CONTENTS

Section I
GENERAL DATA

SPECIFICATIONS

Seating capacity, driver included ... 4
Payload, kg 400
Gross mass (fully serviced car less payload), kg 1550
Overall dimensions ..... see Fig. 1-1
Maximum speed in top gear, km/h:
with driver and passenger 132
fully laden 130
Acceleration time from rest to 100 km/h through gears, s:
with driver and passenger 23
fully laden 25
Minimum turning radius, outer front wheel track, m 5.5
Maximum gradeability, fully laden, without acceleration, in 1st gear, %. 58
Braking distance, fully laden, at 80 km/h, m 40

Engine

Model 2121
Type ..... four-stroke, gasoline carburettor
Number and arrangement of cylinders . four in-line
Bore/stroke, mm 79x80
Displacement, l 1.568
Compression ratio 8.5
Rated horsepower, kW (hp):
GOST 14846-81 (net) and ISO 1585-82 ..... 53.7(73.0)
DIN 70020 ..... 54.8(74.5)

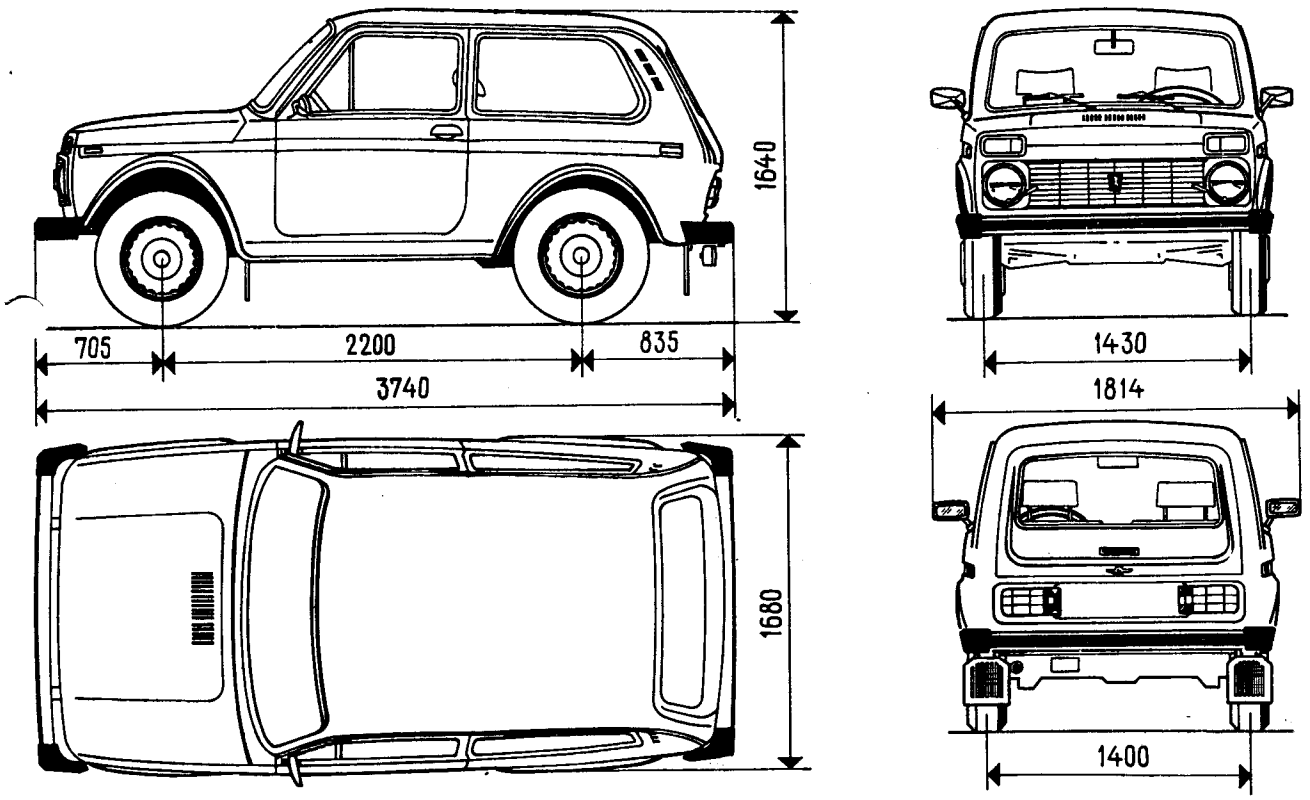

Fig. 1-1. VAZ-2121 Car. Main Overall Dimensions

Crankshaft speed at rated power, min^{-1} 5400
Maximum torque, N.m (kgf.m):
GOST 14846-81 (net) and ISO 1585-82 ..... 114(11.6)
DIN 70020 ..... 116(11.8)
Crankshaft speed at maximum torque, min^{-1} 3400
Firing order ..... 1 - 3 - 4 - 2

Power Train

Clutch ..... dry, single-plate with central pressure spring
Gearbox ..... mechanically-operated, three sliding gears, four- or five-speed
Gear ratios:
1st gear 3.67
2nd gear 2.10
3rd gear 1.36
4th gear 1.00
5th gear 0.82
reverse 3.53
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 universal joints and slip yokes
front axle-to-wheels ..... open, with constant velocity universal joints
Front and rear axle final drives ... bevel, hypoid
gear ratio 4.1
differential ..... bevel, two pinion type

Running Gear

Front suspension ..... independent, lateral 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
Wheels ..... disk, drop-forged
Rim size 127J-406 (5J-16)
Tyres ..... radial or cross-ply, tube type
size ..... cross-ply - 175-16 (6.95-16)
radial-ply - 175/80R16

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, to all wheels

Parking brake	hand-operated, cable-controlled, to rear brake shoes

Electrical Equipment

Wiring system	single-wire, negative ground return
Rated voltage, V	12
Storage battery	55 Ah at 20-h discharge rate
Alternator	with built-in rectifier. Current output 42 A at 5000 min^{-1} rotor speed
Starter	with electromagnetic solenoid switch and overrunning clutch, power 1.3 kW
Spark plugs	АИ7ДВ, FM14-175/2 or FE65P, thread M14x1.25

Body

Model	2121
Type	all-metal, three-door, unitized

MAIN ADJUSTMENT AND CHECK DATA

Valve clearances, engine cold, mm	0.15
Minimum crankshaft speed at idling, min^{-1}	850-900 (720-800[*])
Oil pressure in engine lubricating system, MPa (kgf/cm^2)	0.35-0.45 (3.5-4.5)
Initial ignition advance angle BTDC, deg	5-7 (3-5[*])
Breaker point gap, mm	0.4 ±0.05
Spark plug gap, mm	0.5 - 0.6
Coolant temperature in warmed up engine, °C	95
Coolant level in expansion tank, engine cold	3-4 cm above MIN mark
Deflection of fan drive belt at 100 N (10 kgf), mm	10-15
Brake fluid level in brake and clutch fluid reservoirs	to lower edge of filler necks
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 of laden car after running-in, measured between wheel rims, mm	2-4
Camber of front wheels of laden car after running-in, deg (mm)	0°30' ±20' (1-5)
Caster of front wheels on laden car after running-in	3°30' ± 30'
Tyre pressure, MPa (kgf/cm^2):	
front wheels	0.18 (1.8)
rear wheels	0.17 (1.7)
Maximum gradient of dry firm ground on which fully laden car is held infinitely by parking brake with brake lever shifted through 4-5 teeth of quadrant, %	30
Axial play in front wheel hub bearings, mm	0.01 - 0.07

FUELS, LUBRICANTS AND FLUIDS

Unit	Qty, l	Material
Fuel tank (including 4-6.5 l reserve)	42	Automotive gasoline АИ-93
Engine cooling system (including body heating system)	10.7	Coolant ТОСОЛ А-40М
Engine lubricating system (including oil filter)	3.75	Engine oil:
from -25 °C to +20 °C		М-6з/10Г$_1$, all-weather
from -30 °C to +30 °C		М-5з/10Г$_1$, all-weather
from -25 °C to +45 °C		М-6з/12Г$_1$, all-weather
Gearbox housing	1.35[**]	Transmission oil ТАД-17И
Rear axle housing	1.3	
Steering gear case	0.215	
Transfer case housing	0.75	
Front axle housing	1.5	
Clutch hydraulic system	0.2	Hydraulic brake fluid "Neva" or "Tom"
Brake hydraulic system	0.66	
Front shock absorber	0.11	Shock absorber fluid МГП-10
Rear shock absorber	0.18	
Windshield and headlight washer tanks	2.0	Mixture of water with special fluid НИИСС-4
Front wheel hub bearings		Grease Литол-24

[*] For engines with carburettor 2106-1107010.

[**] 1.55 for five-speed gearbox.

Cont'd

Unit	Qty, l	Material
Starter drive carrier ring		
Universal joint cross bearings		Grease No. 158 or ФИОЛ-2У
Propeller shaft splined joints Seat slides Door locks and striker plates		Grease ФИОЛ-1
Front wheel drive joints		Grease ШРУС-4
Steering rod joints and front suspension ball pins		Grease ШРБ-4

Cont'd

Unit	Qty, l	Material
Storage battery terminals and clamps Door key holes Hood prop Door checks		Aerosol petrolatum ВТВ-1
Pressure regulator		Grease ДТ-1
Engine detergent oil (used when replacing lubricating oil)		Detergent oil ВНИИНП-ФД

Section II
ENGINE

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

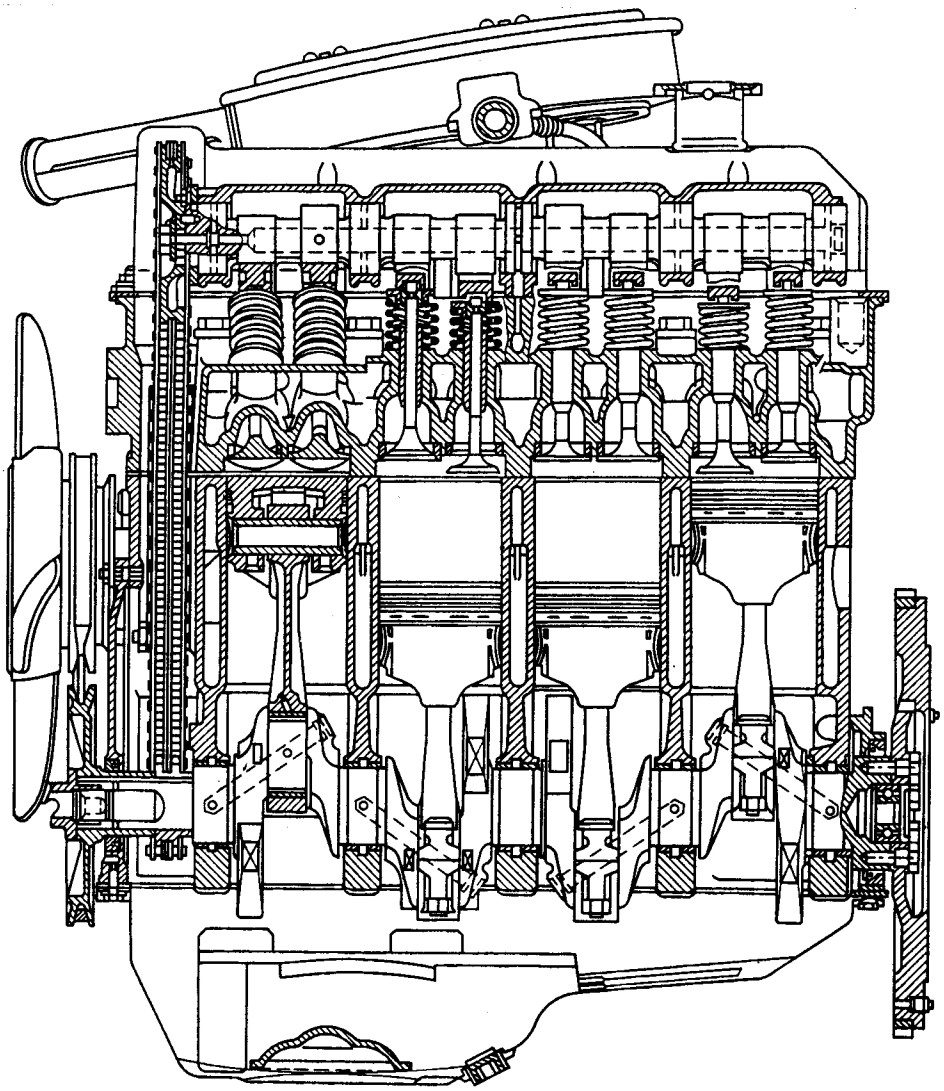

Fig. 2-1. Engine. Longitudinal Section

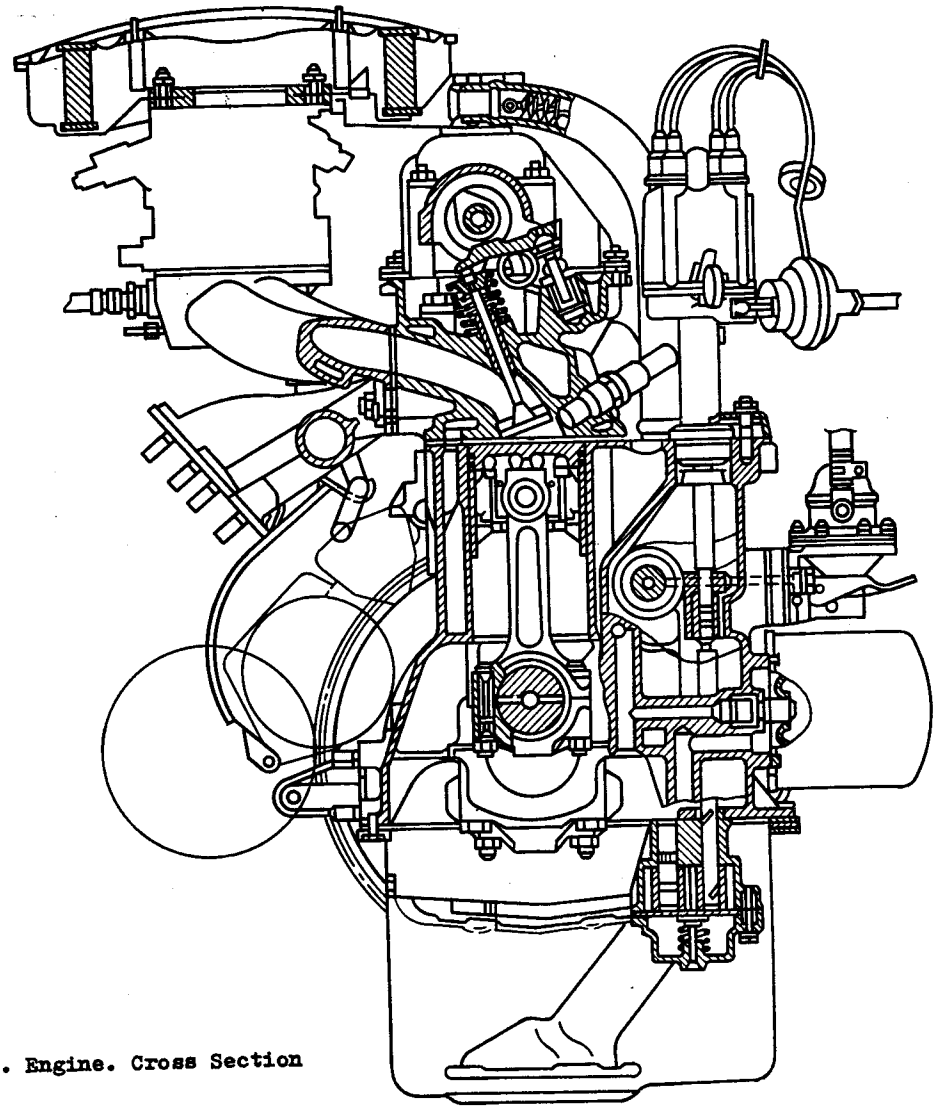

Fig. 2-2. Engine. Cross Section

TROUBLE SHOOTING

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Cause	Remedy
Engine Fails to Start	
1. No. fuel in carburettor:	
(a) fuel pipes or carburettor and fuel pump filters clogged	(a) wash and airblast fuel tank and pipes and filters
(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 when starting engine	3. Eliminate poor tightness of carburettor choke mechanism
Engine Runs Unevenly or Stalls When Idling	
1. Wrong idling adjustment	1. Adjust idling speed
2. Air inleakage through damaged drain pipe	2. Replace drain pipe
3. Air inleakage through damaged hose leading from intake manifold to brake vacuum booster	3. Replace damaged hose
4. Air inleakage through gaskets in joints between intake manifold and carburettor or cylinder head	4. Tighten up nuts or replace gaskets
5. Wrong clearances between valve rockers and camshaft cams	5. Adjust clearances
6. Carburettor faulty:	
(a) carburettor	(a) airblast jets and

Cont'd

Cause	Remedy
jets or channels obstructed	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 throttle valves 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 rocker-to-cam clearances	6. Adjust clearances
7. Poor compression, below 1 MPa (10 kgf/cm^2):	
(a) defective 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 Knocks

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

Cont'd

Cause	Remedy
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 and thicker ones

Big-End Bearing Knocks

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

Piston Slaps

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 a 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 Knocks

Excessive clearances in valve gear cause characteristic knocks, usually with 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-rocker 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 rockers
5. Loosening of adjusting bolt locknut	5. Adjust valve rocker-to-cam clearance and tighten locknut

Cont'd

Cause	Remedy
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 it 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 of oil pump	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. Broken piston rings	3. Replace rings
4. Gummed slots in oil control rings or 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. Adjust 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

Cont'd

Cause	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 interfering 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 alternator 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 outside	4. Clean radiator with jet of water
5. Thermostat faulty	5. Replace thermostat
6. Defective valve in radiator cap [opening pressure below 0.05 MPa (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.

Place the car on a lift or inspection pit. emove the hood. Take away the spare wheel and emove its supporting tube.

Disconnect the wires from the storage battery nd from the engine-mounted electrical devices.

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

Caution

To avoid damaging the radiator, unscrew the rain plug with one wrench and hold the plug union oldered into the radiator with another. Preferably use a socket or box wrench not to mutilate the lug faces

move the fan shroud, first disconnecting ts halves. Disconnect the coolant inlet and outet hoses from the engine and take off the radiator complete with the thermostat and hoses.

Remove the air cleaner, first disconnecting he hoses, removing the cover and the filter 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 laid to the heater and vacuum brake booster.

Using 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 articulated socket wrench A.55035, turn off the clutch housing-to-cylinder block bolts.

Suspend 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 mount pads 3 (Fig. 2-3) to the side brackets and unscrew the nuts and the bolt which fastens the front axle housing to the engine brackets.

Take out the engine, first moving it upward to withdraw the mount pad bolts from the bracket holes, then shift it forward so as to pull the end of the gearbox clutch shaft out of the bearing in the crankshaft flange.

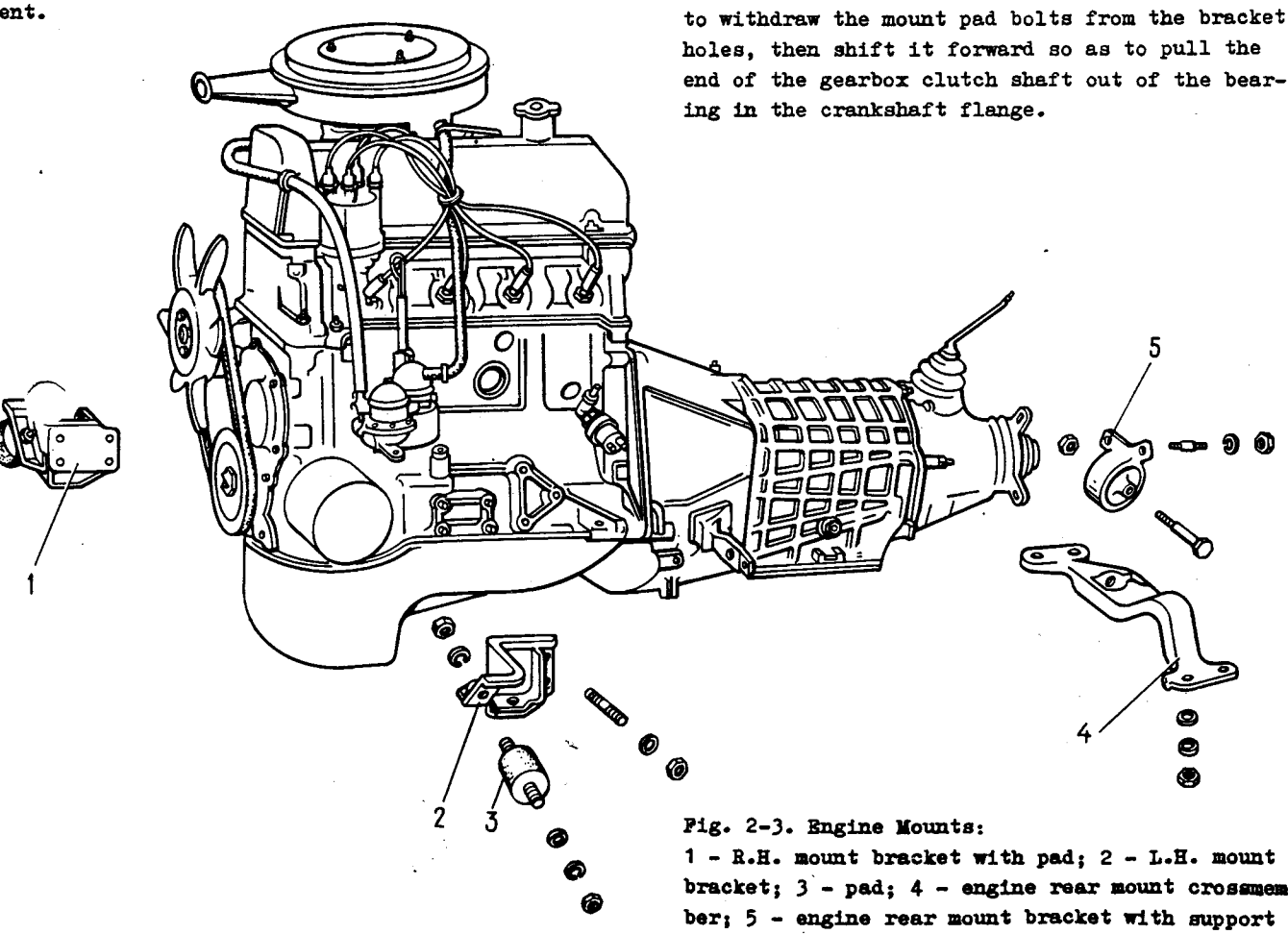


Fig. 2-3. Engine Mounts:
1 - R.H. mount bracket with pad; 2 - L.H. mount bracket; 3 - pad; 4 - engine rear mount crossmember; 5 - engine rear mount bracket with support

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

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 clutch 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 mount pads 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 alternator and coolant pump drive belt, remove the alternator 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 tool A.60312 unscrew and take off the oil filter with the gasket (Fig. 2-4).

Unscrew the oil pressure and oil pressure warning lamp transmitters and remove their 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 jaws 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.

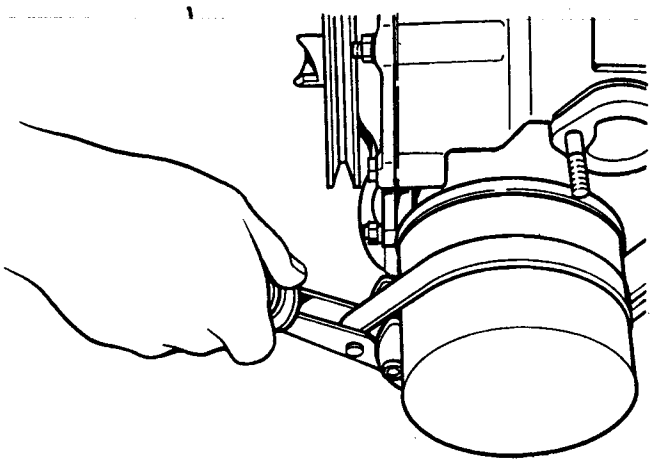


Fig. 2-4. Removing Oil Filter with Remover Tool A.60312

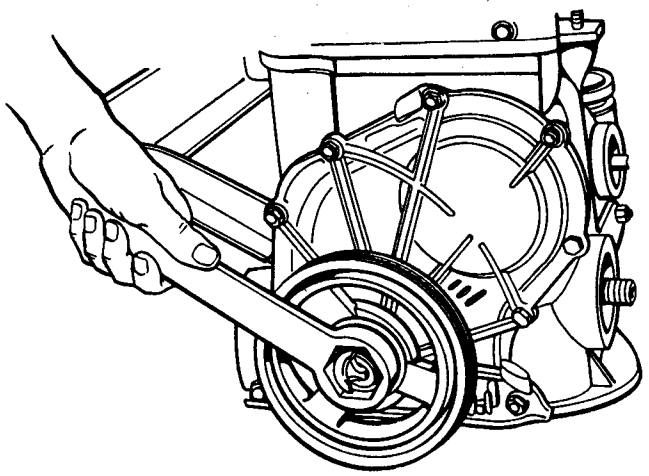


Fig. 2-5. Unscrewing Crankshaft Starting Jaw with Wrench A.50121

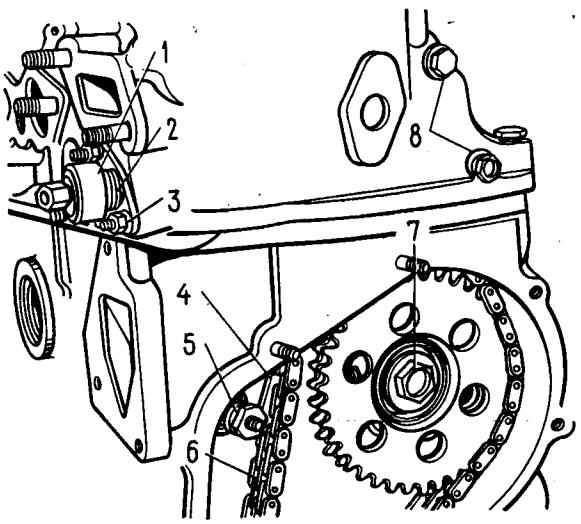
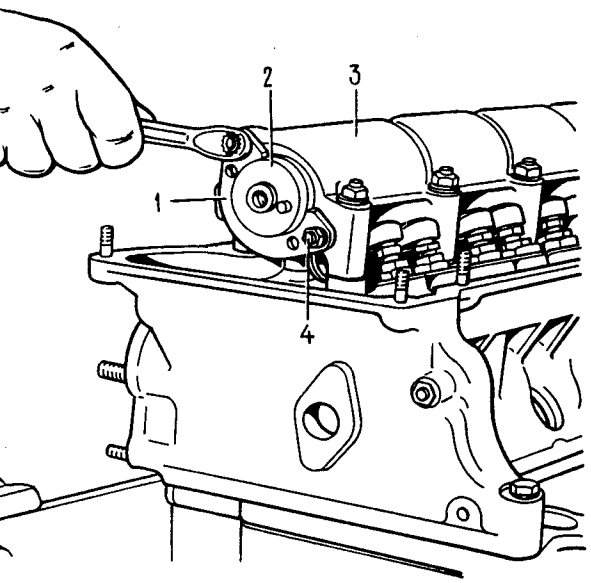
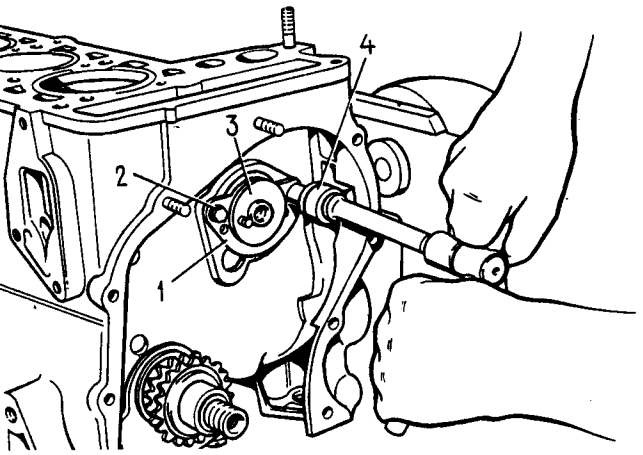


Fig. 2-6. Removing Chain Tensioner and Damper:
1 - tensioner cap nut; 2 - tensioner body;
3 - tensioner fastening nut; 4 - tensioner shoe;
5 - shoe bolt; 6 - camshaft drive (timing) chain;
7 - oil pump drive shaft sprocket bolt; 8 - damper bolts

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.



g. 2-7. Removing Camshaft Thrust Flange:
- ust flange; 2 - camshaft; 3 - bearing hous-
g; - thrust flange fastening stud



g. 2-8. Removing Oil Pump Drive Shaft:
- thrust flange; 2 - flange bolt; 3 - oil pump
iv haft; 4 - wrench

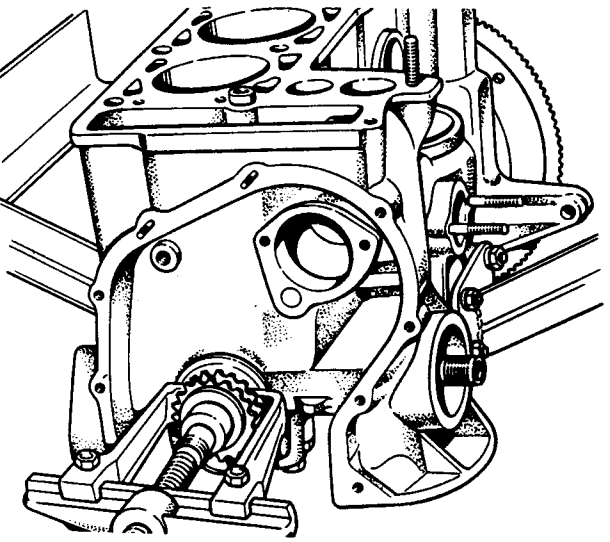


Fig. 2-9. Removing Crankshaft Sprocket with General-Purpose Remover Tool A.40005/1/7

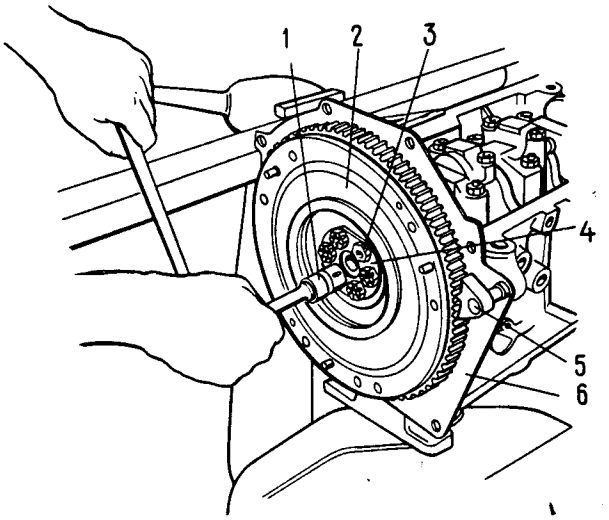


Fig. 2-10. Removing Flywheel:
1 - wrench; 2 -flywheel; 3 - flywheel bolt;
4 - washer; 5 - fixing tool A.60330/R to prevent turning of flywheel; 6 - clutch housing front cover

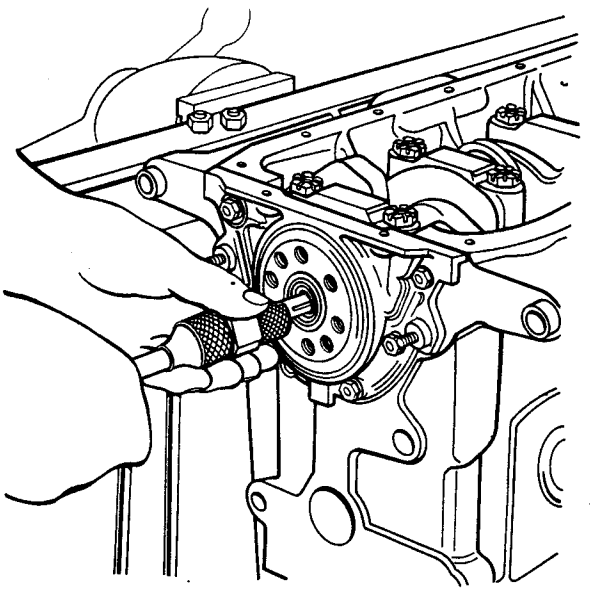


Fig. 2-11. Pressing Out Gearbox Shaft Bearing from Crankshaft with Remover Tool A.40006

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 take 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 intake manifolds.

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

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

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

Insert shells without grooves into the bed and cap of the middle bearing; install shells with grooves 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 by thickness as instructed under "Crankshaft and Flywheel". Install the main bearing caps in accordance with their marks (Fig. 2-13).

Caution

Install the main bearing caps into the cylinder block where they belong. For this purpose the cylinder block and its bearing caps are marked with the same conventional number (Figs 2-13 and 2-24).

Install the thrust half-rings with their recesses facing the thrust surfaces of the crankshaft. 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 bushing from set 02.7854.9500, insert the pistons with connecting rods into the cylinders (Fig. 2-15). Set 02.7854.9500 comprises an inserter bushing for the standard-size pistons and bushings for the repair-size pistons (0.4 and 0.8 mm oversize). Therefore, select the inserter bushing corresponding to the size of the piston being installed.

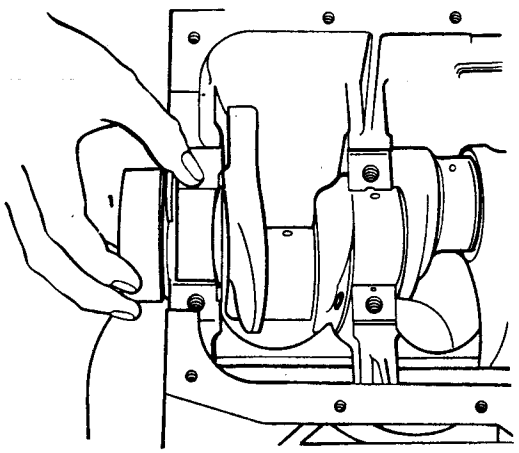


Fig. 2-12. Installing Thrust Half-Rings on Rear Support

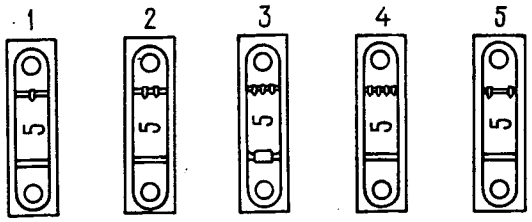


Fig. 2-13. Marks on Main Bearing Caps (bearings are counted from engine front) and Cylinder Block Code Number

* Since 1986 lower shells of the main bearings without grooves on the inner surface are used.

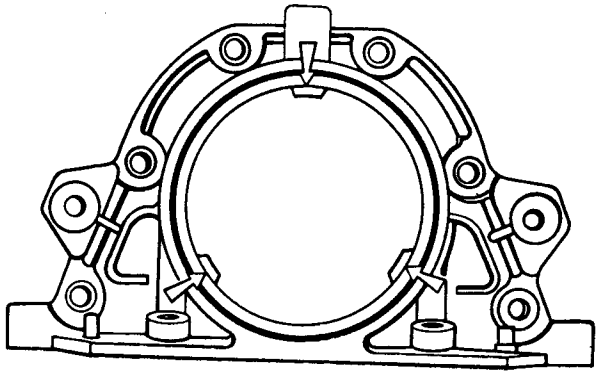
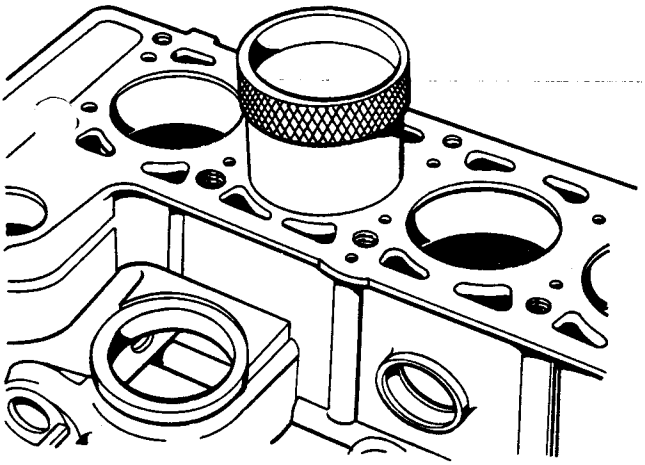
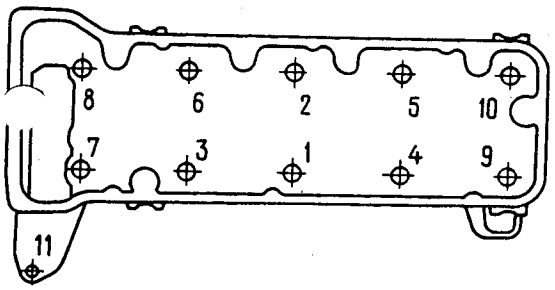


Fig. 2-14. Crankshaft Rear Gland Holder. Arrows Indicate Lugs for Aligning Holder with Crankshaft Flange



ig. 2-15. Installing Piston with Piston Rings into ylinder with Piston Inserter Bushing from Set 2.7854.9500



g. 2-16. Sequence of Tightening Cylinder Head Bolt

Caution

The hole for the pin in the piston is offset 2 mm, therefore the pistons should be installed to the cylinder with the mark "∏" facing the gine front.

Put the bearing shells into the connecting ds and their caps. Join the connecting rods with

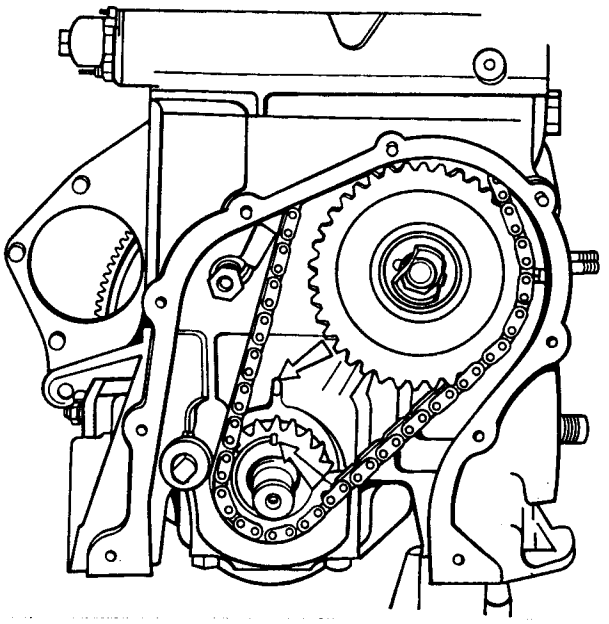


Fig. 2-17. Alignment of Timing Marks on Crankshaft Sprocket and on Cylinder Block

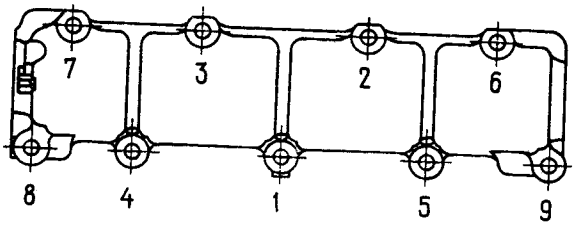


Fig. 2-18. Sequence of Tightening Camshaft Bearing Housing Nuts

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 compete with the gasket, exhaust and intake manifolds. Tighten the fastening bolts in two steps in the sequence shown in Fig. 2-16:

- tighten bolts 1 through 10 preliminarily with a torque of 33.3 - 41.16 N.m (3.4 - 4.2 kgf.m);
- tighten bolts 1 through 10 finally with a torque of 95.94 - 118.38 N.m (9.79 - 12 kgf.m) and bolt 11 with a torque of 31.36 - 39.1 N.m (3.2 - 3.99 kgf.m).

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

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

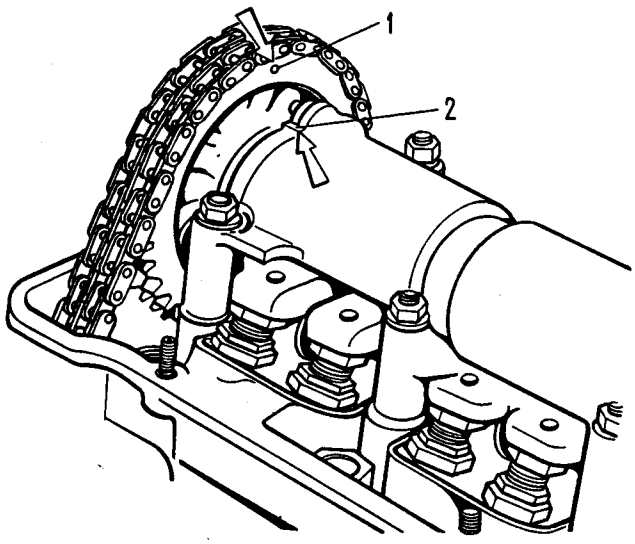


Fig. 2-19. Alignment of Timing Marks on Camshaft Sprocket and on Bearing Housing:
1 - mark on sprocket; 2 - mark on bearing housing

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 lines up 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 lock the sprocket bolts by the lock washers; if the marks fail to coincide, repeat the chain installation operations.

Adjust the valve rocker-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 cra tighten up its fastening bolts and n

Install the crankshaft pulley a starting jaws.

Install the oil filter, screwing cylinder block union handtight. Insta separator of the crankcase breathing the breather cover and secure the ret oil separator drain pipe.

Install the oil pump and the oil its gasket.

Install the coolant pump, alterna and alternator. Run the belt over the adjust its tension.

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

Install the gauge transmitters.

Install the oil pump and ignition drive gear. Install the ignition distr adjust ignition timing. Screw in the sp and tighten them with torque-indicating 67.7812.9515.

Install the fuel pump as instructe "Fuel System".

Install the carburettor and connec hoses.

Install the cylinder head cover wi ket and fuel line bracket.

Install the air cleaner; for this p secure the hoses on the air cleaner body cleaner body with the gasket on the carb install the supporting plate and fasten with nuts. Put in the filter element and the cleaner cover.

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

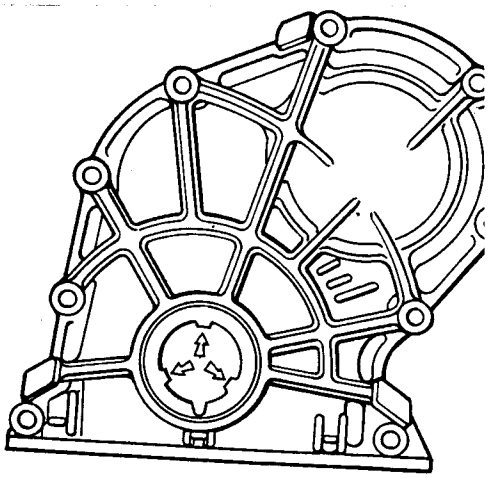


Fig. 2-20. Camshaft Drive Cover. Arrows Sh for Aligning Cover with Crankshaft Pulley

ENGINE STAND TESTS

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

2 min at 850 - 900 rpm
3 min at 1000 rpm
4 min at 1500 rpm, and
5 min at 2000 rpm.

While running-in a repaired engine do not operate it at maximum speed.

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

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

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

If oil leaks are detected past the gasket between the cylinder head and cover or past 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 the 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 working-in period is required.

This applies particularly to the engines where pistons, big-end and main bearings were replaced, the crankshaft journals 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 it carefully for correct 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 linkage ensures complete closing and opening of the throttle and choke valves and adjust the linkage, if necessary;
- alternator drive belt tension; adjust, if necessary;
- see that the wire contacts of electrical equipment are in good condition;
- check to see that the warning 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.

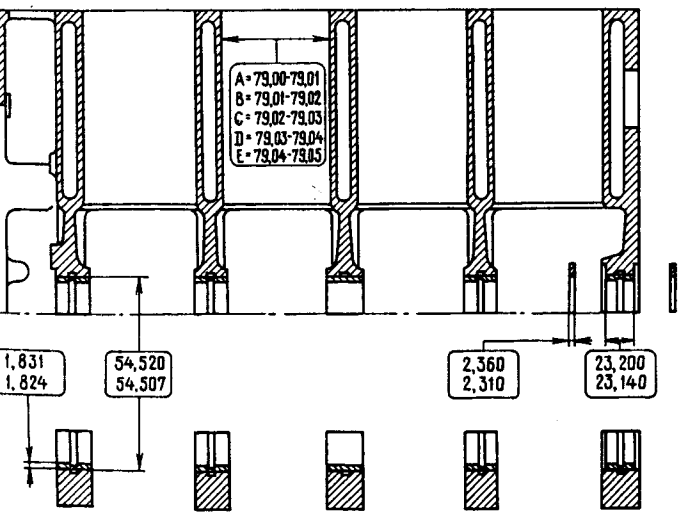


Fig. 2-21. Main Dimensions of Cylinder Block

GENERAL CLEANING AND INSPECTION

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

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. For this purpose plug the holes in the cooling jacket and deliver water at a room temperature under a pressure of 0.3 MPa (3 kgf/cm^2).

There should be no water leaks from the cylinder block in the course of 2 min.

If oil gets into the coolant, before proceeding to disassembling the engine check the cylinder block for cracks in the oil channel zones. For this

purpose drain the coolant from the cooling system, remove the cylinder head, fill the cylinder block cooling jacket with water and deliver compressed air into the vertical oil channel in the cylinder block. If air bubbles appear in the water filling the cooling jacket, replace the cylinder block.

Cylinders

Check the cylinders for wear which should not exceed 0.15 mm (the maximum tolerable value).

The cylinder bore is measured with an internal gauge (Fig. 2-22) in four zones, both along and across the engine (Fig. 2-23). Ring gauge 67.8125.9501is used to set the internal gauge to zero.

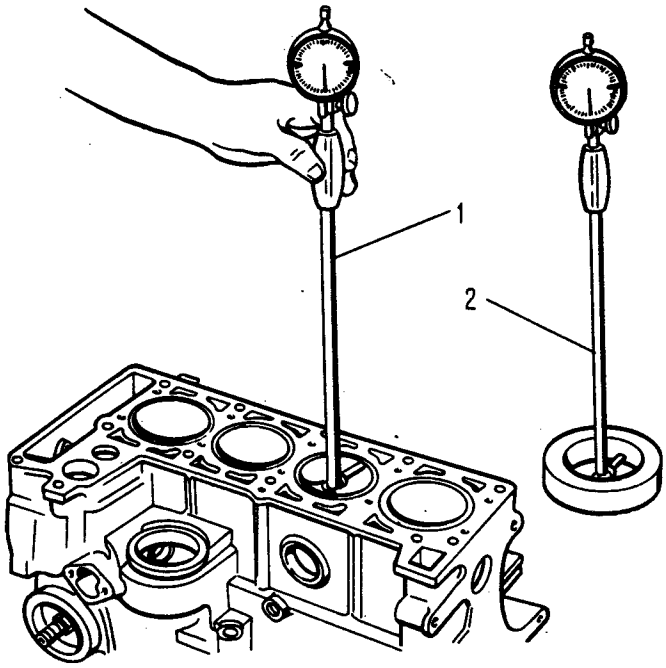


Fig. 2-22. Measuring Cylinders with Internal Gauge: 1 - internal gauge; 2 - zeroing internal gauge by check gauge

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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). The same face and the main bearing caps bear a conventional number of the cylinder block which indicates that the bearing caps belong to this particular block.

In zone No. 1 the cylinders practically do not wear, so this zone may be used as a reference one for determining cylinder wear in other three zones.

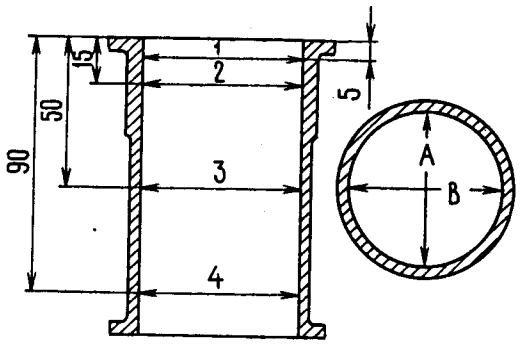


Fig. 2-23. Cylinder Measurement Diagram: A and B - directions of measurements; 1, 2, 3, 4 - zone numbers

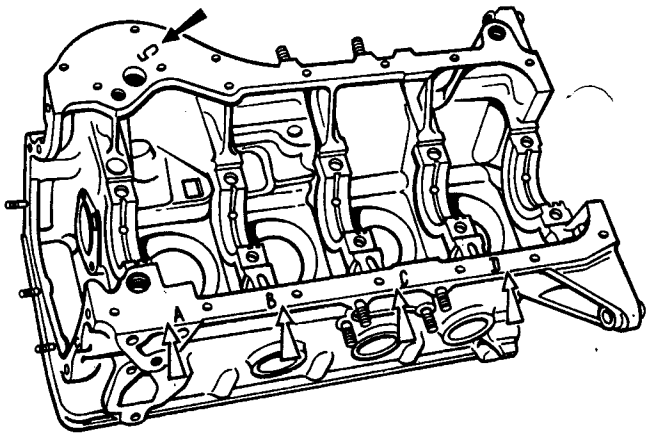


Fig. 2-24. Cylinder Block Marked with Cylinder Size Group (White Arrows) and Cylinder Block Code Number (Black Arrow)

If the maximum wear exceeds 0.15 mm, b[illegible] the cylinders to match the nearest repair size o[illegible] the piston (0.4 or 0.8 mm oversize) with an 0.03 mm allowance in diameter for honing. Then hone the cylinders to the diameter providing the designed clearance between the piston of the selected repair size and the cylinder equal to 0.06 - 0.08 mm.

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.

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

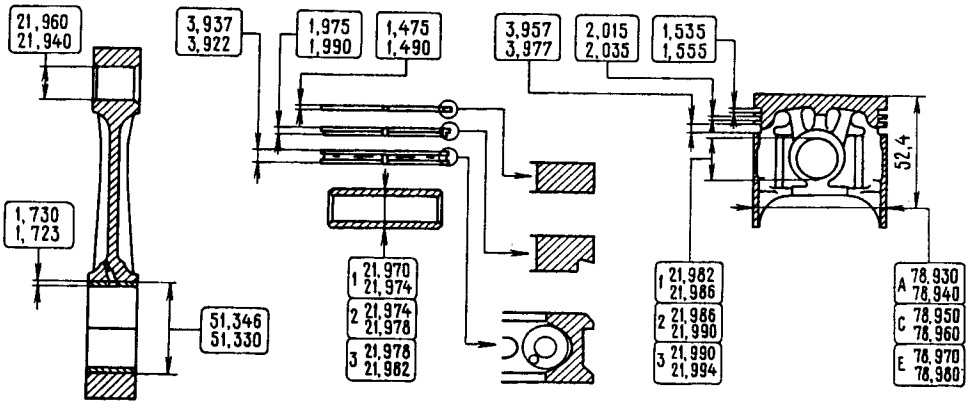


Fig. 2-25. Main Dimensions of Piston, Connecting Rod, Piston Pin and Piston Rings

PRESSING OUT 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 from all deposits.

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 the. Replace the bearing shells if they are deeply scratched or heavily worn.

PISTON-TO-CYLINDER MATCHING

The designed clearance between the piston and cylinder (for new parts) is 0.06 - 0.08 mm. The clearance is determined by measuring the cylinders and pistons and fitting the pistons and cylinders belonging to the same class. The maximum clearance (caused by wear) should not exceed 0.15 mm.

Note. The diameter of the piston is checked in the plane perpendicular to the piston pin at a distance of 52.4 mm from the piston crown (Fig. 2-25).

The pistons are divided into five classes (A, B, C, D and E) by the outside diameter, in 0.01 mm steps and into three categories, in 0.004 mm steps by the diameter of the piston pin hole. The class of the piston (letter) and the category of the piston pin hole (figure) are indented on the piston crown.

If the clearance in a used engine exceeds 0.15 mm, select the pistons to the cylinders to provide the clearance as close to the designed value as possible.

Delivered for spares are pistons of classes A, C and E. These classes permit matching the piston to any cylinder as both the pistons and cylinders are divided into classes with a certain overlapping of dimensions.

CHECKING PISTON-TO-PIN CLEARANCE

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

Note. With respect to the outside diameter the piston pins are divided into three categories in

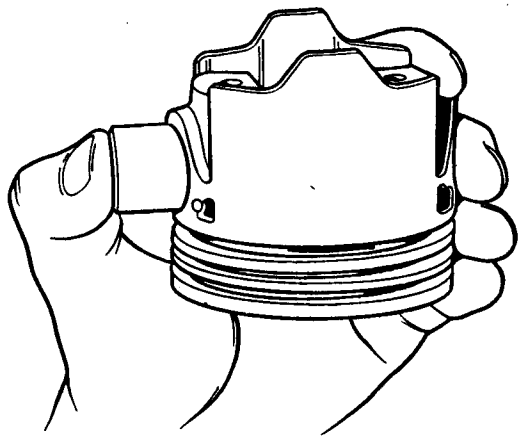


Fig. 2-26. Piston Pin Should Go in Under Thumb Pressure

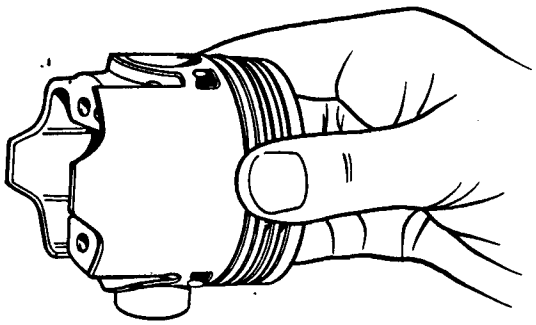


Fig. 2-27. Checking Piston Pin Fit

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

CHECKING 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 0.45 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 BEARING SHELL-TO-CRANKSHAFT CLEARANCES

The clearance between the bearing shells and the crankshaft journals 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;
- 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 50.96 N.m (5.2 kgf.m);
- remove the cap and determine the flattening of the wire (Fig. 2-29) against the scale on the wire packing, thus finding the clearance.

If the clearance is within the tolerance limits (0.036 - 0.086 mm) or does not exceed the wear limit (0.10 mm), 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".

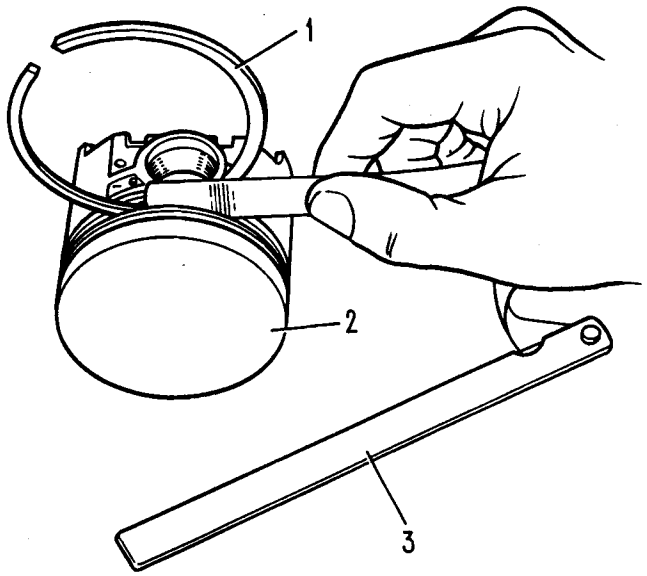


Fig. 2-28. Checking Piston Ring Side Clearance:
1 - piston ring; 2 - piston; 3 - set of feeler gauges

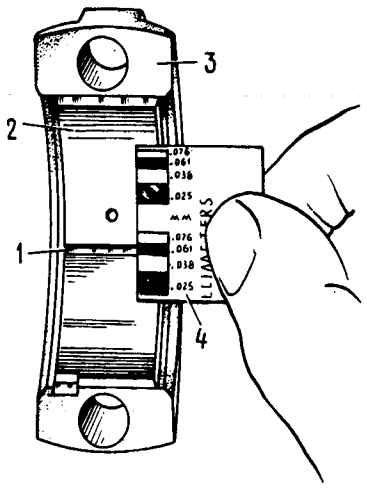


Fig. 2-29. Measuring Width of Flattened Calibrated Wire Against Scale:
1 - calibrated wire; 2 - shell; 3 - big-end bearing cap; 4 - scale

Table 2-1

Thickness of Connecting Rod Bearing Shells, mm

Nominal	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, 0.50, etc. indicate the reduction in the diameter of the big-end journals after grinding.

CHECKING PISTON MASS

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

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.

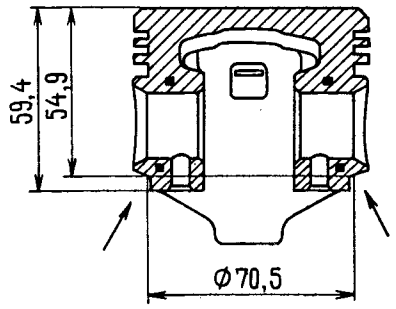


Fig. 2-30. Points (Shown by Arrows) Where Metal Can Be Removed to Equalize Piston Weights

ASSEMBLING 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 oven.

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

For correct jointing of the pin with the connecting rod, press in the pin as rapidly as possible, since the connecting rod cools 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

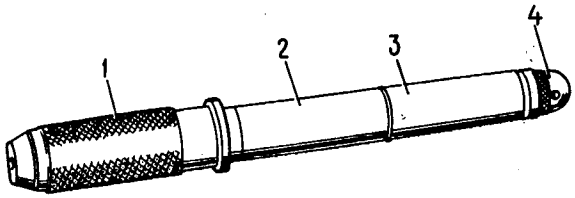


Fig. 2-31. Tool 02.7853.9500 for Press-Fitting Piston Pin into Piston and Connecting Rod End: 1 - tool shaft; 2 - piston pin; 3 - guide; 4 - thrust screw

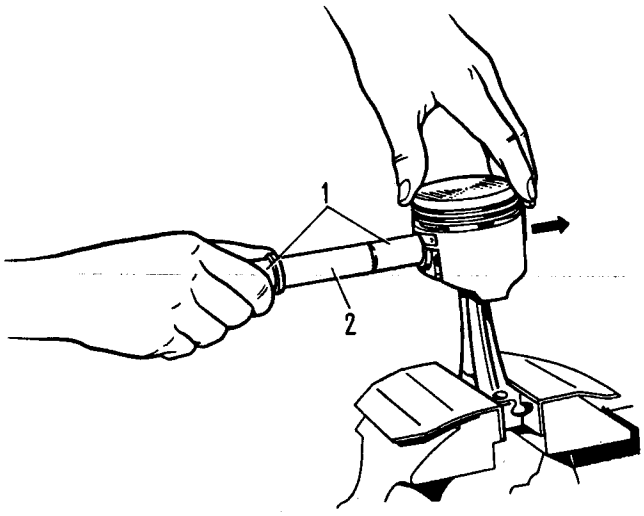


Fig. 2-32. Press-Fitting Piston Pin into Connecting Rod Small End: 1 - tool 02.7853.9500; 2 - piston pin. The piston should rest on connecting rod end as shown by arrow

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 oven 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 small end (Fig. 2-32) until the shoulder of the tool comes in contact with the piston.

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 step 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 and 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. During assembly see that the figures on the connecting rod and cap are located on the same side.

CHECKING 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.95615 as follows:

- 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 thrusts 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 dowel 1 of indicator 9 on head 2 of the spindle inserted into the pin;

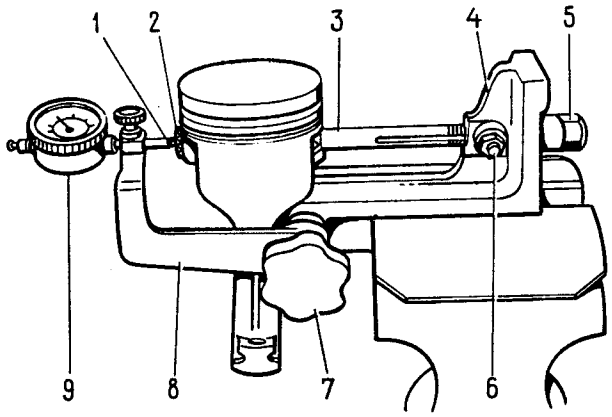


Fig. 2-33. Assembled Piston-Pin-Connecting Rod Group Installed on Tester A.95615 for Pin Pressing-Out Test:
1 - indicator dowel in contact with end of spindle; 2 - spindle head in contact with piston pin; 3 - threaded spindle with slot; 4 - base; 5 - spindle nut; 6 - spindle stop; 7 - bracket clamp handle;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

- set the indicator to zero and insert stop 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 12.7 N.m (1.3 kgf.m) which corresponds to an axial load of 3.92 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 CONNECTING ROD BIG END AND PISTON PIN AXES FOR PARALLELISM

Before installing an assembled connecting rod and piston group on the engine, check their axes for parallel alignment (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 the clearance is larger.

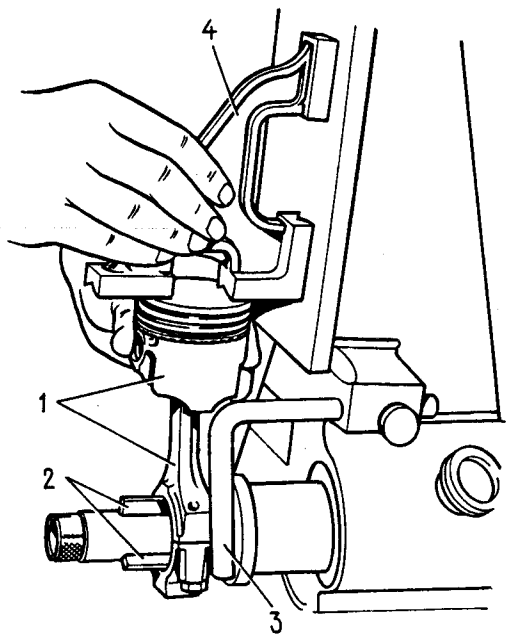


Fig. 2-34. Checking Axes of Piston Pin and Connecting Rod Big End for Parallelism:
1 - assembled connecting rod-pin-piston group; 2 - extensible blades; 3 - thrust bar; 4 - gauge

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

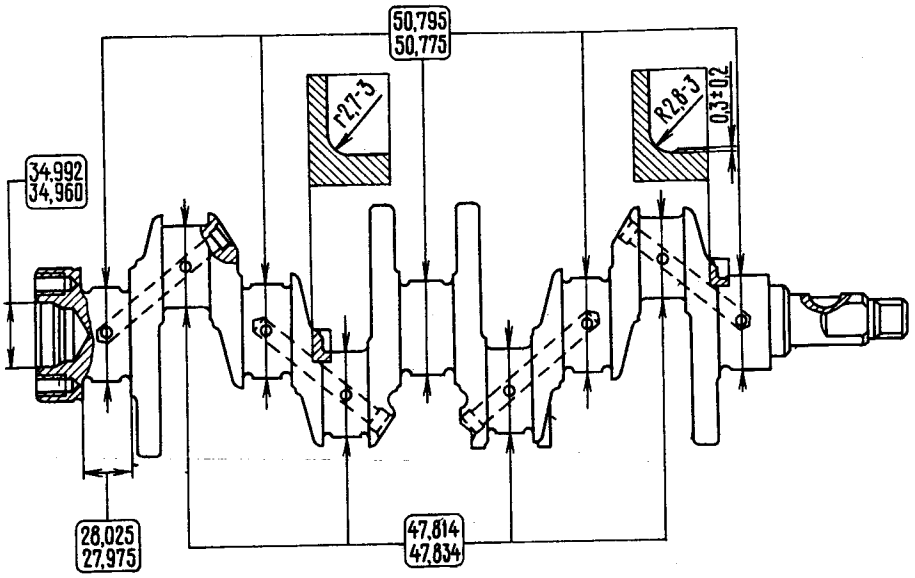


Fig. 2-35. Main Dimensions of Crankshaft Main and Big-End Journals and Fillets

CLEANING 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 MAIN AND BIG-END JOURNALS

Checking. Put the crankshaft on two V-blocks (Fig. 2-36) and using a dial indicator, check:

- runout of the main journals which should not exceed 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 relative to the plane passing through the axes of the big-end and main journals; the maximum permissible displacement is ±0.35 mm;

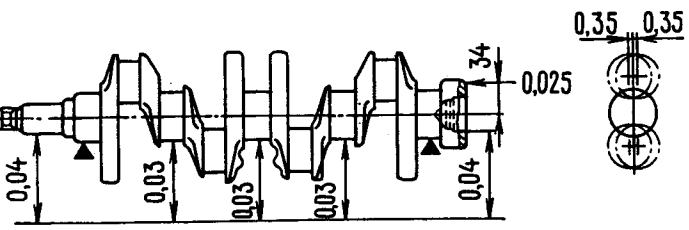


Fig. 2-36. Permissible Runout of Crankshaft Basic Surfaces

- out-of-squareness of the flange end surface relative to the crankshaft axis; with the crankshaft rotated, the indicator installed at the side, 34 mm from the shaft axis, should read runout not exceeding 0.025 mm (Fig. 2-36).

There should be no cracks on the main and big-end journals and webs of the crankshaft, otherwise the crankshaft should be replaced.

The surfaces of the crankshaft mating with the active edges of the glands should be free from scratches, scores and nicks.

Measure the diameters of the main and big-end journals. Grind the journals if their wear exceeds 0.03 mm or out-of-roundness is greater than 0.03 mm and also if the journals are scored or notched.

Grinding. Grind the main and big-end journals reducing their size by 0.25 mm to provide the diameters specified in Tables 2-2 and 2-3 and journal fillet radii as shown in Fig. 2-35.

Table 2-2

Diameter 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

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

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

removing the channel plugs. Mark No. 1 web of the crankshaft with the figure showing the reduction of the journal size (M 0.25; BE 0.50).

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

MAIN BEARING SHELLS

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

Check the shell-to-journal clearances as follows:

- 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 80.36 N.m (8.2 kgf.m);
- remove the caps, find the amount of flattening of the calibrated wire against the scale provided on its packing (Fig. 2-37), thus determining 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.

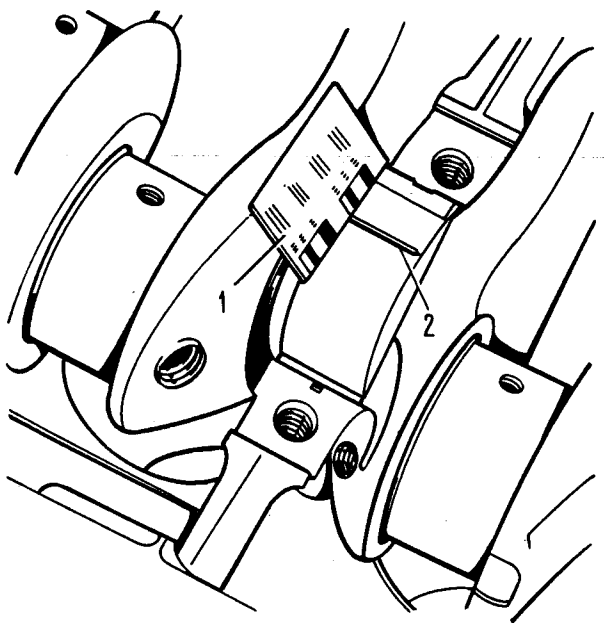


Fig. 2-37. Measuring Clearance with Scale:
1 - scale; 2 - calibrated wire

The nominal designed clearance is 0.050 - 0.095 mm. If the clearance is less than the maximum permissible limit (0.15 mm), the shells may be used again. If the clearance exceeds the maximum permissible limit, replace the shells on the journals with new ones. If the crankshaft journals are worn and reground to a repair size, replace the shells with repair size ones (of increased thickness, see Table 2-4).

Unobstructed turning of the crankshaft is an indication of correct assembly and journal-to-shell matching.

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, 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.

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

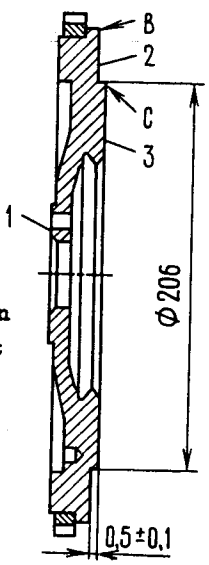


Fig. 2-38. Flywheel:
1 - flywheel-to-crankshaft flange fastening surface; 2 - clutch mounting surface; 3 - clutch driven disc supporting surface; B - point for checking runout of surface 2; C - point for checking runout of surface 3

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

CHECKING CRANKSHAFT END CLEARANCE

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

The end clearance between the thrust half- ings and the thrust surfaces of the crankshaft can e measured as follows:

- install an indicator on a magnetic support nd insert the blades of two screwdrivers as shown n Fig. 2-39;
- shift the crankshaft with the screwdrivers nd note the indicator reading. It should be within .06 and 0.26 mm.

If the clearance exceeds the maximum permis- ible limit of 0.35 mm, replace the thrust half- ings by new ones 0.127 mm oversize.

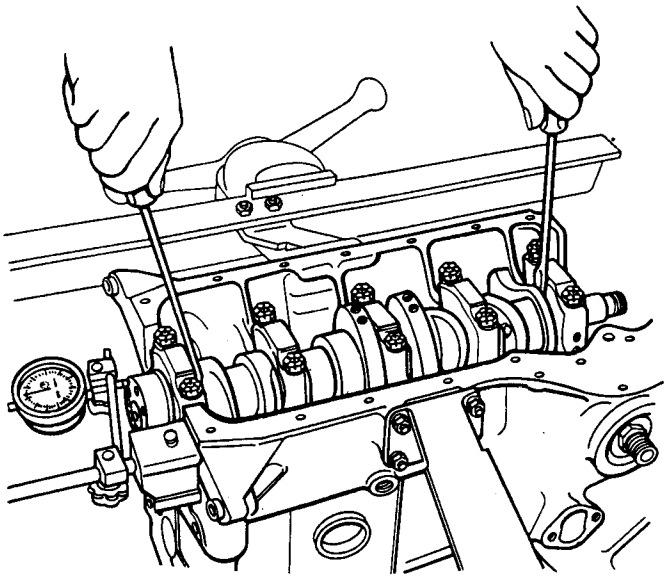


Fig. 2-39. Checking Crankshaft End Clearance

Note. The end clearance of the crankshaft can also be checked on the car-mounted engine using tool 67.8701.9510. In this case axial displacement of the crankshaft is produced by pressing and releasing the clutch pedal, and the end clearance is determined by measuring the displacement of the crankshaft front end.

CYLINDER HEAD AND VALVE GEAR

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

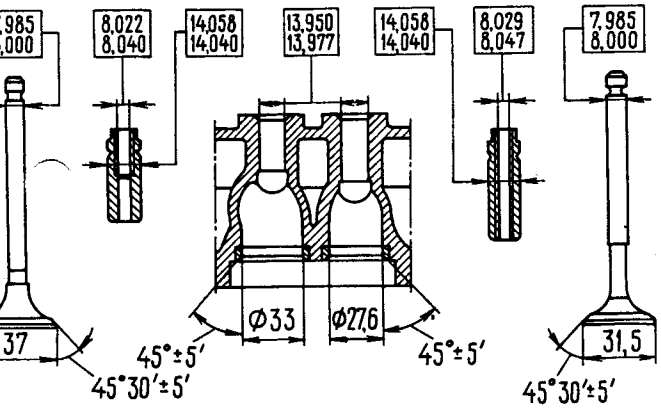


Fig. 2-40. Basic Dimensions of Cylinder Head, Valves and Valve Guides

REMOVAL AND INSTALLATION ON CAR-MOUNTED ENGINE

The cylinder head should be removed from the ar-mounted engine if its defects do not call for he removal of the engine, also when the maintenance ork is confined to decarbonization of the combus- tion 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;
- turn the crankshaft to align the mark on the pulley with the longer mark on the valve gear cover (Fig. 7-19), and the mark on the camshaft sprocket with the mark on the camshaft bearing housing (Fig. 2-19);
- 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, intake 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 intake 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 requirements:

- 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 33.32 - 41.16 N.m (3.4 - 4.2 kgf.m);

- 2nd step - tighten bolts No.1 through 10 with a torque of 95.94 - 118.38 N.m (9.79 - 12 kgf.m) and bolt No. 11 with a torque of 31.36 - 39.1 N.m (3.2 - 3.99 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 wraping the cover. It is recommended that the cover gasket should be replaced by a new one during engine repairs. Having installed the cylinder head check and time the ignition.

DISASSEMBLY AND ASSEMBLY

Put the cylinder head on plate A.60335.

Disconnect the exhaust and intake manifolds complete with the carburettor (simultaneously the hot air intake is removed).

Disconnect the outlet pipe of the cooling jacket.

Disconnect the pipe conducting the coolant to the heater.

Remove valve rockers 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 free the spring locks. 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.

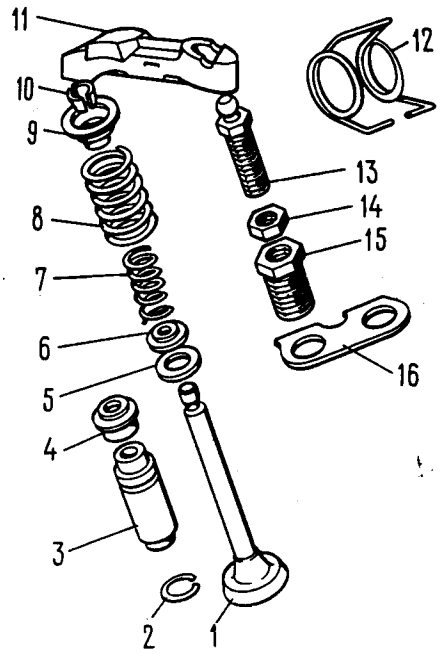


Fig. 2-41. Valve Gear Parts:
1 - valve; 2 - locking ring; 3 - valve guide; 4 - oil-deflecting cap; 5 - outer spring seat; 6 - inner spring seat; 7 - inner spring; 8 - outer spring; 9 - spring retainer; 10 - rocker spring locks; 11 - valve rocker; 12 - lever spring; 13 - adjusting bolt; 14 - adjusting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

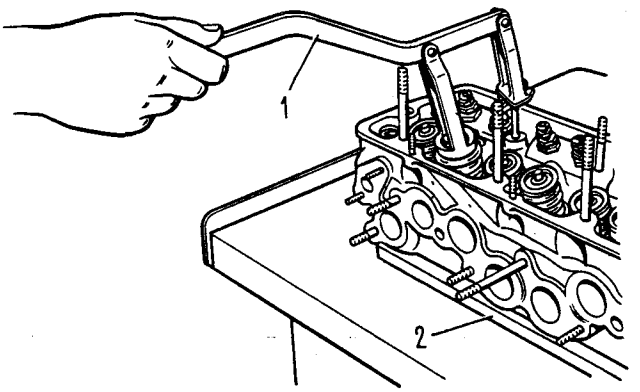


Fig. 2-42. Removing Valve Springs:
1 - tool A.60311/R; 2 - assembly plate A.60335

Remove the oil-deflecting caps from the valve guides.

Assemble the cylinder head by reversing the disassembly operations.

CLEANING 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

nlet channels and the oil channels leading to the alve rockers.

CHECKING AND GRINDING 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 ne valves) should be free from pin-point pits, orrosion and damage. Minor damage can be corrected y grinding the seats. In so doing try to remove as ittle metal as possible. Grinding can be performed ither manually or with a grinding machine.

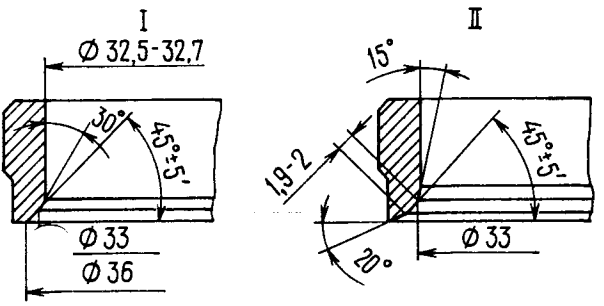


Fig. 2-43. Inlet Valve Seat Contour:
I - new seat; II - refaced seat

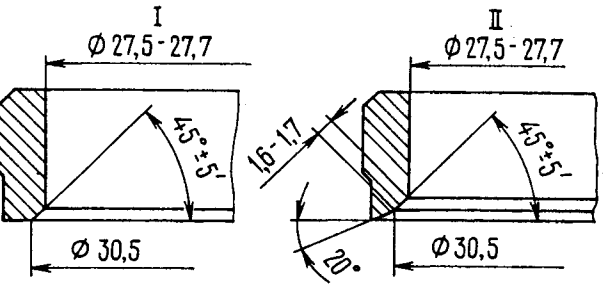


Fig. 2-44. Exhaust Valve Seat Contour:
I - new seat; II - refaced seat

Grind the seats as follows:

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

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

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

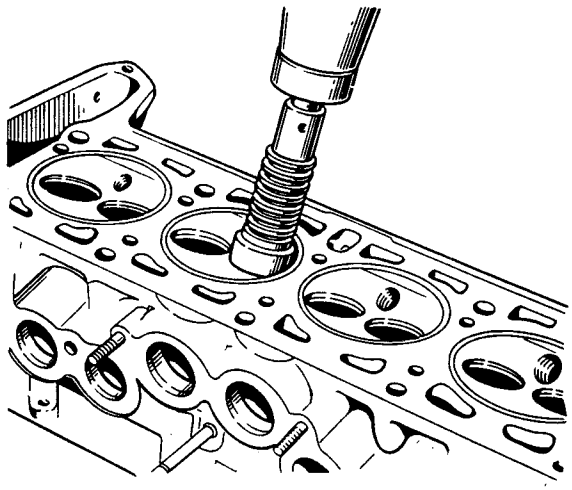


Fig. 2-45. Valve Seat Refacing

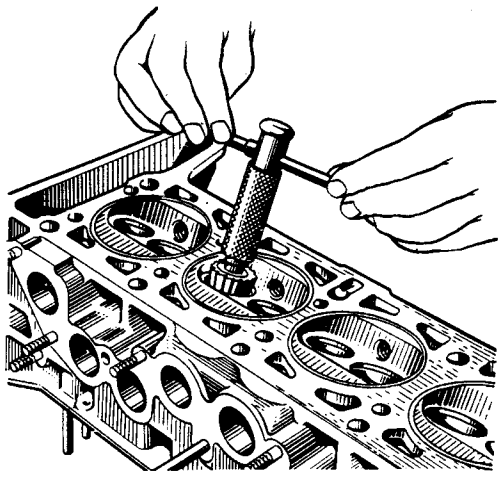


Fig. 2-46. Chamfering Valve Seat Face with Counterbore Installed on Spindle A.94058

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 values specified in Fig. 2-44, using 20° counterbore A.94031 and counterbore A.94092 which removes cold-working on the inside diameter. The counterbores should be slipped on spindle A.94058 and, like during the grinding, aligned by spindle A.94059.

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 1.9 - 2 mm.

VALVES

Remove carbon deposits from the valves. Check to 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 $45^{\circ}30' \pm 5'$ and see that the cylindrical part of the valve head is not thinner than 0.5 mm after grinding. Take care not to remove the hard alloy coating from the face of the exhaust value.

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.

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).

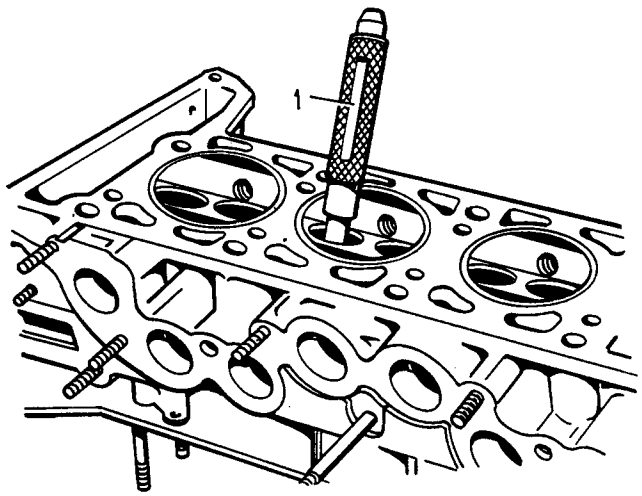


Fig. 2-47. Pussing Out Valve Guides:
1 - mandrel A.60153/R

To replace 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 separations of rubber from the metal, 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.

Replace the damaged oil-deflecting caps having removed the cylinder head not to bend the valve stems. To press-fit a new cap use mandrel 41.7853.4016.

VALVE ROCKERS

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

If the rocker adjusting screw or its bushing is distorted or damaged, replace the faulty part.

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 rocker springs (non-compressed) should be 35 mm and dimension B under a load of 51 - 73.5 N (5.2 - 7.5 kgf) should be 43 mm.

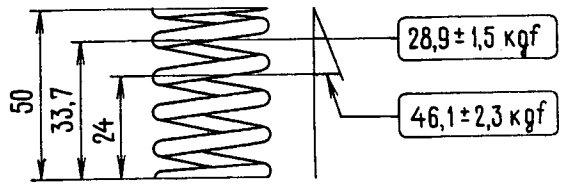


Fig. 2-48. Main Data for Checking Valve Outer Sprin

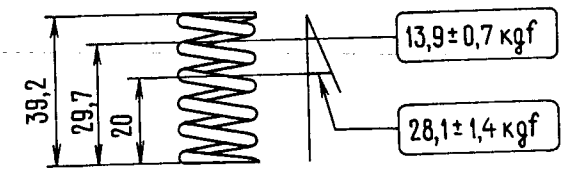


Fig. 2-49. Main Data for Checking Valve Inner Spri

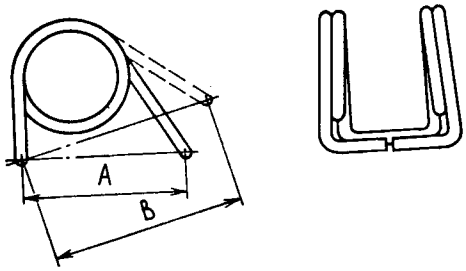


Fig. 2-50. Checking Valve Rocker Spring:
A - free length; B - length under a load

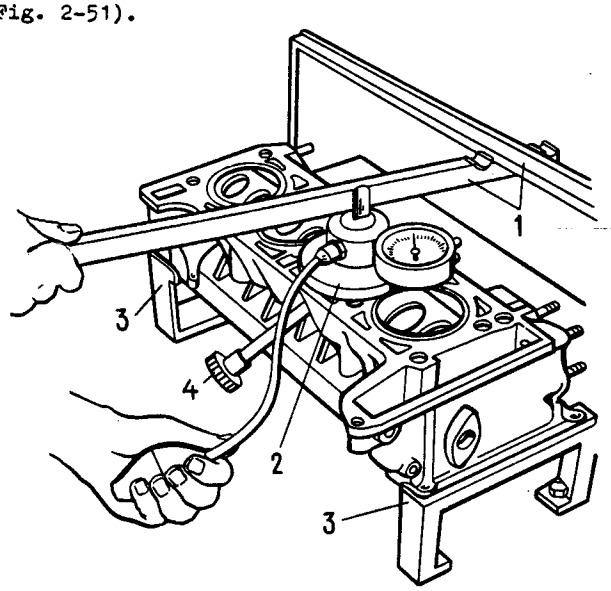
CYLINDER HEAD GASKET

The surfaces of the gasket should be free rom any signs of damage. They should be smooth, ree of dents, cracks, swelling and fractures. eparation of the outer layers from the metal is mpermissible.

The edgings of the holes should have no racks, burns and separations.

CHECKING VALVES FOR TIGHT SEATING

Clean carefully the seats and valves and nstall the cylinder head on support A.60353 ?ig. 2-51).



?ig. 2-51. Checking 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

Insert the valves into the corresponding guides and stop the wells for the spark plugs with st~~ers 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, air leakage 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 with due 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 min.

CYLINDER HEAD TIGHTNESS TEST

To check the cylinder head cooling jacket for tightness by water 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 min. A cracked cylinder head must be replaced.

To check the cylinder head for tightness by compreseed air proceed as follows:

- install the parts from the set of tester A.60334 on the cylinder head;
- dip the cylinder head in water heated to 60 - 80 °C and let the head warm up for 5 min;
- deliver compressed air at a pressure of 0.15 - 0.2 MPa (1.5 - 2 kgf/cm^2) into the cylinder head.

There should be no air escape from the head during 1 - 1.5 min.

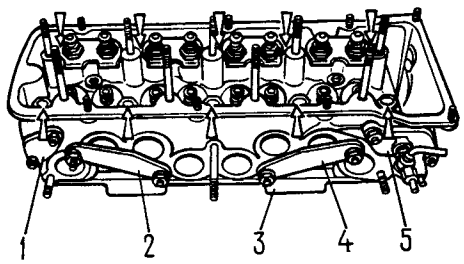


Fig. 2-52. Checking Cylinder Head for Tightness on Tester A.60334:
1, 2, 4 - blank plugs; 3 - tester plate; 5 - flange with water inlet union

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.

ADJUSTING CAM-TO-ROCKER CLEARANCE

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

0.005/.006"

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. 4 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);

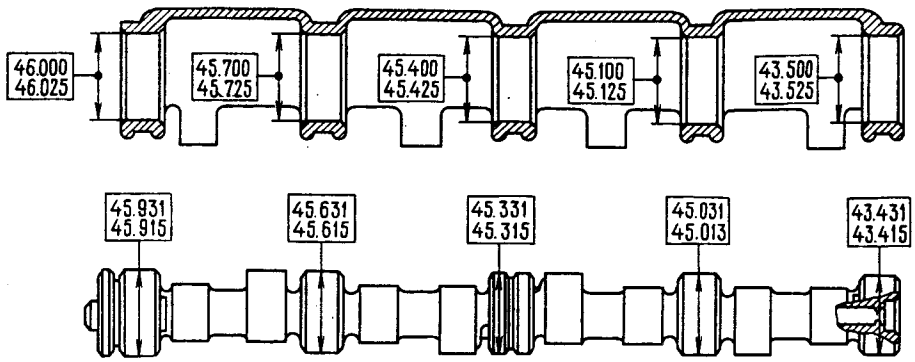


Fig. 2-53. Main Dimensions of Camshaft and of Bores in Camshaft Bearing Housing

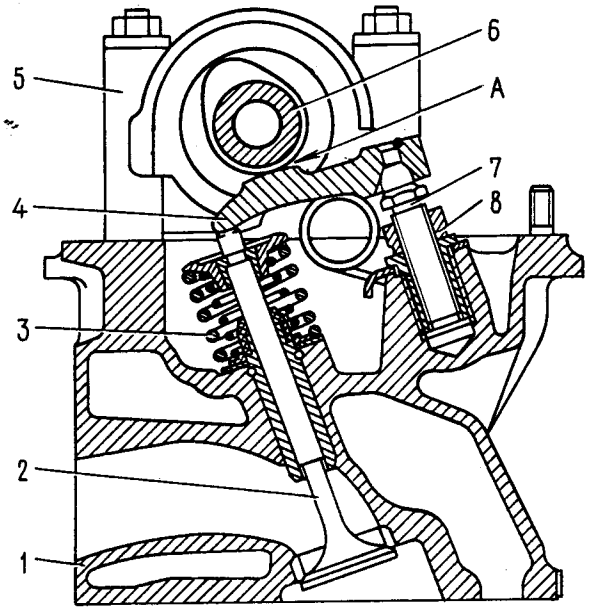


Fig. 2-54. Cylinder Block and Head. Section Through Inlet Valve:
1 - cylinder head; 2 - valve; 3 - spring; 4 - valve lever; 5 - bearing housing; 6 - camshaft; 7 - adjusting bolt; 8 - bolt locknut
A - rocker-to-cam clearance

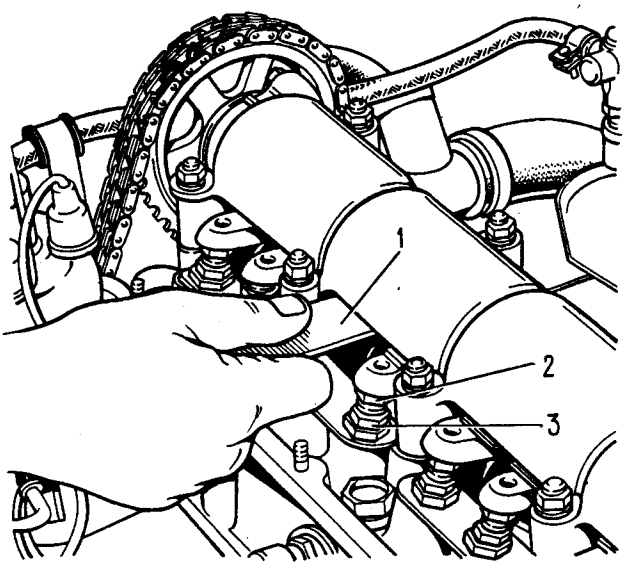


Fig. 2-55. Checking Rocker-to-Cam Clearance: 1 - feeler gauge A.95111; 2 - adjusting bolt; 3 - adjusting bolt locknut

- loosen the locknut of the rocker adjusting bolt;

- insert flat feeler gauge A.95111, 0.15 mm thick, between the rocker 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, turn 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, deg.	End of compression stroke in cylinder No.	Number 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 CHAIN TENSION

Loosen tensioner nut 1 (Fig. 2-56). This will free spindle 3 and the chain will be tensioned by shoe 7 (Fig. 2-57) which is acted upon by spring 8 (Fig. 2-56).

Turn the crankshaft 1-1.5 revolutions 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

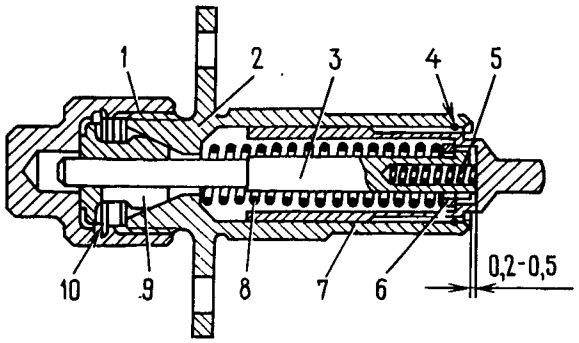


Fig. 2-56. Chain Tensioner. Sectionalized:
1 - cap nut; 2 - tensioner body; 3 - spindle;
4 - spring ring; 5 - plunger spring; 6 - washer;
7 - plunger; 8 - spring; 9 - retainer; 10 - spring
ring

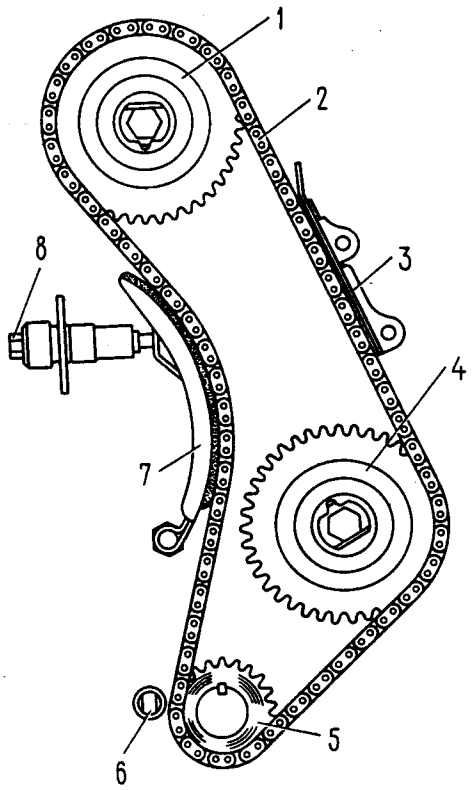


Fig. 2-57. Camshaft and Accessory Drive Diagram:
1 - camshaft sprocket; 2 - chain; 3 - chain damper;
4 - oil pump drive sprocket; 5 - crankshaft
sprocket; 6 - limiting pin; 7 - tensioner shoe;
8 - chain tensioner

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 CAMSHAFT

Scores, nicks, scratches and aluminium galling from the bearing housings are not tolerable on the camshaft journals.

Wear exceeding 0.5 mm on the working surfaces of the cams, and scores and faceting are not tolerable.

Put the camshaft with its extreme journals on two V-blocks placed on a surface plate and check radial runout of the middle journals with an indicator. The runout should not exceed 0.04 mm, otherwise the camshaft should be trued up on a straightening press.

Note. The cars turned out before 1982 were furnished with camshafts whose cams were induction hardened. Since April 1982 the camshafts with nitrided cams are installed. Since 1984 each shaft bears the mark of the year of its manufacture. Since 1985 some cars are furnished with the camshafts with chilled cams. These camshafts are distinguished by a hex belt between the No. 3 and No.4 cams.

CHECKING 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.

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.

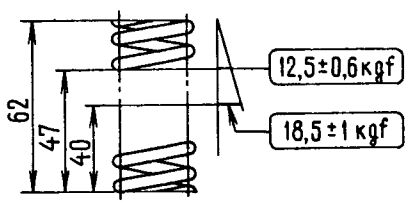


Fig. 2-58. Main Data for Checking Tensioner Spring

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 DRIVE 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 1 (Fig. 2-59) for installing the chain. Stretch the chain with a force of 294 N (30 kgf) then slacken it to 147 N

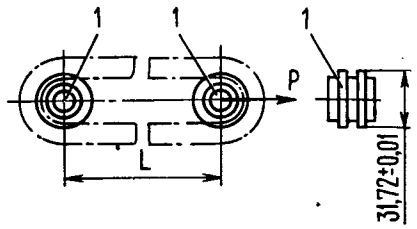


Fig. 2-59. Chain Wear (Stretching) Check Diagram:
1 - rollers

(15 kgf), repeat both operations and measure distance L between the roller axes.

For a new chain distance L between the roller axes is $(495.3^{+0.5}_{+0.1})$ mm. Replace the chain if it is stretched to 499.5 mm.

Before installing the chain on the engine coat it with engine oil.

COOLING SYSTEM

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

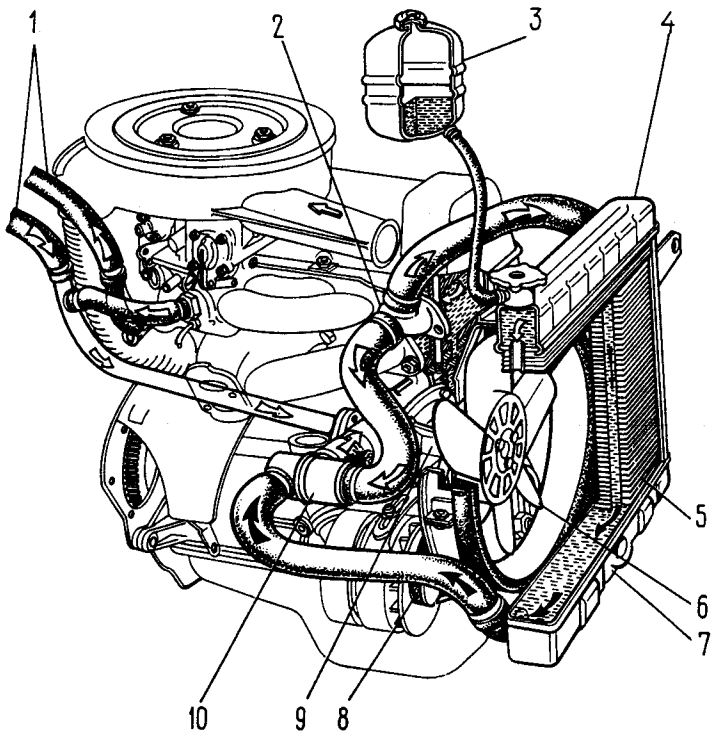


Fig. 2-60. Cooling System:
1 - body heater radiator inlet and outlet hoses; 2 - outlet connection; 3 - expansion tank; 4 - radiator top tank; 5 - radiator cooling fins; 6 - fan; 7 - radiator bottom tank; 8 - pump drive belt; 9 - coolant pump; 10 - thermostat

CHECKING COOLANT LEVEL AND SPECIFIC GRAVITY

The quantity of coolant in the cooling system is checked by 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 1.078 - 1.085 g/cm^3 for ТОСОЛ А-40М liquid used in the VAZ cars.

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 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; eep pouring until the liquid starts flowing from he radiator throat; then replace the radiator cap;
- pour the remaining coolant into the expan- ion tank and put in place its cap;
- run the engine idle for 1 - 2 min to emove any air pockets.

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

ADJUSTING PUMP DRIVE BELT TENSION

The tension of the belt should be checked by easuring its deflection between the alternator and ump pulleys or between those of the pump and crank- haft. The tension is considered correct when eflection A of the belt (Fig. 2-61) under a force f 98 N (10 kgf) is within 10 - 15 mm and deflec- ion B is from 12 to 17 mm.

To tension the belt loosen the alternator asi ng nuts, push the alternator away from the ngine and retighten the nuts.

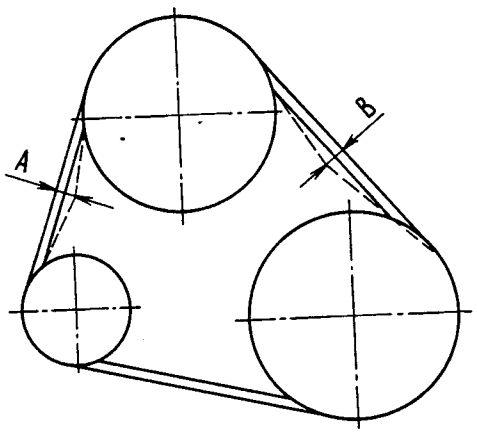


Fig. 2-61. Checking Pump Drive Belt Tension

COOLANT PUMP

Disassembly

To disassemble the pump:
- detach the pump body from cover 2 (Fig.2-62);
- secure the cover in a vice using gaskets and ake the impeller from the shaft with remover tool .40026 (Fig. 2-63);
- remove hub 2 (Fig. 2-64) of the fan pulley rom the shaft with remover tool A.40005/1/5;
- turn out lock screw 9 (Fig. 2-62) and take ut the bearing with the pump shaft;
- pull gland 11 out of body cover 2.

Inspection

Check the end play of the bearing. This opera- ion is mandatory when the pump was very noisy in peration. The clearance should not exceed 0.13 mm

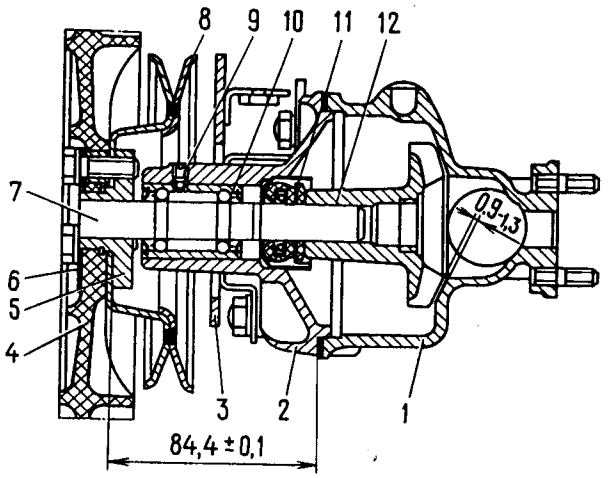


Fig. 2-62. Coolant Pump. Longitudinal Section:
1 - body; 2 - cover; 3 - fan shroud bracket;
4 - fan; 5 - pulley hub; 6 - cover plate;
7 - shaft; 8 - pulley; 9 - bearing lock screw;
10 - bearing; 11 - gland; 12 - impeller

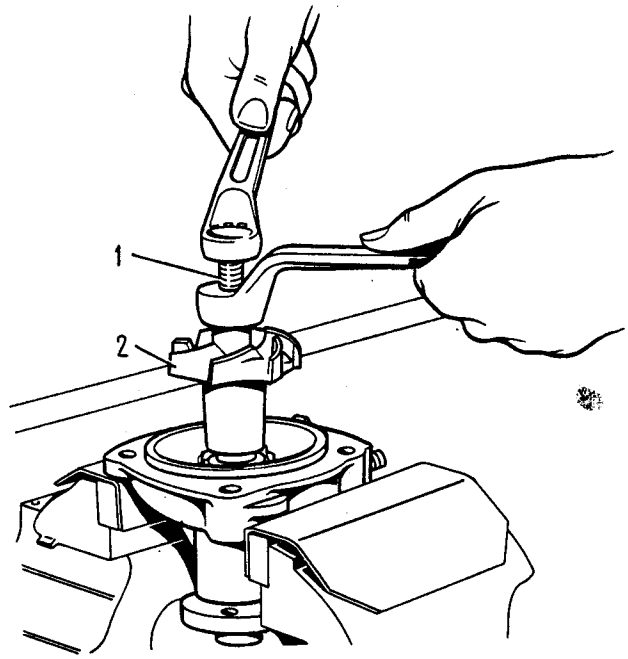


Fig. 2-63. Removing Pump Impeller:
1 - remover tool; 2 - impeller

under a load of 49 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 body and cover; there should be no distortions and cracks.

Assembly

To assemble the pump:
- using a mandrel install the gland without cocking into the body cover;

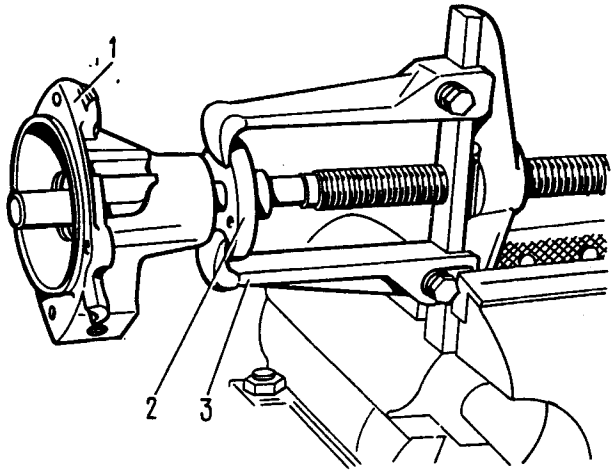


Fig. 2-64. Removing Pulley Hub:
1 - pump body cover; 2 - pulley hub; 3 - remover tool

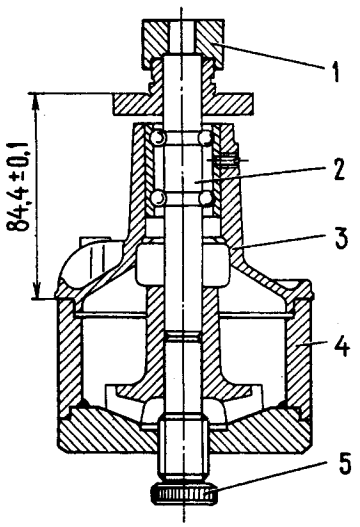


Fig. 2-65. Installing Impeller on Pump Shaft with Tool A.60430:
1 - support; 2 - pump shaft; 3 - pump body cover; 4 - sleeve; 5 - setting screw

- drive in the bearing with the shaft into the cover, seeing that the lock screw socket is in line with the hole in the pump body cover;

- turn in the bearing lock screw 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. If the hub is made of ceramet, only a new hub should be pressed on;

- press-fit 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 body;

- assemble the pump body 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 valve.

For this purpose place the thermostat on a BC-106-000 stand, immersing it into a tank with water or coolant. Touch the indicator rod bracket 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 is the temperature at which the travel of the main valve reaches 0.1 mm.

Replace the thermostat if the temperature of the beginning of opening of the main valve is other than (80±2) °C [(83±2) °C for the valve of PPR production)], 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 bottom 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.

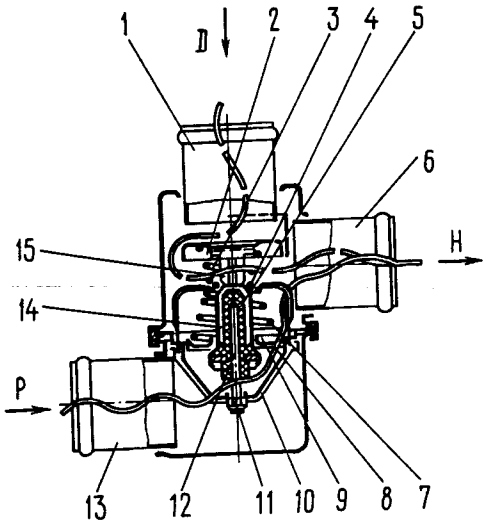


Fig. 2-66. Thermostat:
1 - inlet connection (from engine); 2 - bypass valve; 3 - bypass valve spring; 4 - sleeve; 5 - rubber insert; 6 - outlet connection; 7 - main valve spring; 8 - main valve seat; 9 - main valve; 10 - holder; 11 - adjusting nut; 12 - piston; 13 - inlet connection (from radiator);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

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 drain plug of 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 to prevent mutilation of the plug faces.

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

Tightness Test

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

Plug the radiator 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 bubbles.

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

LUBRICATING SYSTEM

The design of the lubricating system is shown in Fig. 2-67.

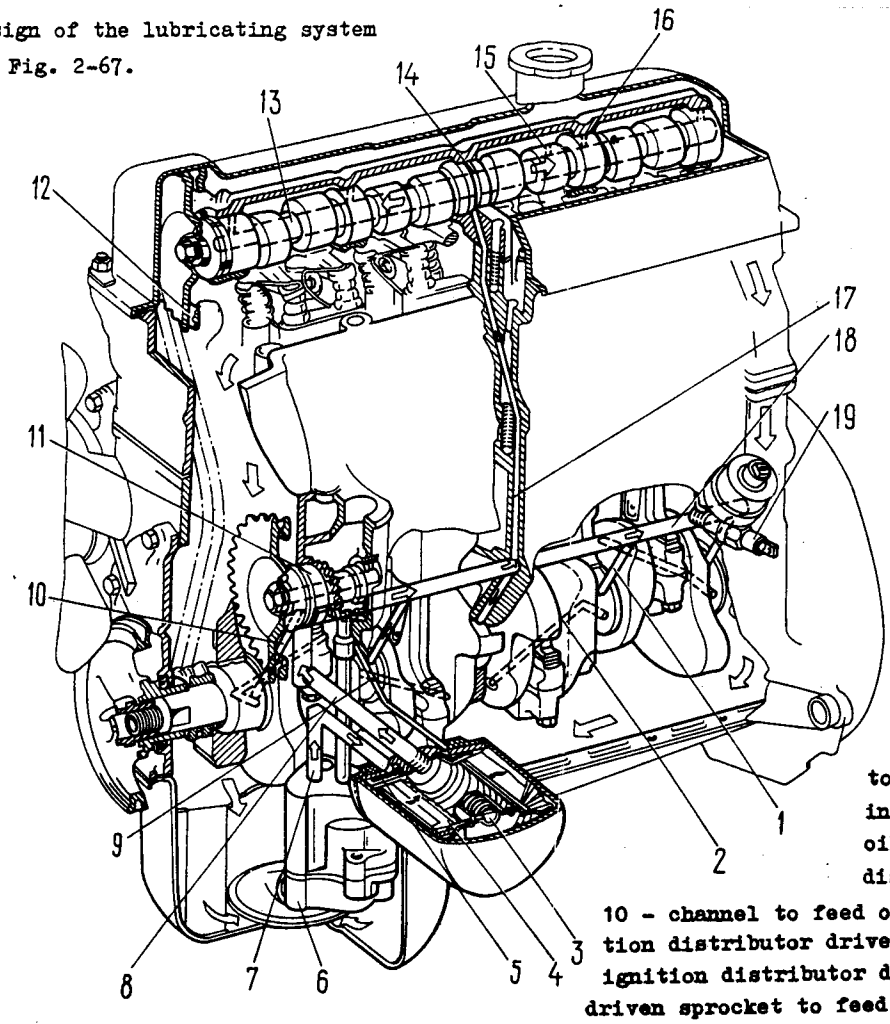


Fig. 2-67. Lubricating System:
1 - channel to feed oil to main bearing; 2 - channel to feed oil from main bearing to big-end bearing; 3 - oil pump by-pass valve; 4 - paper filter element; 5 - antidrain valve; 6 - oil pump; 7 - channel to feed oil from pump to filter; 8 - horizontal channel in cylinder block to feed oil from filter to main oil line; 9 - channel in cylinder block to feed oil to pump and ignition distributor drive gear; 10 - channel to feed oil to oil pump and ignition distributor drive shaft; 11 - oil pump and ignition distributor drive shaft; 12 - channel in driven sprocket to feed oil to chain; 13 - camshaft; 14 - circular groove on middle supporting journal of camshaft; 15 - channel in camshaft cam; 16 - channel in camshaft supporting journal; 17 - vertical channel in cylinder block to feed oil to valve gear; 18 - main oil line; 19 - electric oil pressure transmitter and oil pressure warning lamp transmitter

REPLACING OIL

Change the oil while the engine is still hot. Wait at least 10 min 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 removed with the aid of remover A.60312 (Fig. 2-4).

Install the filter by screwing it in hand-tight.

Every 30000 km of run 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 at the minimum idle speed 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

The main dimensions of the oil pump and its drive are given in Fig. 2-68.

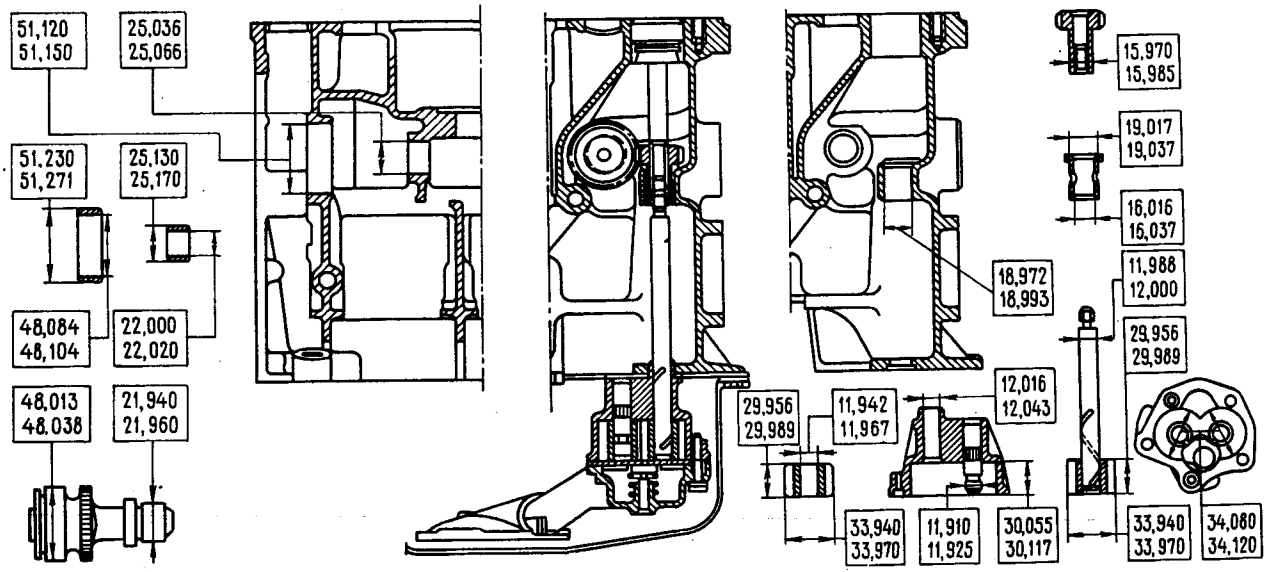


Fig. 2-68. Basic Dimensions of Oil Pump and Drive

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 oil from 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 intake connection.

To install the pump reverse the removal operations.

Disassembly and Assembly

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

- unscrew the bolts and remove the intake connection complete with the oil reducing valve;
- remove pump body cover 3 (Fig. 2-69) and take the pump shaft with the drive gear, then the driven gear, out of the body.

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

- install the drive gear with the shaft into the pump body and slip the driven gear on the axle in the body;
- install the body cover, the reducing valve with the spring and fasten the intake connection to the pump body.

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

Checking Pump Parts

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

Using a set of feeler gauges, check the clearances between the gear teeth, also between the gear tips (outside diameters of the gears) and the pump body walls (Fig. 2-70) 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 limits, replace the gears or, if necessary, the pump body too.

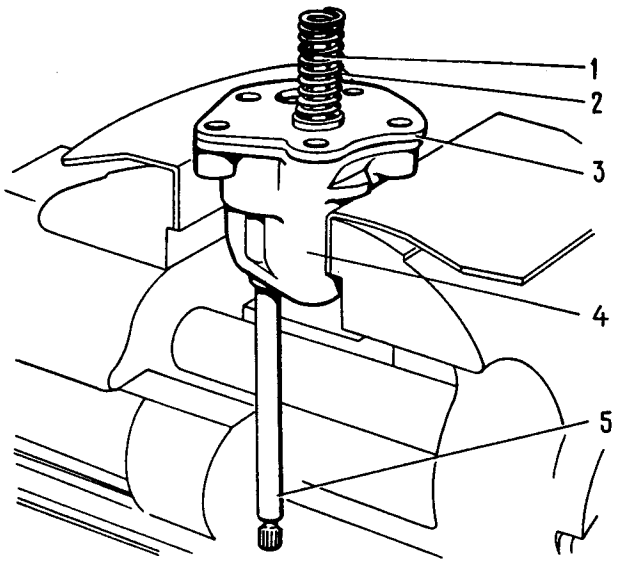


Fig. 2-69. Disassembling Oil Pump:
1 - reducing valve; 2 - spring; 3 - cover; 4 - body; 5 - shaft

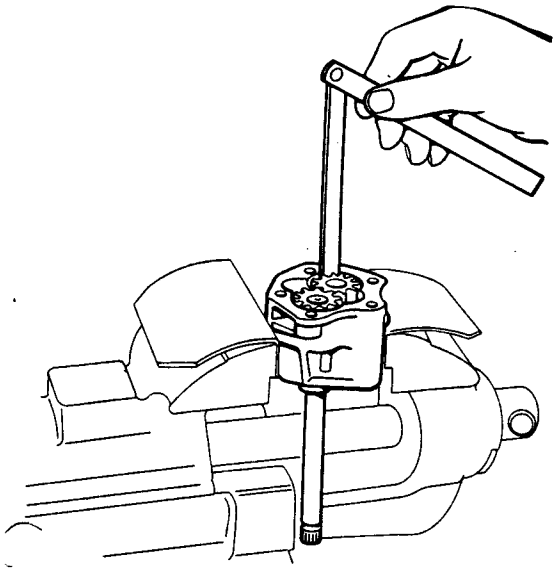


Fig. 2-70. Checking Radial Clearance in Oil Pump

Using a feeler gauge and a straightedge (Fig. 2-71), check the clearance between the gear faces and the surface of the body; 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 body, 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 body. This clearance should be 0.016 - 0.055 mm (maximum permissible 0.1 mm). If the clearances exceed the limits, replace the worn parts.

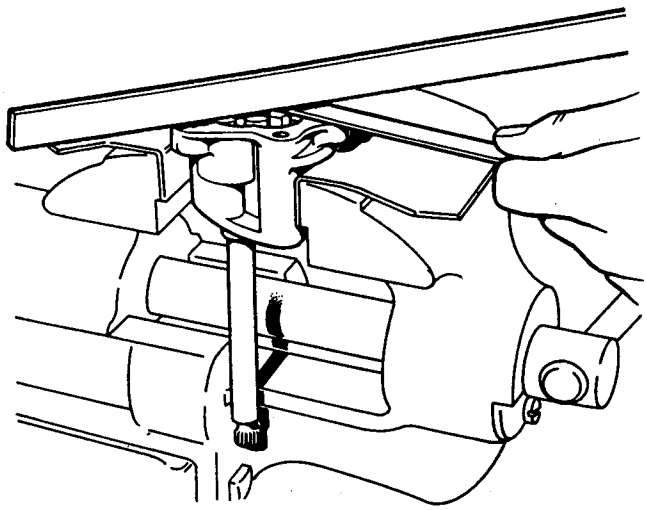


Fig. 2-71. Checking Axial Clearance in Oil Pump

Checking 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 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. 2-72.

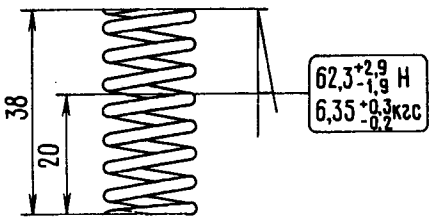


Fig. 2-72. Basic Data for Checking Reducing Valve Spring

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 chipped, otherwise replace the defective 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

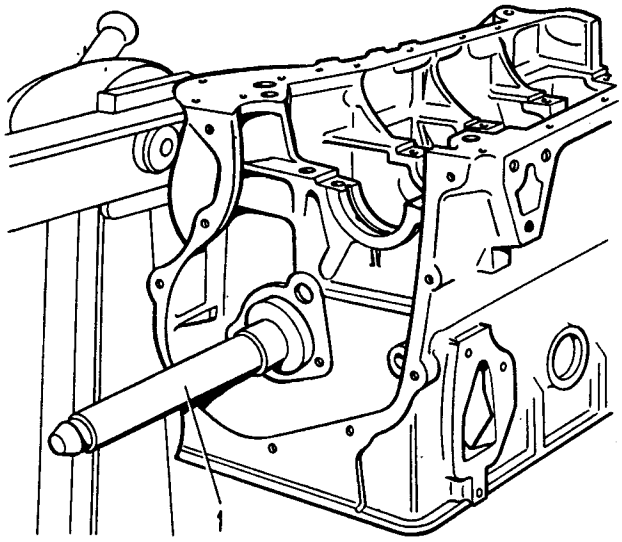


Fig. 2-73. Removal and Installation of Oil Pump Drive Shaft Bushes:
1 - driver A.60333/1/2

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. 2-73), observing the following requirements:

- the bushes must be press-fitted into their bores so that the oil hole in the front bush is lined up with the lubrication channel in the cylinder block;
- after press-fitting the bushes must be finished to the exact inside diameter (for dimensions see Fig. 2-69). 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-fitting 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. 2-74).

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

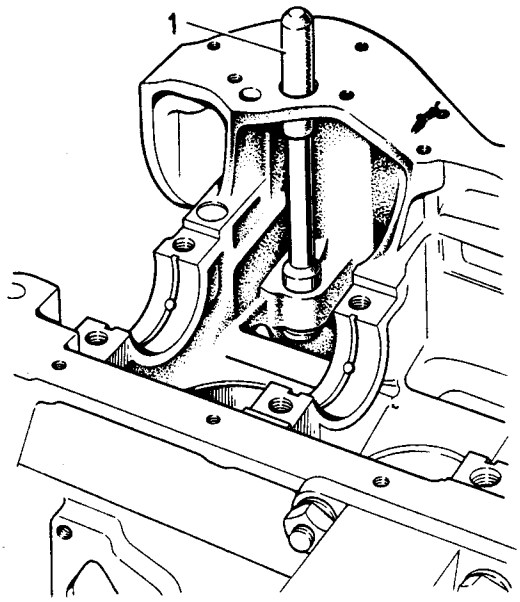


Fig. 2-74. Pressing Out Oil Pump and Ignition Distributor Drive Gear Bush:
1 - driver A.60326/R

CRANKCASE BREATHING SYSTEM

WASHING

To wash the system disconnect breathing hoses 4 and 8 (Fig. 2-75) from the 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

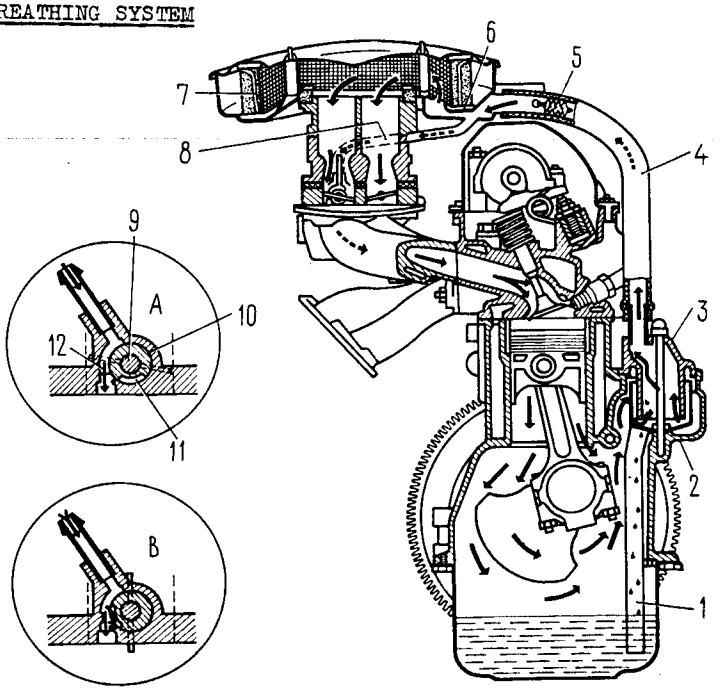


Fig. 2-75. Crankcase Breathing System:
A and B - operation of carburettor fume valve unit at low (A) and high (B) crankshaft speeds;
1 - oil separator drain pipe; 2 - oil separator; 3 - breather cover; 4 - gas drawout hose; 5 - flame arrester; 6 - drawout manifold; 7 - air cleaner filtering element; 8 - crankcase fume recirculation hose; 9 - primary throttle valve shaft; 10 - fume valve; 11 - fume valve groove; 12 - calibrated orifice

fume valve and the air cleaner spaces and connections which conduct the drawn-out gases.

Since 1987, crankcase fume recirculation hose 8 is laid to reach oil separator 2.

FUEL SYSTEM

AIR CLEANER

To remove the air cleaner take off its cover, lift out the filter element, unscrew the fastening nuts (Fig. 2-77) 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 (at temperatures above +15 °C) put the cover so that blue mark A (Fig. 2-76) is in line with black arrow 3. In winter (at temperatures below +15 °C) set the cover to align red mark B with the arrow.

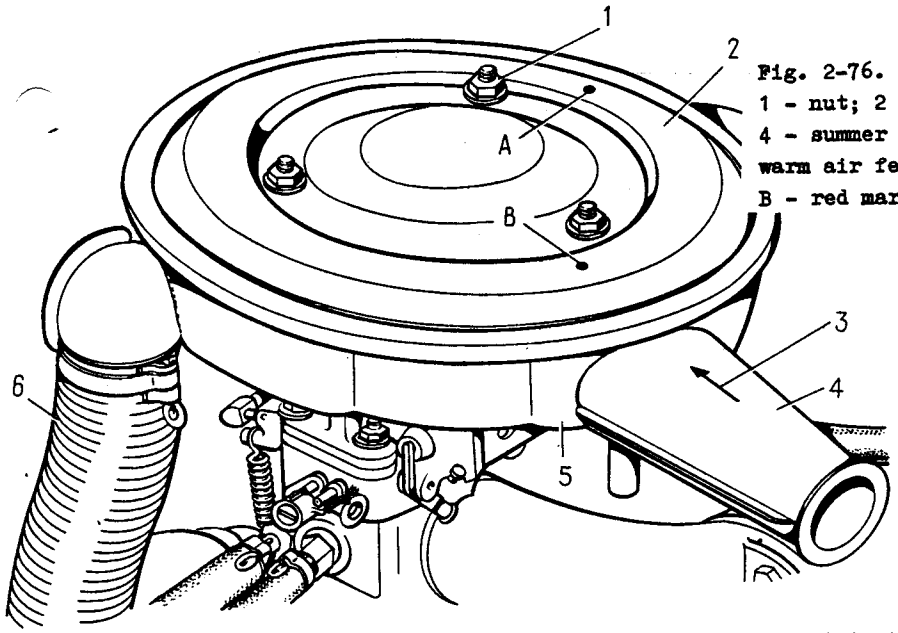


Fig. 2-76. Air Cleaner:
1 - nut; 2 - cleaner cover; 3 - indicating arrow; 4 - summer air intake; 5 - cleaner body; 6 - winter warm air feed hose; A - blue mark SUMMER (ЛЕТО); B - red mark WINTER (ЗИМА)

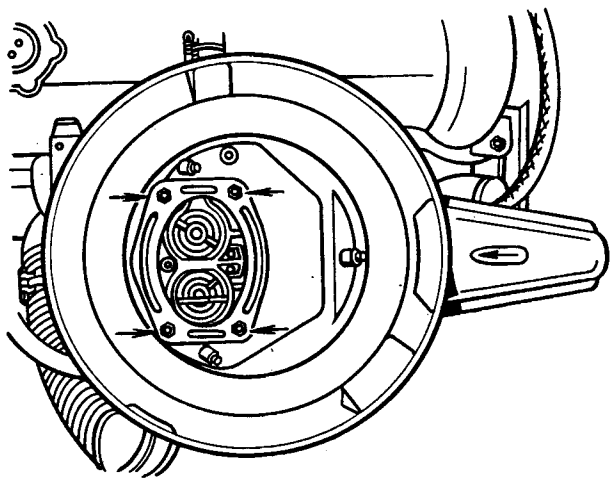


Fig. 2-77. Removing Air Cleaner. Arrows Show Cleaner-to-Carburettor Fastening Nuts

FUEL PUMP

The design of the fuel pump appears in Fig. 2-78.

Checking 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 connection 1 and work hand-priming lever 8 to see whether the fuel is supplied at all. If not, disconnect the hose from suction connection 4 and check for vacuum built up at the outlet of this connection. If vacuum is created, the trouble should be traced to a damaged line; 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 turn out the screws fastening the body to the lower cover, detach these parts from each other, take out the diaphragm unit and the spring.

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

Check the condition of the pump springs.

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

After inspection replace all worn or damaged parts by new ones. The pump gaskets must always be

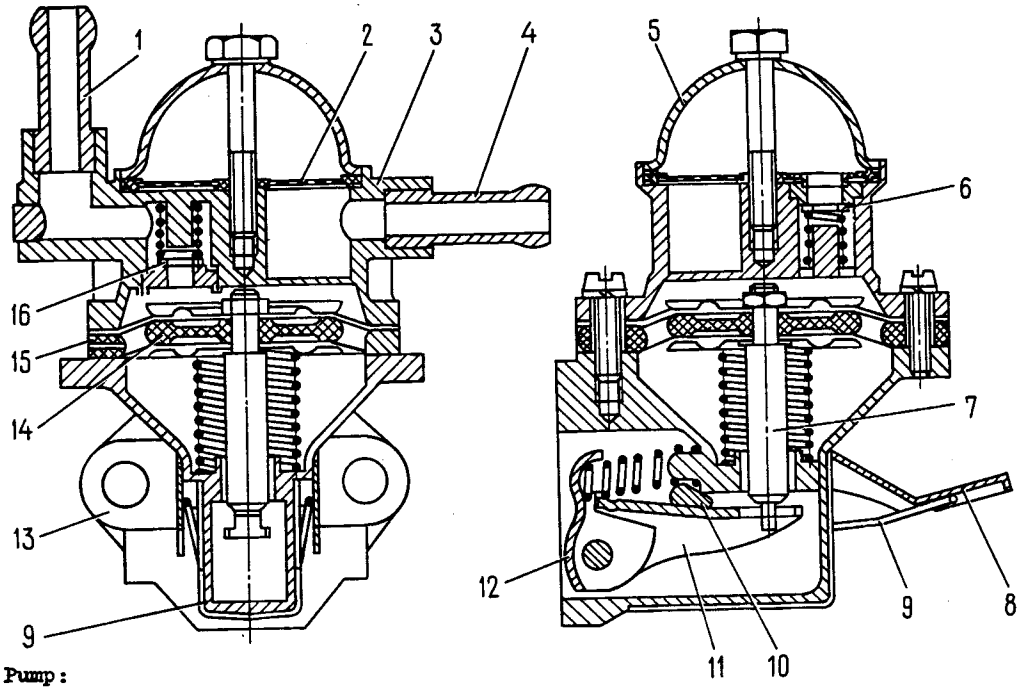


Fig. 2-78. Fuel Pump:
1 - discharge connection; 2 - filter; 3 - body; 4 - suction connection; 5 - cover; 6 - suction valve; 7 - rod; 8 - hand-priming lever; 9 - spring; 10 - eccentric; 11 - rocker; 12 - operating lever; 13 - lower cover; 14 - inner spacer; 15 - outer spacer; 16 - discharge valve

replaced by new ones; before installation, coat them with a thin layer of lubricant.

Installation of 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. 2-79 and proceed as follows.

Install the heat-insulating spacer on the cylinder block, putting gasket A in between, and place gasket B on the spacer surface contacting the pump. Using fixture 67.7834.9506 measure distance d (the minimum protrusion of the pump pushrod 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 cylinder block and the heat-insulating spacer should always be separated by gasket A.

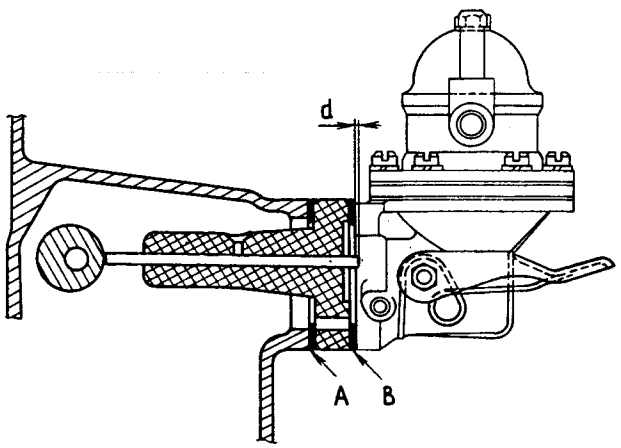


Fig. 2-79. Diagram for Checking and Adjusting Travel of Pump Drive Pushrod:
A - gasket 0.27 - 0.33 mm thick; B - gasket 0.70 - 0.80 mm thick; d - pushrod travel

FUEL TANK

Removal and Installation

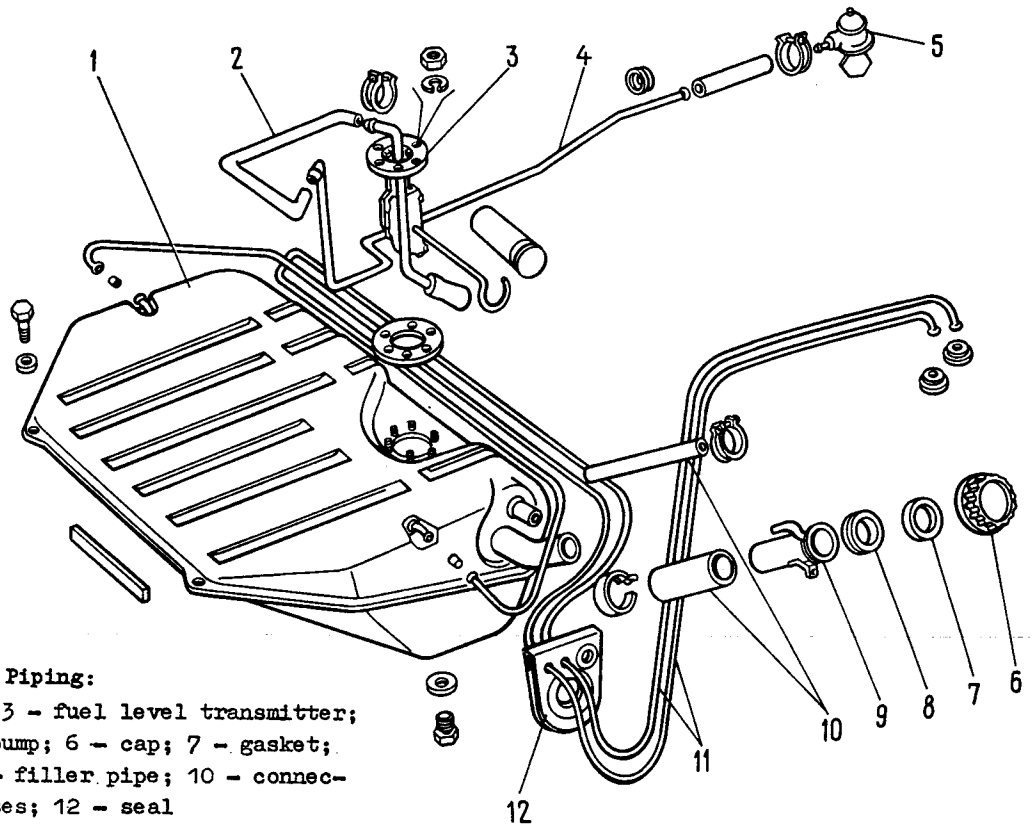
To remove the fuel tank from the car:

- unscrew cap 6 (Fig. 2-80) of filler pipe 9 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 remove the tank.

To install reverse the removal operations.

Cleaning and Inspection

Remove the fuel level transmitter, wash the tank with gasoline to remove sediments. Then wash it with a stream of hot water and steam-treat it to remove remnants of gasoline.



ig. 80. Fuel Tank and Piping:
- fuel tank; 2 - hose; 3 - fuel level transmitter;
- fuel pipe; 5 - fuel pump; 6 - cap; 7 - gasket;
- filler pipe seal; 9 - filler pipe; 10 - connec-
ing hoses; 11 - vent hoses; 12 - seal

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

Caution

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

CARBURETTOR

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

Beginning from 1980 the VAZ-2121 cars are tted with carburettors 2107-1107010-20 jointly th the ignition distributor type 30.3706-02 121-3706010-10) which incorporates a vacuum ark timer. However, some of the cars may be rovided with carburettor 2107-1107010-10 jointly th a conventional ignition distributor (without e vacuum spark timer). On these carburettors the mber is given on the nameplate secured to the rburettor cover.

The carburettor 2106-1107010 is of the emul-ion double-barrel downdraft type. It incorporates balanced float chamber and a system for drawing e crankcase gases into the after-throttle space rankcase fume recirculation system) (Fig. 2-81). e idling system has a heated zone of the rottle valves and an electromagnetic valve of the

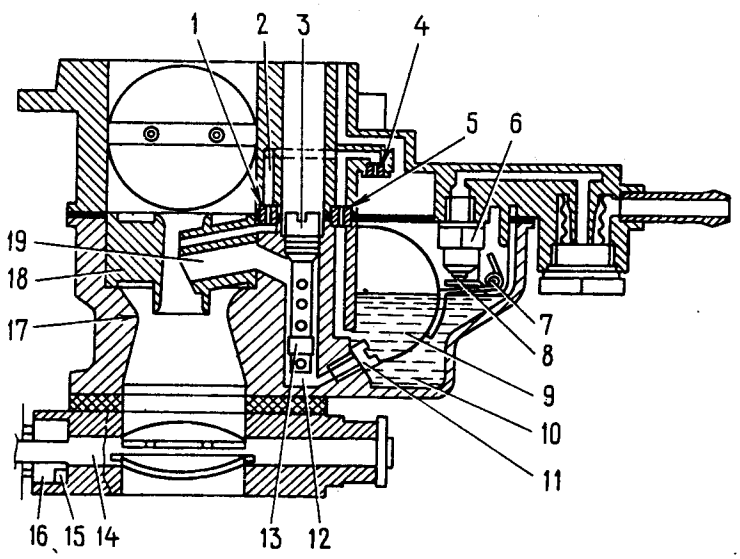


Fig. 2-81. Carburettor Main Metering System and Econostat (econostat atomizer is in carburettor secondary barrel. In this diagram it is shown as if being located in primary barrel):
1 - econostat emulsion jet*; 2 - econostat emulsion channel*; 3 - main metering system air jet; 4 - econostat air jet*; 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

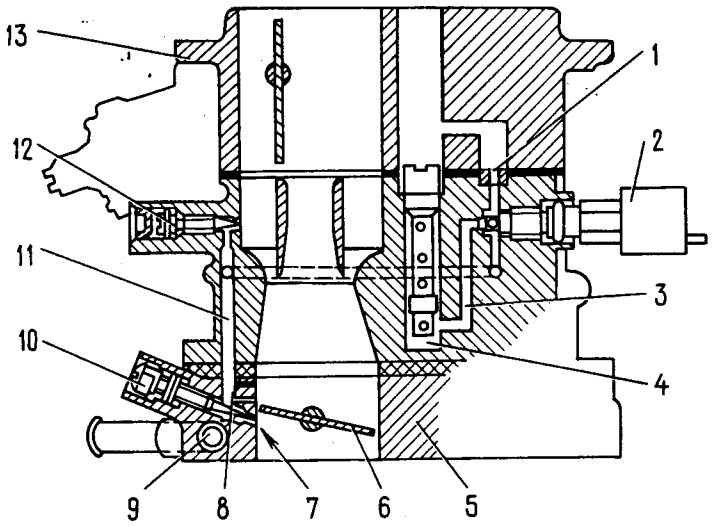


Fig. 2-82. Idling System of Carburettor 2106-1107010:
1 - air jet; 2 - shutoff valve; 3 - fuel channel; 4 - emulsion well; 5 - throttle valve housing; 6 - primary throttle valve; 7 - screw-adjusted hole; 8 - progression holes; 9 - throttle valve housing heating channel; 10 - adjusting screw; 11 - emulsion channel; 12 - additional air adjusting screw; 13 - carburettor upper body

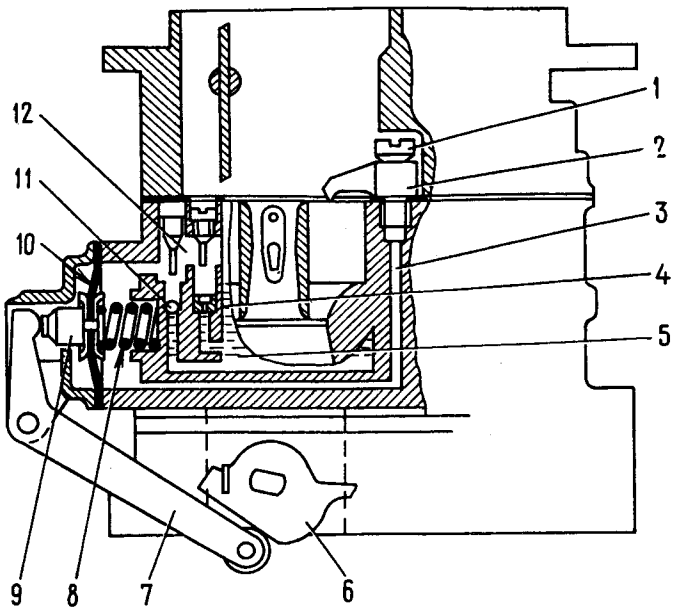


Fig. 2-84. Acceleration Pump. Diagrammatic:
1 - delivery ball valve; 2 - atomizer; 3 - fuel channel; 4 - bypass jet; 5 - float chamber; 6 - acceleration pump operating sector; 7 - operating lever; 8 - pump return spring; 9 - diaphragm cup; 10 - pump diaphragm; 11 - inlet ball valve; 12 - gasoline vapour chamber

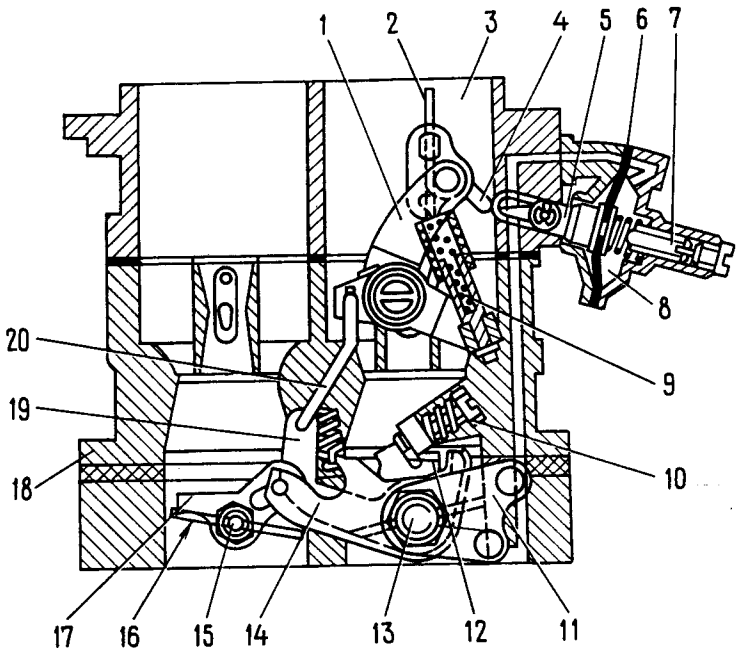


Fig. 2-83. Choke Mechanism and Linkage of Carburettors 2106-1107010, Diagrammatic:
1 - choke control lever; 2 - choke valve; 3 - carburettor primary barrel air horn; 4 - rod; 5 - choke mechanism rod; 6 - diaphragm; 7 - adjusting screw; 8 - space communicating with after-throttle space; 9 - telescopic link; 10 - primary throttle valve adjusting screw; 11 - throttle valve operating lever; 12 - sector; 13 - primary throttle valve shaft; 14 - lever on primary throttle valve shaft; 15 - secondary throttle valve shaft; 16 - secondary throttle valve; 17 - lever; 18 - carburettor body; 19 - lever; 20 - rod

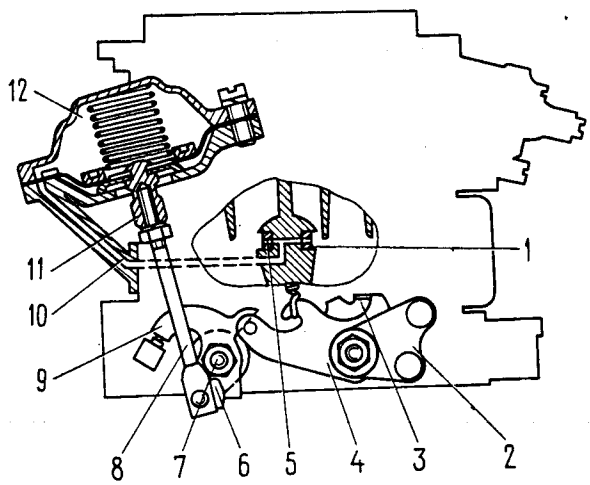


Fig. 2-85. Secondary Throttle Valve Operating Mechanism of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - pneumatic actuator jet in primary barrel venturi; 2 - throttle valve operating lever; 3 - lever rigidly linked with primary throttle valve shaft; 4 - secondary throttle valve opening limiting lever; 5 - pneumatic actuator jet in secondary venturi; 6 - lever spring-connected with lever 9; 7 - secondary throttle valve shaft; 8 - pneumatic actuator rod; 9 - secondary throttle valve operating lever; 10 - vacuum channel to pneumatic actuator; 11 - rod bushing; 12 - secondary throttle pneumatic actuator

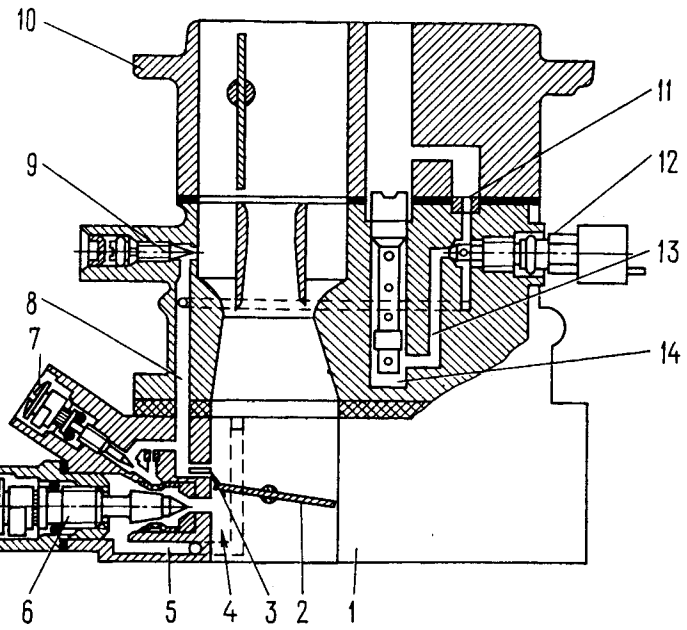


Fig. 2-86. Idling System of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - throttle valve housing; 2 - primary throttle valve; 3 - progression holes; 4 - screw-adjusted hole; 5 - air inlet channel; 6 - idle speed adjusting screw; 7 - idle mixture adjusting screw; 8 - idling system emulsion channel; 9 - additional air adjusting screw*; 10 - carburettor upper body; 11 - idling system air jet; 12 - shutoff valve; 13 - idling system fuel channel; 14 - emulsion well

* Installed on some carburettors

idling jet in the primary barrel (Fig. 2-82). 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. 2-83). A diaphragm-type mechanically-operated acceleration pump (Fig. 2-84) 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 valve (Fig. 2-85) and a modified idling system (Fig. 2-86). There is no heating of the throttle valve zone 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 calibration data of carburettors are tabulated below.

Adjustment of Engine Idle Speed

The idle speed adjusting elements (Figs 2-87 and 2-88) include air-fuel ratio (idle mixture) adjusting screw 2 and mixture quantity (idle speed) 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 (only screw 2 of carburettor 2106-1107010) are provided with pressed-on limiting plastic bushings which allow the screws to be turned through half a revolution only. If the CO con-

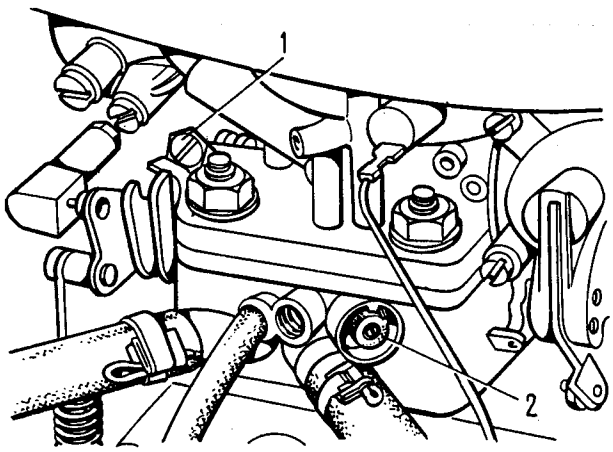


Fig. 2-87. Idling System Adjusting Screws in Carburettors 2106-1107010:
1 - idle speed adjusting screw; 2 - idle mixture adjusting screw

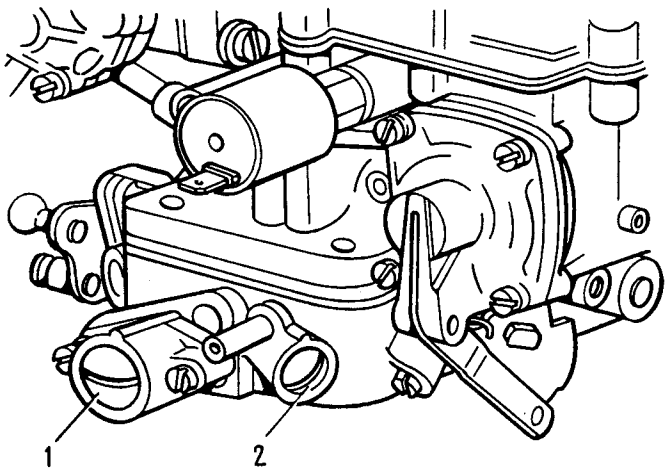


Fig. 2-88. Idling System Adjusting Screws in Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - idle speed adjusting screw; 2 - idle mixture adjusting screw

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 upper body with gasket (Dimension A, Fig. 2-89), mm	6.5-0.25		6.5-0.25		6.5-0.25	
Clearances at valves for adjusting 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.

tent in the exhaust gases cannot be adjusted with these bushings in position, turn 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 ignition advance angle.

To adjust proceed as follows:

2106-1107010 carburettors

Using screw 1 (Fig. 2-87) set a crankshaft speed of 720 - 800 min^{-1} as read by the stand tachometer.

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 720 - 800 min^{-1}.

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. 2-89 b.

Carburettors 2107-1107010-10 and 2107-1107010-2

Using screw 1 (Fig. 2-88) bring the crankshaft speed to 850 - 900 min^{-1} as read by the stand tachometer.

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

Rotate screw 1 to restore the crankshaft speed to 850 - 900 min^{-1}.

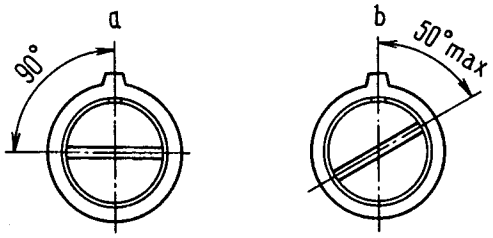
If necessary, rotate screw 2 to restore the concentration of CO to 0.5 - 1.2 %.

Press the plastic limiting bushings on the screws, orientating the bushing slots relative to the locating projections as shown in Fig. 2-89.

Adjustment of Fuel Level in Float Chamber

The fuel level required for normal functioning of the carburettor is ensured by correct setting of

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



ig. 2-89. Installation of Limiting Bushings on
dling System Adjusting Screws:
- on idle speed adjusting screw; b - on idle mix-
ure adjusting screw

he serviceable elements of its shut-off device
Fig. 2-90).

The distance between the float and gasket 10
ontacting the carburettor upper body (dimension A)
hould be (6.5±0.25) mm; this distance can be adjust-
d by bending tongue 8. The bearing surface of the
ongue should be perpendicular to the needle valve
xi d should be free from jags and dents.

o check this distance use gauge 67.8151.9505.
old the upper body vertically, with float tongue 8
ouching lightly upon ball 5 of needle valve 4
ithout making it sink.

The maximum travel of the float [(8±0.25) mm]
an be adjusted by bending stop 3. Needle valve
eturn yoke 6 should not interfere with free move-
ent of the float.

Install the carburettor upper body and
ake sure that the float moves clear of the float
hamber walls.

Note. The setting of the float must be checked
henever the float or the needle valve is replaced;
n the latter case the valve sealing gasket must
lso be replaced.

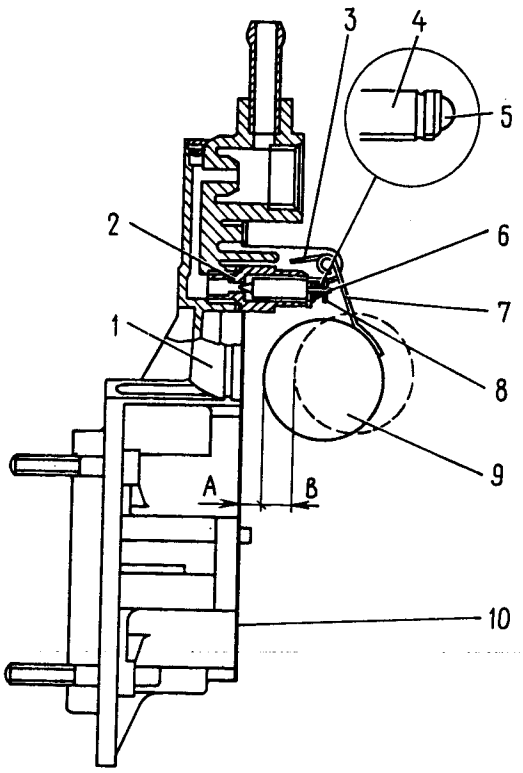
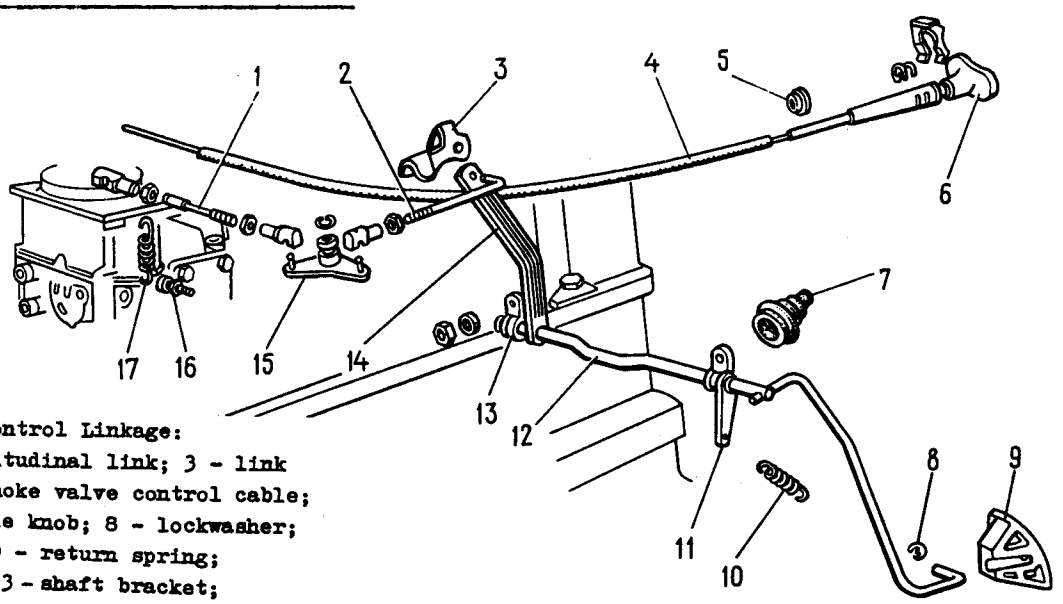


Fig. 2-90. Float Chamber Fuel Level Adjustment:
1 - carburettor upper body; 2 - needle valve seat;
3 - stop; 4 - needle valve; 5 - needle ball;
6 - valve needle return yoke; 7 - float arm;
8 - tongue; 9 - float; 10 - gasket

Adjustment of Carburettor Control Linkage

With accelerator pedal 9 fully depressed (Fig. 2-91) 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



ig. 2-91. Carburettor Control Linkage:
- cross link; 2 - longitudinal link; 3 - link
astening shackle; 4 - choke valve control cable;
and 7 - seals; 6 - cable knob; 8 - lockwasher;
- accelerator pedal; 10 - return spring;
1 - lever; 12 - shaft; 13 - shaft bracket;
4 - lever; 15 - intermediate lever; 16 - return
pring fastening screw; 17 - return spring

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 (Fig. 2-91) and return spring 17 from the throttle valve operating lever. Detach choke valve control 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 intake manifold with a plug.

To install the carburettor reverse the removal operations. After installation adjust the throttle control linkage and the idle speed of the engine.

Disassembly of Carburettor

Remove return spring 7 (Fig. 2-92) of the lever limiting the opening of secondary throttle valve.

Undo and detach link 8 from the throttle valve lever.

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

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

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

Turn out 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 upper body (Fig. 2-93):

- using a driver, carefully push float pivot 16 out of the brackets (in the direction of the bracket with cut-out) 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 upper body gasket 11, unscrew needle valve seat 14, unscrew plug 13 and take out fuel filter 12;

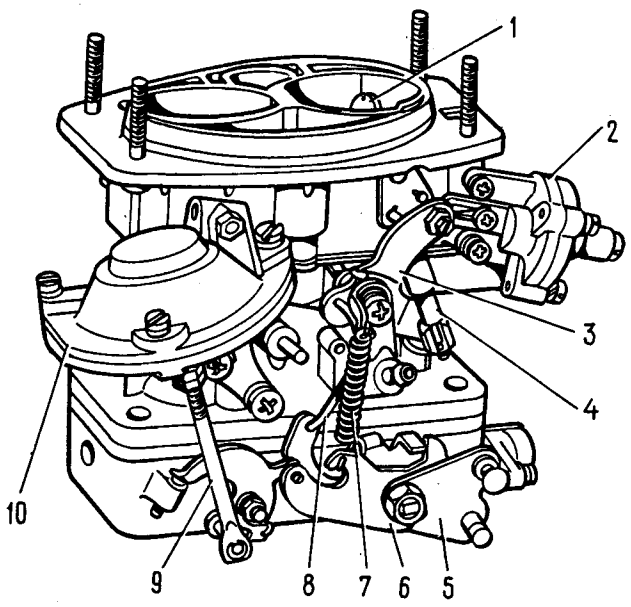


Fig. 2-92. Carburettor 2107-1107010-20 Viewed from Throttle Control Linkage:
1 - choke valve; 2 - choke mechanism; 3 - choke valve control lever; 4 - telescopic link; 5 - primary throttle valve operating lever; 6 - secondary throttle valve opening limiting lever; 7 - return spring; 8 - link connecting primary throttle valve with choke mechanism control linkage; 9 - pneumatic actuator rod; 10 - pneumatic actuator

- disconnect telescopic link 7 and choke mechanism link 19 from the lever of choke valve shaft 8;
- turn out two screws of choke mechanism body 6 and remove the latter;
- turn out three screws of choke mechanism cover 2 and take off the cover with adjusting screw and spring 3;
- remove diaphragm 4.

Disassemble throttle valve housing (Fig. 2-94)

- turn out idle mixture adjusting screw 18;
- remove the fastening screws of idle speed adjusting screw bushing 17 (Fig. 2-95) and take it off complete with screw 16 ;
- unbend the tab of lockwasher 2 (Fig. 2-93) and unscrew nut 1 which fastens the levers on the primary throttle valve shaft;
- remove the lockwasher, levers 3, 5, 8 and 21 with washers 7 and bushing 6 from the primary throttle valve shaft, then take off spring 20 and fume valve 19;
- unscrew nut 9 which fastens lever 10 on the secondary throttle valve shaft and remove the lever with the washers.

On carburettors 2107-1107010-10 and 2107-1107010-20 remove two levers with washers and a spring from the secondary throttle valve shaft (Fig. 2-95).

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

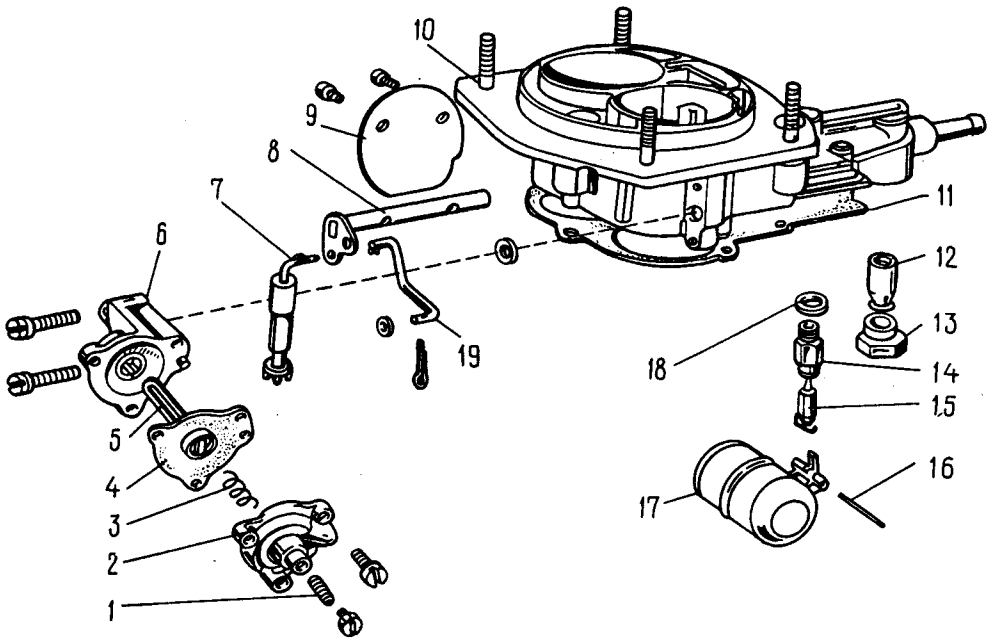


Fig. 2-93. Carburettor Upper Body Parts:
1 - adjusting screw; 2 - choke mechanism cover; 3 - spring; 4 - diaphragm; 5 - diaphragm rod; 6 - choke mechanism body; 7 - telescopic link; 8 - choke valve shaft; 9 - choke valve; 10 - carburettor upper body; 11 - gasket; 12 - filter; 13 - filter plug; 14 - needle valve seat; 15 - needle valve; 16 - float pivot; 17 - float; 18 - gasket; 19 - choke mechanism link

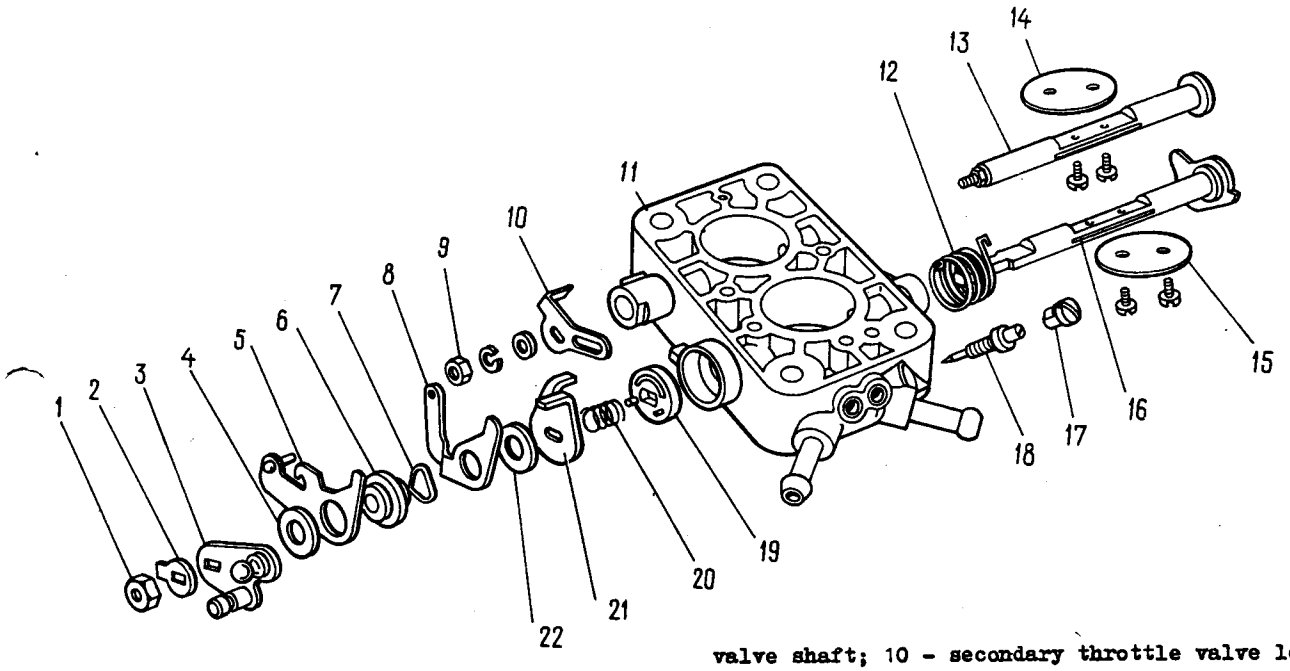
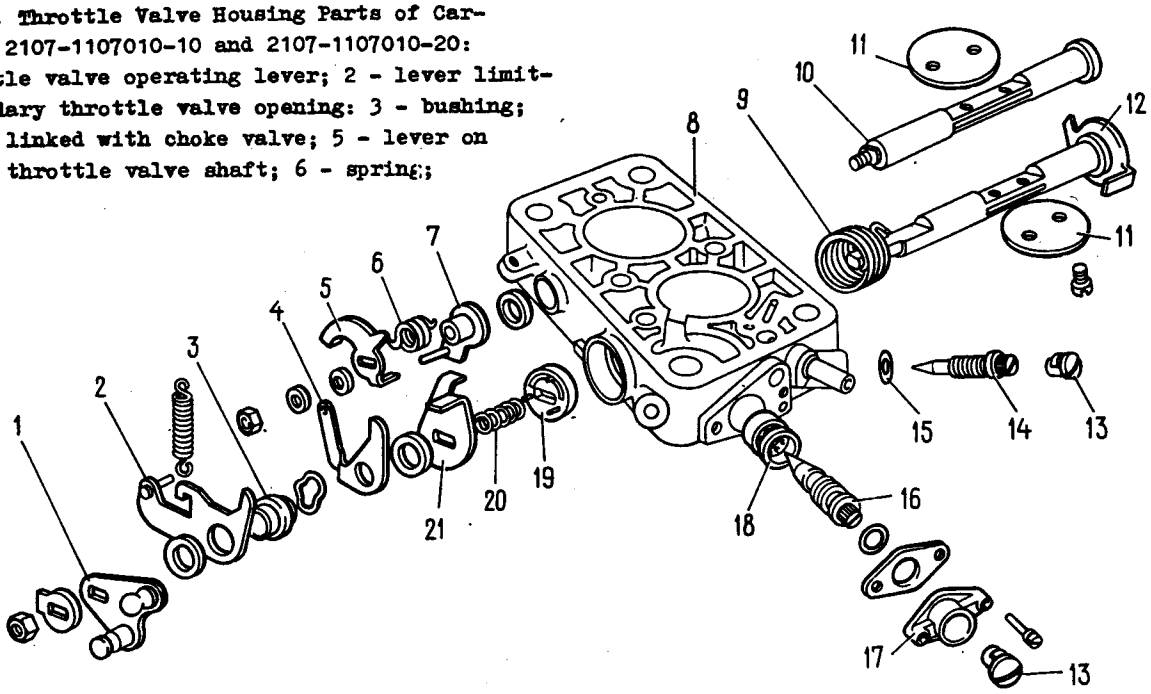


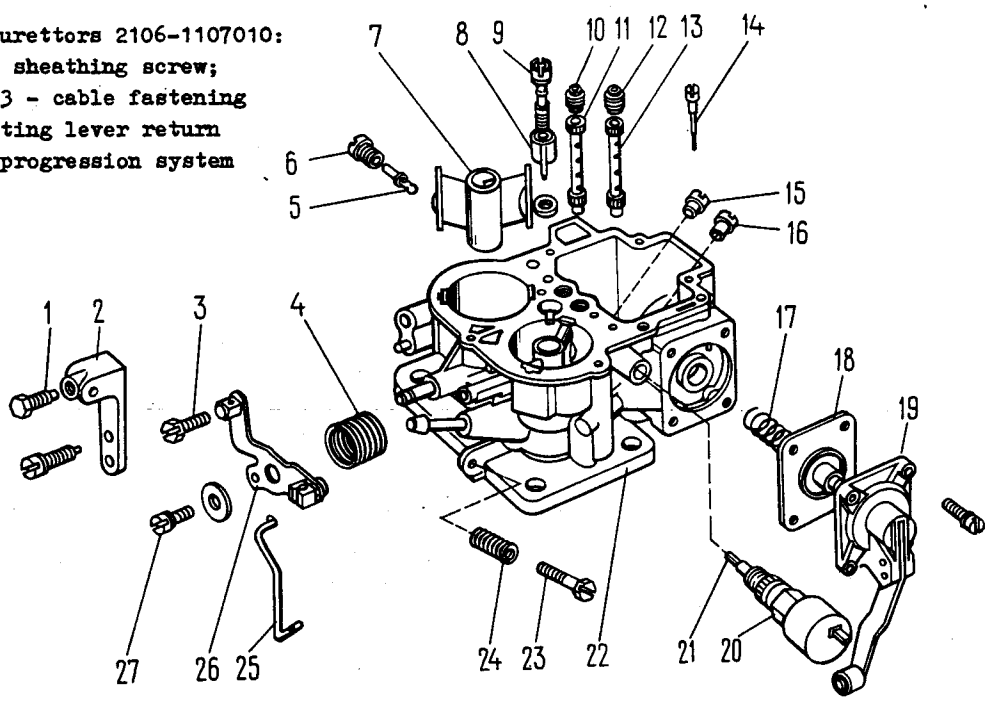
Fig. 2-94. Throttle Valve Housing Parts of Carburettors 2106-1107010:
1 - nut for fastening levers on primary throttle valve shaft; 2 - lockwasher; 3 - throttle valve operating lever; 4 - washer; 5 - secondary throttle valve operating lever; 6 - bushing; 7 - spring washer; 8 - lever linked with choke mechanism; 9 - nut for fastening lever on secondary throttle valve shaft; 10 - secondary throttle valve lever; 11 - throttle valve housing; 12 - primary throttle valve return spring; 13 - secondary throttle valve shaft; 14 - secondary throttle valve; 15 - primary throttle valve; 16 - primary throttle valve shaft; 17 - screw limiting bushing; 18 - idle mixture adjusting screw with sealing ring; 19 - fume valve; 20 - spring; 21 - primary throttle valve shaft lever; 22 - washer

Fig. 2-95. Throttle Valve Housing Parts of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - throttle valve operating lever; 2 - lever limiting secondary throttle valve opening: 3 - bushing; 4 - lever linked with choke valve; 5 - lever on secondary throttle valve shaft; 6 - spring;



7 - lever linked with pneumatic actuator; 8 - throttle valve housing; 9 - primary throttle valve return spring; 10 - secondary throttle valve shaft; 11 - throttle valves; 12 - primary throttle valve shaft; 13 - limiting bushing; 14 - idle mixture adjusting screw; 15 - sealing ring; 16 - idl speed adjusting screw; 17 - idle speed adjusting screw bushing; 18 - mixing bushing; 19 - fume valve; 20 - fume valve spring; 21 - primary throttle valve shaft lever

Fig. 2-96. Body Parts of Carburettors 2106-1107010:
1 - choke valve control cable sheathing screw; 2 - cable sheathing 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 - acceleration pump valve-screw; 10 - secondary barrel main air jet; 11, 13 - emulsion tubes; 12 - primary barrel main air jet; 14 - acceleration pump adjusting screw; 15, 16 - secondary and primary barrels main fuel jets; 17 - acceleration pump return spring; 18 - acceleration pump diaphragm; 19 - acceleration pump cover; 20 - shutoff valve; 21 - idle 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

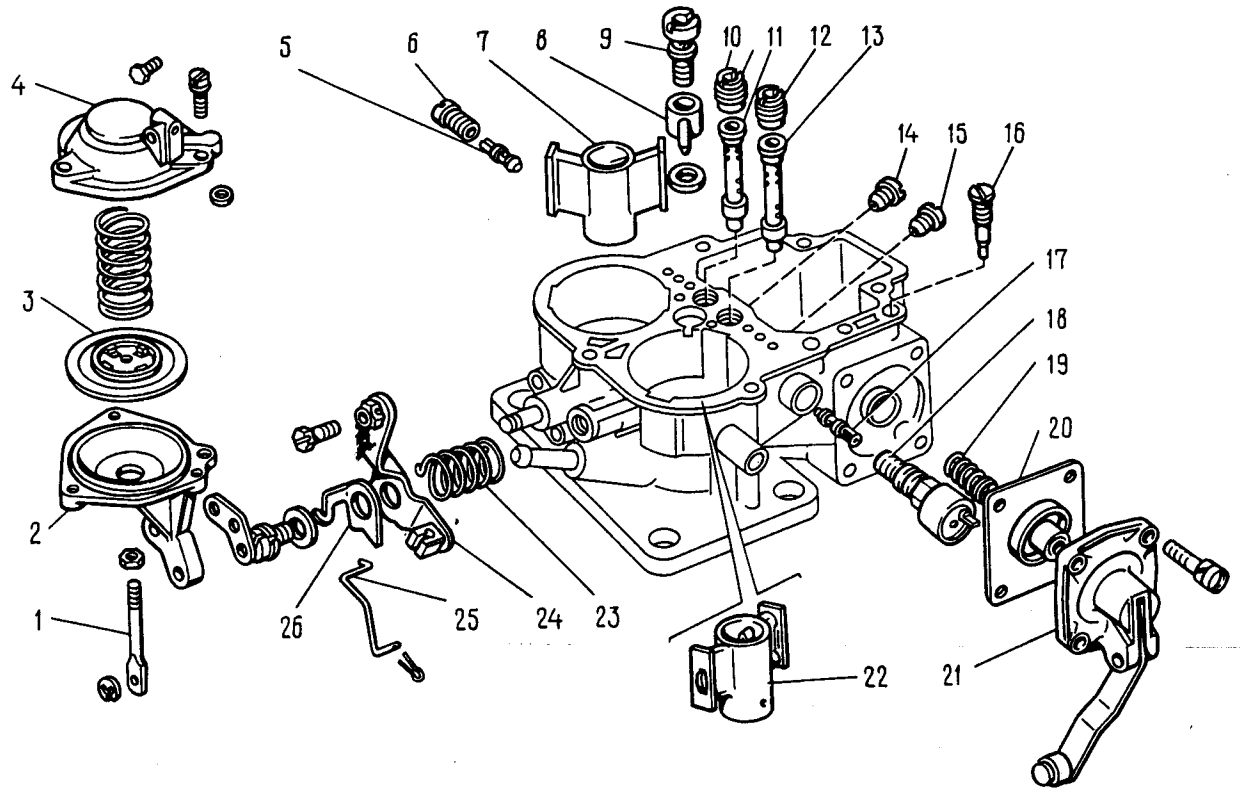


Fig. 2-97. Body Parts of Carburettors 2107-1107010-10 and 2107-1107010-20:
1 - secondary throttle valve pneumatic actuator rod; 2 - pneumatic actuator body; 3 - diaphragm; 4 - pneumatic actuator cover; 5 - secondary barrel progression system fuel jet; 6 - fuel jet body; 7 - smaller venturi; 8 - acceleration pump atomizer; 9 - acceleration pump valve-screw; 10, 12 - secondary and primary barrels main air jets; 11, 13 - secondary and primary barrels emulsion tubes; 14, 15 - secondary and primary barrels main fuel jets; 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 - accelerator pump cover; 22 - primary barrel smaller venturi; 23 - choke valve lever return spring; 24 - choke valve operating lever; 25 - link for connection with throttle valve; 26 - throttle valve return spring bracket

Disassemble the carburettor body (Fig. 2-96):

- turn out screw 27 of choke valve operating lever 26, remove the lever and spring 4, detach rod 25 from the lever;
- turn out the screws of acceleration pump cover 19, remove the cover with the lever and acceleration pump diaphragm 18 with return spring 17;
- turn out main air jets 10 and 12, overturn the body and, striking it gently, shake emulsion tubes 11 and 13 out of their wells;
- unscrew fuel jet body 6 and take it out complete with jet 5; turn out shutoff valve 20;
- remove valve-screw 9 and take off atomizer 8 of the acceleration pump with gaskets and turn out acceleration pump adjusting screw 14;
- turn out screw 23 which adjusts the opening of the throttle valve;
- take out smaller Venturis 7;
- unscrew main fuel jets 15 and 16;
- turn out the screw and remove bracket 2 which holds the casing of the choke valve control cable.

On carburettors 2107-1107010-10 and 2107-1107010-20 remove the pneumatic actuator of the secondary barrel throttle valve instead of bracket 2.

To disassemble the pneumatic actuator, turn out three fastening screws of cover 4 (Fig. 2-97) and remove the cover, then the spring and diaphragm 3 with the rod.

Cleaning and Inspection

Fuel filter. Wash the filter in gasoline and blow it with compressed air. Examine the filter and the tapered sealing bend of the filter plug. Replace the filter or plug, if damaged.

Float mechanism. The float must be neither damaged nor distorted. The mass of the float should be 11 - 13 g. The contact surfaces of the needle valve and its seat shall be free of defects interfering with the valve tightness. The valve should be free to move in its socket and its ball should move freely, without jamming. Replace any faulty parts with new ones.

Carburettor upper body. Clean the upper body and all holes and passages of dirt and oil. Wash the upper body in gasoline or acetone and blow it out with compressed air. Examine the sealing surfaces of the upper body. If the upper body is damaged, replace it by a new one.

Choke mechanism. Clean all the parts of the choke mechanism, wash them in gasoline and airblast. Examine the parts closely and replace any damaged ones.

Jets and emulsion tubes. Clean the jets and emulsion tubes of dirt and gummy deposits. Wash them in acetone or gasoline and blow through with compressed air.

Caution

Do not clear up the jets with metal tools or pieces of wire, nor wipe them and other carburettor parts with cotton wool, fabric or rags since the remaining lints may obstruct the fuel-emulsion path.

In case of heavy obstruction, clean the jets with a softwood needle wetted with acetone.

Carburettor shutoff valve (Fig. 2-98). In case of erratic valve functioning check for jamming of the valve needle and measure resistance of the coil which should be 150-160 Ω at 20 °C. If it is other than nominal, replace the shutoff valve.

Carburettor body. Clean the body of dirt and oil. Wash the body and its passages with gasoline or acetone and blow out with compressed air. If necessary, clean the passages and emulsion wells with special reamers. Examine the sealed surfaces of the body and replace the body, if they are damaged.

Acceleration pump. Clean, wash and airblast the pump parts. Check the ball for ease of motion in valve-screw 9 (Fig. 2-96) and the condition of the sealed surfaces and gaskets.

Check the movable elements of the pump (lever, roller, diaphragm parts) for ease of movement. There should be no jamming. The diaphragm should be intact, without deformations. Replace any damaged parts by new ones.

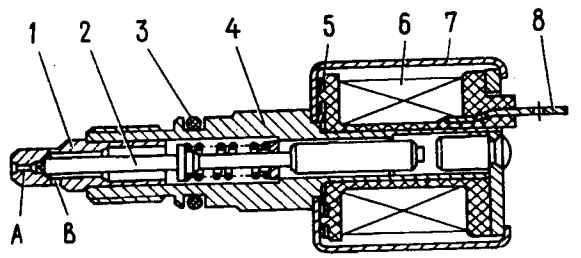


Fig. 2-98. Carburettor Shutoff Valve:
1 - idle fuel jet; 2 - needle; 3 - sealing ring; 4 - valve body; 5 - contact plate; 6 - coil; 7 - coil housing; 8 - plug; A - jet calibrated orifice; B - fuel outlet hole into idling system emulsion channel

Secondary throttle valve pneumatic actuator. Clean, wash and airblast the parts. Examine the diaphragm. It should be perfectly intact.

Throttle valve housing. Clean the parts and wash them with gasoline or acetone. Inspect the parts and replace those damaged.

Assembly of Carburettor

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

- 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. 2-81) 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 cylindrica 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 idle fuel jets have figures indented on the cylindrical band (e.g. "45" or "60"); these figures denote the diameter of the orifice (0.45 or 0.60 mm).

Installation of Secondary Throttle Valve Pneumatic Actuator. To connect rod 8 (Fig. 2-85) tc lever 6 on the secondary throttle valve shaft proceed as follows:

- 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 the pin on lever 6;
- slip rod 8 on the pin of lever 6 and secure it with a lockwasher;
- fasten rod 8 with a locknut, using another wrench to keep bushing 11 against turning.

Post-Assembly Adjustment and Checks of Carburettor

Position of throttle valves in carburettor 2106-1107010. With lever 4 (Fig. 2-99) in a positi where the upper lug of lever 3 contacts lever 2,

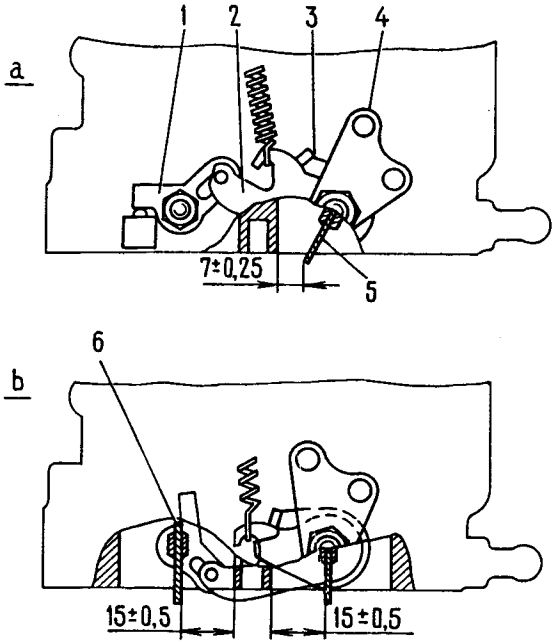


Fig. 2-99. Adjusting Full and Partial Opening of Throttle Valves in Carburettor 2106-1107010:
a - adjusting partial opening of primary throttle valve; b - adjusting position of secondary throttle valve:
1 - lever on secondary throttle valve shaft;
2 - secondary throttle valve operating lever;
3 - lever rigidly linked with primary throttle valve shaft; 4 - throttle valve operating lever;
5 - primary throttle valve; 6 - secondary throttle valve

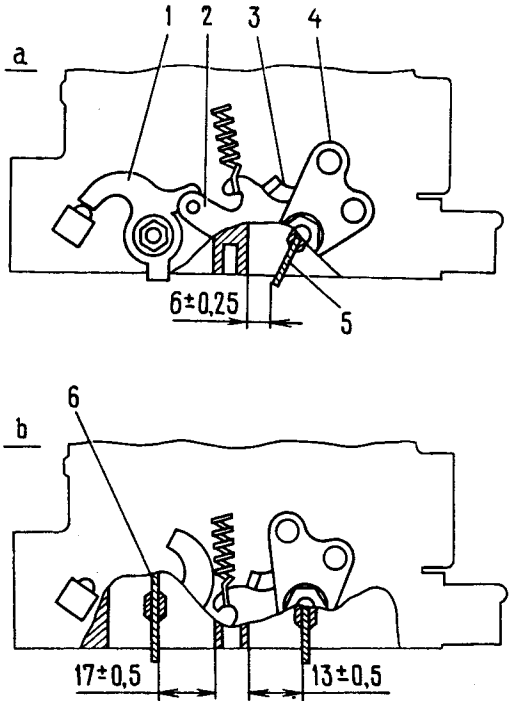


Fig. 2-100. Adjusting Position of Throttle Valves in Carburettors 2107-1107010-10 and 2107-1107010-20:
a - primary throttle valve partially open;
b - throttle valves fully open; 1 - lever on secondary throttle valve shaft; 2 - secondary throttle valve operating lever; 3 - lever rigidly connected with primary throttle valve shaft;
4 - throttle valves operating lever; 5 - primary throttle valve; 6 - secondary throttle valve

the primary throttle valve 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. 2-99 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 to stop.

The maximum opening of the primary throttle valve [(13 ±0.5) mm] should be adjusted by bending the lower lug of lever 3 (Fig. 2-100).

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

Partial opening of the primary throttle valve at which the upper lug of lever 3 contacts lever 2 (Fig. 2-101, a) should be (6±0.25) mm. This distance is adjusted by bending the upper lug of lever 3.

Choke mechanism. When lever 1 (Fig. 2-101) is turned all the way counter-clockwise, the choke valve should be tightly closed. In this position of the lever the end of link 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 link 3.

When the choke valve is tightly closed, the primary throttle valve must be partially 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 through (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 by ten complete strokes (turns) of throttle valve operating lever 4 (Fig. 2-100). Fuel discharged from the pump atomizer during these ten strokes should be collected into a measuring glass. Its volume should range from 5.25 to 8.75 cm^3.

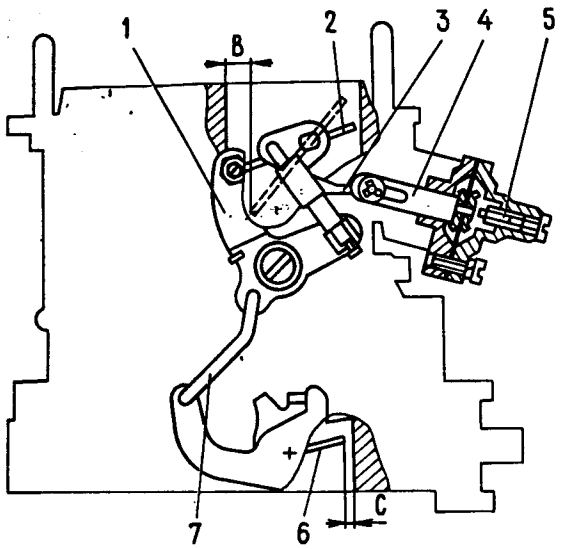


Fig. 2-101. Adjusting Choke Mechanism Control Linkage:
1 - choke valve operating lever; 2 - choke valve; 3 - choke mechanism link; 4 - choke mechanism rod; 5 - adjusting screw; 6 - primary throttle valve; 7 - throttle valve operating link

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

Tightness of 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 for 10 - 15 s. If the level drops, this should be attributed to the leakage of fuel through the needle valve.

EXHAUST SYSTEM

Exhaust gases are discharged from the engine through the exhaust manifold, muffler inlet pipe 1 (Fig. 2-102), 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, they should be replaced by new ones.

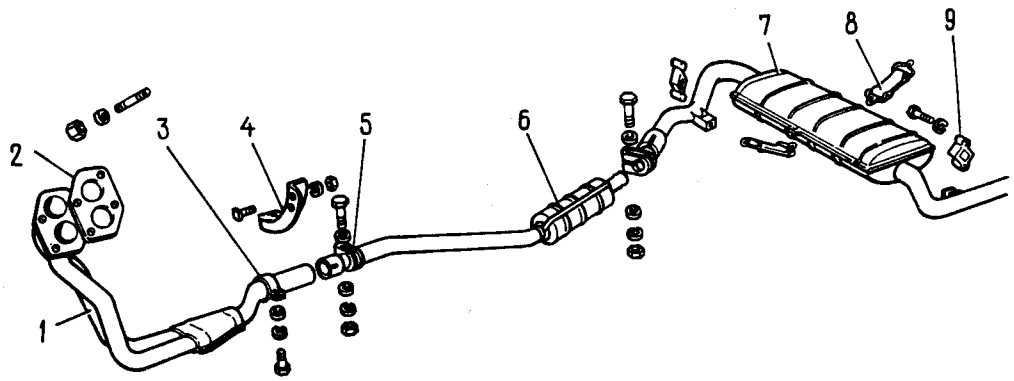


Fig. 2-102. Exhaust System:
1 - muffler inlet pipe; 2 - gasket; 3 - inlet pipe-to-gearbox clamp; 4 - inlet pipe-to-gearbox bracket; 5 - muffler pipe connecting clamp; 6 - front auxiliary muffler; 7 - main muffler; 8 - main muffler fastening strap; 9 - tail pipe fastening pad

Section III
POWER TRAIN

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19 WHITE HALL AVE
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TEL. NO. 720393

CLUTCH

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

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

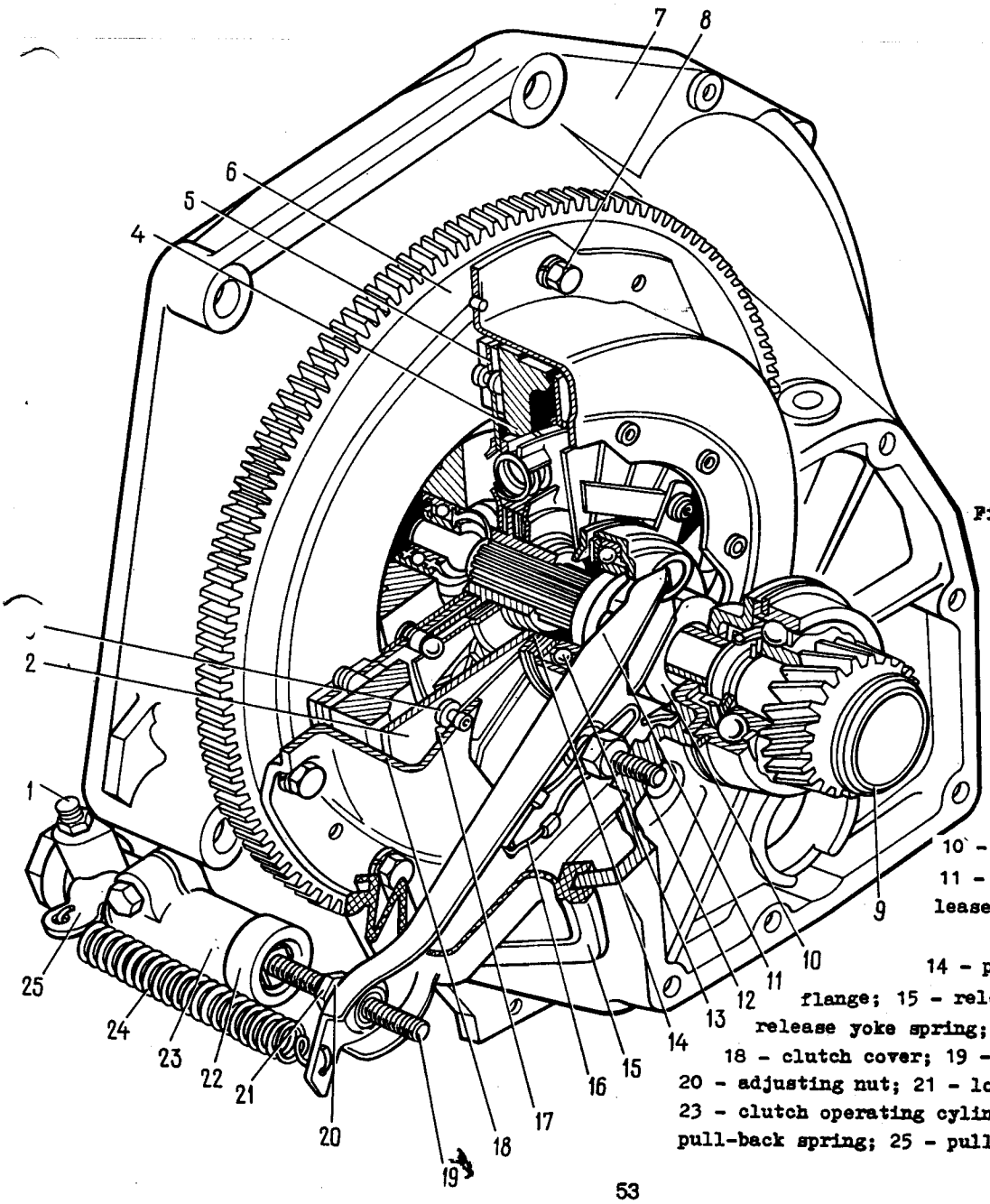


Fig. 3-1. Clutch Assembly: 1 - bleeder union; 2 - central pressure spring; 3 - pressure spring stepped rivet; 4 - pressure plate; 5 - driven disc; 6 - flywheel; 7 - clutch housing; 8 - clutch cover-to-flywheel bolt; 9 - gearbox clutch shaft; 10 - clutch release sleeve; 11 - release yoke; 12 - release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

Cont'd

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

ADJUSTING CLUTCH CONTROL MECHANISM

To adjust the clutch control mechanism perform the following operations:

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

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

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

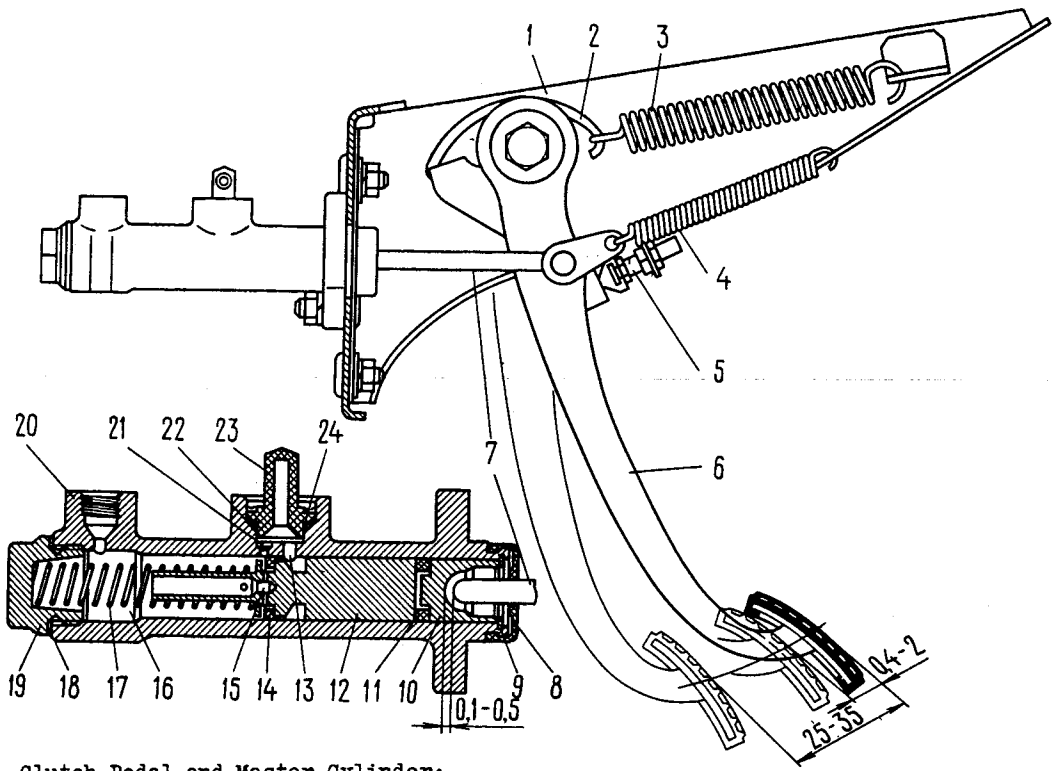


Fig. 3-2. Clutch Pedal and Master Cylinder:
1 - clutch and brake pedals bracket; 2 - hook; 3 - clutch pedal servo spring; 4 - clutch pedal retracting spring; 5 - clutch pedal stop; 6 - clutch pedal; 7 - pushrod; 8 - boot; 9 - lock-ring; 10 - pushrod piston; 11 - sealing ring; 12 - master cylinder piston; 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 (compensating) hole; 22 - union gasket; 23 - union; 24 - lockwasher

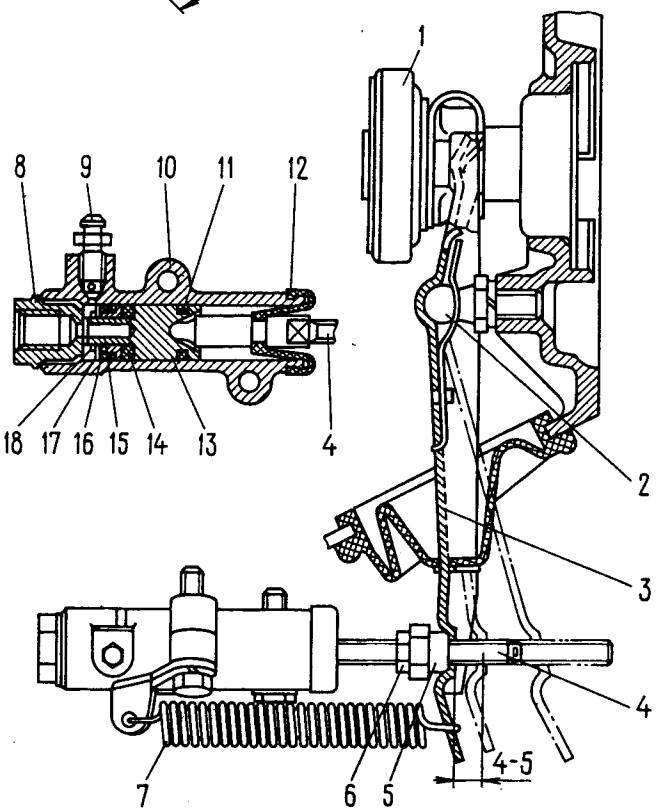


Fig. 3-3. Clutch Operating Cylinder and Release Yoke:
1 - clutch release bearing; 2 - ball support; 3 - release yoke; 4 - pushrod; 5 - adjusting nut; 6 - locknut; 7 - retracting spring; 8 - barrel plug; 9 - bleeder union; 10 - cylinder barrel; 11 - sealing ring; 12 - boot; 13 - piston; 14 - seal; 15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

BLEEDING HYDRAULIC CLUTCH SYSTEM

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

To bleed the hydraulic system:

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

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

When bleeding, observe the following requirements:

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

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

REMOVAL AND INSTALLATION OF CLUTCH

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

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

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

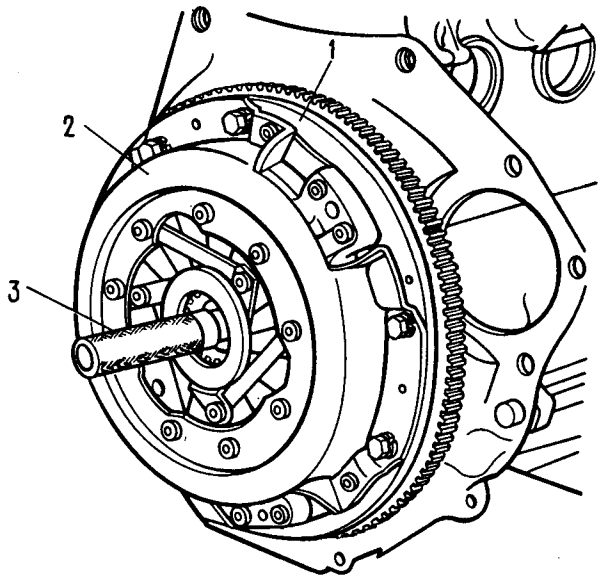


Fig. 3-4. Aligning Driven Disc with Mandrel A.70081:
1 - flywheel; 2 - clutch assembly; 3 - mandrel A.70081

CLUTCH CHECKS

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

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

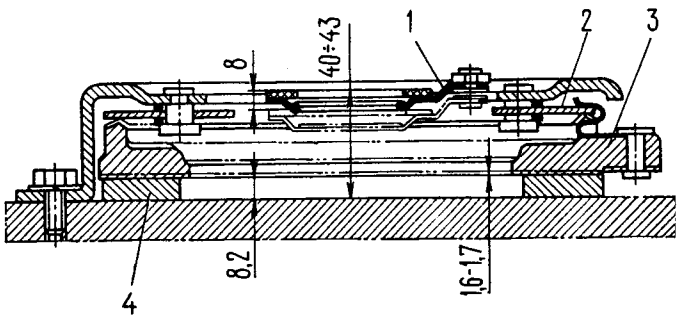


Fig. 3-5. Clutch Checks:
1 - pressure spring thrust flange; 2 - central pressure spring; 3 - pressure plate; 4 - ring

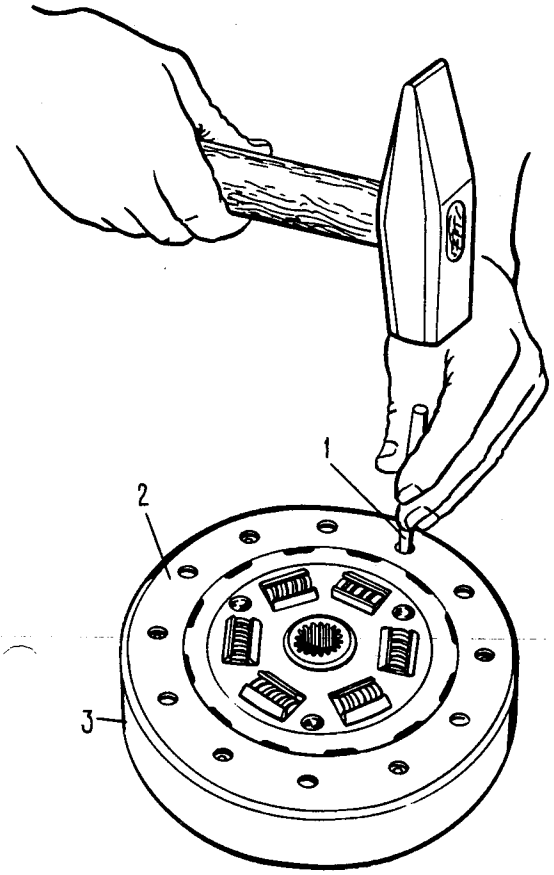


Fig. 3-6. Replacing Driven Disc Friction Facings: 1 - mandrel 67.7851.9500; 2 - driven disc; 3 - jig 67.7822.9517

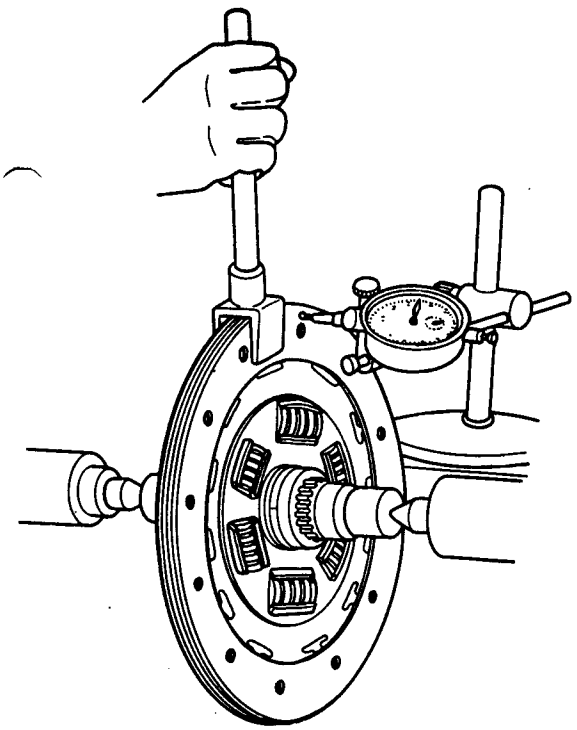


Fig. 3-7. Straightening Clutch Driven Disc

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

REMOVAL AND INSTALLATION OF CLUTCH OPERATING AND MASTER CYLINDERS

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

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

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

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

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

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

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

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

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

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

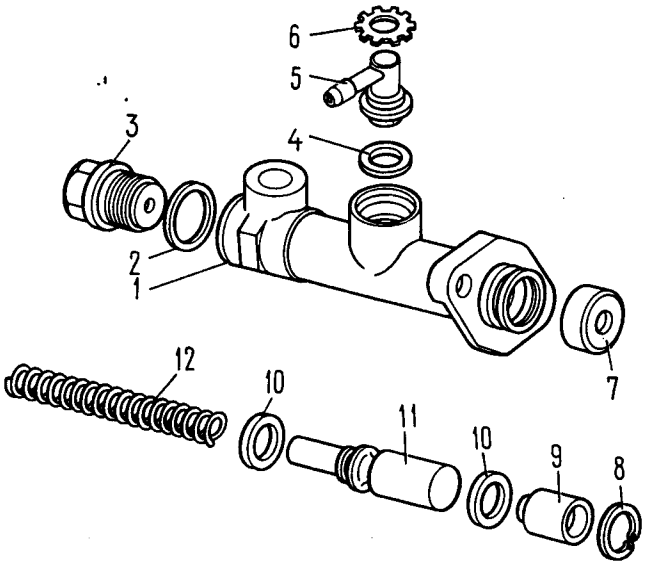


Fig. 3-8. Master Cylinder Parts:
1 - barrel; 2 - sealing gasket; 3 - plug; 4 - gasket; 5 - union; 6 - lockwasher; 7 - boot; 8 - lockring; 9 - pushrod piston; 10 - sealing ring; 11 - master cylinder piston; 12 - spring

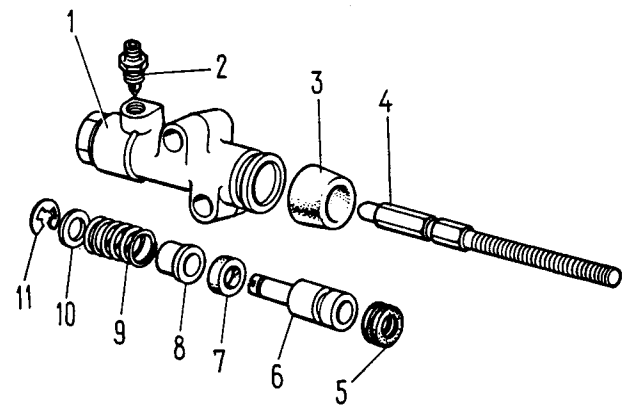


Fig. 3-9. Clutch Operating Cylinder Parts:
1 - barrel; 2 - union; 3 - boot; 4 - pushrod; 5 - sealing ring; 6 - piston; 7 - sealing ring; 8 - spring seat; 9 - spring; 10 - washer; 11 - lockring

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

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

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

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

STAND CHECKS OF CLUTCH MASTER CYLINDER

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

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

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

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

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

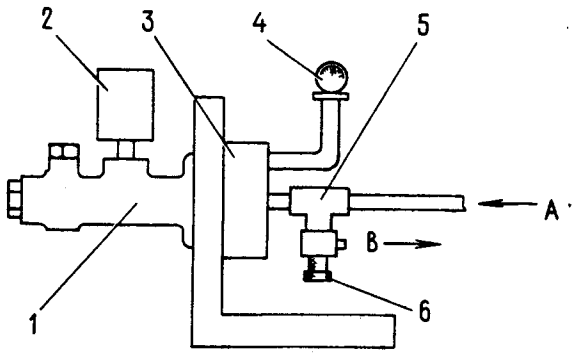


Fig. 3-10. Checking Rear Sealing Ring for Tightness:
1 - master cylinder; 2 - vessel; 3 - adapter with seal; 4 - pressure gauge; 5 - Tee-pipe; 6 - adjusting screw; A - air from compressor; B - air outlet

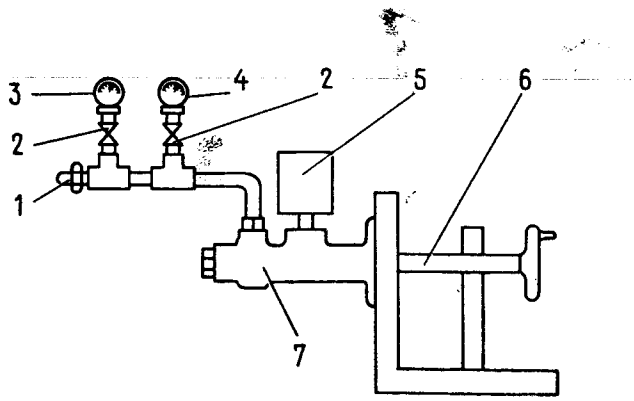


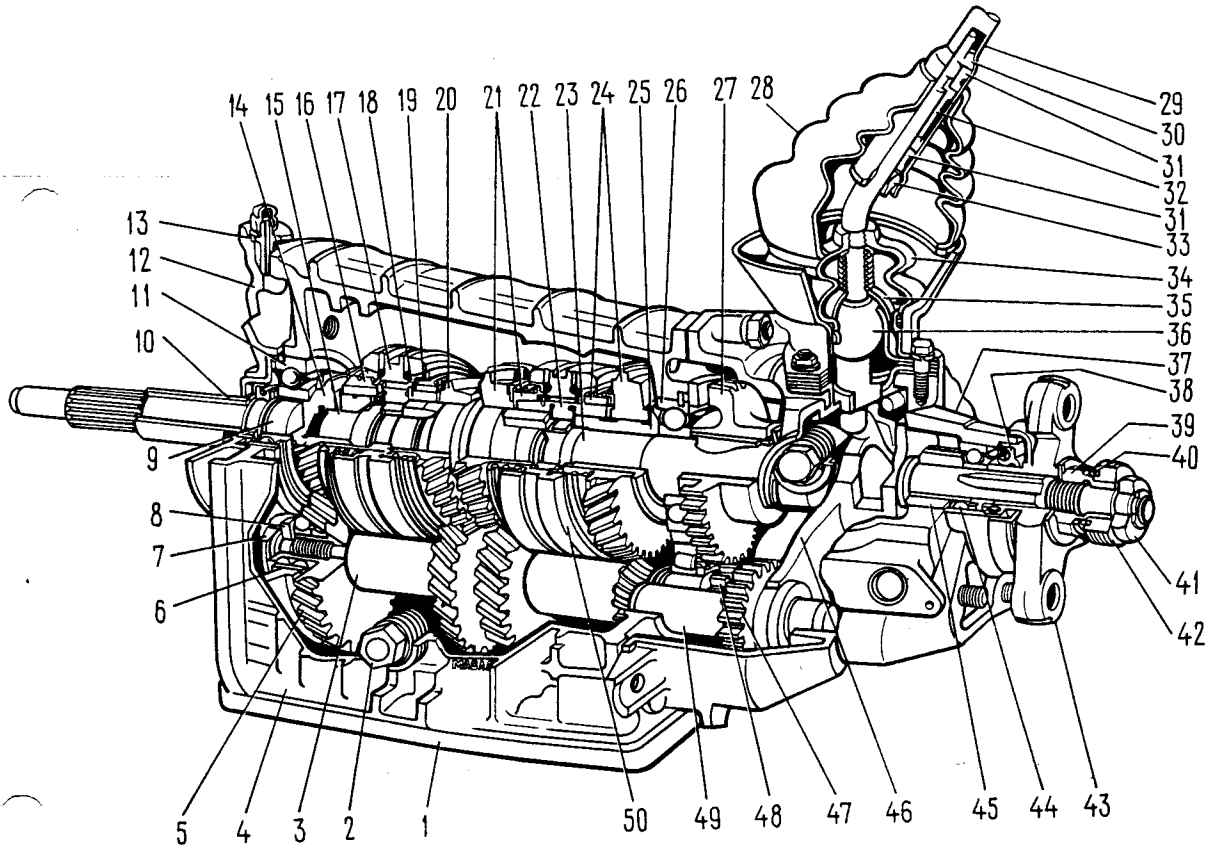
Fig. 3-11. Checking Front Sealing Ring for Tightness:
1 - bleeder screw; 2 - cock; 3 - pressure gauge, division value 0.2 MPa (2 kgf/cm^2); 4 - pressure gauge, division value 0.005 MPa (0.05 kgf/cm^2); 5 - vessel; 6 - pushrod; 7 - master cylinder

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

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

GEARBOX

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



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

TROUBLE SHOOTING

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

REMOVAL AND INSTALLATION

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

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

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

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

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

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

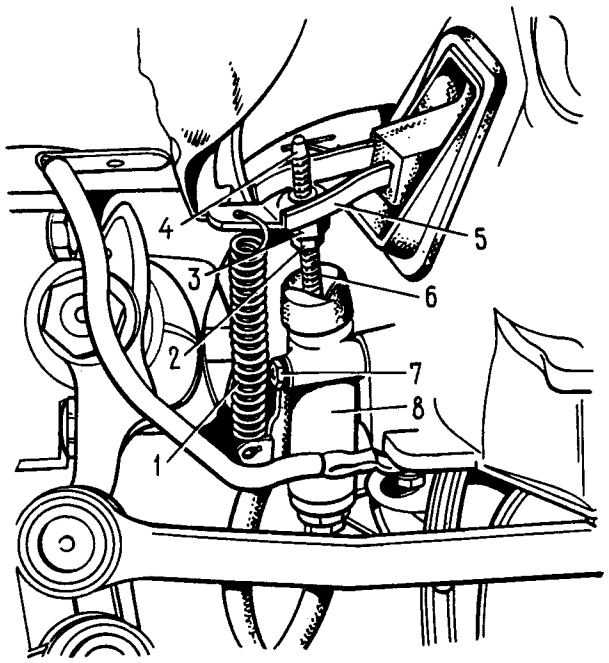


Fig. 3-13. Clutch Control Linkage:
1 - yoke retracting spring; 2 - locknut; 3 - adjusting nut; 4 - cotter pin; 5 - clutch release yoke; 6 - pushrod; 7 - operating cylinder-to-clutch housing bolt; 8 - clutch operating cylinder

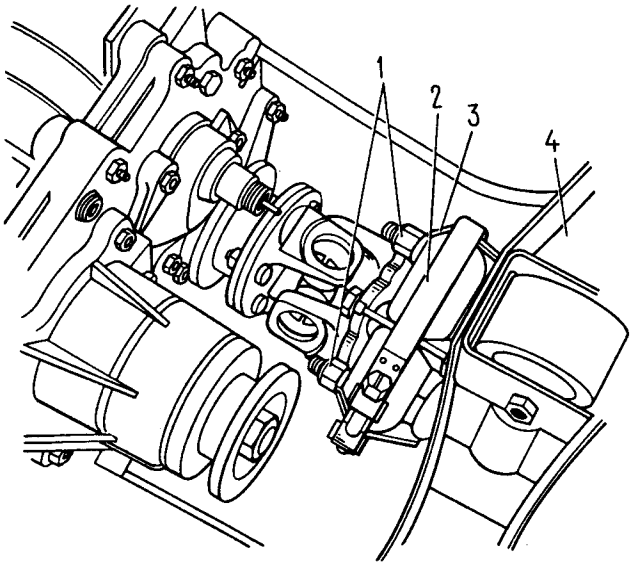


Fig. 3-14. Propeller Shaft-to-Gearbox Flexible Coupling:
1 - propeller shaft-to-flexible coupling nuts; 2 - clamp A.70025; 3 - flexible coupling; 4 - engine rear mount crossmember

from the clutch housing. Cylinder 8 connected by a pipe with the master cylinder remains on the car, thus preventing losses of brake 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 propeller 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. Lower and shift aside the axle drive propeller shafts.

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 mount from cross member 4 (Fig. 3-14) and remove the cross member, propping up the gearbox from underneath.

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

Caution

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

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

DISASSEMBLY AND ASSEMBLY

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

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

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

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

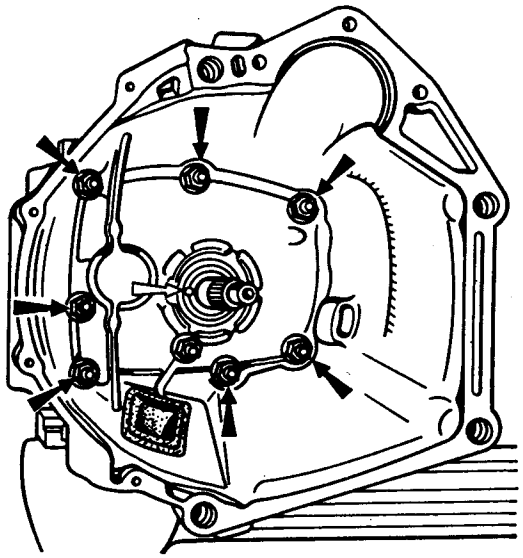


Fig. 3-15. Clutch Housing, Inside View. Black arrows show housing-to-gearbox nuts. White arrow shows hole in front cover for draining oil from gearbox housing to prevent oiling of clutch discs

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

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

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

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

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

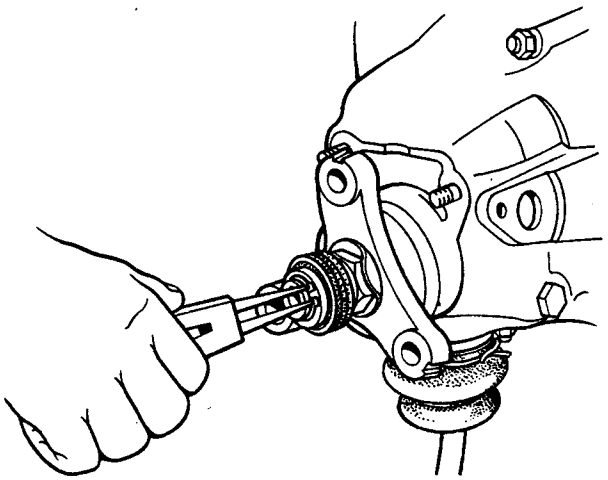


Fig. 3-16. Removing Lockring

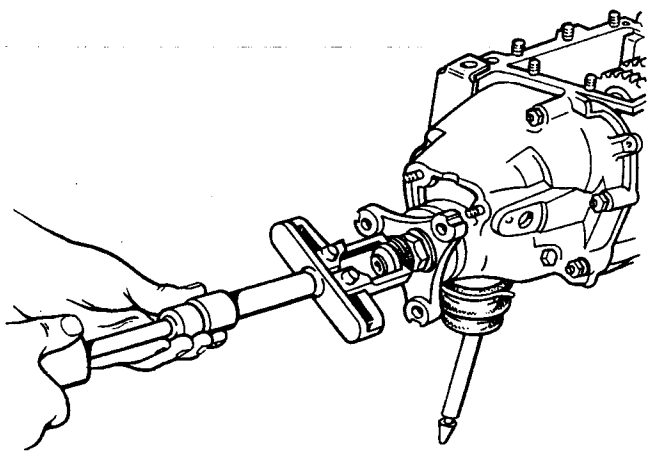


Fig. 3-17. Removing Aligning Ring of Propeller Shaft Flexible Coupling with Remover Tools A.40006/1 and A.40005/4

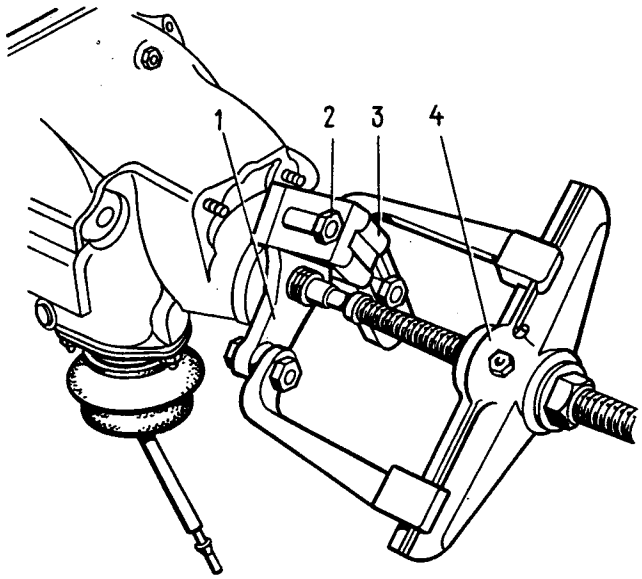


Fig. 3-18. Removing Flexible Coupling Flange with Remover Tool A.40005/3/9B/9C:
1 - flexible coupling flange; 2 - fixture-to-flange fastening bolts; 3 - fixture of remover tool A.40005/3; 4 - remover tool A.40005/3

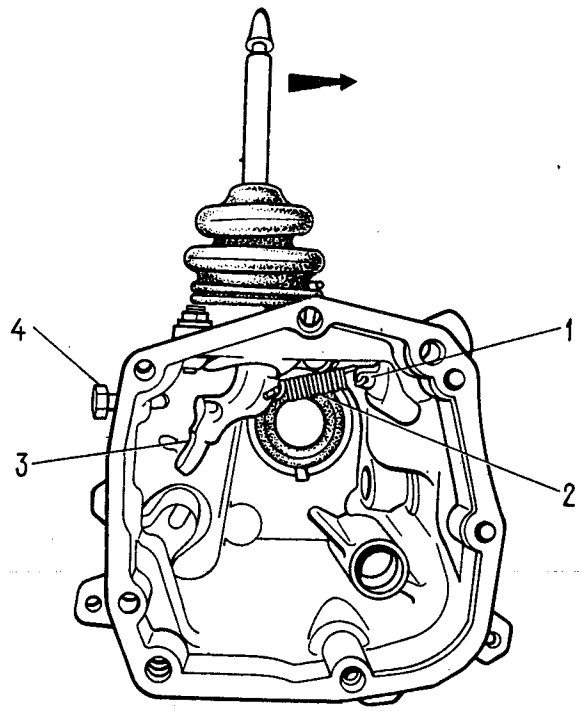


Fig. 3-19. Gearbox Rear Cover. Inside View:
1 - gearshift lever retracting spring eye-screw; 2 - gearshift lever retracting spring; 3 - gearshift lever; 4 - gearshift lever lateral travel stop screw. Arrow shows direction for moving the lever to disengage it from shift rail lugs and to remove gearbox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

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

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

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

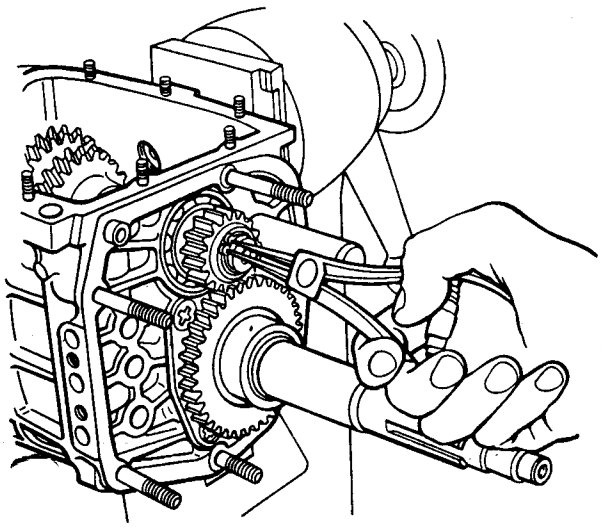


Fig. 3-20. Removing Reverse Gear Lockring from Countershaft

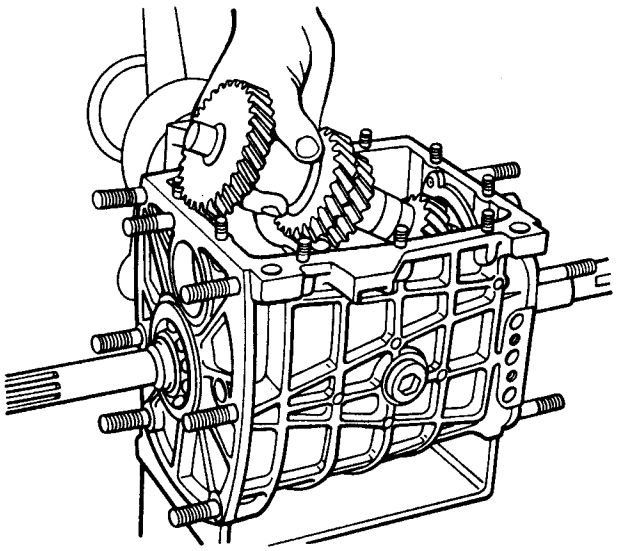
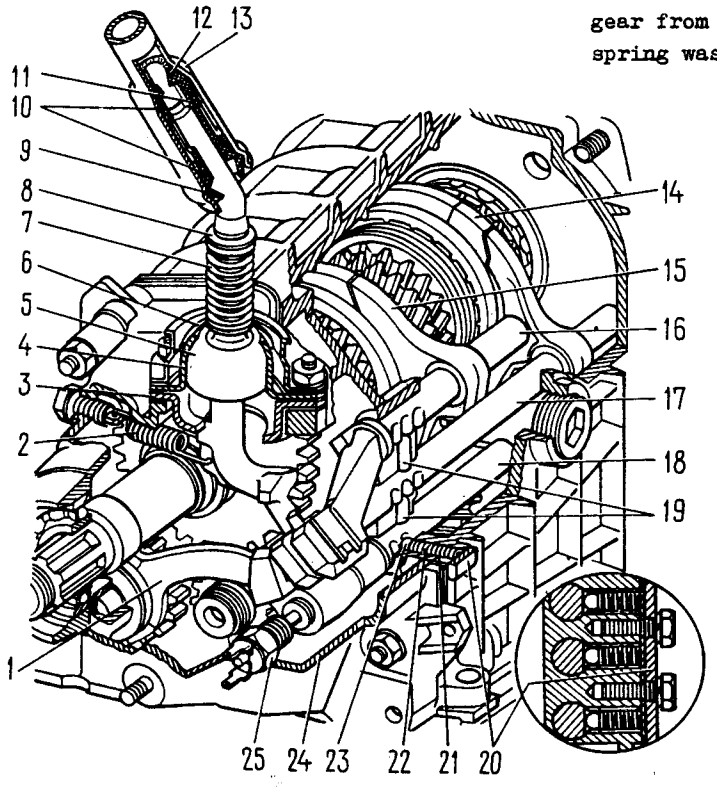


Fig. 3-21. Removing Countershaft from Gearbox Housing

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

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



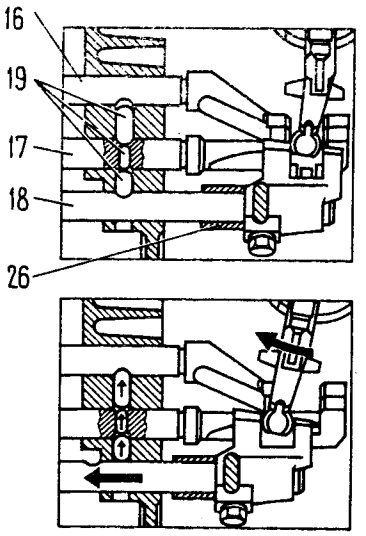


Fig. 3-22. Gearbox Control Mechanism:
1 - reverse shift fork; 2 - gearshift lever retracting spring; 3 - gearshift lever guide seat; 4 - lever ball support; 5 - gearshift lever; 6 - spherical washer; 7 - lever spring; 8 - lockring; 9 - locking bushing; 10 - flexible bushings; 11 - spacer bushing; 12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

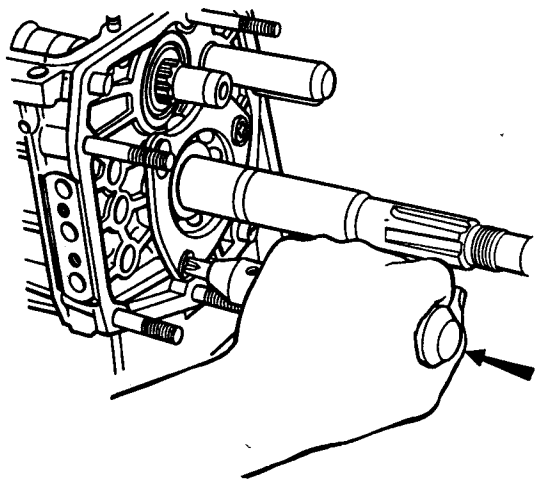


Fig. 3-23. Removing Fastening Screws of Main Shaft Intermediate Bearing Locking Plate with Power Screwdriver. Arrow shows direction of impact stroke (when striking the screwdriver with a hammer)

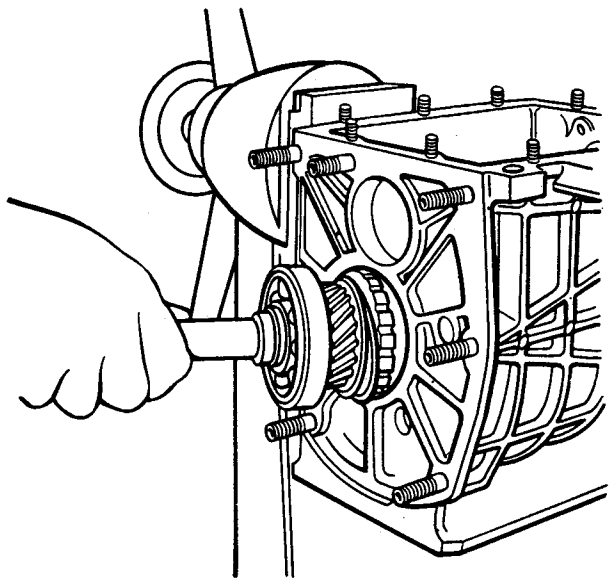


Fig. 3-24. Removing Clutch Shaft from Gearbox Housing

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

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

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

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

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

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

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

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

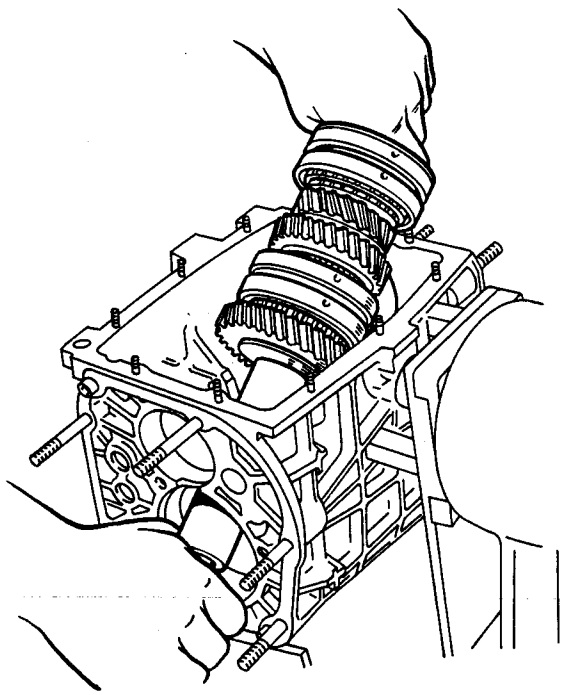


Fig. 3-25. Removing Main Shaft from Gearbox Housing

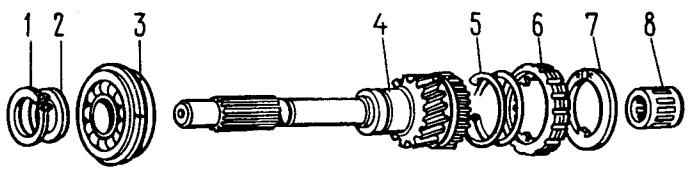


Fig. 3-26. Clutch Shaft Parts:
1 - lockring; 2 - spring washer; 3 - bearing; 4 - clutch shaft; 5 - synchronizer spring; 6 - synchronizer baulk ring; 7 - lockring; 8 - bearing

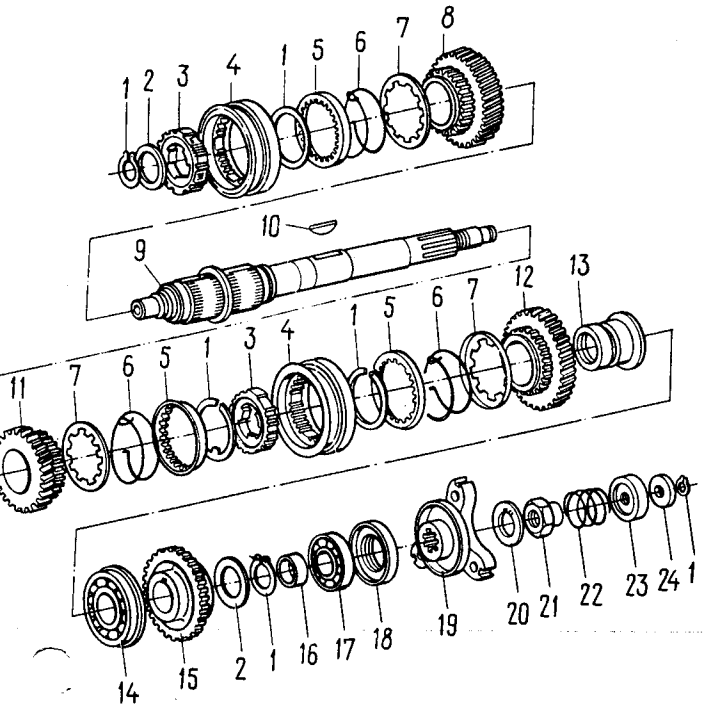


Fig. 3-27. Main Shaft Parts:
1 - lockring; 2 - spring washer; 3 - synchronizer hub; 4 - synchronizer sleeve; 5 - synchronizer baulk ring; 6 - synchronizer spring; 7 - washer; 8 - 3rd speed gear; 9 - main shaft; 10 - key; 11 - 2nd speed gear; 12 - 1st speed gear; 13 - 1st speed gear bushing; 14 - bearing;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

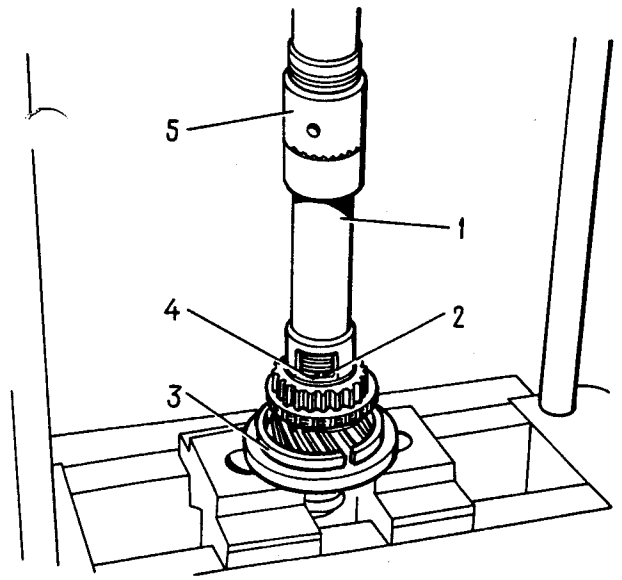


Fig. 3-28. Installing Main Shaft Lockring:
1 - installation tool 41.7816.4069; 2 - lockring; 3 - supporting half-ring; 4 - spring washer; 5 - press rod

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

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

Disassemble the gearshift lever and the rear cover as follows:

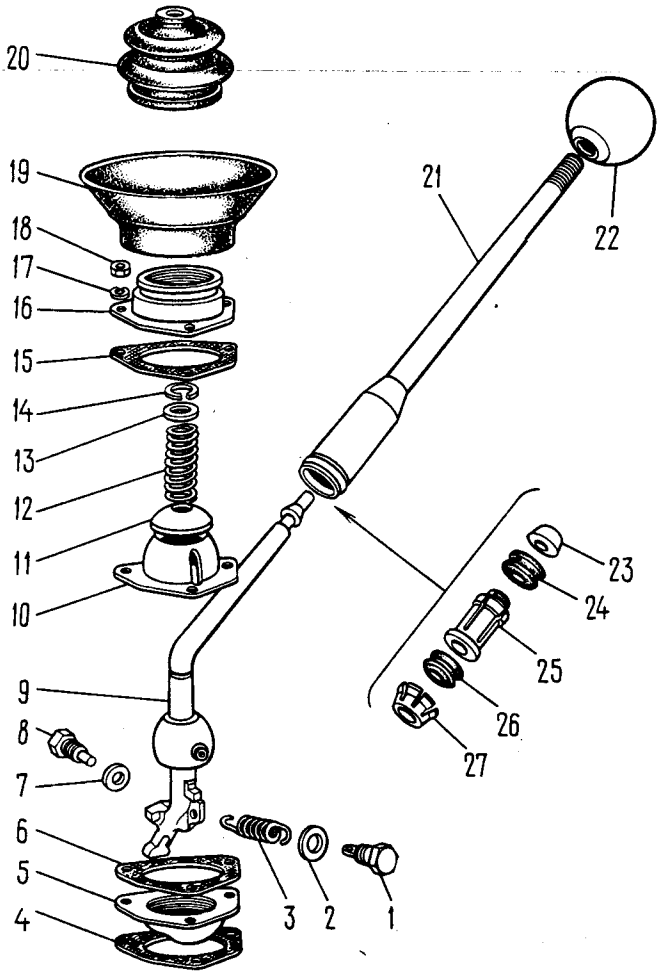


Fig. 3-29. Gearshift Lever Parts:
1 - retracting spring bolt; 2 - washer; 3 - retracting spring; 4 - gasket; 5 - guide seat; 6 - gasket; 7 - washer; 8 - stop bolt; 9 - gearshift lever; 10 - ball support; 11 - spherical washer; 12 - spring; 13 - supporting washer; 14 - lockring; 15 - gasket; 16 - flange;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

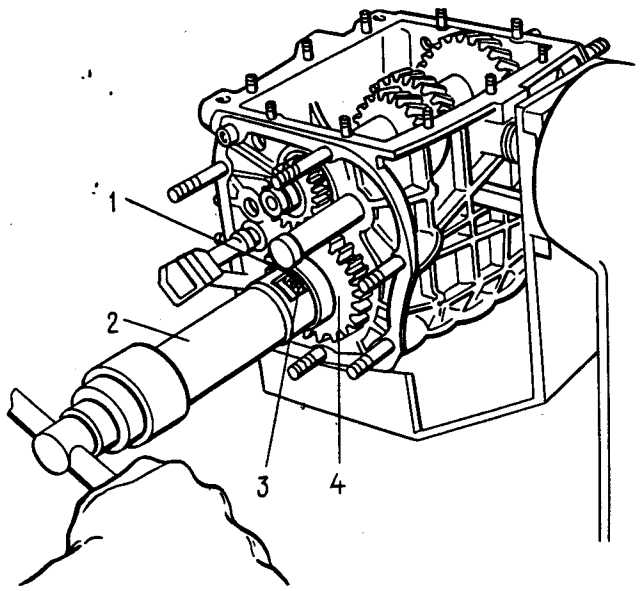


Fig. 3-30. Installing Reverse Gear Lockring on Main Shaft:
1 - lockring; 2 - installation tool 41.7816.4069;
3 - spring washer; 4 - main shaft reverse gear

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

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

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

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

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

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

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

INSPECTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

PECULIARITIES OF REPAIR OF FIVE-SPEED GEARBOX

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

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

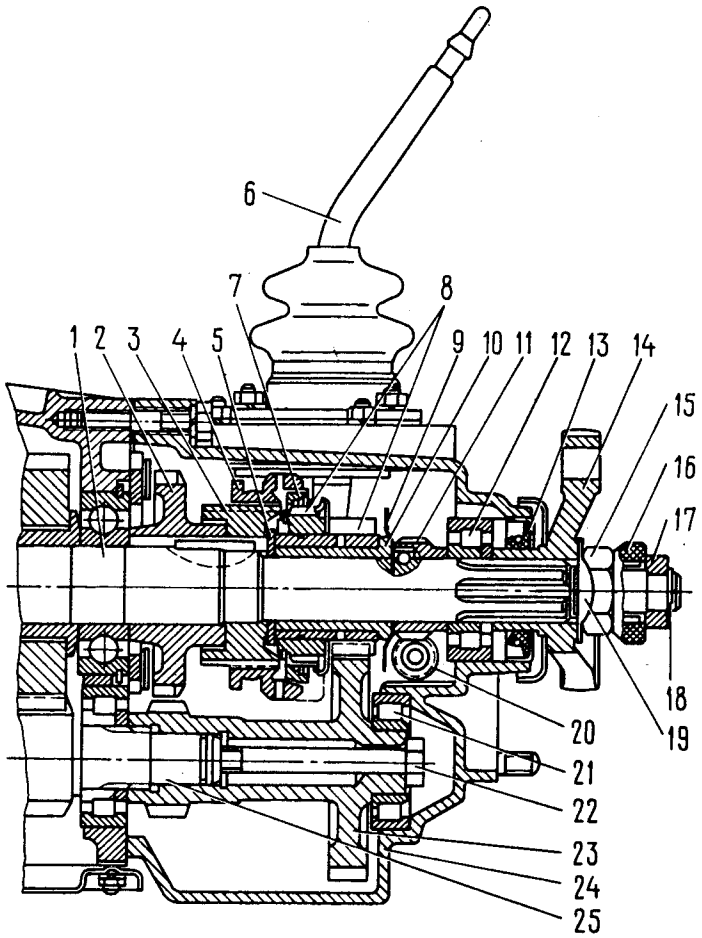


Fig. 3-31. Rear Part of Five-Speed Gearbox: 1 - main shaft; 2 - reverse driven gear; 3 - 5th speed synchronizer sleeve hub; 4 - synchronizer sleeve; 5 - washer; 6 - gearshift lever; 7 - synchronizer baulk ring; 8 - 5th speed synchronizer gear and toothed rim; 9 - oil deflecting washer; 10 - 5th speed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

gear cluster 4 from the splines of the countershaft.

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

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

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

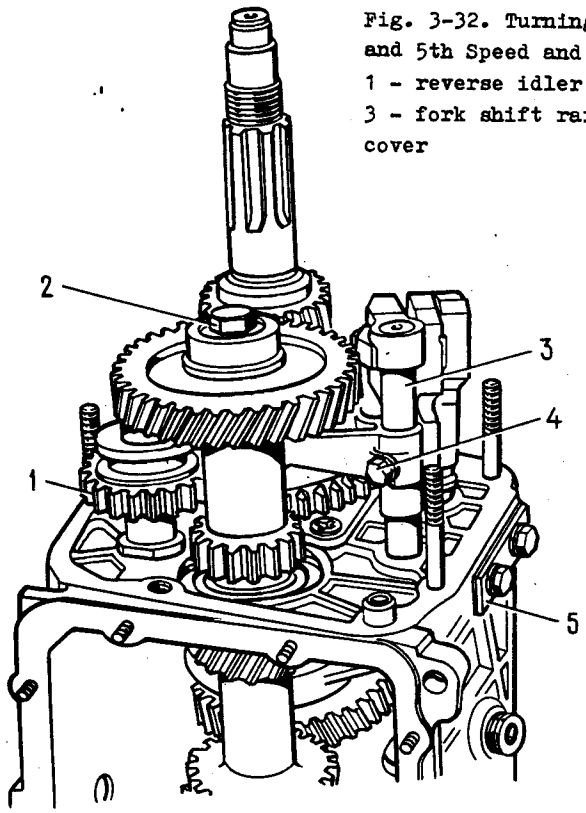


Fig. 3-32. Turning Out Bolts Holding Gear Cluster and 5th Speed and Reverse Shift Fork:
1 - reverse idler gear; 2 - gear cluster bolt; 3 - fork shift rail; 4 - fork bolt; 5 - detent cover

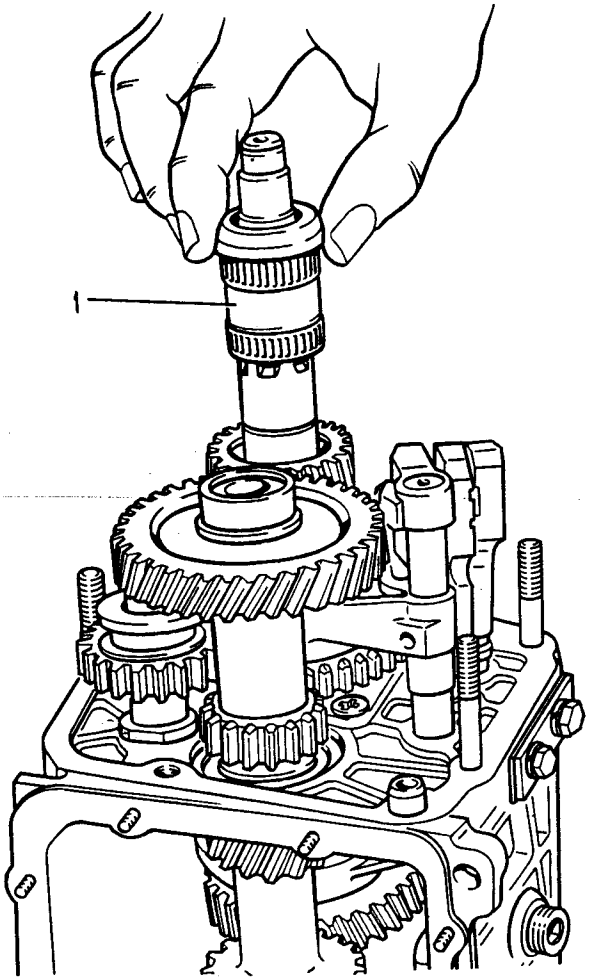


Fig. 3-33. Removing 5th Speed Gear Bushing:
1 - bushing

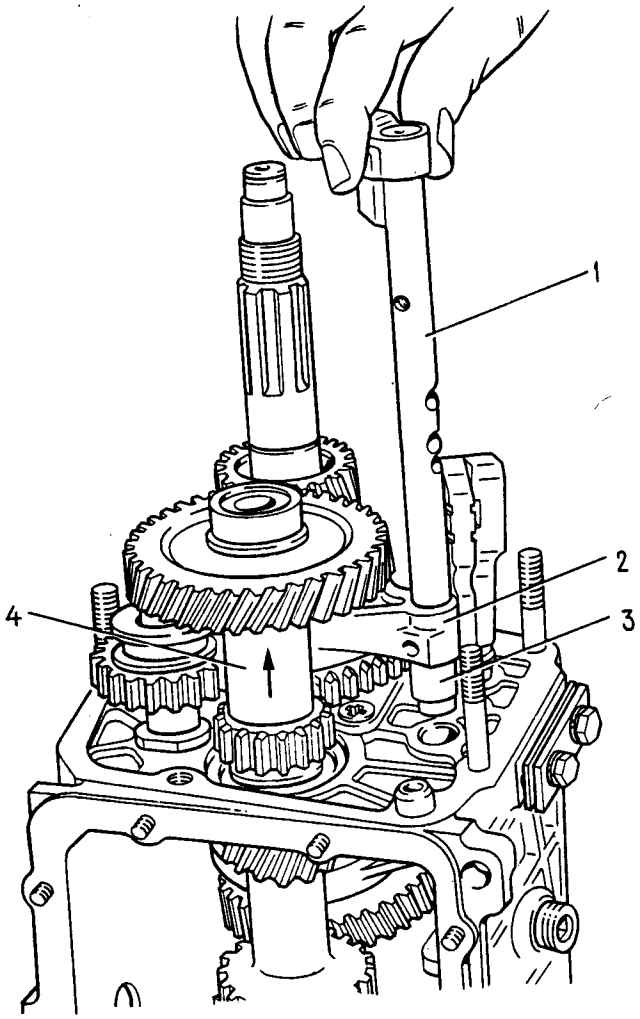


Fig. 3-34. Removing 5th Speed and Reverse Shift Rail and Gear Cluster:
1 - 5th speed and reverse shift rail; 2 - 5th speed and reverse shift fork; 3 - distance bushing; 4 - gear cluster

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

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

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

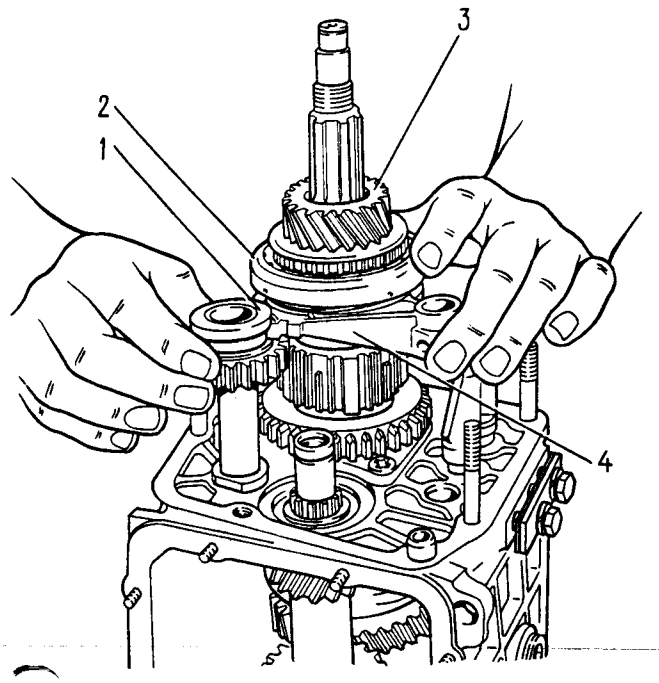


Fig. 3-35. Removing Reverse Idler Gear and 5th Speed Gear Complete with Synchronizer and Fork:
1 - reverse idler gear; 2 - 5th speed shifter sleeve; 3 - 5th speed gear with synchronizer; 4 - 5th speed and reverse shift fork

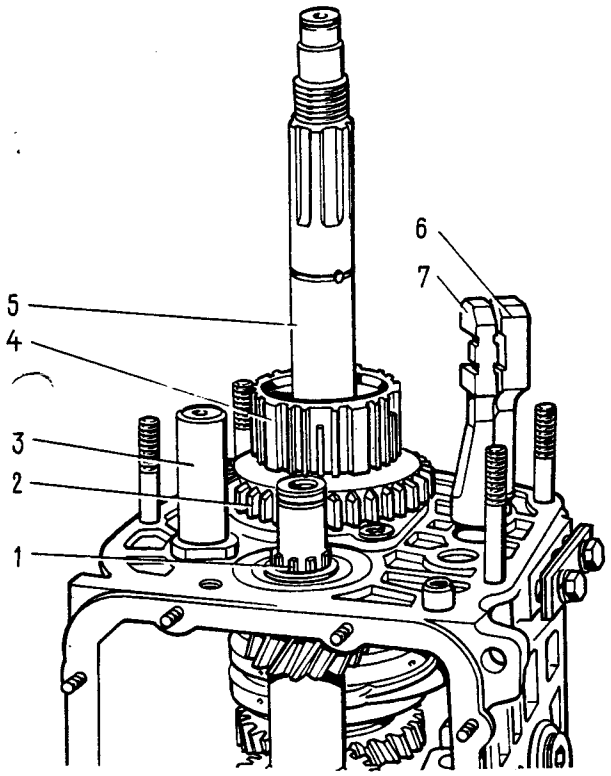


Fig. 3-36. Removing Reverse Driven Gear and 5th Speed Synchronizer Sleeve Hub:
1 - countershaft; 2 - reverse idler gear; 3 - reverse idler gear axle; 4 - 5th speed synchronizer sleeve hub; 5 - main shaft; 6 - 1st and 2nd speed shift rail; 7 - 3rd and 4th speed shift rail

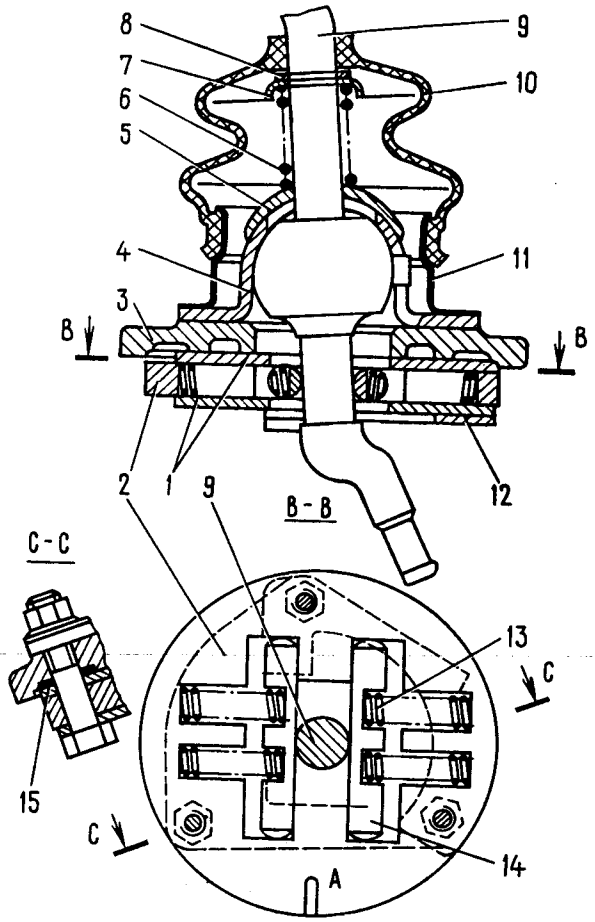


Fig. 3-37. Gearshift Mechanism:
1 - guide plate washer; 2 - guide plate; 3 - gearshift lever housing; 4 - ball support; 5 - spherical washer; 6 - spring; 7, 8 - retaining rings; 9 - gearshift lever; 10 - boot; 11 - flange; 12 - reverse lock plate; 13 - spring; 14 - guide strip; 15 - sealing ring; A -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

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

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

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

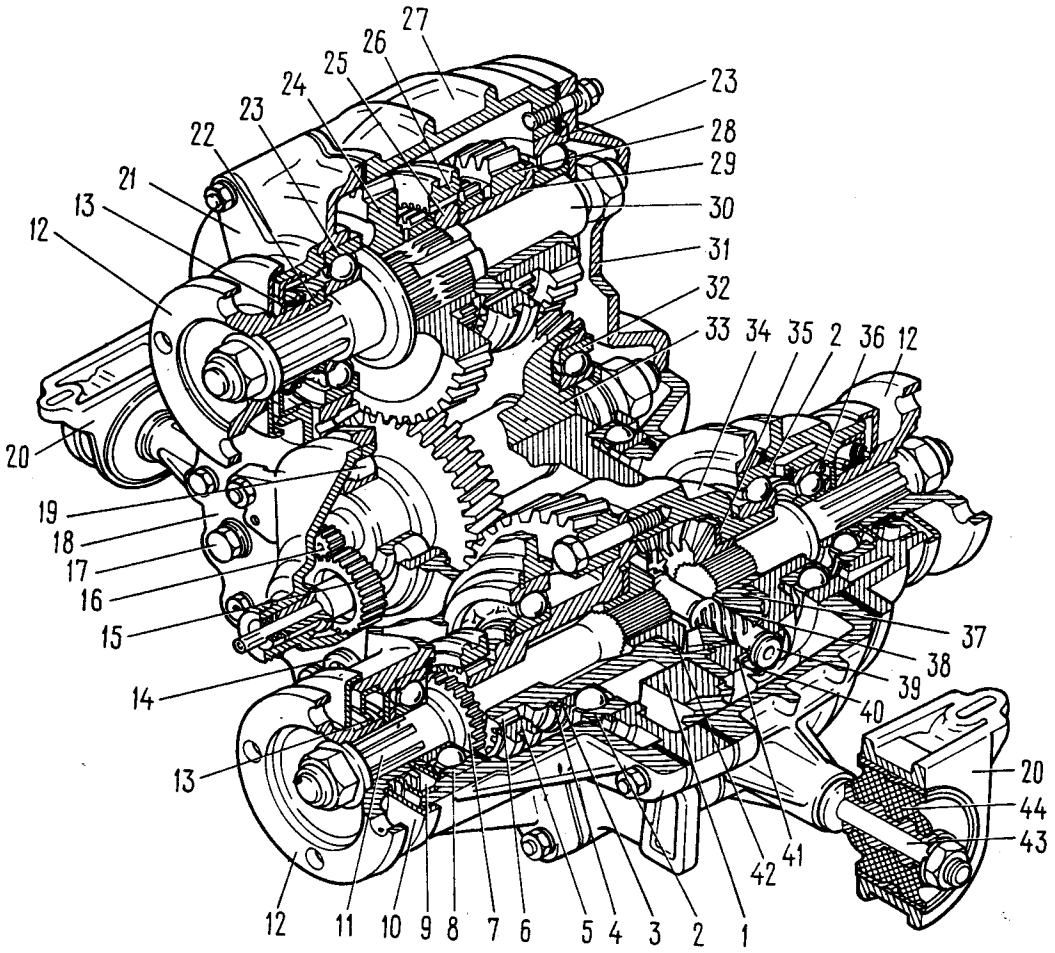


Fig. 3-38. Transfer Case:
1 - driven gear; 2 - differential bearings; 3 - spring washer; 4 - lockring; 5 - differential lock coupling; 6 - differential housing toothed rim; 7 - front axle drive shaft toothed rim; 8 - front axle drive shaft bearing; 9 - oil slinger; 10 - mud guard; 11 - front axle drive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

Cont'd

TROUBLE SHOOTING

Cause	Remedy
Vibration of Transfer Case and Body Floor (in Front Seat Area) and at Starting from Halt and Acceleration in 1st, 2nd and 3rd Gears	
1. Misalignment of transfer case and gearbox	1. Align transfer case and gearbox
2. Bending of bolts and flexible coupling flange	2. Replace bolts or intermediate propeller shaft assembly
3. Loose or damaged supports of transfer case or rear support of gearbox	3. Tighten attachment bolts or replace support

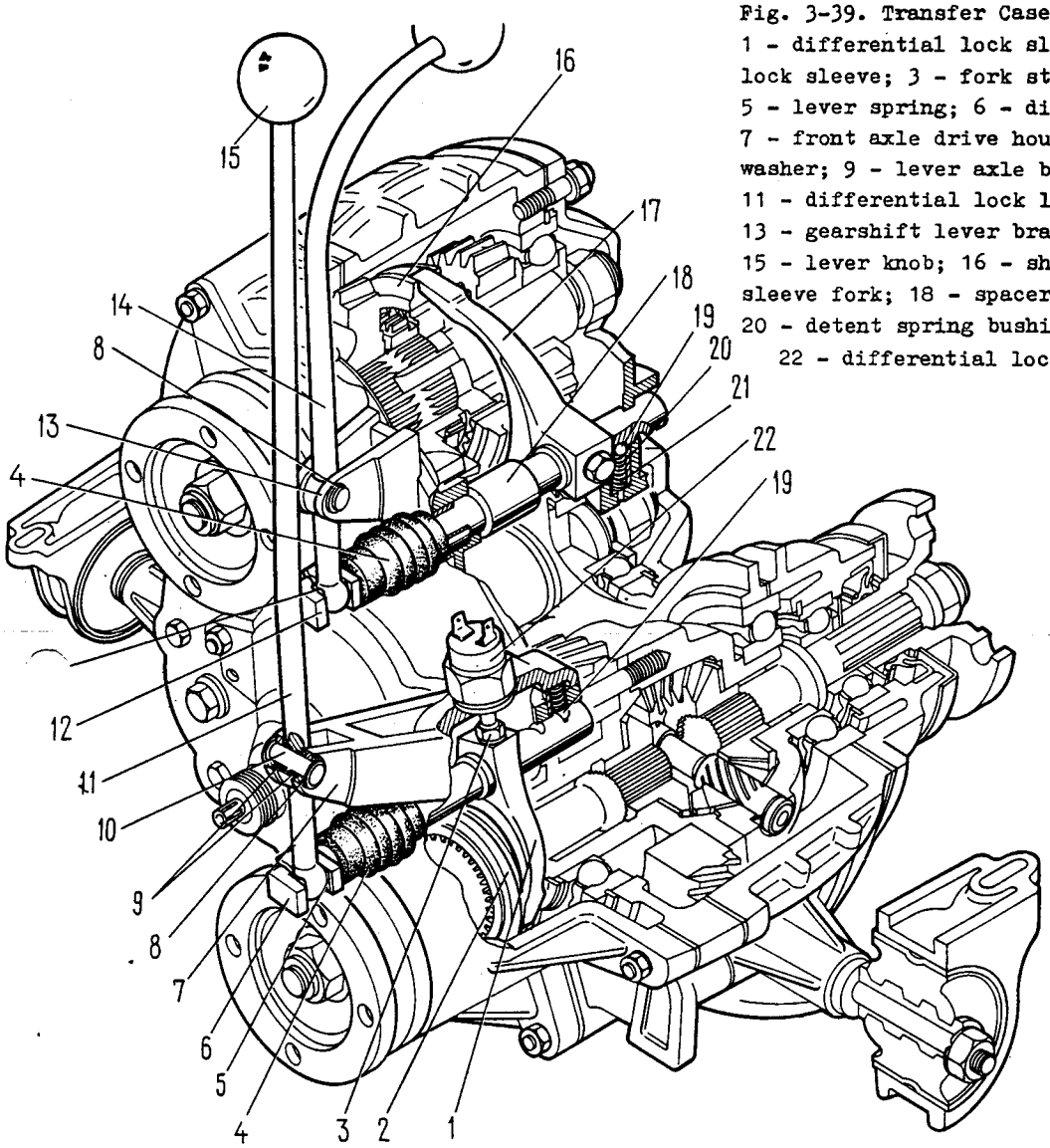


Fig. 3-39. Transfer Case Control Mechanism:
1 - differential lock sleeve fork; 2 - differential lock sleeve; 3 - fork stop bolt; 4 - rod boot; 5 - lever spring; 6 - differential lock fork rod; 7 - front axle drive housing cover; 8 - lock-washer; 9 - lever axle bushing; 10 - lever axle; 11 - differential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

Cont'd

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

Cont'd

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

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

Difficult Gearshifting or Differential Locking

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

Uncontrollable Disengagement of Gears or Differential Lock

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

Leakage of Oil

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

Cause	Remedy

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

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

Test No.1.

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

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

Test No. 2.

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

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

Test No. 3.

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

REMOVAL, INSTALLATION AND ALIGNMENT

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

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

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

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

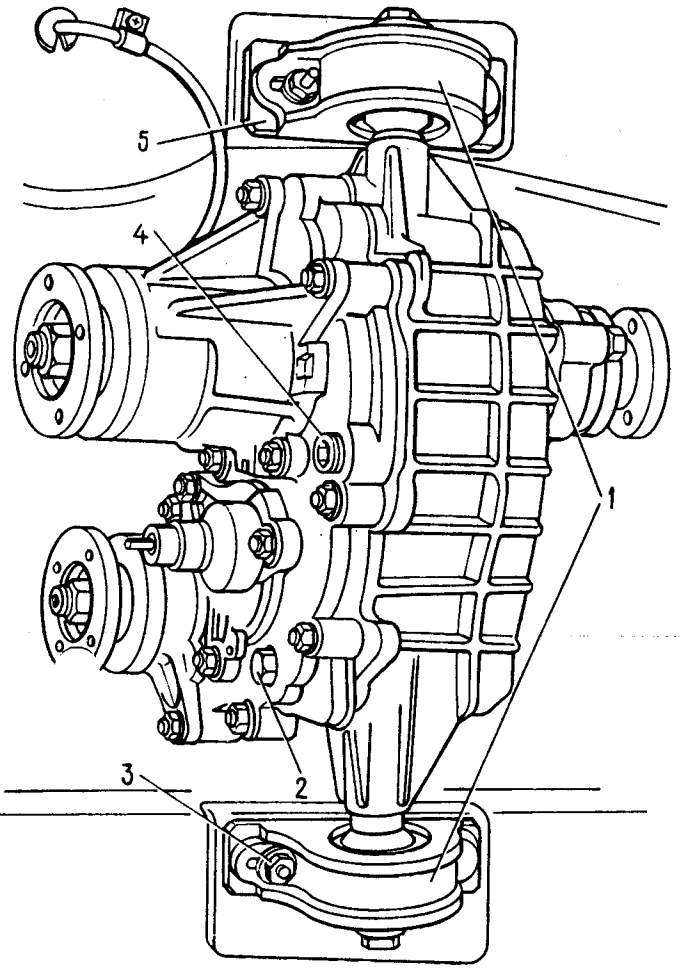


Fig. 3-40. Transfer Case Mounting:
1 - transfer case mount brackets; 2 - filler plug; 3 - mount bracket nut; 4 - drain plug; 5 - adjusting shims

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

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

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

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

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

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

To select the shims proceed as follows:

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

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

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

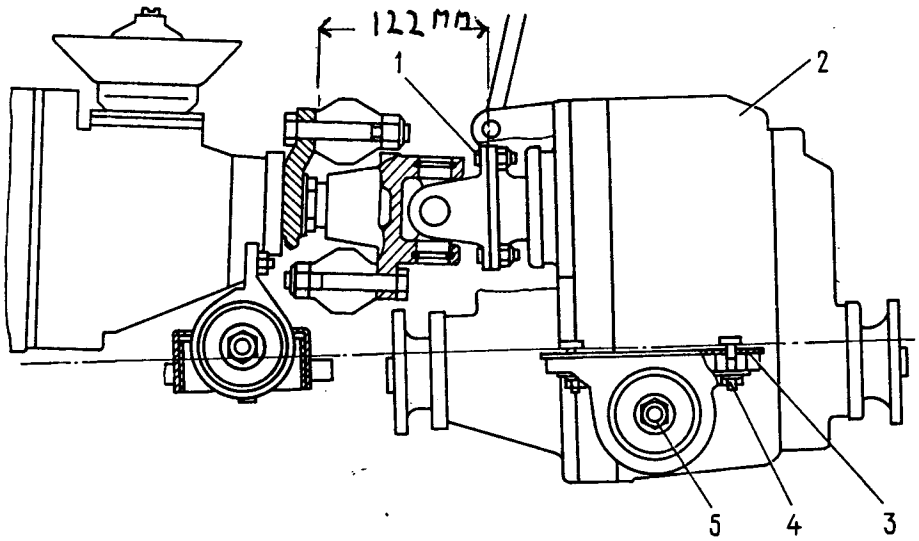
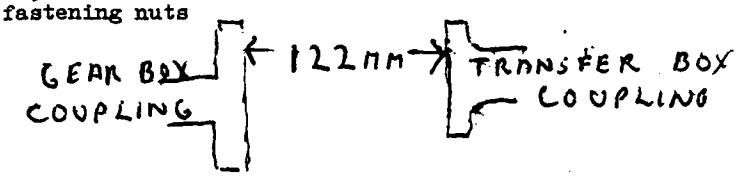


Fig. 3-41. Transfer Case Installation Diagram:
1 - flange bolts of intermediate propeller shaft and transfer case drive shaft; 2 - transfer case; 3 - adjusting shims; 4 - transfer case-to-body nuts; 5 - transfer case mount bracket-to-pivot fastening nuts



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

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

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

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

DISASSEMBLY AND ASSEMBLY

Disassembly. Wash the transfer case and drain oil.

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

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

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

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

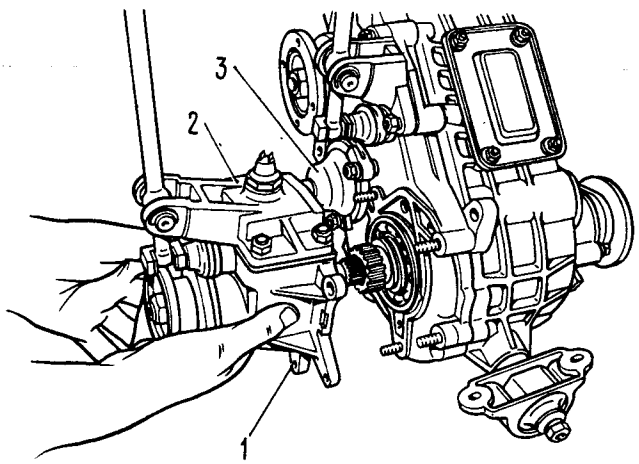


Fig. 3-42. Removing Front Axle Drive Housing:
1 - front axle drive housing; 2 - housing cover;
3 - speedometer drive housing

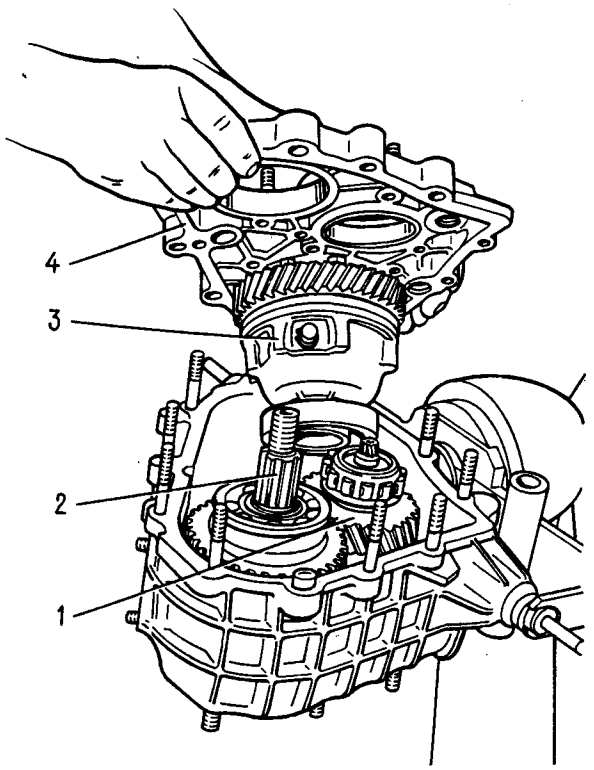


Fig. 3-43. Removing Transfer Case Front Cover:
1 - countershaft; 2 - drive shaft; 3 - differential; 4 - front cover

drive shaft and the front and rear axle drive shafts.

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

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

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

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

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

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

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

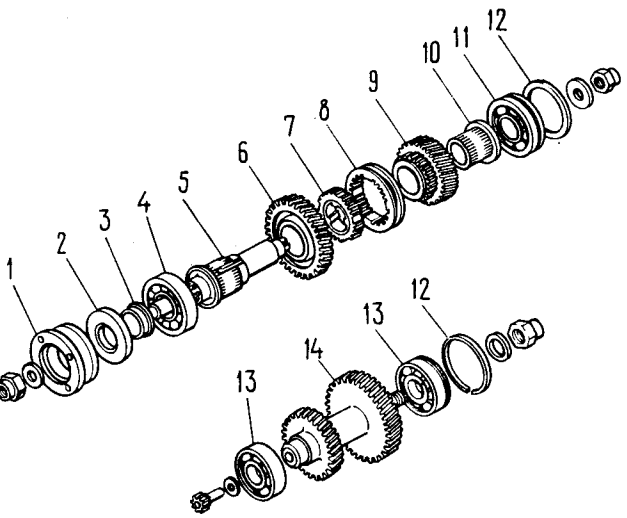


Fig. 3-44. Parts of Drive Shaft and Countershaft:
1 - flange; 2 - gland; 3 - bearing thrust ring; 4 - front bearing; 5 - drive shaft; 6 - high speed gear; 7 - hub; 8 - sleeve; 9 - low speed gear; 10 - washing; 11 - rear bearing; 12 - bearing setting ring; 13 - countershaft bearings; 14 - countershaft

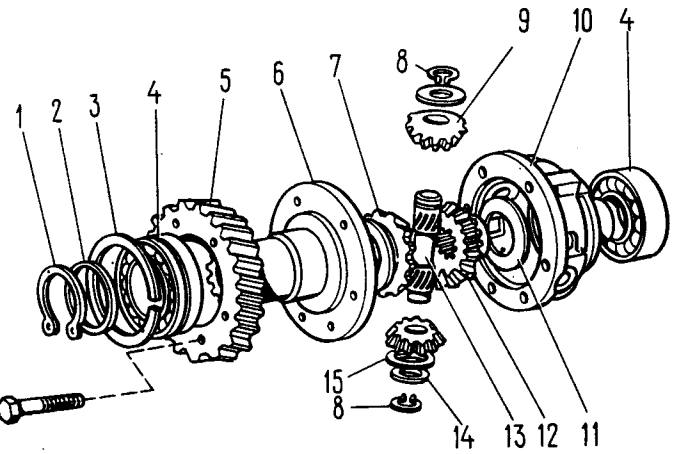


Fig. 3-45. Parts of Transfer Case Differential:
1 - lockring; 2 - spring washer; 3 - bearing setting ring; 4 - differential housing bearings; 5 - driven gear; 6 - differential front housing; 7 - front axle drive gear; 8 - pinion shaft lockring; 9 - differential pinion; 10 - differential rear housing;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

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

Disassemble the differential as follows:

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

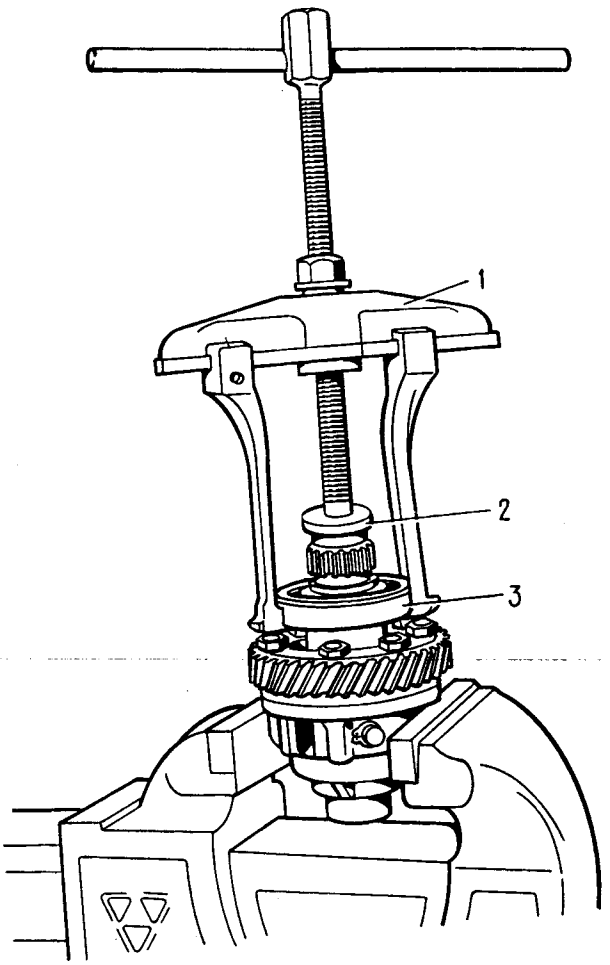


Fig. 3-46. Pressing Bearing Off Differential Housing:
1 - remover tool A.40005/1/6; 2 - stop 67.7853.9559; 3 - bearing

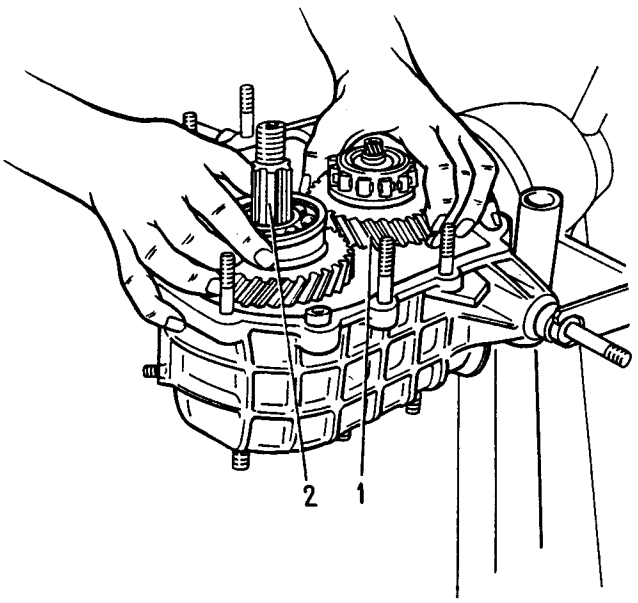


Fig. 3-47. Installation of Drive Shaft and Countershaft:
1 - countershaft; 2 - drive shaft

- remove the differential driven gear;

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

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

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

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

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

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

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

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

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

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

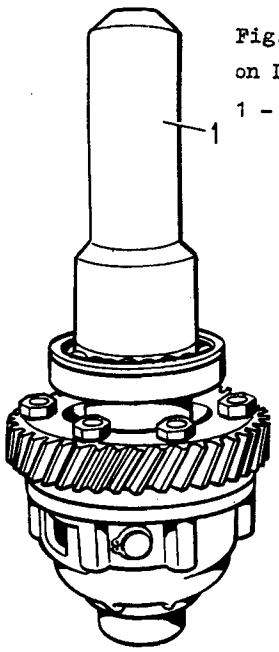


Fig. 3-48. Press-Fitting Bearing on Differential Housing:
1 - mandrel 67.7853.9558

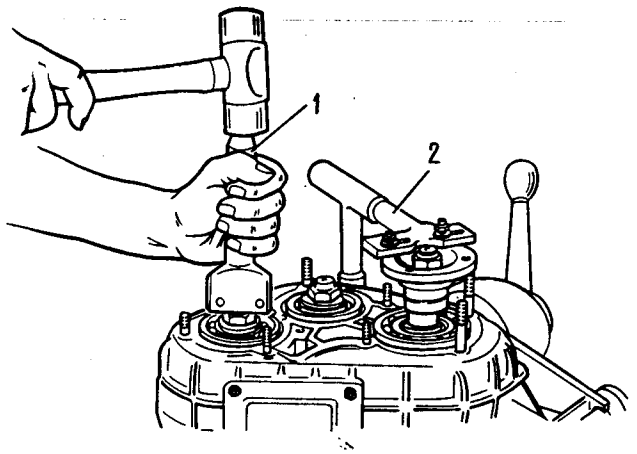


Fig. 3-49. Upsetting Rear Axle Drive Shaft Flange Nut:
1 - fixture 67.7820.9520; 2 - flange retainer

INSPECTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TRANSFER CASE CHECKS

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

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

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

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

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

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

PROPELLER SHAFT DRIVE

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

The new propeller shaft drive is distinguished

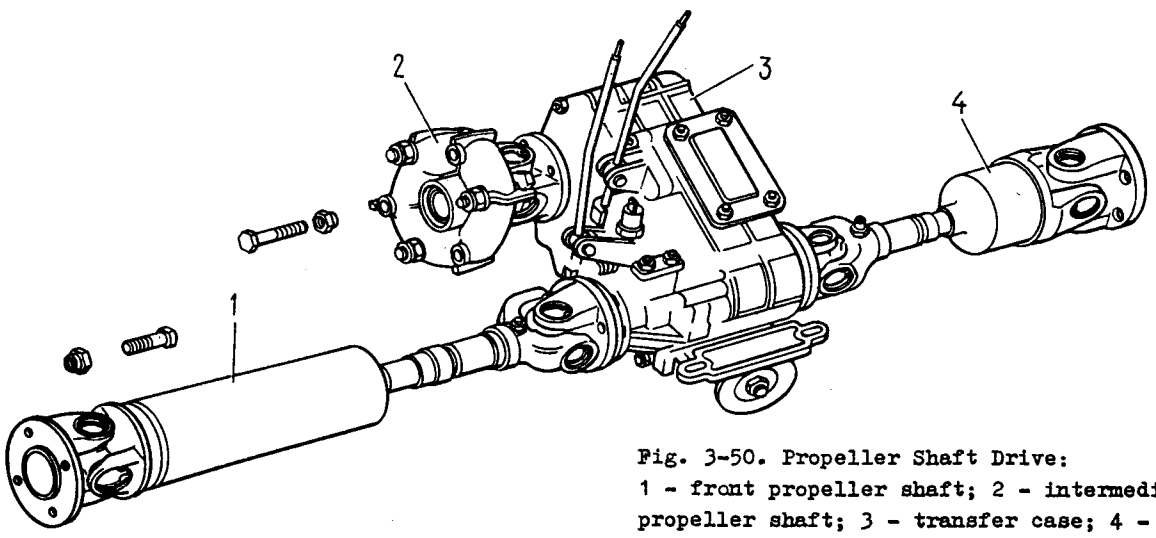


Fig. 3-50. Propeller Shaft Drive:
1 - front propeller shaft; 2 - intermediate propeller shaft; 3 - transfer case; 4 - rear propeller shaft

HARDY SPICER UNIVERSAL JOINT. GKN HS 194

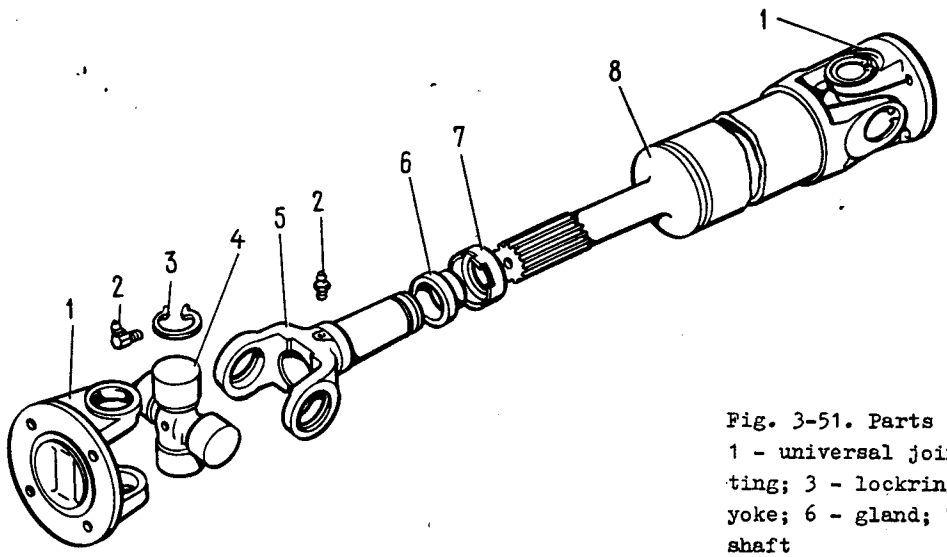


Fig. 3-51. Parts of Front Propeller Shaft:
1 - universal joint flange-yoke; 2 - grease fitting; 3 - lockring; 4 - cross assembly; 5 - slip yoke; 6 - gland; 7 - gland holder; 8 - propeller shaft

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

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

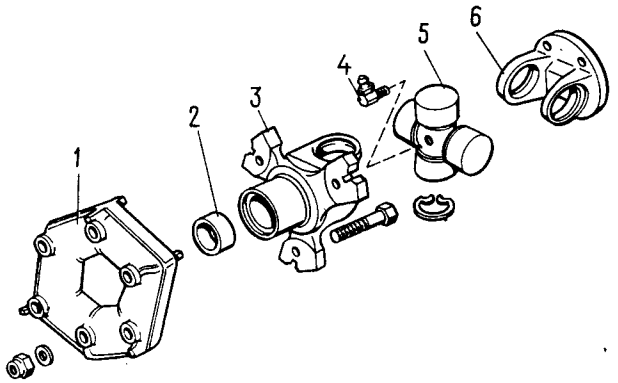


Fig. 3-52. Parts of Intermediate Propeller Shaft:
1 - flexible coupling; 2 - aligning bushing; 3 - flexible coupling flange; 4 - grease fitting; 5 - cross assembly; 6 - universal joint flange-yoke

TROUBLE SHOOTING

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

Cont'd

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

Cont'd

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

REMOVAL AND INSTALLATION

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

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

Remove the front and rear propeller shafts.

Put clamp A.70025 on flexible coupling 3 of the intermediate shaft (Fig. 3-14) and, rotating the shaft, unscrew the nuts of the bolts which 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 Transfer Case. Removal, Installation and Alignment).

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

INSPECTION WITHOUT DISASSEMBLY

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

Check the propeller shafts for balancing on a balance stand as stated below.

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

DISASSEMBLY

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

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

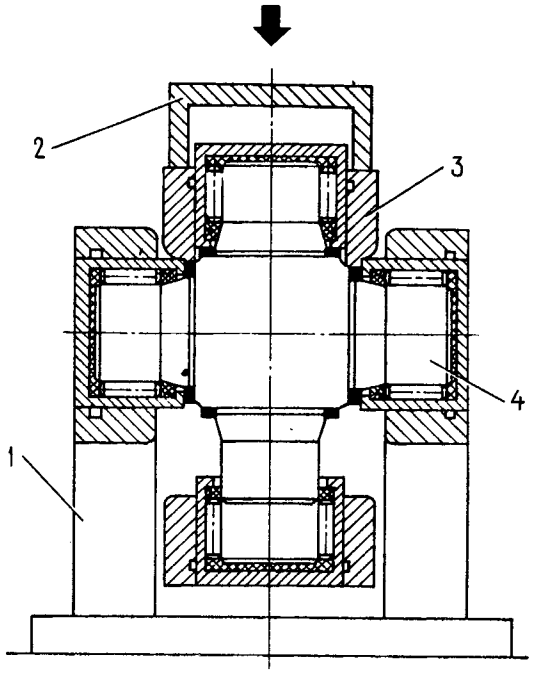


Fig. 3-53. Disassembling Universal Joint:
1 - press support; 2 - bushing; 3 - universal joint yoke; 4 - cross

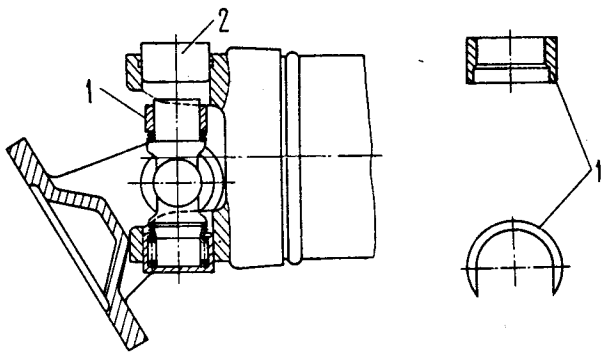


Fig. 3-54. Mounting Bushing for Disassembling Universal Joint:
1 - bushing; 2 - cross bearing

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

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

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

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

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

INSPECTION

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

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

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

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

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

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

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

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

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

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

ASSEMBLY

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

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

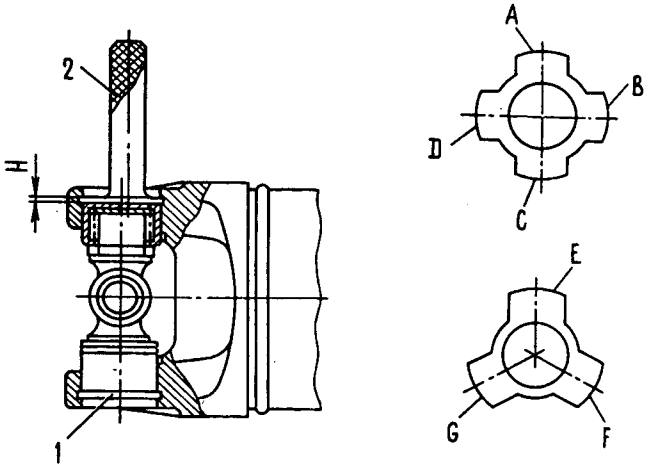


Fig. 3-55. Assembling Universal Joint:
1 - lockring; 2 - gauge; H - clearance
A, B, C, D, E, F, G - gauge blades of thickness, mm: 1.45; 1.48; 1.52; 1.56; 1.60; 1.64; 1.67

To assemble the universal joint proceed as follows:

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

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

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

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

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

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

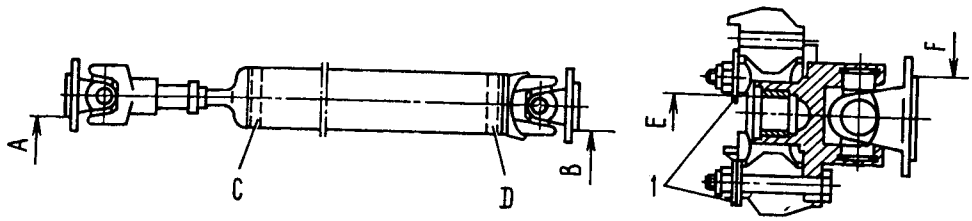


Fig. 3-56. Balancing Propeller Shafts:
1 - balancing washers; A, B, E, F - balance check surfaces; C, D - shaft bearing surfaces on balancing machine

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

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

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

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

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

Caution

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

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

REAR AXLE

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

TROUBLE SHOOTING

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

Cont'd

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

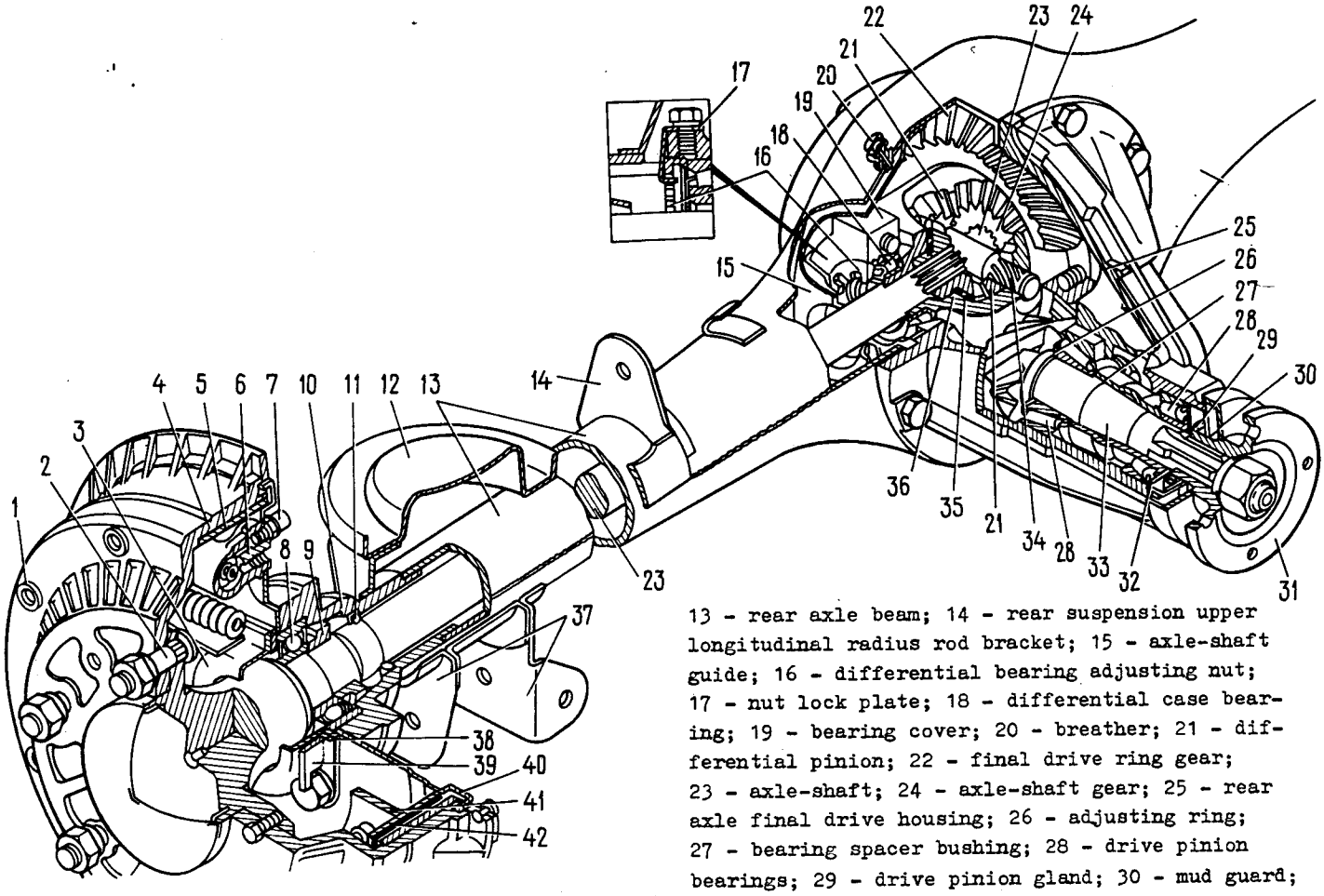


Fig. 3-57. Rear Axle:
1 - wheel cap; 2 - brake drum and wheel bolt; 3 - axle-shaft bearing oil slinger; 4 - brake drum; 5 - drum castiron ring; 6 - rear wheel brake cylinder; 7 - brake bleeder union; 8 - axle-shaft bearing; 9 - bearing lockring; 10 - rear axle beam flange; 11 - gland; 12 - suspension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

Cont'd

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

Cont'd

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

Cont'd

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

REMOVAL AND INSTALLATION

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

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

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

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

DISASSEMBLY AND ASSEMBLY

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

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

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

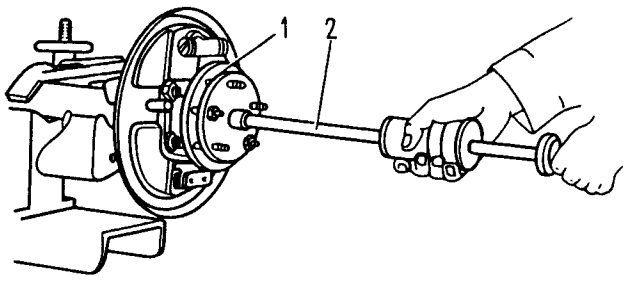


Fig. 3-58. Pressing Out Axle-Shaft:
1 - axle-shaft; 2 - impact remover tool 67.7823.9516

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

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

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

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

CHECKING REAR AXLE BEAM

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

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

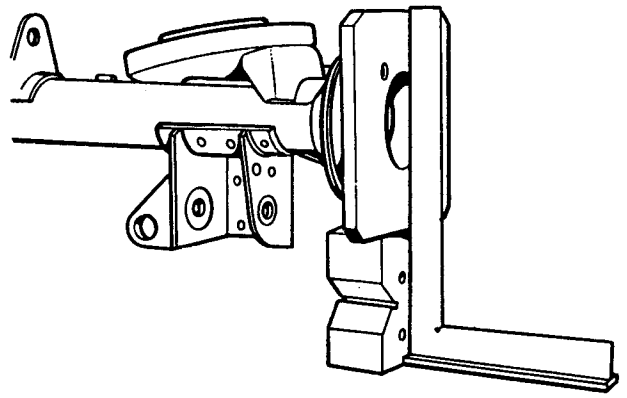


Fig. 3-59. Checking Rear Axle Beam for Vertical Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

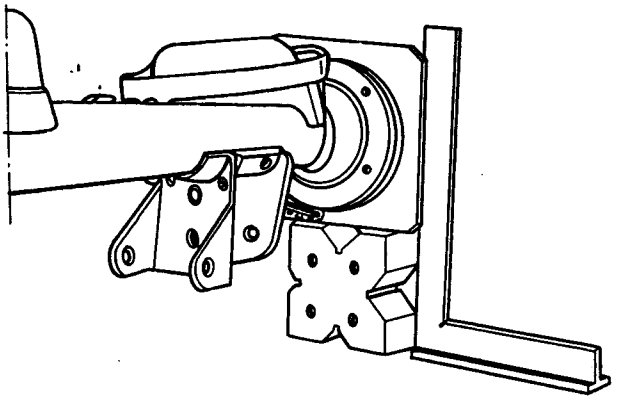


Fig. 3-60. Checking Rear Axle Beam for Twisting Deformations with Angle Gauge Applied to Edge of Flange A.70172

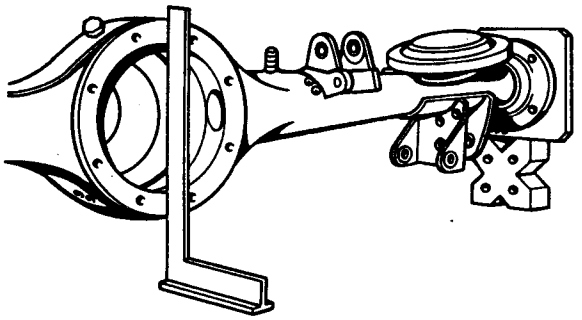


Fig. 3-61. Checking Final Drive Mounting Surface for Perpendicularity

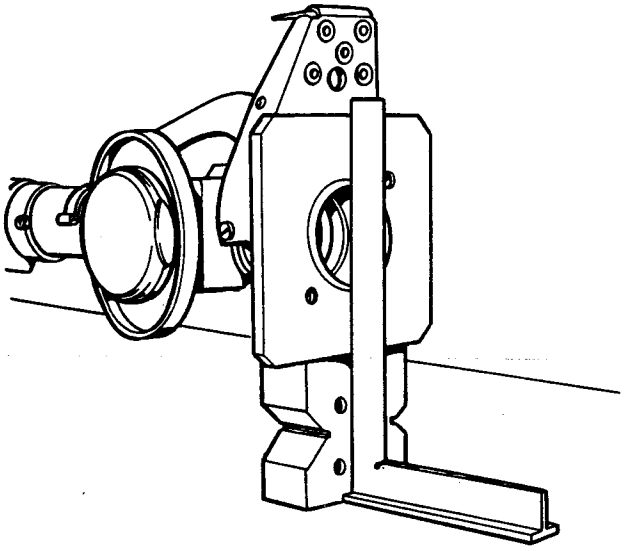


Fig. 3-62. Checking Rear Axle Beam for Horizontal Deformations with Angle Gauge Applied to Outer Face of Flange A.70172

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

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

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

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

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

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

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

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

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

Paint the beam on the outside as protection against corrosion.

STRAIGHTENING REAR AXLE BEAM

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

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

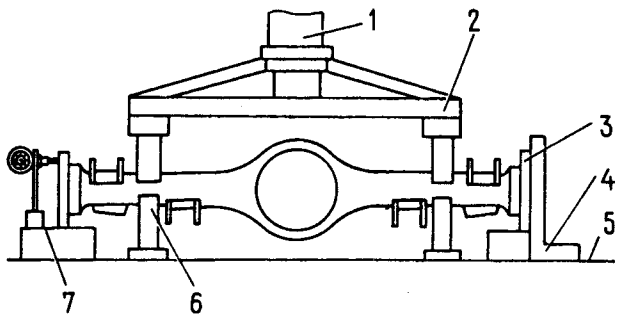


Fig. 3-63. Straightening Rear Axle Beam. Diagrammatic:
1 - hydraulic cylinder; 2 - hold-down cross beam; 3 - flange A.70172; 4 - angle gauge; 5 - press table; 6 - support; 7 - indicator bracket

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

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

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

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

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

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

AXLE-SHAFTS

Removal and Installation

Remove the wheel and the brake drum.

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

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

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

Inspection

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

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

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

Removal of Lockring

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

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

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

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

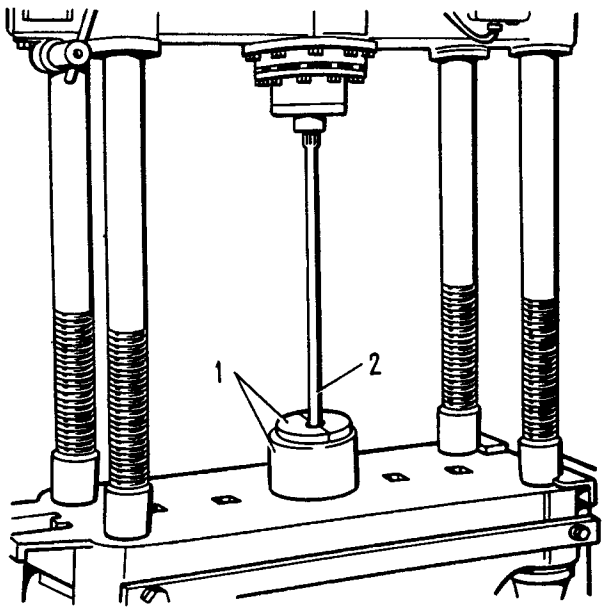


Fig. 3-64. Pressing Out Axle-Shaft Bearing Lockring:
1 - fixture; 2 - axle-shaft

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

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

Assembly

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

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

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

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

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

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

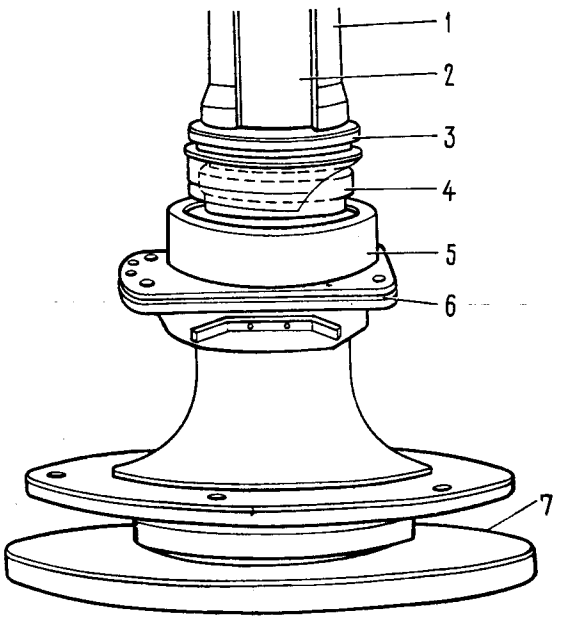


Fig. 3-65. Press-Fitting Axle-Shaft Bearing Lockring:
1 - driver; 2 - axle-shaft; 3 - holder; 4 - lockring; 5 - bearing; 6 - bearing fastening plate and oil slinger assembly; 7 - supporting ring

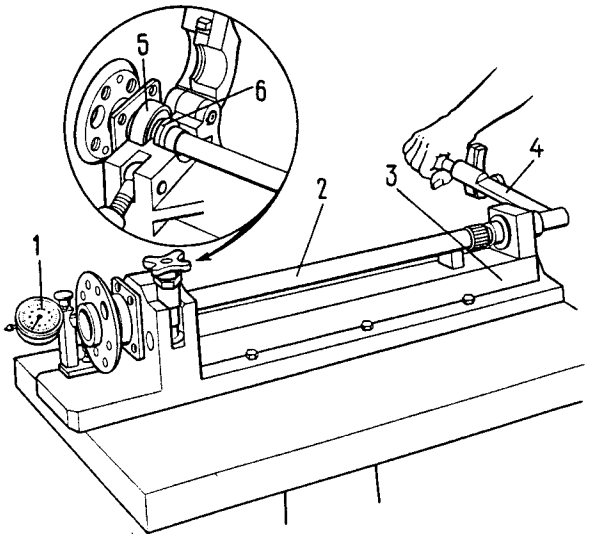


Fig. 3-66. Checking Fit of Axle Shaft Bearing Lockring:
1 - indicator; 2 - axle-shaft; 3 - tester; 4 - torque-indicating wrench; 5 - bearing; 6 - bearing lockring

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

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

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

Measuring Axle-Shaft End Play on Car

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

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

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

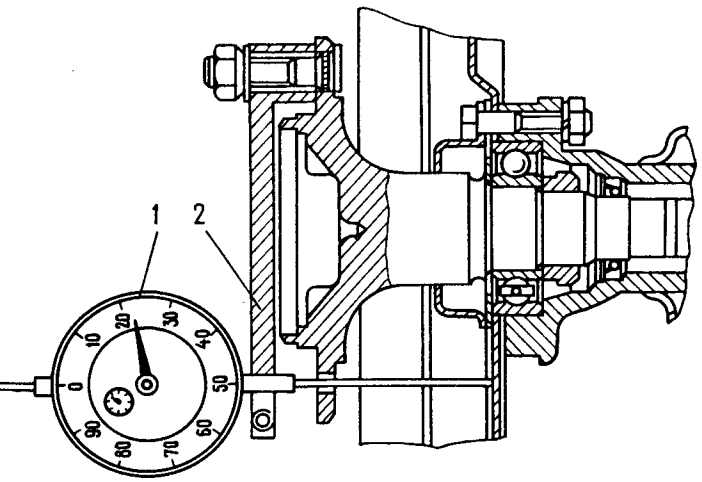


Fig. 3-67. Measuring Axle-Shaft End Play with Wheel and Brake Drum Removed:
1 - indicator; 2 - gauge

FINAL DRIVE

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

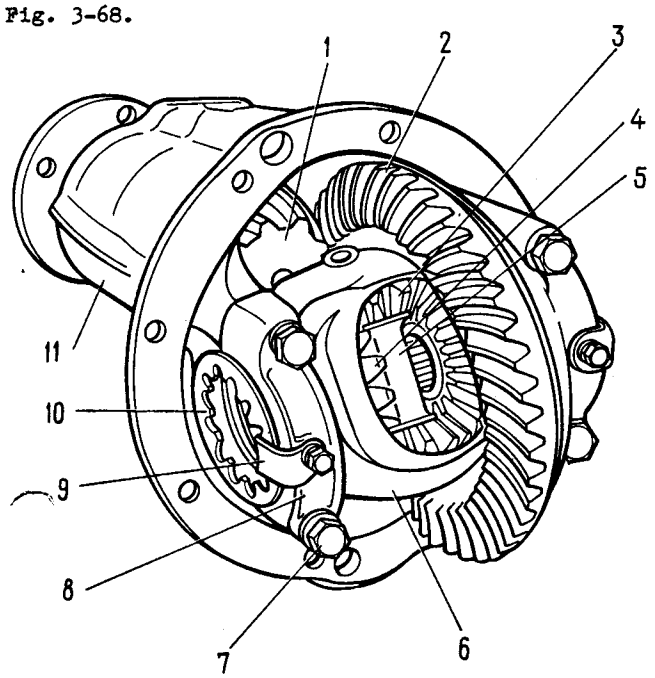


Fig. 3-68. Final Drive Assembly:
1 - drive pinion; 2 - ring gear; 3 - differential pinion; 4 - axle-shaft gear; 5 - differential pinion shaft; 6 - differential case; 7 - differential case bearing cover bolts; 8 - differential case bearing cover; 9 - locking plate; 10 - bearing adjusting nut; 11 - final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

Identifying Final Drive Defects by Noise

Look for final drive troubles in the following sequence:

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

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

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

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

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

Caution

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

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

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

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

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

Removal

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

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

Installation

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

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

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

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

Disassembly

Mount the final drive on a stand. Remove locking plates 9 (Fig. 3-68), unscrew bolts 7 and

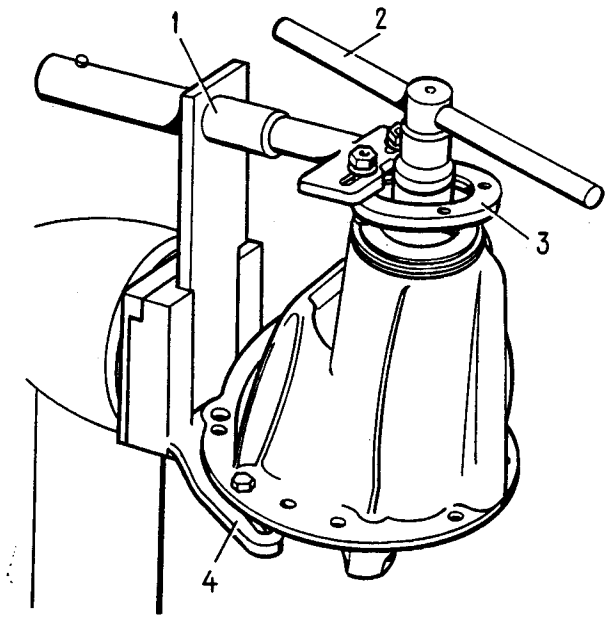


Fig. 3-69. Turning off Drive Pinion Nut:
1 - drive pinion flange retainer; 2 - socket wrench; 3 - drive pinion flange; 4 - bracket

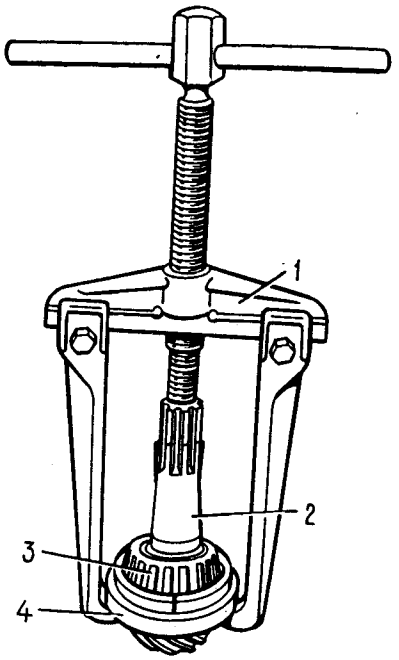


Fig. 3-70. Removing Drive Pinion Rear Bearing Inner Cone with General-Purpose Remover Tool A.40005/1/7:
1 - general-purpose remover tool; 2 - drive pinion; 3 - bearing cone; 4 - tool A.45008

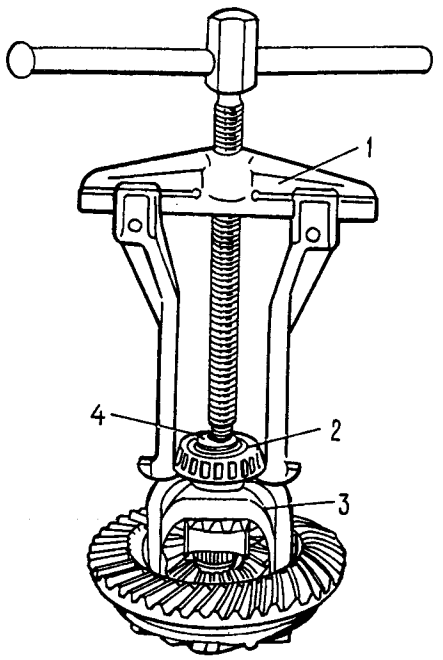


Fig. 3-71. Removing Inner Cone of Differential Case Bearing with General-Purpose Remover Tool A.40005/1/6:
1 - general-purpose remover tool; 2 - bearing inner cone; 3 - case; 4 - stop A.45028

remove covers 8 of the differential case bearings, adjusting nuts 10 and roller bearing outer cups. Mark covers 8 and outer cups of the bearings before removal so as to install them back where they belong during subsequent reassembly.

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

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

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

To disassemble the differential:

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

Inspection of Parts

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

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

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

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

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

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

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

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

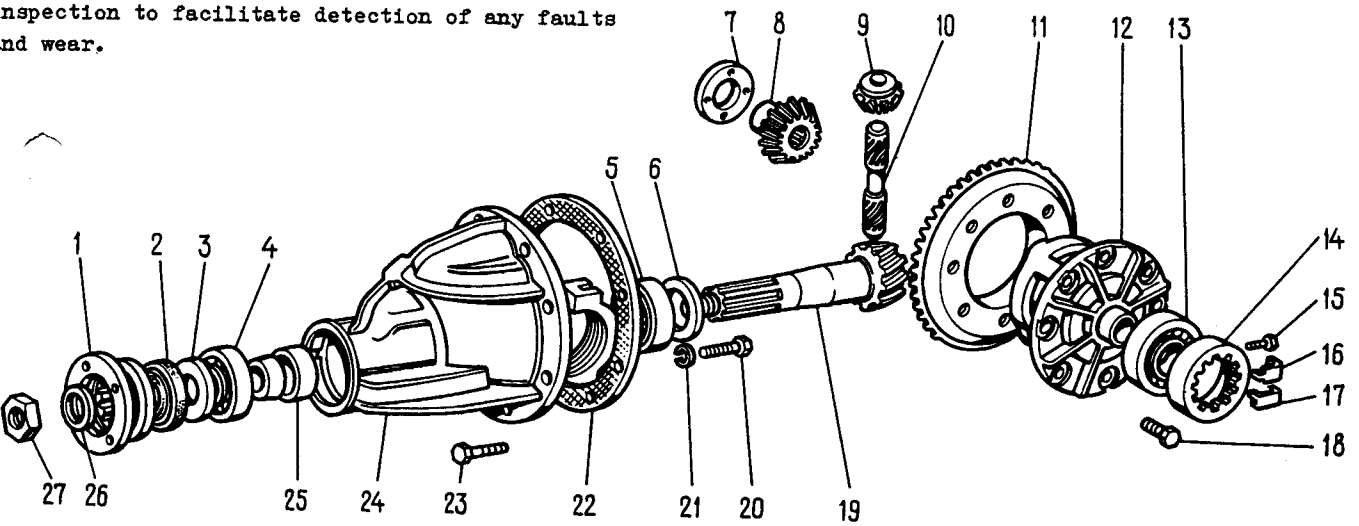


Fig. 3-72. Rear Axle Final Drive Parts:
1 - drive pinion flange; 2 - gland; 3 - oil slinger; 4 - front bearing; 5 - rear bearing; 6 - drive pinion adjusting ring; 7 - axle-shaft gear supporting washer; 8 - axle-shaft gear; 9 - differential pinion; 10 - differential pinion shaft; 11 - ring gear; 12 -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

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

Assembly of Final Drive

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

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

Assembly of Differential

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

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

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

Secure the ring gear on the differential case.

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

Installation and Adjustment of Drive Pinion

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

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

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

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

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

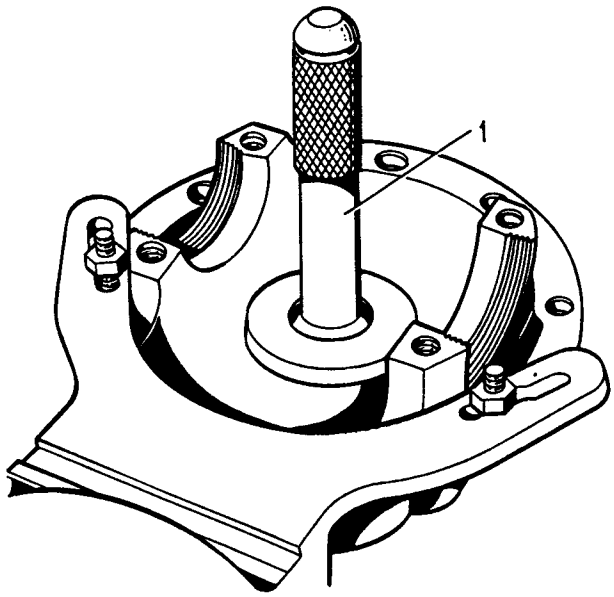


Fig. 3-73. Installing Drive Pinion Rear Bearing Outer Cup:
1 - driver A.70171

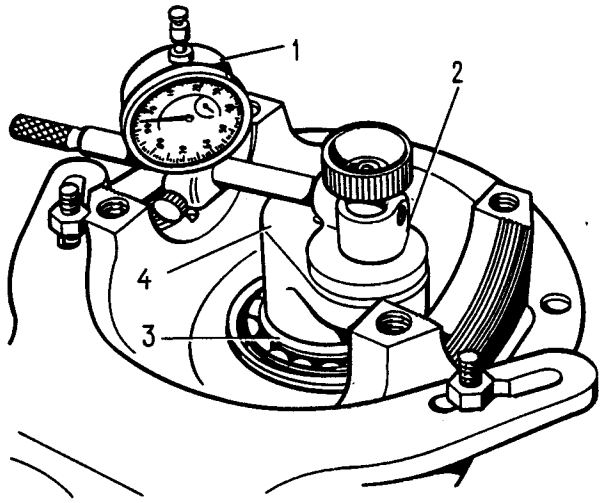


Fig. 3-74. Determining Thickness of Drive Pinion Adjusting Ring:
1 - indicator; 2 - gauge A.95690; 3 - drive pinion rear bearing; 4 - dummy pinion A.70184

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

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

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

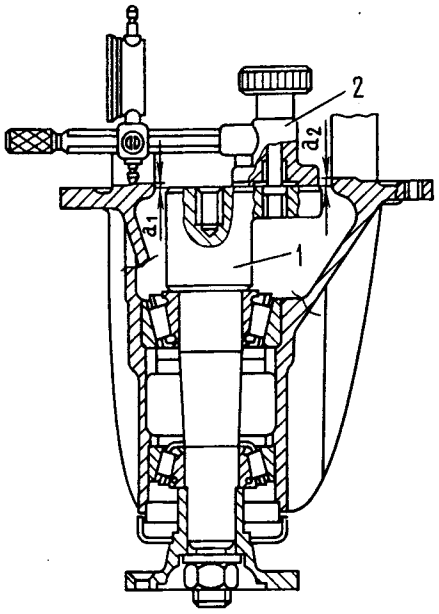


Fig. 3-75. Taking Measurements to Determine Thickness of Drive Pinion Adjusting Ring: 1 - dummy pinion A.70184; 2 - gauge A.95690 with indicator; a_1 and a_2 - distance from dummy pinion face to journals of differential bearings

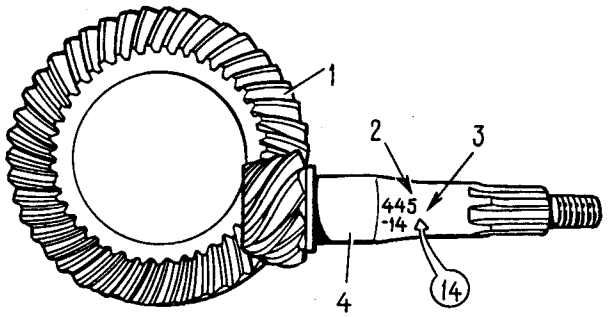


Fig. 3-76. Final Drive Gears: 1 - ring gear; 2- ordinal number; 3 - correction to nominal position in hundredths of a millimeter; 4 - drive pinion

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

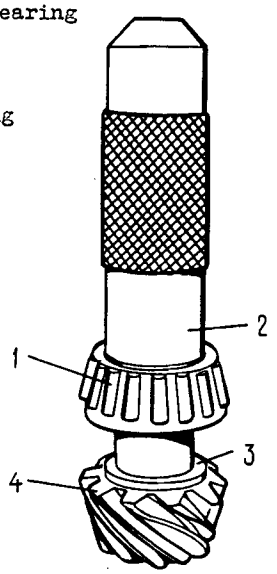
$$S = a - b$$

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

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

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

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



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

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

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

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

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

In this case install the adjusting ring 3.05 mm thick.

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

Caution

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

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

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

Preloading of Drive Pinion Bearings

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

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

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

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

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

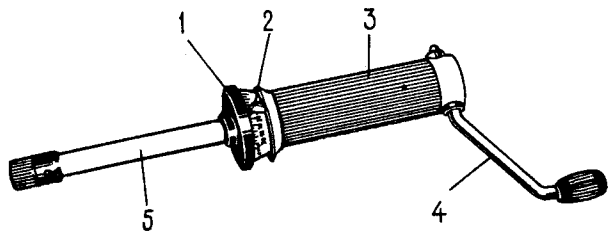


Fig. 3-78. Dynamometer 02.7812.9501:
1 - movable index; 2 - torque-limiting index; 3 - body; 4 - handle; 5 - bar with end-piece inserted into adapter bushing

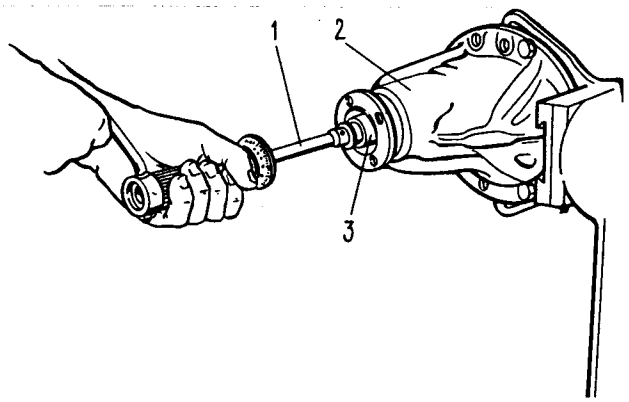


Fig. 3-79. Checking Preload of Drive Pinion Bearings:
1 - dynamometer 02.7812.9501; 2 - housing; 3 - adapter sleeve

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

Installation of Differential Case

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

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

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

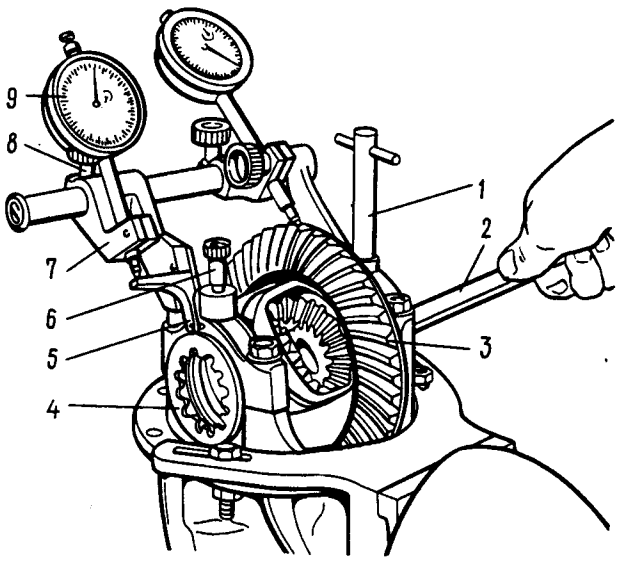


Fig. 3-80. Checking Preload of Differential Case Bearings with Gauge A.95688/R:
1 - gauge screw; 2 - wrench A.55085; 3 - ring gear; 4 - adjusting nut; 5 - intermediate lever; 6 - fastening screw; 7 - indicator bracket; 8 - bracket screw; 9 - bearing preload indicator

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

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

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

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

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

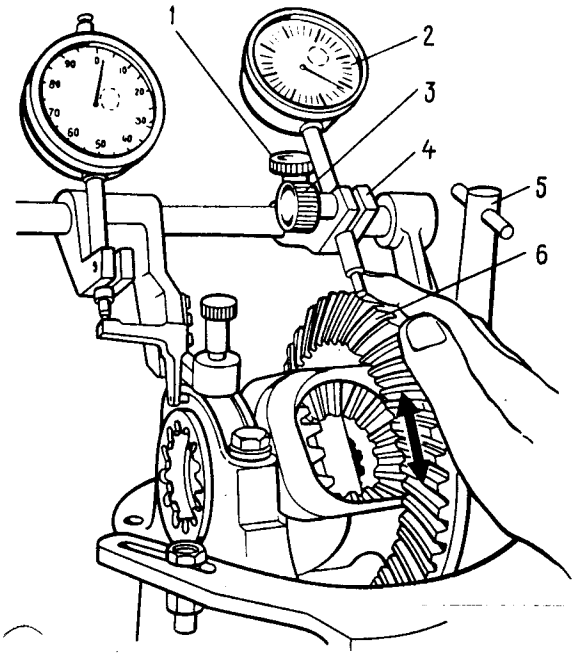


Fig. 3-81. Checking Backlash of Final Drive Gears with Gauge A.95688/R:
1 - bracket screw; 2 - backlash indicator; 3 - indicator clamping screw; 4 - indicator bracket;
5 - fastening screw; 6 - ring gear

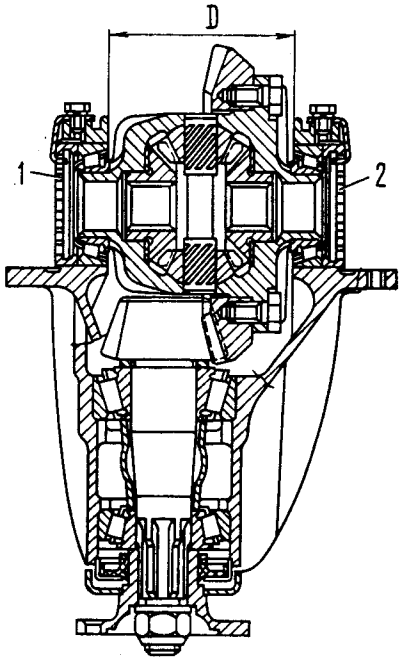


Fig. 3-82. Checking Preload of Differential Case Bearings:
D - distance between differential bearing covers;
1, 2 - adjusting nuts

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

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

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

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

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

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

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

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

Checking Tooth Contact of Final Drive Gears

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

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

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

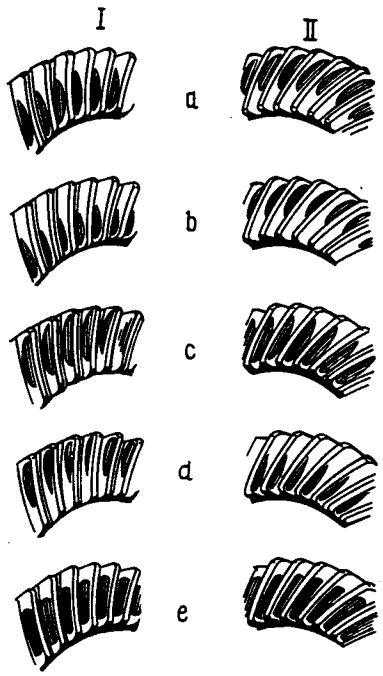


Fig. 3-83. Tooth Contact of Final Drive Gears: I - forward; II - reverse; a and b - wrong tooth contact: shift drive pinion away from ring gear by reducing thickness of adjusting ring; c and d - wrong tooth contact: shift drive pinion towards ring gear by increasing thickness of adjusting ring; e - correct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

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

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

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

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

Replacement of Drive Pinion Gland

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

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

In case of intensive dripping examine the gland as follows:

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

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

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

To replace the gland proceed as follows:

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

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

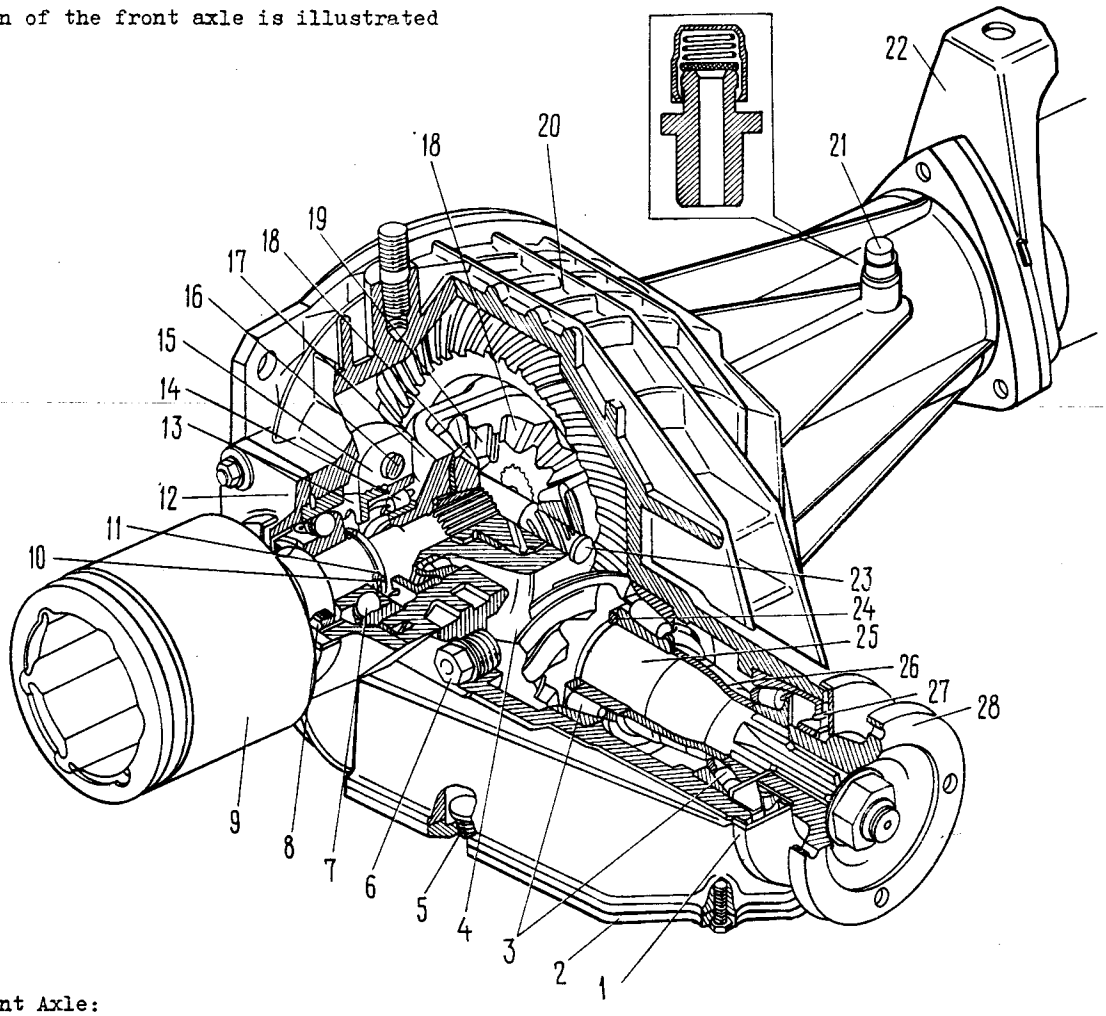
If the nut is tightened to such an extent that the antitorque moment is higher than required, disassemble the final drive, replace the spacer

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

To assemble the rear axle reverse the disassembly operations.

FRONT AXLE

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



NO 3 BEARING PART NO 2101 2402025

NO 27 OIL SEAL PART NO 2101 2402052-C

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

TROUBLE SHOOTING

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

Cont'd

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

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

REMOVAL AND INSTALLATION

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

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

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

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

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

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

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

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

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

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

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

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

DISASSEMBLY

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

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

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

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

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

INSPECTION

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

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

Replace any worn and damaged parts by new ones.

ASSEMBLY

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

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

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

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

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

FRONT WHEEL DRIVE

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

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

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

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

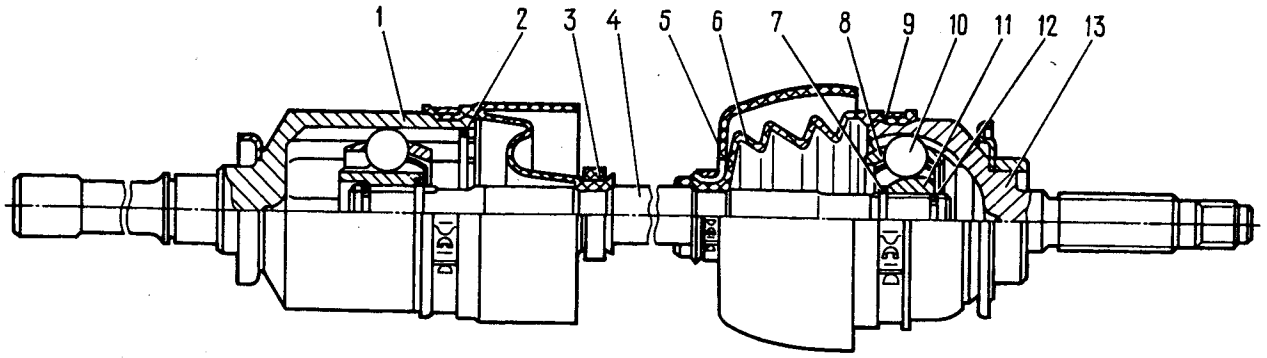


Fig. 3-85. Front Wheel Drive:
1 - inner joint housing; 2 - retainer; 3 - boot ring; 4 - front wheel drive shaft; 5 - boot cover; 6 - boot; 7 - holder thrust ring; 8 - cage; 9 - clamp; 10 - ball; 11 - outer joint holder; 12 - lockring; 13 - outer joint housing

TROUBLE SHOOTING

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

REMOVAL AND INSTALLATION

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

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

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

DISASSEMBLY AND ASSEMBLY

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

Proceed as follows:

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

Caution

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

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

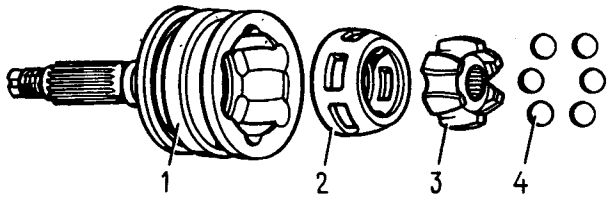


Fig. 3-86. Front Wheel Drive Outer Joint Parts: 1 - joint housing; 2 - cage; 3 - holder; 4 - ball

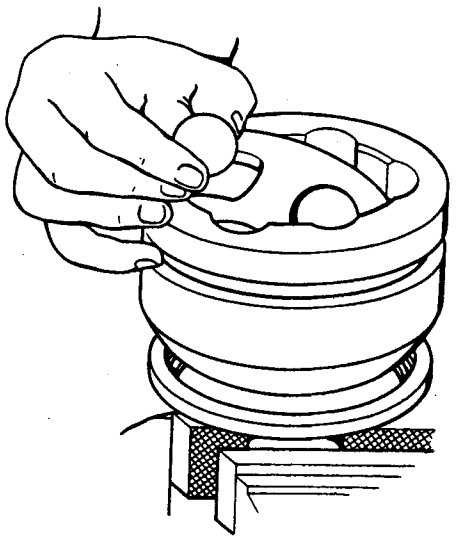


Fig. 3-87. Removing Balls from Cage

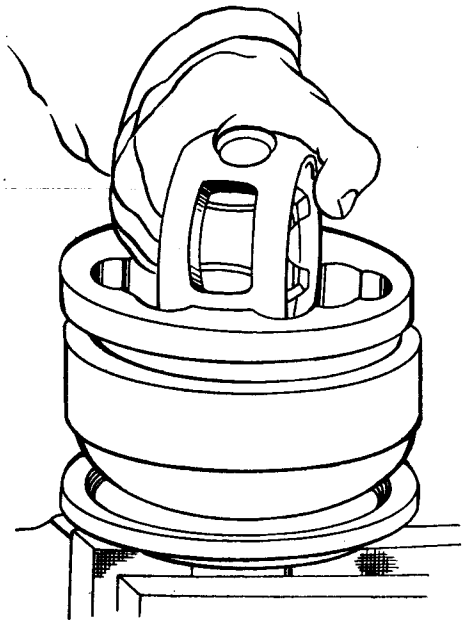


Fig. 3-88. Removing Cage Complete with Holder from Joint Housing

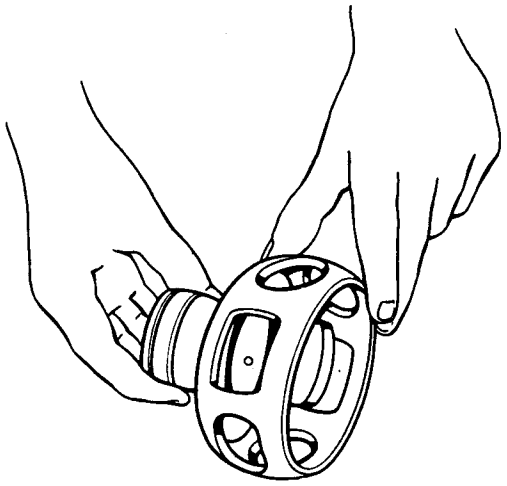


Fig. 3-89. Removing Holder from Cage

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Install the joint boots with mandrel 67.7853.9537.

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

Section IV
RUNNING GEAR

TROUBLE SHOOTING

Cause	Remedy
Suspension Noisy and Knocking on the Move	
1. Shock absorbers faulty	1. Replace on repair shock absorbers
2. Loosening of sway eliminator bar bolts	2. Tighten sway 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	
Distortion of lower wishbone shaft or of wishbones	Replace shaft or wishbones
Car Pulls Sideways	
1. Non-uniform tyre pressure	1. Set correct tyre pressure in all wheels

Cont'd

Cause	Remedy
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. Non-uniform 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
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

Cont'd

Cause	Remedy
2. Shock absorbers inoperative	2. Replace or repair shock absorbers
3. Distortion of wishbones	3. Replace distorted wishbones

Excessive Clearance in Ball Joints

Friction surfaces of ball joint parts worn with dirt penetrating inside through loose or damaged rubber boot	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 over circumference, on extreme tread ribs or, after prolonged driving on unbalanced wheels, on central rib too)	3. Have wheels balanced
4. Non-uniform 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

Wheels Wobble

1. Wrong balancing of wheels:	1. Do the following:
(a) non-uniform wear of tyre tread over circumference	(a) balance or replace wheels
(b) shifting of balance weights and tyres during mounting	(b) balance wheels

Cont'd

Cause	Remedy
(c) deformation of wheel rim	(c) true up or replace rim; balance wheels
(d) damaged 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 hard particles get on gland sealing edges	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
4. Loosening of reservoir nut	4. Tighten 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

Cont'd

Cause	Remedy
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 dust shield caused by impacts	2. Replace or repair dust shield
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. High speed 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 operating instructions
7. Failure to interchange wheels as recommended in Operating Instructions	7. Interchange wheels as recommended in Operating Instructions

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

FRONT SUSPENSION

The design of the front suspension is shown in Fig. 4-1.

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 road obstackles or car body, distortions of the lower wishbone shafts, crossmember or suspension wishbones and body front elements and check the condition of the ball joints and silent blocks.

Distortion of the lower and upper wishbone shaft is checked visually.

Distortion of the front suspension crossmember is determined by measuring the distance between the outer surfaces of the crossmember brackets in the zone of the upper wishbone shaft fastening bolts. This distance should be 736±1.5 mm.

If the crossmember 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 crossmember.

The silent blocks should be examined as follows:

- make sure there is no deformation of the suspension wishbones, lower wishbone shaft, and suspension crossmember; then jack up the front wheels of the car;
- measure 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 is fractured or bulged on one side;
- if rubber is undercut and worn on silent block faces;
- if radial displacement A of the outer bushing relative to the inner one exceeds 2.5 mm;
- if distance B goes out of 3 - 7.5 mm limits.

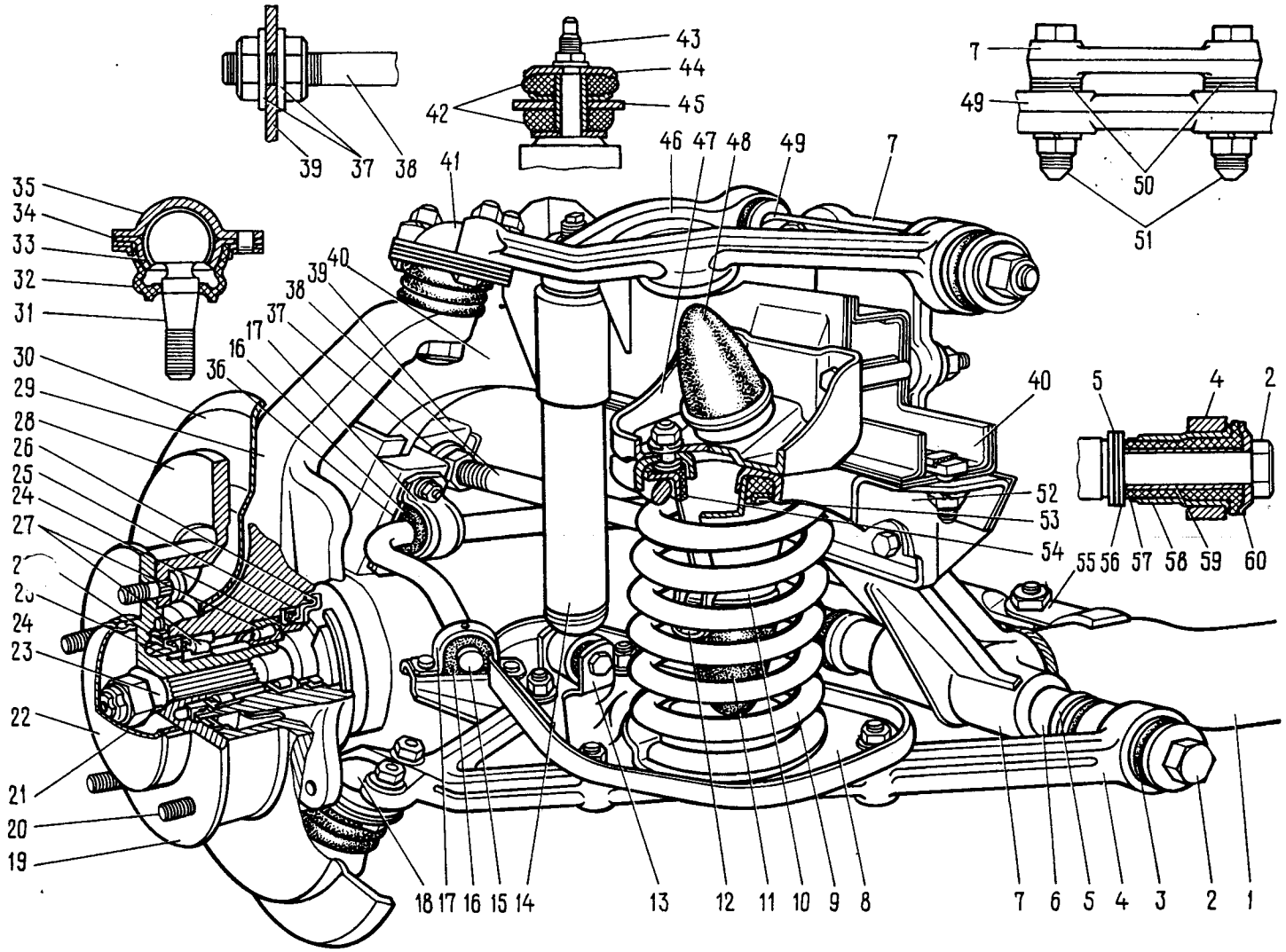


Fig. 4-1. Front Suspension:
1 - front suspension crossmember; 2 - lower wishbone shaft; 3 - lower wishbone silent block; 4 - lower wishbone; 5 - lower wishbone adjusting washers; 6 - lower wishbone shaft bushing; 7 - crossmember bracket; 8 - suspension spring lower seat; 9 - suspension spring; 10 - compression buffer support post; 11 - compression buffer; 12 - compression stroke stop; 13 - shock absorber lower bracket; 14 - shock absorber; 15 - sway eliminator bar; 16 - rubber pad; 17 - sway eliminator bar holder; 18 - lower ball joint; 19 - wheel hub; 20 - brake disc and wheel bolt; 21 - tapered bushing; 22 - cap; 23 - outer constant velocity universal joint housing extension; 24 - gland bushing; 25 - gland; 26 - mud deflecting ring; 27 - wheel hub bearings; 28 - brake disc; 29 - steering knuckle; 30 - front brake guard housing; 31 - ball joint pin; 32 - boot; 33 - bearing; 34 - ball pin seat holder; 35 - ball pin bearing housing; 36 - sway eliminator bar fastening plate; 37 - washers; 38 - tension member; 39 - tension member bracket; 40 - body sidemember; 41 - upper ball joint; 42 - shock absorber rod pad; 43 - shock absorber rod; 44 - washer; 45 - shock absorber bracket; 46 - suspension upper wishbone; 47 - rebound buffer bracket; 48 - rebound buffer; 49 - suspension upper wishbone shaft; 50 - adjusting washers; 51 - upper wishbone shaft bolts; 52 - suspension spring upper support; 53 - suspension spring upper seat; 54 - spring insulating gasket; 55 - tension member-to-crossmember bracket; 56 - thrust washer; 57 - rubber bushing; 58 - outer bushing; 59 - inner bushing; 60 - thrust bushing

If distance B goes beyond the above-specified limits, check silent block press-fitting 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. (L.H.) front side of the car and take off the wheel;
- put a 230 mm-high wooden block under the

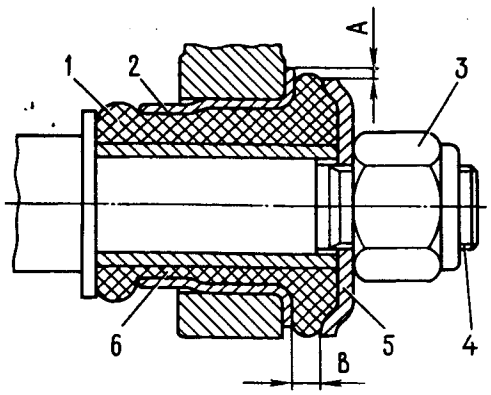


Fig. 4-2. Examining Front Suspension Wishbone Silent Block:
1 - rubber bushing; 2 - outer bushing; 3 - shaft nut; 4 - wishbone shaft; 5 - joint thrust washer; 6 - inner bushing

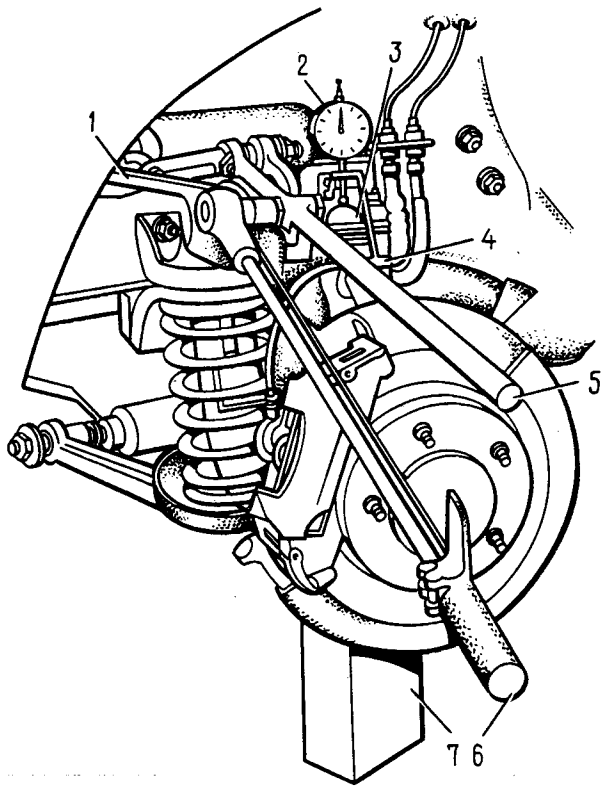


Fig. 4-3. On-Car Checks of Clearance in Suspension Upper Ball Joints:
1 - upper wishbone; 2 - indicator; 3 - upper ball joint housing; 4 - indicator bracket; 5 - lever; 6 - torque-indicating wrench; 7 - block

lower wishbone 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, remove it 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 and then align the zero division of the indicator scale with the pointer;

- secure 0.7 m long forked lever 5 on the upper wishbone of the front suspension;

- build up a load of 196 N.m (20 kgf.m) in the vertical direction with torque-indicating wrench 6 (294 N on the end of the forked lever) first for pushing the ball pin into, then for 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 3140 N (320 kgf) which corresponds to the weight of 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.

Prior to adjustment 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, "pump" the car suspension, by pushing down first the rear then the front bumper two or three times with a force of 392 - 490 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 comes out of the above-specified limits, change the number of adjusting washers 50 (Fig. 4-1) installed between the upper wishbone shaft and the crossmember bracket (see Table 4-1).

To adjust the caster angle:

- unscrew the nuts holding the upper wishbone shaft and transfer the washers from one bolt to the other until the angle is as prescribed. The caster angle increases when the washers are transferred from the rear bolt to the front one and vice versa;
- turn on 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 washers 50 (Fig. 4-1) installed between the upper wishbone shaft and the crossmember bracket.

To decrease or increase the camber angle, remove or add the identical number of washers on both bolts, respectively.

Table 4-1

Adjustments of Camber and Caster by Shims

Number of washers 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 washers 0.75 mm thick. The sign "plus" or "minus" means that a washer must be added or removed, 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 facing backwards, with maximum tolerable tilting by 60° to the horizontal plane. With the nuts tightened the edges of the clamp slots 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.

CHECKS AND ADJUSTMENT OF CLEARANCES IN FRONT WHEEL HUB BEARINGS

To check the clearance remove the cap, loosen the wheel nuts, then jack up the front end 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 rod 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:

- turn off 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 19.6 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 6.86 N.m (0.7 kgf.m);

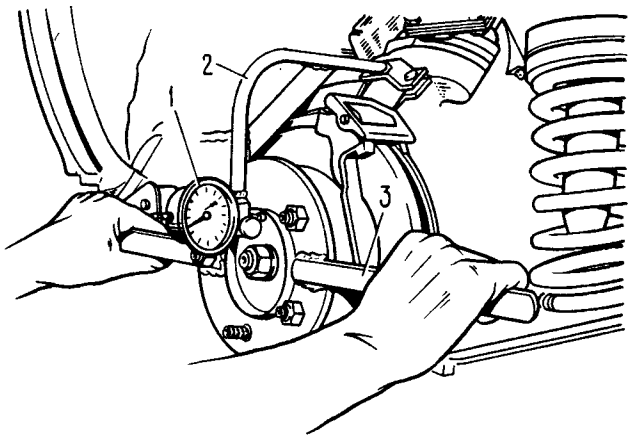


Fig. 4-4. Checking Axial Clearance in Front Wheel Hub Bearings:
1 - indicator; 2 - gauge 67.7834.9507; 3 - lever 67.7820.9521

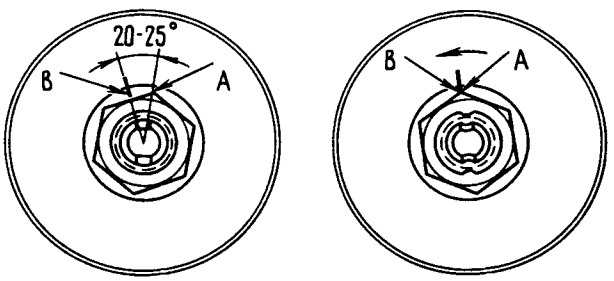


Fig. 4-5. Tightening and Adjusting Front Wheel Hub Bearings:
A - nut edge; B - mark on washer

- 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;

- lock the nut in this position, forcing the metal on the nut neck into the slots on the end of the outer joint holder extension.

After adjustments the clearance in the bearing should range from 0.01 to 0.07 mm.

REPLACEMENT OF GREASE 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 guard, 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 21 (Fig. 4-1);

- taking care not to damage gland 25, remove hub 19 complete with the brake disc;

- put a support under lower wishbone 4 and ease down the front end of the car a little so as to compress spring 9;

- disconnect lower ball joint 18 from the wishbone;

- detach shock absorber 14 from lower wishbone 4 and the side steering rod from the arm of steering knuckle 29;

- shift the front wheel drive shaft all the way towards the front axle;

- turning steering knuckle 29 relative to upper ball joint 41 remove the knuckle from universal joint housing extension 23;

- using handle 67.7853.9535 with washer 67.7853.9540, drive the inner races of bearings 27 from the steering knuckle space complete with dismantling rings and glands 25. Drive out the outer races of the bearings using 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 universal joint housing extension and bearings;

- pack 40 g of fresh grease Литол-24 into the bearing cages, apply it in a uniform layer in 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 press-fit the glands;

- put the steering knuckle on the extension of the universal joint housing and connect the ball joint to the lower wishbone;

- secure the shock absorber and connect the side steering rod to the knuckle arm;

- install the hub complete with the brake disc on the joint housing extension and install tapered bushing 21;

- screw on a new adjusting nut and adjust the clearances in the wheel hub bearings;

- install the wheel hub cap with mandrel 67.7853.9528;

- put in place the brake caliper and the wheel.

Note. In all cases when the nut has been removed from the extension of the outer joint housing, replace it by a new one or use a nut removed from another car.

BALANCING OF WHEELS

The wheels should be balanced on special stands in accordance with the stand Operating Instructions. The unbalance can be eliminated by the use of balance weights held on the wheel rim by special springs.

REMOVAL AND INSTALLATION OF FRONT SUSPENSION

Install the car on a lift or an inspection pit, apply the parking brake, open the hood and remove the spare wheel.

Put chocks under the rear wheels and remove the front ones.

Using remover tool 67.7824.9516 (Fig. 5-10), drive the pins out of the steering knuckle arms and shift aside the steering rods.

Disconnect sway eliminator bar 6 (Fig. 4-6) from the suspension lower wishbones.

Disconnect tension members 5 from the body brackets and crossmember.

Detach the shock absorbers from the suspension lower wishbones.

Remove the engine sump protective shield and the splashguard.

On each side of the car remove the front brake caliper without disconnecting the brake hoses and suspend it so that it does not hang on the hoses.

Compress the suspension spring to relieve completely the lower wishbone.

Disconnect the ball joint from the lower wishbone and take off the spring, relieving it gently; repeat the same operations on the other suspension unit.

Disconnect upper wishbone shaft 49 (Fig. 4-1) from suspension crossmember bracket 7 and remove upper wishbone 46 complete with the steering knuckle, wheel hub, front brake and outer joint housing.

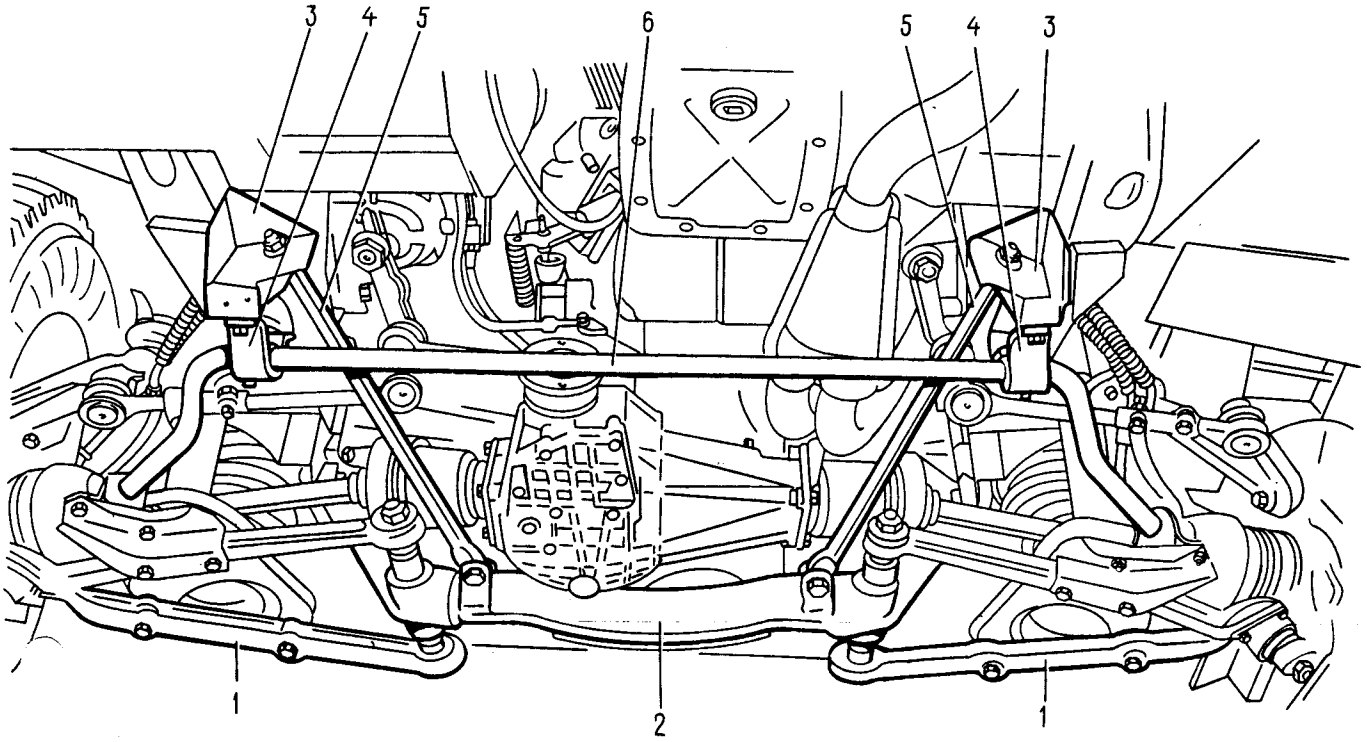


Fig. 4-6. Front Suspension Mounted on Car. Rear View:
1 - lower wishbone; 2 - crossmember; 3 - tension member bracket; 4 - sway eliminator bar-to-body bracket; 5 - tension member; 6 - sway eliminator bar

Note. When removing the upper wishbone shaft, take a note of the number and location of the washers between the upper wishbone shaft and the crossmember and of the adjusting plates between the crossmember and the body sidemember so as to return the washers and plates to their previous places during reassembly.

Disconnect the engine mount rubber pads from the crossmember brackets.

Put a hydraulic jack with a fixing device under the suspension crossmember and, supporting the engine with cross beam 67.7820.9514 or a hoist, detach the suspension crossmember from the body sidemembers, and brackets 47 of the rebound buffers.

Take off crossmember 1 complete with lower wishbones 4.

Install the suspension units and parts in the reverse order of removal operations. The suspension springs should belong to the same class (class A - unmarked, class B - black marks on the coil outer surface). It is permissible to install class A springs in the front suspension if the rear suspension is provided with class B springs.

Having assembled and installed the suspension check the wheel alignment angles and the toe-in.

DISASSEMBLY AND ASSEMBLY OF FRONT SUSPENSION UNITS

Disassembly. If the suspension repairs call for a complete stripping of its units, this should better be begun directly on the car, after removing the sump protective shield and the splashguard.

Proceed as follows:

- unscrew the nut of the pin of upper ball joint 41 (Fig. 4-1) and free the hoses from the clips;
- unbend the tongues of the guard, turn out the bolts of the caliper guide and shift it aside complete with the caliper;

Caution

To protect the hoses against damage, see that the caliper does not hang on them.

- using remover tool 67.7823.9514, take off the hub cap and unscrew the nut of the wheel hub bearings;
- remove the front wheel hub complete with the brake disc using remover tool 67.7823.9516;
- remove the guard of the front brake;
- take down the front suspension shock absorber;
- compress the suspension spring to relieve completely the lower wishbone, easing the wishbone down on a support;
- disconnect the ball joint housings from the suspension lower and upper wishbones and remove the steering knuckle;
- relieve gently and remove the suspension spring;

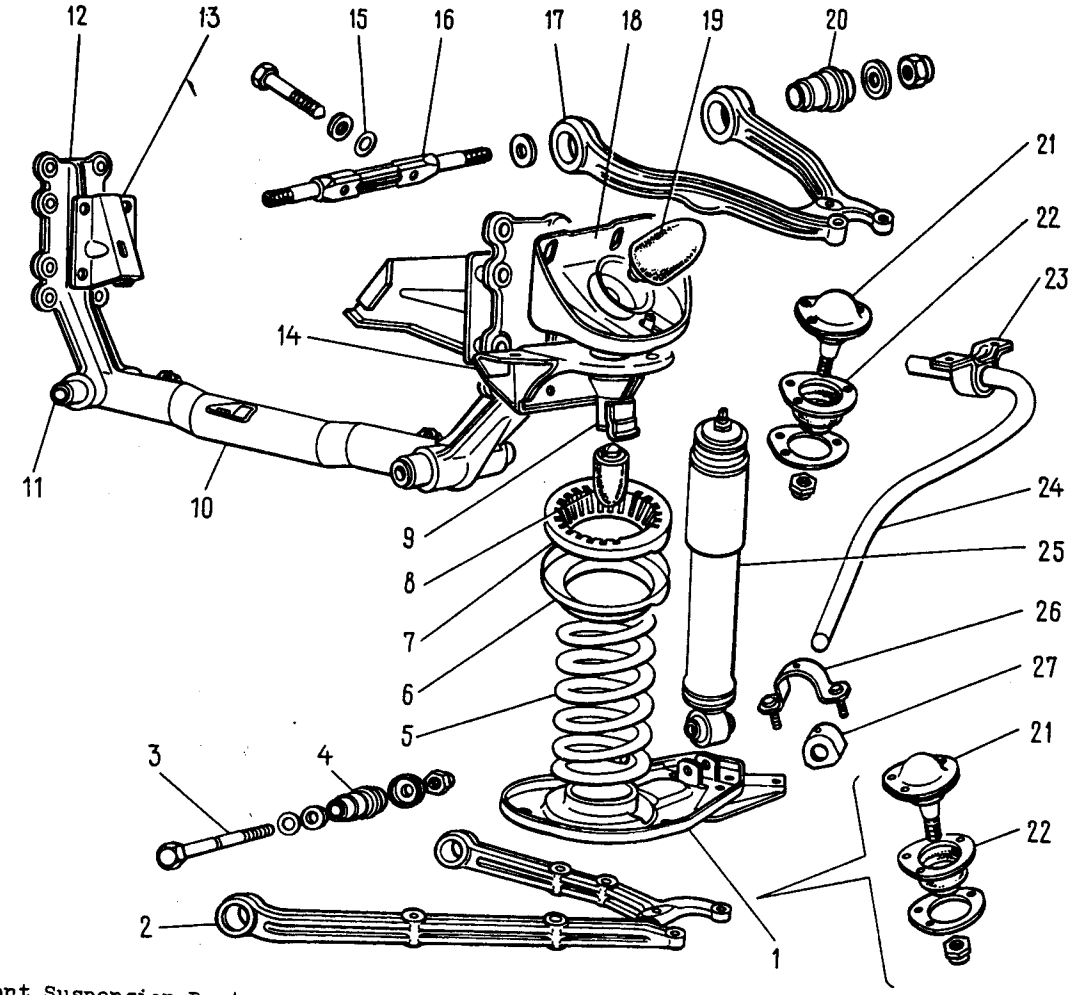


Fig. 4-7. Front Suspension Parts:
1 - suspension spring lower seat; 2 - lower wishbone; 3 - lower wishbone shaft; 4 - lower wishbone silent block; 5 - spring; 6 - upper seat; 7 - spring insulating gasket; 8 - compression stroke buffer; 9 - compression stroke stop; 10 - suspension crossmember; 11 - crossmember bracket bushing; 12 - crossmember bracket; 13 - engine mount bracket; 14 - spring upper support; 15 - adjusting washer; 16 - upper wishbone shaft; 17 - upper wishbone; 18 - rebound stroke buffer bracket; 19 - rebound stroke buffer; 20 - upper wishbone silent block; 21 - ball joint; 22 - ball pin boot; 23 - bar-to-body bracket; 24 - sway eliminator bar; 25 - shock absorber; 26 - pad holder; 27 - pad

- using remover tool 67.7823.9515, knock out the shaft and disconnect the lower wishbone from the crossmember;

- disconnect the upper wishbone shaft from the crossmember and take off the shaft complete with the wishbone;

Note. Before removing the shafts of the upper and lower wishbones, count the number of washers on each end of the lower wishbone shaft and on the bolts of the upper wishbone shaft so as to put them in their own places during reassembly.

- remove the crossmember and the rebound buffer bracket as described above;

- using remover tool 67.7824.9516, drive the ball joint pins out of the steering knuckle holes.

The parts of the front suspension are shown in Fig. 4-7.

Assembly of the front suspension units is carried out in the reverse order of disassembly operations. When assembling the wheel hub, put a layer of Литол-24 grease into the bearing cages and apply a uniform layer of this grease into the steering knuckle space between the bearings, 40 g per knuckle.

When installing the crossmember tension members, screw on the inner nut until the clearanc between the washer and bracket 3 (Fig. 4-6) is taken up; turn on the outer nut with a torque specified in the Appendix.

To avoid wrong distribution of forces in the silent blocks, turn on the wishbone shaft nuts under a static load of the car equal to 3140 N (320 kgf). Then check and adjust the wheel alignment angles and the toe-in.

INSPECTION

Ball joints. Make sure that the ball joint boots are intact; they should be free of such defects as fractures, cracks, separation of rubber from metal and leakage of lubricant.

Examine the working surfaces of the ball joints for wear, turning the ball pin by hand. Play or jamming of the pin are impermissible.

The condition of the ball joint can be assessed more accurately by the amount of radial and axial clearances measured with gauge 02.8701.9502. For this purpose install ball joint 1 (Fig. 4-8A) into the gauge socket and clamp it with a screw. Place indicator 2 into the gauge bracket with the indicator rod bearing against the side surface of the joint housing, and the indicator pointer at the zero division.

Insert torque-indicating wrench 3 into the upper socket of the gauge and, applying a torque of 195 N.m (20 kgf.m) in both directions, read the summary radial clearance in the ball joint from indicator 2. If the clearance is larger than 0.7 mm, replace the ball joint by a new one.

Measure the axial clearance in the ball joint in the same manner, first changing its fastening

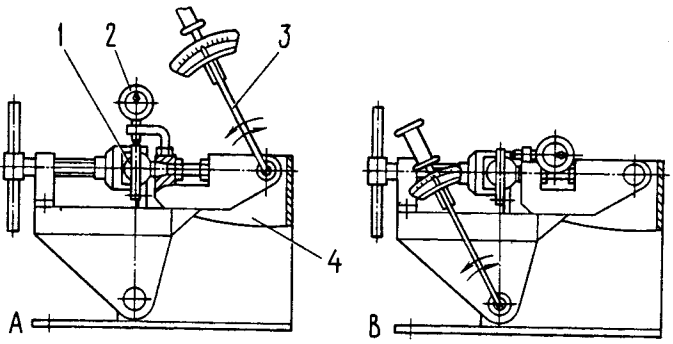


Fig. 4-8. Checking Ball Joint on Gauge 02.8701.9502:
1 - ball joint; 2 - indicator; 3 - torque-indicating wrench; 4 - gauge 02.8701.9502; A - checking radial clearance; B - checking axial clearance

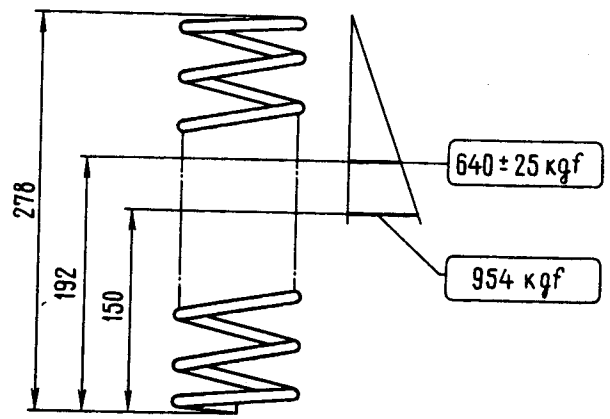


Fig. 4-9. Main Data for Checking Front Suspension Spring

in the gauge as shown in Fig. 4-8B. The maximum permissible axial clearance in the joint is not over 0.7 mm.

Suspension spring. Examine the springs thoroughly and replace them by new ones if the nature of deformations may render them unfit for further service.

Compress the spring three times until its coils close and check its resilience by the reference points (Fig. 4-9).

Examine the insulating gaskets and replace them, if necessary.

Sway eliminator, wishbones, steering knuckle. Check the sway eliminator bar for distortion and see that its ends are in one plane. Straighten out the bar if distortion is slight or replace it, if heavy.

Make a close examination of the wishbones, crossmember and steering knuckles to see that they are neither distorted nor cracked.

Replace any cracked and distorted parts.

Front suspension crossmember. Check the geometrical parameters of the crossmember with gauging mandrel 67.8732.9501. When the crossmember is seriously distorted and the front wheel alignment angles cannot be adjusted by washers though all the other suspension elements are intact, replace the crossmember.

Silent blocks. The necessity for replacing the silent blocks is determined in "Inspection of Front Suspension Parts" above.

REPLACEMENT OF SILENT BLOCKS

Upper wishbone. Install fixture 67.7823.9527 on the shaft between the wishbone lugs and place the wishbone on mandrel A.47045 (Fig. 4-10). Apply the press punch to wishbone shaft 1 until silent block 3 is pressed out of the hole. To press out the other silent block turn the wishbone over and repeat the same operation.

The silent blocks of the upper wishbones are press-fitted with the aid of fixture 67.7853.9519 (Fig. 4-11) clamped in a vice. Place the wishbone with shaft 1 on fixture 2, put the silent block on the shaft and drive it into the wishbone socket with installation tool 3 (A.74177/1). Then repeat the same operations for driving in the other silent block on the other side of the wishbone.

Lower wishbone. The silent block can be driven in and out either on a press with the aid of fixture 67.7823.9526 or using fixture 67.7823.9517 (Fig. 4-12) installed on the wishbone, with the head of the fixture screw directed inward. Press out the silent block by turning in the screw.

To press-fit, insert the silent block into the wishbone socket and install fixture 67.7823.9517 (Fig. 4-13) together with cap 3.

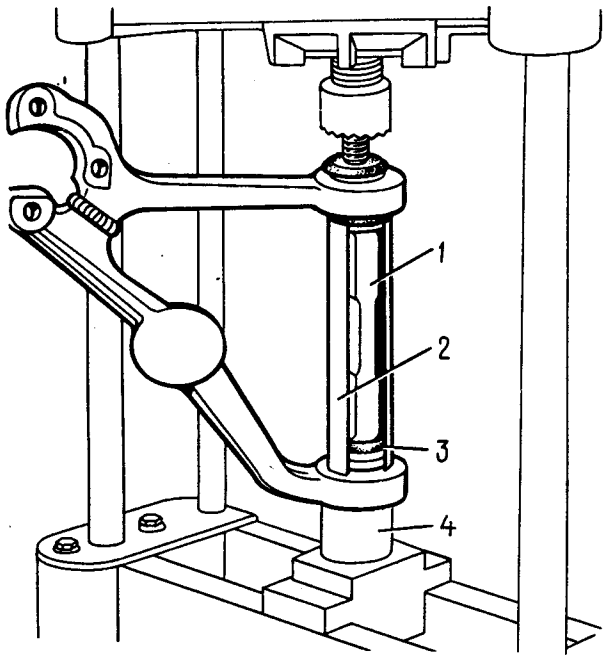


Fig. 4-10. Pressing Out Upper Wishbone Silent Blocks:
1 - wishbone shaft; 2 - fixture 67.7823.9527;
3 - silent block; 4 - mandrel A.47045

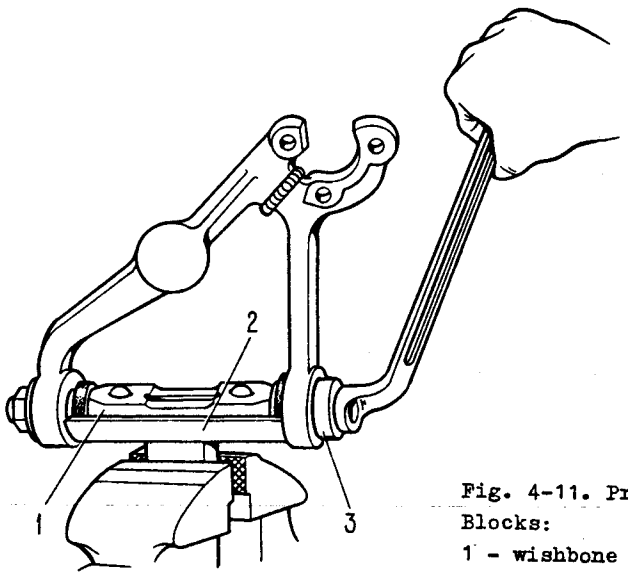


Fig. 4-11. Press-Fitting Upper Wishbone Silent Blocks:
1 - wishbone shaft; 2 - fixture 67.7853.9519;
3 - installation tool A.74177/1

Turning in the fixture screw, press-fit the silent block into the wishbone socket.

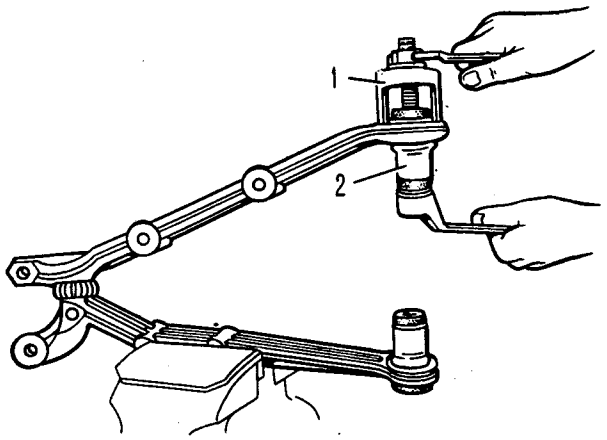


Fig. 4-12. Pressing Out Lower Wishbone Silent Blocks:
1 - fixture 67.7823.9517; 2 - silent block

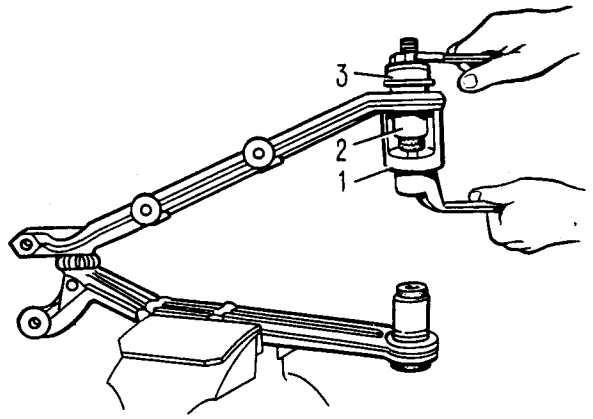


Fig. 4-13. Press-Fitting Lower Wishbone Silent Blocks:
1 - fixture; 2 - silent block; 3 - cap

REAR SUSPENSION

The design of the rear suspension is shown in Fig. 4-14.

REMOVAL AND INSTALLATION

Removal. Jack up the rear end of the car and put it on supports. Remove the rear wheels.

Disconnect the propeller shaft from the final drive pinion flange.

Disconnect the hydraulic brake hose from the steel pipe mounted on the axle and take measures to prevent fluid leaks from the brake system.

Disconnect the brackets of the parking brake rear cable from the car body, take off the front cable return spring and, unscrewing the locknut and the adjusting nut, free the rear cable. Disconnect rod 13 (Fig. 4-14) of the rear brake pres-

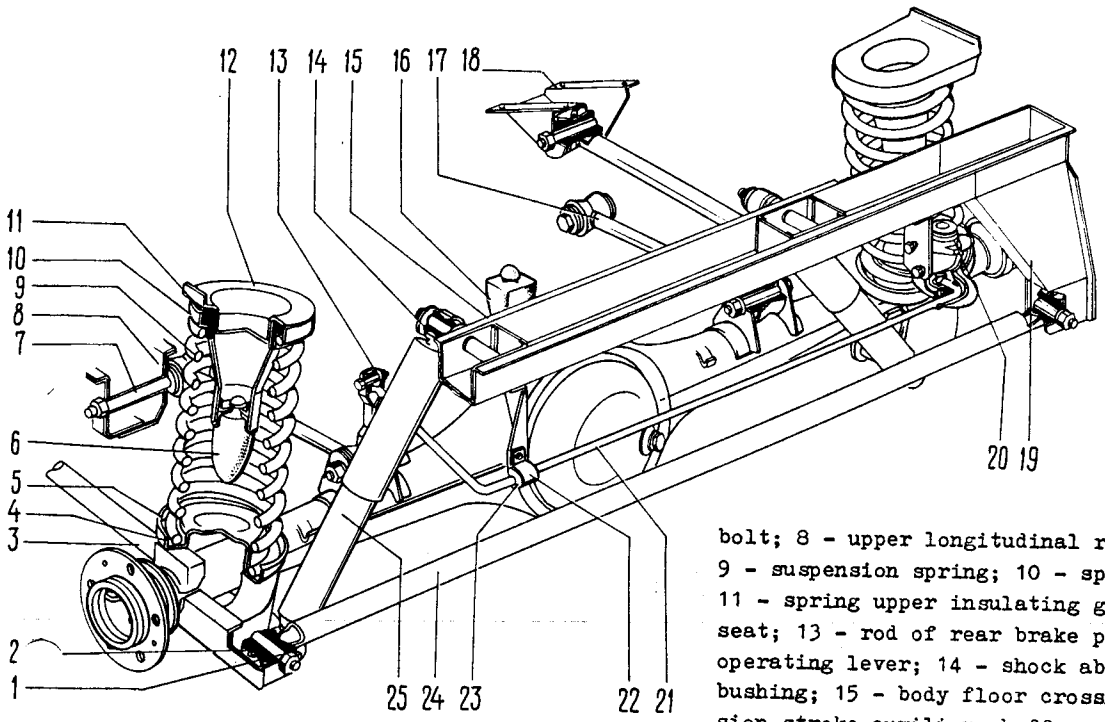
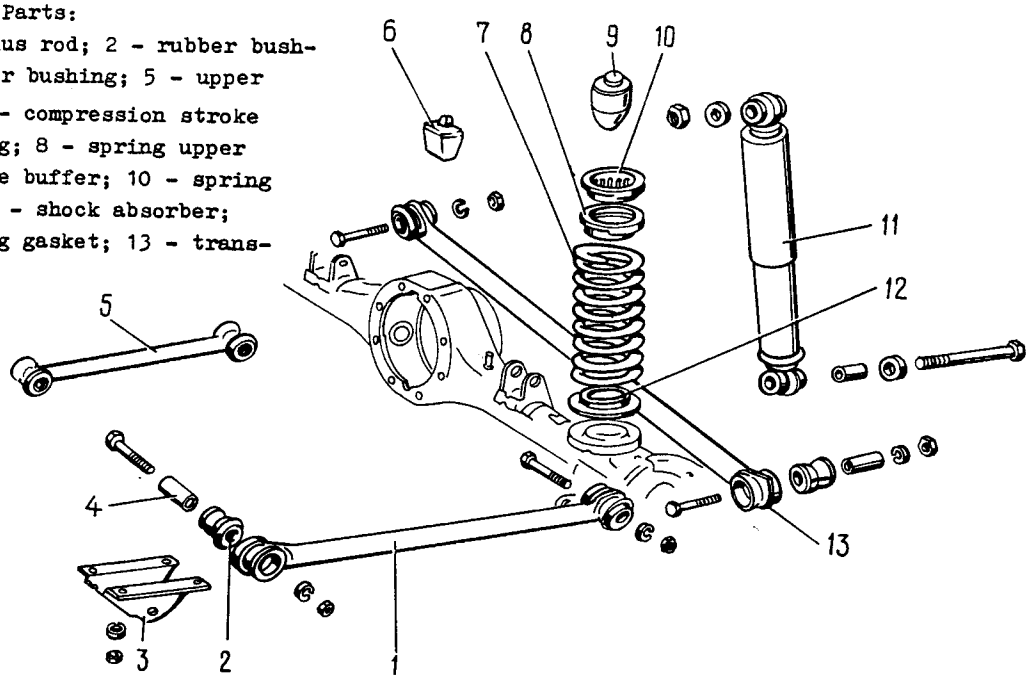


Fig. 4-14. Rear Suspension:
1 - spacer bushing; 2 - rubber bushing; 3 - lower longitudinal radius rod; 4 - spring lower insulating gasket; 5 - spring lower seat; 6 - compression stroke buffer; 7 - upper longitudinal radius rod bolt; 8 - upper longitudinal radius rod bracket; 9 - suspension spring; 10 - spring upper seat; 11 - spring upper insulating gasket; 12 - spring seat; 13 - rod of rear brake pressure regulator operating lever; 14 - shock absorber lug rubber bushing; 15 - body floor crossmember; 16 - compression stroke auxiliary buffer; 17 - upper longitudinal radius rod; 18 - lower longitudinal radius rod bracket; 19 - transverse radius rod-to-car body bracket; 20 - brake pressure regulator; 21 - pressure regulator operating lever; 22 - lever supporting bushing holder; 23 - lever supporting bushing; 24 - transverse radius rod; 25 - shock absorber

Fig. 4-15. Rear Suspension Parts:
1 - lower longitudinal radius rod; 2 - rubber bushing; 3 - bracket; 4 - spacer bushing; 5 - upper longitudinal radius rod; 6 - compression stroke auxiliary buffer; 7 - spring; 8 - spring upper seat; 9 - compression stroke buffer; 10 - spring upper insulating gasket; 11 - shock absorber; 12 - spring lower insulating gasket; 13 - transverse radius rod



sure regulator from the bracket on the axle beam. Disconnect the upper ends of shock absorbers 25.

Put a hydraulic jack under the rear axle beam. Disconnect longitudinal (3, 17) and transverse (24) radius rods from the brackets on the body, then lower the jack and remove the rear axle.

Proceed with disassembling the suspension:

- remove the shock absorbers from the brackets on the rear axle beam;
- disconnect the longitudinal and transverse radius rods from the brackets on the rear axle beam.

The parts of the rear suspension are shown in Fig. 4-15.

Installation. To install the rear suspension reverse the removal operations.

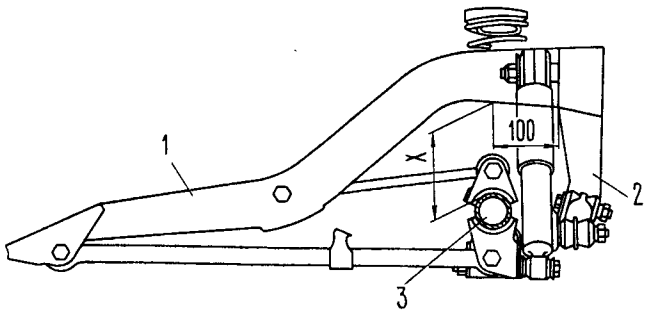


Fig. 4-16. Rear Suspension Installation Diagram: 1 - body sidemember; 2 - transverse radius rod bracket; 3 - rear axle beam; X = 152 mm

The springs of the rear suspension should belong to the same class as those used in the front suspension. In exceptional cases, when class A (unmarked) springs are used in the front suspension and such springs are not available for the rear suspension, class B springs (marked black) may be used. If the front suspension has class B springs, the rear suspension must have only class B springs too.

To avoid damaging and overtightening the flexible bushings of the radius rod joints and shock absorbers:

- load the rear end of the car so that distance "X" from the axle beam to the body sidemember measured at a point located 100 mm from the transverse radius rod bracket (Fig. 4-16) is 152 mm;
- using a torque-indicating wrench tighten the nuts of the bolts of the longitudinal and transverse radius rods, also the nuts of the pins which fasten the shock absorbers to the axle beam and the car body.

Inspection

Before inspection take care to wash all the parts thoroughly.

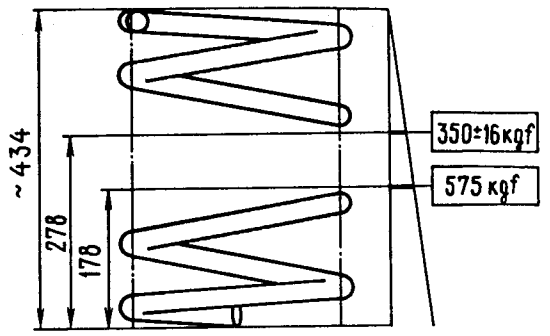


Fig. 4-17. Main Data for Checking Rear Suspension Spring

Protect the rubber parts, bushings and protective coatings against contact with solvents in the course of washing.

Springs. Check the resilience of the spring by the reference points (Fig. 4-17) first compressing it until the coils close.

Note. According to their length under a load of 3425 N (350 kgf), the springs are divided into class A (longer than 278 mm) and class B (278 mm or shorter).

The springs of class A are unmarked, while those of class B are marked black on the external side of the coils.

Check the springs for deformation. Replace th spring if its resilience is other than indicated i Fig. 4-17 or its deformation may interfere with it efficient operation.

Examine the supporting rubber gaskets of the springs and replace them by new ones, if necessary

Radius rods. Check the following:

- distortion of the rods; straighten them, if possible;
- lock for cracks on the brackets of the rear axle beam and car body; repair the brackets, if they are cracked;
- examine the flexible bushings of the radius rod joints; replace them by new ones, if necessary using the set of tools 67.7820.9517.

SHOCK ABSORBERS

The design of the front and rear suspension shock absorbers made at the VAZ autoplant is shown in Fig. 4-18.

STAND CHECKS

To access the serviceability of a shock absorber check its performance curve on a dynamometer test stand.

Take the performance curves in accordance wit the stand operating instructions after at least five working cycles at a fluid temperature of (20±5) °C, a flywheel speed of 60 min^{-1} and a rod travel of 80 mm for the front shock absorber and 100 mm for the rear one.

The curve on the diagram (Fig. 4-19) should be smooth; at the transition points between the

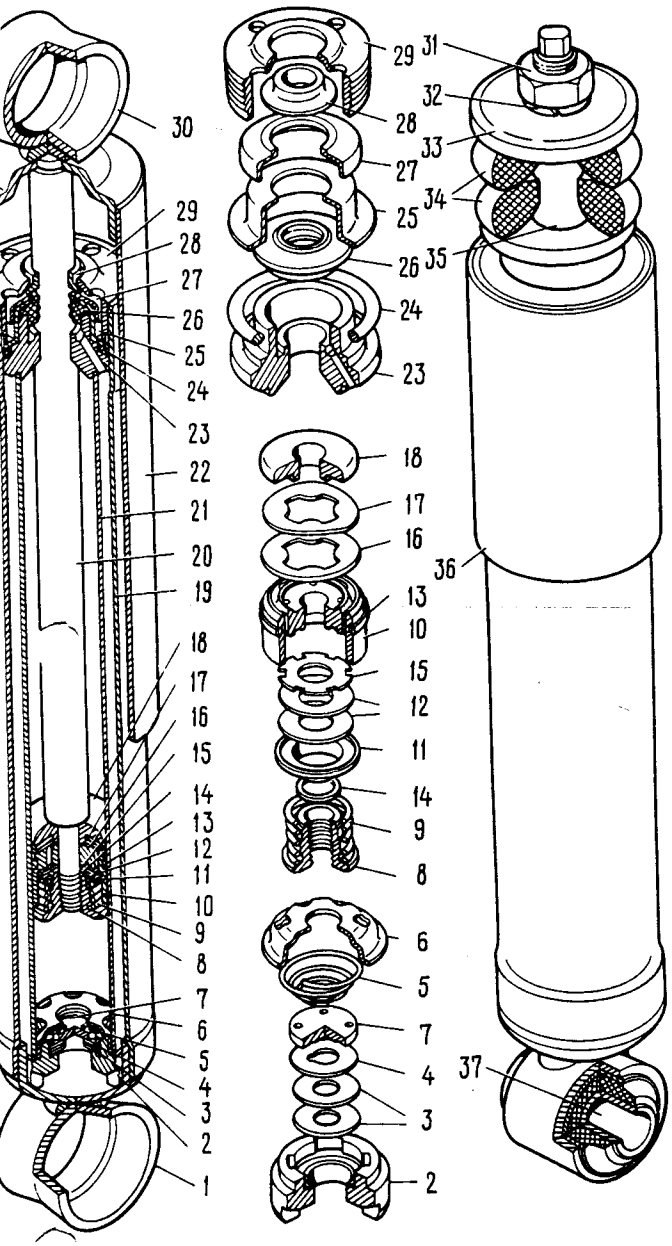


Fig. 4-18. Front and Rear Suspension Shock Absorbers:
1 - lower lug; 2 - compression valve body; 3 - compression valve discs; 4 - compression valve throttling disc; 5 - compression valve spring; 6 - compression valve holder; 7 - compression valve plate; 8 - rebound valve nut; 9 - rebound valve spring; 10 - shock absorber piston; 11 - rebound valve plate; 12 - rebound valve discs; 13 - piston ring; 14 - rebound valve nut washer; 15 - rebound valve throttling disc; 16 - bypass valve plate; 17 - bypass valve spring; 18 - limiting plate; 19 - reservoir; 20 - rod; 21 - cylinder; 22 - dust shield; 23 - rod guide bushing; 24 - reservoir sealing ring; 25 - gland holder; 26 - rod gland; 27 - rod protective ring gasket; 28 - rod protective ring; 29 - reservoir nut; 30 - shock absorber upper lug; 31 - front suspension shock absorber upper fastening nut; 32 - spring washer; 33 - shock absorber pad washer; 34 - pad; 35 - spacer bushing; 36 - shock absorber dust shield; 37 - silent block

Fig. 4-19. Shock Absorber Performance Curve:
I - rebound stroke force; II - compression stroke force

rebound and compression strokes there should be no sections parallel to the zero line.

Evaluation of performance curves. The resistance during the rebound and compression strokes is determined by the maximum ordinates of the corresponding curves.

The peak of the rebound stroke curve on a scale of 47 N (4.8 kgf) per 1 mm should lie at the following distances (A) from the zero line: 25 - 32 mm for the front shock absorbers and 23.5 - 30.5 m for the rear ones.

The peak of the compression stroke curve on the same scale should lie at the following distances (B) from the zero line: 3.5 - 6.5 mm for the front shock absorbers and 4.5 - 7.5 mm for the rear ones.

The reference values of the ordinates on the curves for the front and rear shock absorbers are given for cold shock absorbers at a fluid temperature of (20±5) °C.

After the check remove the shock absorber from the stand and, if necessary, recondition or replace the faulty parts.

Repeat the check to make sure that the shock absorbers function as they should.

DISASSEMBLY AND ASSEMBLY

Wash the shock absorber on the outside and clamp it in a vice.

Note. For clamping the shock absorber and its parts in a vice use special soft jaws 67.7824.9513-001.

Pull the shock absorber rod all the way out, unscrew reservoir nut 29 (Fig. 4-18) with wrench A.57034/R, take operating cylinder 21 with rod 20 and its parts out of the reservoir. Withdraw the reservoir from the vice and drain the fluid.

Using wrench 67.7824.9513-005 remove rod guide bushing 23 from the operating cylinder. Remove piston 10 with the rod from the cylinder and drain the fluid. Drive compression valve body 2 with associated parts gently from the cylinder with a special mandrel.

Clamp the rod with the piston in a vice with special jaws and unscrew rebound valve nut 8. Remove piston 10 with bypass and rebound valves, guide bushing 23, rod gland 26, gland holder 25 and other parts.

Note. To facilitate inspection of the front suspension shock absorber rod which is covered by the dust shield, it is good practice to press off the dust shield too.

Disassemble the compression valve. For this purpose remove holder 6, then take valve spring 5, plate 7 and discs 3 and 4 one after another out of body 2.

To assemble the shock absorber reverse the disassembly procedure observing the following requirements:

- having assembled the compression valve make sure there is free travel of plate 7 and valve discs;
- press-fit holder 6 on body 2 with a special mandrel;
- press-fit the compression valve into the cylinder with mandrel 67.7824.9513-004;
- to facilitate assembly of the rod-mounted parts use guide 67.7824.9513-003;
- throttling disc 15 of the front shock absorber has two slots on the outside diameter, while that of the rear shock absorber, three slots;
- tighten the rebound valve nut with a torque of 9.8 - 14.7 N.m (1 - 1.5 kgf.m);
- tighten the reservoir nut with wrench 67.7824.9513-002 with a torque of 68.6 - 88.2 N.m (7 - 9 kgf.m).

INSPECTION OF PARTS

Wash all metal parts with gasoline or kerosene and leave them to dry; wash rubber parts with lukewarm water and wipe them with clean cloth.

Check thoroughly to see that the parts meet the following requirements:

- the discs of the compression and rebound valves and the plate of the bypass valve should not be distorted; the plate of the bypass valve should be flat, true to 0.05 mm;
- the working surfaces of the piston, piston ring, rod guide bushing, cylinder and valve parts should be free of scores and nicks that may affect adversely the normal functioning of the shock absorber;
- the springs of the rebound and compression valves should be intact and sufficiently resilient;
- the compression valve discs should be intact and not seriously worn;
- it is good practice to replace the gland by a new one during repairs.

Replace all defective parts and proceed with assembling the shock absorber.

Section V
STEERING GEAR

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

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

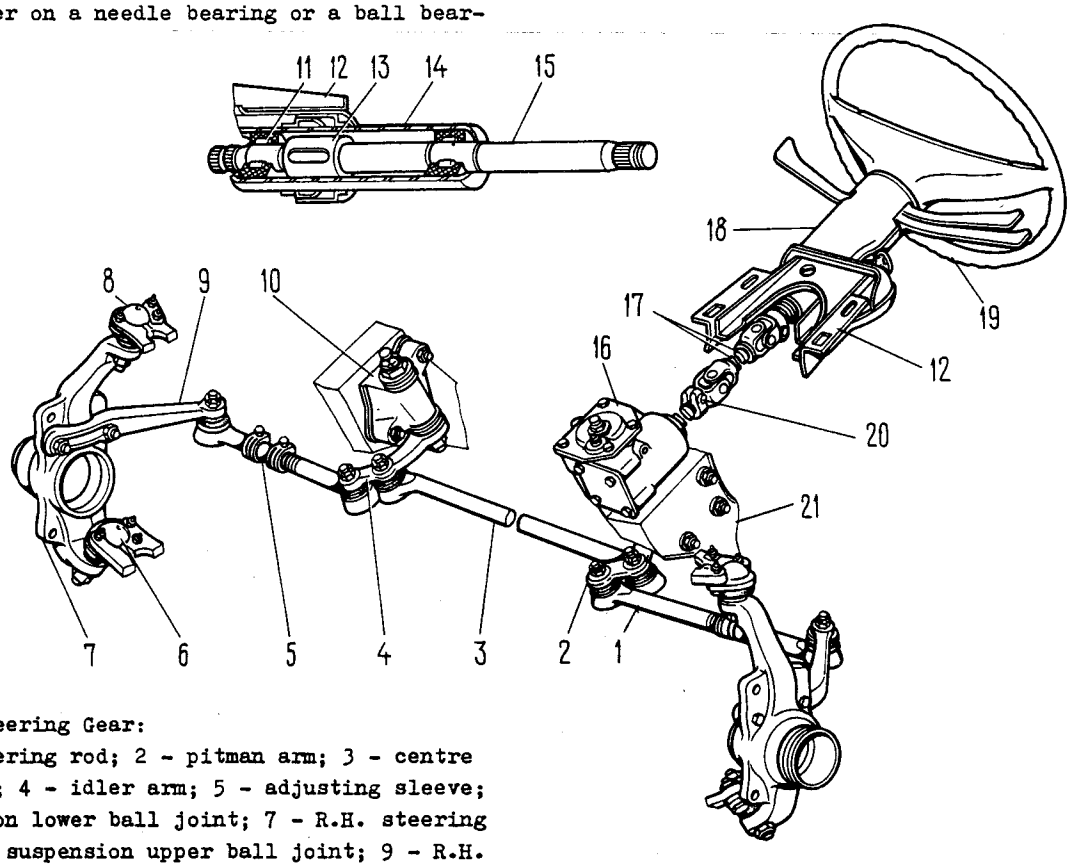


Fig. 5-1. Steering Gear:
1 - side steering rod; 2 - pitman arm; 3 - centre steering rod; 4 - idler arm; 5 - adjusting sleeve; 6 - suspension lower ball joint; 7 - R.H. steering knuckle; 8 - suspension upper ball joint; 9 - R.H. knuckle arm; 10 - idler arm bracket; 11 - upper shaft bearing; 12 - steering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

TROUBLE SHOOTING

Cont'd

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

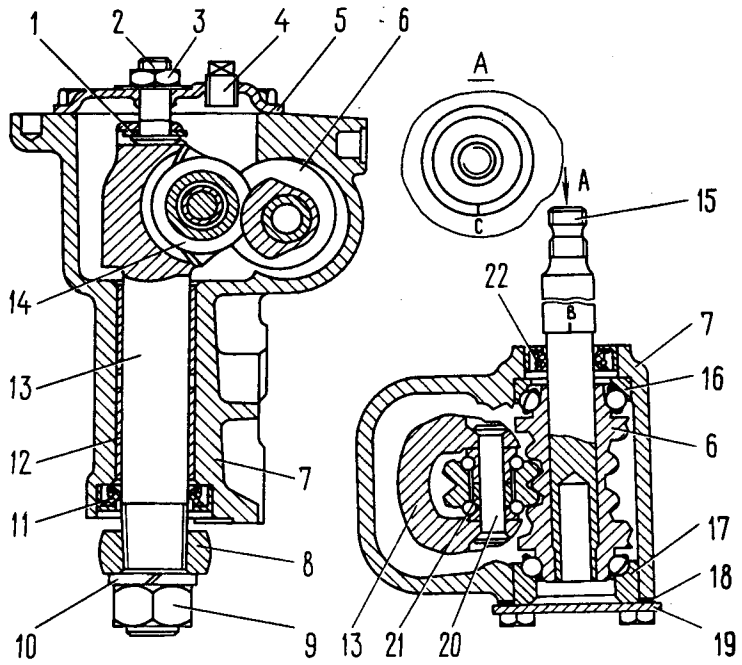


Fig. 5-2. Steering Mechanism, Sectionalized:
1 - adjusting screw plate; 2 - pitman arm shaft adjusting screw; 3 - adjusting screw nut; 4 - oil filler plug; 5 - cover; 6 - worm; 7 - steering gear case; 8 - pitman arm; 9 - pitman arm-to-shaft nut; 10 - spring washer; 11 - gland; 12 - bronze bushing; 13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

Cont'd

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

Difficult Rotation of Steering Wheel

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

Cont'd

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

Knocking in Steering Gear

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

Front Wheel Shimmy

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

Car Pulls Aside

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

Cont'd

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

Poor Road Stability

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

Cont'd

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

Oil Leaks from Steering Gear Case

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

INSPECTION, CHECKS AND ADJUSTMENT

GENERAL INSPECTION

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

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

Turning the steering wheel back and forth make sure that:

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

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

Examine the ball joints and rubber boots as described below.

CHECKING STEERING ROD BALL JOINTS

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

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

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

Examine the boots of the steering rod ball joints.

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

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

CHECKS AND ADJUSTMENT OF STEERING WORM BEARINGS

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

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

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

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

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

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

CHECKS AND ADJUSTMENT OF ROLLER-TO-WORM MESH

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

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

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

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

STEERING MECHANISM

REMOVAL AND INSTALLATION

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

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

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

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

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

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

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

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

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

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

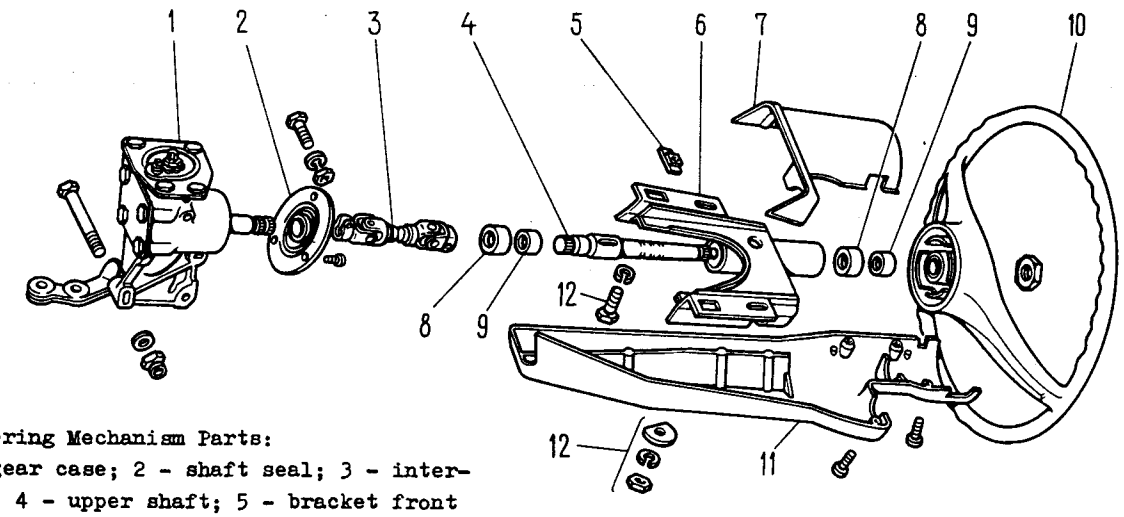


Fig. 5-3. Steering Mechanism Parts:
1 - steering gear case; 2 - shaft seal; 3 - intermediate shaft; 4 - upper shaft; 5 - bracket front part fixing plate; 6 - bracket; 7 - casing upper part; 8 - bearing bushing; 9 - needle bearing; 10 - steering wheel; 11 - casing lower part; 12 - steering gear shaft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

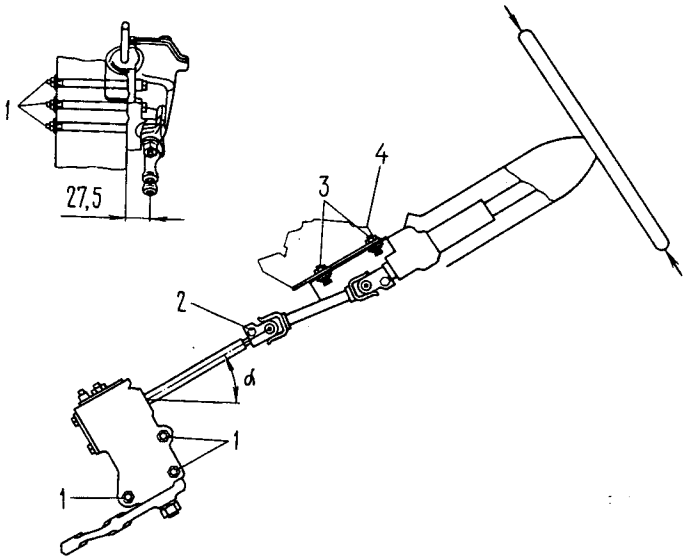


Fig. 5-4. Mounting Steering Mechanism on Car: 1 - steering gear case bolts; 2 - intermediate shaft lower end tie-bolt; 3 - bracket bolts; - steering shaft bracket; 27.5 mm - distance from centre of pitman arm hole to steering gear case mounting surface with pitman arm in neutral

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DISASSEMBLY AND ASSEMBLY OF STEERING GEAR CASE

Disassembly. Drain oil from the steering gear case.

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

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

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

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

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

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

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

Having installed the worm into the steering

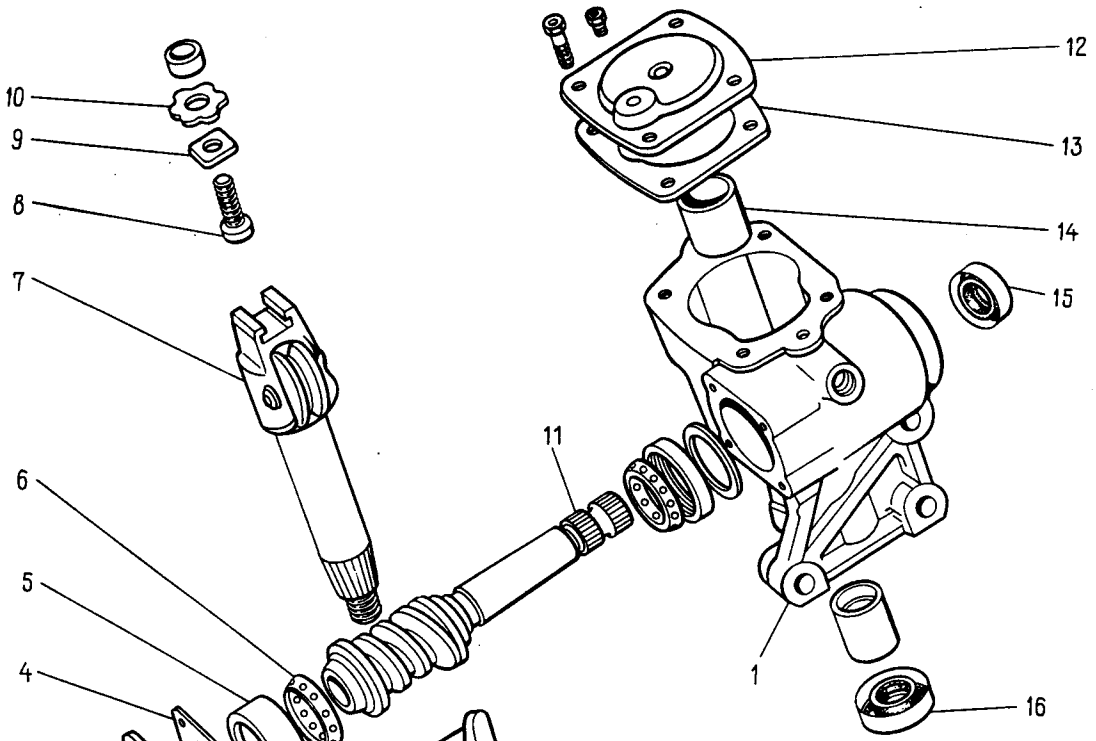


Fig. 5-5. Steering Mechanism Parts:
1 - case; 2 - pitman arm; 3 - case lower cover; 4 - adjusting shims; 5 - worm shaft bearing outer race; 6 - bearing cage with balls; 7 - pitman arm shaft; 8 - adjusting screw; 9 - adjusting plate; 10 - lockwasher; 11 - worm shaft; 12 - case upper cover; 13 - sealing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

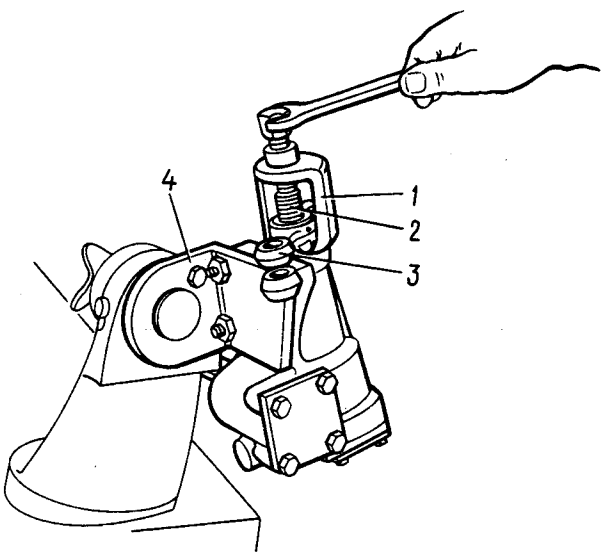


Fig. 5-6. Removing Pitman Arm:
1 - remover tool A.47043; 2 - pitman arm shaft; 3 - pitman arm; 4 - bracket A.74076/R

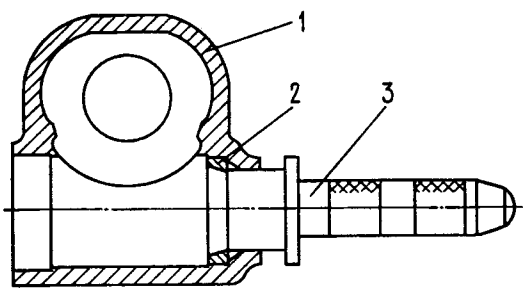


Fig. 5-7. Removing Worm Upper Bearing Outer Race with Mandrel 67.7853.9541:
1 - steering gear case; 2 - worm upper bearing outer race; 3 - mandrel 67.7853.9541

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

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

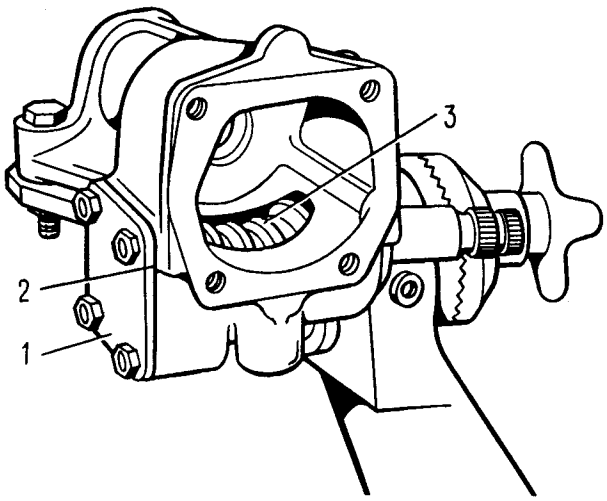


Fig. 5-8. Installing Steering Worm:
1 - bearing cover; 2 - adjusting shim; 3 - worm

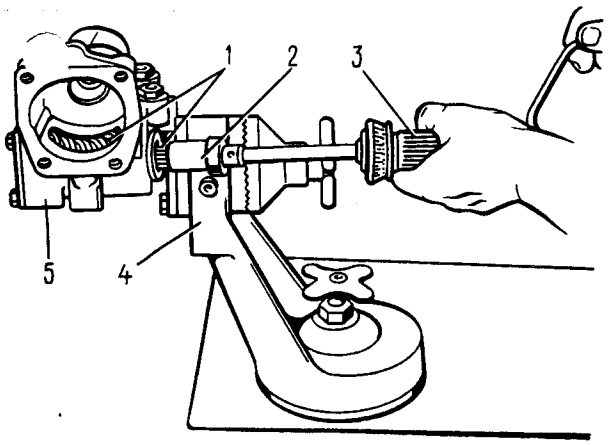


Fig. 5-9. Worm Friction Torque Dynamometer Check:
1 - worm; 2 - head A.95697/5; 3 - dynamometer 02.7812.9501; 4 - repair stand bracket; 5 - steering gear case

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

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

CHECKS AND REPAIRS

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

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

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

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

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

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

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

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

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

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

DISASSEMBLY AND ASSEMBLY OF STEERING SHAFT

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

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

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

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

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

REMOVAL AND INSTALLATION

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

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

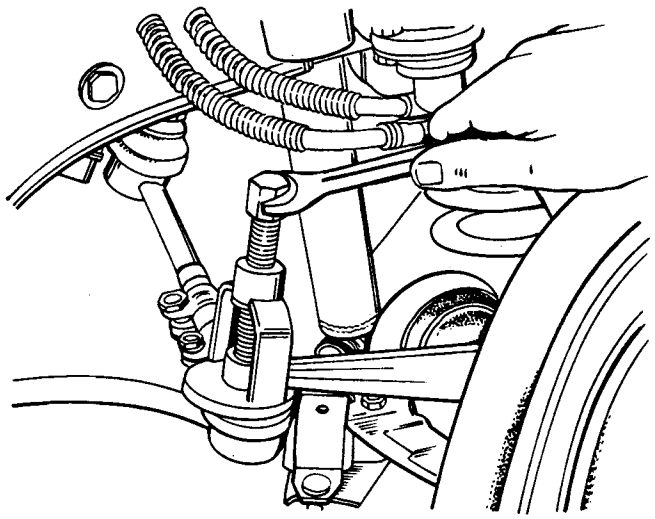


Fig. 5-10. Removing Steering Rod Ball Pins

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

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

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

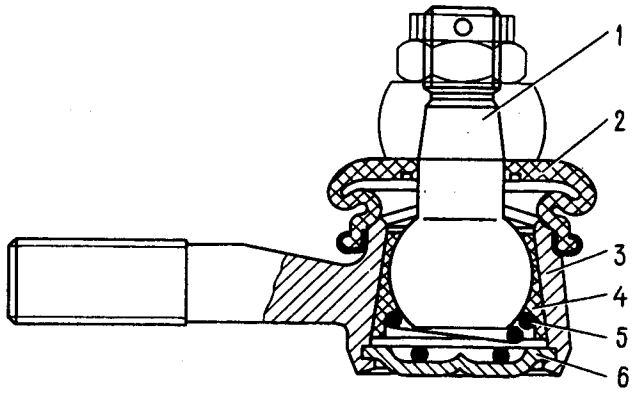


Fig. 5-11. Steering Rod Ball Joint, Sectionalized: 1 - ball pin; 2 - boot; 3 - joint body; 4 - seat; 5 - spring; 6 - plug

CHECKS AND REPAIRS

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

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

IDLER ARM BRACKET

REMOVAL AND DISASSEMBLY

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

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

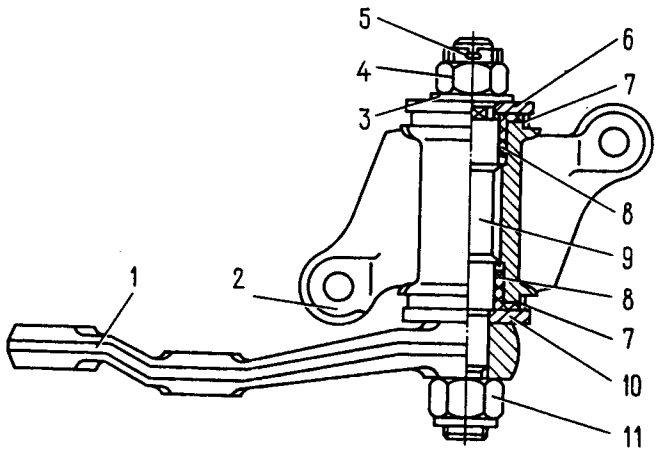


Fig. 5-12. Idler Arm Bracket, Sectionalized: 1 - idler arm; 2 - bracket body; 3 - washer; 4 - adjusting nut; 5 - cotter pin; 6 - upper washer; 7 - seal; 8 - bushing; 9 - idler arm shaft; 10 - lower washer; 11 - self-locking nut

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

CHECKS

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

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

ASSEMBLY AND INSTALLATION

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

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

Washer 6 must be installed with the extrusions facing up.

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

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

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

Attach the steering rod ball pins to the idler arm.

Section VI
BRAKES

The layout of the brake system is shown in Fig. 6-1.

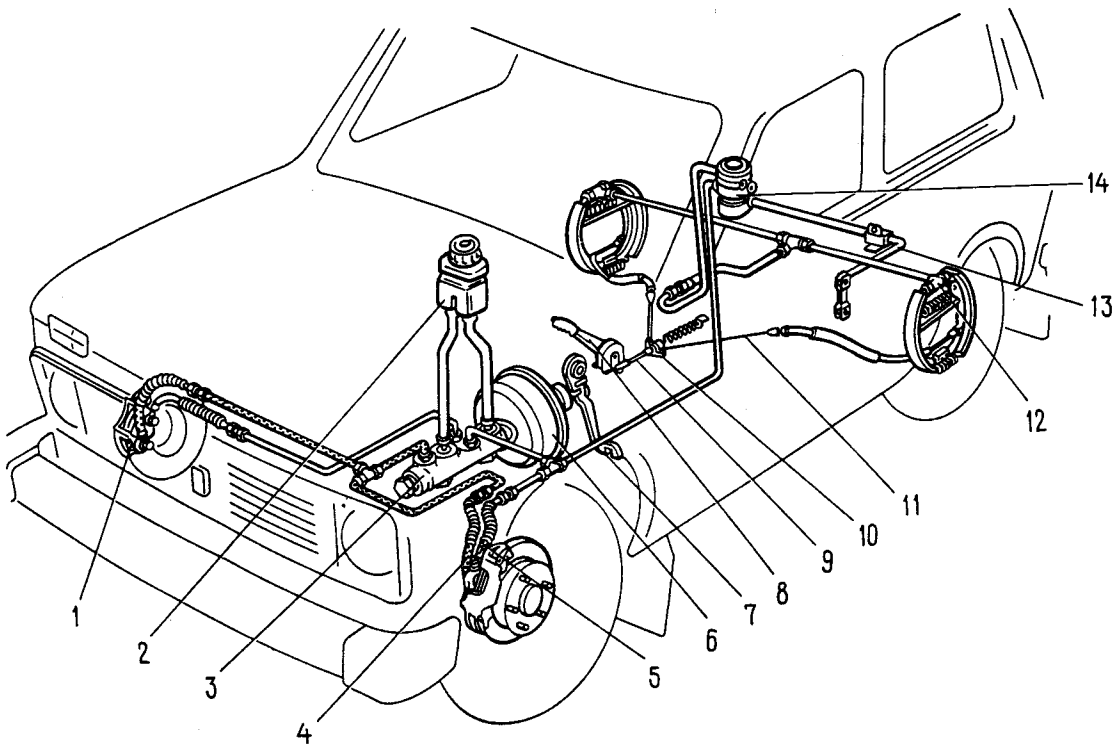


Fig. 6-1. Brake System, Diagrammatic:
1 - front brake cylinder block; 2 - brake fluid reservoir; 3 - brake master cylinder; 4 - primary circuit pipe; 5 - secondary circuit pipe; 6 - vacuum booster; 7 - brake pedal; 8 - parking brake lever; 9 - parking brake front cable; 10 - rear cable guide; 11 - parking brake rear cable; 12 - rear brake wheel cylinder; 13 - pres sure regulator operating lever; 14 - pressure regulator

TROUBLE SHOOTING

Cause	Remedy
Poor Braking Effect	
1. Fluid leaks from wheel cylinders of front or rear brakes	1. Replace faulty parts of wheel cylinders, wash and dry shoes and drums, bleed hydraulic system
2. Air in brake system	2. Bleed system
3. Damaged rubber seals of brake master cylinder	3. Replace seals and bleed system
4. Hydraulic rubber hoses damaged	4. Replace hoses

Cont'd

Cause	Remedy
Spontaneous Braking with Engine Running	
Wrong position of stop-light switch causes infiltration of air between valve body and boot. As a result:	
(a) cover seal is damaged, cocked or improperly fixed	Do the following: (a) replace vacuum booster

Cont'd

ıuse	Remedy
due to defective locking parts; (b) lubrication of cover seal is insufficient	(b) remove boot and pack seal with lubricant
Incomplete Release of All Wheel Brakes	
No free travel of rake pedal due to wrong sition of stoplight itch	1. Adjust position of switch
Protrusion of vacuum oster adjusting bolt om brake master cylin- r mounting surface ex- eds $1.25_{-0.2}$ mm	2. Adjust protrusion of adjusting bolts (See Fig. 6-2)
Jamming of vacuum oste alve body caus- l by swelling of iaphragm or seizure of oster cover seal or ot	3. Replace vacuum booster
Clogging of master linder compensating le	4. Clear out hole. Bleed hydraulic system
Swelling of master linder rubber seals used by penetration gasoline, mineral ls, etc. into fluid	5. Wash entire system thoroughly with brake fluid, replace faulty rubber parts, bleed hydraulic system
Jamming of brake ster cylinder piston	6. Examine master cylinder, replace it, if necessary; bleed hydraulic system
One Wheel Drags with Pedal Released	
Rea rake shoe return ring weak or broken	1. Replace spring
Jamming of wheel linder piston due to rrosion	2. Disassemble cylinder, clean and wash parts, replace faulty ones
Swelling of wheel linder sealing rings e to penetration of fuel oil into fluid	3. Replace rings, wash brake system with fluid
No shoe-to-drum earance	4. Adjust parking and rear brakes
Wrong position of rake caliper relative brake disc due to osening of shoe guide- -steering-knuckle bolts	5. Tighten bolts; if necessary, replace faulty parts
Excessive runout of rake disc (over .15 mm)	6. Grind disc. Replace, if it is thinner than 9 mm

Cont'd

Cause	Remedy
Car Skids or Pulls Sideways on Braking	
1. Fluid leaks from one of wheel cylinders	1. Replace seals and bleed system
2. Jamming of wheel cylinder piston	2. Eliminate jamming, replace faulty parts, if necessary
3. Clogging of one of steel pipe due to den - ting or soiling	3. Replace or clean out pipe. Bleed system
4. Non-uniform tyre pressure	4. Adjust tyre pressure
5. Wrong front wheel alignment angles	5. Adjust
6. Soiling or oiling of discs, drums and shoe linings	6. Clean brake parts
7. Wrong installation of pressure regulator	7. Adjust position of pressure regulator
8. Pressure regulator faulty	8. Repair or replace pressure regulator
Pedal Pressure Too Hard	
1. Clogging of vacuum booster air filter	1. Replace air filter
2. Booster valve body jamming due to swelling of diaphragm or seizure of booster cover seal or boot	2. Replace vacuum booster
3. Hose between booster and engine intake manifold damaged or loosely fitted on pipe unions	3. Replace hose or tighten its clamps
4. Brake pedal metal bushings oxidized or run dry (drying of lubricant)	4. Replace worn parts or change lubricant
Brakes Squeak or Squeal	
1. Weakening of rear brake shoe return spring	1. Examine return spring and replace, if necessary
2. Rear brake drums out of round	2. Rebore drums
3. Shoe linings smeared with oil	3. Clean linings with wire brush, warm water and detergents. Prevent penetration of fluid or oil to brake shoes
4. Shoe linings worn or fouled with embedded foreign particles	4. Replace shoes
5. Excessive runout or uneven wear of brake disc	5. Grind disc. Replace, if it is thinner than 9 mm

CHECKING PIPES AND JOINTS

To prevent sudden failure of the brake system, examine closely all pipes:

- the metal pipes should be free from dents, cracks and should be located sufficiently far from sharp edges which might cause their damage;
- the brake hoses should have no penetrating cracks on the external casing and should be out of contact with mineral oils and lubricants that are apt to attack rubber; depress the brake pedal sharply and see that the hoses do not bulge; bulging is indicative of some defect;
- all the pipe clips should be well tightened since their loosening will result in vibration and breakage;
- there should be no fluid leaks from the pipe unions; if necessary, tighten the nuts home, taking care not to distort the pipes.

Replace the parts by new ones if there is even the slightest doubt as to their serviceability.

It is recommended that the flexible hoses, irrespective of their condition, be replaced by new ones after 100,000 kilometers of run or five years of service in order to preclude sudden bursting due to ageing.

After five years of operation it is good practice to fill the brake system with fresh flui

CHECKING VACUUM BOOSTER

With the engine shut down press the brake pedal 5 - 6 times, thus building up an equal pressure, close to atmospheric, in spaces A and E (Fig. 6-2). At the same time see that valve body is not jammed, judging by the force on the pedal.

Stopping the brake pedal midway of its trave start the engine. If the booster is in order, the brake pedal will sink forward after engine starting.

If, however, the pedal fails to move forward check the fastening of hose nipple 29, condition and fastening of flange 1, fastening of the hose to the nipple and to the union of the engine intake manifold because a loosely fastened or damaged hose and flange 1 decrease sharply the

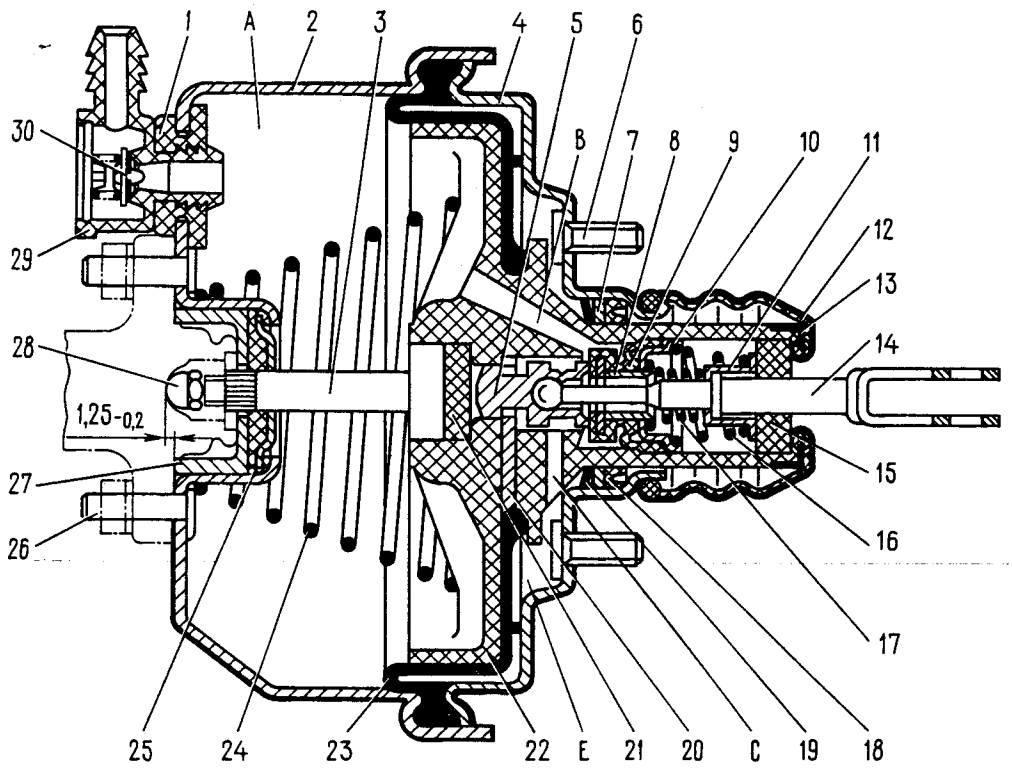


Fig. 6-2. Brake Vacuum Booster:
1 - nipple fastening flange; 2 - booster casing; 3 - rod; 4 - cover; 5 - piston; 6 - booster bolt; 7 - spacer ring; 8 - valve spring seat; 9 - valve; 10 - valve supporting cup; 11 - return spring seat; 12 - boot; 13 - boot holder; 14 - pushrod; 15 - air filter; 16 - valve return spring; 17 - valve spring; 18 - casing cover seal; 19 - seal lockring; 20 - thrust plate; 21 - buffer; 22 - valve body; 23 - diaphragm; 24 - valve body return spring; 25 - rod seal; 26 - master cylinder bolt; 27 - rod seal holder; 28 - adjusting bolt; 29 - hose nipple; 30 - valve
A - vacuum space; B - channel from vacuum space t inside space of valve; C - channel from inside space of valve to atmospheric pressure space; E - atmospheric pressure space

vacuum in space A and the efficiency of booster operation.

If the car gets braked spontaneously check the vacuum booster for tightness with the engine running, first by releasing the brake pedal, then pressing and holding it so. Sticking of boot 12 to the extension of the valve body and the hissing sound of infiltrating air will indicate insufficient tightness of the booster.

Even in the absence of boot sticking, seal 18 should be examined as follows:

- remove boot 12 carefully then shift it from the flange of the hole in cover 4;
- with the engine running, rock the protruding extension of the valve body laterally with a force of 29.4 - 39.2 N (3-4 kgf); there should be no characteristic hissing of the air entering the booster past cover seal 18.

If the vacuum booster is found to be leaky, disconnect pushrod 14 from the brake pedal, remove boot 12 and pack 5 g of ЦИАТИМ-221 grease between the seal and the flanges of the cover and valve body; then examine air filter 15, replace it, if necessary, and put the boot back in position.

If these measures fail to do away with the infiltration of air, replace the vacuum booster.

ADJUSTMENT OF BRAKE OPERATING MECHANISM

Free travel of the brake pedal should be 3-5 mm with the engine inoperative. This travel is ensured by moving stoplight switch 6 (Fig. 6-3).

If the stoplight switch is too close to the pedal, the latter fails to come back to the initial position; as a result, valve 9 (Fig. 6-2) bears against body 22 and disconnects spaces A and E which causes incomplete releasing of the wheel brakes when the pedal is released.

To adjust the position of the stoplight switch back off nut 5 (Fig. 6-3) and move the switch so that its buffer is in light contact with the brake pedal stop. In this position free travel of the brake pedal should be within 3 and 5 mm. After adjustment do not fail to tighten nut 5.

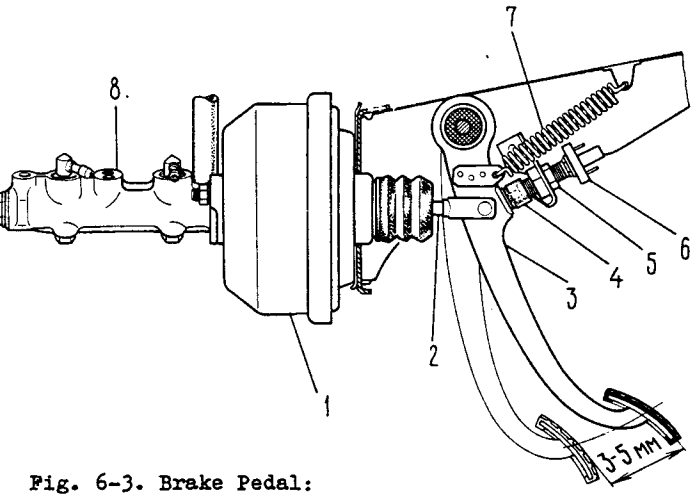


Fig. 6-3. Brake Pedal:
1 - vacuum booster; 2 - pushrod; 3 - brake pedal; 4 - stoplight switch buffer; 5 - switch nut; 6 - stoplight switch; 7 - pedal return spring; 8 - master cylinder

Caution

Free travel of the brake pedal should be adjusted with the engine shut down.

If it proves impossible to eliminate incomplete releasing of brakes by moving the stoplight switch, disconnect the brake master cylinder from the vacuum booster and check the protrusion of adjusting bolt 28 (Fig. 6-2) relative to the mounting surface of the master cylinder flange ($1.25_{-0.2}$ mm). This distance can be set by holding the end of rod 3 with a special wrench and turning adjusting bolt 28 in or out with another wrench.

ADJUSTMENT OF PARKING BRAKE

If the parking brake fails to hold the car reliably on a 30 % gradient or is applied only after its lever has been shifted by more than 4-5 teeth of the ratchet mechanism, adjust the brake as follows:

- jack up the rear end of the car until the wheels are free to rotate and move the lever all the way down;
- loosen locknut 5 (Fig. 6-4) of the tensioning device and keep turning in adjusting nut 6 to tension the cable until the rear wheels are braked and cannot be turned by hand;

Note. If the cables have been replaced by new ones, apply the parking brake 2-3 times, pulling the lever with a force of about 392 N (40 kgf). This will stretch out the cables.

- unscrewing the adjusting nut set a 4-5-tooth travel of the lever on the quadrant and tighten the nut.

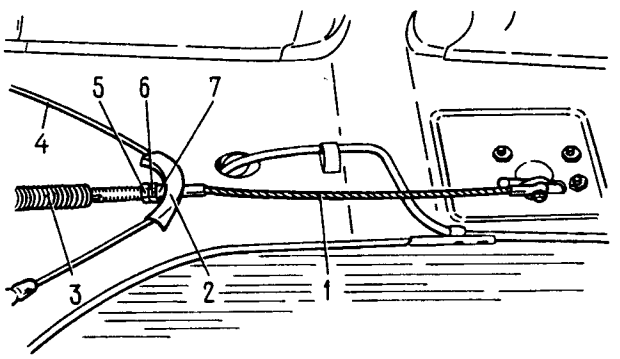


Fig. 6-4. Parking Brake Control Linkage:
1 - front cable; 2 - rear cable guide; 3 - front cable return spring; 4 - rear cable; 5 - locknut; 6 - adjusting nut; 7 - spacer bushing

Apply the brakes several times to make sure that the lever travel has not changed, and the wheels are free to rotate without dragging when the lever is pushed to the downmost position.

CHECKING SERVICEABILITY OF PRESSURE REGULATOR

Put the car on a lift or an inspection pit and clean the pressure regulator and its protective boot.

Take off the boot carefully, remove remnants of lubricant and clean the torsion lever-piston joint.

Ask an assistant to press the brake pedal with a force of 686 - 784 N (70-80 kgf), at the same time watching the protruding part of the pressure regulator piston.

If the piston moves 0.5 - 0.9 mm relative to the regulator body and twists the torsion lever, it means that the pressure regulator is in order. Press the brake pedal again 2 or 3 times to make certain that the pressure regulator is fully serviceable.

If the piston stays still after depression of the brake pedal (this is caused by sticking of the corroded piston to the body), replace the regulator.

On ascertaining that the pressure regulator is fully serviceable and there are no fluid leaks between the regulator piston and body, apply a thin layer of ДТ-1 grease to the axle and to the protruding portion of the piston, pack 5-6 g of the same lubricant into the rubber boot and put the latter back in position.

ADJUSTMENT OF SHOE-TO-DRUM CLEARANCE

Proceed as follows:

- press the brake pedal with a force of 98 - 117.5 N (10-12 kgf) to bring the shoes in contact with the drum;
- holding the shoes in the position, turn the hex heads of eccentrics A and B (Fig. 6-5) in the direction shown by arrows in the figure until they come in contact with the shoes;

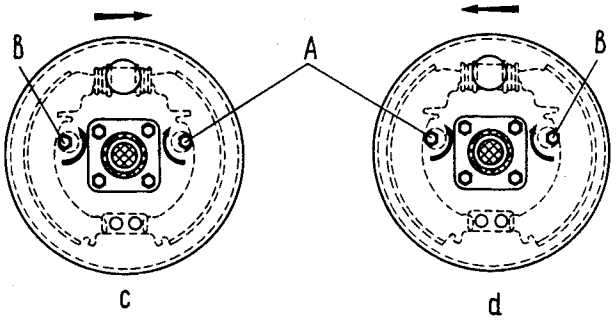


Fig. 6-5. Shoe-to-Drum Clearance Adjustment:
A - front shoe adjusting eccentrics; B - rear shoe adjusting eccentrics. Arrows above show the direction of car travel; C - L.H. wheel; d - R.H. wheel

- let go off the brake pedal and turn the adjusting eccentrics in the opposite direction through 10° approximately;
- press the brake pedal sharply 3 - 4 times, release it and rotate the jacked-up wheels; the shoes should be clear of the drums.

After adjustments it is good practice to drive the car 5 - 7 km without using the brakes, then to stop and hand-feel the brake drums to make sure they are not heated because of friction against the shoes. If the drums feel hot which should be attributed to friction between the shoes and drums, repeat the adjustments.

If adjustments fail to set the required shoe-to-drum clearance, remove the brake drum, examine the shoes and the drum; if necessary, replace or recondition the worn parts, then assemble the brake and adjust once again.

ADJUSTING POSITION OF PRESSURE REGULATOR

If the regulator fastening bolts become loose, adjust the regulator position first jacking up the rear axle of the car.

Then disconnect lever 4 (Fig. 6-6) from link and attach fixture 67.7820.9519 to the end of the lever. Direct the spindle of the fixture upward to bear against the car body floor (Fig. 6-7). This will set a distance "X" of (150±5) mm between the end of the lever and the body sidemember (Fig. 6-6).

Lift rubber boot 6 (Fig. 6-6) a little and, turning the pressure regulator on its bolts, establish a light contact between the lever and piston 2.

Holding the regulator in this position, tighten bolts 1 and 7 as far as they will go and

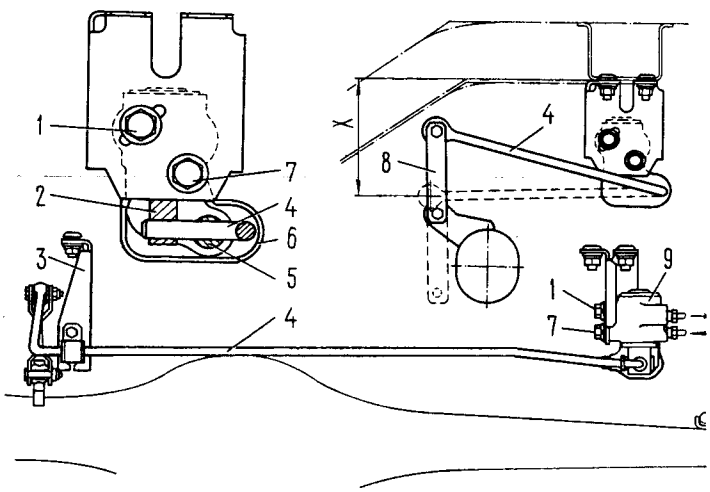


Fig. 6-6. Installation and Adjustment of Rear Brake Pressure Regulator:
1, 7 - regulator fastening bolts; 2 - piston; 3 - supporting bushing bracket; 4 - regulator operating lever; 5 - axle; 6 - boot; 8 - link; 9 - pressure regulator; X = (150 ±5) mm

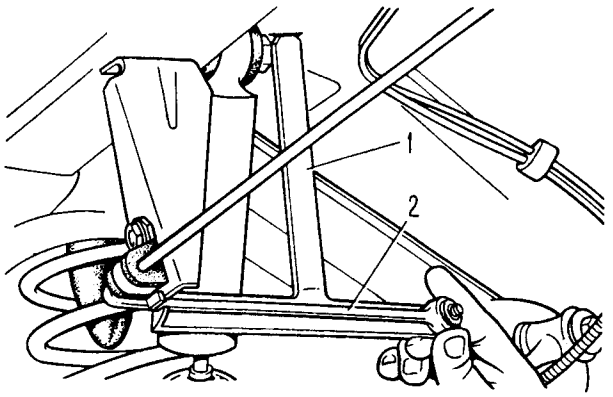


Fig. 6-7. Fixture 67.7820.9519 for Rear Brake Pressure Regulator Adjustment:
1 - fixture 67.7820.9519; 2 - pressure regulator operating lever

apply a thin coat of ДТ-1 grease to axle 5 and to the protruding part of piston 2. Pack 5 - 6 g of the same lubricant into rubber boot 6 and put it back in position.

Remove fixture 67.7820.9519 and connect the end of the lever with link 8.

BLEEDING HYDRAULIC BRAKE SYSTEM

The air getting into the hydraulic brake system during replacement of the pipes, hoses, sealing rings or through loose joints increases free travel of the brake pedal, causes it to feel spongy and impairs the braking effect considerably.

Prior to bleeding the system, make sure that all the units of the brake operating mechanism and their joints are pressuretight, check the amount of fluid in the reservoir and top it up, if necessary, with brake fluid NEVA ("НЕВА"). Then clean the bleeder unions (valves) carefully of dirt and dust and remove the rubber boots (caps) from them.

Put a rubber bleeding hose (Fig. 6-8) on the head of the union and dip the other end of the hose into a transparent vessel partly filled with the brake fluid.

Depress the brake pedal sharply 3-5 times with 2-3 s intervals between successive depressions, unscrew the union $\frac{1}{2}$ - $\frac{3}{4}$ of a revolution with the pedal depressed, then keep depressing the pedal to remove the fluid with air from the system through the hose into the vessel. As soon as the pedal reaches its foremost position and the fluid ceases to flow from the hose, screw in the bleeder union all the way. Repeat these operations until the spray of fluid flowing from the hose becomes free of air bubbles. Holding the pedal depressed, screw in the bleeder union all the way and remove the hose. Wipe dry the bleeder union and put in place the rubber boot.

Perform all the above operations first through the upper unions of the rear R.H. wheel which is

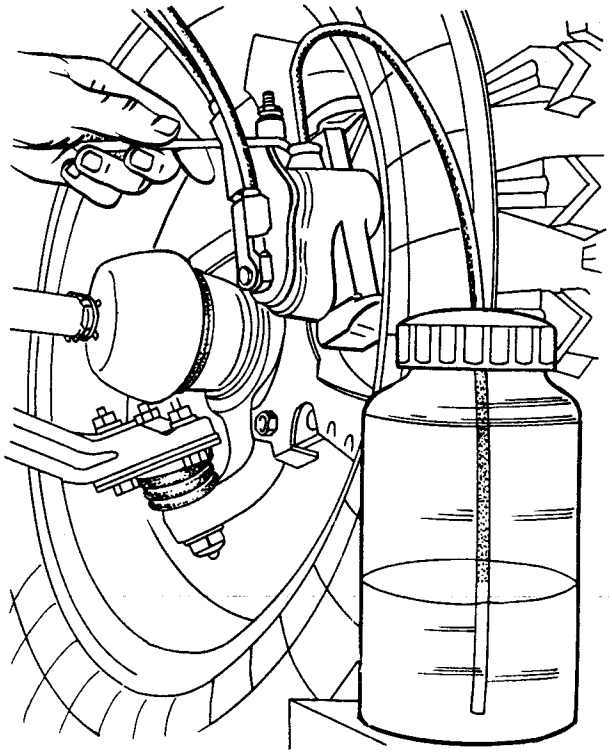


Fig. 6-8. Bleeding Hydraulic Brake System

farthest from the master cylinder, then work in the clockwise direction, i.e. L.H. rear wheel, L.H. and R.H. front wheels. This will expel air from one of the brake circuits. Bleed the other circuit through the lower unions on the block of cylinders of the L.H. and R.H. front brakes. Bleeding may be started either from the R.H. or L.H. wheel.

While bleeding the hydraulic brake system take care to maintain a normal fluid level in the brake fluid reservoir. If there is no air in the hydraulic brake system, the brake pedal should move not farther than $\frac{1}{2}$ - $\frac{2}{3}$ of its travel.

To exclude the influence of the vacuum booster and pressure regulator on the bleeding operation, do it with the engine shut down and the rear wheels loaded (do not jack up the rear end of the car).

If the hydraulic system has been completely drained, the bleeding operation should be preceded by the following:

- unscrew the bleeder unions 1.5 - 2 revolutions on the brake cylinders of all wheels;
- pressing the brake pedal sharply and releasing it slowly, screw in the unions as the fluid has flowed out. Then bleed the system as described above.

If the air bubbles continue to emerge from the hose even after prolonged bleeding, it means that air penetrates into the system through damaged pipes, leaky joints or faulty master or wheel cylinders.

If the hydraulic system is being bled on the car whose brake system has been operating for a long time, it is recommended that the system be filled with fresh fluid.

The fluid considered fit for reuse should be carefully filtered and settled in a tightly closed vessel.

CLUTCH AND BRAKE PEDAL BRACKET

Removal and installation. To remove the pedal bracket:

- take off the steering shaft bracket as advised under "Steering gear";
- detach the vacuum booster pushrod from the brake pedal by removing locking clip 26 (Fig. 6-9) and pin 24;
- unscrew the nuts which fasten the vacuum booster and clutch master cylinder to the bracket;
- unscrew the bracket-to-body nuts and remove the bracket, disconnecting the wires from the stop-light switch.

To install the bracket reverse the removal operations seeing that the pushrod is properly installed in the socket of the clutch master cylinder piston.

Disassembly and assembly. To disassemble remove clutch pedal servo spring 14, springs 8 and 17, unscrew nut 2 of bolt 20, take out the bolt and remove the pedals complete with their bushings.

The springs should be removed and installed by the use of tool A.70017.

To assemble proceed in the reverse sequence of operations. Before assembly apply Литол-24 grease to pedal bushings, to the ends of the springs, the joints of the pushrods with the pedals and to the end of the pushrod contacting the piston of the clutch master cylinder.

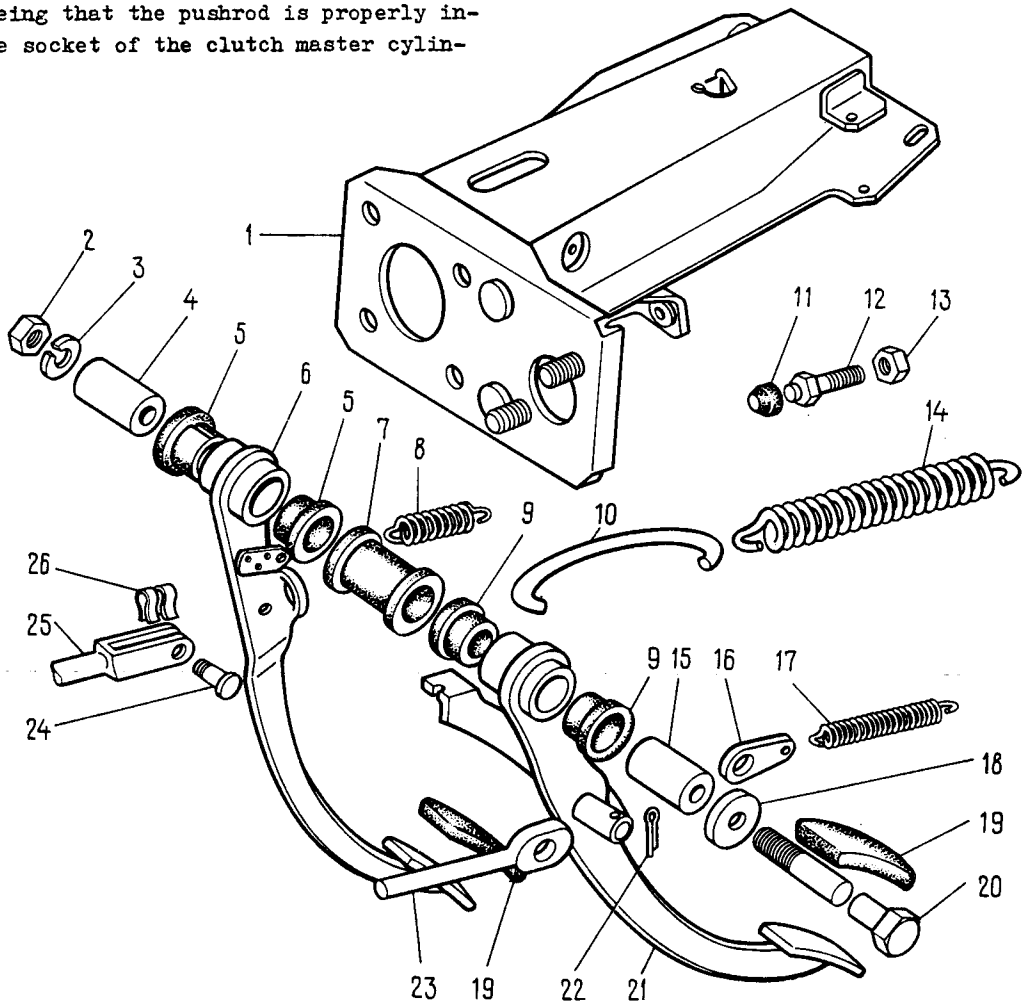


Fig. 6-9. Parts of Clutch and Brake Pedals Bracket: 1 - bracket; 2 - nut; 3 - spring washer; 4 - brake pedal inner bushing; 5 - brake pedal outer bushings; 6 - brake pedal; 7 - spacer bushing; 8 - brake pedal return spring; 9 - clutch pedal outer bushings; 10 - hook; 11 - cap; 12 - clutch pedal stop screw; 13 - nut; 14 - servo spring; 15 - clutch pedal inner bushing; 16 - plate; 17 - clutch pedal retracting spring; 18 - washer; 19 - pedal pads; 20 - bolt; 21 - clutch pedal; 22 - cotter pin; 23 - clutch pedal pushrod; 24 - pin; 25 - vacuum booster pushrod; 26 - locking clip

Checks and repairs. If the pedals move with difficulty examine the working surfaces of the pedals, bushings and shaft.

If the metal parts are found to be lightly scratched or oxidized, it is enough to dress them with abrasive cloth; the outer plastic bushings of the pedals, if worn, should be replaced by new ones.

Check the springs for resilience. The length of the brake pedal spring should be 80 mm under a force of (12.8±1.96) N [(1.3±0.2) kgf] and 160 mm under a force of (117.5±5.88) N [(12±0.6) kgf].

The length of the clutch pedal retracting spring should be 130 mm under a force of $(32.34^{+3.92}_{-1.96})$ N $[(3.3^{+0.4}_{-0.2})$ kgf] and 155 mm under a force of $(45.08^{+4.41}_{-2.45})$ N $[(4.6^{+0.45}_{-0.25})$ kgf]. The length of the clutch servo spring should be 120 mm under a force of (199.92±19.6) N [(20.4±2) kgf] and 152 mm under a force of (587.02±58.8) N [(59.9±6) kgf].

VACUUM BOOSTER

REMOVAL AND INSTALLATION

When removing the vacuum booster, leave the brake master cylinder in place to prevent air from getting into the hydraulic system.

To remove the booster:

- disconnect the booster pushrod from the pedal;
- unscrew the nuts which fasten the master cylinder to the booster, take the cylinder off the studs and shift it sidewise;
- disconnect the hose from the booster;
- unscrew the nuts which hold the booster to the clutch and brake pedal bracket and take off the booster.

To install the booster reverse the removal operations.

BRAKE MASTER CYLINDER

The design of the master cylinder is shown in Fig. 6-10.

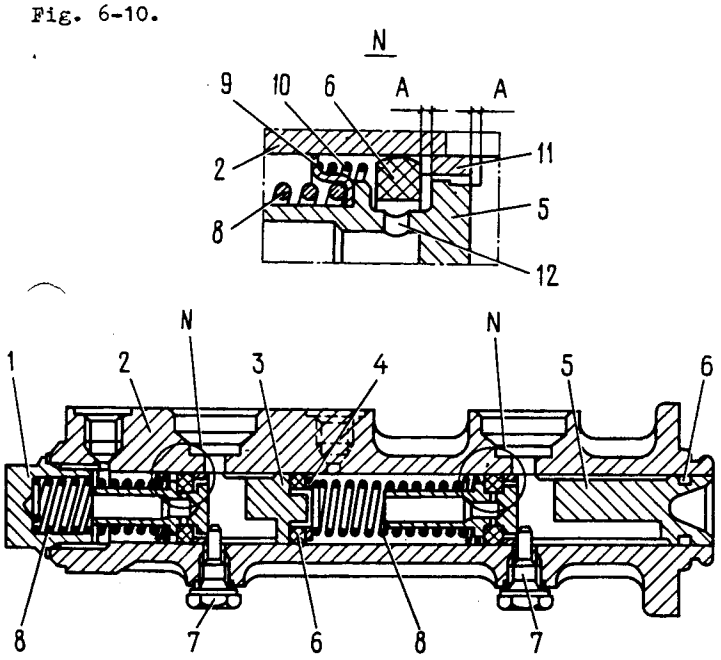


Fig. 6-10. Brake Master Cylinder:
1 - plug; 2 - cylinder barrel; 3 - front brake control piston; 4 - washer; 5 - rear brake control and front brake auxiliary control piston; 6 - sealing ring; 7 - stop screws; 8 - piston return springs; 9 - spring seat; 10 - seal holddown spring; 11 - spacer ring; 12 - inlet hole; A - compensating hole (clearances between sealing ring 6, ring 11 and piston 5)

REMOVAL AND INSTALLATION

Disconnect the flexible hoses from the master cylinder and stop the holes of the cylinder hoses and unions to keep the fluid in and dust and dirt out.

Disconnect from the master cylinder the steel pipes leading to the wheel cylinders of the front and rear brakes, first unscrewing the pipe nuts.

Remove the master cylinder, unscrewing the nuts which fasten it to the vacuum booster.

To install the master cylinder reverse the removal operations. After installation bleed the brake system.

DISASSEMBLY AND ASSEMBLY

Remove unions 3 (Fig. 6-11) with sealing washers 4, take off cap 5, turn out screws 7 and take out all parts in the order shown in Fig. 6-11.

Assemble the cylinder in the reverse order of steps, using mandrel 67.7853.9543 and lubricating the parts with brake fluid.

Checking Master Cylinder Parts

Before assembly wash all parts with isopropyl alcohol, dry them with compressed air or wipe with clean rags, keeping the parts out of contact with mineral oils, kerosene and diesel fuel which are apt to attack the seals.

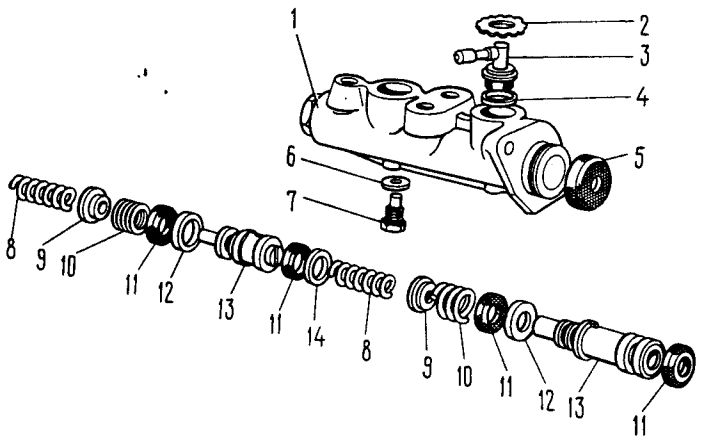


Fig. 6-11. Parts of Brake Master Cylinder:
1 - cylinder barrel; 2 - lock washer; 3 - union; 4 - sealing washer; 5 - dust cap; 6 - sealing washer; 7 - piston locating screw; 8 - piston return spring; 9 - seat; 10 - seal holddown spring; 11 - seal; 12 - spacer ring; 13 - floating piston; 14 - washer

Note. The washing time of the sealing rings in isopropyl alcohol should not be over 20 s, with subsequent blowing the rings with compressed air.

The cylinder inner face and the working surfaces of the pistons should be perfectly clean and free of rust, notches and other defects. Excessive clearance between the cylinder and pistons is impermissible.

Each time when disassembling the cylinder, take care to replace the seals by new ones, even if the old seals appear to be quite serviceable.

Check the piston spring for resilience; its length should be 36 mm under a load of $34.3^{+6.86}$ N ($3.5^{+0.7}$ kgf), 21 mm under a load of $62.23^{+9.8}$ N ($6.35^{+1.0}$ kgf) and 57.5 mm when noncompressed.

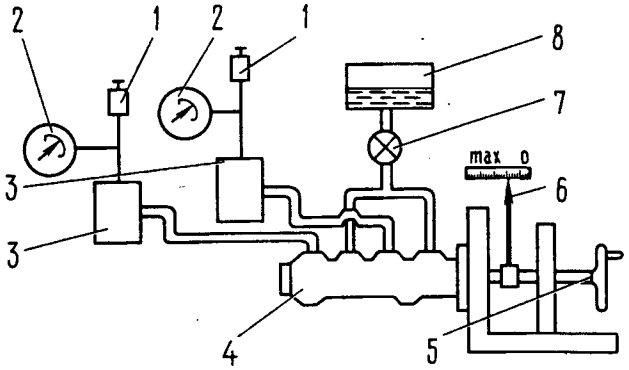


Fig. 6-12. Checking Master Cylinder for Tightness:
1 - stand priming valve; 2 - pressure gauge; 3 - receiving cylinder; 4 - master cylinder; 5 - handwheel; 6 - pushrod travel indicator; 7 - cock; 8 - vessel

BRAKE MASTER CYLINDER TIGHTNESS CHECK

Mount the master cylinder on a stand and connect it to the latter as shown in Fig. 6-12.

Open stand priming valves 1 and, moving the master cylinder pistons a few times through their complete stroke, prime the system. Then close valves 1. Rotating handwheel 5, move the master cylinder pistons slowly until the pressure read by pressure gauges 2 reaches 12.5 MPa (125 kgf/cm^2). In this position lock the master cylinder pushrod. This pressure should stay constant for at least 5 s.

In case of fluid leaks or when pressure fails to remain constant for 5 s, replace the cylinder piston seals.

FRONT BRAKES

The design of the front brake is illustrated in Fig. 6-13.

CLEANING

Prior to repairing the brakes wash them thoroughly with warm water and a special detergent and dry immediately with compressed air.

Caution

Under no circumstances should gasoline, diesel fuel, trichloroethylene or any other mineral solvents be used for cleaning the brakes since these liquids destroy cylinder seals.

REMOVAL AND INSTALLATION

Removal. Jack up the front end of the car, put it on supports and remove the wheel.

Take off the guide brackets of the hoses. Unscrew the bypass bolts, detach hoses 10 (Fig. 6-13) from the block of cylinders, keeping dirt from getting into the cylinders. Stop the inlet holes of the block and hoses.

Unbend the edges of the front brake guard, unscrew the brake-to-steering-knuckle bolts (Fig. 6-14) and remove the brake as a complete unit.

To install the front brake proceed in the reverse order of steps.

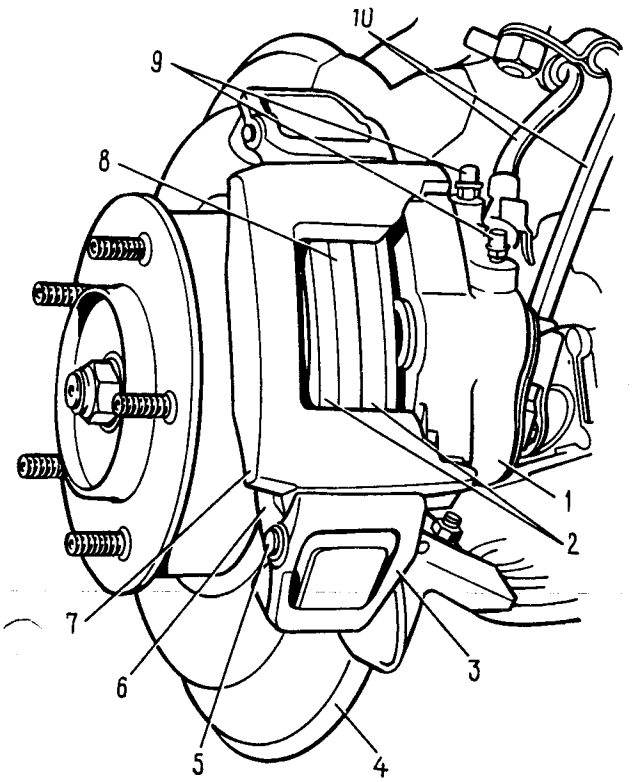


Fig. 6-13. Front Wheel Brake Mechanism:
1 - cylinder block; 2 - brake shoes; 3 - caliper holddown lever; 4 - guard housing; 5 - holddown lever axle; 6 - shoe guide; 7 - brake caliper; 8 - brake disc; 9 - bleeder unions; 10 - brake hoses

After installation restore the fluid level in the reservoir and bleed the brake system.

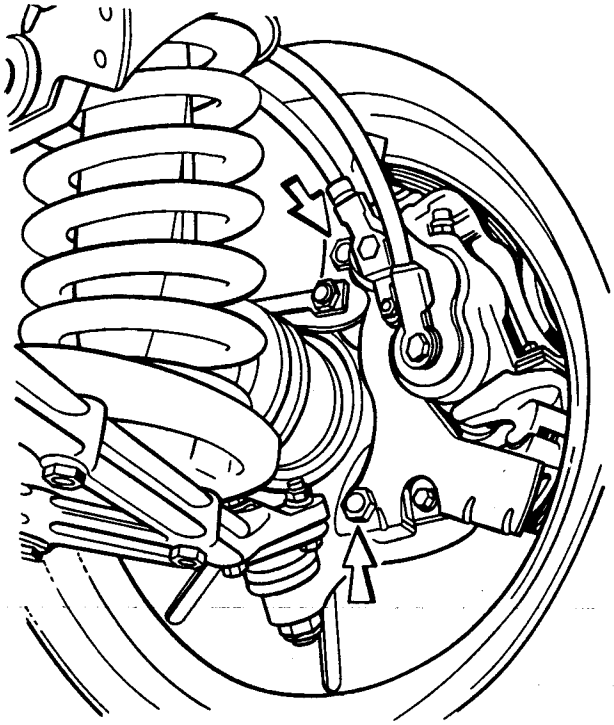


Fig. 6-14. Removing Front Brake:
Arrows show bolts to be unscrewed for removing brake

DISASSEMBLY AND ASSEMBLY

Pull out the cotter pins, then axles 5 (Fig. 6-13), holding levers 3 to prevent the springs from getting out.

Remove the holddown levers and their springs, then caliper 7 complete with cylinder block 1. Remove brake shoes 2.

Take cylinder block 1 from the slots in the caliper, spreading apart the caliper slots to 118.5 mm. Remove dust caps 3 (Fig. 6-15) from the cylinders.

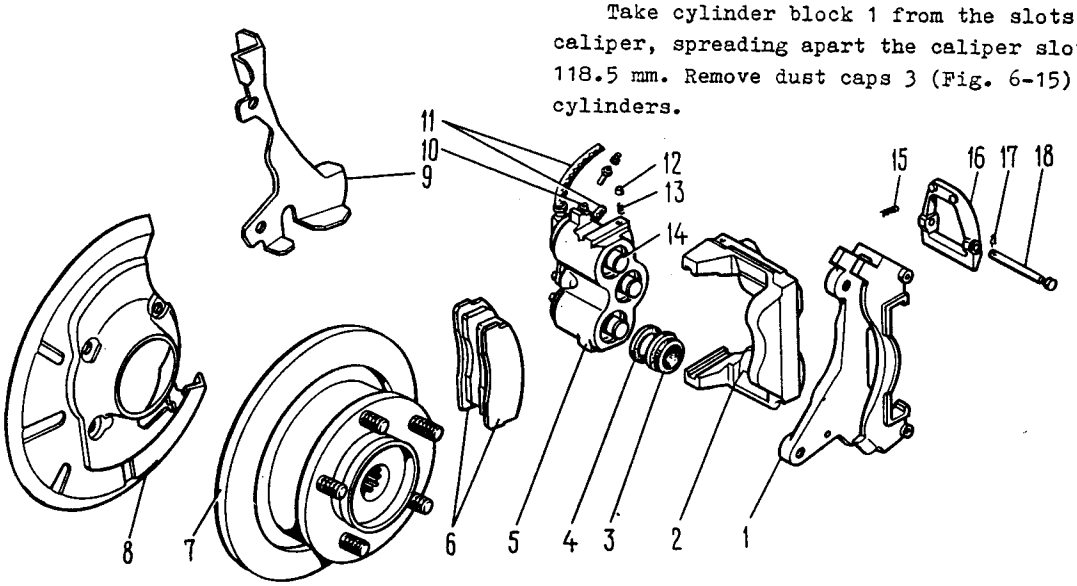


Fig. 6-15. Front Brake Parts:
1 - shoe guide; 2 - brake caliper; 3 - dust cap; 4 - sealing ring; 5 - cylinder block; 6 - brake shoes; 7 - brake disc; 8 - front brake guard housing; 9 - caliper guard; 10 - bleeder union; 11 - brake hoses; 12 - cylinder block detent; 13 - detent spring; 14 - piston; 15 - holddown lever spring; 16 - holddown lever; 17 - cotter pin; 18 - holddown lever axle

Feeding compressed air through the fluid inlet hole, push pistons 14 out of the cylinder block and remove sealing rings 4.

Assemble the front brake in the reverse sequence, coating the sealing rings, pistons and cylinder faces with brake fluid at assembly; pack the caps with ДТ-1 grease.

CHECKING BRAKE PARTS

Wash all parts with lukewarm water and detergent, dry them with compressed air and examine carefully.

If traces of wear or jamming are discovered on the piston or cylinder face, replace the cylinder block by a new one, complete with pistons.

Note. In all cases when the piston is removed from the cylinder, it is good practice to replace the sealing ring in the cylinder grooves and the dust cap to ensure satisfactory performance of the system.

RUNOUT CHECK OF BRAKE DISC

Check the brake disc for face runout without removing it from the car (Fig. 6-16). The maximum permissible runout is 0.15 mm shown by an indicator; if it is larger, grind the disc, bearing in mind that the thickness of the disc after grinding should be not under 9.5 mm. If the disc is damaged, deeply notched or worn in excess of 1 mm on each side, replace it by a new one.

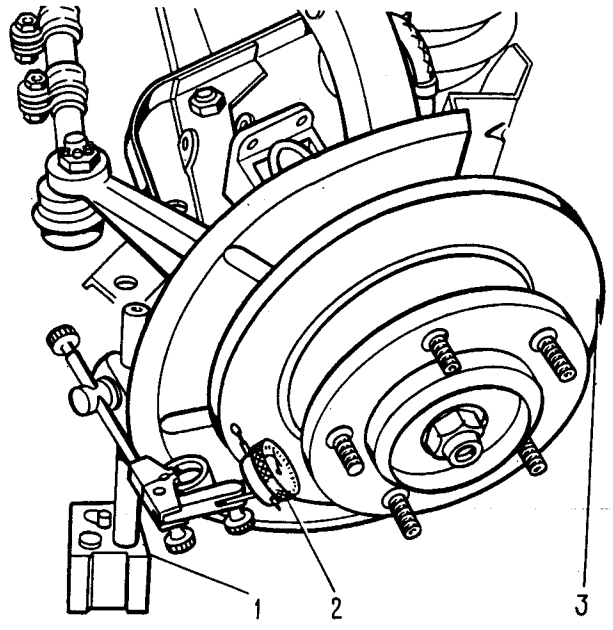


Fig. 6-16. Checking Brake Disc for Face Runout:
1 - magnetic support; 2 - indicator; 3 - brake disc

REPLACEMENT OF BRAKE SHOES

The brake shoes must be replaced by new ones if the thickness of the linings has diminished to 1.5 mm.

To replace the shoes:

- uncotter the axle of the upper holddown lever, take out the axle and remove the lever; remove the caliper assembly and pull the worn shoes from the slots of the guide (Fig. 6-17);
- push the pistons gently into the cylinders all the way, taking care that the fluid is not splashed out of the brake reservoir and insert new shoes into the guide slots;
- bringing the lower guide slant of the caliper under the lower holddown lever, press the caliper against the shoes, insert the lever axle with its head at the wheel side and cotter up the axle.

The brake shoes must be replaced simultaneously on the R.H. and L.H. wheels.

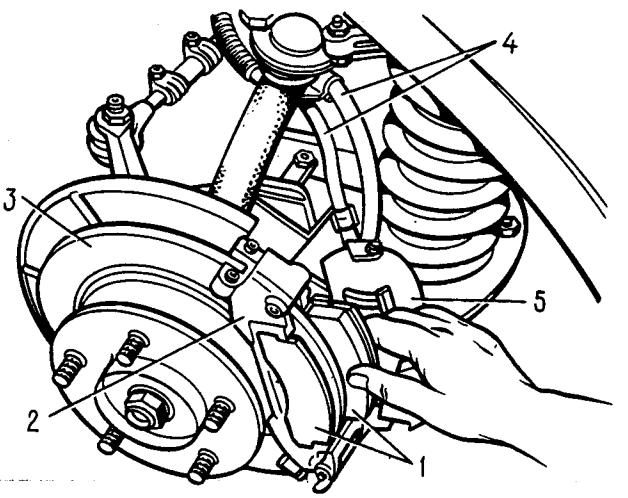


Fig. 6-17. Replacing Brake Shoes:
1 - brake shoes; 2 - shoe guide; 3 - brake disc; 4 - brake hoses; 5 - cylinder block (assembled with caliper)

REAR BRAKES

The design of the rear brake is illustrated in Fig. 6-18.

REMOVAL AND DISASSEMBLY

Lift the rear end of the car and remove the wheel.

Take measures to prevent fluid leaks from the reservoir.

Using remover tool 67.7823.9519 (Fig. 6-19), remove the brake drum.

Disconnect the end of cable 5 (Fig. 6-18) from hand-operated shoe control lever 2, pull out the

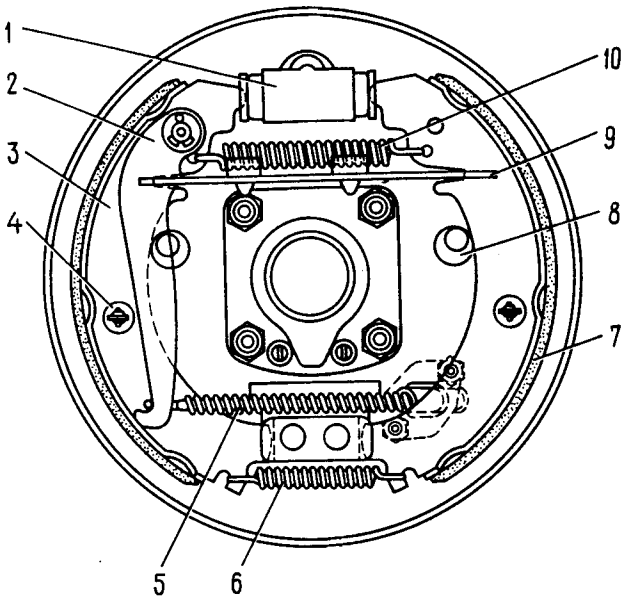


Fig. 6-18. Rear Brake Mechanism:
1 - wheel cylinder; 2 - hand-operated shoe control lever; 3 - brake shoe; 4 - cup and shoe guide; 5 - parking brake operating cable in casing; 6 - lower pull-back spring; 7 - friction lining; 8 - shoe-to-drum clearance adjusting eccentric; 9 - expander strap; 10 - upper pull-back spring

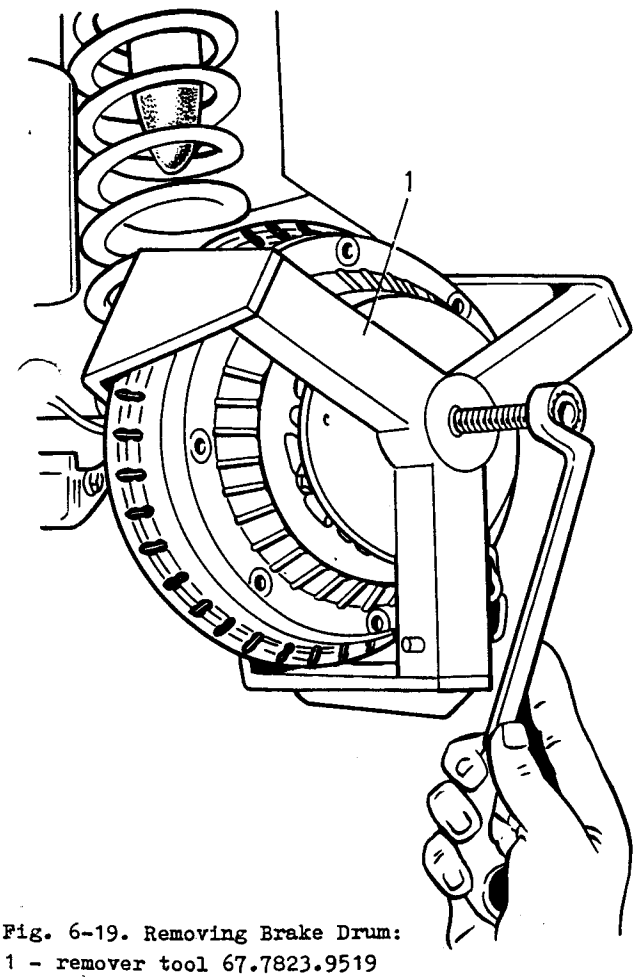


Fig. 6-19. Removing Brake Drum:
1 - remover tool 67.7823.9519

cotter pin, press on the pin and take off lever 2. Disconnect upper 10 and lower 6 pull-back springs. Turn the shoe guide cups and take them out complete with the shoe guides, springs and lower cups; then remove the shoes complete with expander strap 9.

Detach the fluid feed pipe from the wheel cylinder and stop the inlet holes of the cylinder and pipe.

Remove wheel cylinder 1.

When replacing the backing plate, take off the axle-shaft as prescribed under "Rear Axle" and disconnect the parking brake control cable, unscrewing two bolts which hold it to the brake backing plate.

ASSEMBLY AND INSTALLATION

Mount and secure the wheel cylinder on the backing plate, connect the fluid inlet pipe to it and tighten home the union nut.

Connect hand-operated lever 2 to the shoe and install the brake shoes with expander strap 9; then install shoe guides with springs and lower cups, install the upper cups and secure them on the shoe guides by turning right or left. Make sure that the ends of the brake shoes fit properly into the sockets of the wheel cylinder and on the backing plate.

Install the shoe pull-back springs and connect the end of shoe hand-operating cable 5 to lever 2.

Install the brake drum, first coating the mounting band on the axle-shaft and its flange contacting the drum with graphite or ЛСЦ-15 grease and tighten the drum bolts securely. The grease will facilitate subsequent removal of the brake drum.

If the wheel cylinder has been removed during disassembly, bleed the rear brake hydraulic circuit.

INSPECTION OF PARTS

Wheel cylinders. Dismantle the wheel cylinders as follows: take off caps 1 (Fig. 6-20) and pistons 2, take out seals 3, spring seats 5 and spring 7. Then unscrew bleeder union 6. Check the active surfaces of the cylinder and pistons for cleanliness. These surfaces should be perfectly smooth, without roughness so as to rule out fluid

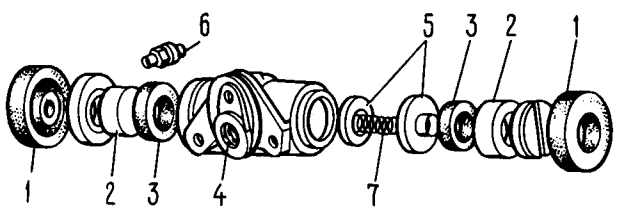


Fig. 6-20. Wheel Cylinder Parts:
1 - cap; 2 - piston; 3 - seal; 4 - barrel; 5 - spring seats; 6 - bleeder union; 7 - spring

leaks and premature wear of the seals and pistons. Eliminate any defects on the cylinder face by lapping or grinding. However, bear in mind that the cylinder bore must not be enlarged.

Replace seals 3 by new ones. Examine caps 1 and replace them, if necessary.

Examine spring 7. Its free length should be 34 mm, while under a load of (34.3±1.96) N [(3.5±0.2) kgf], 17.8 mm. Replace it, if necessary.

Coat all parts liberally with brake fluid before assembly. Install the parts in the reverse sequence of operations. After assembly check the pistons for smooth and free motion.

Shoes. Inspect the shoes carefully for damage and distortion.

Check both the upper and lower pull-back springs for resilience and replace them by new ones, if necessary.

There should be no permanent deformations after the lower and upper springs have been stretched by a force of 343 N (35 kgf) and 412 N (42 kgf), respectively.

Check the linings for cleanliness; if dirt or oil is discovered, clean them thoroughly with a wire brush and wash with white spirit; besides, look for penetration of lubricant or oil into the drum; correct any discovered defects.

Replace the shoes by new ones if the thickness of their linings has diminished below 1.5-2 mm.

Brake drums. Examine the brake drums. If the working surface is deeply scored or excessively out of round, rebore the drums on a lathe.

After reboring finish the working surface of the drum on a turning lathe with fine-grain abrasive stones. This will extend the service life of the linings and promote the uniformity and efficiency of braking.

The nominal diameter of the drum (250 mm) after reboring and grinding should not be increased by more than 1 mm. This limit should be strictly observed, otherwise the strength of the drum and the braking efficiency will be impaired.

STAND CHECKS OF REAR BRAKE WHEEL CYLINDERS

Mount the cylinder on the stand, connect a pipe from the pressure gauges to it (Fig. 6-21) and bleed the system.

Adjust stops 1 so that they bear against the wheel cylinder pistons.

Check for absence of fluid leaks. Connect a low pressure gauge; rotating slowly the handwheel of the stand cylinder, set a fluid pressure of 0.05 MPa (0.5 kgf/cm^2).

Make sure that this pressure remains constant for 5 min. Repeat a similar test under a pressure of 0.1; 0.2; 0.3; 0.4; 0.5 MPa (1, 2, 3, 4, 5 kgf/cm^2).

Reduce the pressure and connect a high-pressure gauge. Observing the above rules, repeat the tests under a pressure of 5, 10, 15 MPa (50, 100, 150 kgf/cm^2).

There should be no pressure drop caused by fluid leaks past the sealing elements, pipe joints and bleeder unions or through the casting pores.

A slight pressure drop [not over 0.5 MPa (5 kgf/cm^2) within 5 min] is permissible, particularly at high pressures, when it is caused by the shrinkage of the seals.

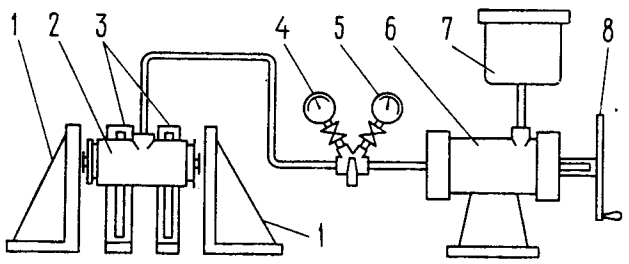


Fig. 6-21. Rear Wheel Cylinder Checking Setup:
1 - piston stops; 2 - cylinder under test;
3 - cylinder bracket; 4 - low-pressure gauge;
5 - high-pressure gauge; 6 - pressure build-up cylinder; 7 - vessel; 8 - handwheel

REAR BRAKE PRESSURE REGULATOR

REMOVAL AND INSTALLATION

Disconnect lever 12 (Fig. 6-22) from link 7, then detach holder 18 from bracket 14 and the clips of the pipes leading to the pressure regulator.

Disconnect the muffler mounting parts from the car body and shift aside the pipeline with mufflers.

Unscrew the regulator-to-bracket and bracket-to-body bolts. Remove the regulator bracket, ease down the regulator and disconnect its pipes.

Remove the regulator and detach its operating lever. Stop the inlet and outlet holes of the pressure regulator and pipes.

To install the pressure regulator reverse the removal operations. Before tightening the regulator bolts install fixture 67.7820.9519 (Fig. 6-7) on the end of the regulator operating lever. Direct the fixture spindle upward to bear against the car body. This will set a distance of (150±5) mm (see under "Adjusting Position of Pressure Regulator") between the end of lever 2 and the body sidemember.

Lift boot 3 (Fig. 6-22) a little and, turning the regulator on its bolts, bring the end of the lever in light contact with the regulator piston.

Holding the regulator in this position

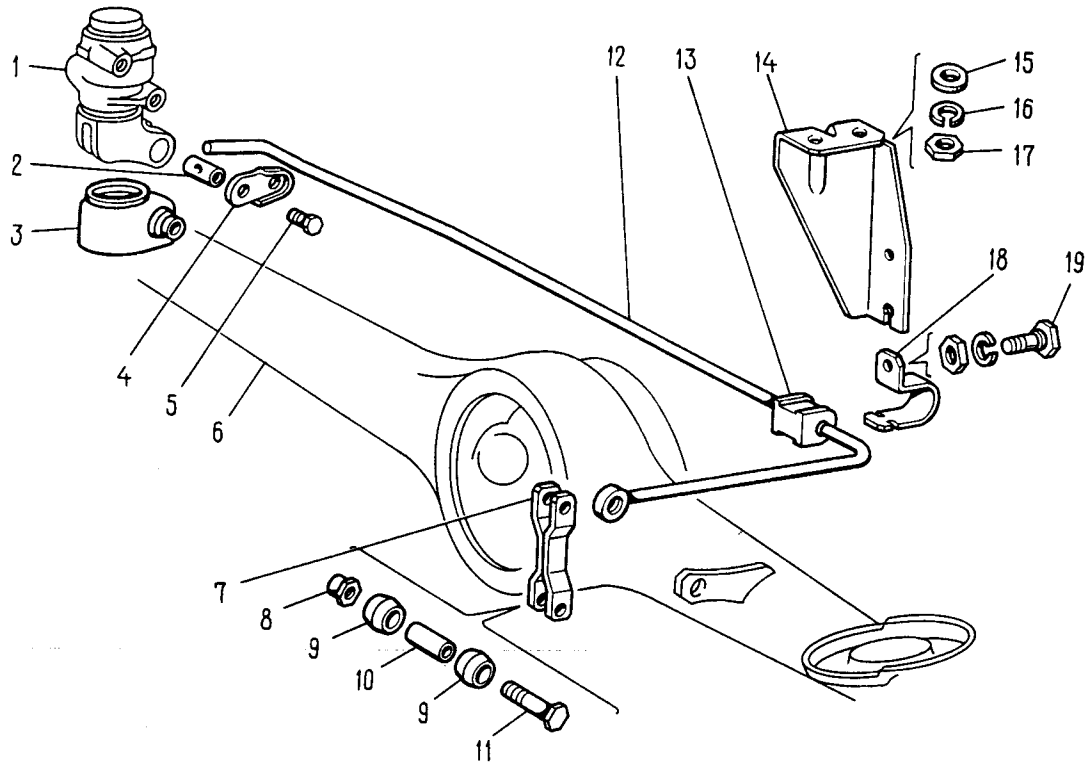


Fig. 6-22. Pressure Regulator Control Linkage:
1 - pressure regulator; 2 - pressure regulator operating lever axle; 3 - boot; 4 - locking plate; 5 - bolt with spring washer; 6 - rear axle beam; 7 - link from pressure regulator operating lever to rear axle bracket; 8 - nut of bolt 11; 9 - plastic bushing; 10 - spacer bushing; 11 - link bolt; 12 - pressure regulator operating lever; 13 - operating lever supporting bushing; 14 - supporting bushing bracket; 15 - washer; 16 - spring washer; 17 - nut; 18 - supporting bushing holder; 19 - holder-to-bracket bolt

tighten its fastening bolts all the way, then apply a coat of ДТ-1 grease to axle 2 and to the protruding part of the piston. Put rubber boot 3 in position, having packed 5-6 g of the grease into the boot.

Remove fixture 67.7820.9519 and connect the end of the lever with link 7, first applying ДТ-1 grease to the bushings of the link-to-lever articulated joint.

Fasten the exhaust system pipes to the car body.

Bleed the brakes to remove any air from the rear brake system.

DISASSEMBLY AND ASSEMBLY

Using wrench A.56124, unscrew the plug, remove gasket 5 (Fig. 6-23), take out piston 10,

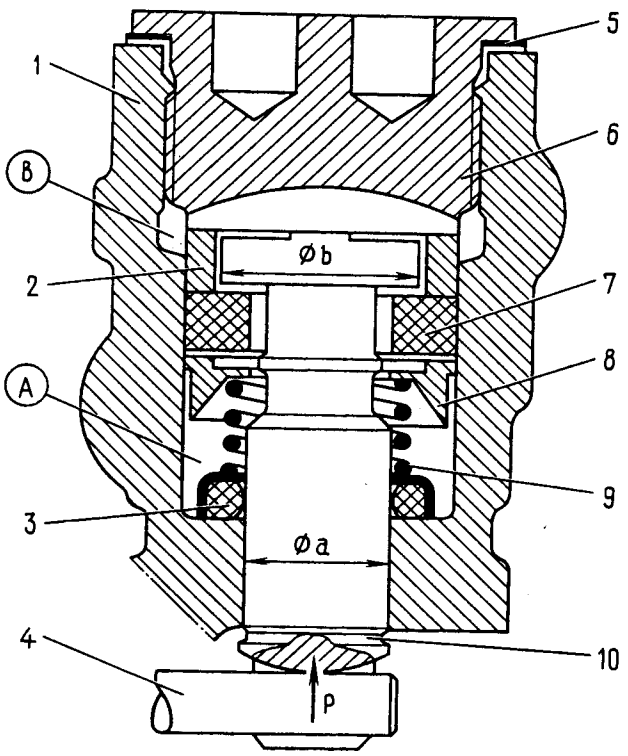


Fig. 6-23. Rear Brake Pressure Regulator (Inactive Position):
A - normal pressure chamber; B - controlled pressure chamber; P - force exerted by regulator lever 4
1 - regulator body; 2 - spacer bushing; 3 - sealing ring; 4 - regulator operating lever; 5 - gasket; 6 - plug; 7 - rubber seal; 8 - spring seat; 9 - piston spring; 10 - piston

spacer bushing 2, seal 7, spring seat 8, spring 9, and thrust washer with sealing ring 3.

To assemble reverse the disassembly operations, lubricating all parts with brake fluid.

Caution

The pressure regulator of the VAZ-2121 car has a recess on the lower part of the piston, to distinguish it from the like regulators of other car models.

Wash the parts with isopropyl alcohol or brake fluid and inspect them. The surfaces of the parts should be free of scratches and rough spots.

Check the condition and resilience of the spring; its free length should be 17.8 mm, while under a load of $(68.6^{+7.84}_{-3.92})$ N $\left[(7^{+0.8}_{-0.4})\ \text{kgf}\right]$, 9 mm.

Replace all damaged parts, the seal and the sealing ring.

PARKING BRAKE

REMOVAL AND INSTALLATION

Shift the parking brake lever to the downmost position and disconnect the ends of the cables from the brake shoe operating levers (see "Rear Brakes").

Loosen locknut 5 (Fig. 6-4) and adjusting nut 6, remove return spring 9 (Fig. 6-24) and unscrew completely the locknut and the nut.

Take the front-end fittings of the rear cable from the body floor brackets and the cable casing out of the brackets on the rear axle beam and remove rear cable 12.

Take off the lever guard case, the lever assembly and the front cable.

Pull out the cotter pin, take off the thrust washer and disconnect the front cable from the parking brake lever.

To install the parking brake reverse the removal operations, then adjust it (see "Adjustment of Parking Brake"). During installation apply Литол-24 or ЛСЦ-15 grease to the rear cable guide, parking brake lever axle and front cable end fitting.

CHECKS AND REPAIRS

Inspect the parking brake parts carefully.

Replace the cable if its strands are broken or chaffed.

Make sure that the quadrant teeth and the handle latches are intact; replace excessively worn parts.

Check the condition of the spring. It must return the lever reliably to the inactive position.

Examine the casing of the rear cable and the fastening of the end fittings to the casing and make sure that the cable is free to slide inside the casing. Replace the cable if its casing is damaged or the end fittings are loose.

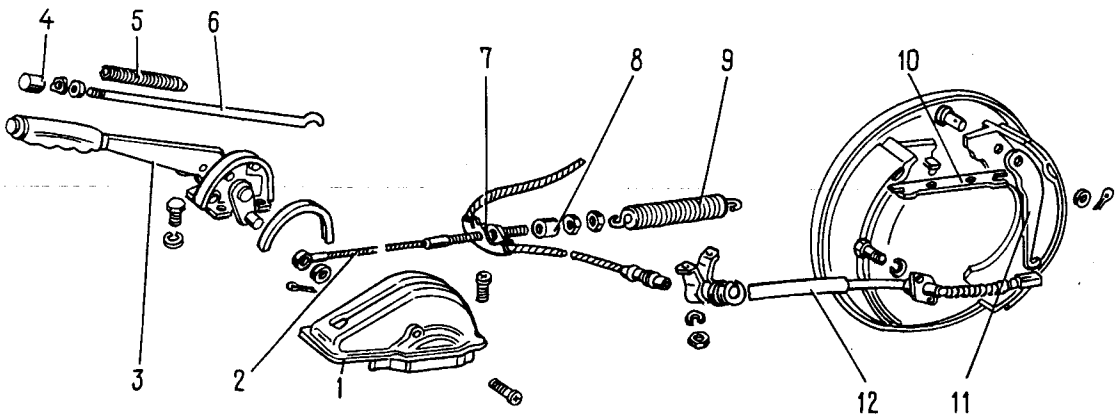


Fig. 6-24. Parking Brake Control Linkage:
1 - case; 2 - front cable; 3 - lever; 4 - button; 5 - rod spring; 6 - pawl rod; 7 - rear cable guide; 8 - spacer bushing; 9 - return spring; 10 - expander strap; 11 - hand-operated shoe control lever; 12 - rear cable

Section VII
ELECTRICAL EQUIPMENT

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GENERAL

The electrical equipment is of the single-wire ground-return type with the negative terminals of the power sources and consumers connected to "ground" which functions as the second wire.

The majority of the circuits are actuated by the ignition switch. The supply circuits of the horns, cigarette lighter, stoplight, interior lamps, distress light switch (at distress mode) and inspection lamp socket are constantly energized, irrespective of the position of the ignition key.

The electrical equipment of the car is protected by fuses (Fig. 7-1) located under the instrument panel, left of the steering column. The battery charging circuit, headlight lower and upper beam relays, ignition and starting circuits are not protected by fuses.

Fuses 11, 13, 14, 15 (Fig. 7-1) installed in the auxiliary fuse unit are vacant.

If a fuse is blown, first identify and eliminate the cause of the trouble, then replace the fuse. To trace down the faulty spot, refer to the table of fuse-protected circuits (Table 7-1) to find which particular fuse protects the given circuit.

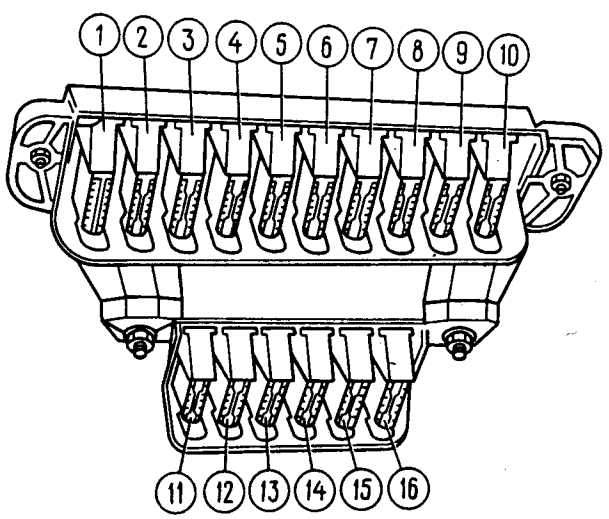


Fig. 7-1. Fuses

Table 7-1

Fuse-Protected Circuits

Fuse No. (Fig. 7-1)	Circuit
1(16A)	Interior lamps. Horns. Inspection lamp socket. Cigarette lighter. Stoplight lamps
2(8A)	Windshield wiper and its relay. Heater motor. Windshield washer motor. Headlight wiper and washer relay (with headlight wiper and washer switch button not pressed on). Headlight wiper motors in all positions of wiper blade, except initial position
3 (8A)	L.H. headlight (upper beam) and its warning lamp
4 (8A)	R.H. headlight (upper beam)
5 (8A)	L.H. headlight (lower beam)
6 (8A)	R.H. headlight (lower beam)
7 (8A)	L.H. side light (marker light). Marker light warning lamp. R.H. tail light (marker light). R.H. number plate light
8 (8A)	R.H. side light (marker light). L.H. number plate light. Cigarette lighter lamp. L.H. tail light (marker light). Instrument lamps
9 (8A)	Oil pressure gauge and warning lamp. Coolant temperature gauge. Fuel level gauge with low fuel level warning lamp. Parking brake warning lamp. Brake fluid low level warning lamp. Direction indicators and warning lamp. Carburettor choke valve warning lamp. Battery no-charge warning lamp. Carburettor shutoff valve. Tachometer. Tail lights (backing light). Differential lock warning lamp

Cont'd

Fuse No. (Fig. 7-1)	Circuit
10 (8A)	Voltage regulator. Alternator field winding
12 (8A)	Headlight wiper and washer (with control button depressed). Headlight washer motor. Headlight wiper motors at starting and when wiper blades pass through initial position.
16 (8A)	Distress light switch and direction indicators at distress mode

The wiring diagram of the car is shown in Fig. 7-2.

In all the diagrams of the "Electrical Equipment" Section the colour of the wires is denoted by letters, the first letter standing for the colour of the wire, while the second one denotes the colour of the wire tracer (Table 7-2).

Table 7-2

Wire Colour Code

Letter	Colour	Letter	Colour
Б	White	О	Amber
Г	Blue	Р	Pink
Ж	Yellow	С	Gray
З	Green	Ф	Violet
К	Brown	Ч	Black
П	Red		

STORAGE BATTERY

Specifications

Type 6СТ-55П
Rated voltage, V 12
Rated capacity at 20-h discharge rate and at 25 °C of electrolyte at beginning of discharge, A.h 55
Discharge current at 20-h discharge rate, A 2.75
Discharge current at starting, at electrolyte temperature of minus 18 °C, A 255

TROUBLE SHOOTING

Cont'd

Cause	Remedy
Rapid Discharge in Service	
1. Slipping of alternator drive belt	1. Adjust belt tension
2. Alternator faulty	2. Check alternator
3. Damaged insulation in car electrical system (discharge current higher than 1 mA with consumers disconnected)	3. Find leaky point and correct defect
4. Short-circuiting of cell plates	4. Replace battery
5. Connection of new loads by car owner in excess of permissible limits	5. Remove new loads
6. Electrolyte contaminated by foreign matter	6. Drain electrolyte, wash and charge battery
7. Battery surface very dirty	7. Clean battery surface
8. Electrolyte level dropped below upper edge of plates	8. Restore normal electrolyte level
Battery Surface Wetted with Electrolyte	
1. Battery overfilled, electrolyte splashes out	1. Adjust normal electrolyte level
2. Electrolyte seeping through cracks in battery case	2. Replace battery
3. Violent gassing of electrolyte caused by excessively high alternator voltage	3. Check connection of voltage regulator body to ground and connectio of its wires; adjust or replace voltage regulat
4. "Boiling" of electrolyte caused by sulphation of plates	4. Replace battery

ACTIVATION OF DRY-CHARGED BATTERY

The cars shipped from the Plant are fitted with storage batteries filled with the electrolyte and charged.

Spare batteries are delivered in a dry-charge state, without the electrolyte. To get the battery ready for use remove the filler plugs and, dependi on the battery design, remove the plug seals or cu off the vent projections. Then fill the battery wi the electrolyte at 15-25 °C.

The specific gravity of the poured-in electrolyte (corrected to 25 °C) should be 1.27 - 1.29 g/cm^3 for temperate climates and 1.22 - 1.24 g/cm^3 for tropics.

Let the plates and separators impregnate with the electrolyte for two hours, then check the battery no-load voltage and the specific gravity of the electrolyte.

The specific gravity of the electrolyte drops omewhat due to interaction with the active aterial of the plates. If the specific gravity as dropped by not more than 0.03 g/cm^3 and the attery voltage is higher than 12 V, the battery hould be considered ready for use. If the voltage s from 10 to 12 V and the specific gravity has ropped by more than 0.03 g/cm^3, charge the batery with a 2-3 A current for 24 h. If the voltage remains lower than 12 V after charging, the attery should be discarded.

After the separators and plates have been oaked with the electrolyte, the electrolyte level ill drop inevitably. Therefore, prior to instaling the battery on the car, bring the electrolyte evel to the normal value by adding the electrolyte f the same specific gravity as that at the begining of filling.

In the course of charging check the electroyte temperature periodically to prevent its rising bov) °C. If the temperature reaches 40 °C, educe the charging current by 50 % or stop charging until the battery cools down to 27 °C.

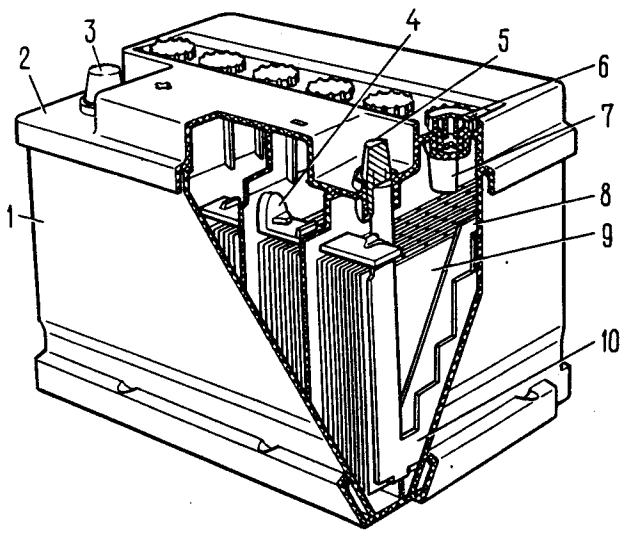
Stop charging when violent gassing begins in ll the cells and when the voltage and specific ravity remain constant in the course of two or hree last hours of charging.

Having filled the battery charge it as a andatory requirement in the following cases:

- if the battery has been out of use for 24 h after filling;
- if the initial service conditions are severe (cold weather, frequent applications of the starter, etc.);
- if the battery has been in storage for more than 6 months after the date of manufacture.

CHECKING ELECTROLYTE LEVEL

The electrolyte level should be 5-10 mm above the er edge of the separators or the baffle plate and should not rise above the lower edge of indicator 7 (Fig. 7-3).



In the course of service the electrolyte level drops gradually due to evaporation of water component of the electrolyte. To restore the normal level add distilled water only.

If it is known for certain that the electrolyte level has dropped due to splashing out, top up the battery with the electrolyte of the same specific gravity as that of the electrolyte remaining in the cells.

If the level is higher than necessary, remove the surplus quantity using a rubber bulb with an ebonite tip.

CHECKING STATE OF CHARGE

To check the state of charge, measure the specific gravity of the electrolyte (Table 7-3) with a hydrometer.

If the battery is discharged to 50 % and over, remove it from the car and have it charged.

When measuring the specific gravity see that drops of the electrolyte do not fall from the pipette on the surface of the battery, car body and other parts: the electrolyte contains sulphuric acid which causes corrosion, current leaks, etc.

Table 7-3

State of Battery Charge VS Specific Gravity of Electrolyte

State of charge, %	Specific gravity at 25 °C, g/cm^3	
	Temperate climate	Tropical climate
100	1.27±0.01	1.23±0.01
50	1.20	1.15
0	1.13	1.10

The specific gravity of the electrolyte depends on its temperature. It changes by 0.01 g/cm^3 approximately per 15 °C. Therefore, if the temperature of the electrolyte is higher or lower than 25 °C, make temperature corrections by adding or abstracting the following values from the hydrometer readings:

Electrolyte temperature, °C	+40	+25	+10	-5	-20
Correction	+0.01	0	-0.01	-0.02	-0.03

To avoid errors do not measure the specific gravity when:

- electrolyte level is other than normal;

Fig. 7-3. Storage Battery. Sectionalized: 1 - battery case; 2 - cover; 3 - positive pole terminal; 4 - cell connector; 5 - negative pole terminal; 6 - plug; 7 - electrolyte level indicator; 8 - separator; 9 - positive plate; 10 - negative plate

- electrolyte is either too hot or too cold; its optimum temperature for measurement is 15-25 °C;

- the cells have just been topped up with distilled water; allow the electrolyte to mix up well; with a discharged battery a delay of a few hours may even become necessary;

- the starter has just been operated several times; wait until the specific gravity in the cells becomes equalized;

- electrolyte is gassing; wait until the bubbles in the hydrometer syringe come up to the surface of the electrolyte.

If the specific gravity of the electrolyte is too low (under 1.22 g/cm^3) and the battery is overheated in service (more than 10 °C above the ambient temperature), or else if the specific gravity of the electrolyte in separate battery cells differs by more than 0.2 g/cm^3, charge the battery with a 2-3 A current during 24 h. If the battery voltage is below 12 V after charging, the battery must be discarded.

If the specific gravity of the electrolyte is too high (1.3 g/cm^3 and higher), bring it to the normal value as described below.

CHARGING BATTERY

Remove the battery from the car, clean it thoroughly, particularly on the top, and check the electrolyte level.

Charge the battery with a 5.5 A current for several hours until the cell voltage and the specific gravity of the electrolyte remain constant.

At the end of charge the specific gravity of the electrolyte may sometimes be other than normal If so, adjust it to the required value.

If the specific gravity is too high, remove some electrolyte from the cells, add some distilled water, wait until the electrolyte gets mixed and measure the specific gravity again.

If the specific gravity is lower than normal, remove some electrolyte from the cells and add the electrolyte of a higher specific gravity (1.40 g/cm^3).

ALTERNATOR

Specifications

Rated voltage, V	12
Sense of rotation	R.H. (viewed from drive end)
Maximum output current at 14 V and rotor speed of 5000 min^{-1}, A	42
Maximum rotor speed, min^{-1}	13000
Engine-to-generator gear ratio	1: 2.04

A sectional view of the alternator is shown in Fig. 7-4 and its connections, in Fig. 7-5.

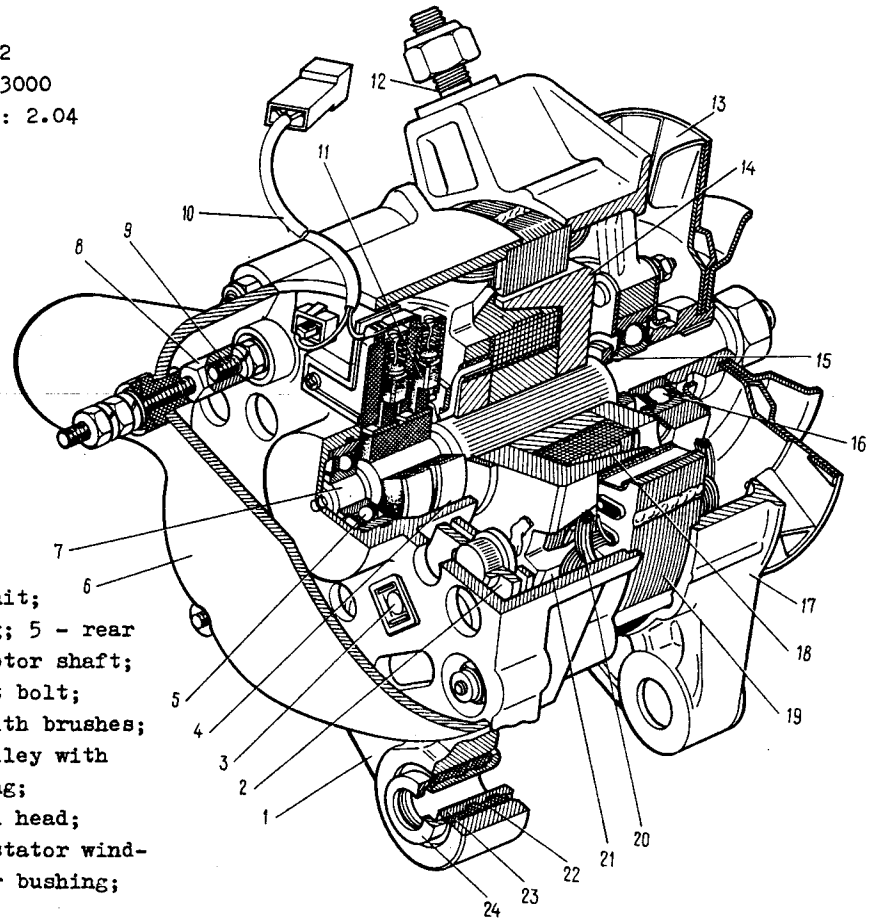


Fig. 7-4. Alternator Г-221:
1 - slip ring end head; 2 - rectifier unit; 3 - rectifier unit screw; 4 - slip ring; 5 - rear ball bearing; 6 - guard housing; 7 - rotor shaft; 8 - contact bolt extension; 9 - contact bolt; 10 - wire harness; 11 - brush holder with brushes; 12 - alternator-to-brace stud; 13 - pulley with fan; 14 - rotor pole piece; 15 - bushing; 16 - front ball bearing; 17 - drive end head; 18 - rotor winding; 19 - stator; 20 - stator winding; 21 - rotor pole piece; 22 - buffer bushing; 23 - bushing; 24 - holddown bushing

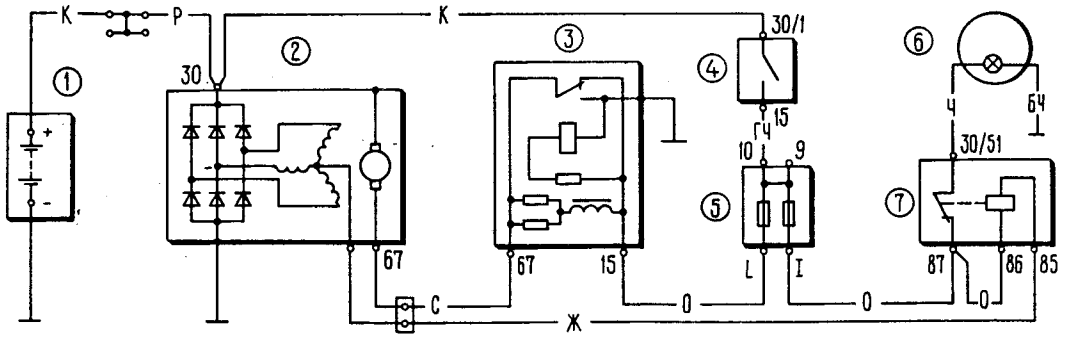


Fig. 7-5. Alternator Connections:
1 - storage battery; 2 - alternator; 3 - voltage regulator; 4 - ignition switch; 5 - fuse unit; 6 -battery no-charge warning lamp; 7 - battery no-charge warning lamp relay

TROUBLE SHOOTING

Cont'd

Cause	Remedy
No-Charge Warning Lamp Constantly Alight or Flashes Up Periodically on Moving Car	
1. Alternator belt slipping	1. Adjust belt tension
2. Open-circuit fault between "85" terminal of no-charge warning lamp relay and centre of alternator star	2. Check and restore connection
3. No-charge warning lamp relay damaged or out of adjustment	3. Check, adjust or replace relay
4. Open-circuit fault in field winding supply circuit	4. Restore connection
5. Voltage regulator de[illegible]ed or maladjusted	5. Clean contacts, adjust or replace regulator
6. Alternator brushes worn or jammed; slip rings oxidized	6. Replace brush holder with brushes; wipe slip rings with gasoline-soaked rag
7. Open-circuit fault or ground fault in alternator field winding	7. Connect winding ends to slip rings or replace rotor
8. One or more positive polarity rectifiers short-circuited	8. Replace rectifier unit
9. Open-circuit fault in one or more alternator rectifiers	9. Replace rectifier unit
10. Open-circuit fault between "86" and "87" terminals of no-charge warning lamp relay	10. Restore connection
11. Open-circuit fault or short circuit in stator winding	11. Replace stator
No-Charge Warning Lamp Fails to Light Up After Turning On Ignition Switch	
1. Lamp filament burnt out	1. Replace lamp
2. No-charge warning lamp relay damaged or maladjusted	2. Clean contacts, adjust or replace relay
3. Open-circuit fault between "87" terminal of no-charge warning lamp relay and terminal "1" of fuse unit	3. Restore connection
4. Short-circuits in one or more negative polarity rectifiers	4. Replace rectifier unit
5. Ground fault of stator winding	5. Replace stator
Alternator Working, Battery Undercharged	
1. Alternator belt slack: slipping at high speed and under load	1. Adjust belt tension
2. Wire clamps loose on alternator and battery; battery terminals oxidized; wires damaged	2. Clean battery terminals of oxides, tighten clamps, replace damaged wires
3. Battery faulty	3. Replace battery
4. Voltage regulator maladjusted or damaged	4. Clean contacts, adjust or replace voltage regulator
Battery Overcharged	
1. Poor contact between "ground" and voltage regulator body	1. Restore contact
2. Voltage regulator maladjusted or damaged	2. Adjust or replace voltage regulator
3. Battery faulty	3. Replace battery

Cont'd

Cause	Remedy
Alternator Noisy	
1. Loosening of alternator pulley nut	1. Tighten up nut
2. Alternator bearings damaged	2. Replace bearings
3. Shorted turns of stator winding (humming of alternator)	3. Replace stator
4. Squeaking of brushes	4. Wipe brushes and slip rings with cotton cloth soaked in gasoline

Caution

1. The "minus" terminal of the storage battery should always be connected to "ground" and its "plus" terminal, to alternator terminal "30". An accidental wrong connection of the battery terminals will immediately cause an overcurrent through the alternator rectifiers, thus ruining them.

2. Do not work the alternator with the loads disconnected from terminal "30" (particularly with the storage battery disconnected). This causes a dangerous voltage rise and may damage the rectifiers.

3. Never check the functioning of the alternator "for spark", i.e. by connecting alternator terminal "30" with "ground" or terminal "67" even for a short time. This creates a very large current in the rectifiers and damages them. The alternator must be checked only with an ammeter and a voltmeter.

4. Do not check the charging circuits with a megger or a 36 V lamp. If such a check is required, first disconnect the wires from the alternator and voltage regulator.

5. The strength of stator insulation should be checked by a high-voltage current only on a test stand, first disconnecting the phase windings from the rectifiers.

6. Do not confuse the wire connected to alternator terminal "67" with the one connected to the star neutral point (unmarked terminal). A wrong connection will make fuse 10 (Fig. 7-1) blow and damage the voltage regulator contacts.

7. If some welding work is to be performed on the car body, disconnect the wires from all the alternator and battery terminals.

8. Under no circumstances should the alternator rectifiers be checked in a circuit supplied from a 110 or 220 V A.C. source even if there in a signal neon lamp; neither should they be checked with a megger since its voltage is too high for the rectifiers. In these cases the rectifier will be broken down (short-circuited).

CHECK TESTS

On-Car Test

If the battery no-charge warning lamp is alight when the engine is running, the fault of the alternator can be identified approximately as follows:

- pull out the carburettor choke knob a little to bring the engine idle speed to 1000-1500 min^{-1};
- disconnect the wire from the battery "minus" terminal for a short time. If the engine stalls, this is an indication that the alternator is faulty and all the loads are supplied from the storage battery.

Stand Test

The stand test is intended to check the condition of the alternator and to ascertain whether its performance agrees with the rated characteristics. Guard housing 6 (Fig. 7-4) of the alternator under test should be removed, the brushes should be well bedded on the slip rings and the slip rings should be perfectly clean.

Mount the alternator on the stand and make connections as shown in Fig. 7-6. Start the stand motor, adjust alternator output voltage to 14 V by rheostat 4 and accelerate the rotor to 5000 min^{-1}. Work the alternator at this speed for at least two minutes and then measure the output current. In a serviceable alternator it should be not under 44 A.

If the output current is smaller, this should be traced to some fault in the stator and rotor windings, to damaged rectifiers or wear of the slip rings and brushes. In this case the windings and rectifiers should be thoroughly checked to identify the faulty spot.

If some fault of the rectifiers is suspected, measure the output current on a warm alternator. This check helps to discover more accurately the faulty condition of the rectifiers by a sharp reduction of the output current at the rise of the alternator temperature. To warm up the machine, wor it for at least 15 minutes at a rotor speed of 5000 min^{-1} and at 14 V across the alternator output terminals. Then measure the output current. On a warmed-up alternator it should be not lower than 42 A.

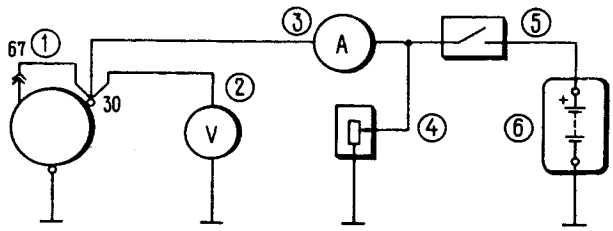


Fig. 7-6. Alternator Test Stand Hookup:
1 - alternator; 2 - voltmeter; 3 - switch;
4 - rheostat; 5 - storage battery; 6 - ammeter

Oscilloscope Test

The oscilloscope makes it possible to check the alternator accurately and quickly and determine the nature of the trouble by the shape of the rectified voltage curve.

For conducting this test, run the alternator rotor at 1500 - 2000 min^{-1}, supplying the field winding from the storage battery but disconnecting the battery from terminal "30".

If the rectifiers and the stator winding are in order, the rectified voltage curve will be of a saw-like pattern with uniform teeth (Fig. 7-7). If there is an open-circuit fault in the stator winding, an open-circuit or a short-circuit fault in the rectifiers, the shape of the curve changes radically: the teeth become nonuniform with deep valleys between them (Fig. 7-7, II and III).

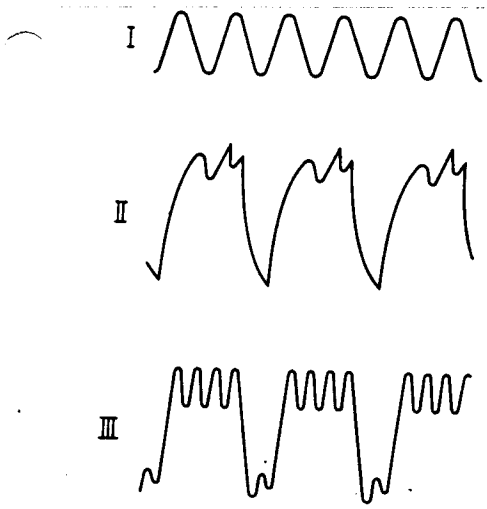


Fig. 7-7. Alternator Rectified Diodes Voltage Curve:
I - alternator serviceable; II - rectifier diode breakdown; III - open circuit fault in rectifier diode

Rotor Field Winding Test

The condition of the winding and the standard of brush-to-slip ring contact can be checked on the stand without disassembling the alternator, by measuring the resistance between terminal "67" and the alternator "ground".

If there are no shorted turns in the winding and the brushes are well seated, the winding resistance should be $(4.4^{+0.3}_{-0.2})$ Ω at 20 °C. In the course of the test ensure a reliable contact between the rotor slip rings and the conductors connected thereto.

Stator Test

The stator should be tested separately after disassembling the alternator and disconnecting the stator winding terminals from the rectifiers.

The first thing to do is to check the stator winding for open circuits and ground faults with an ohmmeter or a test lamp and a storage battery.

The insulation of the winding conductors should bear no signs of overheating caused by a short circuit in the rectifiers. Replace the stator if its winding is damaged in this manner.

Finally, check the stator winding for shorted turns with a growler.

Rectifiers Test

A sound rectifier passes current in one direction only. A faulty one may either pass no current at all (open circuit) or pass it in both directions (short circuit).

If one of the rectifiers is damaged, the entire rectifier unit has to be replaced.

The rectifiers can be checked for shorts without removing the alternator from the car, but first disconnecting the wires from the storage

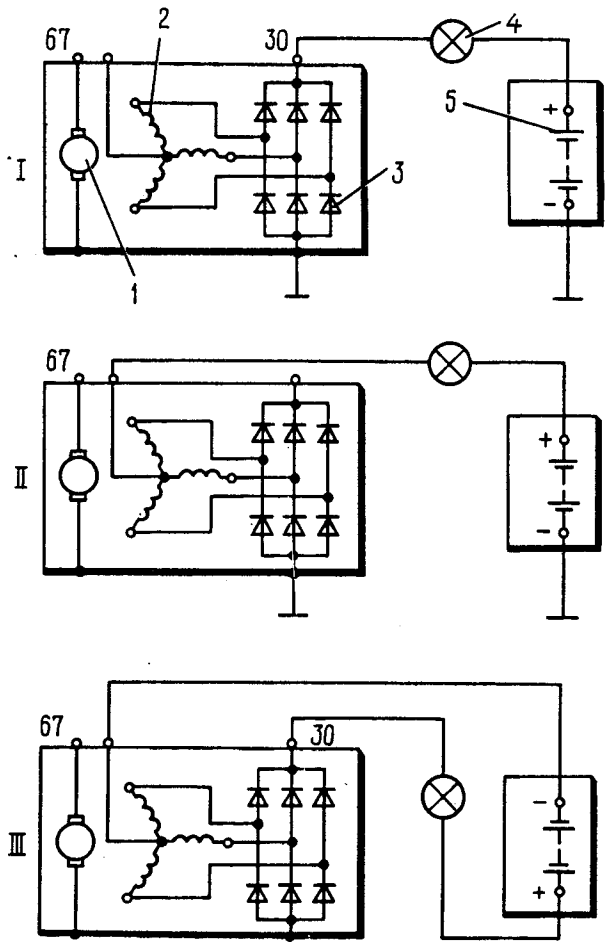


Fig. 7-8. Rectifier Diode Test Hookups:
I - simultaneous test of positive and negative-polarity diodes; II - negative-polarity diode test; III - positive-polarity diode test;
1 - alternator rotor; 2 - stator winding;
3 - rectifier diodes; 4 - signal lamp; 5 - storage battery

battery and alternator. Make the test with an ohmmeter or a 25-40 W test lamp and a storage battery as shown in Fig. 7-8.

Note. To simplify the fastening of the rectifier unit parts, three rectifiers have rectified voltage with the "plus" sign on the body. These are positive rectifiers which are pressed into one plate of the rectifier unit. The other three rectifiers are negative ones and the rectified voltage on their body has the "minus" sign. They are pressed into the other plate of the rectifier unit.

First check for simultaneous shorts in both the positive and negative rectifiers. For this purpose connect the battery "plus" across a lamp to alternator terminal "30" and its "minus", to the alternator frame (Fig. 7-8, I). If the lamp lights up, it means that both the negative and positive rectifiers are shorted.

The negative rectifiers can be tested for shorts by connecting the battery "plus" through a lamp with the terminal of the stator winding neutral wire and its "minus", with the alternator frame (Fig. 7-8, II).

If the lamp is alight, this is an evidence of a short circuit in one or more negative rectifiers.

It should be borne in mind that in this case the lamp may be caused to light due to shorting of the stator winding turns to the alternator frame. However, this fault is by far less frequent than short-circuiting of the rectifiers.

To check the positive rectifiers for shorts, connect the battery "plus" through a lamp with alternator terminal "30" and its "minus" with the terminal of the stator winding neutral wire (Fig. 7-8, III). Lighting up of the lamp will indicate a short circuit in one or more positive rectifiers.

An open-circuit in the rectifiers can be discovered without disassembling the alternator only by an indirect method on a stand, judging by a considerable reduction (by 20 - 30 %) of the output current as compared with the rated value. If the alternator windings are in order and the rectifiers are not short-circuited, the cause of the low current output lies in an open-circuit fault in the rectifiers.

ALTERNATOR REPAIRS

Disassembly

Remove the nuts from contact bolt extension 21 (Fig. 7-9), turn off the fastening screws and remove guard housing 19 with the hose. Disconnect wire harness 22.

Turn off the screws and remove brush holder 2 with brushes.

Unscrew the nuts of through bolts 14 and remove alternator drive end head 11 complete with the rotor.

Clamp the rotor in a vice, unscrew the pulley nut and, using remover tool 02.7823.9504, take the pulley off the rotor shaft. Withdraw the Woodruff key from the shaft slot and remove end head 11.

Turn off the nuts of the screws which connect the rectifier ends with the stator winding terminals, pull the neutral wire plug from connector 4 and withdraw stator 8 from slip ring end head 16.

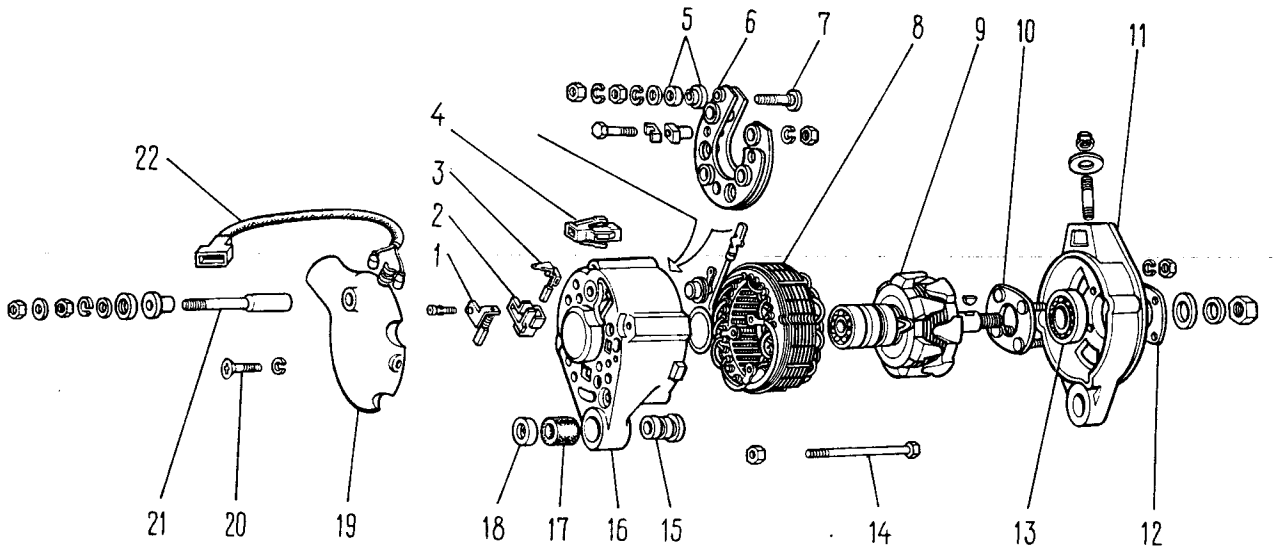


Fig. 7-9. Alternator Parts:
1 - "negative" brush; 2 - brush holder; 3 - "positive" brush; 4 - neutral wire connector; 5 - insulating bushings; 6 - rectifier unit; 7 - contact bolt; 8 - stator; 9 - rotor; 10 - bearing inner fastening washer; 11 - drive end head; 12 - bearing outer fastening washer; 13 - rotor bearing; 14 - through bolt; 15 - holddown bushing; 16 - slip ring end head; 17 - buffer bushing; 18 - bushing; 19 - guard housing; 20 - housing screw; 21 - contact bolt extension; 22 - wire harness

Turn off the nut of contact bolt 7 and remove rectifier unit 6.

Assembly

To assemble the alternator, reverse the disassembly operations. Axial misalignment of the holes in the alternator end head lugs should not exceed 0.4 mm. Therefore, insert a special gauge into these holes at assembly.

The convex side of the tapered spring washer of the pulley should be in contact with the nut. Tighten the pulley nut with a torque of 38.2 - 61.7 N.m (3.9 - 6.3 kgf.m).

Replacement of Brush Holder

If the brushes are worn and protrude by less than 5 mm from the holder, replace the latter complete with the brushes.

Prior to installing the brush holder, blow out the carbon dust and wipe away the oil mixed with carbon dust.

Replacement of Rotor Bearing in Drive End Head

To remove the faulty bearing from the end head, turn off the nuts of the screws that hold together the bearing washers, remove the washers with the screws and force out the bearing on a hand-operated press. If the ends of the screws are lock-punched and the nuts refuse to come off, file off the ends of the screws.

A new bearing may be installed into the alternator end head only if the bore for it is not distorted and its diameter does not exceed 42 mm. If it is larger or the bore is distorted, replace the end head by a new one.

Force the bearing into the end head on a press and then clamp it between two washers which are held together by screws with nuts. After tightening the nuts, lock-punch the ends of the screws.

VOLTAGE REGULATOR

A general view of the voltage regulator appears in Fig. 7-10 and its electrical connections, in Fig. 7-11.

Caution

1. Do not confuse the wires connected to terminals "15" and "67". In case of a wrong connection of the wires the voltage regulator will become inoperative and the upper contacts will be constantly closed. The alternator output voltage will rise high, thus resulting in violent gassing of the electrolyte in the storage battery and in damage to the consumers. Besides, the contacts will get stuck and the voltage regulator will have to be replaced.

2. Do not connect the radio noise suppressor capacitors to the circuit between terminals "67" of the regulator and alternator. This will disturb normal functioning of the contacts and they will be rapidly ruined.

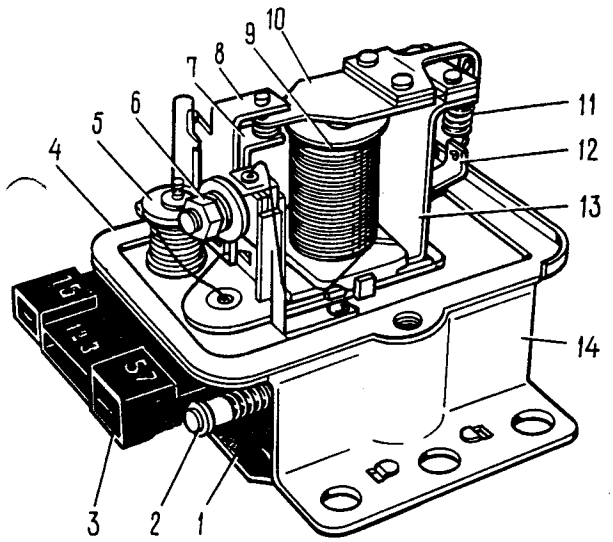


Fig. 7-10. Voltage Regulator PP-380:
1 - protective plate; 2 - series resistor; 3 - lower gasket with sockets for "15" and "67" plugs; 4 - cover gakset; 5 - choke; 6 - bracket fastening nut; 7 - lower contact bracket; 8 - upper contact bracket; 9 - regulator winding; 10 - armature; 11 - armature spring; 12 - spring bracket; 13 - yoke; 14 - base

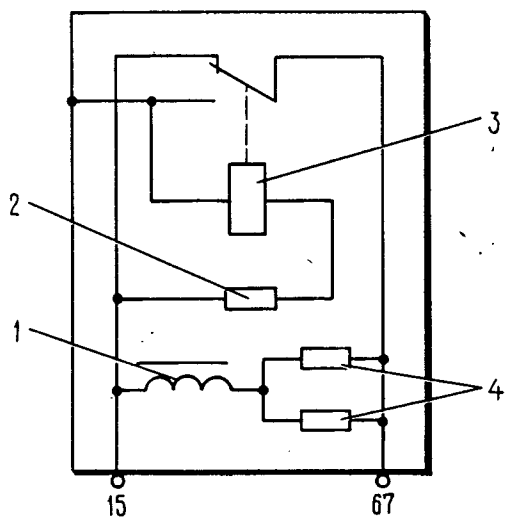


Fig. 7-11. Voltage Regulator Circuit Diagram:
1 - choke; 2 - thermal-compensating resistor; 3 - regulator winding; 4 - series resistors

3. Do not connect additional consumers to the alternator field winding supply circuit as this will raise the alternator voltage excessively.

4. Do not check the regulator by shorting its terminals "15" and "67". This will raise the alternator voltage and may damage the rectifier unit.

5. Do not remove the regulator cover unless urgently necessary so as to avoid disturbing the tightness of the seal. Moisture and various foreign particles penetrating under the cover cause soiling, burning of contacts and interfere with the normal functioning of the regulator. For this reason all the materials of which the regulator is made are checked for absence of gassing; when replacing the gasket, see that the new one is made of polyurethane as prescribed in the regulator design.

6. Keep the regulator always clean and protect it against chance blows that may disturb its setting.

See that the regulator body and "ground" are reliably connected by the fastening screws since inadequate connection steps up the alternator voltage above the specified limit.

Stand Checks and Adjustment. Reference Data

Regulated voltage at regulator and ambient temperature of 50±3 °C, V:

2nd stage ..... 14.2±0.3

1st stage, lower than that of the 2nd stage by not more than 0.7

Resistance between terminal "15" and "ground", Ω ..... 27.7±2

Resistance between terminals "15" and "67" with contacts open, Ω ..... 5.65±0.3

Armature-to-core air gap, mm ..... 1.4±0.07

2nd stage contact gap, mm ..... 0.45±0.1

The regulator should be checked and adjusted on a stand which is equipped with a generator, storage battery, thermostat and an electric motor capable of varying the rotation speed within a wide range. The regulator with the cover closed should be mounted on the stand with its connector plugs down.

A diagram of the stand hookup is illustrated in Fig. 7-12. Pay particular attention to the reliability of connections seeing that their contact resistance should not be higher than that specified in Table 7-4.

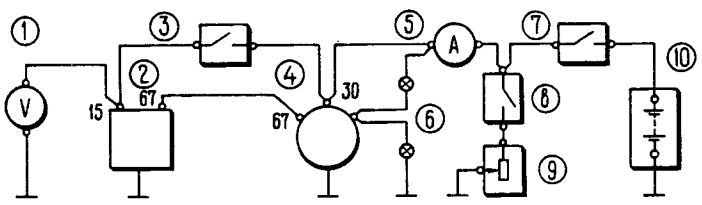


Fig. 7-12. Voltage Regulator Test Stand Hookup: 1 - voltmeter, 15 V scale, accuracy class not under 0.5; 2 - voltage regulator; 3 - master switch; 4 - generator; 5 - ammeter, scale up to 50 A; 6 - signal lamps, 3 W, 12 V; 7 - storage battery switch; 8 - rheostat switch; 9 - rheostat 5 - 30 A, 15 V; 10 - storage battery

Table 7-4

Maximum Ohmic Resistance of Connections

Connections	Resistance, Ω
Generator "30" - battery "plus"	0.005
Generator "ground" - battery "minus"	0.001
Generator "30" - regulator "15"	0.02
Generator "67" - regulator "67"	0.02
Generator "ground" - regulator "ground"	0.02

The wires leading from switch 3 should be connected directly to generator "30" terminal and regulator "15" terminal and the regulator "ground" should be directly connected to generator "ground". All connecting wires should be as short as possible. If tray wiring is used (wires laid in pipes or trays), the trays should be made of a nonmagnetic material.

During stand tests do not operate the regulator with the battery disconnected since this may damage the regulator contacts.

Signal lamps 6 indicating the condition of the generator should light with equal brightness with the generator running.

Before the check warm the regulator in a thermostat for 15-18 min at (50±3) °C, supplying a 12-13 V current to the regulator winding. This voltage is set by rheostat 9 with switches 3, 7, 8 turned ON and the generator inoperative.

Carry out the checks and adjustments immediately after warm-up.

2nd stage tests. Run the generator rotor at 5000 min^{-1}. Set the generator load current to 2-12 A with rheostat 9. Check the generator voltage which must be (14.2±0.3) V. If it is different, stop the generator, disconnect the storage battery, remove the regulator cover and, bending bracket 12 (Fig. 7-10) weaken spring 11 (if the voltage is too high) or increase its tension (if the voltage is too low). Replace the regulator cover and recheck the 2nd stage voltage.

After adjustment of the 2nd stage, check the 1st stage immediately.

1st stage tests. At a rotor speed of 5000 min^{-1}, set a load current to 25-35 A with rheostat 9 (Fig. 7-12). The voltage should be by not more than 0.7 V below the value obtained during the 2nd stage adjustment.

Note. While checking the 1st and 2nd stages see that the adjusted voltage is steady, without sharp fluctuations.

If the voltage fails to fall within these limits, stop the generator, disconnect the storage battery, remove the regulator cover, loosen nut 6 (Fig. 7-10) and shift bracket 8 through 0.1 - 0.2 mm.

If the voltage is high, shift the bracket down and vice versa. Simultaneously shift bracket 7 so as to retain a clearance of (0.45±0.1) mm between the 2nd stage contacts. Meanwhile see that the axes of the 1st and 2nd stage contacts are aligned. The armature contact should not go beyond the outline of the contacts on the brackets.

Tighten nut 6, put the cover in place, recheck the 1st and 2nd stages of the regulator and, if necessary, repeat the adjusting operations.

Upon completion of adjustment clean the regulator cover carefully and install it on the hot regulator to bring the absorption of moisture down to a minimum.

Trouble Shooting

If the storage battery is overcharged systematically on the car, check the voltage regulator without removing it under the following conditions:

- the storage battery should be fully charged;
- all the consumers, except for the storage battery and ignition system, should be disconnected;
- the engine speed should be 2500-3000 min^{-1}.

Measure the voltage across the battery terminals with a voltmeter. If it does not exceed 14.5 V, the regulator may be considered serviceable. If it is higher, connect the regulator body to the car body by a separate conductor and check the voltage again.

If the voltage in the second case is again too high, the voltage regulator is faulty and must be adjusted or replaced. If the voltage is normal, the cause of battery overcharging lies in poor connection of the regulator body with "ground".

The defects of the voltage regulator can be identified by checking its internal parts.

The causes of defects may be as follows:

1. An open-circuit fault in thermal-compensating resistor 2 (Fig. 7-11) or in the regulator winding; in this case the voltage cannot be regulated and rises excessively. This defect can be discovered by measuring the resistance between terminal "15" and the "ground" (base) with an ohmmeter.

2. An open-circuit fault in the winding of the choke or in series resistor 4; in this case voltage is unsteady and fluctuates sharply.

This defect can be identified by checking the electric resistance between terminals "15" and "67" with the contacts of both the 1st and 2nd stages open.

3. Soiling, burning or oxidation of 1st and 2nd stage contacts when the regulated voltage is unsteady.

This defect may be caused by oil, gasoline, and water penetrating into the regulator and soiling the contacts, or by a short circuit in the circuit of terminal "67" or else in the alternator field winding. Foreign matter may penetrate into the regulator due to incorrect installation or damage of the sealing gasket between the regulator cover and base, also when the gasket is made of a material other than that recommended by the manufacturers and fails to ensure adequate tightness or liberates volatile substances.

If the contacts are found damaged, it is good practice to check the circuits for shorts, for correct connections of the wires and to check the condition of the alternator.

REPAIRS

The regulator should be repaired as an exception only; as a rule, it must be replaced. Described below are some of the permitted regulator repair operations.

Replacing the cover and gasket. When installing a new cover see that both the cover and its gasket are perfectly clean and the gasket occupies a correct position. After installation draw up the screws all the way.

If dirt is detected inside the regulator body, clean the regulator contacts and other parts.

Soldering the faulty connections. Solder the connections with a neutral flux in a small amount and take care not to overheat the insulation. After soldering remove the surplus flux since the remaining flux will evaporate under the effect of heat liberated by the operating regulator and soil the contacts.

Cleaning the contacts. To clean the contacts take off the armature spring and, loosening nut 6 (Fig. 7-10), lift somewhat 1st stage stationary contact bracket 8.

Using a flat barette file dress neatly the contacts, removing the burnt matter and oxides throughout the contact surface. The file should be perfectly dry, washed in clean alcohol, gasoline or, even better, in trichloroethylene. The craters on the contacts caused by burning must be dressed with a clean pointed steel tool. Remove the silver chippings from the regulator body, blowing it with dry clean air.

Put the armature spring back in position.

Moving the bracket of the 1st stage stationary contact adjust the armature-to-core gap to (1.4±0.07) mm, ensuring proper touching of the contacts.

Moving the bracket of the 2nd stage stationary

contact, adjust the gap between the 2nd stage contacts to (0.45±0.1) mm, ensuring proper touching of the contacts. Tighten nut 6.

Put in place the gasket and cover, then check the regulator on the stand and adjust it, if necessary.

Cleaning the voltage regulator. If some foreign matter gets inside the regulator, after cleaning the contacts wash the regulator with alcohol or clean gasoline (solvent) before checks and adjustments, then dry it (without the cover) in an oven at 120 °C for 2 hours. Check the regulator on the stand and adjust it, if necessary.

BATTERY NO-CHARGE WARNING LAMP RELAY

The relay, Type PC-702, switches on the warning lamp on the instrument panel when the alternator voltage becomes too low for charging the storage battery. The relay is installed in the engine compartment, on the upper part of the R.H. wheel mudguard.

When the alternator is in operation, the relay winding is supplied with the rectified phase voltage of the alternator. This voltage is approximately a half of the alternator voltage. If the voltage between alternator terminal "30" and "ground" is 13.8 - 14.5 V, the rectified phase voltage is 5 - 7 V.

The relay contacts close the supply circuit of warning lamp 6 (Fig. 7-5). When the ignition switch is turned on but the engine and alternator are still inoperative, the relay contacts pass the current from the storage battery and the lamp is alight.

After engine starting and on the moving car the lamp should go off because the rectified phase voltage should attract the relay armature to the core, thus opening the relay contacts.

If the warning lamp fails to go off after engine starting and on the move, this may be caused by some fault in the alternator or regulator or in the relay proper (an open-circuit fault in the winding, etc.).

Reference Data

Contact-opening voltage*, V	5.3±0.4
Contact-closing voltage*, V	0.2 - 1.5
Winding resistance at 20 °C, Ω	29^{+2}

* At (25±5) °C

STARTER

Specifications

Rated voltage, V	12
Rated power, kW	1.3
Current drain at maximum power, max, A	260
Locked-torque current drain, max, A	500
Current drain at no-load, max, A	35 (60*)

* For starter 35.3708

The design of the starter appears in Fig. 7-13 and its circuit diagram, in Fig. 7-14. The circuit diagram shows the starter with two windings in the solenoid switch installed on some cars since 1983. Before 1983 the starter with one-winding solenoid switch was used.

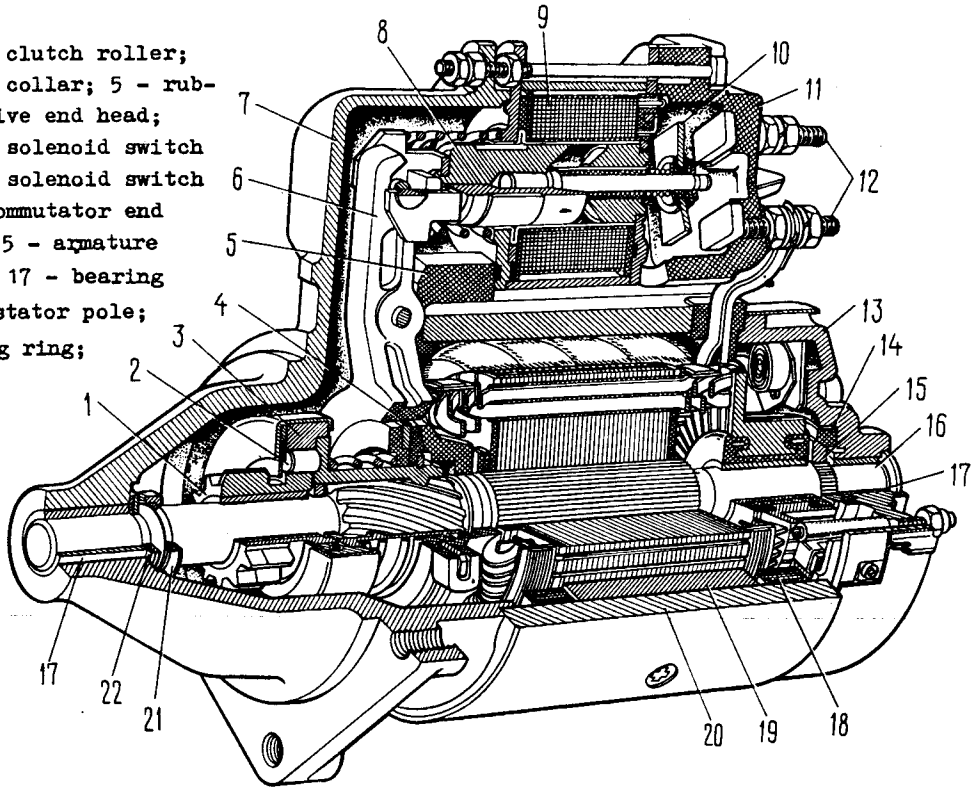
Since 1986 some cars are furnished with the starter type 35.3708 with an end commutator, three series and one shunt windings.

TROUBLE SHOOTING

Cont'd

Cause	Remedy
With Starter Switched on its Armature Stands Still, Solenoid Switch Fails	
1. Storage battery faulty or completely run down	1. Charge or replace battery
2. Heavy oxidation of battery terminals and wire clamps; loosening of wire clamps	2. Clean battery terminals and wire clamps, coat with petrolatum and tighten
3. Shorted turns, ground fault or open-circuit fault in solenoid switch winding	3. Replace solenoid switch
4. Wire terminal disconnected from solenoid switch terminal "50" or from ignition switch	4. Restore connection
5. Faulty ignition switch contact unit: contacts "30" and "50" fail to close	5. Replace ignition switch contact unit
6. Jamming of solenoid switch armature	6. Remove solenoid switch, check armature for freedom of movement
With Starter Switched on, Its Armature Rotates Slowly or Not At All, Solenoid Switch Operates	
1. Storage battery faulty or discharged	1. Charge or replace battery

Fig. 7-13. Starter CT-221:
1 - drive pinion; 2 - overrunning clutch roller; 3 - overrunning clutch; 4 - guide collar; 5 - rubber plug; 6 - shift lever; 7 - drive end head; 8 - solenoid switch armature; 9 - solenoid switch winding; 10 - contact plate; 11 - solenoid switch cover; 12 - contact bolts; 13 - commutator end head; 14 - end head brake disc; 15 - armature shaft brake disc; 16 - armature; 17 - bearing bush; 18 - stator winding; 19 - stator pole; 20 - starter frame; 21 - limiting ring; 22 - adjusting ring



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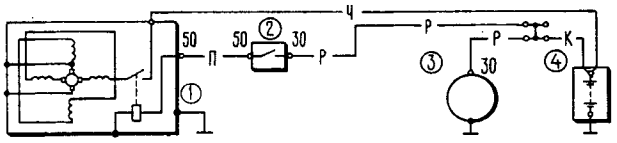


Fig. 7-14. Starter Circuit Diagram:
1 - starter; 2 - ignition switch; 3 - alternator; 4 - storage battery

Cont'd

Cause	Remedy
Battery terminals and wire clamps oxidized; wire clamps loose	2. Clean battery terminals and wire clamps, coat with petrolatum and tighten securely
3. Solenoid switch contact bolts oxidized	3. Dress contact bolts
4. Wire tip nuts loose on solenoid switch contact bolts	4. Tighten nuts
5. Burning of commutator, jamming or wear of brushes	5. Dress commutator, replace brushes
6. Open-circuit fault in stator or armature winding	6. Replace stator coils or armature
7. Shorting of commutator bars, turn-to-turn shorts in armature or stator windings, or ground fault	7. Replace faulty parts
8. Ground fault of positive brush holder	8. Eliminate ground fault or replace commutator end head

With Starter Switched on its Armature Rotates, but Flywheel Stands Still

1. Overrunning clutch slipping	1. Check starter on stand, replace clutch
2. Clutch shift lever broken or its shaft has slipped out	2. Replace lever or put in place its shaft
3. Breaking of clutch carrier ring or buffer spring	3. Replace clutch

Abnormal Noise of Starter During Armature Rotation

1. Excessive wear of bearing bushes or armature shaft bushes	1. Replace armature bushes
2. Starter fastenings loose or drive end head broken	2. Tighten bolts or repair starter
3. Starter fastened out of true	3. Check starter mounting
4. Loosening of stator pole (armature rubs against pole)	4. Tighten pole screw
5. Damaged teeth of starter pinion or flywheel ring gear	5. Replace starter pinion or flywheel

Cont'd

Cause	Remedy
6. Pinion fails to disengage from flywheel:	
(a) jamming of shift lever	(a) replace lever
(b) clutch seized on armature shaft splines	(b) clean splines and coat them with engine oil
(c) clutch or solenoid switch springs weak or broken	(c) replace clutch or solenoid switch
(d) lockring has come off clutch hub	(d) replace faulty parts
(e) solenoid switch armature seized due to overheating	(e) replace solenoid switch
(f) faulty ignition switch contact unit: contacts "30" and "50" fail to open	(f) check for correct contacting in various positions of ignition key; replace faulty contact unit

Stand Tests

The efficiency of the starter can be determined by checking its electrical and mechanical characteristics on a stand.

A hookup for checking the starter on the stand is shown in Fig. 7-15. The cross-section of the wires leading to the power source, ammeter and to the contact bolt of the starter solenoid switch should be not less than 16 mm^2.

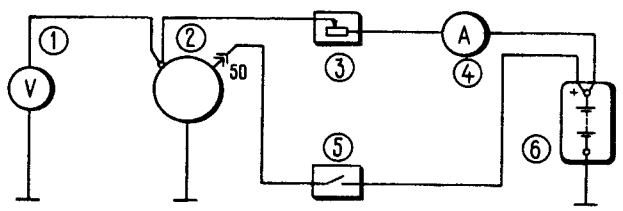


Fig. 7-15. Starter Test Stand Hookup:
1 - voltmeter, scale not under 15 V; 2 - starter; 3 - rheostat, 800 A; 4 - ammeter with 1000 A shunt; 5 - switch; 6 - storage battery

The starter should be supplied from a fully charged battery 6CT-55П or from a special source of power whose voltage drop curve under load corresponds to that of the battery.

The temperature during the tests should be (25±5) °C and the brushes must be well seated on the commutator.

Performance Test

Closing switch 5 and using a 12 V power source, apply the starter four times with different brake torques, e.g. 1.96 - 2.35; 5.4 - 6.45; 8.8 - 10.6; 11.3 - 12.3 N.m (0.2 - 0.24; 0.55 - 0.66; 0.9 - 1.08; and 1.15 - 1.25 kgf.m). Each time the starter should be applied for not longer than 5 s with at least 5-s intervals between successive applications.

If the starter fails to rotate the stand ring gear or is noisy in operation, disassemble it and examine its parts.

Locked-Torque Test

Lock the stand ring gear, switch on the starter and measure the current, voltage and torque which should not be over 500 A and 6.5 V, and not under 13.7 N.m (1.4 kgf.m), respectively. Apply the starter for not longer than 5 s.

If the torque is lower and the current is higher than the above-specified values, this may be probably caused by shorted turns or ground fault of the stator and armature windings.

If the brake torque and current drain are lower than specified above, the cause may be oxidation and soiling of the commutator, heavy wear of brushes or weakening of their springs, jamming of brushes in the holders, loose terminals of the stator winding, oxidation or burning of the solenoid switch contact bolts.

With the pinion locked, the starter armature should not rotate. If it does, the overrunning clutch is at fault.

To remedy the defects disassemble the starter and replace or repair the damaged parts.

No-Load Test

Disengage the ring gear of the stand from the starter pinion. Switch on the starter and measure the current drain and the armature speed which should be, respectively, not over 35 A (60 A for the starter 35.3708) and (5000^{+500}_{-800}) min^{-1} at 11.5 - 12 V across the starter terminals.

If the current drain and the armature speed go beyond the above-indicated limits, the causes may be the same as those in the previous test.

Solenoid Switch Test

Place a gasket, 12.8 mm thick, between limiting ring 21 (Fig. 7-13) and the pinion and energize the solenoid switch. In a single-winding solenoid switch check the current drain which should not exceed 23 A. In a two-winding solenoid switch check the cut-in voltage which should not exceed 9 V at an ambient temperature of (20±5) °C.

Mechanical Test

Using a dynamometer check the brush spring tension which should be (9.8±0.98) N [(1±0.1) kgf] for new brushes. If the brushes are worn to a length of 12 mm, replace the brushes and seat them well on the commutator.

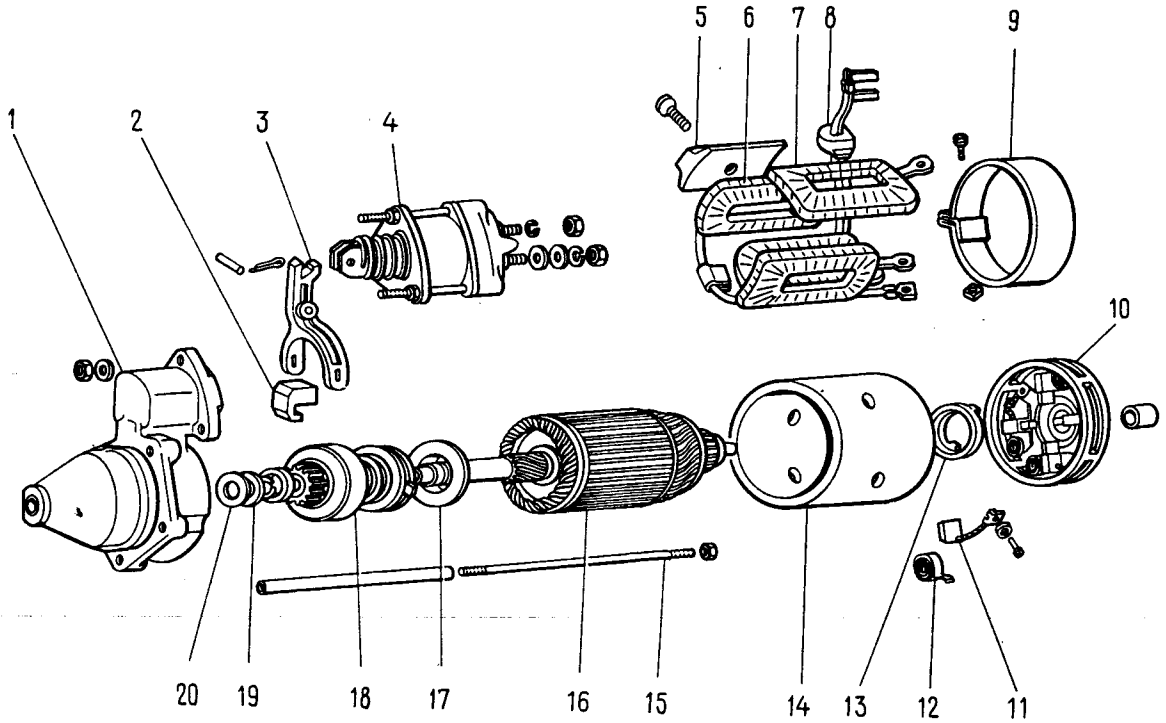


Fig. 7-16. Starter Parts:
1 - drive end head; 2 - rubber plug; 3 - shift lever; 4 - solenoid switch; 5 - stator pole; 6 - stator series winding; 7 - stator shunt winding; 8 - rubber plug; 9 - cover band; 10 - commutator end head; 11 - brush; 12 - brush spring; 13 - end head brake disc; 14 - frame; 15 - through stud; 16 - armature; 17 - pinion stop; 18 - overrunning clutch with drive pinion; 19 - thrust washer; 20 - adjusting washer

The end play of the armature shaft should be from 0.07 to 0.7 mm. If it fails to fall within these limits, disassemble the starter and select the required thickness and number of adjusting washers 20 (Fig. 7-16).

The starter drive should move freely along the splined shaft without perceptible jamming and be pulled from the working to the initial position by the return spring of the switch armature.

When the drive pinion is turned in the normal direction of the armature, the latter should stay still. The torque required for turning the pinion relative to the armature shaft should not exceed 27.4 N.cm (2.8 kgf.cm).

REPAIRS

Defects and damage of the starter should be eliminated by replacing the faulty parts. The only permissible repair operation is turning the commutator on a lathe.

Disassembly

Unscrew the nut on the lower contact bolt of the solenoid switch and disconnect the stator winding. Unscrew the solenoid switch fastening nuts and remove the switch.

Loosen the screw of the cover band on commutator end head 10 and remove cover band 9 with its gasket. Remove the brush terminal screws and take off the brushes. In the starter 35.3708 remove the lockwasher from the rear end of the shaft.

Unscrew the nuts of through studs 15, screw out the latter and remove drive end head 1 complete with armature 16.

Detach the commutator end head from the frame. Remove rubber plug 2 of the lever from the drive end head, uncotter and pull out the shaft of starter shift lever 3, take the lever and the armature from the end head.

To remove the starter drive from the armature, take the lockring from under limiting ring 21 (Fig. 7-13). The drive can be disassembled after removing the lockwasher from the clutch hub.

After disassembly blow the parts with compressed air and wipe them clean.

Inspection and Repairs

Armature. Using a megger or a 220 V test lamp check the armature winding for ground faults.

The voltage is fed through the lamp to the commutator bars and the armature core. If the lamp is alight it means that either the armature winding or the commutator bars are shorted to the ground. When a megger is used, it should read a resistance of not less than 10 kΩ. The armature with a ground fault should be replaced.

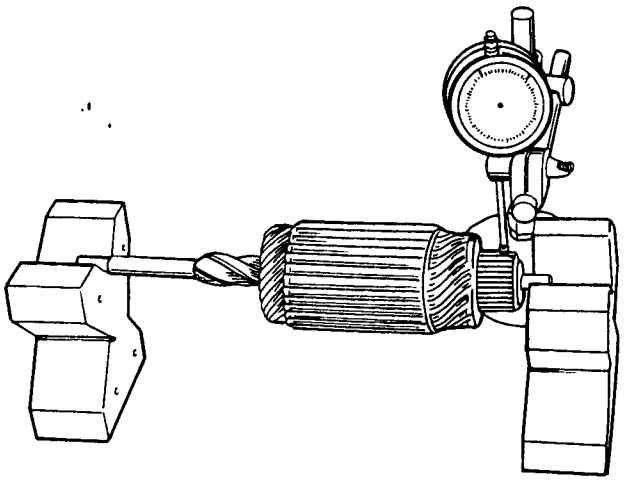


Fig. 7-17. Checking Commutator Runout

Using a special tester check for short circuits between the armature winding sections or commutator bars and for opens at the points where the ends of the winding sections are soldered to the commutator bars.

Examine the working surface of the commutator and check it for runout relative to the shaft journals (Fig. 7-17). If the commutator is soiled or burnt, dress it with fine abrasive cloth. If the surface is heavily damaged or its runout exceeds 0.06 mm, turn the commutator on a lathe, taking care to remove as little metal as possible. The minimum diameter to which the commutator may be turned is 36 mm. After turning grind the commutator with fine abrasive cloth.

Check the core for runout relative to the shaft journals. Replace the armature if the runout exceeds 0.08 mm.

Examine the surfaces of the armature shaft splines and journals. They should be free of scores, nicks and wear. If the shaft surface bears yellow deposit from the pinion bush, remove it with fine abrasive cloth since it may cause jamming of the pinion on the shaft.

Starter drive. The pinion teeth should be free of considerable wear. If the engaging portion of the teeth is nicked, grind the teeth with a fine small-diameter grinding stone. The pinion should rotate easily relative to the clutch hub but only in the direction of armature rotation at engine starting.

If the parts of the starter drive are damaged or considerably worn, replace the drive by a new one.

Stator. Using a megger or a 220 V test lamp, check the stator winding for ground faults. The voltage is fed through the lamp to the common terminal of the winding and to the starter frame. If the lamp lights or the megger reading is under 10 kΩ, also if the winding shows signs of overheating (darkened insulation), replace the winding.

To replace the stator winding coils take off the poles by turning out the pole screws with a power screwdriver. Prior to removing the poles, match-mark both the frame and the poles so as to return them to their initial position.

It is recommended that the winding be heated to 50 °C approximately before installation so as to make it flexible and facilitate its fitting on the poles. Fasten the poles by tightening their screws as far as they will go in order to retain the initial air gap between the armature and the poles (0.38 mm, measured with a feeler gauge).

After assembly check the inside diameter between the poles; it must be 67.80 - 67.97 mm. Besides, using a plug gauge of 67.66 mm diameter, check the concentricity of the frame and the poles. Being touched to the inside surface of the frame, the gauge should go in and turn freely between the poles. If this requirement is not satisfied, it means that the starter was improperly assembled and must again be stripped down and reassembled.

Machining of the poles is by no means permissible.

End heads. Examine the end heads for cracks. Replace them, if cracked. Inspect the end head bushes. If they are worn, replace either the end head assemblies or the bushes alone. After press-fitting ream out the new bushes to a diameter of $12.015^{+0.015}$ mm. Before replacing the bush in the commutator end head, take out the blank plug; having pressed-in the bush, reinstall the blank plug and lock-punch it at three points.

Check to see that the brush holders are reliably secured on the commutator end head. The positive brush holders should have no ground faults. The brushes must be free to move in their holders. The brushes worn down to a length of 12 mm should be replaced by new ones and carefully bedded on the commutator.

Using a dynamometer check the brush spring pressure; for new brushes it should be (9.8 ± 0.98) N $[(1 \pm 0.1)$ kgf$]$. If necessary, replace the springs by new ones.

Solenoid switch. Check the switch armature for freedom of movement. Using an ohmmeter check the contact bolts for reliable contact with the contact plate. If the contact is poor, disassemble the switch and dress the contact bolts with fine abrasive cloth or a flat barette file. If the contact bolts are seriously damaged at the point where they touch upon the contact plate, turn them through 180°.

Assembly

Before assembling the starter, coat the helical splines of the armature shaft and overrunning clutch hub with engine oil М-10ГИ. Lubricate the bushes of both end heads as well as the pinion with engine oil; coat the carrier ring of the drive with Литол-24 grease.

Before assembly check end play of the armature shaft, first assembling the end heads, frame and armature and tightening the nuts of the through studs. The armature can be assembled without the drive; end head 1 (Fig. 7-16) can be assembled without the lever. End play of the shaft should be within 0.07-0.7 mm. It can be changed by selecting the required number or thickness of adjusting washer 20.

In the starter 35.3708 the adjusting washers are installed at both sides of commutator end head 10.

Having installed the appropriate number of adjusting washers, assemble the starter by reversing the disassembly operations.

Check the assembled starter on a stand.

IGNITION SYSTEM

A circuit diagram of the ignition system is given in Fig. 7-18.

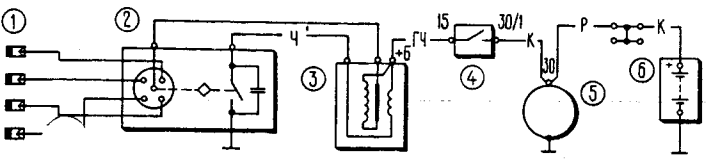


Fig. 7-18. Ignition System Circuit Diagram: 1 - spark plugs; 2 - ignition distributor; 3 - ignition coil; 4 - ignition switch; 5 - alternator; 6 - storage battery

TROUBLE SHOOTING

Cause	Remedy
Engine Fails to Start	
1. Current does not pass through breaker contacts:	
(a) breaker contacts dirty, oxidized or stuck; bulges and craters on contacts due to erosion; excessively large contact gap or weakening of contact spring	(a) dress contacts and adjust contact gap; replace contact unit if spring is weak
(b) L.T. wire tips loose or oxidized; wires broken or shorted to "ground"	(b) inspect wires and connections, replace damaged wires
(c) ignition switch faulty; contacts "15" and "30/1" fail to close	(c) examine switch and, if necessary, replace switch or its contact unit
(d) breakdown of capacitor (short circuit)	(d) replace capacitor
(e) open-circuit fault in ignition coil primary winding	(e) replace coil
2. Breaker contacts fail to open:	
(a) breaker point gap out of adjustment	(a) adjust
(b) heavy wear of breaker arm rubbing block or bushing	(b) replace contact unit
3. No H.T. supply to spark plugs:	
(a) H.T. wire tips loose, broken or oxidized; wires badly soiled or their insulation damaged	(a) inspect and restore connections, clean or replace wires
(b) carbon brush worn, damaged or jammed in distributor cap	(b) inspect distributor cap and replace, if necessary
(c) current leaks through cracks or burnt holes in distributor cap, through carbon deposits or moisture on inside surface of cap	(c) examine cap, remove moisture and carbon deposits; replace cap, if cracked
(d) current leaks through cracks or burnt holes in distributor rotor	(d) examine rotor and replace, if necessary
(e) burnt resistor in distributor rotor	(e) replace resistor
(f) open-circuit or ground fault in ignition coil secondary winding	(f) replace coil
4. H.T. wires confused in distributor cap towers	4. Check and connect wires according to engine firing order (1-3-4-2)
5. Wrong spark plug gap or oiling of spark plugs	5. Clean spark plugs and adjust spark gap
6. Spark plugs damaged (cracked insulator)	6. Replace spark plugs by new ones

Cont'd

Cause	Remedy
7. Wrong ignition timing	7. Check and adjust ignition timing
Engine Runs Unsteadily or Stalls When Idling	
1. Ignition too early	1. Check and adjust ignition timing
2. Excessively large spark plug gap	2. Check and adjust spark plug gap
3. Breaker contact gap too small	3. Check and adjust contact gap
4. Burnt resistor in distributor rotor	4. Replace resistor
Engine Runs Unsteadily at High Speeds	
1. Weakening of breaker arm spring	1. Replace breaker contact unit
2. Breaker contact gap too large	2. Check and adjust contact gap
3. Weak springs of centrifugal spark timer flyweights	3. Replace springs, check centrifugal spark timer on stand
Engine Missing at All Speeds	
1. Faulty ignition wires. Loose wire fastenings or oxidation of wire tips	1. Inspect wires and connections. Replace damaged wires
2. Breaker contacts dirty, oxidized, stuck or displaced	2. Dress contacts and adjust contact gap
3. Reduced capacity or punctured capacitor	3. Check capacitor and replace, if necessary
4. Wear or damage of carbon brush in distributor cap, weakening of its spring	4. Replace distributor cap
5. Badly burnt central contact in distributor rotor	5. Dress central contact
6. Cracks, dirt or burns of distributor rotor or cap	6. Inspect and replace rotor or cap
7. Excessive runout of distributor shaft, heavy wear of shaft bushing	7. Replace ignition distributor
8. Wear or oiling of spark plug electrodes; heavy carbonization; cracked spark plug insulator	8. Examine spark plugs, decarbonize them, adjust spark gap, replace faulty spark plug
Lack of Power and Poor Pickup	
1. Wrong ignition timing	1. Check and adjust
2. Jamming of spark timer flyweights or weakening of their springs	2. Inspect and replace damaged parts
3. Heavy wear of breaker arm bushing	3. Check and replace breaker contact unit

IGNITION TIMING

To check ignition timing there are three marks 1, 2, and 3 (Fig. 7-19) on the valve gear cover and mark 4 on the crankshaft pulley; when mark 4 is aligned with mark 3 on the cover, this indicates the TDC of the pistons in No.1 and No. 4 cylinders.

Ignition timing can be checked and adjusted with a strobe light in the following order:

- set the eccentric of the ignition distributor octane selector to zero (if the P-125B distributor is installed on the engine);
- connect strobe light terminal "+" with ignition coil terminal "+B" and connect the "ground" clamp with the minus terminal of the storage battery;
- insert an adapter for the strobe light between the spark plug of No. 1 cylinder and its wire and make a chalk mark to render mark 4 more conspicuous on the crankshaft pulley;
- start the engine and direct the flashing light of the stroboscope at the mark on the pulley; if ignition timing is correct, mark 4 seen on the pulley will be in line with mark 2 on the valve gear cover when the engine is idling.

To adjust ignition timing stop the engine, loosen the distributor fastening nut and turn the distributor through a required angle. To increase or decrease the ignition advance angle, turn the distributor body counter-clockwise or clockwise, respectively. Then recheck the ignition timing.

If a diagnostic stand with an oscilloscope is available, it can also be used for an easy check of ignition timing, following the instructions for the stand.

If the ignition distributor has been removed from the engine, put it back in place as follows:

- remove the distributor cap, check the breaker point gap and adjust it, if necessary;
- turn the crankshaft until a compression stroke begins in No. 1 cylinder and, continuing to turn the crankshaft, align mark 4 with mark 2;

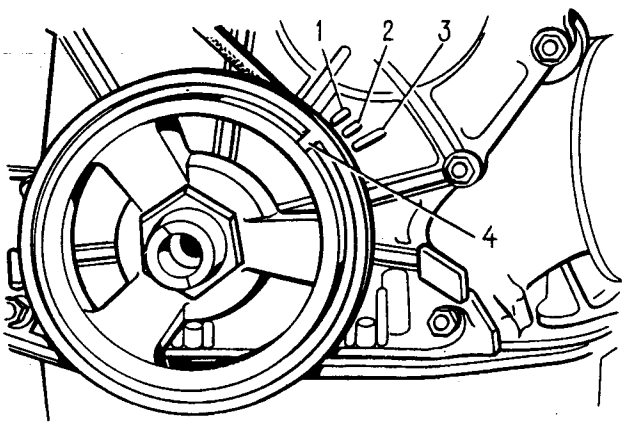


Fig. 7-19. Ignition Timing Marks:
1 - 10° spark advance mark; 2 - 5° spark advance mark; 3 - 0° advance mark; 4 - TDC mark on crankshaft pulley

- turn the rotor to a position in which its outer contact faces the contact of No. 1 cylinder on the distributor cap;

- holding the distributor shaft against turning, insert it into the socket on the cylinder block so that the axis passing through the spring clips be parallel to the engine axis;

- secure the distributor on the cylinder block, install the cap, connect the wires, check and adjust the ignition timing.

Checking and Adjustment of Breaker Point Gap

To check the breaker point gap:

- set the gearshift lever to neutral and apply the parking brake;

- turning the engine crankshaft, bring the breaker cam to a position in which the breaker contacts are completely open;

- measure the gap with a feeler gauge. If the gap not within 0.35 and 0.45 mm limits, loosen screws 21 (Fig. 7-21) of the breaker bracket, insert the blade of a screwdriver into slot 22 and turn the breaker bracket as required. After adjustment tighten screws 21 all the way home.

STAND TESTS OF IGNITION UNITS

Ignition Distributor

Caution

Before 1980 the car engines were fitted with type P-125B ignition distributors (Fig. 7-20).

From 1980, the car engines fitted with carburettor 2107-1107010-20 are furnished with type 30.3706-02 ignition distributors with a vacuum spark timer (Fig. 7-21).

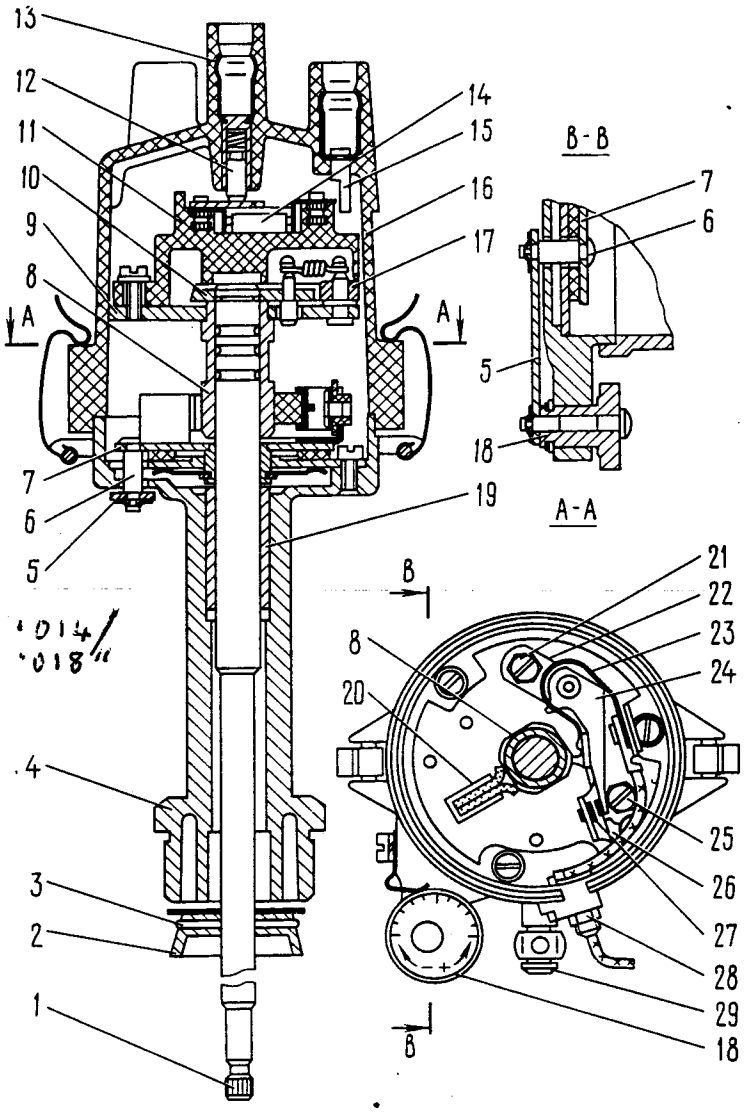


Fig. 7-20. Ignition Distributor P-125B:
1 - shaft; 2 - oil-deflecting sleeve; 3 - spiral stud; 4 - body; 5 - link; 6 - axle; 7 - breaker movable plate; 8 - breaker cam; 9 - driven plate; 10 - driving plate; 11 - rotor; 12 - central carbon electrode; 13 - central electrode terminal; 14 - resistor; 15 - side electrode; 16 - cap; 17 - flyweight; 18 - octane selector eccentric; 19 - shaft bushing; 20 - wick; 21, 25 - breaker contact bracket screws; 22 - breaker contact bracket; 23 - arm spring; 24 - breaker arm; 26 - bracket adjusting slot; 27 - breaker contact points; 28 - L.T. wire terminal nut; 29 - shaft oiler

Prior to mounting the ignition distributor on the stand, examine the breaker contacts, see that the breaker arm with the movable contact is not jammed on its shaft and measure the contact pressure which should be 4.9 - 5.88 N (500 - 600 gf).

Check the rubbing block of the breaker arm for wear; if it is worn, set the required gap between the breaker contact points. If the arm is jammed on its shaft or its spring is weak, replace the contact group.

If the breaker contacts are soiled, stuck or eroded, dress them with a barette file. Never use abrasive cloth or other abrasives for this purpose.

After dressing wipe the breaker contacts with chamois leather soaked in gasoline. Then pull off the breaker arm to allow gasoline to evaporate and wipe the contacts once more with dry chamois leather. The chamois leather may be substituted by any other material which leaves no lints on the contacts.

The contacts should touch each other throughout their surface. If they are not in full contact, adjust the position of the fixed contact by bending the bracket support. It is not permitted to bend the breaker arm with the movable contact.

Wipe the distributor cap to remove any dirt and oil.

Lifting the distributor cap a little, check to see whether the rotor contact faces the electrode of the cap at the moment of opening of the breaker contacts.

CONTACT BREAKER SET
LUCAS DSB 8 G1 C 0394 803

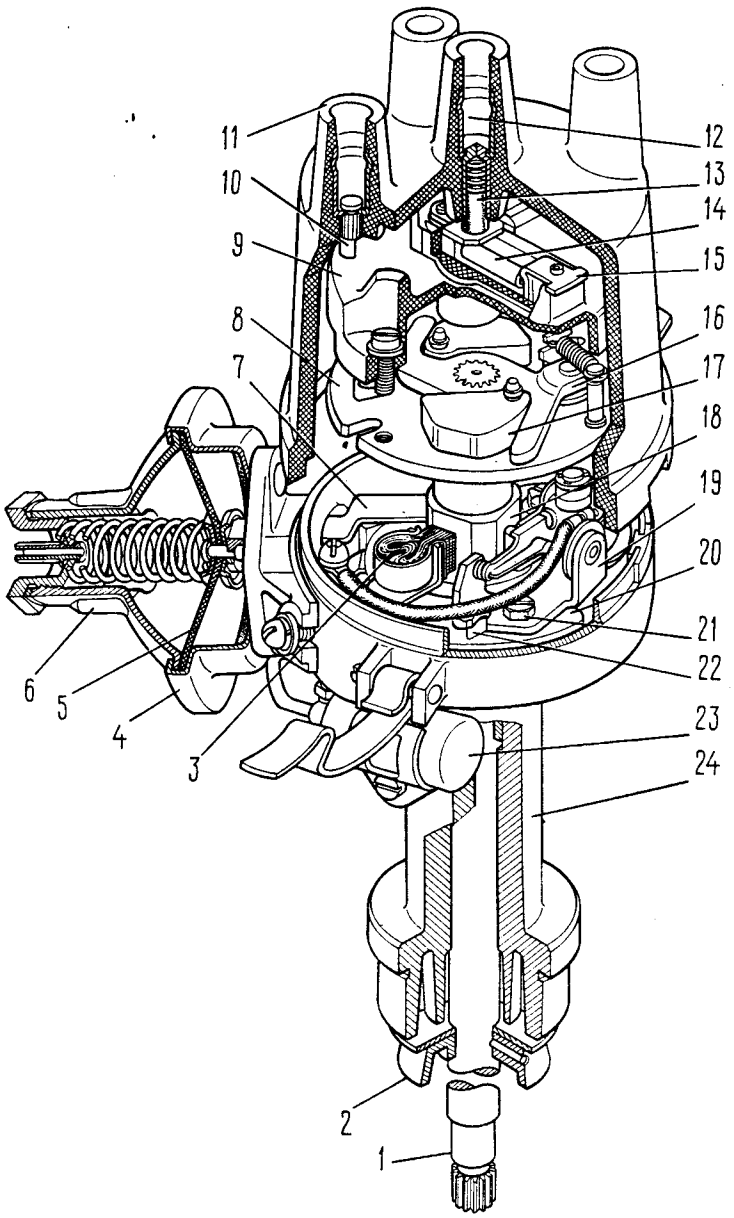


Fig. 7-21. Ignition Distributor 30.3706-02:
1 - shaft; 2 - oil deflecting sleeve; 3 - wick; 4 - vacuum spark timer body; 5 - membrane; 6 - vacuum spark timer cap; 7 - vacuum spark timer link; 8 - centrifugal spark timer supporting plate; 9 - distributor rotor; 10 - side electrode with terminal; 11 - cap; 12 - central electrode with terminal; 13 - central electrode carbon; 14 - resistor; 15 - rotor outer contact; 16 - centrifugal spark timer plate; 17 - flyweight; 18 - breaker cam; 19 - contact group; 20 - breaker movable plate; 21 - contact group screw; 22 - slot; 23 - capacitor; 24 - ignition distributor body

Performance check. Mount the distributor on the test stand and connect it to a variable-speed motor.

Make necessary connections with the ignition coil and storage battery; connect four terminals of the distributor cap with four adjustable spark gaps of the stand.

Set a 5-mm electrode clearance in the spark gaps, start the stand motor and rotate the distributor shaft a few minutes in the clockwise direction at 2000 min^{-1}. Then increase the electrode clearance to 10 mm and look for internal discharges in the distributor. Internal discharges can be noticed either by sound or by weak and missing sparks in the stand spark gaps.

The operating distributor should make no noise at any engine speed.

Measuring the automatic spark advance. Mount the distributor on the stand and connect it in compliance with the stand instructions.

Start the stand motor and rotate the distributor shaft at 150 - 200* min^{-1}. Watching the graduated disc, note the degrees at which one of the four spark occurs.

Increasing the motor speed and taking the readings each time after raising the speed by 200 - 300 min^{-1}, determine the degrees of the spark advance angle relative to the initial setting at various distributor shaft speeds. Compare the obtained curve with that shown in Fig. 7-22.

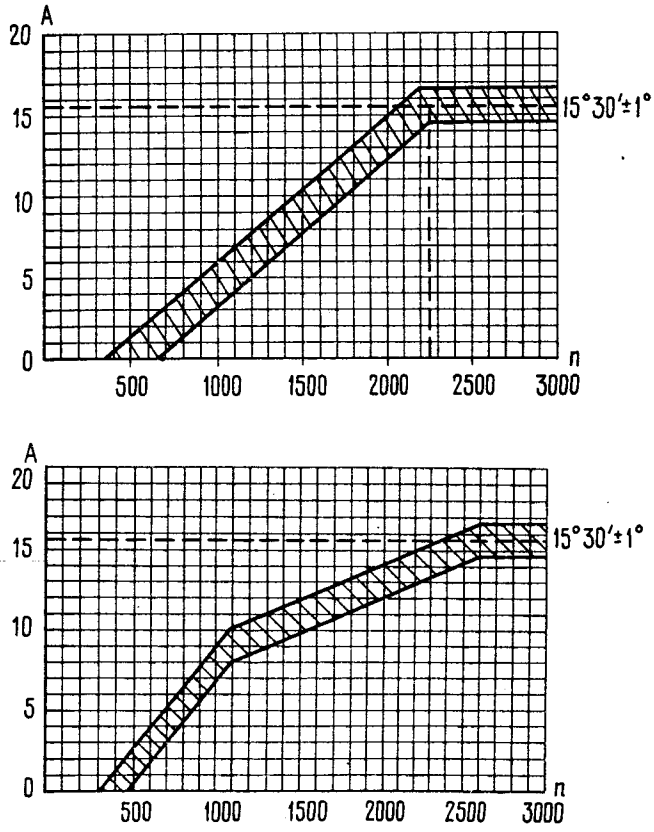


Fig. 7-22. Centrifugal Spark Timer Curve:
a - ignition distributor P-125B; b - ignition distributor 30.3706-02; A - spark advance angle, deg.; n - distributor shaft speed, min^{-1}

* 300 - 400 min^{-1} for ignition distributor P-125B.

Checking the dwell angle.

Turn on the stand motor and accelerate the distributor shaft to 1000 min^{-1}.

Measure the dwell angle on the lighted portions of the scale; the angle should be $(55\pm3)^{\circ}$.

Having checked the dwell angle, check the angles between the contact-opening moments in the cylinders relative to No. 1 cylinder (asynchronism); these angles should not differ by more than $\pm1^{\circ}$ from the nominal values.

Measuring vacuum spark timer response. Connect the vacuum spark timer of the ignition distributor with the vacuum pump of the stand by a hose.

Turn on the stand motor and rotate the distributor shaft at a speed of 1000 min^{-1}. Watching the graduated disc, set an arbitrary "zero" at which a spark occurs in any cylinder.

Increasing the vacuum gradually, note the number of spark advance degrees every 26.7 GPa (20 mm Hg) comparing it with the initial value. Compare the obtained curve with that shown in Fig. 7-23.

Adjust the timer curve by selecting the required number of adjusting washers inserted between the timer spring and plug.

See that the breaker movable plate returns readily to the initial position after the vacuum has been relieved.

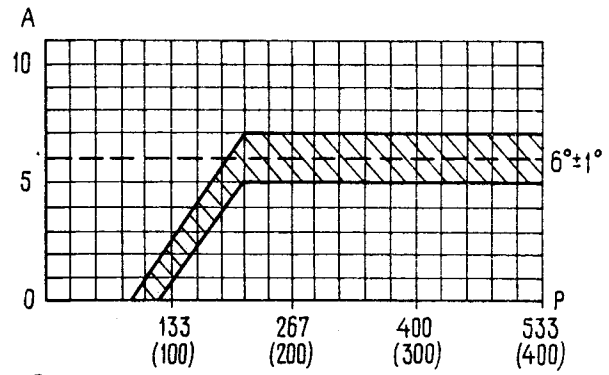


Fig. 7-23. Vacuum Spark Timer Curve of Ignition Distributor 30.3706-02:
A - spark advance angle, deg.; P - vacuum, GPa (mm Hg)

Checking the insulation resistance. The resistance of insulation between various terminals and "ground" at (25 ± 5) °C checked with a megger should be not less than 10 MΩ. Measure the resistance between the breaker L.T. terminal and "ground" with the breaker contacts open.

Checking the capacitor. The capacity measured within a frequency range of 50 - 1000 Hz should be from 0.20 to 0.25 μF.

Ignition Coil

To check the ignition coil, make the following tests:

The ohmic resistance of the primary winding at 20 °C should be 3.07 - 3.5 Ω and that of the secondary winding, 5400 - 9200 Ω.

Insulation to "ground". The coil should withstand 1500 V, 50 Hz A.C. applied during one minute between the end of the primary winding and the body without discharges.

The resistance of insulation to "ground" should be equal to, or higher than, 50 MΩ.

Spark Plugs

If sparks are missing in one or more cylinders, take care to examine the spark plugs.

Before the test clean the carbonized or fouled spark plugs by sand- and airblasting on a special installation.

If carbon deposits are light-brown in colour, they may be left in place since they may appear in a sound engine and do not interfere with normal functioning of the ignition system.

After cleaning examine the spark plugs and adjust the electrode gap. Replace the spark plug, if the insulator is chipped or cracked or the weld of the side electrode is damaged.

The gap between the spark plug electrodes (0.5 - 0.6 mm) should be checked with a round wire feeler gauge included into the driver's tool kit. Do not check the gap with a flat feeler gauge since this measurement will not include the crater on the side electrode that develops in the course of spark plug operation. Adjust the gap by bending the side electrode only. The central electrode must not be bent as this may damage the ceramic insulator.

Tightness test. Screw the spark plug into the corresponding socket of the stand and build up a pressure of 2 MPa (20 kgf/cm^2) in the stand chamber.

Apply a few drops of oil or kerosene to the spark plug; in case of poor tightness bubbles will appear, usually between the insulator and the metal body of the spark plug.

Electric test. Adjust the electrode gap to 0.6 mm, screw the spark plug into the stand socket and tighten to a torque of 30.67 - 39 N.m (3.13 - 3.99 kgf.m) with a torque-indicating wrench; pressure-tightness is ensured by an elastic gasket of the socket union. Set a 12 mm clearance in the spark gaps (which corresponds to a voltage of 18 kV) and build up a pressure of 0.6 MPa (6 kgf/cm^2) with a pump.

Fit the tip of a H.T. wire on the spark plug and press the switch button.

The following conditions may be observed:

1. A good hot spark jumps across the spark plug electrodes as seen through the stand eyepiece. In this case the spark plug is considered to be good.

2. Sparking takes place in the spark gaps. If so, reduce the pressure and note the value at

which the spark plug starts producing sparks. If this occurs at a pressure of 0.5 MPa (5 kgf/cm^2), the spark plug is considered sound; if it occurs at a pressure of 0.4 MPa (4 kgf/cm^2) and lower, the spark plug is defective and must be discarded.

There may be several sparks on the spark gap; if there are no sparks both in the spark plug and spark gap, the fault lies probably with a cracked spark plug insulator so that the discharge takes place inside, between "ground" and the electrode. Such a spark plug is considered faulty.

Ignition Switch

The ignition switch should be checked for proper functioning of the antitheft device and for correct closing of contacts in various positions of the key (Table 7-5). The voltage is fed from the battery and alternator to contacts "30" and "30/1". A vacant additional plug "INT" is intended for connecting a radio receiver.

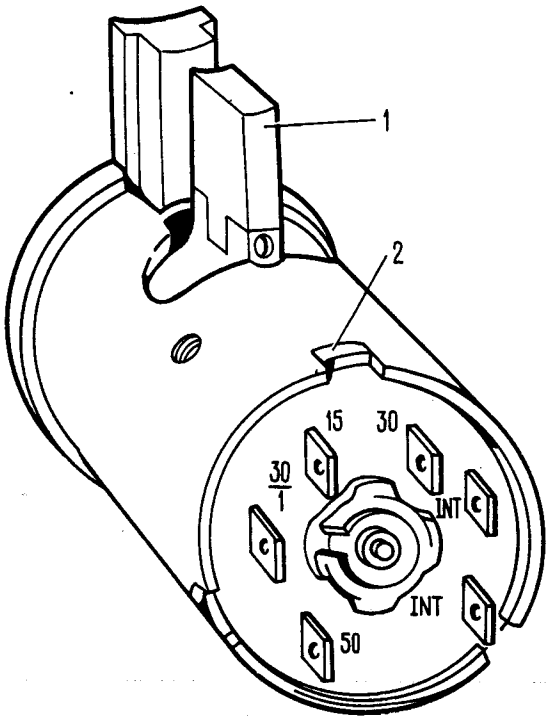


Fig. 7-24. Ignition Switch Contact Group: 1 - locking bar; 2 - wide lug

The locking bar of the antitheft device should extend when the key is turned to the PARKING (СТОЯНКА) position and removed from the lock; it should be retracted when the key is turned from the PARKING (СТОЯНКА) to the OFF (ВЫКЛЮЧЕНО) position.

When installing the contact unit into the switch body, arrange the unit so that terminals "15" and "30" are located at the locking bar side (Fig. 7-24) in which case the wide lug of the contact unit will snap into the wide slot of the switch body.

Checking Radio Noise Suppressors

The radio noise suppressors include the H.T. wires with a distributed resistance of (2000±200) Ω/m and a suppressor resistor in the distributor rotor, rated for 5000-6000 Ω. The condition of these elements can be checked with an ohmmeter.

Table 7-5

Circuits Energized in Various Positions of Key

Key position	Energized contacts	Energized circuits
OFF (ВЫКЛЮЧЕНО)	30 and 30/1	-
III PARKING (СТОЯНКА)	30-INT	External lighting, windshield wiper, heater
	30/1	-
I IGNITION (ЗАЖИГАНИЕ)	30-INT	External lighting, windshield wiper, heater
	30/1 - 15	Ignition system, alternator field, instruments, direction indicators
II STARTER (СТАРТЕР)	30-INT	External lighting, windshield wiper, heater
	30/1 - 15	Ignition system alternator field, instruments, direction indicators
	30 - 50	Starter

LIGHTING AND LIGHT SIGNALLING SYSTEM

The external lighting circuit diagram is shown in Fig. 7-25 and the headlight circuit diagram, in Fig. 7-26.

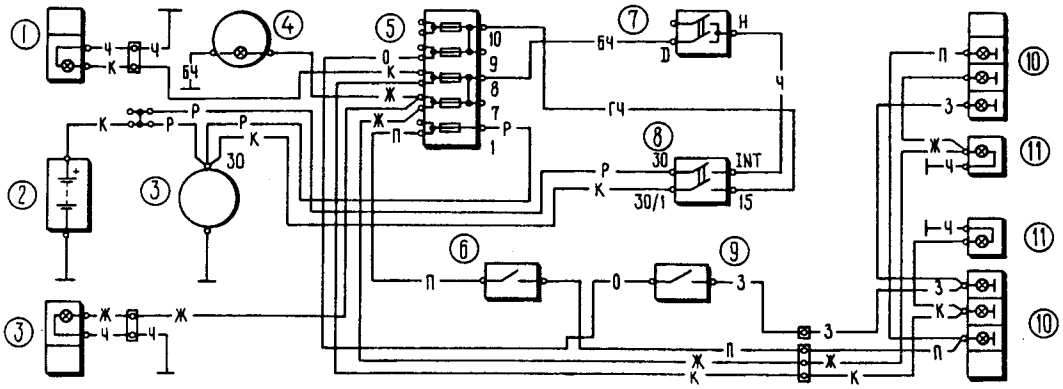


Fig. 7-25. External Lighting Circuit Diagram:
1 - side light; 2 - storage battery; 3 - alternator; 4 - external lighting warning lamp; 5 - fuse unit; 6 - stoplight switch; 7 - external lighting switch; 8 - ignition switch; 9 - backing light switch; 10 - tail light; 11 - number plate light

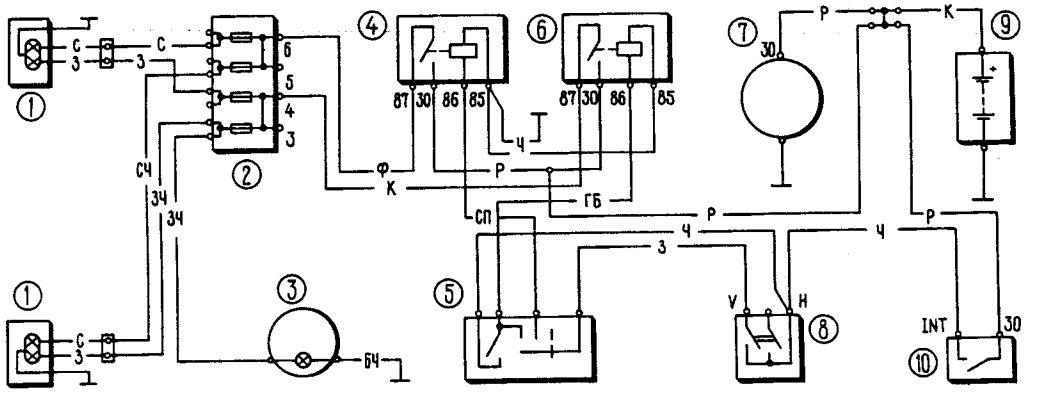


Fig. 7-26. Headlight Circuit Diagram:
1 - headlight; 2 - fuse unit; 3 - headlight upper beam warning lamp in speedometer; 4 - headlight lower beam relay; 5 - headlight beam switch; 6 - headlight upper beam relay; 7 - alternator; 8 - external lighting switch; 9 - storage battery; 10 - ignition switch

TROUBLE SHOOTING

Cont'd

Cause	Remedy
Some Bulbs Inoperative	
1. Fuses blown out	1. Check and replace fuses
2. Bulb filaments burnt out	2. Replace bulbs
3. Wires damaged, their tips oxidized or connections loosened	3. Inspect, replace damaged wires, clean tips
Stoplight Inoperative	
Stoplight switch faulty	Check with test lamp, replace faulty switch
Headlight Lower and Upper Beams Cannot be Changed Over	
1. Defective headlight relay	1. Adjust or replace relay
2. Oxidation of switch contacts	2. Replace three-lever switch
Direction Indicator and Headlight Switch Levers Fail to be Fixed in Position	
1. Lever lock ball has snapped out	1. Replace three-lever switch
2. Damaged sockets of lever locks	2. Replace three-lever switch
Direction Indicators Fail to Switch Off Automatically on Completion of Turn	
1. Jamming of direction indicator lever return mechanism	1. Replace three-lever switch
2. Lugs of direction indicator switch carrier ring worn or broken	2. Replace three-lever switch
Direction Indicator and Headlight Switch Levers Fail to Function	
1. Jamming of lever lock balls	1. Replace three-lever switch

Cont'd

Cause	Remedy
2. Jamming of direction indicator lever return mechanism	2. Replace three-lever switch
Direction Indicator Warning Lamp Inoperative	
1. Bulb filament burnt out	1. Replace bulb
2. Direction indicator and distress light flasher unit faulty	2. Replace flasher unit
After Turning on Direction Indicator Warning Lamp is Constantly Alight (Fails to Blink)	
1. Bulb of front or rear direction indicator burnt out	1. Replace bulb
2. Direction indicator and distress light flasher unit faulty	2. Replace flasher unit

HEADLIGHTS

Replacement of Bulb

To replace the bulb:

- remove decorative facing 4 (Fig. 7-27) on the front end of the body by turning out screws 5;
- loosen headlight moulding screws 3, turn the moulding counter-clockwise and take it off;
- take out the light unit and replace the bulb.

Put the light unit back in position so that its lugs enter the sockets of the headlight inner rim.

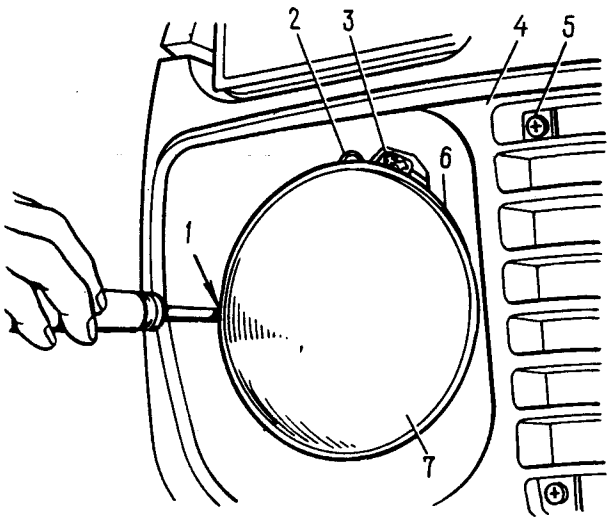


Fig. 7-27. Headlight Aiming:
1 - horizontal adjustment screw; 2 - vertical adjustment screw; 3 - headlight moulding screw; 4 - body front decorative facing; 5 - facing screw; 6 - headlight moulding; 7 - light unit

Headlight Aiming

The headlights should be aimed so as to ensure efficient illumination of the road ahead without dazzling the drivers of the oncoming vehicles by the lower beam. The headlights are aimed by rotating screws 1 and 2 which turn the light unit in the vertical and horizontal planes.

The best practice is to aim the headlights with the aid of portable optical apparatuses. However, if they are not available, this work can be done with the aid of a makeshift screen.

Place a fully primed and equipped car with a 750 N (75 kgf) load on the driver's seat on a level horizontal ground, 5 m away from a smooth wall or some sort of a screen (a sheet of plywood measuring 2x1 m, etc.) so that the car fore-and-aft line (axis) is square to the screen. Before marking out the screen make sure that the car tyres are properly inflated, then swing the car by pushing it from one of its sides to allow the suspension springs to settle.

Mark the screen as shown in Fig. 7-28, drawing an axial vertical line 0 and vertical lines A and B passing through the points which correspond to the headlight centres. These lines should be symmetrical with the fore-and-aft line of the car. Draw line 1 at the height of the headlight centres above the floor and line 2 of the headlight hot spots at a distance of 120 mm below line 1.

Turn on the lower beam. Cover first the L.H., then the R.H. headlight with a piece of cardboard or dark cloth and adjust the light beams with screws 1 and 2 (Fig. 7-27). The upper boundary of the hot spots of well-aimed headlights should coincide with line 2 (Fig. 7-28) while the points of intersection of the horizontal and inclined portions of the hot spots, with lines A and B.

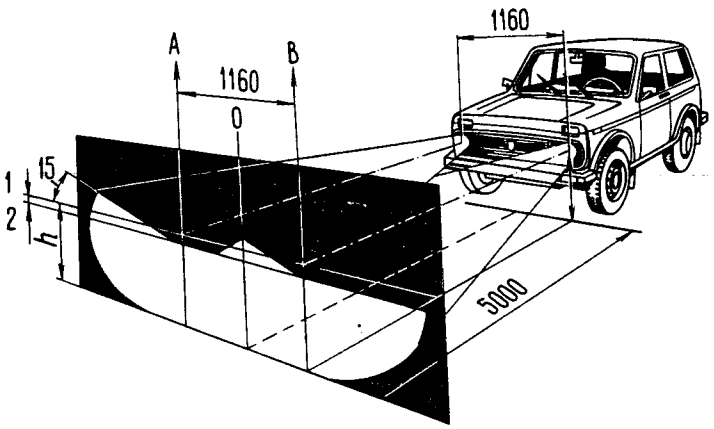


Fig. 7-28. Headlight Aiming Diagram

HEADLIGHT RELAY

Reference Data

Relay cut-in voltage at (23±5) °C, V, maximum 8
Winding resistance at 20 °C, Ω ..... 85±5

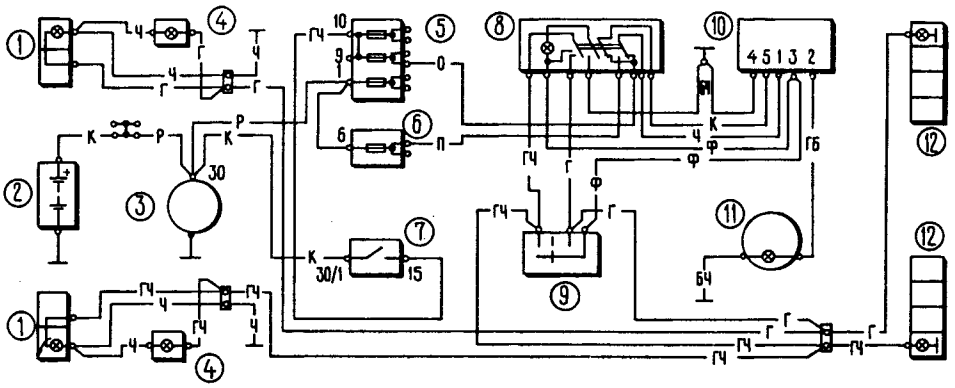


Fig. 7-29. Distress Light and Direction Indicator Circuit Diagram:
1 - side lights; 2 - storage battery; 3 - alternator; 4 - side direction indicators; 5 - main fuse unit; 6 - additional fuse unit; 7 - ignition switch; 8 - distress light switch; 9 - direction indicator switch; 10 - distress light and direction indicator flasher unit; 11 - direction indicator warning lamp in speedometer; 12 - tail lights

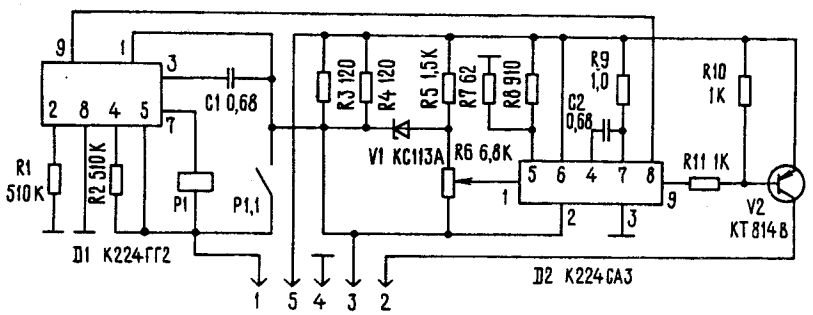


Fig. 7-30. Distress Light and Direction Indicator Flasher Unit Circuit Diagram

The lower and upper beams of the headlights are turned on by identical relays, Type 111.3747. They are installed, together with the headlight wiper and washer relays, under the instrument panel behind the fuse unit.

THREE-LEVER SWITCH

The switch is held by a clamp on the steering shaft bracket.

To remove the switch:

- take off the steering wheel;
- remove the two halves of the steering shaft casing;
- take off the instrument panel and disconnect the switch wires from the wire harness of the car;
- loosen the fastening clamp and take off the switch.

DISTRESS LIGHT AND DIRECTION INDICATOR FLASHER UNIT

Flasher unit 10 (Fig. 7-29) provides for the blinking light of direction indicators both when indicating the turns and giving distress signals, also for checking the condition of the direction indicator bulbs. If these bulbs are sound, warning lamp 11 will be blinking. If the bulbs are faulty (burnt or inoperative because of an open-circuit fault in their supply circuit), the flasher unit will ensure constant light of the warning lamp.

The flasher unit is fastened under the instrument panel on a bolt welded to the wall of the air intake box. A defective flasher unit is not subject to repairs and must be replaced by a new one.

The flasher unit makes the direction indicator bulbs blink at a frequency of 90±30 cycles per minute under a rated load of 92 W, ambient temperature from minus 20 to plus 50 °C and voltage of 10.8 to 15 V.

A circuit diagram of the flasher unit is given in Fig. 7-30.

The car is fitted with two horns (Fig. 7-31): high-tone and low-tone ones. They are bracketed to the radiator L.H. shield in the engine compartment.

The horn connection diagram is shown in Fig. 7-32.

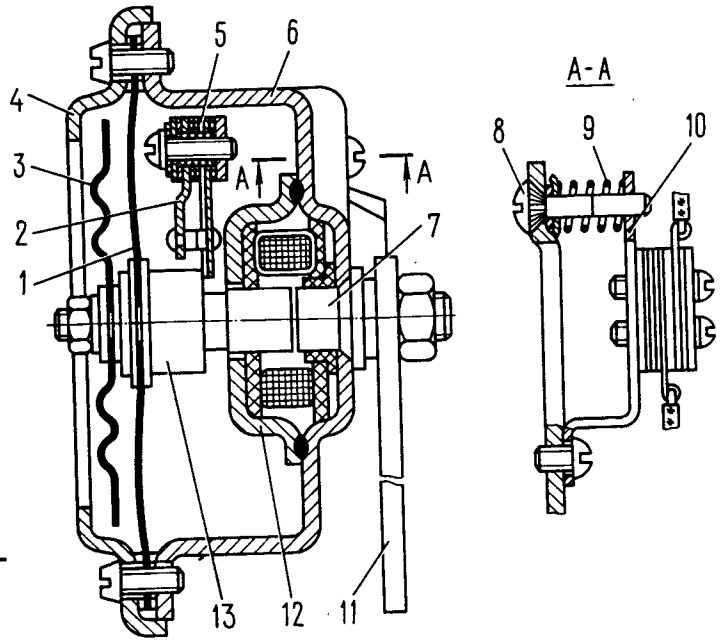


Fig. 7-31. Horn:
1 - membrane; 2 - stationary contact holder; 3 - diffuser; 4 - ring; 5 - movable contact plate; 6 - body; 7 - core; 8 - adjusting screw; 9 - adjusting screw spring; 10 - bridge; 11 - horn fastening plate; 12 - yoke; 13 - armature

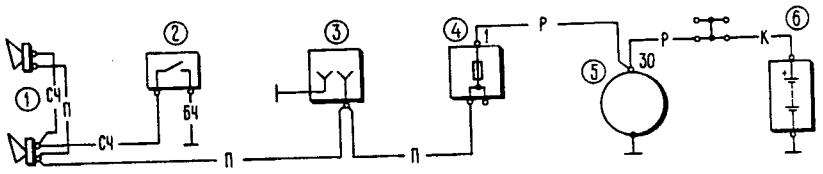


Fig. 7-32. Horn Connection Diagram:
1 - horns; 2 - horn switch; 3 - inspection lamp socket; 4 - fuse unit; 5 - alternator; 6 - storage battery

TROUBLE SHOOTING

Faulty operation of the horns can be caused by a defective or jamming switch and by a defective horn.

To identify the trouble examine the wire connections and the switch contacts. Clean the contacts, if necessary. The faulty switch or horn should be replaced by a new one.

If the sound becomes weak or hoarse, adjust the horn by turning screw 8 in or out (Fig. 7-31) until a loud and clear sound is obtained.

If adjustment fails to eliminate hoarseness or the horn produces intermittent sound, disassemble it and clean the breaker contacts.

When assembling the horn take care to install the previously removed gasket between horn membrane 1 and body 6 so as to retain a clearance of (0.4±0.05) mm between the armature and the core.

WINDSHIELD WIPER

Cont'd

TROUBLE SHOOTING

Cause	Remedy
Wiper Motor Inoperative, Fuse Intact	
1. Damaged motor supply wires, oxidized wire tips	1. Inspect wires, replace damaged ones, clean tips
2. Damaged wiper switch	2. Replace three-lever switch
3. Jamming of motor brushes, heavy oxidation of commutator	3. Inspect, eliminate jamming of brushes or replace faulty parts; dress commutator
4. Breaking of motor leads	4. Inspect and solder up, if necessary
5. Open-circuit fault in motor armature winding	5. Replace armature or motor

Cont'd

Cause	Remedy
Wiper Motor Inoperative, Fuse Blown Out	
1. Short circuit in motor armature	1. Replace motor or armature
2. Wiper arms distorted and brush against car body	2. Inspect, straighten arms or replace wiper
3. Wiper blades frozen to windshield	3. Pull wiper blades off windshield
4. Foreign object in wiper mechanism	4. Inspect, remove foreign object
Wiper Motor Fails to Function at Intermittent Mode	
1. Wiper switch damaged	1. Replace three-lever switch
2. Wiper relay damaged:	
(a) open-circuit fault in relay winding	(a) replace relay
(b) shorted wires on contact bracket	(b) eliminate short circuit
(c) clearance developed between relay breaker contacts	(c) eliminate clearance; replace relay, if necessary
Wiper Motor Fails to Stop at Intermittent Mode	
1. Burnt wiper relay breaker winding	1. Replace relay
2. Cam of motor reduction unit gear fails to force off limit switch sp. ; plate	2. Bend switch plate so that cam can force it off
3. Burning of motor limit switch contacts	3. Dress switch contacts
4. Burning of wiper relay breaker contacts	4. Remedy defect, dress breaker contacts or replace relay

Cont'd

Cause	Remedy
Wiper Motor Stops at Intermittent Mode. Blades Fail to Park in Initial Position	
Oxidation or poor closing of limit switch contacts in motor	Clean switch contacts or bend limit switch plate
Wiper Motor Operating, Blades Stay Still	
1. Broken teeth of motor reduction unit gear	1. Replace gear
2. Loosening of crank on reduction unit gear shaft	2. Inspect, tighten crank nut

REPAIRS

The circuit diagram of the windshield wiper is given in Fig. 7-33. Some of the windshield wipers are furnished with a thermobimetallic cut-out to protect the motor from overloads.

The repairs of the windshield wiper are confined basically to straightening the distorted components of the leverage or replacing them with new ones. A faulty motor should also be replaced by a new one. The only permissible repair operations on the electric motor are replacing the reduction unit gear, the armature and cleaning the commutator.

Removal and Installation

The windshield wiper is removed from the engine compartment as follows:

- remove the blades with the arms;
- disconnect the wires from the storage battery and wiper motor;
- unscrew the nuts of the arm pivots with the locating bushings;
- unscrew the nuts of the motor bracket and take off the motor complete with the leverage.

Put the motor on a work bench and remove the leverage.

To install, reverse the removal operations.

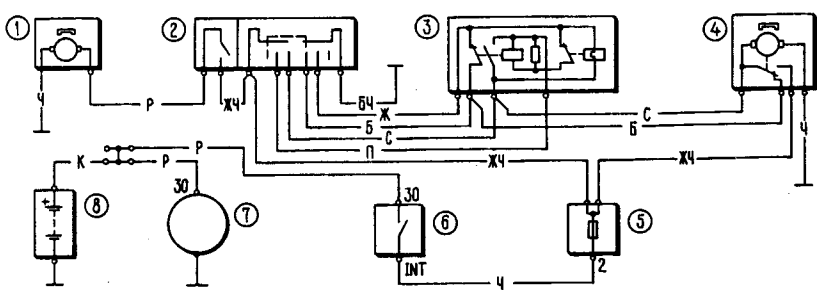


Fig. 7-33. Windshield Wiper and Washer Circuit Diagram:
1 - windshield washer motor; 2 - windshield wiper relay; 3 - windshield wiper and washer switch; 4 - windshield wiper motor; 5 - fuse unit; 6 - ignition switch; 7 - alternator; 8 - storage battery

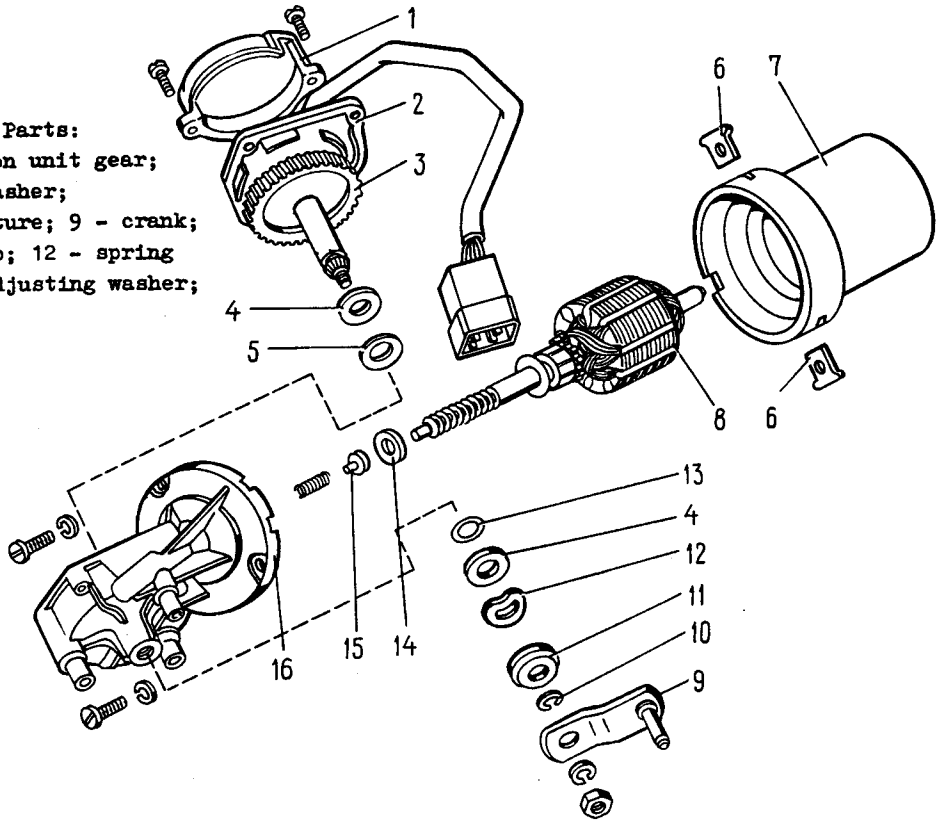


Fig. 7-34. Windshield Wiper Motor Parts:
1 - cover; 2 - panel; 3 - reduction unit gear; 4 - steel washer; 5 - textolite washer; 6 - retainer; 7 - frame; 8 - armature; 9 - crank; 10 - lockring; 11 - protective cap; 12 - spring washer; 13 - sealing ring; 14 - adjusting washer; 15 - spring seat; 16 - end head

Disassembly, Assembly and Inspection of Windshield Wiper Motor

Reference Data

Maximum effective torque on reduction unit shaft*, N.m (kgf.m)	2 (0.2)
Current drain* at a torque of 1 N.m (0.1 kgf.m), maximum, A	2.8
Reduction unit shaft speed* at a torque of 1 N.m (0.1 kgf.m), minimum, min^{-1}	50
Starting torque on reduction unit shaft*, minimum, N.m (kgf.m)	12 (1.2)

* At 14 V and (25±10) °C in cold state.

The МЭ-241 motor (Fig. 7-34) is a D.C. permanent-magnet excitation machine made integral with a worm reduction unit.

To disassemble the motor turn out the screws of reduction unit cover 1 and take off the cover together with panel 2. Then turn out the screws which hold end head 16 to motor frame 7 and detach the end head. Take out motor armature 8.

To remove reduction unit gear 3 unscrew the nut of crank 9, take the lockring off the shaft and take the shaft complete with the gear and washers out of the frame.

After disassembly blow the motor inside spaces with compressed air to remove carbon dust; then examine the brushes and the commutator.

The brushes should be free to move in the holders and the brush springs should be intact and sufficiently resilient. Clean the commutator with fine glass cloth, then wipe it with a clean rag lightly coated with petrolatum. If the commutator is heavily burnt or worn, the best practice is to replace the armature.

Look for the signs of binding on the armature shaft journals. If necessary, clean them with fine abrasive cloth.

During assembly pull the brushes away from the commutator to avoid breakage and damaging their edges. Insert the armature into the frame with particular care without bumping the armature against the pole pieces so as not to break them.

WINDSHIELD WIPER RELAY

Reference Data

Number of operations per minute at 10-14 V and a temperature from minus 20 to plus 50 °C	9-17
Electromagnet winding resistance, Ω	66±2
Breaker winding resistance, Ω	23±1

The PC-514 relay ensures intermittent operation of the windshield wiper. It is installed under the instrument panel at the left-hand side and is held to the car body by two screws.

At the first moment after switching on the wiper for intermittent operation (while the bimetallic plate of the breaker has not yet become heated) the wiper blades may make up to four double strokes in succession.

HEADLIGHT WIPER

The headlight wiper circuit diagram is shown in Fig. 7-35.

The headlight wiper motor is enclosed in one housing with the reduction unit. The motor is not to be disassembled and should be discarded, when faulty.

Motor Reference Data

Rated voltage, V	12
Current drain* at a torque of 1 N.m (0.1 kgf.m), not over, A	1.5
Number of double shaft strokes per minute* at a torque of 1 N.m (0.1 kgf.m)	50±5
Swinging angle of output shaft	65°±1°30'

* At 12 V and (25±10) °C

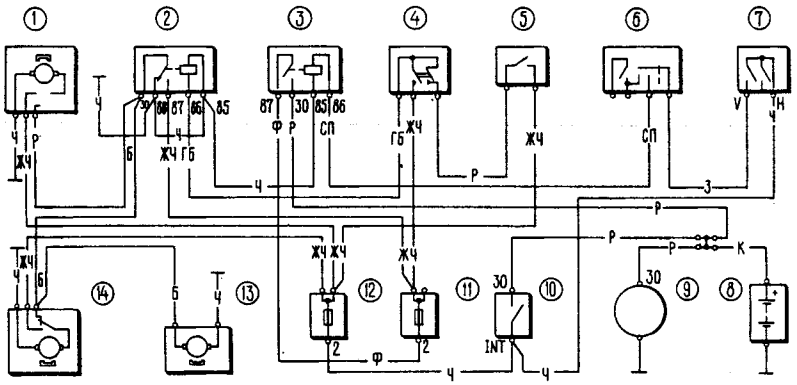


Fig. 7-35. Headlight Wiper and Washer Connection Diagram:
1 - headlight wiper R.H. motor; 2 - headlight wiper and washer relay; 3 - headlight lower beam relay; 4 - headlight wiper and washer switch; 5 - windshield washer switch; 6 - headlight beam switch; 7 - external lighting switch; 8 - storage battery; 9 - alternator; 10 - ignition switch; 11 - additional fuse unit; 12 - main fuse unit; 13 - headlight washer motor; 14 - headlight wiper L.H. motor

HEATER MOTOR

TROUBLE SHOOTING

Cont'd

Cause	Remedy
Motor Inoperative	
1. Wires damaged or connections oxidized	1. Inspect and restore connections. Replace damaged wires
2. Heater switch damaged. No voltage on switch output terminals	2. Examine switch. Replace, if necessary
3. Jamming or wear of motor brushes. Open circuit in armature winding or oxidation of commutator	3. Check motor, repair or replace
4. Ground fault in armature winding. Fuse burns out when motor is turned on	4. Replace motor
Motor Armature Rotates Slowly	
1. Commutator soiled or oxidized	1. Clean commutator
2. Shorted turns in armature winding	2. Replace motor
3. Armature shaft jammed in bearings	3. Disassemble motor, clean shaft journals

REPAIRS

Reference Data

Rated voltage, V	12
Rated power, W	20
Speed of armature shaft with impeller at rated power, min^{-1}	3000±150
Current drain at rated power, not over, A	4.5
Low speed of armature shaft with impeller, min^{-1}	2200±150
Current drain at 2200 min^{-1} of armature shaft, not over, A	2.7

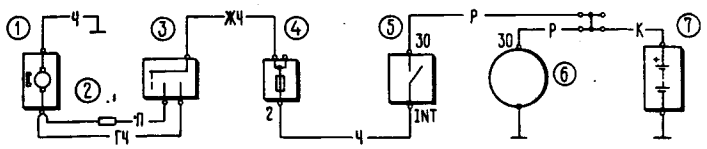


Fig. 7-36. Heater Motor Connection Diagram:
1 - heater motor; 2 - series resistor; 3 - heater switch; 4 - fuse unit; 5 - ignition switch; 6 - alternator; 7 - storage battery

The МЭ-255 motor is a D.C. permanent-magnet excitation machine. The heater motor connection diagram is given in Fig. 7-36.

When series resistor 2 is cut into the motor supply circuit, the armature shaft rotates at a low speed. The resistor is secured by two spring washers in the heater fan shroud. The resistor is rated for 1.5 Ω at 20 °C.

As a rule the faulty motor should be replaced. The only permissible repair operation is cleaning the commutator.

To disassemble the motor turn off the screws of end head 6 (Fig. 7-37) and remove the latter. Then remove lockwasher 1 from the armature shaft and take armature 4 out of the frame. To assemble reverse the disassembly operations.

Inspection of the heater motor is similar to that prescribed for the windshield wiper motor.

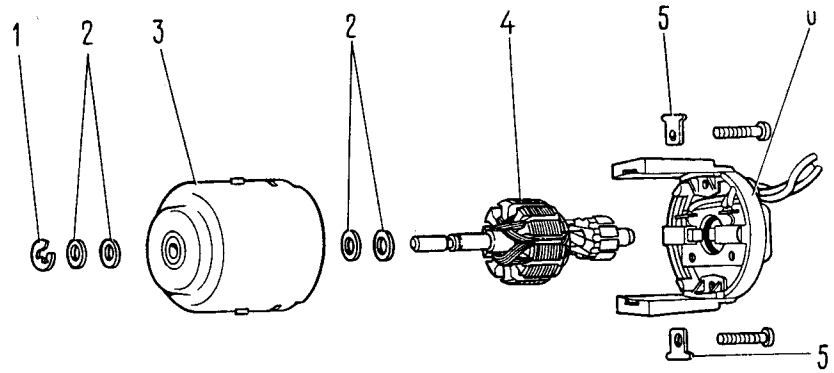


Fig. 7-37. Heater Motor Parts:
1 - lockwasher; 2 - washer; 3 - frame; 4 - armature; 5 - retainer; 6 - end head

INSTRUMENTS

TROUBLE SHOOTING

Cause	Remedy
Instrument Fuse Blows Out Repeatedly	
Breakdown of instrument-protecting diode	Replace damaged diode
Coolant Temperature Gauge Pointer Stays Constantly at Beginning of Scale	
1. Gauge faulty	1. Replace
2. Transmitter faulty	2. Replace
3. Wires damaged or wire tips oxidized	3. Examine wires, restore connections
Coolant Temperature Gauge Pointer Stays Constantly in Red Zone	
1. Gauge faulty	1. Replace
2. Transmitter faulty	2. Replace
3. Transmitter wire shorted to "ground"	3. Check, eliminate ground fault

Cont'd

Cause	Remedy
Fuel Level Gauge Pointer Stays Constantly at "0" Division	
1. Gauge faulty	1. Replace
2. Wires damaged or wire tips oxidized	2. Examine wires, restore connections
3. Transmitter faulty:	
(a) transmitter flexible bus torn off	(a) solder bus or replace transmitter
(b) open-circuit fault in resistor winding	(b) replace transmitter
(c) poor contact of resistor sliding contact	(c) provide reliable contact
(d) leaky float	(d) replace float

Cont'd

Cause	Remedy
Fuel Level Gauge Pointer Stays Constantly at "4/4" Division	
1. Gauge faulty	1. Replace
2. Transmitter flexible bus shorted to fuel suction pipe	2. Bend off bus
3. Transmitter wire shorted to "ground"	3. Check, eliminate ground fault
Fuel Level Gauge Pointer Returns to "0" Division when Tank is Full	
Wrong installation of float travel stop (end of resistor winding)	Bend stop 1-2 mm down
Fuel Level Gauge Pointer Jumps and Falls Frequently to "0" Division	
1. Poor contact between transmitter resistor and slider	1. Bend slider
2. Open circuit fault in transmitter resistor winding	2. Replace transmitter
Low Fuel Warning Lamp Constantly Alight	
1. Flexible bus touches upon fuel suction pipe	1. Bend off bus
2. Transmitter wire shorted to "ground"	2. Check, eliminate ground fault
Low Fuel Warning Lamp Fails to Light Up	
1. Bulb burnt out	1. Replace bulb
2. Transmitter contacts oxidized	2. Clean contacts
3. Transmitter contacts fail to close	3. Bend transmitter sliding contact
4. Broken wire	4. Replace damaged wire
Oil Pressure Warning Lamp Fails to Light Up After Turning On Ignition Switch	
1. Bulb burnt out	1. Replace
2. Transmitter faulty	2. Replace
3. Wires broken or wire tips oxidized	3. Check, replace damaged wires, clean tips
Oil Pressure Warning Lamp Constantly Alight or Goes Off at High Engine Speeds	
1. Transmitter faulty	1. Replace
2. Oil pressure too low	2. See Chapter "Engine"
Parking Brake Warning Lamp Fails to Blink (Constantly Alight)	
Open circuit in flasher unit winding (between "-" and "+" terminals)	Replace flasher unit

Cont'd

Cause	Remedy
Parking Brake Warning Lamp Fails to Light Up	
1. Bulb burnt out	1. Replace
2. Flasher unit contacts oxidized or clearance has formed between contact points	2. Remove flasher unit cover, clean contacts and eliminate clearance between them
3. Warning lamp switch faulty	3. Replace switch
Speedometer Fails to Operate	
1. Loosening of nuts which fasten cable ends to speedometer or its drive	1. Check and tighten nuts
2. Breaking of speedometer drive cable	2. Replace cable
3. Speedometer mechanism damaged	3. Replace speedometer
Speedometer Drive Cable Noisy	
1. Speedometer cable casing distorted (dented, bent, etc.)	1. Replace cable
2. Bending radiuses of speedometer cable smaller than 100 mm	2. Check and correct cable installation

Removal of Instrument Board

To remove the instrument board from the instrument panel for replacing a faulty instrument or a blown out bulb, force off clamps 3 (Fig. 7-38)

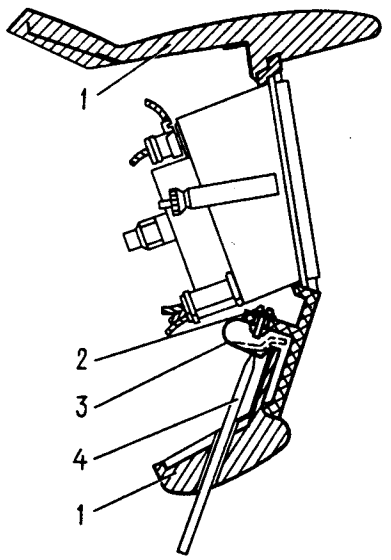


Fig. 7-38. Removing Instrument Board:
1 - instrument panel; 2 - instrument board;
3 - clamp; 4 - broach

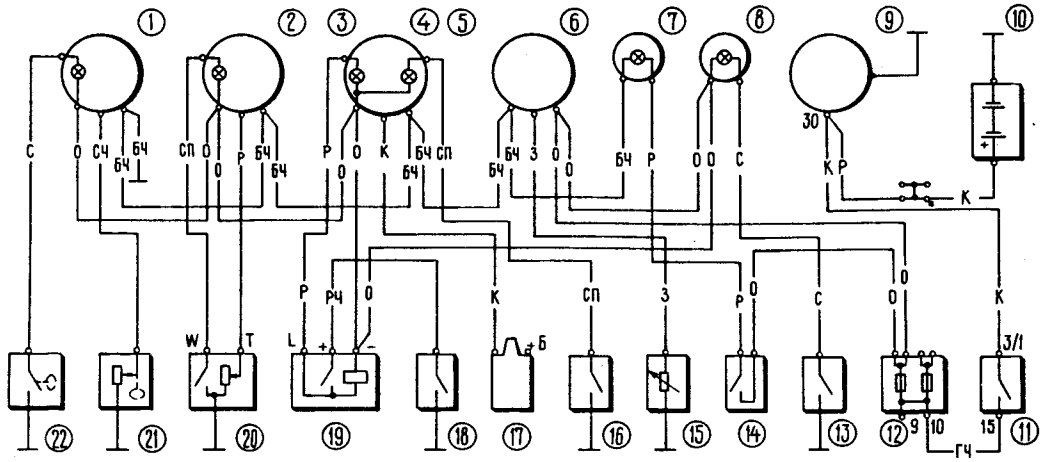


Fig. 7-39. Instrument Circuit Diagram:
1 - oil pressure gauge with low pressure warning lamp; 2 - fuel level gauge with low fuel level warning lamp; 3 - parking brake warning lamp; 4 - tachometer; 5 - carburettor choke valve warning lamp; 6 - coolant temperature gauge; 7 - brake fluid low level warning lamp; 8 - differential lock warning lamp; 9 - alternator; 10 - storage battery; 11 - ignition switch; 12 - fuse unit; 13 - differential lock warning lamp switch; 14 - brake fluid low level transmitter; 15 - coolant temperature gauge transmitter; 16 - carburettor choke valve warning lamp switch; 17 - ignition coil; 18 - parking brake warning lamp switch; 19 - parking brake warning lamp flasher unit; 20 - fuel level and low fuel level transmitter; 21 - oil pressure gauge transmitter; 22 - oil pressure warning lamp transmitter

with broach 4 through special holes in the lower part of the instrument panel, disconnect the plug connectors and detach the cable from the speedometer.

Caution

When removing the instrument board take a note of the manner in which the speedometer cable has been laid; when installing the instrument board position the cable in the previous place to avoid bends with radiuses smaller than 100 mm.

The instrument illumination and warning lamps are removed from their holders complete with the sockets.

Methods of Trouble Shooting

The instrument circuit diagram is shown in Fig. 7-39. The circuit diagrams of the battery no-charge warning lamp, marker light, upper beam warning lamps and direction indicator warning lamp are given earlier in Figs 7-5, 7-25, 7-26 and 7-29.

Coolant Temperature Gauge

If the gauge pointer stays constantly at the beginning of the scale, turn on the ignition switch, disconnect the wire from the gauge transmitter and touch the end of the wire to "ground.

If the pointer deflects, it means that the transmitter is faulty and has to be replaced. If the pointer does not deflect, remove the instrument board, turn on the ignition switch and touch the gauge terminal "V" to "ground". In this case deflection of the pointer will indicate that the instrument is in order, but the wire between the gauge and its transmitter is faulty. If the pointer stays still, replace the instrument.

If the gauge pointer stays constantly in the red zone, turn on the ignition switch and disconnect the wire from the transmitter. If the transmitter is faulty, the pointer will return to division "50".

If the pointer stays in the red zone, it means that either the wire is shorted to "ground" or the instrument is damaged. The condition of the gauge can be checked by disconnecting the green wire leading from the gauge to the transmitter. With the ignition switch turned on the pointer should return to "50" division.

Fuel Level Gauge

The checking procedure is the same as described above. It should be borne in mind that terminal "W" of the gauge transmitter is connected to the wire leading to the low fuel warning lamp, while the wire leading to the gauge proper is connected to terminal "T".

If the gauge pointer stays constantly at the beginning of the scale and does not deflect when the wire disconnected from transmitter terminal "T" is touched to "ground", it is necessary to check the gauge. For this purpose remove the instrument board, turn on the ignition switch and connect terminal "S" of the gauge to "ground". If

the gauge is sound, its pointer will deflect to the end of the scale.

If the gauge pointer is constantly opposite the 4/4 division, the condition of the gauge can be checked by disconnecting from it the pink wire leading to terminal "T" of the transmitter. In this case the pointer of the sound gauge should settle opposite division "0", when the ignition switch is turned on.

Oil Pressure Gauge

The checking procedure is the same as described above. When looking for a trouble, connect terminal "HN" of the gauge to "ground" or disconnect from it the grey wire with black tracer leading to the transmitter.

INSTRUMENT CHECKS

Coolant Temperature Gauge

The gauge УК-193 operates in conjunction with the transmitter ТМ-106. With the transmitter resistance ranging from 640 to 1320 Ω the pointer should stay at the beginning of the scale, at a resistance of 77-89 Ω it should be at the beginning of the red zone, while at a resistance of 40-50 Ω it should move to the end of the red zone of the scale.

Fuel Level Gauge

The gauge УБ-193 operates in conjunction with transmitter БМ-168 installed in the fuel tank. This transmitter is also used to switch on the low fuel warning lamp when 5.3-6.5 l of gasoline remains in the tank.

With the transmitter resistance ranging from 285 to 335 Ω, the pointer should stay at the beginning of the scale, at 100-135 Ω it should be i he middle of the scale and at 7-25 Ω, at the end of the scale.

Oil Pressure Gauge

The gauge УК-194 incorporates a low oil pressure warning lamp turned on by transmitter ММ-120.

The gauge works jointly with a ММ-393А transmitter which changes the resistance of the electrical circuit depending on changes of oil pressure in the engine lubricating system. At a transmitter resistance of 285-335 Ω the gauge pointer is at the beginning of the scale, at 100-135 Ω, in the middle of the scale and at 0-25 Ω, at the end of the scale.

Tachometer

The electronic tachometer ТХ-193 installed on the car operates by measuring the frequency of voltage pulses in the primary circuit of the engine ignition system.

The tachometer should be checked on a stand simulating the engine ignition system. Connect the tachometer to the stand circuitry in the same manner as on the car, set a voltage of 14 V in the primary circuit and a 7-mm clearance in the stand spark gap. Rotate the ignition distributor shaft at a speed at which the tachometer pointer moves to one of the scale divisions. At this instant check to see that the distributor shaft speed is within the limits specified in Table 7-6.

Table 7-6

Tachometer Check Data

Scale divisions, min^{-1}	Distributor shaft speed, min^{-1}
1000	440-550
2000	875-1050
3000	1350-1525
4000	1850-2025
5000	2350-2500
6000	2900-3000
7000	3350-3500
8000	3800-4200

Speedometer

The speedometer СП-193 consists of a pointer-type speed indicator showing the road speed in kilometers per hour, an odometer and a trip counter.

The trip counter can be reset to zero by rotating counter-clockwise the knob on the instrument board.

To avoid damaging the counter do not reset it on the moving car.

To check the speedometer, compare its readings with those of a reference speedometer. The speedometer check data are given in Table 7-7.

Table 7-7

Speedometer Check Data

Drive cable speed, min^{-1}	Speedometer readings, km/h
500	31-35
1000	62-66.5
1500	93-98
2000	124-130
2500	155-161.5

CHECKING INSTRUMENT TRANSMITTERS

Fuel Level Transmitter

The БМ-168 transmitter is fastened by screws in the fuel tank.

The transmitter comprises a variable resistor of nichrome wire. The resistor slider is controlled by a lever with a float. The short end of this lever also carries a movable contact which switches on the low fuel warning lamp when 4 - 6.5 l of gasoline remains in the tank.

With the empty tank the transmitter resistance should be 315 - 345 Ω; it should be 108 - 128 Ω with a half-full tank and 7 Ω or less when the tank is full.

Coolant Temperature Transmitter

The TM-106 transmitter is screwed into the cylinder head at the L.H. side of the engine.

The transmitter comprises a thermal resistor whose electric resistance varies with the temperature of coolant. The transmitter check data are given below in Table 7-8.

Table 7-8

Coolant Temperature Transmitter Check Data

Temperature, °C	Supply voltage, V	Transmitter resistance, Ω
30	8.00	1350-1880
50	7.60	585-820
70	6.85	280-390
90	5.80	155-196
110	4.70	87-109

Oil Pressure Transmitter

The MM-393A transmitter converts pressure in the engine lubricating system into electric resistance. It is installed on the L.H. side of the cylinder block. The transmitter check data are given in Table 7-9.

Table 7-9

Check Data

Pressure, MPa (kgf/cm^2)	Transmitter resistance, Ω
0 0	290-320
0.4 (4)	103-133
0.6 (6)	55-80
0.8 (8)	0-15

Oil Pressure Warning Lamp Transmitter

The MM-120 transmitter is installed on the L.H. side of the cylinder block.

The transmitter contacts should close and open at a pressure of 20 and 60 kPa (0.2 and 0.6 kgf/cm^2) respectively.

Parking Brake Warning Lamp Flasher Unit

The PC-492 flasher unit ensures the blinking light of the parking brake warning lamp. It is suspended from wires behind the instrument board.

The number of closing and opening cycles per minute at a voltage of 10.8-15 V and a temperature from minus 40 to plus 40 °C should range from 60 to 120. The resistance of the flasher unit winding is 26 Ω.

Section VIII
BODY

TROUBLE SHOOTING

Cause	Remedy
Dark Stains Over Entire Body Surface	
1. Car washed with very hot water (over 80 °C)	1. Eliminate minor defects by polishing; repaint body, if heavily damaged
2. Ethylated gasoline and other paint-attacking materials used for removing protective wax coating	2. Polish body or repaint it, if necessary
Pink Stains on Light-Coloured Surfaces	
Coolant spilt on body surfaces	Polish damaged surfaces
Light Stains on Dark-Coloured Surfaces	
Effect of moisture during prolonged storage of car under airtight covers	Polish damaged surfaces or repaint car body, if necessary
Enamel Paint Lost Initial Lustre	
1. Wiping of car with dry rags	1. Polish dull surfaces, repaint body, if necessary
2. Prolonged exposure to sunlight	2. Polish, repaint body, if necessary
3. Employment of paint-attacking materials for washing	3. Polish dull surfaces, repaint body, if necessary
Water Penetrates into Car Body	
1. Clogging of water drain holes in windshield sealing strip	1. Remove windshield, clear up holes or replace sealing strip. When installing sealing strip, align its holes with holes in body

Cont'd

Cause	Remedy
2. Poor tightness of antenna cable seal	2. Replace seal or coat it with nondrying sealing compound
3. Excessively large clearance around door perimeter	3. Adjust position of door and of lock striker plate
4. Crushed metal framework of door sealing strip	4. Replace sealing strip
5. Vacuum booster hose locks valve for draining water from heater air intake box	5. Set vacuum booster hose correctly
Door Opens with Difficulty	
1. Bending of door lock striker plate block axle	1. Replace axle
2. Wear of striker plate block	2. Replace block
3. Wrong door position	3. Adjust door position
Door Lock Cannot be Locked by Button or with Key	
Upper end of outer remote control lever bears against outer handle shoulder	Bend off upper end of lever from handle shoulder to set a clearance of 0.5-2 mm between them
Door Fails to be Opened by Outer Handle	
Excessively large clearance between door outer handle shoulder and upper end of outer lock control lever	Bend upper end of lever to handle shoulder to set a clearance of 0.5 - 2 mm

Cont'd

Cause	Remedy
Door Fails to be Locked	
1. Breaking or weakening of lock central shaft spring or of outer control lever	1. Replace lock
2. Loose staking of outer control lever shaft. Lever tooth fails to engage ratchet due to axial displacement of lever	2. Remove lock and stake axle reliably
3. Outer control lever jamming due to gumming of lubricant and dust	3. Remove lock, wash and lubricate it
Inner Handle Fails to Open Door Completely	
Incomplete travel of inner control lever due to insufficient travel of link	Adjust position of inner lock handle
Hood Lock Cannot be Opened by Handle from Inside the Car	
1. Breaking of lock control cable	1. Replace cable
2. Lock control cable too long	2. Adjust cable length by its fastening loop on lock hook
Hood Fails to be Locked	
1. Lock spring broken	1. Replace spring
2. Lock control cable too short	2. Adjust cable length by its fastening loop on lock hook
3. Lock displaced on car body	3. Adjust position of lock
Roll-Down Window Glass Cannot be Fixed in Desired Position	
Window regulator spring brake broken	Replace window regulator

Cont'd

Cause	Remedy
On Pulling Rake-Adjusting Handle, Front Seat Back Fails to Return from Reclined Position	
Breaking of mechanism spring	Replace spring, check functioning of mechanism
Front Seat Back Fails to be Fixed in Desired Position	
Breaking of back retainer teeth	Replace seat framework
Difficult Adjustment of Front Seat Position	
1. Slides jammed in rail guides due to lack of lubricant	1. Lubricate slides and guides
2. Balls slip out of seat rails over bent edges of slides and guides	2. Disassemble seat rails, insert balls, assemble mechanism and bend guide and slide edges as required. Replace seat rails, if necessary
Hot Air Constantly Supplied into Car Interior	
1. Heater cock control mechanism faulty	1. Examine control mechanism, fasten rod casing and replace rod, if necessary
2. Heater cock fails to shut off coolant flow	2. Replace cock
Only Cold Air Supplied into Car Interior	
1. Heater cock fails to open due to breaking of cock controls	1. Examine control mechanism, fasten rod casing, replace rod, if necessary
2. Cock faulty	2. Replace cock
Insufficient Air Supply into Body Interior	
Faulty control linkage of air intake lid (lid closed)	Examine control linkage, fasten rod casing, replace rod, if necessary

BODY AND ITS ELEMENTS

The design of the body shell and sheet metal parts is shown in Figs 8-1, 8-2, 8-3.

GAUGING AND STRAIGHTENING

A considerable part of body repairs falls to the cars after collisions which in most cases have to be checked for the geometry of the fastening points of the chassis units and mechanisms (Fig. 8-4).

The equipment designed for checking the datum points is also used for repairs in combination with the fixtures for straightening the body.

Distorted surfaces are repaired by mechanical or thermal treatment of metal and by filling the dents with quick-hardening plastics or solders.

Distorted surfaces are straightened, as a rule, manually with the aid of special tools (metal, plastic and wooden hammers, mallets and various mandrels) and fixtures.

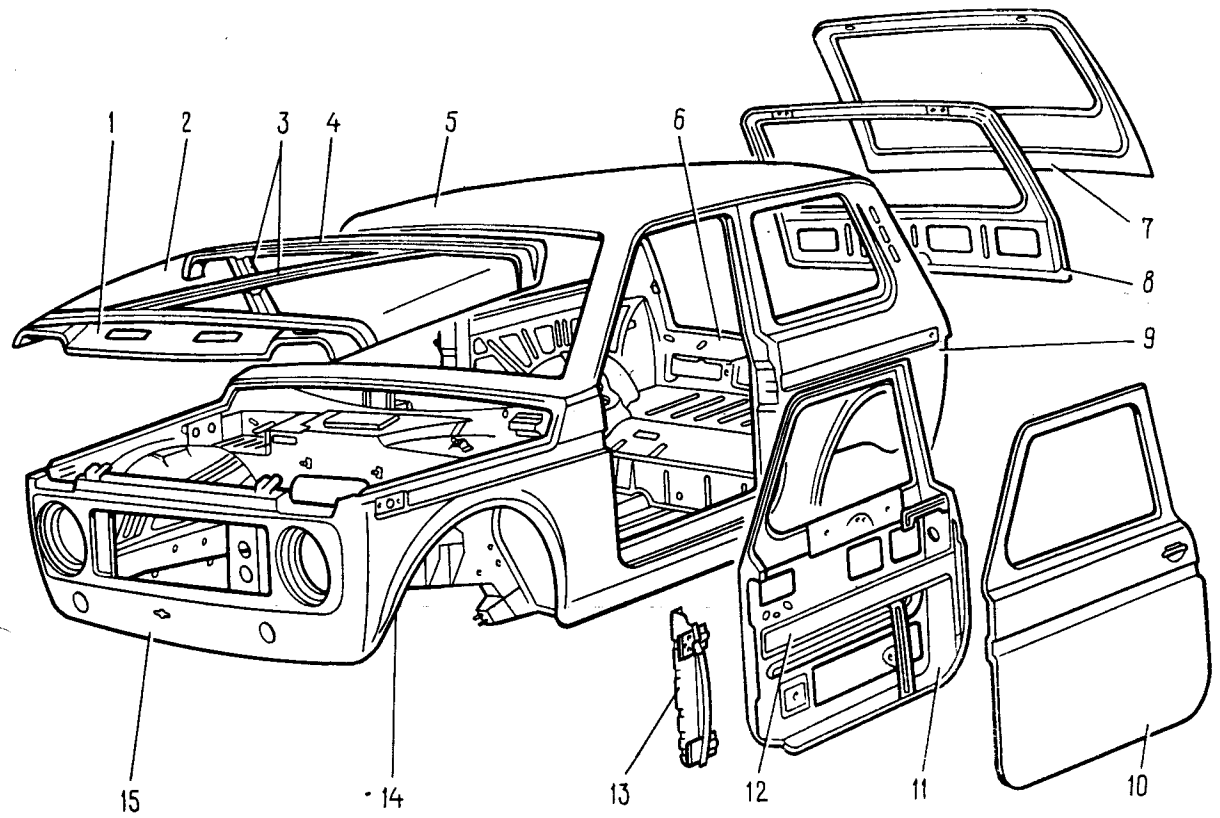


Fig. 8-1. Body:
1 - hood front reinforcement; 2 - hood panel; 3 - hood diagonal reinforcements; 4 - hood rear reinforcement; 5 - roof panel; 6 - body rear panel; 7 - tailgate outer panel; 8 - tailgate inner panel; 9 - body side; 10 - front door outer panel; 11 - front door inner panel; 12 - door rail; 13 - front door extension; 14 - front fender; 15 - radiator grille panel

Hot straightening is resorted to for contracting heavily stretched surfaces of panels. To rule out sharp bulging and deterioration of mechanical properties, the panels are heated to cherry red colour (600-650 °C).

The heated spot should not be larger than 20 mm in diameter.

Contract the surface as follows:

- heat metal with a gas burner from the periphery to the centre of the defective spot and flatten the heated surfaces with a wooden maul and hammer on a flat backing or anvil;
- repeat the heating and upsetting operations until the panel surface becomes smooth.

Surface irregularities on the panels can be smoothed out with polyester putties, thermoplastic, cold-setting epoxy cements and solders.

The polyester putties stick reliably to the panels dressed to bright metal. These are bicomponent materials: unsaturated polyester resin and a curing agent serving as a catalyst for rapid hardening of the mixture, irrespective of the thickness of the putty layer. The drying time is 15-20 minutes at 20 °C. Therefore, there is no necessity in applying several layers of putty and thus the time of its application is reduced.

Corroded surfaces of the body panels can be repaired with cold-setting epoxy cements which feature good adhesion, sufficient strength and are easy to apply to the damaged spots.

The sealing cements are composed of curing agents, plasticizers (to improve plasticity of resin and impact strength of the hardened epoxy compound), fillers (to diminish shrinkage of resin and to bring nearer the coefficients of thermal expansion of resin and metal).

Solders ПОССу-18 and ПОССу-20 are used to straighten the spots already filled with solder, to build up the edges of parts and to fill up clearances. To prevent corrosion it is better to use the acid-free method of solder application.

Heavily distorted panels should be replaced by new ones installed with the use of resistance welding and gas-shielded arc welding.

REPLACEMENT OF FRONT FENDER

If the fender is slightly damaged (shallow dents, scratches, etc.), straighten it out directly on the car and have it painted. After straightening check the condition of the inner anticorrosion coating and restore it, if necessary.

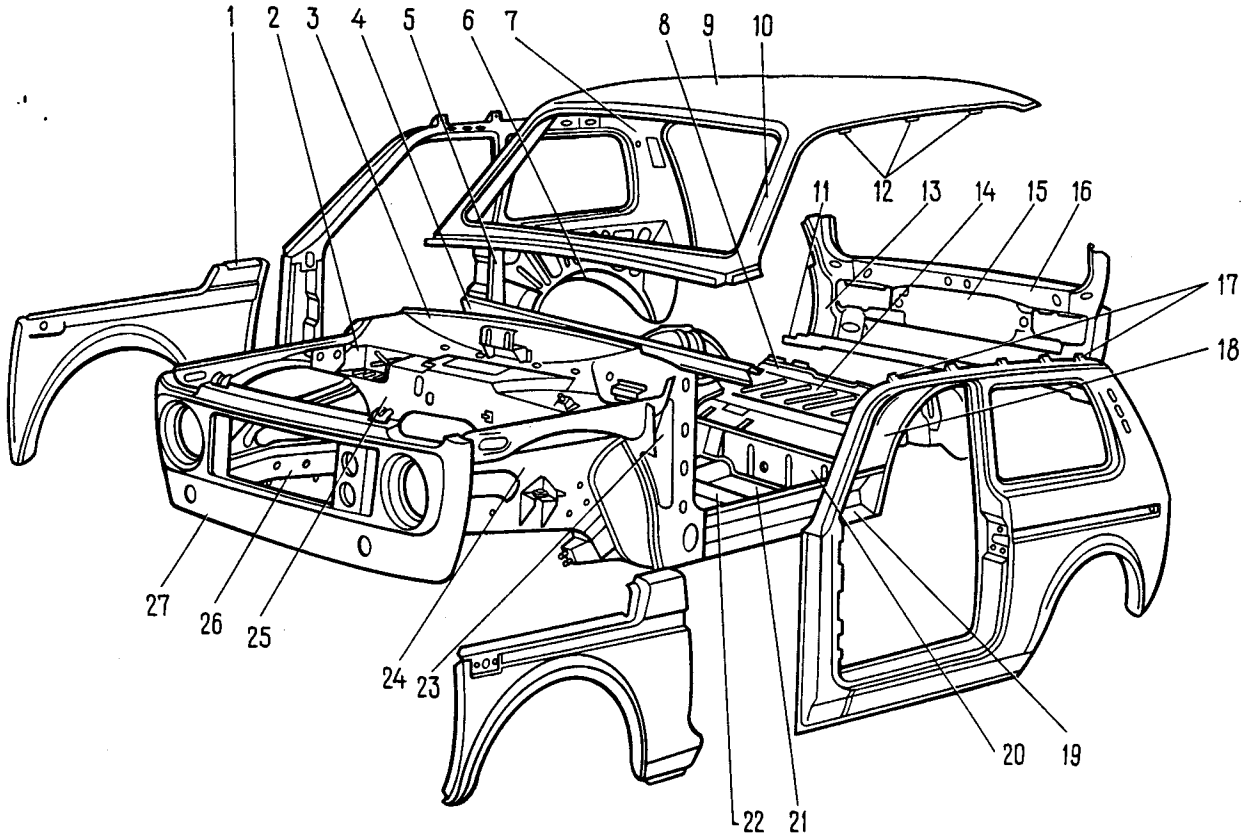


Fig. 8-2. Body Parts:
1 - front fender; 2 - storage battery pan; 3 - dash panel upper reinforcement; 4 - instrument panel crossmember; 5 -central pillar; 6 - rear wheel outer arch; 7 - body side inner panel; 8 - floor rear crossmember; 9 - roof panel; 10 - windshield frame; 11 - wheel splashguard bracket; 12 - roof reinforcements; 13 - rear pullar; 14 - floor rear panel; 15 - body rear panel; 16 - body rear upper crossmember; 17 - roof linin bow brackets; 18 - rear wheel inner arch; 19 - fl and body side connector; 20 - floor crossmember under rear seat; 21 - floor front panel; 22 - flo crossmember under front seat; 23 - body front sid panel; 24 - front fender mudguard; 25 - dash pane 26 - front sidemember; 27 - radiator grille panel

In case of serious distortions and fractures, replace the fender.

Remove the bumper, hood and front door.

Using a sharp chisel or a grinder, cut off the fender along the lines shown in Fig. 8-5.

Detach the fender, remove the remaining metal strips, straighten out the distorted edges and dress them with an electric or pneumatic grinder.

Install the front door and a new fender and fasten it with quick-fix clamps.

Gas-weld the fender at the points shown by arrows in the Figure. Use solder bars Л62, Л63 of 2-3 mm diameter as a filler material.

Install the hood and check the position of the fender. It must protrude or sink relative to the door or hood not in excess of 2 mm; the gaps between the fender and the hood and door over the face surface should not exceed (5±2) mm.

Remove the hood and the door.

Weld the fender, using resistance welding with a pitch of 40-50 mm, to the front pillar, mudguard and dash panel. It is also permissible to use gas

Fig. 8-4. Chassis Mounting Points:
0 - datum lines; 1 - steering mechanism centre; 2 - axis of brake and clutch pedals; 3 - steerin wheel shaft axis; 4 - rear suspension shock abso ber fastening points; 5 - rear wheel axis; 6 - ma muffler front pipe fastening points; 7 - main mu fler rear fastening points; 8 - radiator lower fastening points; 9 - radiator upper fastening points; 10 - front suspension crossmember fasten ing points; 11 - differential centre; 12 - wheel centre; 13 - sway eliminator fastening points; 14 - engine unit rear mount fastening points; 15 - transfer case fastening points; 16 - hand brake fastening points; 17 - longitudinal radius rods front fastening points; 18 - longitudinal radius rods rear fastening points; 19 - rear sho absorbers fastening points; 20 - transverse radi rod fastening points; 21 - main muffler front fa tening points; 22 - main muffler tail pipe faste ing points;

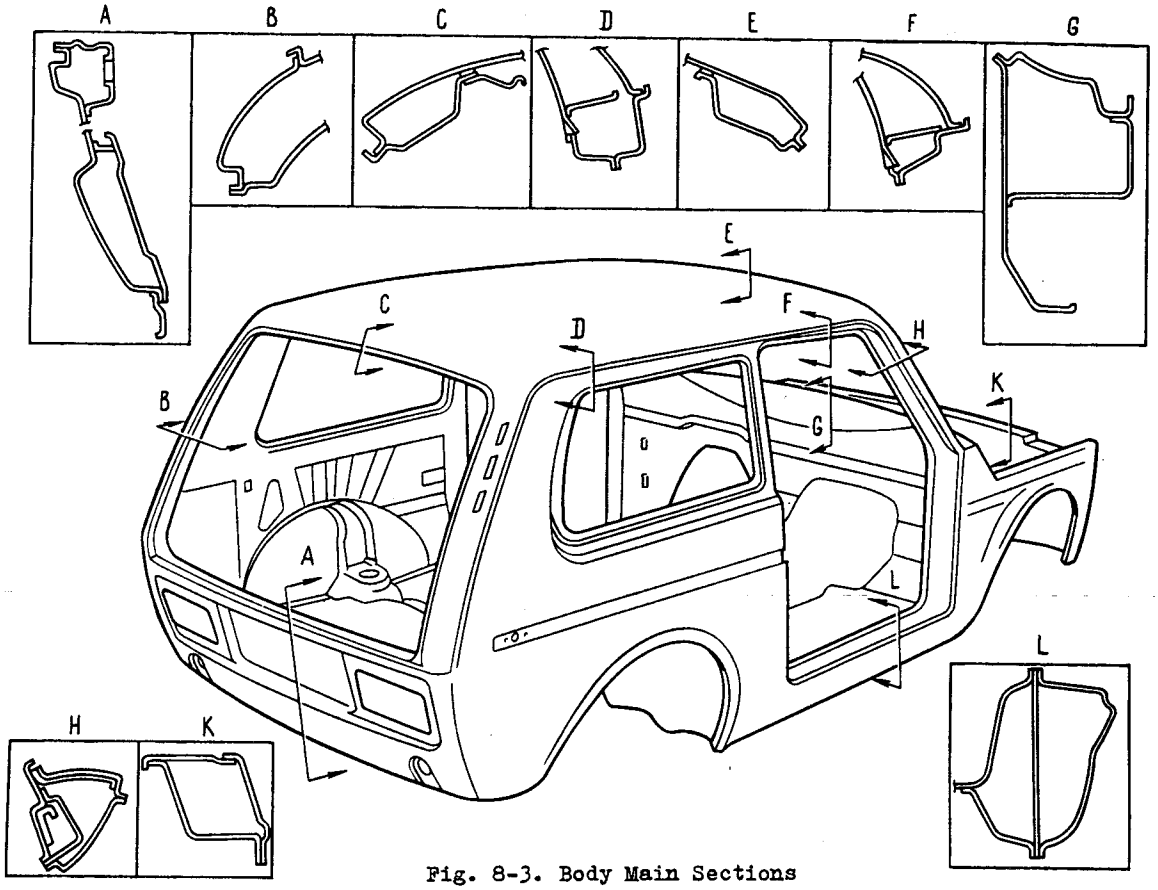
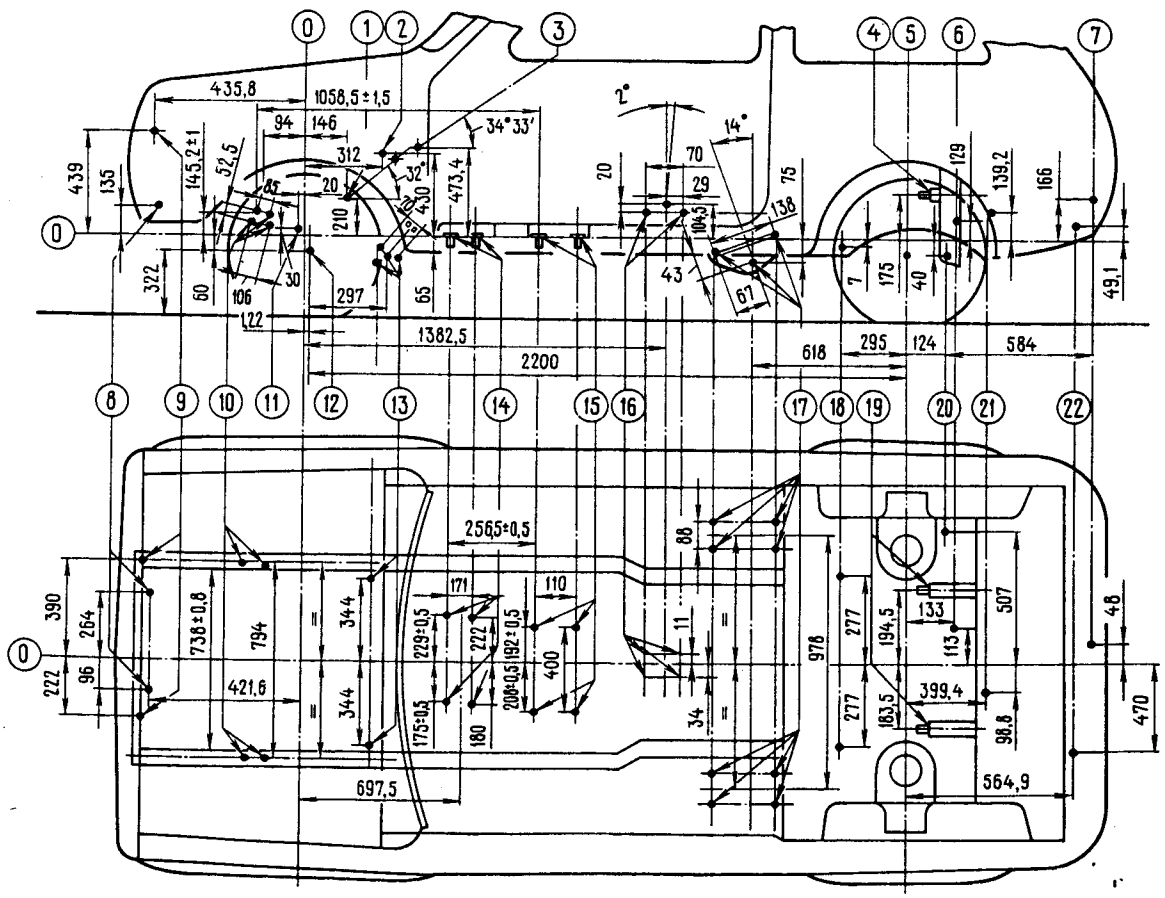


Fig. 8-3. Body Main Sections



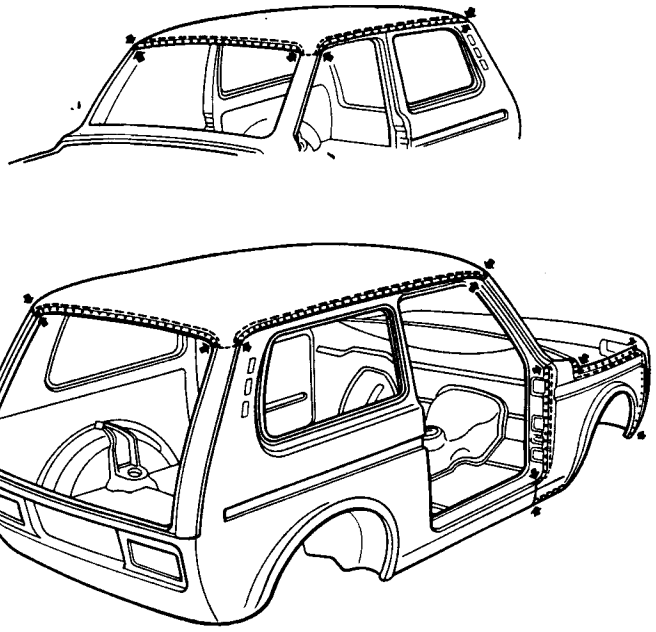


Fig. 8-5. Front Fender and Roof Panel Welding Lines. Dots show resistance welding seams. Arrows show gas-tacking points

welding with brass solder or carbon-dioxide shielded arc welding with intermittent 10 mm welds applied every 50-60 mm. Weld the fender with semiautomatic arc welders using welding wire СВ.08 ГІС or СВ.08 Г2С, 0.8 mm in diameter.

Gas-weld the fender to the body front panel with intermittent welds by flashing off the edges.

REPLACEMENT OF ROOF

As a rule the roof of a crashed car has to be replaced.

Remove the tailgate, drip channel mouldings, windshield, roof lining and accessories.

Place a new roof panel on the body and determine the points where the pillars and roof side panels have to be cut.

Cut off the roof panel along the lines shown in Fig. 8-5.

Detach the roof panel, remove the remaining panel strips and straighten the distorted surfaces.

Remove the paint and prime-coat to bring metal on the edges of the roof panel, windshield frame, body side panels, roof side panels and reinforcements to be welded.

Replace gaskets on the roof reinforcements.

Install the roof panel, fasten it with quick-fix clamps and gas-tack the panel at points shown by arrows in Fig. 8-5.

Weld the roof panel by resistance welding at a pitch of 40-50 mm or by gas welding at points spaced 50-60 mm through the previously drilled holes of 5-6 mm diameter. To rule out distortion of parts, work from the middle of the weld to the right and left.

Dress the welds with an electric or pneumatic grinder.

BODY PAINT COATING

POLISHING

To preserve the paint coating of the body and provide its attractive appearance for a long period use the polishing compounds which suit the condition of the paint coating and strictly follow the instructions for their use.

During the first 2 - 3 months of service wash the body with cold water. To treat a new coating (of a car up to 3 years in service) use non-abrasive polishes recommended for new coatings.

In the period of 3 to 5 years of service use autopolishes for weather-beaten coatings containing a little amount of abrasives; after 5 years of intensive service use autopolishes for old coatings.

To prevent drying of the polish on the coating, apply it to small areas of the body and polish with a piece of clean flannel cloth by hand.

To eliminate minor defects of the paint coating use polishing pastes ВАЗ-1, ВАЗ-2 and a polishing compound ВАЗ-03. Polishing can be done manually or mechanically, using flannel-cloth or beaver-lamb wheels.

Take care to mix the polishing paste before the application; if it becomes thick, dilute it with water. After polishing wipe the surfaces with clean flannel cloth.

REPAINTING WITH SYNTHETIC ENAMELS

Wash the body with water and remove the old flaking paint from the defective surfaces with a putty knife or a brush.

Wet-rub the surfaces to be painted using grinding cloth 55С 4-П. If the coating is thin and bears no mechanical defects dress the surface to the epoxy primer layer applied at the autoplant. If the surfaces are seriously corroded or the body has previously been painted with nitrocellulose enamel, dress it down to bare metal.

Wash the body with water, airblast it and leave to dry.

Degrease the surfaces to be painted with white spirit or БР-1 gasoline-solvent and apply "plastisol (пластизоль) Д-4 А" sealant to the welds and joints. Remove surplus sealant with rags soaked in white spirit.

The surfaces not to be painted should be masked with thick paper and adhesive tape.

Using a spray gun apply primer ГФ-073 to the surfaces dressed down to bright metal and let it dry for 5 min.

The viscosity of the primer should be 22-24 s at 20 °C, as read by viscometer ВЗ-4. Dilute the primer with xylene.

Using a paint spray gun apply epoxy primer ЭФ-083 to the surfaces coated with primer ГФ-073 and to the replaced body parts and dry them at 90 °C for 60 minutes. Before applying primer ЭФ-083, mix it with 5-7 % of drier НФ-1 (by weight). The primer with catalyst is fit for use in the course of 7 h. The primer viscosity should be 23-25 s at 20 °C, as read by viscometer ВЗ-4. The primer can be diluted with solvent РЭ-11В or xylene.

Cool down the body, wet-rub it with abrasive c а 55С 4-П, wash with water, airblast and leave to dry.

Fill, if necessary, the rough surfaces with putty МС-00-6, applying a layer not thicker than 0.3 mm. If the putty is found to be thickened, dilute it with xylene to the required condition.

Dry the body for 30 min at 18-20 °C. Flatten the surface again with emery cloth 55С 4-П, wash the body, airblast it and leave to dry.

Mask the not-to-be painted surfaces of the body with thick paper and adhesive tape and place it into the painting chamber.

Degrease the surfaces to be painted with white spirit.

Open the doors, hood and trunk lid and apply two layers of enamel МЛ-197 from a spray gun, to the internal painted surfaces of the car interior, door shuts, door edges, engine compartment and trunk, making an interval of 7-10 minutes between successive applications.

Apply three layers of МЛ-197 enamel to the external surfaces of the body, making 7-10 minute intervals between successive applications.

Dry the paint coating at 90 °C in the course of 60 min and cool it down under natural conditions.

Before using the enamel mix it with 4-5 % of catalyst ДГУ-70 or 10 % solution of maleic anhydride in cellulose acetate. The enamel viscosity should be 20 s as read by viscometer ВЗ-4. Dilute the enamel with solvent Р-197 followed by filtering it through screen No.015К.

If the old paint should be removed, use paint remover СП-7. Apply the remover with a brush 2-3 times depending on the thickness of the old paint and primer. The cold coating will soften in 30-40 min after which it can be scraped off with a brush or a putty knife.

Wipe the surface with white spirit to take off the remaining paint remover, wash with water abundantly and dry the body.

PAINTING OF SEPARATE PARTS

After the replacement of separate parts (fender, door, hood, etc.), as well as after straightening the distorted parts, paint the part in question over the entire external surface.

Before painting the newly installed parts, coat them all over with epoxy primer ЭФ-083.

The preparation for painting and for the application of enamel paint should go along the same lines as when repainting the car body.

ANTICORROSIVE TREATMENT OF BODY

The elements most likely to be attacked by corrosion include the load-bearing hollow spaces of the body, bottom, lower parts of the doors and pillars, as well as the joints of body parts including the spot-welded seams.

Corrosion is apt to spread intensively in the boxed spaces and lower parts of the body when they get in contact with moisture, dirt, salts and acids.

This calls for an additional protection of the internal surfaces and boxed spaces of the body by applying special anticorrosive compounds and by filling the joints with sealants.

The materials used for anticorrosive treatment are given in Table 8-1.

The autopreservative Movil is recommended for treating the boxed spaces. A good practice is to treat them every 1 - 1.5 years. This autopreservative may be used for application to the surfaces previously coated with nigrol and other oils and to the rusty surfaces. The required amount of Movil is 3 kg per car.

The protective lubricant НГМ-МЛ is used for treating the boxed spaces. All new cars are treated with this lubricant.

The protective film coating НГ-216Б is applied to the car parts under the body.

The soundproofing bituminous sealant БПМ-1 is used for anticorrosive protection of the body underside and for reducing the noise caused by vibration. The sealant is applied by spraying or by hand in a layer 1.5-2 mm thick.

Plastisol Д-11А protects the body underside against corrosion, abrasive wear and ensures soundproofing. The thickness of coating is 1 - 1.5 mm. At room temperature the best adhesion is achieved to primers ЭФ-083, ФЛ-093 and ВКЧ-0207.

Plastisol Д-4А is used for sealing the welded joints on the external zones of the body.

Table 8-1

Materials for Anticorrosive Treatment of Car Body

Name	Grade	Viscosity, at 20 °C, read by viscometer VZ-4, s	Name of thinner or solvent	Drying conditions	
				temperature, °C	time, min
1. Sill preservative	Movil	15-40	White spirit, gasoline	20	20-30
2. Non-drying protective lubricant	НГМ-МЛ	45	White spirit	20	15
3. Protective film coating	НГ-216Б	18-22	White spirit, gasoline	20	20
4. Soundproofing sealant	БПМ-1	High-viscosity	Xylene, solvent	100-110 (or 24 h at 18-20 °C)	30
5. PVC plastic material	Plastisol Д-11А	Ditto	-	130	30
6. PVC plastic material	Д-4А	Ditto	-	130	30
7. Non-drying sealant	51-Г-7	Ditto	-	-	-

The non-drying sealant 51-Г-7 seals the body joints.

The internal spaces are coated with anticorrosive materials by air or airless spraying.

Air spraying with compressed air at a pressure of 0.3 - 0.4 MPa is carried out with a spray gun and a reservoir, hoses and spray gun extension nozzles. The best coating is achieved by airless spraying under a pressure up to 16 MPa which makes it possible to spray highly viscous materials.

PREPARATION AND ANTICORROSIVE TREATMENT OF BOXED SPACES

Inasmuch as treatment of boxed spaces calls for the use of sophisticated technological equipment and for high quality of work, this treatment should be performed only at service stations.

The procedure is as follows:

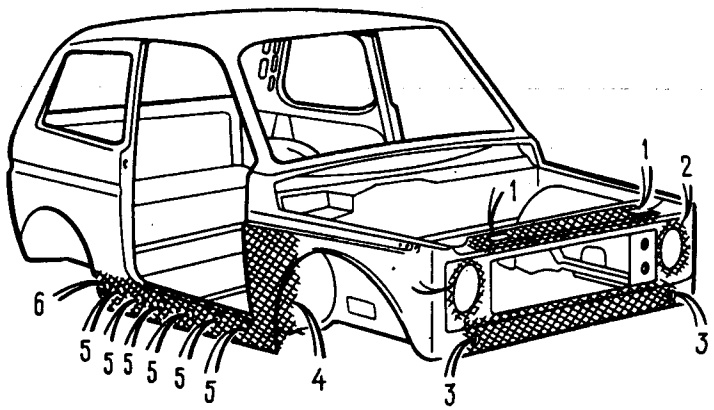


Fig. 8-6. Boxed Spaces (Body Front View):
1 - body front upper crossmember; 2 - headlight housings; 3 - body front lower crossmember; 4 - under front fender; 5 - outer sill; 6 - inner sill

1. Place the car on a lift, remove the parts and upholstery that interfere with access to the boxed spaces.

2. Wash the boxed spaces (Table 8-2), body underside and wheel arches with water at 40-50 °C through auxiliary and drain holes until the water flowing out becomes clean. The vent glasses should be closed and drop windows lifted up all the way.

3. Remove any moisture that could have penetrated into the body and trunk, airblast all the boxed spaces and the surfaces to which the anticorrosive compounds will be applied.

4. Drive the car to the anticorrosion-treatment chamber and put it on a lift. Spray the anticorrosive compound onto the surfaces shown in Figs 8-6, 8-7 and 8-8. The treatment should be performed at a temperature not below 15 °C.

5. Lower the car from the lift and clean the external surfaces of the body with rags soaked in white spirit.

RESTORATION OF ANTICORROSIVE AND SOUNDPROOFING COATINGS OF BODY UNDERSIDE AND WHEEL ARCHES

In the course of service, the coatings on the body bottom suffer from gravel, sand, salt and moisture. As a result the sealant and primer are damaged and abraded. The bare metal is attacked by corrosion.

With a view to soundproofing and anticorrosive treatment, the lower part of the body base and sidemembers are protected at the autoplant with a layer of PVC plastic Plastisol Д-11А, 1 - 1.5 mm thick, on top of epoxy primer ЭФ-083.

If the bottom coating is damaged but the layer of primer remains intact, clean the damaged surfaces of dirt, degrease them with waste cloth wetted with white spirit and apply a 1.5 mm layer

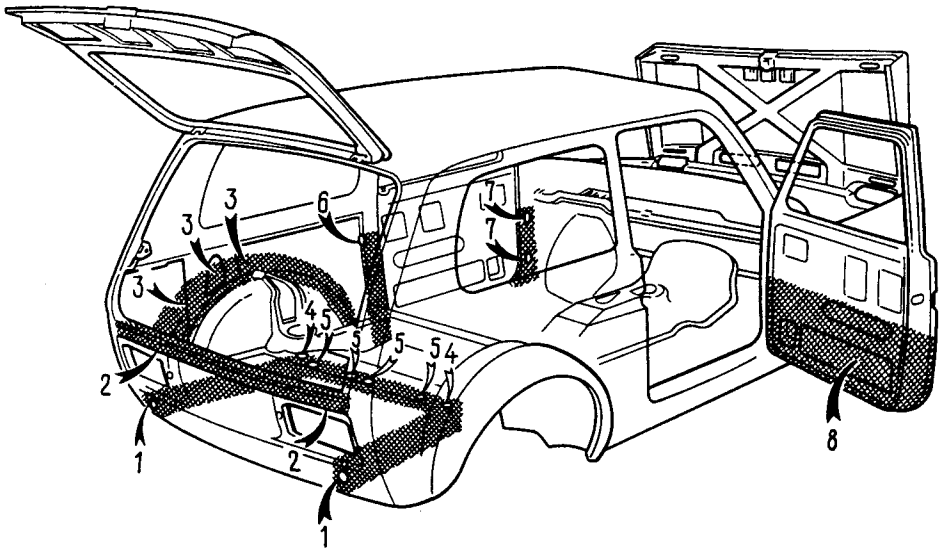


Fig. 8-7. Boxed Spaces (Body Rear View):
1 - rear sidemembers; 2 - rear upper crossmember (in slot with tail lights removed); 3 - between rear wheel arches and body sides; 4 - rear sidemembers; 5 - rear floor crossmember; 6 - door rear pillars; 7 - door front pillars; 8 - door pocket

Table 8-2

Boxed Spaces Treated with Anticorrosive Compounds

	Name of space	Where injected	Direction of injection	Additional instructions
1.	Body front upper crossmember	Through two upper holes	Right and left	Open engine hood
2.	Headlight housings	In front (from outside)	All over	Remove headlights
3.	Body front lower crossmember	Through two holes for installation of bumper	Right and left	Remove front bumper
4.	Under front fenders	Through opening closed with shield	All over	Remove sealing shield
5.	Door outer sills	Through six side holes	Forward and back	Remove mouldings and fasteners
6.	Door inner sills	Through rear hole in sill end	Along sill	
7.	Front sidemembers	Through bumper installation holes	Along sidemember	Remove front bumper
8.	Front sidemember connectors	Through holes on body underside	Right and left	Put car on lift
9.	Middle and rear sidemembers	Through seven holes in body underside	Forward and back	Put car on lift
10.	Middle sidemember connectors	Through holes in body underside	Right and left	Put car on lift
11.	Rear floor crossmember	Through holes in trunk and body underside	Right and left	Remove trunk lining
12.	Body rear lower crossmember	Through two holes in body underside	Right and left	Put car on lift
13.	Body rear upper crossmember	Through openings under tail lights	Right and upward, left	Remove tail lights
14.	Between rear wheel arches and body sides	Into openings in trunk	All over	Remove trunk lining
15.	Door rear pillars	Through hole behind pillar	Downward	Remove lining
16.	Door front pillars	Through two holes from interior side	Downward	Remove lining
17.	Door pockets	Through openings in door inner panel	All over internal surface	Remove door trim panels

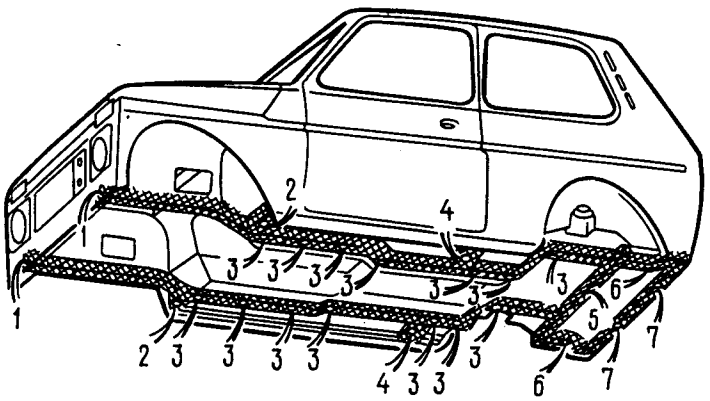


Fig. 8-8. Boxed Spaces (Body Bottom View):
1 - front sidemembers; 2 - front sidemember connectors; 3 - middle sidemembers; 4 - middle sidemember connectors; 5 - rear floor crossmembers; 6 - rear sidemembers; 7 - body rear lower crossmember

of sealant БПМ-1 to the dry surface. Let the coating dry under natural conditions for 24 h, or dry it for 30 min at 90 °C.

If the coating layer and even the primer are damaged, clean the affected spots from dirt and rust to metal, degrease them, let dry and apply ГФ-073 primer to the surface with subsequent application of sealant БПМ-1 to the prime-coated surfaces. Use a brush for this purpose.

If the car has been operated for a period not exceeding 1.5 years see to it that the new layer of the sealant overlaps the old one to a minimum. After a longer service apply the sealant all over the bottom and wheel arches.

Clean the paint coating of the body from sealant stains with waste cloth wetted with white spirit.

In cold season keep the sealant before application in a warm room at a temperature not below 20 °C. If the sealant gets thick, dilute it with up to 3 % of xylene.

Clean the paint coating of the body from stains of sealant with waste cloth wetted with white spirit. Dry the sealant at a temperature of 100 - 110 °C for 30 min or for not less than 24 h at 18 - 20 °C.

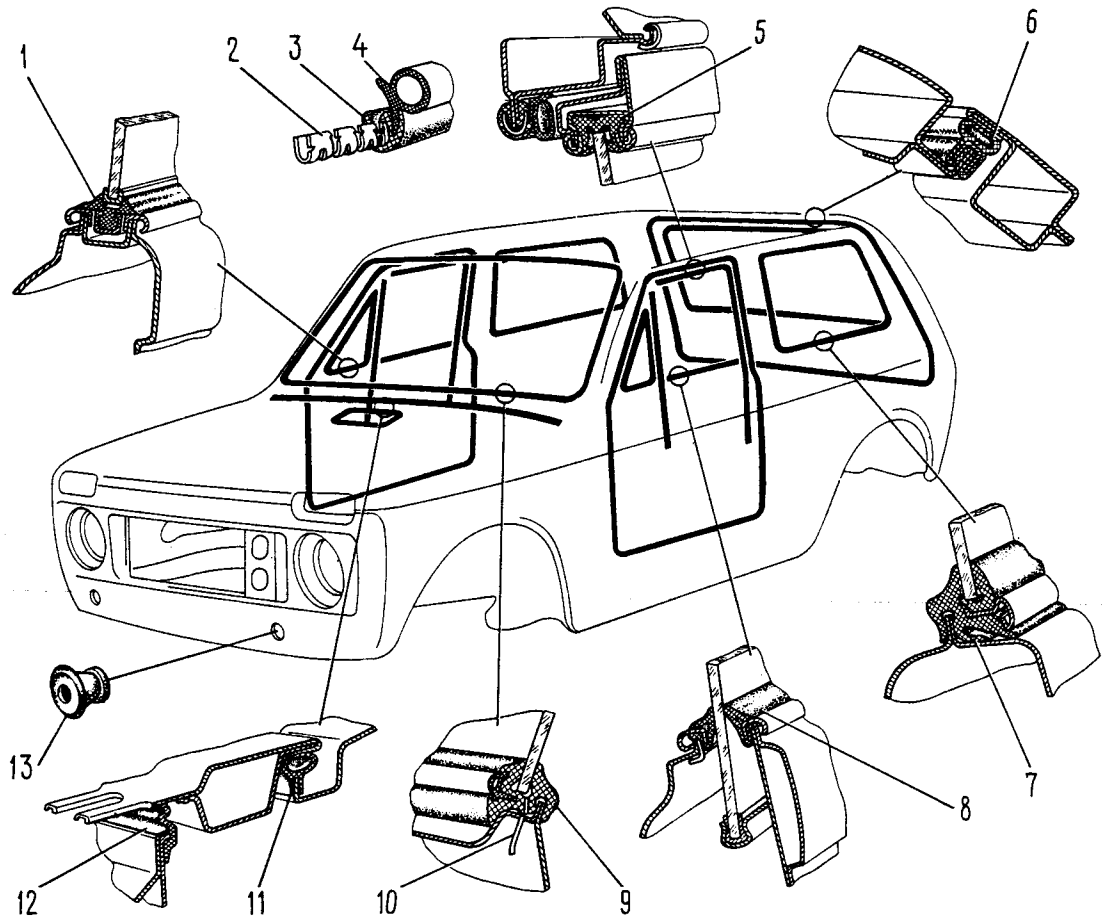


Fig. 8-9. Rubber Sealing Strips:
1 - vent window glass; 2 - front door sealing strip reinforcement; 3 - sealing strip edging; 4 - front door shut sealing strip; 5 - drop window glass sealing strip; 6 - tailgate shut sealing strip; 7 - side window sealing strip; 8 - drop window glass lower sealing strip; 9 - windshield sealing strip; 10 - drain pipe; 11 - hood sealing strip; 12 - air intake box sealing strip; 13 - front bumper connector bushes

SEALING OF BODY WITH RUBBER SEALING STRIPS AND SEALANTS

The body is sealed by various sealing strips (Fig. 8-9), sealing compounds, rubber plugs installed in auxiliary holes, and by carefully fitting the mating parts.

When removing and installing the sealing strips, avoid crushing their metal reinforcements and corrugating the strips.

The resistance spot welds joining the stamped parts of the body fail to provide a tight joint. They are subjected to heavy corrosion, particularly at the bends of sheets with small rounding radiuses and at overstrained points.

The welded seams are protected at the Autoplant against ingress of moisture and dirt with Plastisol Д-4А.

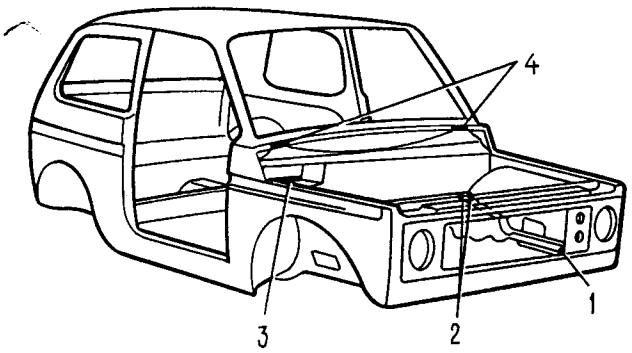


Fig. 8-10. Points of 51-Г-7 Sealant Application (Front View of Body):
1 - front sidemember-to-radiator frame joint;
2 - front sidemember to dash panel joints;
3 - storage battery pan to dash panel joint (at body interior side); 4 - dash panel to body front strip joints (under the hood)

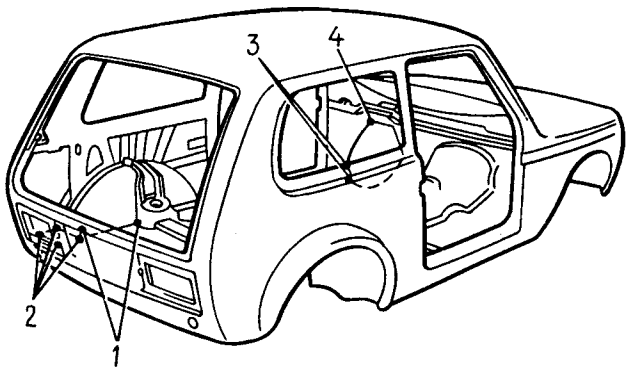


Fig. 8-11. Points of 51-Г-7 Sealant Application (Rear View of Body):
1 - rear floor to rear wheel arch joints; 2 - slots in corner joints of rear floor extensions with rear wheel arches, body sides and body rear panel;
3 - corner joints of dash panel with floor sill;
4 - dash panel corner with body side front pillar panel

When replacing body parts, after welding and prime-coating operations, coat the welds on both sides with Plastisol Д-4А and apply the non-drying sealant 51-Г-7 (Figs 8-10, 8-11) at the corners, between the following parts:

- door sills and the dash panel (at the body interior side);
- dash panel and the front pillar panel and the storage battery pan;
- front sidemember joints with radiator frame and dash panel;
- dash panel joints with body front cover plate;
- rear floor and its extensions with rear wheel arches, body sides and rear panel.

DOORS

REMOVAL AND INSTALLATION OF FRONT DOOR

Open the door all the way and detach the door check, driving out the pin which fastens the check to the body front pillar.

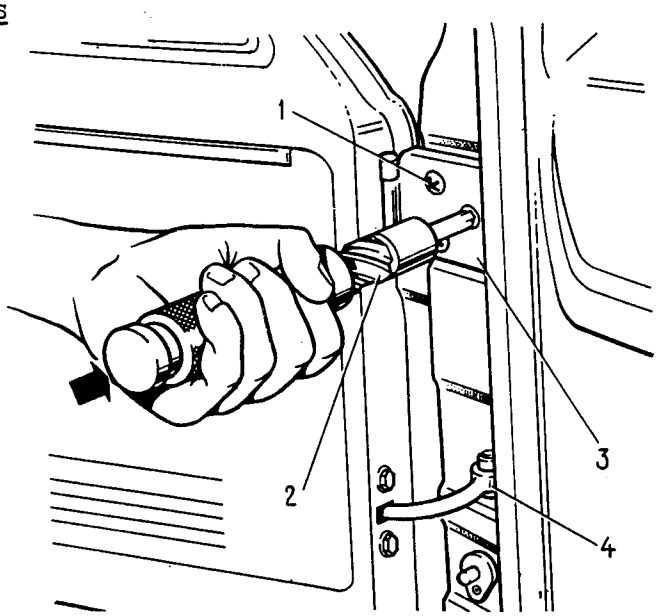


Fig. 8-12. Removing Front Door:
1 - hinge screw; 2 - impact screwdriver; 3 - hinge;
4 - door check. Arrow shows direction of blow

Holding the door open and using impact screwdriver 2 (Fig. 8-12) turn out screws 1 which fasten the door hinges to the body pillar and remove the door.

To install the door, reverse the removal operations.

Before final tightening of the screws, adjust the gaps between the door and the car body.

DISASSEMBLY AND ASSEMBLY OF FRONT DOOR

Disassemble the door, if some of its parts and mechanisms have to be repaired or replaced.

Turn off the armrest screws, first taking off plastic decorative plug 2 (Fig. 8-13) of the upper screw and remove the armrest.

Force off excutcheon 20 (Fig. 8-14), take out circlip 1 with A.78034 remover tool 2 and take off window regulator handle 22. Take off the facing of the inner lock handle with a screwdriver.

Override the resistance of the plastic spring holders (shown by arrows in Fig. 8-13) and remove the door trim panels.

Lift the drop window glass, turn out the fastening screws and remove the front and rear glass guide runs.

Lower the glass, loosen the nut of the window regulator tension roller, disconnect the cable from the drop-window glass channel, slip the cable off the rollers and take out the glass through the lower opening of the door. Unscrew the nuts and remove the window regulator mechanism.

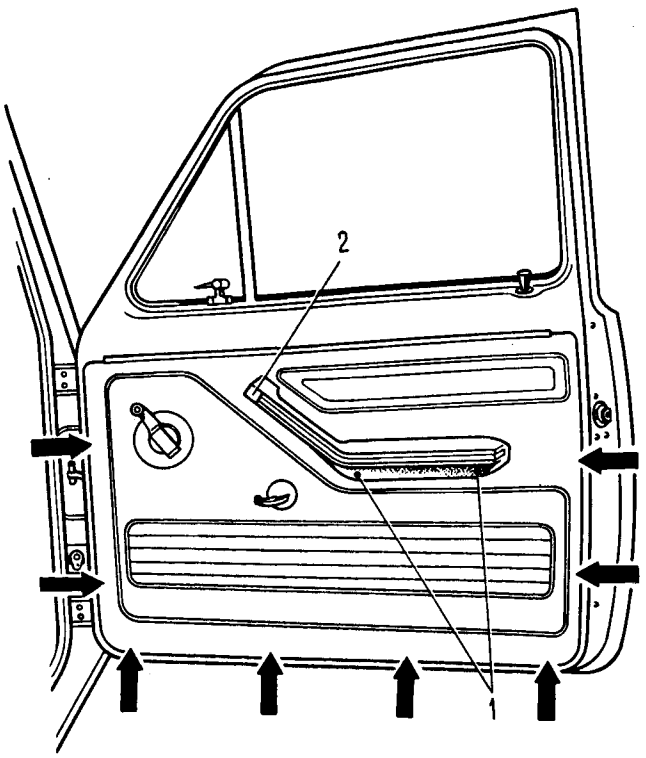


Fig. 8-13. Front Door. Inside View:
1 - armrest lower screws; 2 - armrest upper screw plug. Arrows show location of door trim panel holders

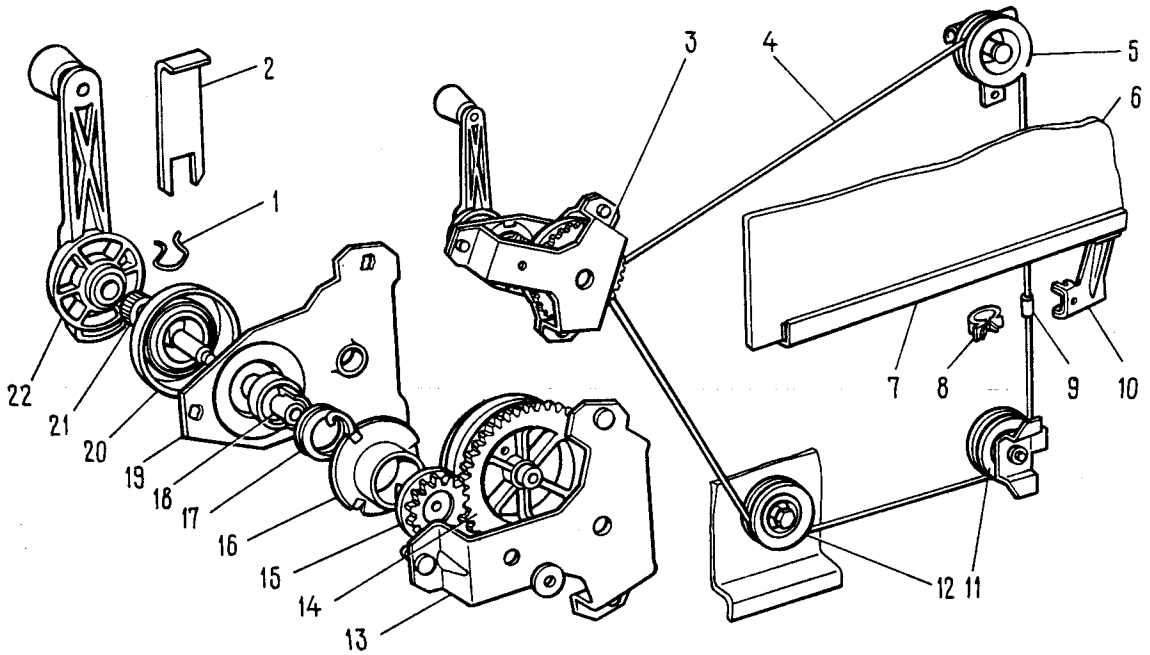


Fig. 8-14. Drop Window Regulator:
1 - circlip; 2 - circlip remover tool A.78034; 3 - regulator mechanism; 4 - cable; 5 - upper roller; 6 - drop window glass; 7 - drop window glass channel; 8 - cable holder; 9 - cable coupling; 10 - glass channel bracket; 11 - lower roller; 12 - tension roller; 13 - regulator mechanism body; 14 - drum with driven gear; 15 - drive gear; 16 - drive shaft support; 17 - brake spring; 18 - spring brake carrier; 19 - body cover; 20 - escutcheon; 21 - drive shaft; 22 - regulator handle

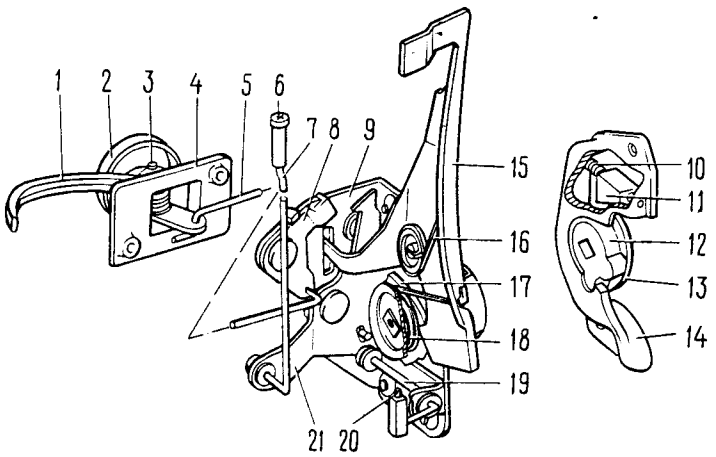


Fig. 8-15. L.H. Front Door Lock:
1 - lock inner handle; 2 - inner handle facing; 3 - axle; 4 - inner handle bracket; 5 - inner handle rod; 6 - door lock button; 7 - door lock b n rod; 8 - inner lock release lever; 9 - lock body; 10 - block spring; 11 - striker plate block; 12 - rotor; 13 - central shaft support; 14 - striker plate body; 15 - outer lock release lever; 16 - outer lock release lever spring; 17 - ratchet; 18 - ratchet spring; 19 - lock release shaft; 20 - lock release link; 21 - door lock lever

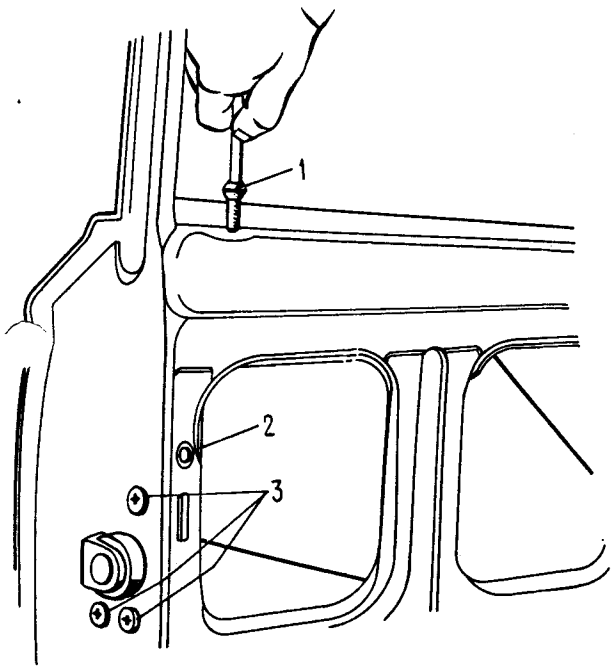


Fig. 8-16. Front Door Lock Fastenings:
1 - door lock button; 2 - lock button rod; 3 - lock fastening screws

Remove the drop-window glass sealing strip and the vent glass assembly by turning off its screws.

Unscrew door lock button 6 (Fig. 8-15), turn out the screws of bracket 4 of lock inner handle 1, turn out screws 3 (Fig. 8-16) of the lock body and take off the lock complete with the links, first

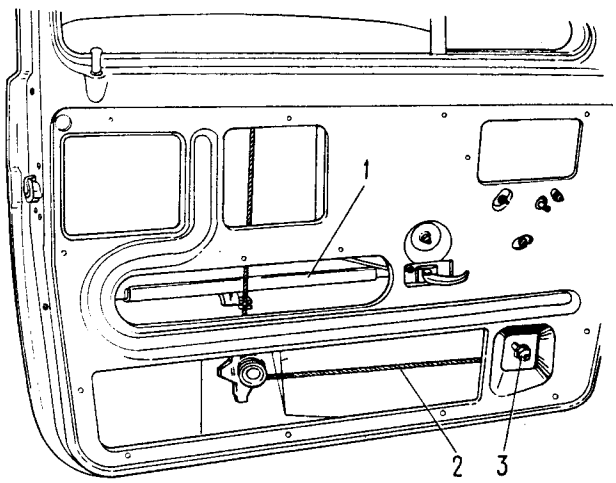


Fig. 8-17. Adjusting Window Regulator Cable Tension:
1 - drop window glass channel; 2 - cable; 3 - tension roller bolt nut

disconnecting link 20 (Fig. 8-15) from the lock release carrier.

Unscrew two nuts and remove the outer handle of the door.

Remove two fastening bolts and take off the door check.

Assemble the front doors in the reverse sequence of disassembly operations.

When installing the window regulator, see that the cable coils are not laid one on another on the drum. Adjust the tension of cable 2 (Fig. 8-17) and smooth functioning of the window regulator by shifting the tension roller; for this purpose loosen nut 3.

Before installing the door trim panels examine the plastic holders.

ADJUSTMENT OF FRONT DOOR POSITION

Before adjustment mark out the contours of the hinges on the body pillar. Using impact screwdriver 2 (Fig. 8-12) loosen hinge screws 1.

Set the required external clearances by displacing the hinges relative to the marked-out contour and turn in the screws.

ADJUSTMENT OF DOOR LOCKS

To ensure trouble-free operation of the door lock adjust the position of striker plate body 14 (Fig. 8-15) first loosening its fastening bolts.

Before adjustment it is practicable to mark out the outline of the striker plate on the body pillar.

If the door closes too tightly, shift the striker plate outward and tighten the bolts.

If the door closes loosely, shift the thrust block inward.

If the door sags after closing, move the striker plate upward; if it rises after closing (sagging when open), shift the striker plate down.

If it is difficult to open the door by inner handle 1, adjust the handle position. For this purpose loosen the fastening screws and shift the handle with the bracket as required.

Tighten the fastening screws after adjustment.

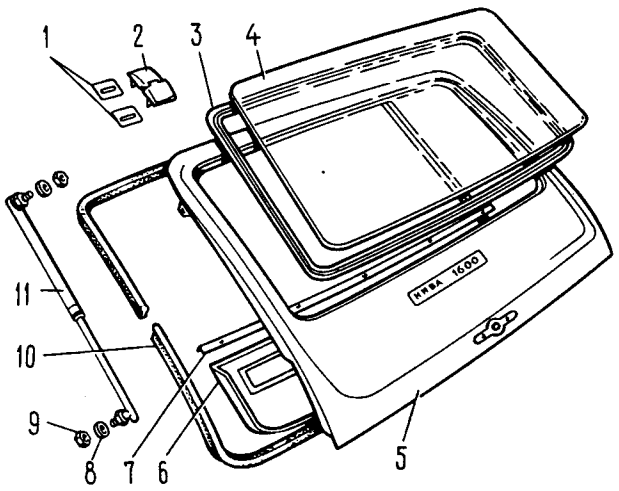


Fig. 8-18. Tailgate with Prop:
1 - gasket; 2 - hinge; 3 - glass sealing strip; 4 - glass; 5 - door; 6 - door trim panel; 7 - strip; 8 - washer; 9 - prop nut; 10 - body shut sealing strip; 11 - tailgate gas-filled hydraulic prop

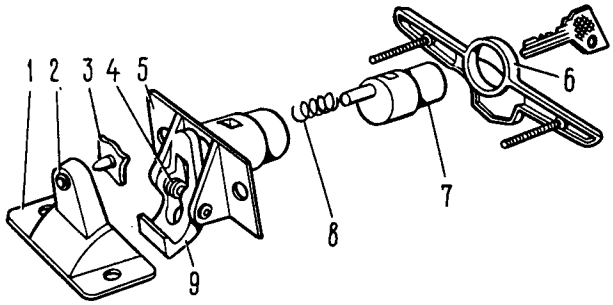


Fig. 8-19. Tailgate Lock:
1 - striker plate; 2 - striker plate socket; 3 - lock tenon; 4 - hook spring; 5 - lock body; 6 - tailgate lock handle; 7 - button; 8 - button spring; 9 - hook

REMOVAL, INSTALLATION AND ADJUSTMENT OF TAILGATE

The tailgate is mounted on the body on two hinges 2 (Fig. 8-18) and closed by a lock. When open, it is held by two gas-filled hydraulic props 11 which are not subject to disassembly.

Detach the props from the tailgate, unscrew the door-to-hinge nuts and remove the tailgate.

When installing, adjust the position of the tailgate in the body shut with the aid of the oval holes for the hinge studs, then tighten the nuts home.

If the tailgate lock closes with difficulty, adjust it by shifting its body 5 (Fig. 8-19) or striker plate 1 as required.

Replace the gas-filled props by new ones, if they fail to hold the door open.

HOOD, BUMPERS

Removal, Installation and Adjustment of Position of Hood

Open hood 3 (Fig. 8-20), uncotter axle 1 of prop 2 and detach the latter from the hood.

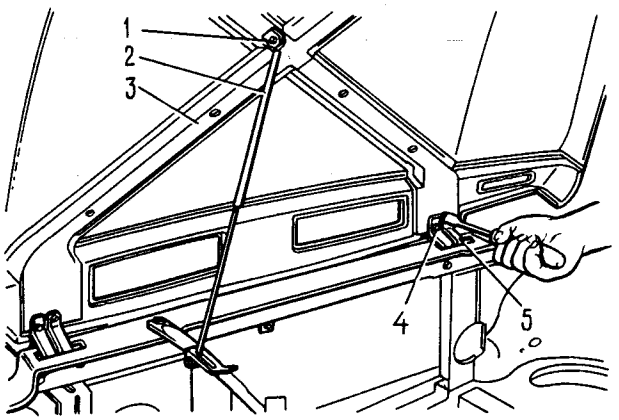


Fig. 8-20. Removing Hood:
1 - prop axle; 2 - prop; 3 - hood; 4 - hood bolt; 5 - hinge

Supporting the hood, unscrew bolts 4 of the upper plates of hinges 5 and take off the hood.

Install the hood in the reverse order of operations.

Adjust the position of the hood by the use of enlarged holes in the hinges.

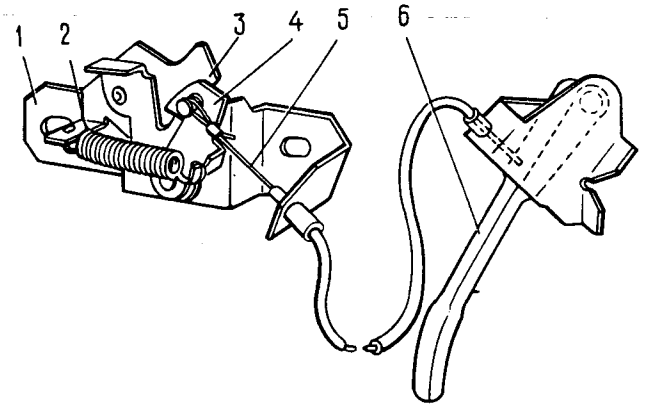


Fig. 8-21. Hood Lock:
1 - lock body; 2 - spring; 3 - pusher; 4 - hook; 5 - control cable; 6 - control handle

ADJUSTMENT OF HOOD LOCK

If the lock is not reliable in closing the hood or opens with difficulty, adjust its position (Fig. 8-21).

Open the hood, mark out the contours of lock body 1, loosen the fastening nuts and shift the lock body in the required direction, using the enlarged holes.

Tighten the fastening nuts and check functioning of the lock.

REMOVAL AND INSTALLATION OF BUMPERS

The bumpers are made of aluminium shapes whose face wall is provided throughout the length of the bumper with black rubber strip 9 (Fig. 8-22) and the ends of the bumpers are fitted with black plastic side covers 6.

Each bumper is held to the body by two bolts; to remove the bumper, these bolts must be unscrewed.

Install the bumpers in the reverse order of operations.

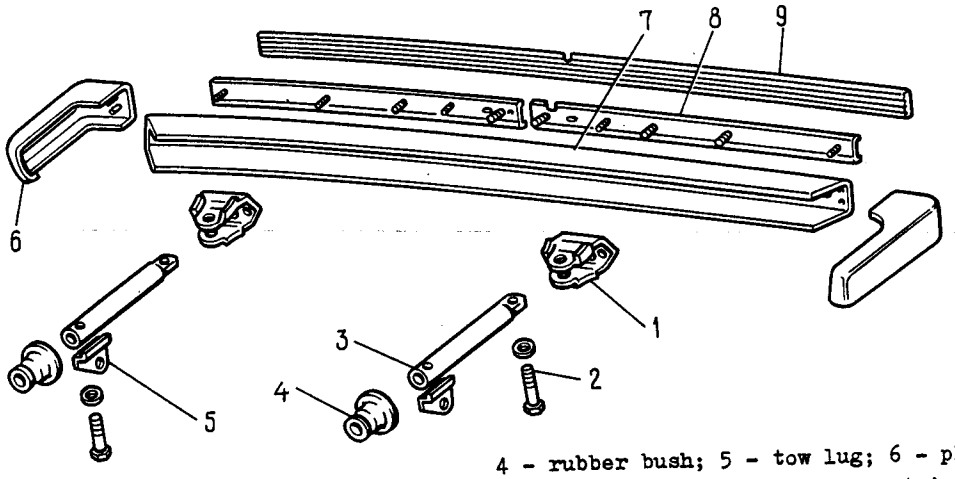


Fig. 8-22. Front Bumper Assembly:
1 - bracket; 2 - fastening bolt; 3 - connector; 4 - rubber bush; 5 - tow lug; 6 - plastic side cover; 7 - bumper; 8 - rubber strip holder; 9 - rubber strip

WINDOW GLASSES, WINDSHIELD AND HEADLIGHT WASHERS

REPLACEMENT OF WINDSHIELD GLASS

To take out the damaged glass, remove the wiper arms, sealing strip edging and, pressing on upper corners of the glass, push it outward. An assistant should support the glass from the outside (Fig. 8-23).

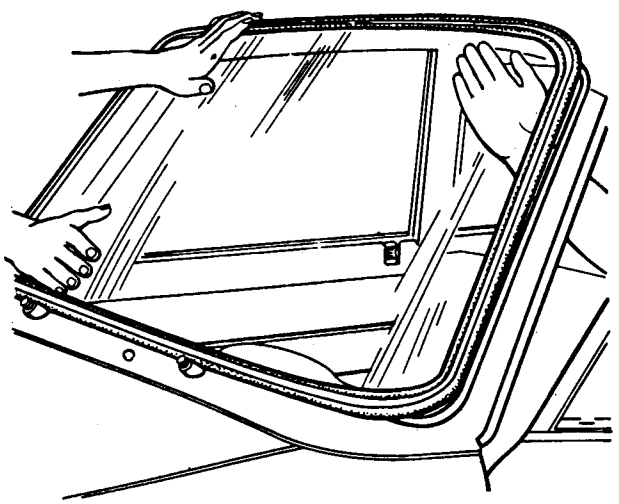


Fig. 8-23. Removing Windshield

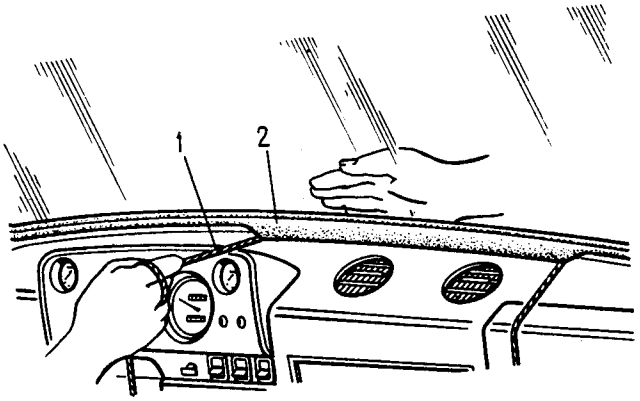


Fig. 8-24. Installing Windshield:
1 - installation cord; 2 - windshield sealing strip

To install the windshield:

- wash the recesses of sealing strip 9 (Fig. 8-9) with gasoline;
- slip the sealing strip with the edging on the glass;
- using a screwdriver, insert installation cord 1 (Fig. 8-24) into the recess by which sealing strip 2 is slipped on the body opening flange;

- fit the glass into the body opening and pull at the ends of the cord from inside the body until the sealing strip snaps in position. The assistant should press the glass gently from the outside.

REPLACEMENT OF SIDE AND TAILGATE GLASSES

To remove the glasses take off the sealing strip edging and, pressing on the lower corners of the glass, push it outward. An assistant should support the glass from the outside.

Installation of the glasses is similar to that of the windshield.

WINDSHIELD AND HEADLIGHT WASHERS

A schematic diagram of the windshield and headlight washers is shown in Fig. 8-25.

The headlight washer is provided with non-return valve 8 between the pumps and nozzles; it rules out leaks of the fluid after the washer has been stopped; this saves time for filling the pipes when the pump is restarted.

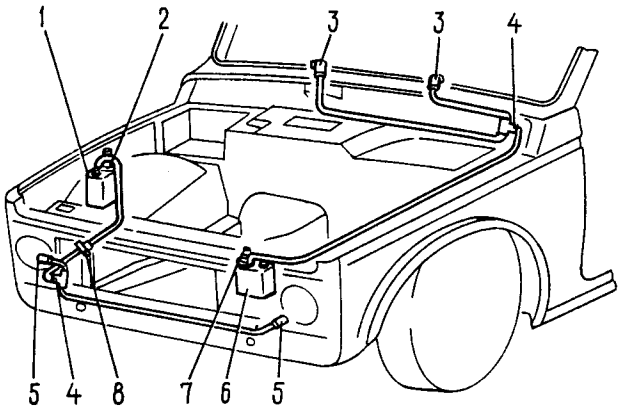


Fig. 8-25. Windshield and Headlight Washers. Diagrammatic:
1 - fluid tank; 2 - headlight washer pump; 3 - windshield washer pump; 4 - windshield washer nozzles; 5 - headlight washer nozzles; 6 - nozzle Tee pipes; 7 - non-return valve; 8 - Tee pipes assembled with flow restrictors

REMOVAL AND INSTALLATION OF WASHER PUMP

Disconnect the electric wires from motor 1 (Fig. 8-26) and take the pipe from the union of the washer pump.

Turn cover 2 with the electric motor counter-clockwise and take them off complete with the pump from the tank.

To install reverse the removal operations.

DISASSEMBLY AND ASSEMBLY OF WASHER PUMP

The pump and electric motor (Fig. 8-26) are fastened by screws and nuts to cover 2.

To disassemble the pump turn out the screws, remove the motor and cover, detaching fluid feed pipe 4.

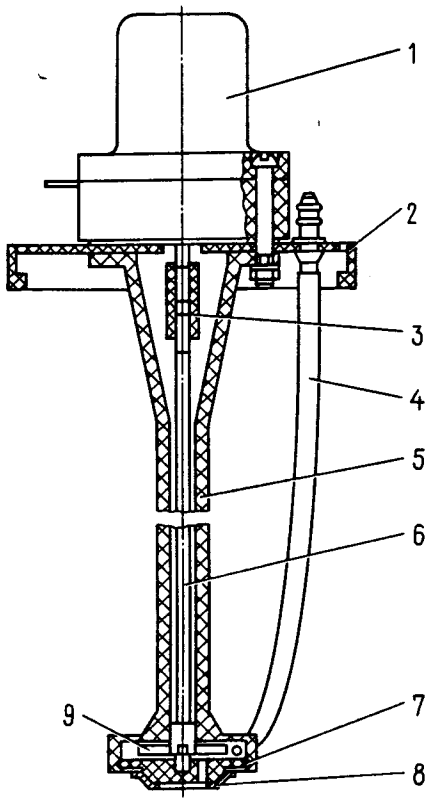


Fig. 8-26. Washer Pump:
1 - electric motor; 2 - tank cover; 3 - coupling; 4 - fluid feed pipe; 5 - pump casing; 6 - rotor shaft; 7 - rotor shaft support; 8 - rim with filter screen; 9 - rotor

Insert a pointed tool under the edge of rim 8 and take it off complete with the filter screen.

Remove coupling 3 and, tapping gently at shaft 6 of rotor 9, push out support 7 and take out the shaft with the rotor.

To assemble, proceed in the reverse sequence of operations.

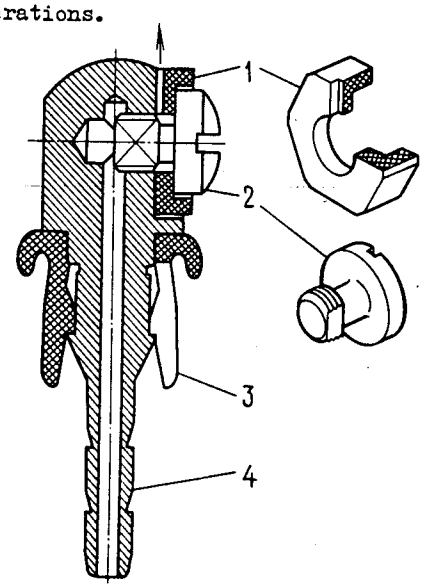


Fig. 8-27. Windshield Washer Nozzle:
1 - atomizer; 2 - screw; 3 - bushing; 4 - nozzle body with union

REMOVAL AND INSTALLATION OF WINDSHIELD WASHER NOZZLES

If the nozzles become clogged, remove and disassemble them.

Squeeze lightly plastic bushing 3 (Fig. 8-27) at the side of the air intake box, then pry the bushing from above with a screwdriver and, applying a certain force to overcome resistance take out the nozzle complete with the bushing.

Turn out screw 2, clean all parts thoroughly and airblast body 4 and atomizer 1.

Insert bushing 3 into the hole in the car body. Then insert smartly the nozzle into the bushing so that the slot of body 4 engages the bushing edges.

Check the functioning of the nozzle.

Adjust the direction of fluid spray by turning the body in the bushing and turning atomizer 1 with screw 2 loosened.

INSTRUMENT PANEL

REMOVAL AND INSTALLATION

Disconnect the "ground" wire from the storage battery.

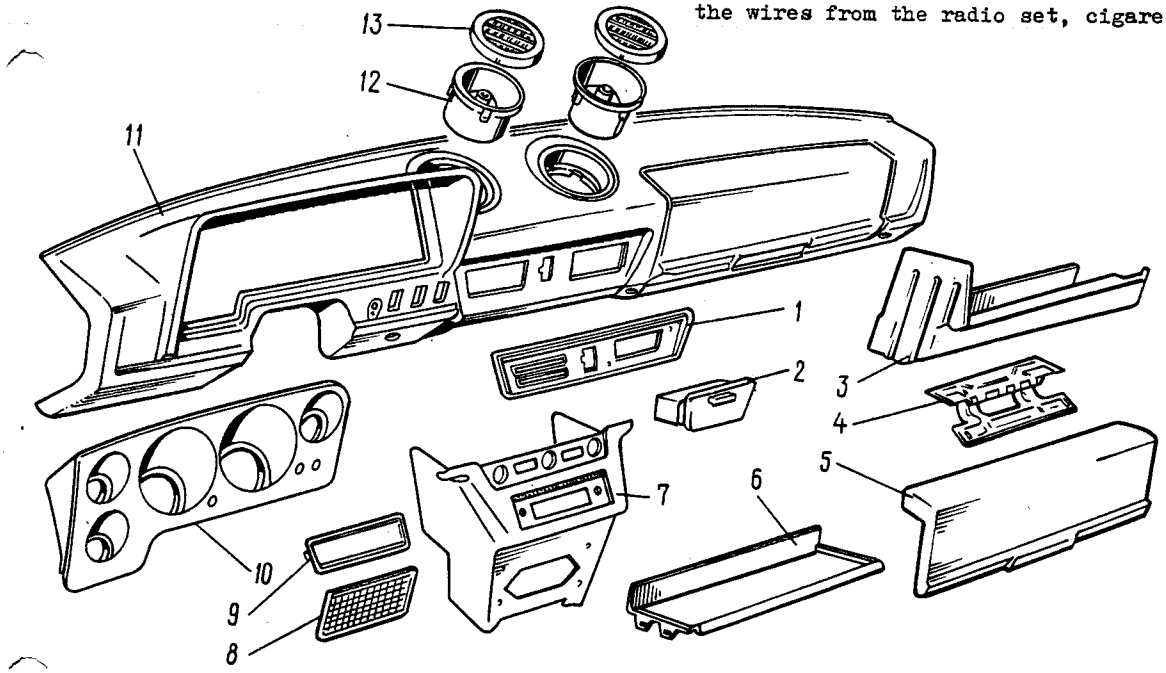


Fig. 8-28. Instrument Panel and its Accessories:
1 - ash tray and heater lever facing; 2 - ash tray; 3 - glove box body; 4 - glove box lid hinge; 5 - glove box lid; 6 - shelf; 7 - radio set panel; 8 - loudspeaker facing; 9 - radio set panel facing; 10 - instrument board; 11 - instrument panel; 12 - deflector pipe; 13 - deflector

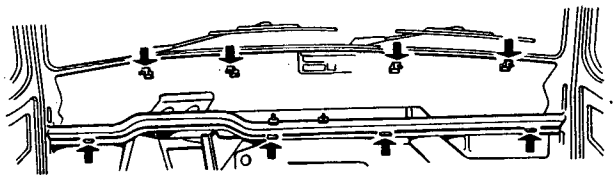


Fig. 8-29. Instrument Panel Fastening Points: (Shown by arrows)

Remove the lining of the windshield pillars, the steering column casing and the instrument board (see "Electrical Equipment") and disconnect the plugs and sockets of the wire harness.

Pull out the knob of the instrument lighting switch, unscrew the nut and take off the switch.

Remove shelf 6 (Fig. 8-28) and radio set panel 7, first turning out their screws; disconnect the wires from the radio set, cigarette lighter, headlight wiper and washer switch, and from the distress light switch.

Turn out the fastening screws and remove glove box body 3.

Remove the knobs from the heater control levers; for this purpose bend off the lower part of the upper knob and the upper part of the lower knob, using a flat sharp tool.

Remove four lower screws (Fig. 8-29) that fasten the instrument panel to the body front crossmember, then turn off four upper nuts which hold the panel to the dash panel, reaching through the openings of the glove box, and take off the instrument panel.

To install, reverse the removal operations.

REMOVAL AND INSTALLATION

Front seats. To take out the seat (Fig. 8-30) tilt it forward and unscrew the bolts holding it to the framework.

Remove the seat with the adjuster mechanisms.

Install the seat in the reverse order of operations.

Rear seat. Force off seat back retainers 9 (Fig. 8-30) and secure the back with the strap located under the cushion. Unscrew the bolts that fasten the cushion hinges to the floor crossmember and take out the seat.

Install the seat in the reverse sequence of steps.

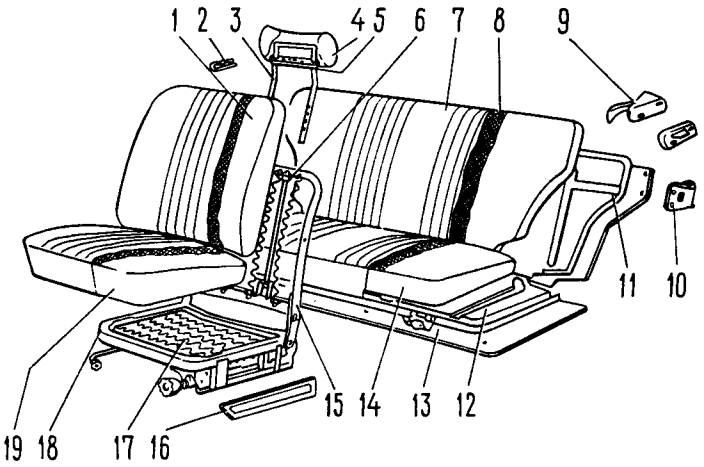


Fig. 8-30. Seats:
1 - front seat back padding; 2 - head rest lock; 3 - head rest support; 4 - head rest padding; 5 - head rest support strip; 6 - guide pipe; 7 - seat upholstery; 8 - seat upholstery backing; 9 - seat back retainer; 10 - rear seat back shackle; 11 - seat back base; 12 - seat cushion base; 13 - mat; 14 - rear seat cushion padding; 15 - back frame; 16 - front seat facing; 17 - seat cushion spring; 18 - front seat frame; 19 - front seat cushion padding

DISASSEMBLY AND ASSEMBLY OF FRONT SEAT ADJUSTERS

Perform disassembly and assembly work on the removed seats.

Fore-and-aft adjuster. Unbend the edges of rail slides 14 (Fig. 8-31) and of rail guides 12, take out all balls 10 and shift the guides over the slides until rollers 13 come out.

To assemble put the rollers into the slot of the slide and slip on the guide. Then insert the balls and bend the edges.

Seat back rake adjuster. Disconnect spring 5 from the rod and knock out the pin which connects rod 6 with the seat back reinforcement. Pull out cotter pin 7 and remove the rod from back rake adjuster lock 4.

Assemble the adjuster in the reverse order of steps.

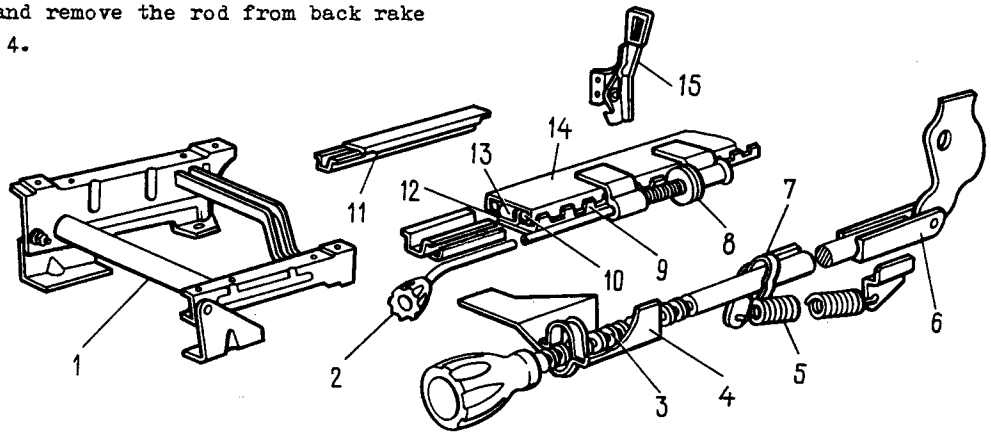


Fig. 8-31. Front Seat Adjusters:
1 - front seat support; 2 - fore-and-aft adjuster handle; 3 - back rake adjuster threaded rod; 4 - back rake adjuster lock; 5 - spring; 6 - rod; 7 - cotter pin; 8 - fore-and-aft adjuster catch; 9 - fore-and-aft adjuster lock; 10 - ball; 11 - seat rails; 12 - rail guide; 13 - roller; 14 - rail slide; 15 - seat catch

REMOVAL AND INSTALLATION

To remove the body heater:

- shift control lever 6 (Fig. 8-32) of heater cock 14 all the way to the right and drain the engine cooling system;
- detach the "ground" wire from the storage battery;
- turn out the fastening screws, remove the instrument panel shelf and radio set panel, disconnecting the wires;
- remove internal ventilation air duct 1 by turning out its screws;
- loosen the clamps and disconnect the coolant inlet and outlet rubber hoses from heater pipes 13;

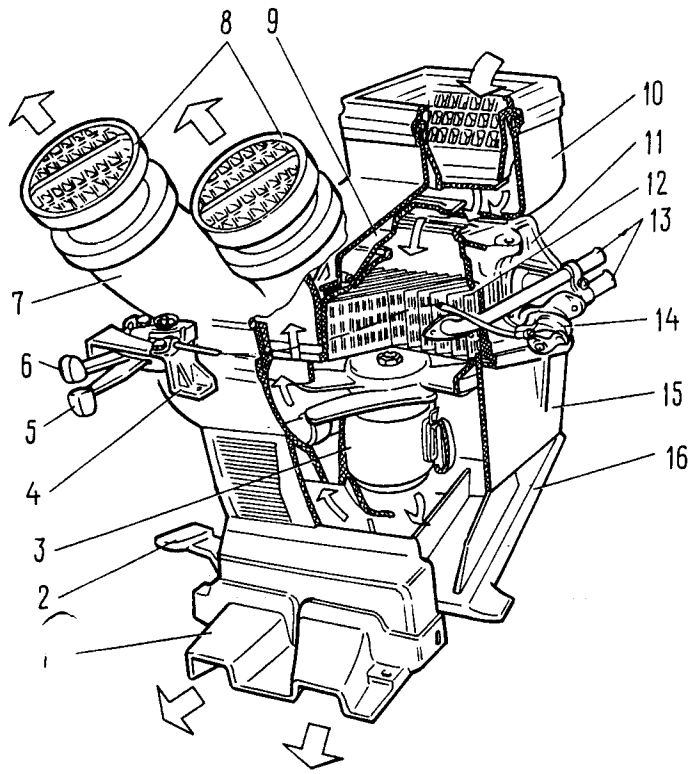


Fig. 8-32. Body Heater:
1 - internal ventilation air duct; 2 - air distributing cover lever; 3 - electric fan; 4 - control lever bracket; 5 - air intake lid control lever; 6 - heater cock control lever; 7 - rotatable deflector air duct; 8 - rotatable deflectors; 9 - air intake lid; 10 - air intake box; 11 - radiator housing; 12 - radiator; 13 - fluid inlet and outlet pipes; 14 - cock; 15 - fan housing; 16 - air distributing cover

- unscrew two fastening bolts in the engine compartment and take off the seal of the heater radiator pipes;

- loosen the bolt of the flexible rod casing clip on the cock and take the link off the cock;

- remove the switch of the heater fan motor and disconnect its wires;

- remove four spring holders and heater fan housing 15 assembly;

- take off the instrument board, through a special opening for the board in the instrument panel loosen the screw of the flexible rod of air intake lid 9 and take the rod off the lever;

- unscrew the nuts of housing 11, radiator 12 and air intake box 10, disconnect the "ground" wire from under one of the nuts, remove the housing and the air intake box;

- if necessary, remove air duct 7 which is connected with deflectors 8 by two rubber seals.

Install the heater in the reverse order of steps. Be careful to provide a correct position of the sealing gasket between the radiator housing and the car body and see that the hose clamps are properly tightened.

Having installed the heater on the car and connected all the hoses to the engine, fill the cooling system and check the heater connections for leaks.

DISASSEMBLY AND ASSEMBLY

Take off two spring clips 15 (Fig. 8-33) and take the electric fan out of housing 2. Unscrew the nut of impeller 13 and take it off electric motor 14.

Unscrew the nut of inlet and outlet pipe clip 8, remove the clip and take radiator 11 out of housing 5.

Unscrew the clip nuts and take off air intake lid 7.

Unscrew the nuts of clips 17 and remove air-distributing cover 1 of the fan housing.

Assemble the heater in the reverse sequence of operations, taking care to install radiator sealing gasket 10 properly.

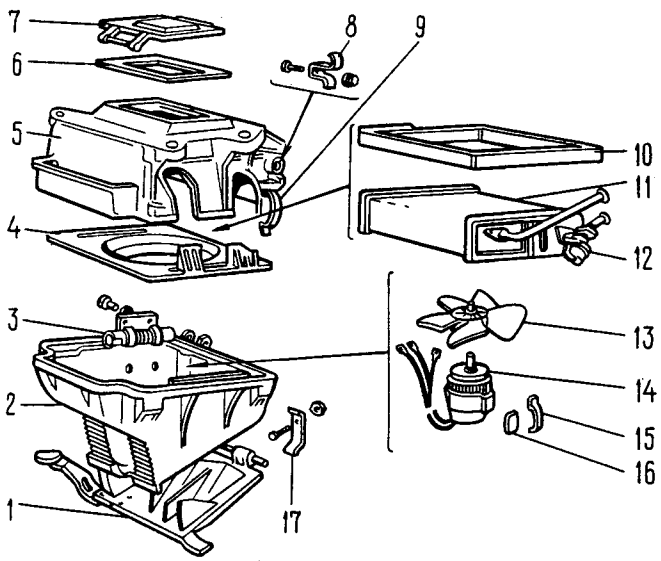


Fig. 8-33. Heater Parts:
1 - air distributing cover; 2 - fan housing; 3 - series resistor; 4 - fan guide housing; 5 - radiator housing; 6 - gasket; 7 - air intake lid; 8 - inlet and outlet pipe clip; 9 - fan housing spring holder; 10 - radiator gasket; 11 - radiator; 12 - cock; 13 - impeller; 14 - electric motor; 15 - spring clip; 16 - electric motor pad; 17 - air distributing cover clip