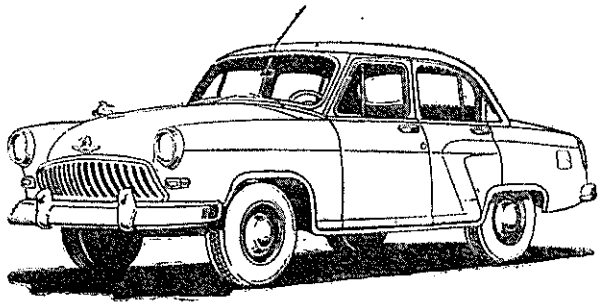
The "VOLGA" AUTOMOBILE

OPERATION AND CARE

THE 1959 „VOLGA“ CARS

Models M-21K and M-21И

OPERATION AND CARE



The 1959 „Volga" cars have a new radiator shell with vertical slots, a new bumper, owing to which the overall length of the car is reduced by 60 mm to 4770 mm, and new side lamps. The cars are provided with a windshield washer. The washer control handle is located on the instrument panel to the left of the steering column.

The washer reservoir should be filled with clean water. Soft arm rests and an ash tray are fitted on the front seat back contributing to the passenger comfort.

The new car model M-21K (introduced instead of the M-21Д model) is powered by a 80 h. p. engine of 7.5:1 compression ratio. This engine should be run on gasoline, having a rating of 80 octane number.

The new car model M-21И (introduced instead of the M-21B model) is equipped with a 70 h. p. engine of 6.6:1 compression ratio. This engine requires the use of gasoline having a rating of 70 octane number.

Gasolines, having a low octane rating, may cause engine to knock. With a slightly reduced octane rating knock may be prevented by reducing the amount of spark advance.

The use of the ethylized gasolines having a high octane rating (i. e. higher than the above indicated) should be also avoided because they cause lead deposits to form on valves, which will result in valve leaking and burning out rapidly.

We recommended to adjust the clearances between valves and rocker arms after the first 1000 km. Grind the valves after the first 5000—8000 km.

Some automobiles are not provided with central lubrication. In this case it is necessary to lubricate with grease the joints of steering rods, steering idler arm and front suspension every 1000 km; the king pins should be lubricated every 500 km.

On automobiles provided with central lubrication the steering rod joints should not be disassembled unless it is necessary.

If the joints become worn giving rise to lost motion replace the worn parts; if wear cannot be compensated for by the action of the steering rod end spring lubricate the disassmbled parts with light oil before re-assembly. Tighten the tie rod ball seat until it bears against the face of the tie rod end.

When tightening the tie rod ball seat apply a torque of 20-25 kgm. To prevent the seat from unscrewing after assembly cut a locking projection on the tie rod end with a diamond point chisel. During this operation the metal of the rod end is pressed down on to the seat face.

ERRATA

Page	Line		Printed	Should be printed
3	1	(from lower edge)	packed	parked
5	13	(from bottom of right column)	with suction noise muffler	with silencer
6	20	from top of right column	tubeless low	low
7	8		of	off
7	27		bimetal fuse	thermal breaker
7	28		melting fuses	fuses
8	4	from top	5 . 6	6 . 2
8	6		0 . 8	0 . 9
11	3	(under Fig. 3)	fuse	thermal circuit breaker
11	9	(from lower edge)	fuse	circuit breaker
11	8	from lower edge	fuse	breaker
14	9		6 . 7 to 7 . 2	7 . 3 to 7 . 8
	1	(from bottom of Errata List right column)	grill	grille
22	15	from lower edge	grease fitting	oiler
22	14		grease	lubricating
22	11		remove	removed
24	5	(from bottom of right column)	thin oil	grease
29	18, 19	(from upper edge)	Cracked and leaky case should be repaired or replaced	If cracked and leaky, repair or replace the battery
36	6	from lower edge	cuts off the filter if its element	opens when the filter element
39	1		1 . 2	0 . 9
41	22	(from upper edge)	pump of the centrifugal type is	pump is
43	3	(from lower edge)	tha	that
45	6	(under Fig 19)	bypass	bleeder
47	3	(from upper edge)	bypass	bleeder
50	4	under Fig 24	sahft	shaft
50	5		rear joint	joint
53	3	(from lower edge)	pushing	bushing
54	2	(from upper edge)	armshaft	arm shaft
54	2	under Fig 28	adjusting nut	nut
54	3		wheel support	steering knuckle support
54	4		wheel support	steering knuckle support
54	6		lever	arm pivot
54	9		wheel support	steering knuckle support
54	9		bolt	bolt nut
54	10		knuckle	king

Page	Line		Printed	Should be printed
55	13	from lower edge	wheel support	steering knuckle support
55	7	from lower edge	wheel support	steering knuckle support
57	2	(under Fig 30)	protective	packing
58	4	(from upper edge)	securely	too tight
59	1	from bottom	shackle	cap
61	1	from bottom	guide shackle	thrust
63	13	from upper edge	bypass	bleeder
63	22	from upper edge	bypass	bleeder
66	21	from upper edge	fuse	circuit breaker
68	5	(under Fig 39)	dawel	dowel
69	3	from upper edge	fuse	circuit breaker
69	8	from upper edge	fuse	breaker
69	11	from upper edge	by hand	depressed
69	12	from upper edge	fuse	breaker
69	19	from upper edge	10 A	20 A
69	20	from upper edge	fuse	circuit breaker
69	20	from upper edge	fuse	breaker
69	22	from upper edge	fuse	thermal circuit breaker
69	24	from upper edge	fuse	circuit breaker
69	26	from upper edge	fuse	breaker
69	28	from upper edge	Melting 5 A	5 A
73	15	from upper edge	(breaker)	(radio set)

CAUTION

When operating the "Volga" car, Model M-21Д, the driver should bear in mind the following recommendations:

1. Inspect frequently the temperature and the level of the cooling water. Do not allow the radiator upper tank to become empty as this will damage the water temperature sensitive unit installed in the cylinder head. The green pilot lamp located on the instrument panel flashes up when the temperature of water in the radiator reaches 92 to 98° C.

2. When draining the cooling system, be sure to open two drain cocks and the radiator filler cap. Besides, while draining the water, open the heater cock located on the cylinder head to avoid freezing of water in the heater radiator.

3. The engine is fitted with a throttling speed-limiting washer, which is installed at the Works, being placed between the carburettor and inlet manifold. The car fitted with this washer has a low pick up and fails to develop full rated speed on the road. Upon completion of the running-in schedule the washer should be removed.

4. Enrichment of the working mixture during starting of a cold engine by the use of the choke knob should be resorted to with moderation to prevent excess gasoline from getting into the inlet pipe.

While warming-up after starting, pull the choke knob only a little way out. The use of the choke valve, while starting a warm engine, is not allowable. In the rear bottom part of the inlet pipe there is a threaded plug for draining excess gasoline.

5. After starting from cold do not race the engine at once. Cold oil reaches the bearings slowly and at high engine speed the bearings may be melted out.

Remember, that the thermostat valve prevents the circulation of water through the radiator during engine warm-up, so that the radiator may get frozen even though the water in the engine water jacket is hot. Do not open the heater port lid, unless the water is already warm.

6. Do not switch on the ignition (the key turned to the right), when using the radio set with engine inoperative, as this caused overheating and damage of the ignition coil. The radio set consumes a 3.5 a.c., therefore, do not use it in excess of 3 hours, when the car is packed, to avoid discharging the storage battery.

7. Do not fail to operate the central chassis lubrication system of the car every day before driving out and every 200 *km* of operation. When driving over muddy roads, lubricate the chassis every 30 to 40 *km* and immediately after crossing a water obstacle, or after washing.

8. The luggage compartment is capacious but is designed to hold not more than 50 *kg* of baggage. Overloading cuts down the service life of the springs and tyres.

SPECIFICATIONS

GENERAL

Number of seats (driver incl.)	5
Overall dimensions (nominal):	
length	4,830 *mm*
width	1,800 *mm*
height (in working order, without load)	1,620 *mm*
Wheel base (axle-to-axle distance)	2,700 *mm*
Wheel tread:	
front wheels	1,410 *mm*
rear wheels	1,420 *mm*
Road clearance (fully loaded, with normal tyre pressure):	
front suspension cross member	200 *mm*
muffler pipe	190 *mm*
rear axle housing (at flange)	190 *mm*
Minimum turning radius (outer wheel tread)	6.3 *m*
Angle of approach (fully loaded)	27°
Angle of departure (fully loaded)	19°
Maximum speed with normal load on horizontal level road	135 *km/hr*
Dry weight of car	1,360 *kg*

Note: Dry weight of the car does not include the weight of fuel, water, lubricant, spare wheel and driver's kit, which, taken together, weighs approximately 100 *kg*.

Fuel	automobile gasoline, 80 octane rating
Engine and chassis numbers	manufacturer's numbers of the engine and chassis are stamped on the plate located under the hood. Besides, the engine number is stamped on the left-hand side of the cylinder block in the middle of its upper part. The chassis number is stamped on the plate fixed in the right-hand front part of the body side member

ENGINE

Type	four-stroke cycle gasoline carburettor
Number and arrangement of cylinders	four, vertically in line
Bore	92 *mm*
Stroke	92 *mm*
Displacement	2.445 *l*
Compression ratio	7.5
Horsepower and engine speed	80 *H.P.* at 4,000 *r.p.m.*
Maximum torque	18 *kg·m*
Firing order	1—2—4—3
Cylinder block	aluminium alloy, with easily replaceable "wet" cast-iron liners which are fitted on top with corrosion- and wear-resistant cast-iron sleeves
Cylinder head	aluminium alloy
Pistons	aluminium alloy, tinned
Piston rings	two compression rings and one oil control ring on each piston. Compression rings chromium plated, other rings tinned
Number of main bearings	5
Crankshaft	magnesium cast iron, with balance weights. Statically and dynamically balanced. Journal surfaces hardened
Bearing shells	bimetal, thin-walled
Valves	overhead valves installed vertically in line in cylinder head. Inlet valve disc diameter 44 *mm*, exhaust valve disc — 36 *mm*
Lubricating system	combination pressure and splash type. Crankshaft and camshaft bearings, connecting rod bearings, rocker arm bearings and push rod upper endpieces are pressure-lubricated. Other parts are splash-lubricated
Oil filters	two. Laminated coarse filter, passing all oil forced by oil pump into oil pressure line, and fine filter with replaceable element, passing only part of oil
Lubricating system valves (their setting should not be tampered with)	two. Reduction valve of piston type installed on right-hand front part of engine and by-pass valve — in coarse filter body
Crankcase ventilation	forced type
Air cleaner	inertia oil bath-and-screen type with suction noise muffler
Carburettor	vertical, downdraft balanced type with acceleration pump and economizer
Fuel pump	diaphragm type with inverted sediment bowl, which incorporates screen filter. Pump fitted with manual priming lever
Cooling system	closed type with forced circulation of water
Thermostat valve	installed in cylinder head pipe union. Thermostat valve begins to open at 70° C and opens fully at 83° C
Water pump	centrifugal type with face self-adjusting gland

POWER TRANSMISSION

Clutch	dry, single-plate type with hydraulic release mechanism
Transmission	mechanically operated, three-speed type, with three speeds forward and one reverse. Synchromesh in 2nd and 3rd speeds. Gear-shift lever installed on steering column
Gear ratios:	
1st gear	3.115
2nd gear	1.772
3rd gear	1.000
reverse	3.788
Propeller shafts	two open type shafts with three-needle bearing type universal joints and centre bearing
Final drive	hypoid type. Ratio 4.555
Differential	bevel type, with two pinions
Axle shafts	flange type, semi-floating
Transmission of effort from rear axle	pushing effort and torque reaction moment of rear axle are taken by springs

RUNNING GEAR

Tyres	tubeless, low-pressure, 6.70—15
Front suspension	independent, lever type, on coiled cylindrical springs mounted on detachable cross member
Lateral stabilizer	torsion type, located in front of front suspension
Rear suspension	longitudinal semi-elliptic leaf springs enclosed in boots
Front and rear shock absorbers	double acting, hydraulic, piston-lever type

FRAME

Frame	short frame in the front end of automobile only

STEERING GEAR

Type	hour glass worm with twin roller
Ratio	18.2 (mean)
Steering wheel play	in straight ahead position not more than 5°, in extreme positions up to 30°

BRAKES

Foot brake	four-wheel, shoe type
Hand brake	central, drum type

ELECTRIC EQUIPMENT AND INSTRUMENTS

Rated voltage	12 *V*
Wiring	single-wire type; positive pole grounded
Generator	shunt-wound, 220 *W*
Current and voltage regulator	incorporates three units: circuit breaker, voltage regulator and current limiting regulator
Storage battery	54 *A-hr*
Ignition coil	with additional resistor switched of automatically while starting the engine with electric starter
Distributor	with centrifugal and vacuum spark advance control and octane selector
Spark plugs	14 *mm* thread
Starter	remotely controlled
Head lamps	with country and traffic beams. Equipped with semi-sealed optical units with 50×21 *c.p.* bulbs
Side lamps	with double-filament 6×21 *c.p.* bulbs for direction indication and parking light
Tail lamps	produce the rear overall light, stop light, white light for backward motion, and indicate direction of turn. Equipped with double-filament 6×21 *c.p.* bulbs and single-filament 21 *c.p.* bulbs
Licence plate light	6 *c.p.* bulb
Sound horns	combination of two-tone signals
Fuses	button type bimetal fuse in lighting circuit and three melting fuses in one block
Instrument cluster	includes: ammeter, gasoline level gauge, oil pressure gauge, water temperature gauge, and speedometer with odometer. Illuminated by four 1 *c.p.* bulbs
Clock	wound electrically from storage battery. Illuminated by two 1 *c.p.* bulbs
Radio set	two-range type, with fine and button type tuning

BODY

Body	four-door sedan of all-metal integral construction
Seats	front and rear soft seats with springs. Adjustable front seat is equipped with dropping back rest for converting sitting places into sleeping berths

EQUIPMENT

Central chassis lubrication	consists of pump, metering devices, pipes and hoses
Driver's kit	two tool bags, jack, starting crank, tyre pump and inspection lamp

CAPACITIES (litres)

Fuel tank	60
Cooling system	11.5
Engine lubricating system	5.6
Air cleaner	0.3
Transmission housing	0.8
Rear axle housing	0.75
Steering gear case	0.25
Central chassis lubrication system	0.6
Front shock absorbers	0.235 (each)
Rear shock absorbers	0.145 (each)
Brake and clutch control system	0.7
Front hubs	120 *g* (each)

ADJUSTMENT DATA

Clearance between rocker arm lever and valve	0.25—0.30 *mm* (engine cold)
Engine oil pressure (not to be adjusted)	2 to 4 *kg/cm²* at 50 *km/hr*. Not less than 0.5 *kg/cm²* at idle speed on warmed up engine
Fan belt sagging:	10—15 *mm*
Spark plug gap	0.8—0.9 *mm*
Breaker point gap	0.35—0.45 *mm*
Normal temperature of cooling water in radiator	75—85° C
Clutch pedal play	32—40 *mm*
Brake pedal play	10—15 *mm*
Tyre pressure	1.7 *kg/cm²*

INSTRUMENT AND CONTROLS

Arrangement of controls is shown in Fig. 1.

Steering wheel *3* is located on the left-hand side and is fitted with circular horn button *2*.

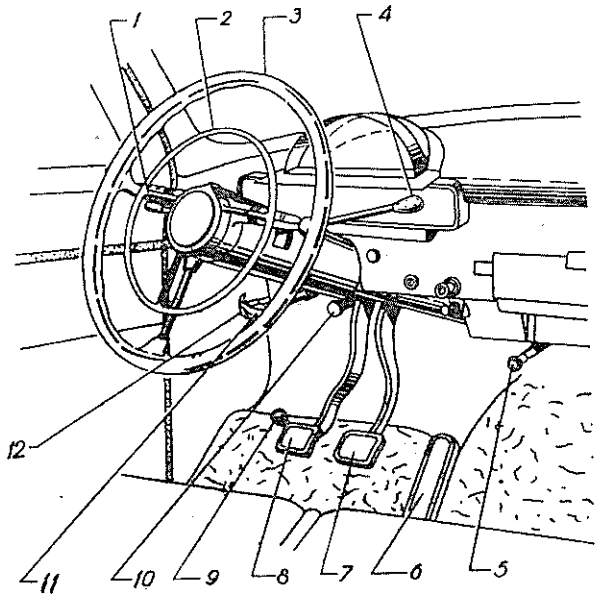


Fig. 1. Controls

1 — direction indicator switch lever; *2* — horn circular button; *3* — steering wheel; *4* — gear shift lever; *5* — ventilation inside port lid handle; *6* — accelerator pedal; *7* — brake pedal; *8* — clutch pedal; *9* — lighting foot switch; *10* — central chassis lubrication pump pedal; *11* — hand brake handle; *12* — radiator blind control handle

Direction indicator switch lever *1* is located on the left-hand side of the steering column. Right turn is indicated by moving the lever up, and left turn — by moving it down. Simultaneously a pilot lamp flashes up on the right-hand side of the instrument panel. Direction indicators are switched off automatically as the turn is completed.

Gear shift lever *4* is located on the right-hand side of the steering column. Lever positions are shown in Fig. 2.

Brake pedal *7*, **clutch pedal** *8*, and **accelerator pedal** *6* are located in accordance with universally accepted standard.

Hood control handle is located under the instrument panel, to the right (not shown in the illustration). To open hood, pull the handle.

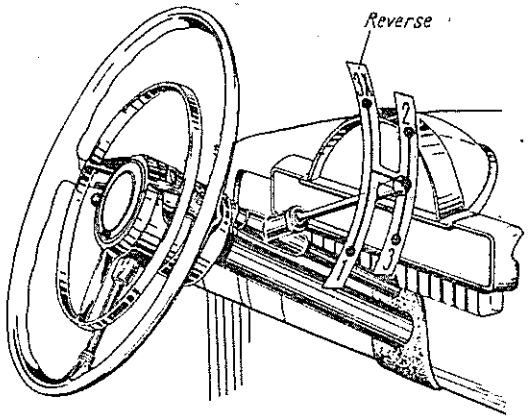


Fig. 2. Gear Shift Diagram

Ventilation inside port lid handle *5* is located under the instrument panel, in the middle. Pushing the handle opens the lid, pulling it closes the lid.

Central chassis lubrication pump pedal *10* is located on the body front panel, left of the clutch pedal. To lubricate the chassis, depress the pedal three times all the way down.

Lighting foot switch *9* is located on the left side of the inclined floor. Depending on the position of the lighting master switch knob the lighting foot switch allows to change over from traffic light to side lamps, or from country light to traffic light.

Hand brake lever *11* is located under the instrument panel, left of the steering column. To apply the brake, pull the handle all the way out. This is accompanied by flashing up of a red pilot lamp on the instrument panel. To release the brake, turn the lever counter-clockwise and push it down.

Radiator blind control handle *12* is located under the instrument panel, left of the hand brake lever. To close the blind, pull the handle. To open the blind, push the handle forward.

Illustrated in Fig. 3 is arrangement of control knobs and instruments.

Air intake port handle *1* **and heater lid handle** *2* are located in the left part of the instrument panel. With the air intake handle in the extreme left position "O" the outer ventilation port is open. With the handle in the extreme right position "3" the outer ventilation port is closed.

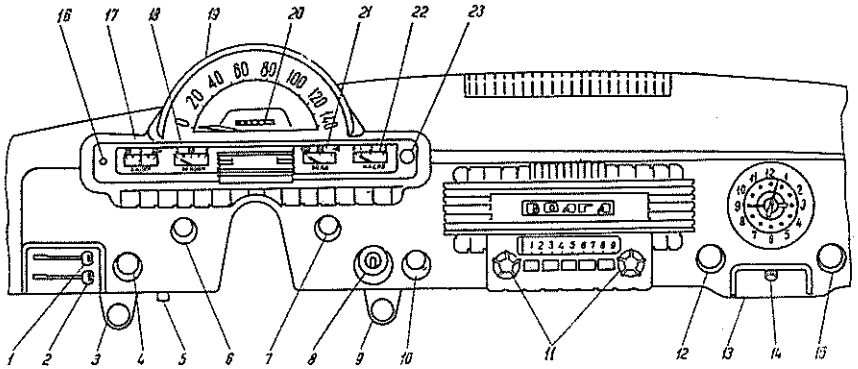


Fig. 3. Instrument Panel

1 — air intake port handle; *2* — heater lid handle; *3* — heater fan switch; *4* — lighting master switch; *5* — lighting fuse button; *6* — hand brake pilot lamp; *7* — water temperature pilot lamp; *8* — ignition and starter switch; *9* — windshield wiper switch; *10* — carburettor choke valve knob; *11* — radio set knobs; *12* — throttle valve knob; *13* — ash tray; 14 — clock hand setting knob; *15* — cigar lighter; *16* — head lamp country beam pilot lamp; *17* — ammeter; *18* — gasoline level gauge; *19* — speedometer dial; *20* — odometer; *21* — water temperature gauge; *22* — oil pressure gauge; *23* — direction indicator pilot lamp

Turning the heater handle *2* to the right "O" opens the heater lid and warm air is supplied for heating the body. Turning the handle to the left "3" closes the lid and warm air is supplied for windshield defrosting only.

Heater fan switch *3* is located under the instrument panel, to the left. It has three positions: OFF, Low, and High. When the fan is ON, a pilot lamp flashes up inside the switch knob.

Lighting master switch *4* is located left of the steering column. It has three positions: knob pushed all the way in — all lights out; knob pulled half way out — traffic light; knob pulled all the way out — country light.

Thermal fuse button *5* is located under the instrument panel, left of the steering column. The fuse opens the lighting circuit of the car when there is a shorting at some point. Having corrected the trouble, press the button until a click is heard.

Instrument cluster consists of speedometer *20* with odometer, ammeter *17*, gasoline level gauge *18*, water temperature gauge *21*, and oil pressure gauge *22*. Left of the instruments the country light pilot lamp *16* is installed and right of the instruments — the direction indicator lamp *23*.

Pilot lamps: hand brake red lamp *6* flashes up when the hand brake is applied; water temperature green lamp *7* flashes up when the temperature of water in the radiator upper tank rises to 92—98° C.

Ignation and starter switch *8* is located on the instrument panel, right of the steering column. The key may be shifted into any one of the four positions:

middle position — ignition OFF;
first right position — ignition and radio ON;
second right position — radio OFF, ignition and starter ON;
extreme left position — radio ON, only.

Windshield wiper switch *9* is located under the instrument panel, right of the steering column, has three positions: OFF, Low, and High.

Carburettor choke valve knob *10* is located right of the ignition switch.

Radio set control knobs and buttons *11* are located in the middle of the instrument panel. The left outer knob is the ON-OFF and volume control knob. The left inner knob is tone control. The right outer knob serves for tuning up the set. The buttons marked "Д" are long wave buttons, those marked "С" — medium waves. The aerial positioning handle is located above the windshield in the middle.

Throttle manual control knob *12* is located left of the clock. To open the throttle, pull the button out. To close the throttle, push it all the way in.

Clock hand positioning knob *14* is located under the instrument panel opposite the clock. To shift the clock hands, press the knob upward and turn as required.

Ash tray *13* is located under the clock. To use it, pull it out. To dispose of ash, remove the ash tray by pressing upon the spring located inside the ash tray body.

Cigar lighter *15* is located right of the clock. To use the lighter, depress it and remove the hand. As soon as the knob jumps out with a click it means that the lighter element is red hot and ready for use.

Running-In a New Car

Service life of the car depends to a great extent on the running-in period. During this period the friction surfaces of various parts become worked to each other, the gaskets become compressed, etc. Therefore, during running-in the car should be given particular attention and care and its operation should be subjected to certain limitations. The running-in programme for the "Volga" car covers 1,000 *km* of operation.

RUNNING-IN INSTRUCTIONS

1. Do not drive the car in direct gear over 55 to 60 *km/hr*, in second gear — over 35 *km/hr*, and in first gear — over 25 *km/hr*.

2. Do not start driving with the cold engine and do not race the engine. The engine should be warmed up during 2 or 3 minutes at moderate revolutions.
3. Do not overload the engine. The number of passengers, including the driver should not exceed four. Avoid driving over difficult roads (deep mud, sand, steep uphill slopes, etc.).
4. During running-in use gasoline with octane rating of 80. The use of gasoline with lower octane rating is not allowable.
5. During running-in add the winter grade of engine lubricating oil. This grade is thinner and contributes to better working-in of parts.
6. Adjust a somewhat higher idle speed, because the new engine rotates with a certain difficulty and cannot run regularly at a low idle speed.
7. Inspect frequently the temperature of the brake drums and, if overheated, allow them to cool down and re-adjust the brakes.

It should be noted, that the brakes become fully efficient only after the brake shoes have become worked-in to the brake drums.

8. Simultaneously check the temperature of the front wheel hubs and, if they are considerably overheated, loosen the adjusting nut one slot (see "Adjusting the Front Wheel Hub Bearings" section).
9. During running-in pay special attention to condition of all the car attachment points. Loose bolts and nuts should immediately be tightened.
10. Check carefully the pipe joints and eliminate any possible oil, gasoline, water and brake fluid leaks.
11. Swing the coarse filter handle 15 to 20 times every day after driving.

Before First Run

1. Check:
   a) fuel level in the tank;
   b) water or anti-freeze level in the radiator;
   c) oil level in the engine;
   d) electrolyte level in the battery cells;
   e) fluid level in the brake master cylinder;
   f) oil level in the air cleaner oil bath;
   g) oil level in the central chassis lubrication pump reservoir;
   h) tyre pressure;
   i) tightening of wheel nuts.
2. Operate the central chassis lubrication system by depressing many times the pump pedal until lubricant oozes from under the joint seals. Make sure the lubricant is fed to all the points in the front suspension and steering rods. Lubricate all the 1,000 *km* points in accordance with the Lubrication Chart.
3. Start the engine and check for oil, water and gasoline leaks.
4. Inspect the entire car.

After 500 km of Operation

1. Change oil in the engine if winter (thin) grade of oil is available. If it is not available complete the running-in programme with the oil filled at the Works by filtering it.
2. Operate the central chassis lubrication system. Lubricate all the 1,000 *km* points in accordance with the Lubrication Chart.
3. Tighten up all the wheel nuts.
4. Tighten the steering arm nut.
5. Tighten the four bolts, fixing the inlet and exhaust pipes.
6. Tighten the nuts of eight bolts attaching universal joints to flanges, tighten four hand brake drum bolts, and the attachments of the universal joint to the transmission flange.
7. Check the oil level in the transmission and rear axle housings. If the level is below the edge of the filler hole, add lubricant; if it is higher — allow excess lubricant to drip down.
8. Drain sediment (dirt and water) from the fuel tank through the drain plug.

AFTER FIRST 1,000 km OF OPERATION

Engine and Fuel System

1. Remove the seal, unscrew the carburettor bolts and remove the speed-limiting washer installed between the carburettor and inlet pipe flanges.
2. Tighten the cylinder head nuts in the sequence given in Fig. 4; this operation should be performed with a torque indicating wrench or with a special wrench furnished with the car without jerks and on the cold engine only. A torque of 6.7 to 7.2 *kg·m* should be exerted.

Avoid overtightening these nuts to avoid breaking of the studs.

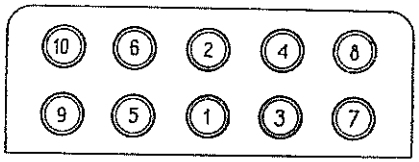


Fig. 4. Cylinder Head Nut Tightening Sequence

3. Tighten the nuts attaching the inlet and exhaust pipes to the engine.
4. Tighten the bolts clamping the inlet and exhaust pipes.
5. Tighten the nuts connecting the manifold to the muffler inlet pipe.

6. Check fan belt tension and adjust, if necessary.
7. Check, whether the throttle valve is opened fully when the accelerator pedal is completely depressed. Also check whether the choke valve is fully opened and closed by the control knob. Adjust, if necessary.
8. Check for sediment deposits in the glass jar of the gasoline sediment bowl. Clean the sediment bowl in case of urgent necessity only. Having replaced the jar check for fine leaks from under the jar.

Electric Equipment

9. Check the electrolyte level in all the battery cells and add distilled water, is necessary (see "Storage Battery" section).
10. Tighten the cable terminals on the storage battery and coat them with petrolatum.
11. Check the tightness and cleanliness of the connections of the generator, current and voltage regulator, starter cables, etc.
12. Blow through the generator with compressed air and wipe the commutator with a rag soaked in clean gasoline.
13. Tighten the generator bracket to engine bolts and those attaching the generator to the bracket.

Chassis units

14. Check adjustment of the front wheel bearings and adjust them, if necessary, as outlined in the "Adjusting the Front Wheel Hub Bearings" section.
15. Check free travel of the brake pedal (10—15 *mm*) and clutch pedal (32—40 *mm*), and adjust, if necessary.
16. Check functioning of the foot brake and adjust it if, with the fully depressed pedal, the clearance between the pedal and the body front panel is less than 35—40 *mm*.
17. Check and adjust, if necessary, the hand brake linkage, as described in the "Hand Brake" section.
18. Check the fluid level in the brake master cylinder and add fluid, if necessary.
19. Make sure there is no play of the steering pendulum lever pivot (rocking the pendulum lever up and down by hand) and tighten the upper threaded bushing, if necessary (see "Adjusting the Pendulum Lever" section).

Attachment of Units and Parts

20. Tighten the bolt attaching the steering gear case to the side member.

21. Tighten the steering arm nut.

22. Check the nuts attaching the steering rod ball pins and tighten, if necessary.

23. Uncotter and tighten the nuts attaching the steering levers to the steering knuckles and cotter them up again. If during tightening of nuts the bolts start to turn, access to the bolt heads is achieved by removing the brake drum.

24. Tighten the bolts attaching the bracket of the steering pendulum lever.

25. Tighten the bolt clamping the pendulum lever.

26. Tighten the spring clip nuts after loading the car to such an extent as to straighten up the springs.

27. Tighten the nuts of the bolts coupling the rubber bushings of the spring pins in the spring eyes and brackets. Tighten them with a box wrench as far as they will go. Before tightening load the car fully.

28. Tighten the bolts attaching the rear shock absorbers to the car body and the nuts of their bracket pins. Tighten four outer nuts attaching the front suspension shock absorbers and four bolts located inside the springs.

29. Tighten the lateral stabilizer bushing bolts.

30. Tighten ten bolts attaching the front suspension cross member to the side members and six bolts of the engine rear mounting cross member.

31. Tighten eight bolts attaching the bracings leading from the side members to the front panel.

32. Tighten all the other loose joints, paying attention to the attachment of the front and rear bumpers, mud guards, hood and fenders, hood hinges, luggage compartment lid hinges and door hinges.

Lubrication

33. Drain sediment from the coarse and fine oil filters.

34. Change oil in the engine. Viscosity of the fresh oil should conform to the recommendations of the Lubrication Chart depending on the season.

35. Change oil in the air cleaner.

36. Change lubricant in the rear axle housing.

37. Lubricate all the 1,000 *km* chassis lubrication points shown in the Lubrication Chart. Operate the central chassis lubrication system.

After 1,000 km of operation and after completion of all the above operations the car is ready for normal service. However, in the course of the next 3,000 *km* of operation do not drive the car continuously at a speed exceeding 90 *km/hr* and do not race the engine while driving over difficult roads in low gear.

The running-in programme is completed after a 5 to 6 thousand kilometres' run after which the car may be driven continuously at a speed of 120 *km/hr*; higher speeds may be developed on short sections of road only.

SERVICING THE CAR

After correct running-in, the service life of the car depends on the standard of subsequent servicing and quality of materials used.

Driver's Kit

Each car is furnished with the jack, starting crank, manual tyre pump, grease gun, hand fuel transfer pump, inspection lamp and two tool bags.

Special wrenches furnished with the car are shown in Fig. 5.

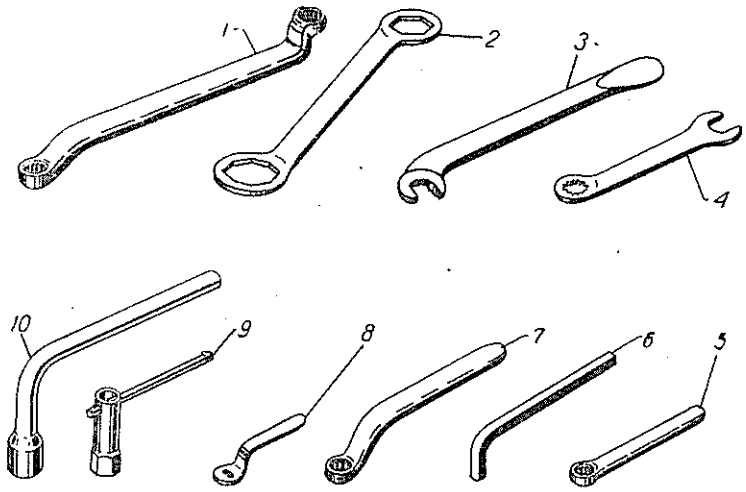


Fig. 5. Special Tools

1 — spring clip nut and brake shoe anchor pin nut wrench; *2* — front hub inner cap and front axle steering knuckle nut wrench; *3* — steering arm nut wrench; *4* — drain plug and coarse oil filter gland nut wrench; *5* — exhaust manifold nut box wrench; *6* — steering gear adjusting screw and rear axle oil drain plug wrench; *7* — cylinder head nut box wrench; *8* — brake shoe anchor pin wrench; *9* — spark plug wrench; *10* — wheel nut wrench

How to Use the Jack

Prior to jacking up the car apply the hand brake, engage the 1st gear and put special wooden chocks under the wheels. The chocks are included in the driver's kit. The jack should be placed under the front bumper bracket (Fig. 6) or under the rear bumper.

To lift the car, shift the jack latch up and swing the jack handle smoothly up and down. To lower the car, put the latch down and swing the handle in the same manner.

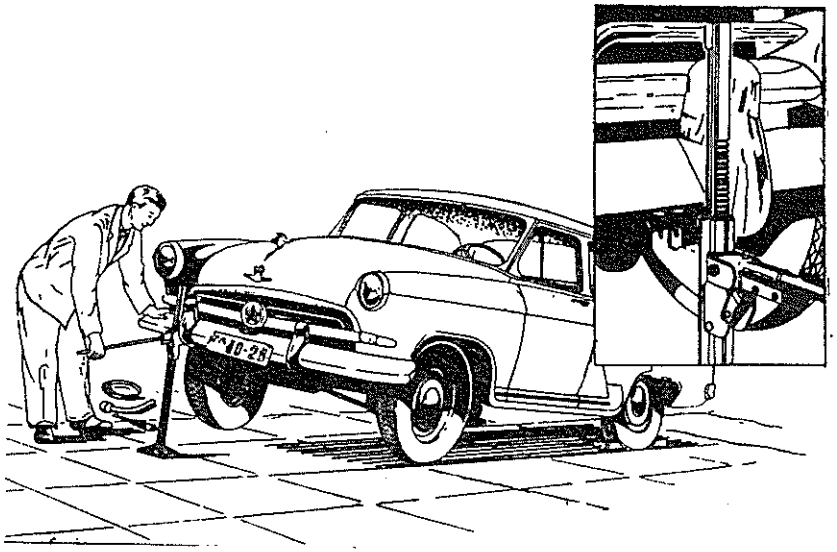


Fig. 6. Jacking Up the Car

Filling the Cooling System

The cooling system should be filled with water. In winter it is recommended to use liquids with a low freezing point. The cooling system should be drained through two cocks: on the radiator pipe and on the cylinder block. While draining, open the radiator filler cap and the heater cock.

LUBRICATING THE CAR

Lubricating the Car Chassis

Lubrication reduces considerably friction in the car mechanisms and wear of its parts. Therefore the car should be lubricated in due time in accordance with Table 1. Lubrication points are shown in Fig. 7.

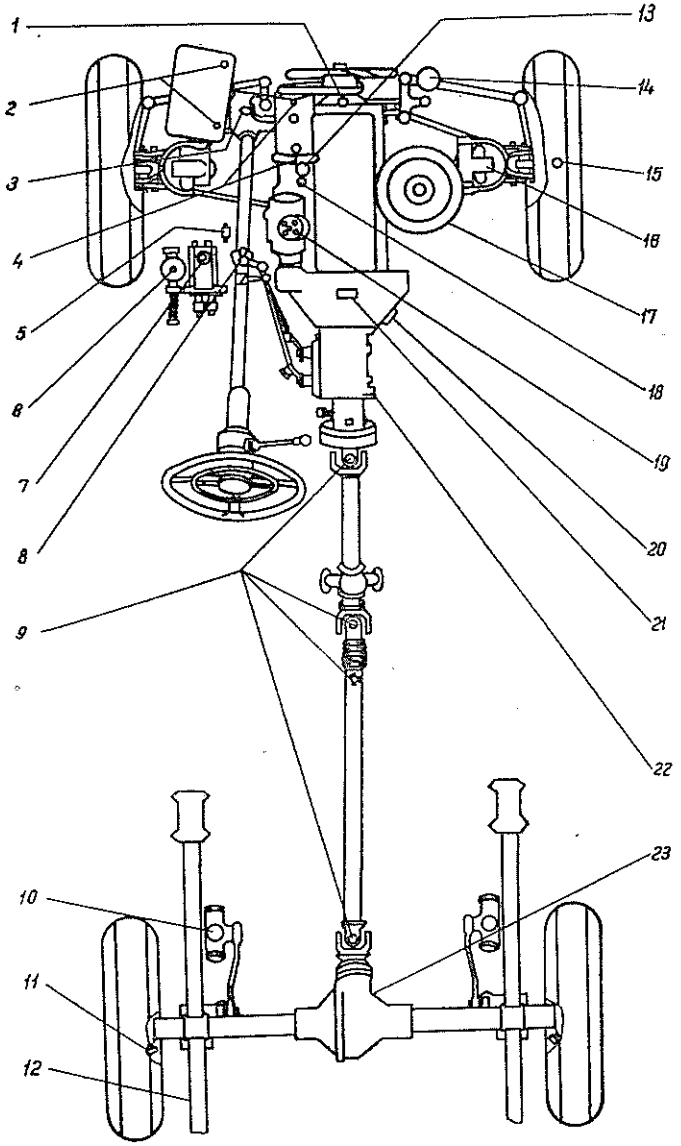


Fig. 7. Chassis Lubrication Points

Table 1

CHASSIS LUBRICATION CHART

Nos. on Fig. 7	Name of units	Number of lubricant points	Lubricant symbol	Daily	Lubrication interval, *km*					Seasonal (twice a year)	Once a year	Remarks
					200	1,000	2,000	6,000	12,000			
1	Water pump	1	У	—	—	Ж	—	—	—	—	—	
2	Storage battery	2	С	—	—	—	—	Ж	—	Ж	—	
3	Steering gear	1	Н	—	—	Ж	—	—	—	Ж	—	
4	Generator	2	М	—	—	Ж	—	—	—	—	—	
5	Hand brake control linkage	1	LP	—	—	—	—	Ж	—	—	—	
6	Central chassis lubrication pump	1	М	Ж	Ж	—	—	Ж	—	—	Ж	
7	Brake and clutch master cylinder	1	Т	—	—	Ж	—	—	—	—	—	
8	Gear shift shaft lower support	1	У	—	—	Ж	—	—	—	—	—	
9	Joints and splines of the propeller and intermediate shafts	4	Н	—	—	—	—	Ж	—	—	—	
10	Rear shock absorbers	2	А	—	—	—	—	Ж	—	—	Ж	
11	Rear wheel bearings	2	У	—	—	—	—	Ж	—	—	—	
12	Springs	2	G	—	—	—	—	Ж	—	—	—	
13	Engine crankcase	1	М	Ж	—	—	Ж	—	—	Ж	—	
14	Fine oil filter	1	—	—	—	—	Ж	—	—	—	—	
15	Front wheel bearings	2	У	—	—	—	—	—	Ж	—	—	
16	Front shock absorbers	2	А	—	—	—	—	Ж	—	—	Ж	
17	Carburettor air cleaner	1	М	Ж	—	—	Ж	—	—	—	—	
18	Coarse oil filter	1	—	Ж	—	—	Ж	Ж	—	—	—	
19	Ignition distributor:											
	cap oiler	1	У	—	—	—	—	Ж	—	—	—	
	breaker lever pivot	1	М	—	—	—	—	Ж	—	—	—	
	cam brush	1	М	—	—	—	—	Ж	—	—	—	
20	Clutch release bearing	1	У	—	—	Ж	—	—	—	—	—	
21	Transmission drive gear shaft bearing	1	У	—	—	—	—	—	—	—	—	during overhaul
22	Transmission	1	Н	—	—	—	—	Ж	Ж	Ж	—	
23	Rear axle	1	GS	—	—	—	—	Ж	Ж	Ж	—	

Table 2

RECOMMENDED LUBRICANTS AND FLUIDS

Symbol in Chart	Lubricants used in summer (atmospheric temperatures above +5° C)	Lubricants used in winter (atmospheric temperatures below +5° C)
M	**Summer grade engine oil** Viscosity 3.5—5° E at 50° C (SAE 20—5*W* or 30—5*W* oil)	**Winter grade engine oil** Viscosity 7—10° E at 50° C (SAE 20—5*W* or 30—5*W* oil)
H	**Summer grade transmission oil** Viscosity 3.0—4.5° E at 100° C (SAE 90 oil)	**Winter grade transmission oil** Viscosity 2.7—3.2° E at 100° C (SAE 90 oil). In extremely cold weather use SAE 80 oil
GS	Hypoid grease, summer grade	Hypoid grease, winter grade

ERRATA

page	line	is printed	to be read
21	7 (from top)	Viscosity 3.5—5° E at 50° C Viscosity 7—10° E at 50° C	Viscosity 7—10° E at 50° C Viscosity 3.5—5° E at 50° C
39	4 (from top)	drill	grill

1. **The water pump** is made with two ball bearings lubricated through one cap oiler. Force lubricant into the bearings until it appears from the check hole in the pump body. Then remove excess lubricant, otherwise it will quickly render the fan belt unserviceable.

2. **Storage battery terminals** should be cleaned of corrosion and lubricated every 6,000 *km* but not less than twice a year.

3. **The steering gear** is lubricated with the same lubricant as used in the transmission. Check the oil level every 1,000 *km*. The oil level should be 20 *mm* below the edge of the filler hole.

As the frosty weather sets in, do not fail to add fluid oil into the case to reduce viscosity of the lubricant. For this purpose remove the

lower right bolt of the front cover and drain about 0.1 *l* of lubricant. Then replace the bolt and add fluid oil through the filler hole in the top to the edge of this hole. Change oil in spring.

4. **The generator** is provided with two oilers into which five drops of oil should be poured.

5. **Hand brake cable** should be lubricated through the hole closed with a spring clamp located in the upper part of the cable tube.

6. Every day check the oil level in the tank of the central chassis lubrication system. This level should not drop below ⅔ of the tank height. Add oil, if necessary.

Operate the system daily before driving out and every 200 *km* of operation by depressing the pump pedal twice.

While driving over muddy and wet roads, lubricate the chassis every 30 to 40 *km*.

Having forded a stream, lubricate the chassis immediately.

Every 6,000 *km* clean the pump and metering device filters. Once a year remove and clean the pump and metering devices.

7. **The brake and clutch master cylinder** should be replenished with brake fluid every 1,000 *km*, if necessary. The fluid level should not drop below 20 *mm* from the filler hole edge.

8. **The lower bearing of the gear shift shaft** should be lubricated by turning the cap oiler two turns every 1,000 *km*.

9. **Intermediate and propeller shaft joints and splines** are lubricated with thin transmission oil by means of the lubricating gun. Lubrication of these points with consistent lubricants is not allowed.

The universal joints (3 oilers) should be lubricated until the oil appears from the check valves located on the opposite side of the cross.

The splines (1 grease fitting) should be lubricated by 5 to 6 strokes of the grease gun without waiting for the lubricant to appear. Excessive quantity of lubricant may press out the shaft plug and get inside the shaft tube thereby interfering with its balancing.

10. **The rear shock absorbers** should be remove every 6,000 *km* and replenished to the level of the filler plug, leaving the space above the plug empty.

Once a year remove the shock absorbers, flush out with kerosene or gasoline and leave to dry.

11. **The rear wheel bearings** are lubricated by filling the cap oiler and pressing it out twice.

12. **The springs** should be lubricated every 6,000 *km* or at an earlier date, if squeaking appears.

13. **Check the crankcase oil level** every day and top up, if necesary. Change crankcase oil every 2,000 to 3,000 *km*. Drain the crankcase immediately after stopping the engine when the oil is still hot and drips down easily. In spring and autumn carry out seasonal oil changes.

14. **The fine oil filter element** should be replaced, as a rule, simultaneously with the crankcase oil change. The element should be replaced earlier if the oil becomes darker which is an evidence of the clogged fine filter.

15. **When changing lubricant in the front wheel hubs,** flush out the hubs and bearings and pack with fresh grease.

16. **The front shock absorbers** should be replenished every 6,000 *km* without removing them from the car. Once a year remove the shock absorbers and flush out with kerosene or gasoline.

17. **Change oil in the carburettor air cleaner** simultaneously with crankcase oil change.

While driving over dusty roads, change oil every day.

When the air cleaner element becomes dirty, rinse it in kerosene, allow the kerosene to drip down then dip it in clean oil. It should be borne in mind that the air cleaner does not function properly unless its filter element is covered with an oil film. Therefore keep the quantity of the oil filled into the cleaner in conformity with the recommendations of the Lubrication Chart.

18. **Clean the coarse oil filter** by turning its stem every day 1.5 to 2 turns on the hot engine for which purpose swing its handle 15 to 20 times.

Drain sediment every 2,000 *km* when changing crankcase oil. Every 6,000 *km* disassemble the filter and flush it out.

19. **In the ignition distributor** lubricate the following points:
shaft bushing by turning the cap oiler one turn every 6,000 *km*;
breaker lever pivot by 1 or 2 drops of oil every 6,000 *km*;
breaker cam brush by 1 or 2 drops of oil every 6,000 *km*.

20. **The clutch release bearing** should be lubricated by turning the cap oiler 2 or 3 times every 1,000 *km*. Excessive lubrication of the bearing results in the slipping of the clutch. If a new hose is installed, fill it with lubricant.

21. **The transmission drive gear shaft bearing** located in the flywheel is to be lubricated during engine overhaul.

22. **Check the oil level in the transmission housing** every 6,000 *km*; change oil every 12,000 *km* of operation also in spring (for the summer grade) and autumn (for the winter grade) regardless of the mileage.

23. **Check the lubricant level in the rear axle housing** every 6,000 *km* and top up, if necessary. Change lubricant every 12,000 *km* of operation, but not less than twice a year: in spring and autumn.

Lubrication of the Car Body

The cab body lubrication points and lubrication intervals are shown in Fig. 8. Description of the lubricating points, their number and lubrication instructions are given in Table 3.

Table 3

BODY LUBRICATION TABLE

No. of lubricant points	Name of lubricating point	No. of lubricant points	Lubricating instructions
1	Hood hinges	4	Apply thin oil every 6,000 *km*
2	Hood lock catch	1	do
3	Door locks and outer door handle knobs	8	Apply consistent grease twice a year
4	Door lock cylinder	2	Apply graphite powder every 6,000 *km*
5	Door guide dowels .	8	Lubricate with lubricating pencil every 6,000 km
6	Door lock rotor	4	Lubricate every 1,000 *km* with lubricating pencil
7	Door dowel retainer lock	4	Lubricate every 6,000 *km* with lubricating pencil
8	Retainer teeth	4	Lubricate every 1,000 *km* with lubricating pencil
9	Door hinges	8	Apply consistent grease every 6,000 *km* (earlier, if necessary)
10	Door stop hinge	4	Apply thin oil every 6,000 *km*
11	Door rubber sealing strip	4	Rub with graphite powder every 6,000 *km*
12	Luggage compartment lock and button	2	Every 6,000 *km* lubricate lock rotor with lubricating pencil. Twice a year lubricate lock with thin oil
13	Luggage compartment lock cylinder	1	Apply graphite powder every 6,000 *km*
14	Luggage compartment lid rubber sealing strip	1	Apply graphite powder every 6,000 *km*

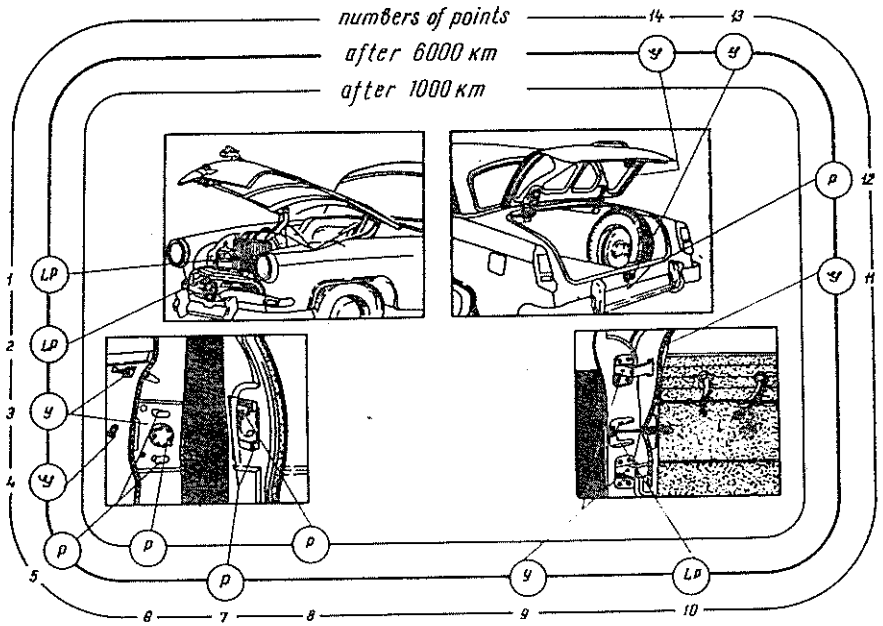


Fig. 8. Body Lubrication Points

CARE OF THE CAR

Upon completion of the running-in programme the service life of the car depends on the attention given to it and on the quality of the servicing materials used. Failure to observe the recommendations given in the instructions causes sharp reduction of the car life.

The maintenance operations should be carried out as required, daily and every 200; 1,000; 2,000; 3,000; 6,000 and 12,000 kilometres of operation, also twice a year (seasonal maintenance in spring and autumn) and once a year.

Maintenance As Required

Operations carried out as required include those whose periodicity depends not so much on the mileage, as on the conditions of car operation, those which become necessary not regularly but at odd intervals, and those which cannot be postponed.

These operations are:

1. Washing the car chassis and body.

2. Removal of carbon deposits in the engine. These deposits formed on the inner surface of the combustion chamber in the cylinder head and on the piston crowns may be removed by driving the car at high speed. If high quality gasoline is used the engine is self-cleaned after a 150 to 200 *km* run. If the engine has not been self-cleaned remove the cylinder head and clean both the cylinder head and piston crowns. If in a short time the engine becomes carbonized again, this is an indication that the engine should be repaired in the first place by cleaning or replacing of the piston rings.

Excessive oil consumption should not be always attributed to worn piston rings or cylinders, it may be caused by gumming up of oil control ring slots. In this case remove carbon deposits from the rings.

3. Checking and adjusting the valve-to-rocker arm clearances and lapping the valves. Check the valve-to-rocker arm clearances on the cold engine with removed valve cover.

The clearance should be 0.25 to 0.30 *mm*. Check clearances with fully lowered tappets. When adjusting, do not make the clearances smaller than indicated above, as small clearances cause poor seating and burning of valves.

4. Elimination of irregular engine performance at low speed during acceleration. This deficiency may be caused by clogged carburettor, improper breaker point gap, wear of breaker points, faulty spark plugs (with cracked or burnt insulators), improper spark plug gaps, leakage of H. T. current due to soiled distributor, faulty wires.

Poor engine performance at low speed may also be caused by air leaking through loose connections of the manifold.

5. Squeaking of the springs is remedied by lubricating them.

6. If braking begins during the second half of the brake pedal travel, and when the pedal, being firmly depressed, comes close to the floor, it means that the brakes want adjustment.

Each time, when driving the car, after adjustment of brakes and front wheel bearings check the brake drums and front hubs for heating.

Daily Maintenance

Inspect the storage battery and, if necessary, perform the following operations:

1. Wipe the storage battery with a rag soaked in ammonium hydroxide or in a solution of soda ash. Oxidized battery and cable terminals should be cleaned and coated with petrolatum.

2. Check attachment of the storage battery in its frame.

The wing nuts, fixing the frame, should be tightened securely by hand without the use of any tools, because overtightening may result in breaking of the battery case.

3. Check attachment and contacts between the wire terminals and battery lead-out terminals.

4. Clear the battery cell ventilation holes.

Before Driving Out

5. Check the gasoline level in the fuel tank, water level in the radiator, oil level in the engine and oil level in the central lubrication pump reservoir.

6. Inspect the car and make sure there are no fuel, water, oil and brake fluid leaks.

7. Check proper functioning of the steering gear, brakes, horn and lighting.

8. Check tyre pressure.

9. Turn the coarse oil filter handle twice (on the warmed up engine).

10. Lubricate the front suspension and steering rods by operating the pedal of the central lubrication pump.

Make sure the lubricant is fed to the king-pin, steering rod joints, and front suspension lever connections (lubricant oozing out through the joint and connection seales is an evidence of a properly functioning lubricating system).

200 km Maintenance

Lubricate the front suspension and steering rods.

1,000 km Maintenance

1. Check fan belt tension (the belt pressed by finger should sag for 10 or 15 *mm*).

2. Check the electrolyte level in the storage battery and add distilled water, if necessary. Check specific gravity of electrolyte (see "Storage Battery Operation and Care Instructions").

3. Check tightening and cleanliness of wire connections of the storage battery, generator, current and voltage regulator, starter and other electrical equipment.

4. Check the brake pedal free travel (10—15 *mm*) and clutch pedal travel (32—40 *mm*) and adjust, if necessary.

5. Check the fluid level in the brake master cylinder and add fluid, if necessary.

6. Check operation of foot brakes and, if the clearance between the pedal and the body front panel is less than 35—40 *mm* with fully depressed pedal, adjust as described in the "Brakes" section.

7. Check condition of all the car attachments paying maximum attention to attachment of the steering gear case and steering arm, and generator-to-bracket bolts.

8. Carry out all the chassis lubrication operations in conformity with the Lubrication Chart.

2,000 km Maintenance

1. Change oil in the engine. Replace the fine oil filter element subsequent to draining the sediment from the filter. Drain sludge from the coarse oil filter.

3,000 km Maintenance

2. Inspect the tyres. If the tread is worn unevenly, find out and eliminate the cause of trouble. Interchange the tyres together with wheels as shown in Fig. 9.

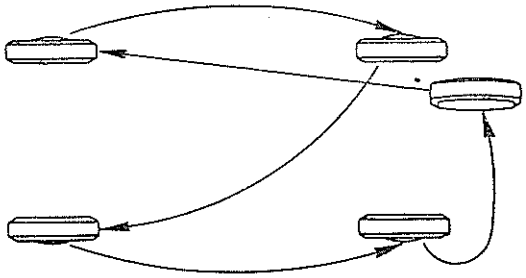


Fig. 9. Tyre Interchanging Order

6,000 km Maintenance

1. On the moving vehicle make the following checks:
a) deflections of the ammeter pointer;
b) cooling water temperature;
c) operation of brakes;
d) operation of the steering gear and behaviour of the car on road;
e) engine performance at idle speed and under load;
f) oil pressure in the engine lubricating system as shown by the oil pressure gauge (on the warmed up engine of the parked car).

ENGINE

2. Listen to the valve operating noises and adjust clearances, if necessary.

3. Tighten the nuts attaching the manifold to the engine, the nuts attaching the inlet pipe to the exhaust pipe, and the nuts connecting the manifold to the muffler inlet pipe.

4. Tighten the bolts attaching the generator bracket to the engine and the generator to the bracket.

5. Remove the carburettor and clean the mixing chamber of gummy residue. Having replaced the carburettor adjust engine low speed as described in the "Ignition System" section.

6. Inspect the breaker points in the ignition distributor and clean, if necessary. Adjust the breaker point gap. Readjust ignition timing disturbed during adjustment of the breaker point gap.

7. Inspect the spark plugs, check electrode gaps (0.8 to 0.9 *mm*) and adjust, if necessary.

8. Inspect fuel pump to engine attachment, condition of the flexible fuel hose and check its connections for tightness.

9. Clean the sediment bowl and filter screen of the fuel pump.

10. Check fan belt tension.

11. Inspect the water pump and check for leaks.

12. Drain dirt and water from the fuel tank.

13. Check condition of gaskets on the radiator filler cap.

Electric Equipment

14. Check the level and specific gravity of electrolyte in the storage battery and add distilled water, if necessary (see "Storage Battery" section).

15. Wipe and inspect the storage battery case. Cracked and leaky case should be repaired or replaced.

16. Clean the contacting surfaces of the storage battery wire terminals. Coat the connections and terminals with petrolatum.

17. Check condition of the generator and starter commutator and brushes. Blow them with compressed air and wipe the commutators with a clean rag soaked in gasoline.

18. Check functioning of the current and voltage regulator by means of special instruments.

19. Check generator, current and voltage regulator, and starter wire connections for cleanliness and tightness.

20. Check condition of other wires and cables and repair all the damaged places on the cable insulation.

21. Check head lamp aiming and the functioning of the entire lighting system.

22. Check attachment of horns and attachment of wires leading to the horns and to their relay.

23. Check and clean, if necessary, the contacting surfaces of the cigar-lighter.

After cleaning check the time required for heating the element. If necessary, adjust by bending the bimetal springs.

The cigar-lighter should be automatically switched off after 8 to 16 *sec.*

Chassis Units

24. Check free travel of the brake and clutch pedals.

25. Check condition of the propeller shaft joint locking rings and look for leaks.

26. Inspect condition of the spring rubber bushings.
27. Inspect condition of the front and rear shock absorbers. If there are leaks, tighten the glands, check the fluid level and add shock absorber fluid, if necessary; tighten the bolts and rear shock absorber post pin nuts.
28. By rocking the front wheel brake drums check tightening of the front wheel bearings and the clearances in the king pins and upper threaded pins of the front suspension. Clearances in the king pins and threaded pins are eliminated by adjustments. If there are excessive clearances between the king pins and bushings, they should be replaced.
29. Remove the brake drums and inspect condition of brakes. Make sure there is no leakage of the brake fluid. If the fluid leaks from under the cylinder cap, disassemble the cylinder and rinse with alcohol. Check brake linings for wear. Make sure the rivet heads are still sufficiently sunk into the linings.
30. Check the toe-in, camber and caster of the front wheels and adjust, if necessary.
31. Check operation of the foot brakes and adjust them, if necessary.
32. Check operation of the hand brake and its linkage.
33. Make sure there is no play in the pendulum lever pivot and, if necessary, tighten a little the upper threaded bushing. Tighten the bolt of the terminal clamp of the pendulum lever head.

Attachment of Units and Parts

34. Tighten the bolts of the bracings leading from the side members to the body front panel.
35. Tighten the bolts attaching the front suspension cross member to the side member.
36. Uncotter and tighten the bolts attaching the front suspension lower lever pivots to the cross member and install the cotter pins back.
37. Tighten the bolts attaching the lateral stabilizer bushing casing.
38. Tighten the four threaded bushings of the lower levers, four threaded pin nuts, four terminal clamps of the front suspension post; tighten the lower threaded bushing of the pendulum lever and the pendulum lever bracket bolts.
39. Tighten the bolts attaching the steering gear case to the side member.
40. Tighten the steering arm nut.
41. Uncotter and tighten the nuts attaching the steering levers to the steering knuckles. After tightening replace cotter pins.
42. Tighten the steering rod ball pin nuts.
43. Check tightening of the spring clip nuts.
44. Check attachment of body parts: door hinges, door dowels and latches, hood hinges, front and rear fenders, mud guards, etc.

Lubrication

45. Carry out all the chassis lubrication operations as instructed in the Lubrication Chart.
46. Lubricate the door hinges and body fittings.
47. Lubricate the springs.
48. Prime the central chassis lubrication system by operating the pump pedal many times. Check pipe connections for tightness. Clean the pump and metering device filters.
49. Lubricate the universal joints and propeller shaft splines.

12,000 km Maintenance

1. Carry out all the operations listed in 6,000 *km* maintenance.
2. During a trial run check, whether it is necessary to remove carbon deposits from the combustion chambers (see "Maintenance As Required").
3. Remove, disassemble and clean the carburettor. Clear carefully all the orifices and the mixing chamber. Inspect all the gaskets and replace the faulty ones. Check the fuel level in the float chamber. Having reinstalled the carburettor adjust closing of the choke valve and minimum idle speed.
4. Look for resinous deposits in the engine inlet pipe. If it is to be cleaned wash it with benzol or turpentine.
5. Remove the coarse oil filter from the engine, and clean its sediment bowl and filter of sediment.
6. Blow the fine oil filter connecting pipes.
7. Remove the starter, clean it and blow with compressed air. Check the setting of the beginning of engagement.
8. Check operation of the vacuum and centrifugal spark advance automatic control devices.
9. Remove the front wheel hubs and wash the bearings, steering knuckles and inner chambers of the wheel hubs in kerosene. Having checked their condition, assemble and adjust the tightening of bearings. When assembling, pack them with 120 *g* of fresh consistent grease with a high melting point.
10. Remove the propeller shafts and the central brake drum, and tighten the nuts attaching the flanges to the transmission, rear axle and intermediate propeller shaft tail pieces.
11. Change oil in the rear axle and transmission bearings.

Seasonal Maintenance (once or twice a year)

1. In autumn (at an air temperature of under +5° C) and in spring (at a temperature above +5° C) change oil in the engine, transmission and rear axle in conformity with the recommendations of the Lubrication Chart.

2. In autumn add fluid oil into the steering gear case. In spring change oil.

3. In autumn remove the gasoline tank and wash it carefully.

4. In autumn flush out the engine cooling and body heating systems.

5. In autumn check carefully the engine ignition system to avoid difficulties while starting a cold engine in winter.

6. In autumn fill the cooling system with anti-freezing solution.

7. In spring and autumn change the specific gravity of electrolyte if this is required by the conditions of operation.

Yearly Maintenance

1. Remove all the shock absorbers, take out the plugs, remove the valves and flush out the body and valves several times with kerosene or gasoline until all dirt is removed.

When washing, clamp the shock absorber lever in a vice and rock the body by hand. Do not clamp the shock absorber body as this will inevitably lead to deformation of the inner surface of the cylinder. The bodies of the front and rear shock absorbers should be flushed out without removing the cylinder face covers. After flushing remove the remaining kerosene (or gasoline) by carefully blowing the bodies with compressed air and subsequent rinsing with shock absorber fluid.

To avoid improper functioning of the shock absorber do not confuse the springs during assembly, and do not undertake any adjustments. It is advisable to mark the valves before disassembly. Having screwed in the valves fill the shock absorbers with fluid (see Lubrication Chart). After filling allow excess fluid to flow out and install the plug.

2. Inspect the brakes and the brake system. Remove the brake drums, flush and wipe the drums and backing plates of all the brakes. Disassemble the master cylinder and the wheel cylinders.

Clean off dirt from the pistons, working surfaces of the cylinders and other parts with great care. While disassembling and cleaning do not use metal tools and fluids of mineral origin (gasoline, kerosene, etc.). Rinse the cylinders and brake piping with alcohol or brake fluid. Rinsing may be carried out by priming the fluid through the master cylinder. Before reassembly lubricate the pistons and collars with castor oil or brake fluid.

3. Disassemble the springs. Check condition of gaskets between the spring leaves and replace, if necessary. Lubricate the springs with oildag.

4. Check the readings of the water temperature gauge and oil pressure gauges, and condition of the water temperature tell-tale lamp sensitive unit.

5. Once a year but not less than every 20—25 thousand kilometres lubricate the speedometer flexible shaft.

6. Remove the central lubrication pump and metering devices, disassemble and flush in kerosene or gasoline (except for the rubber parts). Disconnect the pipes and blow them through with compressed air. Wipe and blow with compressed air the pump body, metering device body, and screen filters. While assembling, pay attention to condition of gaskets and collars. Replace the faulty ones. The metering device caps should be installed back in their corresponding places. Confusing of caps will result in unduly abundant lubrication of some points and insufficient lubricant fed to the other points.

Engine

The "Volga" automobile is powered by Model М-21Д gasoline, four-stroke cycle engine with overhead valves (Figs. 10 and 11). The valves, located in the cylinder head are actuated by the camshaft through the valve tappets, push rods and rocker arms.

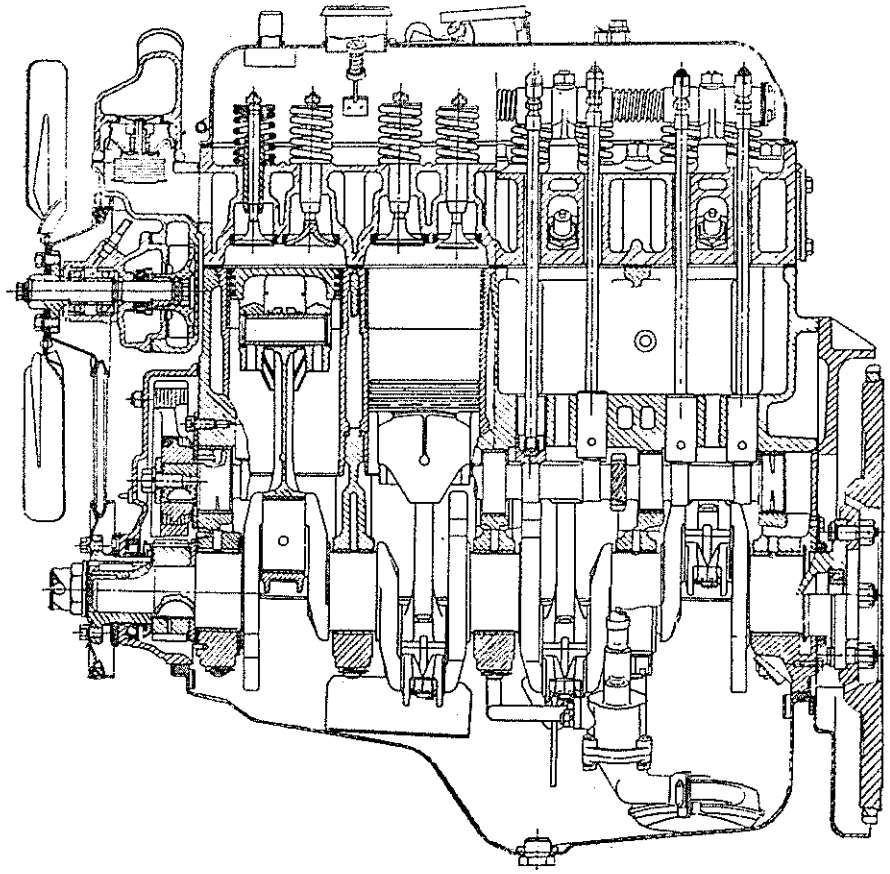


Fig. 10. Engine Longitudinal Section

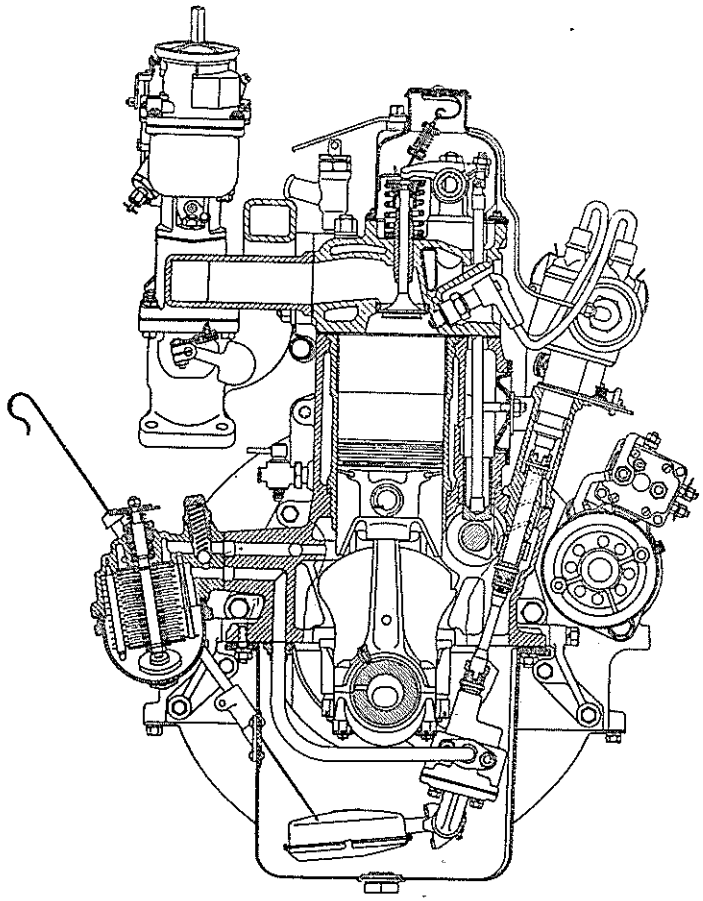


Fig. 11. Engine Cross Section

Engine Lubricating System

The main and big end bearings of the crankshaft, the camshaft bearings, rocker arm bearings and the rocker arm upper tips are pressure lubricated. Other working surfaces are splash-lubricated.

Engine lubrication diagram is shown in Fig. 12. The oil pressure in the engine lubricating system with the car moving at 50 *km/hr* should be from 2 to 4 *kg/cm²*. On a cold engine it may rise to 4.5 *kg/cm²* and in a hot summer weather it may drop to 1.5 *kg/cm²*.

A pressure drop below 1.0 *kg/cm²* at medium engine speed is a symptom of some engine deficiency. In this case further operation of the car should be stopped. At low idle speed the oil pressure in a warmed up engine should be not less than 0.5 *kg/cm²*.

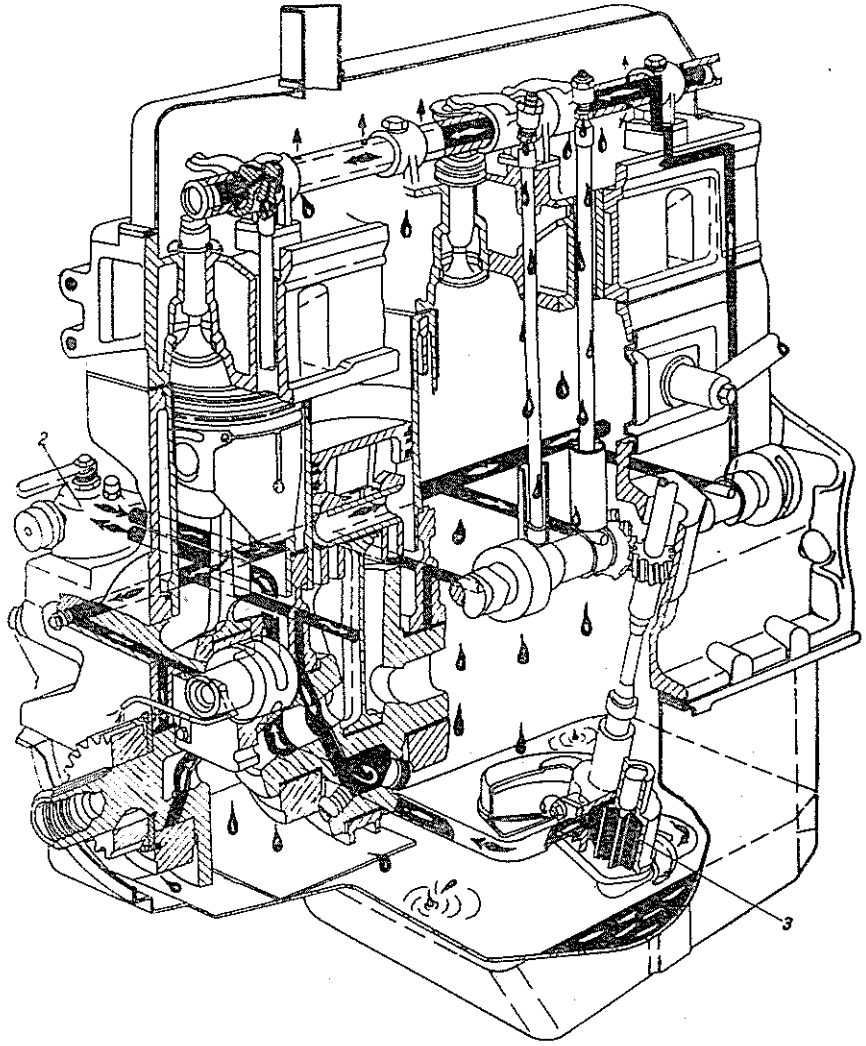


Fig. 12. Engine Lubrication Diagram

1 — relief valve; *2* — coarse oil filter; *3* — oil pump

The engine lubricating system is protected against overpressure by the relief valve located in the front end of the cylinder block, on the right-hand side, under the generator bracket.

Abrupt pressure drop in the lubricating system may be caused by clogging of the relief valve. In such a case disassemble the relief valve and rinse its parts carefully in gasoline. Blow with compressed air the valve chamber in the cylinder block and reassemble the valve. Do

not tamper with the valve setting (do not change the thickness of the gasket, nor extend the spring, nor place washers under it).

The oil level in the engine crankcase should be maintained at all times between the "O" and "П" marks on the dipstick. Instructions for changing the oil are given in the "Lubricating the Car" section. If large quantities of sediment accumulate in the engine crankcase the

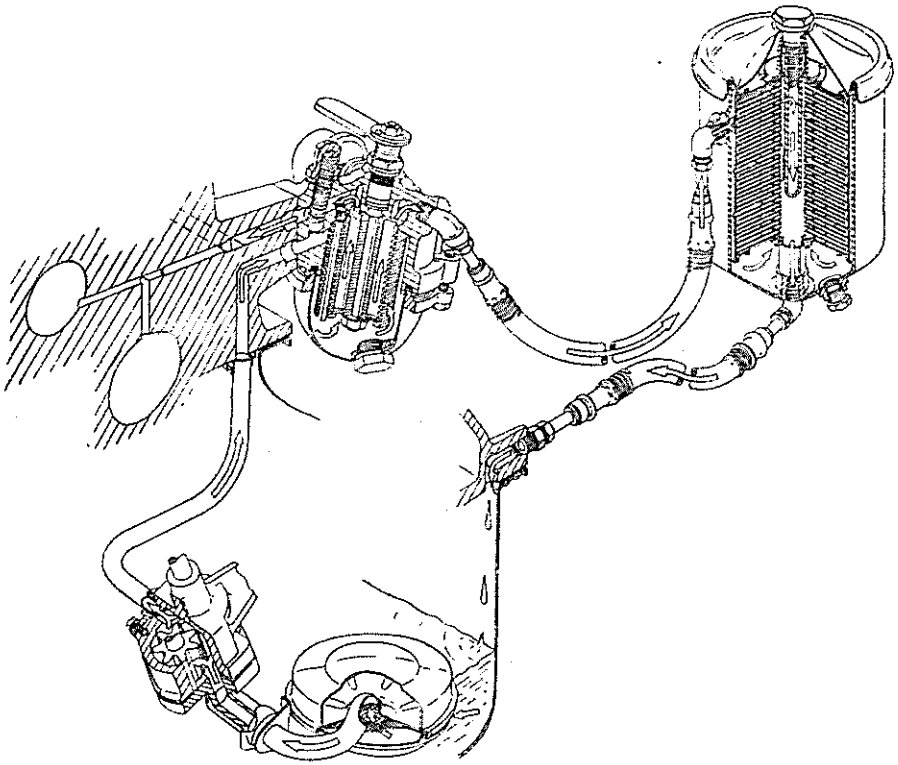


Fig. 13. Engine Oil Filter Installation Diagram

latter should be flushed out. For this purpose use thin oil and not kerosene. Drain oil, fill the crankcase with 5 litres of flushing oil and work the engine at low speed for 2 or 3 minutes. Then drain flushing oil and fill with fresh oil as usual.

The coarse oil filter (Fig. 13) is provided with a by-pass valve which cuts off the filter if its element becomes badly clogged. The element must be cleaned on the hot engine by rocking the handle by hand. The handle is fitted with an overrunning spring mechanism.

Drain sediment from the filter sediment bowl every 2,000 to 3,000 *km* of operation when changing crankcase oil. Before removing the drain plug pump the handle 15 to 20 times. If the filter becomes

clogged, which is indicated by difficult rotation of the handle, it should be cleaned.

The fine oil filter is mounted on the right side of the radiator shield. It is fitted with a replaceable filter element. Every 2,000 to

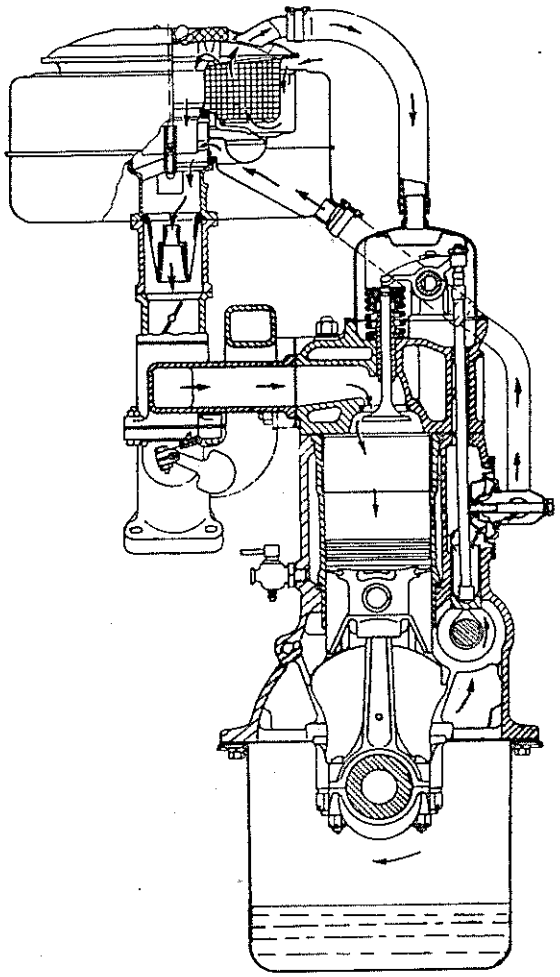


Fig. 14. Engine Crankcase Ventilation Diagram

3,000 *km* of car operation (when changing crankcase oil) clean the filter of dirt and water accumulated in the sediment bowl and replace the filter element.

Crankcase ventilation is of the closed forced type, functioning due to a difference of the vacuum in the different zones of the air cleaner (Fig. 14).

Do not disconnect the cranscase ventilation system, and do not disturb its tightness. It is not allowable to work the engine with opened oil filler neck, as this will cause dust to be sucked into the crankcase which will greatly increase the wear of the engine.

Periodically check the crankcase ventilation pipe connections for tightness. Every 6,000 *km* of operation flush out the lower reservoir of the air cleaner and clean the pipes and hoses of the crankcase ventilation system.

Engine Cooling System

The cooling system is of the closed type with forced circulation of coolant. To ensure the best temperature conditions for the working engine (80—90° C) and to speed up its warming, the cooling system

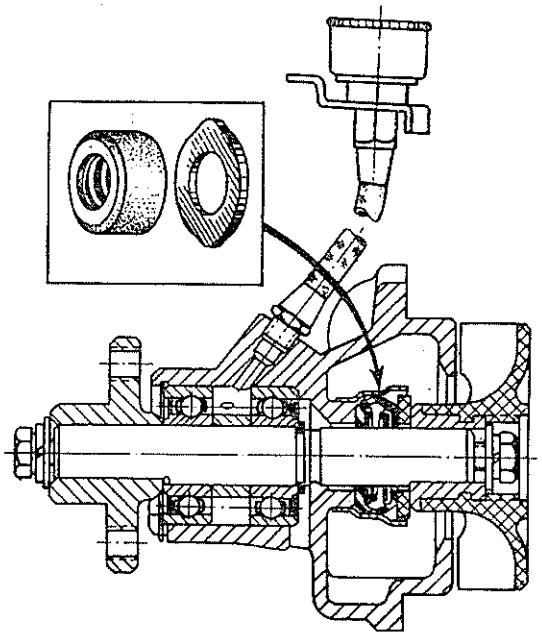


Fig. 15. Water Pump

includes a thermostat valve located in the cylinder head jacket pipe and a radiator blind installed in front of the radiator and controlled by the handle from the driver's seat. When starting the engine, close the blind, then gradually open it as the engine begins to be warmed up. Warming up the engine in winter with the opened radiator blind may

result in freezing of water in the radiator, because the thermostat prevents the water from circulating through the radiator at the beginning of warming up.

To maintain engine temperature in winter the radiator drill should be covered with a warm jacket.

The radiator filler cap closes the radiator hermetically, so that the cooling system communicates with the atmopshere through the cap valves only. The valves prevent water losses even if the water temperature rises a little above 100° C.

For proper functioning of the cap see that its gaskets are in good working order.

The water pump (Fig. 15) is of the centrifugal type. It is attached to the cylinder block face through a hollow cast bracket by means of four studs. The pump shaft is sealed by the shelf-adjusting face gland consisting of a textolite thrust washer and a rubber collar with cases and spring.

Water leaking through the check hole in the lower part of the pump is an indication of a faulty gland. Under no circumstances should this hole be plugged, because in this case the water seeping through the gland will get into the pump ball bearings and damage them.

The bearings are lubricated through a cap oiler located on the bracket attached to the outlet pipe stud. Lubricant must be packed in until it appears from the check hole on the pump body.

Fuel System

The engine installed on the "Volga" car should be run on gasoline of 80 octane rating.

If gasoline with lower octane rating is used, the ignition must be retarded. This involves loss of power and increases fuel consumption.

The quantity of the fuel in the tank is checked by means of the electric gasoline level gauge installed in the instrument cluster, and by the dipstick installed in the tank (inside the luggage compartment).

The carburettor, Model К-22И, is of the vertical downdraft type with balanced float chamber (Fig. 16). To reduce overflooding of fuel through the main jet atomizer when negotiating steep uphills and during rough jerks, the float mechanism is provided with a needle valve with spring and thrust stem.

The jet capacity (tested by water) at a head of 1 *m* and at 20° C is given below:

Main jet	220 ± 5 *cu.cm*
Compensating jet	325 ± 8 *cu.cm*
Idle speed jet	52 ± 3 *cu.cm*
Power jet diameter	1.2 ± 0.06 *mm*

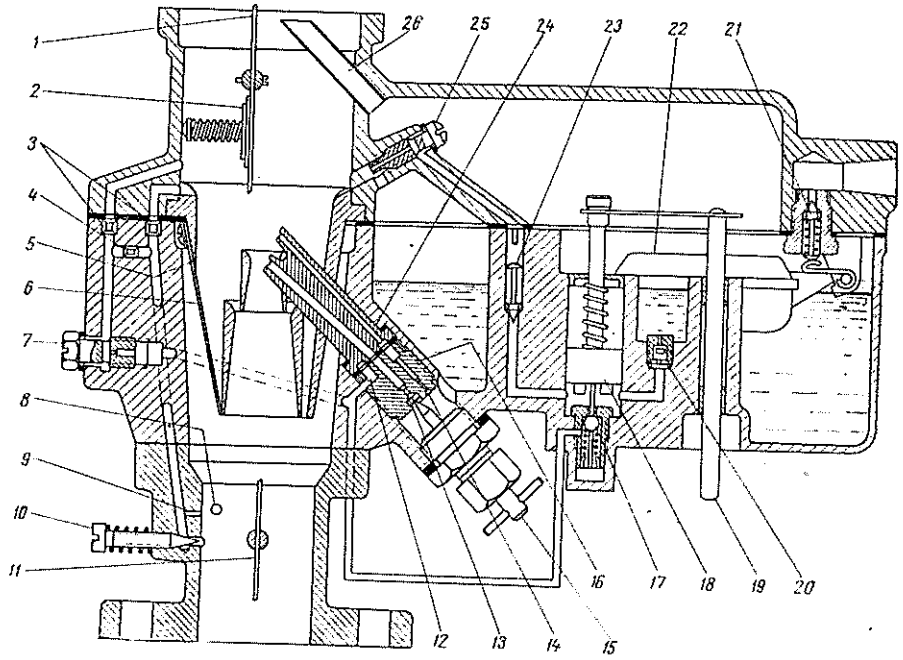


Fig. 16. Carburettor K-22H Diagram

1 — choke valve; *2* — choke valve safety valve; *3* — air jets; *4* — emulsion jet; *5* — venturi bank; *6* — venturi spring plates; *7* — idle speed jet; *8* — vacuum regulator, hole; *9* — idle speed system upper outlet hole; *10* — idle mixture adjusting screw; *11* — throttle valve; *12* — power jet (economizer); *13* — main jet; *14* — compensating jet; *15* — main jet adjusting needle; *16* — bank of jets; *17* — economizer valve; *18* — acceleration pump piston; *19* — acceleration pump drive; *20* — acceleration pump return valve; *21* — float chamber needle valve consisting of valve, spring, and stem; *22* — float; *23* — acceleration pump valve; *24* — atomizer bank; *25* — acceleration pump jet; *26* — balancing pipe

The carburettor should be serviced as follows:

1. Wash and blow the float chamber, jets, air holes, venturies and passages in the bodies with air.
2. Wash the float valve and check it for tightness.
3. Check the fuel level in the float chamber.
4. Check carburettor joints for tightness and condition of cardboard gaskets, plugs, fuel pipes, etc.
5. Adjust minimum idle speed.
6. Periodically remove resinous sludge from the mixing chamber, because gumming up results in irregular engine running at idle speed.
7. Systematically check the acceleration pump rod for absence of binding.

To start successfully the cold engine see that pulling out of the choke knob closes the choke valve and opens partly the throttle valve. This is ensured automatically by the rod connecting the choke valve control with the level whose cam opens the throttle valve a little.

Minimum idle speed of the engine is adjusted by the thrust screw limiting the closing of the throttle valve and by the adjusting screw changing composition of the combustible mixture. While adjusting, remember, that screwing the adjusting screw IN makes the mixture leaner, and screwing it OUT, enriches the mixture.

Begin the adjustment by turning the adjusting screw all the way IN (though not too tightly); then back it off 2 or 2½ turns. This will make the mixture too rich. Start the engine and use the thrust screw to adjust the minimum opening of the throttle at which the engine runs steady. Then proceed to make the mixture leaner turning the adjusting screw each time ¼ of a turn until the engine starts to fire irregularly due to excessive lean mixture. Then make the mixture richer by backing the adjusting screw ½ of a turn.

Having adjusted mixture composition reduce the idle speed, unscrewing gradually the throttle valve thrust screw and set such a speed at which the engine does not stall when the accelerator pedal is released.

Idle speed of the engine should be adjusted only on the fully warmed up engine and with the ignition system in a perfectly serviceable order. Pay particular attention to condition of spark plugs and correct spark plug gap.

The fuel pump of the centrifugal type is actuated by the eccentric fitted over the camshaft. It is provided with a lever for manual priming.

Ignition System

The ignition system is of the storage battery type (see "Ignition System Diagram", Fig. 17). To ensure fail-safe functioning of the ignition system inspect periodically the ignition distributor, spark plugs, ignition coil and H. T. cables.

The ignition coil is installed on the body front panel. An additional resistance installed between the coil terminals is shorted automatically when the engine is started by the starter.

When adjusting the spark plug gap, bend the side electrode only, because bending of the central electrode results in cracking of the spark plug insulator. Check the gap by the feeler gauge furnished by the Works.

Adjusting the Breaker Point Gap

Prior to adjustment inspect the working surfaces of the breaker points and, if they are oiled, burned or soiled, clean them with a dry clean rag and a needle file. The use of emery cloth for this purpose is not allowable. After cleaning wipe the points.

To adjust the gap, rotate the crankshaft by the starting crank to set the breaker cam in the position in which the breaker points are at their widest.

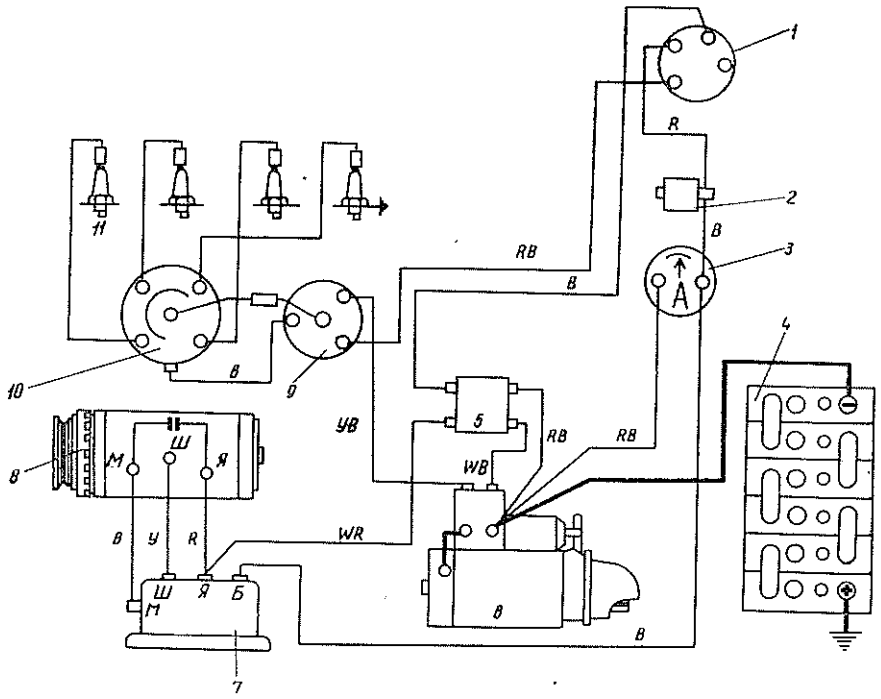


Fig. 17. Ignition System Diagram

1 — ignition switch; *2* — bimetal thermal fuse; *3* — ammeter; *4* — storage battery; *5* — starter relay; *6* — starter; *7* — current and voltage regulator; *8* — generator; *9* — ignition coil; *10* — distributor; *11* — spark plugs

Symbols: М — ground; Ш — shunt; Я — armature; Б — battery

Cable Colour Code: B — black; R — red; Y — yellow; WB — white black; YB — yellow black; RB — red black; WR — white red

To change the gap, loosen the stop screw (Fig. 18) holding the plate with the fixed breaker point and, rotating the adjusting screw, located near the lever pivot, set a clearance of 0.35 to 0.45 *mm* measuring it by the feeler gauge. Having set a correct clearance turn in the stop screw.

Ignition Timing

Ignition is timed by means of the marks on the crankshaft pulley where the TDC is marked and a 15° scale is stamped on either side of the TDC mark.

The breaker should open the circuit at the moment when the piston in No. 1 cylinder approaches the top dead centre on the compression stroke. The TDC mark should be at this moment exactly opposite the timing pin located in the timing gear cover.

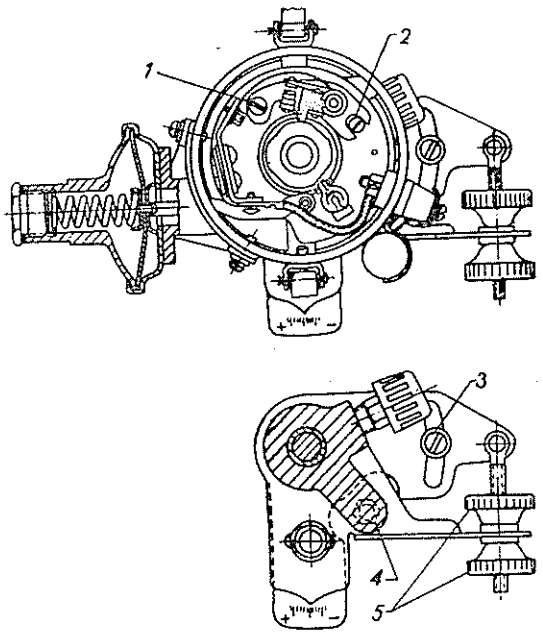


Fig. 18. Ignition Distributor

1 — stop screw; *2* — adjusting screw; *3* — distributor adjusting screw; *4* — octane selector to distributor body bolt; *5* — octane selector nuts

The distributor rotor should be located correspondingly opposite No. 1 cylinder contact in the distributor cap. Ignition should be timed with a high degree of precision as even insignificant errors will result in abrupt increase of fuel consumption and loss of power.

Ignition is Timed in the Following Sequence

1. Remove the distributor cap and rotor and check the breaker point gap. (Adjust the gap, if necessary). Replace the rotor.
2. Remove No. 1 cylinder spark plug.
3. Closing the spark plug hole in the cylinder block with finger, turn the crankshaft by the starting crank until the air begins to escape from under the finger. This will take place at the beginning of the compression stroke in No. 1 cylinder.
4. Make sure that compression has begun and continue to rotate the crankshaft carefully until the TDC mark on the crankshaft pulley coincides with the timing pin on the timing gear cover.
5. Make sure tha the rotor is located opposite the inside contact of the distributor cap, connected to the wire leading to No. 1 cylinder spark plug.

6. Using the fine adjustment nuts set the octane selector scale at zero.

7. Loosen the distributor to drive bracket screw and turn the distributor body a little counter-clockwise, so as to close the breaker points.

8. Pull the hood lamp wire end out of the connector and connect it through an additional piece of wire to the L. T. terminal on the coil (i.e. to the terminal from which the cable leads to the distributor).

9. Turn on the ignition switch and rotate gently the distributor body clockwise until the lamp flashes up. Stop rotating the distributor exactly at the moment of flashing. If you failed to stop the distributor, turn its body into the initial position and repeat the operation.

10. Keeping the distributor body against rotation, tighten the distributor attachment screw, and replace the cap and central wire. Connect the octane selector pipe.

11. Check connection of spark plug wires beginning with No. 1 cylinder. The wires should be connected in the engine firing order, i. e. 1-2-4-3 in the counter-clockwise direction.

Each time after ignition timing and breaker point gap adjustment check the accuracy of ignition timing by listening to the engine operating noises on the moving car.

Final adjustment of the ignition timing should be done by means of the octane selector without loosening the distributor attachment screw. For this purpose it is sufficient to rotate the octane selector nuts (turning OUT one of them, and turning IN the other one). Moving the pointer one division on the octane selector scale changes ignition timing by 2° (crankshaft degrees). Turning the distributor body clockwise makes the spark advance angle more advanced, while turning it counter-clockwise — retards it.

In order to finaly time the ignition, check engine performance as follows: warm up the engine to 80 or 90° C. Driving the car in direct gear over the level road at a speed of 30 to 35 *km/hr* accelerate the car by sharply depressing the accelerator pedal as far as it will go. If this is accompanied by insignificant and momentary detonation (erroneously called "piston pin knocking") you may consider the ignition timing correct.

If detonation noises are too loud turn the distributor body counter-clockwise one division of the octane selector scale. If detonation is altogether absent turn the distributor body clockwise also one division of the octane selector scale. If necessary, re-check ignition timing. It is recommended always to have such ignition timing which produces but a light detonation when the engine is heavily loaded.

If the ignition is too much advanced, this may result in blow-by of gases through the cylinder head gasket and in burning of the valves and pistons.

If ignition is too much retarded this causes excessive fuel consumption, loss of pick up, and overheating of the engine.

CLUTCH

The car is equipped with a dry, single-plate clutch. The clutch release mechanism is operated hydraulically and consists of the pedal, master cylinder, pipe-line and working cylinder (Fig. 19).

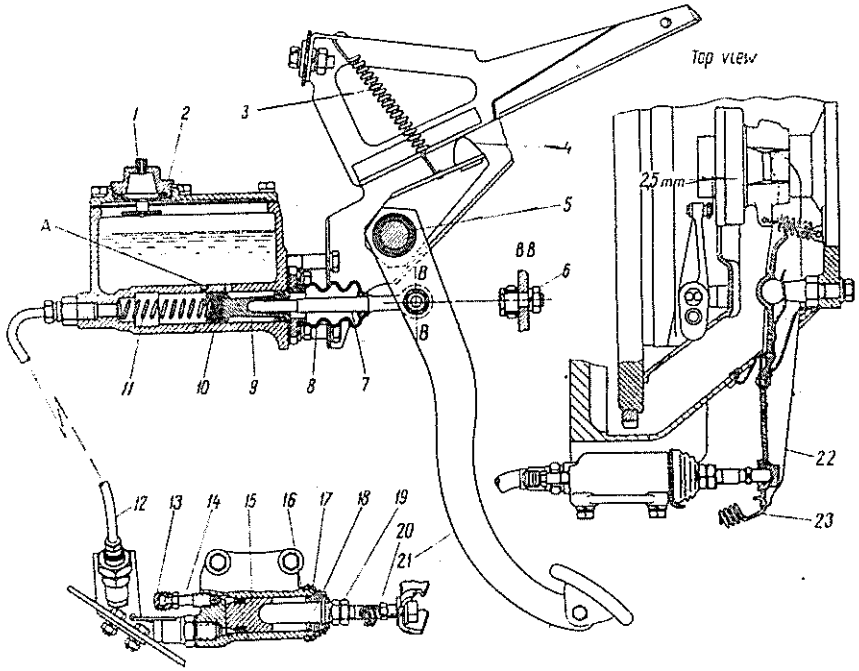


Fig. 19. Clutch Release Linkage

1 — threaded endpiece; *2* — plug; *3* — pedal retracting spring; *4* — bumper; *5* — pedal pivot; *6* — eccentric bolt; *7* — pusher; *8* — case; *9* — piston; *10* — collar; *11* — master cylinder; *12* — pipe; *13* — cap; *14* — bypass valve; *15* — piston; *16* — working cylinder; *17* — case; *18* — pusher; *19* — lock nut; *20* — rod; *21* — pedal; *22* — release yoke; *23* — yoke retracting spring A — master cylinder bypass hole

The clutch release master cylinder is made in one casting with the brake master cylinder and has a common reservoir for fluid, with a partition in the lower part, therefore a failure of one of the systems (brakes or clutch control mechanism) has no bearing on the operation of the other.

For normal functioning of the clutch and its control mechanism adjust the free travel of the clutch pedal equal to 32—40 *mm* and the stroke of the working cylinder piston not less than 19 *mm* with the fully depressed pedal.

The clearance between the pusher and piston of the master cylinder is adjusted by the eccentric bolt which connects the pusher to the clutch pedal. After adjustment tighten the eccentric bolt nut securely.

The clearance between the clutch collar and clutch pressure levers is adjusted by changing the length of the working cylinder pusher. The free travel of the end of the release yoke should be equal to 3—4 *mm* which corresponds to 20—27 *mm* of the pedal free travel. After adjustment tighten the nut securely.

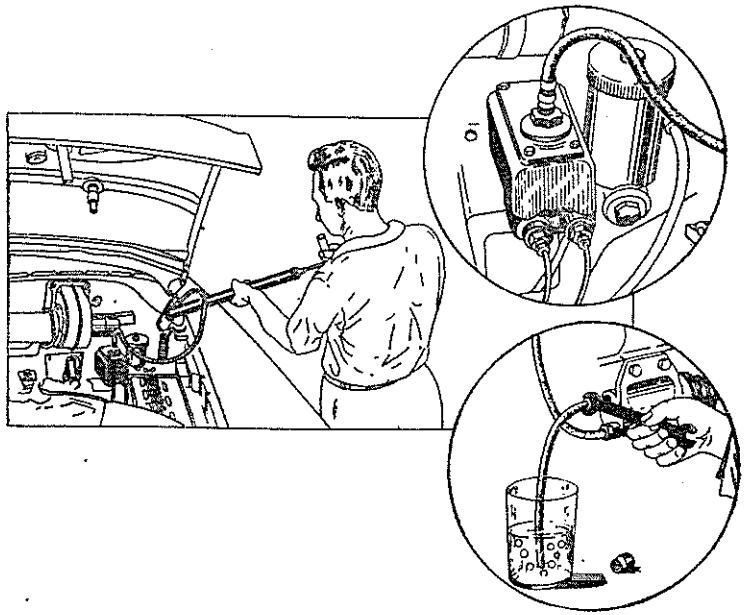


Fig. 20. Bleeding the Clutch Control System

As has already been mentioned above the travel of the working cylinder pusher with the fully depressed clutch pedal should be not less than 19 *mm*. A shorter travel fails to ensure efficient operation of the clutch. The pusher travel is not subject to adjustment and is ensured by the construction of the clutch control mechanism when the system is filled with fluid.

Air locks in the system reduce the pusher travel and cause faulty operation of the clutch control mechanism.

The clutch control mechanism is filled with brake fluid through the master cylinder neck. Having filled the reservoir of the master cylinder screw in the plug and produce a small pressure on this fluid by the use of the tyre pump. Connect the tyre pump hose to the threaded endpiece on the plug (Fig. 20).

This pressure forces the fluid contained in the master cylinder reservoir to fill the system. The air is forced out of the system through the bypass valve and hose. Immerse the hose tip into a glass vessel filled with a small quantity of brake fluid.

As soon as the air ceases to escape from the system and the fluid begins to flow in a uniform stream without air bubbles, tighten the valve, remove the hose, put the cap in place and add fluid. The fluid level in the master cylinder reservoir should be 15 to 20 *mm* below the upper edge of the plug hole in the cover.

While bleeding the system see that the fluid in the master cylinder reservoir is not used up entirely, so that the bottom of the reservoir is exposed. Therefore, if about 150 *cu. cm* of fluid has been discharged from the system, stop bleeding and continue it only after adding some fluid.

Next depress the pedal and measure the pusher travel which should be not less than 19 *mm*. If it is less, continue bleeding as described above until the air is completely discharged from the system and the pusher travel reaches its normal value.

Every 1,000 *km* of operation do the following:

1. Check the fluid level in the master cylinder; top up, if necessary.
2. Check the free travel of the clutch pedal as described above and adjust, if necessary, by changing the length of the pusher.

TRANSMISSION

The three-speed transmission is of the mechanically operated type (Fig. 21).

The 2nd and 3rd speeds are fitted with a synchronizer (Fig. 22) ensuring noiseless gear shifting. To provide for correct operation of the synchronizer and noiseless gear shifting, move the gear shift lever smoothly without jerks.

If the shifting is performed too quickly, particularly from the third speed to the second, this may damage the synchronizer.

It should be borne in mind that the first speed is not fitted with synchromesh, therefore the shifting from the 2nd to the 1st speed should be done only after slowing down the car to approximately the speed of a pedestrian, to avoid breaking of gears.

Care of the transmission consists in maintaining the lubricant level flush with the filler hole, in periodical changing of the lubricant and washing the transmission housing.

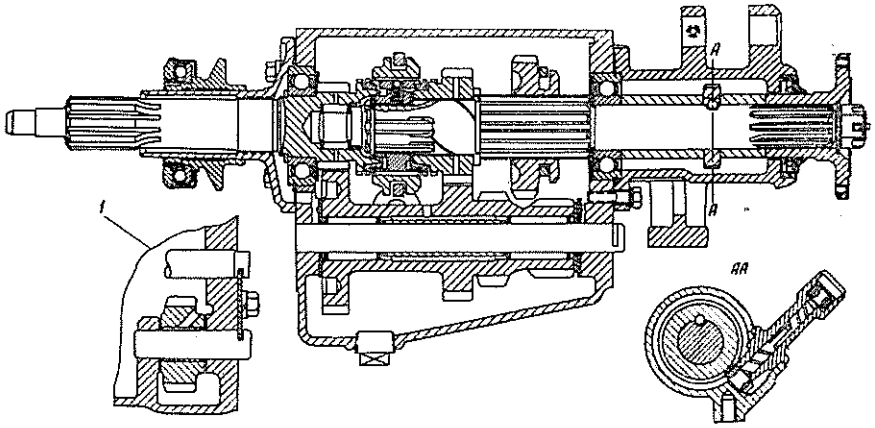


Fig. 21. Transmission

1 — section through reverse speed gear

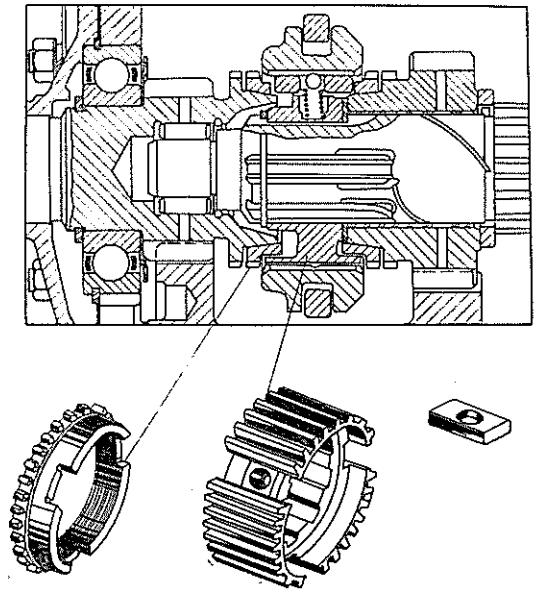


Fig. 22. Transmission Synchronizer

ADJUSTING THE TRANSMISSION CONTROL MECHANISM

1. Engage the 3rd speed and make sure the gear shift lever *7* (Fig. 23) is in the horizontal position. If necessary, change the length of rod *14* by rotating its endpiece.

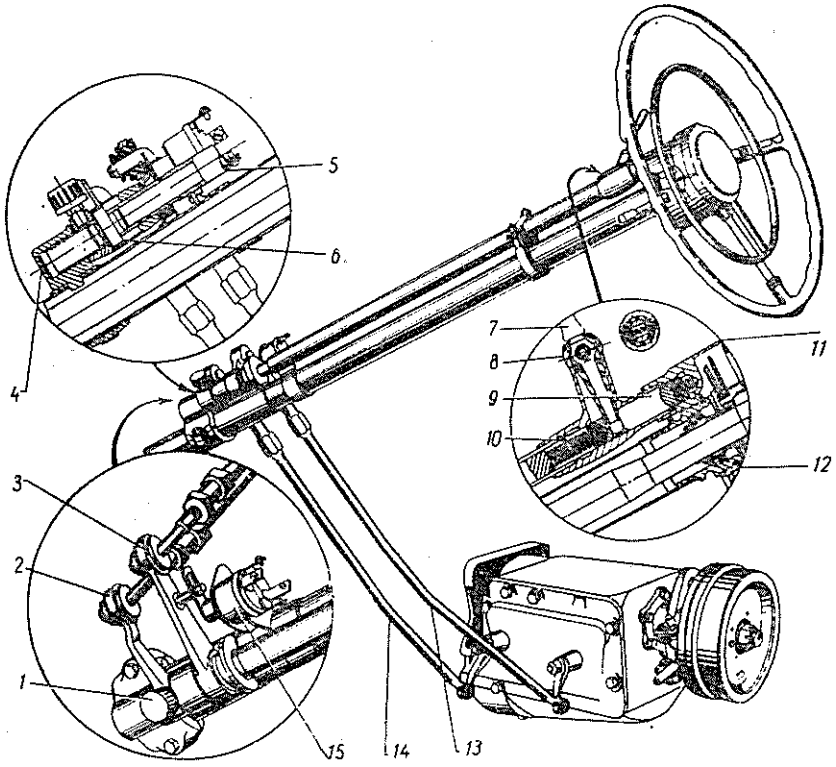


Fig. 23. Transmission Control Mechanism

1 — oiler; *2* and *3* — control levers; *4* — lower bracket; *5* — shift shaft; *6* — dowel; *7* — gear shift lever; *8* — rubber seal; *9* — shaft pin; *10* — shift shaft extension; *11* — direction indicator switch body; *12* — locking ring; *13* and *14* — shift rods; *15* — backward motion light switch

2. Shift the lever *7* into neutral and make sure the shaft *5* is free to move along the steering column.

3. Check whether all the speeds are fully engaged and disengaged by hand-rocking the ends of the levers on the transmission side cover. In all the engaged positions and in the neutral position the levers should be securely locked. Absence of reliable locking is caused by incomplete engagement the cause of which should be indentified and done away with. Upon completion of adjustment the rod endpiece should be locked.

4. Check functioning of the backward motion light switch. Engagement of the reverse gear must be accompanied by flashing up of white light in the tail lamps. If the rear light is not switched on, unscrew the bolt of the switch and adjust its position. It should be noted that the rear light flashes up only with the ignition switch turned ON.

PROPELLER SHAFTS

There are two shafts: the front-intermediate shaft, and the rear-propeller shaft. Arrangement of universal joint yokes is shown in Fig. 24. Disturbed arrangement of the yokes results in vibration of the centre bearing under heavy loads.

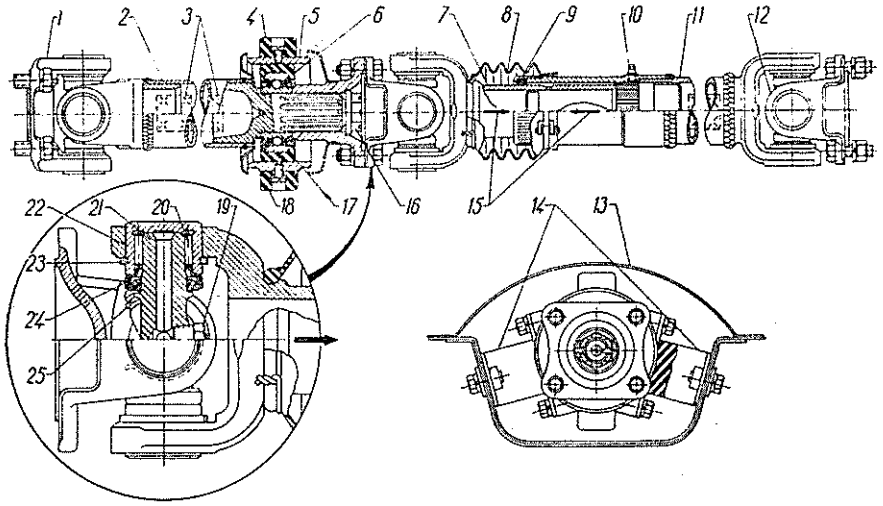


Fig. 24. Propeller Shafts

1 — intermediate shaft universal joint front yoke; *2* — intermediate shaft; *3* — balancing plates; *4* and *18* — upper and lower rubber bumpers; *5* — centre bearing body; *6* — bearing; *7* — slip yoke; *8* — protective sleeve; *9* — gland; *10* — oiler; *11* — propeller sahft; *12* — propeller shaft rear joint rear yoke; *13* — body floor; *14* —rubber pads; *15* — aligning pointers; *16* — flange nut; *17* — rubber case; *19* — safety valve; *20* — needle bearing; *21* — cross; *22* — bearing cup; *23* — locking ring; *24* — gland; *25* — oiler

Universal joints should be lubricated with fluid lubricant and only in accordance with the Lubrication Chart; lubricant should be forced in until it appears from the safety valve of the cross. Consistent lubricants are not fit for the joints as they are too thick and fail to reach the needles during operation, therefore the use of such lubricants results in deterioration of the needle bearings.

REAR AXLE

The rear axle of the "Volga" car is equipped with a hypoid final drive (Fig. 25).

The axle shafts (Fig. 26) are of the semi-floating type. The axle shaft ball bearings take both radial and axial loads. The brake drum

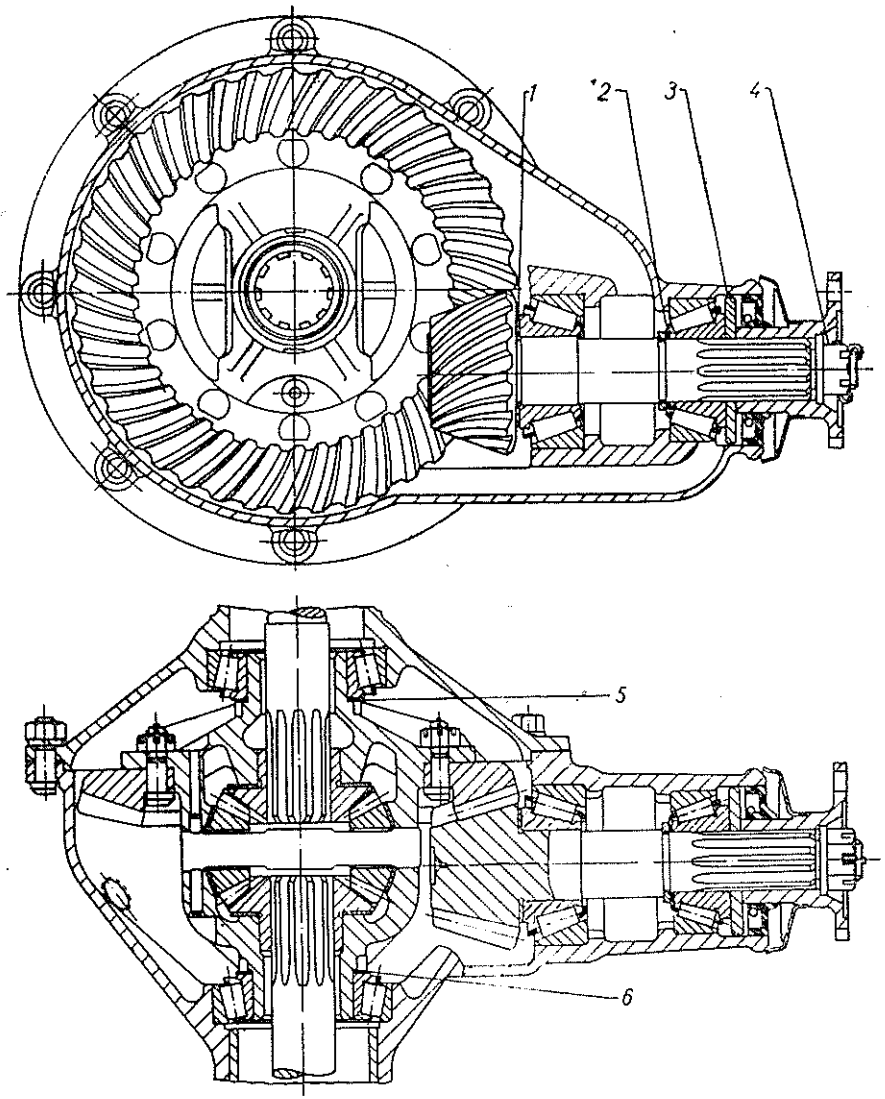


Fig. 25. Rear Axle Differential

1 — driving gear adjusting ring; *2* — driving gear shaft bearing adjusting shims; *3* — oil guard ring; *4* — driving gear shaft bearing nut; *5* and *6* — differential bearing adjusting shims

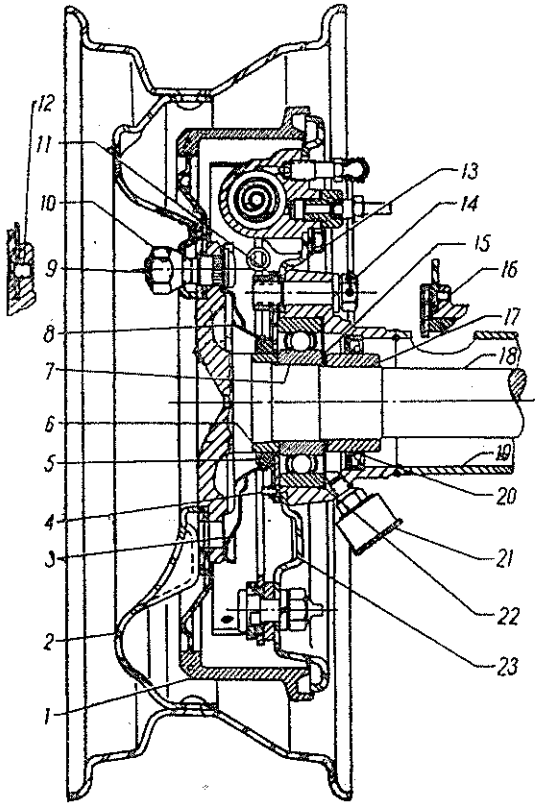


Fig. 26. Axle Shaft and Rear Wheel Attachment

1 — brake drum; *2* — wheel disc; *3* — outer oil guard; *4* — gland body screw; *5* — felt gland; *6* — gland bushing; *7* — axle shaft bearing; *8* — inner oil guard; *9* — wheel bolt; *10* — nut; *11* — gland body; *12* — brake drum screw; *13* — bearing plate; *14* — axle shaft bearing bolt; *15* — spring ring; *16* — backing plate screw; *17* — bearing locking ring; *18* — axle shaft; *19* — axle shaft housing; *20* — rubber gland; *21* — oiler; *22* — spring gasket; *23* — backing plate

and rear wheel are attached directly to the axle shaft flange without separate hub. The bearing is fixed on the axle shaft by means of a locking ring pressed on the axle shaft journal. The bearing outer race is inserted in the recess in the axle shaft housing flange and is fixed in it by means of a plate and gland body with four bolts. The clearances are taken up by a spring gasket located between the bearing outer race and flange face.

Lubricant is retained in the axle shaft bearing chamber by the rubber and felt glands fitted over the bushings.

The felt gland is of the split type and may be replaced without pressing the bearing off the axle shaft. The gland body and axle shaft flange are fitted with oil catchers keeping the oil against penetrating into the brakes in case of a leak through the felt gland. The bearing is lubricated with consistent lubricant through a cap oiler.

Care of the rear axle consists in maintaining a proper lubricant level (flush with the filler hole), regular changing of lubricant in accordance with the Lubrication Chart, tightening loose joints (driving gear nut, axle shaft bearing bolts and housing bolts), periodical lubrication of the axle shaft bearing by the cap oiler, and in periodical cleaning of the breather.

STEERING GEAR

The steering gear (Fig. 27) consists of the hour glass worm pressed on the steering shaft and mounted on two tapered roller

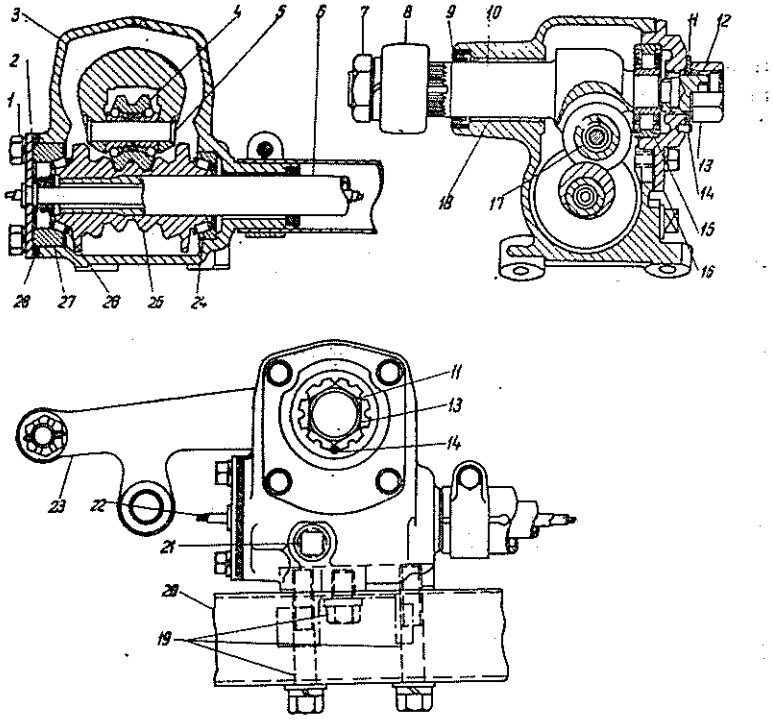


Fig. 27. Steering Gear

1 — bolt; *2* — front cover; *3* — case; *4* — roller; *5* — roller pin; *6* — steering shaft; *7* — steering arm nut; *8* and *23* — steering arm; *9* — gland; *10* — steering arm shaft; *11* — lock washer; *12* — adjusting screw; *13* — cap nut; *14* — locking dowel; *15* — roller bearing; *16* — upper cover; *17* — bearing; *18* — pushing; *19* — case bolts; *20* — side member; *21* — filler plug; *22* — horn cable; *24* and *26* — worm bearings; *25* — worm; *27* — bearing race; *28* — gaskets

bearings and of the twin roller installed in the recess of the steering armshaft head.

Care of the steering gear consists in lubricating the steering mechanism and joints, tightening the attachment of the steering gear case, steering arm and pendulum lever, and checking the free travel of the steering wheel.

If a noticeable free travel is discovered during the straight-ahead movement of the car, adjust the worm-to-roller mesh. In case of the axial displacement of the worm remove the steering gear from the car and adjust the worm bearings by removing the necessary number of gaskets from under the front cover.

FRONT SUSPENSION

Independent wheel suspension is mounted on the second cross member of the car frame (Fig. 28). The suspension together with the cross member forms a separate unit which is adjusted at the Works on

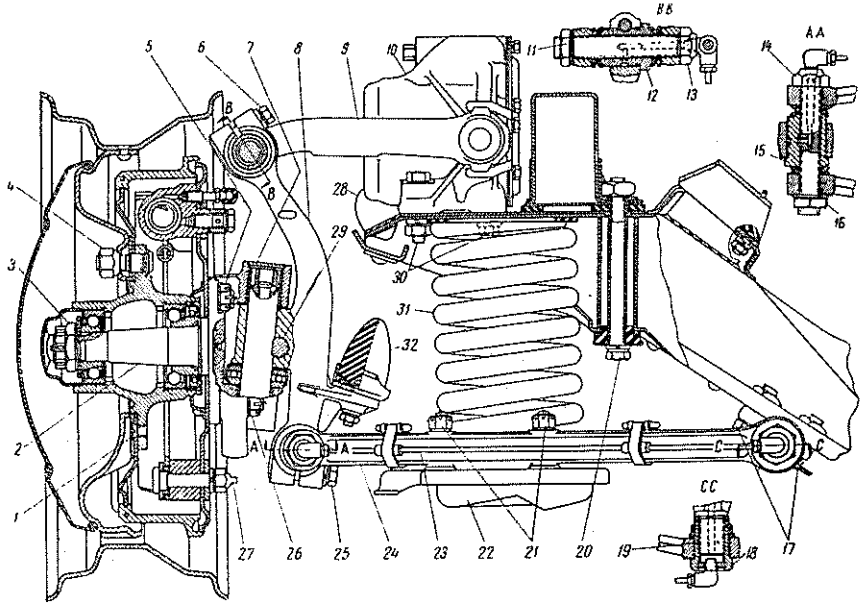


Fig. 28. Front Suspension

1 — brake drum screw; *2* — steering knuckle; *3* — hub bearing adjusting nut; *4* — wheel bolt nut; *5* — brake backing plate bolt nut; *6* — wheel support upper end coupling bolt; *7* — king pin; *8* — wheel support; *9* — shock absorber lever; *10* — shock absorber; *11* — nut; *12* — threaded bushing; *13* and *14* — pins; *15* — eccentric adjusting bushing; *16* — nut; *17* — suspension lever to cross member bolts; *18* — threaded bushing; *19* — lower suspension lever pivot; *20* — suspension cross member to frame bolt; *21* — supporting plate to suspension lever bolt nuts; *22* — spring supporting plate; *23* — suspension pin central lubrication pipe; *24* — suspension lever; *25* — wheel support lower end coupling bolt; *26* — steering lever bolt; *27* — brake shoe anchor pin; *28* — upper bumper; *29* — knuckle pin stop; *30* — shock absorber bolts; *31* — spring; *32* — lower bumper

a special stand. Therefore, check front wheel adjustment at the prescribed intervals, but do not re-adjust unless urgently necessary.

Front wheel adjustment consists in setting correct caster, camber and toe-in.

Toe-in is adjusted by means of adjusting tubes of the side steering rods.

Change of wheel camber affects simultaneously wheel caster and toe-in, therefore the front suspension should be adjusted in the following sequence:

1) camber;
2) caster;
3) toe-in.

Under full static load the setting angles should be as follows:

Caster — $0 \pm 1°$

Camber — $0 \pm 0°30'$

Toe-in (measured on tyres at the height of wheel centres) — 1.5=3 *mm*.

Prior to adjustment of the front wheels do the following:

1. Adjust front wheel hub bearings as outlined below.
2. Check tyre pressure and bring it to the required value.
3. Load the car to the rated value, corresponding to the weight of two passengers (about 150 *kg*) on the front seat and three passengers (about 225 *kg*) on the rear seat.
4. Place the car on a special stand (or a level floor).
5. Set the wheels in the straight-ahead position.

Adjusting the wheel camber (right and left wheels in turn)

1. Loosen bolt *25* in the lower head of the wheel support to release the eccentric bushing.
2. Turn the eccentric bushing *15* with a wrench to obtain the required camber.
3. Tighten bolt *25*.

Adjusting the Wheel Caster
(right and left wheels in turn)

1. Loosen bolt *6* in the upper head of the wheel support.
2. Turn the upper bushing *12* with a wrench to obtain the necessary caster angle. Under no circumstances should the bushing be turned as far as it will go: leave about 1/6 of a turn to go. If this distance is not provided for, then during swinging of the shock absorber arm the bushing face end may bear against the upper head of the wheel support, which will cause the bushing to turn and the caster angle will be disturbed.
3. Tighten bolt *6*.
4. Check camber and caster angles of both wheels.

As a rule, wheel caster is not changed during operation. Therefore, do not adjust this angle unless there are some extreme symptoms calling for it.

If the lower end of the king pin is inclined too much forward (in excess of +1°) this is diagnosed by an increased effort on the steering wheel and sharp return motion upon completion of a turn.

Conversely, if the lower end of the king pin is inclined too much to the rear (in excess of —1°) return motion of the wheels becomes weaker or altogether disappears and the car fails to hold the road properly while moving straight-ahead.

Adjusting the Wheel Toe-In

Prior to adjusting the toe-in make sure there is no back-lash of the pendulum lever by swinging the lever end up and down by hand, and adjust, if necessary (see "Adjusting the Pendulum Lever" section, below). Correct setting of the wheel toe-in with a back-lash in the pendulum lever is absolutely unattainable.

The toe-in is adjusted by measuring the distance between the outer surfaces of the tyres on a special stand. For this purpose it is necessary to find the position of the equal side run-out of the tyres and place them in a horizontal plane, otherwise the wheel toe-in will not be adjusted properly.

If, prior to adjustment, during the straight-ahead motion the steering wheel has occupied correct position, i. e. its side arms have been in a horizontal position, and the error of the toe-in setting has not exceeded 3 to 4 *mm*, the adjustment may be carried out by changing the length of any one of the side steering rods.

Proceed as follows:

1. Uncotter and loosen two bolts *9* of clamps *10* coupling the ends of adjusting tube *3* (Fig. 29).

2. Insert a drift into the hole in the adjusting tube and rotate it until the required toe-in is obtained.

3. Having completed the adjustments set the rods and their endpieces with the face surfaces of their heads parallel to he faces of the heads on the steering levers, steering arm and pendulum lever,

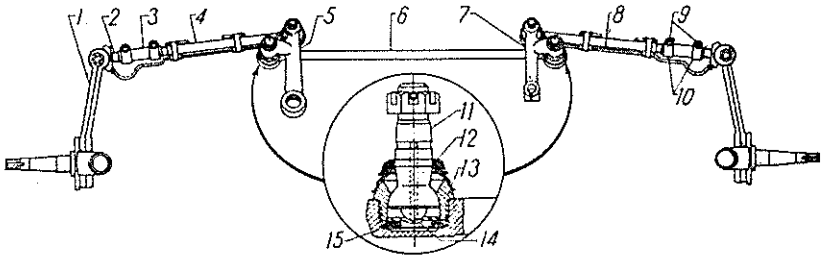


Fig. 29. Steering Rods

1 — steering lever; *2* — side rod endpiece; *3* — adjusting tube; *4* — side rod; *5* — steering arm; *6* — middle rod; *7* — pendulum lever; *8* — central lubrication pipe; *9* — clamp coupling bolts; *10* — clamps; *11* — ball head pin; *12* — protective seal; *13* — retainer; *14* — socket; *15* — spring

then turn the clamps in the position shown in Fig. 29, tighten the clamp bolts and insert cotter pins.

If, before adjustment, the steering wheel has occupied a wrong position during straight-ahead movement (also when adjustment operations are carried out after disassembly of the steering rods, so that their original length is disturbed), the wheel toe-in should be adjusted as follows:

1. Set the steering wheel in the normal position for straight-ahead movement (side arms in a horizontal plane).

2. Stretch a string from the left rear wheel to the left front wheel at the height of the wheel centres and adjust the length of the left steering rod to set the left wheel in the straight-ahead position. Change the rod length by turning the adjusting tube until the string touches the front wheel tyre simultaneously in the front and rear parts of the tyre.

3. Adjust the toe-in by changing the length of the right steering rod.

Caution: Adjustment of wheel camber disturbs the toe-in, therefore after each wheel camber adjustment the toe-in should also be re-adjusted.

Adjusting the Pendulum Lever

Design of the pendulum lever is shown in Fig. 30. Adjustment of this lever consists in elimination of the play of threaded pin *10* in bushings *2* and *9*. To eliminate the play, tighten upper threaded bush-

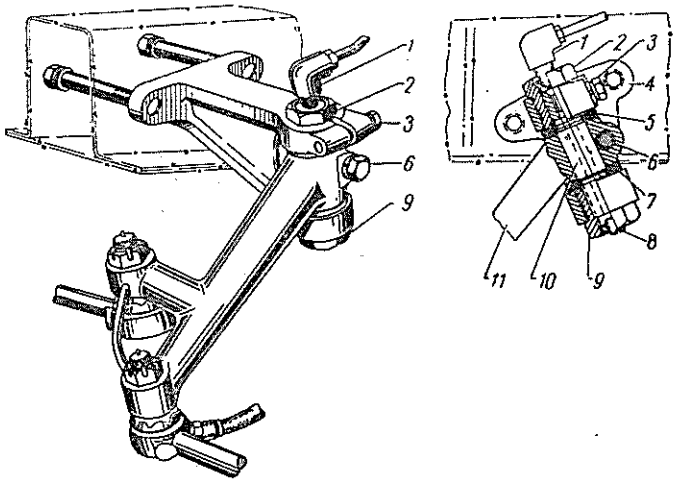


Fig. 30. Pendulum Lever

1 — oil pipe union; *2* — threaded bushing; *3* — coupling bolt; *4* — bracket; *5* and *7* — protective rings; *6* — coupling bolt; *8* — plug; *9* — threaded bushing; *10* — pin; *11* — pendulum lever

ing *2* subsequent to loosening bolt *3* of the upper head clamp of bracket *4*. Tighten by turning smoothly the upper threaded bushing clockwise until the play of the pendulum lever is eliminated. Do not tighten the bushing securely as this will increase friction in the threaded pin with resultant increase of effort on, and impaired return motion of the steering wheel.

Upon completion of adjustments tighten bolt *3* of the bracket upper head clamp and do not fail to tighten the bolt of the pendulum lever head clamp and to check tightening of the lower threaded bushing. The latter should be tightened to 12—17 *kgm* with a wrench 500—600 *mm* long.

Adjusting the Front Wheel Hub Bearings

To adjust the bearings proceed as follows:

1. Jack up the front end of the car, remove the wheel cap, and unscrew the hub cap. Extract the cotter pin and back off the adjusting nut on the end of the steering knuckle spindle one slot (1/8 of a turn). Push the wheel by hand to see whether it rotates freely. If the wheel rotates with difficulty, eliminate the cause of drag (one of the causes is brushing of the drum against the brake shoes) and only then proceed with bearing adjustment.
2. Tighten the nut with a wrench 200 *mm* long applying the effort of one hand so that the wheel can be rotated with difficulty by hand. While tightening the nut, press on the wrench smoothly without jerks. Simultaneously with the tightening of the nut keep turning the wheel to make the balls occupy correct positions in the bearings.
3. Loosen the nut one or two slots depending on the position taken by the nut slot with respect to the cotter pin hole in the steering knuckle spindle after nut tightening.

Correct adjustment of the bearings is checked finally on the moving car by hand-feeling the temperature of the wheel hubs. Noticeable overheating after a 8 to 10 *km* run is an indication that the bearings have been overtightened and that the nut should be backed off one slot. Insignificant heating of the hub is allowable only when new bearings have been installed or the hub gland has been replaced.

When checking bearing adjustment by the heating of the hubs, do not apply foot brakes, because in this case the hubs become heated by the brake drums.

REAR SUSPENSION

The rear suspension consists of two longitudinal semi-elliptic springs operating in conjunction with two double-acting hydraulic shock absorbers. The spring eyes and shackles are connected to the car body by means of pins and rubber bushings.

The rear axle is fastened to the springs by clips which should be securely tightened at all times. The spring clip nuts should be tightened to 7—9 *kgm* which corresponds to an effort of 22—28 *kg* on the end of the wrench included in the driver's kit.

Care of the springs consists in periodical cleaning them of dirt, lubrication of leaves and replacement of worn gaskets.

Once a year remove the spring, disassemble and wash carefully in kerosene. While assembling lubricate the spring leaves with oildag.

SHOCK ABSORBERS

Design of the shock absorbers is shown in Figs. 31 and 32. Care of the shock absorbers includes periodical adding of fluid in conformity with the recommendations of the Lubrication Chart and washing them once a year with gasoline or kerosene with subsequent drying.

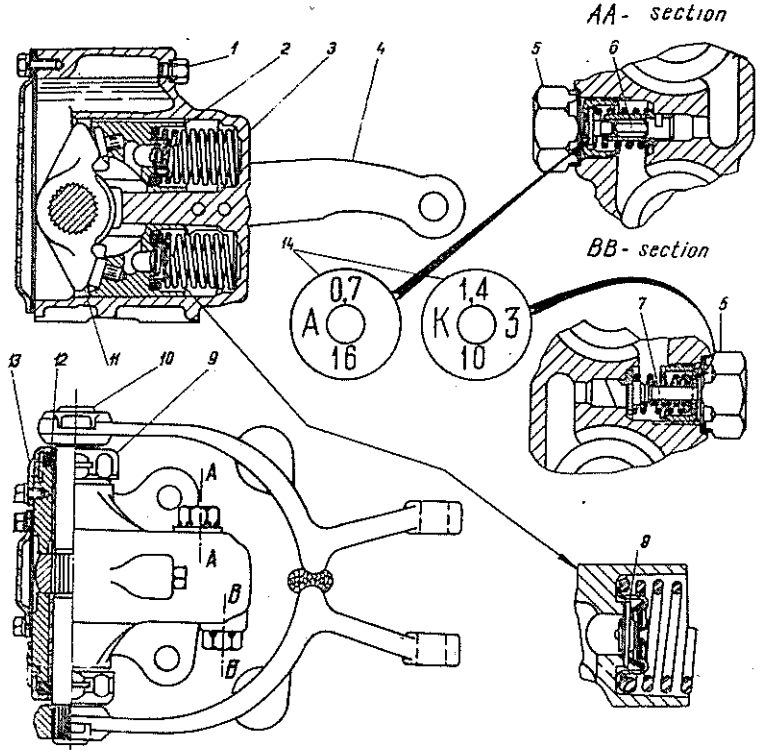


Fig. 31. Front Shock Absorber

1 — filler plug; *2* — piston; *3* — body; *4* — arm; *5* — valve plugs; *6* — rebound valve; *7* — compression valve; *8* — inlet valve; *9* — gland nut; *10* — shaft; *11* — cam; *12* — gland; *13* — gland locking shackle; *14* — valve marking

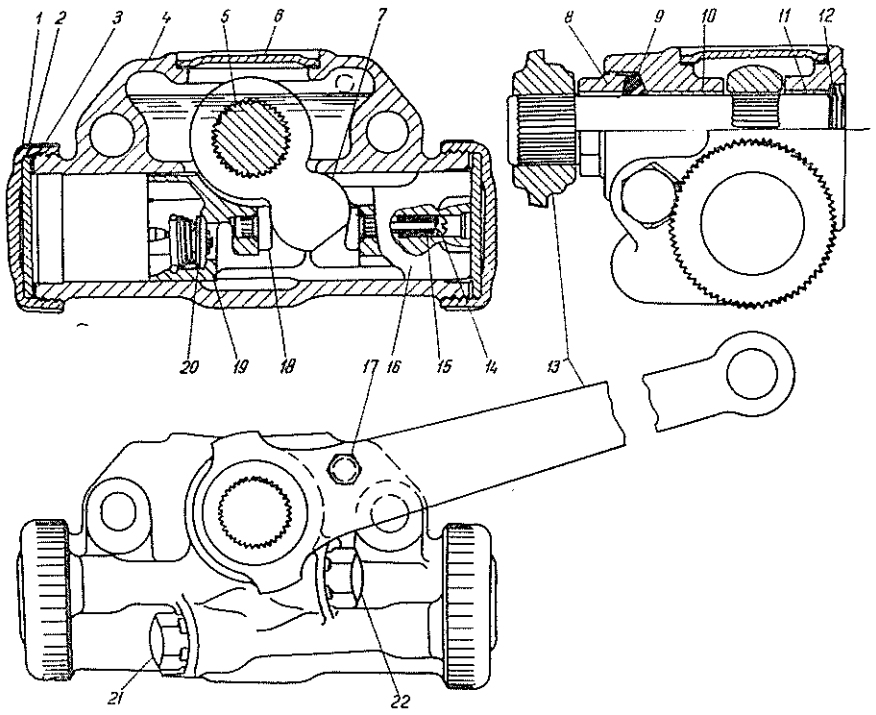


Fig. 32. Rear Shock Absorber

1 — shock absorber cylinder cover; *2* — washer; *3* — gasket; *4* — body; *5* — shaft; *6* — upper expansion plug; *7* — cam; *8* — gland nut; *9* — gland; *10* and *11* — bushings; *12* — side plug; *13* — arm; *14* — coupling screw; *15* — spring; *16* and *19* — pistons; *17* — filler plug; *18* — piston thrust head; *20* — inlet valve; *21* — compression valve plug; *22* — rebound valve plug

In case of a fluid leak tighten the shock absorber shaft gland. For this purpose remove fixing washers from the gland covers and tighten the covers with a wrench. The glands should be tightened to 4 or 5 *kgm* corresponding to an effort of 12—16 *kg* on the wrench 300 *mm* long.

Replacement of gland packing involves removal of shock absorber arms. The front shock absorber arms must be preliminarily cut along the welding seams.

BRAKES

Foot Brakes

The "Volga" car is equipped with four-wheel hydraulic brakes. Design of the front and rear wheel brakes is illustrated in Figs. 33 and 34.

As the brake linings gradually wear out the clearances between the linings and brake drums are increased and during braking the pedal comes close to the body front panel.

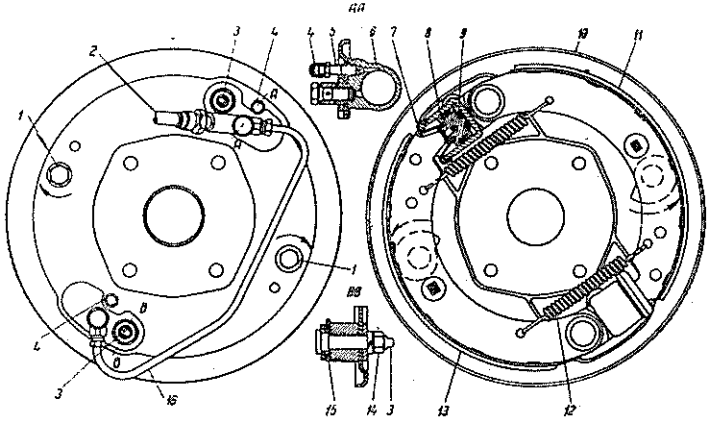


Fig. 33. Front Brake

1 — adjusting eccentric head; *2* — brake hose; *3* — anchor pins; *4* — bypass valve cap; *5* — bypass valve; *6* — wheel cylinder; *7* — wheel cylinder rubber cap; *8* — piston; *9* — spring; *10* — backing plate; *11* and *13* — brake shoes; *12* — return spring; *14* — anchor pin nut; *15* — anchor pin eccentric; *16* — pipe

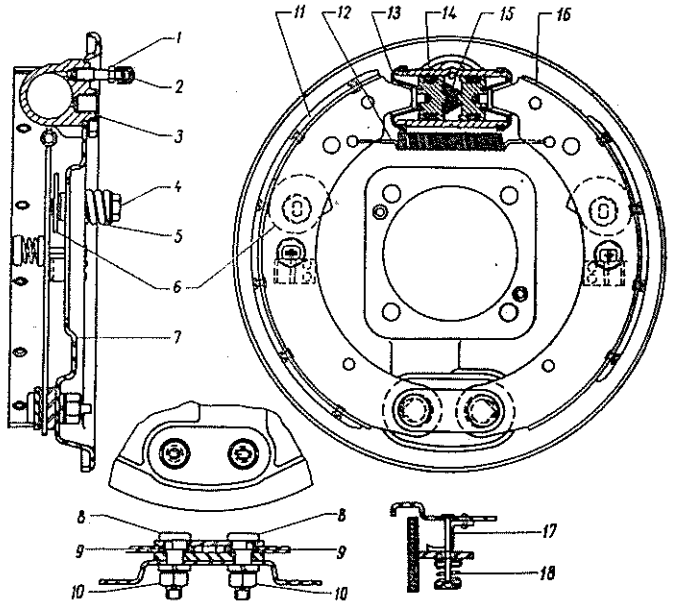


Fig. 34. Rear Brake

1 — bypass valve; *2* — cap; *3* — wheel cylinder; *4* — eccentric head; *5* — spring *6* — eccentric; *7* — backing plate; *8* — anchor pins; *9* — anchor pin eccentrics; *10* — nuts; *11* — front shoe; *12* — return spring; *13* — protecting sleeve; *14* — piston; *15* — spring; *16* — rear shoe; *17* — guide shackle; *18* — spring

To restore the original clearance each brake must be adjusted by means of two eccentrics. Hexahedral ends of the eccentric pivots extend outside through the brake backing plate.

To adjust:

1. Jack up the wheel whose brake is to be adjusted.
2. Turning the wheel forward rotate gently the adjusting eccentric of the front shoe until the latter brakes the wheel.
3. Loosen the eccentric gradually (simultaneously turning the wheel by hand) until the wheel rotates freely without the drum brushing against the shoe.
4. Adjust he rear shoe in a likewise manner. While adjusting the rear shoe of the front brake, rotate the wheel forward; while adjusting the rear shoe of the rear brake, rotate the wheel backward.
5. Carry out the above adjustment operations on all the four brakes.
6. Check for heating of the brake drums on the moving car.

Caution: Under no circumstances should the shoe anchor pin nuts be tampered with during brake adjustment, as this disturbs their factory setting. These pins must be adjusted only when either the shoes or the shoe linings are being replaced.

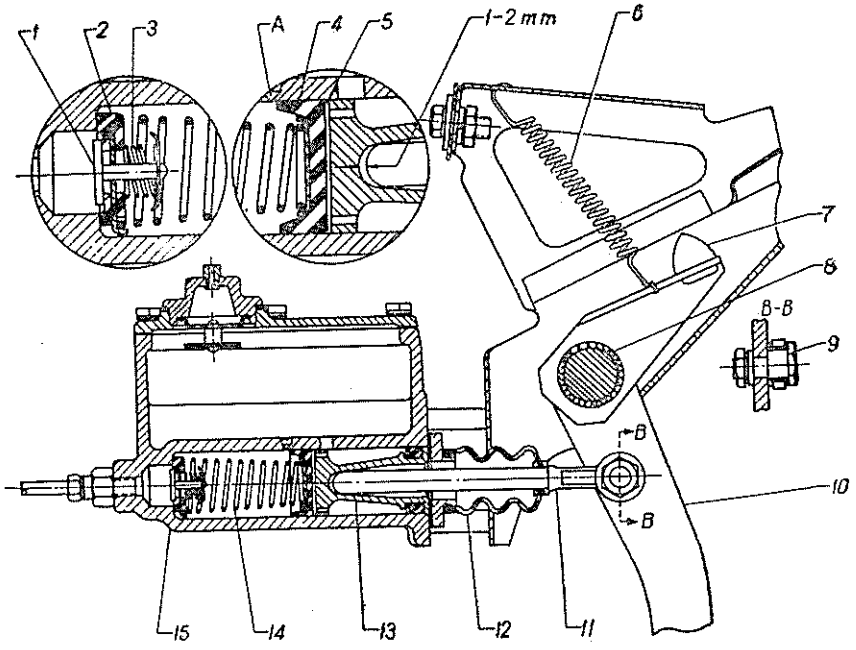


Fig. 35. Brake Master Cylinder

1 — outlet valve; *2* — inlet valve; *3* — spring; *4* — collar; *5* — star-shaped plate; *6* — pedal retracting spring; *7* — pedal bumper; *8* — pedal shaft; *9* — adjusting pin; *10* — pedal; *11* — pusher; *12* — case; *13* — piston; *14* — spring; *15* — master cylinder body. A — bypass valve

See that there is a clearance between the brake master cylinder piston and pusher (Fig. 35). This clearance is necessary as it allows the master cylinder piston to return to its initial position (until it bears against the washer) with the released brake pedal to avoid obstructing the bypass hole by the rubber collar. The clearance should be equal to 1.2—2 *mm* which corresponds to 10—15 *mm* of pedal travel. Free travel of the pedal is adjusted by the eccentric pin.

The brake system should be filled with special brake fluid only. The empty brake system is filled as follows:

1. Remove the master cylinder filler plug and fill the cylinder with fluid.
2. Remove the rubber cap from the right rear brake cylinder and fit a rubber hose 350—400 *mm* long over the bypass valve. Dip the open end of the hose into a glass container of not less than 0.5 *l* capacity and fill it to half its capacity.
3. Unscrew the bypass valve $^1/_2$ or $^3/_4$ of a turn and depress the brake pedal a few times. Keep pumping the fluid through the master cylinder until air bubbles cease to be discharged from the hose immersed into the container with fluid. While priming, add fluid into the master cylinder reservoir seeing to it that the fluid constantly covers the bottom of the reservoir.
4. Tighten the wheel cylinder bypass valve securely, remove the rubber hose from it and replace the rubber cap. The valve should be screwed in with the depressed pedal.
5. Bleed the brakes in the following sequence: rear right, front right, front left and rear left. In the front brakes fitted with two wheel cylinders each, bleed at first the lower cylinder then the upper one.
6. After bleeding all the four brakes (six brake cylinders) add fluid into the brake and clutch master cylinder so that the fluid level is 15—20 *mm* below the upper edge of the hole and screw in the filler plug snugly.

Hand Brake

The hand brake (Fig. 36) is designed for braking the parked car and for holding it on slopes. The use of this brake for braking the moving car is allowable in emergency only when the foot brakes are unserviceable. Frequent application of the hand brake without serious necessity results in premature wear of the friction linings and imposes undue loads on the power transmission of the car.

The hand brake is installed behind the transmission and is applied to the propeller shaft of the vehicle. The brake control handle is located under the instrument panel, left of the driver.

Poor or no braking effect with the control handle pulled all the way out indicates the necessity of hand brake adjustment. Increased travel of the handle may be caused by worn brake shoe linings or by a large clearance in the brake linkage.

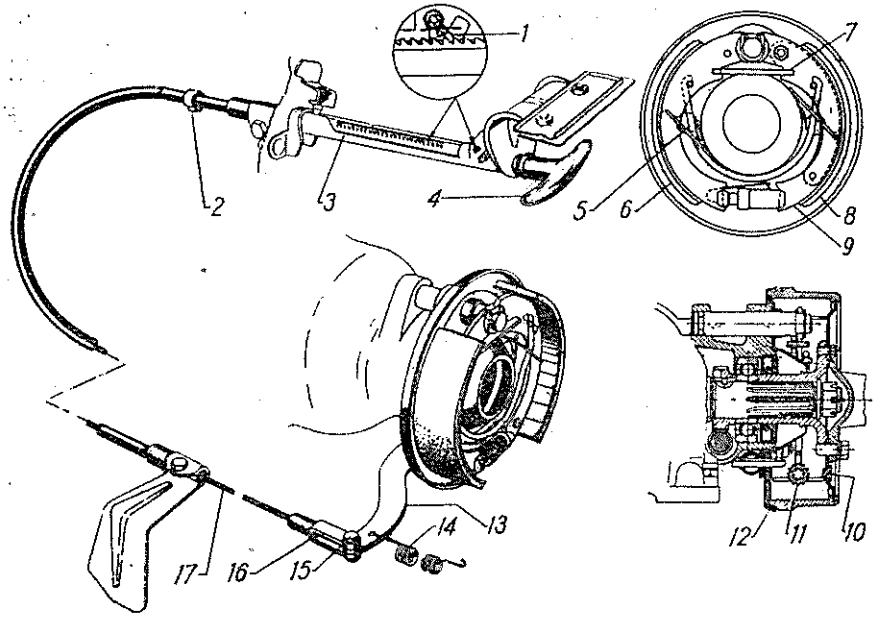


Fig. 36. Hand Brake

1 — brake latch; *2* — spring clamp for closing cable lubricating hole; *3* — rack; *4* — handle; *5* — shoe return spring; *6* and *8* — shoes; *7* — expander link; *9* — brake lever; *10* — plug; *11* — adjusting nut; *12* — drum; *13* — operating lever; *14* — retracting spring; *15* — pin; *16* — yoke; *17* — cable

Clearances between the shoes and the drum of the hand brake are adjusted in the following order:

1. Jack up one rear wheel.

2. Reach the adjusting nut 11 through the slot in the drum and screw in the nut until the drum cannot be turned by hand.

3. Back off the adjusting nut until drum *12* is free to rotate without brushing against the brake shoes. Free rotation of the drum must be checked after pressing lever *13* by hand.

4. After adjustment close the slot in the drum with plug *10*.

If after the above described adjustment the handle travel is still too large, it means that the brake control mechanism wants adjustment. This is done as follows:

1. Push the hand brake handle *4* to the extreme forward position.

2. Adjust the length of the cable by rotating the yoke *16*. Take up the cable slack and turn the yoke until the holes in the yoke and lever 13 are lined up. The lever *13* should be in the rearmost position until it bears against the brake backing plate (retracted by spring *14*). Insert pin *15* head up and cotter it. A properly adjusted control handle should be pulled out by hand not more than *5* to *7* teeth of rack *3*.

CENTRAL CHASSIS LUBRICATION SYSTEM

The central chassis lubrication system (Fig. 37) comprises a plunger pump installed under the engine hood, two four-chamber metering devices, pipes and flexible hoses. The control lubrication pump serves for feeding the oil into the system under pressure. The metering devices, as their name implies, serve for metering and distributing of oil.

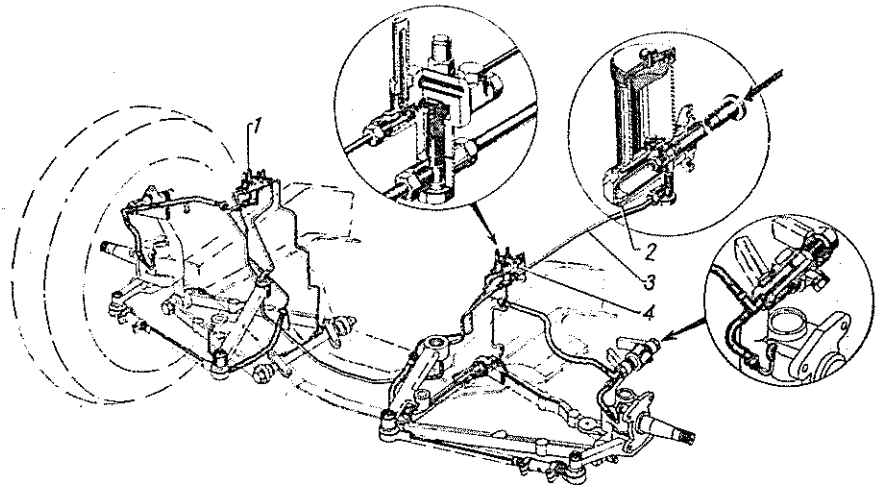


Fig. 37. Central Chassis Lubrication System

1 and *4* — metering devices; *2* — pump; *3* — main oil line

As various points require different quantities of lubricant, these quantities are regulated by the size of the metering chamber cap.

Confusing of the caps during installation will result in excessive quantity of lubricant fed to one group of lubrication points and insufficient lubricant supplied to the other points. The largest caps are installed on the chambers supplying the king pins and upper threaded pins, also steering rod joints, the smallest cap is installed on the chamber supplying the pendulum lever joint.

How to Use the Central Chassis Lubrication System

1. Operate the central chassis lubrication system every 200 *km*, but not less than once a day before driving out. While driving over muddy and wet roads lubricate the chassis not less than every 30 *km*, after fording a stream or after washing lubricate immediately to remove water and dirt getting into the joints.

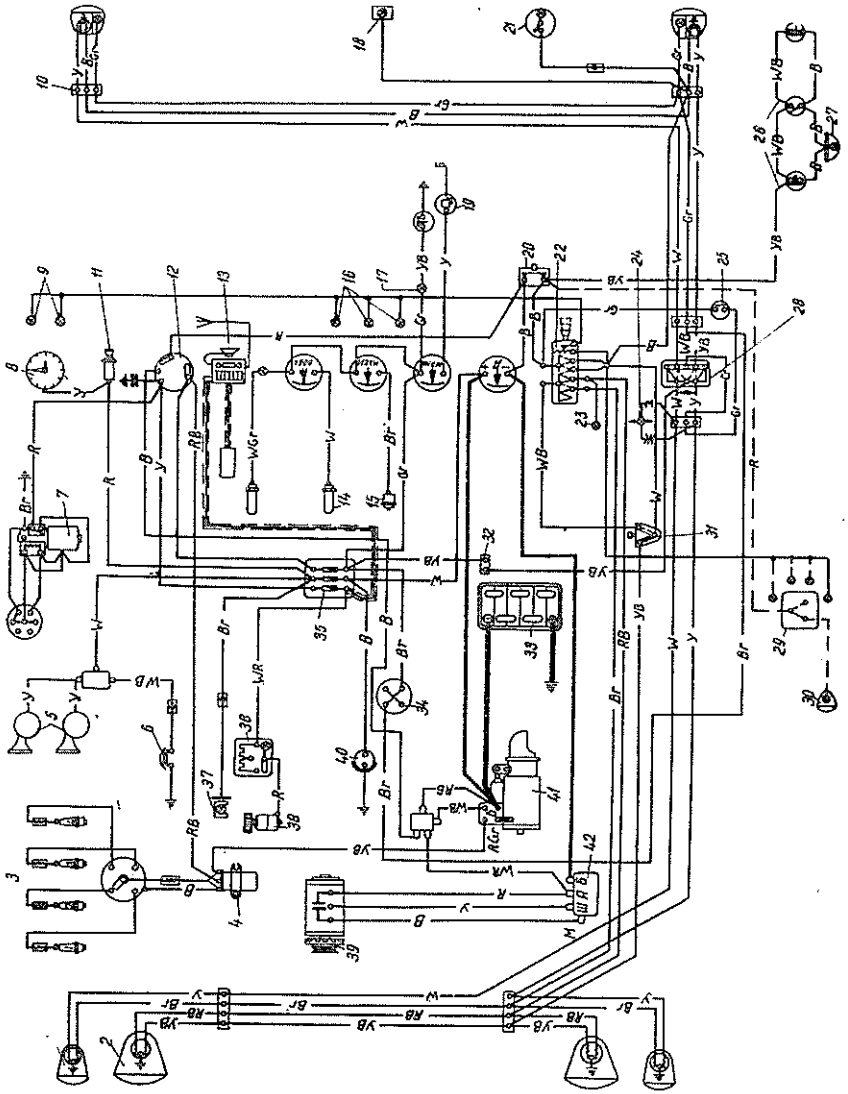


Fig. 38. Wiring Diagram

1 — side lamp and direction indicator; *2* — head lamp; *3* — spark plugs; *4* — ignition coil; *5* — horns; *6* — horn button; *7* — windshield wiper; *8* — clock; *9* — clock lighting; *10* — stop light, direction indicator and backward motion light; *11* — cigar lighter; *12* — ignition switch; *13* — radio set; *14* — water temperature unit; *15* — oil pressure unit; *16* — instrument lighting; *17* — hand brake pilot lamp; *18* — licence plate lamp; *19* — gasoline level unit; *20* — thermal fuse; *21* — luggage compartment lamp; *22* — lighting master switch; *23* — country beam idicator; *24* — direction indicator pilot lamp; *25* — stop light switch; *26* — dome lamp switches; *27* — dome lamp; *28* — direction indicator switch; *29* — taximeter (installed on radio set); *30* — taxicab identification lamp; *31* — lighting loot switch; *32* — taxicabs only instead of direction indicator breaker; *33* — storage battery; *34* — backward motion light switch; *35* — fuse block; *36* — switch; *37* — hood lamp; *38* — heater motor; *39* — generator; *40* — plug socket; *41* — starter; *42* — current and voltage regulator. (M — ground, Ш — shunt; Я — armature, Б — battery) Wire Colour Code. W — White, Y — yellow, Gr — green, R — red, Br — brown, B — black, WB — white black, YB — yellow black, RB — red black, WGr — white with green strands, WR — withe with red strands.

2. To lubricate, depress the pump pedal smoothly two or three times and release it after a pause.

3. When the car is kept out of doors in winter, operate the system after warming up the engine and having covered 10 to 15 *km* when the oil in the system is somewhat heated and the lubricated joints have begun their work.

4. When filling the reservoir with oil do not remove the screen filter as it keeps dirt from entering the system.

5. Replenish the reservoir with lubricant in due time seeing that its level does not drop below $^2/_3$ of the reservoir height. Refilling of the reservoir in due time excludes the possibility of air getting inside the system.

6. When the system becomes air bound which is diagnosed by a too small effort on the pump pedal, the air should be removed. For this purpose open the reservoir cover, remove the screen filter, and press with wire of 1.5 to 3 *mm* diameter on the return valve ball in order to keep it in the lower position. Then depress the pump pedal smoothly a few times until air bubbles cease to appear on the surface of the oil in the reservoir.

7. Periodically check lubricant supply to all the points. For this purpose wipe clean the steering rod joints and front suspension connections, press the pump pedal several times and inspect carefully the lubrication points. Oil appearing from under the seals is an evidence of normal lubricant supply.

ELECTRIC EQUIPMENT

The electric system is of the D.C. 12 *V* single wire type. The working diagram is shown in Fig. 38.

Generator

The generator is a two-brush machine with parallel excitation. It is driven by the engine and works in conjunction with the current and voltage regulator. The generator and regulator hook-up is shown in Fig. 39.

The electrical circuit of the generator and regulator is such that absence of the charging current shown by the ammeter does not mean that the electric system is faulty. If after starting the engine the charging current decreases gradually and becomes almost unnoticeable, this means that the storage battery is fully charged and the system is in order.

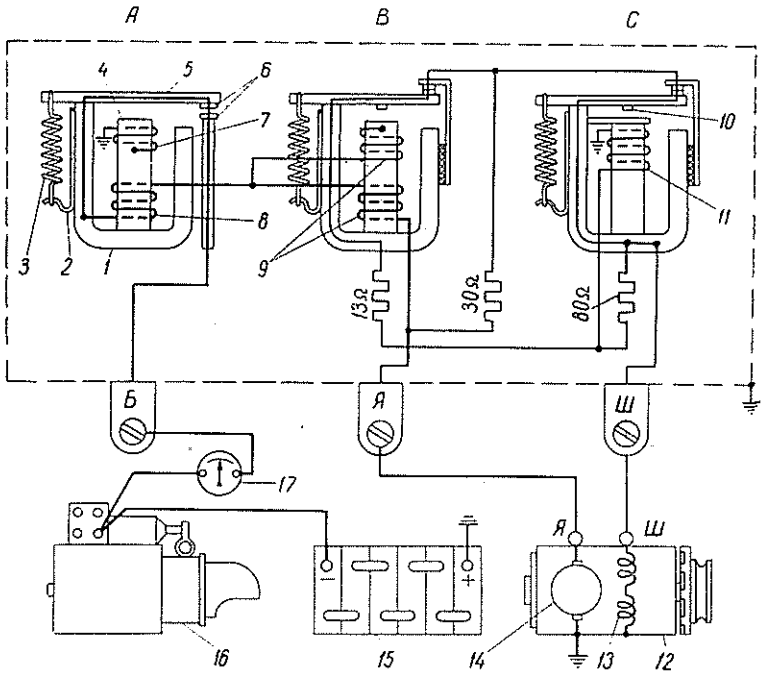


Fig. 39. Current and Voltage Regulator and Generator Hook-Up

A — circuit breaker, B — current limiting regulator, C — voltage regulator *1* — yoke; *2* — adjusting post; *3* — spring; *4* — core; *5* — armature; *6* — contacts; *7* — shunt winding; *8* — series winding; *9* — current limiting winding; *10* — brass dawel; *11* — voltage regulator winding; *12* — generator; *13* — generator field winding; *14* — generator armature; *15* — storage battery; *16* — starter; *17* — ammeter

Symbols: Я — armature, Б — storage battery, Ш — shunt

Current and Voltage Regulator

The current and voltage regulator installed on the car is intended for cutting the generator in and out of the circuit, protecting the generator against overload, and for regulating the voltage and amperage of the charging current.

Starter

The starter used on the car is equipped with an electromagnetic switch.

This switch forces the starter pinion into mesh with the flywheel ring gear and closes the contacts of the starter circuit. Disengagement of the pinion is ensured by the pull-back spring as soon as the electromagnetic switch ceases to function.

Fuses

The electric network of the car includes the following fuses:

1. Thermal bimetal 20 *A* fuse of the button type protects all the lighting circuits except hood and inspection lamps, direction indicators and backward motion light.

At overload or shorting in the circuits the bimetal plate bends due to heating and opens the contacts thereby breaking the circuit.

After elimination of shorting the fuse is again connected by pressing upon its button protruding through the lower flange of the instrument panel. Press on the button for a short time only. Holding the button by hand for a long time may cause burning of the car wiring and damage the fuse if the cause of shorted electric circuit has not been eliminated in due time.

2. Three numbered fuses combined in one block. These fuses protect the following circuits:

No. 1 — 20 *A* fuse — horns, cigar lighter, and clock;

No. 2 — 10 *A* fuse — instruments, direction indicators and backward motion light;

No. 3 — 10 *A* fuse — radio set and heater motor.

3. Thermal bimetal fuse for the clock. This fuse is mounted on the rear cover of the clock and disconnects power supply in case of shorts and voltage drops below the permissible value. The fuse is switched on again by pressing the button.

4. Bimetal fuse of the vibrating type, mounted on the windshield wiper body is connected to the windshield wiper circuit. In case of some failure this fuse opens the contacts periodically which is accompanied by characteristic clicks.

5. Melting 5 *A* fuse mounted on the radio set housing protects the radio set.

Storage Battery

The "Volga" car is equipped with a storage battery consisting of six series-connected cells. Rated voltage is 12 *V*, capacity — 54 *A-hr* at 10-hour discharge rate.

Care of the storage battery. Care of the storage battery consists in periodical inspection and keeping it clean and charged in accordance with the "Storage Battery Servicing Instructions".

To ensure correct functioning and long life of the battery the first thing is to maintain the correct level of electrolyte. It should be borne in mind that only water evaporates from electrolyte, therefore the storage battery should be topped up with distilled water only. If the electrolyte level drops to such an extent that the battery plates are no longer covered with electrolyte this causes sulphation of the uncovered parts. The use of town water is strictly objectionable as it

contains noxious admixtures (iron, chlorine) which cause deterioration of the battery.

Add distilled water (or electrolyte) as follows (Fig. 40): remove the filler plug, (Fig. 40-*1*) and place it tightly over the tapered nozzle of the ventilation hole located next to the filler hole (Fig. 40-*2*). Add the required amount of liquid almost to the edge of the filler hole

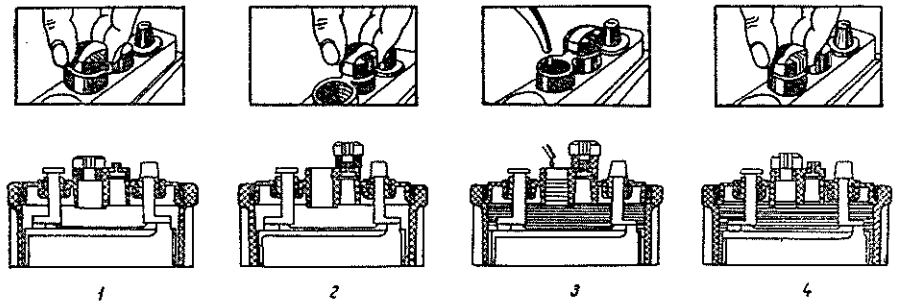


Fig. 40. Storage Battery Topping Up Sequence

(5 or 10 *mm* below it) (Fig. 40-*3*). Then remove the plug from the tapered nozzle. The electrolyte level will drop to normal and no further adding is required (Fig. 40-*4*). Replace the filler plug.

Storage Battery Trouble Tracing

Battery discharges. This is caused by the following:

1. Prolonged driving at a low speed with the head lamps turned on.
2. Faulty generator or current and voltage regulator.
3. All or some of the battery cells are faulty, which is accompanied by quick discharging of the battery.

This defect may be attributed to:

a) shorted plates due to damaged separators, or pieces of paste getting between the plates, or a high level of mud on the bottom of the cell;

b) noxious admixtures getting into the electrolyte or soiling of the battery surface causing intensive self-discharge and reducing the capacity of battery cells;

c) sulphation of battery plates which takes place if the battery has been out of service for long, or has been operated for a long time with insufficient electrolyte level or due to systematic undercharging.

4. Water evaporates too quickly from the battery cells. This is accompanied, as a rule, by intensive gassing during charging ("boiling" of electrolyte). This phenomenon calls for checking the voltage regulator.

5. During charging a stream of electrolyte flows from the ventilation holes of one or more cells. This may be caused by:

a) electrolyte level too high;

b) charging current too strong.

Head Lamps

The head lamps (Fig. 41) are equipped with a semi-sealed unit consisting of the reflector, lens, two-filament bulb with a flange base and the cover with block. The lower 50 *c.p.* filament, located in the reflector focus produces country beam. The upper 21 *c.p.* filament produces dipped traffic beam.

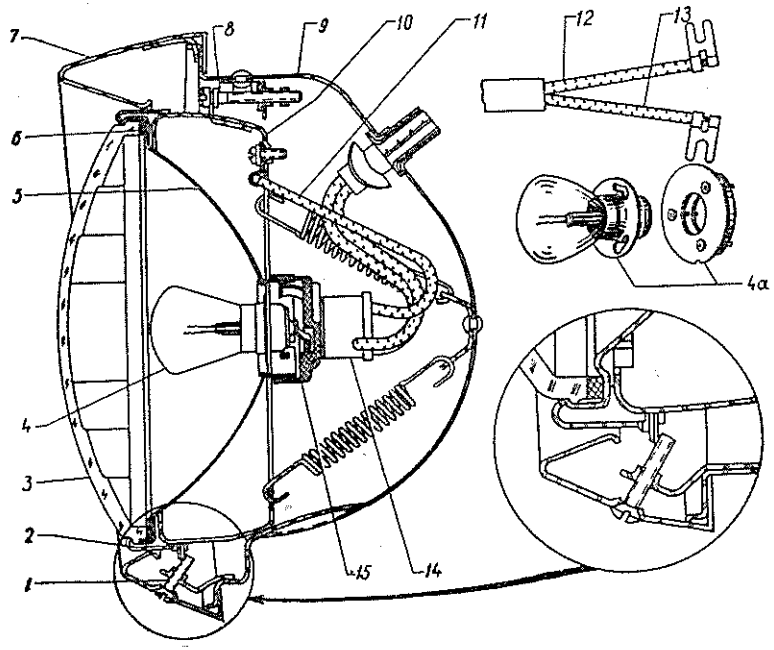


Fig. 41. Head Lamp

1 — rim attachment screw; *2* — optical unit rim; *3* — lens; *4* — bulb with large flange; *4a* — bulb with small flange and adapter; *5* — reflector; *6* — gasket; *7* — facing rim; *8* — adjusting screw; *9* — head lamp body; *10* — mounting ring; *11* — ground cable; *12* and *13* — country and traffic beam cables; *14* — panel; *15* — cover

Head lamp aiming. Correct aiming of the head lamps is vital for the proper distribution of light over the surface of the road. To aim the head lamps:

1. Place the unloaded car on a level floor in front of and square to a screen at a distance of 7.5 *m* from it and remove the rims of both head lamps.

2. Turn on the light and operate the foot switch to make sure the connections are correct and the country and traffic beams are turned on and off simultaneously in both head lamps.

3. Switch on the country beam, cover one of the head lamps and aim the other one using the adjusting screws located on top and on the side of the head lamp under the rim. Aim the hot spot on the screen at a height of 765 *mm* above the floor and at a distance of 700 *mm* from the longitudinal axis of the car.

4. Proceed in the same manner with the second head lamp, locating both hot spots at the same height.

5. Replace the head lamp rims.

RADIO SET

The radio set is installed in the middle of the instrument panel (Fig. 42).

For description of the radio set and its operating rules refer to the special booklet issued by the "Radio Manufacturing Works".

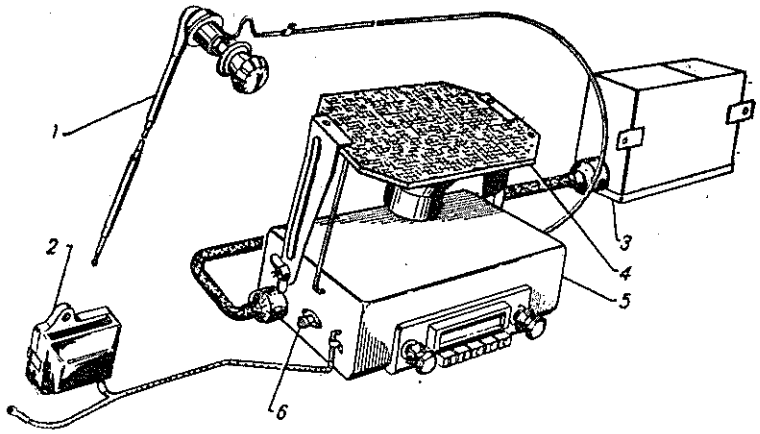


Fig. 42. Radio Set and Wiring

1 — aerial; *2* — fuse block; *3* — power supply unit; *4* — loudspeaker; *5* — radio set; *6* — fuse

While using the radio set on a parked car with a stopped engine, turn the ignition key to the extreme left position (counter-clockwise).

The use of the radio set on a parked car with engine stopped and ignition system turned ON is not allowable as it causes failure of the ignition coil due to overheating.

Prior to removal of the radio set, loud-speaker and power supply unit, disconnect the "ground" cable from the battery.

Operation of the radio set in the car is accompanied, besides atmospheric and industrial disturbances, with noises produced by the working electric equipment of the car. Normal radio reception is ensured by the following interference suppressing devices:

1. Suppressor resistors of 8,000 to 13,000 ohm in the H.T. circuit, i. e. in the cables leading from the ignition distributor to the spark plugs and from the ignition coil to the distributor.

2. Blocking condenser of 0.1 mfd capacity installed between the "М" (ground) and "Я" (armature) terminals of the generator.

3. Radio shielded braid of the aerial cable, connected to the car body.

4. The engine is connected to the body of the car.

5. To ensure reliable grounding of the electric instruments they are fastened by bolts with star-shaped washers.

6. A 0.25 mfd condenser is connected to the "ПР" (breaker) terminal of the ignition switch.

When operating the car, maintain all the anti-interference devices and the entire electric system in perfect order which will ensure normal functioning of the radio set.

BODY

The "Volga" car has an all-metal, four-door body of integral construction with two rows of seats, luggage compartment in the rear end, and a short frame in the front end, designed for mounting the engine and attaching the front suspension.

The front seat is adjustable, with folding back rest. To shift the seat forward or back, pull the seat guide handle up. To convert into sleeping berths, shift the seat to the foremost position and carefully lower the back rest close to, and flush with the rear seat cushion.

The doors are of the two-panel type without inner facing frames. Door hinges are attached to the body pillars with bolts and screws without adjustment. The doors are adjusted at the Works. Therefore, if it becomes necessary to remove the doors, take them off together with the hinges to avoid tempering with their adjustment. Door hinges are lubricated through special grease fittings.

In the closed position the door is held by two hinges on one side and by the guiding dowels on the other. The dowels rest on the retainer screwed to the lock pillar of the body. Position of the retainer may be adjusted after loosening the screws.

Door opening stops keep the doors against knocking on the outer surface of the body. If necessary, the distance of door opening may be adjusted by changing the length of the stop rod.

Heating and Ventilation

The body of the car is heated by hot water forced into the heater radiator from the engine cooling system (Fig. 43). A cock is mounted on the engine cylinder head to admit hot water to the heater during winter months.

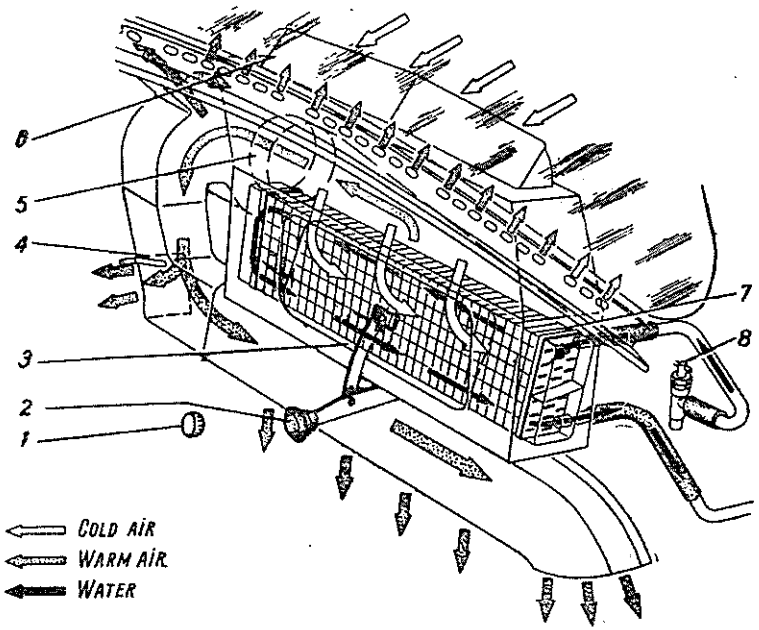


Fig. 43. Body Heating and Ventilation and Windshield Defrosting

1 — fan motor control knob; *2* — inside port handle; *3* — inside port; *4* — body heater lid; *5* — fan with motor; *6* — air intake port lid; *7* — heater radiator; *8* — cylinder head cock

When starting a cold engine in winter it is recommended, prior to filling the radiator with water, to close the cock on the cylinder head to avoid freezing of cold water in the heater radiator. Open the cock only after warming up the engine. While draining the cooling system keep the heater cock open, otherwise the water will not be drained from the heater radiator.

Air for body ventilation comes in from outside through the air intake port closed with a lid. Part of heated air is directed for windshield defrosting. The amount of air delivered into the body may be regulated by adjusting the fan speed.

TYRE OPERATING AND STORAGE INSTRUCTIONS

Daily, before driving out check tyre pressure (1.7 *kg/sq. cm*) while the tyres are cold. Check the presence and condition of the spare wheel and its tyre. Inspect condition of tube valves and presence of valve caps.

En route, do the following:

a) make certain that the car is not dragged right or left. If this is discovered, stop the car immediately and inspect tyres;

b) check frequently the tyre pressure and avoid driving on under-inflated tyres even for a short distance. And it is absolutely impermissible to drive on deflated tyres;

c) do not reduce the pressure in the heated tyres by letting the air out. An increase of tyre pressure during driving is unavoidable due to heating of the air inside the tyres;

d) do not apply the brakes sharply and do not rub the tyre sides against the curb stones.

Every 3,000 *km* interchange the tyres in the order shown in Fig. 9.

Efficient suspension of the car and a low centre of gravity allow for making sharp turns at high speed. However, this is objectionable due to side slipping of the wheels and premature wear of the tyres.

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Vneshtorgizdat. Order No. 03440
Resp: Zhuchkova N. G., Badaeva V. A., Kuzmin I. F.