - adjusting nut; 5 - cotter pin; 6 - upper washer; 7 - seal; 8 - bushing; 9 - idler arm shaft; 10 - lower washer; 11 - self-locking nut

nd idler arm 1 complete with shaft 9, washer 10 nd self-locking nut 11; remove seals 7 and press ut bushings 8.

CHECKS

Examine the bushings of the idler arm shaft; : they are out of round or there is an excessive .earance between the shaft and the bushings, the ıtter must be replaced by new ones.

Examine the shaft for out-of-roundness and ımage and replace it with a new one, if necessary. ıke sure that the idler arm is not distorted; :herwise replace it by a new one.

ASSEMBLY AND INSTALLATION

Before assembly coat the bushings of the ller arm shaft and fill the spaces between them with Литол-24 grease. Assemble the idler arm bracket by reversing the disassembly operations.

If shaft 9 has been replaced, tighten self-locking nut 11 of the arm with a torque-indicating wrench.

Washer 6 must be installed with the extrusions facing up.

After tightening nut 4, the idler arm positioned horizontally should not turn under its own weight. It must turn under a force of 9.8 - 19.6 N (1-2 kgf) applied to its end.

If nut 4 proves to be overtightened, unscrew it, lift washer 6 somewhat and tighten the nut again.

Secure the bracket on the sidemember by bolts with self-locking nuts and plain washers; tighten the nuts with a torque-indicating wrench.

Attach the steering rod ball pins to the idler arm.