CARS

VAZ-2121 and VAZ-21211

REPAIR MANUAL

AVTOEXPORT • USSR • MOSCOW

INTRODUCTION

The present Manual is intended as a guidance for the repairs and maintenance of VAZ-2121 and VAZ-21211 cars at service centres and stations, in motor transport pools and repair shops.

The Manual applies to the following car models:

VAZ-2121 - four-wheel drive passenger three-door sedan;

VAZ-21211 - modification of VAZ-2121 model with a less powerful engine and different gearbox ratios.

The Manual offers recommendations for servicing and repairing the car by the use of ready-made spare parts. Besides, it contains instructions covering the trouble shooting, disassembly and assembly, adjustments and repairs of car units.

The recommended items of repair equipment are listed in Appendix 2. The tightening torques for the screw joints are specified in Appendix 1.

In view of constant improvements of the car units and parts, there may be certain discrepancies between the text and illustrations on the one hand and the actual design of the car on the other. All the design modifications will be duly covered in the subsequent editions of the Manual.

The construction of the car is described in the Manual as of December 1980.

Section I
GENERAL DATA

SPECIFICATIONS

Main parameters	VAZ-2121	VAZ-21211
Seating capacity, motorist including	4	
Payload, kg	400	
Gross mass (fully serviced car less payload), kg	1150	
Overall dimensions	see Fig. 1-1	
Maximum speed in top gear, km/h:		
with motorist and passenger	132	127
fully laden	130	125
Acceleration time from rest to 100 km/h with gearshifting, s:		
with motorist and passenger	23	27
fully laden	25	29
Minimum turning radius, outer front wheel track, m	5.5	
Maximum gradeability, fully laden, without acceleration, in 1st gear, %	58	

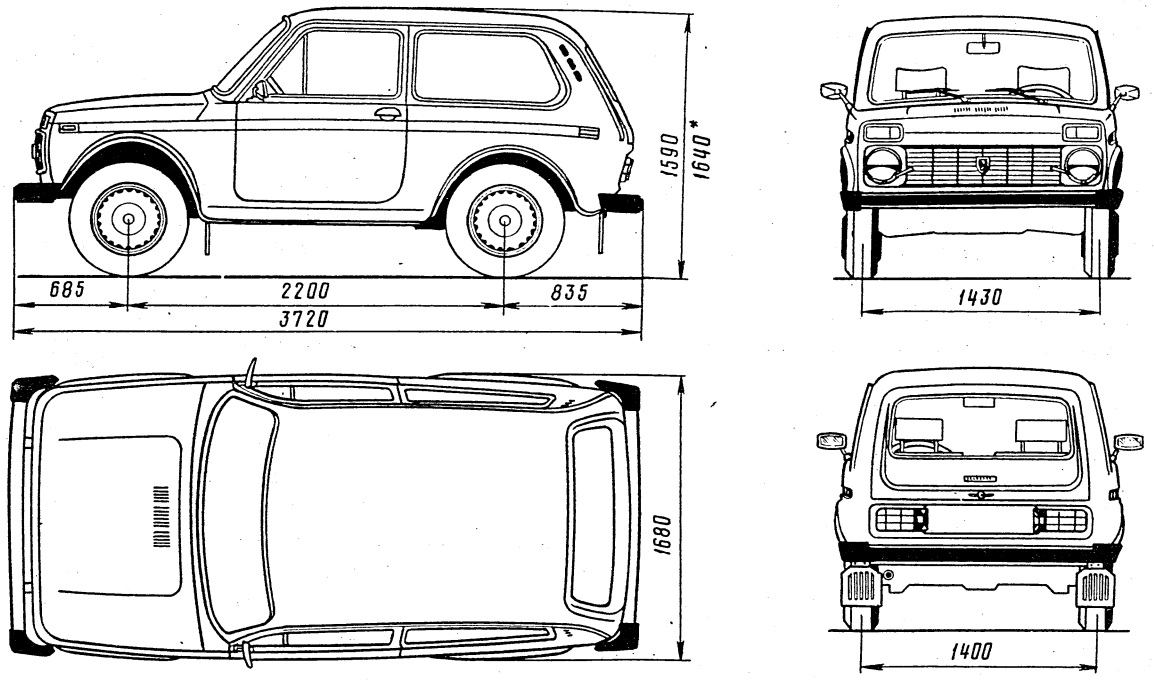


Fig.1-1. VAZ-2121 car. Main Overall Dimensions
(*height empty)

Main parameters	VAZ-2121	VAZ-21211
Engine		
Model	2121	21211
Type	four-stroke, gasoline, carburettor	
Number and arrangement of cylinders	four in-line	
Bore/stroke, mm	79x80	79x66
Displacement, l	1.57	1.3
Compression ratio	8.5	
Rated horsepower at 90 s^{-1} (5400 rpm), kW (hp), minimum:		
GOST	58.9(80)	50.7(69)
DIN	55.9(76)	47.8(65)
SAE	63.2(86)	53(72)
Maximum torque at 50 s^{-1} (3000 rpm), N.m (kgf.m), minimum	122 (12.4)	94(9.6)
Minimum idling speed, s^{-1} (rpm)	13.6- 15* (820 - 900)	
Firing order	1 - 3 - 4 - 2	
Power Transmission		
Clutch	dry, single-plate with central pressure spring	
Gearbox	mechanically-operated, three-range, four-speed	
Gear ratios:		
1st gear	3.242	3.75
2nd gear	1.989	2.30
3rd gear	1.289	1.49
4th gear	1.000	1.00
reverse	3.340	3.87
Transfer case	two-stage type with interaxle locking differential	
Gear ratios:		
high speed	1.2	
low speed	2.135	
transfer case differential	bevel gear, two- pinion type	
Propeller shaft drives:		
gearbox to transfer case	flexible coupling and needle bearing universal joint	
transfer case to front and rear axles	two needle bearing joints and slip yokes	
front axle to wheels	exposed, with constant velocity joints	
Front and rear axle final drives:		
gear ratio	4.3	4.78
differential	bevel gear two pinion type	
Running Gear		
Front suspension	independent, transverse wishbones with coil springs, hydraulic telescopic shock absorbers and sway eliminator	
Rear suspension	rigid beam linked to body by one transverse and four longitudinal radius rods; coil springs and hydraulic telescopic shock absorbers	

* 12-13.3 s^{-1} (720-800 rpm) with carburettor 2106-1107010.

Continued

Main parameters	VAZ-2121	VAZ-21211
Wheels	disc, stamped	
rim size	127J-406 (5J-16)	
Tyres	radial or cross-ply, tube type	
size	cross ply - 175-16 (6.95-16) radial-ply - 175R16	
Steering		
Steering mechanism	hourglass worm with double roller. Ratio 16.4	
Steering linkage	centre rod and two symmetrical side rods, pitman arm, idler arm, knuckle arms	
Brakes		
Service brakes:		
front	disc type with movable caliper	
rear	drum-type with self-aligning shoes and rear brake pressure regulator	
Service brake control	hydraulic, foot-operated, separate front and rear brake circuits with vacuum booster	
Brake booster	vacuum type on all wheels	
Parking brake	hand-operated, cable-controlled rear brake shoes	
Electrical Equipment		
Wiring system	single-wire, negative earth return	
Rated voltage, V	12	
Storage battery	55 A-h at 20-h discharge rate	
Generator	A.C. machine with built-in rectifier. Output current 42A at 83 s^{-1} (5000 rpm) of crankshaft	
Starter	with electromagnetic solenoid switch and overrunning clutch, power 1.3 kW	
Spark plugs	A17ДВ (A7.5XC) or FM14-200/2, thread M14x25-6E	
Body		
Model	2121	
Type	all-metal three-door sedan of unitized construction	

MAIN ADJUSTMENT DATA

Valve lever-to-cam clearance, engine cold, mm	0.15
Breaker point gap, mm	0.4±0.05
End play of front wheel hub bearings, mm	0.01-0.07
Spark plug gap, mm	0.5 - 0.6
Free travel of clutch pedal, mm	25 - 35
Free travel of brake pedal, mm	3 - 5
Steering wheel play, deg. (mm)	5 - (18-20)
Toe-in of front wheels on laden car, measured between wheel rims, mm	2 - 4
Camber of front wheels on laden car, deg. (mm)	0°30'±20'(1-5)
Caster, deg	3°30'±30'
Steering knuckle inclination, deg	11°30'

Continued

Main parameters	VAZ-2121	VAZ-21211
Coolant temperature in warmed-up engine, °C	95	
Coolant level in expansion tank of cold engine	3-4 cm above "MIN" mark	
Brake fluid level in brake and clutch fluid reservoirs	to lower edge of filler holes	
Engine oil pressure, MPa (kgf/cm²)	0.35-0.45(3.5-4.5)	
Initial spark advance angle before TDC, deg	3 - 5*	
Tyre pressure, MPa (kgf/cm²):		
front wheels	0.18(1.8)	
rear wheels	0.17(1.7)	
Maximum gradient on dry solid ground on which fully laden car is held infinitely after shifting parking brake lever 4 - 5 quadrant teeth, %	30	

FUELS, LUBRICANTS, FLUIDS

Unit	Q'ty, l	Material
Fuel tank (including 4-6.5 l reserve)	42	Automotive gasoline АИ-93, GOST 2084-67
Cooling system (including body heating system)	10.7	Coolant Тосол А-40, Тосол А-65
Engine lubricating system (including oil filter)	3.75	Engine oil: M-I2Г$_I$ summer grade; M-I2ГИ summer grade; M-8Г$_I$ winter grade; M-8ГИ winter grade; M-6з/IOГ$_I$ all-weather grade; M-IOГИ all-weather grade
Gearbox housing	1.35	Transmission oil ТАД-I7п
Rear axle housing	1.3	
Steering gear case	0.215	
Transfer case housing	0.75	
Front axle housing	0.9	
Clutch hydraulic system	0.2	Hydraulic brake fluid "Нева"("Neva")
Brake hydraulic system	0.66	
Front shock absorber	0.11	Shock absorber fluid МГП-10
Rear shock absorber	0.18	
Windshield washer tank	4.0	Mixture of water with special fluid НИИСС-4
Front wheel hub bearings		Consistent grease Литол-24, GOST 21150-75
Starter drive carrier ring		Consistent grease ФИОЛ-2У
Universal joint cross bearings		Consistent grease ФИОЛ-1
Propeller shaft splined joints		Consistent grease ЛИМОЛ or ФИОЛ-1
Seat slides		Consistent grease ШРУС-4
Front wheel drive joints		Consistent grease ШРБ-4
Steering rod joints and front suspension ball pins		Petrolatum ВТВ-1 in aerosol form
Storage battery terminals and clamps		Consistent grease "Dispersol-1";
Door locks		ЦИАТИМ-221, GOST 9433-60
Door keyholes		Petrolatum ВТВ-1 in aerosol form
Pressure regulator		Consistent grease ДТ-1
Engine detergent oil (used when replacing lubricating oil)		Detergent oil ВНИИНП-ФД

* 5 - 7° for engines with carburettors 2107-1107010-10, 2107-1107010-20, 2105-1107010-10 and 2105-1107010-20.

Section II
ENGINE

The longitudinal and cross sections of the engine are shown in Figs 2-1 and 2-2.

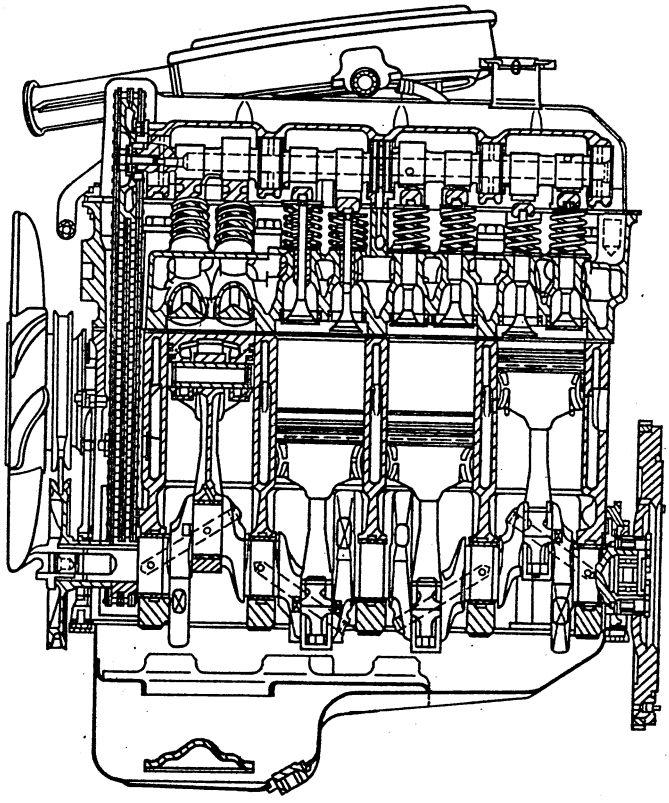


Fig.2-1. Engine. Longitudinal Section

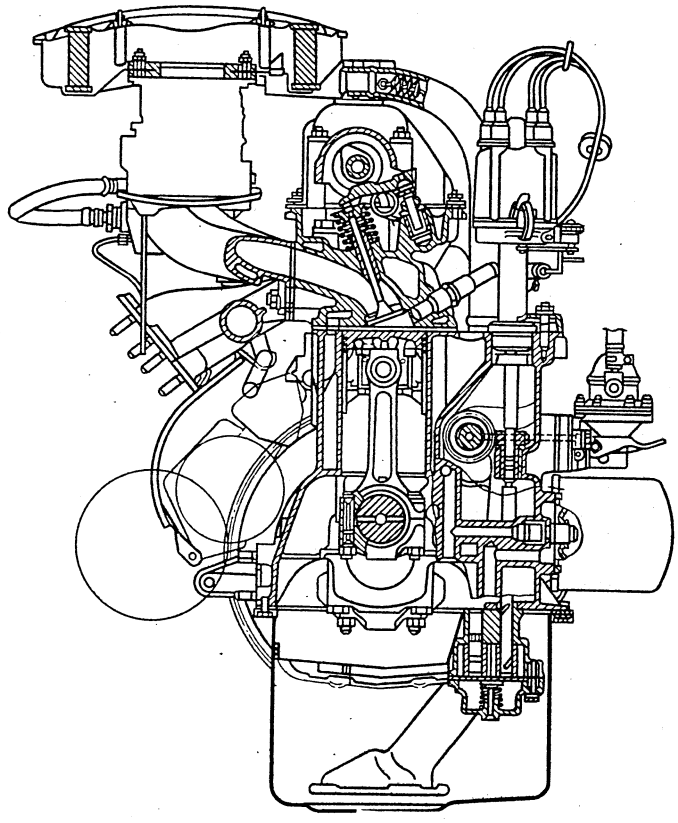


Fig.2-2. Engine. Cross Section

TROUBLE SHOOTING

Cause of trouble	Remedy
Engine Fails to Start	
1. No fuel in carburettor:	
(a) fuel lines clogged	(a) wash and airblast fuel tank and lines
(b) fuel pump faulty	(b) examine fuel pump and replace faulty parts
2. Ignition system inoperative	2. See chapter "Ignition System"
3. Carburettor choke valve remains closed after engine starting	3. Eliminate poor tightness of carburettor choke mechanism

Cause of trouble	Remedy

Engine Idles Unevenly or Stalls

1. Idling performance maladjusted	1. Adjust idling engine speed
2. Air infiltrates through damaged drain pipe	2. Replace drain pipe
3. Air infiltrates through damaged hose leading from inlet manifold to brake vacuum booster	3. Replace damaged hose
4. Air infiltrates through gaskets in joints between inlet manifold and carburettor or cylinder head	4. Tighten up nuts or replace gaskets
5. Wrong clearances between valve levers and camshaft cams	5. Adjust clearances
6. Carburettor faulty:	
(a) carburettor jets or channels obstructed	(a) airblast jets and channels
(b) water in carburettor	(b) remove water from carburettor, drain sediment from fuel tank
(c) choke mechanism diaphragm leaky	(c) replace diaphragm
7. Ignition system faulty	7. See chapter "Ignition System"

Engine Lacks Power and Pickup

1. Carburettor throttles open incompletely	1. Adjust throttle valve control linkages
2. Air cleaner clogged	2. Replace cleaner element
3. Ignition system faulty	3. See under "Ignition System"
4. Fuel pump faulty	4. Check pump performance and replace damaged parts
5. Carburettor faulty:	
(a) acceleration pump defective	(a) check pump capacity, replace faulty parts
(b) main jets clogged	(b) airblast jets
(c) choke valve opens incompletely	(c) adjust choke valve linkage
(d) wrong fuel level in float chamber	(d) adjust carburettor float setting
6. Wrong valve lever-to-cam clearances	6. Adjust clearances
7. Poor compression, below 1 MPa (10 kgf/cm^2):	
(a) disruption of cylinder head gasket	(a) replace gasket
(b) burning of pistons, breaking or sticking of piston rings	(b) decarbonize piston grooves and rings, replace defective rings and pistons
(c) poor seating of valves	(c) replace faulty valves, reface seats
(d) excessive wear of cylinders and piston rings	(d) replace pistons, rebore and hone cylinders

Crankshaft Main Bearing Knock

As a rule, this knocking is of a dull metallic nature, detected when the throttle valve is sharply opened at idling speed. Grows with acceleration of crankshaft speed. Excessive crankshaft end play causes a sharper sound with uneven intervals most conspicuous during gradual throttling up and down

1. Spark advance angle too early	1. Adjust ignition timing
2. Oil pressure too low	2. See "Oil Pressure Too Low at Idling Speed"
3. Loosening of flywheel bolts	3. Tighten up to specified torque
4. Excessive clearance between main journals and their bearing shells	4. Grind journals and replace shells
5. Excessive clearance between thrust half-rings and crankshaft	5. Replace thrust half-rings by new, thicker ones

Big-End Bearing Knock

Usually, knocking of big-end bearings is sharper than that of the main bearings. It is heard at engine idling speed when the throttle valve is sharply opened. The origin of knocking can be easily identified by disconnecting spark plug wires one after another.

1. Insufficient oil pressure	1. See "Oil Pressure Too Low at Idling Speed"
2. Excessive clearance between big-end journals and shells	2. Replace shells and grind journals

Cause of trouble	Remedy

Piston Slap

As a rule, it is a dull knocking caused by slackness of piston in the cylinder. It is best audible at a low engine speed and under load

1. Excessive piston-to-cylinder clearance	1. Replace pistons, rebore and hone cylinders
2. Excessive piston ring side clearance	2. Replace rings or pistons with rings

Valve Knock

Excessive clearances in valve gear cause a characteristic knock, usually at regular intervals. Knocking frequency is lower than that of any other engine knocks since the valves are operated by the camshaft which rotates at half the crankshaft speed

1. Excessive valve-to-lever clearances	1. Adjust clearances
2. Valve spring broken	2. Replace spring
3. Excessive clearance between valve stem and guide	3. Replace worn parts
4. Wear of camshaft cams	4. Replace camshaft and valve levers
5. Loosening of adjusting bolt locknut	5. Adjust valve lever-to-cam clearance and tighten locknut

Camshaft Drive Chain Noise

The camshaft drive chain noise becomes noticeable against the background of general engine noise in case of excessive clearances between the chain and sprockets and is particularly loud at low engine speed

1. Chain becomes slack through natural wear	1. Tension chain
2. Chain tensioner shoe or damper broken	2. Replace tensioner shoe or damper
3. Chain tensioner plunger rod jamming	3. Eliminate jamming

Oil Pressure Too Low at Idling Speed of Warm Engine

1. Foreign matter getting under reducing valve	1. Clean valve of foreign matter and burrs, wash out oil pump
2. Oil pump gears worn	2. Repair oil pump
3. Excessive clearance between crankshaft main journals and bearing shells	3. Grind journals and replace shells

Oil Pressure Too High in Warm Engine

Oil pump reducing valve jamming	Replace valve

Excessive Oil Consumption

1. Oil leaking past engine seals	1. Tighten fastenings or replace gaskets and glands
2. Wear of piston rings, pistons or cylinders	2. Rebore cylinders and replace pistons and rings
3. Breaking of piston rings	3. Replace rings
4. Gumming of slots in oil control rings or of cutouts in piston grooves	4. Remove carbon deposits from slots and cutouts
5. Valve oil-deflecting caps worn or damaged	5. Replace caps
6. Heavy wear of valve stems or guides	6. Replace valves, repair cylinder head

Excessive Fuel Consumption

1. Choke valve fails to open completely	1. Examine choke valve linkage
2. High resistance to car motion	2. Check and adjust tyre pressure, brake system, front wheel alignment
3. Wrong ignition timing	3. Adjust ignition timing

Continued

Cause of trouble	Remedy
4*. Ignition distributor vacuum spark timer faulty	4*. Replace vacuum timer or ignition distributor
5. Carburettor fuel level too high:	
(a) carburettor needle valve or its gasket leaky	(a) look for foreign particles between valve seat and needle; replace gasket or valve if necessary
(b) jamming or friction interferring with normal motion of float; float leaky	(b) examine float and replace it, if necessary
6. Carburettor air jets clogged	6. Clear up jets
Engine Overheats	
1. Slackening of pump and generator drive belt	1. Adjust belt tension
2. Lack of coolant in cooling system	2. Add coolant into cooling system
3. Wrong ignition timing	3. Adjust ignition timing
4. Radiator heavily soiled on the outside	4. Clean radiator with a strong jet of water
5. Thermostat faulty	5. Replace thermostat
6. Defective valve in radiator cap (opening pressure below 0.05 MPa or 0.5 kgf/cm^2)	6. Replace cap
7. Coolant pump faulty	7. Check, replace or repair coolant pump
Rapid Drop of Coolant Level in Expansion Tank	
1. Radiator damaged	1. Replace or repair radiator
2. Damaged hoses or pipe joint gaskets	2. Replace damaged hoses or gaskets
3. Coolant leaking from heater cock	3. Replace cock
4. Loosening of hose clamps	4. Tighten up clamps
5. Coolant leaks through coolant pump gland	5. Replace gland
6. Radiator cap or its gasket damaged	6. Replace cap
7. Cylinder head gasket damaged	7. Replace gasket

* Defects relating to the engines with carburettor 2107-1107010-20

ENGINE REMOVAL AND INSTALLATION

Place the car on a lift or a service pit. Remove the hood. Take away the spare wheel and remove its supporting tube.

Disconnect the wires from the storage battery and from the engine-mounted electrical units.

Drain the coolant from the radiator, cylinder block and heater; for this purpose unscrew the plugs on the L.H. side of the cylinder block and on the radiator bottom tank; shift the heater control upper lever to the right (this lever opens the heater cock) and take off the caps from the expansion tank and the radiator.

Caution

To avoid damaging the radiator, unscrew the drain plug with one wrench and hold the plug union soldered into the radiator with another, preferably a socket or box wrench so as not to shear the plug faces.

Remove the fan shroud, first disconnecting its halves. Disconnect the coolant inlet and outlet hoses from the engine and take off the radiator complete with thermostat and hoses.

Remove the air cleaner, first disconnecting the hoses, removing the cover and the cleaner element.

Unscrew the nuts which hold the muffler inlet pipe to the exhaust manifold. Detach the inlet pipe from the bracket on the gearbox and ease it down.

Detach the throttle valve control rod and choke valve cable from the engine.

Disconnect the fuel feed hose from the engine and detach the hoses leading to the heater and vacuum brake booster.

Using the articulated socket wrench 02.7812.9500, unscrew the bolts which hold the starter to the clutch housing. Unscrew the bolts which fasten the clutch housing cover to the lower part of the housing. Using the articulat-

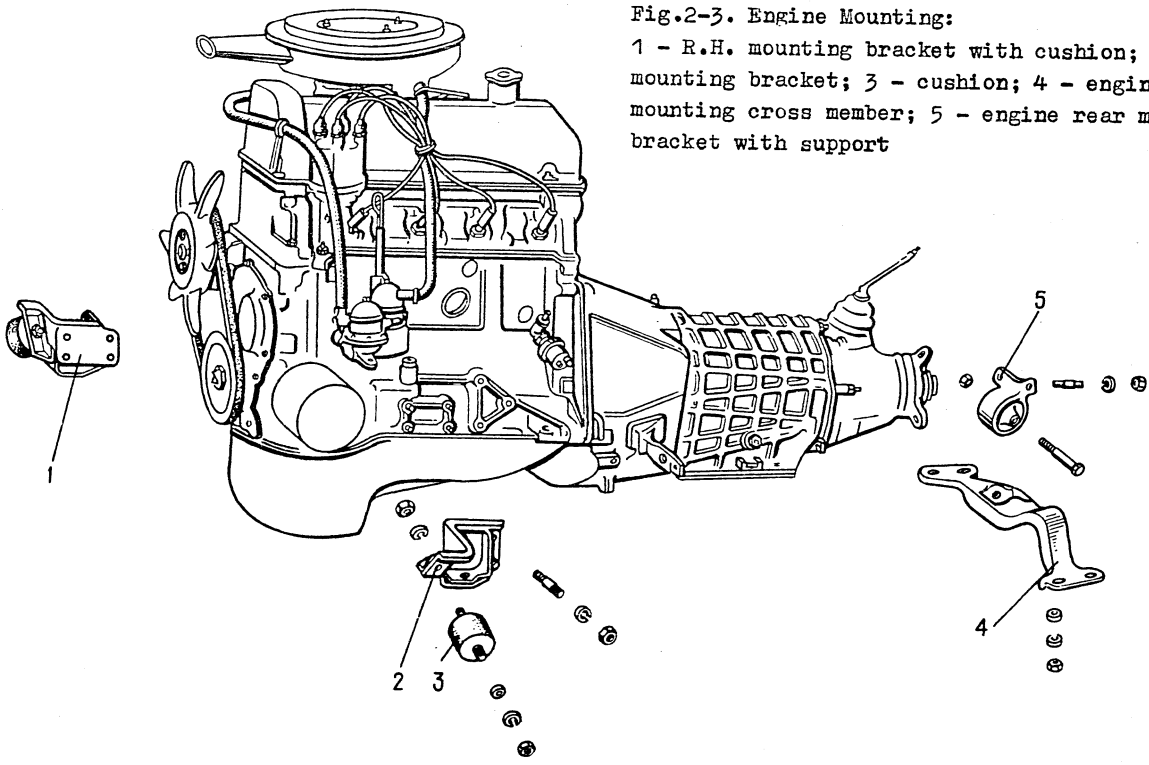


Fig.2-3. Engine Mounting:
1 - R.H. mounting bracket with cushion; 2 - L.H. mounting bracket; 3 - cushion; 4 - engine rear mounting cross member; 5 - engine rear mounting bracket with support

ed socket wrench A.55035, turn off the clutch housing to cylinder block bolts.

Suspend the cross beam TCO-3/379 from a lifting tackle and sling the engine by the shackle installed on the exhaust manifold front fastening stud at the R.H. side and by the clutch housing fastening hole at the L.H. side.

Tension the tackle chain a little, unscrew the nuts which fasten engine front mounting cushions 3 (Fig. 2-3) to the side brackets, unscrew the nuts and the bolt which fastens the front axle housing to the engine brackets.

Lift out the engine, first moving it upward to withdraw the mounting cushion bolts from the bracket holes, then shift it forward so as to pull the ends of the gearbox clutch shaft from the bearing in the crankshaft flange.

Remove the heat-insulating shield of the starter, the starter proper and the hot air intake complete with the inlet hose. Remove the side brackets from the cylinder block, complete with the engine front mounting cushions.

Unscrew the clutch fastening bolts and remove the clutch.

To install the engine, reverse the removal operations. Pay particular attention to the connection of the engine with the gearbox; the main shaft should enter accurately into the splines of the clutch driven disc. Besides, for proper alignment of the engine with the transfer case, the aligning washers of the engine front mounting cushions must enter the corresponding holes in the side brackets.

ENGINE DISASSEMBLY

Wash the engine on the washing stand, put it on the disassembly bench and drain the oil sump.

Disconnect the hoses and throttle valve control rod from the carburettor and remove the latter.

Remove the fuel pump and ignition distributor; unscrew the spark plugs and the coolant temperature transmitter with wrench 67.7812.9514.

Take off the generator and coolant pump drive belt, remove the generator and its bracket.

Remove the coolant pump, disconnecting the heater pipe from the pump and exhaust manifold.

Detach the coolant outlet pipe and the pipe conducting coolant to the heater and remove them from the cylinder head.

Using remover A.60312, unscrew and take off the oil filter with the gasket (Fig. 2-4).

Unscrew the oil pressure and oil pressure signal lamp transmitters and remove their pipe unions. Take off the crankcase breather cover, the oil sump and the oil pump. Take off the retainer of the oil separator drain pipe and take out the crankcase breathing oil separator.

Remove the crankshaft pulley, securing the flywheel with fixing tool A.60330/R (Fig. 2-10)

and unscrewing the crankshaft starting jaw with wrench A.50121 (Fig. 2-5).

Remove the cylinder head cover and the cover of the camshaft chain drive. Unscrew the bolts of the camshaft and oil pump drive shaft sprockets.

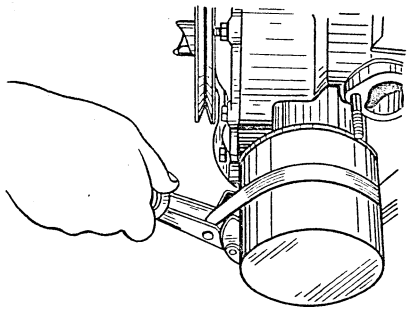


Fig.2-4. Removing the Oil Filter with Remover Tool A.60312

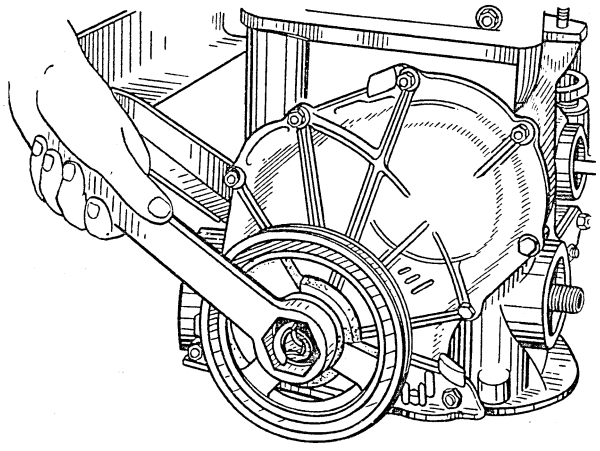


Fig.2-5. Unscrewing the Crankshaft Starting Jaw with Wrench A.50121

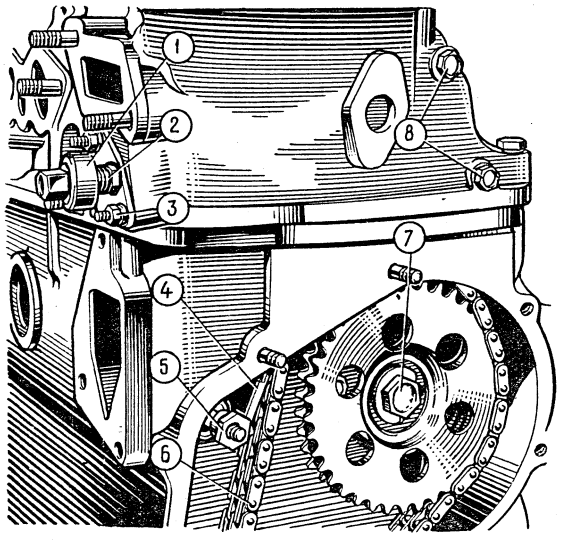


Fig.2-6. Removing the Chain Tensioner and Damper: 1 - tensioner cap nut; 2 - tensioner body; 3 -tensioner fastening nut; 4 - tensioner shoe; 5- shoe bolt; 6 - camshaft drive chain; 7 - oil pump drive shaft sprocket bolt; 8 - damper bolts

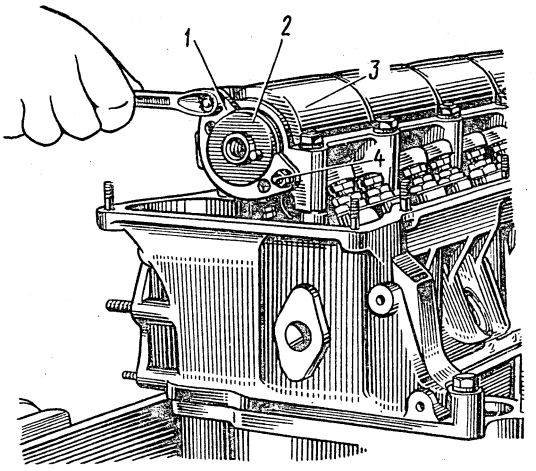


Fig.2-7. Removing the Camshaft Thrust Flange: 1 - thrust flange; 2 - camshaft; 3 - bearing housing; 4 - thrust flange fastening stud

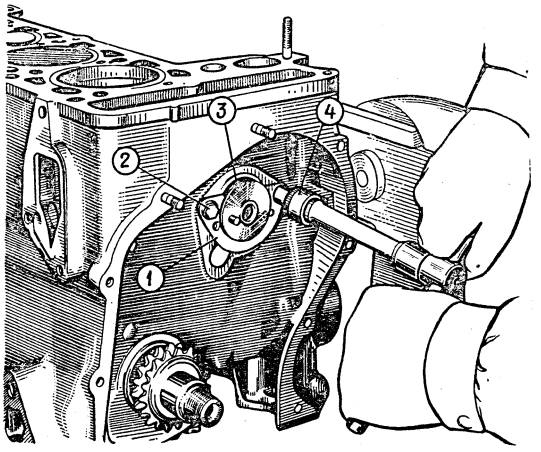


Fig.2-8. Removing the Oil Pump Drive Shaft: 1 - thrust flange; 2 - flange bolt; 3 - oil pump drive shaft; 4 - wrench

Loosen cap nut 1 (Fig. 2-6) of the chain tensioner, unscrew nuts 3 which hold it to the cylinder head, remove the tensioner and, unscrewing bolt 5, take off chain tensioner shoe 4.

Unscrew the chain limiting pin, take off the drive sprockets of the oil pump and camshaft and take out the chain.

Loosen the nuts of studs 4 (Fig. 2-7). Take off the camshaft bearing housing. Unscrew the nuts of studs 4, remove thrust flange 1 and lift out the camshaft taking care not to damage the surfaces of the bearing housing supports.

Unscrew the cylinder head bolts and take off the head complete with the exhaust and inlet manifolds.

Remove thrust flange 1 (Fig. 2-8) of the oil pump drive shaft and take the shaft out of the cylinder block.

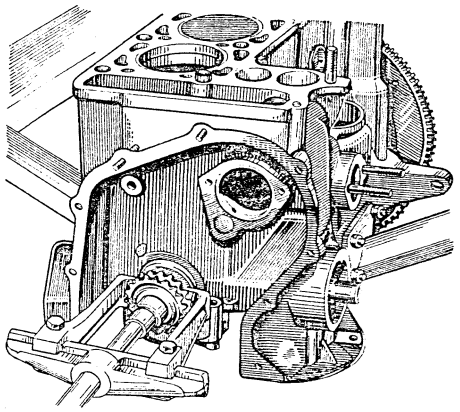


Fig.2-9. Removing the Crankshaft Sprocket with General-Purpose Remover Tool A.40005/1/7

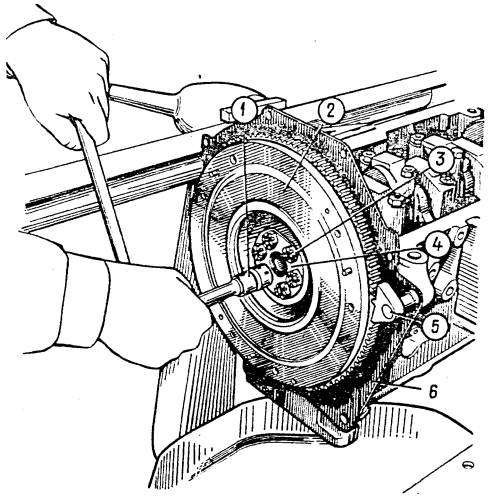


Fig.2-10. Removing the Flywheel:
1 - wrench; 2 - flywheel; 3 - flywheel bolt; 4 - washer; 5 - fixing tool A.60330/R; 6 - clutch housing front cover

Using general-purpose remover tool A.40005/1/7 from the set A.40005, remove the sprocket from the crankshaft (Fig. 2-9).

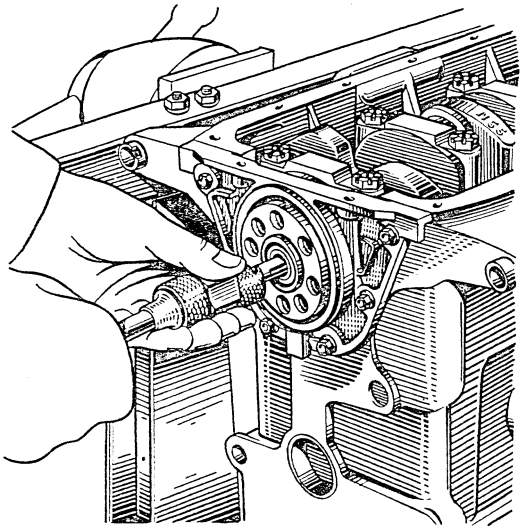


Fig.2-11. Driving out the Gearbox Shaft Bearing from Crankshaft with Remover Tool A.40006

Unscrew the connecting rod bolt nuts, take off the connecting rod caps and lift out the pistons with the connecting rods cautiously through the cylinders.

Note. When disassembling the engine, mark the piston, connecting rod, main and big-end bearing shells so as to install them back where they belong during subsequent reassembly.

Install fixing tool 5 (Fig. 2-10), unscrew bolts 3, take off washer 4 and pull the flywheel from the crankshaft. Remove the front cover of the clutch housing.

Using remover tool A.40006, take out the gearbox clutch shaft bearing from its bore in the crankshaft (Fig. 2-11).

Remove the crankshaft gland holder.

Unscrew the main bearing cap bolts, take out the caps complete with the lower shells, remove the crankshaft, the upper shells and the thrust half-rings on the rear support.

ENGINE ASSEMBLY

Put the washed and cleaned cylinder block on the stand and screw in any missing studs.

Insert the unrecessed shells into the bed and cap of the middle bearing; install the recessed shells into the remaining bearing beds and caps.

Note. The engine cylinders, pistons and glands, bearing shells and thrust half-rings of the crankshaft should be lubricated with engine oil before installation.

Place the crankshaft on the main bearings and insert two thrust half-rings into the sockets of the rear support (Fig. 2-12); the half-rings should be selected for thickness as instructed under "Crankshaft and Flywheel". Install the main bearing caps in accordance with their markings (Fig. 2-13).

Caution

Install the main bearing caps into the cylinder block they belong to. For this purpose the cylinder block and its bearing caps bear the same conventional number (Figs 2-13 and 2-14).

Install the thrust half-rings with their recesses facing the thrust surfaces of the crank-

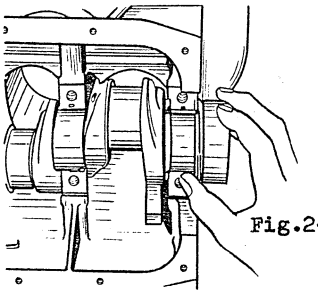


Fig.2-12. Installing the Thrust Half-Rings on Rear Support

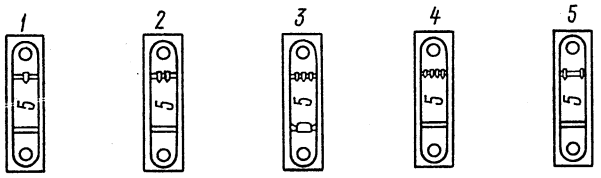


Fig.2-13. Marks on Main Bearing Caps (bearings are counted from engine front) and Cylinder Block Code Number

shaft. The steel-aluminium half-ring should be placed at the front side of the rear support and the cerametallic (yellow) half-ring, at the rear side.

Put the gland holder gasket on the crankshaft flange and insert the clutch housing front cover bolts into the holder holes (Fig. 2-14). Slip the holder with the gland on mandrel 41.7853.4011, move it from the mandrel onto the crankshaft flange and fasten it to the cylinder block.

Install clutch housing front cover 6 (Fig. 2-10) with the aid of two aligning bushings.

Install the flywheel on the crankshaft with the mark (tapered hollow) near the rim facing the axis of the big-end journal of No.4 cylinder, lock the flywheel with fixing tool A.60330/R and bolt it up to the crankshaft flange.

Using an inserter from the set 02.7854.9500, insert the pistons with connecting rods into the cylinders (Fig. 2-15). The set 02.7854.9500 comprises four inserter bushings: one for the standard-size pistons and three for the repair-size ones (0.4 - 0.7 - 1.0 mm oversize). Therefore, select the inserter corresponding to the size of the piston being installed.

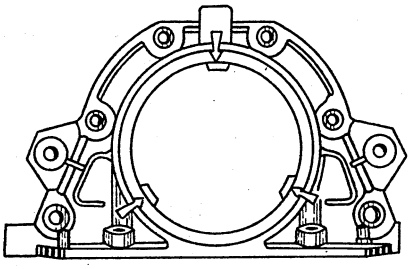


Fig.2-14. Crankshaft Rear Gland Holder. Arrows Indicate Lugs for Aligning the Holder with Crankshaft Flange

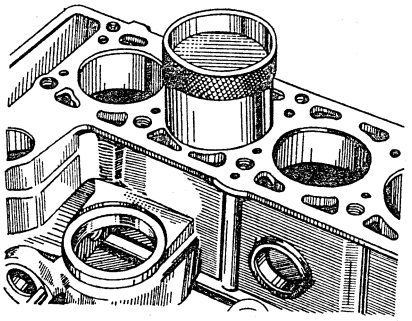


Fig.2-15. Installing the Piston with Rings into Cylinder with Piston Inserter from Set 02.7854.9500

Caution

The hole for the pin in the piston is offset by 2 mm, therefore the pistons should be installed into the cylinder with the mark "П" facing the engine front.

Put the bearing shells into the connecting rods and their caps. Join the connecting rods with the crankshaft journals, install the caps and tighten the connecting rod bolts.

Install the sprocket on the crankshaft. Install the oil pump drive shaft and fasten it by the thrust flange.

Using two aligning bushings, install the cylinder head on the cylinder block complete with the gasket, exhaust and inlet manifolds. Tighten the fastening bolts in two steps in the sequence shown in Fig. 2-16.

- tighten preliminarily bolts 1 through 10 with a torque of 34 - 42 N.m (3.4 - 4.2 kgf.m);
- tighten finally bolts 1 through 10 with a torque of 98 - 121 N.m (9.8 - 12.1 kgf.m) and bolt 11 with a torque of 32 - 40 N.m (3.2 - 4.0 kgf.m).

Turn the flywheel so that the mark on the crankshaft sprocket checks with the mark on the cylinder block (Fig. 2-17).

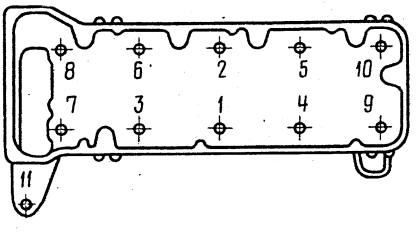


Fig.2-16. Cylinder Head Bolt Tightening Sequence

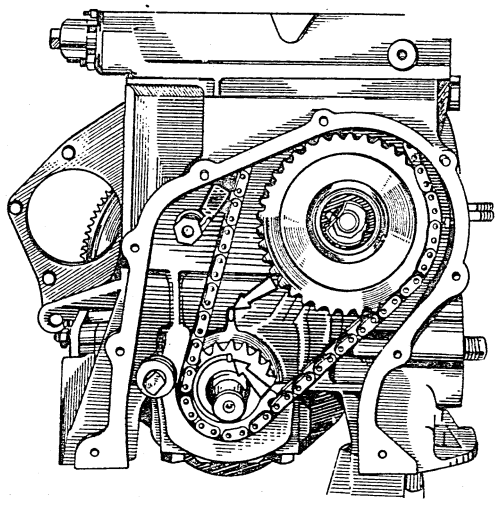


Fig.2-17. Alignment of Timing Marks on Crankshaft Sprocket and on Cylinder Block

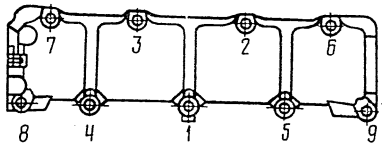


Fig.2-18. Camshaft Bearing Housing Nut Tightening Sequence

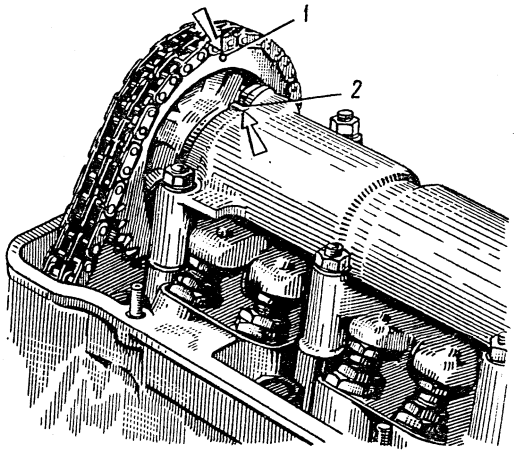


Fig.2-19. Alignment of Timing Marks on Camshaft Sprocket and on Bearing Housing:
1 - mark on sprocket; 2 - mark on bearing housing

Install the sprocket on the camshaft assembled with the bearing housing and turn the shaft so that the mark on the sprocket faces the mark on the bearing housing (Fig. 2-19). Remove the sprocket and, without changing the position of the camshaft, install the bearing housing on the cylinder head and fasten it by tightening the nuts in the sequence shown in Fig. 2-18.

Install the chain damper on the cylinder head.

Install the camshaft drive chain as follows:

- put the chain on the camshaft sprocket and move it into the drive space, seeing that the mark on the sprocket checks with the mark on the bearing housing (Fig. 2-19). Do not tighten the sprocket bolt all the way home;
- install the sprocket on the oil pump drive shaft, also without tightening the fastening bolt completely;
- install the tensioner shoe and the tensioner proper, without tightening the cap nut to allow the tensioner spring to press down the shoe; screw the chain limiting pin into the cylinder block;
- turn the crankshaft two revolutions in its regular direction thereby ensuring the required chain tension; check to see that the marks on the sprockets are aligned with the marks on the cylinder block (Fig. 2-17) and on the bearing housing (Fig. 2-19);
- if the marks are in alignment, lock the flywheel with fixing tool A.60330/R (Fig. 2-10), tighten up finally the sprocket bolts, the chain tensioner cap nut and bend the lock washers of the sprocket bolts; if the marks fail to coincide, repeat the chain installation operations;

Adjust the valve lever-to-cam clearances.

Install the camshaft drive cover (Fig. 2-20) with the gasket and gland on the cylinder block without tightening the fastening bolts and nuts all the way. Using mandrel 41.7853.4010, align the cover relative to the end of the crankshaft and tighten up its fastening bolts and nuts.

Install the crankshaft pulley and screw in the starting jaw.

Install the oil filter, screwing it on the cylinder block pipe union handtight. Install the oil separator of the crankcase breathing system, the breather cap and secure the retainer of the oil separator drain pipe.

Install the oil pump and the oil sump with its gasket.

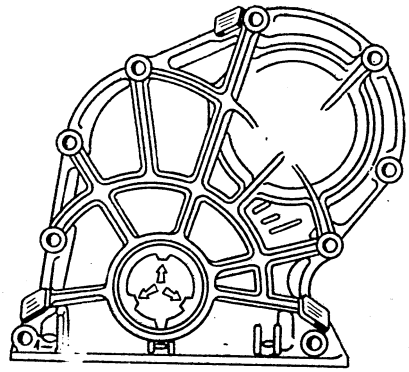


Fig.2-20. Camshaft Drive Cover. Arrows Show Lugs for Aligning the Cover with Crankshaft Pulley Hub

Install the coolant pump, generator bracket and generator. Run the belt over the pulleys and adjust its tension.

Install the heater radiator inlet pipe and the outlet pipe connection on the cylinder head. Fasten the heater radiator outlet pipe to the coolant pump and exhaust manifold.

Install the gauge transmitters.

Install the oil pump and ignition distributor drive gear. Install the ignition distributor and adjust ignition timing. Screw in the spark plugs and tighten them with torque-indicating wrench 67.7812.9515.

Install the fuel pump as instructed under "Fuel System".

Install the carburettor and connect its hoses.

Install the cylinder head cover with the gasket and fuel line bracket.

Install the air cleaner; for this purpose secure the hoses on the air cleaner body, place the cleaner body with the gasket on the carburettor, install the supporting plate and fasten the body with nuts. Put in the cleaner element and fasten the cleaner cover.

Fill the engine with oil through the filler throat on the cylinder head cover.

ENGINE STAND TESTS

The repaired engine shall be subjected to stand tests (running-in) at no-load duty in accordance with the following program:

2 min at 13.6 - 15 s^{-1} (850 - 900 rpm)

3 min at 16.6 s^{-1} (1000 rpm)

4 min at 25 s^{-1} (1500 rpm), and

5 min at 33.3 s^{-1} (2000 rpm).

While running-in the repaired engine do not operate it at maximum ratings.

Mount the engine on the stand, start it and check the following:

- any water and fuel leaks between the mating parts, from the pipe joints and through gaskets;
- oil pressure;
- ignition timing;
- idling speed;
- unusual knocking.

In case of abnormal knocking or other defects, stop the engine, correct the defects and resume the tests.

If oil leaks are detected through the gasket between the cylinder head and cover or through the gaskets between the engine oil sump, cylinder block and covers, tighten the corresponding bolts with the recommended torque. If leakage persists, check for correct installation of gaskets and replace them, if necessary.

A repaired engine is not yet run-in, therefore friction of the working surfaces of new parts offers a considerable resistance to rotation; consequently, a certain running-in period is required.

This applies particularly to the engines where pistons, big-end and main bearings were replaced, the crankshaft main bearings were ground and the cylinders honed. Therefore, the running-in program should always end on the car driven at the speeds recommended for the early stages of car operation.

ENGINE CHECKOVER ON CAR

After installing the engine on the car, check carefully the correctness of its mounting.

Run the engine for some time and check the following:

- leaks of coolant and fuel at the pipe joints; tighten the joints, if necessary;
- oil leaks;
- see that the carburettor control rods ensure complete closing and opening of the throttle and choke valves and adjust the linkage, if necessary;
- generator drive belt tension; adjust, if necessary;
- see that the electrical contacts are in good condition;
- check to see that the signal lamps on the instrument panel function as they should.

Caution

Do not check the engine and the car on a stand with running drums without additional rollers under the front wheels.

CYLINDER BLOCK

The main dimensions of the cylinder block are shown in Fig. 2-21.

General Cleaning and Inspection

Wash the cylinder block thoroughly and clear up the oil channels. Airblast and dry the cylinder block, particularly its oil channels.

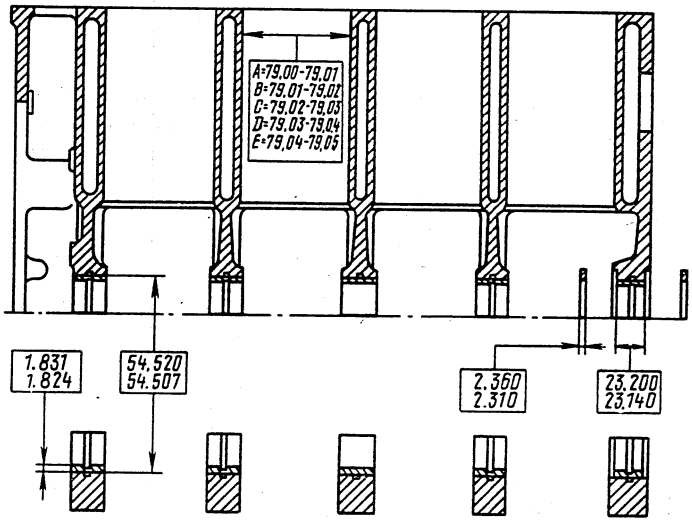


Fig.2-21. Main Dimensions of Cylinder Block

Examine the cylinder block and replace it, if cracked in the supports or elsewhere.

Cylinder Block Tightness Check

If there is a suspicion that the coolant penetrates into the crankcase, the cylinder block can be checked for tightness on a special stand.

Plug the holes in the cooling jacket and force in water at room temperature under a pressure of 0.3 MPa (3 kgf/cm^2).

There should be no coolant leaks in the course of 2 minutes.

Cylinders

Check to see that the cylinder-to-piston clearance does not exceed 0.15 mm.

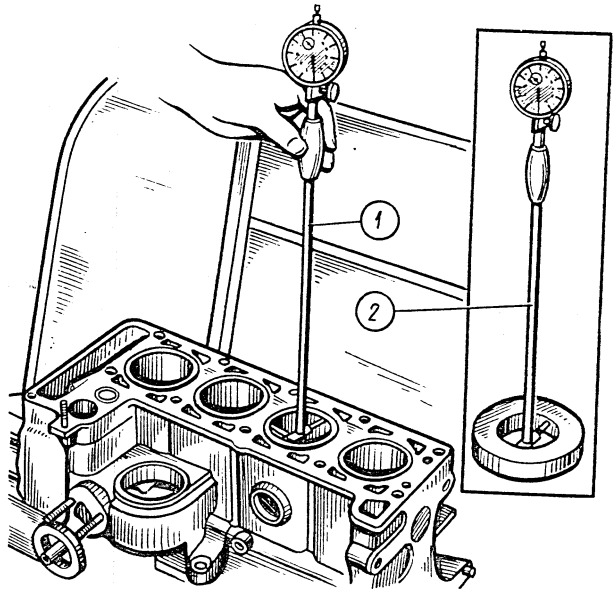


Fig.2-22. Measuring the Cylinders with Internal Gauge:

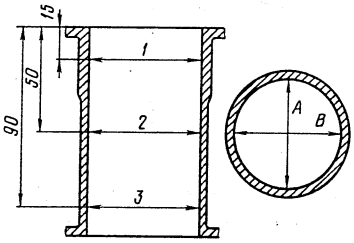
1 - internal gauge; 2 - zeroing internal gauge by check gauge

The clearance can be determined by measuring the cylinders and pistons. The cylinder bore should be measured (Fig. 2-22) in three zones, both along and across the engine (Fig. 2-23). The piston diameter should be measured in the plane perpendicular to the piston pin at a distance of 52.40 mm from the piston crown.

Note. The cylinders in the block are divided into five diameter classes A, B, C, D and E in steps of 0.01 mm. The class of the cylinder is marked on the lower face of the block (Fig. 2-24).

Fig.2-23. Cylinder Measurement Diagram:

A and B - directions of measurements; 1, 2 and 3 - zone numbers



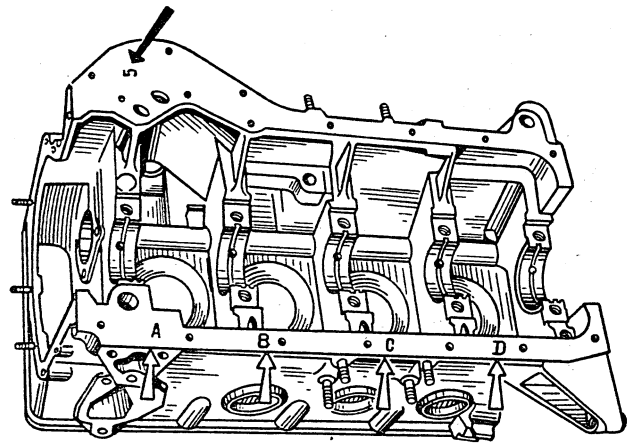


Fig.2-24. Cylinder Block Marked with Cylinder Size Group (White Arrows) and Cylinder Block Code Number (Black Arrow)

The same face and the main bearing caps bear a conventional number of the cylinder block which indicates that the bearing caps should be matched with this particular block.

If the maximum clearance exceeds 0.15 mm, rebore and hone the cylinders for the repair diameter of pistons (0.4, 0.7, 1.0 mm oversize) with an allowance of 0.06 - 0.08 mm for the piston-to-cylinder clearance.

Cylinder Head Jointing Surface

The upper face of the cylinder block may be distorted. Therefore, check this surface with a straightedge and a set of feeler gauges. Place the straightedge on the diagonals of the cylinder block and in the middle, both lengthwise and crosswise. If the surface is out-of-true by more than 0.1 mm, replace the cylinder block.

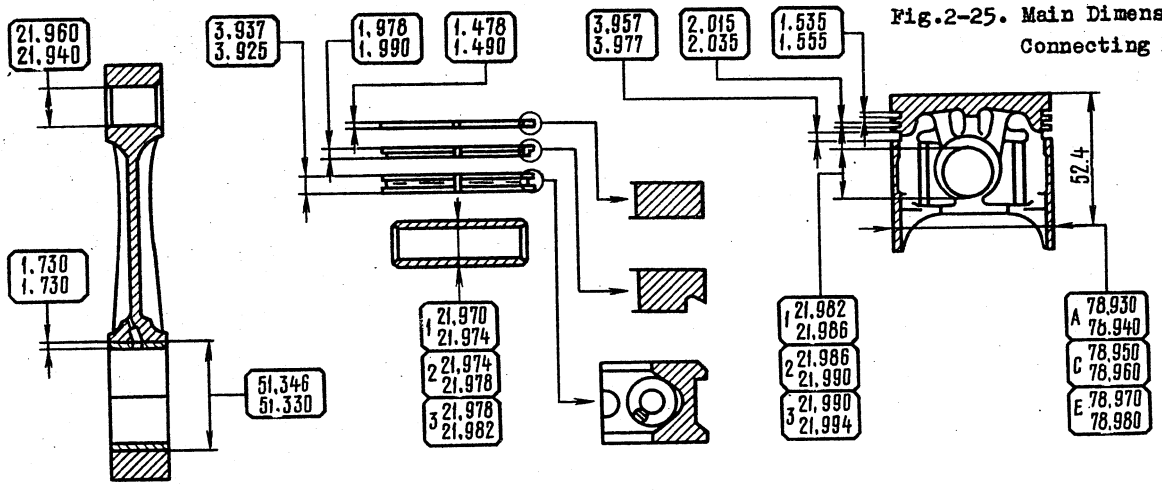


Fig.2-25. Main Dimensions of Piston, Connecting Rod, Piston Pin and Rings

The main dimensions of the connecting rod and piston group are given in Fig. 2-25.

Removing the Piston Pin

The piston pin should be removed on a press, using driver A.60308 and a support with a cylindrical hollow to receive the piston. Take care to remove the piston rings before driving out the piston pin.

The removed parts can be reused if they are but slightly worn and undamaged. Therefore, mark the parts during disassembly so as to reassemble them in the original sets.

Cleaning

Remove carbon deposits from the piston crown and ring grooves and clean the lubricating channels of the piston and connecting rod of all sediment.

Examine the parts thoroughly for probable damage. Cracks of any nature on the piston, piston rings, pin, connecting rod and its cap are impermissible and call for immediate replacement of parts. Replace the bearing shells if they are deeply scratched or heavily worn.

Piston-to-Cylinder Matching

The piston and the corresponding cylinder usually belong to one and the same class just like the piston and piston pin which belong to the same category.

Note. With regard to the outside diameter the pistons are divided into five classes (A, B, C, D, E) in steps of 0.01 mm while with regard to the diameter of the hole for the piston pin - into three categories in steps of 0.004 mm. The class of the piston (letter) and the category of the hole for the piston pin (digit) are stamped on the piston crown.

The spare pistons are available in classes A, C, E. These classes are sufficient for matching the piston to any cylinder since both the pistons and cylinders are divided into classes with a certain overlapping of dimensions.

The major requirement in fitting the piston is to ensure the necessary piston-to-cylinder assembly clearance which is determined by measuring both parts (see "Cylinder Block").

The assembly clearance between the piston and cylinder should be 0.06 to 0.08 mm, the wear limit being 0.15 mm.

Checking the Piston-to-Pin Clearance

The piston pin is press-fitted into the small end of the connecting rod with an interference while being free to rotate in the piston bosses.

Note. With respect to the outside diameter the piston pins are divided into three categories in steps of 0.004 mm. The category is marked by paint on the end of the pin: blue for the 1st category, green for the 2nd one and red for the 3rd category.

The fit of the piston pin in the piston is checked by coating the pin with engine oil and inserting it into the piston boss. The fit is considered correct if the pin enters the hole under thumb pressure (Fig. 2-26) and does not fall out of the boss (Fig. 2-27) of the piston held with the pin positioned vertically.

If the pin slides out of the boss, use a replacement pin of the next larger category. If,

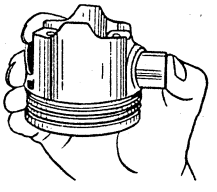


Fig.2-26. Piston Pin Should Go in under Thumb Pressure

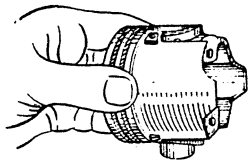


Fig.2-27. Checking the Piston Pin Fit

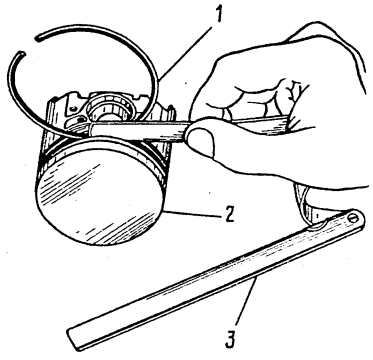


Fig.2-28. Checking the Piston Ring Side Clearance: 1 - piston ring; 2 - piston; 3 - set of feeler gauges

however, the pin belongs to the 3rd category, both the piston and the pin must be replaced.

Checking the Piston-to-Ring Clearance

The side clearance of the piston rings should be measured as shown in Fig. 2-28, installing the ring into the corresponding groove.

The assembly clearance should be 0.045 - 0.077 mm for the upper compression ring, 0.025 - 0.057 mm for the 2nd compression ring and 0.020 - 0.052 mm for the oil control ring. The wear limit is 0.15 mm.

The ring joint gap should be checked with a set of feeler gauges, inserting the rings into a gauge whose inside diameter is equal to the nominal diameter of the ring, true to ±0.003 mm.

The gap should range from 0.25 to 0.40 mm for all rings. File off the jointing surfaces of the ring if the gap is insufficient and replace the ring, if it is too big.

Checking the Bearing Shell-to-Crankshaft Clearances

The clearance between the bearing shells and the crankshaft journal can be checked by calculations (by measuring the parts) or with a piece of calibrated plastic wire in the following order:

- clean thoroughly the working surfaces of the shell and big-end journal and install the connecting rod with the piston on the big-end journal in accordance with their numbers;

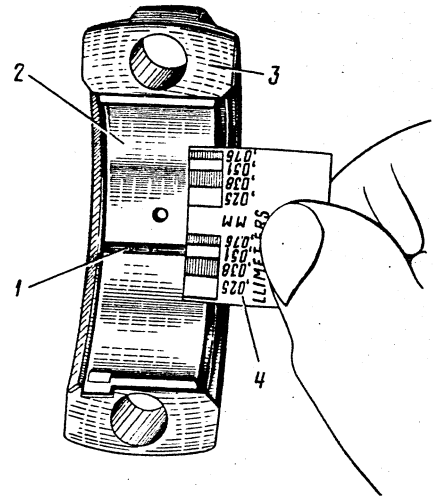


Fig.2-29. Measuring the Width of Flattened Calibrated Wire with a Scale:

1 - calibrated wire; 2 - shell; 3 - big-end bearing cap; 4 - scale

- put a piece of calibrated plastic wire on the big-end journal, install the connecting rod and its cap and tighten the nuts with a torque of 52 N.m (5.2 kgf.m);

- remove the cap and, using the scale on the wire packing, determine the flattening of the wire (Fig. 2-29), thus finding the clearance.

If the clearance is within the 0.036 - 0.086 mm tolerance limits or does not exceed the 0.10 mm wear limit, the shells may be used without changing the diameter of the big-end journals.

If the clearance exceeds the 0.10 mm wear limit, use replacement shells (Table 2-1) and grind the big-end journals to the repair size specified under "Crankshaft and Flywheel".

Table 2-1

Thickness of Connecting Rod Bearing Shells, mm

Standard	Oversize			
	0.25	0.50	0.75	1.0
1.723	1.848	1.973	2.098	2.223
1.730	1.855	1.980	2.105	2.230

Figures 0.25, 50 mm, etc. indicate the reduction in the diameter of the big-end journals after grinding.

Checking the Mass of Pistons

The pistons in the engine should be of the same mass, true to ±2.5 g.

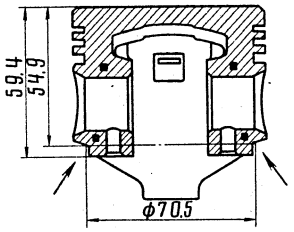


Fig.2-30. Points (Shown by Arrows) Where Metal Can Be Removed to Equalize Piston Weights

If a set of pistons belonging to the same mass group is not available, they can be adjusted for mass by removing some metal from the base of the piston pin boss as shown by arrows in Fig. 2-30. However, the metal must not be removed deeper than 4.5 mm relative to the nominal height of the piston (59.40 mm) while the removal of metal in width should be limited by a diameter of 70.5 mm.

Assembling the Connecting Rod and Piston Group

To provide for an interference fit of the piston pin in the small end of the connecting rod, heat the latter to 240 °C for expanding its small end. For this purpose place the connecting rods into an electric heater, small end first.

If the heater has already been brought to a temperature of 240 °C, hold the connecting rods there for 15 minutes.

For correct jointing of the pin with the connecting rod, press in the pin as rapidly as possible, since the connecting rod cools down quickly after which the position of the pin will be impossible to change.

To prepare the piston pin for assembly, put it on shaft 1 (Fig. 2-31) of tool 02.7853.9500. Fit guide 3 on the end of this shaft and secure it with screw 4. Do not overtighten the screw to avoid seizure due to heat expansion of the pin caused by contact with the hot connecting rod.

Take the connecting rod out of the heater and clamp it quickly in a vice. Put the piston on the connecting rod, aligning the pin hole in the piston with the hole in the small end of the connecting rod. Using tool 02.7853.9500, push the piston pin into the piston boss and into the connecting rod (Fig. 2-32) until the shoulder of the tool comes in contact with the piston.

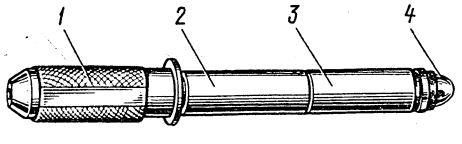


Fig.2-31. Tool 02.7853.9500 for Pressing the Piston Pin into Piston and Connecting Rod:
1 - tool shaft; 2 - piston pin; 3 - guide;
4 - thrust screw

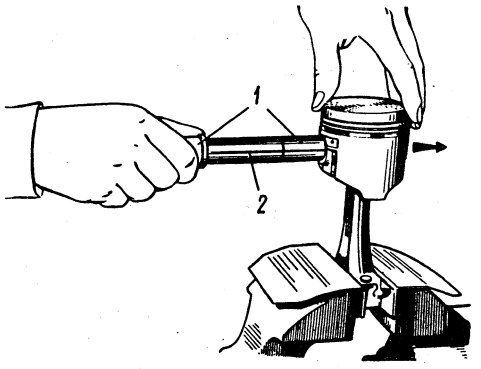


Fig.2-32. Pressing the Piston Pin into Connecting Rod Small End:
1 - tool 02.7853.9500; 2 - piston pin. The piston should rest on connecting rod as shown by arrow

During this operation the piston boss should be pressed against the small end of the connecting rod in the direction of the force applied for press-fitting the pin (shown by arrow in Fig. 2-32). In this way the piston pin will occupy the correct position.

Caution

The piston and connecting rod should be jointed so that the mark "П" on the piston is located at the side of the oil outlet hole in the connecting rod big end.

Allow the connecting rod to cool down and lubricate the piston pin with engine oil through the holes in the piston bosses.

When installing the piston rings, space their joints at 120°. The recess on the outer surface of the 2nd (scraper) compression ring should be directed down and the chamfers on the outer surface of the oil control ring should face upward (Fig. 2-25).

The connecting rod is machined jointly with the cap so that the caps are not interchangeable. In order not to confuse them during assembly, the connecting rod and the corresponding cap are marked with the number of the cylinder they belong to. The figures on the connecting rod and cap should be located on the same side during assembly.

Checking the Piston Pin Fit

After assembling the connecting rod with the piston pin and piston, check the pin fit with a torque-indicating wrench and tester A.96615 as follows:

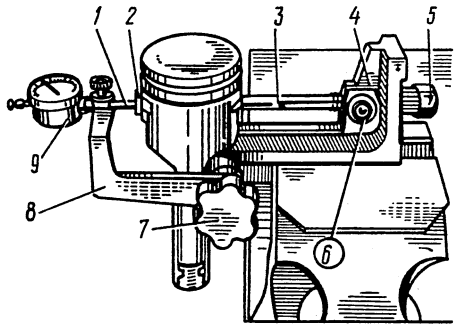


Fig.2-33. Assembled Piston-Pin-Connecting-Rod Group Installed on Tester A.95615 for Pin Pressing-Out Test:
1 - indicator point in contact with end of spindle; 2 - spindle head in contact with piston pin; 3 - threaded spindle with slot; 4 - base; 5 -spindle nut; 6 - spindle thrust pin; 7 - bracket clamp handle; 8 - indicator bracket; 9 - indicator

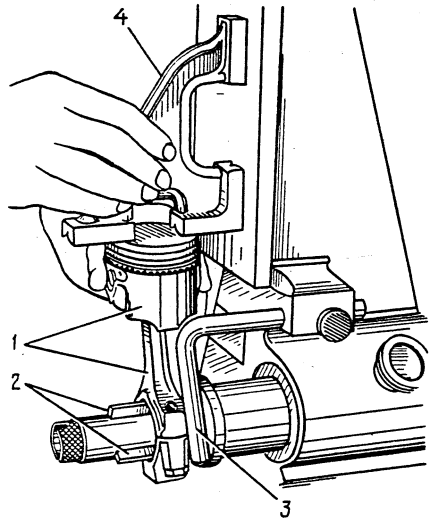


Fig.2-34. Checking the Axes of Piston Pin and Connecting Rod Big End for Parallelism:
1 - assembled connecting-rod-pin-piston group; 2 - extensible blades; 3 - thrust bar; 4 - gauge

- clamp tester base 4 (Fig. 2-33) in a vice and install the piston-pin-connecting rod assembly on it;

- lower indicator bracket 8, insert threaded spindle 3 into the pin hole and move it into the piston boss until spindle head 2 comes up against the end of the pin;

- screw nut 5 on the end of the spindle and draw up the nut against the support to take up the clearances, if any;

- lift indicator bracket 8 to a horizontal position, secure it by handle 7 and set point 1 of indicator 9 on head 2 of the spindle inserted into the pin;

- set the indicator to zero and insert thrust pin 6 into the slot of the threaded spindle to keep the latter against turning;

- using a torque-indicating wrench, tighten spindle nut 5 with a torque of 13 N.m (1.3 kgf.m) which corresponds to an axial load of 4 kN (400 kgf).

The fit of the pin in the connecting rod is correct if, after withdrawing the torque wrench and returning the nut to the initial position, the indicator pointer returns to zero.

If the pin slips in the connecting rod small end, replace the connecting rod by a new one.

Checking the Connecting Rod Big End and Piston Pin Axes for Parallelism

Before installing the assembled connecting rod and piston on the engine, check the parallel alignment of their axes (Fig. 2-34).

To check, align the connecting rod big end (without bearing shells) on extensible blades 2 and put gauge 4 on the piston crown. Using a set of feeler gauges, check the clearance between the vertical plate of the jig and the vertical surface of the gauge at a distance of 125 mm from the corner or the upper end of the gauge, depending on whether it contacts the plate by the corner or the upper end.

The clearance should not be over 0.4 mm. Replace the connecting rod, if it is larger.

CRANKSHAFT AND FLYWHEEL

The main dimensions of the crankshaft are given in Fig. 2-35.

Cleaning the Lubricating Channels

Remove the channel plugs. Run counterbore A.94016/10 fitted on spindle A.94016 through the plug sockets. Wash the channels thoroughly with gasoline and blow them with compressed air.

Install new plugs with the aid of driver A.86010 and lock-punch them at three points for higher reliability.

Crankshaft Journals

Journal grinding. There should be no cracks on the main and big-end journals and on the crankshaft webs. Replace the crankshaft if these parts are cracked.

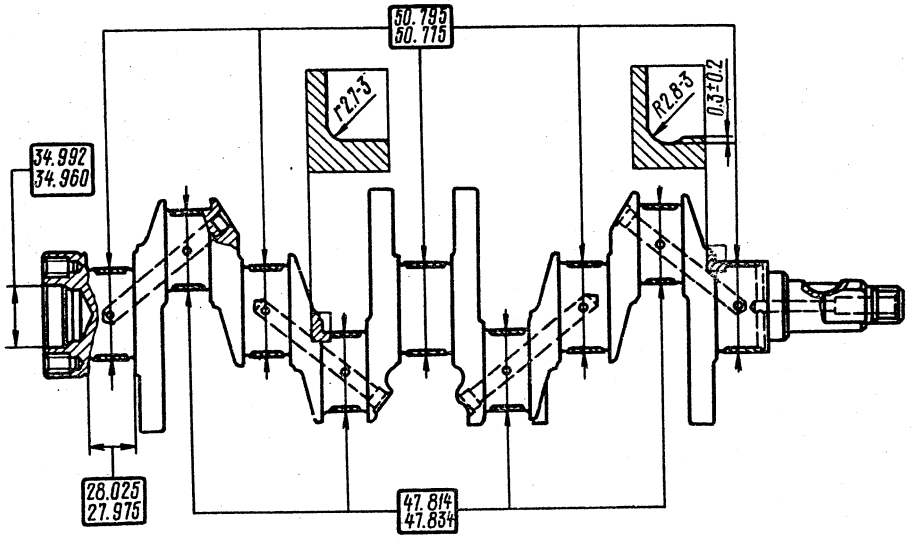


Fig.2-35. Main Dimensions of Crankshaft Journals and Fillets

Minor scores on the journals can be removed with a fine carborundum stone. If the scores are very deep or the journals are out of round in excess of 0.05 mm, they should be reconditioned by grinding.

Depending on the degree of wear, the main and big end journals should be ground to reduce their size by 0.25 mm and thus to obtain the diameters specified in Tables 2-2 and 2-3 and the journal fillet radiuses shown in Fig. 2-35.

Table 2-2

Diameters of Big End Journals, mm

Nominal	Undersize			
	0.25	0.50	0.75	1.0
47.814	47.564	47.314	47.064	46.814
47.834	47.584	47.334	47.084	46.834

Table 2-3

Diameters of Main Journals, mm

Nominal	Undersize			
	0.25	0.50	0.75	1.0
50.775	50.525	50.275	50.025	49.775
50.795	50.545	50.295	50.045	49.795

After grinding and finishing the journals, wash the crankshaft thoroughly to remove the remaining abrasive particles. Wash the lubricating channels several times with gasoline under pressure first removing the channel plugs. Mark No.1 web of the crankshaft with the figure showing the reduction of the journal size (0.25, 0.50 mm, etc.).

The out-of-round and taper of the main and big-end journals after grinding should not be over 0.007 mm.

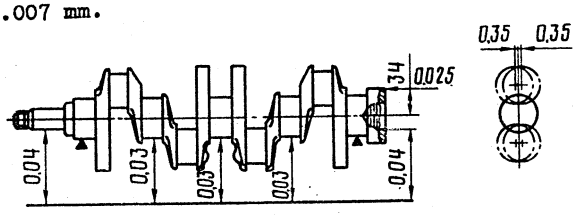


Fig.2-36. Permissible Runout of Basic Crankshafts Surfaces

Checking the Journals for Runout and Axial Misalignment. Put the crankshaft on Two Vee-blocks (Fig. 2-36) and make the following checks with a dial indicator:

- runout of main journals: the maximum permissible runout is 0.03 mm;
- runout of the seating surfaces for the sprocket and the gearbox clutch shaft bearing; the maximum permissible runout is 0.04 mm;
- displacement of the big end journal axes from the plane passing through the axes of the big-end and main journals; the maximum permissible displacement is ±0.35 mm;
- out-of-squareness of the flange face relative to the crankshaft axis; on rotating the crankshaft, the runout should not exceed 0.025 mm as read by the indicator installed sideways of the crankshaft, 34 mm from its axis (Fig. 2-36).

Main Bearing Shells

The shells must not be subjected to any fitting operations. In case of scores, scratches and exfoliations, they should be replaced.

Check the shell-to-journal clearances as follows:

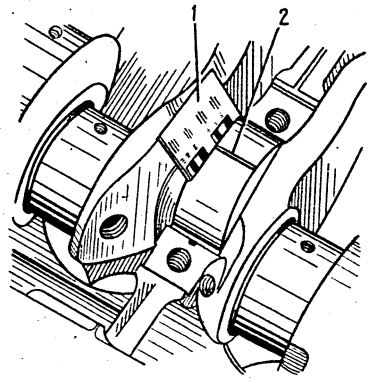


Fig.2-37. Measuring the Clearance with Scale:
1 - scale; 2 - calibrated wire

- put a piece of calibrated plastic wire on the journal;

- install the main bearing caps complete with the shells and tighten the cap bolts with a torque of 82 N.m (8.2 kgf.m);

- remove the caps, find the amount of flattening of the calibrated wire from the scale provided on its packing (Fig. 2-37) and thus determine the clearance.

The clearance between the main journals and bearing shells can also be found by calculations, measuring the diameters of the main journals and shell beds, and the thickness of the shells.

The nominal assembly clearance between the main bearing shells and crankshaft journals is 0.050 - 0.095 mm. If the clearance exceeds the 0.15 mm wear limit, regrind the journals and use thicker shells (Table 2-4).

A properly assembled crankshaft should rotate freely in the bearings.

Table 2-4

Thickness of Main Bearing Shells, mm

Nominal	Oversize			
	0.25	0.50	0.75	1.0
1.824	1.949	2.074	2.199	2.324
1.831	1.956	2.081	2.206	2.331

The figures 0.25, 0.50 mm, etc. denote the reduction in the diameter of the main journals after grinding.

Flywheel

Examine the teeth of the flywheel ring gear; replace the flywheel if they are damaged.

The flywheel surfaces mating with the crankshaft and the clutch driven disc should be perfectly flat and free from scratches and scores.

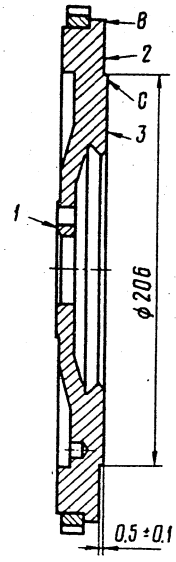


Fig.2-38. Flywheel:
1 - flywheel to crankshaft flange fastening surface; 2 - clutch mounting surface; 3 - clutch driven disc supporting surface; B - point for checking the runout of surface 2; C - point for checking the runout of surface 3

If surface 3 (Fig. 2-38) of the flywheel mating with the clutch driven disc is scratched, dress it on a turning lathe, cutting off not more than 1 mm of metal. Then machine surface 2, ensuring a dimension of 0.5±0.1 mm and the parallelism of surfaces 2 and 3 relative to surface 1. The permissible disparallelism is not over 0.1 mm as measured at extreme points of surfaces 2 and 3.

Install the flywheel on a mandrel, aligning it by the mounting hole until it bears against surface 1 (Fig. 2-38) and check the runout of surfaces 3 and 2. The runout read by the indicator at points B and C should not exceed 0.1 mm.

Glands

The surfaces of the crankshaft mating with the working edges of glands should be free from scratches, nicks and notches. It is good practice to replace both crankshaft glands during engine repairs.

Checking the Crankshaft End Play

The end play of the crankshaft is limited by two thrust half-rings installed at both sides of the rear main bearing. The half-ring at the front side of the bearing is of the steel-aluminium type while that at the rear side is a cerametallic (yellow) one. The half-rings are available in nominal size (2.310 - 2.360 mm thick) and oversize (2.437 - 2.487 mm thick).

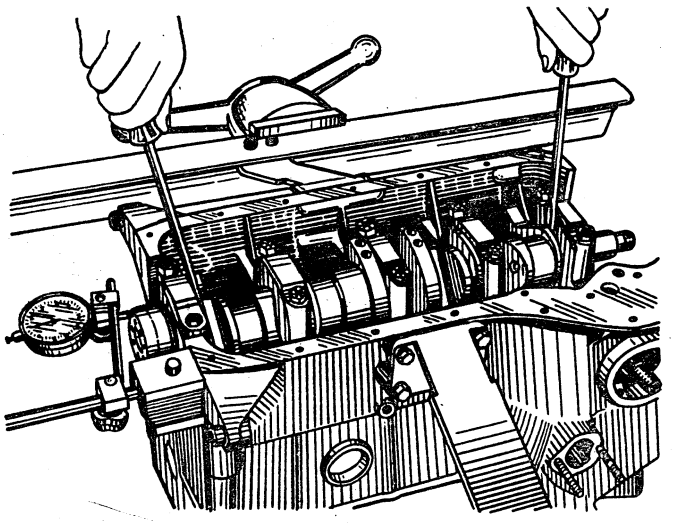


Fig.2-39. Checking the Crankshaft End Play

The end play between the thrust half-rings and the thrust surfaces of the crankshaft can be measured as follows:

- install the indicator on a magnetic support and insert the blades of two screwdrivers as shown in Fig. 2-39;
- shift the crankshaft with the screwdrivers and note the indicator reading. It should be 0.055 - 0.265 mm.

If the end play exceeds the maximum permissible limit of 0.35 mm, replace the thrust half-rings by new ones 0.127 mm oversize.

Note. The end play of the crankshaft can also be checked on the car-mounted engine. In this case the axial displacement of the crankshaft is produced by pressing and releasing the clutch pedal and the end play is determined by measuring the displacement of the crankshaft front end.

CYLINDER HEAD AND VALVE GEAR

The main dimensions of the cylinder head are given in Fig. 2-40.

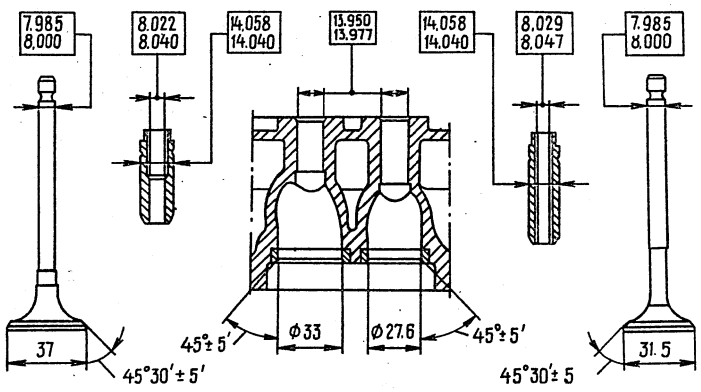


Fig.2-40. Basic Dimensions of Cylinder Head, Valves and Valve Guides

Removal and Installation on Car

The cylinder head should be removed from the car-mounted engine if its defects do not call for the removal of the entire engine, also when the maintenance work is confined to decarbonization of the combustion chamber and valves. To remove the cylinder head, proceed as follows:

- remove the spare wheel;
- drain the coolant from the radiator and cylinder block and remove the air cleaner;
- disconnect the wires from the storage battery, spark plugs and from the coolant temperature transmitter; disconnect the choke valve control cable from the carburettor;
- using wrench 67.7812.9514, unscrew the spark plugs and the coolant temperature transmitter;
- disconnect the throttle valve control rods from the intermediate lever on the cylinder head cover and take off the cover;
- disconnect the hose from the heater inlet pipe and detach the heater outlet pipe bracket from the exhaust manifold;
- disconnect the hoses from the carburettor, inlet manifold and from the cylinder head cooling jacket outlet pipe;
- disconnect the starter protective shield and the muffler inlet pipe from the exhaust manifold.

Note. It is good practice to leave the exhaust and inlet manifolds with the carburettor on the cylinder head. They can be removed later, when disassembling the cylinder head.

- loosen the cap nut of the chain tensioner, force off the tensioner rod with a tyre iron and fix it with the cap nut;
- remove the camshaft sprocket and the bearing housing complete with the camshaft;
- turn off the cylinder head to block bolts and remove the cylinder head.

To reinstall the cylinder head, reverse the removal operations, observing the following points:

- do not forget to install the gaskets of the cylinder head and its cover;
- tighten the cylinder head bolts in the sequence shown in Fig. 2-16 and the nuts of the camshaft bearing housing studs, in the sequence shown in Fig. 2-18.

Tighten the cylinder head bolts in two steps:

1st step - tighten bolts No.1 through 10 (Fig. 2-16) with a torque of 34-42 N.m (3.4 - 4.2 kgf.m);

- 2nd step - tighten bolts No.1 through 10 with a torque of 98 - 12.1 N.m (9.8 - 12.1 kgf.m) and bolt No.11 with a torque of 32 - 40 N.m (3.2 - 4.0 kgf.m).

When installing the cylinder head cover with its gasket, tighten the cover nuts with a torque not over 8 N.m (0.8 kgf.m) to avoid fracturing the gasket at the fastening holes and warping the cover. It is recommended that the cover gasket should be replaced by a new one during engine repairs.

Disassembly and Assembly

Put the cylinder head on plate A.60335.

Disconnect the exhaust and inlet manifolds with the carburettor (together with the hot air intake).

Disconnect the outlet pipe of the cooling jacket.

Disconnect the pipe conducting the coolant to the heater.

Remove valve levers 11 (Fig. 2-41) and take off their springs 12.

Loosen locknuts 14, unscrew adjusting bolts 13 and their bushings 15.

Install tool A.60311/R as shown in Fig. 2-42, compress the valve springs and take out the spring

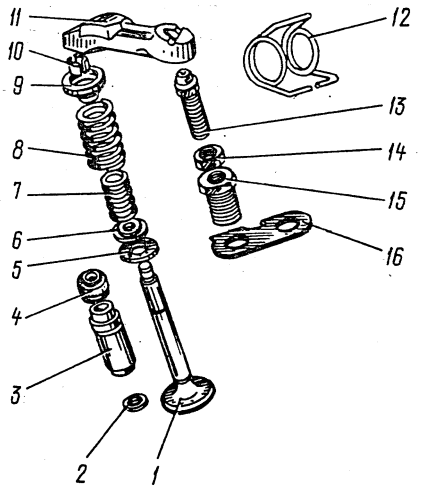


Fig.2-41. Valve Gear Parts:
1 - valve; 2 - locking ring; 3 - valve guide; 4 - oil-deflecting cap; 5 - outer spring seat; 6 - inner spring seat; 7 - inner spring; 8 - outer spring; 9 - spring retainer; 10 - valve spring locks; 11 - valve lever; 12 - lever spring; 13 - adjusting bolt; 14 - adjusting bolt lock nut; 15 - adjusting bolt bushing; 16 - lever spring locking plate

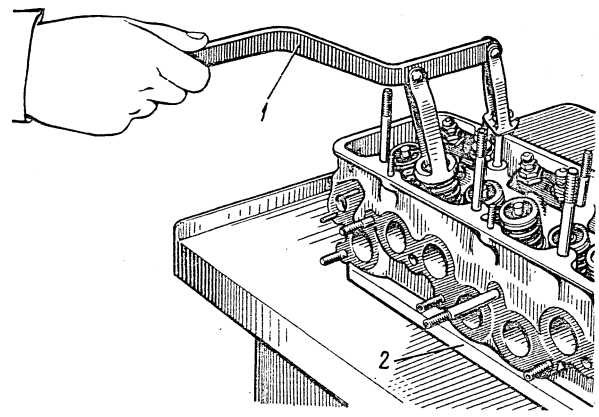


Fig.2-42. Removing the Valve Springs:
1 - tool A.60311/R; 2 - assembly plate A.60335

locks. The portable tool A.60311/R can be replaced by stationary jig 02.7823.9505.

Remove the valve springs with retainers and seats. Turn over the cylinder head and take out the valves from its underside.

Remove the oil-deflecting caps from the valve guides.

Assemble the cylinder head by reversing the disassembly operations.

Cleaning the Cylinder Head

Install the cylinder head on support A.60353.

Decarbonize the combustion chambers and the surfaces of exhaust channels with a wire brush clamped on an electric drill. Clean and examine the inlet channels and the oil channels leading to the valve levers.

Checking and Grinding the Valve Seats

The shape of the valve seat faces is illustrated in Figs 2-43 and 2-44.

The seat faces (in the zone of contact with the valves) should be free from pin-point pits, corrosion and damage. Minor damage can be corrected by grinding the seats. In so doing try to remove as little metal as possible. Grinding can be performed either manually or with a grinding machine.

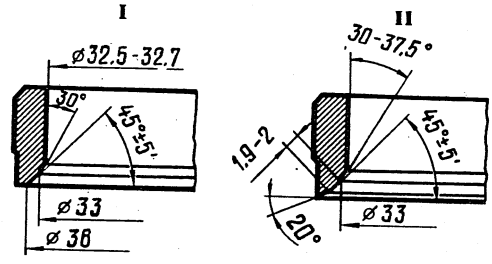


Fig.2-43. Inlet Valve Seat Contour:
I - new seat; II- refaced seat

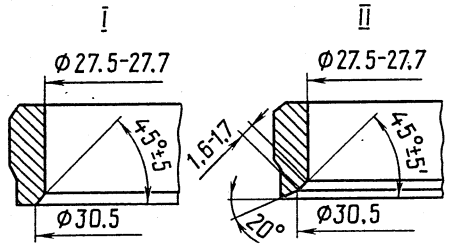


Fig.2-44. Exhaust Valve Seat Contour:
I - new seat; II - refaced seat

Grind the seats as follows:

- put the cylinder head on support A.60353, insert spindle A.94059 into the valve guide and decarbonize the seat faces with counterbores A.94031, A.94092 (exhaust valve seats) and A.94003, A.94101 (inlet valve seats). The counterbores should be secured on spindle A.94058 and aligned by pilot spindle A.94059;

Note. Spindles A.94059 are available in two different diameters: A.94059/1 for inlet valve guides and A.94059/2 for exhaust valve guides.

- put spring A.94069/5 on pilot spindle A.94059, install tapered wheel A.94078 (for exhaust valve seats) or wheel A.94100 (for inlet valve seats) on spindle A.94069, secure the spindle in the grinding machine and reface the valve seat (Fig. 2-45).

At the moment of contact between the grinding wheel and the valve seat the machine should be turned off to avoid vibration which will distort the seat face.

It is recommended that the grinding wheel should be dressed frequently with diamond tools.

Bring the width of the working face on the exhaust valve seats to the limits specified in Fig. 2-44, using 20° counterbore A.94031 and counterbore A.94092 which removes the signs of cold-working on the inside diameter. The counterbores should be slipped on spindle A.94058 and, like during grinding, aligned by spindle A.94059.

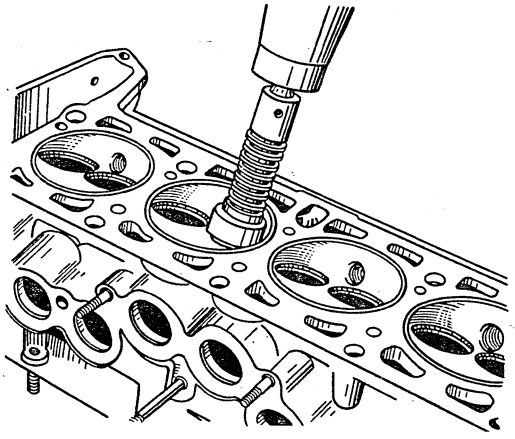


Fig.2-45. Valve Seat Refacing

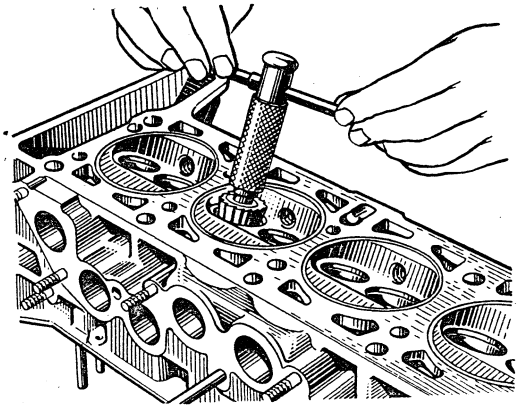


Fig.2-46. Chamfering the Valve Seat Face with Counterbore Installed on Spindle A.94058

Bring the width of the working face of the inlet valve seats to the values specified in Fig. 2-43, first machining the internal face with counterbore A.94003 (Fig. 2-46) to obtain a diameter of 33 mm, then the 20° face with counterbore A.94101 until the width of the working face is enlarged to 1.9 - 2 mm.

Valves

Remove the carbon deposits from the valves. See that the valve stem is not distorted and the valve head is not cracked; replace the valve if it is found to be damaged.

Look for excessive wear and damage of the working face. When refacing the valve on the grinding machine, ensure a face angle of 45°30'±5' and see that the cylindrical part of the valve head is not thinner than 0.5 mm after grinding.

Valve Guides

Check the clearance between the valve guides and the valve stem, measuring the diameter of the stem and the hole in the valve guide.

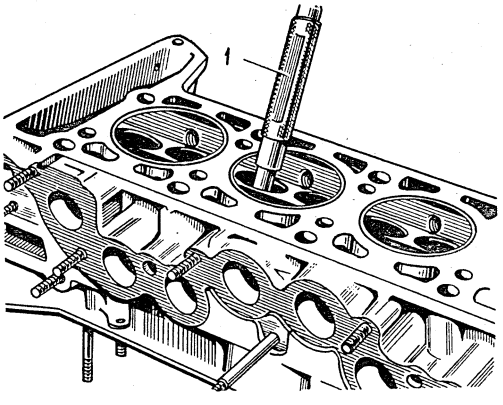


Fig.2-47. Removing the Valve Guides:
1 - mandrel A.60153/R

The assembly clearance for new guides is 0.022 - 0.055 mm (inlet valves) and 0.029 - 0.062 mm (exhaust valves). The maximum wear limit is 0.15 mm.

If the guide-to-valve clearance is too big and cannot be eliminated by replacing the valve, replace the valve guides with the aid of mandrel A.60153/R (Fig. 2-47).

To replace the two guides of the inlet and exhaust valves in cylinders No.1 and No.4, unscrew two studs of the camshaft bearing housing since they interfere with the installation of the mandrel.

Drive in the valve guides complete with the locking ring until the latter comes to bear against the surface of the cylinder head.

Having pressed-in the guides, ream out their holes with reamers A.90310/1 (inlet valve guides) and A.90310/2 (exhaust valve guides). Then grind the valve seat and bring the width of the working face to the required dimensions specified above.

Valve Guide Oil-Deflecting Caps

In the oil-deflecting caps there should be no exfoliations of rubber from the carcass, no cracks and heavy wear of the working edge.

During engine repairs it is recommended that the caps should always be replaced by new ones.

The damaged oil-deflecting caps can be replaced without taking the cylinder head off the engine. For this purpose remove the camshaft bearing housing, bring the piston of the corresponding cylinder to TDC and remove the valve springs. Then take off the damaged cap from the valve guide and, using mandrel 41.7853.4016, fit on a new cap.

Valve Levers

Examine the active surfaces of the lever which are in contact with the valve stem, the camshaft cam and the spherical end of the adjusting screw. Replace the lever if these surfaces are scored or notched.

If the lever adjusting screw or its bushing is distorted, replace the faulty parts.

Valve Springs

Make sure that the springs are not cracked and have not lost their resilience. For this purpose check them for deformation under load (Figs 2-48, 2-49, 2-50).

Dimension A (Fig. 2-50) of the lever springs (noncompressed) should be 35 mm and dimension B - 43 mm under a load of 63.5±11.5 N (6.35±11.5 kgf).

Cylinder Head Gasket

The surfaces of the gasket should be free from any signs of damage. They should be smooth,

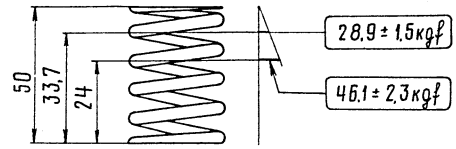


Fig.2-48. Main Data for Checking the Valve Outer Spring

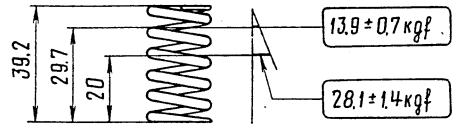


Fig.2-49. Main Data for Checking the Valve Inner Spring

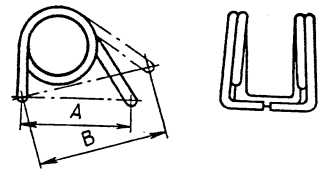


Fig.2-50. Checking the Valve Lever Spring: A - free length; B - length under a load of 55±6 N (5.5±0.6 kgf)

free of dents, cracks, swelling and fractures. Exfoliation of the outer layers from the carcass is impermissible.

The edgings of the holes should have no cracks, burns and exfoliations.

Checking the Valves for Tight Seating

Clean carefully the seats and valves and install the cylinder head on support A.60353 (Fig. 2-51).

Insert the valves into the corresponding guides and stop the holes for the spark plugs with stoppers A.60018.

Set tester A.60148 in the position shown in Fig. 2-51 and, pressing the lever hard, keep forcing in the air with a rubber bulb until the pressure gauge reads 50 kPa (0.5 kgf/cm^2); there should be no pressure drop within 10 s.

If the valve faces fail to be in tight contact with the seats, the leakage of air will be indicated by the pointer moving towards the zero division. If so, grind again the valve face and the seat in the cylinder head, trying to exert an utmost care.

Tight seating of the valves can also be checked by pouring kerosene into the inlet and exhaust chambers of the cylinder head. There should be no kerosene leaks through the valves in the course of 3 minutes.

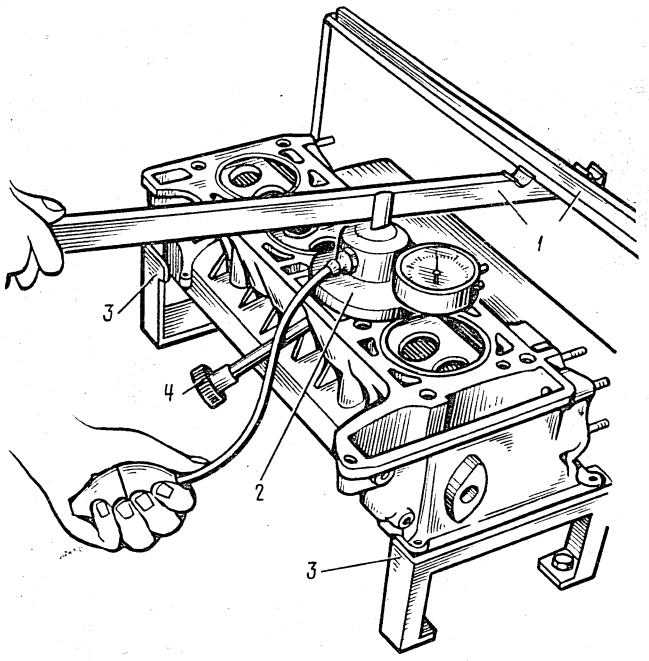


Fig.2-51. Checking the Valves for Tight Seating: 1 - holder A.60041/2; 2 - tester A.60148; 3 - support A.60353; 4 - stopper A.60018 for spark plug wells

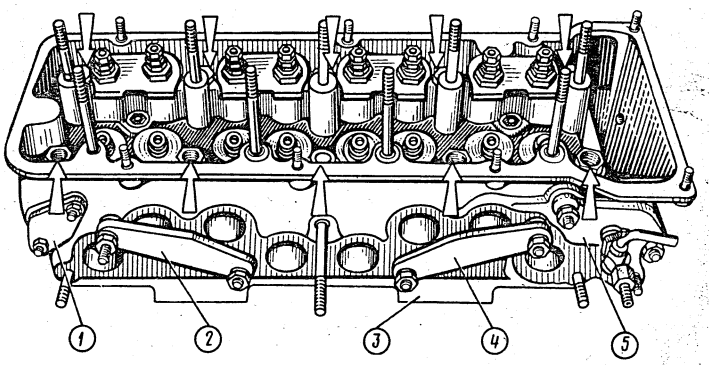


Fig.2-52. Checking the Cylinder Head for Tightness on Tester A.60334:
1, 2, 4 - blank plugs; 3 - tester plate; 5 - flange with water inlet union

Cylinder Head Tightness Test

To check the cylinder head cooling jacket hydraulically for tightness, proceed as follows:

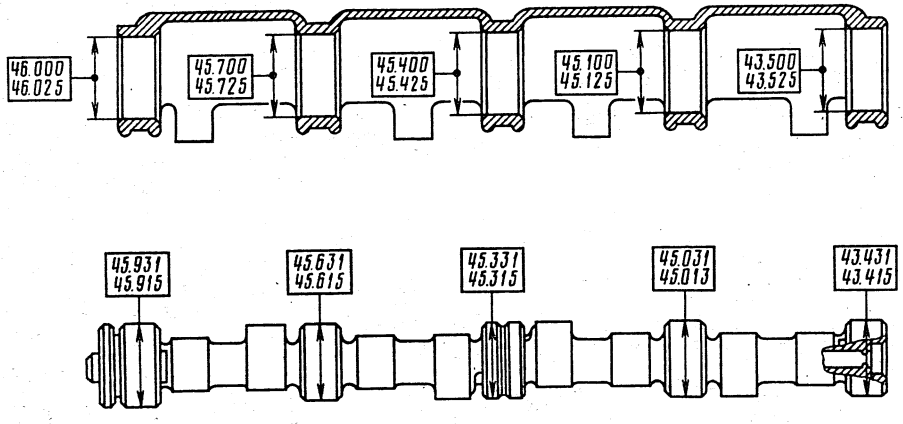
- install the parts of tester A.60334 (Fig. 2-52) on the cylinder head;
- keep forcing water under a pressure of 0.5 MPa (5 kgf/cm^2) by the pump into the cylinder head.

There shall be no water leaks from the cylinder head within two minutes. A cracked cylinder head must be replaced.

CAMSHAFT AND DRIVE

The main dimensions of the camshaft and camshaft bearing housing are given in Fig. 2-53 while Fig. 2-54 illustrates a section through the cylinder head and block across the inlet valve.

Fig.2-53. Main Dimensions of Camshaft and of Bores in Camshaft Bearing Housing



Adjusting the Cam-to-Lever Clearance

Adjust the clearances on a cold engine, first adjusting the timing chain tension. After adjustment, the clearance should be 0.14 to 0.17 mm.

Proceed as follows:

- turn the crankshaft clockwise until the mark on the camshaft sprocket gets in line with the mark on the bearing housing which will correspond to the end of the compression stroke in No.1

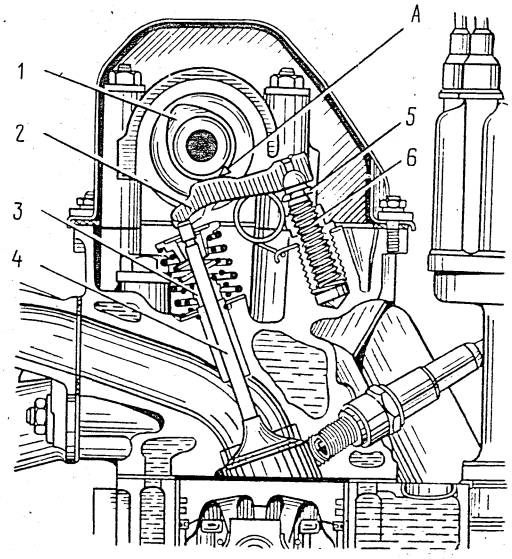


Fig.2-54. Cylinder Block and Head. Section Through Inlet Valve:
1 - camshaft; 2 - valve lever; 3 - oil-deflecting cap; 4 - inlet valve; 5 - adjusting bolt; 6- bolt locknut; A - lever-to-cam clearance

cylinder. In this position adjust the clearance of the exhaust valve in No.4 cylinder (8th cam) and in the inlet valve of No.3 cylinder (6th cam);

- loosen the locknut of the valve adjusting lever;

- insert a flat feeler gauge A.95111 0.15 mm thick between the lever and the camshaft cam and turn the bolt in or out with a wrench, securing the bolt by the locknut until, with the locknut tightened, the feeler gauge goes in with a slight drag (Fig. 2-55);

- having adjusted the clearance in the exhaust valve of No.4 cylinder and inlet valve of No.3 cylinder, keep turning the crankshaft each time through 180° and adjust the clearances in the sequence specified in Table 2-5.

Table 2-5

Sequence of Valve Clearance Adjustment

Crankshaft rotation	End of compression stroke in cylinder No.	Numbers of adjusted valves (cams)
0	4	8 and 6
180°	2	4 and 7
360°	1	1 and 3
540°	3	5 and 2

Adjusting the Chain Tension

Loosen tensioner nut 1 (Fig. 2-56). This will free spindle 3 and the chain will be tensioned by

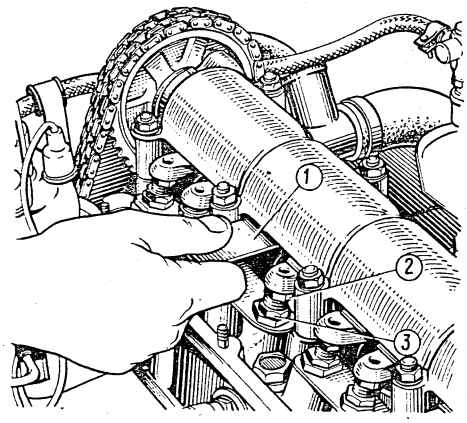


Fig.2-55. Checking the Lever-to-Cam Clearance:
1 - feeler gauge A.95111; 2 - adjusting bolt; 3 - adjusting bolt locknut

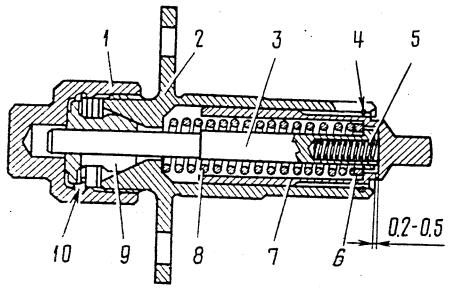


Fig.2-56. Chain Tensioner. Sectionalized:
1 - cap nut; 2 - tensioner body; 3 - spindle; 4 - spring ring; 5 - plunger spring; 6 - washer; 7 - plunger; 8 - spring; 9 - retainer; 10-spring ring

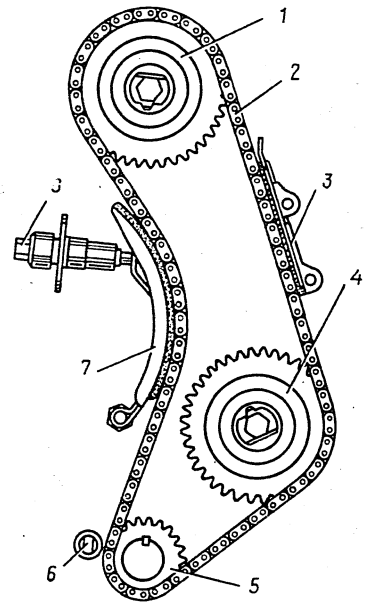


Fig.2-57. Camshaft and Accessory Drive Diagram:
1 - camshaft sprocket; 2 - chain; 3 - chain damper; 4 - oil pump drive sprocket; 5 - crankshaft sprocket; 6 - limiting pin; 7 - tensioner shoe; 8 - chain tensioner

shoe 7 (Fig. 2-57) which is acted upon by spring 8 (Fig. 2-56).

Turn the crankshaft 1-1.5 revolution in the normal direction. The tensioner spring which actuates the shoe will automatically set the proper chain tension.

Tighten tensioner nut 1; as a result, spindle 3 will be clamped by the collets of retainer 9 so that on the running engine plunger 7 will be loaded by spring 5 alone. This spring forces the plunger off the head of spindle 3 and the clearance between the two is filled with oil on the running engine, this oil functioning as a shock-absorbing medium during chain impacts.

Due to a guaranteed clearance of 0.2 - 0.5 mm between spindle 3 and plunger 7, in case of strong chain impacts spring 8 starts functioning too.

Checking the Camshaft

The surfaces of the camshaft journals and cams should be well polished and free from any defects. If there are any traces of seizure, deep scratches, or steps caused by wear, the camshaft should be replaced.

Put the end journals of the camshaft on two Vee blocks which rest on a surface plate and check the radial runout of the intermediate journals with an indicator; the runout should not exceed 0.02 mm.

Checking the Camshaft Bearing Housing

Wash and clean the camshaft bearing housing and the oil channels.

Check the diameter of holes in the supports. If the clearance between the camshaft journals and supports exceeds the 0.2 mm wear limit, the bearing housing should be replaced.

The internal supporting surfaces should be smooth and free of scores. Replace the housing if these surfaces are damaged.

Examine the housing for cracks and replace it, if cracked.

Chain Tensioner

Disassembly and assembly. To disassemble the chain tensioner, remove cap nut 1 (Fig. 2-56), retainer 9 and spring ring 4 then take out plunger 7, spring 5 and spindle 3 complete with spring 8 and washer 6.

To reassemble, reverse the disassembly procedure.

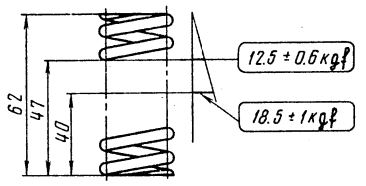


Fig.2-58. Main Data for Checking the Tensioner Spring

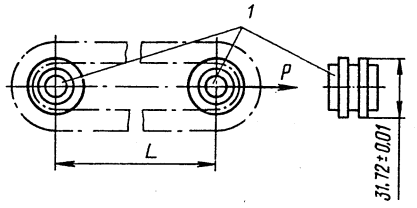


Fig.2-59. Chain Wear (Stretching) Check Diagram: 1 - rollers

Inspection. See that retainers 9 and spindle 3 are not scored and the mating surfaces of the shoe and plunger are free of deep notches. Replace any damaged parts.

The resilience of the tensioner spring should be within the limits indicated in Fig. 2-58. Replace the spring if it is weak.

Inspect the shoe and damper for heavy wear and replace them, if necessary.

Camshaft Chain

Wash the chain in kerosene and examine its links. The rollers and sideplates should be free from chipping, cracks and other kinds of damage.

The chain is apt to become stretched in service. It is considered serviceable if the tensioner is capable of ensuring its adequate tension, i.e. when the chain is stretched by not more than 4 mm.

Check the stretching of the chain on a device equipped with two rollers (Fig. 2-59) for installing the chain. Stretch the chain with a force of 300 N (30 kgf) then slacken it to 150 N (15 kgf), repeat both operations and measure the distance L between the roller axes.

The distance L between the roller axes for a new chain is $495.3^{+0.5}_{+0.1}$ mm; replace the chain if it is stretched to 499.4 mm.

Coat the chain with engine oil before installation on the engine.

A diagram of the cooling system is shown in Fig. 2-60.

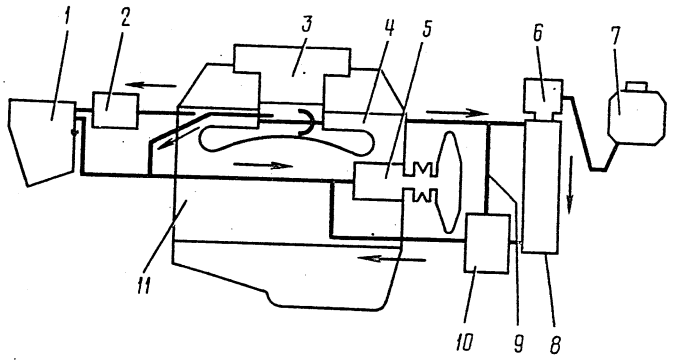


Fig.2-60. Schematic Diagram of Cooling System: 1 - heater; 2 - heater cock; 3 - carburettor*); 4 - cylinder head; 5 - pump; 6 - radiator cap; 7 - expansion tank; 8 - radiator; 9 - bypass; 10 - thermostat; 11 - cylinder block; *)Carburettors 2107 have no provision for heating the throttle housing

Checking the Level and Specific Gravity of Coolant

The quantity of coolant in the cooling system is checked by watching the liquid level in the expansion tank. On a cold engine (15 - 20 °C) the level should be 3 - 4 cm above the "MIN" mark on the expansion tank.

Caution

It is good practice to check the coolant level on a cold engine since the volume of heated coolant increases so that its level in a hot engine may rise considerably.

If necessary, check the specific gravity of coolant with a hydrometer. It should be 1.075 - 1.085 g/cm^3 for "Тосол А-40" liquid or 1.085 - 1.095 g/cm^3 for the "Тосол А-65" grade.

If the coolant level in the expansion tank is lower than prescribed and its specific gravity is too high, add some distilled water. If the specific gravity is normal, add some coolant of the grade contained in the system.

If the specific gravity of the coolant is lower than prescribed for the cold season, take care to replace it with a proper grade.

Filling the Cooling System

As a rule, the cooling system is filled either when the coolant has to be changed, or after engine repairs. To fill the system:

- remove the radiator and expansion tank caps and open the heater cock;
- pour 10.7 l of coolant into the radiator; keep pouring until it starts flowing from the radiator throat; then replace the radiator cap;
- pour the remaining coolant into the expansion tank and put in place its cap;
- run the engine for 1 - 2 minutes at idling speed to remove any air pockets.

Allow the engine to cool down and recheck the coolant level. If it drops below the prescribed mark and there are no leaks in the system, add up the required amount of coolant.

Adjusting the Pump Drive Belt Tension

The tension of the belt should be checked by measuring its sagging between the generator and pump pulleys or between those of the pump and crankshaft. The tension is considered correct when the belt sag A (Fig. 2-61) under a force of 100 N (10 kgf) is within 10 - 15 mm and sag B is from 12 to 17 mm.

To tension the belt, loosen the generator fastening nuts, push the generator away from the engine and retighten the nuts.

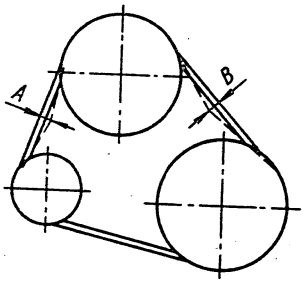


Fig.2-61. Checking the Pump Drive Belt Tension

Coolant Pump

Disassembly

To disassemble the pump:

- detach the pump casing from cover 2 (Fig. 2-62);
- secure the cover in a vice, using soft gaskets, and take the impeller from the shaft with remover tool A.40026 (Fig. 2-63);
- remove hub 2 (Fig. 2-64) of the fan pulley from the shaft with remover tool A.40005/1/5;
- remove lockscrew 9 (Fig. 2-62) and take out the bearing with the pump shaft;
- pull gland 11 out of casing cover 2.

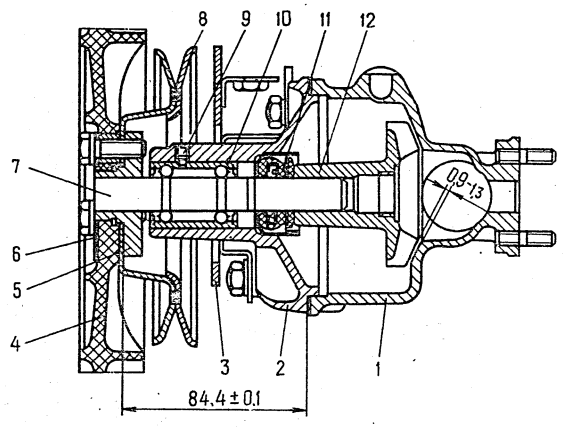


Fig.2-62. Coolant Pump. Longitudinal Section:
1 - casing; 2 - cover; 3 - fan shroud bracket;
4 - fan; 5 - pulley hub; 6 - strip; 7 - shaft;
8 - pulley; 9 - bearing lock screw; 10 - bearing;
11 - gland; 12 - impeller

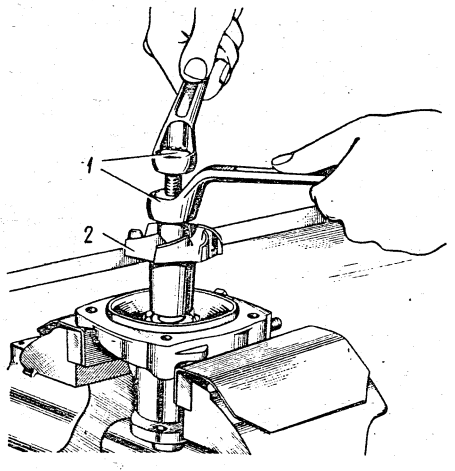


Fig.2-63. Removing the Pump Impeller:
1 - remover tool; 2 - impeller

Inspection

Check the end play of the bearing. This operation is mandatory when the pump was very noisy in operation. The clearance should not exceed 0.13 mm under a load of 50 N (5 kgf). Replace the bearing if the clearance is larger.

It is good practice to replace the pump gland and the pump-to-cylinder block gasket during repairs.

Examine the pump casing and cover; there should be no distortions and cracks.

Assembly

To assemble the pump:

- using a mandrel, install the gland without cocking into the casing cover;
- drive in the bearing with the shaft into the cover, seeing that the lockscrew socket is in line with the hole in the pump casing cover;

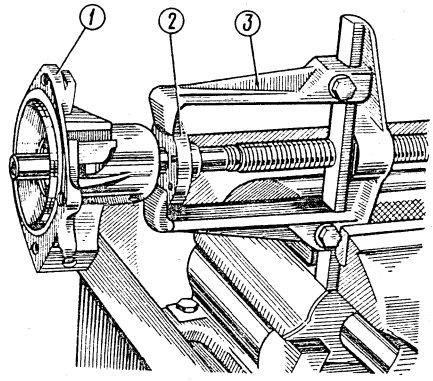


Fig.2-64. Removing the Pulley Hub:
1 - pump casing cover; 2 - pulley hub; 3 - remover tool

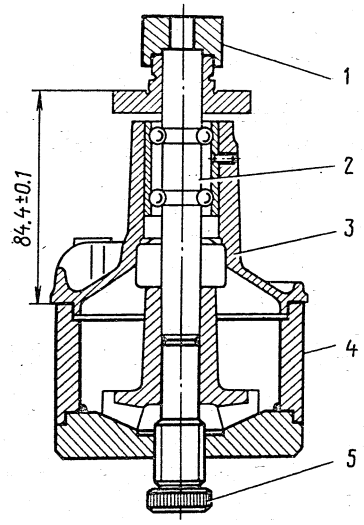


Fig.2-65. Installing the Impeller on Pump Shaft with Tool A.60430:
1 - support; 2 - pump shaft; 3 - pump casing cover;
4 - sleeve; 5 - setting screw

- turn in the bearing lockscrew and lock-punch the socket along the contour to prevent the screw from working loose;
- using installation tool A.60430 (Fig. 2-65), force the pulley hub on the shaft ensuring a dimension 84.4±0.1 mm;
- drive the impeller on the shaft with installation tool A.60430, ensuring a clearance of 0.9 - 1.3 mm between the impeller blades and the pump casing;
- assemble the pump casing with the cover, installing the gasket in between.

Thermostat

Check the temperature at which the thermostat main valve starts opening and measure the travel of the bypass valve.

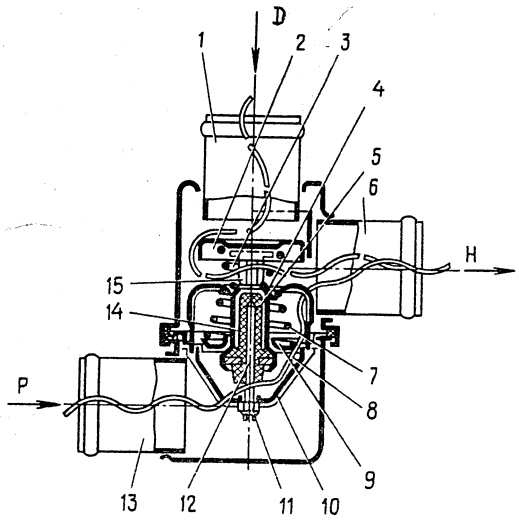


Fig.2-66. Thermostat:
1 - inlet pipe connection (from engine); 2 - bypass valve; 3 - bypass valve spring; 4 - sleeve; 5-rubber insert; 6 - outlet pipe connection; 7 - main valve spring; 8 - main valve seat; 9 - main valve; 10 - holder; 11 - adjusting nut; 12 - piston; 13 - inlet pipe connection (from radiator); 14-filler; 15 - case; D - coolant from engine; P - coolant from radiator; H - coolant to pump

For this purpose place the thermostat on BC-106 stand, immersing it into a tank with water or coolant. Touch the indicator rod against the bottom of main valve 9 (Fig. 2-66).

The initial temperature of the liquid in the tank should be 73 - 75 °C. Raise the liquid temperature gradually at the rate of 1 °C per minute approximately, stirring the liquid constantly so as to obtain uniform temperature throughout its volume.

The temperature at which the valve starts opening should be registered when the travel of the main valve reaches 0.1 mm.

Replace the thermostat if the opening temperature of the main valve is other than 81^{+5}_{-4} °C or the valve travel is shorter than 6.0 mm.

The simplest check of the thermostat can be made directly on the car. Having started a cold engine, hand-feel the radiator; if the thermostat is in order, the lower tank of the radiator should start getting warmer when the pointer of the coolant temperature gauge is about 3 - 4 mm from the red zone on the scale, which corresponds to 80 - 85 °C.

Radiator

Removal from Car

To remove the radiator from the car:

- take away the spare wheel and remove its supporting tube;
- drain the radiator and the cylinder block by removing the drain plugs from the radiator bottom tank and the cylinder block; open the heater cock and remove the radiator filler cap;

Caution

To avoid damaging the radiator, unscrew the bottom tank with one wrench, applying another one to the plug union soldered into the radiator. Unscrew the plug with a socket or box wrench so as to protect the plug faces against damage.

- disconnect the coolant hoses from the radiator;
- remove the fan shroud, first separating its halves;
- unscrew the radiator-to-car body bolts and lift the radiator out of the engine compartment.

Tightness Test

The radiator can be checked for tightness in a water bath.

Plug the radiator pipe connections, feed in air at a pressure of 0.1 MPa (1 kgf/cm^2) and dip the radiator into the water bath for at least 30 s. There should be no air leaks.

Minor leaks can be corrected by soft-soldering; a heavily damaged radiator should be replaced by a new one.

LUBRICATING SYSTEM

The main dimensions of the oil pump and its drive are given in Fig. 2-67.

Replacing the Oil

Change the oil while the engine is still hot. Wait at least 10 minutes after opening the drain hole to provide for complete drainage of oil.

While replacing the oil be sure to replace the oil filter too. It can be unscrewed with the aid of remover A.60312 (Fig. 2-4).

Install the filter by screwing it in hand-tight.

During the 30000 km oil change (or earlier if sticky resinous deposits are discovered on the

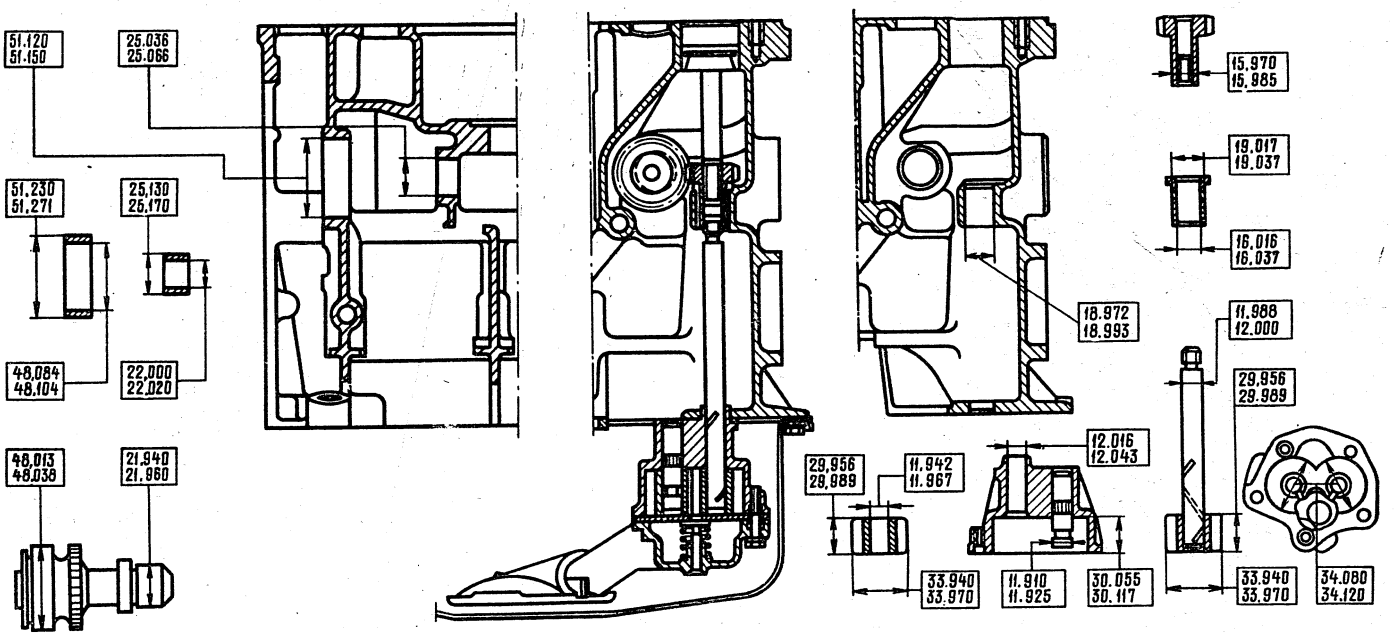


Fig.2-67. Basic Dimensions of Oil Pump and Drive

camshaft bearing housing), it is good practice to wash the lubricating system with ВНИИНП-ФД oil in the following order:

- stop the engine, drain the used oil and, without removing the oil filter, pour in the detergent oil ВНИИНП-ФД to the "MIN" mark on the oil dipstick (2.9 l);
- start the engine and run it idle for 10 min;
- drain all detergent oil and remove the old oil filter;
- install a new oil filter and pour in fresh lubricating oil of the grade suited to the season.

Oil Pump

Removal and Installation

If the oil pump alone has to be repaired, remove the engine from the car (see "Engine Removal"), mount it on a turnover stand, drain the engine sump, turn over the engine and remove the oil sump. Then unscrew the oil pump fastening bolts and take off the pump complete with the suction pipe.

To install the pump, reverse the removal operations.

Disassembly and Assembly

Clamp the pump in a vice taking care not to damage the casing and do the following:

- unscrew the bolts and remove the suction pipe complete with the reducing valve;

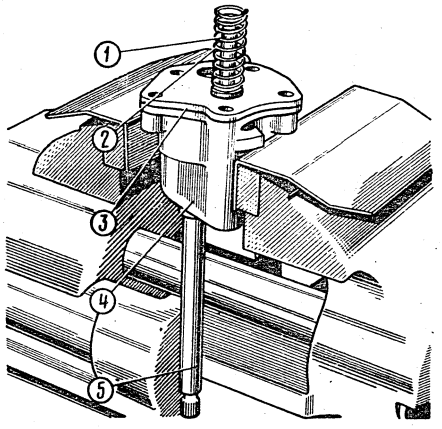


Fig.2-68. Disassembling the Oil Pump:
1 - reducing valve; 2 - spring; 3 - cover; 4 - casing; 5 - shaft

- remove pump casing cover 3 (Fig. 2-68) and take the pump shaft with the drive pinion, then the driven gear, from the casing.

To assemble, clamp the pump cautiously in a vice and proceed as follows:

- install the drive pinion with the shaft into the pump casing and slip the driven gear on the axle in the casing;
- install the casing cover, the reducing valve with the spring and fasten the suction pipe to the pump casing.

Note. The gears in the assembled pump should rotate smoothly and without jemming when the drive shaft is being turned by hand.

Checking the Pump Parts

Wash the parts of the disassembled pump in kerosene or gasoline and blow them with compressed air; then examine the pump casing and cover; replace any cracked parts.

Using a set of feeler gauges, measure the clearances between the gear teeth, also between the outside diameters of the gears and the pump casing walls (Fig. 2-69) which should be, respectively, 0.15 mm (maximum permissible 0.25 mm) and 0.11 - 0.18 mm (maximum permissible 0.25 mm). If the clearances exceed the permissible wear limits, replace the gears or, if necessary, the pump casing too.

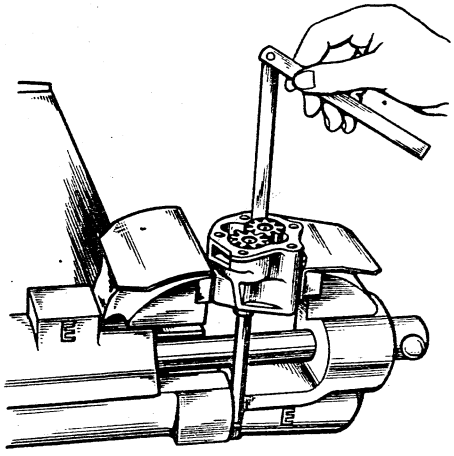


Fig.2-69. Checking the Radial Clearance in Oil Pump

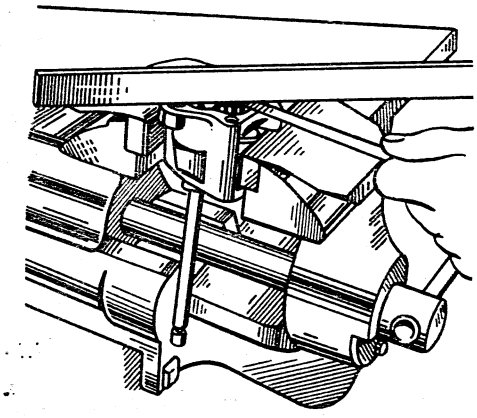


Fig.2-70. Checking the Axial Clearance in Oil Pump

Using a feeler gauge and straightedge (Fig. 2-70), check the clearance between the gear faces and the surface of the casing; this clearance should be 0.066 - 0.161 mm (maximum permissible 0.2 mm).

If the clearance is larger than 0.2 mm, replace the gears or the pump casing, depending on whichever is worn heavier.

Measure the parts to determine the clearance between the driven gear and its axle. It should be 0.017 - 0.057 mm (wear limit being 0.1 mm). Besides, measure the clearance between the pump shaft and the bore in the casing. This clearance should be 0.016 - 0.055 mm (maximum permissible 0.1 mm). If the clearances exceed the wear limits, replace the worn parts.

Checking the Reducing Valve

When repairing the oil pump, take care to examine the reducing valve. Pay attention to the condition of the valve and body surfaces since possible dirt or deposits on the mating surfaces may cause jamming. The mating surfaces of the valve should be free from nicks and burrs which may decrease pressure in the system.

Check the valve spring for resilience against the data given in Fig. 2-71.

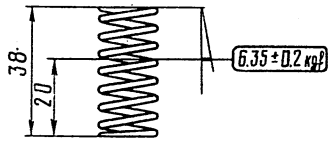


Fig.2-71. Basic Data for Checking the Reducing Valve Spring

Oil Pump Drive Shaft and Gears

The shaft journals and the active surface of the eccentric should be free from dents and notches.

The teeth of the oil pump and ignition distributor drive gears should not be crumbled out; in case of this defect replace either the shaft or the gear.

Oil Pump Drive Shaft Bushes

Check the inside diameter of the bushes, their fit in the bores and alignment of the oil hole in the front bush with the channel in the cylinder block (turning of the bush). The inside surface of the bushes should be smooth and free of scores.

Measure the diameters of the shaft and bushes and determine the clearances between the bushes and the bearing surfaces of the shaft. If the clearance exceeds the 0.15 mm wear limit, also if the bushes are damaged on the surface or loose in the bores, replace them by new ones.

Both installation and removal of the bushes should be performed with driver A.60333/1/2 (Fig. 2-72), observing the following points:

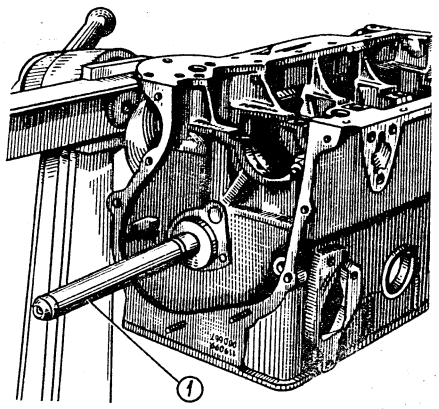


Fig.2-72. Removal and Installation of Oil Pump Drive Shaft Bushes:
1 - driver A.60333/1/2

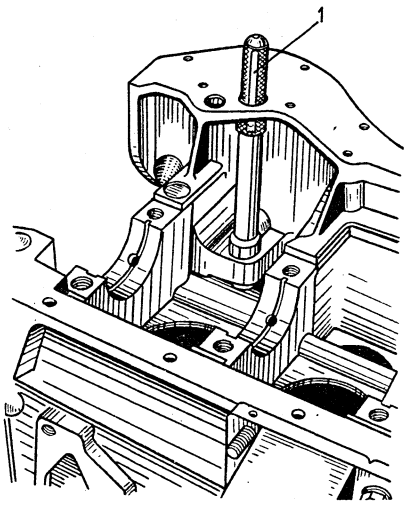


Fig.2-73. Driving Out the Oil Pump and Ignition Distributor Drive Gear Bush:
1 - driver A.60326/R

- the bushes must be pressed into their bores so that the oil hole in the front bush is lined up with the lubrication channel in the cylinder block;

- after pressing in, the bushes must be finish-machined to the exact inside diameter (for dimensions see Fig. 2-68). To ensure perfect axial alignment of the shaft bushes, ream both of them jointly with the aid of reamer A.90353.

Oil Pump Drive Gear Bush

Check the bush for reliable press fit in the bore. Replace the bush if its inside surface is rough and scored.

To force the bush in or out, use driver A.60326/R (Fig. 2-73).

After press-fitting, ream out the bush to 16.016 - 16.037 mm.

CRANKCASE BREATHING SYSTEM

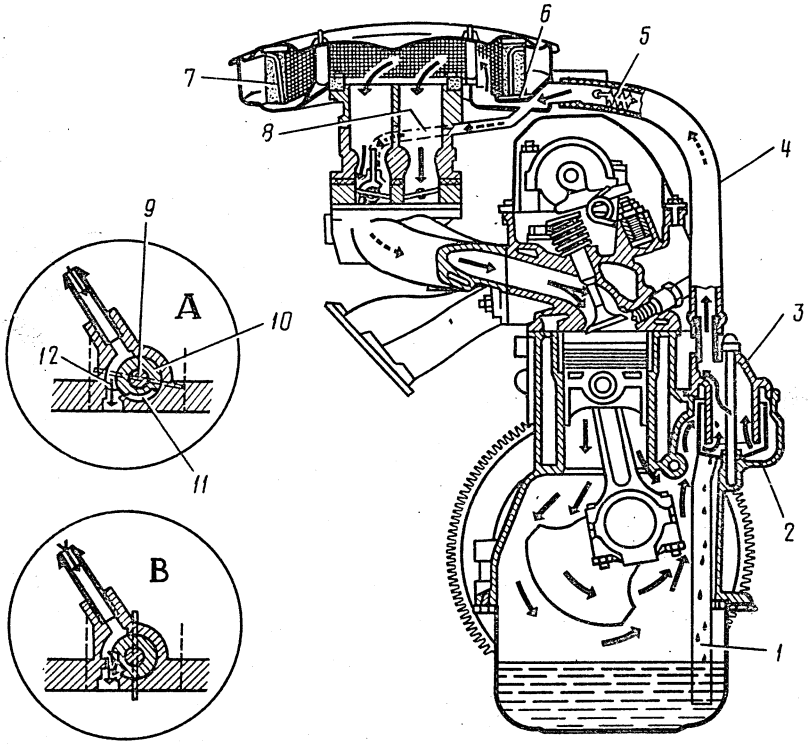


Fig.2-74. Crankcase Breathing System: A and B - operation of carburettor fume valve unit at low (A) and high (B) crankshaft speeds; 1 - oil separator drain pipe; 2 - oil separator; 3 - breather cover; 4 - gas drawout hose; 5 - flame arrester; 6 - drawout manifold; 7 - air cleaner element; 8 - hose discharging gases into carburettor after-throttle space; 9 - primary throttle valve shaft; 10 - fume valve; 11 - fume valve groove; 12 - calibrated orifice

Washing the System

To wash the system, disconnect breathing hoses 4 and 8 (Fig. 2-74) from the pipe connections, take flame arrester 5 out of hose 4, remove breather cover 3 and wash them with gasoline or kerosene.

It is also necessary to wash the carburettor fume valve and the air cleaner spaces and pipes which conduct the drawn-out gases.

FUEL SYSTEM

Air Cleaner

To remove the air cleaner, take off its cover, lift out the cleaner element, unscrew the fastening nuts (Fig. 2-76) and remove the cleaner body with the gasket. Now disconnect the hoses.

When installing the air cleaner take care to position its cover properly. In summer (above +15 °C) put the cover so that the blue mark A (Fig. 2-75) is in line with black arrow 3. In winter (below +15 °C) set the cover to align the red mark B with the arrow.

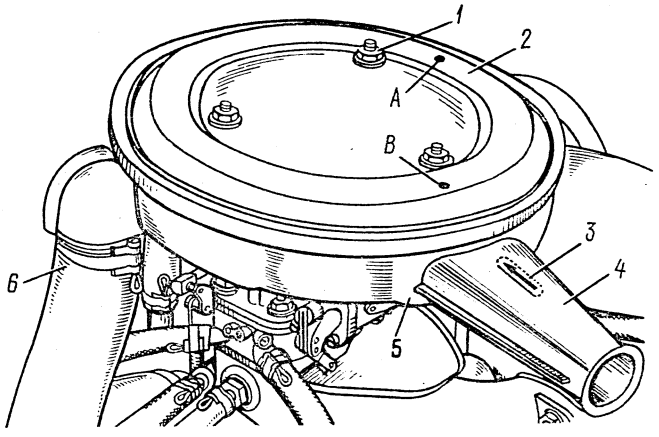


Fig.2-75. Air Cleaner:
1- nut; 2 - cleaner cover; 3 - indicating arrow; 4 - summer air intake; 5 - cleaner body; 6 -winter warm air feed hose; A - blue mark "Summer"; B -red mark "Winter"

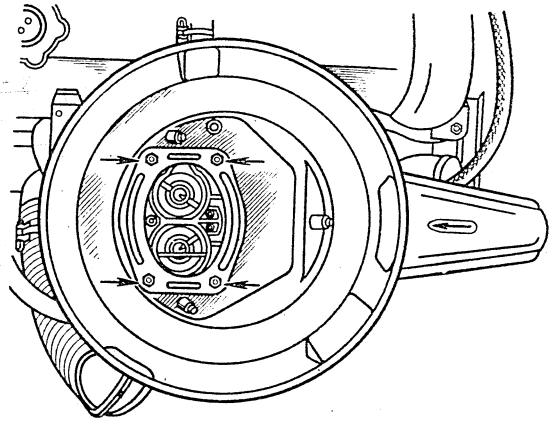


Fig.2-76. Removing the Air Cleaner. Arrows Show Cleaner-to-Carburettor Fastening Nuts

Fuel Pump

The design of the fuel pump appears in Fig. 2-77.

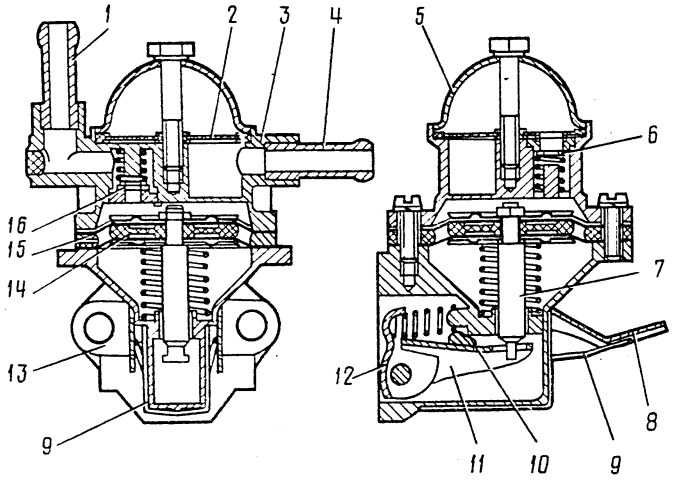


Fig.2-77. Fuel Pump:
1 - discharge pipe union; 2 - filter; 3 - casing; 4 - suction pipe union; 5 - cover; 6 - suction valve; 7 - rod; 8 - hand priming lever; 9 - spring; 10 - eccentric; 11 - valve arm; 12 - operating lever; 13 - lower cover; 14 - inner spacer; 15 - outer spacer; 16 - discharge valve

Checking the Pump

Insufficient supply of gasoline to the carburettor may be caused by some fault of the fuel pump or by clogging or damage of the fuel lines.

To identify the cause of the trouble, disconnect the hose from discharge pipe union 1 and work hand-priming lever 8 to see whether the fuel is supplied at all. If not, disconnect the hose from suction pipe union 4 and check for vacuum built up at the outlet of this union. If vacuum is created, the trouble should be traced to a damaged pipe; if not, the pump is at fault.

Disassembly, Inspection and Checking of Parts

To disassemble the pump, unscrew the bolt of cover 5, remove the cover and filter 2. Then remove the screws fastening the casing to the

lower cover, detach these parts from each other, take out the diaphragm unit and the spring.

Wash all the parts in gasoline and blow them with compressed air.

Check the condition of the pump springs.

Look for probable jamming of valves. Examine the diaphragms. They should be free from cracks and age-hardening.

After inspection replace all the worn or damaged parts by new ones. The pump gaskets must always be replaced by new ones; before installation, coat them with a thin layer of lubricant.

Installing the Pump

Correct installation of the fuel pump will be ensured by using two of the following three gaskets:

A - 0.27 - 0.33 mm thick;

B - 0.70 - 0.80 mm thick;

C - 1.10 - 1.30 mm thick.

To install the pump, refer to Fig. 2-78 and proceed as follows.

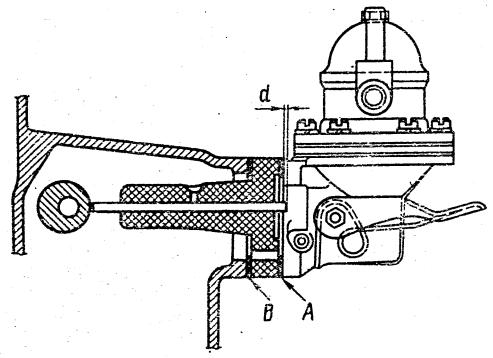


Fig.2-78. Diagram for Checking and Adjusting the Travel of Pump Drive Pushrod:
A - gasket 0.27 - 0.33 mm thick; B - gasket 0.70 - 0.80 mm thick; d - pushrod travel

Install the heat-insulating spacer on the cylinder block, putting gasket B in between, and place gasket A on the spacer surface contacting the pump. Using fixture 67.7834.9506, measure distance d (the minimum protrusion of the pump lifter, determined by slowly turning the crankshaft). If distance d is within 0.8 - 1.3 mm, secure the pump on the engine; if it is smaller than 0.8 mm, replace gasket B by gasket A; if distance d is larger than 1.3 mm, replace gasket B by gasket C. Recheck distance d and secure the pump on the engine. Remember that the pump and the heat-insulating spacer should always be separated by gasket A.

Fuel Tank

Removal and Installation

To remove the fuel tank from the car:

- unscrew cap 6 (Fig. 2-79) of filler pipe 10 and drain gasoline;
- remove the rear seat, turn off the fastening screws of the R.H. and L.H. linings of the wheel arches and remove the R.H. lining;
- turn off the fastening screws and remove the cover of the fuel tank compartment;
- remove the hoses which connect the fuel tank with the filler pipe, disconnect the wires and hose from the fuel level transmitter, unscrew the fastening bolts and take out the tank.

To install, reverse the removal operations.

Cleaning and Inspection

Remove the fuel level transmitter, wash the tank through the filler pipe with a powerful jet of a detergent solution so as to expel any sediment and dirt, then shake up the solution smartly, drain it and airblast the tank. Repeat these operations two or three times.

Examine the fuel tank closely along the jointing line, make sure there are no leaks and, if necessary, soft-solder the leaky point.

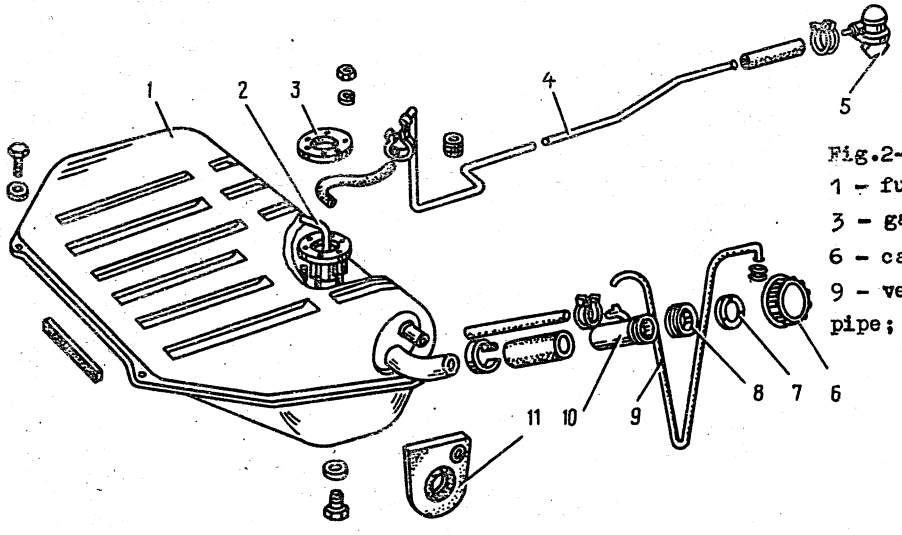


Fig.2-79. Fuel Tank and Piping:
1 - fuel tank; 2 - fuel level transmitter; 3 - gasket; 4 - fuel pipe; 5 - fuel pump; 6 - cap; 7 - gasket; 8 - filler pipe seal; 9 - vent pipe connecting hose; 10 - filler pipe; 11 - seal of filler and vent pipes

Caution

Soldering is permitted only on a thoroughly washed tank containing no gasoline fumes which may ignite during soldering.

Carburettor

Up to 1980 the VAZ-2121 cars had been equipped with carburettors 2106-1107010. This number is cast on the lower flange of the carburettor body.

Beginning from 1980, the VAZ-2121 cars have been fitted with carburettors 2107-1107010-20 jointly with the ignition distributor Type 30.3706-02 (2121-3706010-10) which incorporates a vacuum spark timer. However, some of the cars may be provided with carburettor 2107-1107010-10 jointly with a conventional ignition distributor (without the vacuum spark timer). On these carburettors the number is written on a nameplate secured to the carburettor cover.

The carburettor 2106-1107010 is of the emulsion double-barrel downdraft type. It incorporates a balanced float chamber and a system for drawing the crankcase gases into the after-throttle space (Fig. 2-80). The idling system has a heated zone of the throttle valves and an electromagnetic valve of the idling jet in the primary barrel

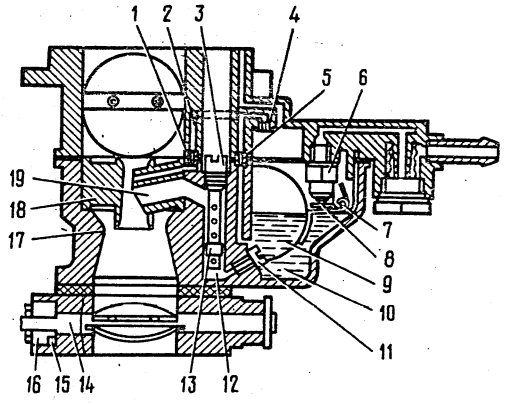


Fig.2-80. Carburettor Main Metering System and Econostat (econostat atomizer is in carburettor secondary barrel, In this diagram it is shown as if being located in primary barrel):
1 - econostat emulsion jet*); 2 - econostat emulsion channel*); 3 - main metering system air jet; 4 - econostat air jet*); 5 - econostat fuel jet*); 6 - needle valve; 7 - float pivot; 8 - needle ball; 9 - float; 10 - float chamber; 11 - main fuel jet; 12 - emulsion well; 13 - emulsion tube; 14 - primary throttle valve shaft; 15 - fume valve groove; 16 - fume valve; 17 - larger Venturi; 18 - smaller Venturi; 19 - atomizer

*) Not provided on carburettor 2106-1107010.

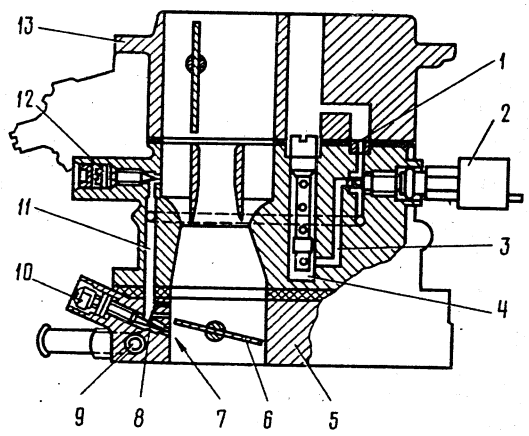


Fig.2-81. Idling System of Carburettor 2106-1107010:
1 - air jet; 2 - shut-off valve; 3 - fuel channel; 4 - emulsion well; 5 - throttle valve housing; 6 - primary throttle valve; 7 - screw-adjusted hole; 8 - progression duty holes; 9 - throttle housing heating channel; 10 - adjusting screw; 11 - emulsion channel; 12 - addition air adjusting screw; 13 - carburettor body cover

(Fig. 2-81). A system of levers ensures the successive opening of the throttle valves; the choke valve has a diaphragm-type mechanism for starting a cold engine (Fig. 2-82). The diaphragm-type mechanically-operated acceleration pump (Fig. 2-83) supplies fuel into the primary barrel.

The carburettor 2107-1107010-10 is distinguished by different calibration data (see Table 2-6), provision of an enrichment device (econostat), pneumatically-operated secondary throttle (Fig. 2-84) and a modified idling system (Fig. 2-85). There is no heating of throttle valve housing in these carburettors. The carburettor 2107-1107010-10 is fully interchangeable with the 2106-1107010 model and can be installed on the cars manufactured before 1980.

The carburettor 2107-1107010-20 differs from the 2107-1107010-10 model by different diameters of some jets and a provision of a pipe for feeding vacuum to the ignition distributor vacuum spark timer. This carburettor can be used instead of 2106-1107010 carburettors on the cars turned out before 1980. However, in this case the conventional ignition distributor (without vacuum spark timer) must be replaced by the ignition distributor Type 30.3706-02 with such timer.

The cars VAZ-21211 are equipped with carburettors 2105-1107010-20 though some of the cars can be fitted with carburettors 2105-1107010-10 and with ignition distributors without vacuum spark timers.

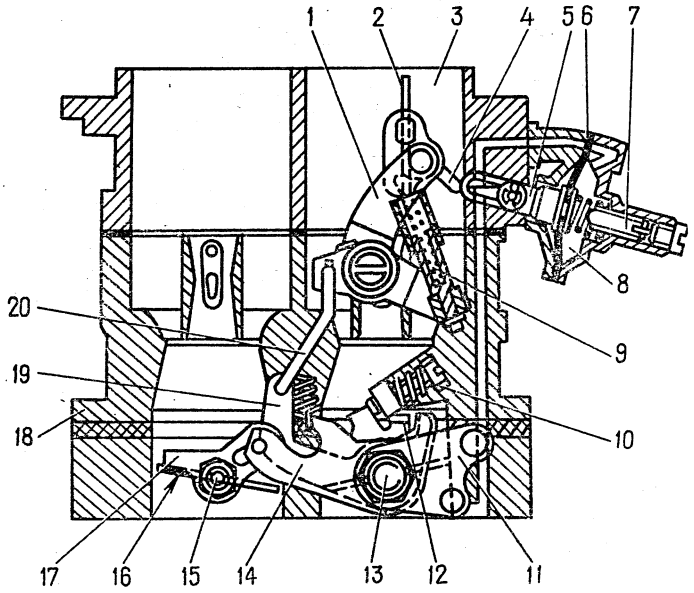


Fig.2-82. Choke Mechanism of Carburettors 2106-1107010, Diagrammatic:
1 - choke control lever; 2 - choke valve; 3 -carburettor primary barrel air horn; 4 - rod; 5 - choke mechanism rod; 6 - diaphragm; 7 - adjusting screw; 8 - space communicating with after-throttle space; 9 - telescopic link; 10 - primary throttle adjusting screw; 11 - throttle valve operating lever; 12 - sector; 13 - primary throttle shaft; 14 - lever on primary throttle shaft; 15 - secondary throttle shaft; 16 - secondary throttle; 17 - lever; 18 - carburettor body; 19 - lever; 20 - rod

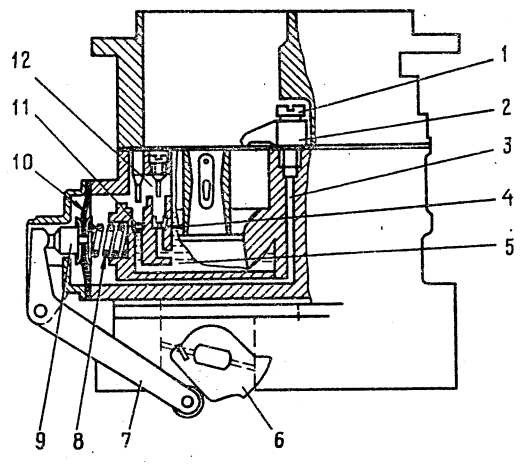


Fig.2-83. Acceleration Pump. Diagrammatic:
1 - delivery ball valve; 2 - atomizer; 3 - fuel channel; 4 - bypass jet; 5 - float chamber; 6 - acceleration pump operating sector; 7 - operating lever; 8 - pump return spring; 9 - diaphragm cup; 10 - pump diaphragm; 11 - inlet ball valve; 12 - pump vapour chamber

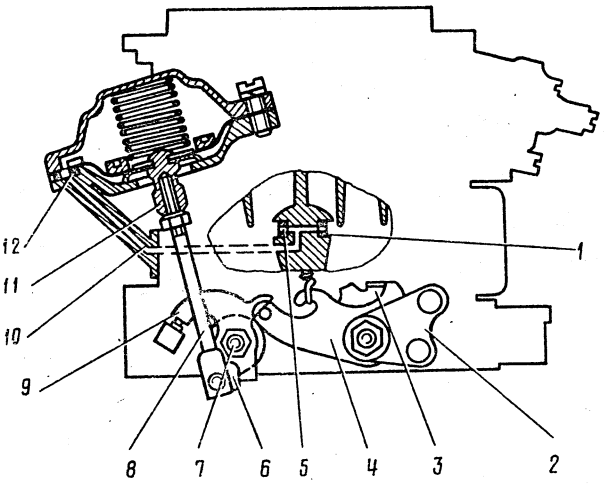


Fig.2-84. Secondary Throttle Operating Mechanism of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - pneumatic actuator jet in primary barrel venturi; 2 - throttle valve operating lever; 3 - lever rigidly linked with primary throttle shaft; 4 - secondary throttle opening-limiting lever; 5 - pneumatic actuator jet in secondary venturi; 6 - lever spring-connected with lever 9; 7 - secondary throttle shaft; 8 - pneumatic actuator rod; 9 - secondary throttle operating lever; 10 - vacuum channel to pneumatic actuator; 11 - rod bushing; 12 - secondary throttle pneumatic actuator

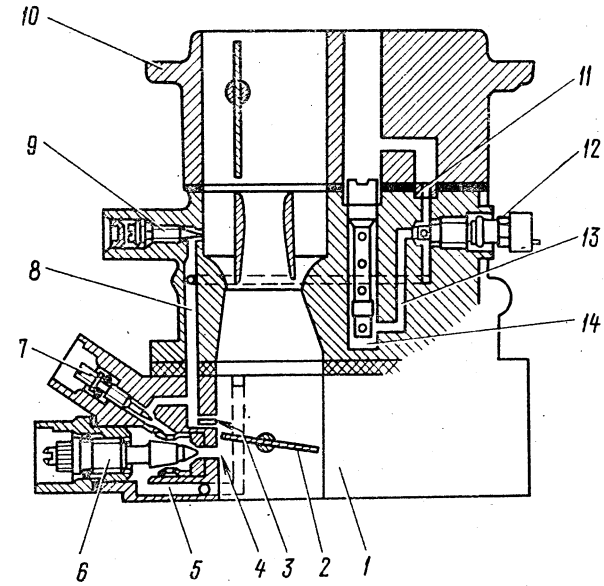


Fig.2-85. Idling System of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - throttle valve housing; 2 - primary throttle; 3 - progressive duty holes; 4 - screw-adjusted hole; 5 - air inlet channel; 6 - mixture quantity adjusting screw; 7 - air fuel ratio (mixture quality) adjusting screw; 8 - idling system emulsion channel; 9 - additional air adjusting screw*; 10 - carburettor body cover; 11 - idling system air jet; 12 - shutoff valve; 13 - idling system fuel channel; 14 - emulsion well

* Installed on some carburettors.

As distinct from the carburettor 2107-1107010-20, the carburettor 2105-1107010-20 has different diameters of some jets, starting clearances of the throttle and choke valves and has no idling shut-off valve. Adjustments of this carburettor are the same as those for the Model 2107-1107010-20.

The calibration data of carburettors are summarized in Table 2-6.

Table 2-6

Carburettor Calibration Data

Parameters	2106-1107010		2107-1107010-10 2107-1107010-20		2105-1107010-10 2105-1107010-20	
	1st barrel	2nd barrel	1st barrel	2nd barrel	1st barrel	2nd barrel
Venturi diameter, mm	23	24	22	25	21	25
Mixing chamber diameter, mm	32	32	28	36	28	32
Mixture atomizer calibration number	4	4	3.5	4.5	3.5	4.5
Diameter of main fuel jet, mm	1.30	1.40	1.12*	1.50	1.07*	1.62
Diameter of main air jet, mm	1.50	1.50	1.50	1.50	1.70	1.70
Emulsion tube calibration number	F 15	F 15	F 15	F 15	F 15	F 15
Diameter of idling and progression system fuel jet, mm	0.45	0.60	0.50	0.60	0.50	0.60
Diameter of idling and progression system air jet, mm	1.70	0.70	1.70	0.70	1.70	0.70
Diameter of orifice of acceleration pump atomizer, mm	0.40	-	0.40	-	0.40	-
Diameter of acceleration pump bypass jet, mm	0.40	-	0.40	-	0.40	-
Capacity of acceleration pump per 10 full strokes, cm^3	7±25 %	-	7±25 %	-	7±25 %	-
Diameter of econostat fuel jet, mm	-	-	-	1.50	-	1.50
Diameter of econostat air jet, mm	-	-	-	1.20	-	1.20
Diameter of econostat emulsion jet, mm	-	-	-	1.50	-	1.50
Diameter of choke mechanism air jet, mm	0.70	-	0.70	-	0.70	-
Diameter of secondary throttle pneumatic actuator jet, mm	-	-	1.50	1.20	1.20	1.00
Distance from float to carburettor cover with gasket (Dimension A, Fig. 2-89), mm	6.5-0.25		6.5-0.25		6.5-0.25	
Clearances at the valves for adjusting the choke mechanism (Fig. 2-100), mm:						
choke valve (clearance B)	7±0.25		5.5±0.25		5±0.5	
throttle valve (clearance C)	0.85-0.95		0.9-1.00		0.7-0.8	

* 1.15 mm for carburettor 2107-1107010-10; 1.09 mm for carburettor 2105-1107010-10.

Adjusting the Engine Idling Speed

The idling speed adjusting elements (Figs 2-86 and 2-87) include air-fuel ratio adjusting screw 2 and mixture quantity adjusting screw 1.

To prevent the Owner from interfering with the factory setting of the carburettor, screws 1 and 2 of carburettors 2107-1107010-10 and 2107-1107010-20 (screw 2 of carburettor 2106-1107010 only) are provided with pressed-on limiting plastic bushings which allow the screws to be turned through half a revolution only. If the CO content in the exhaust gases cannot be adjusted with these bushings in position, turn off the screws until the bushing heads are broken, remove the screws, take off their bushings and turn the screws back into the carburettor.

Note. The bushings installed at the Manufacturing Plant are blue while those installed at Service Stations, red.

The idling speed should be adjusted on a warm engine (coolant temperature 90 - 95 °C or oil temperature 75 - 90 °C) with well-adjusted valve clearances and a correct spark advance angle.

To adjust, proceed as follows:

2106-1107010 carburettors

Using screw 1 (Fig. 2-86), set a crankshaft speed of 12 - 13.3 s^{-1} (720 - 800 rpm) as read by the stand tachometer.

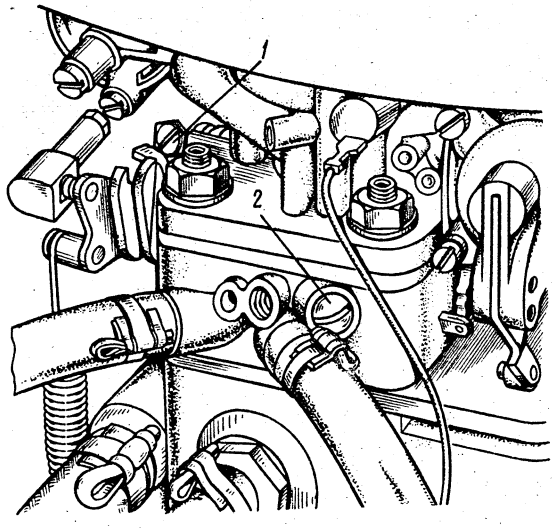


Fig.2-86. Idling System Adjusting Screws in Carburettors 2106-1107010:
1 - mixture quantity adjusting screw; 2 - air-fuel ratio adjusting screw

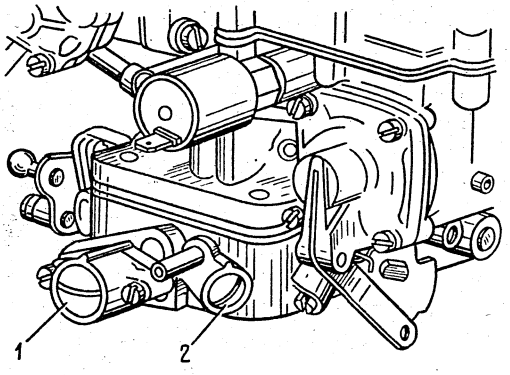


Fig.2-87. Idling System Adjusting Screws in Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - mixture-quantity adjusting screw; 2 - air-fuel ratio (mixture quality) adjusting screw

Rotating screw 2, bring the concentration of CO* in the exhaust gases to 1.5 - 2.5 % at the given position of the throttle valve.

Using screw 1, bring the crankshaft speed again to 12 - 13.3 s^{-1} (720 - 800 rpm).

If necessary, restore the concentration of CO to 1.5 - 2.5 % with screw 2.

Press the plastic limiting bushing on screw 1 as shown in Fig. 2-88 b.

Carburettors 2107-1107010-10 and 2107-1107010-20

Using screw 1 (Fig. 2-87) bring the crankshaft speed to 13.6 - 15 s^{-1} (820 - 900 rpm) as read by the stand tachometer.

* Reduced to 20 °C and 1013 GPa (760 mm Hg).

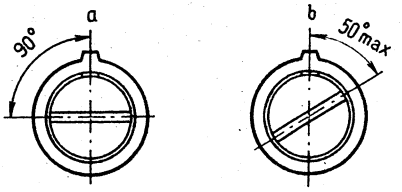


Fig.2-88. Installation of Limiting Bushings on Idling System Adjusting Screws
a - on mixture quantity adjusting screw; b - on air-fuel ratio adjusting screw

Rotating screw 2, bring the concentration of CO* in the exhaust gases to 0.5 - 1.2 % at a given position of screw 1.

Rotate screw 1 to restore the crankshaft speed to 13.6 - 15 s^{-1} (820 - 900 rpm).

If necessary, rotate screw 2 to restore the concentration of CO to 0.5 - 1.2 %.

Press the plastic limiting bushings on the screws, orienting the bushing slots relative to the locating projections as shown in Fig. 2-88.

Adjusting the Fuel Level in Float Chamber

The fuel level required for normal functioning of the carburettor is ensured by correct setting of the serviceable elements of its needle valve (Fig. 2-89).

The distance between the float and gasket 10 contacting the carburettor cover (dimension A)

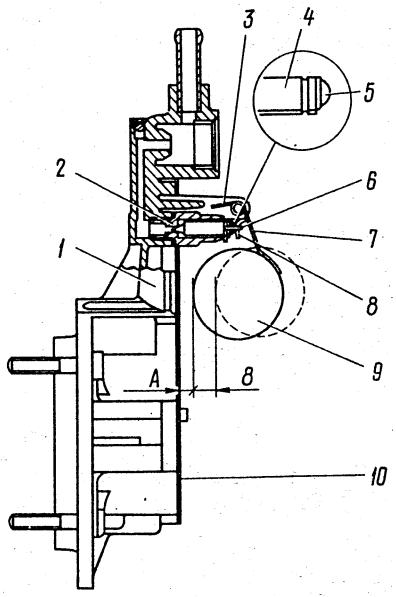


Fig.2-89. Float Chamber Fuel Level Adjustment:
1 - carburettor cover; 2 - needle valve seat; 3 - stop; 4 - needle valve; 5 - needle ball; 6 - needle yoke; 7 - float arm; 8 - tongue; 9 - float; 10 - gasket

should be 6.5±0.25 mm; this distance can be adjusted by bending tongue 8. The bearing surface of the tongue should be perpendicular to the needle valve axis and free from jags and dents.

To check this distance, use gauge 67.8151.9505. Hold the body cover vertically, with float tongue 8 touching lightly upon ball 5 of needle valve 4 without sinking it.

The maximum travel of the float (8±0.25 mm) can be adjusted by bending stop 3. Needle return yoke 6 should not interfere with the free movement of the float.

Install the carburettor cover and make sure that the float moves clear of the float chamber walls.

Note. The setting of the float must be checked whenever the float or the needle valve is replaced; in the latter case the valve sealing gasket must also be replaced.

Adjusting the Carburettor Control Linkage

With accelerator pedal 9 fully depressed (Fig. 2-90) the primary throttle valve should be wide open and the throttle valve lever should have no additional travel. When the pedal is released, the throttle valve should be tightly closed. If these requirements are not satisfied, the position of the pedal and throttle valve can be coordinated by changing the length of link 2 which is done by screwing its head on or off. Simultaneously check and, if necessary, adjust the length of link 1. The centre-to-centre distance of its heads should be 80 mm.

The cable and its casing should be positioned so that the choke valve is fully closed when knob 6 is pulled all the way out and fully open when the knob is pushed in.

Removal and Installation of Carburettor

Remove the air cleaner.

Disconnect link 1 and return spring 17 from the throttle valve operating lever (Fig. 2-90). Detach choke cable 4 from the carburettor.

Disconnect the hoses from the carburettor. Stop the ends of the fuel and coolant hoses to rule out leakage of fuel and coolant.

Remove the carburettor. Stop the inlet hole of the inlet manifold with a plug.

To install the carburettor, reverse the removal operations. After installation, adjust the throttle controls and the idling speed of the engine.

Disassembling the Carburettor

Remove return spring 7 (Fig. 2-91) of the lever limiting the opening of secondary throttle.

Undo and detach link 8 from the throttle valve lever.

Disconnect pneumatic actuator rod 9 from the secondary throttle operating lever*.

Compress the spring of telescopic link 4 and disconnect it from three-arm lever 3.

*Carburettors 2107-1107010-10 and 2107-1107010-20.

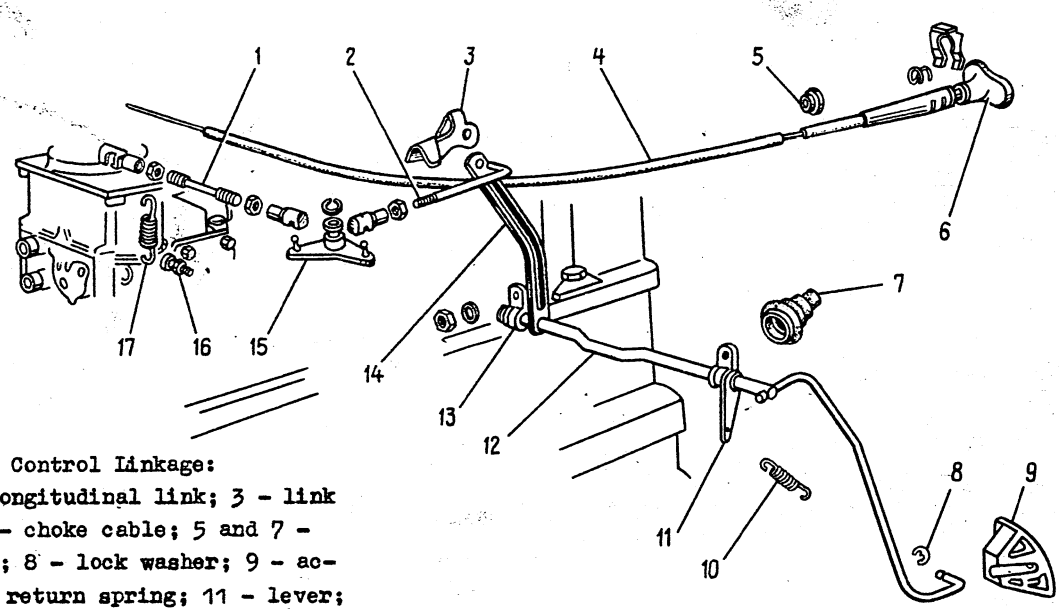


Fig.2-90. Carburettor Control Linkage:
1 - cross link; 2 - longitudinal link; 3 - link fastening shackle; 4 - choke cable; 5 and 7 - seals; 6 - cable knob; 8 - lock washer; 9 - accelerator pedal; 10 - return spring; 11 - lever; 12 - shaft; 13 - shaft bracket; 14 - lever; 15 - intermediate lever; 16 - return spring fastening screw; 17 - return spring

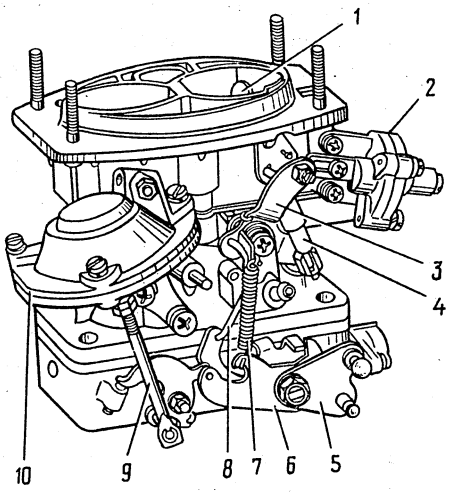


Fig.2-91. Carburettor 2107-1107010-20 Viewed from Throttle Control Linkage:
1 - choke valve; 2 - choke mechanism; 3 - choke valve control lever; 4 - telescopic link; 5 - primary throttle operating lever; 6 - secondary throttle opening limiting lever; 7 - return spring; 8 - link connecting primary throttle with choke mechanism control; 9 - pneumatic actuator rod; 10 - pneumatic actuator

Detach the cover with the gasket from the carburettor body, trying not to damage the cover and the float.

Remove the fastening screws, disconnect the throttle valve housing from the carburettor body, taking care not to damage the air-fuel passage adapter bushings pressed into the carburettor body, and the bushing sockets. Detach cautiously the heat-insulating gasket.

Disassemble the carburettor cover (Fig. 2-92):

- carefully push float pivot 16 with a mandrel out of the brackets (in the direction of the cut-out bracket) and pull out the pivot with unserrated flat-nose pliers. Remove the float and needle valve 15 taking care not to damage the float tongues;
- remove cover gasket 11, unscrew needle valve seat 14, unscrew plug 13 and take out fuel filter 12;
- disconnect telescopic link 7 and choke mechanism link 19 from the lever of choke valve shaft 8;
- turn off two screws of choke mechanism body 6 and remove the latter;

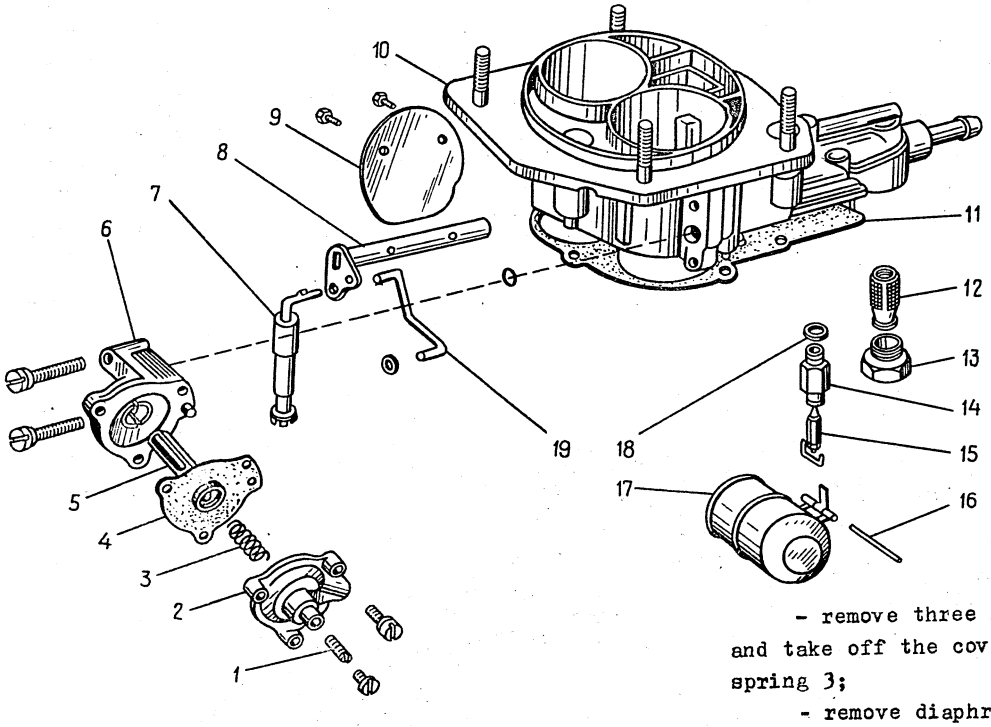


Fig.2-92. Carburettor Cover Parts:
1 - adjusting screw; 2 - choke mechanism cover; 3 - spring; 4 - diaphragm; 5 - diaphragm rod; 6 - choke mechanism body; 7 - telescopic link; 8 - choke valve shaft; 9 - choke valve; 10 - carburettor cover; 11 - gasket; 12 - filter; 13 - filter plug; 14 - needle valve seat; 15 - needle valve; valve; 16 - float pivot; 17 - float; 18 - gasket; 19 - choke mechanism link

- remove three screws of mechanism cover 2 and take off the cover with adjusting screw 1 and spring 3;
- remove diaphragm 4.

Disassemble throttle valve housing (Fig. 2-93):

- turn off idling mixture quality adjusting screw 18;
- remove the fastening screws of idling mixture quantity adjusting screw bushing 17 (Fig. 2-94) and take it off complete with screw 16*;

*Carburettors 2107-1107010-10 and 2107-1107010-20.

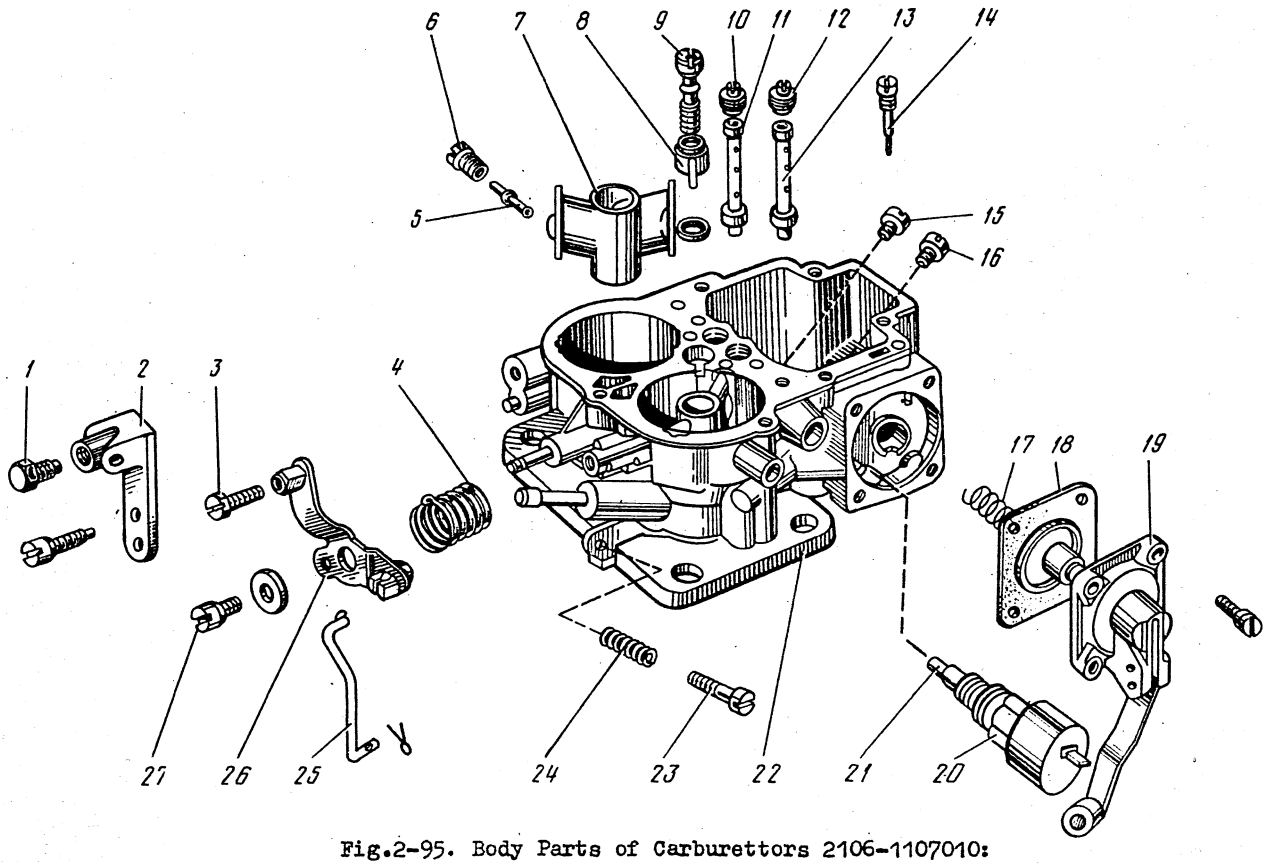


Fig.2-95. Body Parts of Carburettors 2106-1107010:

1 - choke control cable casing screw; 2 - cable casing bracket; 3 - cable fastening screw; 4 - choke valve operating lever return spring; 5 - secondary barrel progression system fuel jet; 6 - fuel jet body; 7 - smaller Venturi; 8 - acceleration pump atomizer; 9 - valve-screw of acceleration pump; 10 - secondary barrel main air jet; 11 - secondary barrel emulsion tube; 12 - primary barrel main air jet; 13 - primary barrel emulsion tube; 14 - acceleration pump adjusting screw; 15 - secondary barrel main fuel jet; 16 - primary barrel main fuel jet; 17 - acceleration pump return spring; 18 - acceleration pump diaphragm; 19 - acceleration pump cover; 20 - shutoff valve; 21 - idling fuel jet in shutoff valve; 22 - carburettor body; 23 - throttle valve opening adjusting screw; 24 - lock spring; 25 - throttle valve operating rod; 26 - choke valve operating lever; 27 - lever screw

Assembling the Carburettor

To assemble the carburettor, reverse the disassembly operations, observing the following points:

- the float should rotate freely on its pivot, without rubbing against the chamber walls;
- the needle valve should slide easily in its socket, without cocking and jamming and the valve drive link should not interfere with the movement of the float tongue.

To avoid confusing the jets of the primary and secondary barrels at assembly, take a note of their markings and install them in conformity with the table of calibration data given at the beginning of this chapter.

Main air jets 3 (Fig. 2-80) are marked on the upper surface of their heads (e.g. "150") which denotes the diameter of the jet orifice (1.50 mm).

Main fuel jets 11 bear figures on the side surface ("130") which likewise denote the diameter of the jet orifice (1.30 mm).

Emulsion tubes 13 are marked on the cylindrical surface in the lower part. The figures on the tubes (e.g. "F15") stand for the tube calibration number.

Smaller Venturis 18 also bear figures (e.g. "4") which denote the calibration number of the atomizer orifice.

The idling fuel jets have figures punched on the cylindrical band (e.g. "45" or "60"); these figures denote the diameter of the orifice (0.45 or 0.60 mm).

Installing the pneumatic actuator of the secondary throttle valve. To connect rod 8 (Fig. 2-84) to lever 6 on the secondary throttle valve shaft, proceed as follows:

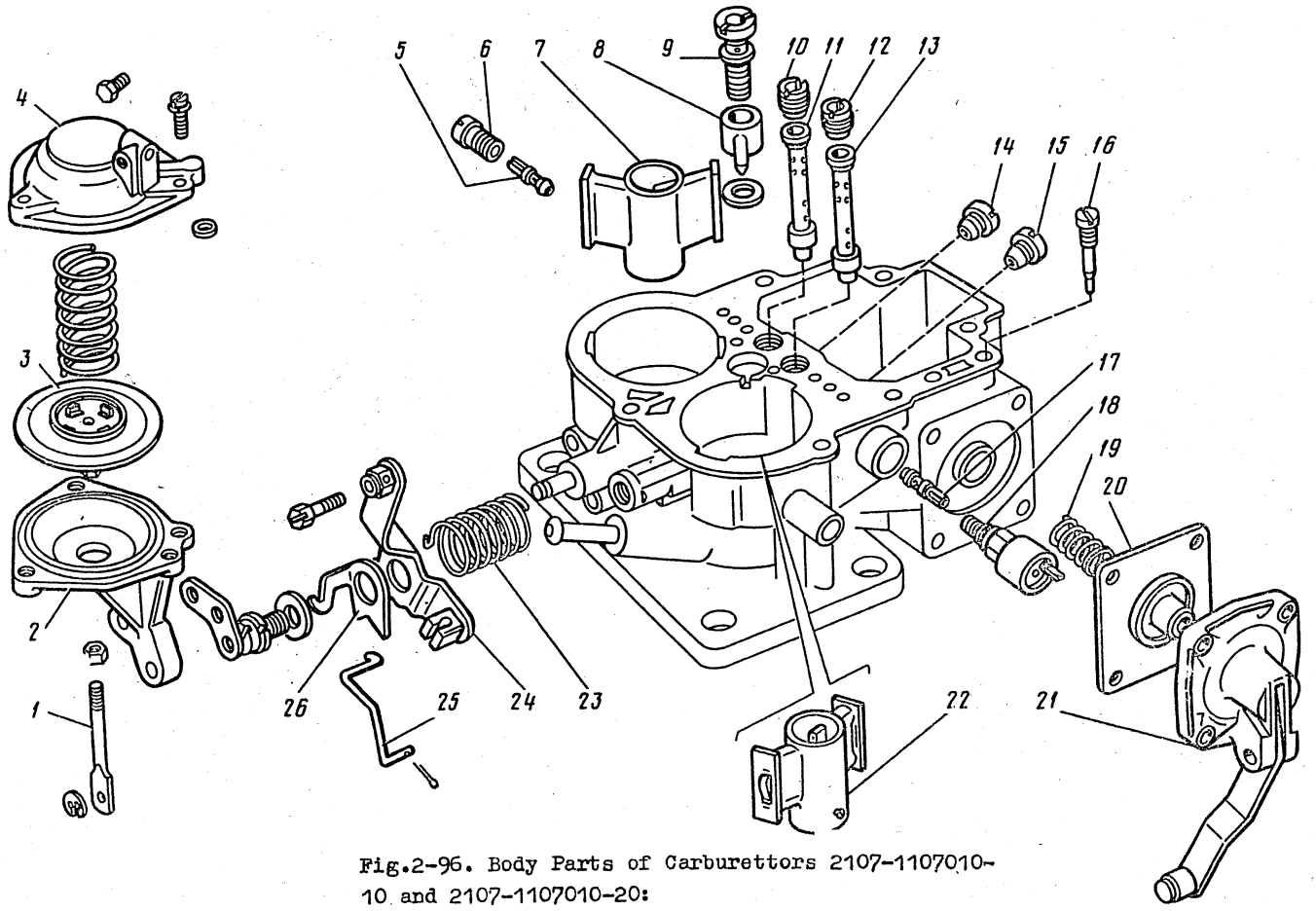


Fig.2-96. Body Parts of Carburettors 2107-1107010-10 and 2107-1107010-20:

1 - secondary throttle pneumatic actuator rod; 2 - pneumatic actuator body; 3 - diaphragm; 4 -pneumatic actuator cover; 5 - secondary barrel progression system fuel jet; 6 - fuel jet body; 7 - smaller Venturi; 8 - acceleration pump atomizer; 9-acceleration pump valve-screw; 10 - secondary barrel main air jet; 11 - secondary barrel emulsion tube; 12 - primary barrel main air jet; 13 - primary barrel emulsion tube; 14 - secondary barrel main fuel jet; 15 - primary barrel main fuel jet; 16 - acceleration pump adjusting screw; 17 - primary barrel idling system fuel jet; 18 - shutoff valve; 19-acceleration pump return spring; 20 - acceleration pump diaphragm; 21 - acceleration pump cover; 22 - primary barrel smaller Venturi; 23 - choke valve lever return spring; 24 - choke valve operating lever; 25 - choke valve lever return spring; 26 - throttle valve return spring bracket.

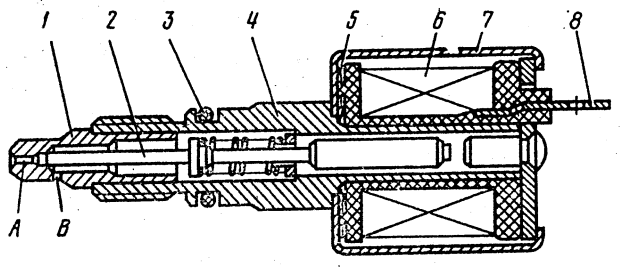


Fig.2-97. Carburettor Shutoff Valve
1 - idling fuel jet; 2 - needle; 3 - sealing ring; 4 - valve body; 5 - contact plate; 6 - coil; 7 - coil housing; 8 - plug; A - jet calibrated orifice; B - fuel outlet hole into idling system emulsion channel

- turn the secondary throttle valve to a vertical position;
- press pneumatic actuator rod 8 all the way and, holding bushing 11 against turning, turn the rod in or out thus adjusting its length until the hole in the end of rod 8 gets in line with a pin on lever 6:
- slip rod 8 on the pin of lever 6 and secure with a lock washer;
- fasten rod 8 with a locknut, using another wrench to keep bushing 11 against turning.

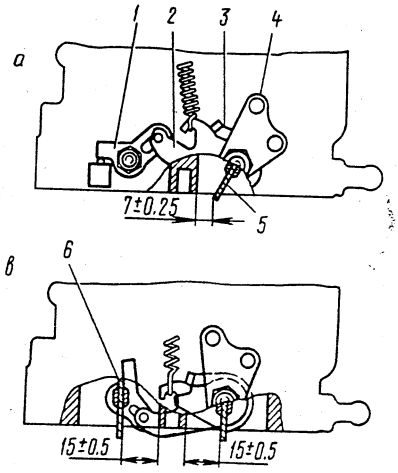


Fig.2-98. Adjusting Full and Part-Way Opening of Throttle Valves in Carburettor 2106-1107010:
a - adjusting part-way opening of primary throttle; b - adjusting position of secondary throttle
1 - lever on secondary throttle shaft; 2 - secondary throttle operating lever; 3 - lever linked with primary throttle shaft; 4 - throttle operating lever; 5 - primary throttle; 6 - secondary throttle

Post-Assembly Adjustments and Checks of Carburettor

Position of throttle valves of carburettor 2106-1107010. With lever 4 (Fig. 2-98) in a position where the upper lug of lever 3 contacts lever 2, the primary throttle should be partially open (7±0.25 mm). This opening can be adjusted by bending the upper lug of lever 3.

Both throttle valves should be fully open when lever 4 is turned to the extreme position in which the lug of lever 3 bears against a special boss on the throttle valve housing (Fig. 2-98 b).

This position of the throttle valves should be adjusted by bending the lower lug of lever 3.

Position of throttle valves of carburettors 2107-1107010-10 and 2107-1107010-20. Check the throttle valves for full opening by turning their operating levers all the way.

The maximum opening of the primary throttle (13± 0.5 mm) should be adjusted by bending the lower lug of lever 3 (Fig. 2-99).

The maximum opening of the secondary throttle (17±0.5 mm) should be adjusted by screwing the pneumatic actuator rod in or out.

The part-way opening of the primary throttle at which the upper lug of lever 3 contacts lever 2 (Fig. 2-99) should be 6±0.1 mm. This distance is adjusted by bending the upper lug of lever 3.

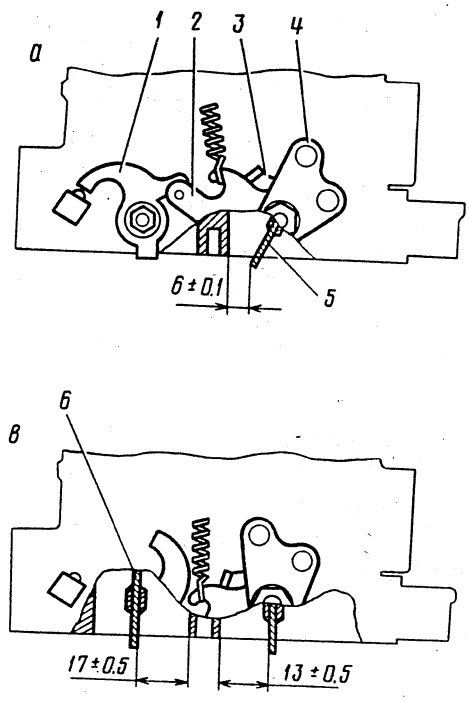


Fig.2-99. Adjusting the Position of Throttle Valve in Carburettors 2107-1107010-10 and 2107-1107010-20:
a - primary throttle partly open; b - throttle valves fully open; 1 - lever on secondary throttle shaft; 2 - lever limiting secondary throttle opening; 3 - lever rigidly connected with primary throttle shaft; 4 - throttle operating lever; 5 - primary throttle; 6 - secondary throttle

Choke mechanism. When lever 1 (Fig. 2-100) is turned all the way counterclockwise, the choke valve should be tightly closed. In this position of the lever the end of rod 3 should be located in the end of the slot of choke mechanism rod 4, without moving the latter. This requirement can be met by bending rod 3.

When the choke valve is tightly closed, the primary throttle valve must be partly open, i.e. through 0.85 - 0.95 mm (clearance C is the distance between the valve and chamber wall at the progression holes of the idling system). This clearance can be adjusted by bending link 7.

A completely closed choke valve should be opened to 7±0.25 mm (clearance B) by choke mechanism rod 4 when the latter is shifted by hand all the way to the right. This opening can be adjusted by screw 5.

In carburettors 2107-1107010-10 and 2107-1107010-20 clearance B should be 5.5±0.25 mm and clearance C, 0.9 - 1.0 mm.

Acceleration pump capacity. This should be measured within ten complete strokes (turns) of throttle valve operating lever 4 (Fig. 2-99). The

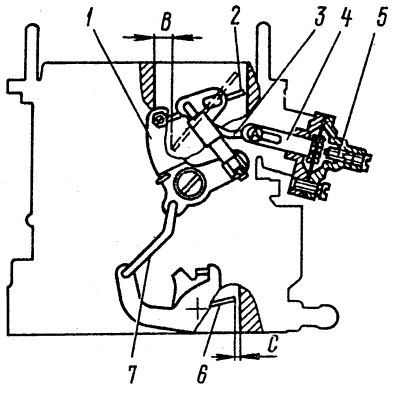


Fig.2-100. Adjusting the Choke Mechanism Controls:
1 - choke valve operating lever; 2 - choke valve; 3 - choke mechanism link; 4 - choke mechanism rod; 5 - adjusting screw; 6 - primary barrel throttle valve; 7 - throttle valve operating link

fuel discharged from the pump atomizer during these ten strokes should be collected into a measuring tube. Its volume should range from 5.25 to 8.75 cm^3.

Before the checks, make ten trial strokes of lever 4 in order to fill up the acceleration pump passages.

Tightness of the needle valve should be checked on a stand which is capable of delivering fuel to the carburettor under a pressure of 30 kPa (3 m H_2O). After the fuel level has settled in the test tube of the stand, it must not drop within 10 - 15 s. If the level drops, this should be attributed to the leakage of fuel through the needle valve.

EXHAUST SYSTEM

The exhaust gases are discharged from the engine through the exhaust manifold, muffler inlet pipe 1 (Fig. 2-101), auxiliary muffler 6 and main muffler 7.

The joint between the exhaust manifold and muffler inlet pipe flanges is sealed by gasket 2. The muffler pipes are interconnected by clamps 5.

The mufflers and their pipes are suspended from the car at three points.

The inlet pipe is fastened to bracket 4 which is mounted on the gearbox rear cover. The main muffler is fastened to the body floor by two straps while the tail pipe, by rubber pad 9.

The welded mufflers complete with pipes constitute inseparable units and, in case of failure, should be replaced by new ones.

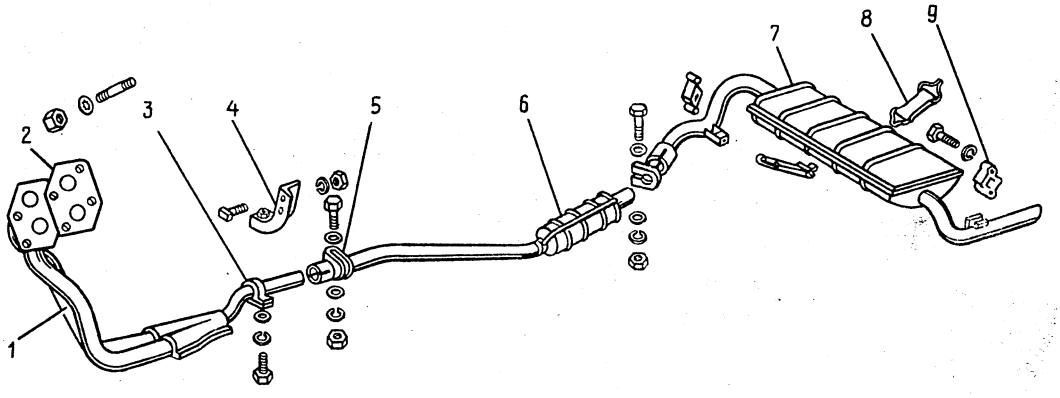


Fig.2-101. Exhaust System:
1 - muffler inlet pipe; 2 - gasket; 3 - inlet pipe to gearbox clamp; 4 - inlet pipe to gearbox bracket; 5 - muffler pipe connecting clamp; 6 - front auxiliary muffler; 7 - main muffler; 8 - main muffler fastening strap; 9 - tail pipe fastening pad

Section III
POWER TRANSMISSION

CLUTCH

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

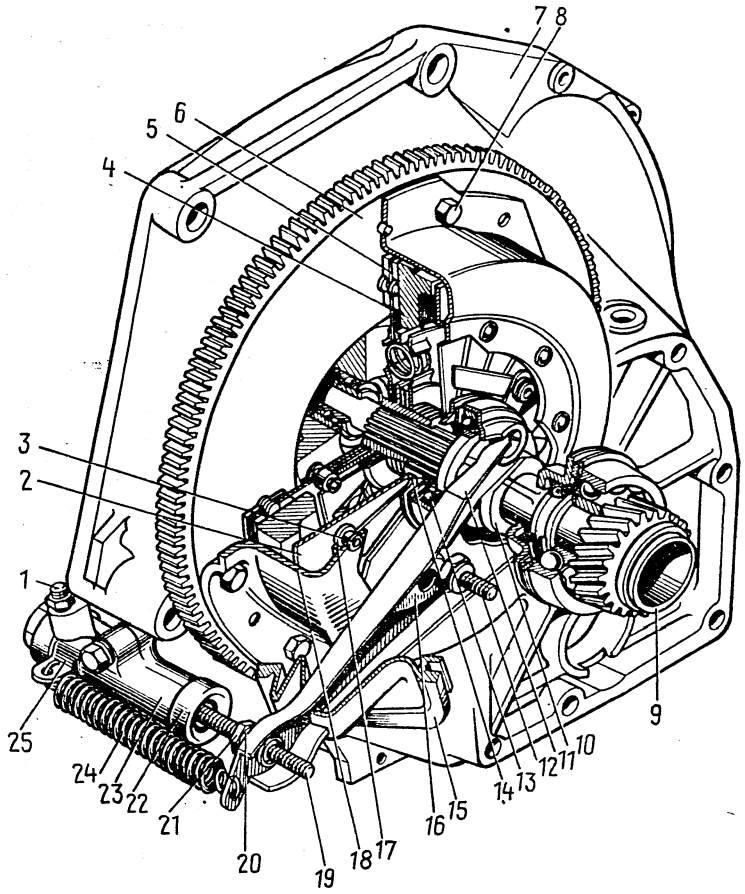


Fig.3-1. Clutch Assembly:
1 - bleeder pipe union; 2 - central pressure spring; 3 - pressure spring stepped rivet; 4-pressure plate; 5 - driven disc; 6 - flywheel; 7 - clutch housing; 8 - clutch cover to flywheel bolt; 9 - gearbox clutch shaft; 10 - clutch release collar; 11 - release yoke; 12 - release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

Trouble Shooting

Cause of trouble	Remedy
Clutch Drags	
1. Excessive clearances in clutch control mechanism	1. Adjust clutch control mechanism
2. Distortion of driven disc (face runout over 0.5 mm)	2. Straighten or replace disc

Cause of trouble	Remedy
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 face runout of disc
5. Jamming of driven disc hub on gearbox clutch shaft splines	5. Clean splines and coat them with lubricant ЛСЦ-15 or Литол-24. If jamming is caused by crushing 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 causing 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. Warping 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 surfaces and pressure plate	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 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 lubricant. If seizure is caused by crushing or wear of splines, replace clutch shaft or driven disc
2. Oiling of driven disc facings and of 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 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 Release	
1. Wear, damage, or lubricant leaks from clutch release bearing	1. Replace bearing
2. Wear of gearbox clutch shaft front bearing	2. Replace bearing

Cause of trouble	Remedy
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 the 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 the free travel of the pedal which is equal to 0.4 - 2 mm;
- adjust the free travel of the operating cylinder pushrod (4 to 5 mm) with nut 5 (Fig. 3-3) which is fixed by locknut 6. The free travel of the pushrod is checked with a special templet.

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

Bleeding the 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:

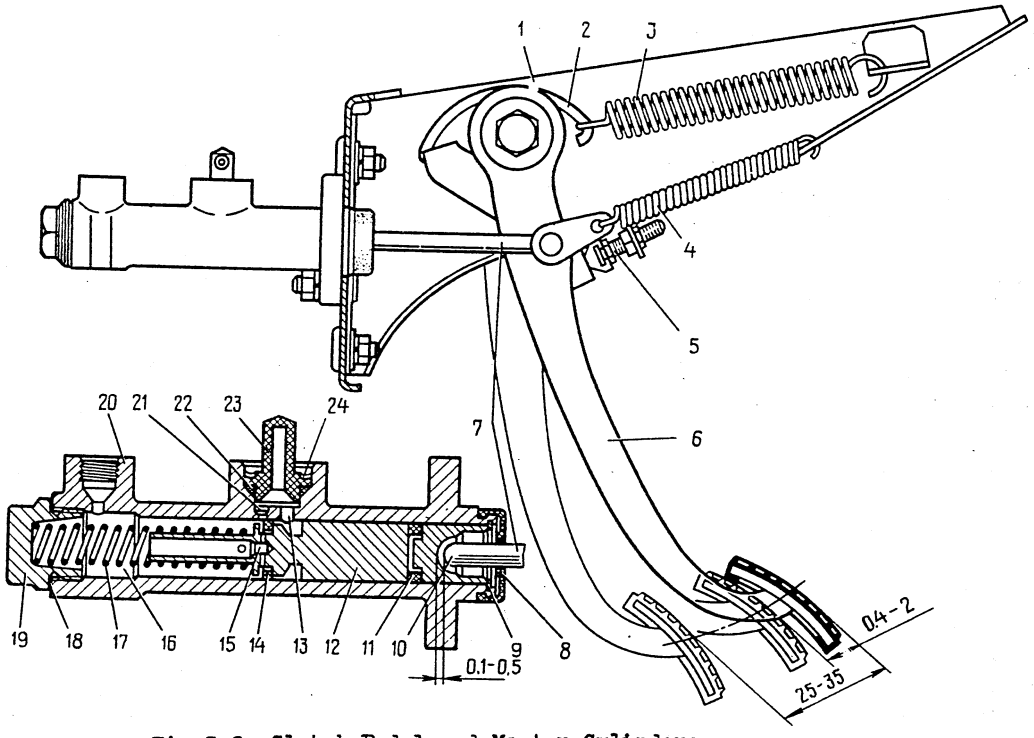


Fig.3-2. Clutch Pedal and Master Cylinder:

1 - clutch and brake pedal 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-locking ring; 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 hole; 22 - pipe union gasket; 23 - pipe union; 24 - lock washer

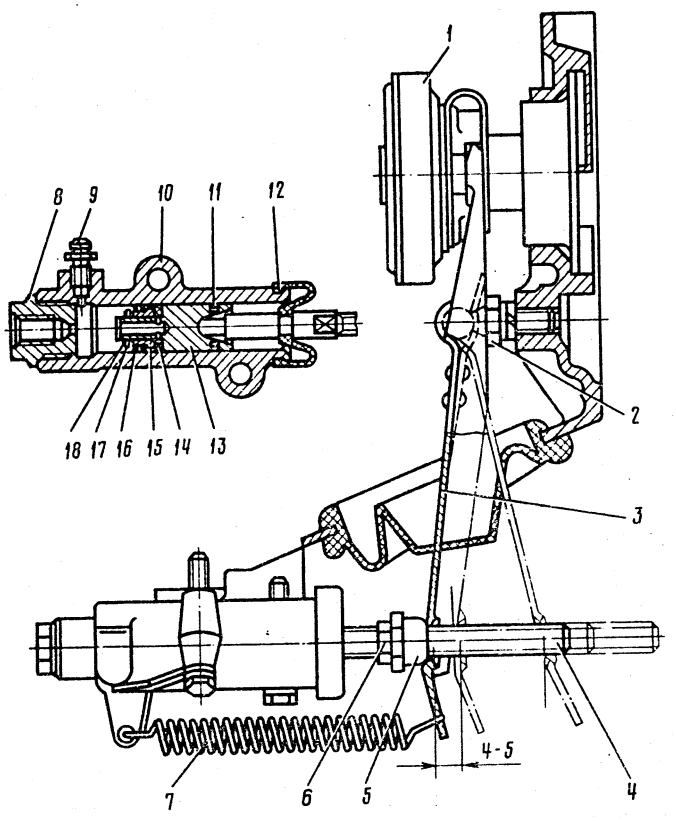


Fig.3-3. Clutch Operating Cylinder and Release Yoke:
1 - clutch release bearing; 2 - ball support; 3 - release yoke; 4 - pushrod; 5 - adjusting nut; 6 - locknut; 7 - retracting spring; 8 - barrel plug; 9 - bleeder pipe union; 10 - cylinder barrel; 11 - sealing ring; 12 - boot; 13 - piston; 14 - seal;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

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

When bleeding, observe the following points:
- the fluid level in the reservoir should be above the hole of the tube 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.

Removing and Installing the 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, reverse the removal operations and observe the following points:
- 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 consistent 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).

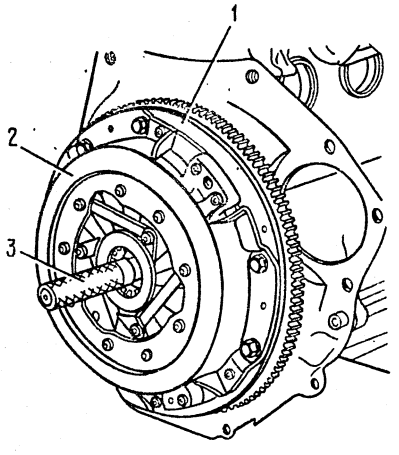


Fig.3-4. Aligning the Driven Disc with Mandrel A.70081:
1 - flywheel; 2 - clutch assembly; 3 - mandrel A.70081

Clutch Checks

The clutch must be inspected and checked on a base plate shaped like an engine flywheel and provided with a 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 1400 N (140 kgf) to the thrust flange of the pressure spring. A 8-mm

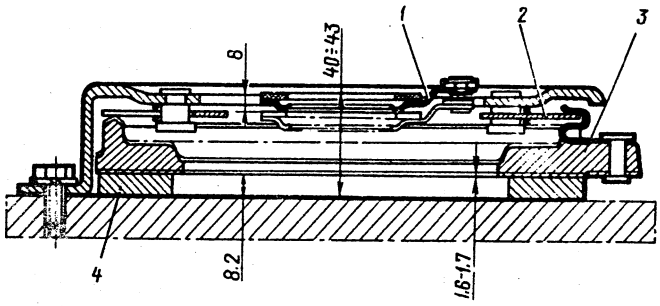


Fig.3-5. Clutch Checks:
1 - pressure spring thrust flange; 2 - central pressure spring; 3 - pressure plate; 4 - ring

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.

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,

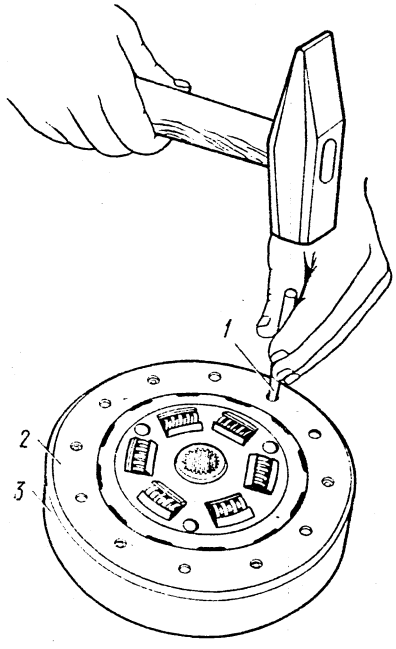


Fig.3-6. Replacing the Driven Disc Friction Facings:
1 - mandrel 67.7851-9500; 2 - driven disc; 3 - jig 67.7822-9517

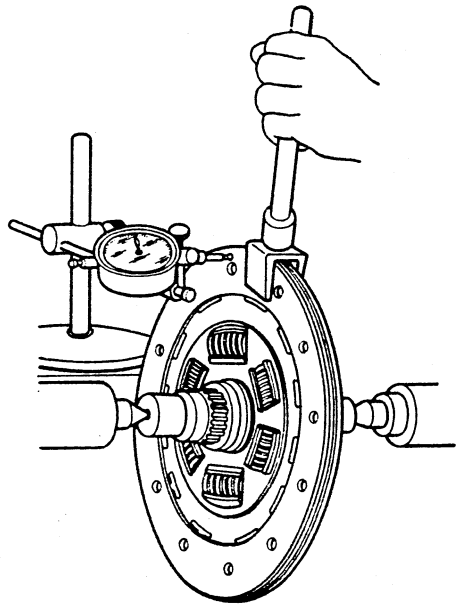


Fig.3-7. Straightening the Clutch Driven Disc

jig 67.7822.9517 (Fig. 3-6) and tools 67.7813-9503. The upset rivets shall have no fractures. The 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.

Removing and Installing the Clutch Master and Operating Cylinders

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

To remove the master cylinder, unscrew the 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 any air.

Disassembling, Checking, Repairing and Assembling the Master and Operating Cylinders

Master cylinder. Unscrew plug 3 (Fig. 3-8), remove rubber boot 7 and locking ring 8 after

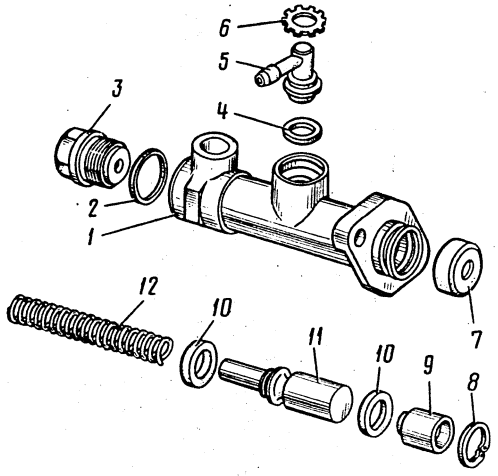


Fig.3-8. Master Cylinder Parts:
1 - barrel; 2 - sealing gasket; 3 - plug; 4 - gasket; 5 - pipe union; 6 - lock washer; 7 - boot; 8 - locking ring; 9 - pushrod piston; 10 - sealing ring; 11 - master cylinder piston; 12 - spring

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 the 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 the parts, assemble the master cylinder by reversing the disassembly operations; 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 locking ring 11.

After disassembly, wash carefully and examine all the 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 hydraulic fluid.

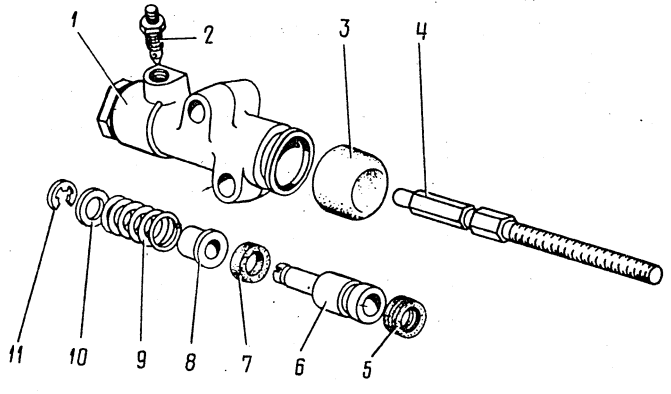


Fig.3-9. Clutch Operating Cylinder Parts:
1 - barrel; 2 - pipe union; 3 - boot; 4 - pushrod; 5 - sealing ring; 6 - piston; 7 - sealing ring; 8 - spring seat; 9 - spring; 10 - washer; 11- locking ring

Stand Checks of the Clutch Master Cylinder

Tightness check of the 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 close this screw slowly until all air escapes from vessel 2.

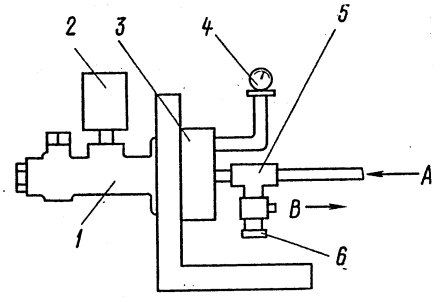


Fig.3-10. Checking the Rear Sealing Ring for Tightness:
1 - master cylinder; 2 - vessel; 3 - adapter with seal; 4 - pressure gauge; 5 - Tee pipe; 6 - adjusting screw; A - air from compressor; B - air outlet

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

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

With the pushrod locked and in absence of fluid leaks the pressure should remain constant within 2 minutes.

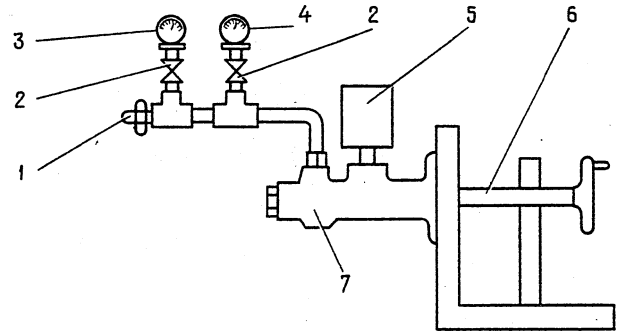


Fig.3-11. Checking the Front Sealing Ring for Tightness:
1 - bleeder screw; 2 - cock; 3 - pressure gauge, graduation unit 0.2 MPa (2 kgf/cm^2); 4 - pressure gauge, graduation unit 0.005 MPa (0.05 kgf/cm^2); 5 - vessel; 6 - pushrod; 7 - master cylinder

Close the cock of pressure gauge 4 and open that of pressure gauge 3. Moving the pushrod, set a steady pressure of 10 MPa (100 kgf/cm^2) as read by the pressure gauge.

With the pushrod locked and in absence of fluid leaks this pressure should stay constant within not less than 2 minutes. If not, replace the front sealing ring.

GEARBOX

The design of the gearbox is illustrated in Fig. 3-12.

Trouble Shooting

Cause of trouble	Remedy
Gearbox Noisy	
1. Noise in bearings	1. Replace faulty bearings
2. Wear of gear and synchronizer teeth	2. Replace worn parts
3. Lack of oil in gearbox	3. Add oil. If necessary, eliminate causes 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. Straighten out or replace by a new lever
4. Restricted movement of shift rails (burrs, soiling of rail bores, wedging of retainers)	4. Repair or replace worn parts
5. Sluggish 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 bores, weakening of retainer 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

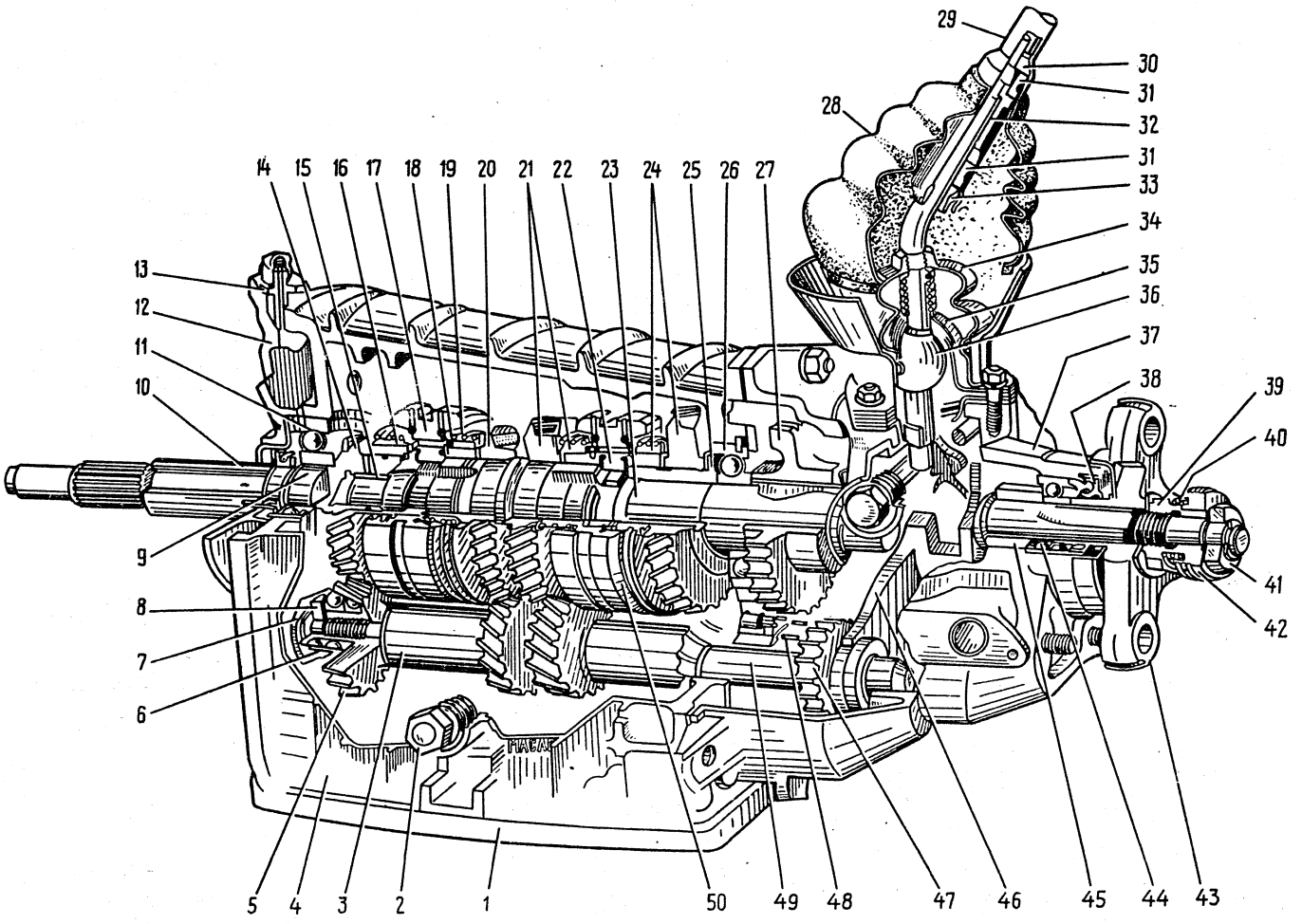


Fig.3-12. Gearbox:

1 - lower cover; 2 - oil level plug; 3 - countershaft; 4 - gearbox housing; 5 - countershaft constant-mesh gear; 6 - countershaft front bearing; 7 - bolt; 8 - washer; 9 - clutch shaft; 10 - front cover; 11 - clutch shaft rear bearing; 12 - clutch housing; 13 - breather; 14 - gearbox clutch shaft constant-mesh gear; 15 - needle bearing; 16 - 4th speed synchronizer toothed rim; 17 - 4th and 3rd speed synchronizer sliding sleeve; 18 - synchronizer baulk ring; 19 - synchronizer spring; 20 - 3rd speed gear; 21 - 2nd speed gear; 22 - 1st and 2nd speed synchronizer sliding sleeve hub; 23 - main shaft; 24 - 1st speed gear; 25-gear bushing; 26 - main shaft intermediate bearing; 27 - reverse speed 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 speed shift fork; 47 - reverse speed idler gear; 48 - countershaft reverse speed gear; 49 - reverse speed idler gear shaft; 50 - 1st and 2nd speed synchronizer sleeve

Removal and Installation

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

Remove the front floor 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

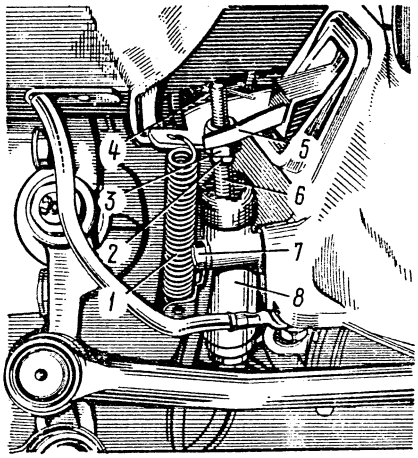


Fig.3-13. Clutch Control Linkage:
1 - yoke retracting spring; 2 - lock nut; 3 - adjusting nut; 4 - cotter pin; 5 - clutch release yoke; 6 - pushrod; 7 - operating cylinder to clutch housing bolt; 8 - clutch operating cylinder

on the lever shank; remove the shank.

Disconnect the pipe and muffler mountings in the rear end of the car then 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 housing cover. Disconnect the "ground" wire from the clutch housing and the wires from the backing lamp switch.

Unhook retracting spring 1 from clutch release yoke 5 (Fig. 3-13) and remove cotter pin 4 from pushrod 6. Disconnect operating cylinder 8 from the clutch housing. Cylinder 8 connected by a pipe with the master cylinder remains on the car thus preventing losses of hydraulic fluid and eliminating the need for subsequent bleeding of the clutch system.

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

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

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

Detach the flanges of the front and rear axle propeller shafts from the flanges of the transfer case shafts. Let down and shift aside the propeller shafts.

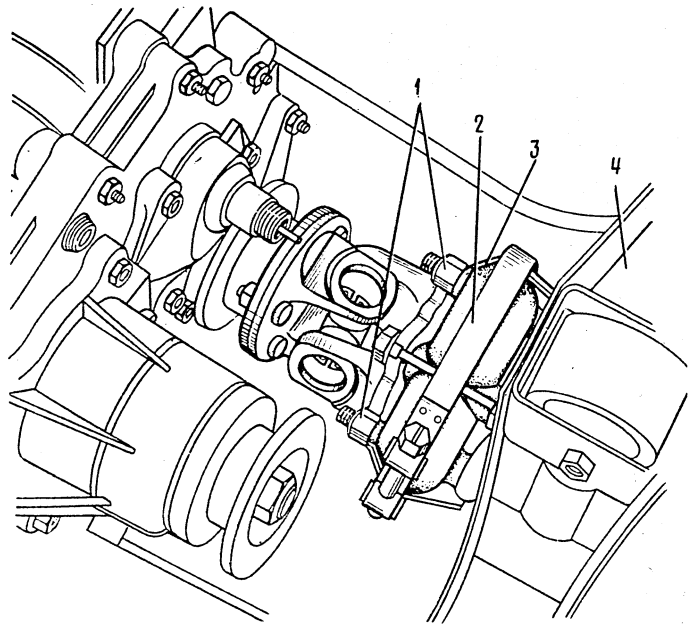


Fig.3-14. Propeller-Shaft-to-Gearbox Flexible Coupling:
1 - propeller shaft-to-flexible coupling nuts; 2 - clamp A.70025; 3 - flexible coupling; 4 - engine rear support cross member

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

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

Disconnect the support of the engine rear mounting 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) lubricant to the splined end of the clutch shaft and align the clutch driven disc (Fig. 3-4) with mandrel A.70081.

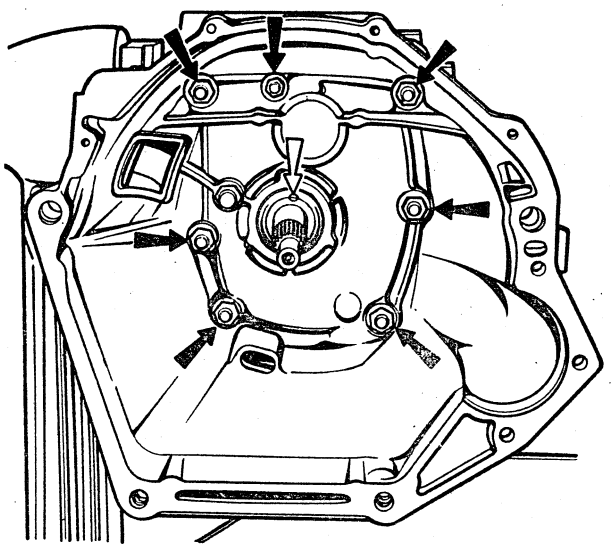


Fig.3-15. Clutch Housing, Inside View. Black arrows show housing to gearbox nuts. White arrow shows hole in front cover for draining oil from gearbox housing to prevent oiling of clutch discs

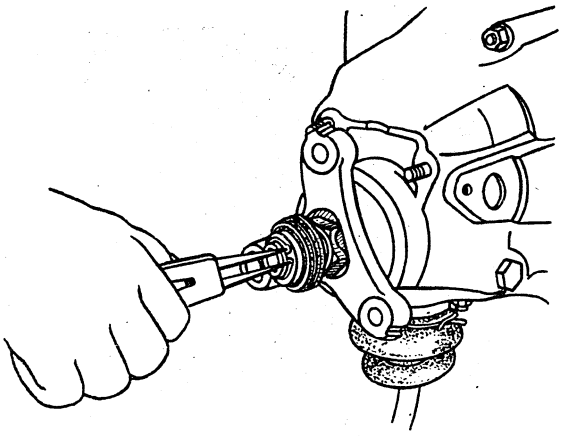


Fig.3-16. Removing the Locking Ring

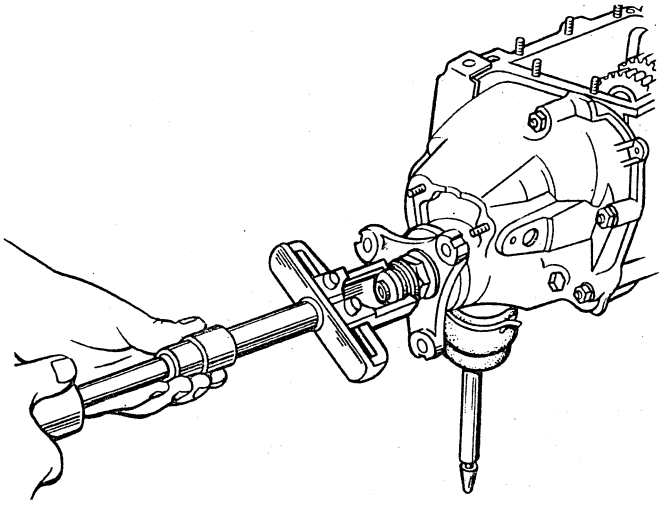


Fig.3-17. Removing the Aligning Ring of Propeller Shaft Flexible Coupling with Remover Tools A.40006/1 and A.40005/4

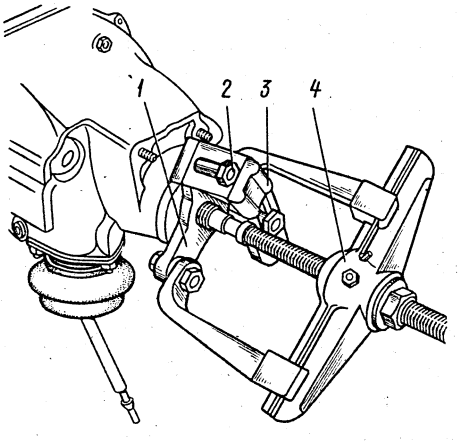


Fig.3-18. Removing the Flexible Coupling Flange with Remover Tool A.40005/3/9B/9C:
1 - flexible coupling flange; 2 - fixture-to-flange fastening bolts; 3 - fixture of remover tool A.40005/3; 4 - remover tool A.40005/3

Disassembly and Assembly

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

Take out the clutch release yoke. Remove the release collar 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 lamp switch taking care not to distort its body.

Unscrew the bolt of the 3rd and 4th gear 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 the subsequent disassembly operations.

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

Unbend the lock washer, unscrew the nut a few revolutions so as to shift the aligning ring of the flexible coupling and screw in 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).

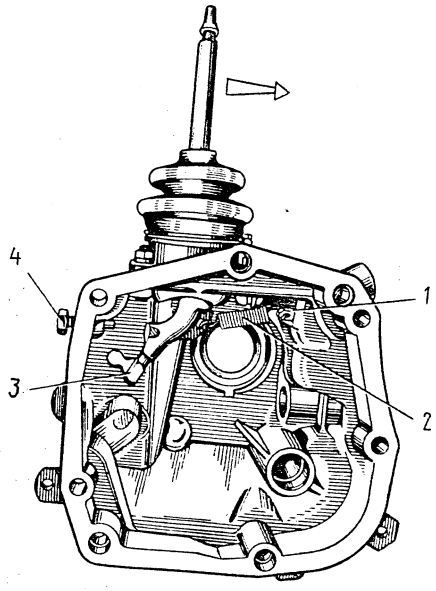


Fig.3-19. Gearbox Rear Cover. Inside View: 1 - gearshift lever retracting spring eye-bolt; 2 - gearshift lever retracting spring; 3 - gearshift lever; 4 - gearshift lever lateral travel stop screw. Arrow shows direction for moving lever to disengage it from shift rail lugs and to remove gearbox rear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

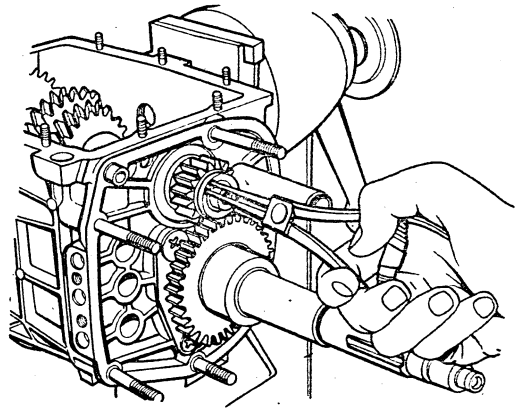


Fig.3-20. Removing the Reverse Speed Gear Locking Ring from Countershaft

Remove the rear cover of the gearbox by turning off the nuts and screw 4 (Fig. 3-19) which 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 yoke with the spacer bushing from the reverse speed shift rail. Remove the reverse speed idler gear from the axle.

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

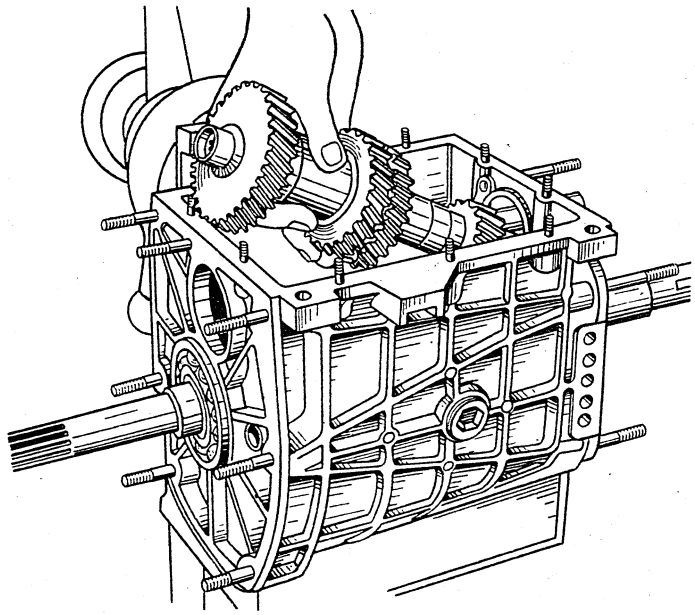


Fig.3-21. Removing the Countershaft from Gearbox Housing

Remove the locking ring of the reverse speed driven gear from the main shaft, applying pressure to the spring washer by tool 41.7816-4069 in order to relieve the locking ring. Remove the reverse speed 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 reassemble them later in their own 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 lock cover 20 (Fig. 3-22) complete with the gasket, remove reverse speed shift rail 18, 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 speed 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 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:

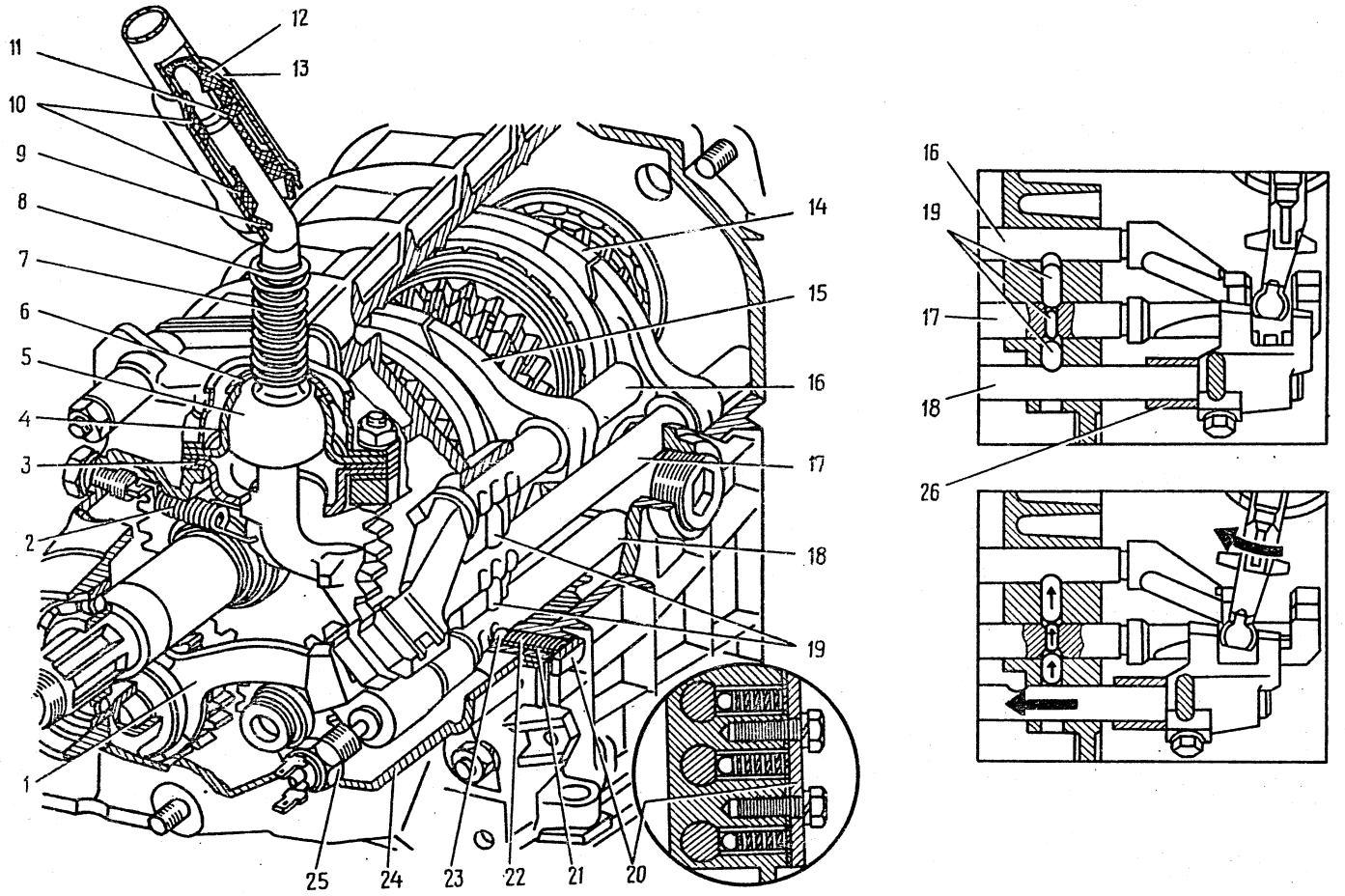


Fig.3-22. Gearshift Mechanism:

1 - reverse speed 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 - locking ring; 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 3nd speed shift fork; 16 - 1st and 2nd speed shift rail; 17 - 3rd and 4th speed shift rail; 18 - reverse speed shift rail; 19 - interlock retainers; 20 - lock cover; 21 - bushing; 22 - lock spring; 23 - lock ball; 24 - gearbox rear cover; 25 - backing light switch; 26 - reverse speed shift rail spacer bushing

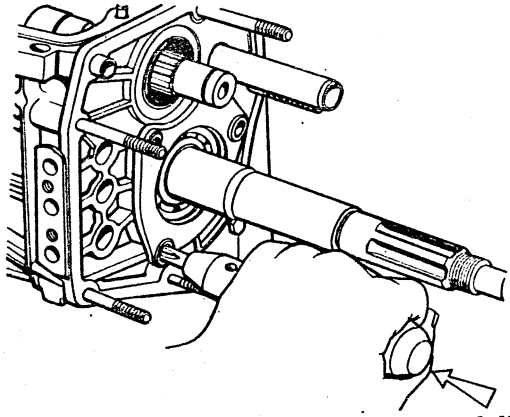


Fig.3-23. Removing the Fastening Screws of Main Shaft Intermediate Bearing Locking Plate with Power Screwdriver. Arrow shows direction of impact stroke after striking the screwdriver with a hammer

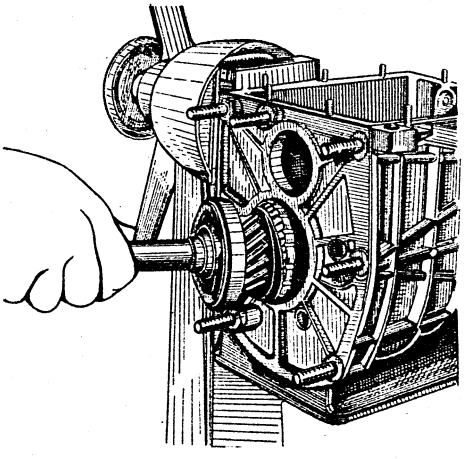


Fig.3-24. Removing the Clutch Shaft from Gearbox Housing

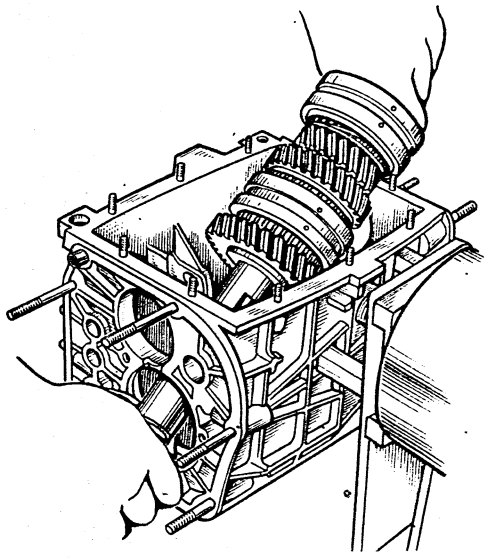


Fig.3-25. Removing the Main Shaft from Gearbox Housing

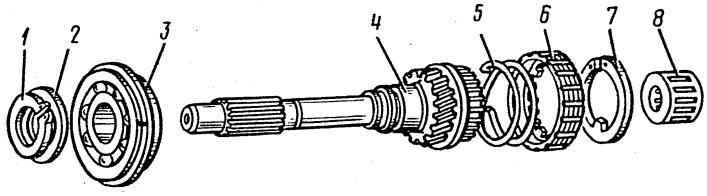


Fig.3-26. Clutch Shaft Parts:
1 - locking ring; 2 - spring washer; 3 - bearing;
4 - clutch shaft; 5 - synchronizer spring;
6 - synchronizer baulk ring; 7 - locking ring;
8 - bearing

- remove locking ring 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 locking ring 1, the spring washer and bearing 3.

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 the spring washer with the tool, remove locking ring 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:

- remove cup 19 (Fig. 3-29) and boot 21 of the lever with its clamp, take off locking ring 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 lock ball of the reverse speed shift rail differs from other springs in its resilience; it is painted green or is cadmium coated;

- 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 lubricant;

- install the locking ring of the reverse speed 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 remaining lubricant.

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 damage should be smoothed out with a file. Replace the parts 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 or irregular in shape.

The 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 over the splines, without jamming. The rol-

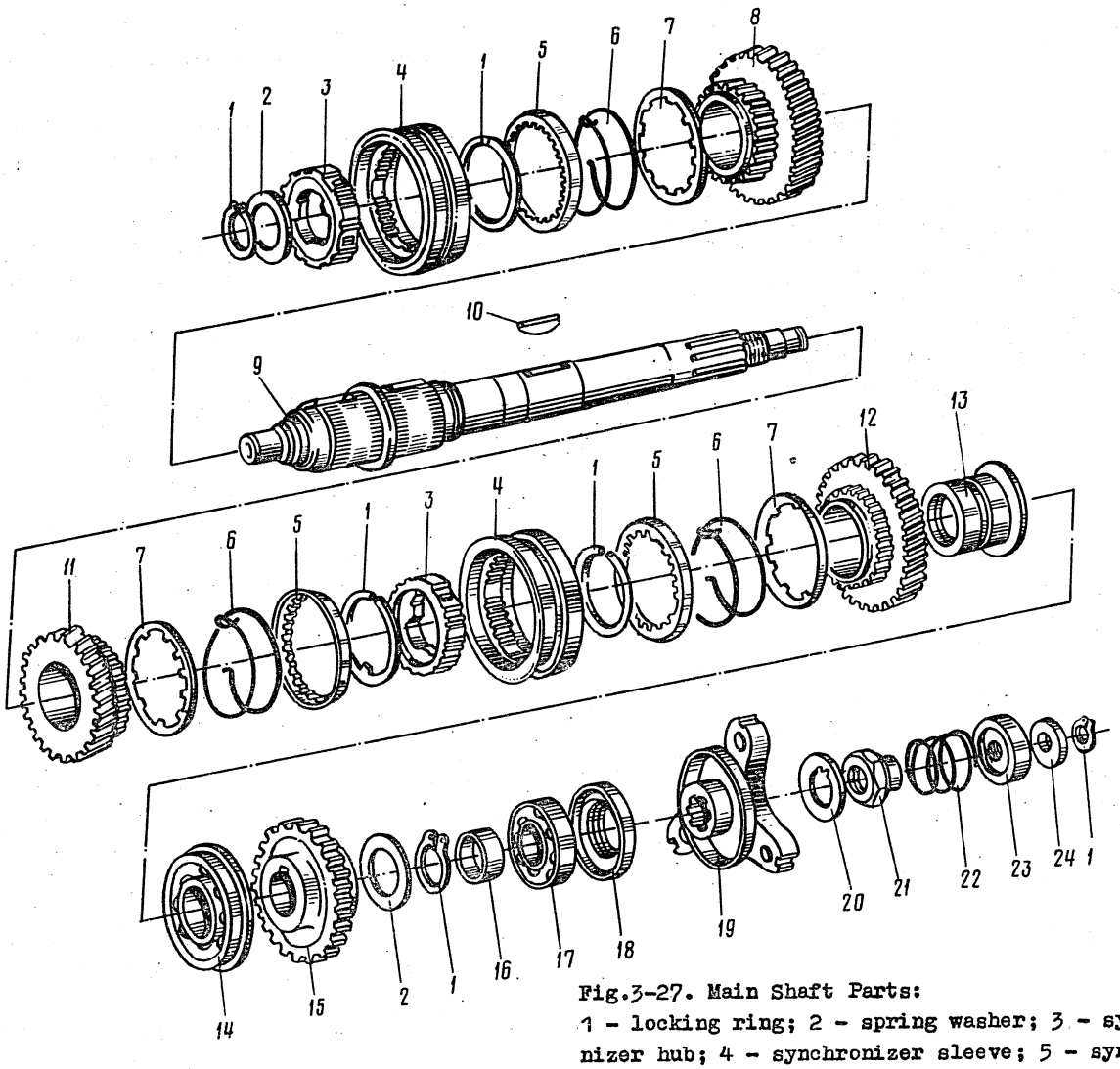


Fig.3-27. Main Shaft Parts:
1 - locking ring; 2 - spring washer; 3 - synchronizer hub; 4 - synchronizer sleeve; 5 - synchronizer baulk ring; 6 - synchronizer spring; 7 - washer; 8 - 3rd speed gear; 9 - main shaft; 10 - key; 11- 2nd speed gear; 12 - 1st speed gear; 13 - 1st speed gear bushing; 14 - bearing;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

ling 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 crumbling or excessive wear of teeth.

The axle of the reverse speed gear must be perfectly smooth and bear no signs of jamming. The assembly clearance between the axle and bushing of the reverse speed 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 these new parts are as follows: gear axle - $19.9^{+0.094}_{+0.079}$ mm, the inside diameter of the pressed-in 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. The 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.

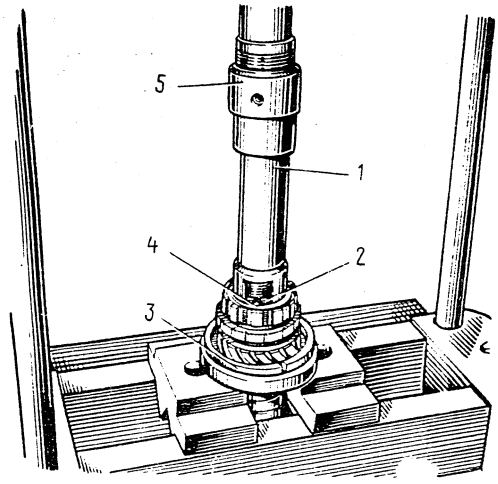


Fig.3-28. Installing the Main Shaft Locking Ring:
1 - installation tool 41.7816-4069; 2 - locking ring; 3 - supporting half-ring; 4 - spring washer; 5 - press rod

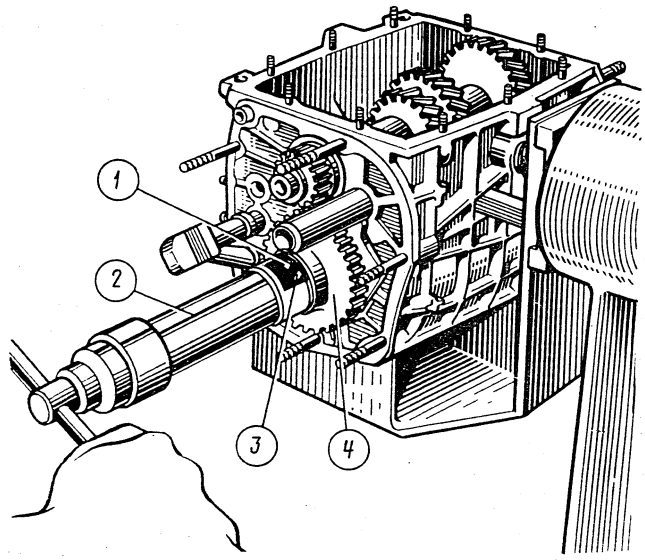


Fig.3-30. Installing the Reverse Speed Gear Locking Ring on Main Shaft
1 - locking ring; 2 - installation tool 41.7816-4069; 3 - spring washer; 4 - main shaft reverse speed gear

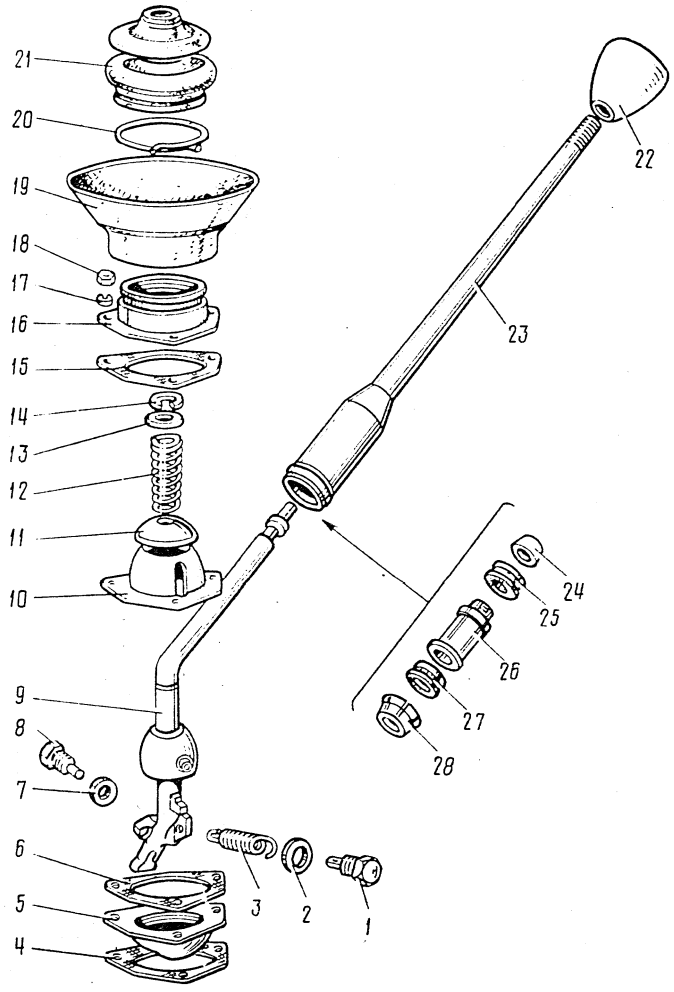


Fig.3-29. Gearshift Lever Parts:
1 - retracting spring bolt; 2 - washer; 3 - retracting spring; 4 - gasket; 5 - guide seat; 6 - gasket; 7 - washer; 8 - stop bolt; 9 - gearshift lever; 10 - ball support; 11 - spherical washer; 12 - spring; 13 - supporting washer; 14 - locking ring; 15 - gasket; 16 - flange; 17 - spring washer; 18 - nut; 19 - cup; 20 - clamp; 21 - inner boot; 22 - lever shank; 23 - boot; 24 - thrust pad; 25 - flexible bushing; 26 - spacer bushing; 27 - flexible bushing; 28 - locking bushing

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 and the shift rails should be free to slide in the housing bores without considerable looseness.

Examine the shift rail interlock retainers, lock 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 fine file. The parts worn beyond the permissible limits should be replaced.

TRANSFER CASE

The design of the transfer case is illustrated in Figs 3-31 and 3-32.

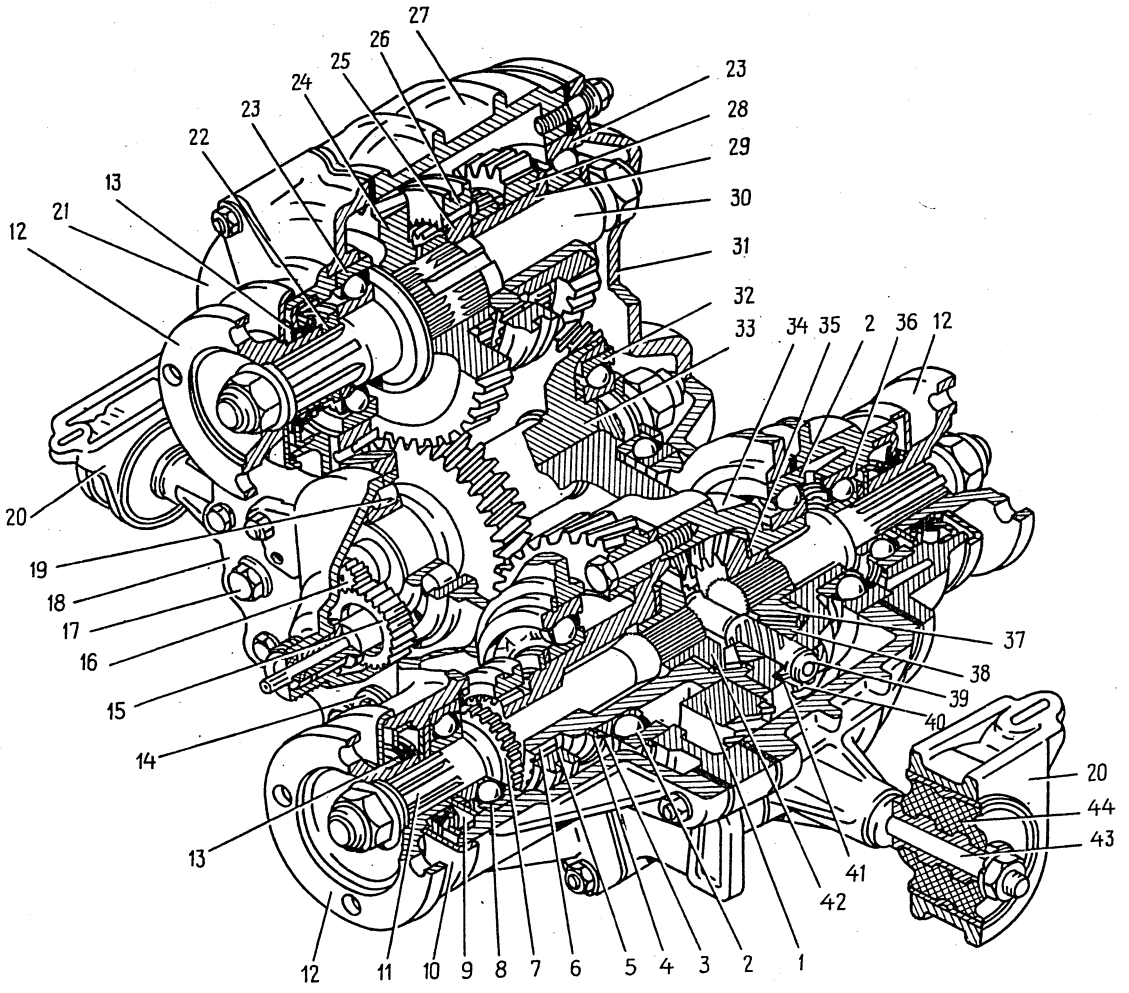


Fig.3-31. Transfer Case:

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 baffle; 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 plug; 18 - transfer case front cover; 19 - countershaft roller bearing; 20 - transfer case mounting bracket; 21 - drive shaft bearing cover; 22 - bearing thrust ring; 23 - drive shaft bearings; 24 - high speed gear; 25 - gearshift coupling hub; 26 - gearshift coupling; 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 mounting pivot; 44 - mounting bracket rubber pad

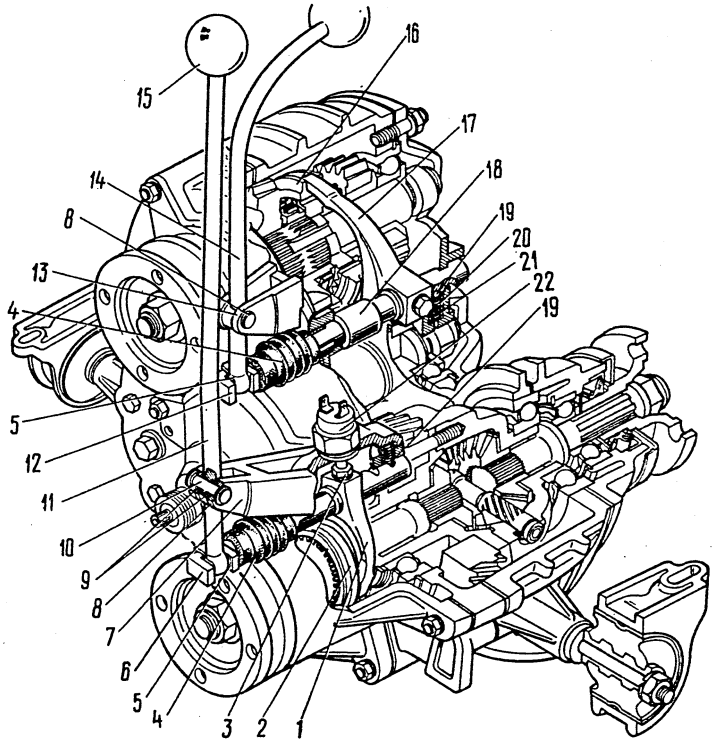


Fig.3-32. Transfer Case Controls:
1 - differential lock coupling fork; 2 - differential lock coupling; 3 - fork locking bolt; 4 - rod boot; 5 - lever spring; 6 - differential lock fork rod; 7 - front axle drive housing cover; 8- lock washer; 9 - lever axle bushing; 10 - lever axle; 11 - differential lock lever; 12 - shift rail; 13 - gearshift lever bracket; 14 - gearshift lever; 15 - lever knob; 16 - gearshift coupling; 17-gearshift coupling fork; 18 - spacer bushing; 19-lock ball; 20 - lock spring bushing; 21 - lock spring; 22 - differential lock signal lamp switch

Trouble Shooting

Cause of trouble	Remedy
Loud Noise and Vibration	
1. Wear of gear teeth	1. Replace gears
2. Wear of bearings	2. Replace bearings
3. Lack of oil	3. Add oil
4. End play of shafts	4. Replace bearings or their fastening parts
5. Wear of splined joint between gears and axle drive shafts	5. Replace worn parts
6. Excessive clearance between lever head and shift rail	6. Replace worn or broken springs in shift rail slots
7. Wear of cross bearings of axle propeller shafts and of intermediate propeller shaft	7. Repair universal joints, replacing worn parts
8. Misalignment of gearbox main shaft and transfer case drive shaft	8. Align transfer case (see under "Installation and Alignment of Transfer Case")
9. Poor balancing of axle propeller shafts or of intermediate propeller shaft	9. Balance shafts
10. Failure of transfer case mounting supports or of engine rear support	10. Replace worn parts
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. Scored working surface of pinion shaft	3. Replace worn or damaged parts
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

Continued

Cause of trouble	Remedy
Difficult Gearshifting or Differential Locking	
1. Coupling jammed on splines of hub or differential housing	1. Dress of 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 couplings and on splines of front axle drive shaft	2. Dress off any nicks and burrs, replace faulty parts
3. Bending of 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 of Differential Lock	
1. Wear of gear and coupling teeth	1. Replace worn parts
2. Retainer springs lost their resilience or retainer parts heavily worn	2. Replace springs or worn parts
3. Incomplete engagement of gears and differential lock caused by distortion of control parts or nicking of gears, couplings 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 leaky points
3. Shaft glands worn or damaged	3. Replace glands
4. Worn glands of transfer case shift rail bushings	4. Replace glands

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 to 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 signal lamp transmitter. Rotating the propeller shafts, detach their flanges from the transfer case shafts.

Unscrew the nuts of bolts 3 (Fig. 3-33) of transfer case 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:

- make sure that the engine mounting cushions are properly installed in the brackets (see under "Engine Removal and Installation");
- mount the transfer case on the car without tightening completely the transfer case bracket nuts;
- shifting the transfer case along the body and in a vertical plane, align the flange faces of the transfer case drive shaft and intermediate propeller shaft by the contours and aligning bands; in this position connect the shaft flanges with bolts and tighten the nuts;
- installing the 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 signal lamp.

Caution

When replacing the transfer case, also in case of sagging of the engine rear mounting which has caused vibration of the transfer case, select and install adjusting shims between the body and each transfer case mounting bracket.

To select adjusting shims while aligning the transfer case, proceed as follows:

- check to see that the engine mounting pads are properly installed in the brackets (see under

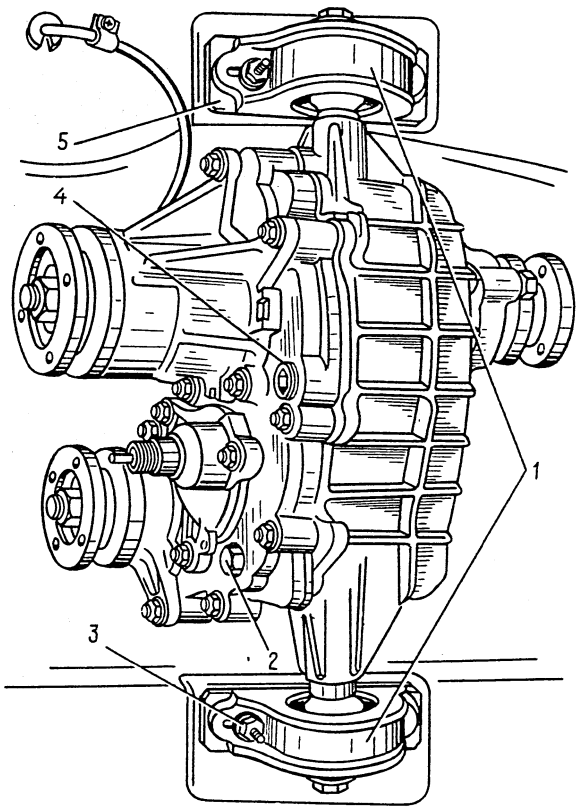


Fig.3-33. Transfer Case Mounting:
1 - transfer case mounting brackets; 2 - filler plug; 3 - mounting bracket bolt; 4 - drain plug; 5 - adjusting shims

"Engine Removal and Installation");

- install the transfer case on the car without tightening completely nuts 4 and 5 (Fig. 3-34) of the transfer case mounting brackets;

- connect the front and rear propeller shafts to the axle drive shafts;

- shifting the transfer case along and across the car body and in a vertical plane, displace the faces of the transfer case drive shaft and intermediate propeller shaft flanges over the contour and aligning bands, without straining the transfer case and engine supports;

- holding the transfer case in this position, tighten nuts 4 and 5 in order to fix the transfer case in this position;

- connect the flanges of the transfer case drive shaft and intermediate propeller shaft with bolts and tighten the flange nuts;

Note. If the flange bolts go freely through the flange holes, it means that the transfer case has been properly aligned; otherwise align again the flanges of the drive and propeller shafts.

- select the required thickness of adjusting shims in order to take up the clearance between

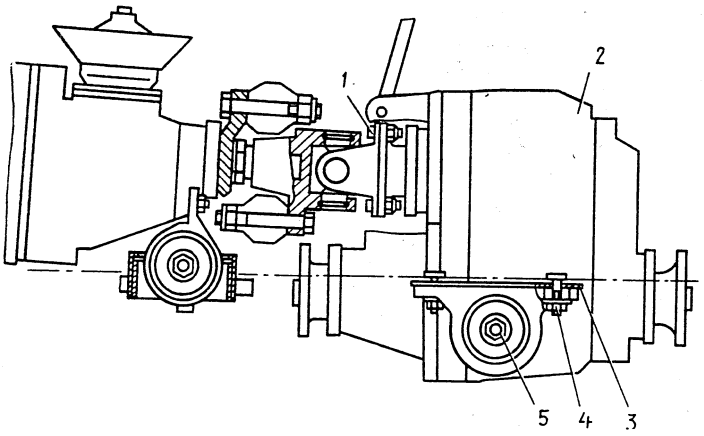


Fig.3-34. Transfer Case Installation Diagram
1 - flange bolts of intermediate propeller shaft and transfer case drive shaft; 2 - transfer case; 3 - adjusting shims; 4 - transfer case to body nuts; 5 - transfer case mounting bracket fastening nuts

the transfer case mounting brackets and the body side members;

- install adjusting shims 3 and tighten nuts 4 and 5 with a torque-indicating wrench.

Disassembly and Assembly

Disassembly. Wash the transfer case and drain oil.

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

Unscrew the fastening nuts and take off front axle drive housing 1 (Fig. 3-35) complete

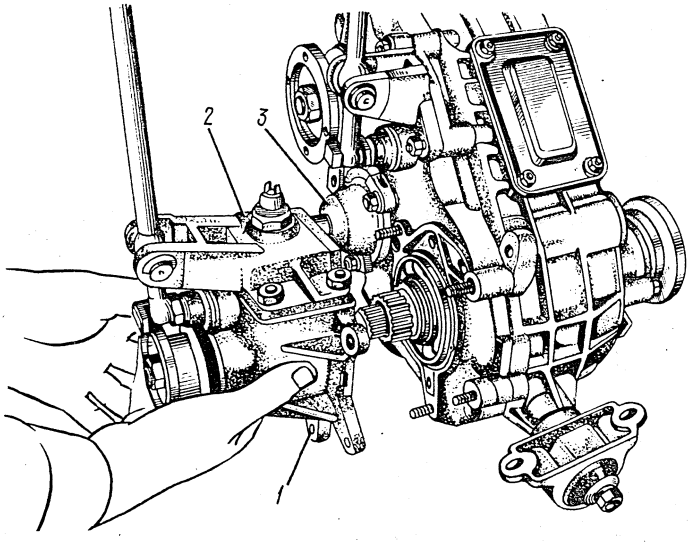


Fig.3-35. Removing the Front Axle Drive Housing:
1 - front axle drive housing; 2 - housing cover; 3 - speedometer drive housing

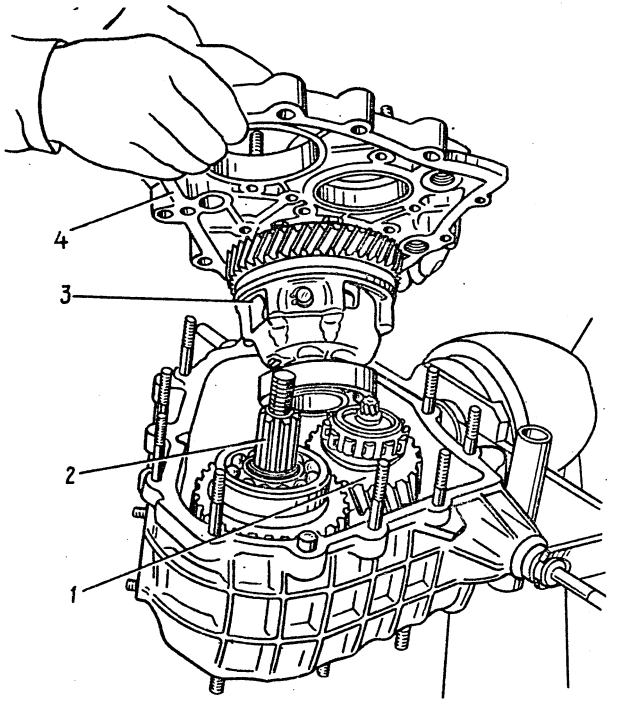


Fig.3-36. Removing the Transfer Case Front Cover: 1 - countershaft; 2 - drive shaft; 3 - differential; 4 - front cover

with cover 2, lever, fork, differential lock coupling and front axle drive shaft. Remove speedometer drive housing 3 complete with the speedometer drive driven gear.

Take off lock washer 8 (Fig. 3-32), pull out axle 10 and remove differential lock lever 11. Then take off front axle drive housing cover 7, lift out the spring and lock ball 19. Unscrew locking bolt 3 of differential lock fork 1 and take out rod 6, fork 1 and lock coupling 2.

Remove rear cover 31 (Fig. 3-31) 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.

Remove the mounting rings of the front and rear axle drive shaft bearings. Remove front axle drive shaft 11 (Fig. 3-31) from the housing complete with bearing 8, thrust ring and oil baffle 9. Take out the rear axle drive shaft from rear cover 31 complete with bearing 36, thrust ring and oil baffle.

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

Remove gearshift lever bracket 13 (Fig. 3-32) with lever. Then take off the lock washer, pull out the axle and remove lever 14.

Unscrew the locking bolt of gearshift fork 17 and, closing the retainer socket with a finger, take out carefully shift rail 12 and the retainer parts.

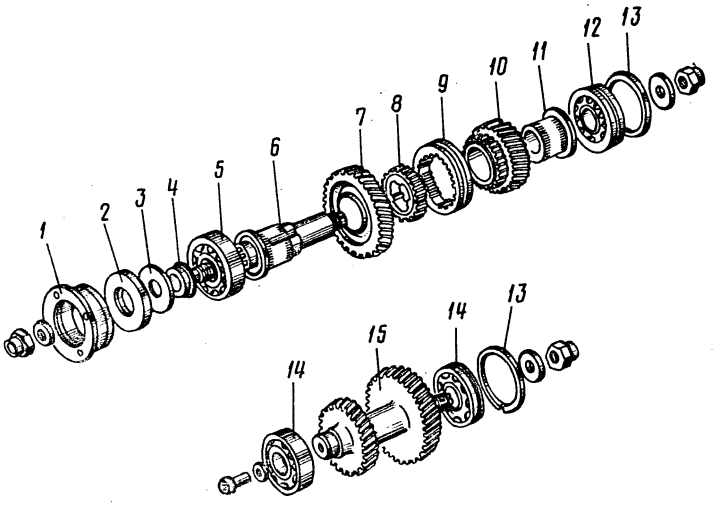


Fig.3-37. Parts of Drive Shaft and Countershaft: 1 - flange; 2 - gland; 3 - oil baffle; 4 - bearing thrust ring; 5 - front bearing; 6 - drive shaft; 7 - high speed gear; 8 - hub; 9 - coupling; 10 - low speed gear; 11 - bushing; 12 - rear bearing; 13 - bearing mounting ring; 14 - countershaft bearings; 15 - countershaft

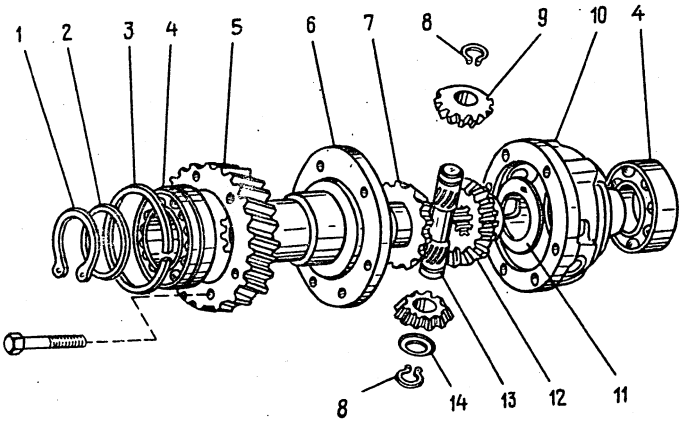


Fig.3-38. Parts of Transfer Case Differential: 1 - lockring; 2 - spring washer; 3 - bearing mounting ring; 4 - differential housing bearings; 5 - driven gear; 6 - differential front case; 7 - front axle drive gear; 8 - pinion shaft lockring; 9 - differential pinion; 10 - differential rear case; 11 - supporting washer; 12 - rear axle drive gear; 13 - differential pinion shaft; 14 - pinion shaft spring washer

Remove front cover 4 (Fig. 3-36) complete with the differential, then the differential bearing locating ring and pull the bearing complete with the differential from the front cover.

Remove the locating rings from the rear bearings of the drive and intermediate shafts and remove both shafts, the drive and intermediate ones from the transfer case housing.

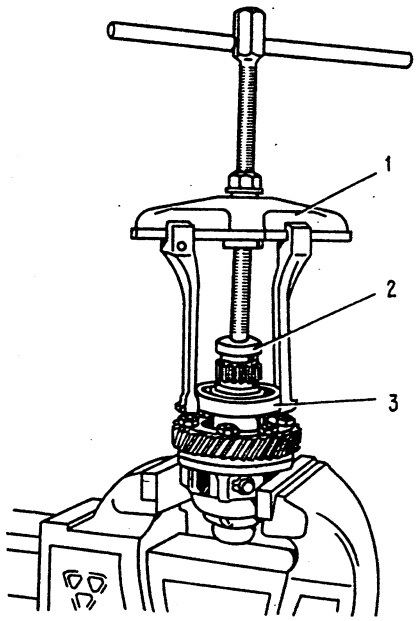


Fig.3-39. Removing the Bearing from Differential Housing:
1 - remover tool A.40005/1/6; 2 - stop 67.7853-9559; 3 - bearing

Clamp the drive shaft in a vice, remove the thrust ring and rear bearing 12 (Fig. 3-37) with a general-purpose remover tool. Remove low speed gear 10 from the drive shaft complete with bushing 11, then gearshift coupling 9, coupling hub 8 and high speed gear 7.

Disassemble the differential as follows:

- remove lockring 1 (Fig. 3-38) and spring washer 2 of the front bearing;
- remove the front and rear bearings from the differential housing (Fig. 3-39) with a general-purpose remover tool and stop 67.7853-9559;
- unscrew the differential housing bolts and separate the housing halves;
- remove the differential crown wheel;
- remove lockrings 8 (Fig. 3-38) 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 suspension cushion axles and take off bracket assemblies.

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

- the axial clearance of each axle drive gear should be 0 - 0.10 mm and the antitorque moment of gears should not be over 15 N.m (1.5 kgf.m). If the clearance is larger, install thicker supporting washers; if the thickest washers fail to

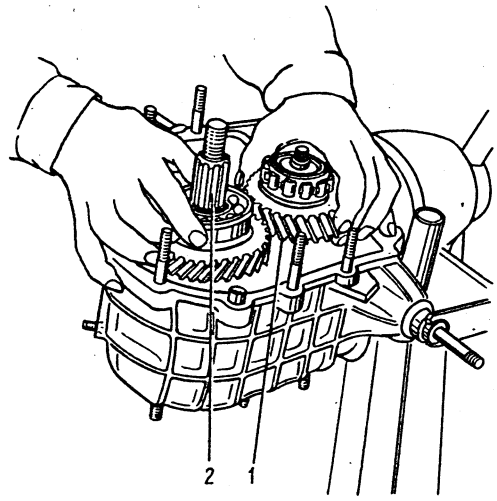


Fig.3-40. Installation of Drive Shaft and Countershaft:
1 - countershaft; 2 - drive shaft

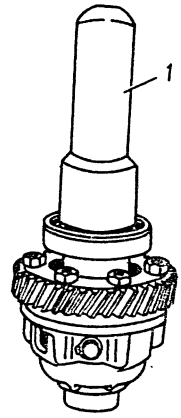


Fig.3-41. Installing the Bearing on Differential Housing:
1 - mandrel 67.7853.9558

produce the prescribed clearance, replace the gears with new ones since they are excessively worn;

- the drive and intermediate shafts should be installed into the transfer case housing simultaneously (Fig. 3-40);
- pres the bearings on the differential housing with installation tool 67.7853-9558 (Fig. 3-41);
- coat the working surfaces of glands with Литол-24 lubricant before installing them into covers and housings;
- tighten the screw joints with torques indicated in Appendix 2;
- for upsetting the nuts of the transfer case shaft use fixture 67.7820-9520 (Fig. 3-42).

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

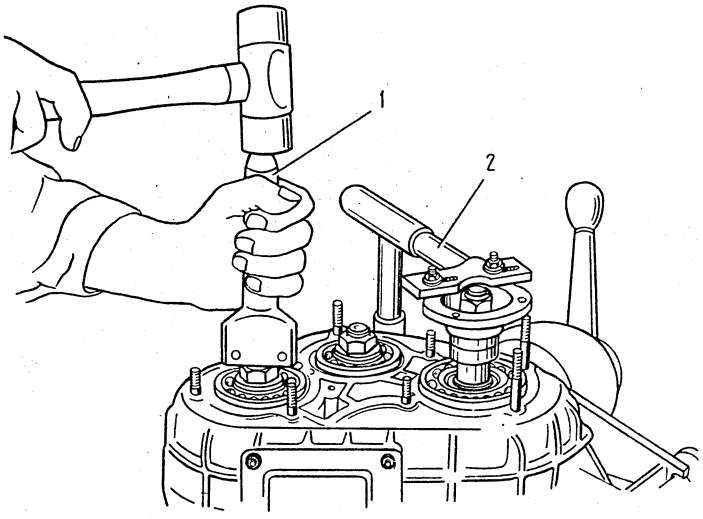


Fig.3-42. Pressing the Rear Axle Drive Shaft Flange Nut:
1 - mandrel 67.7820-9520; 2 - flange retainer

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 air blasting 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 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 width of the worn working edge should not be over 1 mm.

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

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

Gears. While examining the gears, check their teeth and mounting surfaces. The teeth must not be crumbled out 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 mm, 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 forks and jamming of shift rails in the housing bores. Replace the retainer parts with new ones in case of jamming. The retainer springs should also be replaced if they have lost their resilience. The length of the spring under a load of 110±8 N (11±0.8 kgf) should be 19 mm, and its free length, 23.3 mm.

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

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

Examine the surfaces of the journals of the axle drive gears and of their mounting surfaces 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-grade abrasive cloth or a fine file; heavily damaged or worn parts must be replaced.

Remove spring washer 14 (Fig. 3-38) and make sure there is no radial displacement of lockrings 8 in the grooves of shaft 13. Replace the lockrings if they are found to be loosely fitted.

Transfer Case Checks

Check the 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 stage - 1.5 - 3 s^{-1} (100-200 rpm)

2nd stage - 30 - 40 s^{-1} (2000-2500 rpm)

3rd stage - 60 - 70 s^{-1} (3500- 4000 rpm).

At the 2nd stage check the transfer case at no-load and loaded duties under a variable torque; at the 1st and 3rd stages - unloaded.

Check the functioning of the differential at the 1st stage, 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 stationary shafts of the transfer case.

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

The design of the propeller shafts is shown in Figs 3-43 and 3-44.

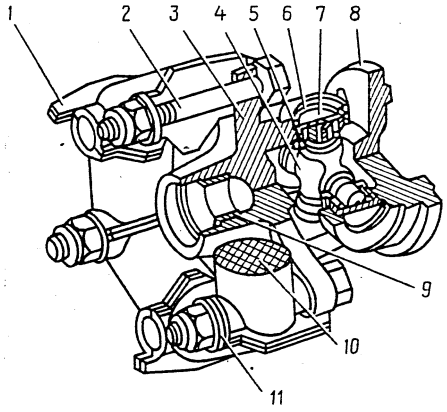


Fig.3-43. Intermediate Propeller Shaft:
1 - flexible coupling block; 2 - flexible coupling flange bolt; 3 - flexible coupling flange; 4-universal joint cross; 5 - cross gland; 6 - lockring; 7 - needle bearing; 8 - universal joint flange-yoke; 9 - aligning bushing; 10 - flexible coupling rubber element; 11 - balancing washer

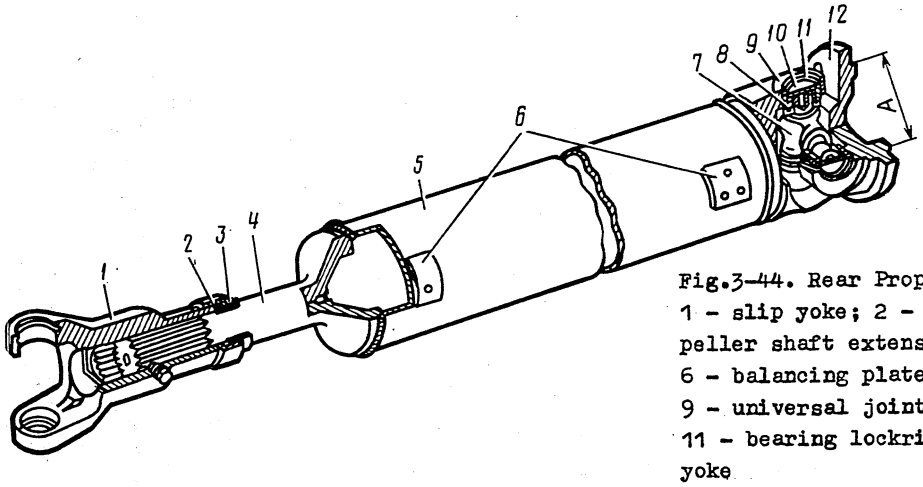


Fig.3-44. Rear Propeller Shaft:
1 - slip yoke; 2 - gland holder; 3 - gland; 4-propeller shaft extension; 5 - propeller shaft tube; 6 - balancing plate; 7 - cross; 8 - cross gland; 9 - universal joint yoke; 10 - needle bearing; 11 - bearing lockring; 12 - universal joint flange-yoke

Trouble Shooting

Cause of trouble	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

Cause of trouble	Remedy
2. Excessive peripheral clearance in splined joints of front or rear propeller shafts	2. Measure clearance; replace worn parts if it exceeds 0.30 mm
3. Wear of universal joint cross bearings	3. Repair joints, replace 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")
3. Wear or damage of flexible coupling flange aligning bushing and of gearbox main shaft aligning ring	3. Replace both flexible coupling flange complete with bushing, and main shaft aligning ring
4. Wear of universal joint cross bearings	4. Repair universal joints, 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. Unscrew plug and lubricate splined joints with ФИОЛ-1 lubricant
Oil Leakage	
1. Loosening of gland holder of front or rear propeller shaft splined joint	1. Compress gland and its holder; replace gland, if worn
2. Damage or wear of universal joint seals	2. Disassemble joints and replace seals; if necessary, replace cross complete with bearings

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 fasten the flexible coupling to the gearbox main shaft flange 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 Installation of the Transfer Case).

Before installing the intermediate shaft, apply 5-6 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.

Check the propeller shafts for proper balance as advised below.

If the yokes rotate smoothly, without jamming, the unbalance of the axle drive shafts does not exceed 2.2 N.mm (220 gf.mm) and that of the intermediate shaft is not over 2.4 N.mm (240 gf.mm) 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 (or rear) propeller shaft in a vice with aluminium jaws. Remove locking rings (Fig. 3-45).

Note. Before disassembling the universal joints, mark the locking rings, bearing housings, crosses and corresponding yokes to ensure correct installation during reassembly.

Using screw clamp 67.7823-9522 (Fig. 3-46) or a drift, drive the bearing housings out of the universal joint yokes.

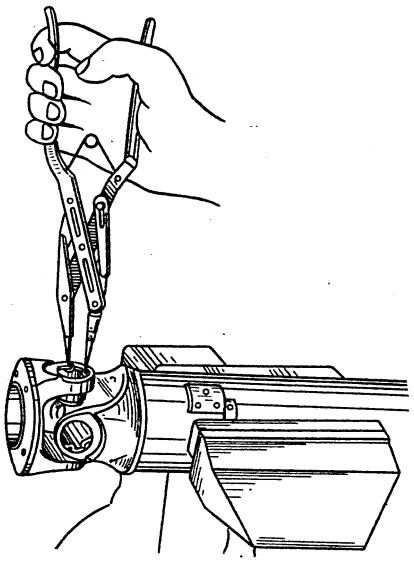


Fig.3-45. Removing the Cross Bearing Lockrings

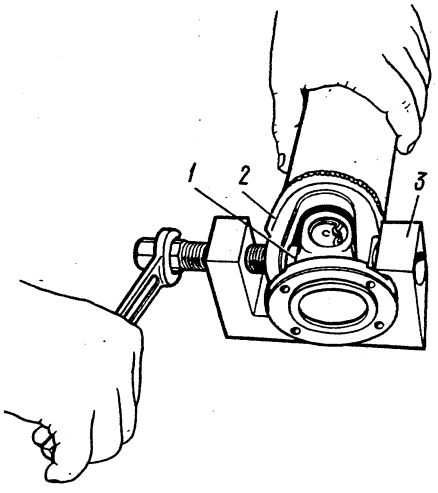


Fig.3-46. Removing the Cross Bearings from Universal Joint Yokes:
1 - needle bearing; 2 - universal joint yoke;
3 - screw clamp 67.7823-9522

Intermediate shaft. Disconnect the flexible coupling from the flange, making a note of the number and location of balancing washers 11 (Fig. 3-43) 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 (or rear) propeller shaft in centres and rotate it to check the runout of the tube which should not be over the following limits:

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

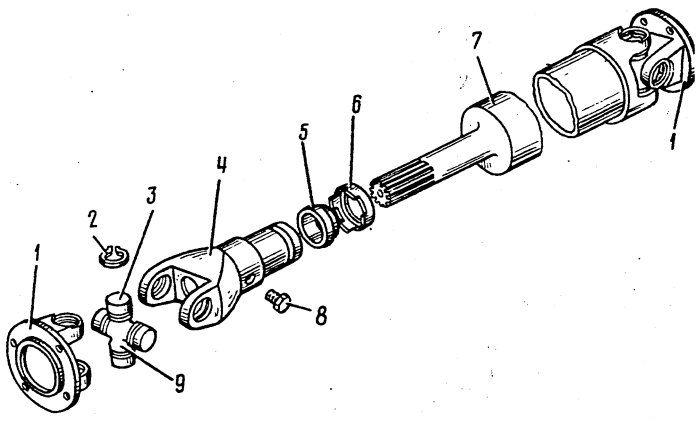


Fig.3-47. Parts of Front Propeller Shaft:
1 - universal joint flange (yoke); 2 - lockring;
3 - needle bearing; 4 - slip yoke; 5 - gland;
6 - gland holder; 7 - propeller shaft; 8 - plug;
9 - cross

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

Splined joint. Examine the clearance in the splined joint of the front (or 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 4 (Fig. 3-47) is not missing and examine the condition of holder 6 and slip yoke gland 5. Replace the gland, if necessary, and the holder, if it is damaged.

Universal joints. Examine the bearing housings, needles, cross arms, glands and holders.

If these parts are damaged or worn, replace the cross complete with bearings. If the cross arms and bearings are serviceable, examine the glands and their holders. If the glands show serious circular wear or pass lubricant which can

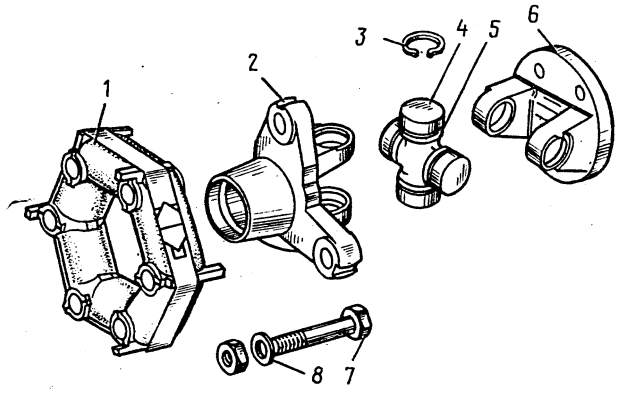


Fig.3-48. Parts of Intermediate Propeller Shaft:
1 - flexible coupling; 2 - coupling flange;
3 - lockring; 4 - needle bearing; 5 - cross;
6 - universal joint flange (yoke); 7 - flexible coupling to flange bolt; 8 - balancing washer

be noticed while inspecting the propeller shaft drive without disassembly, replace the glands by new ones.

The diameter of the bore in the yoke for the needle bearing should not exceed 23.825 mm.

Flexible coupling. Examine the rubber elements of flexible coupling 1 (Fig. 3-48). 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 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.

Assemble the universal joint as follows:

Remove the thick old lubricant, fill the spaces in the cross arms and lubricate the internal surfaces of bearing housings with ФИОЛ-24 lubricant (0.4 - 0.6 g per bearing). Do not lubricate the cross arms to prevent formation of an air pocket during assembly. Insert the cross arms into the yoke.

Put the bearing housings with needles on the cross arms and press them into the holes of the yoke with a force of 8000 N (800 kgf). Install the lockrings in the yoke recesses in accordance with the marks made before disassembly. Now check the free end play of the cross which should be 0.01 - 0.04 mm. If the end play is larger, replace one thin lockring by a thicker one. When replacing the universal joint parts, select lockrings with the aid of a matching feeler gauge 41.8734-4092 which has four blades 1.53, 1.56, 1.59 and 1.62 mm thick. For this purpose install lockring 2 (Fig. 3-49) 1.56 mm thick. While driving in the bearings and when the cross bears against the bearing housing (in which case there are no clearances), determine the distance between the bearing housing and the face of the circular groove with gauge 41.8734-4092. Depending on the measured distance and taking in account the axial clearance of 0.01 - 0.04 mm, insert the second lockring of an appropriate thickness.

Note. The spare lockrings are available in five thicknesses, each painted a different colour: 1.62 mm-yellow; 1.59 mm - black; 1.56 mm - blue; 1.53 mm - dark brown; and 1.50 mm - unpainted.

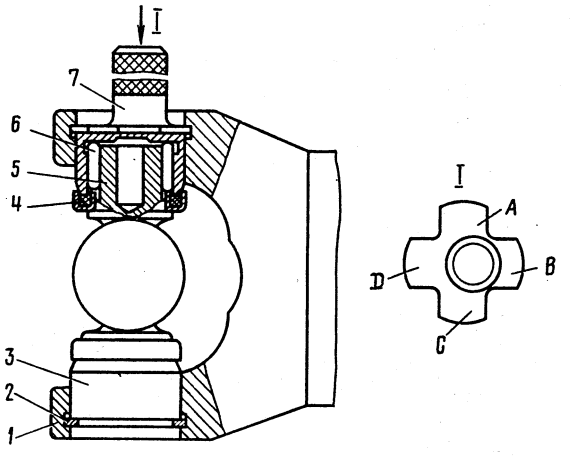


Fig.3-49. Assembling the Universal Joint:
1 - universal joint yoke; 2 - lock ring; 3 - bearing housing; 4 - gland; 5 - cross arm; 6 - bearing needle; 7 - measuring gauge 41.8734-4092; A,B,C, D - gauge blades 1.53, 1.56, 1.59 and 1.62 mm thick; I - gauge

If, for example, the 1.56 mm blade goes through, install a lockring 1.53 mm thick. If the thinnest blade (1.53 mm) fails to enter the groove, replace the ring by another one (1.50 mm). If the thickest blade (1.62 mm) enters the groove loosely, replace lockring 2 by another one, 1.62 mm thick.

Having installed the lockrings, strike the joint yokes with a plastic-head hammer. Under the effect of the blow and of the flexibly compressed glands the clearance between the bearing bottom and the lockring is taken up and there appear clearances between the bearing housings and the butt ends of the cross arms. After assembly check the joint yokes for ease of rotation and the propeller shafts for proper 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 91 s^{-1} (5500 rpm) the unbalance of the shafts checked on surfaces A (Fig. 3-44) should not exceed 1.75 N.mm (175 gf.mm); during the balance check it should not exceed 2.2 N.mm (220 gf.mm).

The balance of the intermediate propeller shaft is checked at 13 s^{-1} (800 rpm). The required balance is ensured by the use of balancing washers 8 (Fig. 3-48). The unbalance should not exceed 2.4 N.mm (240 gf.mm).

Caution

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

The design of the rear axle is illustrated in Fig. 3-50.

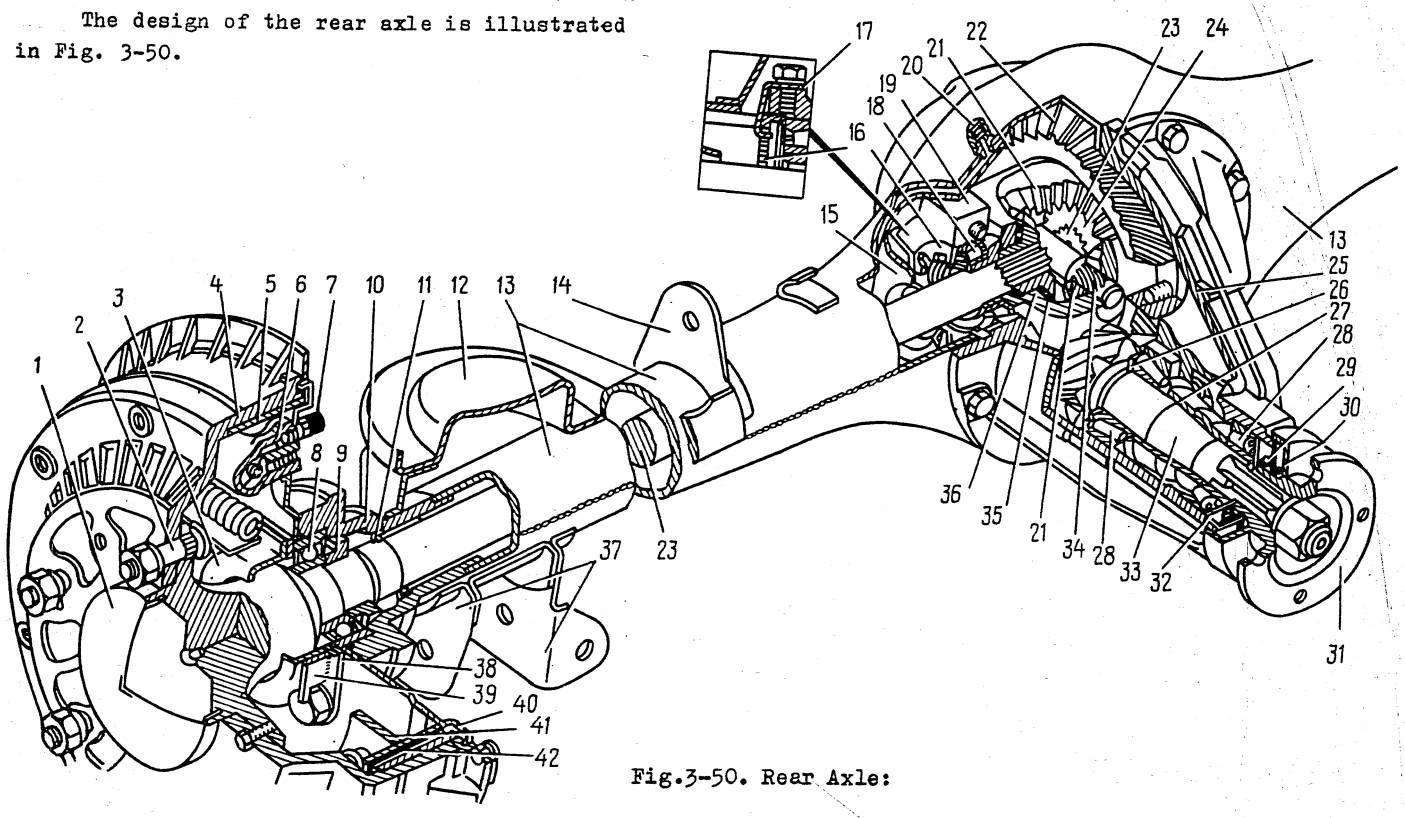


Fig.3-50. Rear Axle:

1 - wheel cap; 2 - brake drum and wheel bolt; 3 - axle shaft bearing oil baffle; 4 - brake drum; 5 - drum cast-iron ring; 6 - rear wheel brake cylinder; 7 - brake bleeder pipe 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 plate lock; 18 - pinion cage bearing; 19 - bearing cover; 20 - breather; 21 - differential pinion; 22 - final drive crown wheel; 23 - axle shaft; 24 - side gear; 25 - rear axle final drive housing; 26 - adjusting ring; 27-bearing spacer bushing; 28 - pinion bearings; 29-pinion gland; 30 - mud guard; 31 - flange; 32- oil baffle; 33 - final drive pinion; 34 - differential pinion shaft; 35 - side gear supporting washer; 36 - pinion cage; 37 - suspension bracket; 38- axle shaft bearing fastening plate; 39 - plate bolt holder; 40 - rear bracket backing plate; 41 - rear brake shoe; 42 - shoe lining

Trouble Shooting

Cause of trouble	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 side gears	3. Replace worn or damaged parts
4. Maladjustment, damage or wear of final drive gears or bearings	4. Identify the fault and repair final drive
5. Lack of lubricant	5. Restore oil level and look for leaks through seals or in rear axle beam

Cause of trouble	Remedy
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
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 between teeth of final drive gears	2. Examine gears, replace those faulty and restore normal backlash
Noise on Turns	
1. Difficult rotation of differential pinions on shaft	1. Replace damaged or worn parts
2. Scoring of differential pinion shaft	2. Dress down minor roughness with fine emery cloth; replace pinion shaft if reconditioning is impossible
3. Side gears jamming in pinion cage	3. Dress down minor defects of gears and mating surfaces in pinion cage 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
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 cage bore for differential pinion shaft	3. Replace pinion cage
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 "Rear Suspension" Chapter. To remove the rear axle, it is sufficient to disconnect the suspension radius rods and shock absorbers from the rear axle beam only.

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

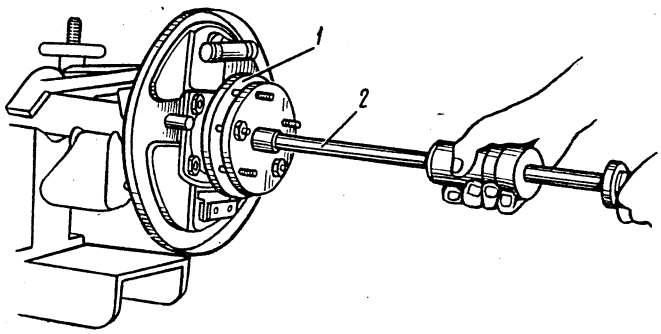


Fig.3-51. Pressing Out the Axle Shaft: 1 - axle shaft; 2 - impact remover tool 67.7823-9516

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. 3-51), take out the axle shaft complete with the oil baffle, bearing fastening plate, bearing, and locking ring. Remove the brake backing plate and the sealing ring. If the gland is in poor condition, and wants replacement, pull it out of the axle beam flange.

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 points:

- coat the threads of the final drive bolts with a sealing compound, first degreasing the bolts and their threaded holes in the rear axle beam;

- before installing the gland of the axle beam bearing, coat it with Литол-24 lubricant 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 lubricant or ЛСЦ-15 lubricant.

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

Checking the Rear Axle Beam

Examine thoroughly the axle beam, particularly if the car has been in a crash. The distorted beam may cause noise of 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.

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 a vertical plane.

Check the axle beam for deformation, setting an angle gauge against the outer surface (Fig. 3-52) and side surface (Fig. 3-53) of flange A.70172; if the beam is not distorted, the angle gauge will fit snugly against the surfaces.

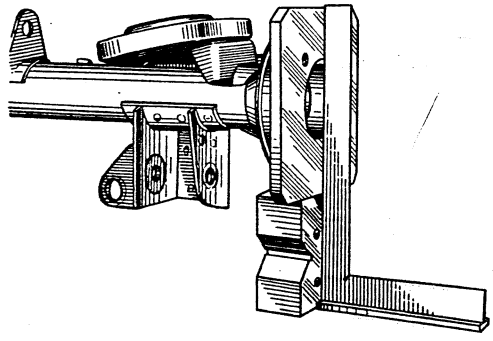


Fig.3-52. Checking the Rear Axle Beam for Vertical Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

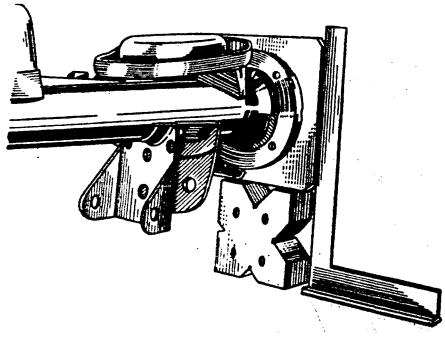


Fig.3-53. Checking the Rear Axle Beam for Twisting Deformations with Angle Gauge Applied to Edge of Flange A.70172

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

Using an angle gauge (Fig. 3-54), check the final drive mounting surface for perpendicularity

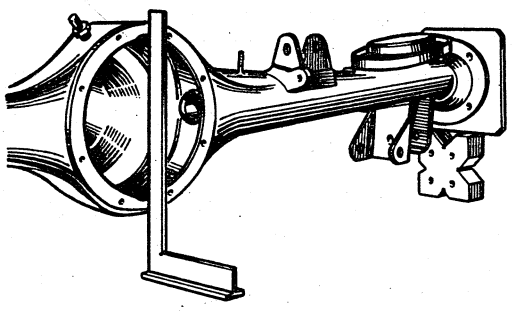


Fig.3-54. Checking the Final Drive Mounting Surface for Perpendicularity

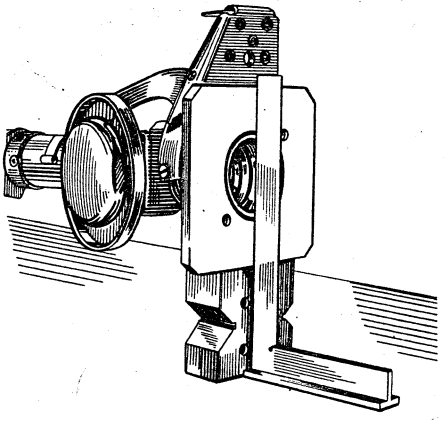


Fig.3-55. Checking the Rear Axle Beam for Horizontal Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

to the bearing surface of flange A.70172. The 0.2 mm feeler gauge must not go through.

Turn the axle beam through 90° and place it on Vee-blocks. Apply the angle gauge to the outer surface of the flange (Fig. 3-55). The angle gauge should fit tightly. If otherwise, check the value of distortion with a feeler gauge. The 0.2 mm feeler gauge must not go through.

If deformation exceeds the value stipulated 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 pressuretightness of the beam;
- cleanliness inside the beam (absence of burrs, chips and remaining oil) and of the beam breather.

Paint the beam on the outside as protection against corrosion.

Straightening the Rear Axle Beam

Fasten flanges A.70172 (the ones used for straightening, not for checking) to each end of

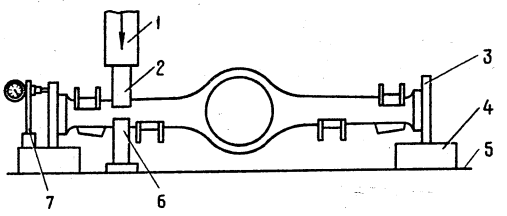


Fig.3-56. Straightening the Rear Axle Beam. Diagrammatic:
1 - hydraulic cylinder; 2 - hold-down cross-beam; 3 - flange A.70172; 4 - angle gauge; 5 - press table; 6 - support; 7 - indicator bracket

the beam and put the latter on the supports of a hydraulic press so that the ends of hold-down cross-beam 2 (Fig. 3-56) 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 indicator bracket 7 so that the indicator rod bears against the upper part of the flange side surface and the indicator pointer is settled at the division showing the value of beam distortion measured with the feeler gauge during the beam checks. Install either a bracket with 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 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 100 kN (10000 kgf) to avoid excessive deformation of the housing section.

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

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

If the prescribed equipment is unavailable, the rear axle beam may be straightened, as an exception, consecutively at each end followed by a mandatory check of the beam distortion at both sides (see "Checking the 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 baffle, bearing fastening plate and locking ring.

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 lubricant. 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 not worn nor damaged; replace the bearing if its axial clearance is larger than 0.7 mm;
- the bearing and its locking ring are not displaced from their initial positions; if the inner race of the bearing turns on the axle shaft, replace the locking ring;
- the bearing fastening plate and the oil baffle 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 gland journal should not exceed 0.08 mm. Before putting the axle shaft in the centres, clean the centre 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.

Removing the Locking Ring

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

First bend outward holders 39 (Fig. 3-50) of the bolts which fasten plate 38 with the oil baffle 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 locking ring.

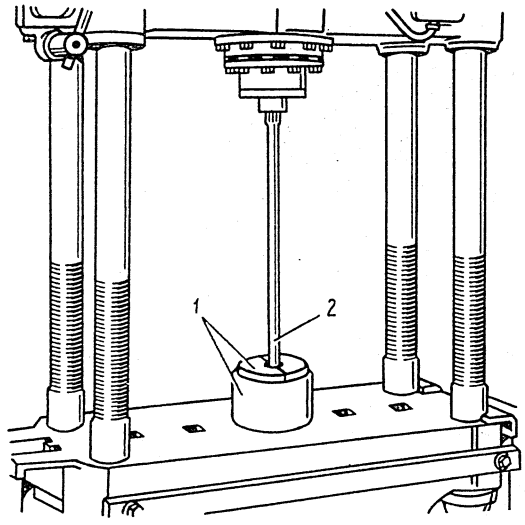


Fig.3-57. Removing the Axle Shaft Bearing Locking Ring:
1 - fixture; 2 - axle shaft

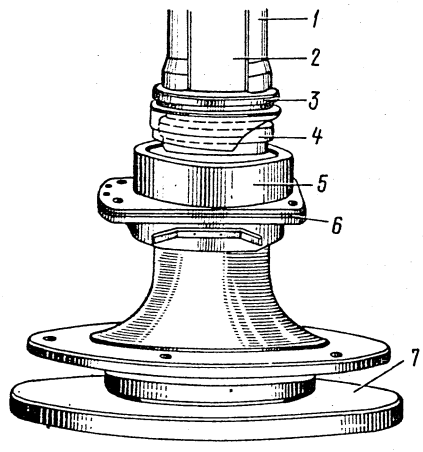


Fig.3-58. Driving in the Axle Shaft Bearing Locking Ring:
1 - driver; 2 - axle shaft; 3 - holder; 4 - lock-ring; 5 - bearing; 6 - bearing fastening plate and oil baffle assembly; 7 - supporting ring

Put the axle shaft on the press (Fig. 3-57) and apply a gradually increasing force to the splined end of the axle shaft until the locking ring comes off. The locking ring must not be reused but only 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 of installation tool 67.7823-9530 (Fig. 3-58).

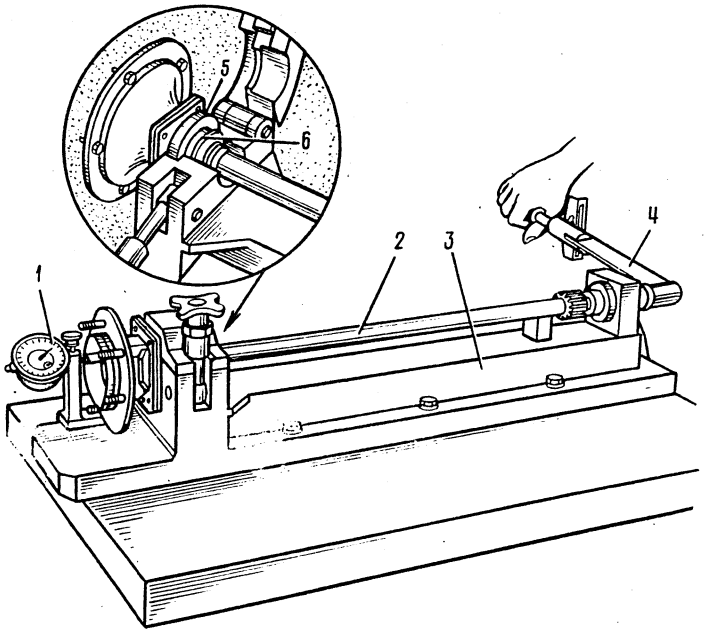


Fig.3-59. Checking the Fit of Axle Shaft Bearing Locking Ring:
1 - indicator; 2 - axle shaft; 3 - tester; 4- torque-indicating wrench; 5 - bearing; 6 - bearing locking ring

Connect the oil baffle 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 locking ring into special holder 3 and heat it in a heater to 300 °C approximately so that the temperature of the ring during installation on the axle shaft is 220 - 240 °C.

Drive the locking ring on the axle shaft with driver 1 on a press, applying a force not higher than 60 kN (6000 kgf) until the inner race of the bearing is clamped between the locking ring and the axle shaft shoulder.

Having pressed-on the locking ring, check to see that it will not be displaced under an axial load of 20 kN (2000 kgf). For this purpose place the assembled axle shaft on a tester (Fig. 3-59) and clamp the locking ring in a special vice.

Place the rod of indicator 1 graduated into 0.01 mm divisions against the axle shaft flange. Set the indicator pointer to zero and apply the axial load specified above by tightening the screw of the tester to 80 - 85 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 locking ring 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 locking ring over the axle shaft. Failure of the indicator pointer to come back to zero indicates that the locking ring has been displaced and the axle shaft assembly must be replaced by a new one.

Having checked the fit of the locking ring, install the bolts which fasten the plate and oil baffle 6 (Fig. 3-58) and fix them by bending the bolt holders inward.

Measuring the 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 gearshift lever to neutral.

Remove the wheels and brake drums. Screw gauge 02.7834.9504 on the axle shaft (Fig. 3-60), pass the rod extension of indicator 1 through one of the two holes in the axle shaft until the rod comes to bear against the brake backing plate or oil baffle and secure the indicator.

Measure the end play with the indicator, applying a force of about 50 N (5 kgf) in both directions along the rear axle axis. The permissible end play shall not exceed 0.7 mm.

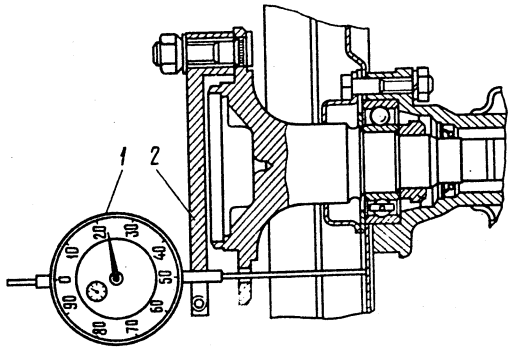


Fig.3-60. Measuring the Axle Shaft End Play with Wheel and Brake Drum Removed:
1 - indicator; 2 - gauge

Final Drive

The assembled final drive is shown in Fig. 3-61.

Identifying the 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 the various kinds of noise and taking

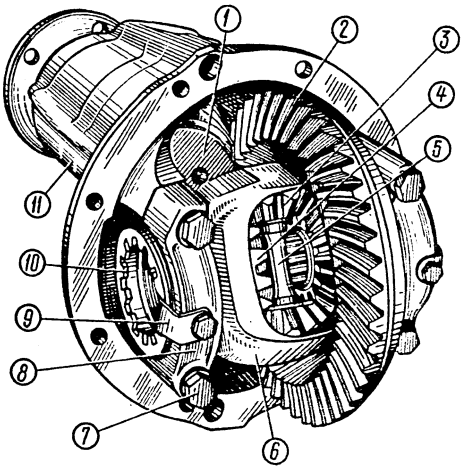


Fig.3-61. Final Drive Assembly:
1 - drive pinion; 2 - crown wheel; 3 - differential pinion; 4 - side gear; 5 - differential pinion shaft; 6 - pinion cage; 7 - pinion cage bearing cover bolts; 8 - pinion cage bearing cover; 9 - locking plate; 10 - bearing adjusting nut; 11 - final drive housing

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 to neutral, turn off the ignition switch and allow the car to coast to a standstill; listen to the nature 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 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 pinion cage;
- 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 axle housing 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 woth a torque-indicating wrench.

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

Disassembly

Mount the final drive on a stand. Remove locking plates 9 (Fig. 3-61), unscrew bolts 7 and remove covers 8 of the pinion cage bearings, adjusting nuts 10 and roller bearing outer races. Mark covers 8 and outer races of bearings before removal so as to install them back where they belong during subsequent reassembly.

Take the pinion cage from final drive housing 11 complete with crown wheel 2 and bearing inner races.

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

- turn the final drive housing with the throat up (Fig. 3-62) and unscrew the flange nut with wrench 2, holding drive pinion flange 3 with retainer 1;

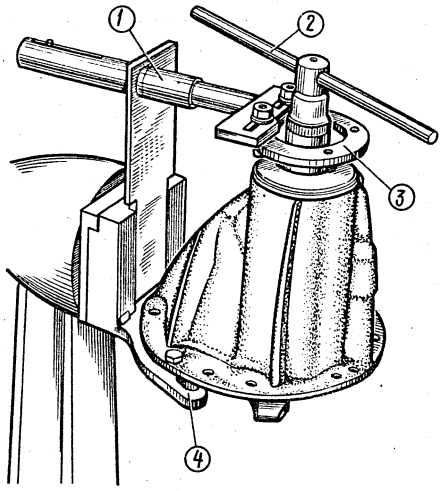


Fig.3-62. Removing the Pinion Nut:
1 - drive pinion flange retainer; 2 - socket wrench; 3 - drive pinion flange; 4 - bracket

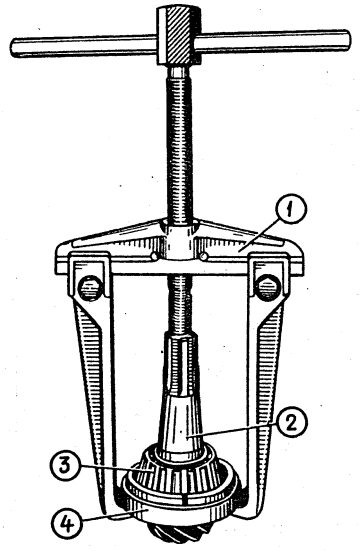


Fig.3-63. Removing the Drive Pinion Rear Bearing Inner Race:
1 - general-purpose remover tool A.40005/1/7; 2 - drive pinion; 3 - bearing race; 4 - remover tool A.45008

- remove the flange and take out the drive pinion complete with the adjusting ring, rear bearing inner race and spacer sleeve;
- take the gland, oil baffle and front bearing inner race from the final drive housing;
- press out the outer races 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. 3-63), remove the inner race of the rear roller bearing;
- take off the drive pinion adjusting ring.

To disassemble the differential:
- remove roller bearing inner races 2 (Fig. 3-64) from pinion cage 3 using general-purpose remover tool A.40005/1/6 and stop A.45028;
- unscrew the crown wheel bolts and drive the differential pinion shaft out of the cage;
- turn the side gears and the differential pinions so that the latter roll out into the differential ports where they can be taken out;
- remove the side 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 crown wheels 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 side gear journals and their seats in the pinion cage, condition of holes in the cage 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 side 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 pinion cage; 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 gear teeth.

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

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.

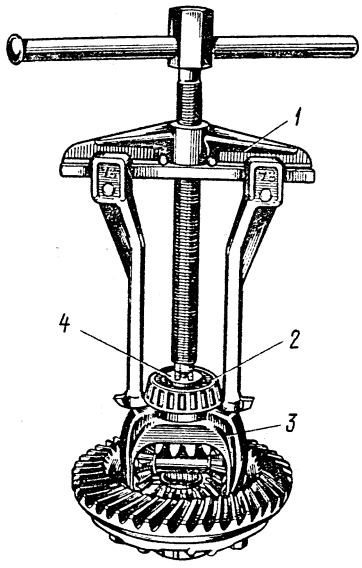


Fig.3-64. Removing the Inner Race of Differential Pinion Cage Bearing:
1 - general-purpose remover tool A.40005/1/6; 2 - bearing inner race; 3 - pinion cage; 4 - stop A.45028

Assembly

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. 3-65.

Assembling the differential.

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

Check the axial clearance of each side gear; it should be 0 - 0.10 mm; the antitorque moment of the differential gears should not exceed 15 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 side 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 crown wheel on the pinion cage.

Using installation driver A.70152, force the inner races of the roller bearings on the pinion cage.

Installation and Adjustment of Drive Pinion

Correct position of the drive pinion relative to the crown wheel depends on the thickness of the adjusting ring installed between the thrust face of the drive pinion and the inner race of the rear bearing.

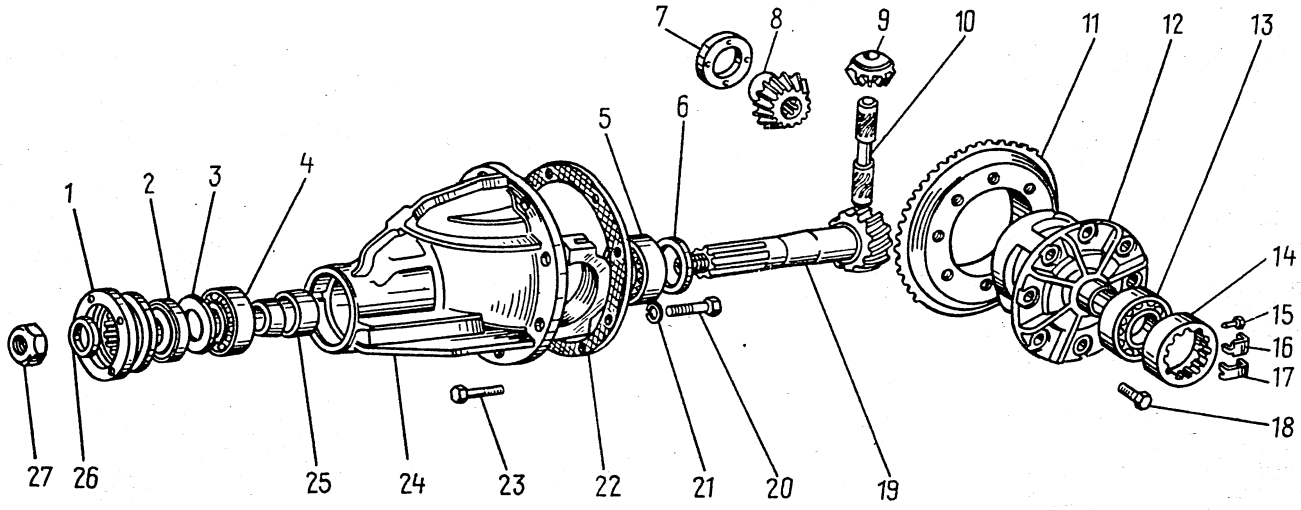


Fig.3-65. Rear Axle Final Drive Parts:

1 - pinion flange; 2 - gland; 3 - oil baffle; 4 - front bearing; 5 - rear bearing; 6 - pinion adjusting ring; 7 - side gear supporting washer; 8 - side gear; 9 - differential pinion; 10 - differential pinion shaft; 11 - crown wheel; 12 - pinion cage; 13 - pinion cage bearing; 14 - adjusting nut; 15 - locking plate bolt; 16 - locking plate; 17 - locking plate; 18 - crown wheel 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

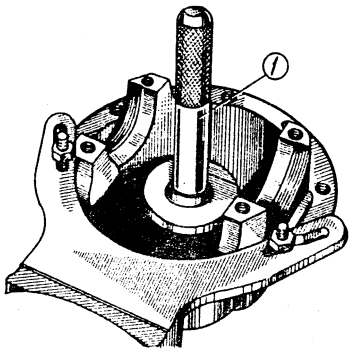


Fig.3-66. Installing the Drive Pinion Rear Bearing Outer Race:
1 - driver A.70171

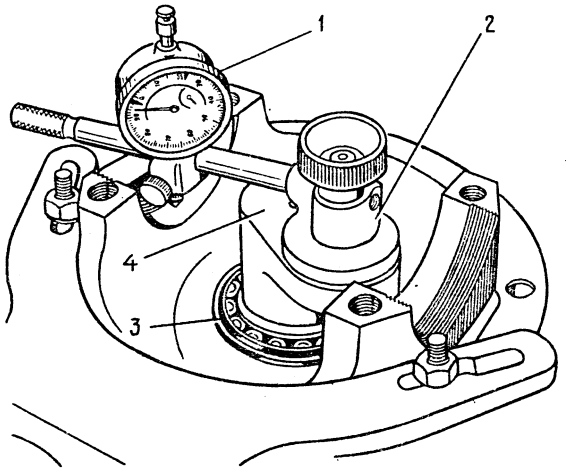


Fig.3-67. Determining the Thickness of Drive Pinion Adjusting Ring:
1 - indicator; 2 - gauge A.95690; 3 - drive pinion rear bearing; 4 - dummy pinion A.70184

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 races 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. 3-66).

Using driver A.70152, install the inner race of the rear bearing on dummy pinion A.70184 and insert the latter into the throat of the final drive housing (Fig. 3-67).

Install the inner race of the front bearing and the drive pinion flange and draw up the nut with a torque of 8 - 10 N.m (0.8 - 1 kgf.m) rotating the dummy pinion to ensure correct location of the bearing rollers.

Secure thickness gauge A.95690 on the face of dummy pinion 4 and set the gauge graduated into 0.01 mm divisions to zero, placing its rod

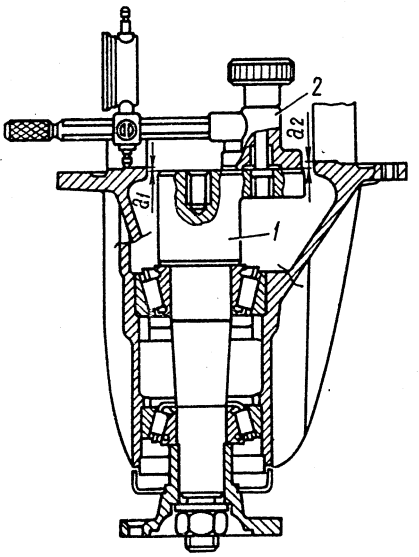


Fig.3-68. Measuring the Thickness of Drive Pinion Adjusting Ring:
1 - dummy pinion A.70184; 2 - gauge A.95690 with indicator; a_1 and a_2 - distance from dummy pinion face to journals of differential bearings

on the same face of dummy pinion A.70184. Then shift indicator 1 so that its rod rests on the seating surface of the pinion cage 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. 3-68) and write down the reading. Repeat this operation on the seating surface of the other bearing and find the value of "a_2".

Determine the 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. 3-68) to the journals of the differential bearings.

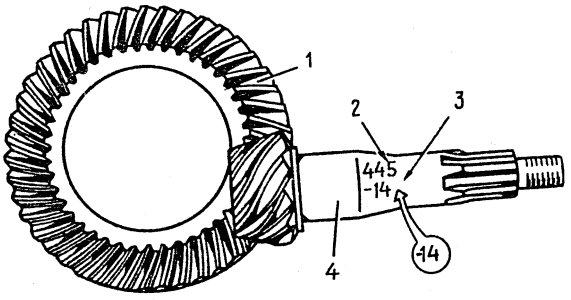


Fig.3-69. Final Drive Gears:
1 - crown wheel; 2 - ordinal number; 3 - correction to nominal position in hundredths of a millimeter; 4 - drive pinion

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

b - deviation of the drive pinion from the nominal position in millimeters. The value of deviation is marked on the drive pinion (Fig. 3-69) in the hundredth fractions of a millimeter with a plus or minus sign.

In determining the thickness of the adjusting ring the sign and the unit of measurement of "b" should be taken in 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 written 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. 3-70), install the rear bearing inner race removed from dummy pinion A.70184. Put in position the spacer bushing.

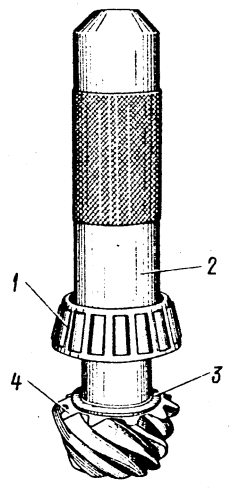


Fig.3-70. Installing the Rear Bearing Inner Race on Drive Pinion:
1 - roller bearing race; 2 - driver A.70152;
3 - adjusting ring; 4 - drive pinion

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 left in place.

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

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

Preloading the Drive Pinion Bearings

It is essential that the drive pinion bearings be properly preloaded in order to offset the axial displacement of the pinion under working loads. This preloading is checked by dynamometer 02.7812.9501 (Fig. 3-71) which measures the antitorque moment of the drive pinion.

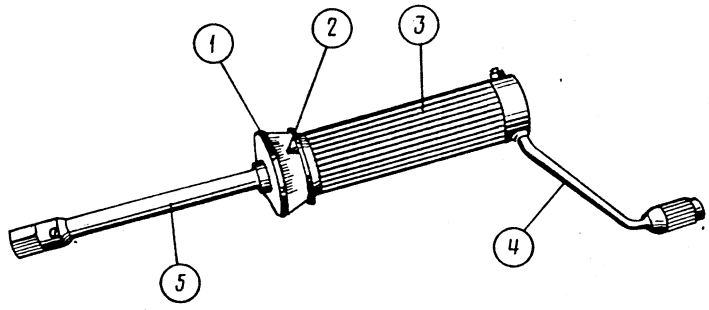


Fig.3-71. Dynamometer 02.7812.9501:
1 - movable index; 2 - torque-limiting index;
3 - body; 4 - handle; 5 - bar with end-piece inserted into adapter bushing

The antitorque moment determines the degree of bearing tightening. This moment should be 160 - 200 N.cm (16-20 kgf.cm) for new bearings and 40 - 60 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 120 - 260 N.m (12 - 26 kgf.m), periodically checking the resistance of the bearings to rotation of the drive pinion with a dynamometer.

To check the antitorque moment, place the dynamometer on adapter sleeve 3 (Fig. 3-72), set index 2 (Fig. 3-71) to the 200 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 160 N.cm (16 kgf.cm).

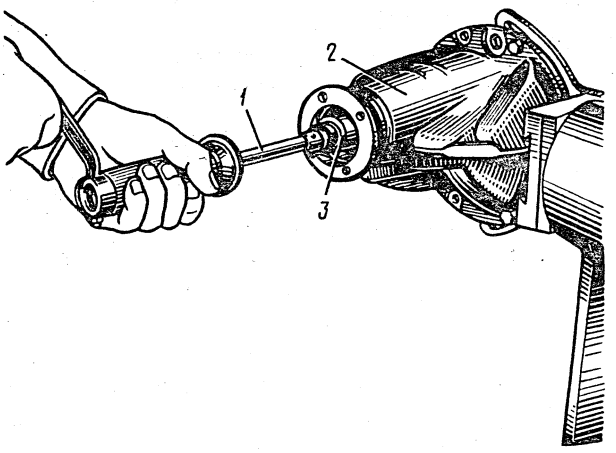


Fig.3-72. Checking the Preload of Drive Pinion Bearings:
1 - dynamometer 02.7812.9501; 2 - final drive housing; 3 - adapter sleeve

If the antitorque moment is under 160 N.cm (16 kgf.cm) or 40 N.cm (4 kgf.cm) for the bearings after 30 km, tighten the pinion flange nut without exceeding the prescribed preload and recheck the antitorque moment of the drive pinion.

If the antitorque moment exceeds 200 N.cm (20 kgf.cm) or 60 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 adjustments. Having replaced the spacer sleeve, repeat the assembly operations performing appropriate adjustments and checks.

Installing the Pinion Cage

Assemble the pinion cage complete with the bearing outer races and install it into the housing.

Install two adjusting nuts 4 (Fig. 3-73) so that they contact the bearing races.

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

Adjusting the Preload of Pinion Cage Bearings and the 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. 3-73) by turning screws 1 and 6 into the holes for the bolts which fasten the adjusting nut locking plates.

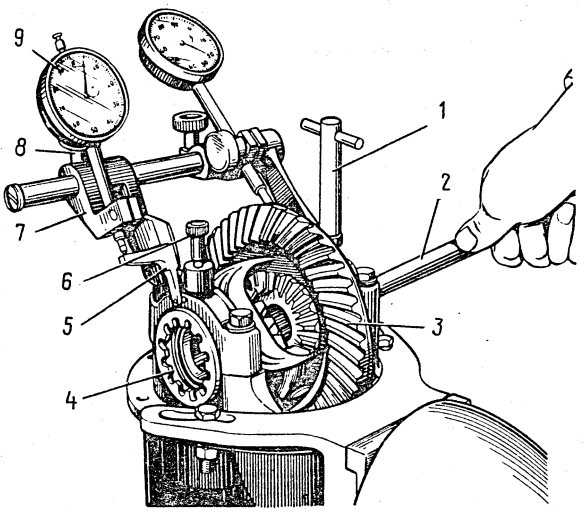


Fig.3-73. Checking the Preload of Pinion Cage Bearings with Gauge A.95688/R:
1 - gauge screw; 2 - wrench A.55085; 3 - crown wheel; 4 - adjusting nut; 5 - intermediate lever; 6 - fastening screw; 7 - indicator bracket; 8 - bracket screw; 9 - pinion cage bearing preload indicator

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. 3-74) and set bracket 4 so that the rod of indicator 2 rests on the tooth flank of the crown wheel at the tooth edge; then draw up screws 1 and 3.

Adjust the pinion-to-wheel backlash preliminarily to 0.08 - 0.13 mm by turning the

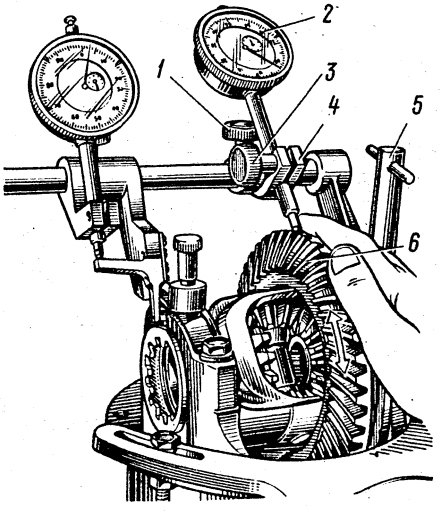


Fig.3-74. Checking the Backlash of Final Drive Gears with Gauge A.95688/R:
1 - bracket screw; 2 - backlash indicator; 3 - indicator clamping screw; 4 - indicator bracket; 5 - fastening screw; 6 - crown wheel

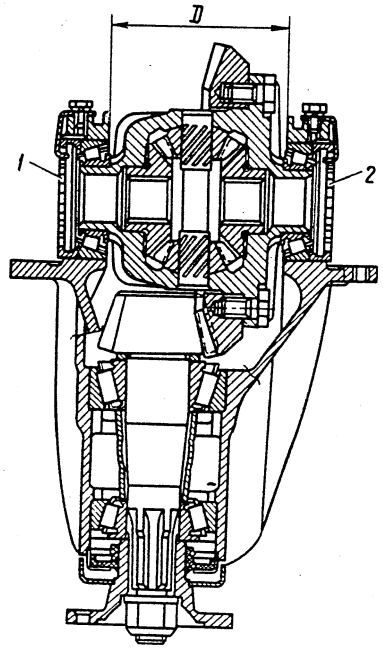


Fig.3-75. Checking the Preload of Pinion Cage Bearings:
D - distance between differential bearing covers;
1, 2 - adjusting nuts

adjusting nuts. Check the backlash with indicator 2, at the same time rocking crown wheel 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 move apart the differential bearing covers, thus increasing distance "D" (Fig. 3-75). This increase of distance "D" will be registered by indicator 9 (Fig. 3-73) whose rod is pressed upon by lever 5. Tighten the bearing adjusting nuts to increase distance "D" (Fig. 3-75) by 0.14 - 0.18 mm.

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

If the backlash is greater than 0.08 - 0.13 mm, shift the crown wheel towards the pinion; shift it away, if the backlash is smaller. In order to retain the preset preload of the bearings, move the crown wheel 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. 3-73) which reads the previously adjusted preload of bearings. Tightening one of the nuts will change the indicator reading because the divergence "D" of the covers (Fig. 3-75) 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 crown wheel, check the backlash by indicator 2 (Fig. 3-74). 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 with bolts and spring washers. The spare locking plates are available in two types, either with one or 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 the 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 crown wheel teeth with a thin coat 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 crown wheel teeth;
- reverse the rotation of the stand and, braking the gears, obtain the contact stains on the other side of the crown wheel 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 of the crown wheel teeth, nearer to the narrow end of the tooth, occupying two thirds of its length and without extending to the tip or the root of the tooth as shown in Fig. 3-76 "e".

The patterns of wrong tooth contact on the active surface of the tooth are illustrated in Fig. 3-76 "a", "b", "c", "d".

Correct 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 pinion cage roller bearings, and adjusting the backlash of the final drive gears.

Replacing the 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 the leakage of oil through the

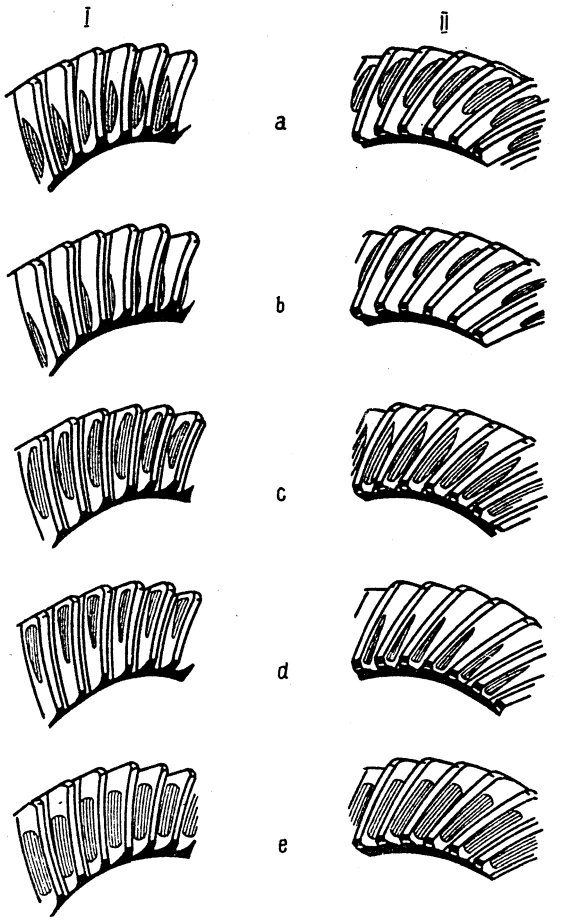


Fig.3-76. Tooth Contact of Final Drive Gears: I - forward; II - reverse; a and b - wrong tooth contact; shift drive pinion away from crown wheel by reducing thickness of adjusting ring; c and d - wrong tooth contact: shift drive pinion towards crown wheel by increasing thickness of adjusting ring; e - correct tooth contact

gland; the oil level drops so low 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 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 minutes;
- with the direct gear thrown in, at a speed of 100 km/h determine the amount of oil leaking out in 15 minutes.

The leakage exceeding 5 drops in 15 minutes 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 to 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 shaft from the differential pinion cage with a special knock-out 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 memorize 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, trying to avoid cocking the gland; before installation coat the working surfaces of the gland with Литол-24 lubricant;
- 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 60 N.cm (6 kgf.cm) and higher, the new one should be 10 - 20 N.cm (1 - 2 kgf.cm) higher than the initial one. If, however, the initial antitorque moment was lower than 60 N.cm (6 kgf.cm), tighten the flange nut until the antitorque moment becomes 60 - 90 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.

The design of the front axle is illustrated in Fig. 3-77.

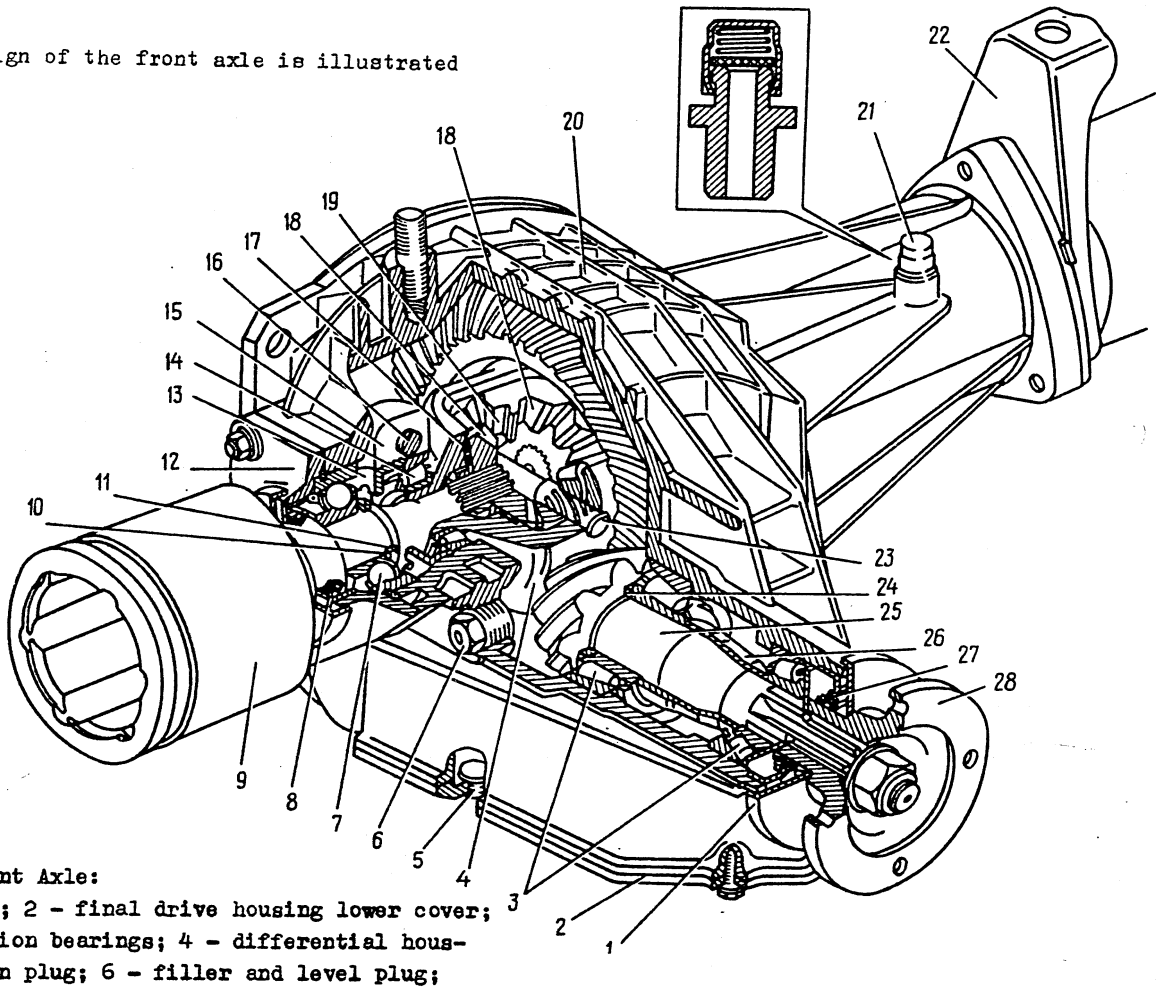


Fig.3-77. Front Axle:
1 - mud guard; 2 - final drive housing lower cover; 3 - drive pinion bearings; 4 - differential housing; 5 - drain plug; 6 - filler and level plug; 7 - inner joint housing bearing; 8 - gland; 9 - inner joint housing; 10 - spring washer; 11 - locking ring; 12 - bearing cover; 13 - adjusting nut; 14 - pinion cage bearing; 15 - bearing cover; 16 - cover bolt; 17 - supporting washer; 18 - side 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 of trouble	Remedy
Constant Loud Noise on the Move	
1. Wear of splined joint with side 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. Lack of oil 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 adjusted during repairs	2. Adjust meshing of final drive gears as 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

Cause of trouble	Remedy
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 pinion cage	3. In case of minor damage of gears and mating surfaces of pinion cage, dress them with fine emery cloth; replace damaged parts, if necessary
4. Wrong backlash of differential gear teeth	4. Adjust gear 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 pinion cage	3. Replace differential pinion cage and, if necessary, pinion shaft
4. Wear of splined joint with side gears	4. Replace worn parts
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 jack up its front end.

Remove the sway eliminator bar, the braces of the suspension cross member 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 car.

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 front engine mounting cushions to the brackets of the front suspension cross member.

Supporting the front axle, unscrew the bolt which fastens R.H. bracket 22 (Fig. 3-77) 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 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 locking ring 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 not 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 is no wear and cracks on the housing mounting surfaces.

Replace any worn and damaged parts by new ones.

Assembly

Assemble and adjust the front axle final drive in the manner prescribed in the "Rear Axle" chapter and see that distance "D" (Fig. 3-75) is increased by 0.08 - 0.11 mm. To adjust the final drive, use bracket 67.8701-9508 with a measuring point and wrench 67.7812-9520.

Install bearing cover 12 with gland 8 on inner joint housing 9 (Fig. 3-77) then press on bearing 7. Install spring washer 10 and locking ring 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 in the nuts of the joint bearing covers.

FRONT WHEEL DRIVE

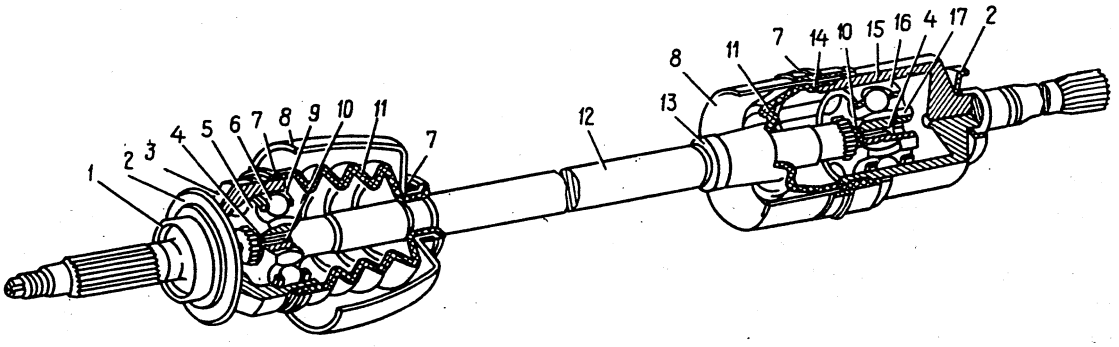


Fig.3-78. Front Wheel Drive:

1 - gland ring; 2 - mud guard; 3 - outer joint housing; 4 - lockring; 5 - outer joint holder; 6 - ball; 7 - clamp; 8 - boot cover; 9 - outer joint cage; 10 - holder thrust ring; 11 - outer joint boot; 12 - front wheel drive shaft; 13 - boot ring; 14 - retainer; 15 - inner joint housing; 16 - inner joint cage; 17 - inner joint race

The front wheels receive the torque moment from the front driving axle via two joints interconnected by shaft 12 (Fig. 3-78). The outer joint (constant velocity joint) consists of housing 3, holder 5, cage 9 with balls 6, lockring 4 and thrust ring 10. Holder 5 is connected with housing 3 by the balls which enter the hollows of holder 5 arranged radially, and into the housing slots. The holder is slipped on the splines of shaft 12 all the way to bear against thrust ring 10 and is secured by lockring 4. When compressed, this ring passes freely through the splined hole of holder 5 which contributes to easy joining and disconnection of the joint and shaft 12.

- 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 bolts of the front axle 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 11 and covers 8 with a view to examining the parts and checking the quality of lubricant.

Proceed as follows:

- shift wire clamp 7 (Fig. 3-78) from rubber boot 11;
- loosen the clamp which fastens cover 8 and boot 11 on shaft 12 and shift the cover with boot along the shaft to ensure access to joint holder 5;
- knock holder 5 off the shaft with a drift and hammer;

Caution

To prevent wedging of lockring 4, take care not to cock the holder by selecting properly the force and direction of the blow.

- take thrust ring 10, boot 11 and cover 8 off shaft 12;
- shift the boot and cover of the inner joint along the shaft, remove retainer 14, take shaft 12 complete with race 17, cage 16 and joints from housing 15;
- knock race 17 off shaft 12 with a drift and hammer;
- take off thrust ring 10 and shift the boot off the shaft;
- wash out the inner spaces of the joint housings and other parts.

Trouble Shooting

Cause of trouble	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	
1. Damage or fracturing of boots of inner or outer joints	1. Replace lubricant in joint and protective boot. If joint parts are worn or damaged, replace joint assembly

The joint is protected against ingress of dirt and moisture by boot 11 which, in turn, is protected against mechanical damage by cover 8. The cover and boot are held on shaft 12 by clamp 7; boot 11 is held on housing 3 by a wire clamp.

The inner joint differs from the outer one in that it has straight slots. The axial displacement of the joint parts in the housing is limited by wire retainer 14.

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 8 and boots 11, clamps 7, rings 4 and 10, retainer 14, rubber ring 13.

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:

- jack up the front end of the car and put trestles under it;
- disconnect the shock absorber from the lower wishbone;

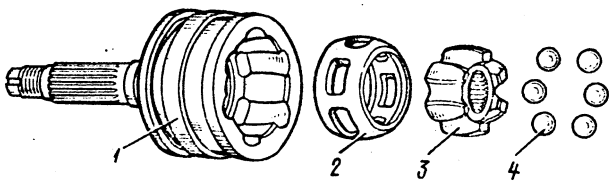


Fig.3-79. Front Wheel Drive Outer Joint Parts: 1 - joint housing; 2 - cage; 3 - race; 4 - ball

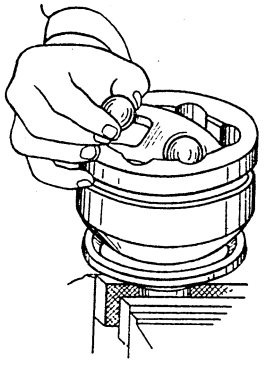


Fig.3-80. Removing the Balls from Cage

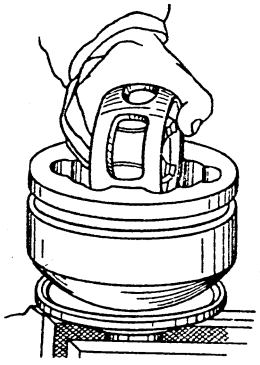


Fig.3-81. Removing the Cage Complete with Race from Joint Housing

The most complicated and vital are the operations related to disassembly and assembly of the outer joint whose parts are illustrated in Fig. 3-79.

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

Mark the race, cage and housing of the joint with paint to define their relative positions. Clamp the outer joint in a vice as shown in Fig. 3-80. Incline the race 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 from 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 race 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 race in such a manner that the elongated holes of the cage face the projections of the joint housing (Fig. 3-81) and withdraw the cage complete with the race.

Take the race out of the cage; for this purpose insert one of the cage projections into an elongated hole of the cage (Fig. 3-82) then roll out the cage towards the straight edge of

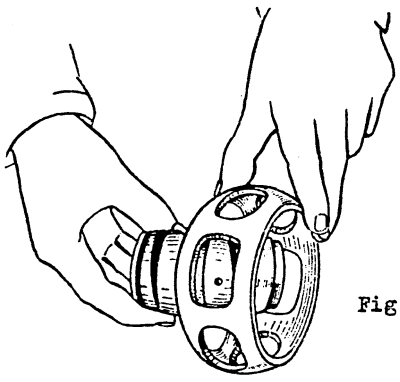


Fig.3-82. Removing the Race from Cage

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 lubricant HPVC-4 or Molykote VW 2461c.
- when installing the cage complete with race into the joint housing align the marks made before disassembly and set the circular recess of the race (for the thrust ring) towards the shaft;
- while installing the balls into the cage, incline the race to an angle approximately twice as large as that of the cage;
- fill the joint with 75 cm^3 of one of the lubricants mentioned above;
- before striking shaft 12 (Fig. 3-78) for connecting it with inner holder 5, install lockring 4 strictly on the centre then strike smartly the end of the shaft down; the compressed lockring will slide through the splined hole of the holder;
- press in the ring of the joint housing gland with mandrel 67.7853-9533.

After assembly it may happen that the race gets locked when the shaft is rocked and the joint does not rotate. This should not be regarded as improper assembly because without such locking the joint will fail to rotate in service.

Using the procedure described above disassemble the inner joint completely. The race 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 12.

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

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.

Section IV
RUNNING GEAR

TROUBLE SHOOTING

Cause of trouble	Remedy
Suspension Noisy and Knocking on the Move	
1. Shock absorbers faulty	1. Replace or repair shock absorbers
2. Loosening of sway eliminator bar bolts	2. Tighten eliminator bar bolts and nuts; replace rubber pads, if worn
3. Wear of wishbone silent blocks	3. Replace silent blocks
4. Shock absorbers loosely fastened or rubber bushes of their lugs are worn	4. Tighten bolts and nuts, replace bushes in shock absorber lugs
5. Wear of wishbone ball joints	5. Replace ball joints
6. Excessive clearance in wheel bearings	6. Adjust clearance or replace bearings
7. Heavy unbalance of wheels	7. Have wheels balanced
8. Deformation of wheel discs	8. Replace wheel discs
9. Spring weak or broken	9. Replace spring
10. Wear of rubber bushings of rear suspension radius rods	10. Replace bushings
11. Bumps of rear suspension caused by damage of compression buffers	11. Replace damaged buffers
12. Frequent bumps of rear suspension caused by overloading of rear axle	12. Relieve load on rear axle
Front Wheel Alignment Angles Fail to be Adjusted	
1. Distortion of lower wishbone shaft or of wishbones	1. Replace shaft or wishbones
Car Pulls Sideways	
1. Nonuniform tyre pressure	1. Set correct tyre pressure in all wheels
2. Wrong front wheel alignment angles	2. Adjust
3. Wrong clearance in front wheel bearings	3. Adjust
4. Distortion of wishbones	4. Replace distorted wishbones
5. Nonuniform resilience of suspension springs	5. Replace weak spring
6. Incomplete release of wheel brakes	6. Correct defect
7. Considerable difference in wear of tyres	7. Replace worn tyres
8. Heavy unbalance of front wheels	8. Balance front wheels
9. Displacement of rear axle caused by deformation of rear suspension radius rods	9. Straighten out or replace radius rods
Front Wheel Shimmy	
1. Tyre pressure other than normal	1. Set correct tyre pressure
2. Excessive clearances in wheel hub bearings	2. Adjust clearances
3. Shock absorbers inoperative	3. Replace or repair shock absorbers

Cause of trouble	Remedy
4. Loose nuts of ball joint pins	4. Tighten nuts
5. Wrong front wheel alignment angles	5. Adjust
6. Wear of wishbone shaft silent blocks	6. Replace silent blocks
7. Heavy unbalance of wheels	7. Check and balance wheels
8. Wear of wishbone ball joints	8. Replace joints
Frequent Suspension Bumps	
1. Weakening of suspension springs	1. Replace springs by new ones
2. Shock absorbers inoperative	2. Replace or repair shock absorbers
3. Distortion of wishbones	3. Replace distorted wishbones
Excessive Clearance in Ball Joints	
1. Friction surfaces of ball joint parts worn with dirt penetrating inside through loose or damaged rubber boot	1. Replace ball joint and boot
Irregular Wear of Tyre Treads	
1. Excessive speed on turns	1. Reduce speed
2. Heavy wear of suspension joints and bushings	2. Repair suspensions
3. Unbalance of wheels (worn spots uniformly arranged around circumference on extreme tread ribs or, after prolonged driving on unbalanced wheels, on central rib too)	3. Have wheels balanced
4. Nonuniform braking of wheels	4. Adjust brake system
5. Shock absorbers inoperative	5. Replace or repair shock absorbers
6. Wrong camber (wear of tread inner ribs)	6. Adjust wheel camber
7. Underinflated tyres (heavy wear on extreme ends of tread)	7. Inflate tyres as required
8. Overinflated tyres (heavy wear of central tread rib)	8. Inflate tyres as required
9. Insufficient toe-in of front wheels (wear of tread inner ribs)	9. Adjust toe-in
10. Excessive toe-in of front wheels (wear of tread outer ribs)	10. Adjust toe-in
Wheel Wobble	
1. Wrong balancing of wheels:	1. Do the following:
(a) nonuniform wear of tyre tread around circumference	(a) balance or replace wheels
(b) shifting of balance weights and tyres during mounting	(b) balance wheels
(c) deformation of wheel rim	(c) straighten out or replace rim; balance wheels
(d) injured tyres	(d) replace tyre and balance wheel
2. Excessive clearance in wheel hub bearings	2. Adjust clearance
Fluid Leaks from Shock Absorber	
1. Wear or damage of rod gland	1. Replace gland
2. Foreign mechanical particles get on gland sealing edge	2. Wash shock absorber parts, replace or filtrate fluid
3. Nicks, notches, scores on rod; complete wear of chromium coating	3. Replace worn or damaged rod and gland

Cause of trouble	Remedy
4. Loosening of reservoir nut	4. Draw up nut
5. Reservoir damaged in sealing ring zone	5. Replace or repair reservoir
6. Reservoir sealing ring shrunk or damaged	6. Replace ring
7. Too much fluid in shock absorber	7. See that shock absorber contains prescribed amount of fluid
Insufficient Resistance of Shock Absorber during Rebound Stroke	
1. Poor tightness of rebound or bypass valve	1. Replace or repair faulty valve parts
2. Piston ring broken or stuck in groove	2. Replace ring or eliminate its sticking
3. Lack of fluid caused by leaks	3. Replace faulty parts and fill shock absorber with fluid
4. Piston or cylinder scored	4. Replace damaged parts, replace fluid
5. Wear of hole in guide bushing	5. Replace guide bushing
6. Fluid contaminated with mechanical impurities	6. Wash all parts, replace fluid
7. Weakening of rebound valve spring	7. Replace spring
Insufficient Resistance of Shock Absorber during Compression Stroke	
1. Poor tightness of compression valve	1. Replace or repair damaged parts
2. Lack of fluid due to leaks	2. Replace damaged parts, add fluid
3. Wear of guide bushing and rod	3. Replace worn parts by new ones
4. Fluid contaminated with mechanical impurities	4. Wash all parts, replace fluid
5. Wear or damage of compression valve discs	5. Replace damaged parts
Shock Absorber Knocks and Squeaks	
1. Wear of rubber bushes in lugs	1. Replace bushes
2. Deformation of housing caused by impacts	2. Replace or repair housing
3. Lack of fluid caused by leaks	3. Replace damaged parts, add fluid
4. Loosening of reservoir and piston nuts	4. Tighten up nuts
5. Jamming of rod due to deformation of cylinder, reservoir or rod	5. Replace or true up defective parts
6. Loosening of shock absorber fastening nuts	6. Tighten up nuts
7. Breaking of shock absorber parts	7. Replace damaged parts by new ones
Heavy Wear of Tyre Treads	
1. Speedy motoring	1. Choose correct speed to suit road conditions
2. Excessively sharp accelerations with slipping of wheels	2. Avoid sharp accelerations
3. Unduly frequent use of brakes	3. Use brakes skillfully
4. Wrong front wheel alignment angles	4. Adjust
5. Excessive clearances in wheel hub bearings	5. Adjust
6. Car overloaded	6. Do not overload car above limits indicated in Instruction Manual
7. Failure to interchange wheels as recommended in Instruction Manual	7. Interchange wheels as recommended in Instruction Manual
Tyres Squeal on Turns	
1. Wrong tyre pressure	1. Set correct tyre pressure
2. Wrong front wheel alignment angles	2. Adjust
3. Distortion of suspension wishbones, crossmember or body front end parts	3. Replace distorted parts, straighten body front end parts

The design of the front suspension is shown in Fig. 4-1.

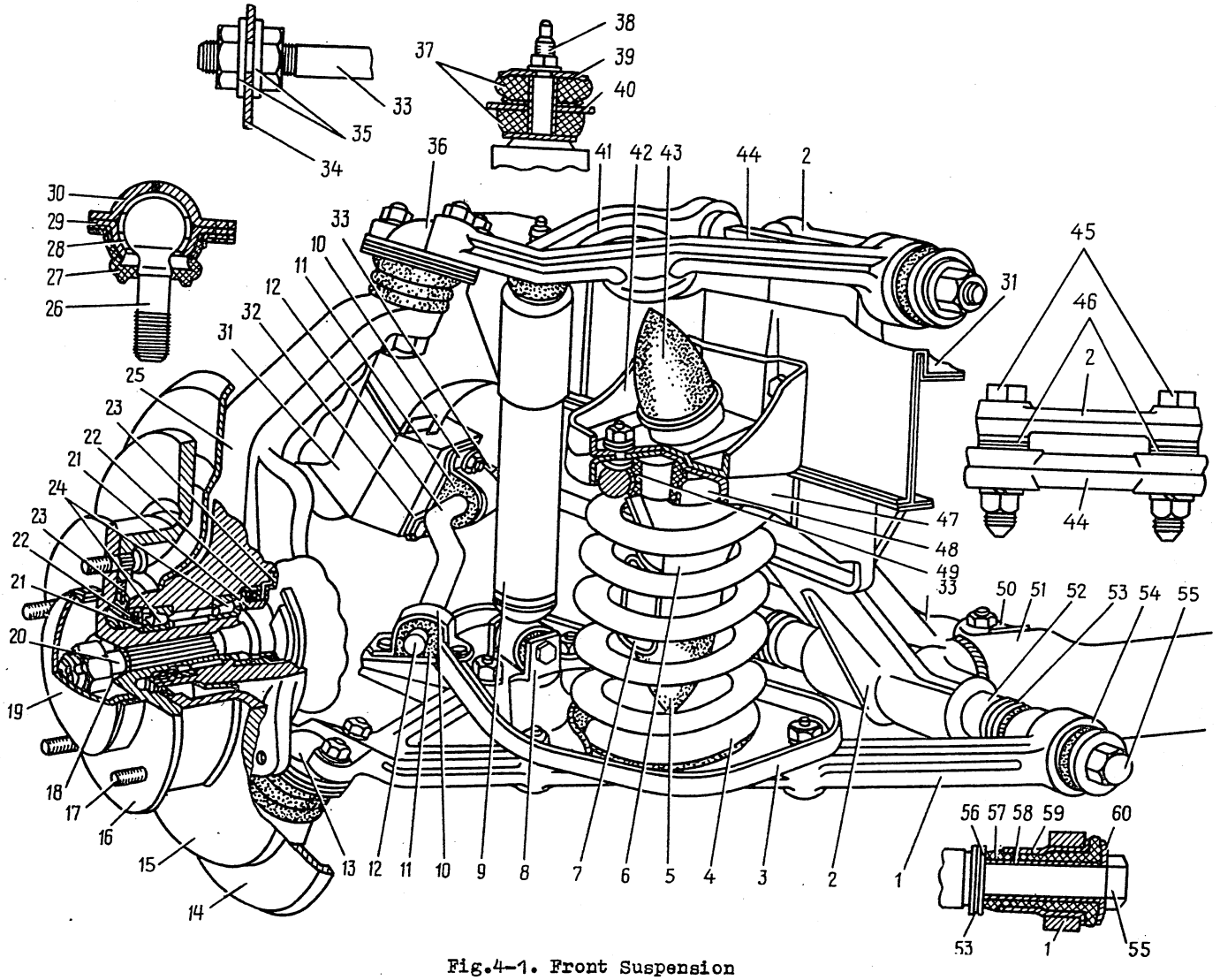


Fig.4-1. Front Suspension

1 - lower wishbone; 2 - cross member bracket; 3 - suspension spring lower seat; 4 - suspension spring; 5 - compression buffer; 6 - compression buffer support post; 7 - compression stroke stop; 8 - shock absorber lower bracket; 9 - shock absorber; 10 - sway eliminator bar holder; 11 - rubber cushion; 12 - sway eliminator bar; 13 - lower ball joint; 14 - front brake housing; 15 - brake disc; 16 - wheel hub; 17 - brake disc and wheel bolt; 18 - tapered bushing; 19 - cap; 20 - outer constant velocity joint housing extension; 21 - gland bushing; 22 - gland; 23 - mud-deflecting ring; 24 - wheel hub bearings; 25 - steering knuckle; 26 - ball joint pin; 27 - boot; 28 - bearing; 29 - ball pin seat holder; 30 - ball pin bearing housing; 31 - sway eliminator bar fastening plate; 32 - body side member; 33 - brace; 34 -brace bracket; 35 - washers; 36 - upper ball joint; 37 - shock absorber rod pad; 38 - shock absorber rod; 39 - washer; 40 - shock absorber bracket; 41 - upper wishbone; 42 - rebound buffer bracket; 43 - rebound stroke buffer; 44 - upper wishbone shaft; 45 - upper wishbone shaft bolts; 46 - adjusting shims; 47 - suspension spring upper support; 48 - suspension spring upper seat; 49 - spring insulating gasket; 50 - brace-to-cross member bracket; 51 - front suspension cross member; 52 - lower wishbone shaft bushing; 53 - lower wishbone adjusting washers; 54 - lower wishbone silent block; 55-lower wishbone shaft; 56 - thrust washer; 57 - joint rubber bushing; 58 - joint inner bushing; 59 - joint outer bushing; 60 - joint thrust washer

Inspection of Front Suspension Parts

During each round of maintenance and repairs make sure to examine the protective boots of the suspension ball joints, paying particular attention to absence of mechanical damage. Scrutinize the suspension parts carefully for cracks, signs of rubbing against the road or car body, distortions of the lower wishbone shafts, cross member or suspension wishbones and body front elements and the condition of the ball joints and silent blocks.

Distortion of the lower and upper wishbone shafts is checked visually.

Distortion of the front suspension cross member is determined by measuring the distance between the outer surfaces of the cross member brackets in the zone of the upper wishbone shaft fastening bolts. This distance should be 736 ± 1.5 mm.

If the cross member is distorted to such an extent that the wheel alignment angles cannot be adjusted with washers, though the other elements of the suspension are in order, replace the cross member.

The silent blocks should be examined as follows:

- make sure there is no deformation of the suspension wishbones, lower wishbone shaft, and suspension cross member then jack up the front wheels of the car.
- measure the radial displacement A (Fig. 4-2) of outer bushing 2 relative to inner bushing 6 and distance B between thrust washer 5 and the outer face of outer bushing 2.

The silent blocks of the upper and lower wishbones must be replaced in the following cases:

- when rubber bushings are fractured or bulge on one side;
- if rubber is undercut and worn on silent block faces;
- if radial displacement A of the outer bushing with relation to the inner one exceeds 2.5 mm;
- if distance B is other than 3 - 7.5 mm.

If distance B goes beyond the above-specified limits, check the standard of silent block installation in the wishbone socket.

The clearance in the upper ball joints should be checked as follows:

- put the car on a level horizontal hard-surface floor;
- jack up the R.H. or L.H. front side of the car and take off the wheel;
- put a wooden block 230 mm high under the lower ball joint nearer to the ball pin and ease down the car on the block;
- make sure that resin does not ooze out of the hole in the upper ball pin housing; if necessary, dress it down with a file to prevent measurement errors;
- secure indicator bracket 4 (Fig. 4-3) on the upper end of the steering knuckle;
- set indicator 2 in the centre of the sphere of upper ball joint housing 3 with a small preliminary tension then align the zero division of the indicator scale with the pointer;
- secure forked lever 5 0.7 m long on the upper wishbone of the front suspension;
- build up a load of 200 N.m (20 kgf.m) in the vertical direction with torque-indicating wrench 6 (300 N on the end of the forked lever)

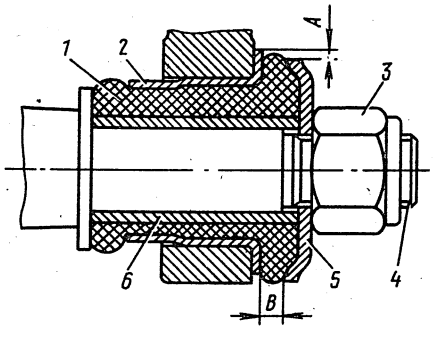


Fig.4-2. Examining the Front Suspension Wishbone Silent Block:
1 - rubber bushing; 2 - outer bushing; 3 - shaft nut; 4 - wishbone shaft; 5 - joint thrust washer; 6 - inner bushing

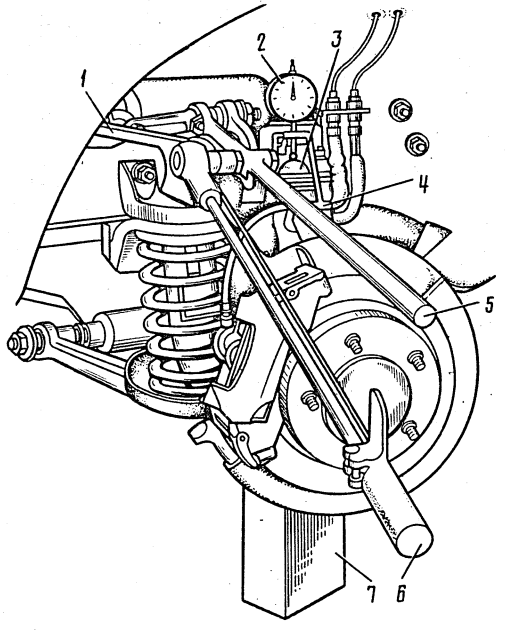


Fig.4-3. On-Car Checks of Clearance in Suspension Upper Ball Joints:
1 - upper wishbone; 2 - indicator; 3 - upper ball joint housing; 4 - indicator bracket; 5 - lever; 6 - torque-indicating wrench; 7 - block

first for pushing the ball pin into, then pulling it out of, the joint housing;

- register the respective maximum deflections of the indicator pointer;
- calculate the values of the clearance in the upper ball joint by summing up the deviations from the zero division;
- the summary readings of the indicator should not exceed 0.8 mm.

Front Wheel Alignment

The front wheel alignment angles should be checked and adjusted on special stands as instructed in their Operating Instructions.

Caution

The checks of the wheel alignment angles are mandatory after replacement or repairs of the suspension parts which may disturb the angle settings.

Check and adjust the wheel alignment angles on a car under a static load of 3200 N (320 kgf) which corresponds to four men and a 40-kg load in the trunk.

The alignment angles should be as follows:

- camber $0^{\circ}30' \pm 20'$
- caster $3^{\circ}30' \pm 30'$
- toe-in 3 ± 1 mm.

Before proceeding with adjustments check the following:

- tyre pressure;
- axial clearance in front wheel hub bearings;
- condition of shock absorbers (absence of rod jamming);
- radial and axial wobble of tyres;
- clearance in suspension ball joints;
- steering wheel play.

Eliminate any discovered defects and make necessary adjustments.

After installing the car on a stand, directly before checking the alignment angles, compress the car suspension, by pushing down first the rear then the front bumper two or three times with a force of 400 - 500 N (40 - 50 kgf).

The sequence of adjustments should be as follows:

1. Caster
2. Camber
3. Toe-in.

Caster. If the measurements show that the caster angle is other than the above-specified limits, change the number of adjusting shims 46 (Fig. 4-1) installed between the upper wishbone shaft and the cross member bracket (see Table 4-1).

Table 4-1

Adjustments of Camber and Caster by Shims

Number of shims added or removed		Camber	Caster
front bolt	rear bolt		
+1	+1	+(8'42")	0
-1	-1	-(8'42")	0
+1	0	-(7'30")	+(20'24")
-1	0	+(7'30")	-(20'24")
0	+1	+(15'18")	-(25'18")
0	-1	-(15'18")	+(25'18")
-1	+1	+(27'30")	-(43'18")
+1	-1	-(21'36")	+(40')

Note. These data refer to shims 0.75 mm thick. The sign "plus" or "minus" means that a shim must be added or removed, respectively.

To adjust the caster angle:

- unscrew the nuts holding the upper wishbone shaft and transfer the shims from one bolt to the other until the angle is as prescribed. The caster angle increases when shims are transferred from the rear bolt to the front one and vice versa;
- turn in the nuts with a torque-indicating wrench and check for correct caster angle.

Camber angle. If the camber angle is other than normal, adjust it by changing the number of shims 46 (Fig. 4-1) installed between the upper wishbone shaft and the cross member bracket.

To decrease or increase the camber angle, remove or add the identical number of shims on both bolts, respectively.

Toe-in of front wheels. If the toe-in is other than normal, loosen the clamps of the side rods and turn both sleeves with wrench 67.7813-9504 through the same angle in opposite directions; in this manner the sleeves are turned on or off, thus changing the length of the side steering rods.

On completion of adjustments, install the clamps with their slots turned down and tighten them in this position. With the nuts tightened the edges of the clamp ends should not meet.

Having adjusted the toe-in, check to see that the wheels and the parts of the steering linkage do not rub against the adjacent parts of the suspension and body. For this purpose turn the wheels all the way back and forth until the pitman arm comes to bear against the bolts of the steering gear case.

Checking and Adjusting the Clearances in Front Wheel Hub Bearings

To check the clearance, remove the cap, loosen the wheel nuts then jack up the front end

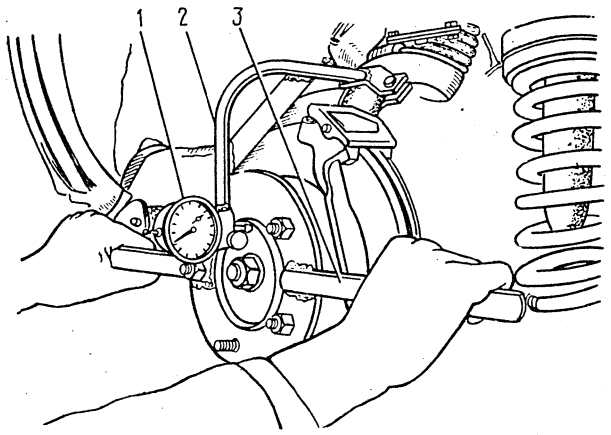


Fig.4.4. Checking the End Play in Front Wheel Hub Bearings:
1 - indicator; 2 - gauge 67.7834-9507; 3 - lever 67.7820-9521

of the car, put it on a support and remove the front wheel.

Remove the front brake caliper with brake shoes. See that the caliper does not hang down from the H.P. hoses.

Fasten gauge 67.7834-9507 with an indicator (Fig. 4-4) on the steering knuckle so that the indicator spindle bears against the wheel hub as near to the adjusting nut as possible. Turning the hub back and forth, move it with lever 67.7820-9521 along the steering knuckle axis (forward and back). Measure the displacement (clearance) with the indicator.

If the clearance is larger than 0.15 mm, adjust it as follows:

- unscrew the adjusting nut from the outer joint housing extension;
- install a new nut or a used nut from another car and screw it on with a torque of 20 N.m (2 kgf.m), at the same time rotating the hub back and forth two or three times to allow the bearing rollers to seek their proper places;
- loosen the adjusting nut and tighten it up again with a torque of 7 N.m (0.7 kgf.m);
- make mark B on the washer (Fig. 4-5), then back off the nut through 20 - 25° until the first edge A gets in line with the mark;

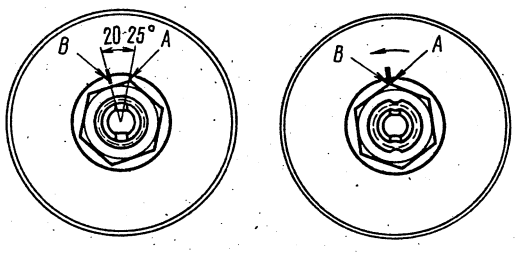


Fig.4-5. Adjusting the Front Wheel Hub Bearings:
A - nut edge; B - mark on washer

- lock the nut in this position, forcing the metal on the nut neck into the slots on the end of the outer joint race extension.

After adjustments, the clearance in the bearing should range from 0.01 to 0.07 mm.

Replacing the Lubricant in Front Wheel Hub Bearings

Do the following on both sides of the car:

- jack up the front end of the car and remove the wheel;
- unbend the edges of the brake front protective housing, unscrew the bolts of the brake shoe guide and take the brake caliper off the brake disc, shifting it aside. Do not disconnect the brake hoses so as to prevent ingress of air into the hydraulic system and see that the caliper does not hang on the hoses;
- using remover tool 67.7823-9514, remove the cap from the wheel hub, unscrew the adjusting nut and remove bushing 18 (Fig. 4-1);
- taking care not to damage gland 22, remove hub 16 complete with the brake disc;
- put a support under lower wishbone 1 and ease down the front end of the car a little so as to compress spring 4;
- disconnect lower ball joint 13 from the wishbone;
- detach shock absorber 9 from lower wishbone 1 and the side steering rod from steering knuckle arm 25;
- shift the front wheel drive shaft all the way towards the front axle;
- turning steering knuckle 25 relative to upper ball joint 36, remove the knuckle from housing extension 20;
- using handle 67.7853-9535 with washer 67.7853-9540, drive the inner races of bearings 24 from the steering knuckle space complete with dismantling rings and glands 22. Drive out the outer races of bearings with washer 67.7853-9534 and drive them in with the aid of mandrel 67.7853-9536. Mark the bearing races so as to install them back where they belong;
- remove the old lubricant and wash with kerosene the inner space of the steering knuckle, outer and inner spaces of the hub, constant velocity joint housing extension and bearings;
- pack 40 g of fresh grease Литол-24 into the bearing cages, apply it in a uniform layer to the steering knuckle spaces between the bearings and lubricate the splines of the joint housing extension;
- install the bearing inner races, the dismantling rings and drive in the glands;
- put the steering knuckle on the extension of the joint housing and connect the ball joint to the lower wishbone;