Section III
POWER TRAIN

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CLUTCH

The design of the clutch is illustrated in Fig. 3-1.

Clutch release yoke 11 (Fig. 3-1) of one of two types is used: with a flat spring or with a wire spring.

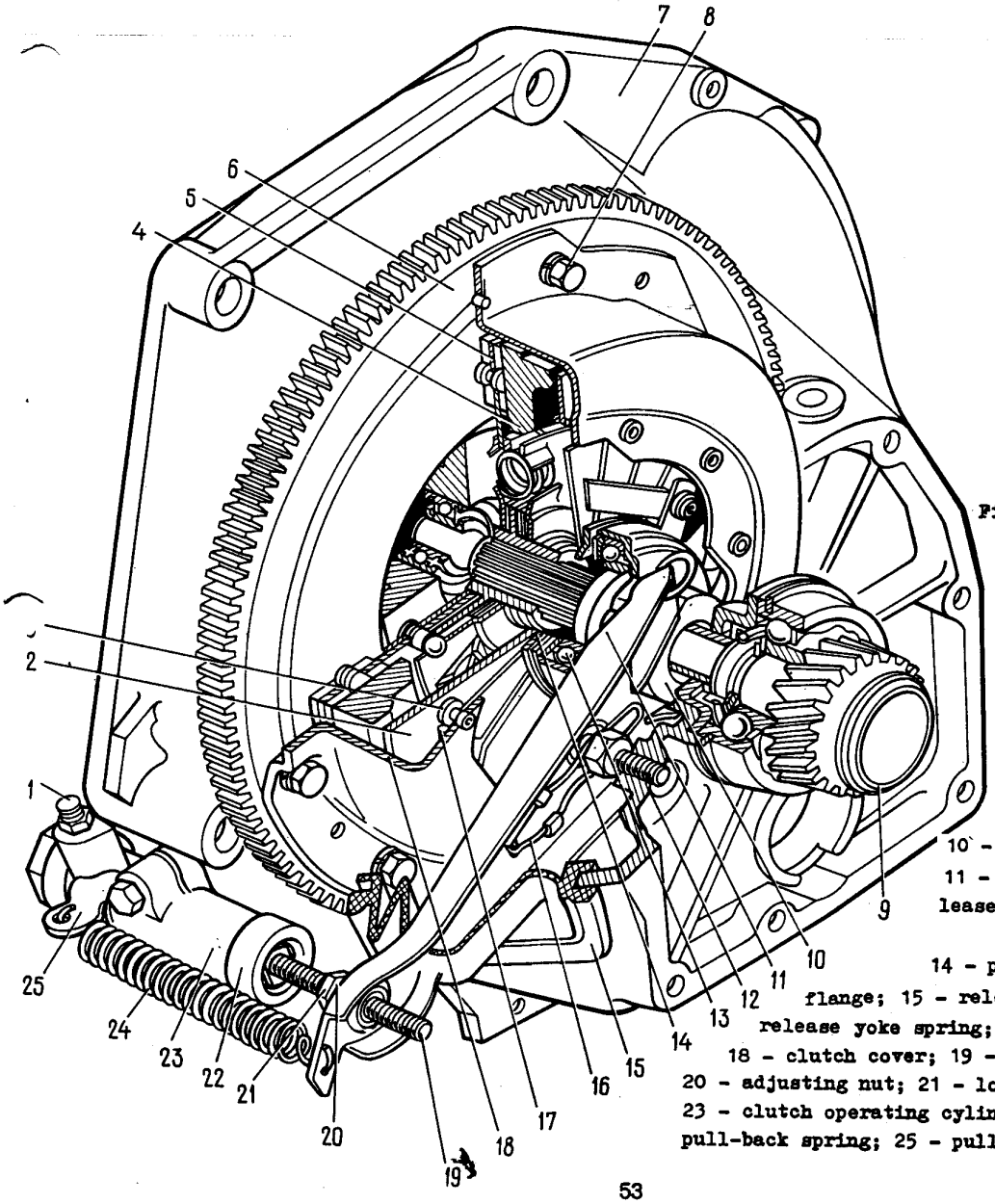


Fig. 3-1. Clutch Assembly: 1 - bleeder union; 2 - central pressure spring; 3 - pressure spring stepped rivet; 4 - pressure plate; 5 - driven disc; 6 - flywheel; 7 - clutch housing; 8 - clutch cover-to-flywheel bolt; 9 - gearbox clutch shaft; 10 - clutch release sleeve; 11 - release yoke; 12 - release yoke ball support; 13 - release bearing; 14 - pressure spring thrust flange; 15 - release yoke cover; 16 - release yoke spring; 17 - supporting ring; 18 - clutch cover; 19 - release yoke pushrod; 20 - adjusting nut; 21 - locknut; 22 - boot; 23 - clutch operating cylinder; 24 - release yoke pull-back spring; 25 - pull-back spring shackle

Cont'd

Cause	Remedy
Clutch Drags	
1. Excessive clearances in clutch control mechanism	1. Adjust clutch control mechanism
2. Warpage of driven disc (face runout over 0.5 mm)	2. Straighten or replace disc
3. Roughness of driven disc facings	3. Replace facings or driven disc assembly
4. Loosening of rivets or breaking of driven disc facings	4. Replace facings, check end runout of disc
5. Jamming of driven disc hub on gearbox clutch shaft splines	5. Clean splines and coat them with grease ЛСЦ-15 or Литол-24. If jamming is caused by mutilation or wear of splines, replace clutch shaft or driven disc
6. Breaking of plates connecting thrust flange with clutch cover	6. Replace clutch cover complete with pressure plate
7. Air in hydraulic system	7. Bleed hydraulic system
8. Fluid leaks from joints or damaged pipes of hydraulic system	8. Tighten joints, replace damaged parts, bleed hydraulic system
9. Fluid leaks from master or operating cylinder	9. Replace sealing rings, bleed system
10. Clogging of hole in reservoir cover which causes depression in master cylinder and infiltration of air into cylinder through seals	10. Clear up hole in reservoir cover, bleed hydraulic system
11. Poor tightness caused by soiling or wear of master cylinder front sealing ring	11. Clean sealing ring or replace, if worn
12. Loosening of pressure spring rivets	12. Replace clutch cover complete with pressure plate
13. Warpage or wear of pressure plate	13. Replace clutch cover complete with pressure plate
Clutch Slips	
1. No clearances in clutch control mechanism	1. Adjust clutch control mechanism
2. Heavy wear or burning of driven disc facings	2. Replace friction facings or driven disc assembly
3. Oiling of driven disc facings, flywheel and pressure plate surfaces	3. Wash oiled surfaces carefully with white spirit, eliminate cause of oiling
4. Clogging of master cylinder compensating hole	4. Wash cylinder, clear up compensating hole
5. Clutch control mechanism damaged or jammed	5. Eliminate cause of jamming
Jerky Engagement of Clutch	
1. Driven disc hub seized on clutch shaft splines	1. Clean splines, lubricate them with ЛСЦ-15 or Литол-24 grease. If seizure is caused by mutilation or wear of splines, replace clutch shaft or driven disc
2. Oiling of driven disc facings, flywheel and pressure plate surfaces	2. Wash oiled surfaces carefully with white spirit and eliminate cause of oiling
3. Jamming in clutch control mechanism	3. Replace distorted parts. Eliminate causes of jamming
4. Heavy wear of driven disc friction facings	4. Replace facings with new ones, check condition of disc surfaces
5. Loosening of driven disc facing rivets	5. Replace faulty rivets and, if necessary, facings
6. Pressure plate warped or its surfaces damaged	6. Replace clutch cover complete with pressure plate
Noisy Clutch Disengagement	
1. Wear, damage, or lubricant leaks from clutch release bearing	1. Replace bearing
2. Wear of gearbox clutch shaft front bearing	2. Replace bearing
Noisy Clutch Engagement	
1. Breaking or loss of resilience of driven disc damper springs	1. Replace driven disc assembly
2. Clutch release yoke return spring broken, lost its resilience or came off its hook	2. Fasten spring as required or replace by new one
3. Breaking of plates connecting pressure plate with cover	3. Replace clutch cover complete with pressure plate

ADJUSTING CLUTCH CONTROL MECHANISM

To adjust the clutch control mechanism perform the following operations:

- set a clearance of 0.1 - 0.5 mm between the pushrod and piston of the master cylinder (Fig. 3-2). This clearance, required for a complete release of the clutch, is adjusted by clutch pedal stop 5. The clearance can be determined by free travel of the pedal equal to 0.4 - 2 mm;

- adjust free travel of the operating cylinder pushrod (4 to 5 mm) with nut 5 (Fig. 3-3) which is fixed by locknut 6. Free travel of the pushrod is checked with a special templet.

On completion of these adjustments free travel of the clutch pedal (before the commencement of disengagement) should be 25 to 35 mm.

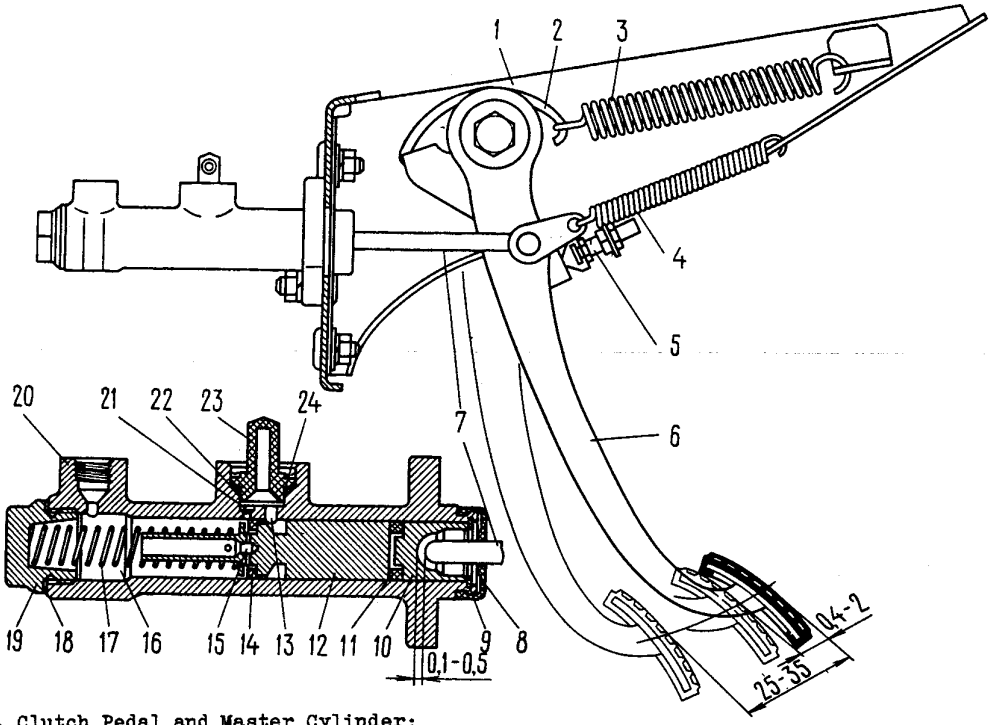


Fig. 3-2. Clutch Pedal and Master Cylinder:
1 - clutch and brake pedals bracket; 2 - hook; 3 - clutch pedal servo spring; 4 - clutch pedal retracting spring; 5 - clutch pedal stop; 6 - clutch pedal; 7 - pushrod; 8 - boot; 9 - lockring; 10 - pushrod piston; 11 - sealing ring; 12 - master cylinder piston; 13 - inlet hole; 14 - sealing ring (circular valve); 15 - piston bypass hole; 16 - cylinder working chamber; 17 - piston retracting spring; 18 - gasket; 19 - plug; 20 - master cylinder barrel; 21 - bypass (compensating) hole; 22 - union gasket; 23 - union; 24 - lockwasher

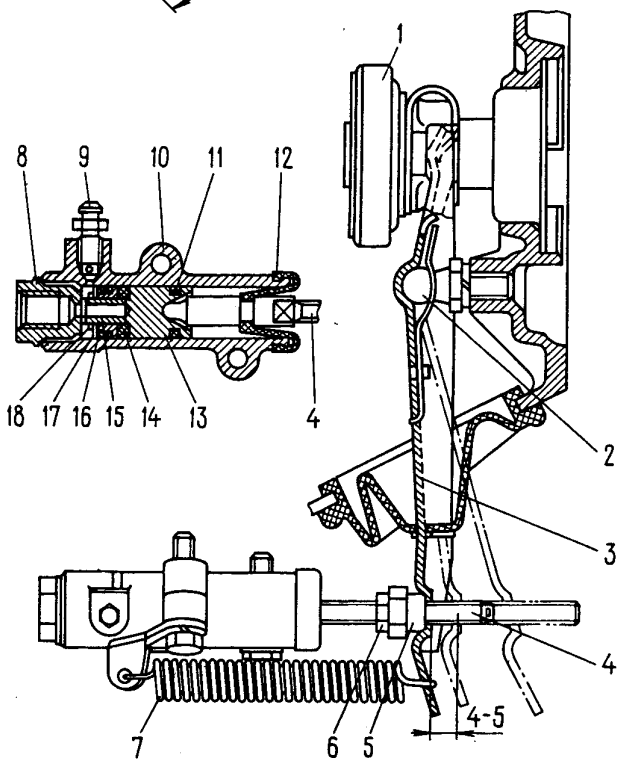


Fig. 3-3. Clutch Operating Cylinder and Release Yoke:
1 - clutch release bearing; 2 - ball support; 3 - release yoke; 4 - pushrod; 5 - adjusting nut; 6 - locknut; 7 - retracting spring; 8 - barrel plug; 9 - bleeder union; 10 - cylinder barrel; 11 - sealing ring; 12 - boot; 13 - piston; 14 - seal; 15 - plate; 16 - spring; 17 - supporting washer; 18 - lockring

BLEEDING HYDRAULIC CLUTCH SYSTEM

Penetration of air into the hydraulic clutch system can be diagnosed by incomplete disengagement of the clutch as well as by a "soft" or "sinking" pedal.

To bleed the hydraulic system:

- clean the reservoir and the bleeder union of dust and dirt;
- check fluid level in the hydraulic reservoir and top up, if necessary;
- put a hose on the head of operating cylinder bleeder union 9 (Fig. 3-3) and dip its other end into a vessel with the brake hydraulic fluid (30 - 50 g);
- turn off bleeder union 9 through 1/2 - 3/4 of a revolution depressing the pedal sharply and releasing it smoothly until air bubbles cease to emerge from the hose;
- depress the pedal and screw union 9 all the way on. Take off the hose and put the union boot in place.

If air bubbles continue to emerge from the hose after prolonged bleeding, check the joints for tightness and examine the pipes for cracks or dripping at the joints with the unions. Air may penetrate through faulty sealing rings of the master or operating cylinders.

When bleeding, observe the following requirements:

- fluid level in the reservoir should be above the hole of the pipe leading to the master cylinder;
- the end of the bleeder hose should be constantly immersed in fluid.

After bleeding bring the fluid level in the reservoir to the lower edge of the filler throat.

REMOVAL AND INSTALLATION OF CLUTCH

Removal. First remove the gearbox (see "Gearbox"). Unscrew the bolts and take off the clutch cover complete with the pressure plate. Do not lift this unit by gripping the thrust flange of the pressure spring.

Installation. To install the clutch reverse the removal operations and observe the following requirements:

- examine the bearing in the end of the engine crankshaft and replace it, if necessary;
- examine the splines on the driven disc hub and on the gearbox clutch shaft, clean the splines and coat them with a thin layer of grease ЛСЦ-15 or Литол-24;
- position the protruding part of the driven disc hub with the circular groove towards the gearbox and align the disc relative to the bearing with the aid of mandrel A.70081 which imitates the splined end of the gearbox clutch shaft (Fig. 3-4).

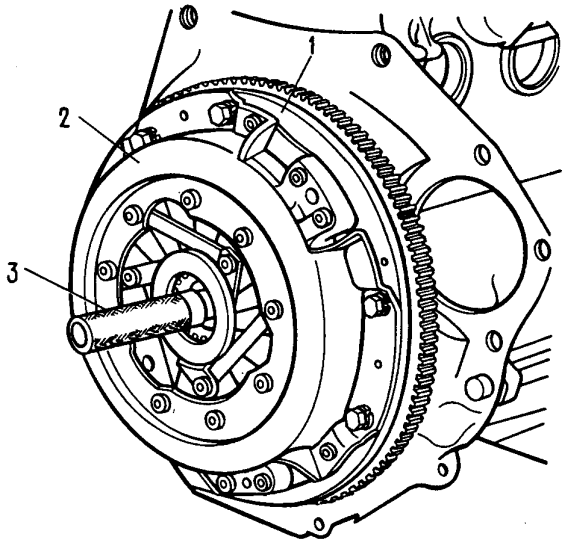


Fig. 3-4. Aligning Driven Disc with Mandrel A.70081:
1 - flywheel; 2 - clutch assembly; 3 - mandrel A.70081

CLUTCH CHECKS

The clutch must be inspected and checked on a base plate shaped like the engine flywheel and provided with metal spacer ring 4 (8.2 mm thick) instead of the driven disc (Fig. 3-5). Secure the clutch cover and make four release strokes, applying a load not exceeding 1370 N (140 kgf) to the thrust flange of the pressure spring. A 8-mm release stroke should correspond to 1.6 - 1.7 mm travel of the pressure plate (the minimum permissible travel being 1.4 mm).

The distance from the base plate to the working surface of the friction ring on the thrust flange should be 40 - 43 mm. In the course of service this distance is apt to grow due to wear of the clutch plates. As soon as it reaches 48 mm or the pressure plate travel becomes smaller than 1.4 mm, the clutch cover must be replaced complete with the pressure plate.

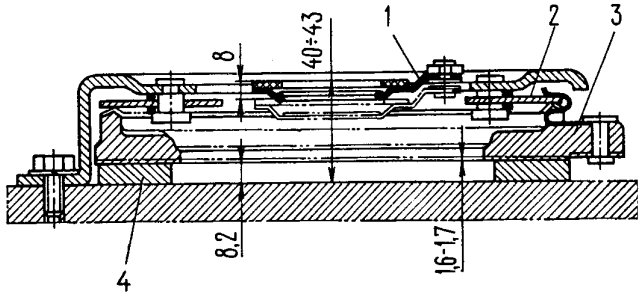


Fig. 3-5. Clutch Checks:
1 - pressure spring thrust flange; 2 - central pressure spring; 3 - pressure plate; 4 - ring

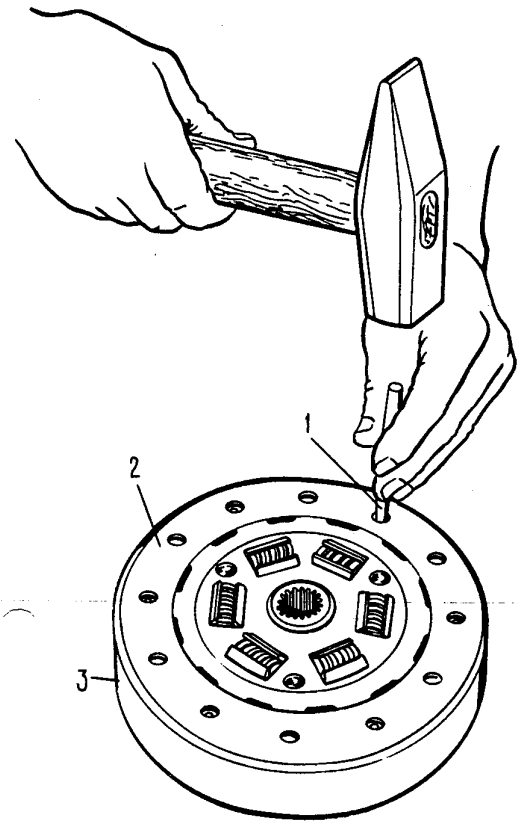


Fig. 3-6. Replacing Driven Disc Friction Facings: 1 - mandrel 67.7851.9500; 2 - driven disc; 3 - jig 67.7822.9517

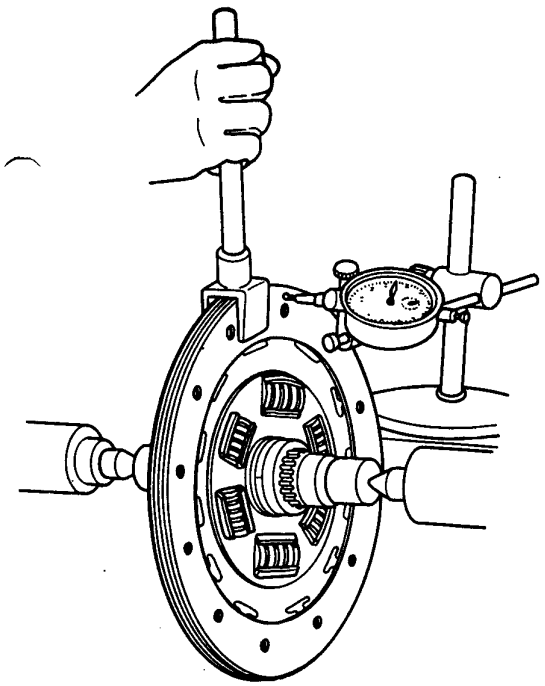


Fig. 3-7. Straightening Clutch Driven Disc

Replace the friction facings of the driven disc if they become cracked, scored on one side or when the distance between the rivet and the working surface has diminished to 0.2 mm. During repairs of the driven disc and replacement of the friction facings use mandrel 67.7851.9500, jig 67.7822.9517 (Fig. 3-6) and tools 67.7813.9503. The upset rivets shall have no fractures. Runout of the working surface of the friction facings shall not exceed 0.5 mm. If it is larger, straighten out the disc (Fig. 3-7) or replace it by a new one. If the driven disc or damper springs become cracked, replace the driven disc assembly.

REMOVAL AND INSTALLATION OF CLUTCH OPERATING AND MASTER CYLINDERS

The first thing to do is to drain the hydraulic fluid. For this purpose slip one end of the hose on bleeder union 9 (Fig. 3-3) of the operating cylinder, dip its other end into a clean vessel, unscrew union 9 through 1/2 - 3/4 of a revolution and keep pumping the pedal until all fluid is drained from the hydraulic system. Then disconnect the pipes laid between the master and operating cylinders, disconnect retracting spring 7, remove the cotter pin from the end of the pushrod, unscrew two bolts which fasten the operating cylinder and remove the latter.

To remove the master cylinder unscrew two nuts which fasten it on the pedal bracket studs and disconnect the flexible hose of the reservoir.

For installing the master and operating cylinders reverse the above operations.

Fill the hydraulic system with fluid and bleed it to expel air.

DISASSEMBLY, CHECKING, REPAIR AND ASSEMBLY OF MASTER AND OPERATING CYLINDERS

Master cylinder. Unscrew plug 3 (Fig. 3-8), remove rubber boot 7 and lockring 8 after which it becomes possible to take piston 9, sealing ring 10, floating piston 11 with another sealing ring, and piston return spring 12 out of the cylinder barrel.

The cylinder face and the external surface of the piston must have no scores and notches. The bore diameter of a serviceable master cylinder should be $(19.05^{+0.025}_{-0.015})$ mm.

Check the piston return spring and replace it, if it has lost its resilience.

Replace the sealing rings. Examine the rubber boot on the rear end of the cylinder and, if damaged, replace it by a new one. Before assembly clean carefully and wash the parts with brake fluid. Keep mineral oil, gasoline, kerosene and diesel fuel away from the parts since these liquids cause swelling of the rubber seals.

Having checked all parts assemble the master cylinder by reversing the disassembly operations;

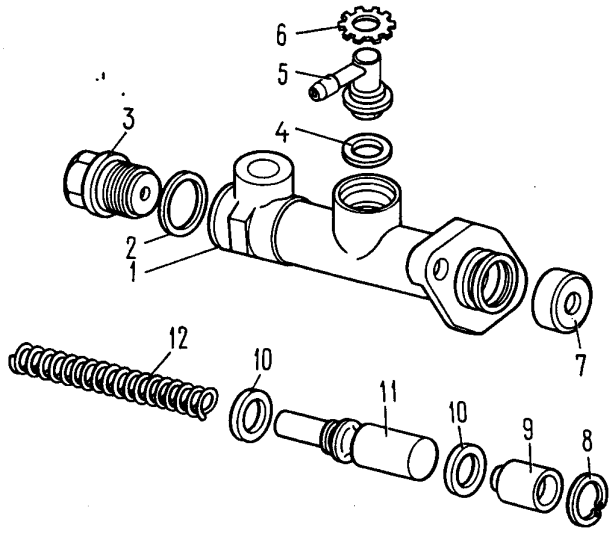


Fig. 3-8. Master Cylinder Parts:
1 - barrel; 2 - sealing gasket; 3 - plug; 4 - gasket; 5 - union; 6 - lockwasher; 7 - boot; 8 - lockring; 9 - pushrod piston; 10 - sealing ring; 11 - master cylinder piston; 12 - spring

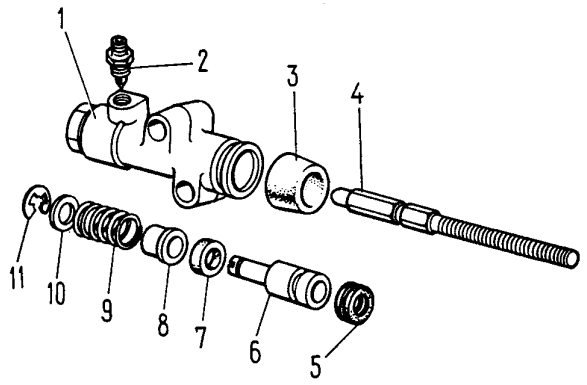


Fig. 3-9. Clutch Operating Cylinder Parts:
1 - barrel; 2 - union; 3 - boot; 4 - pushrod; 5 - sealing ring; 6 - piston; 7 - sealing ring; 8 - spring seat; 9 - spring; 10 - washer; 11 - lockring

lubricate the cylinder parts with brake fluid or preservative fluid НГ-213.

Operating cylinder. Unscrew the plug, remove rubber boot 3 (Fig. 3-9) complete with pushrod 4, take out the piston and disassemble it, first removing lockring 11.

After disassembly wash carefully and examine all parts as prescribed for the master cylinder. Discard the pushrod if it is distorted.

Having inspected the parts, assemble the cylinder in the reverse order of operations, lubricating the parts with the hydraulic fluid.

STAND CHECKS OF CLUTCH MASTER CYLINDER

Tightness check of rear sealing ring. Put the master cylinder on a stand (Fig. 3-10), ensuring efficient sealing of the joint between the cylinder flange and the mounting surface of the stand. Connect vessel 2 with hydraulic fluid to the cylinder. Open the compressed air cock with adjusting screw 6 turned off, then turn in this screw slowly until all air escapes from vessel 2.

Watch the air pressure gauge; it should read from 0.05 to 0.08 MPa (0.5 - 0.8 kgf/cm^2). Replace the rear sealing ring, if the pressure is lower.

Tightness check of front sealing ring. Mount the master cylinder on the stand and connect it to a vessel filled with the hydraulic fluid and to pressure gauges (Fig. 3-11).

Close the cock of pressure gauge 3 and, moving the pushrod of the master cylinder, set a steady pressure of 0.2 MPa (2 kgf/cm^2).

With the pushrod locked and no fluid leaks the pressure should remain constant for 2 min.

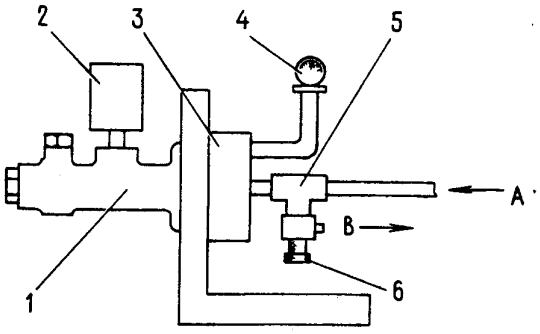


Fig. 3-10. Checking Rear Sealing Ring for Tightness:
1 - master cylinder; 2 - vessel; 3 - adapter with seal; 4 - pressure gauge; 5 - Tee-pipe; 6 - adjusting screw; A - air from compressor; B - air outlet

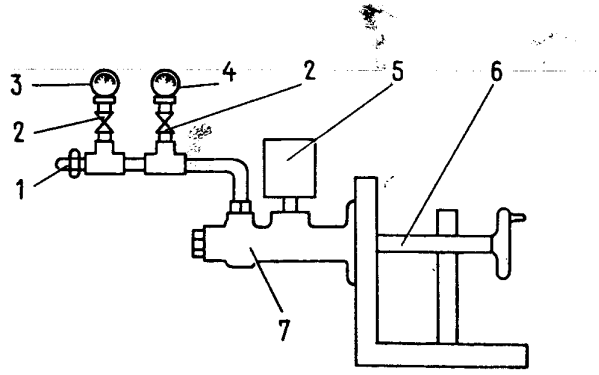


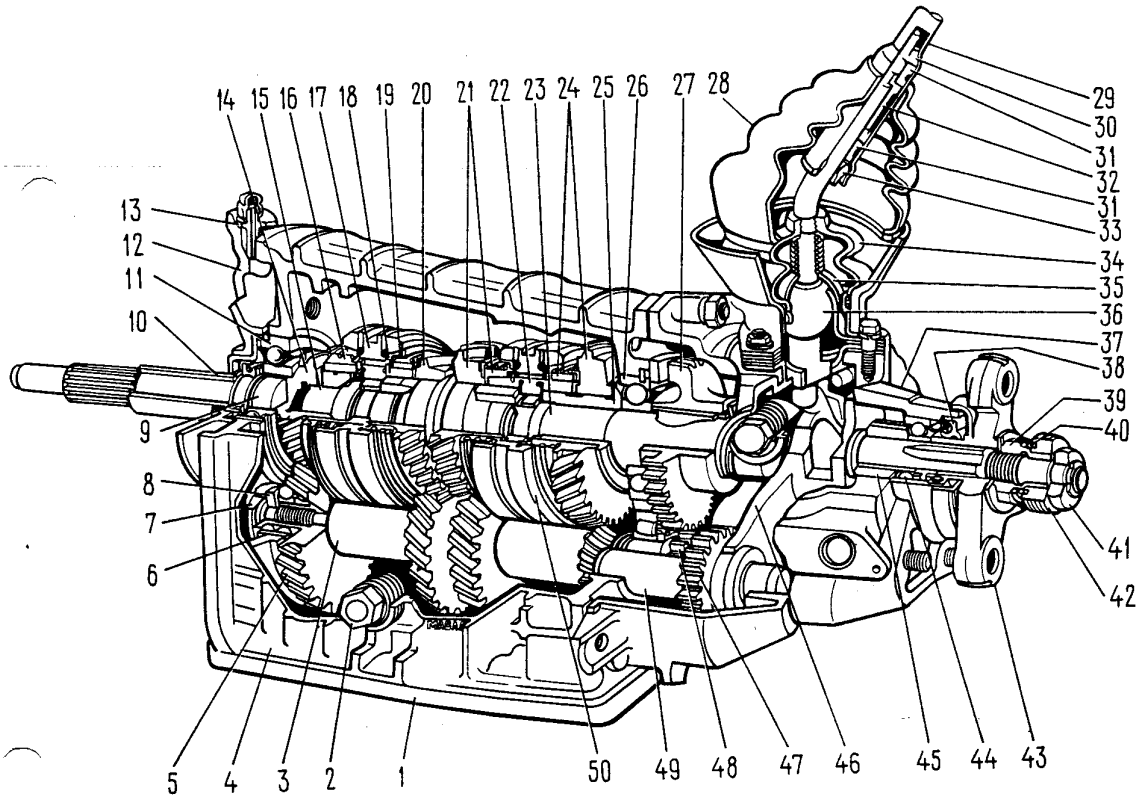
Fig. 3-11. Checking Front Sealing Ring for Tightness:
1 - bleeder screw; 2 - cock; 3 - pressure gauge, division value 0.2 MPa (2 kgf/cm^2); 4 - pressure gauge, division value 0.005 MPa (0.05 kgf/cm^2); 5 - vessel; 6 - pushrod; 7 - master cylinder

Close the cock of pressure gauge 4 and open hat of pressure gauge 3. Moving the pushrod set . steady pressure of 10 MPa (10 kgf/cm^2), as read rom the pressure gauge.

With the pushrod locked and no fluid leaks this pressure should remain constant for not less than 2 min. Otherwise replace the front sealing ring.

GEARBOX

The cars are furnished with four-speed or five-peed gearboxes illustrated in Figs 3-12, 3-31 and -32. The five-speed gearbox is the development of the four-speed one, that is why only the peculiarities of its repair are given in the end of the Chapter.



ig. 3-12. Gearbox:
- lower cover; 2 - oil level plug; 3 - counter-haft; 4 - gearbox housing; 5 - countershaft con-tant-mesh gear; 6 - countershaft front bearing; - bolt; 8 - washer; 9 - clutch shaft; 10 - front ver; 11 - clutch shaft rear bearing; 12 - clutch ousing; 13 - breather; 14 - gearbox clutch shaft nstant-mesh gear; 15 - needle bearing; - 4th speed synchronizer toothed rim; 17 - 4th id 3rd speed synchronizer sliding sleeve; - synchronizer baulk ring; 19 - synchronizer ring; 20 - 3rd speed gear; 21 - 2nd speed gear; - 1st and 2nd speed synchronizer sliding sleeve b; 23 - main shaft; 24 - 1st speed gear; 25 - gear bushing; 26 - main shaft intermediate bearing; 27 - reverse gear; 28 - outer boot; 29 - gearshift lever shank; 30 - thrust pad; 31 - flexible bushing; 32 - spacer bushing; 33 - locking bushing; 34 - inner boot; 35 - ball support spherical washer; 36 - gearshift lever; 37 - rear cover; 38 - gland; 39 - nut; 40 - seal spring; 41 - flexible coupling aligning ring; 42 - aligning ring seal; 43 - flexible coupling flange; 44 - main shaft rear bearing; 45 - spacer bushing; 46 - reverse shift fork; 47 - reverse idler gear; 48 - countershaft reverse gear; 49 - reverse idler gear shaft; 50 - 1st and 2nd speed synchronizer sliding sleeve

TROUBLE SHOOTING

Cause	Remedy
Gearbox Noisy	
1. Noise in bearings	1. Replace faulty bearings
2. Wear of gear and synchronizer teeth	2. Replace worn parts
3. Low oil level in gearbox	3. Add oil. If necessary, eliminate cause of oil leakage
4. End play of shafts	4. Replace bearings or their fastening parts
Difficult Gearshifting	
1. Incomplete release of clutch	1. See under "Clutch"
2. Jamming of gearshift lever spherical joint	2. Dress mating surfaces of spherical joint
3. Deformation of gearshift lever	3. Eliminate trouble or replace lever by new one
4. Restricted movement of shift rails (burrs, soiling of rail seats, wedging of interlock retainers)	4. Repair or replace worn parts
5. Restricted movement of sliding sleeve on hub due to soiled splines	5. Clean soiled parts
6. Deformation of gearshift forks	6. Straighten out or replace, if necessary
Uncontrollable Disengagement or Unreliable Engagement of Gears	
1. Wear of balls and shift rail seats, weakening of detent springs	1. Replace damaged parts by new ones
2. Wear of synchronizer baulk rings	2. Replace baulk rings
3. Breaking of synchronizer spring	3. Replace spring
4. Worn teeth of synchronizer sleeve or rim	4. Replace sleeve or gear
Leakage of Oil	
1. Wear of clutch shaft and main shaft glands	1. Replace glands
2. Loosening of gearbox housing covers, defects of sealing gaskets	2. Tighten up nuts (for tightening torques see Appendix) or replace sealing gaskets
3. Loosening of clutch housing-to-gearbox housing fasteners	3. Tighten up nuts

REMOVAL AND INSTALLATION

Removal. Place the car on an inspection pit or a lift, put chocks under the front wheels and raise the rear axle at one or both sides. Release the parking brake and set the gearshift lever in neutral. Disconnect the wires from the storage battery.

Remove the floor front mat and the outer boots of the gearbox and transfer case gearshift levers. Take off the lever hatch lids and the seals. Unscrew the knobs from the transfer case levers.

Press down lever shank 29 (Fig. 3-12) and, using a screwdriver or some other sharp-pointed tool, pull locking bushing 33 out of its groove on the lever shank; remove the shank.

Disconnect the pipe and muffler mounts in the rear end of the car and detach the muffler pipe from the inlet pipe. Disconnect the clamp which holds the inlet pipe to the gearbox. Using a box wrench, unscrew the nuts which hold the muffler inlet pipe to the exhaust manifold and move the pipe down and out of the car.

Unscrew the lower bolts of the clutch housin cover. Disconnect the "ground" wire from the clutch housing and the wires from the backing light switch.

Unhook retracting spring 1 from clutch release yoke 5 (Fig. 3-13) and remove cotter pin from pushrod 6. Disconnect operating cylinder 8

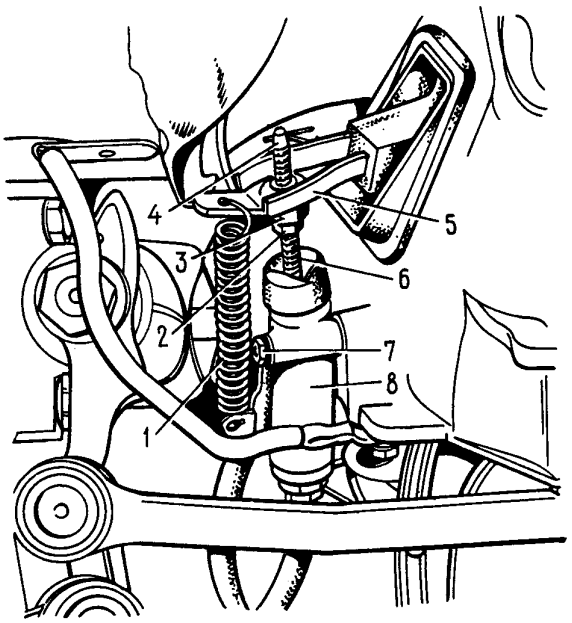
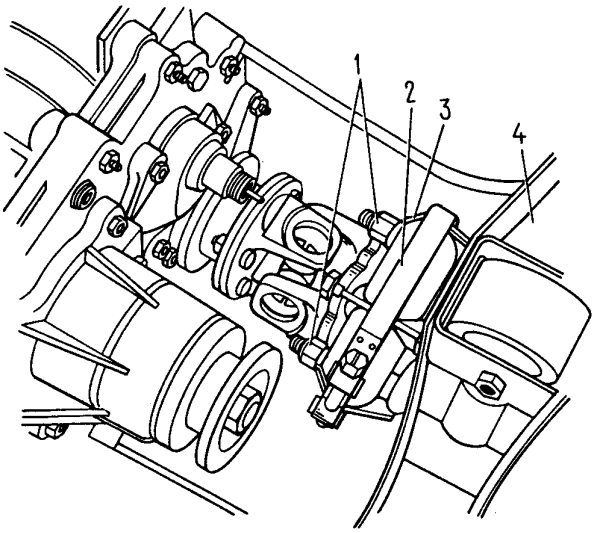


Fig. 3-13. Clutch Control Linkage:
1 - yoke retracting spring; 2 - locknut; 3 - adjusting nut; 4 - cotter pin; 5 - clutch release yoke; 6 - pushrod; 7 - operating cylinder-to-clutch housing bolt; 8 - clutch operating cylinder



ig. 3-14. Propeller Shaft-to-Gearbox Flexible oupling:
- propeller shaft-to-flexible coupling nuts;
- p A.70025; 3 - flexible coupling;
- engine rear mount crossmember

rom the clutch housing. Cylinder 8 connected by pipe with the master cylinder remains on the ar, thus preventing losses of brake fluid and liminating the need for subsequent bleeding of he clutch system.

Put clamp 2 (A.70025) on flexible coupling 3 Fig. 3-14) and tighten it securely. This will acilitate the removal and subsequent installation f the flexible coupling. Unscrew nuts 1 and, otating the intermediate propeller shaft, take ut the bolts which hold flexible coupling 3 to he flange of the gearbox main shaft.

Note. The gearbox can also be removed complete with the intermediate shaft. In this case isconnect the flange of the intermediate propeller shaft from the flange of the transfer case shaft.

Disconnect the speedometer flexible shaft rom the speedometer drive on the transfer case.

Detach the flanges of the front and rear axle ropeller shafts from the flanges of the transfer ase shafts. Lower and shift aside the axle drive ropeller shafts.

Unscrew the bolts that hold the transfer case rackets to the car body and remove the transfer ase complete with the propeller shaft.

Using articulated socket wrench 02.7812.9500, nscrew the bolts which fasten the starter to the lutch housing and detach the starter. Unscrew the olts of the clutch housing cover.

Disconnect the support of the engine rear ount from cross member 4 (Fig. 3-14) and remove the cross member, propping up the gearbox from underneath.

Place a jack, a trestle or another suitable support under the gearbox housing. Using articulated socket wrench A.55035, unscrew the bolts and remove the gearbox complete with the clutch housing by moving the unit towards the rear end of the car so as to withdraw the clutch shaft from the front bearing and from the driven disc hub.

Caution

When removing or installing the gearbox DO NOT rest the end of the clutch shaft against the thrust flange of the clutch pressure spring to avoid distorting the clutch connecting plates.

Installation of the gearbox is carried out by reversing the removal operations. Before installation apply a thin coat of ЛСЦ-15 (Литол-24) grease to the splined end of the clutch shaft and align the clutch driven disc (Fig. 3-4) with mandrel A.70081.

DISASSEMBLY AND ASSEMBLY

Disassembly. Wash the gearbox and install it on a stand. Drain oil and remove the lower cover with the gasket.

Take out the clutch release yoke. Remove the release sleeve complete with the bearing and connecting spring from the guide sleeve of the gearbox front cover.

Remove the clutch housing with the gasket and the front cover of the gearbox complete with the gland and spring washer (Fig. 3-15).

Remove the backing light switch taking care not to distort its body.

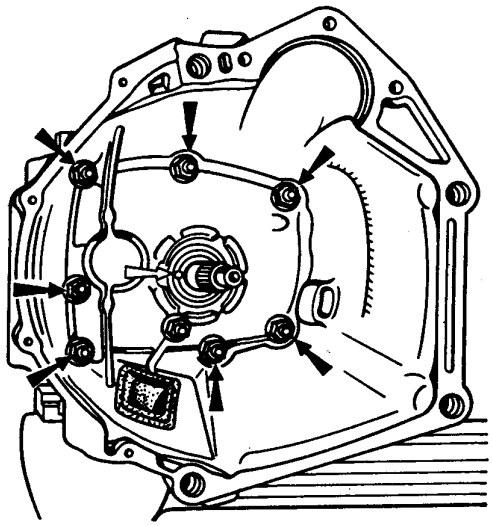


Fig. 3-15. Clutch Housing, Inside View. Black arrows show housing-to-gearbox nuts. White arrow shows hole in front cover for draining oil from gearbox housing to prevent oiling of clutch discs

Unscrew the bolt of the 3rd and 4th speed shift fork. Put fixing tool 41.7816.4068 on the clutch shaft or throw in two gears simultaneously. This will prevent rotation of the clutch shaft, main shaft and countershaft and facilitate subsequent disassembly operations.

Remove the lockring from the end of the gearbox main shaft (Fig. 3-16).

Unbend the lockwasher, unscrew the nut a few revolutions so as to shift the aligning ring of the flexible coupling and screw on the nut again. Using pusher A.40006/1 with remover tool A.40005/4, take the aligning ring of the propeller shaft flexible coupling off the end of the main shaft (Fig. 3-17).

Remove the seal of the flexible coupling aligning ring with the spring from the end of the main shaft, unscrew the nut and, using remover tool A.40005/3/9B/9C, take off the flexible coupling flange (Fig. 3-18).

Remove the rear cover of the gearbox by turning off the nuts and screw 4 (Fig. 3-19) which

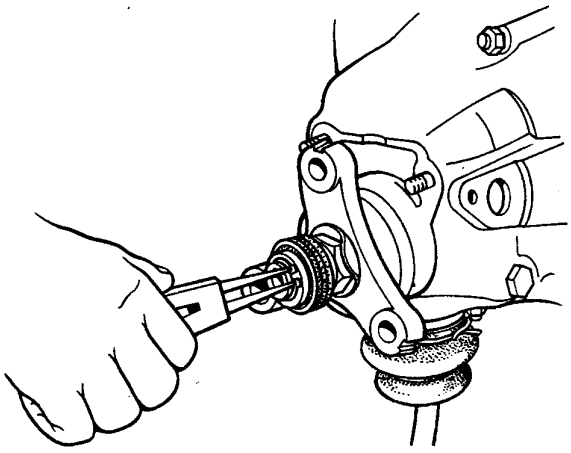


Fig. 3-16. Removing Lockring

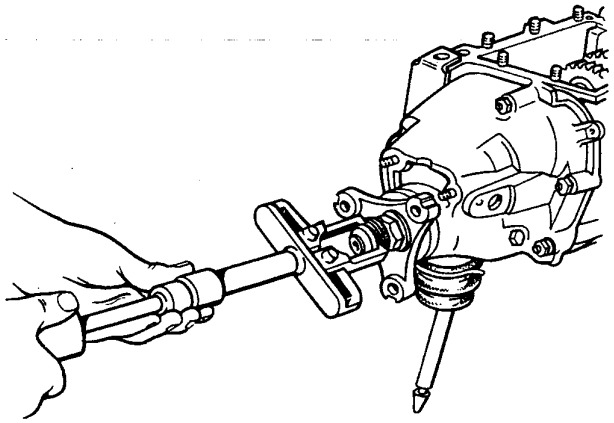


Fig. 3-17. Removing Aligning Ring of Propeller Shaft Flexible Coupling with Remover Tools A.40006/1 and A.40005/4

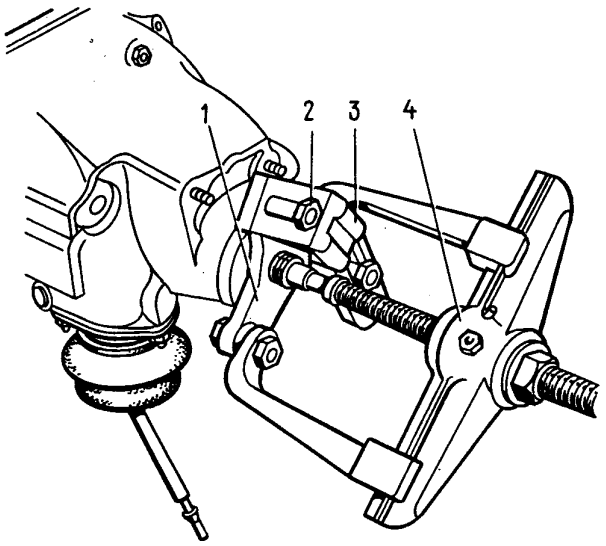


Fig. 3-18. Removing Flexible Coupling Flange with Remover Tool A.40005/3/9B/9C:
1 - flexible coupling flange; 2 - fixture-to-flange fastening bolts; 3 - fixture of remover tool A.40005/3; 4 - remover tool A.40005/3

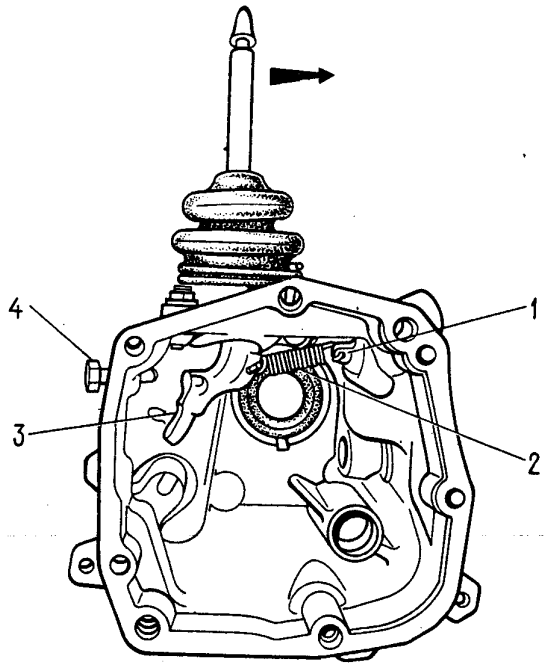


Fig. 3-19. Gearbox Rear Cover. Inside View:
1 - gearshift lever retracting spring eye-screw; 2 - gearshift lever retracting spring; 3 - gearshift lever; 4 - gearshift lever lateral travel stop screw. Arrow shows direction for moving the lever to disengage it from shift rail lugs and to remove gearbox rear cover

limits the lateral travel of the gearshift lever, and shift the gearshift lever to the left so as to withdraw it from the shift rails.

Remove the rear bearing from the main shaft, then take off the spacer bushing of the bearing.

Remove the fork with the spacer bushing from the reverse shift rail. Remove the reverse idler gear from the axle.

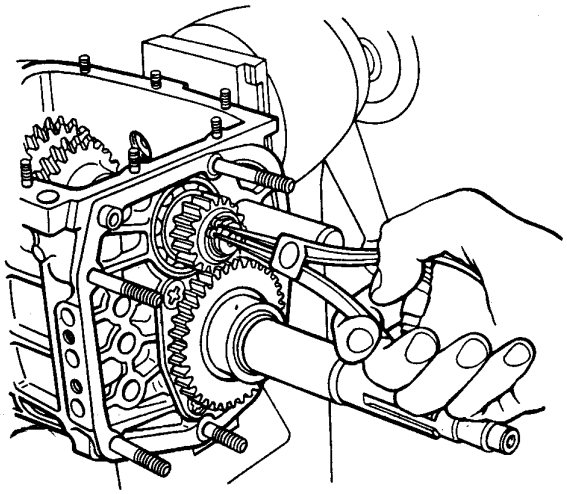


Fig. 3-20. Removing Reverse Gear Lockring from Countershaft

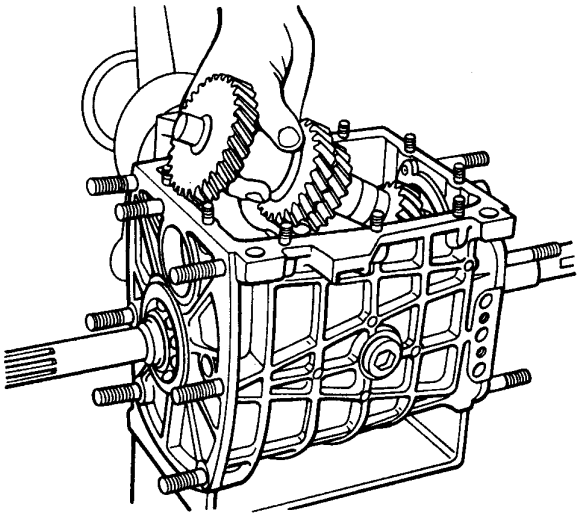
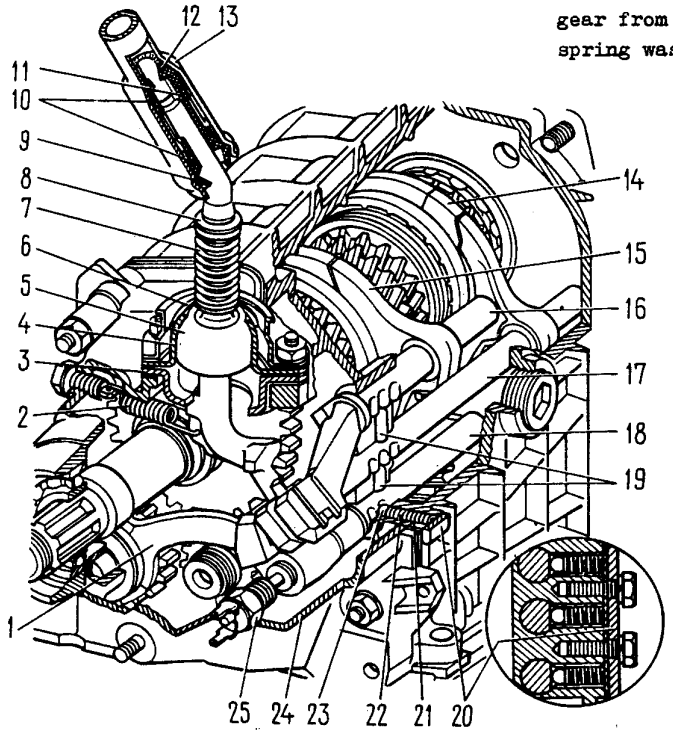


Fig. 3-21. Removing Countershaft from Gearbox Housing

Remove the lockring of the reverse driving gear from the countershaft (Fig. 3-20); take off the gear and the spring washer.

Remove the lockring off the reverse driven gear from the main shaft, applying pressure to the spring washer by tool 41.7816.4069 in order to



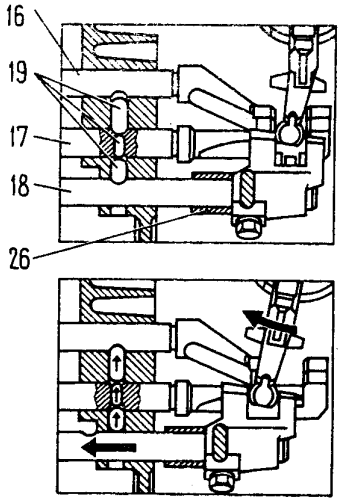


Fig. 3-22. Gearbox Control Mechanism:
1 - reverse shift fork; 2 - gearshift lever retracting spring; 3 - gearshift lever guide seat; 4 - lever ball support; 5 - gearshift lever; 6 - spherical washer; 7 - lever spring; 8 - lockring; 9 - locking bushing; 10 - flexible bushings; 11 - spacer bushing; 12 - thrust pad; 13 - gearshift lever shank; 14 - 3rd and 4th speed shift fork; 15 - 1st and 2nd speed shift fork; 16 - 1st and 2nd speed shift rail; 17 - 3rd and 4th speed shift rail; 18 - reverse shift rail; 19 - interlock retainers; 20 - detent cover; 21 - bushing; 22 - detent spring; 23 - detent ball; 24 - gearbox rear cover; 25 - backing light switch; 26 - reverse shift rail spacer bushing

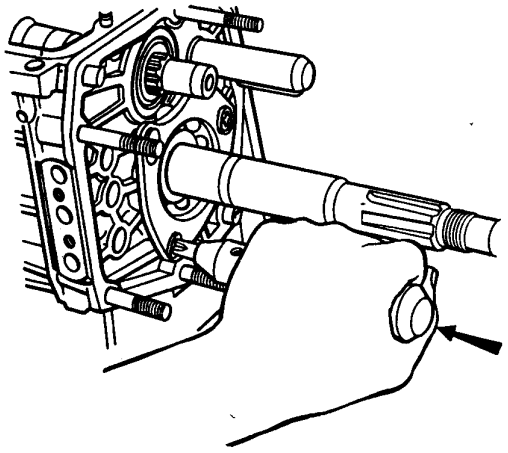


Fig. 3-23. Removing Fastening Screws of Main Shaft Intermediate Bearing Locking Plate with Power Screwdriver. Arrow shows direction of impact stroke (when striking the screwdriver with a hammer)

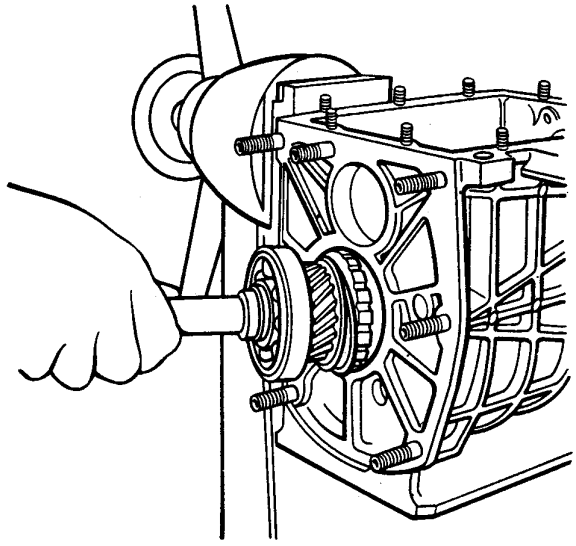


Fig. 3-24. Removing Clutch Shaft from Gearbox Housing

relieve the lockring. Remove the reverse driven gear and the spring washer.

Using mandrels shaped like screwdrivers and drifts, remove the front and rear bearings of the countershaft from the gearbox housing. Make marks on the inner races of the double-row front bearing so as to return them to their places in the bearing outer race.

Take the countershaft from the gearbox housing, inclining it as shown in Fig. 3-21.

Take off shift rail detent cover 20 (Fig. 3-22 complete with the gasket, remove reverse shift rail 18 and 3rd and 4th speed shift rail 17 from the gearbox housing. Unscrew the bolt of 1st and 2nd speed shift fork, take out the shift rail and forks. While removing the shift rails, take out simultaneously three interlock retainers 19. Remove the locking plate (Fig. 3-23) of the main shaft intermediate bearing and the reverse idler gear axle.

Using mandrels of the screwdriver type take out the clutch shaft complete with the bearing and synchronizer ring (Fig. 3-24) and pull the needle bearing from the front end of the main shaft.

Drive the main shaft out of the intermediate bearing, take out the latter and, inclining the main shaft as shown in Fig. 3-25, take it out of the housing complete with the gears, synchronizer sleeves and rings. Remove the 3rd and 4th speed synchronizer sleeve from the shaft.

Disassemble the clutch shaft (Fig. 3-26) as follows:

- remove lockring 7, baulk ring 6 and spring 5 of the synchronizer;
- mount the shaft on a press and, compressing spring washer 2 with tool 41.7816.4069, remove lockring 1, the spring washer and bearing 3.

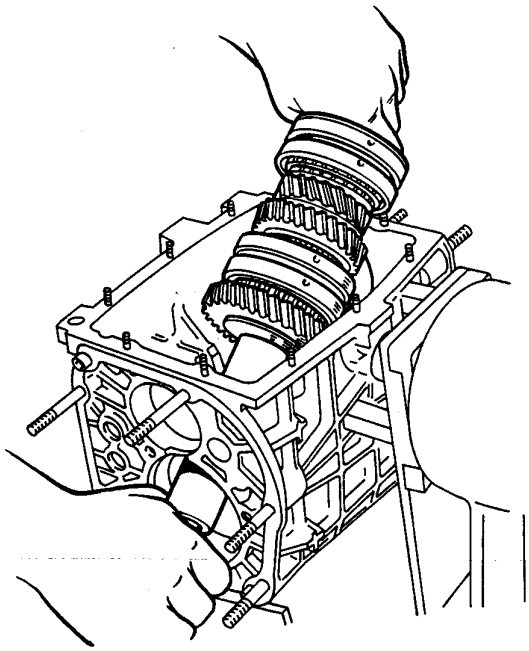


Fig. 3-25. Removing Main Shaft from Gearbox Housing

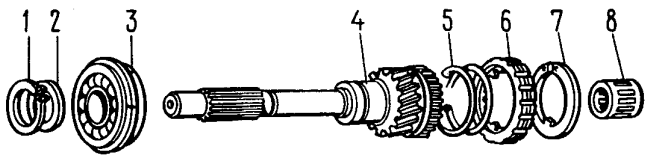


Fig. 3-26. Clutch Shaft Parts:
1 - lockring; 2 - spring washer; 3 - bearing; 4 - clutch shaft; 5 - synchronizer spring; 6 - synchronizer baulk ring; 7 - lockring; 8 - bearing

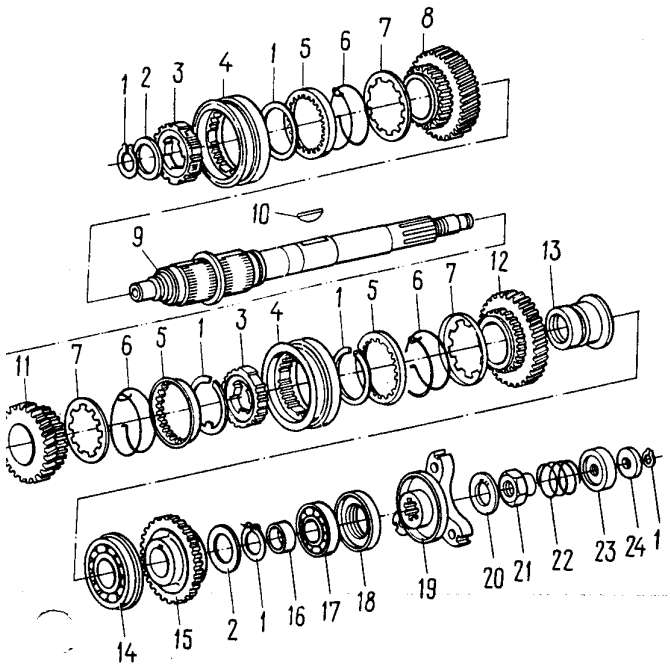
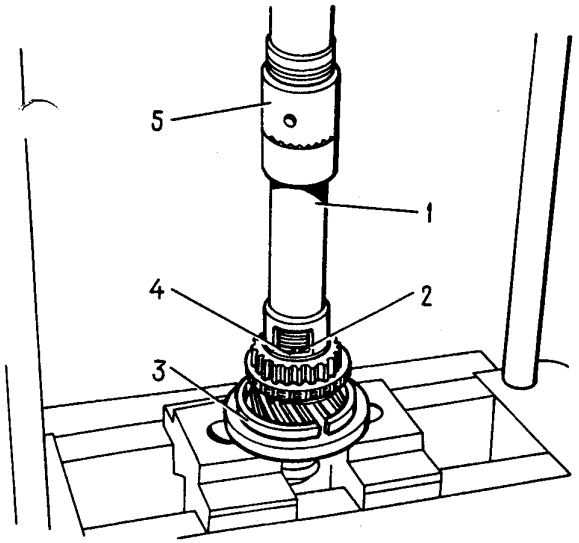


Fig. 3-27. Main Shaft Parts:
1 - lockring; 2 - spring washer; 3 - synchronizer hub; 4 - synchronizer sleeve; 5 - synchronizer baulk ring; 6 - synchronizer spring; 7 - washer; 8 - 3rd speed gear; 9 - main shaft; 10 - key; 11 - 2nd speed gear; 12 - 1st speed gear; 13 - 1st speed gear bushing; 14 - bearing; 15 - reverse gear; 16 - spacer bushing; 17 - rear bearing; 18 - gland; 19 - flexible coupling flange; 20 - lockwasher; 21 - nut; 22 - seal spring; 23 - seal; 24 - aligning ring



ig. 3-28. Installing Main Shaft Lockring:
- installation tool 41.7816.4069; 2 - lockring;
- supporting half-ring; 4 - spring washer;
- press rod

Disassemble the main shaft (Fig. 3-27) as follows:

- remove 1st speed gear 12 with bushing 13 from the rear end of the shaft, remove hub 3 with 1st and 2nd speed sliding shift sleeve, 2nd speed gear 11 complete with synchronizer baulk ring 5;
- install the main shaft with tool 41.7816.4069 on a press (Fig. 3-28), put supporting half-rings 3 under the 3rd speed gear and, pressing on the spring washer with the tool, remove lockring 2; then remove spring washer 4, the hub of the 3rd and 4th speed sliding shift sleeve and the 3rd speed gear.

Disassemble the gearshift lever and the rear cover as follows:

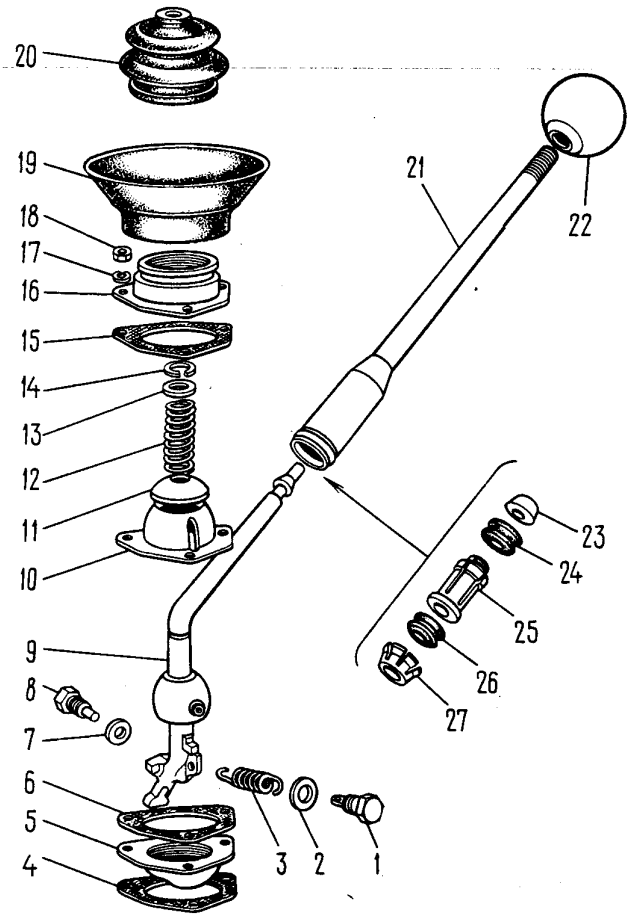


Fig. 3-29. Gearshift Lever Parts:
1 - retracting spring bolt; 2 - washer;
3 - retracting spring; 4 - gasket; 5 - guide seat;
6 - gasket; 7 - washer; 8 - stop bolt; 9 - gearshift lever; 10 - ball support; 11 - spherical washer; 12 - spring; 13 - supporting washer;
14 - lockring; 15 - gasket; 16 - flange; 17 - spring washer; 18 - nut; 19 - cup; 20 - inner boot;
21 - lever shank; 22 - knob; 23 - thrust pad;
24 - flexible bushing; 25 - spacer bushing;
26 - flexible bushing; 27 - locking bushing

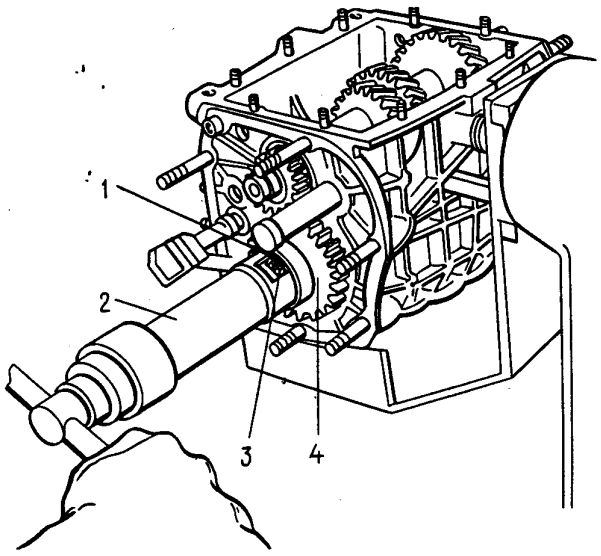


Fig. 3-30. Installing Reverse Gear Lockring on Main Shaft:
1 - lockring; 2 - installation tool 41.7816.4069; 3 - spring washer; 4 - main shaft reverse gear

- remove cup 19 (Fig. 3-29) and boot 20 of the lever, take off lockring 14, washer 13, spring 12 and spherical washer 11;

- unscrew the nuts of flange 16, disconnect lever retracting spring 3 from the lug of bolt 1 and remove the lever complete with the flange, support 10 and seat 5.

Assembly. To assemble the gearbox reverse the disassembly operations. In so doing, observe the following:

- spring 22 (Fig. 3-22) of the detent ball of the reverse shift rail differs from other springs in its resilience; it is pointed green or is cadmium-plated, and since 1985 - black oxidized;

- when installing the clutch housing with the front cover of the gearbox, arrange the hole in the front cover as shown in Fig. 3-15;

- before installation coat the active surfaces of the glands with Литол-24 grease;

- install the lockring of the reverse gear using tool 41.7816.4069 as shown in Fig. 3-30; when installing shaft bearings and glands, use mandrels 41.7853.4028, 41.7853.4032 and 41.7853.4039.

INSPECTION

Cleaning. Before inspection clean the gearbox parts thoroughly. Remove all deposits with a brush or scraper and dislodge any dirt from holes and splines; then wash the parts so as to remove and dissolve any lubricant remnants.

Airblast the parts and wipe them carefully. Particular care should be exerted in airblasting the bearings. Direct the air jet so as to avoid rapid rotation of the bearing races.

Housing and covers. The housing should be free of cracks and the bores for the bearings must be neither worn nor damaged.

The surfaces contacting the clutch housing, the rear and lower covers must be free of damage so as to avoid axial misalignment and poor tightness which causes leakage of oil. Minor defects should be smoothed out with a file. Replace the parts with new ones if they are heavily damaged or worn.

Examine the front cover and check to see that the clutch shaft runs clear of the cover. If the shaft and cover are axially misaligned, replace the faulty parts. Check to see that the oil drain hole in the clutch shaft cover (shown by arrow in Fig. 3-15) is not obstructed. Clean the drain plug.

Glands. Examine the glands and make sure their working edges are not damaged, worn out or irregular in shape.

Wear of the working edges in width should not be over 1 mm. Replace the glands no matter how slightly they are damaged.

Shafts. The working surfaces and splines of the main shaft must be neither damaged nor worn; the flexible coupling flange should be free to slide without jamming on the splines. The rolling surfaces of the needles on the front end of the shaft must not be rough nor scored.

Examine the rolling surfaces of the needles in the clutch shaft bore.

Inspect the countershaft; it must be free of chipping or excessive wear of teeth.

The axle of the reverse gear must be perfectly smooth and bear no signs of jamming. The assembly clearance between the axle and bushing of the reverse idler gear is 0.056 - 0.09 mm, the wear limit being 0.15 mm. Check this clearance by measuring the diameters of the gear axle and the hole in the bushing. The diameters of the new parts are as follows: gear axle - $(19.9^{+0.094}_{-0.079})$ mm, the inside diameter of the press-fitted bushing - $(20^{+0.07}_{+0.05})$ mm.

Minor roughness of the surfaces can be smoothed down with fine emery cloth. In case of serious damage and distortions, replace the shaft by a new one.

Gears. Gear teeth must not be damaged, nor excessively worn. Pay particular attention to the synchronizer rim tooth faces.

The tooth contact of the meshing gears should cover the entire working surface which must be smooth and unworn. Check the gear backlash. Its assembly value is 0.10 mm, the wear limit being 0.20 mm.

The assembly clearance between the 1st speed gear and its bush and that between the main shaft and the 2nd and 3rd speed gears should be

0.05 - 0.10 mm; the wear limit for this clearance is 0.15 mm.

The gears worn beyond this limit should be replaced by new ones.

Bearings. The ball and roller bearings must be in perfect condition. Their radial clearance should not exceed 0.05 mm.

Pressing the inner race against the outer one by fingers, rotate one of the races back and forth and see that the rolling motion is smooth and unobstructed. The surfaces of the balls and rollers and those of the bearing races must be free of damage. Replace the defective bearings by new ones. To replace the clutch shaft front bearing use remover tool A.40006 (Fig. 2-11) which permits this operation to be performed without removing the flywheel.

Shift rails and forks. The gearshift forks must not be distorted. The shift rails should be free to slide in the housing bores without considerable looseness.

Examine the shift rail interlock retainers, de ; balls and springs. Replace these parts if they show signs of jamming and wear.

Synchronizer hubs, sleeves and baulk rings. Check the hubs of the 1st-2nd and 3rd-4th speed sleeves for evidence of binding, particularly on the sliding surfaces of the sleeves.

Pay particular attention to the condition of the sleeve tooth faces.

See that the surfaces of the baulk rings are not excessively worn. Replace them, if their faces bear against the synchronizer sleeves. Any roughness interfering with free sliding should be removed with a superfine file. The parts worn beyond the permissible limits should be replaced.

PECULIARITIES OF REPAIR OF FIVE-SPEED GEARBOX

Disassembly. Prior to removing the rear cover se he gearshift lever in neutral, turn off the nu of the gearshift mechanism and remove the gearshift lever complete with the mechanism. Turn off the nuts holding the rear cover and remove the latter. One of the cover nuts is to be turned off from inside of the gearbox housing, with the lower cover removed. When removing the rear cover pull it backwards with a turn to prevent its rubbing against the reverse and 5th speed gear cluster.

Having removed the inner race of rear bearing 12 (Fig. 3-31) and speedometer drive driving gear 11 from the main shaft, back off the bolts of detent cover 5 (Fig. 3-32) and turn off bolts 2 and 4 holding the gear cluster and the 5th speed gear and reverse shift fork. Remove oil deflecting washer 9 (Fig. 3-31) and bushing 1 (Fig. 3-33) of the 5th speed gear and take shift rail 1 (Fig. 3-34) out of fork 2. Simultaneously remove distance bushing 3 from the shift rail. Then remove

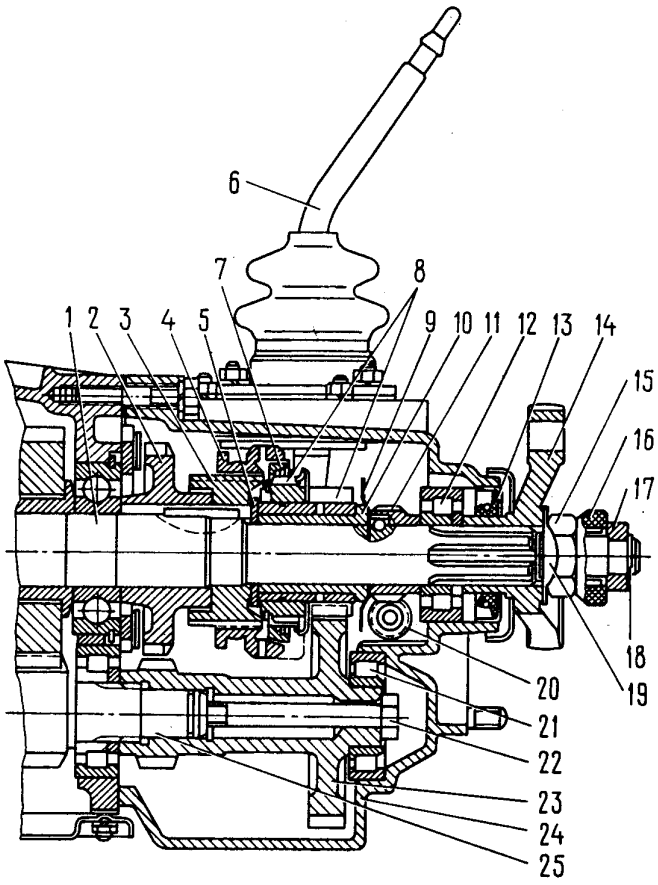


Fig. 3-31. Rear Part of Five-Speed Gearbox: 1 - main shaft; 2 - reverse driven gear; 3 - 5th speed synchronizer sleeve hub; 4 - synchronizer sleeve; 5 - washer; 6 - gearshift lever; 7 - synchronizer baulk ring; 8 - 5th speed synchronizer gear and toothed rim; 9 - oil deflecting washer; 10 - 5th speed gear bushing; 11 - speedometer drive driving gear; 12 - main shaft rear bearing; 13 - gland; 14 - flexible coupling flange; 15 - nut; 16 - aligning ring seal; 17 - aligning ring; 18 - lockring; 19 - lockwasher; 20 - speedometer drive driven gear; 21 - gear cluster bearing; 22 - gear cluster bolt; 23 - 5th speed and reverse gear cluster; 24 - gearbox rear cover; 25 - countershaft

gear cluster 4 from the splines of the countershaft.

Remove reverse idler gear 1 (Fig. 3-35) from the axle and gear 3 complete with the sleeve and shift fork 4 from the main shaft.

Remove washer 5 (Fig. 3-31) from the main shaft and then, using the shaped drivers of screwdriver type remove 5th speed synchronizer sleeve hub 4 (Fig. 3-36) and reverse driven gear 2 from the key.

Further disassembly of the five-speed gearbox should be carried out in the order specified for the four-speed gearbox.

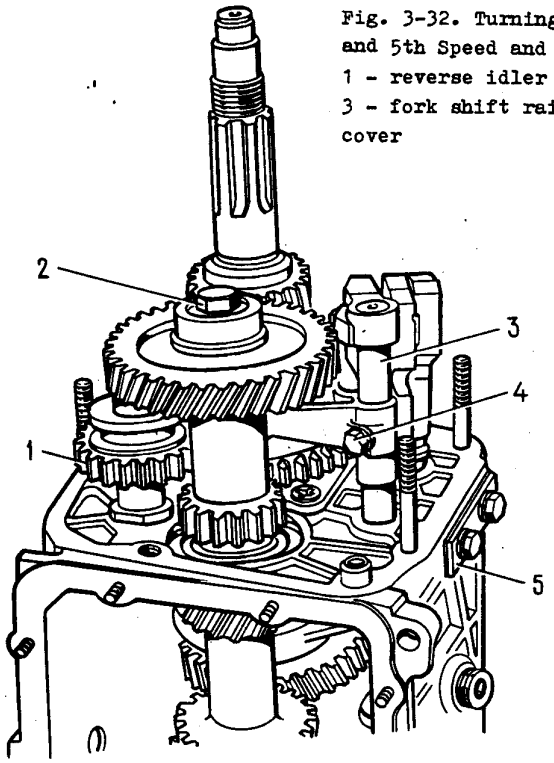


Fig. 3-32. Turning Out Bolts Holding Gear Cluster and 5th Speed and Reverse Shift Fork:
1 - reverse idler gear; 2 - gear cluster bolt; 3 - fork shift rail; 4 - fork bolt; 5 - detent cover

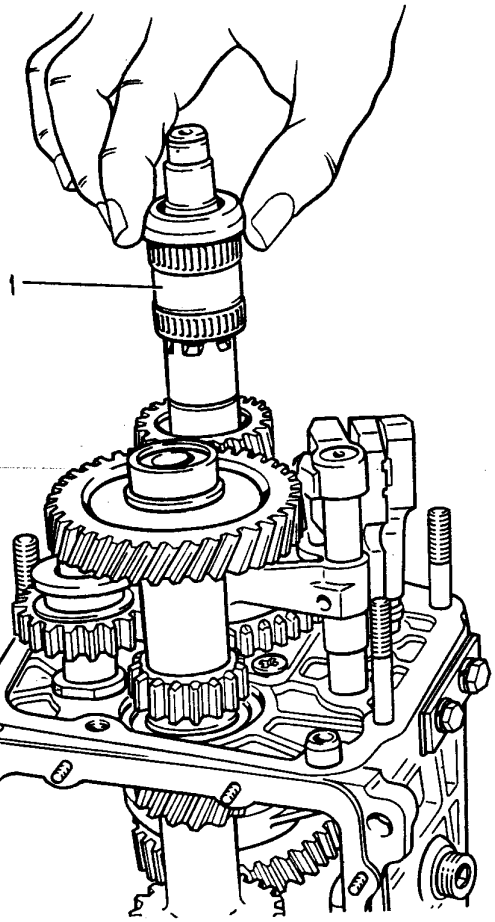


Fig. 3-33. Removing 5th Speed Gear Bushing:
1 - bushing

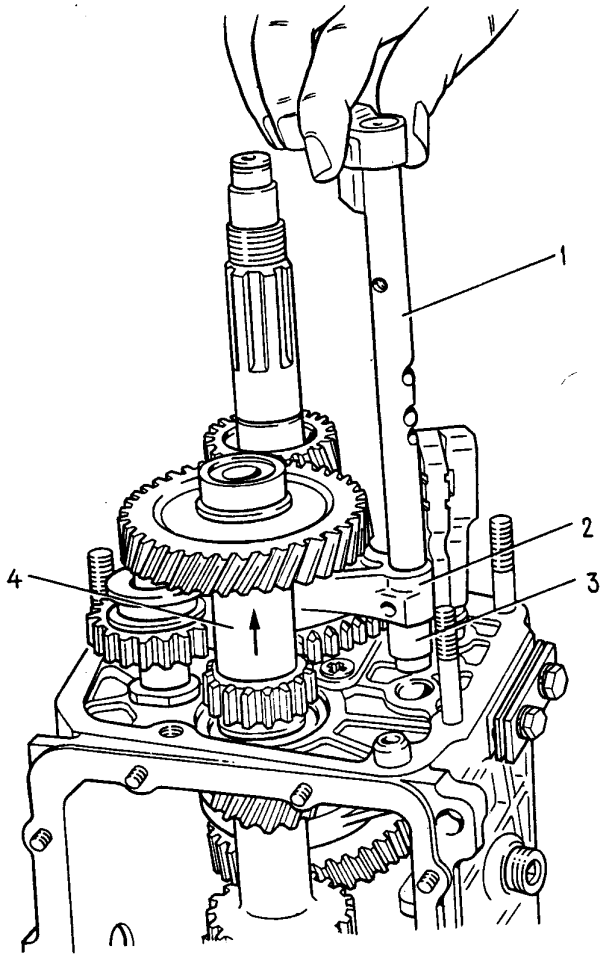


Fig. 3-34. Removing 5th Speed and Reverse Shift Rail and Gear Cluster:
1 - 5th speed and reverse shift rail; 2 - 5th speed and reverse shift fork; 3 - distance bushing; 4 - gear cluster

When necessary, disassemble the gearshift lever and mechanism proceeding as follows:

- remove boot 10 (Fig. 3-37), lockring 8 and thrust ring 7, the spring and spherical washer 5 from the gearshift lever;
- note visually the arrangement of the parts relative to notch A on the guide plate to return the parts in the initial position during the assembly;
- having turned off the nuts, disconnect the parts of the gearshift mechanism and remove lever 9, its ball support 4 and rubber sealing rings 15.

Assembly of the 5th speed, reverse and gearshift mechanism should be carried out in the

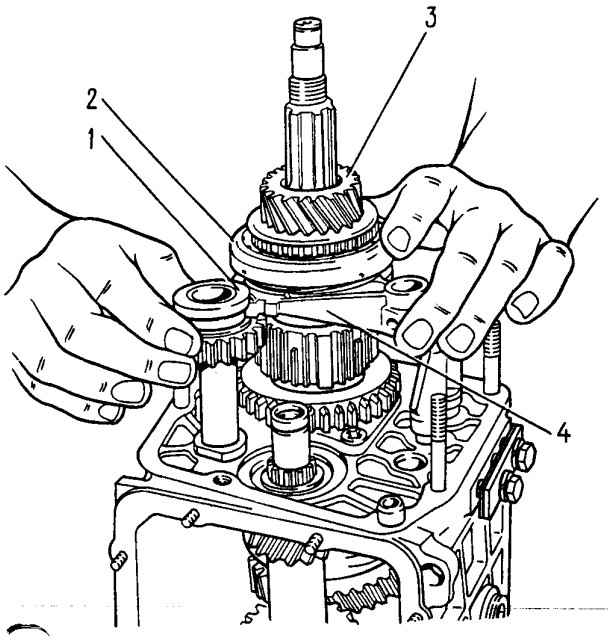


Fig. 3-35. Removing Reverse Idler Gear and 5th Speed Gear Complete with Synchronizer and Fork:
1 - reverse idler gear; 2 - 5th speed shifter sleeve; 3 - 5th speed gear with synchronizer; 4 - 5th speed and reverse shift fork

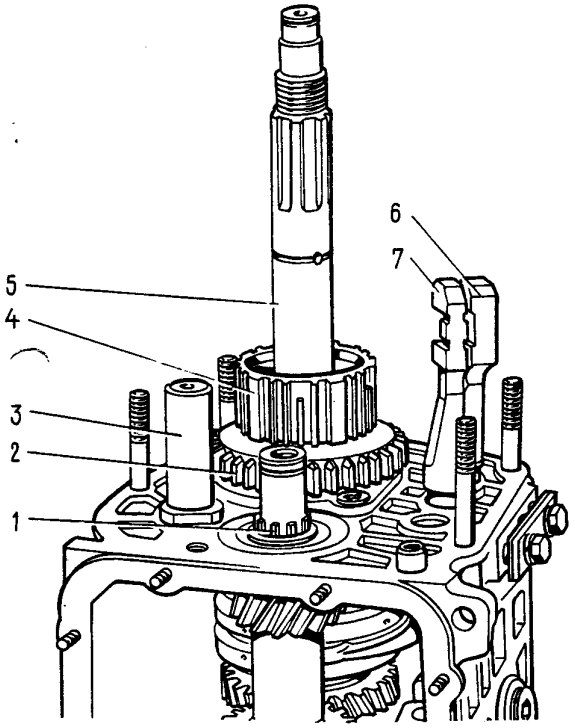


Fig. 3-36. Removing Reverse Driven Gear and 5th Speed Synchronizer Sleeve Hub:
1 - countershaft; 2 - reverse idler gear; 3 - reverse idler gear axle; 4 - 5th speed synchronizer sleeve hub; 5 - main shaft; 6 - 1st and 2nd speed shift rail; 7 - 3rd and 4th speed shift rail

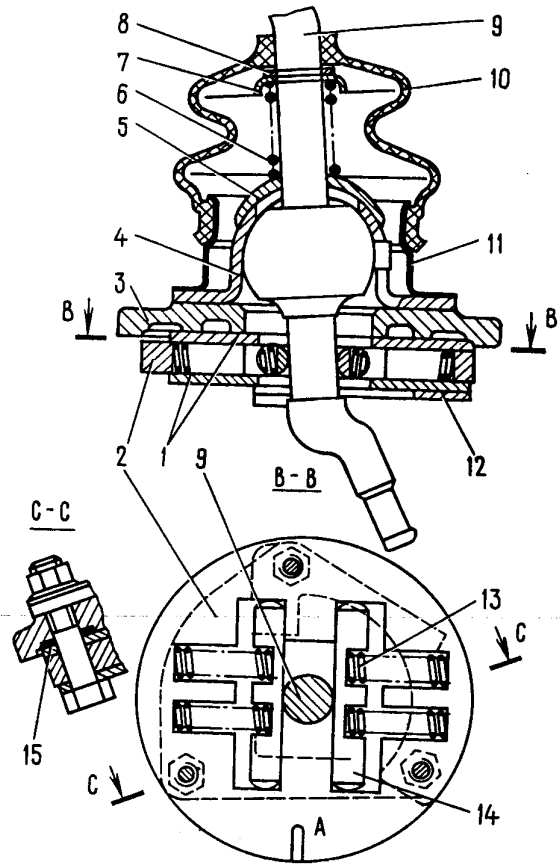


Fig. 3-37. Gearshift Mechanism:
1 - guide plate washer; 2 - guide plate; 3 - gearshift lever housing; 4 - ball support; 5 - spherical washer; 6 - spring; 7, 8 - retaining rings; 9 - gearshift lever; 10 - boot; 11 - flange; 12 - reverse lock plate; 13 - spring; 14 - guide strip; 15 - sealing ring; A - notch

sequence reverse to their disassembly with due account of the following:

- secure the reverse idler gear axle applying a torque of 78 N.m (8kgf·m)before mounting the shafts in the gearbox housing;
- prior to installing the 5th speed and reverse shift rail in the housing, mount the distance bushing on the shift rail;
- press-fit the inner race of the bearing on the reverse and 5th speed gear cluster and the outer race, in the socket of the rear cover;
- press-fit the rear bearing of the main shaft onto the shaft to facilitate mounting the rear cover;
- install simultaneously reverse idler gear 1 (Fig. 3-35), gear 3 and fork 4;
- when assembling the gearshift lever, coat the ball head or the sphere of the ball support with ЛСЦ-15 or Литол-24 grease;
- tighten the bolt of the gear cluster with a torque of 78 N.m (8 kgf.m).

The design of the transfer case is illustrated in Figs 3-38 and 3-39.

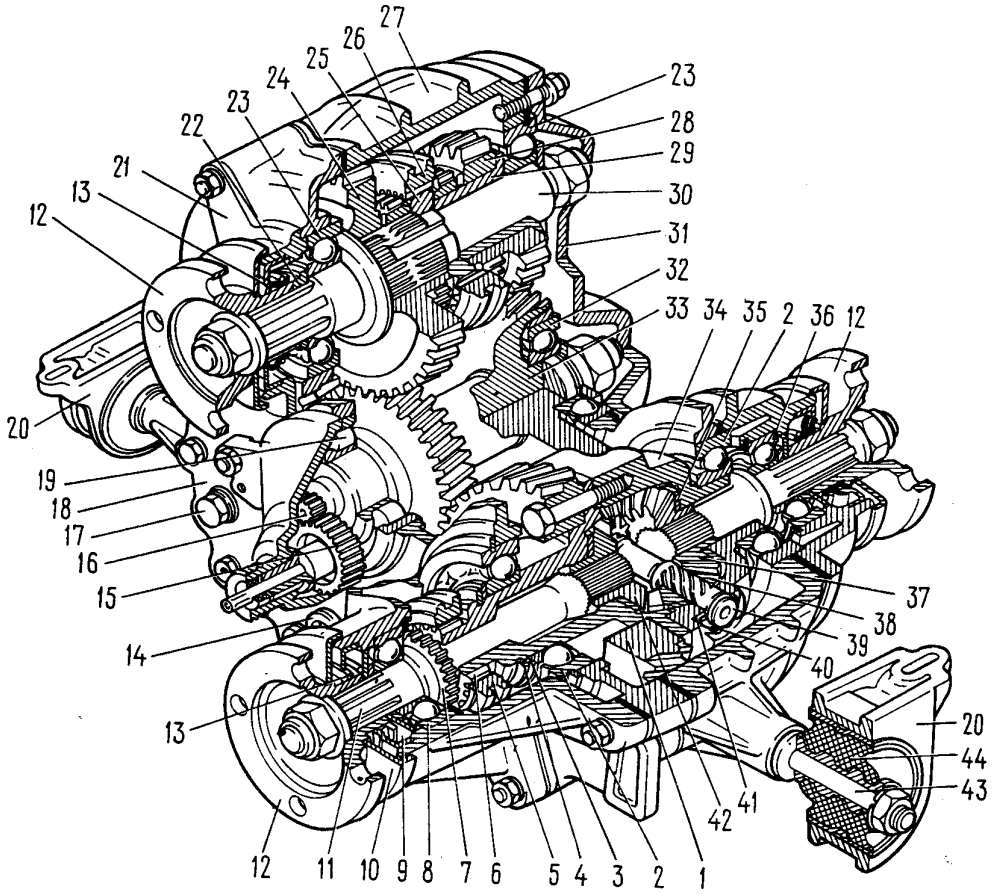


Fig. 3-38. Transfer Case:
1 - driven gear; 2 - differential bearings; 3 - spring washer; 4 - lockring; 5 - differential lock coupling; 6 - differential housing toothed rim; 7 - front axle drive shaft toothed rim; 8 - front axle drive shaft bearing; 9 - oil slinger; 10 - mud guard; 11 - front axle drive shaft; 12 - flange; 13 - gland; 14 - oil drain plug; 15 - speedometer drive driven gear; 16 - speedometer drive driving gear; 17 - oil filler and level check plug; 18 - transfer case front cover; 19 - countershaft roller bearing; 20 - transfer case mount bracket; 21 - drive shaft bearing cover; 22 - bearing thrust ring; 23 - drive shaft bearings; 24 - high speed gear; 25 - shifter sleeve hub; 26 - shifter sleeve; 27 - transfer case housing; 28 - low speed gear; 29 - low speed gear bushing; 30 - drive shaft; 31 - rear cover; 32 - countershaft ball bearing; 33 - countershaft; 34 - differential housing; 35 - rear axle drive gear thrust washer; 36 - rear axle drive shaft bearing; 37 - rear axle drive gear; 38 - differential pinion; 39 - pinion shaft; 40 - pinion shaft lockring; 41 - spring washer; 42 - front axle drive gear; 43 - transfer case mount pivot; 44 - mount bracket rubber pad

TROUBLE SHOOTING

Cause	Remedy
Vibration of Transfer Case and Body Floor (in Front Seat Area) and at Starting from Halt and Acceleration in 1st, 2nd and 3rd Gears	
1. Misalignment of transfer case and gearbox	1. Align transfer case and gearbox

Cont'd

Cause	Remedy
2. Bending of bolts and flexible coupling flange	2. Replace bolts or intermediate propeller shaft assembly
3. Loose or damaged supports of transfer case or rear support of gearbox	3. Tighten attachment bolts or replace support

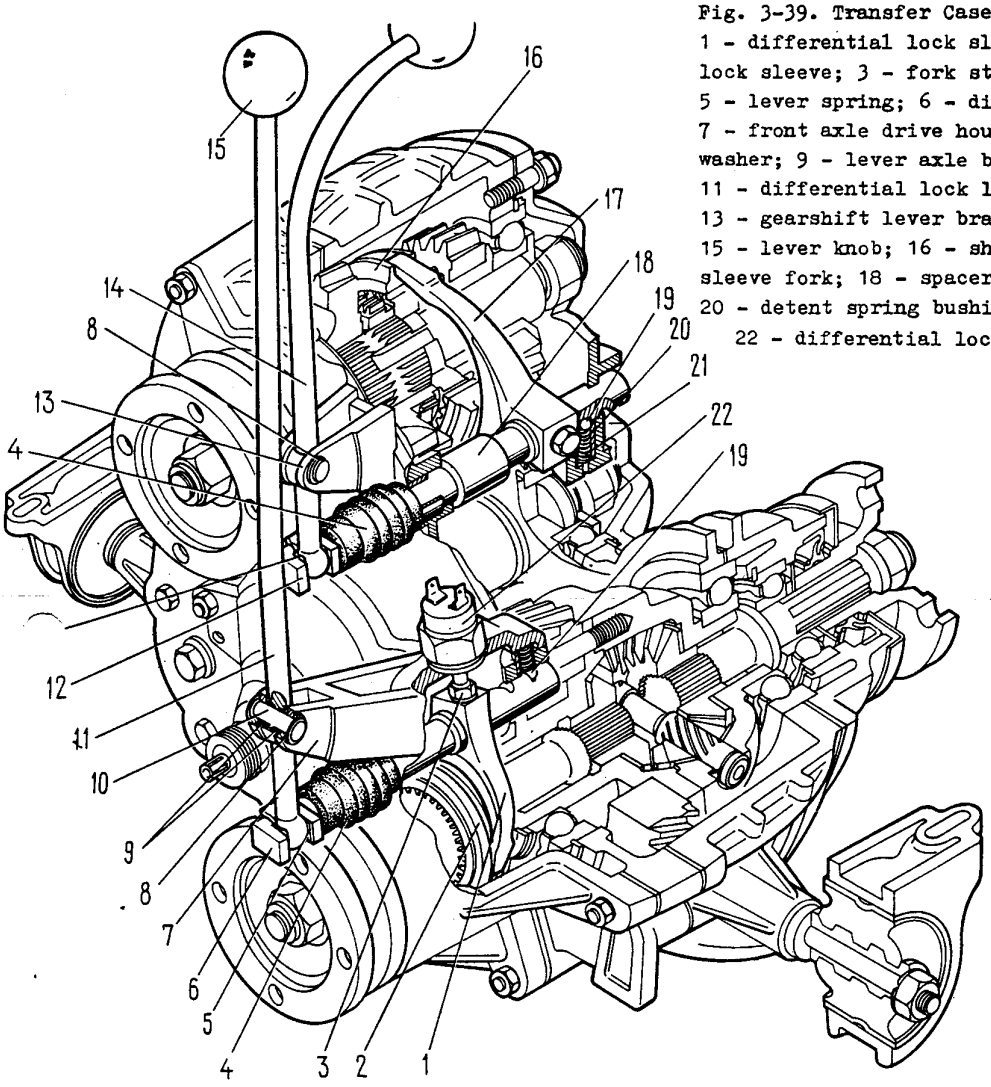


Fig. 3-39. Transfer Case Control Mechanism:
1 - differential lock sleeve fork; 2 - differential lock sleeve; 3 - fork stop bolt; 4 - rod boot; 5 - lever spring; 6 - differential lock fork rod; 7 - front axle drive housing cover; 8 - lock-washer; 9 - lever axle bushing; 10 - lever axle; 11 - differential lock lever; 12 - shift fork rail; 13 - gearshift lever bracket; 14 - gearshift lever; 15 - lever knob; 16 - shifter sleeve; 17 - shifter sleeve fork; 18 - spacer bushing; 19 - detent ball; 20 - detent spring bushing; 21 - detent spring; 22 - differential lock warning lamp switch

Cont'd

Cause	Remedy
	Vibration of Transfer Case and Body Floor (in Front Seat Area) in Motion (especially at 80 - 90 km/h)
1. Intermediate propeller shaft out of balance	1. Replace intermediate propeller shaft
2. Bending of bolts and flexible coupling flange	2. Replace bolts and intermediate propeller shaft
3. Binding of universal joint of intermediate propeller shaft	3. Replace damaged parts of universal joint
4. Loose bolts of engine mounts or defective engine mounts	4. Tighten up bolts or replace engine mounts
5. Excessive vibration of engine	5. Reveal cause of vibration and eliminate it

Cont'd

Cause	Remedy
6. Front or rear propeller shaft out of balance	6. Replace or repair damaged or worn propeller shaft
7. Binding in universal joints of front or rear propeller shaft	7. Repair or replace universal joints
8. Centre differential out of balance	8. Balance centre differential
	Noise on Turns or During Slipping of Wheels
1. Difficult rotation of differential pinions on shaft	1. Replace worn or damaged parts
2. Jamming of axle drive gears in differential housing	2. Replace worn or damaged parts
3. Damaged working surface of pinion shaft	3. Replace worn or damaged parts

Cause	Remedy
4. Excessive end play of axle drive gears in differential housing	4. Set a clearance of 0 - 0.10 mm with adjusting shims
5. Wear of spherical surface of differential housing	5. Replace worn parts

Difficult Gearshifting or Differential Locking

1. Sleeve jammed on splines of hub or differential housing	1. Dress off any burrs, nicks or scores, replace defective parts
2. Nicks on teeth of smaller rim of high or low speed gears, also on teeth of sleeves and on splines of front axle drive shaft	2. Dress off any nicks and burrs, replace faulty parts
3. Bent fork or shift rail	3. Straighten distorted parts
4. Distortion of transfer case control levers	4. Straighten levers or replace them by new ones
5. Jamming of control levers on axles	5. Remove levers, clean axles and bushings. Replace faulty parts

Uncontrollable Disengagement of Gears or Differential Lock

1. Wear of gear and sleeve teeth	1. Replace worn parts
2. Detent springs lost their resilience or its parts heavily worn	2. Replace springs or worn parts
3. Incomplete engagement of gears and differential lock caused by distortion of control parts or nicks on gears, sleeves and splines	3. Straighten or replace distorted parts, dress down nicks and burrs; replace defective parts

Leakage of Oil

1. Sealing gaskets damaged	1. Replace gaskets
2. Loosening of cover-to-housing nuts and studs	2. Tighten up nuts and studs at places of leakage
3. Shaft glands worn or damaged	3. Replace glands
4. Worn glands of transfer case shift rail bushings	4. Replace glands

Cause	Remedy

Methods of Revealing Causes of Vibration of Transfer Case and Body Floor (in Front Seats Area)

First of all note the speed at which vibration of the transfer case appears and then proceed to revealing its cause.

Test No.1.

Set the transfer case and gearbox levers in neutral and start the engine. Raise the crankshaft speed to the value corresponding to the car speed at which vibration appears.

If vibration appears on the motionless car, check attachment and condition of the engine mounts as they cause the vibration.

Test No. 2.

If test No. 1 does not reveal vibration, set the transfer case levers in neutral, start the engine and shift into the direct drive in the gearbox and set the crankshaft speed corresponding to the car speed at which vibration of the transfer case appears.

If vibration is detected on the motionless car, its cause is a defect in the intermediate propeller shaft (unbalance, bending of the bolts or flange of the flexible coupling, jamming in the universal joint).

Test No. 3.

If tests Nos 1 and 2 do not reveal vibration, proceed to test No. 3. For this purpose race the car to the speed at which vibration was detected and set the transfer case and gearbox levers in neutral. If vibration persists, the cause of trouble is a defect in the front or rear propeller shafts (unbalance, jamming of the universal joints) or unbalance of the centre differential.

REMOVAL, INSTALLATION AND ALIGNMENT

Removal. Place the car on an inspection pit or a lift. Release the parking brake lever and set the gearbox and transfer case control levers in neutral. Take off the facing of the floor housing lining, the lever hatch lid and the knobs from the levers.

Disconnect the speedometer flexible drive shaft from the transfer case and the wires from the differential lock warning lamp transmitter. Rotating the propeller shafts, detach their flanges from the transfer case shafts.

Unscrew the nuts of bolts 3 (Fig. 3-40) of transfer case mount brackets 1 and take off the case complete with the brackets and shims 5 located under the brackets. Mark each shim so as to put them back in the unchanged number.

To install and align the transfer case, proceed as follows:

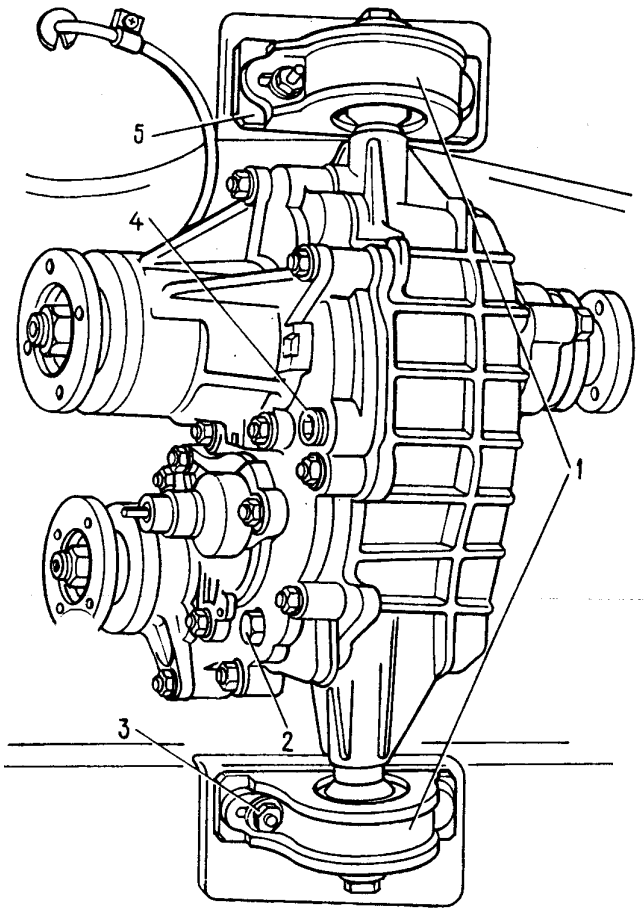


Fig. 3-40. Transfer Case Mounting:
1 - transfer case mount brackets; 2 - filler plug; 3 - mount bracket nut; 4 - drain plug; 5 - adjusting shims

- make sure that the engine mount pads are properly installed in the brackets (the centring washers of the front mount pads of the engine should get into the respective holes in the side brackets);

- mount the transfer case on the car without tightening completely the transfer case mount bracket nuts 4 and 5 (Fig. 3-41);

- shifting the transfer case along and across the body and in the vertical plane find the position in which the flanges of the transfer case drive shaft and the intermediate propeller shaft are at one level and parallel, with a minimum clearance in between; the shafts of the transfer case should be parallel to the body bottom;

- installing previously removed adjusting shims 5 under the brackets, tighten completely the transfer case bracket nuts;

- connect the front and rear propeller shafts to the transfer case shafts; connect the flexible shaft to the speedometer drive and fasten the wires to the transmitter of the differential lock warning lamp.

When replacing the transfer case or changing the four-speed gearbox by the five-speed one or vice versa and also in case of sagging of the engine rear mount which causes vibration of the transfer case, select adjusting shims 5 (Fig. 3-40) of a required thickness and install them in place.

To select the shims proceed as follows:

- make sure the engine mount pads are installed correctly in the brackets (see Engine Removal and Installation);

- separate the flanges of the transfer case drive shaft and the intermediate propeller shaft;

- loosen the nuts holding the transfer case supports to the body, remove adjusting shims and shifting the transfer case along and across the body and in the vertical plane find the position

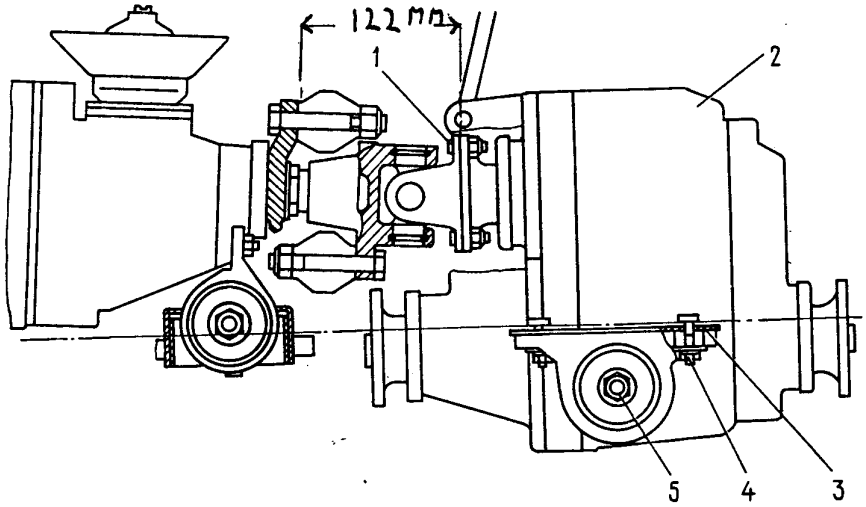
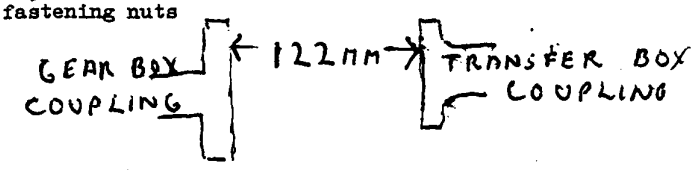


Fig. 3-41. Transfer Case Installation Diagram:
1 - flange bolts of intermediate propeller shaft and transfer case drive shaft; 2 - transfer case; 3 - adjusting shims; 4 - transfer case-to-body nuts; 5 - transfer case mount bracket-to-pivot fastening nuts



of the transfer case in which the disconnected flanges are at one level and in parallel with each other and the clearance between the flanges is minimum, and the transfer case shafts are parallel to the car bottom;

- fill up the clearance between the body floor and the supports with the required number of shims;

- align the centring belts of the flanges taking care to prevent interference in the transfer case and engine mounts and, holding the transfer case in this position, tighten up the previously backed off nuts of the transfer case mounts;

- insert and tighten the bolts of the transfer case and intermediate shaft flanges; if the bolts freely pass into the flange holes, the alignment is correct, otherwise repeat the flange alignment operation.

DISASSEMBLY AND ASSEMBLY

Disassembly. Wash the transfer case and drain oil.

Fasten the transfer case on a disassembly stand and loosen the flange nuts on the drive shaft and on the front and rear axle drive shafts.

Unscrew the fastening nuts and take off front axle drive housing 1 (Fig. 3-42) complete with cover 2, lever, fork, differential lock sleeve and front axle drive shaft. Remove speedometer drive housing 3 complete with the speedometer drive driven gear.

Take off lock washer 8 (Fig. 3-39), pull out axle 10 and remove differential lock lever 11. Then take off front axle drive housing cover 7, take out the spring and detent ball 19. Unscrew stop bolt 3 of differential lock fork 1 and take out rod 6, fork 1 and lock sleeve 2.

Remove rear cover 31 (Fig. 3-38) complete with the rear axle drive shaft taking care not to damage the sealing gasket. Then take flanges 12 off the drive shaft and the front and rear axle drive shafts.

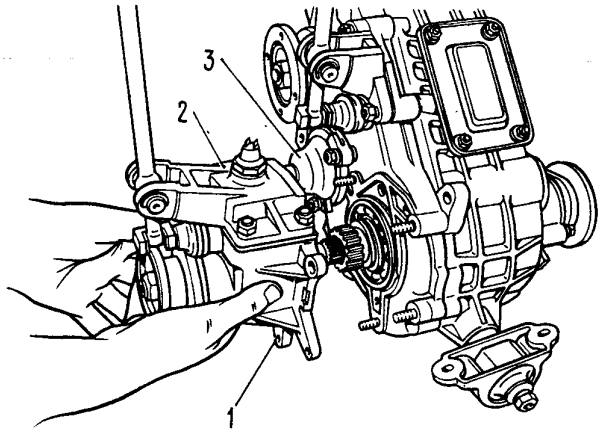


Fig. 3-42. Removing Front Axle Drive Housing:
1 - front axle drive housing; 2 - housing cover;
3 - speedometer drive housing

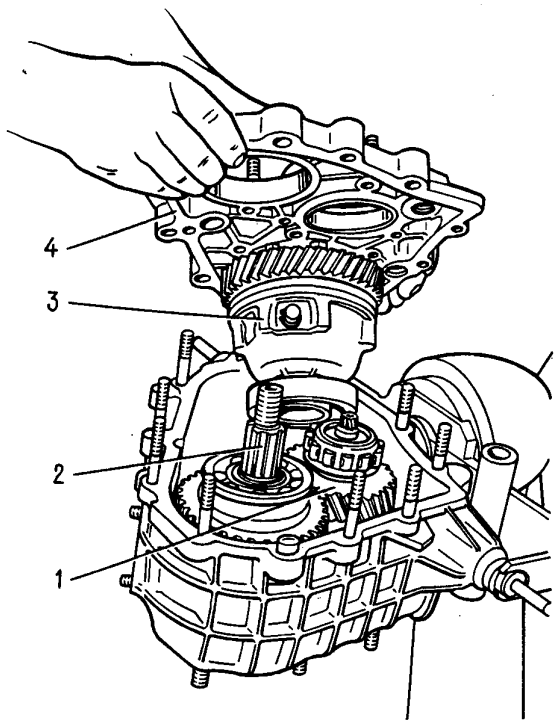


Fig. 3-43. Removing Transfer Case Front Cover:
1 - countershaft; 2 - drive shaft; 3 - differential; 4 - front cover

Remove the setting rings of the front and rear axle drive shaft bearings. Remove front axle drive shaft 11 from the housing complete with bearing 8, thrust ring and oil slinger 9. Take the rear axle drive shaft out of rear cover 31 complete with bearing 36, thrust ring and oil slinger.

Remove drive shaft front bearing cover 21 and the inspection port lid.

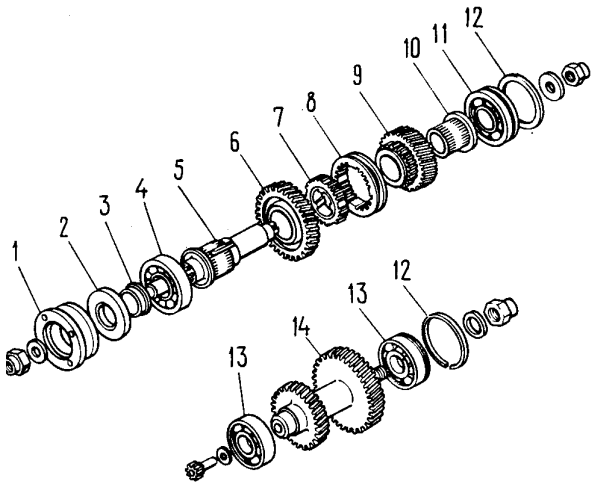
Remove gearshift lever bracket 13 (Fig. 3-39) with the lever. Then take off the lock washer, pull out the axle and remove lever 14.

Unscrew the stop bolt of shifter sleeve fork 17 and, closing the detent socket with a finger, take out carefully shift rail 12 and the detent parts.

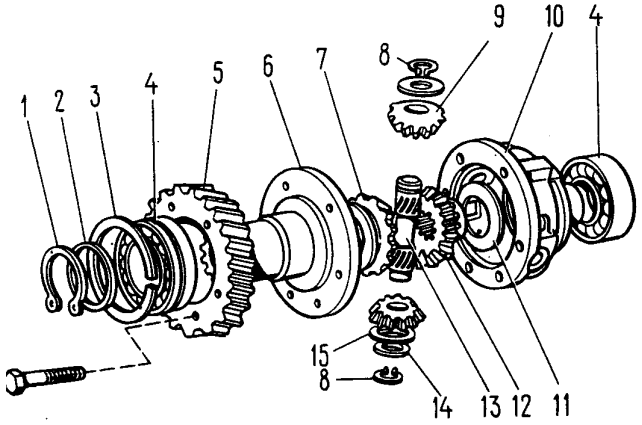
Remove front cover 4 (Fig. 3-43) complete with the differential, then the differential bearing setting ring and take the bearing complete with the differential out of the front cover.

Remove the setting rings from the rear bearings of the drive shaft and countershaft and remove both shafts, the drive shaft and countershaft, from the transfer case housing.

Clamp the drive shaft in a vice, remove the thrust ring and rear bearing 11 (Fig. 3-44) with a general-purpose remover tool. Remove low speed gear 9 from the drive shaft complete with bushing



ig. 3-44. Parts of Drive Shaft and Countershaft:
- flange; 2 - gland; 3 - bearing thrust ring;
- front bearing; 5 - drive shaft; 6 - high speed
gear; 7 - hub; 8 - sleeve; 9 - low speed gear;
10 ashing; 11 - rear bearing; 12 - bearing set-
ting ring; 13 - countershaft bearings; 14 - coun-
tershaft



Fi 3-45. Parts of Transfer Case Differential:
1 - lockring; 2 - spring washer; 3 - bearing set-
ting ring; 4 - differential housing bearings;
5 - driven gear; 6 - differential front housing;
7 - front axle drive gear; 8 - pinion shaft lock-
ring; 9 - differential pinion; 10 - differential
rear housing; 11 - supporting washer; 12 - rear
axle drive gear; 13 - differential pinion shaft;
14 - pinion shaft spring washer; 15- washer

10, then shifter sleeve 8, hub 7 and high speed gear 6.

Disassemble the differential as follows:

- remove lockring 1 (Fig. 3-45) and spring washer 2 of the front bearing;
- remove the front and rear bearings from the differential housing (Fig. 3-46) with a general-purpose remover tool and stop 67.7853.9559;
- unscrew the differential housing bolts and separate the housing halves;

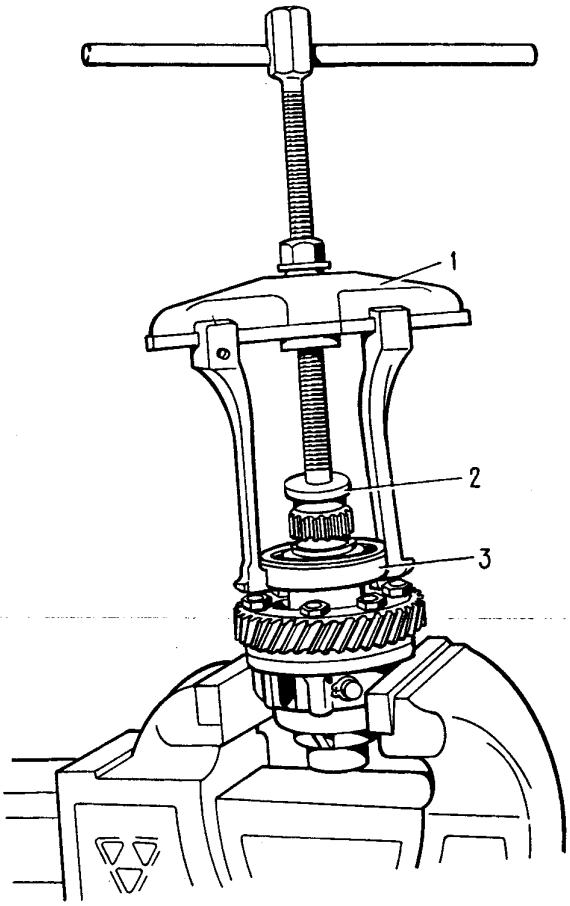


Fig. 3-46. Pressing Bearing Off Differential Housing:
1 - remover tool A.40005/1/6; 2 - stop 67.7853.9559; 3 - bearing

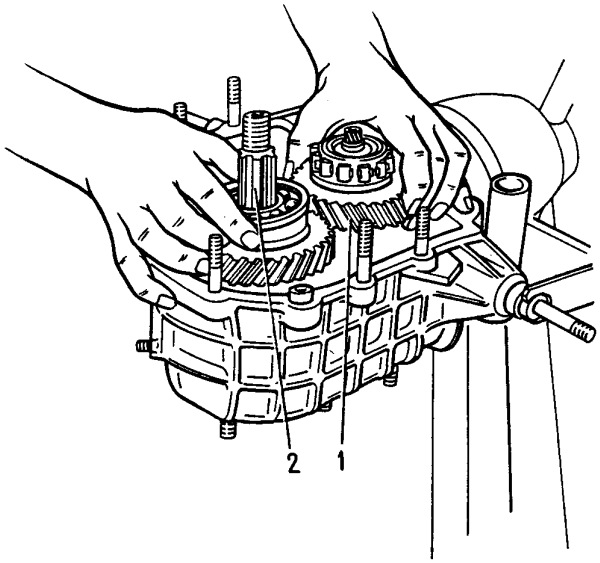


Fig. 3-47. Installation of Drive Shaft and Countershaft:
1 - countershaft; 2 - drive shaft

- remove the differential driven gear;

- remove lockrings 8 (Fig. 3-45) and spring washer 14, then drive out the pinion shaft and take off the differential pinions and the driving axle gears with supporting washers.

Press the worn or damaged glands out of the front axle drive housing, from the front bearing cover and from the rear cover. Unscrew the nuts from the mount pad axles and take off the bracket assemblies.

Assembly. To assemble the transfer case reverse the disassembly procedure, observing the following requirements:

- the axial clearance of each axle drive gear should be 0 - 0.10 mm and the antitorque moment of the gears should not be over 14.7 N.m (1.5 kgf.m). If the clearance is larger, install thicker supporting washers; if the thickest washers fail to produce the prescribed clearance, replace the gears with new ones since they are excessively worn;

- the drive shaft and countershaft should be installed into the transfer case housing simultaneously (Fig. 3-47);

- press the bearings on the differential housing with mandrel 67.7853.9558 (Fig. 3-48);

- coat the working surfaces of glands with grease Литол-24 before installing them into covers and housings;

- tighten the threaded joints with torques indicated in Appendix 2;

- for upsetting the nuts of the transfer case shafts use fixture 67.7820.9520 (Fig. 3-49).

After assembly pour oil into the transfer case to the lower edge of the filler hole.

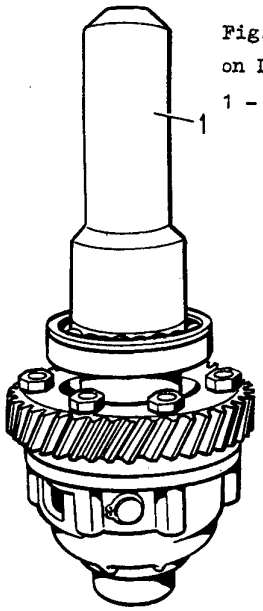


Fig. 3-48. Press-Fitting Bearing on Differential Housing:
1 - mandrel 67.7853.9558

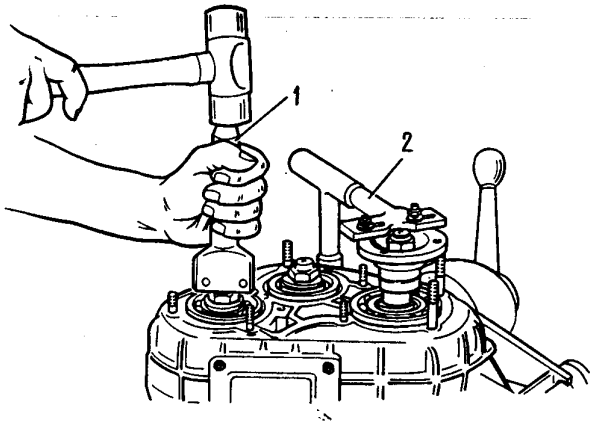


Fig. 3-49. Upsetting Rear Axle Drive Shaft Flange Nut:
1 - fixture 67.7820.9520; 2 - flange retainer

INSPECTION

Before inspection clean all the transfer case parts with a brush and scraper, wash them carefully and airblast. Pay particular care to washing and airblasting the bearings; protect them against being quickly rotated and damaged by the compressed air jet.

Housing and covers. The housing and covers should be free of cracks; the surfaces of the bearing bores should bear no signs of wear, nicks and chipping. Scoring of the housing surfaces contacting the covers may bring about axial misalignment of the shafts and leakage of oil. Minor scores should be smoothed down with a file. Replace the parts that are heavily damaged or worn.

Glands. Examine the glands closely and replace even if slightly damaged. The working edge should not be worn in width by more than 1 mm.

Shafts. The active surfaces, threaded portions and splines of the shafts should bear no signs of damage. Check runout of the drive shaft and the front and rear axle drive shafts, mounting them on Vee-blocks and turning by hand. Runout of the face part of the thrust bands for the bearings should not exceed 0.01 mm.

While examining the countershaft take a note of the condition of the gear cluster and the speedometer drive driving gear. The teeth must not be chipped, nor excessively worn. Replace defective parts.

Gears. While examining the gears, check their teeth and mounting surfaces. The teeth must not be chipped, nor excessively worn. The mounting surfaces of the gears should have no scores or wear which cause excessively large clearances.

Check the clearance of meshing gears; the assembly clearance should be 0.10, wear limit - 0.20 mm.

The assembly clearance between the low speed gear and bushing and that between the drive shaft and the high speed gear should be 0.05 - 0.10 mm, the wear limit being 0.15 mm. Replace the gears if they are worn in excess of the permissible limits.

Bearings. The ball and roller bearings should have no damage on the raceways, cages, roller or balls, and no cracks and chipping on the races. The radial clearance of the bearings should not be over 0.05 mm.

Rotation of the dry and clean bearing should produce no noise and it should be even, without jamming. Replace the bearings if they are damaged.

Shift rails, forks. There should be no distortion of the forks and jamming of the shift rails in the housing bores. Replace the detent parts with new ones in case of jamming. The detent springs should also be replaced if they have lost their resilience. The length of the spring under a load of (107±7.85) N [(11±0.8) kgf] should be 19 mm, and its free length, 23.3 mm.

Hubs, sleeves. Look for any signs of jamming on the hub of the shifter sleeve, particularly on the sliding surfaces of the sleeves, and on the splines of the differential housing. Dress any scores and burrs with a file. Pay particular attention to the faces of the sleeve teeth; if they are damaged or mutilated, and thus interfere with free movement of the sleeve during gearshifting, replace the sleeve.

Differential. Examine the surfaces of the pinion shafts and of the bores in the pinions; in case of minor damage, dress the surfaces with fine grain abrasive cloth; in case of heavy damage, replace the parts by new ones.

Examine the surfaces of the necks of the axle drive gears and of their mounting holes in the differential housing, the condition of the surfaces of the axle drive gear supporting washers and of the supporting surfaces in the differential housing for the pinions. Smooth down any discovered roughness with fine-grain abrasive cloth or a superfine file; heavily damaged or worn parts must be replaced.

Remove spring washer 15 (Fig. 3-45) and make sure there is no radial displacement of lockrings 8 in the grooves of shaft 14. Replace the lockrings if they are found to be loosely fitted.

TRANSFER CASE CHECKS

Check an assembled transfer case on a stand for noise, standard of assembly and absence of oil leaks. Carry out the checks successively in high and low gears at the following drive shaft speeds in both directions:

1st mode - 100-200 min^{-1}
2nd mode - 2000-2500 min^{-1}
3rd mode - 3500-4000 min^{-1}

At the 2nd mode check the transfer case at no-load and at a load with a variable torque; at the 1st and 3rd mode - under no load.

Check the functioning of the differential at the 1st mode, braking the front and rear axle drive shafts one after the other to a complete stop.

Be sure to shift the gears and lock the differential with the shafts of the transfer case stationary.

There should be no such defects as jamming and rough engagement of gears and differential lock, knocking or uneven noise of gears, and oil leaks.

PROPELLER SHAFT DRIVE

Since the second half of 1988 the VAZ-2121 cars and their versions are furnished with the propeller shaft drive on universal joints of increased longevity. The components of the new propeller shaft drive are not interchangeable with those of earlier make, but propeller shaft drives in assembly may be used one instead of the other.

The new propeller shaft drive is distinguished

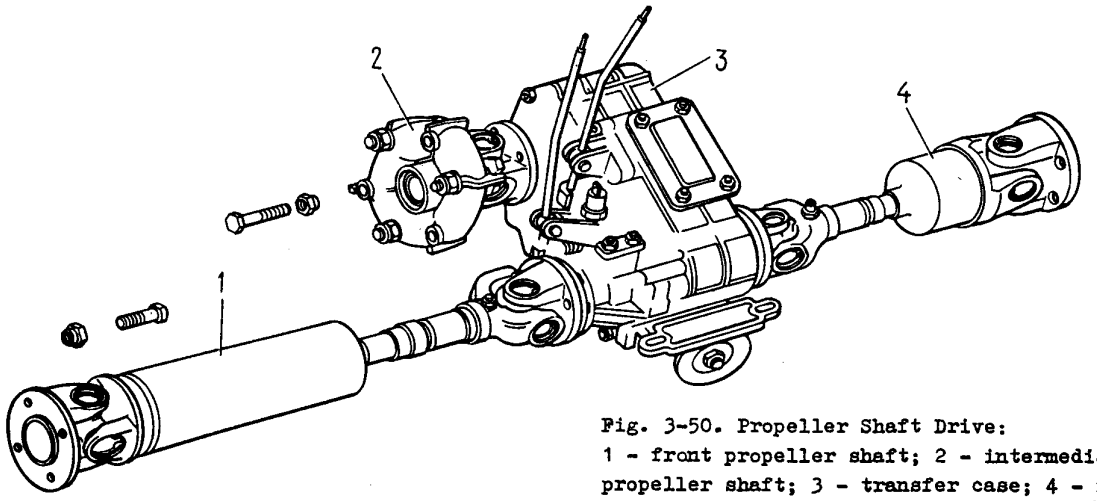


Fig. 3-50. Propeller Shaft Drive:
1 - front propeller shaft; 2 - intermediate propeller shaft; 3 - transfer case; 4 - rear propeller shaft

HARDY SPICER UNIVERSAL JOINT. GKN HS 194

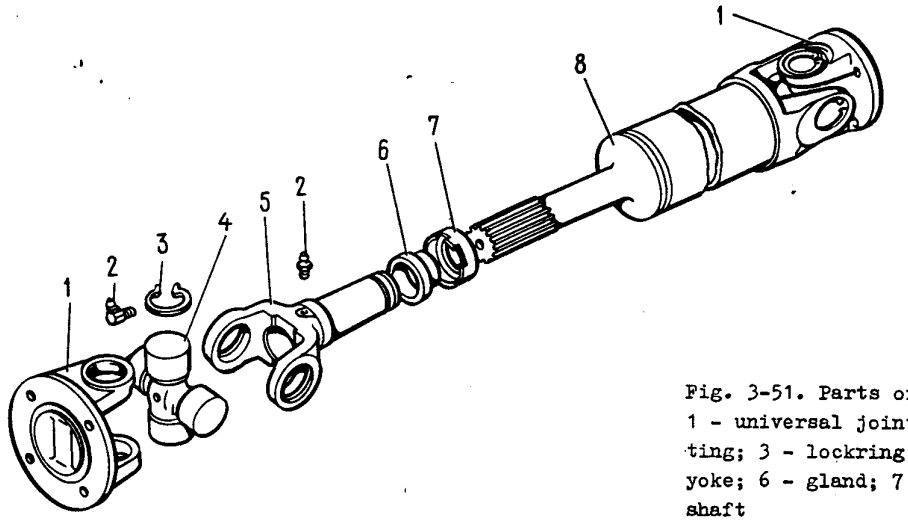


Fig. 3-51. Parts of Front Propeller Shaft:
1 - universal joint flange-yoke; 2 - grease fitting; 3 - lockring; 4 - cross assembly; 5 - slip yoke; 6 - gland; 7 - gland holder; 8 - propeller shaft

by the increased size of the parts and the provision of grease fittings in the universal joints and splined forks. The universal joints of the new propeller shaft drive are notable for improved sealing of the needle bearings and reliable dirt protection which is provided by the use of two glands of radial and end sealing type. The diameter of the cross trunnions and that of the bearings is increased. Cross bearings are lubricated through grease fittings with grease No. 158 or ФИОЛ-2У and the splined connections, by grease ФИОЛ-1 or ФИОЛ-2У.

The design of the propeller shafts is shown in Figs 3-50, 3-51 and 3-52.

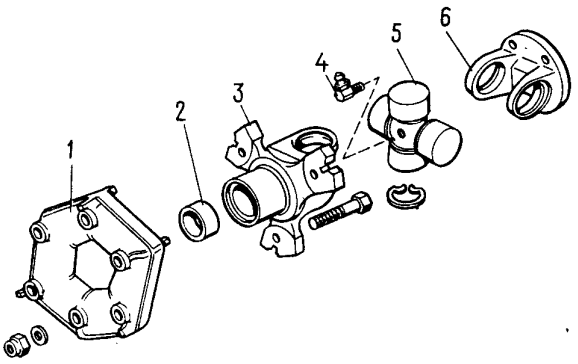


Fig. 3-52. Parts of Intermediate Propeller Shaft:
1 - flexible coupling; 2 - aligning bushing; 3 - flexible coupling flange; 4 - grease fitting; 5 - cross assembly; 6 - universal joint flange-yoke

TROUBLE SHOOTING

Cause	Remedy
Knocking in Propeller Shaft Drive When Starting from Rest, During Quick Acceleration or Gearshifting	
1. Loosening of bolts and nuts of flexible coupling and universal joint flanges	1. Tighten nuts with torques specified in Appendix 1
2. Excessive peripheral clearance in splined joints of front or rear propeller shafts	2. Measure clearance on pitch diameter of splines; replace worn parts if it exceeds 0.30 mm
3. Wear of universal joints	3. Repair joints by replacing worn parts
Noise and Vibration of Propeller Shaft Drive	
1. Distortion of front or rear propeller shafts	1. True up on a press, or replace shafts
2. Unbalance of propeller shafts	2. Check and balance shafts (see under "Balancing of Shafts")

Cont'd

Cause	Remedy
3. Wear or damage of flexible coupling flange aligning bushing of intermediate propeller shaft and of gearbox main shaft aligning ring	3. Replace flexible coupling flange complete with bushing, and main shaft aligning ring
4. Wear of universal joints	4. Repair universal joints by replacing worn parts
5. Loosening of gland holder of front or rear propeller shaft splined joint	5. Compress gland and its holder; replace gland in case of lubricant leaks
6. Insufficient lubrication of splined joints	6. Lubricate splined joints with ФИОЛ-1 or ФИОЛ-2У lubricant through grease fittings

Cont'd

Cause	Remedy
Oil Leakage	
Loosening of gland holder of front or rear propeller shaft splined joint	Compress gland and its holder; replace gland, if worn

REMOVAL AND INSTALLATION

Place the car on a lift or an inspection pit ensuring free rotation of front and rear wheels at one or both sides.

Fix the car in position reliably, release the parking brake and set the gearbox gearshift lever to neutral.

Remove the front and rear propeller shafts.

Put clamp A.70025 on flexible coupling 3 of the intermediate shaft (Fig. 3-14) and, rotating the shaft, unscrew the nuts of the bolts which fast[illegible] the flexible coupling to the gearbox main shaf[illegible]lange and of the bolts which fasten the intermediate shaft yoke to the flange of the transfer case drive shaft. Remove the intermediate shaft.

To install the propeller shafts reverse the removal operations. While installing the intermediate shaft align properly the gearbox and transfer case shafts (see Transfer Case. Removal, Installation and Alignment).

Before installing the intermediate shaft, apply 7-8 g of ЛСЦ-15 or Литол-24 lubricant to the surface of the flange aligning bushing.

INSPECTION WITHOUT DISASSEMBLY

Clean and wash the propeller shafts and check the universal joints for ease and smoothness of rotation of the yokes and for absence of considerable axial and radial clearances.

[illegible]heck the propeller shafts for balancing on a ba[illegible]nce stand as stated below.

If the yokes rotate smoothly, without jamming, the unbalance of the axle drive shafts does not exceed 2.16 N.mm (220 gf.mm) and that of the intermediate shaft is not over 2.36 N.mm (240 gf.mm) and if there are no leaks of lubricant through the glands of the cross bearings, it is better to refrain from disassembly of the propeller shafts.

DISASSEMBLY

Rear and Front Shafts. Mark the parts with paint or by centre-punching so as to reassemble them in the original position and to keep the balancing of the shafts unchanged.

Clamp the front (rear) propeller shaft in a vice with aluminium jaws. Remove the lockrings by means of round-nosed pliers.

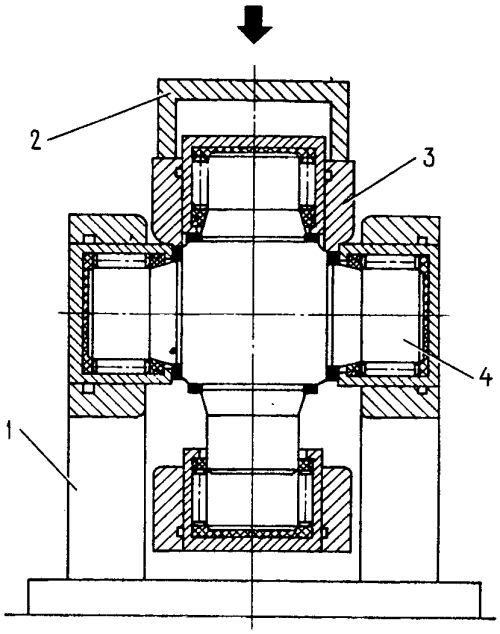


Fig. 3-53. Disassembling Universal Joint:
1 - press support; 2 - bushing; 3 - universal joint yoke; 4 - cross

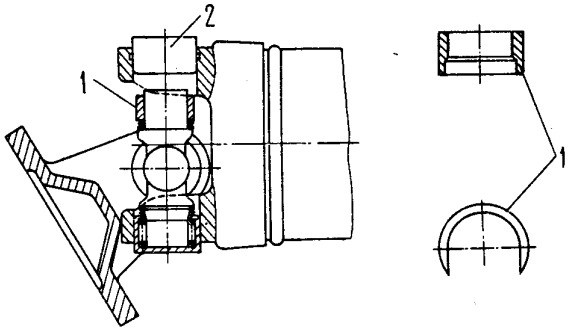


Fig. 3-54. Mounting Bushing for Disassembling Universal Joint:
1 - bushing; 2 - cross bearing

Press the bearing housings out of the universal joint yokes proceeding as follows:

- rest the universal joint fork of the propeller shaft on press support 1 (Fig. 3-53). Shift the other yoke (Ref. No. 3) of the joint to thrust against the cross by means of special bushing 2 and the rod of the press;
- turn the universal joint yoke through 180° and repeat the above operations, i.e. shift the other end of the yoke to thrust against the cross. When carrying out these operations, the opposite bearing of the cross will partially come out of the hole in the yoke and bushing 1 (Fig. 3-54) with a cut on the side can be installed into the clearance between the yoke and the cross to press out the bearing completely;

- install bushing 1 (Fig. 3-54) onto the cross trunnion and move the universal joint yoke down to press out bearing 2;

- proceeding as described above press out other bearings of the cross.

Intermediate shaft. Disconnect the flexible coupling from the flange, making a note of the number and location of balancing washers 1 (Fig. 3-56) and of the coupling relative to the flange so as to return them where they belong during reassembly. Disassemble the universal joint of the intermediate shaft in the same manner as described above.

INSPECTION

Runout check. Mount the front (rear) propeller shaft in centres and rotate it to check the runout of the tube which should not exceed following limits:

- 0.5 mm at 50 mm from the end welds;
- 0.3 mm in the middle.

If the runout exceeds the above limits, true up the shaft on a press or replace it by a new one.

Splined joint. Check the clearance in the splined joint of the front (rear) shaft slip yoke. The maximum permissible peripheral clearance on the pitch diameter of the splines is 0.30 mm.

Check whether the plug in yoke 5 (Fig. 3-54) is not missing and examine holder 7 and slip yoke gland 6. Replace the gland, if necessary, and the holder, if it is damaged.

Universal joints. Examine the bearing housings, needles, cross trunnions, glands and end washers.

If the bearing housings, needles and trunnions of the cross and glands or end washers are damaged or worn out, replace the cross in assembly with the bearings.

The diameter of the hole in the yoke for the needle bearing should not exceed 28.021 mm.

Flexible coupling. Examine the rubber elements of flexible coupling 1 (Fig. 3-52). In case of cracks or separation of rubber from the metal inserts, replace the flexible coupling.

Flexible coupling flange. Examine the aligning bushing of the flexible coupling flange. Replace the flange assembly in case of considerable wear or damage of the bushing.

ASSEMBLY

Assemble the propeller shafts by reversing the disassembly procedure, bearing in mind the following:

- apply 3 - 4 g of ФИОЛ-1 or ФИОЛ-2У lubricant uniformly to the splined joints;
- while joining the parts, align the marks made on the separable parts before disassembly;
- having assembled the splined joint, apply an axial load to the gland for compressing it by 0.3 - 0.5 mm and compress the holder on the yoke recess.

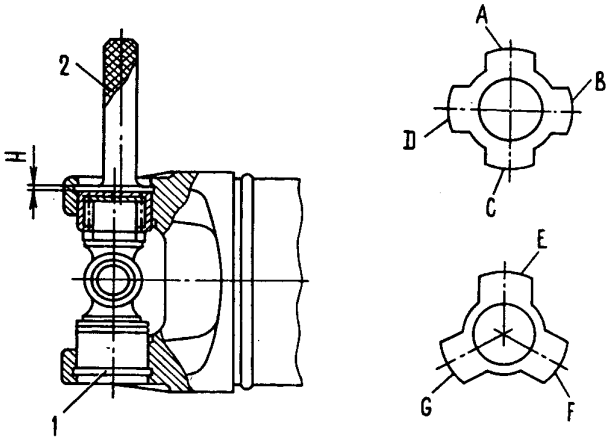


Fig. 3-55. Assembling Universal Joint:
1 - lockring; 2 - gauge; H - clearance
A, B, C, D, E, F, G - gauge blades of thickness, mm: 1.45; 1.48; 1.52; 1.56; 1.60; 1.64; 1.67

To assemble the universal joint proceed as follows:

- remove old thick grease and coat the inner surface of the bearing housing with grease No. 158 or ФИОЛ-2У (0.8 - 1.2 g per bearing). Do not coat with grease the cross trunnions to prevent formation of air pocket during the assembly. Insert the cross into the holes in the yokes. Press-fit the bearing into one hole in the yoke and fit 1.56 mm thick lockring 1 (Fig. 3-55) into the groove in the yoke. Press-fit the bearing into the other hole in the yoke till the opposite bearing thrusts against the end of the lockring. The effort of press-fitting should not exceed 15,000 N (1,500 kgf).

Using two gauges 2 with, respectively, 4 and 3 blades of different thickness, determine which blade gets tightly in clearance H between the bearing bottom and the end face of the yoke groove and fit into the groove a lockring of thickness equal to that of the gauge blade.

Note. One gauge has blades, 1.45, 1.48, 1.52 and 1.56 mm thick and the other, 1.60, 1.64 and 1.67 mm thick.

If the gauge blade of the minimum thickness (1.45 mm) fails to get into clearance H, replace ring 1 with another one, 1.4 mm thick, and repeat the operations described above.

If the blade of the maximum thickness (1.67 mm is loose in clearance H, fit the ring, 1.67 mm thick, having removed ring 1 and again carry out th operations described above.

Note. Measure the clearance with the gauge blades from the pipe side.

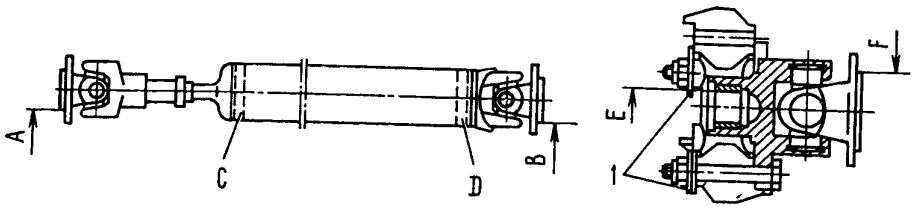


Fig. 3-56. Balancing Propeller Shafts:
1 - balancing washers; A, B, E, F - balance check surfaces; C, D - shaft bearing surfaces on balancing machine

The lockrings of eight sizes (in thickness) are delivered for spares, distinguished by the colour: 1.45 - non-painted; 1.48 - yellow; 1.52 - brown; 1.56 - blue; 1.60 - black; thickness of 1.64, 1.67 and 1.40 blades is to be determined by measurement.

Having installed the lockrings, strike the yokes with a plastic-head hammer. As a result the clearance between the bearing bottom and the locking will be taken up and clearances within 0.01 - 0.04 mm will be formed between the bearing housings and the cross trunnion ends. After assembly check the universal joint yokes for easy turning and the shafts for balancing.

Balancing of shafts. The front and rear propeller shafts are dynamically balanced on a special stand by welding up metal balancing plates.

At a rotation speed of 5500 min^{-1} the unbalance of the shafts checked on surfaces A and B (Fig. 3-56) should not exceed 1.72 N.mm (175 gf.mm); during the balance check it should not exceed 2.16 N.mm (220 gf.mm).

The balance of the intermediate propeller shaft is checked at 800 min^{-1} on surfaces E and F. The required balance is ensured by the use of balancing washers 1 (Fig. 3-56). The unbalance should not exceed 2.36 N.mm (240 gf.mm).

Caution

If the shaft parts have been replaced during repairs, the shafts have to be balanced.

After balancing the shafts coat the bearings of the universal joints with grease No. 158 or ФИОЛ-2У through the grease fittings. Grease gun until grease shows up through the seals.

REAR AXLE

The design of the rear axle is illustrated in Fig. 3-57.

TROUBLE SHOOTING

Cause	Remedy
Rear Wheels Noisy	
1. Wheel loose on axle-shaft	1. Tighten wheel nuts
2. Axle-shaft ball bearing worn or damaged	2. Examine axle-shaft and replace bearing
Constant Loud Noise of Rear Axle	
1. Distortion of rear axle beam	1. Straighten out beam and check its dimensions
2. Axle-shafts distorted and run untrue	2. True up axle shafts. Replace, if heavily damaged
3. Wear of splined joint with axle-shaft gears	3. Replace worn or damaged parts
4. Maladjustment, damage or wear of final drive gears or bearings	4. Identify fault and repair final drive

Cont'd

Cause	Remedy
5. Lack of oil	5. Restore oil level and look for leaks through seals or in rear axle beam
Noise during Acceleration	
1. Wear or wrong adjustment of differential bearings	1. Remove and repair final drive, replace faulty parts
2. Wrong meshing of final drive gears after repairs	2. Adjust gear mesh
3. Axle-shaft bearings damaged	3. Replace bearings
4. Lack of oil	4. Restore oil level and look for leaks through seals or in rear axle beam
Noise during Engine Braking	
1. Improper meshing of final drive gears	1. Adjust gear mesh

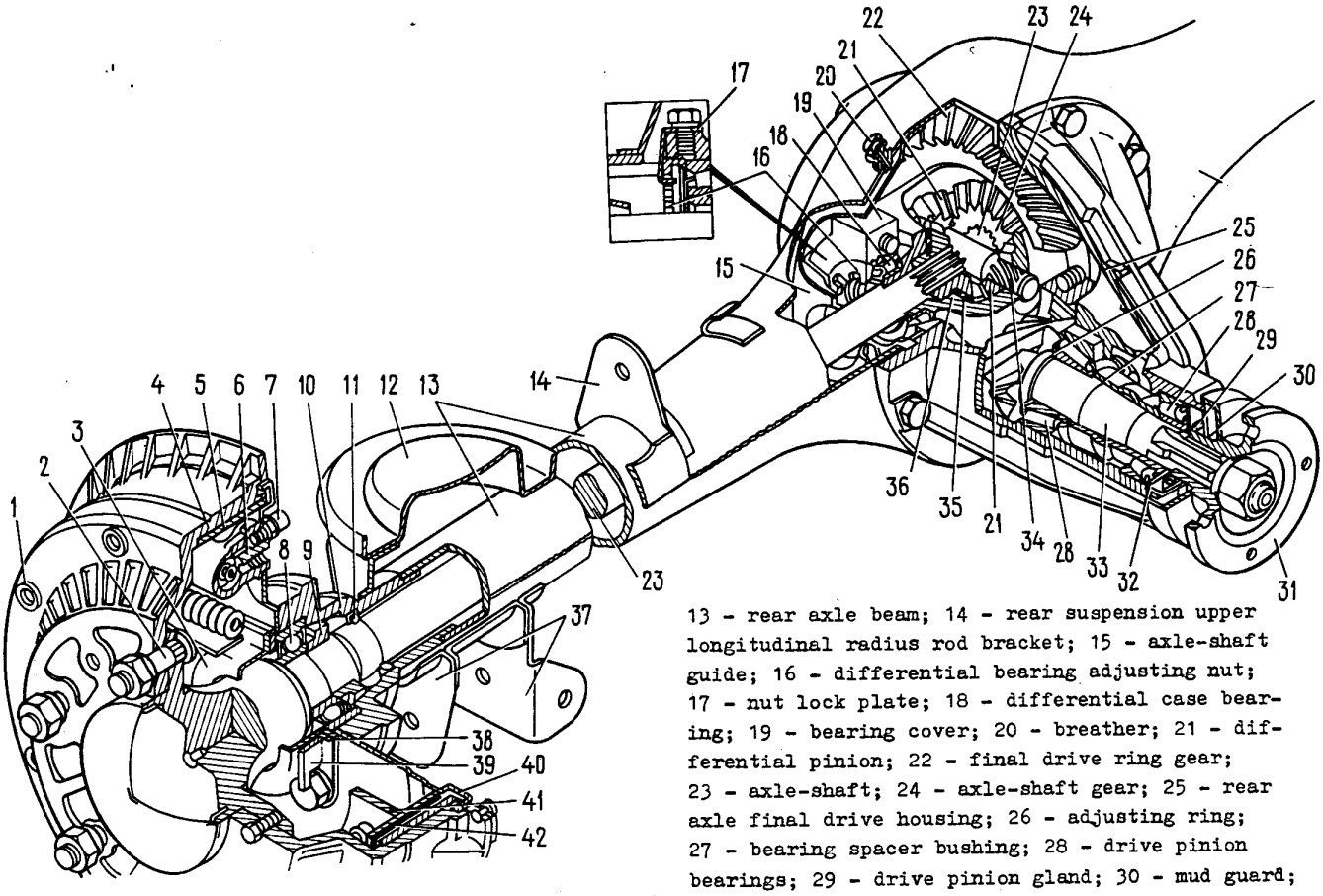


Fig. 3-57. Rear Axle:
1 - wheel cap; 2 - brake drum and wheel bolt; 3 - axle-shaft bearing oil slinger; 4 - brake drum; 5 - drum castiron ring; 6 - rear wheel brake cylinder; 7 - brake bleeder union; 8 - axle-shaft bearing; 9 - bearing lockring; 10 - rear axle beam flange; 11 - gland; 12 - suspension spring seat; 13 - rear axle beam; 14 - rear suspension upper longitudinal radius rod bracket; 15 - axle-shaft guide; 16 - differential bearing adjusting nut; 17 - nut lock plate; 18 - differential case bearing; 19 - bearing cover; 20 - breather; 21 - differential pinion; 22 - final drive ring gear; 23 - axle-shaft; 24 - axle-shaft gear; 25 - rear axle final drive housing; 26 - adjusting ring; 27 - bearing spacer bushing; 28 - drive pinion bearings; 29 - drive pinion gland; 30 - mud guard; 31 - flange; 32 - oil slinger; 33 - final drive pinion; 34 - differential pinion shaft; 35 - axle-shaft gear supporting washer; 36 - differential case; 37 - suspension bracket; 38 - axle-shaft bearing fastening plate; 39 - plate bolt holder; 40 - rear brake backing plate; 41 - rear brake shoe; 42 - shoe lining

Cont'd

Cause	Remedy
2. Excessive clearance in drive pinion bearings caused by looseness of flange fastening nut or by wear of bearings	2. Check antitorque moment of drive pinion, tighten nut or replace defective parts
Noise during Acceleration and Engine Braking	
1. Wear or damage of drive pinion bearings	1. Replace faulty parts
2. Wrong backlash of final drive gears	2. Examine gears, replace faulty ones and restore normal backlash
Noise on Turns	
1. Difficult rotation of differential pinions on shaft	1. Replace damaged or worn parts

Cont'd

Cause	Remedy
2. Scoring of differential pinion shaft	2. Dress down minor roughness with fine emery cloth; replace pinion shaft if reconditioning is impossible
3. Axle-shaft gears jamming in pinion case	3. Dress down minor defects of gears and mating surfaces in pinion case with emery cloth; replace damaged parts with new ones
4. Wrong backlash of differential gears	4. Adjust backlash
5. Axle-shaft bearings damaged	5. Replace bearings

Cont'd

Cause	Remedy
Knocking on Starting from Rest	
1. Excessive clearance in splined joint between drive pinion shaft and flange	1. Replace flange and final drive gears
2. Excessive backlash of final drive gears	2. Adjust backlash
3. Wear of pinion case bore for differential pinion shaft	3. Replace pinion case
4. Loose bolts of rear suspension radius rods	4. Tighten up bolts
Oil Leaks	
1. Drive pinion gland worn or damaged	1. Replace gland
2. Wear of axle-shaft gland symptomized by oiling of brake backing plates, drums and shoes	2. Check runout of axle-shaft, deflection of beam; true up or replace damaged parts. Replace gland
3. Loose bolts of final drive housing; faulty sealing gaskets	3. Tighten bolts; replace gaskets

REMOVAL AND INSTALLATION

The operations related to the removal and installation of the rear axle are dealt with in the "Rear Suspension" Chapter. To remove the rear axle it is sufficient to disconnect the suspension radius rods and shock absorbers only from the rear axle beam.

When installing the rear axle tighten the nuts of the radius rod bolts in keeping with the recommendations of the "Rear Suspension" Chapter.

After installation bleed the brake system and adjust the service and parking brake systems as instructed under "Brakes".

Fill the rear axle housing with ТАД-17И oil through the oil filler hole.

DISASSEMBLY AND ASSEMBLY

Disassembly. Remove the brake pipeline with the Tee-piece from the rear axle, disconnecting the ends of the pipes from the wheel brake cylinders.

Put the rear axle on a repair stand and drain oil from the housing.

Remove the brake drum, unscrew the brake backing plate nuts and, using remover tool 67.7823.9516 (Fig. 3-58), take out the axle-shaft complete with the oil slinger, bearing fastening plate, bearing, and lockring. Remove the brake backing plate and the sealing ring. If the gland wants replacement, pull it out of the axle beam flange.

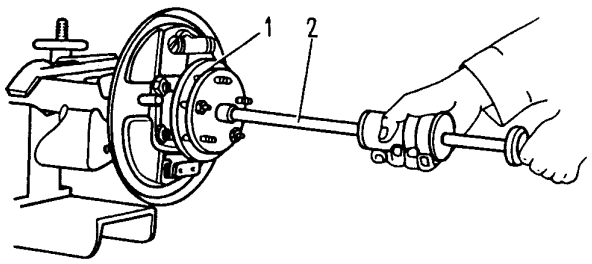


Fig. 3-58. Pressing Out Axle-Shaft:
1 - axle-shaft; 2 - impact remover tool 67.7823.9516

Perform the same operations at the other end of the beam and remove the final drive.

To assemble the rear axle reverse the disassembly operations observing the following recommendations:

- coat the threads of the final drive bolts with a sealing compound, having first degreased the bolts and their threaded holes in the rear axle beam;
- before installing the gland of the axle-shaft bearing, coat it with Литол-24 grease and install the gland into the beam flange using driver A.70157;
- coat the mounting band on the axle-shaft and the surface of its flange contacting the brake drum with graphite grease or ЛСЦ-15 grease.

Install the brake drums only after mounting the rear axle on the car and fastening the cable ends on the parking brake levers.

CHECKING REAR AXLE BEAM

Examine thoroughly the axle beam, particularly after a collision. A distorted beam may cause noise in the rear axle and rapid wear of the tyres.

Check the axle beam for distortion both in the horizontal and vertical planes. Proceed as follows.

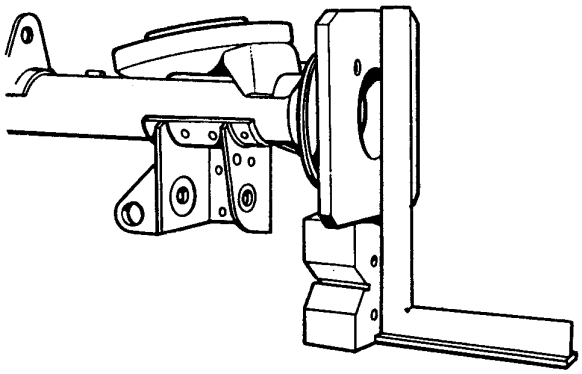


Fig. 3-59. Checking Rear Axle Beam for Vertical Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

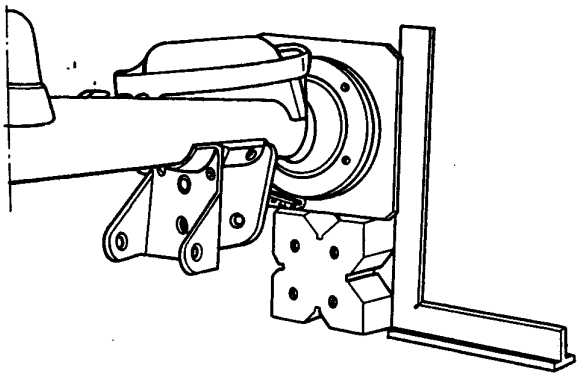


Fig. 3-60. Checking Rear Axle Beam for Twisting Deformations with Angle Gauge Applied to Edge of Flange A.70172

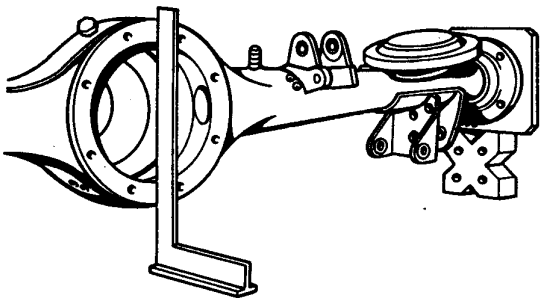


Fig. 3-61. Checking Final Drive Mounting Surface for Perpendicularity

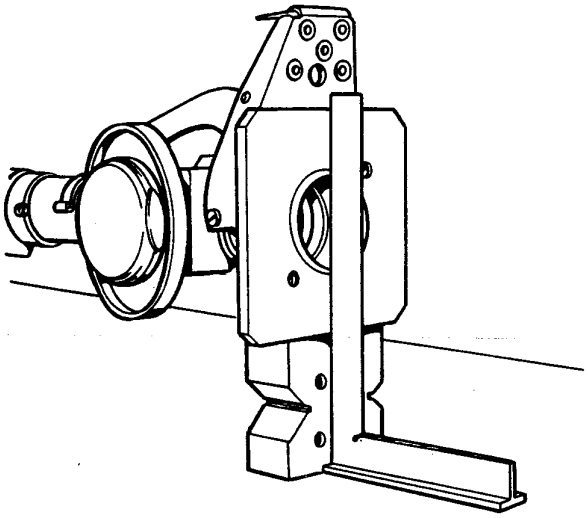


Fig. 3-62. Checking Rear Axle Beam for Horizontal Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

Secure flange A.70172 to each end of the beam, put the beam, with both its flanges resting on identical Vee-blocks located on a surface plate at least 1600 mm long, so that the surface for mounting the housing on the beam is in the vertical plane.

Check the axle beam for deformation, setting an angle gauge against the outer surface (Fig. 3-59) and side surface (Fig. 3-60) of flange A.70172; if the beam is not distorted, the angle gauge will fit snugly against the surfaces.

Check the value of distortion with a feeler gauge. If a 0.2 mm feeler gauge goes on either flange, straighten the beam.

Using an angle gauge (Fig. 3-61) check the final drive mounting surface for perpendicularity to the bearing surface of flange A.70172. The 0.2 mm feeler gauge must not go.

Turn the axle beam through 90° and place it on Vee-blocks. Apply the angle gauge to the outer surface of the flange (Fig. 3-62). The angle gauge should fit tightly. Otherwise check the value of distortion with a feeler gauge. The 0.2 mm feeler gauge must not go.

If deformation exceeds the value stated above, straighten the beam as advised below.

Having trued up the beam, wash it carefully, clean and install the magnetic plug, then check the following:

- quality of the welds and pressure-tightness of the beam;

- cleanliness inside the beam (absence of burrs, chips and oil remnants and of the beam breather.

Paint the beam on the outside as protection against corrosion.

STRAIGHTENING REAR AXLE BEAM

Fasten flanges A.70172 (the ones used for straightening, not for checking) to each end of the beam and put the latter on the supports of a hydraulic press so that the ends of hold-down crossbeam 2 (Fig. 3-63) are in the distorted zone of the axle beam. Most likely, the zone of distortion will be located 200 - 300 mm from the faces of the beam flanges.

Set bracket 7 with the indicator so that the indicator rod bears against the upper part of the

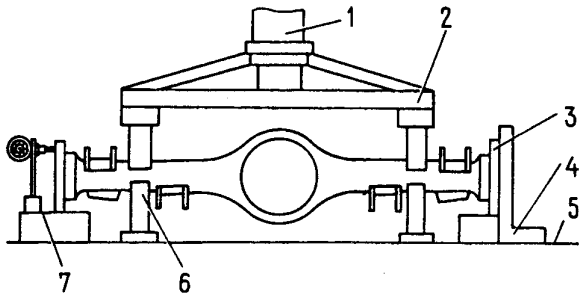


Fig. 3-63. Straightening Rear Axle Beam. Diagrammatic:
1 - hydraulic cylinder; 2 - hold-down cross beam; 3 - flange A.70172; 4 - angle gauge; 5 - press table; 6 - support; 7 - indicator bracket

flange side surface and the indicator pointer is at the division showing the value of beam distortion measured with the feeler gauge during the beam checks. Install either a bracket with an indicator or angle gauge 4 at the other side of the beam.

Install supports 6 under the beam (in the zone of distortion), straighten up the beam by the hydraulic press first in the horizontal then in the vertical plane, checking the results of straightening with the indicator or with a feeler gauge and angle gauge 4.

The maximum force on the press during beam straightening should not exceed 98 kN (10,000 kgf) to avoid excessive deformation of the housing section.

Note. If the height of support 6 has been correctly selected by experiment, the beam may be straightened without angle gauge or indicator checks.

Remove the beam from the press and check it as advised above, replacing "straightening" flanges A.70172 by the "checking" ones.

If the prescribed equipment is not available, the rear axle beam may be straightened, as an exception, consecutively at each end with subsequent check of the beam distortion at both sides (see "Checking of Rear Axle Beam").

AXLE-SHAFTS

Removal and Installation

Remove the wheel and the brake drum.

Unscrew the nuts which hold the brake backing plate to the axle beam; using remover tool 67.7823.9516 and supporting the backing plate, pull out the axle-shaft complete with the oil slinger, bearing fastening plate and lockring.

If gland replacement is necessary, remove it from the axle beam flange.

Install the axle-shaft by reversing the removal operations, and taking care not to damage the working edge of the gland. Before installing the brake drum, lubricate the mounting band on the axle-shaft with graphite or ЛСЦ-15 grease. After installation check the functioning of the axle-shaft on the road.

Inspection

Examine the parts of the axle-shaft and make sure that:

- the ball bearing is neither worn nor damaged; replace the bearing if its axial clearance is larger than 0.7 mm;
- the bearing and its lockring are not displaced from their initial positions; if the inner race of the bearing turns on the axle-shaft, replace the lockring;
- the bearing fastening plate and the oil slinger are free of damage;
- the axle-shaft is not distorted and the mounting surfaces are not damaged; the runout of the axle-shaft measured in centres on the journal for the gland should not exceed 0.08 mm. Before putting the axle-shaft in the centres clean the alignment holes on the axle-shaft carefully of dirt and rust.

If any parts mounted on the axle-shaft are found to be worn or damaged, replace them by new ones observing the rules laid down below and using special devices. Minor bending of the axle-shaft should be corrected by truing up. After truing the runout of the flange face measured in the centres should not exceed 0.05 mm. If it is larger but does not exceed 0.08 mm, the flange face may be turned on a lathe to eliminate face runout. Turning must not reduce the thickness of the flange by more than 0.2 mm.

Removal of Lockring

The lockring of the axle-shaft bearing must be removed and installed only on a hydraulic press.

First bend outward holders 39 (Fig. 3-57) of the bolts which fasten plate 38 with the oil slinger and brake backing plate and take out the bolts.

Put the half-rings of remover tool 67.7823.9529 around the bearing and set the axle-shaft vertically so that the half-rings rest on the lockring.

Put the axle-shaft on the press (Fig. 3-64) and apply a gradually increasing force to the splined end of the axle-shaft until the lockring

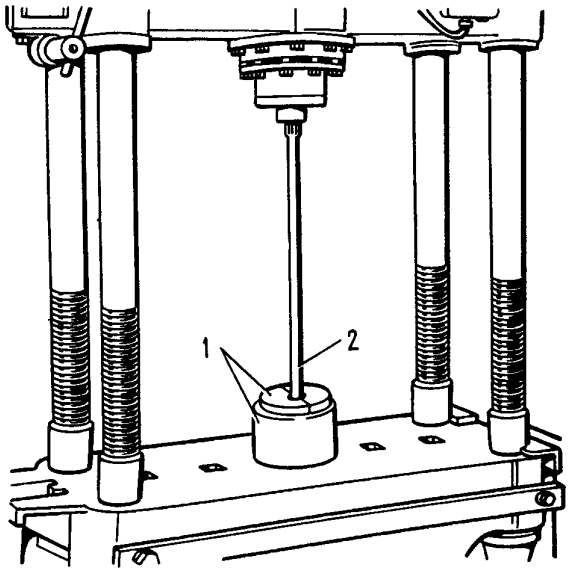


Fig. 3-64. Pressing Out Axle-Shaft Bearing Lockring:
1 - fixture; 2 - axle-shaft

comes off. The lockring must not be reused, it must be replaced by a new one.

Check the axle-shaft mounting surface for notches, and other defects; replace the axle-shaft by a new one, if necessary.

Assembly

Set the axle-shaft vertically with its flange resting on ring 7 (Fig. 3-65) of installation tool 67.7823.9530.

Connect the oil slinger of the axle-shaft bearing and the bearing fastening plate with the gasket by two screws and install these parts on the axle-shaft; install the axle-shaft ball bearing.

Insert a new lockring into special holder 3 and heat it in an oven to 300 °C approximately so that the temperature of the ring during installation on the axle-shaft is 220 - 240 °C.

Drive the lockring on the axle-shaft with driver 1 on a press, applying a force not higher than 58.8 kN (6,000 kgf) until the inner race of the bearing is clamped between the lockring and the axle-shaft shoulder.

Having pressed-on the lockring, check to see that it will not be displaced under an axial load of 19.6 kN (2,000 kgf). For this purpose place the assembled axle-shaft on a tester (Fig. 3-66) and clamp the lockring in a special vice.

Place the rod of indicator 1 graduated in 0.01 mm against the axle-shaft flange. Set the indicator pointer to zero and apply the axial load specified above by tightening the screw of the

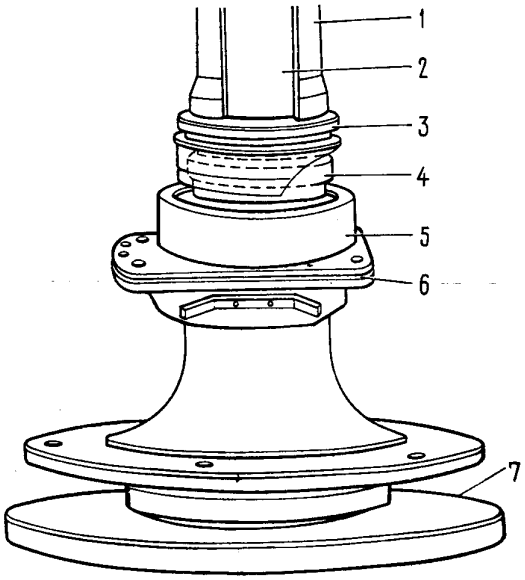


Fig. 3-65. Press-Fitting Axle-Shaft Bearing Lockring:
1 - driver; 2 - axle-shaft; 3 - holder; 4 - lockring; 5 - bearing; 6 - bearing fastening plate and oil slinger assembly; 7 - supporting ring

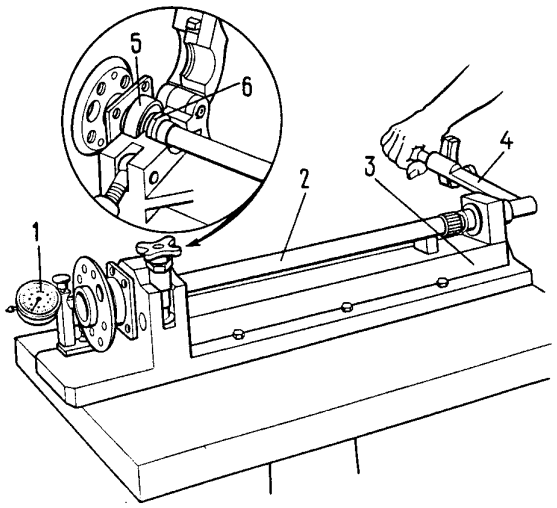


Fig. 3-66. Checking Fit of Axle Shaft Bearing Lockring:
1 - indicator; 2 - axle-shaft; 3 - tester; 4 - torque-indicating wrench; 5 - bearing; 6 - bearing lockring

tester to 78.5 - 83.3 N.m (8 - 8.5 kgf.m) with a torque-indicating wrench. The screw will bear through a ball against the end of the axle-shaft. The applied force should not cause any clearance, however small, between the lockring and the inner race of the bearing.

Relieve the load by turning off the tester screw and make sure that the indicator pointer returns to zero. This means that there has been no shifting of the lockring over the axle-shaft. Failure of the indicator pointer to come back to zero indicates that the lockring has been displaced and the axle-shaft assembly must be replaced by a new one.

Having checked the fit of the lockring, install the bolts which fasten the plate and oil slinger 6 (Fig. 3-65) and fix them by bending the bolt holders inward.

Measuring Axle-Shaft End Play on Car

Loosen the nuts of the rear wheels. Put chocks under the front wheels and jack up the rear axle. Release the parking brake and set the gear-shift lever to neutral.

Remove the wheels and brake drums. Screw gauge 02.7834.9504 on the axle-shaft (Fig. 3-67), pass the rod extension of indicator 1 through one of the two holes in the axle-shaft until the rod extension comes to bear against the brake backing plate or oil slinger and secure the indicator.

Measure the end play with the indicator applying a force of about 49 N (5 kgf) in both directions along the rear axle axis. The permissible end play shall not exceed 0.7 mm.

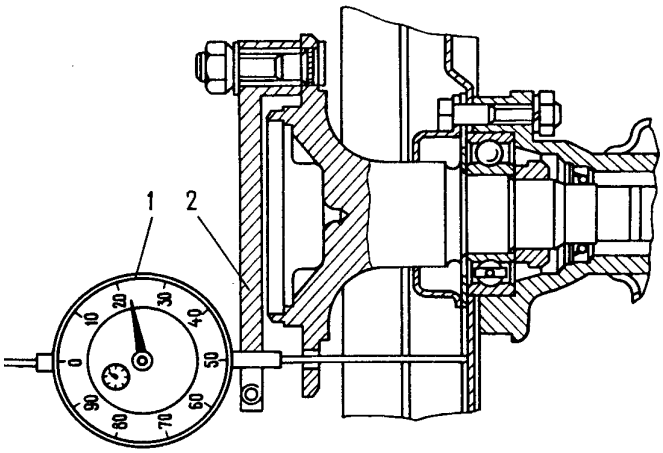


Fig. 3-67. Measuring Axle-Shaft End Play with Wheel and Brake Drum Removed:
1 - indicator; 2 - gauge

FINAL DRIVE

The assembled final drive is shown in Fig. 3-68.

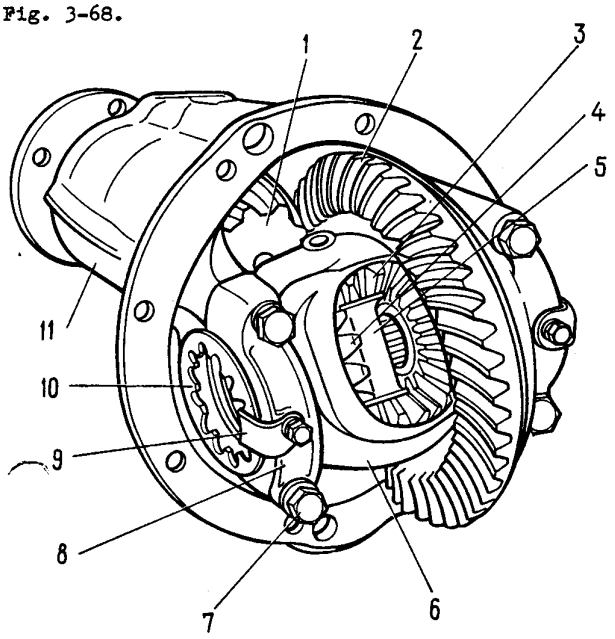


Fig. 3-68. Final Drive Assembly:
1 - drive pinion; 2 - ring gear; 3 - differential pinion; 4 - axle-shaft gear; 5 - differential pinion shaft; 6 - differential case; 7 - differential case bearing cover bolts; 8 - differential case bearing cover; 9 - locking plate; 10 - bearing adjusting nut; 11 - final drive housing

Identifying Final Drive Defects by Noise

Look for final drive troubles in the following sequence:

Test No. 1. In order to identify the exact nature of the noise, drive the car on a highway at 20 km/h approximately.

Then accelerate the car gradually to 90 km/h listening to various kinds of noise and taking a note of the speeds at which they appear and vanish.

Let go of the accelerator pedal and slow down the car by the engine without applying the brakes.

In the course of deceleration note the changes in the character of the noise and the moments when it gets louder. As a rule the noise arises and vanishes at the same speeds both during acceleration and deceleration.

Test No. 2. Accelerate the car to 100 km/h approximately, set the gearshift lever in neutral, turn off the ignition switch and allow the car to coast to standstill; listen to the character of the noise at various deceleration speeds.

Caution

While turning off the ignition switch take care not to move it farther than necessary so as to avoid operation of the antitheft device.

The noise occurring during this test and corresponding to that noticed during Test No. 1 is not caused by the final drive gears since they produce no noise when not under load.

On the contrary, the noise registered during Test No. 1 and not recurring during Test No. 2 may be caused by the final drive gears or by the bearings of the drive pinion or differential.

Test No. 3. Start the engine on a stationary and braked car and, throttling it up gradually, compare the arising noises with those registered during the previous tests. If the noises resemble those noticed during Test No. 1, they are caused not by the final drive but by some other units.

Test No. 4. The noises noticed during Test No.1 and not observed during the subsequent tests are caused by the final drive; to confirm, jack up the rear wheels, start the engine and throw in the 4th speed gear. This will prove that the noise is actually produced by the final drive and not by other units, e.g. suspension or body.

Removal

If the final drive alone has to be removed, do the following:

- drain oil from the rear axle housing;
- jack up the rear end of the car, put it on trestles and remove the wheels and brake drums;
- unscrew the nuts which hold the brake backing plate to the axle beam and pull out the axle-shafts from the differential case;
- disconnect the propeller shaft from the final drive, put a support under the final drive housing, remove the bolts that fasten this housing to the rear axle beam and take the final drive out of the beam exerting care not to damage the gasket.

Installation

Prior to installing the final drive, clean the axle beam thoroughly of oil. Put a sealing gasket on the jointing surface, insert the final drive into the beam and fasten it with bolts. Before installation coat the bolt threads with a sealing compound. Before applying the sealing compound degrease carefully the bolts and the holes in the beam. Attach the propeller shaft to the final drive, install the axle-shafts and brake drums.

Install the wheels with tyres and tighten the wheel nuts preliminarily. Remove the supports and lower the car; now tighten the wheel bolts with a torque-indicating wrench.

Fill the rear axle beam with oil, first cleaning and screwing in the drain plug.

Note. Since 1984 a final drive, gear ratio 4.1, is used instead of the final drive, gear ratio 4.3. To distinguish the final drives marks 21 or 2 are made at their throats, the first mark corresponds to the final drive, gear ratio 4.3, and the second one, to gear ratio 4.1. In repairs the final drives with equal gear ratios should be installed in the front and rear axles. The speedometer drive on the transfer case should suit the gear ratio of the final drive. The speedometer drive marked with green figure I is used with the final drive, gear ratio 4.1.

Disassembly

Mount the final drive on a stand. Remove locking plates 9 (Fig. 3-68), unscrew bolts 7 and remove covers 8 of the differential case bearings, adjusting nuts 10 and roller bearing outer cups. Mark covers 8 and outer cups of the bearings before removal so as to install them back where they belong during subsequent reassembly.

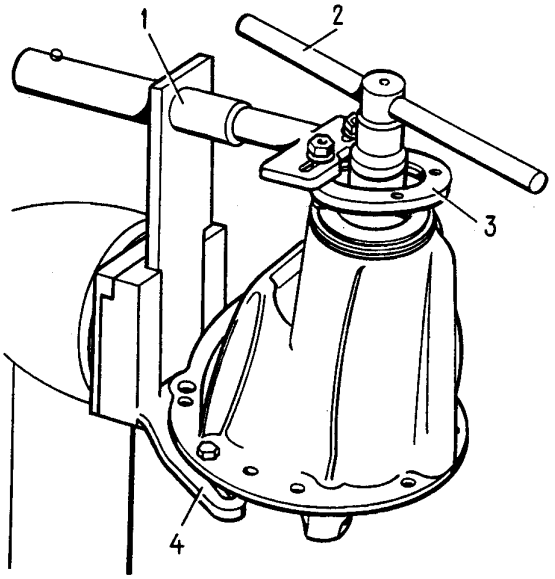


Fig. 3-69. Turning off Drive Pinion Nut:
1 - drive pinion flange retainer; 2 - socket wrench; 3 - drive pinion flange; 4 - bracket

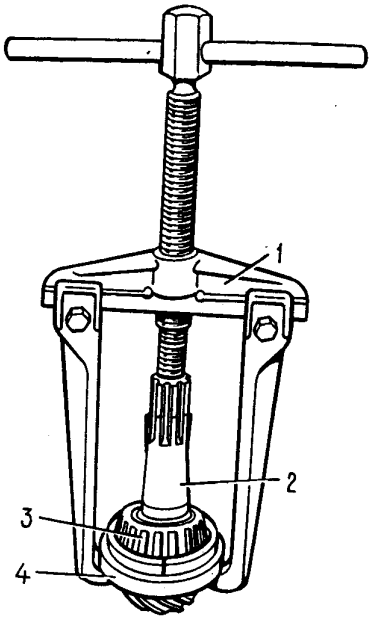


Fig. 3-70. Removing Drive Pinion Rear Bearing Inner Cone with General-Purpose Remover Tool A.40005/1/7:
1 - general-purpose remover tool; 2 - drive pinion; 3 - bearing cone; 4 - tool A.45008

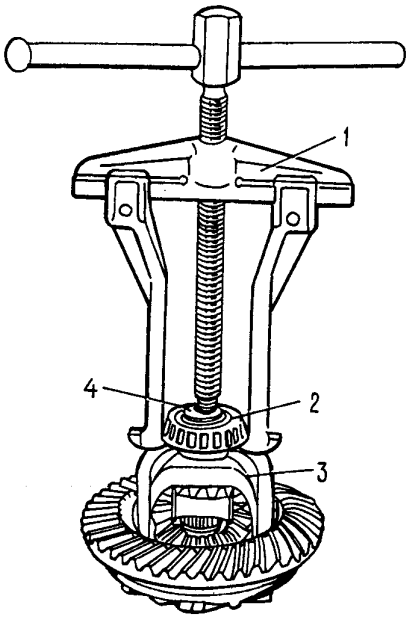


Fig. 3-71. Removing Inner Cone of Differential Case Bearing with General-Purpose Remover Tool A.40005/1/6:
1 - general-purpose remover tool; 2 - bearing inner cone; 3 - case; 4 - stop A.45028

Take the differential case from final drive housing 11 complete with ring gear 2 and bearing inner cones.

To remove drive pinion 1 and associated parts proceed as follows:

- turn the final drive housing with the throat up (Fig. 3-69) and unscrew the flange nut with wrench 2, holding drive pinion flange 3 with retainer 1;
- remove the flange and take out the drive pinion complete with the adjusting ring, rear bearing inner cone and spacer sleeve;
- take the gland, oil slinger and front bearing inner cone from the final drive housing;
- press out the outer cups of the front and rear bearings with driver A.70198;
- remove the spacer sleeve from the drive pinion and, using remover tools A.40005/1/7 and A.45008 (Fig. 3-70), remove the inner cone of the rear roller bearing;
- take off the drive pinion adjusting ring.

To disassemble the differential:

- remove roller bearing inner cones 2 (Fig. 3-71) from case 3 using general-purpose remover tool A.40005/1/6 and stop A.45028;
- unscrew the ring gear bolts and drive the differential pinion shaft out of the case;
- turn the axle-shaft gears and the differential pinions so that the latter roll out into the differential ports where they can be taken out;
- remove the axle-shaft gears with supporting washers.

Inspection of Parts

Wash the final drive parts thoroughly before inspection to facilitate detection of any faults and wear.

Look for the signs of damage on the gear teeth and check for correct tooth contact pattern on the working surfaces of teeth; replace any heavily worn parts; identify the cause of improper tooth contact.

Note. Replacement pinions and ring gears are available in sets matched for noiseless operation and proper tooth contact. Therefore, if one of these parts is damaged, both should be replaced as a set.

Examine the differential pinion shafts and the bores in the pinions; minor damage can be worked out by polishing with fine abrasive cloth. In case of heavy damage replace the parts by new ones.

Inspect the axle-shaft gear journals and their seats in the differential case, condition of holes in the case for the pinion shaft. Attend to the discovered defects in the same manner as in the previous operation, replace the worn or damaged parts, if necessary.

Inspect the surfaces of the axle-shaft gear supporting washers and eliminate even the slightest damage. If replacement is necessary, select washers of the proper thickness.

Inspect the roller bearings of the drive pinion and differential case; they should be unworn and have smooth working surfaces. Replace the bearings if there is any doubt as to their serviceability; faulty bearings may cause noise and seizure of gears.

Look for distortion and cracks on the final drive housing and differential case and replace them, if faulty.

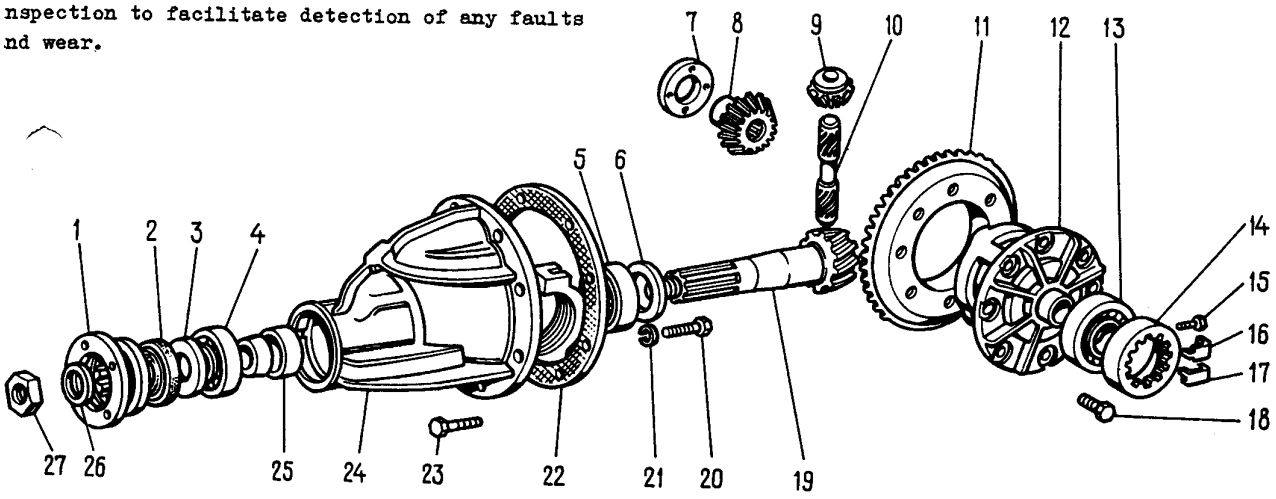


Fig. 3-72. Rear Axle Final Drive Parts:
1 - drive pinion flange; 2 - gland; 3 - oil slinger; 4 - front bearing; 5 - rear bearing; 6 - drive pinion adjusting ring; 7 - axle-shaft gear supporting washer; 8 - axle-shaft gear; 9 - differential pinion; 10 - differential pinion shaft; 11 - ring gear; 12 - differential case; 13 - differential case bearing; 14 - adjusting nut; 15 - locking plate bolt; 16 - locking plate; 17 - locking plate; 18 - ring gear bolt; 19 - drive pinion; 20 - cover bolt; 21 - spring washer; 22 - gasket; 23 - final drive fastening bolt; 24 - final drive housing; 25 - spacer bushing; 26 - plain washer; 27 - drive pinion flange nut

Examine closely the drive pinion gland and replace it in case of even the slightest damage or when the working edge is worn in width to 1 mm and over.

Assembly of Final Drive

Strict observance of the assembly and adjustment rules given below will ensure reliable functioning of the final drive.

The parts of the final drive are illustrated in Fig. 3-72.

Assembly of Differential

Coat the axle-shaft gears with transmission oil and install them complete with the supporting washers and differential pinions through the ports in the differential case. Turn the pinions and the axle-shaft gears so as to align the rotation axis of the differential pinions with the axis of the port in the case, then insert the pinion shaft.

Check the axial clearance of each axle-shaft gear; it should be 0 - 0.10 mm; the antitorque moment of the differential gears should not exceed 14.7 N.m (1.5 kgf.m).

In case of an unduly large clearance caused by the wear of the differential parts, replace the supporting washers of the axle-shaft gears by thicker ones. If the above-stated clearance cannot be ensured even after installation of the thickest washers, it means that the gears are heavily worn and must be replaced by new ones.

Secure the ring gear on the differential case.

Using installation driver A.70152, press-fit the inner cones of the roller bearings on the differential case.

Installation and Adjustment of Drive Pinion

A correct position of the drive pinion relative to the ring gear depends on the thickness of the adjusting ring installed between the thrust face of the drive pinion and the inner cone of the rear bearing.

Select the adjusting ring by the use of dummy pinion A.70184 and thickness gauge A.95690 with an indicator. Proceed as follows:

Secure the final drive housing on a stand and install the outer cups of the drive pinion front and rear bearings into the housing. Use driver A.70185 for the front bearing and A.70171 for the rear one (Fig. 3-73).

Using driver A.70152, install the inner cone of the rear bearing on dummy pinion A.70184 and insert the latter into the throat of the final drive housing (Fig. 3-74).

Install the inner cone of the front bearing and the drive pinion flange and draw up the nut with a torque of 7.85 - 9.8 N.m (0.8 - 1 kgf.m)

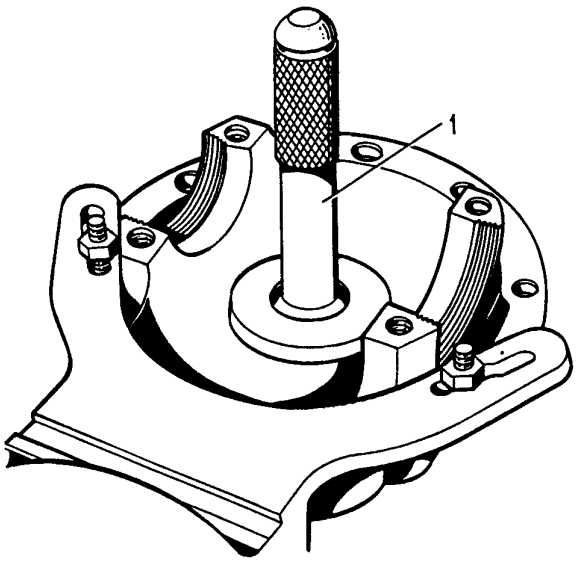


Fig. 3-73. Installing Drive Pinion Rear Bearing Outer Cup:
1 - driver A.70171

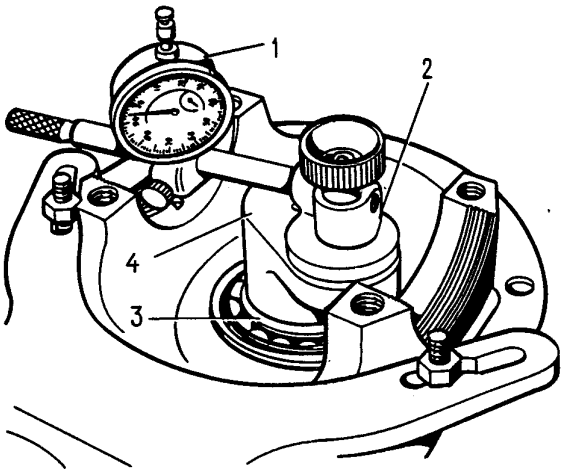


Fig. 3-74. Determining Thickness of Drive Pinion Adjusting Ring:
1 - indicator; 2 - gauge A.95690; 3 - drive pinion rear bearing; 4 - dummy pinion A.70184

rotating the dummy pinion to make the bearing rollers find their correct position.

Secure thickness gauge A.95690 on the face of dummy pinion 4 and set the gauge graduated in 0.01 mm to zero, placing its rod on the same face of dummy pinion A.70184. Then shift indicator 1 so that its rod rests on the seating surface of the differential case bearing.

Moving dummy pinion 4 with the indicator right and left, stop it when the indicator pointer is at a minimum value of "a_1" (Fig. 3-75) and write down the reading. Repeat this operation on the seating surface of the other bearing and find the value of "a_2".

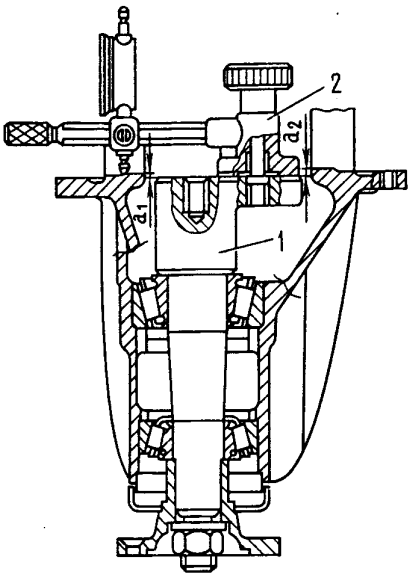


Fig. 3-75. Taking Measurements to Determine Thickness of Drive Pinion Adjusting Ring: 1 - dummy pinion A.70184; 2 - gauge A.95690 with indicator; a_1 and a_2 - distance from dummy pinion face to journals of differential bearings

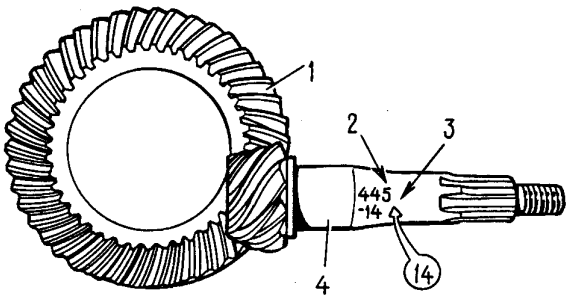


Fig. 3-76. Final Drive Gears: 1 - ring gear; 2- ordinal number; 3 - correction to nominal position in hundredths of a millimeter; 4 - drive pinion

Determine thickness "S" of the drive pinion adjusting ring; this thickness is the algebraic difference of "a" and "b".

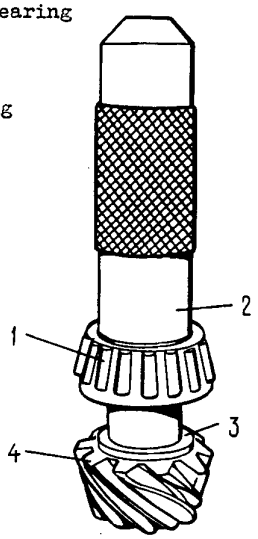
$$S = a - b$$

where: a - arithmetical mean of the distances from the faces of dummy pinion 1 (Fig. 3-75) to the journals of the differential bearings.

$$a = \frac{a_1 + a_2}{2}$$

b - deviation of the drive pinion from the nominal position in millimeters. The value of deviation is marked on the drive pinion (Fig. 3-76) in the hundredth fractions of a millimeter with a plus or minus sign.

Fig. 3-77. Installing Rear Bearing Inner Cone on Drive Pinion: 1 - roller bearing cone; 2 - driver A.70152; 3 - adjusting ring; 4 - drive pinion



In determining the thickness of the adjusting ring the sign and the unit of measurement of "b" should be taken into account.

Example. Let the value of "a" found by the indicator be 2.91 mm ("a" is always positive) and the deviation of the drive pinion given after its Serial No. be "-14". To find the value of "b" in millimeters the amount of deviation should be multiplied by 0.01 mm.

$$b = -14 \times 0.01 \text{ mm} = -0.14 \text{ mm}$$

Now find the thickness of the pinion adjusting ring in millimeters:

$$S = a - b = 2.91 \text{ mm} - (-0.14 \text{ mm}) = 2.91 \text{ mm} + 0.14 \text{ mm} = 3.05 \text{ mm}$$

In this case install the adjusting ring 3.05 mm thick.

Put the adjusting ring of the required thickness on the drive pinion and, using driver A.70152 (Fig. 3-77), install the rear bearing inner cone removed from dummy pinion A.70184. Put in position the spacer bushing.

Caution

During repairs of the rear axle final drive be sure to use a new spacer bushing if the housing, gears, or the pinion bearings have been replaced. If, however, these parts have not been replaced, the old spacer bushing may be used.

Insert the drive pinion into the final drive housing and put in place the inner cone of the front bearing, the oil slinger, gland, drive pinion flange, and the washer.

Screw the nut on the drive pinion extension, lock the pinion flange and tighten the nut with a torque specified below.

Preloading of Drive Pinion Bearings

It is essential that the drive pinion bearings be properly preloaded in order to limit the axial displacement of the pinion under working loads. This preloading is checked by dynamometer 02.7812.9501 (Fig. 3-78) which measures the antitorque moment of the drive pinion.

The antitorque moment determines the degree of bearing tightening. This moment should be 157 - 196 N.cm (16-20 kgf.cm) for new bearings and 39.2 - 58.8 N.cm (4 - 6 kgf.cm) for the bearings after a run of 30 km and more.

Tighten the flange nut with a torque of 118 - 255 N.m (12 - 26 kgf.m), periodically checking with a dynamometer the resistance of the bearings to rotation of the drive pinion.

To check the antitorque moment place the dynamometer on adapter sleeve 3 (Fig. 3-79), set index 2 (Fig. 3-78) to the 196 N.cm (20 kgf.cm) scale division and turn handle 4 a few revolutions clockwise. When turning the pinion see that movable index 1 does not go beyond index 2 and reads not less than 157 N.cm (16 kgf.cm).

If the antitorque moment is under 157 N.cm (16 kgf.cm) or 39.2 N.cm (4 kgf.cm) for the bearings after 30 km of run, tighten the pinion flange nut without exceeding the prescribed preload and recheck the antitorque moment of the drive pinion.

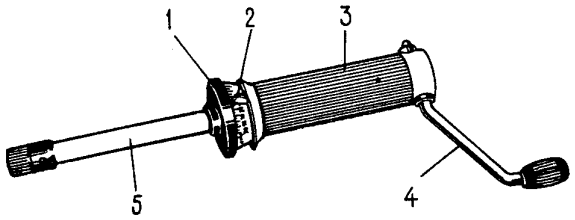


Fig. 3-78. Dynamometer 02.7812.9501:
1 - movable index; 2 - torque-limiting index; 3 - body; 4 - handle; 5 - bar with end-piece inserted into adapter bushing

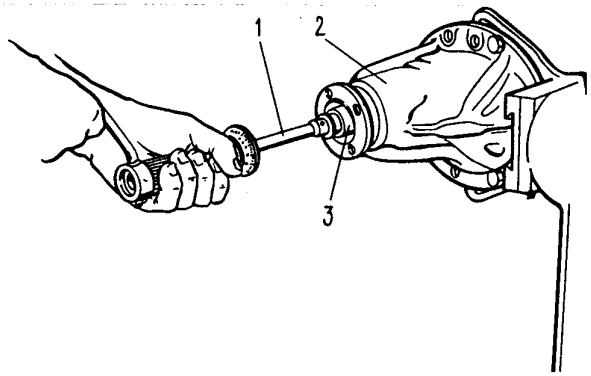


Fig. 3-79. Checking Preload of Drive Pinion Bearings:
1 - dynamometer 02.7812.9501; 2 - housing; 3 - adapter sleeve

If the antitorque moment exceeds 196 N.cm (20 kgf.cm) or 58.8 N.cm (6 kgf.cm) for bedded-in bearings, this being traced to an excessive preload of the bearings, replace the spacer sleeve by a new one since it has been overloaded and distorted to a point which denies the possibility of correct adjustment. Having replaced the spacer sleeve repeat the assembly operations performing appropriate adjustment and checks.

Installation of Differential Case

Assemble the differential case complete with the bearing outer cups and install it into the housing.

Install two adjusting nuts 4 (Fig. 3-80) so that they contact the bearing cups.

Install the bearing covers and tighten the fastening bolts with a torque-indicating wrench.

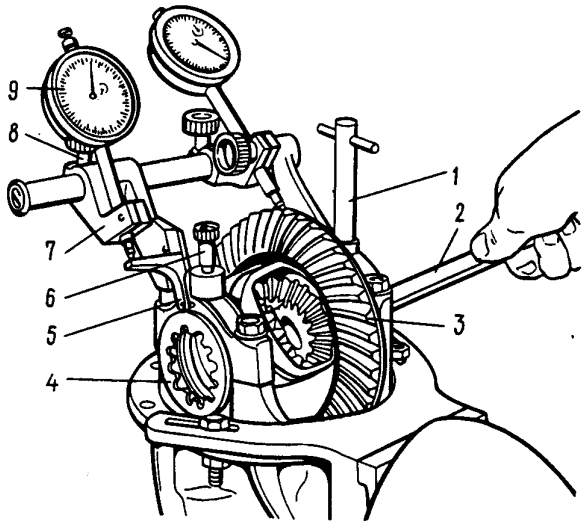


Fig. 3-80. Checking Preload of Differential Case Bearings with Gauge A.95688/R:
1 - gauge screw; 2 - wrench A.55085; 3 - ring gear; 4 - adjusting nut; 5 - intermediate lever; 6 - fastening screw; 7 - indicator bracket; 8 - bracket screw; 9 - bearing preload indicator

Adjusting Preload of Differential Case Bearings and Backlash of Final Drive Gears

These operations should be carried out concurrently, using gauge A.95688/R and wrench A.55085.

Secure the gauge on the final drive housing (Fig. 3-80) by turning screws 1 and 6 into the holes for the bolts which fasten the adjusting nut locking plates.

Move bracket 7 along the guide until lever 5 comes in contact with the external side surface of the cover and draw up screw 8.

Loosen screws 1 and 3 (Fig. 3-81) and set bracket 4 so that the rod of indicator 2 rests on the tooth flank of the ring gear at the tooth edge; then draw up screws 1 and 3.

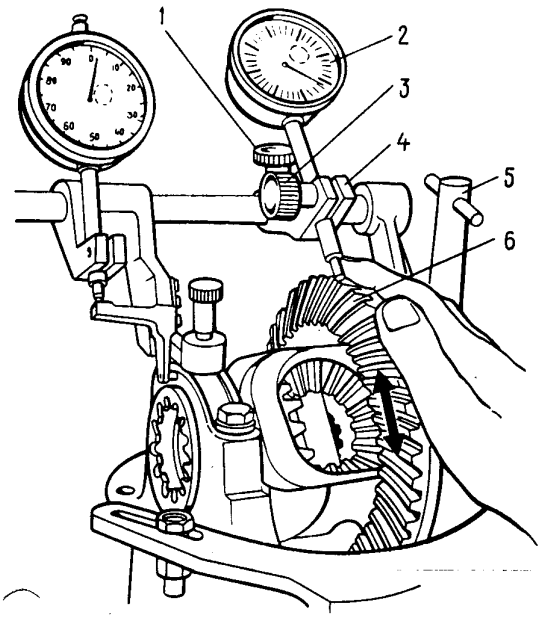


Fig. 3-81. Checking Backlash of Final Drive Gears with Gauge A.95688/R:
1 - bracket screw; 2 - backlash indicator; 3 - indicator clamping screw; 4 - indicator bracket; 5 - fastening screw; 6 - ring gear

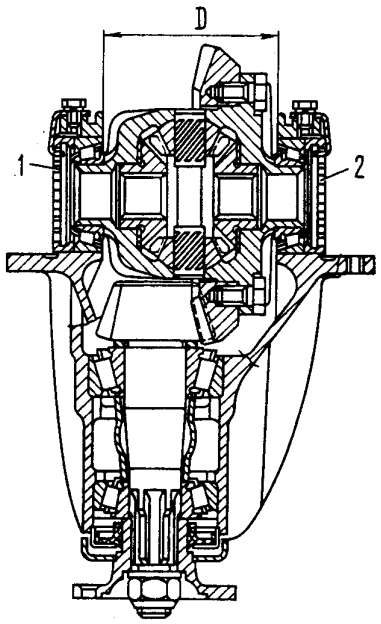


Fig. 3-82. Checking Preload of Differential Case Bearings:
D - distance between differential bearing covers; 1, 2 - adjusting nuts

Adjust the pinion-to-gear backlash preliminarily to 0.08 - 0.13 mm by turning the adjusting nuts. Check the backlash with indicator 2, at the same time rocking ring gear 6. This should be done without preloading the bearings. The adjusting nuts must only touch upon the bearings otherwise the preload reading will be wrong.

Tighten two bearing adjusting nuts successively and uniformly. This will make the differential bearing covers move apart thus increasing distance "D" (Fig. 3-82). This increase of distance "D" will be registered by indicator 9 (Fig. 3-80) whose rod is pressed upon by lever 5. Tighten the bearing adjusting nuts to increase distance "D" (Fig. 3-82) by 0.14 - 0.18 mm.

Having adjusted the correct preload of the differential case bearings, check finally the backlash of the final drive gears. It must remain unchanged.

If the backlash in greater than 0.08 - 0.13 mm, shift the ring gear towards the pinion; shift it away, if the backlash is smaller. In order to retain the preset preload of the bearings, move the ring gear by tightening one of the bearing adjusting nuts and loosening the other nut through the same angle.

For accurate performance of this operation watch the readings of indicator 9 (Fig. 3-80) which reads the previously adjusted preload of the bearings. Tightening one of the nuts will change the indicator reading because distance "D" between the covers (Fig. 3-82) will increase and so will the preload of the bearings. Therefore, keep loosening the other nut until the indicator pointer returns to the initial position.

Having moved the ring gear, check the backlash by indicator 2 (Fig. 3-81). Repeat the adjustments if the backlash is other than required.

Remove gauge A.95688/R, install the locking plates of the adjusting nuts and fasten them by bolts with spring washers. The spare locking plates are available in two types, with one or with two lugs to suit the position of the nut slot.

The final drive units can be adjusted and repaired on a special stand which is also suitable for checking the gears for noise and for the position and pattern of the tooth contact on the working surfaces of the teeth as advised below.

Checking Tooth Contact of Final Drive Gears

The final check of the final drive gears for proper meshing is carried out on a stand as follows:

- set the adjusted final drive on the stand and coat the working surfaces of the ring gear teeth with a thin layer of lead oxide;
- start the stand; brake the rotating axle-shafts by the stand levers so as to leave the traces of contact with the pinion teeth on the ring gear teeth;
- reverse the rotation of the stand and, braking the gears, obtain the contact traces on the other side of the ring gear teeth which corresponds to the backward movement of the car.

The tooth contact is considered correct if the contact pattern is located uniformly on both sides

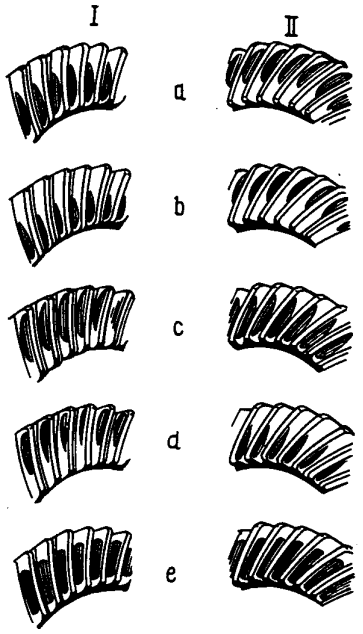


Fig. 3-83. Tooth Contact of Final Drive Gears: I - forward; II - reverse; a and b - wrong tooth contact: shift drive pinion away from ring gear by reducing thickness of adjusting ring; c and d - wrong tooth contact: shift drive pinion towards ring gear by increasing thickness of adjusting ring; e - correct tooth contact

of the ring gear teeth, nearer to the narrow end of the tooth, occupying two thirds of its length and without extending to the tip and the root of the tooth as shown in Fig. 3-83 "e".

The patterns of wrong tooth contact on the active surface of the tooth are illustrated in Fig. 3-83 "a", "b", "c" and "d".

Adjustment of the pinion position involving the replacement of the ring calls for the disassembly of the unit.

During assembly, repeat all the operations related to adjusting the preload of the pinion roller bearings, checking the antitorque moment, setting the preload of the differential case roller bearings, and adjusting the backlash of the final drive gears.

Replacement of Drive Pinion Gland

The need for replacing the gland is symptomized by a drop of the oil level in the rear axle housing caused by oil leakage through the gland so that it interferes with normal functioning of the final drive.

Sweating of the housing throat and even formation of individual oil drops not in excess of the below-stated number should not be regarded as a symptom of leakage.

In case of intensive dripping examine the gland as follows:

- put the car on a lift or an inspection pit;
- clean and inspect the breather;
- unscrew the level check plug and check the oil level in the rear axle housing; bring the level to the normal mark, if necessary;
- clean the housing throat of oil and wipe it dry;
- jack up the rear axle and put it on trestles;
- start the engine, throw in the direct gear and run the stationary car at 90 - 100 km/h until the oil gets heated to 80 - 90 °C (it will take about 15 min);
- with the direct gear thrown in, at a speed of 100 km/h determine the amount of oil leaking out in 15 min.

Oil leakage exceeding 5 drops in 15 min indicates that the gland is damaged.

The faulty gland can be replaced without removing the final drive from the car, provided the other final drive parts do not require replacement.

To replace the gland proceed as follows:

- drain oil from the rear axle housing;
- loosen the rear wheel nuts; put chocks under the front wheels and jack up the rear axle; release the parking brake and set the gearshift lever in neutral;
- remove the wheels and brake drums;
- unscrew the nuts which hold the brake backing plate to the rear axle beam and withdraw the axle-shafts from the differential case with a special knockout tool;
- disconnect the propeller shaft from the drive pinion flange and shift the shaft aside;
- using a dynamometer measure the antitorque moment of the drive pinion and note its value;
- holding the flange with a special wrench unscrew the drive pinion flange nut and remove the flange complete with the washer;
- take off the drive pinion gland;
- install a new gland with a mandrel without cocking; before installation coat the working surfaces of the gland with Литол-24 grease;
- install the flange with the washer on the drive pinion and, holding it with a special wrench, tighten the flange nut, checking periodically with the dynamometer the antitorque moment of the drive pinion.

If the initial antitorque moment was 58.8 N.cm (6 kgf.cm) and higher, the new one should be 9.8 - 19.6 N.cm (1 - 2 kgf.cm) higher than the initial one. If, however, the initial antitorque moment was lower than 58.8 N.cm (6 kgf.cm), tighten the flange nut until the antitorque moment becomes 58.8 - 88.2 N.cm (6 - 9 kgf.cm).

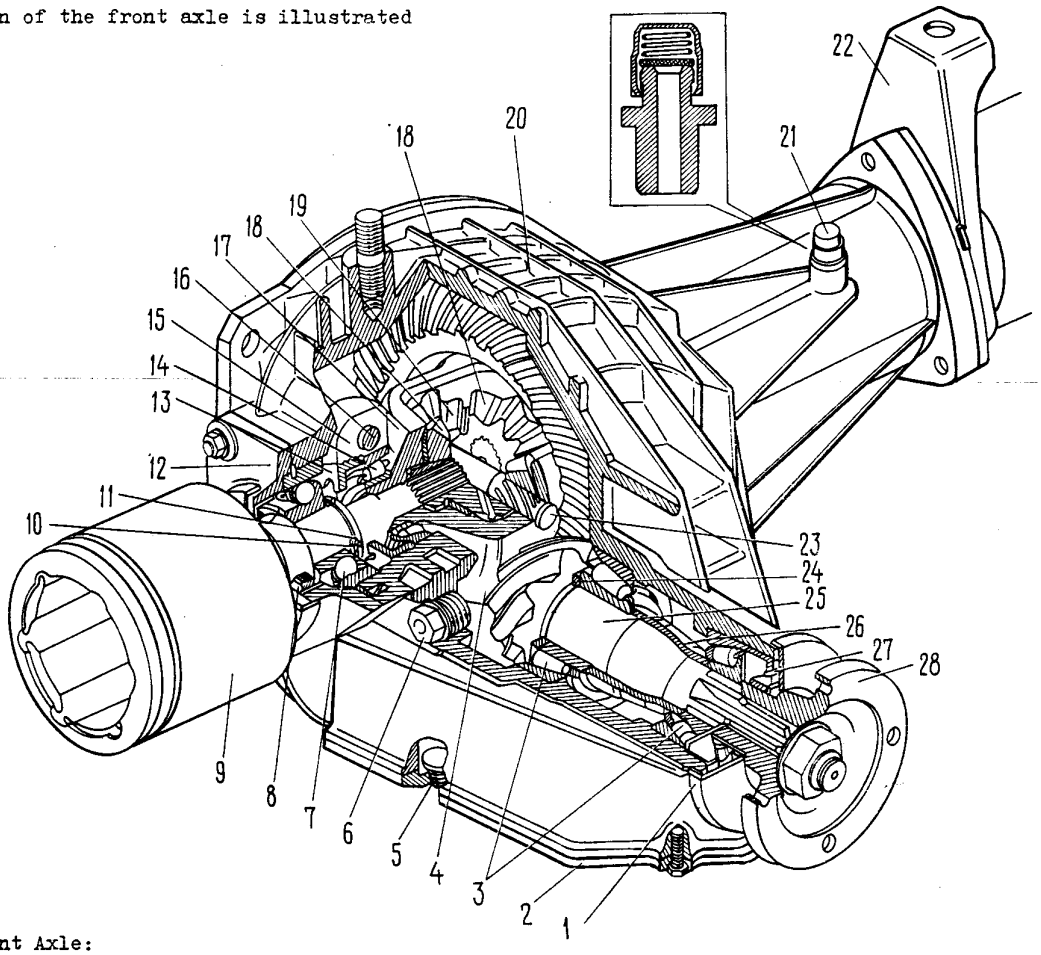
If the nut is tightened to such an extent that the antitorque moment is higher than required, disassemble the final drive, replace the spacer

sleeve by a new one, assemble the final drive and adjust as prescribed under "Assembly and Adjustments".

To assemble the rear axle reverse the disassembly operations.

FRONT AXLE

The design of the front axle is illustrated in Fig. 3-84.



NO 3 BEARING PART NO 2101 2402025

NO 27 OIL SEAL PART NO 2101 2402052-C

Fig. 3-84. Front Axle:
1 - wheel guard; 2 - final drive housing lower cover; 3 - drive pinion bearings; 4 - differential housing; 5 - drain plug; 6 - filler and check level plug; 7 - inner joint housing bearing; 8 - gland; 9 - wheel drive inner joint housing; 10 - spring washer; 11 - lockring; 12 - bearing cover; 13 - adjusting nut; 14 - differential case bearing; 15 - bearing cover; 16 - cover bolt; 17 - supporting washer; 18 - axle-shaft gears; 19 - differential pinion; 20 - final drive housing; 21 - breather; 22 - front axle bracket; 23 - differential pinion shaft; 24 - adjusting ring; 25 - drive pinion; 26 - bearing spacer bushing; 27 - drive pinion gland; 28 - flange

TROUBLE SHOOTING

Cause	Remedy
Constant Loud Noise on the Move	
1. Wear of splined joint with axle-shaft gears	1. Replace worn or damaged parts
2. Maladjustment, damage or wear of final drive gears or bearings	2. Identify cause of trouble, repair or replace final drive
3. Low oil level in front axle housing	3. Restore oil level, check for oil leaks from housing seals
4. Wear or breakage of inner joint housing bearing	4. Replace bearing
Noise during Acceleration of Car	
1. Wear or maladjustment of differential bearings	1. Replace worn parts, adjust differential bearings
2. Meshing of final drive gears improperly	2. Adjust meshing of final drive gears as

Cause	Remedy
adjusted during repairs	instructed under "Rear Axle"
3. Damaged bearings of inner joint housings	3. Replace bearings
4. Lack of oil	4. Restore oil level and check for oil leaks in axle housing seals
Noise during Engine Braking	
1. Wrong backlash in final drive gears	1. Adjust backlash as instructed under "Rear Axle"
2. Excessively large clearance in drive pinion bearings caused by loosening of flange nut or wear of bearings	2. Adjust clearance (see "Rear Axle"); replace bearings, if necessary
Noise during Acceleration and Engine Braking	
1. Drive pinion bearings worn or broken	1. Replace damaged parts
2. Wrong backlash of final drive gears	2. Adjust normal backlash, replace damaged parts
Noise on Turns	
1. Differential pinions rotate with difficulty on shaft	1. Replace damaged or worn parts
2. Differential pinion shaft scored	2. Smooth out minor scores with fine emery cloth; if necessary, replace pinion shaft
3. Seizure of gears in differential case	3. In case of minor damage of gears and mating surfaces of differential case dress them with fine emery cloth; replace damaged parts, if necessary
4. Wrong backlash of differential gears	4. Adjust backlash
Knocking at Beginning of Motion	
1. Excessively large clearance in splined joint of drive pinion shaft with flange	1. Replace final drive flange and gears
2. Excessively large backlash of final drive gears	2. Adjust backlash (see "Rear Axle")
3. Wear of bore for pinion shaft in differential case	3. Replace differential case and, if necessary, pinion shaft
4. Wear of splined joint with axle-shaft gears	4. Replace worn parts

Cause	Remedy
Oil Leaks	
1. Wear or damage of drive pinion gland	1. Replace gland
2. Wear of inner joint housing gland	2. Replace gland
3. Loose fastenings of inner joint housing bearing covers or of axle housing covers, damaged sealing gaskets	3. Tighten nuts and bolts, replace sealing gaskets

REMOVAL AND INSTALLATION

Place the car on a lift or an inspection pit and raise its front end.

Remove the sway eliminator bar, the braces of the suspension crossmember and the protective shield of the engine sump. Disconnect the shock absorbers from the lower wishbones and detach the front propeller shaft from the drive pinion flange of the front axle final drive.

Compress the suspension spring, detach the ball joint from the lower wishbone and remove the spring, relieving it gently of the load. Disconnect the steering rods from the knuckle arms.

Take off the cap and unscrew the nut of the wheel hub bearings.

Perform the same operations on the other side of the suspension.

Loosen the clamp which holds together the inlet pipe and the muffler pipe, disconnect the pipe and muffler mountings in the rear end of the car and on the gearbox.

Using wrench 02.7812.9500 unscrew the nuts which fasten the muffler inlet pipe to the exhaust manifold and ease the pipe down.

Unscrew the nuts which fasten the engine front mount pads to the brackets of the front suspension crossmember.

Supporting the front axle, unscrew the bolt which fastens R.H. bracket 22 (Fig. 3-84) to the engine and two nuts fastening the front axle at the L.H. side.

Lift the engine 25 - 30 mm and remove the front axle complete with the front wheel drive.

To install the front axle on the car reverse the removal procedure. During installation tighten the nuts and bolts with the torques specified in the Appendix.

Fill the front axle housing through the filler hole with transmission oil ТАД-17И; the oil level should reach the lower edge of the hole.

DISASSEMBLY

Install and fasten the front axle on a repair stand. Unscrew plug 5 (Fig. 3-84) and empty the

housing, then do the following on both ends of the front axle:

- unscrew the nuts of cover 12 of inner joint housing bearing 7 and take out the joint taking care not to damage the sealing gasket;
- remove lockring 11 and spring washer 10, press bearing 7 off inner joint housing 9 and remove gland 8.

Take off the stamped cover of the axle housing and the sealing gasket. Removal of lower cover 2 should be discouraged.

Disassemble the front axle final drive following the procedure described in the "Rear Axle" chapter.

INSPECTION

Examine the parts following the recommendations given in the "Rear Axle" chapter and, additionally, make sure that:

- the ball bearing of the inner joint housing is neither worn nor damaged (replace the bearing if its radial clearance exceeds 0.05 mm);
- the inner joint housing is not distorted and its mounting surfaces are not damaged;
- there are no scores and dents in the slots of the inner joint housing;
- there are no wear or cracks on the housing mounting surfaces.

Replace any worn and damaged parts by new ones.

ASSEMBLY

Prior to assembling refer to the marks on the final drive gears to make sure the gear ratio is equal to that of the rear axle final drive.

Assemble and adjust the front axle final drive in the manner prescribed in the "Rear Axle" chapter and see that distance "D" (Fig. 3-82) is increased by 0.08 - 0.11 mm. To adjust the final drive use bracket 67.8701.9508 with a measuring tip and wrench 67.7812.9520.

Install bearing cover 12 with gland 8 on inner joint housing 9 (Fig. 3-84), then press-fit bearing 7. Install spring washer 10 and lockring 11.

Install front axle bracket 22 on the R.H. housing of the inner joint, together with the cover.

Install the assembled inner joint into the housing, first slipping sealing gaskets on the studs. Screw on the nuts of the joint bearing covers.

FRONT WHEEL DRIVE

The front wheels receive the torque from the front driving axle via two joints interconnected by shaft 4 (Fig. 3-85). The outer joint (constant velocity joint) consists of housing 13, holder 11, cage 8 with balls 10, lockring 12 and thrust ring 7. Holder 11 is connected with housing 13 by the balls which enter the slots of holder 11 arranged radially, and into the housing slots. The holder is slipped on the splines of shaft 4 all the way to bear against thrust ring 7 and is secured by lockring 12. When compressed, this ring passes freely through the splined hole of holder 11 which contributes to easy connection and disconnection of the joint and shaft 4.

The joint is protected against ingress of dirt and moisture by boot 6 which, in its turn, is protected against mechanical damage by cover 5. The boot is held on shaft 4 and on the joint housing by clamps 9.

The inner joint differs from the outer one in that it has straight slots. Axial displacement of the joint parts in the housing is limited by wire retainer 2.

The parts of the inner joint and some outer joints are divided according to size into several assembly groups; therefore not a single part of the joint may be replaced individually. The joint should be replaced as an integral assembly. The parts that may be replaced separately are boot covers 5 and boots 6, clamps 9, ring 3, retainer 2.

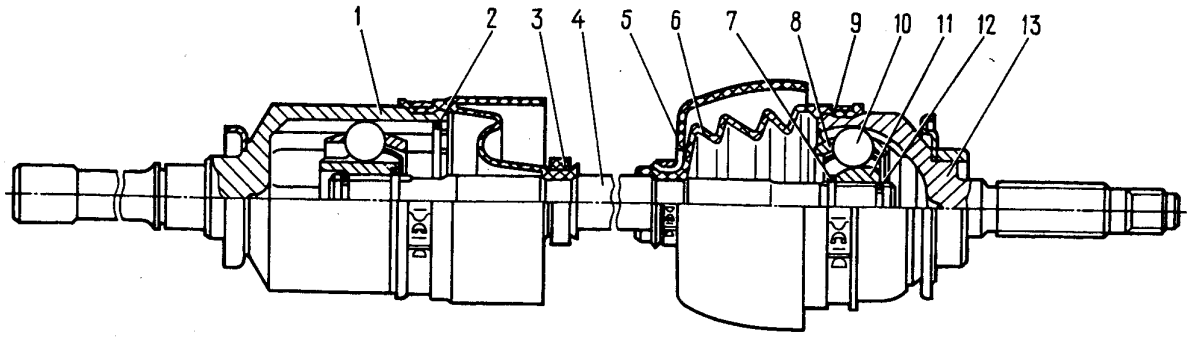


Fig. 3-85. Front Wheel Drive:
1 - inner joint housing; 2 - retainer; 3 - boot ring; 4 - front wheel drive shaft; 5 - boot cover; 6 - boot; 7 - holder thrust ring; 8 - cage; 9 - clamp; 10 - ball; 11 - outer joint holder; 12 - lockring; 13 - outer joint housing

TROUBLE SHOOTING

Cause	Remedy
Noise and Knocking of Front Wheel on the Move (Particularly on Turns)	
1. Wear of outer or inner joint parts	1. Replace worn or damaged joints
2. Distortion of wheel drive shafts	2. Straighten or replace shafts
Leakage of Lubricant	
Damage or fracturing of boots of inner or outer joints	Replace lubricant in joint and protective boot. If joint parts are worn or damaged, replace joint assembly

REMOVAL AND INSTALLATION

Removal. Put the car on a lift or inspection pit, apply the parking brake and perform the following operations on both sides of the car:

- raise the front end of the car and put trestles under it;
- disconnect the shock absorber from the lower wishbone;
- compress the suspension spring and disconnect the ball joint from the lower wishbone;
- remove the wheel hub cap and unscrew the hub bearing nut, then the nuts of the inner joint housing bearing cover;
- unscrew the bolt of the front axle suspension R.H. bracket;
- remove the outer and inner joints from the wheel hub and from the front axle.

Installation. The front wheel drive is installed by reversing the removal operations.

DISASSEMBLY AND ASSEMBLY

The front wheel drive must be disassembled in case of damage to boots 6 and covers 5 with a view to examining the parts and checking the quality of lubricant.

Proceed as follows:

- unclamp and remove clamp 9 (Fig. 3-85) from rubber boot 6;
- unclamp the inner clamp which fastens cover 5 and boot 6 on shaft 4 and shift the cover with boot along the shaft to ensure access to joint holder 11;
- knock holder 11 off the shaft with a drift and hammer;

Caution

To prevent wedging of lockring 12, take care not to cock the holder by selecting properly the force and direction of the blow.

- take thrust ring 7, boot 6 and cover 5 off shaft 4;
- shift the boot and cover of the inner joint along the shaft, remove retainer 2, take shaft 4 complete with the holder, cage and balls from housing 1;

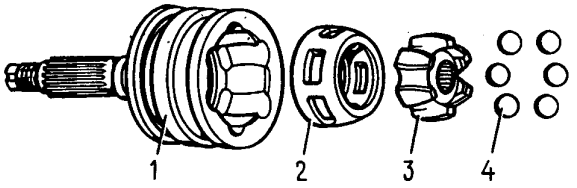


Fig. 3-86. Front Wheel Drive Outer Joint Parts: 1 - joint housing; 2 - cage; 3 - holder; 4 - ball

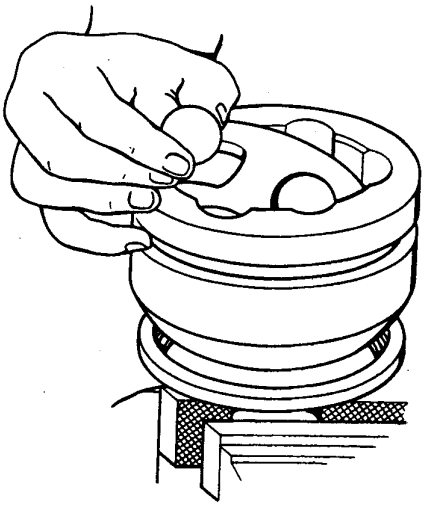


Fig. 3-87. Removing Balls from Cage

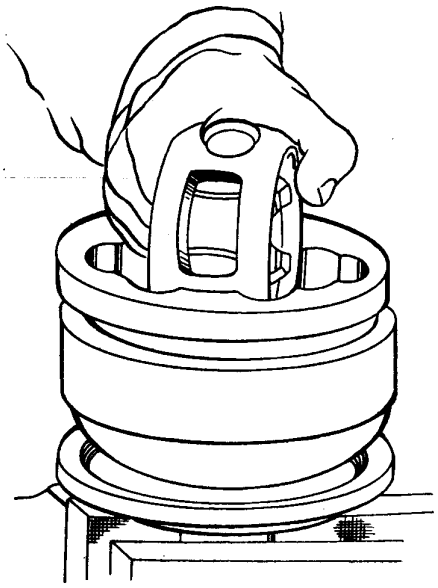


Fig. 3-88. Removing Cage Complete with Holder from Joint Housing

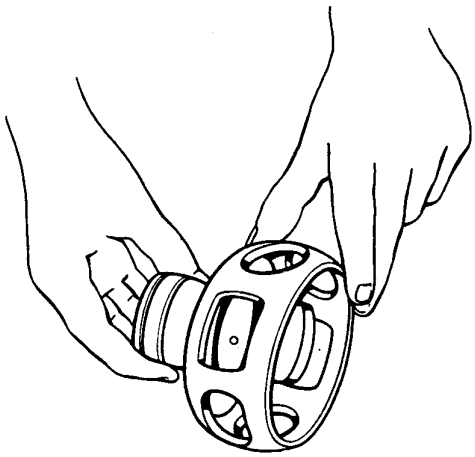


Fig. 3-89. Removing Holder from Cage

- knock the holder of the inner joint off shaft 4 with a drift and a hammer;

- take off the thrust ring and shift the boot off the shaft;

- wash the inner spaces of the joint housings and other parts.

The most complicated and important are the operations related to disassembly and assembly of the outer joint whose parts are illustrated in Fig. 3-86.

Observance of the below-stated rules will ensure a high standard of disassembly and assembly.

Mark the holder, cage and housing of the joint with paint to define their relative positions. Clamp the outer joint in a vice as shown in Fig. 3-87. Incline the holder and cage so that one of the balls comes out as much as possible from the slot in the joint housing. Force the ball with a soft-metal screwdriver out of the cage. Then turn all the parts so that the next adjacent ball comes to the same position and remove it from the cage. Take out the remaining balls in the same manner. There can also be another sequence of removing the balls, viz., every other one.

It is permitted to strike the cage or holder gently with a tool made of a soft material. Do not exert too much force for turning the cage as this may jam the balls and thus hamper further disassembly.

Install the cage with the holder in such a manner that the elongated holes of the cage face the projections of the joint housing (Fig. 3-88) and withdraw the cage complete with the holder.

Take the holder out of the cage; for this purpose arrange one of the holder projections in an elongated hole of the cage (Fig. 3-89) and then roll out the holder towards the straight edge of the hole. Wash and airblast all the parts of the joint.

Assembly. Assemble the outer joint in the reverse order of disassembly operations, bearing in mind the following:

- before assembly coat all the parts lightly with grease ШРУС-4 or Molykote VN 2461c;

- when installing the cage complete with holder into the joint housing align the marks made before disassembly and set the circular recess of the holder (for the thrust ring) towards the shaft;

- while installing the balls into the cage, incline the holder to an angle approximately twice as large as that of the cage;

- fill the joint with 75 cm^3 of one of the greases mentioned above;

- before striking shaft 4 (Fig. 3-85) for connecting it with inner holder 11, install lockring 12 strictly on the centre and then strike smartly the end of the shaft down; the compressed lockring will slide through the splined hole of the holder;

- press-fit the ring of the joint housing gland with mandrel 67.7853.9533.

After assembly it may happen that the holder gets locked when the shaft is rocked and the joint does not rotate. This should not be regarded as improper assembly because there will be no such locking when the joint rotates in service.

Using the procedure described above disassemble the inner joint completely. The holder should be removed towards the larger diameter of the cage.

Assemble the inner joint by reversing the disassembly operations and aligning the marks made before disassembly. The elongated tapered part of the cage should face shaft 4.

During assembly pack the joint with 150 cm^3 of one of the above-mentioned greases.

Install the joint boots with mandrel 67.7853.9537.

If there is no knocking and vibration and the boots are intact, the front wheel drive should better be left without disassembly.