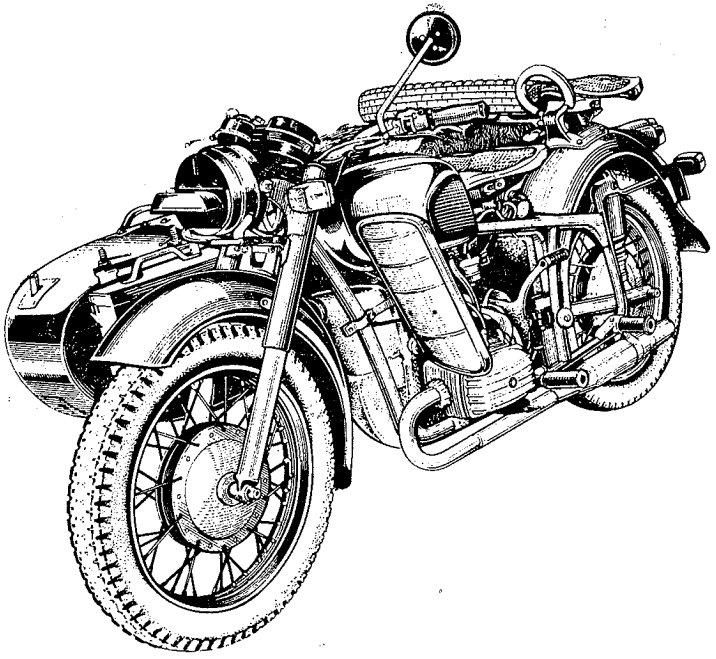


MOTORCYCLE MB650M1

SERVICE INSTRUCTIONS

MB650M1 P3

AVTOEXPORT
USSR • MOSCOW

Since efforts are continually made to improve the reliability and performance of the product, minor changes may be introduced without special notice.

MOTORCYCLE

MB650M1

OPERATING INSTRUCTIONS
MB650M1 РЭ

AVTOEXPORT ● USSR MOSCOW

INTRODUCTION

Motorcycle MB650M1 (Fig. 1) is a special machine of a heavy class which is provided with an up-to-date high-power valve-in-the-head engine, an improved transmission and running gear. The presence of a drive to the sidecar wheel considerably increases the cross-country capability of the motorcycle.

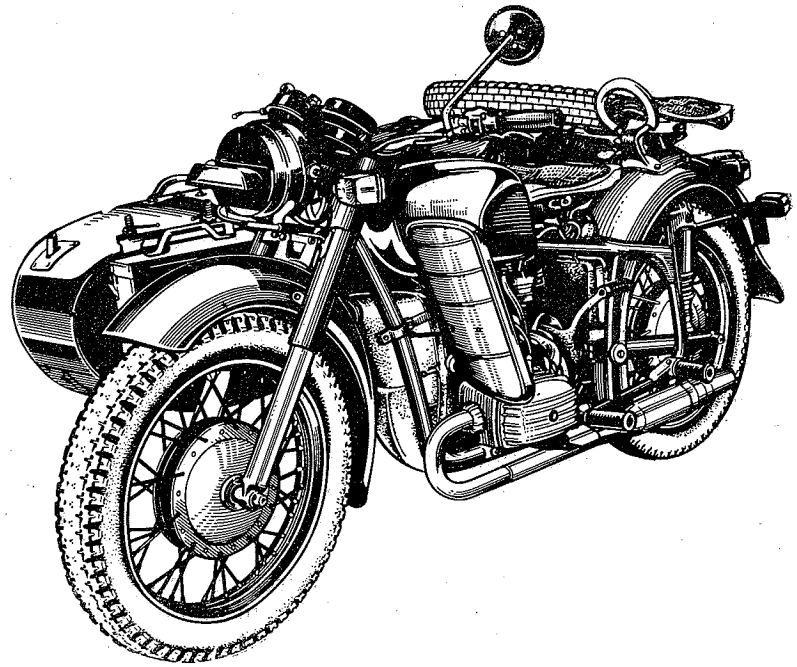


Fig. 1. Motorcycle MB650M1

The motorcycle is to be operated only with a sidecar.

Do not disassemble the motorcycle and its units without an utmost necessity: unnecessary disassemblies and assemblies can disturb correct interaction of parts, cause their premature wear and even breakdowns.

The repair of the motorcycle units and assemblies, their disassembly and assembly are to be carried out in accordance with the repair manual for the motorcycle.

The maintenance of the motorcycle is to be performed in accordance with the system which envisages the compulsory conduct of a definite kind of maintenance of the motorcycle both in the period of its use after a predetermined run and in the process of keeping it in storage. Thoroughly familiarize yourself with the Operating Instructions to service the motorcycle properly.

GENERAL DIRECTIONS

Prior to driving the motorcycle you are required to perform several jobs so as to prepare the motorcycle for operation:

remove the protective (anticorrosive) wax coating from the chromium-plated parts with the aid of soft waste moistened in gasoline, then wipe the cleaned surfaces dry with dry clean waste;

check the oil level in the engine crankcase, gearbox, differential and speed reducer (ref. to subsection "Preparing for Trip"), if necessary, add the oil;

check the tire air pressure and, if necessary, adjust it;

check the attachments especially of the wheel axles, handlebars, front fork, sidecar and, if necessary, tighten them;

install on the motorcycle the sparking plug caps, rear-view mirror, storage battery, mudguards and driver's windshield;

charge the storage battery in accordance with its operating instructions supplied with the motorcycle and mount the storage battery on the motorcycle;

check the controls of the throttle, clutch and brakes for proper functioning;

check the proper functioning of the motorcycle lighting system;

check and, if necessary, adjust the expansion clearance between rocker noses and valve ends (ref. to subsection "Valve Adjustment");

upon starting the engine you are required to check and, if necessary, adjust the carburetors for a minimum stable idling speed and a synchronous operation of the engine cylinders (ref. to subsection "Carburetor Adjustment"). In the process of maintenance of the motorcycle you are to use only those oils and lubricants which are recommended by the manufacturing plant (see Table 3). The use of other oils and lubricants can result in failure of the motorcycle units and assemblies. Do not leave the ignition in the switched-on state during parking of the motorcycle since this can result in the discharge of the storage battery and in the damage of the ignition coil.

The gases outgoing through the breather from the crankcase contain the water vapours due to which during operation in winter season in the rubber tube, connecting the breather to the air filter, the ice plug can be formed which obstructs the outlet of gases from the crankcase. This can result in oil leakage through the seal. Therefore it is recommended to remove the rubber tube during operation in winter season at a temperature of 0 °C and below.

SAFETY PRECAUTIONS

Do not use the open flame in inspections of the motorcycle mechanisms, in performing the maintenance jobs for lighting purposes or heating of oil in the cases of the motorcycle units.

When the necessity arises to carry out the mounting and dismantling jobs dealing with the motorcycle electrical equipment devices, preliminarily disconnect the wire, connected to "frame", from the negative terminal of the storage battery so as to avoid the short circuit. The circuit can be also opened with the aid of a battery switch.

Prior to starting and warming up the cold engine in the closed room you are required to make sure that this room is well aired. Remember that the exhaust gases of the engine are noxious since they contain carbon monoxide.

When the motorcycle has been parked, especially in the closed room, shut off the gasoline tank cock without fail and see that the gasoline would not leak from the carburetors.

Do not make the sharp and abrupt turns of the motorcycle, when driving it at high speeds. This can result in skidding and overturning of the motorcycle. Do not brake the motorcycle abruptly, when driving it on the slippery (ice-covered) or wet road. Use the combined braking (by brakes and engine) under such conditions.

Never operate the motorcycle when its brakes, sound and light signalling devices are defective or misadjusted.

When the ethylated gasoline is used for the engine, remember that it is very toxic. The ethylated gasoline upon getting into the gastroenteric tract or onto the skin as well as upon inhalation of its vapours causes heavy poisoning.

When using the ethylated gasoline (painted in blue, orange or other bright colour), observe the following safety regulations:

1) do not blow off the gasoline lines and hoses by the mouth;

2) do not use the gasoline for washing of hands and motorcycle parts.

Prior to removing the carbon deposit from the surfaces of the cylinder head combustion chambers, piston bottoms, valve heads you are to moisten the carbon deposit with kerosene or liquid oil. This will prevent the formation of lead-bearing dust.

SPECIFICATIONS

General

Maximum speed, km/h, at least	95
Operating speed on gear IV, km/h	60—70
Reference fuel consumption per 100 km of route at a travelling speed of 65—70 km/h, l, not over	8.0
Oil consumption per 100 km of route, l, not over	0.15
Braking distance (by all brakes), m, not over:	
at a travelling speed of 30 km/h	7.3
at a travelling speed of 60 km/h	28
Fuel distance with additional tank on asphalt highway, km	350
Motorcycle base (distance between axes of front and rear wheels), mm, not over	1510
Road clearance, mm, at least:	
with running mass (driver and two passengers)	125
in unloaded state	150
Track, mm, not over	1200
Radius of turn, mm, not over:	
to the left	3300
to the right	2550
Angle of maximum gradient at lower gear, %, at least	20
Overall dimensions of motorcycle with sidecar, mm:	
length	2430
height (less driver's windshield)	1100
width	1700
Dry mass of motorcycle, kg, not over	370
Maximum load, kg (including the load of not over 90 kg in sidecar)	390

Notes: In winter season the fuel consumption can increase up to 15 %.

Engine

Engine type	four-stroke, carburetor, valve-in-the-head, two-cylinder
Cylinder arrangement	horizontal, opposed
Cylinder rated bore, mm	78
Piston rated stroke, mm	68
Cylinder displacement, cm^3	649
Compression ratio	7.0
Maximum power at crankshaft rotational speed of 5200 min^{-1}, kW (h.p.), at least	23.5 (32)
Maximum torque at crankshaft rotational speed of 4200 min^{-1} N·m (kgf·m), at least	47 (4.8)

Cooling	air, by air flow coming from opposite direction
Lubricating system	combined—forced lubrication and splash lubrication
Quantity of carburetors	2
Carburetor type	K63T
Fuel	automobile gasoline A-76 or A-72
Air cleaner	with paper filter element

Transmission

Clutch	dry, two-disk. Clutch release linkage is double: hand linkage—from lever on handlebars; foot linkage is interlocked with gear-shift mechanism
Gearbox	four-speed gearbox with reverse gear
Gear shifting	foot pedal for engagement of four gears for forward running, hand lever — for engagement of gear for reverse running
Gear ratios in gearbox:	
gear I	3.60
gear II	2.28
gear III	1.70
gear IV	1.30
reverse gear	3.67
Transmission from gearbox to rear wheel	by torsion cardan shaft via differential gear
Differential gear	spiral-bevel pair of gears and asymmetrical spur-gear differential, asymmetry ratio of 19 : 11
Gear ratio of spiral-bevel pair of gears	4.62
Transmission to sidecar wheel	by cardan shaft via speed reducer
Gear ratio of speed reducer	2.4

Running Gear

Frame	tubular, welded, enclosed type
Rear wheel suspension	wishbone suspension from double-acting spring-hydraulic shock-absorbers with step load control

Front fork	telescopic with double-acting spring-hydraulic shock-absorbers
Wheels	interchangeable, easily removable, with cast bodies and adjustable tapered roller bearings
Brakes	drum brakes, front brake is a double-cam brake, brake of rear wheel and of sidecar wheel is a single-cam brake
Tires	3.75—19
Sidecar	single-seater sidecar, passenger-type body cushioned by rubber springs; wheel has wishbone suspension with double-acting spring-hydraulic shock-absorber similar to shock-absorbers in rear suspension of motorcycle
Sidecar frame	tubular, welded

Electrical Equipment

Storage battery	6MTC9
Alternating-current generator 14 V, 150 W	Г424
Voltage regulator	33.3702
Ignition system	battery ignition, 12 V, with automatic control of ignition advance angle
Ignition coil	Б204
Breaker	ПМ302А
Sparking plugs	А14В
Horn	С304 or С205Б
Speedometer	СП102

Filling Capacities

Fuel tank, l	19
Additional tank, l	10
Engine crankcase, cm^3	2200
Gear case, cm^3	1500
Final drive case, cm^3	100
Differential gear, cm^3	100
Sidecar wheel speed reducer, cm^3	200
Front fork blade, cm^3	130
Suspension shock-absorber, cm^3	105

Clearance between rocker and valve on cold engine (at 15—20 °C), mm	0.07—0.12
Breaker point gap, mm	0.4—0.6
Spark-plug gap, mm	0.50—0.65
Gap between discharger and ignition coil terminal, mm	9
Free travel of front arm of gear-shift pedal, mm	10—15
Free travel of rear wheel brake pedal, mm, not over	45
Wheel tire air pressure, kgf/cm^2:	
front wheel and sidecar wheel	$1.5^{+0.1}$
rear wheel	$2.5^{+0.1}$
spare wheel	$2.0^{+0.1}$
Toe-in of planes of motorcycle wheels and sidecar wheel on the length of motorcycle base, mm, not over	0 ± 5
Camber angle of rear wheel of motorcycle and of sidecar measured from vertical plane, not over	$0°\pm30'$

MOTORCYCLE CONTROLS AND INSTRUMENTATION

The arrangement of the motorcycle controls and instrumentation is shown in Fig. 2.

Combined switch *14* consists of a turn indicator switch, a distance and dim light switch and a horn button. The turn indicator switch has three positions: a middle position is a neutral one (turn indicators are switched off) and two extreme positions in which the turn indicators are switched on on the right-hand or left-hand side of the motorcycle.

Combined switch *7* consists of a "day—night" switch and an emergency ignition switch. The "day—night" switch has three positions: an extreme right-hand position ("Д"—day)—driving in the day-time; a middle (intermediate) position—driving in town at night; an extreme left-hand position ("Н"—night) — driving in the country at night. The emergency ignition switch has two positions. In the СТОП ДВИГ. (ENGINE STOP) position the switch key is shifted (pushed) to the extreme upper position—the ignition circuit is opened, in the extreme lower position of the switch key the ignition circuit is closed.

Battery switch *11* is installed under the driver's saddle. It has two positions. When the switch is in the ВКЛ.(ON) position, the circuit is closed and when it is in the ВЫКЛ. (OFF) position, the circuit is opened.

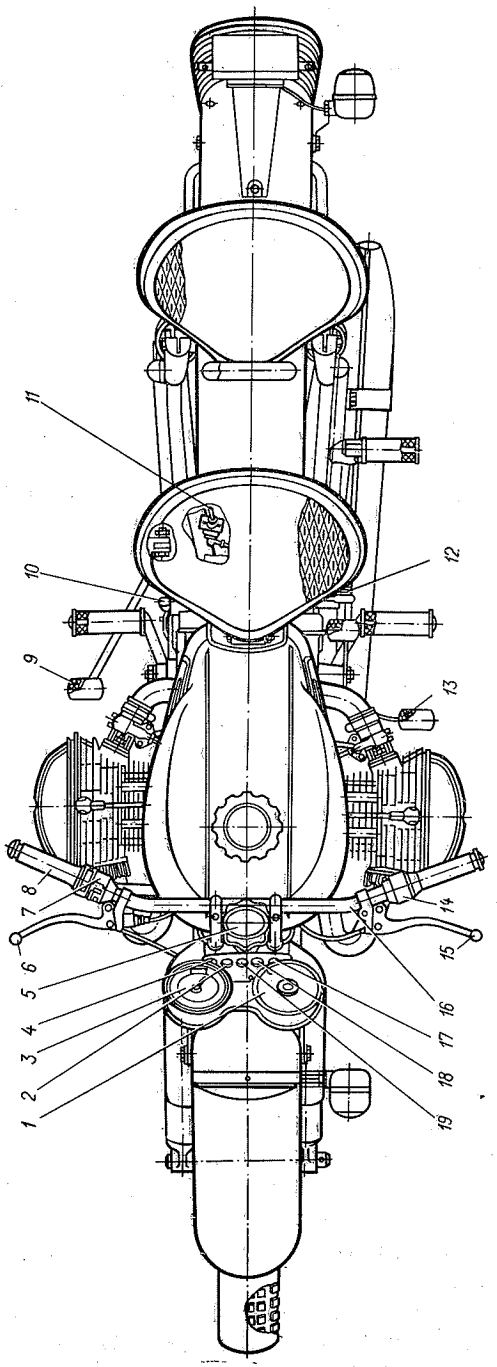


Fig. 2. Motorcycle controls and instrumentation:
1—ignition lock; *2*—emergency oil pressure transmitter pilot lamp cap; *3*—speedometer; *4*—turn indicator pilot lamp cap; *5*—handlebars shock-absorber; *6*—front brake lever; *7*—combined switch ("day-night" switch and emergency ignition switch); *8*—throttle control handle; *9*—rear wheel and sidecar wheel brake pedal; *10*—reverse gear engaging handle; *11*—battery switch; *12*—starting gear lever; *13*—gear-shift pedal; *14*—combined switch (switching-in of distance and dim light, turn indicators, horn); *15*—clutch operating lever; *16*—handlebars; *17*—gearbox neutral position indicator pilot lamp cap; *18*—generator operation and storage battery charging pilot lamp cap; *19*—distance light pilot lamp cap

Ignition lock *1* is mounted in the dashboard. The ignition lock head can be set with the aid of an ignition key to one of the following three positions (Fig. 3):

0 — key is fully inserted—all instruments are switched off.

I — key is fully inserted and turned clockwise to the first fixed position; the ignition system is switched on, the horn button, the stop-light switch, switches *7* (Fig. 2) and *14* are energized. When the engine is not operating, the following pilot lamps light up on the dashboard: generator operation and battery charging (red) pilot lamp *18;* emergency oil pressure transmitter (red) pilot lamp *2* and gearbox neutral position indicator pilot lamp *17* (when the main neutral position between gears *I* and *II* has been engaged), (green) pilot lamp *4* of the turn indicators, if they have been switched on; (blue) pilot lamp *19* of distance light, if it has been switched on and the "day — night" switch lever has been set to the "H" position. In this position you can switch on the dim light with the aid of the distance and dim light switch. When the "day — night" switch lever is set to the intermediate position or to the "H" position, the motorcycle tail lamp, the sidecar front and rear lamps, the speedometer lighting lamp, the marker (parking) lamp in the headlight light up too. **When the engine is not operating, never leave the ignition key in position I.**

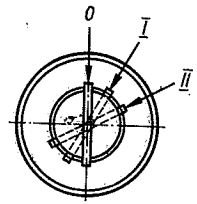


Fig. 3. Position of ignition lock key

II — key is fully inserted and turned clockwise to the second fixed position. The lamps which light up in this case are as follows: the parking lamp in the headlight, the motorcycle tail lamp, the sidecar front and rear lamps. In this case the ignition key can be removed from the ignition lock without disturbing the above-mentioned switching-in (marker or parking lamps).

The carburetor throttles are controlled by handle *8*. When the handle is turned to yourself, the throttles are lifted, the quantity of combustible mixture supplied to the cylinders increases owing to which the engine crankshaft rotation frequency increases. When the handle is turned from yourself, the throttles are lowered, the quantity of combustible mixture supplied to the cylinders decreases and the engine crankshaft rotation frequency diminishes.

Rear wheel and sidecar wheel brake pedal *9* is arranged at the right-hand side of the frame.

Front brake lever *6* is arranged at the right-hand side of the handlebars. You are recommended to use the front brake together with the rear wheel and sidecar wheel brake.

Reverse gear engaging handle *10* has two positions; rear position—reverse gear is disengaged; front position—reverse gear is engaged.

Starting gear level *12* is intended for starting the engine and is arranged at the left-hand side of the motorcycle.

Gear-shift pedal *13* is arranged at the left-hand side of the gearbox and has two supporting platforms. In the process of gear shifting the driver's foot toe is put on one platform and the heel—on the other platform. When the pedal is depressed by the toe, the gears are shifted from the higher to lower ones and gear I is engaged from the main neutral position. When the pedal is depressed by the heel, the gears are shifted from the lower to higher ones. The engagement of gears is shown in Fig. 4.

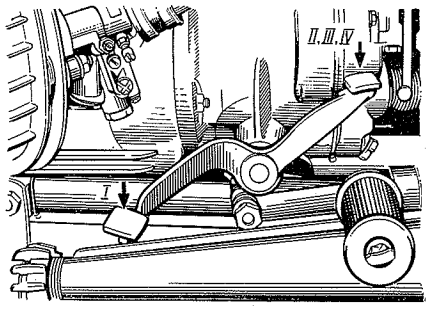


Fig. 4. Engagement of gears:
I—IV—gears

After being depressed each time the pedal returns to the initial position. As the pedal deviates from the middle position, the process of clutch release occurs too.

The clutch is controlled by lever *15* (Fig. 2). Upon pressing on the lever the clutch is released. Upon return of the lever to the initial position the clutch becomes engaged. The clutch is to be used in getting away, in braking and in gear shifting.

OPERATION

PREPARING FOR TRIP

The thorough check of the motorcycle prior to a trip is a precondition for trouble-free operation and prevents any troubles on the route. Prior to a trip you are required to pay attention to the attachment of the wheels, sidecar and handlebars, to the serviceability of the brakes, turn indicators and stop-light switch, to the presence of light in the headlight and lamps.

Check the oil level in the crankcase and cases with the aid of an oil dipstick, fitted in the filler plug of each unit and provided with two check marks: an upper marks which shows the complete filling and a lower mark which shows the minimum admissible level. The dipstick of the gear case, final drive case and speed reducer case are similar in design and differ in their length and

arrangement of the marks. The shorter dipstick is screwed into the gear case. The dipsticks, screwed into the final drive case and into the speed reducer case, are similar in their length but have different arrangement of the marks. The marks on the speed reducer case dipstick are arranged higher than the marks on the final drive case dipstick. When checking the oil level, do not screw in the plug with the dipstick but insert it into the hole as far as it rests in the thread.

The air pressure in the tires is to be checked with the aid of a tire-pressure gauge and, if necessary, inflate the tires.

The inspection and filling of the motorcycle over, begin to start the engine.

ENGINE STARTING

To start the engine, proceed as follows:

switch on the battery switch by setting it to the ON position. Check the position of the switch key of the emergency ignition switching-off. The key must be in the extreme lower position;

check and, if necessary, shift the reverse gear engaging handle to the rear position;

set the main neutral position (between gears I and II) of the gear-shift mechanism. In this case the neutral position indicator pilot lamp, arranged on the dashboard, must light up, when the ignition has been switched on;

open the gasoline cock (ref. to Fig. 15) by setting its handle to the О—ОТКРЫТО (OPEN) position;

press on float depressors *18* (ref. to Fig. 16) of the carburetor floats and fill the float chambers with fuel.

When starting the cold engine (at an ambient temperature of down to minus 15 °C), use the carburetor starting gear. For this purpose turn starting gear lever *23* (ref. to Fig. 16) upwards, then turn the gas handle a little to yourself.

The warming-up of the engine over, return the starting gear lever to the initial position (down). At an ambient temperature from minus 15 °C and below you are recommended to close the air cleaner choke.

Press on the starting gear lever several times so that the oil would fill the main oil line;

insert the ignition key as far as it will go and turn it clockwise to the first fixed position. In this case the generator operation and storage battery charging pilot lamp, the emergency oil pressure transmitter pilot lamp and the neutral position indicator pilot lamp light up;

mesh the starting gear shaft toothed quadrant with the small gear of the countershaft by pressing smoothly with your foot on the starting gear lever, then start the engine by an abrupt kick with your foot. When the quadrant has failed to mesh (rigid resistance is felt), push the motorcycle forward or backward. In the event of an attempt to overcome the resistance to the starting by applying the excessive efforts the breakdowns are possible. Do

not remove your foot from the lever during repeated kicks. Press on the lever by the foot toe so as to avoid an impact in case of an early ignition.

After starting the engine is to be warmed up. The warming-up of the cold engine is compulsory since with thickened oil the friction surfaces operate with insufficient lubrication which results in their abnormal wear.

Remember that after starting the cold engine (at an ambient air temperature of below 0 °C) it is not allowed to develop the great revolutions of the engine crankshaft. This factor can result in the pressing-out of the centrifuge gasket and the oil will fail to be supplied to the connecting rod bearings which causes their breakdown.

After starting the engine the generator operation pilot lamp and the emergency oil pressure pilot lamp go out. When any forward speed gear has been engaged, the neutral position indicator pilot lamp goes out. When the reverse speed gear has been engaged, this pilot lamp lights up. The normally adjusted engine must operate stably at an idling speed with the throttle control handle turned to yourself as far as it will go.

Start the motorcycle driving only after warming up the engine when it operates stably at an idling speed.

DRIVING OF MOTORCYCLE

Start the movement only on gear I. Never release the clutch operating lever abruptly in getting away since this can result in breakdown or abrupt jerks of the motorcycle. The engine crankshaft rotation frequency must be such at which the engine would not stall upon smooth engagement of the clutch.

At negative temperatures of the ambient air and after long-time outage of the motorcycle you are recommended not to operate the engine at a great rotation speed for the first 3—5 km of the run and to drive at a speed of 30—40 km/h so that the oil in the gear case, in the final drive case with the differential gear and in the speed reducer case would become warmed up and would obtain the viscosity required for normal lubrication of gears and bearings.

In addition, you are required to brake the motorcycle several times so as to dry the drums and the brake linings on which the ice deposit can be formed during long-time parking of the motorcycle.

Upon accelerating the motorcycle to a speed of 15—25 km/h, engage gear II. When the travelling speed has reached 25—35 km/h, engage gear III and engage gear IV at a speed of 45—50 km/h. After this control the speed by the position of the carburetor throttles, i.e. by turning of the gas handle.

Owing to the fact that the gearbox is provided with a clutch automatic release mechanism two methods of gear shifting are possible (ref. to subsection "Gearbox").

Driving on gears II, III and IV at speeds lower than the recommended ones is inadmissible since in this case the engine operates with an overload, nonuniformly, by jerks.

Do not drive on gears I and II for a long time when the road conditions do not require to do so since the engine develops a great rotation frequency, becomes overheated and is worn out sooner. In addition, the considerable excessive consumption of fuel occurs during driving on low gears.

Brake the motorcycle for rapid decrease of its travelling speed. Brake the motorcycle smoothly since the abrupt braking can result in an accident. The abrupt braking is especially dangerous on the slippery roads.

There are three methods of braking: by brakes, by engine, by engine and brakes simultaneously.

The first braking method can be used when the necessity arises to rapidly stop the motorcycle under conditions of the good adhesion of the wheels with the road. Release the clutch for braking with the aid of the brakes, simultaneously decrease the engine rotation frequency ("reduce the gas") and smoothly press on the brake pedal of the motorcycle rear wheel and of the sidecar wheel and on the front brake lever. Upon the action of the brakes on all wheels simultaneously the motorcycle stability is greater than upon the action of one brake.

Decrease the engine rotation frequency without releasing the clutch for braking the motorcycle by the engine. In the event of the considerable decrease in the engine rotation frequency in the process of braking the clutch is to be released so that the engine would not stall and, if necessary, stop the motorcycle by the brakes. The motorcycle can be braked by the engine on continuous slopes or on direct sections of roads as well as in those cases when the necessity arises to decrease the travelling speed on the slippery road.

To brake the motorcycle by the engine and brakes simultaneously, decrease the combustible mixture supply ("reduce the gas") without releasing the clutch, then smoothly press on the motorcycle rear wheel and sidecar wheel brake pedal and on the front brake lever. In this case do not brake the driving wheel completely since the engine stoppage and even the breakdown of the power transmission parts can occur. The simultaneous braking of the motorcycle by the engine and brakes is used on steep slopes and in driving on the slippery road so as to avoid the skidding. Brake the motorcycle carefully since the probability of its skidding and overturning is great in the event of abrupt braking. The abrupt braking is especially dangerous in winter season and on the wet road.

In case of emergency braking some turn is possible, especially without use of the front wheel brake. Due to this cause prior to operation you are required to test the motorcycle behavior at a slow speed under braking conditions: separately by the front wheel brake, by the motorcycle rear wheel and sidecar wheel brake and by all brakes simultaneously.

At the stopping places (slopes including) to hold a motorcycle in place with the engine cut engage gear I or reverse gear and turn the handlebars as far as it will go to the wayside.

The presence in the motorcycle transmission of the differential drive to the motorcycle rear wheel and sidecar wheel considerably increases the motorcycle cross-country capability on the heavy sections of the road. In this case you are required to take into account the peculiarities of the motorcycle with the sidecar driving wheel and to observe the following rules:

1. When driving the motorcycle with one passenger, the latter must be located only in the motorcycle sidecar.

2. Avoid the motorcycle driving with separation of the sidecar wheel from the road bed. More often this can occur when the driver drives the motorcycle without passengers during sharp turns towards the sidecar (during the right-hand turns) or when the sidecar wheel runs on the road section with ruts and potholes.

At the instant of loss of adhesion the sidecar wheel rotation frequency sharply increases and upon the subsequent contact of the wheel with the road bed the sharp impact load on the transmission appears which can cause the breakdown of parts and the failure of the transmission units.

The definite requirements are to be complied with in driving the motorcycle on the route.

In driving the motorcycle on upgrade you are required to reckon your actions and the motorcycle speed so as to avoid the forced stoppage. When the upgrade is gentle, accelerate the motorcycle before its beginning so as to drive the motorcycle through the whole upgrade or the considerable part of it on the engaged high gear. If in driving the motorcycle on upgrade its speed begins to considerably decrease, engage the low gear.

Do not release the clutch incompletely for overcoming the upgrade, increasing the engine crankshaft rotation frequency on account of clutch slippage. Such method results in rapid wear of the clutch parts.

When the motorcycle approaches to the steep upgrade and does not possess the sufficient speed, engage one of lower gears and do not change it up to the end of the upgrade.

Overcome the road sections covered with dry loose sand or crumbly snow on engaged gear II or I at an increased speed, maintaining the constant rotation frequency of the engine crankshaft and the rectilinear direction of movement.

In driving on sand you must not steeply turn the handlebars, release the clutch, shift the gears and sharply increase the engine crankshaft rotation frequency.

This can result in slippage of the rear wheel and in stoppage of the motorcycle.

In overcoming the road sections covered with thick sticky mud you are to drive the motorcycle in the same way as on the dry loose sand. When under the mudguards much mud has accumulated which impairs the wheel rotation, stop the motorcycle and remove the mud.

In the turns to the right and to the left the motorcycle stability is different. In turning to the right, i.e. towards the sidecar, the motorcycle loses its stability to a greater extent and overturns more easily than in turning to the left.

You should take into account that the definite maximum admissible angle of handlebars turn corresponds to the definite travelling speed of the motorcycle. With the rise in the travelling speed the admissible value of the steering angle decreases.

Turn the motorcycle handlebars smoothly, without jerks, especially in turning to the right.

In operation of the motorcycle you are required to attentively watch for thermal operating conditions of the engine, power transmission units and running gear mechanisms.

The good pickup of the motorcycle is a symptom of normal operation of the engine. Operation of the engine on the hot-bulb ignition, loss of power as a result of which the motorcycle slowly picks up speed, harsh metallic knocking appears in the crank mechanism, all these factors are a symptom of overheating of the engine.

In evaluation of the knocking in the engine you are to differentiate the knocking caused by overheating from the knocking caused by the setting of early ignition. Upon setting the early ignition the knocking appears simultaneously in both cylinders. The knocking caused by overheating of the engine appears first in the left-hand cylinder. This is explained by the fact that the temperature of the left-hand cylinder (when the motorcycle is used with the sidecar) is higher than the temperature of the right-hand cylinder.

Remember that the driving of the motorcycle with the overheated engine can result in breakdowns and accidents. To avoid the overheating, you are to choose the road sections more favourable for driving which provide an opportunity of avoiding the engine overload.

For cooling the overheated engine you are required to end the driving and stop the engine.

Do not cool the engine by water since this can result in failure of the cylinders or their heads. So stop the overheated engine, decrease the engine crankshaft rotation frequency to the minimum value, switch off the ignition and sharply open the carburetor throttles as far as they will go with the aid of the gas handle.

Do not:

operate the engine at a low rotation frequency with overload, when the engine runs with jerks.

The handlebars shock-absorber of a friction type is used for absorbing the side impacts of the front wheel, appearing in driving on the rough road. The degree of tightening the shock-absorber depends on the road condition and travelling speed. In driving at a great speed and especially on the rough road (on cobblestone) the handlebars shock-absorber wing nut is to be more tightened; in slow driving with frequent turns the handlebars shock-absorber wing nut is to be somewhat slackened since it is difficult to turn the handlebars when the shock-absorber is strongly tightened.

In order to ensure the reliability and useful life of the motorcycle it is not recommended to drive the motorcycle for a long time with fully opened throttles of the carburettor.

Do not exceed the following maximum admissible speeds: on gear I—30, on gear II—45 on gear III—70, on gear IV—95 km/h. Drive the motor at these speeds for a short period of time (not over 2—3 min).

The recommended speed of the motorcycle on the highway with improved pavement is 60—70 km/h.

DESIGN, OPERATION AND ADJUSTMENT OF MOTORCYCLE MAIN UNITS

ENGINE

By the structural peculiarities and specifications the engine (Figs 5—7) belongs to the category of the augmented motorcycle engines of a road type.

The horizontal arrangement of the cylinders ensures the good cooling and equalizing of the crank mechanism. Each cylinder is provided with a separate carburetor. This factor facilitates the starting and increases the engine power.

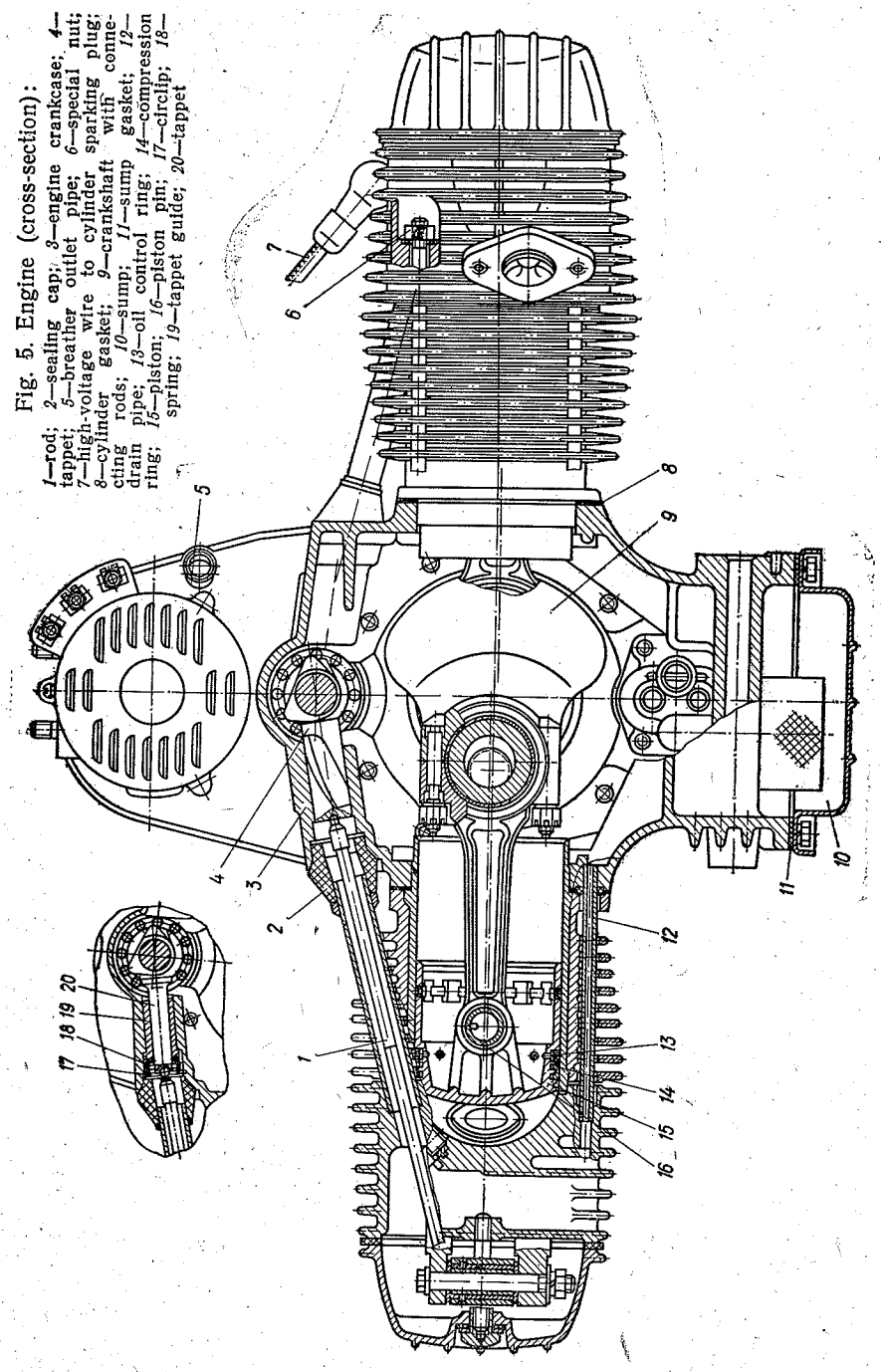


Fig. 5. Engine (cross-section):
1—rod; *2*—sealing cap; *3*—engine crankcase; *4*—tappet; *5*—breather outlet pipe; *6*—special nut; *7*—high-voltage wire to cylinder sparking plug; *8*—cylinder gasket; *9*—crankshaft with connecting rods; *10*—sump; *11*—sump gasket; *12*—drain pipe; *13*—oil control ring; *14*—compression ring; *15*—piston; *16*—piston pin; *17*—circlip; *18*—spring; *19*—tappet guide; *20*—tappet

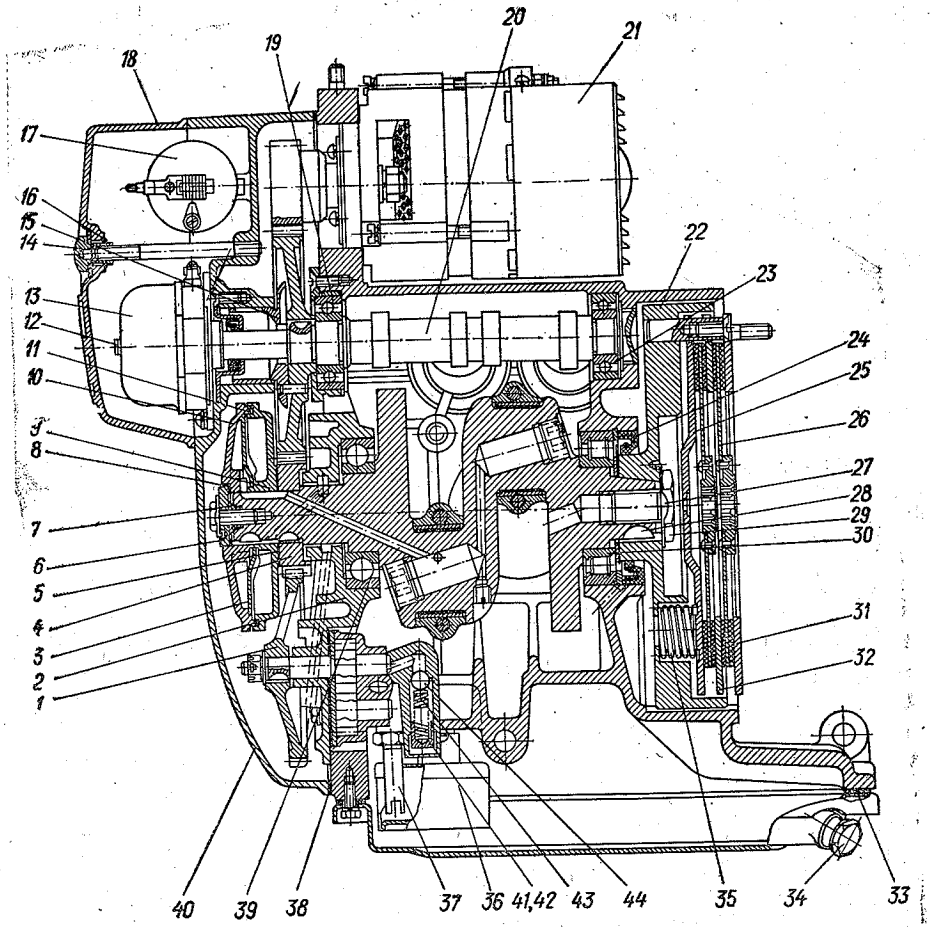


Fig. 6. Engine (longitudinal section):

1—oil pump drive gear; *2*—front bearing body with oil pump; *3*—centrifuge screen; *4*—driving timing gear; *5*—driving timing gear gasket; *6*—centrifuge washer; *7*—sealing ring; *8*—centrifuge washer gasket; *9*—centrifuge body; *10*—centrifuge cover; *11*—centrifuge sealing ring; *12*—breaker cover holder with cleat; *13*—motorcycle breaker; *14*—cover fastening nut; *15*—breather; *16*—cover locking ring; *17*—ignition coil; *18*—crankcase front cover; *19*—camshaft front bearing; *20*—camshaft with gear; *21*—generator with gear; *22*—flywheel with clutch pins; *23*—camshaft rear bearing; *24*—crankshaft seal; *25*—clutch driving pressure disk; *26*—clutch driven disk; *27*—flywheel lock washer; *28*—flywheel Woodruff key; *29*—flywheel fastening bolt; *30*—crankshaft rear bearing; *31*—clutch driving bearing disk; *32*—clutch driving intermediate disk; *33*—sump gasket; *34*—drain plug; *35*—clutch pressure spring; *36*—oil header; *37*—oil intake pipe; *38*—timing gear case gasket; *39*—crankshaft front bearing; *40*—timing gear case cover; *41*—cotter pin; *42*—plug; *43*—spring; *44*—ball

Crank Mechanism

The crank mechanism consists of a crankshaft with connecting rods, pistons with piston rings and piston pins, crankcase and two cylinders with heads.

Crankshaft. The two-bearing crankshaft is a casting made of high-strength cast iron, has two cranks arranged in one plane at an angle of 180° and consists of a front journal, a crank cheek and two crankpins.

The crankshaft is installed in the engine crankcase on two bearings *30* (Fig. 6) and *39*. Driving gear *4* of the timing gear and the centrifuge are fixed on the front end of the crankshaft and flywheel *22* is secured on the tapered part of the crankshaft rear end.

Under normal operating conditions the crankshaft with connecting-rod sliding bearings has a considerable service life. However, during capital repair of the engine it is recommended to replace the shells of the connecting-rod bearings. This measure protects the crankpins of the crankshaft from the premature wear.

Connecting Rods in Assembly with Shells. The connecting rods are steel, forged and of an I-beam cross-section. Press-fitted into the connecting-rod small end is a bronze bush the hole in which is made with a great accuracy for correct fitting of a piston pin. The connecting-rod big end is asymmetrical, split, with thin-walled interchangeable shells. For correct installation of the connecting rods on the crankshaft the connecting rod stems are provided with lugs which must be directed outside relative to the crank cheek (for the right-hand connecting rod the lug is directed towards the flywheel and for the left-hand connecting rod the lug is directed towards the centrifuge).

The connecting rod caps are not interchangeable. The connecting rod bolt nuts are to be tightened and to be locked. The repeated use of the old cotter pins is inadmissible.

Piston, Piston Rings and Piston Pins. Piston *15* (Fig. 5) of the engine consists of piston head, skirt and bosses. The piston is provided with four grooves in which the piston rings are fitted. Two upper rings *14* establish the required tightness in the cylinder and prevent the escape of gases from the combustion chamber to the engine crankcase. Two lower rings *13* are intended for removing the excessive oil from the cylinder walls.

Fitted in the third groove of the piston is an oil control ring, which consists of four elements: two steel disks, an axial and a radial expanders. A cast iron control ring is fitted in the lower groove of the piston.

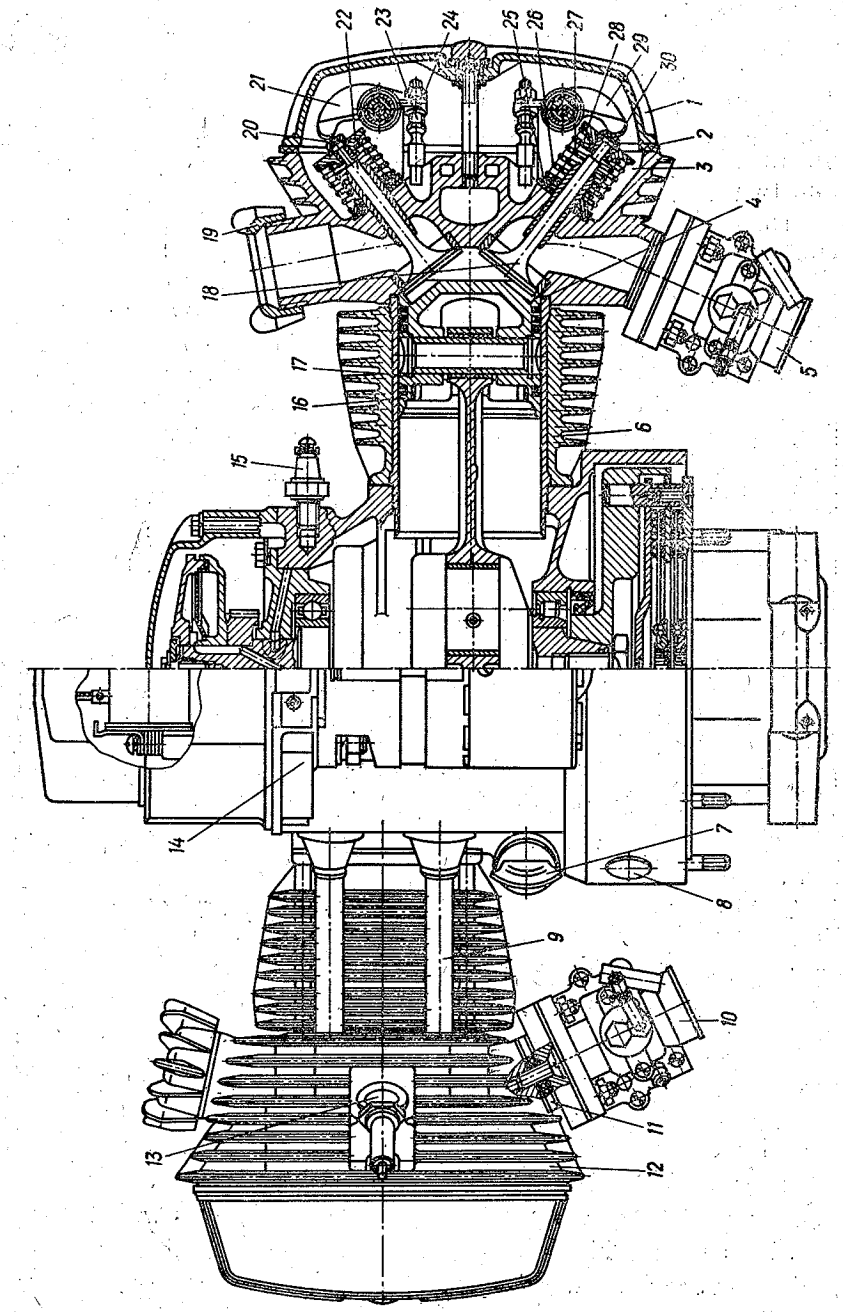


Fig. 7. Engine (horizontal section):
1—cylinder head cover; *2*—head cover gasket; *3*—right-hand cylinder head with valves; *4*—cylinder head gasket; *5*—right-hand carburetor; *6*—cylinder; *7*—filler plug; *8*—rubber plug; *9*—rod casing; *10*—left-hand carburetor; *11*—carburetor gasket; *12*—left-hand cylinder head with valves; *13*—sparking plug A14B; *14*—generator gasket; *15*—emergency oil pressure transmitter; *16*—piston with rings and pin; *17*—piston pin circlip; *18*—intake valve; *19*—exhaust pipe fastening nut; *20*—valve stem cap; *21*—right-hand rocker; *22*—exhaust valve; *23*—adjusting bolt; *24*—jam nut; *25*—lower plate; *26*—valve outer spring; *27*—valve inner spring; *28*—upper plate; *29*—left-hand rocker; *30*—block

The axis of the hole intended for the piston pin is offset through 1.5 mm from the diametral plane of the piston owing to which the piston travels smoothly, without impacts within the range of a clearance between the piston skirt and the cylinder walls upon changing the direction of travel in the top dead centre. Punched on the piston bottom is an arrow which shows the correct arrangement of the piston in the cylinder; in mounting the arrow must be directed on both pistons forward, i. e. towards the centrifuge.

The piston rings are made from special cast iron and are provided with direct locks. The gap in the piston ring locks upon setting into the cylinder must be in the range of 0.25 . . . 0.50 mm.

Upon installing the cylinders on the pistons the compression rings must be turned with their locks to different sides so as to minimize the gas escape.

Piston *16* (Fig. 7) is connected to the connecting rod with the aid of a floating pin whose axial displacement is limited by two circlips *17* inserted into the annular grooves in the piston bosses.

Crankcase. Crankcase *3* (Fig. 5) cast of an aluminium alloy is the main stationary base member of the engine.

The cylinders with heads and the auxiliary mechanisms are installed and fixed on the crankcase. In addition, the crankcase serves as an oil reservoir. Inside the crankcase the crankshaft and the camshaft revolve, in the front part the timing gear case is arranged and from above the generator is located. From below the crankcase is closed by stamped sump *10*. Sealing gasket *11* is fitted between the crankcase and the sump.

During operation of the engine a part of combustible mixture and exhaust gases penetrates into the crankcase through the piston ring gaps, additionally, upon travel of the pistons to the bottom dead centre the gases located in the crankcase chamber are compressed and under their pressure the oil can leak outside from the places of the joints of the crankcase with the covers and through the seals. To avoid this factor, the forced ventilation of the crankcase is used. Breather *15* (Fig. 6) which is located in the central hole of timing gear case cover *40* is intended for connection of the crankcase inner chamber to the atmosphere upon downward travel of the pistons and its isolation from the atmosphere upon upward travel of the pistons.

Cylinders. The engine has similar, interchangeable, bimetallic cylinders *6* (Fig. 7) which are an aluminium jacket with a cast iron liner. The lower part of the cylinder is provided with a flange which has the holes, passing through all fins and intended for the anchor studs fixing the cylinders and the cylinder heads to the crankcase. The upper part of the cylinder has an annular shoulder which enters the groove in the head.

Sealing gasket *4* is fitted between the cylinder and the head.

Cylinder Heads. Cylinder heads *3* and *12* are made of an aluminium alloy with fins on their outer surface which increase the cooling surface area. The combustion chamber of the head is of a semispherical shape. On the head from the side opposite to the combustion chamber four brackets are available in the holes of which the rockers are fixed. The threaded hole for the sparking plug is made in the upper part of the head.

Attendance of Crank Mechanism

In the process of daily maintenance you are to clean the crankcase, cylinders and cylinder heads of dirt and dust, paying attention to the cleanness of fins since the fins clogged with dirt worsen the engine cooling, watch for the absence of oil leakage from the engine crankcase chamber.

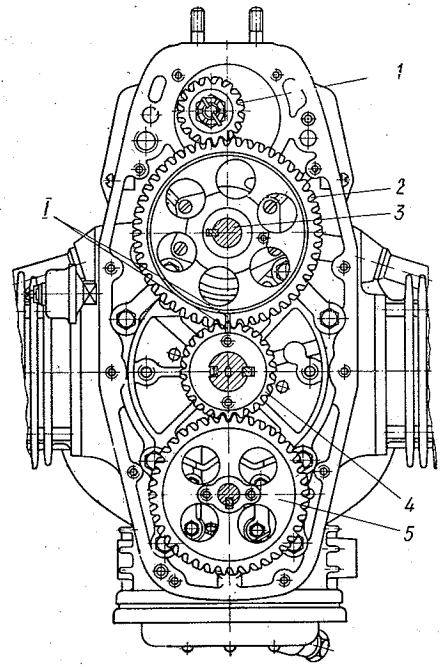


Fig. 8. Engine gears:
1—generator gear; *2*—camshaft driven gear; *3*—camshaft; *4*—driving timing gear; *5*—oil pump drive gear; I—marks

In the event of failure in the paper or rubber gaskets, seals the air inflow occurs and the pressure increases in the engine crankcase which results not only in the oil leakage from the places of joints and through the seals but also in the premature fouling of oil and in the abnormal wear of the engine parts.

After the run of 10 000 km you are required to clean the combustion chambers of cylinder heads, pistons, piston rings and valves of carbon deposit. In case of the presence of carbon deposit in the engine the engine knocks can appear which reduce the service life of the engine.

Replace the piston rings when the oil consumption in the engine exceeds 0.25 l per the run of 100 km.

Timing Gear

The timing gear controls the opening and closing of the exhaust and intake valves at the required instants corresponding to a definite angle of the crankshaft rotation. The timing gear consists of camshaft *3* (Fig. 8), tappets *4* (Fig. 5), rods *1*, rockers *21* (Fig. 7) and *29*, adjusting bolts *23*, jam nuts *24*, exhaust *22* and intake *18* valves with caps *20*, springs *26, 27*, supporting plates *25, 28* and blocks *30*. Installed on the front part of the camshaft is driven gear *2* (Fig. 8) which is meshed with driving gear *4* of the timing gear and generator drive gear *1*. The camshaft is installed in the engine crankcase on two ball bearings *19* (Fig. 6) and *23*.

The correct timing setting is ensured by matching of the marks on timing gears *2* (Fig. 8) and *4* in the process of assembly.

The mushroom-shaped tappets (ref. to Fig. 5, Refs *17, 18, 19* and *20*) can be installed on the engine.

Valve Timing

The intake valve of the engine opens when the piston passes the angle of 6 ° after the T.D.C. measured by the angle of rotation of the crankshaft and closes when the piston passes the angle of 34° after the B.D.C. (retardation of closing the intake). Duration of the intake makes up 208° (Fig. 9). The exhaust valve opens

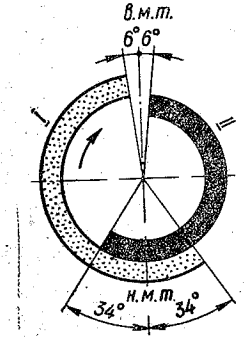


Fig. 9. Timing diagram of engine:
I—exhaust; II—intake

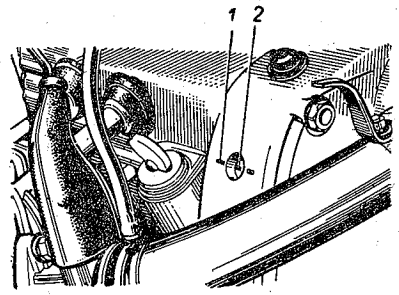


Fig. 10. Arrangement of marks on engine crankcase and flywheel:
1—mark on engine crankcase; *2*—mark on flywheel

when the piston does not reach 34° before the B.D.C. and closes when the piston does not reach the angle of 6° before the T.D.C. (retardation of closing). Duration of the exhaust makes up 208° too.

The above-mentioned values of the valve timing are specified at the theoretical clearance between the valve end and the rocker nose equal to 2 mm.

The correct setting of the valve timing is ensured by matching of the marks on timing gears *2* (Fig. 8) and *4* in the process of assembly.

Valve Adjustment

Normal operation of the engine depends to a considerable extent on the value of an expansion clearance between the valve stem and the rocker end.

Take it into account that on the air-cooled engine due to the absence of a water jacket and the presence of a considerable finning on the cylinders, crankcase and cylinder heads the operation of the valve-actuating gear can be well heard. Therefore the periodic knocking of the valves and tappets with normal clearances between the valve stem (cap) and the rocker end as well as the even, not harsh noise of a high tone caused by operation of the timing gear drive are not to be considered to be a symptom of a trouble.

While checking and adjusting the valve clearance, put the tub under the cylinder head, remove the cylinder head cover and drain the accumulated oil. Set the piston to the T.D.C. in the compression stroke by rotating the crankshaft so that the mark "B", drawn on the flywheel, would be matched with the mark on the engine crankcase; watch for this through an inspection hole in the engine crankcase with the rubber plug removed (Fig. 10).

In this position both (intake and exhaust) valves will be fully closed and their rockets must freely swing on the axles. Then check the clearance between both rockers and valves with the aid of a flat feeler gauge 0.07 mm thick.

When the clearance is misadjusted, slacken jam nut *24* (Fig. 7) and set the required clearance by rotating of adjusting bolt *23* to this or that side. The adjustment over, tighten the jam nut. Adjust the clearance when the engine is in the cold state; in this case the clearance must be equal to 0.07 . . . 0.12 mm. When the clearance is missing or is too small, the valve will not fit tightly to its seat at the instant of closing; when the clearance is great, the beginning of opening the valve will be retarded and the filling of the cylinder with combustible mixture will be worsened. To adjust the clearance in the second cylinder, turn the crankshaft through one revolution (through 360°), then check and adjust the valves as has been mentioned above.

Valve Grinding

After every 10 000 km of the motorcycle run you are required to check the valves of the timing gear for condition and, if necessary, grind them to their seats.

The necessity of valve grinding arises as a result of the disturbance of tightness on account of the wear of the faces, appearance of pits and other faults on the seat faces and valve heads.

Determine the failure in fitting of the valve head to the seat by filling of kerosene into the intake and exhaust ducts in the cylinder head. When kerosene seeps through fitted valve-to-seat surfaces in less than 10 s, the valves are to be ground.

To grind the valve to the seat, remove the valve, clamp the cylinder head in the vice, apply a thin coat of grinding paste to the valve head face and insert the valve into the guide sleeve of the cylinder head. Put the hand brace or the breast drill on the valve stem end. You can use a piece of gasoline hose by rotating it between hands. While pressing the valve to the seat, rotate it to both sides so that the valve turn to one side would be approximately twice greater than the turn to the other side, i.e. the valve would gradually turn in one direction. At the instant of variation of the sense of rotation of the valve the valve should be disengaged from the seat.

Grind the valve to the head seat carefully, without removing the greater quantity of metal from the working faces than necessary, since this factor reduces the number of admissible repairs. In the end of the grinding you are to decrease the quantity of paste and in the last period you are to grind the valve on pure oil.

The unitint mat colour of the working surfaces of the valve head and seat is a visual symptom of the satisfactory grinding.

The valve grinding over, thoroughly wash the valves, valve seats, guide sleeves, neck and compression chamber of the cylinder head until complete removal of the grinding paste. After this check the valve fit for tightness, for this purpose install the valves in situ, pour kerosene in turn into the intake and exhaust ducts in the cylinder head. There must be no seepage of kerosene for 10 s. When kerosene has seeped earlier than specified above, the additional grinding is required.

Checking and Setting of Ignition Timing

To facilitate the checking and setting of ignition timing, the mark "P" (early ignition) is available on the external surface of the flywheel. This mark can be seen through an inspection hole in the engine crankcase (Fig. 10) during rotation of the flywheel.

Prior to checking or setting the ignition timing you are required to adjust the gap between the breaker contact points. Then connect the pilot lamp with the lamp holder by one wire to the ignition coil low-voltage terminal (to which the wire running to the breaker is connected) and by the other wire—to "frame". Such a test device can be made by yourself from lamp A12-1, a holder and two wires which are desired to be provided with alligator clips on the ends.

Remove the rubber plug, closing the inspection hole in the engine crankcase, and match the mark "P" on the flywheel with the mark on the engine crankcase by rotating the crankshaft with a starting lever in the direction of its run.

Switch on the ignition and fully spread weights *14* (Fig. 11) of the automatic spark timer. If at the instant of maximum separation of the weights the pilot lamp lights up (the break of the breaker contact points has occurred), the ignition timing is set correctly.

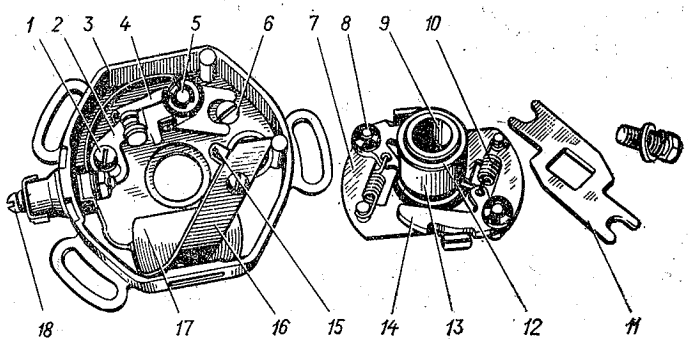


Fig. 11. Breaker ПМ302А with automatic spark timer:
1—screw; *2*—contact leg; *3*—breaker body; *4*—breaker arm; *5*—arm pivot; *6*—eccentric; *7*—automatic spark timer; *8*—weight axle; *9*—sleeve; *10*—spring; *11*—dog; *12*—locking ring; *13*—cam; *14*—weight; *15*—felt; *16*—capacitor holder; *17*—capacitor; *18*—terminal

If upon the maximum separation of the weights the pilot lamp fails to light up, the ignition is late and when the pilot lamp lights up until the instant of maximum separation of the weights, the ignition is early.

To set the required ignition timing, slacken the screws fastening the breaker and the contact leg and fully spread the weights of the automatic spark timer, then turn breaker body *3* clockwise, if the ignition is late, or counter-clockwise, if the ignition is early, until the pilot lamp lights up.

Fix the present position of the breaker body and fasten it with the aid of screws and a contact leg. Again check the correctness of setting of the ignition timing without disconnecting the pilot lamp. When the ignition is set correctly, disconnect the pilot lamp and re-install the breaker cover in situ.

Simultaneously check and, if necessary, adjust the gap between the dischargers and the terminals of the ignition coil which must be 9 mm (see Fig. 40).

Do not bend or stretch the springs of the automatic spark timer as they have been specially calibrated.

When dismantling and installing automatic spark timer ПМ302А, pay attention to the position of dog *2* (Fig. 12). For its correct installation you are required to match the cuts in the dog with axles *3* of the weights so that the ports via which springs *1* are seen would be of a rectangular shape (ref. to Fig. 12).

It is allowed to use a simplified method of setting the ignition timing based on the top dead centre.

To make use of this method it is required to remove the rubber plug stopping the inspection hole in the engine crankcase and match mark "B" on the flywheel with the mark on the engine crankcase by rotating the crankshaft in the direction of its run. Then connect the pilot lamp with the lamp holder by one wire to the low-voltage terminal of the ignition coil (to which the wire running to the breaker is secured) and by the other wire — to "frame".

Switch on the ignition, slacken the screws fastening the breaker and the breaker cover holder, and turn the breaker body clockwise or counter-clockwise until the pilot lamp lights up. This accomplished, fix the present position of the breaker body and fasten it by screws.

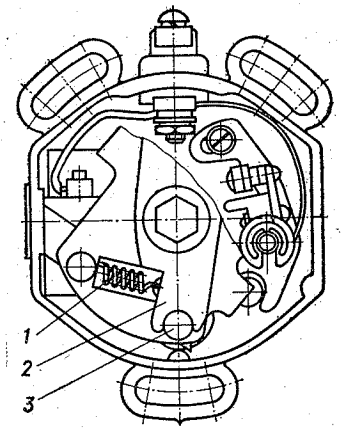


Fig. 12. Installation of dog on automatic spark timer ПМ302А:
1—spring; *2*—dog; *3*—weight axle

If the pilot lamp is not available, then the moment of the beginning of the breaker contact points separation can be determined in the following manner. After matching mark "B" on the flywheel with the mark on the crankcase and slackening the screws that fasten the body and the breaker cover holder, turn the body till the breaker contact points are effectively closed. Switch on the ignition and attach a screwdriver or any other steel object to one of the core ends of the ignition coil. The breaker contact points being closed, the current passing through the coil winding magnetizes the core which attracts and holds a screwdriver. Then slowly turn the breaker body until a screwdriver drops down due to demagnetization of the core following the breaker contact points parting. Therefore, this event can serve as an indication of the beginning of the breaker contact points parting. Fasten the breaker body in this position.

Adjustment of Breaker Contact Point Cap

To adjust the gap between the breaker contact points, remove the crankcase front cover, trim the contacts with a needle file or fine glass cloth and wipe them with clean waste moistened in gasoline. Turn the crankshaft so that the breaker cam would be set to the position of maximum opening of the contacts (cam apex). Set the gap between the breaker contact points in the range of 0.4 . . . 0.6 mm by slackening of screw *1* (Fig. 11) and turning of eccentric *6* with a screwdriver to this or that side. The gap is to be measured with the aid of a flat feeler gauge included in the set of SPTA of the motorcycle. Tighten the screw after setting the gap of the required value.

Lubricating System

The engine is provided with a combined (forced and splash) lubrication system. The lubrication chart is given in Fig. 13.

The oil is filled into the engine crankcase through a filling hole which is closed by plug *2* with an oil level dipstick. Hereof

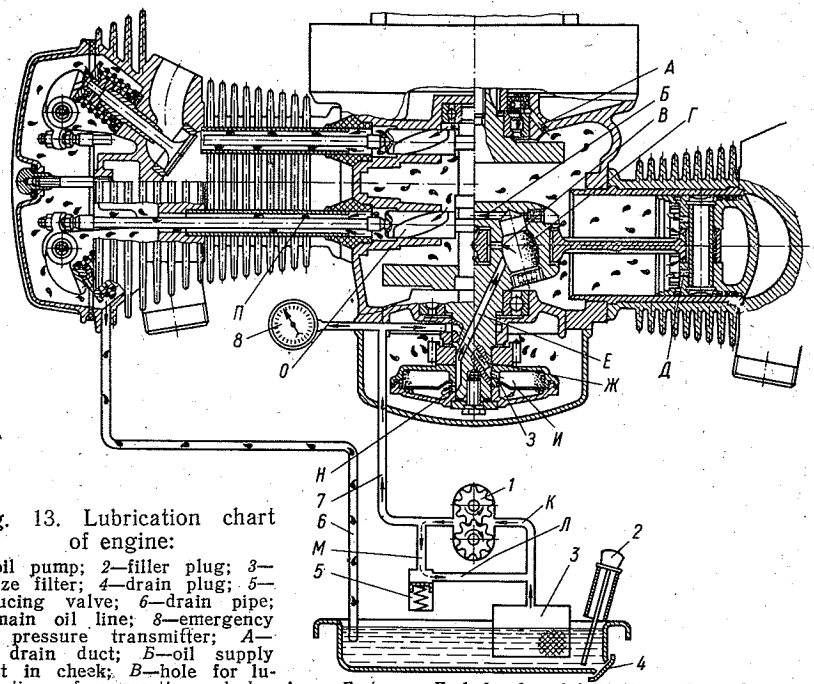


Fig. 13. Lubrication chart of engine:

1—oil pump; *2*—filler plug; *3*—gauze filter; *4*—drain plug; *5*—reducing valve; *6*—drain pipe; *7*—main oil line; *8*—emergency oil pressure transmitter; *А*—oil drain duct; *Б*—oil supply duct in cheek; *В*—hole for lubrication of connecting-rod bearing; *Г*—trap; *Д*—hole for lubrication of piston pin; *Е*—crankshaft oil outlet duct; *Ж*—crankshaft oil supply duct; *З*—oil supply hole in centrifuge body; *И*—hole in screen; *К*—suction duct; *Л*—bypass duct; *М*—reducing valve oil supply duct; *Н*—hole for oil outlet from centrifuge; *О*—groove in tappet for oil supply to cylinder head; *П*—oil supply duct in rod casing

the oil is sucked via gauze filter *3* by a gear pump, installed in the front bearing body, which is actuated from a gear, meshed with the driving gear of the timing gear. In the oil pump there are two gears which are installed in the body and force the oil to main oil line *7*. Reducing valve *5* is installed in the oil pump body for preventing the oil pressure rise in the system above an admissible value.

In normal operation of the lufricating system the excessive oil pressure opens the reducing valve and the excessive quantity of oil is bypassed back to the suction duct of the oil pump.

In the process of operation the reducing valve does not require an adjustment.

From the main oil line the oil is supplied to the annular groove in the front bearing body wherefrom it is fed via a duct to the centrifuge body. The oil, cleaned in the centrifuge, via oil outlet

duct *Е* of the crankshaft and oil supply duct *Б* in the crank cheek is fed to traps *Г*, located in the crankshaft crankpins, wherefrom the oil via holes *В* gets into the shells of the connecting rods.

The rapidly moving parts of the crank mechanism facilitate the intensive splashing of oil, formation of an oil fog in the crankcase by which the working surfaces of the cylinders, piston pins, connecting-rod small ends, tappet guides, main antifriction bearings, timing gears, ball bearings and cams of the camshaft, tappets and other friction parts are lubricated.

Upon getting into grooves О of the tappets, the atomized oil is supplied to the rod casings, settles in them and flows to the cylinder heads. Here the oil is splashed by the valves, springs and lubricates the valves and rockers. The excessive oil drains via drain pipe *6* back into the engine crankcase.

Oil drain duct *А* in the engine crankcase is intended for draining of the accumulated oil, deflected by the flywheel seal.

The rubber seal on the flywheel hub is envisaged for preventing the oil from seeping from the crankcase to the clutch and the rubber seal on the camshaft is envisaged for preventing the oil from getting to the breaker.

The centrifuge is a fine oil filter. Before the centrifuge the oil is cleaned only by the oil intake gauze. Aluminium body *8* (Fig. 14)

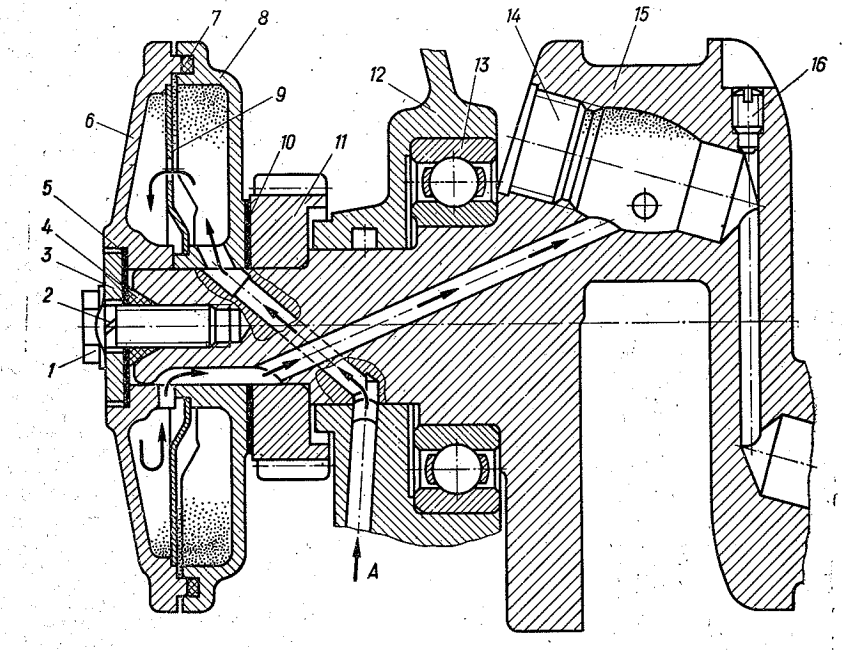


Fig. 14. Centrifuge and front main ball bearing:

1—centrifuge fastening bolt; *2*—lock washer; *3*—centrifuge washer; *4*—sealing ring; *5*—gasket; *6*—centrifuge cover; *7*—sealing ring; *8*—centrifuge body; *9*—screen; *10*—timing gear gasket; *11*—driving timing gear; *12*—front bearing body; *13*—front main ball bearing; *14*—plug; *15*—crankshaft; *16*—screw; *А*—from oil pump

and cover *6* of the centrifuge are installed on the crankshaft front journal, are fixed by a key and are fastened by bolt *1* via special washer *3,* fitted in the centrifuge cover. Lock washer *2* is fitted for prevention of the spontaneous unscrewing of bolt *1.* Between the centrifuge body and cover screen *9* is installed with one elongated hole for oil passage from the body chamber to the cover chamber of the centrifuge and further via the ducts to the connecting-rod bearings. The correct position of the hole in the screen relative to the duct is ensured by a tongue which enters the centrifuge body.

The centrifuge body and cover are sealed by special rubber ring *7.* Sealing ring *4* is fitted between the washer and the crankshaft end for minimizing the oil leakage.

Attendance of Lubricating System

During operation of the motorcycle the oil level in the engine crankcase is to be maintained at the upper mark of the oil level dipstick. When the oil level has dropped to the lower mark on the dipstick, the engine operation is inadmissible. Add the oil from the clean containers and compulsorily use the funnel with gauze so as to prevent the getting of dust, dirt and moisture into the engine crankcase.

To check the oil level, wipe the oil level dipstick and lower it into the filling hole in the crankcase as far as it will go, without screwing the plug in. Replace the oil when the engine is hot.

During replacement of oil in the engine crankcase you are to thoroughly clean the crankcase filling and draining hole plugs of dirt and unscrew them. Further drain the used oil, screw the filling hole plug in and fill the fresh oil. After every 10 000 km of the run the engine lubricating system is to be rinsed. For this purpose drain the used oil, unscrew the draining hole plug and fill 1.2...1.5 l of the И-20А industrial oil into the crankcase. For rinsing you are to start the engine and, upon letting the engine operate for 2—3 min, drain the oil again. Remove and wash the crankcase sump, then fill the fresh oil into the crankcase.

In winter season you are required to warm up the oil to a temperature of 70—80 °C prior to filling.

Remember that even a short-time failure in operation of the lubricating system can result in breakdown of the engine.

The excessive heating of the cylinders and heads, power decrease and knocking in the engine are the symptoms of insufficient lubrication.

Operation of the lubricating system is checked with the aid of emergency oil pressure transmitter *8* (Fig. 13) of a membrane type which operates when the pressure in the system drops to 0.13—0.18 MPa (1.3—1.8 kgf/cm^2).

The emergency oil pressure transmitter pilot lamp, fitted on the dashboard, is a pressure drop indicator. When the ignition is switched on, the pilot lamp lights up. Upon starting the engine the pilot lamp goes out. The lighting-up of the pilot lamp when

the engine is operating is indicative of a trouble in the transmitter or in the engine. In these cases the operation of the engine until the discovery and remedy of the trouble is inadmissible.

In the event of the instantaneous lighting-up of the emergency oil pressure transmitter pilot lamp at a mean rotation frequency of the engine crankcase which is possible due to the getting of metal particles under ball *44* (Fig. 6) of the reducing valve, clean its seat.

For this purpose drain the oil from the engine crankcase, remove the sump, disassemble the reducing valve (remove cotter pin *41,* plug *42,* spring *43* and ball *44*) and clean the seat.

It is recommended to clean the seat with the aid of a drill Ø 10 mm, sharpened at an angle of 90 °, while turning it by hand with a light pressure. It is admissible to seal the valve seat by a ball Ø 10 mm with the aid of a light impact (2—3 times) with a hammer (mass of 0.1—0.2 kg) through a mandrel (it is admissible to use a tommy bar available in the tool bag). After this you are required to turn the crankshaft through 2—3 revolutions and assemble everything in the reverse order.

In the event of the overheated engine or operation at a slow idling speed (engine crankshaft rotation frequency of 800 min^{-1}) the pilot lamp can light up with the serviceable lubricating system. It is recommended to periodically unscrew the transmitter and check the oil pressure with the aid of a reference pressure gauge. At a mean rotation frequency of the warmed-up engine the oil pressure must be at least 0.3 and not over 0.6 MPa (3 and 6 kgf/cm^2 respectively).

In the process of operation of the engine on account of the centrifugal forces the dirt is separated from the oil and settles on the centrifuge body and cover. Therefore the centrifuge is to be cleaned after every 10 000 km of the run.

Fuel System

The engine fuel system comprises a gasoline tank, a three-way cock with a filter and a sediment bowl, two carburetors, an air cleaner, air ducts and gasoline lines.

Gasoline Cock with Sediment Bowl

The gasoline cock is screwed into the adapter nut of the gasoline tank. Sediment bowl *5* (Fig. 15) with filter gauze *6* is arranged in the lower part of the cock. Gasoline is supplied via one of two gasoline line pipes *10* and *11* of a different height.

Control valve *3,* possessing one axial and two radial holes, is arranged in the cock body. One of the holes is through and coincides with the hole of the high gasoline line pipe (main fuel) and the other hole coincides with the duct of the low gasoline line pipe (reserve fuel).

From the other side of the body two unions are available which are intended for connection of the fuel supply rubber hoses running to the carburetors.

The cock handle has three positions:

O—cock is opened; *3*—cock is closed; *P*—cock is opened for consumption of reserve fuel.

The reserve comprises about 2 l of fuel.

Wash the sediment bowl and the gasoline cock filter in the periods envisaged in section "Maintenance".

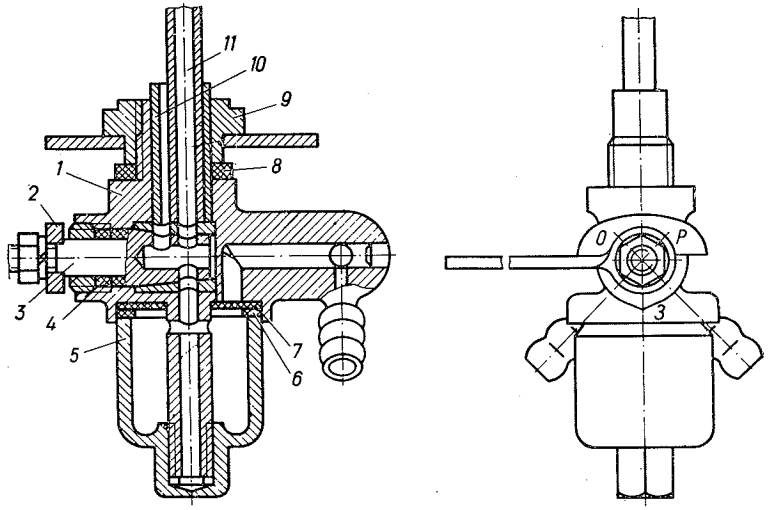


Fig. 15. Gasoline cock:

1—body; *2*—handle: *3*—control valve; *4*—control valve sealing gasket; *5*—sediment bowl; *6*—filter gauze; *7*—sediment bowl sealing gasket; *8*—sealing gasket of gasoline cock body; *9*—adapter nut; *10*—gasoline line reserve fuel pipe; *11*—gasoline line main fuel pipe

To wash the sediment bowl and the gauze filter, unscrew the lower nut fixing the sediment bowl, remove the sediment bowl and the cup with filter, clean them of dirt and wash in clean gasoline.

While re-installing the sediment bowl in situ, pay attention to the serviceability and correct installation of the sealing gasket.

Carburetors K63T

The carburetors are interchangeable and similar in design.

Carburetor Adjustment. Prior to adjusting the carburetors you are required to check the dimension of gaps and clearances: sparking plug gaps, breaker point gap, clearance between valve stems and rocker ends.

Adjustment of Idling Speed. Prior to adjustment you are to check the presence of a clearance between the cable sheath tip and the union which must be in the range of 2—3 mm. When there

is no clearance or this clearance is greater than the specified one, slacken the jam nut of union *1* (Fig. 16) and adjust the clearance by turning the union to the right or to the left, then lock the union with a jam nut. The above-mentioned clearance must be similar in both carburetors.

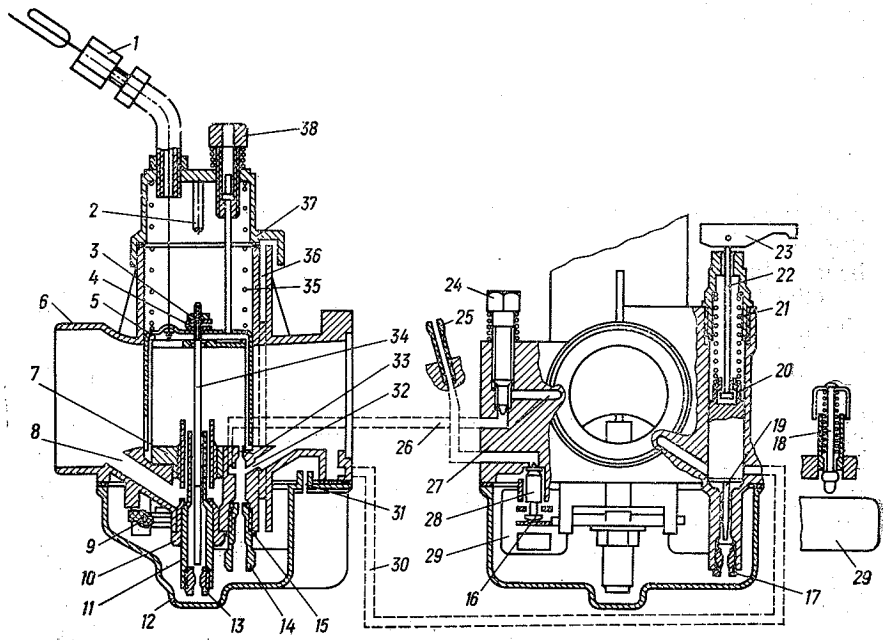


Fig. 16. Carburetor K63T:

1—union with jam nut; *2*—throttle lift limiter; *3*—jam nut; *4*—metering needle cleat; *5*—throttle; *6*—body; *7*—nozzle chamber; *8*—atomizer air duct; *9*—float lever axle; *10*—atomizer body; *11*—atomizer; *12*—float chamber cover; *13*—main fuel jet; *14*—idling fuel jet; *15*—lock washer; *16*—stop of fuel valve for adjustment of fuel level; *17*—starting gear fuel jet; *18*—float depressor; *19*—plunger needle; *20*—starting gear plunger; *21*—spring; *22*—stem; *23*—starting gear lever; *24*—air-fuel ratio adjusting screw for adjustment at slow speed; *25*—fuel inlet union; *26*—idling jet air duct; *27*—air duct; *28*—fuel valve; *29*—float; *30*—duct for supply of air-fuel mixture from starting gear; *31*—drain hole; *32*—emulsion hole; *33*—passing hole; *34*—metering needle; *35*—throttle spring; *36*—duct for float chamber connection to environment; *37*—body cover; *38*—idling crankshaft adjustment screw

The adjustment of the carburetors for the idling speed of the engine is to be carried out on the warmed-up operating engine. When the warmed-up engine stops at an idling speed, adjust the system of an idling speed.

Each carburetor is to be adjusted separately in the sequence as follows: set the minimum stable rotation frequency of the crankshaft with the aid of screw *38*, then gradually unscrew screw *24* until the appearance of misses in operation of the engine; then slowly tighten the screw until the engine operation has become stable; further decrease the throttle closing with the aid of screw *38* again until the minimum stable rotation frequency of the crankshaft has been attained, simultaneously controlling the air-fuel

ratio of the combustible mixture with the aid of screw *24*. Carry out the above-mentioned jobs until the minimum stable rotation frequency of the engine crankshaft has been attained.

Adjust the carburetor of the other cylinder in a similar way.

After adjustment of the idling speed the crankshaft rotation frequency during operation of the left-hand and right-hand cylinders must be similar.

This is to be checked by switching off in turn now the right-hand cylinder, now the left-hand cylinder by removing the cap from the sparking plug.

Determine the variation of the engine crankshaft rotation frequency by ear on each cylinder. When the engine crankshaft rotation frequency on the right-hand and left-hand cylinders is different, the carburetors are to be adjusted by screwing in or unscrewing throttle screws *38* until the similar rotation frequency has been attained.

Check the rotation frequency stability at an idling speed by sharp opening and closing of the throttles (by turning of the "gas" handle).

When the engine operation is stable at an idling speed but the engine stops upon the sharp opening of the throttle, tighten screw *24* through 1/4—1/2 of a revolution (combustible mixture will become richer); when the engine stops upon the sharp closing of the thottle—unscrew screw *24* through 1/4—1/2 of a revolution (combustible mixture will become leaner).

Adjustment of Air-fuel Ratio of Combustible Mixture at Operating Speeds of the Engine. The engine operation at operating (middle load) speeds depends on the position of the needle in the throttle therefore the adjustment of the carburetors consists in the choice of a correct position of the needle.

The necessity in this adjustment arises upon the variation of climatic conditions, e.g. in transition from the summer period of operation to the winter one; in the running-in period or for increasing the engine power to the detriment of economical efficiency of the engine operation. The adjustment is to be performed by shifting metering needle *34* on the thread relative to cleat *4* by means of its rotation, having preliminarily slackened jam nut *3*. When the needle is screwed into the cleat, the needle is lifted relative to the atomizer orifice—the combustible mixture becomes enriched, when the needle is unscrewed from the cleat—the combustible mixture becomes leaner. When the needle is turned through one revolution, its travel makes up 0.5 mm.

The adjustment over, tighten jam nut *3*.

The correctness of adjustment of the carburetors for the middle load conditions is to be checked by the sharp increase of the engine crankshaft rotation frequency. When in this case the knocking is heard in the carburetor, the combustible mixture is to be enriched by lifting the needle.

Setting of Fuel Level in Float Chamber. In the event of an excessive level of fuel in the float chamber, an excessive consumption of fuel or an insufficient pickup of the engine as well as in case of replacement of the fuel valve or float you are required to set the normal fuel level in the float chamber of the carburetor.

To set the fuel level in the float chamber, remove the float chamber cover, install the carburetor vertically—with the float chamber upwards. In this position the belt on the side surface of the float (in the middle part) must be parallel to the carburetor body plane, fitting to the float chamber cover, and the distance between the float belt and this plane must be equal to (13±1) mm. If necessary, the position of the float is to be changed by bending of fuel valve stop *16*.

Attendance of the Carburetors. It is recommended to wash and blow off the carburetors after every 5000 km of the run. The washing of the carburetor parts with acetone (except the jets) and other similar solvents is inadmissible. The washing over, blow off the carburetors and their parts with air or dry them. Do not wipe the parts with waste or other similar materials. Do not use the steel wire for clearing the jets as the wire can vary their orifice cross-sections and, hence, can disturb the operation of the carburetors.

In the event of a long-time operation of the motorcycle under hot climate conditions (temperature of 35 . . . 40 °C and above) as well as at an altitude of 2000 m and higher above the sea level you are recommended to lower the metering needle and in case of operation of the motorcycle under cold climate conditions (air temperature of minus 15 °C and below) you are recommended to lift the metering needle.

The fuel leakage through drain hole *31* of the carburetor is indicative of failure in tightness of the fuel valve of the float chamber. In this case you are required to wash the fuel valve or replace its elastic washer, remedy the lines and nicks on the valve seat.

Air Cleaner with Paper Filter Element

Both carburetors have a common air filter which is fixed with the aid of two studs to the gear case. The design of the filter is shown in Fig. 17.

Dry filter element *11* consists of the cardboard bellows, fixed between the annular metal rims, and the prefilter made of non-woven synthetic fabric which serves as a coarse filter element.

The air cleaning occurs as follows: upon getting under the filter cover, the dusty air under the action of rarefaction in the cylinders via air choke ports comes to the outer annular chamber of the filter. The coarse dust particles, arriving together with the air, are retained by the coarse filter element. The fine dust particles, carried away by an air flow, are retained by the cardboard bellows filter element. The cleaned air from the inner chamber of the filter via air ducts comes to the carburetors.

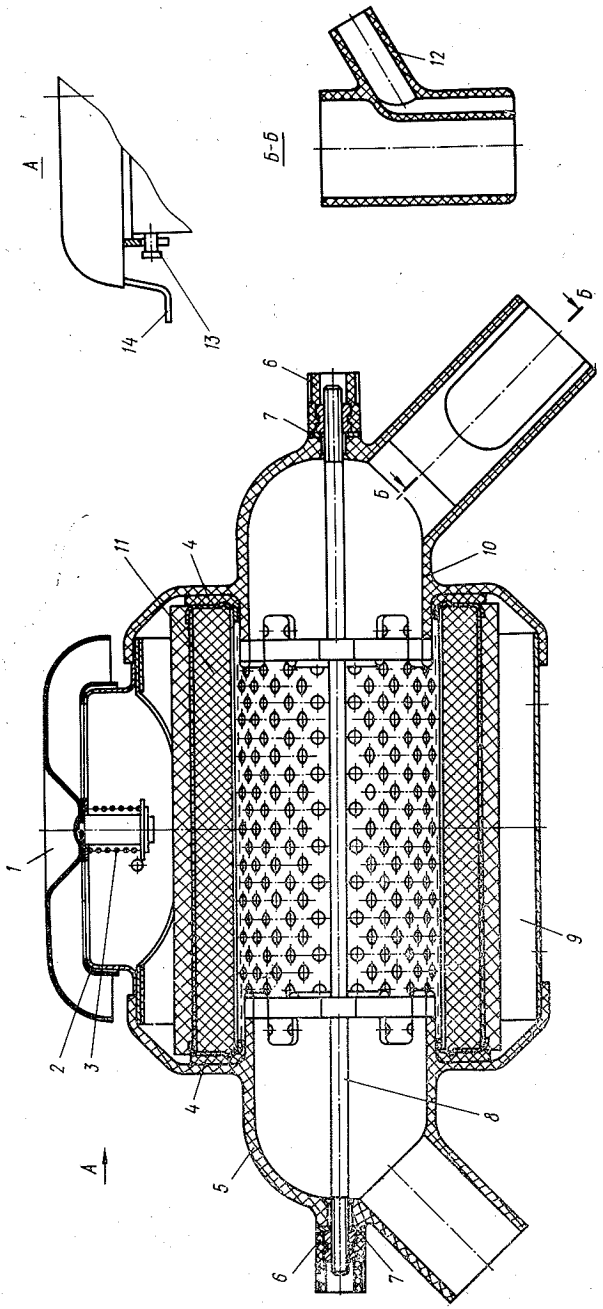


Fig. 17. Air cleaner with paper filter element:
1—cover; *2*—air choke; *3*—air choke spring; *4, 8*—gasket; *5*—left-hand filter cover; *6*—special bolt; *7*—washer; *9*—filter bowl; *10*—right-hand filter cover; *11*—filter element; *12*—filter cover retention pin; *13*—branch pipe for connection of breather pipe; *14*—air choke control handle;

The air cleaner is provided with air choke *2* which facilitates the starting and warming-up of the engine in cold weather. When the air choke is fully opened, handle *14* is located in the extreme rear position. To close the air choke, slightly lift cover *1* upwards by handle *14,* turn the cover clockwise as far as it will go and lower it. The warming-up of the engine over, set handle *14* to the initial position. For this purpose slightly lift it up again, turn counter-clockwise as far as it will go and lower it.

Attendance of Fuel System Equipped with Carburetors and Air Filter with Paper Filter Element

During the check inspection you are required to check the filling of the tank with fuel, the fuel supply to the carburetors, the reliability of connection of the gasoline lines and the functioning of the carburetor throttle control linkage.

It is recommended after every 5000 km of the run during carry-in-out of maintenance No. 1 to remove the dirt accumulated in the sediment cup, wash and clean the fuel filters, blow off the carburetor jets and ducts, wash the float chambers.

In the event of insufficient fuel supply the engine power decreases, the explosions in the carburetor appear, the engine crankshaft rotation frequency fails to correspond to the usual position of the throttle control handle. In this case first of all you are to check whether the hole in the fuel tank plug (connecting the tank to the atmosphere) is not clogged. Then close the gasoline cock, unscrew the sediment cup, clean and wash the sediment cup and the filter located inside it. After a trip you are recommended to drain the gasoline from the gasoline tank and blow off the cock in two of its positions *O* and *P* (Fig. 15) with compressed air.

It is necessary to periodically check the tightness of the connections and the condition of the intake air ducts since the inflow of dusty air causes the premature wear of the engine parts.

In the event of operation of the motorcycle on the asphalt roads after every 2500—3000 km of the run you are recommended to clean the air filter element by blowing off with dry air. The air jet is to be directed onto the inner surface of the element. You can use the motorcycle pump for blowing off. The coarse filter preliminarily removed from the filter element is to be blown off in a similar way. For this purpose unscrew special bolt *6* (Fig. 17), remove cover *5* and remove filter element *11.*

After the motorcycle run of 10 000 km the filter element is to be replaced by a new one.

In case of driving the motorcycle on very dusty roads the filter element is to be cleaned and replaced more frequently.

Under exceptional circumstances the repeated use of the filter element is admissible after its washing.

The filter element is to be washed in solution of detergents ОП-7, ОП-10 of GOST 8433—57 (State standard) or powdered domestic detergents in warm (40—50 °C) water. The concentration of detergents is equal to 20—25 g per litre of water.

The filter element is to be put into the above-mentioned solution for 15—30 min and to be washed by successive dipping and and rotation. Then the filter element is to be rinsed in clean warm water and to be thoroughly dried.

In case the abundant moisture got on the filter element of the air filter the engine may miss. When driving the motorcycle under the torrential rain conditions remove a prefilter from the filter element. Dry and reinstall the prefilter and filter element after trip.

TRANSMISSION

The motorcycle transmission consists of the interconnected units intended for conveying the torque from the engine crankshaft to the motorcycle rear wheel and sidecar wheel as well as varying the tractive force on the driving wheels.

The transmission comprises a clutch, a gearbox, a final drive with a differential gear, a speed reducer.

Clutch

The dry two-disk clutch is intended for conveying the torque from the engine to the gearbox, disengagement of the engine from the gearbox during gear shifting and smooth engagement in getaway of the motorcycle.

The clutch consists of driven and driving parts and a clutch release mechanism. The driving parts of the clutch comprise flywheel *7* (ref. to Fig. 23) and (pressure *8*, intermediate *9* and bearing *11*) disks which are installed on the flywheel pins.

In the centre of the pressure disk the square hole is available into which clutch control rod *12* enters.

The bearing disk is attached to the pin ends by screws which are locked by centre-punching the bearing disk into the slot in the screw head.

The driven parts of the clutch comprise two driven disks *10* provided from both sides with press-fitted liners made of friction material; the disks are engaged with the splined part of the primary shaft of the gearbox.

The correct use of the clutch considerably increases its service life.

Do not drive the motorcycle with clutch slipping. In getaway and gear shifting you are to engage the clutch smoothly. The abrupt engagement at a great rotation frequency of the engine crankshaft results not only in rapid wear of the disk friction linings but also overloads the transmission parts, increases the wear of the tires.

The clutch has two control linkages: from the clutch operating lever arranged on the handlebars (hand linkage) and from the gear-shift pedal (foot linkage).

When the hand linkage is used, release the clutch before engaging (shifting) the gear and smoothly release the clutch operating lever after engaging (shifting) the gear.

When the foot linkage is used, the clutch is released automatically in the process of engaging (shifting) the successive gear, without any action on the clutch operating hand lever.

In this case after engaging the gear the pedal is to be held by the foot toe and heel, while smoothly returning it to the initial position and simultaneously increasing the engine crankshaft rotation frequency.

Adjustment of Clutch Release Linkage

The clutch release linkage is adjusted, when necessary, with the aid of adjusting bolt *6* (ref. to Fig. 23) and adjusting screw *20* of clutch control cable *19*. First the foot linkage is to be adjusted.

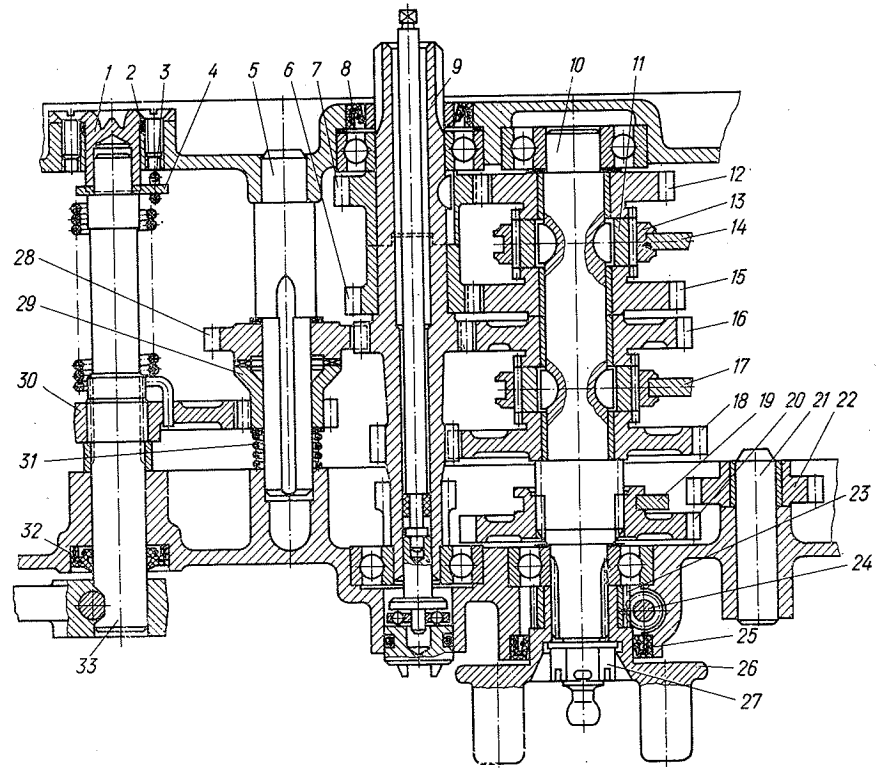


Fig. 18. Layout of shafts:

1—starting shaft sleeve; *2*—rubber sealing ring; *3*—starting shaft spring; *4*—spring stop; *5*—countershaft; *6*—primary shaft 3rd speed gear; *7*—primary shaft 4th speed gear; *8*—seal; *9*—primary shaft; *10*—main shaft; *11*—splined sleeve; *12*—main shaft 4th speed gear; *13*—gear-shift sleeve; *14*—shifting fork of gears III and IV; *15*—main shaft 3rd speed gear; *16*—main shaft 2nd speed gear; *17*—shifting fork of gears I and II; *18*—main shaft 1st speed gear; *19*—shifting fork of reverse gear; *20*—main shaft reverse speed sliding gear; *21*—idler gear shaft; *22*—reverse speed idler gear; *23*—driving gear of speedometer drive; *24*—driven gear of speedometer drive; *25*—seal; *26*—elastic coupling disk; *27*—elastic coupling disk fastening slotted nut; *28*—large gear of starting gear; *29*—small gear of starting gear with end face ratchet; *30*—toothed quadrant of starting gear shaft; *31*—spring; *32*—seal; *33*—starting gear shaft

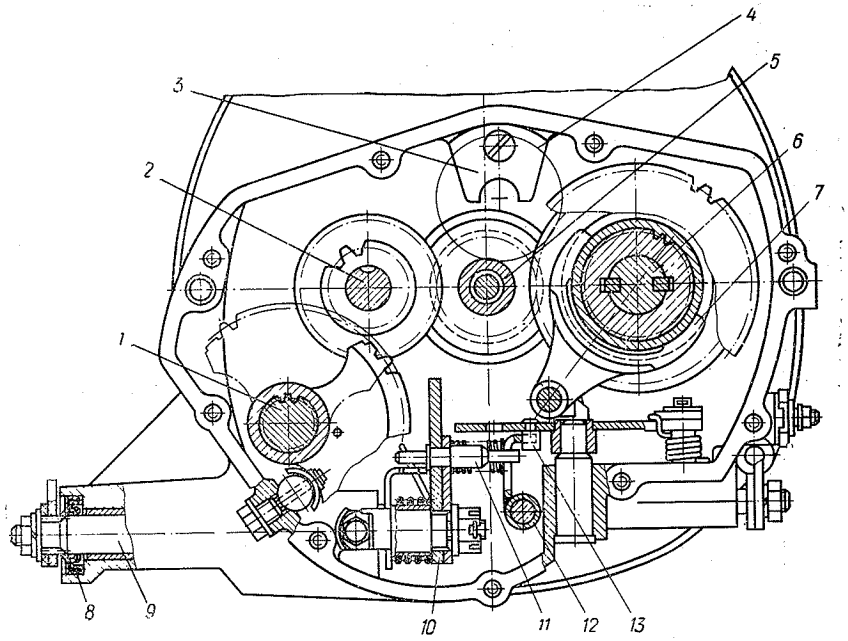


Fig. 19. Gearbox (cross-section):
1—starting gear shaft; *2*—countershaft; *3*—idler gear stop; *4*—place of installation of idler gear; *5*—primary shaft; *6*—main shaft; *7*—gear shifting fork; *8*—seal; *9*—gear shift shaft; *10*—cam-crank; *11*—crank pin; *12*—gear-shift mechanism pawl; *13*—gear-shift disk pin

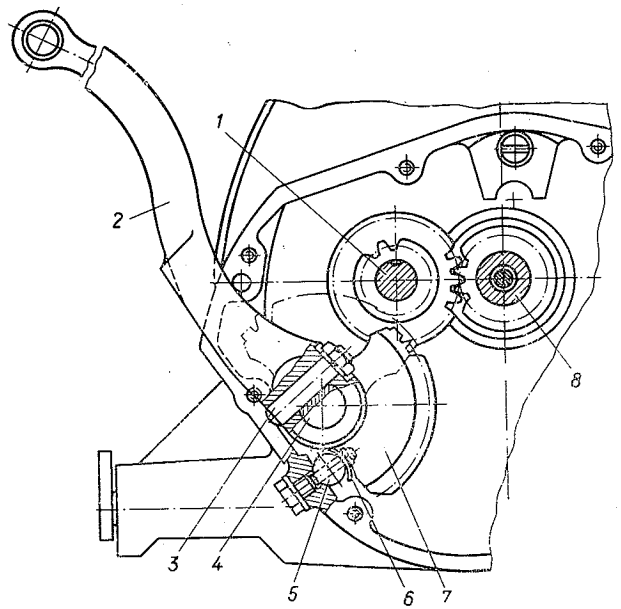


Fig. 20. Starting gear:
1—countershaft; *2*—starting gear lever; *3*—wedge bolt; *4*—starting gear shaft; *5*—buffer; *6*—buffer cover plate; *7*—toothed quadrant of starting gear shaft; *8*—primary shaft

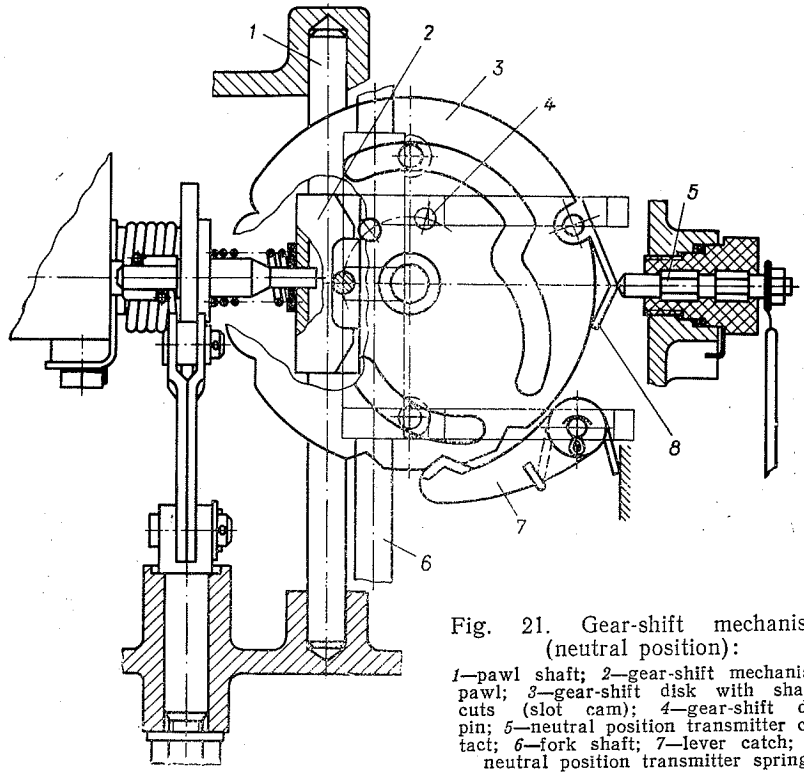


Fig. 21. Gear-shift mechanism (neutral position):
1—pawl shaft; *2*—gear-shift mechanism pawl; *3*—gear-shift disk with shaped cuts (slot cam); *4*—gear-shift disk pin; *5*—neutral position transmitter contact; *6*—fork shaft; *7*—lever catch; *8*—neutral position transmitter spring

When the foot linkage has been adjusted correctly, there must be a small clearance between the end of the adjusting bolt and intermediate rod *5*. The presence of the clearance can be determined upon shaking of gear-shift pedal *1*.

The free travel of the front arm of the gear-shift pedal must be in the range of 10—15 mm. The amount of travel of slider *16* in releasing the clutch by hand must not exceed the amount of travel of the slider in releasing the clutch by the gear-shift pedal. To check the correctness of adjustment of the hand linkage, proceed as follows: completely engage some gear by pressing with your foot on the gear-shift pedal (as far as it will go), this causes disengagement of clutch disks.

Then adjust the cable tension with screw *20* so that the perception of load on the hand lever appears when the lever is led up to the handlebars handle (at a distance of 1—5 mm from the handle).

The adjustment of the clutch linkage over, lock the adjusting bolt and the adjusting screw with the aid of jam nuts.

Gearbox

The gearbox is a two-shaft four-speed gearbox with a reverse gear and a clutch automatic release mechanism in gear shifting. The design of the gearbox is shown in Figs 18—23.

Shafts. Primary shaft *9* (Fig. 20) is installed on two ball bearings. The shaft is made together with the rims of the gears of reverse speed, gears I and II. Gear wheels of gears III and IV are of a mountable type. The turning of the gear wheel of gear IV on the shaft is prevented with the aid of a Woodruff key. The gear wheel of gear III is connected to the gear wheel of gear IV with the aid of the face lugs.

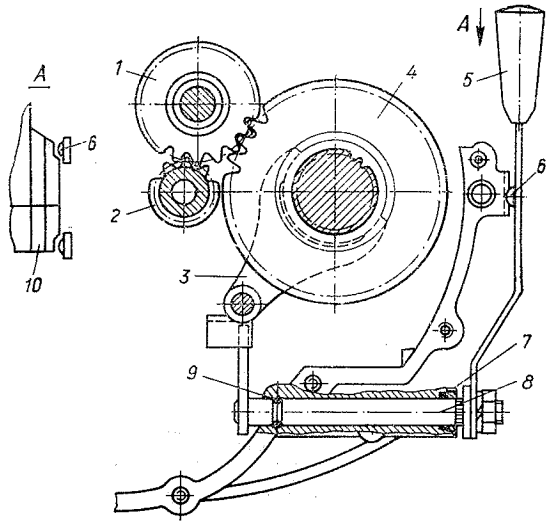


Fig. 22. Reverse gear engaging mechanism:
1—reverse speed idler gear; *2*—primary shaft reverse speed gear; *3*—reverse gear shifting fork; *4*—main shaft reverse speed sliding gear; *5*—reverse gear engaging handle; *6*—spherical head; *7*—rubber sealing ring; *8*—reverse gear shifting fork lever; *9*—pin; *10*—cover; *11*—casing; *I*—gear is engaged (front position); *II*—gear is disengaged (rear position)

Main shaft *10* is also installed on two ball bearings. It is provided with a toothed rim for reverse speed sliding gear *20*. Press-fitted on the shaft are two splined sleeves *11* whose turning on the shaft is prevented by keys. Gear wheels of gears I, II, and III freely rotate on the cermet bushes and the gear wheel of gear IV freely rotates on the bronze bush. The gear wheels are connected to the main shaft with the aid of moving gear-shift sleeves *13*. There is no special supply of lubricant to the friction surfaces.

Starting Gear. It comprises starting shaft *33* and countershaft *5* with gears. Two gears with twelve ratchet teeth on their faces freely rotate on the countershaft. The shaft by its front end is press-fitted into the case.

Toothed quadrant *30* is press-fitted on the starting shaft (on the splines). The quadrant is pressed to rubber buffer *5* (Fig. 20) with the aid of a torsion spring.

The spring is wound by turning of sleeve *1* (Fig. 18), fitted in the front wall of the case, counter-clockwise through half a revolution.

The sleeve is sealed by rubber ring *2* and the shaft is sealed by a two-edge framework seal. The starting lever is connected to the starting shaft with the aid of a wedge bolt. Upon pressing by foot on the starting lever, the quadrant is meshed with the small gear of the countershaft which with the aid of the face ratchet is

connected to the large gear, constantly meshed with the 2nd speed gear of the primary shaft of the gearbox. After starting the engine the foot is removed from the starting lever which under the action of the return spring together with the quadrant returns to the initial position. In this case the impact of the quadrant is absorbed by the rubber buffer provided with a steel cover plate.

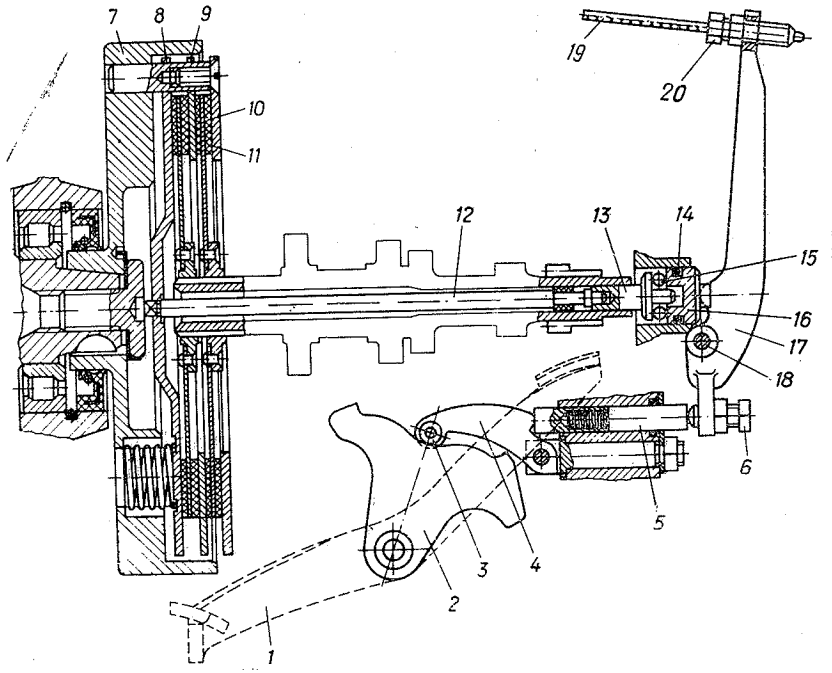


Fig. 23. Clutch and clutch release mechanism in gear shifting:
1—foot gear-shift pedal; *2*—cam-crank; *3*—roller; *4*—inner lever; *5*—intermediate rod; *6*—adjusting screw; *7*—engine flywheel; *8*—pressure disk; *9*—intermediate disk; *10*—driven disk; *11*—bearing disk; *12*—clutch control rod; *13*—rod tip; *14*—rubber sealing ring; *15*—thrust ball bearing; *16*—slider; *17*—outer clutch operating lever; *18*—pivot; *19*—clutch manual control cable; *20*—clutch control cable adjusting screw

Gear-shift Mechanism. Four forward speed gears are engaged by splined gear-shift sleeves *13* (Fig. 18) located on the main shaft and set in motion along the shaft by the gear shift forks. The forks by the special lugs enter the shaped cuts in gear-shift disk *3* (Fig. 21). Upon turning of the disk the forks travel along shaft *6* installed in the case. Fitted on the gear-shift disk are three pins *4* and spring *8* of the neutral position transmitter.

In the neutral position the transmitter spring via an insulated contact closes the electric circuit of a pilot lamp arranged on the dashboard. Upon pressing by foot on one of the arms of the foot gear-shift pedal gear-shift shaft *9* (Fig. 19), connected to the

cam-crank, turns through some angle. Fitted in the crank is a pin which enters the slot in pawl *2* (Fig. 21) which slides on shaft *1*.

The pawl, acting on one of the pins of the gear-shift disk, turns it. The disk is fixed with the aid of a lever catch. The reverse gear is engaged by handle *5* (Fig. 22) arranged at the right-hand side of the gearbox. On account of its own elasticity the handle is fixed in the definite position on the chamfers of the case and cover spherical head *6*. When the lever handle moves forward, the reverse gear shifting fork and the main shaft sliding gear travel forward. In this case the above-mentioned sliding gear becomes meshed with the idler gear, installed on the gearbox cover. The idler gear is constantly meshed with the reverse gear of the primary shaft.

The reverse speed gear can be engaged only when the motorcycle is stopped and only when the gear-shift mechanism is in the main neutral position (between gears I and II).

When some forward speed gear is engaged, the reverse speed gear cannot be engaged. This is prevented by s special lug on the reverse gear shifting fork which upon engagement of the reverse gear enters the slot in the gear-shift disk.

The reverse gear engaging handle on the lever shaft is fixed on the fluted taper and is set to the required position before tightening the nut.

Clutch Release Mechanism in Gear Shifting. In shifting of gears cam-crank *2* (Fig. 23), while turning forward or backward from its middle position, lifts the long arm with the roller of inner lever *4*, arranged in the chamber of the gear case.

The short arm of this lever acts on sectional intermediate rod *5* which by its outer end presses on adjusting screw *6* of outer clutch operating lever *17*.

The outer lever, swinging on the axle, via slider *16*, bearing *15* and tip *13* acts on clutch control rod *12*.

Directions for Use

Maintenance of the gearbox consists in the timely replacement of oil in the case and in adjustment of the clutch release mechanism, when necessary.

Replace the oil in the intervals, envisaged in the present manual. Check the oil level in the case with an oil level dipstick as specified in section "Preparing for Trip". The dipstick has a red polyethylene head which serves as a breather. When the necessity arises to clean the breather, the head can be removed.

Replace the oil in the gearbox immediately after the return from a trip. Prior to draining the used oil from the case and filling the fresh one, you are to thoroughly clean the filler and drain necks with plugs of dust and dirt. After this unscrew the plugs of the filler and drain holes, drain the used oil and fill the fresh oil into the case via a funnel with gauze. The oil level in

the case must reach the upper mark on the dipstick, lowered into the filling hole as far as it will go with the plug being not screwed in.

When the oil of one grade is replaced by the oil of the other grade, the gear case after draining of used oil is to be rinsed. For this purpose fill 1.5.1 of oil for washing into the case, tighten the plug of the filter hole, start the engine and at a middle frequency of crankshaft revolutions let the engine operate for 2—3 min with subsequent engagement of gears 1, II, III and IV (the motorcycle must be put on the support with its rear wheel lifted). Further drain the washing oil and fill the fresh oil into the case via a funnel with gauze.

The long-time coasting or operation of the engine with the released clutch is inadmissible since this results in overheating and failure of the clutch thrust bearing. To avoid the difficulties, engage the neutral or gear close to the neutral (I or II) until complete stopping of the motorcycle during slowing-down of the motion. In the event of failure in engaging some gear before starting the motion you are to release the clutch operating lever (in this case the primary shaft begins to revolve), then press on the clutch operating lever again and engage the gear.

To engage gear I or reverse gear without impacts in getaway, you are required after releasing the clutch before engaging the gear to wait for several seconds until the primary shaft rotation frequency decreases.

The reverse gear is to be engaged only in the main neutral position which corresponds to the gear-shift mechanism position between gears I and II. This position is indicated by the lighting neutral position indicator pilot lamp. Application of an excessive force for engaging the reverse gear in the other positions of the gearshift disk can result in the breakdown. An attempt to engage some forward speed gear, when the reverse speed gear is engaged, by applying an excessive force also results in the breakdown. Do not engage and disengage the reverse gear by foot.

The gearbox has one more fixed neutral position between gears III and IV. This neutral is to be used in coasting. The neutral position is to be found when the clutch is released by the hand lever. To engage gears III and IV without impacts after coasting, you are required to increase the engine crankshaft rotation frequency and only after that engage the gear.

During operation in the non-warmed-up gearbox in cold season the noise (crackling) of the starting gear ratchet is possible. In this case it is not recommended to considerably increase the engine crankshaft rotation frequency. As the gearbox becomes warmed up, the noise disappears.

The rubber ring can be installed for more reliable sealing of the joint of the speedometer flexible shaft with the gearbox cover. To prevent the fouling, the hollow in which the ring is installed must be filled with grease.

Disassembly. The disassembly is to be performed as follows.

1. Remove the starting gear lever, clutch operating lever, slider, thrust bearing and clutch control rod cap. Remove the elastic clutch disk.

2. Undo two screws which fix the bush of the starting gear shaft to the front wall of the case, release the winding (tension) of the spring of the starting gear shaft.

3. Unscrew nine bolts fastening the cover.

4. Install the axle of the clutch operating lever, pass a soft cord via it. While holding the cover with the aid of the cord, knock out the primary shaft and the main shaft by light impacts. Remove the cover. In the process of work you are to watch for the serviceability of the gasket.

Remove the idler gear of the reverse speed gear. Remove the reverse gear together with fork from the main shaft.

5. Take out the starting gear shaft in assembly, remove the shaft, gears and washers from the countershaft.

6. Remove the fork shaft from the hole in the case (without removing the shaft from forks).

7. Disengage the forks together with a shaft from the gear-shift disk slots.

8. Put the elastic clutch disk on the main shaft and fix it by a nut.

9. Knock out the shafts together with forks from the case by light impacts on the front end of the primary shaft and on the elastic clutch disk.

10. Slightly pull back the catch, remove the gear-shift disk from the axle.

11. Remove the pawl shaft, pawl and spring.

12. Unlock and unscrew the nut fixing the cam-crank, remove the cam-crank from the splines of the gear-shift shaft, remove the gear-shift shaft.

13. Remove the reverse gear engaging handle, take out the pin and lever from the case.

Assembly. The assembly is to be performed in the reverse order.

1. Install the gear-shift mechanism.

2. Install the primary shaft assembly into the case so that its front bearing would be buried in the case seat up to a half of its length.

3. Insert the shifting forks into the slots of the gear-shift sleeves of the main shaft, pass the fork shaft through them and install the main shaft into the case. Drive the shaft into the case by light impacts of a hammer made of soft metal so that the rims of the gears on the primary and main shafts would be matched, press-fit the shafts into the case as far as they will go. Insert the forks into the gear-shift disk slots and insert the fork shaft into the case.

The further assembly arouses no difficulties and is to be carried out in the sequence reverse to the disassembly.

Final Drive and Differential Gear

The final drive and the differential gear are mounted in the common split body which consists of three parts: differential cover *1* (Fig. 24), differential casing *3* and final drive case *6*.

The final drive consists of a pair of spiral-bevel gears *7* and *9*.

The spur differential of the motorcycle consists of the following main parts: two hubs *8* and *14*, two satellite gears *10*, two idler gears *13* and differential cup *15*.

Hub *8* is mounted in the final drive case on two needle bearings, hub *14* — in the differential cup.

The satellite gears and the idler gears are fitted on shafts *11* whose tongues from one side enter differential cup *15* and from the other side enter large bevel gear *9*. The cup and the gears are centred by means of two rollers and are clamped by two bolts which are locked by a special lock washer.

The assembled differential is installed on two bearings: ball bearing *16* fitted in the differential casing and the roller (composite) bearing in the final drive case.

The force from the differential to the sidecar wheel is conveyed by a pair of gears *18* and *19*. Gear *18* is installed on the splines of hub *14* and is fixed by locking ring *20*.

Nuts *5* on both ends are provided with the left-hand thread.

The oil is filled into the final drive case via a filling hole, and into the differential gear — via a side port in the cover. When checking the oil level it is required to insert the dipstick into a filling hole of the crankcase as far as it will go, not screwing the plug up. When the oil level has dropped below the lower mark on the dipstick, the operation of the motorcycle is inadmissible.

Speed Reducer

The force from the differential gear via a transverse torsion cardan shaft is conveyed to small gear *16* (Fig. 25) of the speed reducer, gear *16* is meshed with gear *11*.

Constructionally the transverse cardan shaft is made so that on account of its own elasticity it cushions the impact loads which appear in the power transmission of the sidecar wheel drive.

Gear *16* is interchangeable with gear *19* (Fig. 24) of the differential.

Gear *11* (Fig. 25) is installed on two ball bearings *10* and *13*.

Covers *3* and *6* are bolted on the case.

The tightness of the speed reducer is ensured by means of gaskets *4*, collar seal *7* and two rubber seals press-fitted in nut *2*.

The oil is filled into the speed reducer casing via a filling hole. When the oil level has dropped below the lower mark on the dipstick, the operation of the motorcycle is inadmissible.

When the speed reducer cardan shaft is installed, pay attention to the position of the universal-joint forks. The forks, fitted on the cardan shaft splines, must be in one plane.

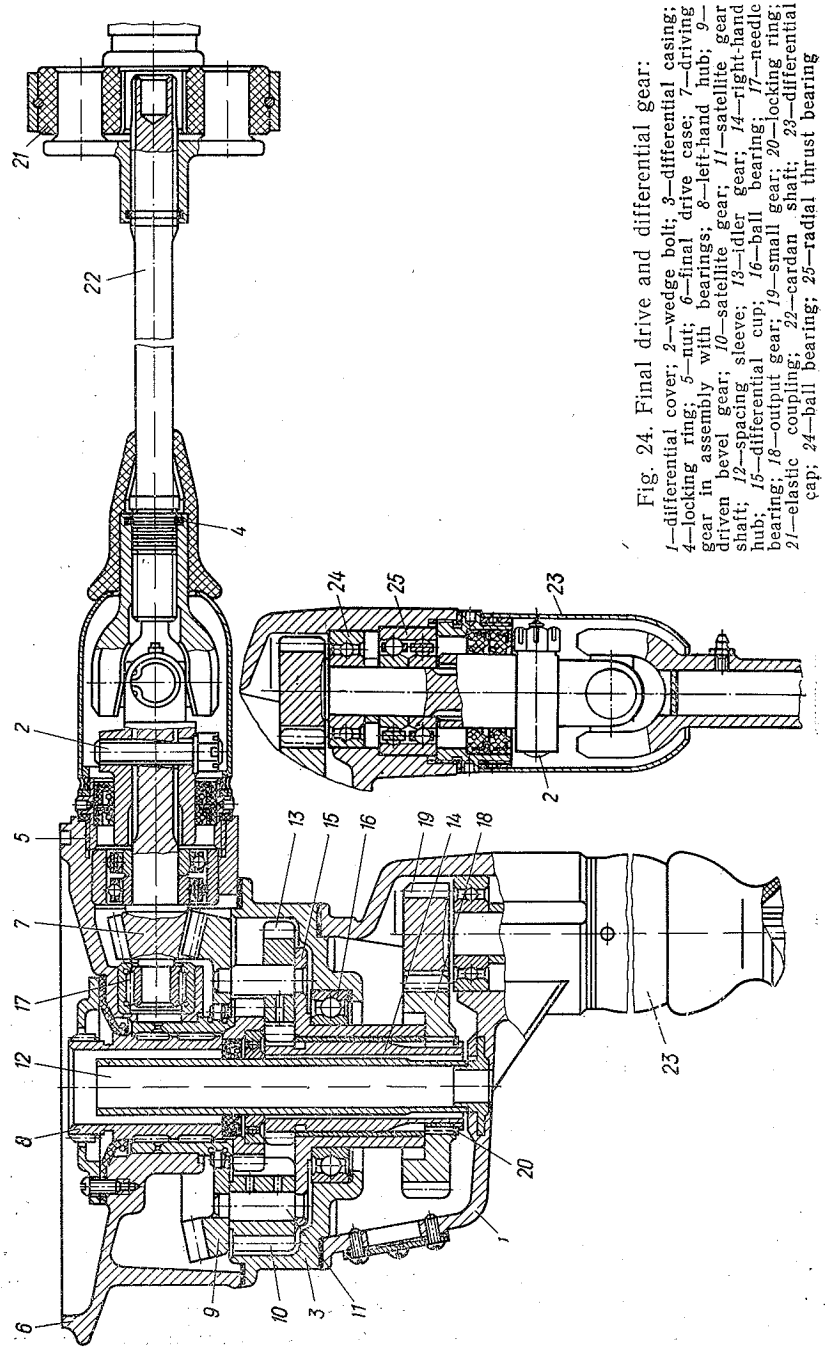


Fig. 24. Final drive and differential gear:
1—differential cover; *2*—wedge bolt; *3*—differential casing; *4*—locking ring; *5*—nut; *6*—final drive case; *7*—driving gear in assembly with bearings; *8*—left-hand hub; *9*—driven bevel gear; *10*—satellite gear; *11*—satellite gear shaft; *12*—spacing sleeve; *13*—idler gear; *14*—right-hand hub; *15*—differential cup; *16*—ball bearing; *17*—needle bearing; *18*—output gear; *19*—small gear; *20*—locking ring; *21*—elastic coupling; *22*—cardan shaft; *23*—differential cap; *24*—ball bearing; *25*—radial thrust bearing

Maintenance of the differential and of the speed reducer consists in checking the oil level and in the timely replacement of oil in the intervals specified in section "Maintenance".

Replace the oil in the differential and in the speed reducer immediately after returning from a trip when the oil is warm and is well drained. When in all seasons the same oil is used in the differential and in the speed reducer, it is not compulsory to wash the cases. When in replacement of oil you are to fill the other oil into the cases, wash the differential case and the speed reducer case with oil by which the gearbox is washed in the same sequence. The needle bearings of the cardan shaft universal joints are lubricated with lubricant Lithol-24 via the pressure lubricators screwed into the universal-joint centre crosses.

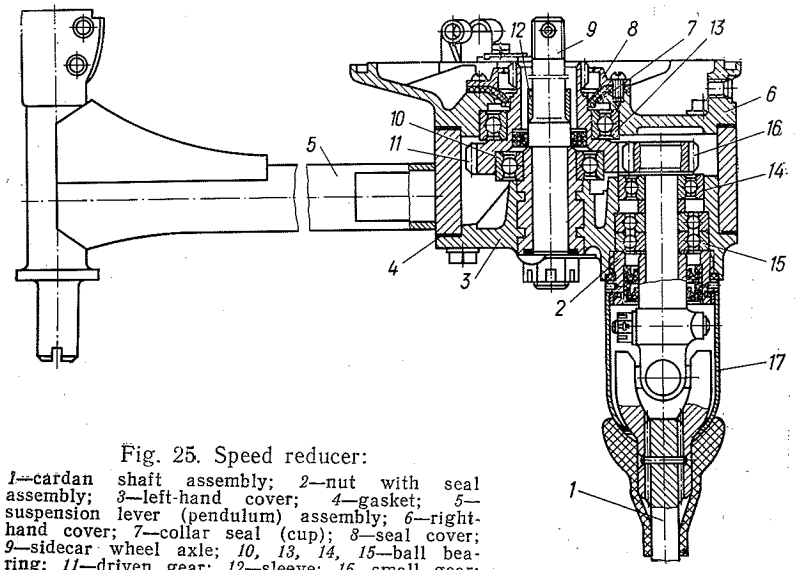


Fig. 25. Speed reducer:
1—cardan shaft assembly; *2*—nut with seal assembly; *3*—left-hand cover; *4*—gasket; *5*—suspension lever (pendulum) assembly; *6*—right-hand cover; *7*—collar seal (cup); *8*—seal cover; *9*—sidecar wheel axle; *10, 13, 14, 15*—ball bearing; *11*—driven gear; *12*—sleeve; *16*—small gear; *17*—speed reducer cap

To lubricate the universal joint, shift the rubber seal and unscrew the protective cap with the aid of a radius wrench. Differential caps *23* (Fig. 26) are provided with the left-hand thread and speed reducer cap *17* (Fig. 27) is provided with the righ-hand thread.

WHEELS

The motorcycle wheels (Fig. 26) are provided with a steel rim, a cast aluminium body and a reinforced steel brake drum. The adjustable tapered roller bearings are installed in the wheel body. The labyrinth packing in the joint of the brakes with the wheels protects the brake parts from direct getting of dirt.

Attendance of Wheels

In the period of running-in the slackening of the wheel spokes is possible. The symptom of weak tension of the spokes is a sound of a lower tone produced when knocking on them. Therefore in the running-in period you are required to periodically check the tension of the spokes and tighten them, when necessary. Further with the increase of the run the number of the spokes which lost the tension will considerably decrease.

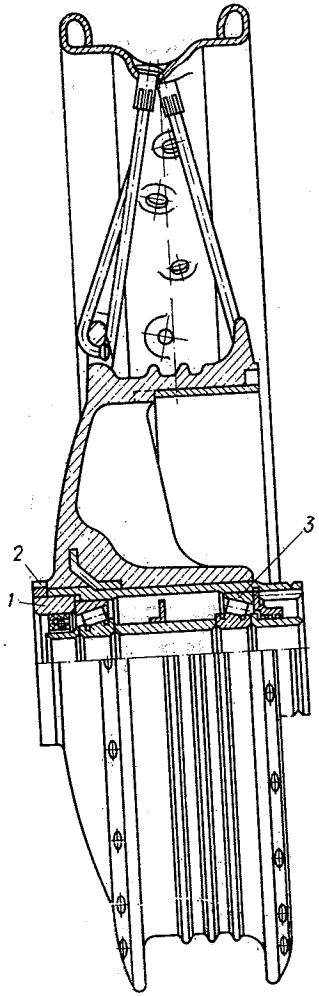


Fig. 26. Wheel:
1—bearing adjustment nut; *2*—jam nut; *3*—tapered roller bearing

The spokes must be stretched uniformly and tightly. The tension is checked by knocking on the spokes with a wrench or another metallic object and uniformity of their tension is determined by the same tone of their sound in knocking.

Simultaneously with checking of the spoke tension in the running-in period of the motorcycle you are to check the clearance in the wheel bearings and, when necessary, remedy it by adjustment. For this purpose: lift the wheel above the ground surface; unscrew and remove the axle;

remove the sand collar;

insert and tighten the axle (without the sand collar);

slacken the bearing adjustment jam nut;

holding the wheel by hand, smoothly tighten the nut without a clearance (it is determined by rolling of the wheel), undo the nut by 10°—15°;

holding the nut, tighten the jam nut, remove the axle and install the sand sollar in situ, insert and tighten the axle;

make sure that there is no tangible clearance in the bearing assembly. Overtightening of the bearings is inadmissible.

The adjustment of the bearings over, check their heating in the process of driving the motorcycle. Check the heating with the aid of touching by hand nearer to the central part of the wheel body immediately after the run of 5—6 km without stopping and braking the motorcycle. When the

bearings are overtightened, the wheel body will be strongly heated (to be checked by touch) and the adjustment is to be repeated.

Check the tightening of the wheel bearings and their adjustment as well as perform the lubrication of the bearings in the intervals specified in section "Maintenance".

To lubricate the wheel bearings, proceed as follows: remove the wheel, unscrew jam nut *2* (Fig. 28) and nut *1;* insert the wheel axle into the bearings from the side of the splined rim of the hub and by light impacts on the thickened end of the axle press out the bearings (outer race of the bearing, fitted from the side of splines, is not to be pressed out); remove the old lubricant from the bearings and from the hub, wash the bearings in kerosene and dry them; lubricate the bearings with fresh lubricant and assemble the wheel in the reverse order.

Re-install the wheel in situ and adjust the tightening of the bearings.

TIRES

The service life of the tires depends to a considerable degree on the air pressure in them and on the load. The driving of the motorcycle with the decreased air pressure in its tires results in the damage of the tire tread and of the cord on the tire sides.

In the event of a long-time operation of the motorcycle with an incomplete load (a driver and one passenger in the sidecar body) it is recommended to decrease the air pressure in the rear wheel tire by 0.05 MPa (0.5 kgf/cm²).

The motorcycle rear wheel tire operates under more heavy conditions. To ensure the uniform wear of all tires, perform the tire rotation after every 5000 km of the run, i.e. install the rear wheel instead of the front one, the front wheel instead of the sidecar wheel, the sidecar wheel instead of the spare wheel and the spare wheel instead of the rear wheel. The long-time parking (over 30 days) of the motorcycle on the tires is inadmissible. In the event of preservation the motorcycle must be put on the supports which ensure the complete unloading of the tires.

In the process of operation of the motorcycle the necessity can arise for repair of the tubes (remedy of pucture) or their replacement which requires the dismantling and mounting of the tires.

Dismantling. To dismantle the tire, proceed as follows:

fully relieve the air from the tube;

push the valve inside the tire;

place the wheel on the floor, put your both feet on the tire and press the tire rim into the wheel rim recess;

lever up the tire rim by tire-mounting tools from the side of the valve, stepping back by about 1/4 of the circumference of the wheel rim, and transfer it over the wheel rim edge. In this case the opposite part of the tire rim must be dipped into the wheel rim recess;

gradually remove the whole tire rim outside by shifting both tire-mounting tools along the wheel rim edge, then remove the tube too.

When necessary, the second tire rim is removed in the same way.

Remedy of Tube Damage. The defective place in the tube can be discovered by the noise of outgoing air. When the puncture is very small, put the tube into water, then air bubbles will indicate the place of puncture. The damage is remedied by vulcanization.

Under road conditions the repair is to be carried out with the aid of the motorcycle repair kit in accordance with the directions available in it.

The defective valve is to be replaced.

Mounting. To mount the tire and tube, proceed as follows:

pour out talc onto the inner surface of the tire; put the flap on the wheel rim, having matched the hole in it for the valve with the hole in the wheel rim. See that the flap would fully cover all nipple heads and the spokes would not protrude from their heads;

place a part of the tire rim into the wheel rim recess and put all the tire rim on the wheel rim with the aid of tire-mounting tools;

insert the tube valve into the hole in the wheel rim, screw the control valve in the tube valve, slightly inflate the tube and enclose it into the tire. In this case you are to see that there would be no folds;

put on the second tire rim, starting from the side opposite to the valve. See that the fitted part of the tire rim would enter the wheel rim recess. Usually about $^2/_3$ of the tire rim are fitted by hands and the remaining part, by tire-mounting tools. When using the tire-mounting tools, be careful not to damage the tube. Do not apply the great force in mounting the tire rim since this can result in damaging the tire rim cable;

the tire mounting over, slightly dip the valve inside, inflate the tube slightly and knock by a hammer the tire along its circumference so that it would be uniformly fitted in the wheel rim recess;

inflate the tube to the required pressure and screw up the cap;

check the correctness of the tire arrangement on the wheel rim (check stripes on the tire must be concentric on the wheel rim).

FRONT FORK

The front fork of a telescopic type is installed on the motorcycle.

Two steel tubes *31* (Fig. 27), which are inserted into split holes of bridge *57* and are clamped in it by coupling bolts *54,* are a bearing part of the fork. Press-fitted into the bridge by the lower end is steering column bar *18* which is intended for attachment of the fork to the frame head on two radial-thrust bearings *17*. Two nuts

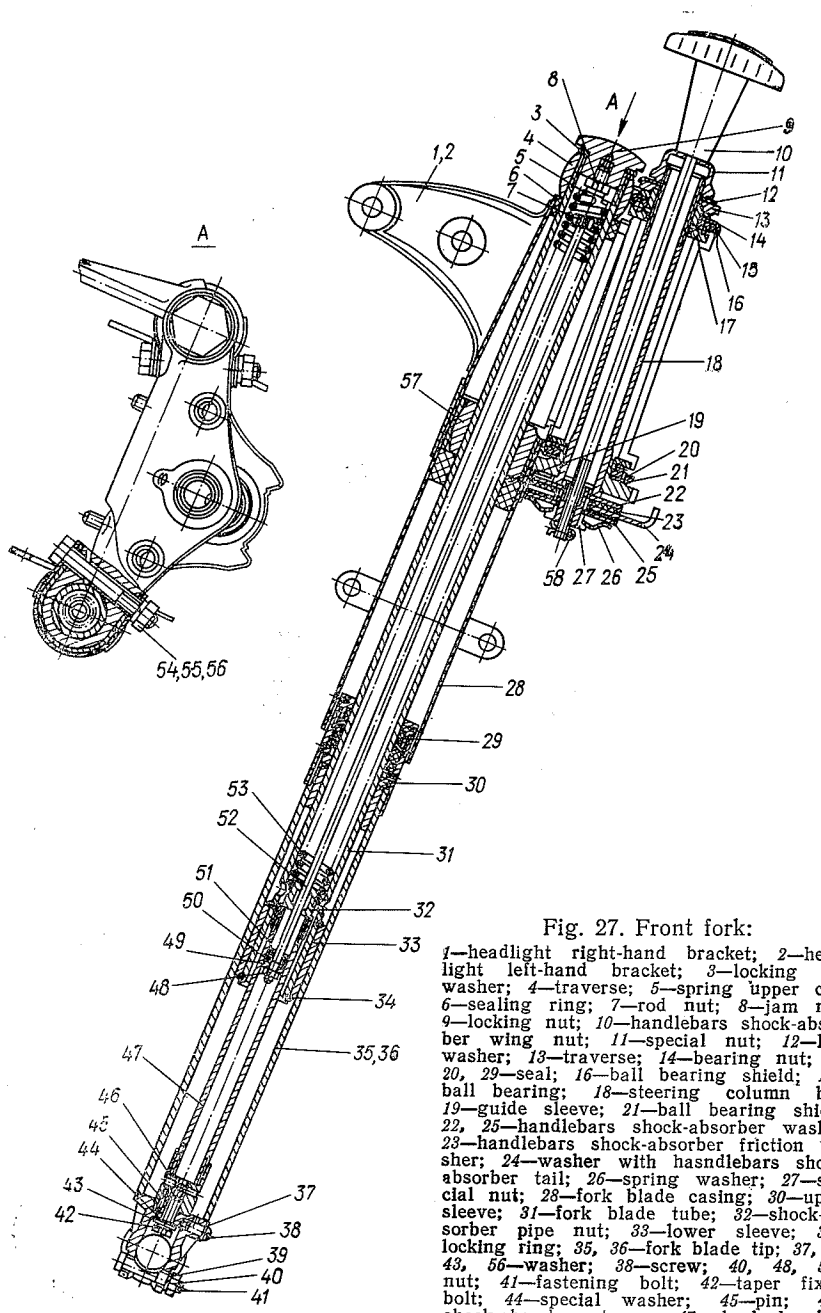


Fig. 27. Front fork:
1—headlight right-hand bracket; *2*—headlight left-hand bracket; *3*—locking nut washer; *4*—traverse; *5*—spring upper cap; *6*—sealing ring; *7*—rod nut; *8*—jam nut; *9*—locking nut; *10*—handlebars shock-absorber wing nut; *11*—special nut; *12*—lock washer; *13*—traverse; *14*—bearing nut; *15, 20, 29*—seal; *16*—ball bearing shield; *17*—ball bearing; *18*—steering column bar; *19*—guide sleeve; *21*—ball bearing shield; *22, 25*—handlebars shock-absorber washer; *23*—handlebars shock-absorber friction washer; *24*—washer with hasndlebars shock-absorber tail; *26*—spring washer; *27*—special nut; *28*—fork blade casing; *30*—upper sleeve; *31*—fork blade tube; *32*—shock-absorber pipe nut; *33*—lower sleeve; *34*—locking ring; *35, 36*—fork blade tip; *37, 39, 43, 56*—washer; *38*—screw; *40, 48, 55*—nut; *41*—fastening bolt; *42*—taper fixing bolt; *44*—special washer; *45*—pin; *46*—shock-absorber taper; *47*—shock-absorber; *49*—guide; *50*—piston; *51*—pin; *52*—shock-absorber rod; *53*—blade spring; *54*—bolt; *57*—steering column bridge; *58*—cotter pin

are screwed up on the upper threaded end of the steering column bar: lower nut *14* is intended for adjustment of the bearings and upper nut *11* is intended for attachment of the steering column to traverse *13* which is fitted on the tapered parts of the fork tubes and is clamped by nuts *9*.

Casing *28* is installed on the rubber sealing rings *6* between the traverse and the bridge. The casing has a bracket for attachment of the headlight and in the lower part it is provided with a bracket for attachment of the front wheel mudguard.

Fitted on the lower end of the tube is guide sleeve *33* which is secured by locking ring *34*. Upper guide sleeve *30* is secured in tips *35*. In each blade of the fork springs *53* are installed for cushioning the impacts conveyed from the wheel to the frame during driving of the motorcycle. The spring is put on shock-absorber rod *52* and is secured in the spiral groove of the upper tip *5* and from below it is fixed by shock-absorber pipe nut *32*.

The lower moving part of fork blade tips *35, 36* consists of the pipes with the bases welded to them which are intended for attachment of the front wheel axle. The wheel axle passes through the hole in the left-hand tip and is screwed into the right-hand tip which is provided with the left-hand thread.

The wheel axle is locked by fastening bolt *41* so as to avoid its spontaneous unscrewing.

In the lower part of each tip there are two holes: the side threaded hole for oil draining (screw *38* with washers *37* is screwed into it) and the central hole via which bolt *42* with washers *43* and *44* passes. Each blade of the fork has hydraulic shock-absorber *47*. It consists of a pipe which from below is screwed into taper *46* of the shock-absorber body and from above is screwed into pipe nut *32* on which the fork spring end is secured. From above the shock-absorber rod is screwed into locking nut *9* and on the lower end of the rod guide *49* and pin *51* are fixed which limit the upward travel of piston *50* put on the rod.

In the middle part the body taper has four radial drilled ducts for oil passage and in the centre it has a threaded hole for its attachment to the fork blade tip.

Seal *29,* consisting of the three-edge rubber collar and of the felt sealing ring, is installed for sealing the fork inner chamber.

Disassembly

Do not disassemble the front fork without an utmost necessity.

Disassemble the fork after installing the motorcycle on the wooden bar (which is to be placed under the engine crankshaft) with the front wheel being lifted.

Prior to disassembly you are to unscrew bolt *41* of the left-hand tip, undo the front wheel axle (left-hand thread), remove the front wheel and the brake disk (after disconnecting the front brake cable).

Unscrew shock-absorber wing nut *10* and remove it.

Undo nuts *9* and *11,* remove traverse *13*. Undo screws *38* of the drain holes and drain the oil. Unscrew nuts *55* of bolts *54* and remove tips *35* and *36* of the fork blades with guide tubes *31*. Unscrew the body of seal *29* and remove the fork guide tubes from the tips. Detach locking rings *34,* sleeves *30, 33* and seal *29* from the guide tubes.

To disassemble the fork shock-absorber, undo bolt *42* fastening the shock-absorber taper and remove shock-absorber *47* assembly. Then unscrew jam nut *8* in the upper part of the rod, remove upper cap *5* and spring *53* of the fork blade. Unscrew shock-absorber pipe nut *32* and remove the rod with the piston assembly (protect the shock-absorber pipe from damage).

To disassemble seal *29,* unscrew the seal nut, remove the felt ring, remove the seal collar spring and take out the collar.

Disconnect the headlight after dismantling of upper casing *28,* unscrew the nuts, remove the bolts fastening the mudguard to the casing. Unscrew the nuts fastening the front mudguard to the bridge and remove the mudguard. Remove bolts *54* and take out casings *28*.

Assembly

Prior to assembly all parts of the fork must be thoroughly cleaned of dirt and washed in kerosene.

To perform the assembly, proceed as follows.

Assemble shock-absorber *47,* compress the spring, insert the shock-absorber with the spring into fork blade tips *35* and *36* and tighten by bolt *42*.

In this case you are to see that the pin, arranged on the shock-absorber body taper, would enter the appropriate hole in the fork tip.

Put the body of seal *29* in assembly, guide sleeves *30* and *33* and locking rings *34* on tube *31*. Insert the tube into the tip and screw up the seal body on the tip.

Coat the seal body thread with minimum or bakelite lacquer. Insert the tube with the tip into casing *28* with guide sleeve *19* and pass through steering column bridge *57*.

Preliminarily fix tubes *31* in the bridge by coupling bolts *54*. Insert screws *38* with washers *37* into the drain holes in the tips and tighten them. Fill 130 cm^3 of oil M-6_3/10B or M-$8B_1$, or liquid АЖ-12Т, АУП into each blade of the fork.

Prior to mounting the front fork on the frame you are required to check the quantity of balls in the steering column bearings (there must be 24 pcs in each of them). Install the balls into the bearing races, press-fitted in the frame head, on the lubricant Lithol-24. Put the fork into the frame head and fasten by nut *14,* then install traverse *13* in the tube tapers. Screw the shock-absorber rod ends into nuts *9* and lock them by jam nuts. The shock-absorbers may be refilled.

See that there would be a clearance in the range of 0.2... ...0.4 mm between the jam nut ends and the spring upper cap. Slightly tighten nuts *9,* slacken bolts *54,* fully tighten nuts *9* on traverse *4* and tighten bolts *54;* screw up nut *11* and wing nut *10* of the shock-absorber.

Connect the front brake cable to the lever on the brake disk and install the disk together with the wheel between the fork blades. Put the front wheel axle through the hub and the brake disk and fully tighten the axle (left-hand thread).

Fix the axle in the left-hand tip of the fork blade with the aid of bolt *41.* In the running-in period during daily maintenance you are to periodically check the tightening of the supporting bearings of the steering column frame.

Adjustment of Tightening of Steering Column Bearings

The excessive or weak tightening of the steering column bearings results in their premature failure and worsens the motorcycle behavior in driving. The abnormal tightening of the steering column bearings can be easily determined during driving of the motorcycle, especially on the bed roads. In the event of weak tightening the knocking is heard in the steering column and in case of excessive tightening it becomes difficult to turn the handlebars and steer the motorcycle. The steering column bearings must be tighten so that there would be no tangible clearance in the bearings and the handlebars would be easily turned. To adjust the tightening of the steering column bearings, unscrew and remove wing nut *10* of the handlebars shock-absorber, unscrew the nuts of the brackets intended for attachment of the handlebars to the traverse and (without disconnecting the cable and the electric wiring) remove the handlebars from the traverse and put it on the gasoline tank. Unscrew special nut *11* and locking nuts *9,* remove traverse *4.* When the traverse fails to be removed from the fork tubes, knock out the traverse from tubes *31* by light impacts of a hammer delivered through the wooden pad. Adjust the tightening of the bearings by screwing of nut *14* with the aid of a special wrench. Re-install the traverse and the handlebars in situ in the reverse order.

After elimination of the clearance the front fork must freely, without jamming turn on the bearings to both sides until resting in the limiters.

Checking and Adjustment of Clearance between Jam Nut and Spring Upper Cap

The amount of a clearance between jam nut *8* and spring upper cap *5* must be constantly maintained in the range of 0.2... ...0.4 mm. To check and adjust this clearance, unscrew locking nuts *9.* Slightly lift up the fork to such an extent that upper caps

5 would go out of the tubes. When the amount of the clearance is within the above-mentioned range, lower the rods and screw the nuts into the tubes.

When the necessity arises to adjust the clearance, slacken jam nut *8* and slightly unscrew locking nut *9* from the rod. Set the required amount of the clearance between the jam nut and the cap by screwing up or unscrewing jam nut *8* from the rod. While holding the jam nut by a wrench, fully tighten locking nut *9* and the jam nut and reliably lock them.

Adjust the clearance in the right-hand and left-hand blades of the fork, put the fork down and screw nuts *9* into the fork tubes.

Oil Replacement in Front Fork Shock-absorbers

To replace the oil, undo drain hole screws *38* and drain the used oil from the fork shock-absorbers. Unscrew nuts *9* intended for tube attachment to the traverse and unscrew them from the rods. Slightly lift the front part of the motorcycle and lower the front fork down together with the rods. Screw in the drain hole screws, fill 150—200 cm^3 of kerosene into each tube of the fork and wash the shock-absorbers (by lifting and lowering the fork several times). Drain the kerosene via the drain holes, screw in the drain hole screws and fill 130 cm^3 of fresh oil M-6_3/10B or M-$8B_1$ into each tube of the fork. Slightly lift the front fork, screw up nuts *9* on the rods and screw them into the fork tubes.

REAR WHEEL SUSPENSION

The rear wheel wishbone suspension from the double-acting spring-hydraulic shock-absorbers ensures the comfort of a trip.

The vertical forces, appearing due to an uneven road, are taken by the wheel and are conveyed via the suspension lever and the shock-absorber to the frame. The spring-hydraulic shock-absorbers cushion the impacts and damp the suspension vibrations. The side forces from the wheel are conveyed to the frame via a suspension lever installed on the rubber sleeves. The hinge joints of the spring-hydraulic shock-absorbers with the suspension lever and the lever joint with the frame are also made on the rubber sleeves. Such hinge joints ensure the silent operation and practically are not worn out, therefore the attendance of them in operation consists in checking the reliability of the tightening of the fastening parts.

Spring-hydraulic Shock-absorbers. They are easily removable and interchangeable units.

Bearing spring *4* (Fig. 28) is an elastic element of the shock absorber. The vibrations are damped by the double-acting hydraulic shock-absorber arranged in body *7.* The shock-absorber body is a sealed vessel, closed from above by nut *6* and seal *33,* via which rod *9* passes. Housed inside the body is cylinder *8* in which piston *27,* fixed on the rod by nut *15,* performs the reciprocating motion.

In the lower part of the shock-absorber cylinder there is a compression valve *26* and on the upper end of the piston the bypass valve is arranged which consists of plates *22, 24* and spring *23*. Rod guide *28*, seal yoke *31* with seal *33* are installed in the upper

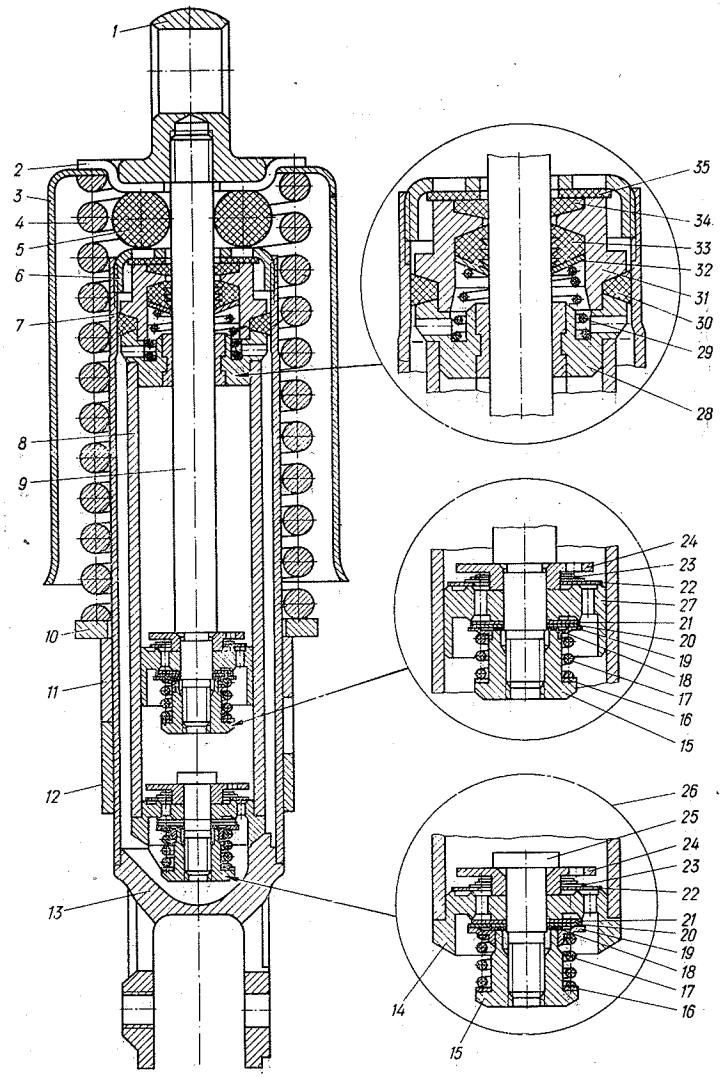


Fig. 28. Shock-absorber design:

1—upper cap; *2*—block; *3*—upper casing; *4*—spring; *5*—buffer; *6*—tank nut; *7*—shock-absorber body; *8*—working cylinder; *9*—rod; *10*—supporting ring; *11*—movable cam; *12*—fixed cam; *13*—lower cap; *14*—compression valve body; *15*—rebound valve nut; *16*—rebound valve adjusting shim; *17*—rebound valve spring; *18*—rebound valve washer; *19*—rebound valve plate; *20*—rebound valve disk; *21*—rebound valve throttling disk; *22*—inlet valve plate; *23*—bypass valve spring; *24*—bypass valve limiting plate; *25*—compression valve stem; *26*—compression valve assembly; *27*—piston; *28*—rod guide; *29*—seal spring; *30*—tank nut seal; *31*—seal yoke; *32*—seal washer; *33*—rod rubber seal; *34*—rod felt seal; *35*—pressure washer

part of the cylinder. The spring-hydraulic shock-absorbers are provided with an adjusting device of a cam type (*11*—movable cam, *12*—fixed cam) for varying the degree of preliminary compression of the bearing springs depending on the load and on the road condition.

The preliminary compression of the springs is adjusted to two positions. The first position—the springs are not compressed (it corresponds to the load—a driver and a passenger in the sidecar); the second position—the springs are compressed (it corresponds to the maximum load and driving on bad roads). The adjustment is to be carried out by turning movable cam *11* counterclockwise (by a special wrench) until its fixing in the upper position.

Disassembly. To disassemble the shock-absorber, remove it from the motorcycle, having put the motorcycle on the support. Then put the shock-absorber in the vertical position and clamp its lower tip in the vice. To disassemble the shock-absorber, proceed as follows.

1. Upon pressing on casing *3*, lower it through 5—10 mm and remove blocks *2* released in this case.

2. Remove casing *3*, spring *4*, supporting ring *10* and movable cam *11*.

3. Shift upward cap *1* with rod *9* and unscrew nut *6* by a special wrench. Take the rod upper cap by hand and lift it upwards by pushes. In this case the rod in assembly with piston *27*, yoke *31* and working cylinder *8* must go outside.

4. Dip the rod in assembly with the cylinder and lower valve body into kerosene and, while holding the cylinder by the left hand, pump the rod up and down several times by the right hand. Remove the cylinder together with the rod from kerosene and, while holding the cylinder by one hand, remove from it the rod together with the seal yoke, guide *28* and piston in assembly. Drain the oil from the cylinder and body of the shock-absorber.

5. Clamp the rod upper cap in the vice and unscrew rebound valve nut *15*.

6. Remove the piston together with all valve parts, rod guide, spring *29* and yoke *31* of seals in assembly.

7. Carefully remove felt seal *34* from the yoke, remove the reservoir nut seal and push out rubber seal *33* from the upper side of the yoke by a wooden stem.

8. Press out the compression valve assembly from the working cylinder by light impacts of a hammer delivered through a wooden pad.

Assemble the shock-absorber in the reverse order. Use the taper tip in putting the seal yoke on the rod so as not to damage the rubber seal.

Fill the oil when the working cylinder with a compression valve is inserted into the shock-absorber body. Fill the oil into the working cylinder up to the top and pour out the oil remains into the shock-absorber body.

The oil filling over, insert the rod with piston into the working cylinder, close the cylinder by the rod guide and, having thoroughly pushed the seal body close to the guide, screw up the reservoir nut. After this pump the rod with piston by hand for removing the air from the working cylinder.

Note: Carry out the complete disassembly of the shock-absorber only when the necessity arises to replace the parts. For inspection or oil replacement the shock-absorber is to be disassembled in the scope specified in items 1—4. While disassembling, protect the cylinder inner surface, piston and rod outer surfaces from scratches and dents.

Maintenance. Fill the clean oil into the shock-absorbers. After every 10 000 km of the run of the motorcycle you are recommended to remove the shock-absorbers, disassemble, wash all parts in clean kerosene and fill with oil.

See that the oil and gasoline would not get onto the buffers and silent-blocks of the tips. When the leak is discovered in the shock-absorbers, they are to be overhauled and the defective parts (seal, rod) are to be replaced.

BRAKES

The brakes of all wheels of the motorcycle are provided with a mechanical linkage.

The front wheel brake is equipped with a separate linkage from the lever on the handlebars. The motorcycle rear wheel and sidecar wheel brake is provided with a control linkage from the common foot brake pedal. In addition, the motorcycle is equipped with a parking brake.

Front Wheel Brake. Brake shoes *1* (Fig. 29) by the spherical seats rest on the heads of pushers *5* and by the lower platforms

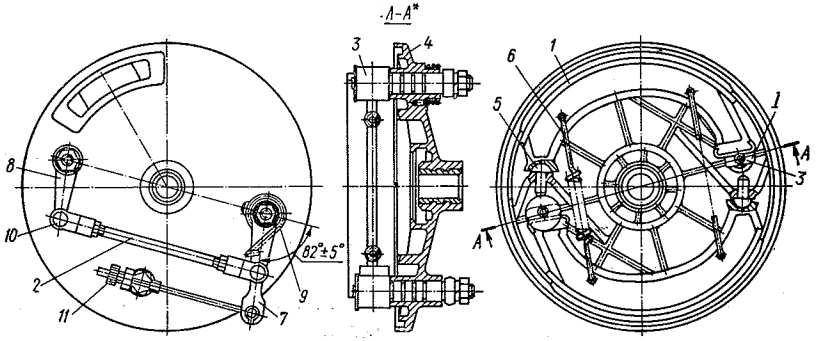


Fig. 29. Front wheel brake:
1—brake shoe; *2*—pull rod with forks; *3*—cam; *4*—disk; *5*—pusher; *6*—spring; *7*—driving lever; *8*—driven lever; *9*—return spring; *10*—pin; *11*—adjusting union; *1*—washer is conventionally not shown; * revolved

they rest on cams *3* installed in disk *4*. Driving *7* and driven *8* levers, arranged on the front side of the brake disk, are connected to the cams by means of splines.

The levers are interconnected by pull rod *2* adjustable in length.

The driving lever is connected by the cable to the control lever of the front wheel brake arranged on the motorcycle handlebars. When you press on the front wheel brake control lever, the cable acts on the brake driving lever and both levers turn the cams simultaneously owing to which the brake shoes become spread and are pressed to the wheel brake drum. The brake shoes are returned to the initial position under the action of two springs *6*.

Special devices are envisaged in the brake design for compensation of wear of the brake linings. At first the compensation of wear is carried out by tension of the cable sheath with the aid of unscrewing of adjusting union *11*. Further when the adjustment by the union becomes already impossible, fully tighten the union, remove both (driving and driven) levers from the cams and install them to a new position by turning them counterclockwise relative to the cams through 10° (through one tooth).

After this you are to adjust the brake by unscrewing the union. When in the process of operation and further wear of the brake linings the union length becomes again insufficient for performing the adjustment, disassemble the brake and turn the cams round their own axle through 180°.

In this case owing to the asymmetry of the cam relative to the axis of its stem the brake shoe is set to the position in which the wear of the brake linings is compensated on the diameter through 3 mm.

When the wear is less than specified above, the cam turn is premature and results in the fact that the brake shoes in the assembled brake will not enter the brake drum of the wheel. The cases are not excluded when the turn of the cam through 180° is possible without preliminary rearrangement of the levers.

The additional compensation of wear of the brake linings, when necessary, can be carried out by fitting the adjusting shims of similar thickness between the pushers and their supports in the brake disk (motorcycle is not complete with spare adjusting shims).

The disassembly of the brake is simple and does not require any explanations.

To assemble the brake, proceed as follows:

install the cams into the disk holes;

install return spring *9* by direct catch with the hole in the disk;

install the brake shoes with springs on the spherical ends of the pushers and the bearing surfaces of the cams;

install and fix the driving and driven levers on the cam splines maintaining the angles of 82°±5° as shown in Fig. 29. Nonparallelism of the levers between themselves must not exceed 5°.

Connect the pull rod to the driving lever after installation of the brake on the motorcycle.

Turn each lever clockwise until the brake shoes are pressed to the brake drum of the wheel.

Adjust the distance between the centres of the holes in the forks by unscrewing or screwing the pull rod into the forks so that the pin, connecting the fork to the driven lever, would freely enter the holes in the lever and in the fork. In this case the pull rod must be screwed into the fork through the length of at least 5 mm.

Lock the pull rod on the fork, connect the pull rod to the driven lever and lock with a cotter pin. Insert the return spring. On condition of observance of the above-mentioned rules of assembly the required conditions will be created for reliable operation of the brake on account of the simultaneous pressing of both brake shoes to the brake drum of the wheel.

When assembling the brake, the brake shoes are to be installed on their previous places otherwise their wearing-in is disturbed and the braking effectiveness becomes worse for some time.

Also pay attention to the fact on what surfaces of the cam the brake shoes rested since the cam surfaces are asymmetric relative to the axis of cam rotation. Both brake shoes must rest on the cam planes which are similar offset relative to the stem.

The brake is adjusted in the process of operation, when necessary, by unscrewing the adjusting union as mentioned above. The adjustment over, lock the union.

Adjust the brake so that the lifted wheel would rotate freely, without rubbing on the brake shoes and in braking the required effectiveness and the convenience of pressing on the lever by hand would be attained.

Rear Wheel Brake. Brake shoes *8* (Fig. 30) rest by seats on the heads of pushers *2* and by pressing platforms they rest on cam *5*. The cam has a slot in which equalizer *6* is installed. When the cam with equalizer is turned, the brake shoes are pressed to the brake drum.

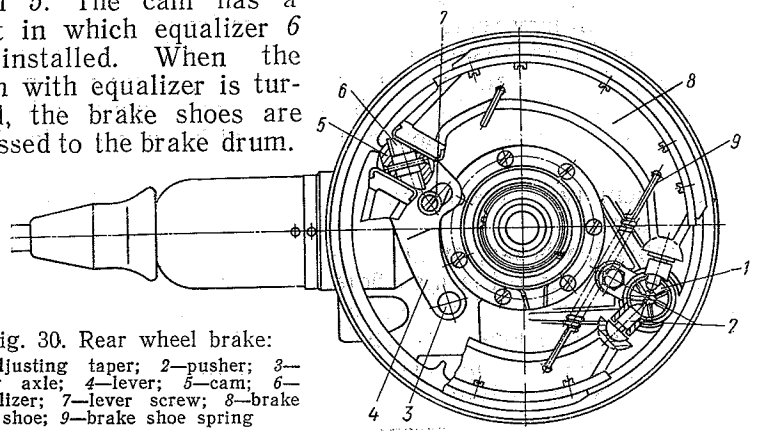


Fig. 30. Rear wheel brake:
1—adjusting taper; *2*—pusher; *3*—lever axle; *4*—lever; *5*—cam; *6*—equalizer; *7*—lever screw; *8*—brake shoe; *9*—brake shoe spring

As the brake linings are worn out, the clearance between the brake shoes and the brake drums of the wheel increases. To maintain this clearance within the required range, the wear compensator in the form of taper *1* is envisaged in the brake. When necessary, the taper is screwed in (from the outer side of the brake

disk) and spreads pushers *2*, which bring the brake shoes nearer to the drum and cam. To fix the position of the taper, on its surface the longitudinal grooves are envisaged into which the pushers enter under the action of springs *9* which draw the brake shoes together.

The necessity of adjustment of the brake is determined by the amount of a free travel of an outer hinge lever *12* (Fig. 31). The free travel is considered to be normal when it does not exceed

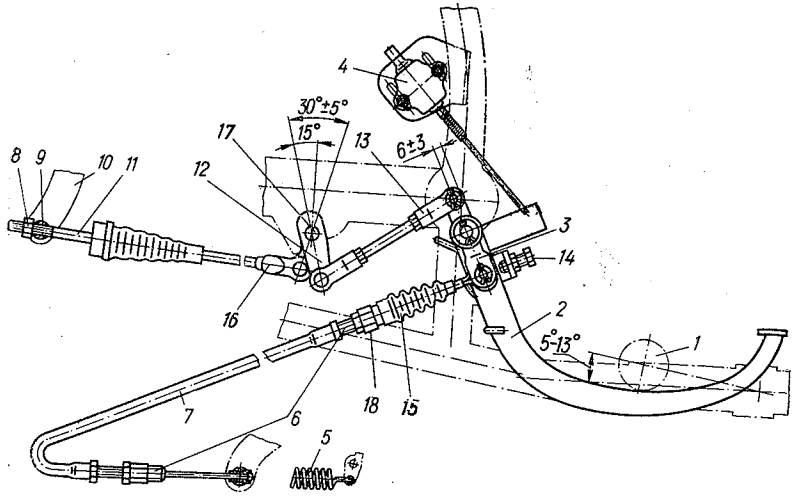


Fig. 31. Brake linkage of rear wheel and sidecar wheel:
1—footrest; *2*—pedal; *3*—equalizer; *4*—stop-light switch; *5*—cable return spring; *6*—adjusting union; *7*—sidecar wheel brake cable; *8*—nut; *9*—lever axle; *10*—brake cam lever; *11*—rear pull rod; *12*—intermediate lever; *13*—front pull rod; *14*—adjusting equalizer bolt; *15*—sleeve; *16*—rear pull rod fork; *17*—outer hinge axle; *18*—stop

5 mm. When it is greater than the above-mentioned value, lift the rear wheel and turn the protruding square of the adjusting taper by a wrench with a mouth of 8 mm clockwise (as shown in Fig. 32) until the brake shoes begin to touch the brake drum during rotation of the wheel. After this turn the adjusting taper backward through one fixed interval so that the wheel would rotate without touching the brake shoes.

The motorcycle rear wheel and sidecar wheel brake is actuated from the foot brake pedal via equalizer *3*. The upper arm of the equalizer is connected to the control linkage of the rear wheel brake, the lower arm is connected to the sidecar wheel brake. The presence of the equalizer ensures the correct distribution of the braking torques and the synchronous operation of the brakes.

The length of front pull rod *13* of the control linkage of the rear wheel brake must be such which ensures the dimension of 3—9 mm from the equalizer symmetry plane to the axis of oscillation of the lever of the rear wheel suspension. In this case the symmetry plane of the equalizer must coincide with the symmetry plane of the upper arm of brake pedal *2*. The brake pedal must

be pressed to footrest rubber roller *1* which must be installed in accordance with Fig. 31 (5°—13°).

The length of rear pull rod *11* is adjusted during its installation or repair of the brakes.

The adjustment is to be carried out with the wheel removed, the brake assembled and the brake pedal pressed to the motorcycle footrest in the sequence as follows:

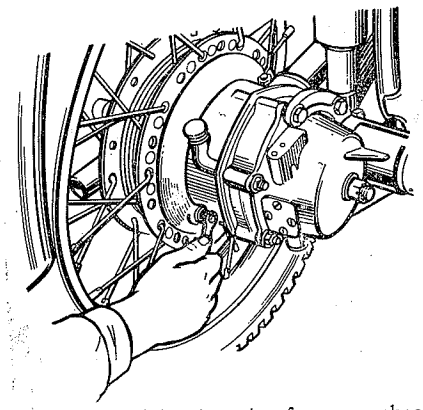


Fig. 32. Adjustment of rear wheeel brake

push lever *10* forward and disengage nut *8* from the lever;

while unscrewing or screwing up the nut, bring it to axle *9* without a clearance. Small tension is admissible at which the lower head of lever *10* is shifted forward through a distance of not over 5 mm. The threaded part of the pull rod must not be buried in the nut.

Sidecar Wheel Brake. This brake is similar in design to the rear wheel brake. The brake is actuated by cable *7*. From two sides on the cable adjusting unions *6* are installed on which the rubber protective tube is put. To protect the cable from getting of dirt, see that the tube would be pulled on the unions and rubber sleeve *15* would seal the front end of the cable.

Check the adjustment of the brake and its control linkage when the wheel is lifted.

At first you are to check the adjustment of the clearance between the brake shoes and the drum with the aid of the adjusting taper (in the same way as on the rear wheel brake). In this case the position of adjusting unions *6* must exclude the action of the cable on the lever of the brake cam.

Then adjust the tension of the cable with the aid of unions *6*. At first set the position of the beginning of braking the wheel by unscrewing the unions or one of them. After this release the wheel brake by screwing in one of the unions. Further with the mounted wheel you are to tighten the cable (by the same unions) until the beginning of braking with subsequent minimum slackening of the tension until the free rotation of the wheel.

When screwing in or unscrewing the adjusting union from the brake side, there is no necessity of removing the rubber envelope from it. After releasing the attachment of the cable from the brake pedal side you can rotate the union together with the cable.

To minimize the cable friction on the envelopes during adjustment, the cable should be slightly shaked.

The excessive tension of the cable can cause via the equalizer the braking of not only the sidecar wheel but also of the motorcycle rear wheel. The adjustment of the brake system over, check its effectiveness in braking at a slow speed and check the absence of heating of the wheel bodies in driving without braking.

If in periodic brakings the wheel bodies overheat increase the clearance between the brake shoes and brake drums.

On the bracket of pedal *2* adjusting bolt *14* is available which limits the turn of equalizer *3*. With the correctly adjusted position of bolt *14* the clearance between the equalizer and end of bolt *14* must be in the range of 2—3 mm when you press on the pedal with a force of 40—50 kgf.

The rest of the equalizer in bolt *14* weakens the action of the sidecar wheel brake or releases it in general. The above-mentioned bolt serves as a stop for the lower arm of the equalizer in the event of break of the cable.

The brake parts are to be lubricated in the intervals specified in section "Maintenance". The excessive lubricant must be removed so as to prevent the greasing of the brake linings.

The wear of shoe brake linings is limiting when the rivet heads are recessed for at least 0.3 mm.

SADDLES

On the motorcycle the separate saddles (driver's saddle and pillion) of a rocking type with rubber covers are installed.

The absorption of the saddles is ensured by the elasticity of the covers and rubber springs. The saddles are installed on the hinges, in the frame bracket the driver's saddle (Fig. 33) is in-

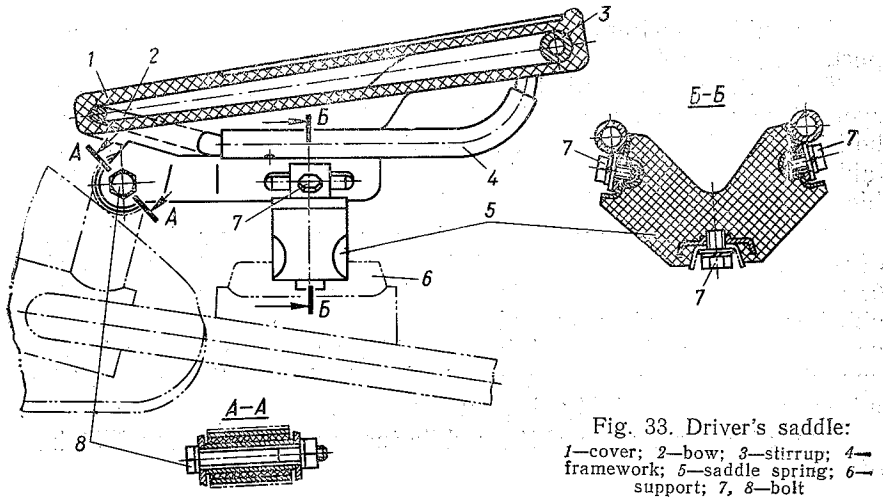


Fig. 33. Driver's saddle:
1—cover; *2*—bow; *3*—stirrup; *4*—framework; *5*—saddle spring; *6*—support; *7*, *8*—bolt

stalled and in the base the pillion is mounted (Fig. 34). They rest on rubber springs *5*. Covers *1* with bows *2* and stirrups *3*, fitted in them, are stretched on frameworks *4*.

The front part of the frameworks of both saddles is connected to the motorcycle by bolts *8* via the rubber-metal blocks which are press-fitted into the holes in the frame bracket (driver's saddle) and base (pillion).

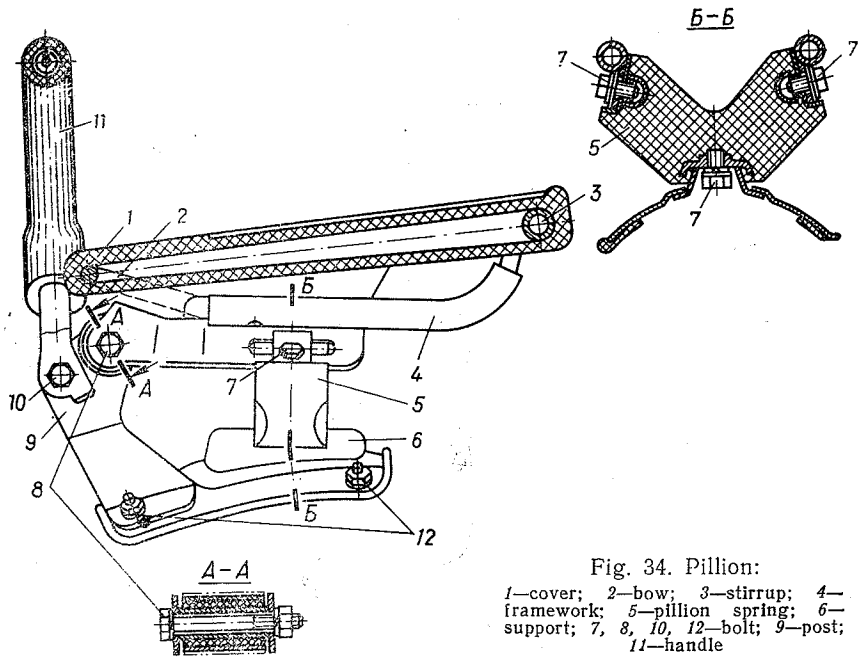


Fig. 34. Pillion:
1—cover; *2*—bow; *3*—stirrup; *4*—framework; *5*—pillion spring; *6*—support; *7, 8, 10, 12*—bolt; *9*—post; *11*—handle

The rubber springs are connected to the frameworks and supports *6* by bolts *7*.

The pillion is installed on the rear mudguard of the motorcycle. The pillion support is attached to the mudguard by four bolts *12*. In the front part of the pillion elastic handle *11* is available which consists of a steel cable with a rubber tube. The assembled handle is attached to the pillion support by bolt *10*.

Depending on the mass of a driver or a passenger the stiffness of the saddles is adjusted by shifting of the springs along supports *6;* in this case you are required to slacken fastening bolts *7*. The shifting of the spring towards the front hinge ensures the more soft cushioning of the saddle, the shifting of the spring in the opposite side ensures the more stiff cushioning of the saddle. The adjustment over, reliably tighten the bolts.

Check the tightening of the saddle fasteners after every 2500 km of the run.

SIDECAR

The sidecar is of a single-seater type, with the wishbone suspension of the wheel from the spring-hydraulic shock-absorber. It features a smooth running and longevity in use.

The sidecar body is of a passenger type, all-metal, welded.

The body is equipped with a soft seat which consists of two spring-mounted cushions (seat and back). Rubber mat *11* (Fig. 35) is placed on the body bottom in front of the seat.

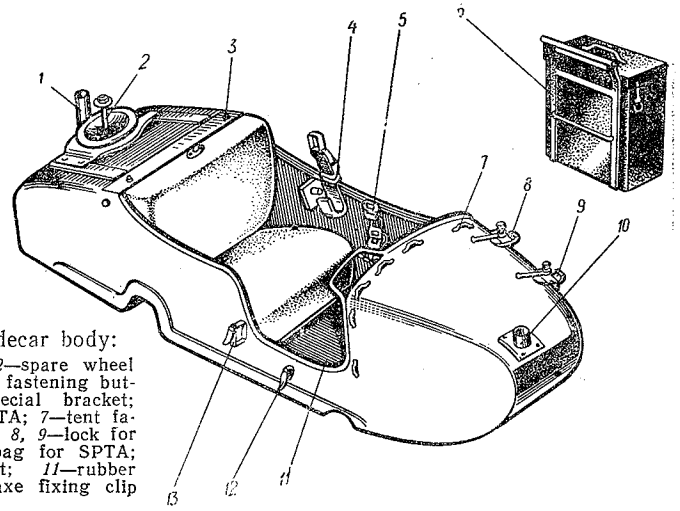


Fig. 35. Sidecar body:
1—rear post; *2*—spare wheel holder; *3*—tent fastening button; *4, 5*—special bracket; *6*—bag for SPTA; *7*—tent fastening staple; *8, 9*—lock for fastening of bag for SPTA; *10*—front post; *11*—rubber mat; *12, 13*—axe fixing clip

The opening of the sidecar body is covered by a tent made of artificial leather which is attached by fasteners and straps to buttons *3* and staples *7*.

The folded easily removable back of the seat provides an access to the boot. To open the boot, press on the button of the lock, arranged on the back of the seat. The lock can be closed with the aid of a special key.

Spare wheel holder *2*, swivel post *1* and spare wheel are mounted on the upper rear panel of the sidecar body.

On the boot bottom the holder is attached and on the inner right-hand side wall the clips are available for fastening the motorcycle accessories.

From the outer side of the right-hand wall of the sidecar clips *12* and *13* are arranged which are intended for fastening the axe. On the left-hand wall of the sidecar the brackets are mounted: outside—for fastening of a shovel, inside—three brackets *4, 5* (third bracket is not seen in Figure) for fastening of special accessories. On the upper front panel of the sidecar to the left locks *8* and *9* for fastening of bag *6* for SPTA are arranged and to the right—swivel post *10* is arranged.

To the left from the rear, from the outside, the holder is fixed which is intended for installation of the fuel can of 10-litre holding capacity. The sidecar body is fixed to the front pipe of the frame

by two clips with rubber pads. The rear part of the body is fixed to two unified rubber (undersaddle) springs, fastened on the brackets of the rear pipe of the frame. To restrict the body vibrations, in the rear part of the frame the limiter is installed which is connected to the body by means of a stem with a rubber buffer.

To protect the shock-absorber from very strong impacts in driving with complete load on bad roads, on the right-hand longitudinal pipe of the sidecar frame the shock-absorber travel limiter with rubber buffer is installed which takes up the impacts in case of the extreme downward (to "rebound") deviation of the sidecar wheel speed reducer.

The sidecar frame is connected to the motorcycle in four points (Fig. 36). Two lower attachment points are the collet joints

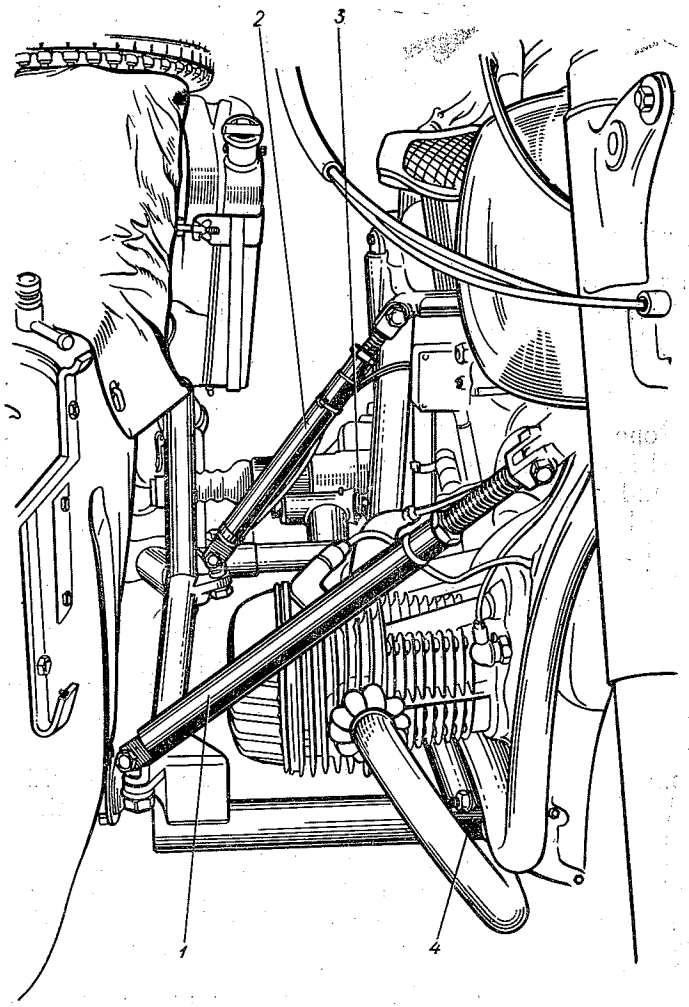


Fig. 36. Sidecar attachment to motorcycle:
1—front tie rod; *2*—middle tie rod; *3*—rear collet; *4*—front collet

(Fig. 37) which embrace the ball brackets of the motorcycle frame. The rear collet joint is mounted in the bend lever which is attached to the sidecar frame by two fastening bolts.

When the fastening bolts are slackened, the bend lever can be turned or removed from the pipe of the sidecar frame.

The upper attachment consists of two pull rods adjustable in length. The pull rods are provided with the hinge joints to the sidecar frame ears and to the motorcycle frame brackets.

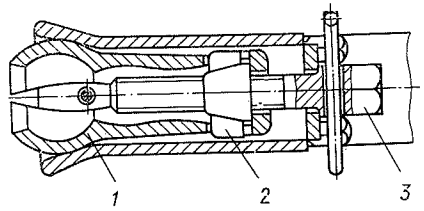


Fig. 37. Sidecar attachment collet joint:
1—collet; *2*—nut; *3*—bolt

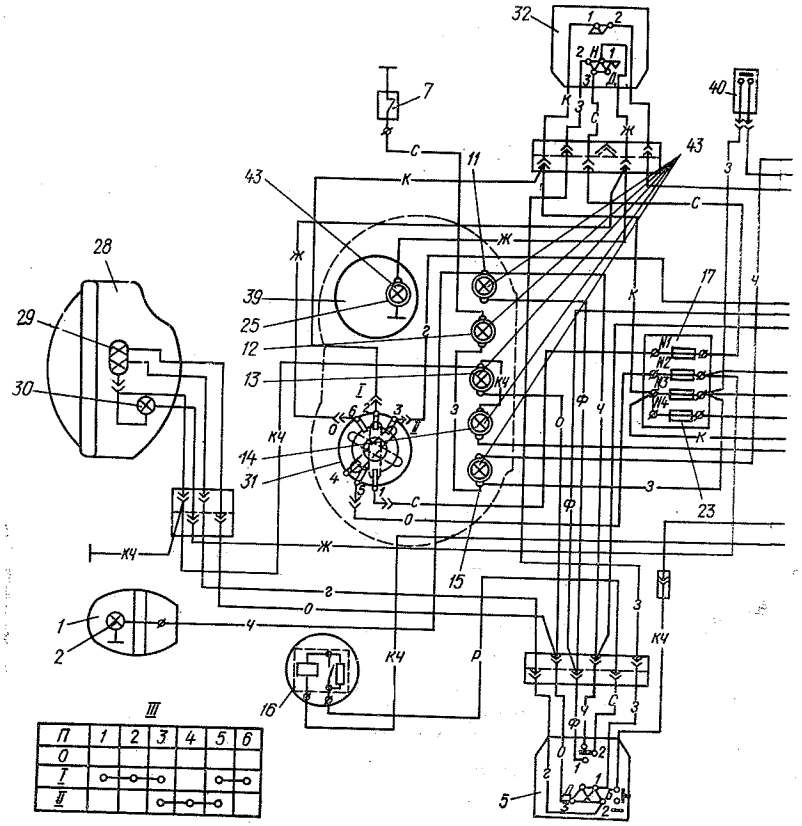
The wheel is mounted on the axle of the speed reducer which is hinged onto the frame.

The vertical forces, appearing due to the rough road, are taken up by the spring-hydraulic shock-absorber which is installed on the frame bow and in the speed reducer bracket on the rubber sleeveshinges. The speed reducer is connected to the frame with the aid of rubber sleeves-hinges which are unified with the sleeves used in the motorcycle rear wheel suspension. Such connection ensures the silent operation, does not require any attendance in service and is practically not worn out.

The motorcycle with the correctly installed sidecar is easily steerable and does not depart from the predetermined direction of driving. Since motorcycle MB650M1 is provided with two driving wheels (rear wheel and sidecar wheel), in setting the position of the sidecar relative to the motorcycle you must obtain such a position in which the sidecar wheel is parallel to the motorcycle wheels and all wheels are perpendicular to the horizontal plane of the road. The installation of the sidecar relative to the motorcycle is checked in the process of operation in driving at a slow speed on the even horizontal section of the road by releasing the handlebars — "without hands". The motorcycle must not be led aside.

When the necessity arises to adjust the parallelism of the wheels, slacken the fastening bolts which clamp the bend lever and, then pushing it into or withdrawing it from the rear pipe, attain the correct mutual position of the wheels which can be checked with the aid of two straight gauge sticks, applied to the wheels at a height of 90—100 mm from the ground.

The perpendicularity of the wheels in relation to the road is attained by increasing or decreasing the length of adjustable tie rods *1, 2* (Fig. 36). In adjustment all hinges are to be lubricated with the lubricant Lithol-24.



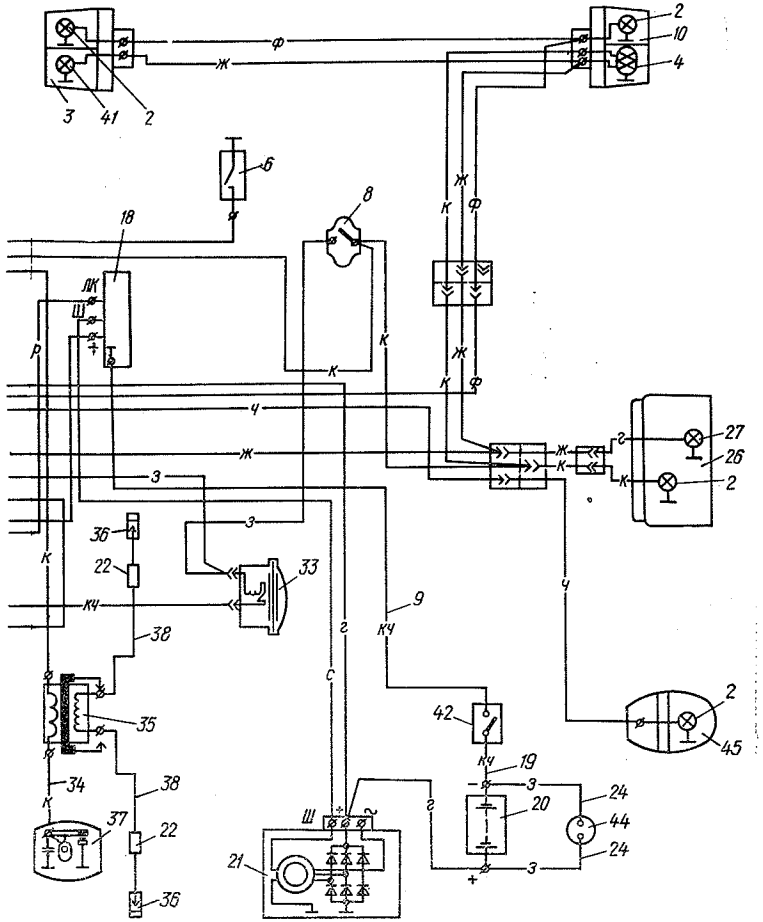


Fig. 38. Electrical equipment diagram:

1—front turn indicator 16.3726; *2*—lamp A 12-21-3; *3*—sidecar front light ПФ232В; plug; *7*—emergency oil pressure transmitter ММ126; *8*—stop-light switch ВК854Б; tail lamp ФП219В; *11*—turn indicator pilot lamp cap ПД20Д; *12*—emergency oil *14*—generator operation pilot lamp cap ПД20Е; *15*—neutral position transmitter *18*—voltage regulator 33.3702; *19*—switch 46.3710 — "frame" storage battery wire; А14ТГЛ; *23*—fuse ПР119-Б-210; *24*—socket-storage battery wire; *25*—lamp holder lamp A 12-45+40; *30*—lamp A 12-4; *31*—ignition lock 141.3704; *32*—"day-night" Б204; *36*—sparking plug А14В; *37*—breaker ПМ302А; *38*—high-voltage wire; *39*— *42*—battery switch 4607.3710; *43*—lamp A 12-1; *44*—socket 47К; *45*—rear turn in- II—parking; III—ignition

4—lamp A 12-21+6; *5*—dimmer and direction indicator switch 171.3709; 6—contact *9*—battery switch 46.3710 — voltage regulator 33.3702 "frame" wire; *10*—sidecar pressure pilot lamp cap ПД20Е; *13*—distance light pilot lamp cap ПД20М; pilot lamp cap ПД20Д; *16*—turn indicator blinker РС427; *17*—fuse unit ПР11М; *20*—storage battery 6МТС9; *21*—generator Г424; *22*—sparking plug cap type ППП1-200; *26*—tail lamp 171.3716; *27*—lamp A 12-5; *28*—headlight ФГ137Б; *29*— switch 181.3709; *33*—horn С304; *34*—"bobbin"—breaker wire; *35*—ignition coil speedometer СП102; *40*—hand brake "stop light" switch 13.3720; *41*—lamp A 12-8; dicator 161.3726; *П*—position (1—6—terminal numbers); *0*—OFF; I—movement; lock wiring diagram

The electrical equipment of the motorcycle consists of the electric power sources and consumers, auxiliary devices and electric circuit. It provides the ignition of combustible mixture in the engine cylinders, lighting, sound and light signalling.

The diagram of the motorcycle electrical equipment is shown in Fig. 38.

The electric circuit, consisting of low-voltage wires, is made following a pattern of a single-wire system, i.e. from the electric power sources to the consumers one wire is led (from the positive poles of the storage battery and of the generator) and the frame and other metal parts of the motorcycle and of the devices themselves ("frame") serve as the second wire.

The negative poles of the storage battery and of the generator are connected to "frame". Pilot lamp ПД20-Е (red light) is intended for checking the operation of the generator and voltage regulator. When the lamp goes out with the operating engine, it is indicative of the serviceability of the generator and of the voltage regulator.

To check the oil pressure in the engine lubricating system, emergency oil pressure transmitter ММ126 is installed for which pilot lamp ПД20-Е (red light) serves as an indicator.

Pilot lamps ПД20-Д (green lights) serve as an indicator of the gear-shift mechanism neutral position and an indicator of the switching-in of turn indicators; pilot lamp ПД20-М (blue light) serves as an indicator of the switching-in of distance light.

Prior to mounting and dismantling the electrical equipment devices you are required to open the electric circuit with the aid of battery switch 46.3710.

For convenience in servicing and in carrying-out of minor repair at night the motorcycle is complete with a portable lamp which is to be connected to socket *44* (Fig. 38).

Electric Power Source

Storage Battery

Storage battery type 6МТС-9 is mounted on the motorcycle. The rated voltage of the storage battery is 12 V, the rated electric charge in case of 20-hour discharging rate is 9 А·h.

The storage battery supplies the electric power to all consumers of the motorcycle when its engine is not operating or in the event of a low rotation frequency of the engine crankshaft. When the rotation frequency is over 1800 min^{-1}, the load is changed over from the storage batery to the generator from which the storage battery is also charged.

The operation and servicing of the storage battery are to be carried out in accordance with its maintenance and operating instructions.

Mounted on the motorcycle is generator Г424 rated for a voltage of 14 V and power of 150 W. The maximum power in case of short-time loads is 200 W. The mass of the generator is 3.7 kg.

Generator

Design. The generator is a three-phase synchronous machine with electromagnetic excitation and possesses the following constructional elements and peculiarities of design: cover *1* (Fig. 39) from the drive side has a cylindrical lug (eccentric to the rotor axle) intended for adjustment of a centre distance of the toothed wheel gearing of the drive and a flange for attachment of the generator on the crankcase of the motorcycle engine.

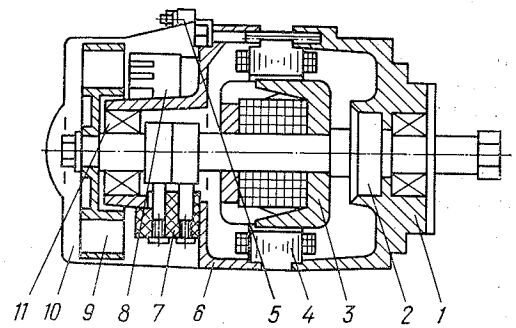


Fig. 39. Generator Г424: *1*—cover; *2*—seal; *3*—rotor; *4*—stator winding; *5*—terminal block; *6*—rear cover; *7*—brush holder; *8*—rectifier unit; *9*—fan; *10*—protective casing; *11*—bearing

From the drive side the generator has rubber seal *2* for isolation of the generator chamber from the crankcase aggressive medium. Rotor *3* with an exciting winding and slip-rings revolves in prelubricated double-sealed bearings *11*.

Three-phase winding *4* of the stator has a star connection to the insulated neutral. The phase ends are soldered to the heads of the bolts which fasten rectifier unit *8*. Two covers *1* and *6* as well as the stator are fastened by three screws М6. The brushes with the current-conducting plates are fixed to brush holder *7* and cover *6* with the aid of captive screws.

Built into the generator is semiconductor rectifier unit *8* of type ВБГ-2А which allows to obtain the direct current from the generator terminals.

The rectifier unit consists of three monoblock units, cast of an aluminium alloy and provided with finning for heat transfer. Built into each monoblock unit are two semiconductor elements of opposite polarity whose electrical connection is made with the aid of two busbars: "frame" busbar and insulated busbar. The contact screw is available on the insulated busbar.

The disassembly of the rectifier unit is inadmissible.

Installed under protective casing *10* on the shaft of rotor *3* is axial-flow fan *9* which is intended for cooling of the rectifier unit. The terminals for connection of the generator to the motorcycle electric circuit are arranged on common terminal block *5* and are

provided with the restricting washers which prevent an opportunity of wrong connection of wires in assembly and their spontaneous disconnection in the process of service.

Principle of Operation. Generator Г424 belongs to the three-phase synchronous machines with electromagnetic excitation. The peculiarities of the generator are as follows: at a small rotation frequency of the rotor the generator exciting winding must be fed from an external direct-current source (storage battery) and only after excitation from the storage battery at a rotation frequency of the rotor exceeding 2400 min^{-1} the generator goes over to operation from self-excitation.

Operation of the generator with fully discharged storage batteries is impossible — the generator fails to be excited.

Do not operate the generator without load!

When the generator operates without load (break or disconnection of the wires running to the consumers) at a great rotation frequency the interphase alternating-current voltage attains the values which are able to break through the semiconductor elements of the unit and damage the generator.

Installation on Motorcycle. The fitting lug of the cover from the drive side is to be installed into the mounting hole in the engine crankcase. Simultaneously the gears must become meshed and the studs must enter the elongated holes in the generator flange. The gasket must be fitted between the end face planes of the generator and of the crankcase.

Put the plain and spring washers and screw up the nuts until the light pressing of the generator to the crankcase. Connect the wires to the terminal bolts and put on the protective caps.

Start the engine and, while slowly turning the generator clockwise and counterclockwise (at a small rotation frequency of the engine crankshaft), find the optimum position of gear meshing at which the gears operate with the least noise. Tighten the nuts without changing the position of the generator.

The improper setting of meshing of the drive gears can result in breakdown of the generator shaft.

Attendance of Generator. The design of generator Г424 enables to minimize the scope of attendance during its service. The use of the prelubricated bearings allows to exclude the periodic lubrication of the bearings. The Manufacturer's lubrication of the bearings is sufficient for the whole service life of the generator. The sliprings of generator Г424 in service do not produce the carbon deposit, are practically little worn out and are not clogged with brush dust therefore they do not require the frequent lapping and periodic grinding.

The electric brushes installed on generator Г424 are sufficient for the whole service life of the generator.

In the process of operation of the generator you are to check the reliability of tightening the nuts of the terminal bolts with the cable lugs, generator fastening bolts, fan fastening screw, generator fixing nuts.

After the motorcycle run of 20 000 km the generator cover chamber must be cleaned of brush dust from the slip-ring side.

For convenience of cleaning you are recommended to remove the generator from the motorcycle, detach the casing and the brush holder with brushes.

The complete disassembly of the generator until expiration of the guarantee period is inadmissible.

Voltage Regulator

Generator Г424 operates together with contactless voltage regulator 33.3702. The voltage regulator is intended for automatic maintaining the voltage on the generator terminals and controlling the pilot lamp of storage battery charging: after starting the engine the pilot lamp goes out, indicating the serviceability of the generator and of the voltage regulator.

When installing the voltage regulator on the motorcycle, see that the regulator body would be reliably connected to the motorcycle "frame" with the aid of a fastening bolt.

Electric Power Consumers

Ignition coil Б204 and breaker ПМ302А with an automatic spark timer are installed on the motorcycle engine for obtaining the high-voltage current.

The position of the ignition coil and of the breaker is shown in Fig. 40.

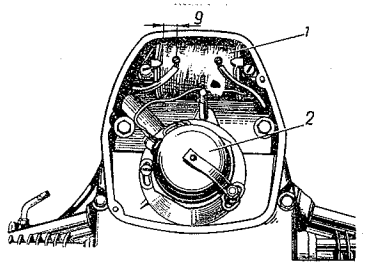


Fig. 40. Ignition coil and breaker with automatic spark timer:
1—coil Б204; *2*—breaker ПМ302А

Ignition coil

Ignition coil Б204 has two output terminals each of which feeds one of the cylinder sparking plugs and operates in combination with the breaker provided with the automatic spark timer.

The gap between the dischargers and the high-voltage terminals is set equal to 9 mm. In the process of operation it is inadmissible to increase or decrease the gap. Slackening of the attachment of the current-conducting wires to the terminals, fouling of the wires and terminals are also inadmissible.

Breaker with Automatic Spark Timer

Keep the breaker clean, timely tighten its fastenings, replenish the lubricant in the felt and on the friction surfaces of the automatic spark timer. Wipe the breaker with clean waste moistened in gasoline.

After the run of 500 km and further after every run of 5000 km you are required to check the condition of contacts, if necessary, trim them and adjust the gap. Trim the contacts with a needle file or other tool which leaves no abrasive dust. While trimming, you are to remove a pimple on one of the contacts, it is not recommended to remove a hollow on the other contact. The trimming over, wash the contacts with clean gasoline and set the gap of 0.4—0.6 mm between the breaker contact points.

After every run of 5000 km you are to lubricate the breaker lever axle, axle — weight clearances with one drop of oil. Lubricate the cam—bush clearance, felt with 2-3 drops of oil.

Operation of Ignition System

When the ignition has been switched on, the ignition coil primary winding circuit is switched on too. Upon opening of the breaker contact points in the secondary winding the high-voltage (10000—15000 V) current appears which is required for ignition of combustible mixture, the simultaneous formation of a spark between the electrodes of the sparking plugs of the left-hand and right-hand cylinders occurs: one spark is formed when in one of the cylinders the compression stroke ends and the other spark is formed in the period of the exhaust-stroke.

Headlight, Dashboard, Motorcycle and Sidecar Lights, Horn and Stop-light Switch

Headlight type ФГ137-Б is installed on the motorcycle. Mounted in the headlight are: a distance and dim light lamp, a marker (parking) lamp.

The pilot lamps of generator operation, emergency oil pressure, gear-shift mechanism neutral position, turn indicator switching-in and distance light switching-in, speedometer with a lighting lamp and an ignition lock are arranged on the dashboard.

To set the headlight to the correct position, proceed as follows:

install the motorcycle (with load) on the even ground area in front of a white wall or a screen at a distance of 10 m measured from the headlight glass to the wall (Fig. 41);

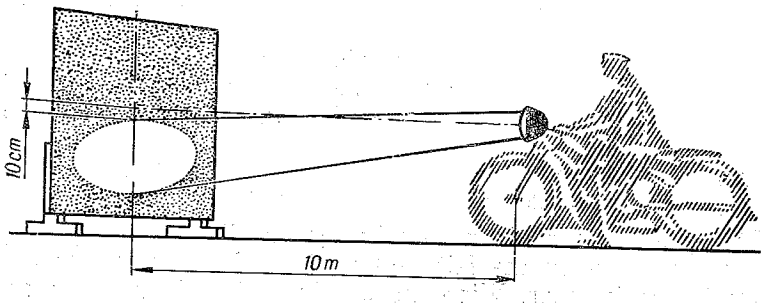


Fig. 41. Headlight installation diagram

slacken the bolts, fastening the headlight, and set it to such a position in which the axis of the light beam emitted from the distance light filament is horizontal, i.e. when the light spot centre on the screen and the headlight centre are located at a similar distance from the ground;

check the dim light. The upper boundary of the light spot on the screen when the dim light filament is switched on must be by at least 10 cm lower than the headlight centre;

tighten the headlight fastening bolts.

Installed on the motorcycle are the turn indicators provided with an orange lens and lamps A12-21.

Installed on the motorcycle rear wheel mudguard is red light 171.3716 with lamps A12-21-3 and A12-3; mounted in the lower part of the light is a clear lens for lighting the number plate.

On the front part of the sidecar mudguard two-section light ПФ232-В is installed, lamp A12-8 is installed in the section equipped with a clear lens and lamps A12-21-3 is fitted in the section equipped with an orange lens. On the rear part of the sidecar mudguard two-section light ФП219-В is installed, lamp A12-21-3 is fitted in the section equipped with an orange lens and lamp A12-21+6 is installed in the section equipped with a red lens.

Horn С304 is mounted on the motorcycle. It operates when the ignition is switched on and the horn button (arranged at the left-hand side of the handlebars) is depressed. The horn is adjusted with a screw which is found on the rear side of the horn body.

Switches ВК854 and 13.3720 are used on the motorcycle as stop-light switches. Stop-light switch ВК854Б is attached by two screws to the bracket, welded to the lower right-hand side pipe of the frame. The terminals are protected by a rubber cap from getting of moisture onto them. Hand brake "stop" switch 13.3720 is mounted on the handlebars bracket and is protected by a rubber sleeve.

Electric Wiring

The electric power sources and consumers as well as auxiliary devices are interconnected by wires. For convenience in erection the wires (except high-voltage wires) are combined in bundled conductors. The wires are connected among themselves and to the consumers with the aid of metal joints, protected by rubber tubes from shorting to "frame", the wire tags are protected by rubber caps.

The bundled conductors are attached to the motorcycle frame and sidecar frame by bands and are fastened by clips.

The wire colouring is as follows (ref. to Fig. 38): *Г*—blue; *Ж*—yellow; *З*—green; *Кч*—brown; *К*—red; *О*—orange; *С*—grey; *Ф*—violet; *Ч*—black; *Р*—pink.

All light-signalling devices are protected by fuses. Fuse unit ПР11М is installed on the bracket under the dashboard. Four fuses rated for 15 A are installed in the fuse unit.

Upper fuse No. 1 is intended for protection of the circuit of the ДЕНЬ-НОЧЬ (DAY-NIGHT) switch against short circuit. Fuse No. 2 is intended for protection of the marker light circuit against short circuit. Fuse No. 3 protects against short circuit the circuits of the horn, hand brake and foot brake stop light switches and the circuit of the pilot lamps-indicators of "gear-shift mechanism neutral position" and "emergency oil pressure". Fuse No. 4 protects the turn indicator-blinker relay circuit from short circuit.

Instead of the fuse rated for 15 A the fuse rated for 10 A can be installed in this circuit.

Trouble Shooting in Motorcycle Electric Circuits and Units

The failure in operation of the electric power sources and consumers (generator, generator regulator, instrumentation, lighting, etc.) is indicative of a trouble in the electric circuit.

In this case the defects which can be discovered are as follows:

break or failure of contact in the wires which connect a consumer to an electric power source;

a trouble of fuses or switching equipment (ignition lock, switch, transmitter, etc.);

short circuit or overload in a circuit as a result of which the fuses operate.

Prior to checking the electric circuit you are to make sure that the fuse is intact. It can be checked with the aid of a test lamp—connect one end of the wire to the "+" terminal of the storage battery and the other end of the wire, to one of the sides of a fuse to be tested. Connect the vacant end of the fuse via the test lamp to the "—" terminal of the storage battery or to the motorcycle "frame". When the fuse is intact, the lamp will light up.

To check the electric circuits, proceed as follows:

switch on the ignition lock;

switch on the circuit with consumers to be tested.

When the consumer fails to operate and the fuse is intact, the circuit or the consumer is defective. When the fuse is blown, it is indicative of a short circuit in the circuit. Discover and remedy a trouble prior to switching on the ignition lock or the circuit section under test. The break in the circuit is also checked with the aid of the test lamp.

Check the presence of voltage starting from the terminals of a consumer. In this case the possible versions are as follows:

no voltage on the consumer terminals (test lamp fails to light up) — the break of a wire or the absence of contact in connections are possible. In this case depending on the trouble you are to tighten the contacts or replace the wire. While checking the voltage on the primary winding of the highvoltage coil, see that the breaker contact points are closed;

voltage exists on the consumer terminals (test lamp is on). The consumer is faulty. Replace and repair it.

When the pilot lamp of operation of the generator and voltage regulator fails to light up upon switching on the ignition, check connection of terminals on the voltage regulator and storage battery as well as connection of the voltage regulator body to the "frame" for reliability, voltage on the "+" terminal of the voltage regulator for presence.

If this test was ineffectual check the serviceability of the pilot lamp circuit from the dashboard to the terminal "ЛК" of voltage regulator. For this purpose disconnect the wire from the terminal "ЛК" on the generator regulator, switch on the ignition and connect the disconnected wire to the terminal "В3" of the generator regulator. If in this case the lamp fails to light up, check the wires, the reliability of contacts and the pilot lamp. If upon closing the circuit the lamp lights up, the cause of a trouble is in the generator regulator which must be replaced.

When the pilot lamp of operation of the generator and generator regulator fails to go out after starting the engine, with the operating engine you are to switch on the distance light, then switch off the storage battery with battery switch. When the generator and its exciting circuit are sound, the engine continues to operate and the lighting of the lamp in the headlight varies negligibly. In this case the lighting of the pilot lamp is indicative of a loose contact on the storage battery terminals or malfunction of the voltage regulator which must be replaced. Never attempt to check the serviceability of the generator by closing to the frame the terminal designated with the "+" sign since in this case the rectifier unit in the generator can fail.

The erroneous connection of the "+" terminal of the storage battery to the motorcycle "frame" can result in the same consequences.

When at a medium frequency of crankshaft rotation the engine stalls upon disconnecting the "+" terminal of the storage battery, first of all you are to make sure that the generator exciting circuit is energized. For this purpose, when the engine is not operating and the ignition is switched off, you are to disconnect the wire from the terminal "Ш" of the voltage regulator and contact it for a short time to the terminal "+" of voltage regulator. When in this case a small spark appears, the generator excitation circuit is serviceable.

The absence of sparking on the terminal "+" is indicative of (if the wire from the terminal "Ш" of the generator to the voltage regulator is not damaged) a trouble in the generator. After checking the intact condition of wires and the reliability of connections (on the storage battery, generator and generator regulator) you are to check the generator for serviceability.

The generator and its semiconductor rectifier can be also checked with the aid of a test lamp.

To check the semiconductor rectifier, disconnect the generator from the circuit, then perform the following jobs:

1. Connect the terminal "+" of the storage battery to the "~" of the generator and the "—" terminal of the storage battery via a test lamp to the generator body. In this case the test lamp must not light up. Then connect the "+" terminal of the storage battery to the generator body and the "—" terminal of the storage battery to the "~" terminal of the generator via the test lamp. In this case the lamp must light up. If in the first case the test lamp lighted up—the semiconductor rectifier (lower semiconductor element) is defective. If in the second case the test lamp fails to light up—it is indicative of a break in the "~" — generator "frame" circuit.

2. Connect the "+" terminal of the storage battery to the "+" terminal of the generator and the "—" terminal of the storage battery via the test lamp to the "~" terminal of the generator. In this case the test lamp must not light up. Then connect the "+" terminal of the storage battery to the "~" terminal of the generator and the "—" terminal of the storage battery to the "+" terminal of the generator via the test lamp. In this case the test lamp must light up. If in the first case the test lamp lighted up—the semiconductor rectifier (upper semiconductor element) is defective. If in the second case the test lamp fails to light up—it is indicative of a break in the generator "~" — "+" circuit.

In addition, you are to check the serviceability of the generator excitation circuit which can be also carried out with the aid of the test lamp.

For this purpose connect the "+" terminal of the storage battery via the test lamp to the "III" terminal (generator shunt), having disconnected the "III" terminal from the voltage regulator, and connect the "—" terminal of the storage battery to the generator frame.

While rotating the generator rotor with the aid of the engine starting lever, watch for the lighting of the test lamp. When the test lamp lights up and does not flicker up, it is indicative of the good condition of the contacts in the excitation circuit. The flickering-up of the test lamp is indicative of the poor contact of the brush with the ring or of the ring with the output leads of the generator excitation winding.

Attendance of Electrical Equipment

In the process of daily maintenance you are to check the operation of the headlight, horn, lights, storage battery, generator and ignition.

In the event of failure of the electric lamps in the headlight they are to be replaced. For this purpose undo the screw which fastens the moulding of the headlight to its body and remove the moulding together with a lens and a reflector from the headlight body. Then disconnect the lamp holders, remove the terminal block

from the two-filament distance light and dim light lamp and replace the lamp by a new one, performing all jobs in the reverse order.

To replace the lamps in the marker (parking) light, remove the holder together with a lamp and detach the lamp from the holder.

To replace the burnt pilot lamp in the caps remove the cap from the dashboard and detach the lamp from the holder.

In the event of worsening of the sound of the horn it is to be adjusted by rotating the adjusting screw to this or that side.

After every 5000 km of the run you are required to check:

a sparking plug gap and, if necessary, clean the sparking plugs of carbon deposit;

reliability of wire connections;

attachment and serviceability of lamps in the headlight and in the lights: if necessary, remove the dust from reflectors, wipe the lenses of the lights.

Prior to the replacement of a blown fuse you are required to discover and remedy a trouble in the electric circuit which resulted in the blowing of the fuse.

Installation of Black-out Devices

To install the black-out device on the headlight, proceed as follows:

undo the screw intended for fastening the headlight moulding and remove the sealed beam unit together with the moulding (disconnect the wires for greater convenience);

remove the spring intended for attachment of the sealed beam unit to the moulding and take off the headlight moulding;

install the headlight sealed beam unit into the black-out device and fasten it by springs;

connect the wires to the headlight;

install the black-out device with the sealed beam unit on the headlight body and tighten the screw.

To install the black-out device on the turn indicator light, proceed as follows:

undo the screws intended for fastening the lens and remove it;

install the base of the black-out device with a rubber seal on the lens;

fasten the lens with the installed base of the black-out device to the turn indicator light body with the removed screws;

install the black-out device cover on the light, having fixed it in the base lugs.

To install the black-out device on the rear light of the motorcycle, proceed as follows:

disconnect the plug connectors of the rear light wires;

undo two screws fastening the light body to the bracket, remove the light and rubber gasket;

fit the black-out device base on the light body;

fasten the light body with the installed base of the black-out device via a rubber seal to the light bracket on the rear board with the removed screws;

connect the plug connectors of the rear light wires;

install the black-out device cover on the light, fastening it in the lower lugs of the base and clamping by a screw from above;

check the rear light for operation.

To install the black-out devices on the sidecar lights, proceed as follows:

remove the lenses;

remove the gasket of the lenses;

disconnect the bracket together with the light body from the sidecar wheel mudguard;

disconnect the light body from the bracket;

disconnect the wires;

remove the light rubber seal;

install the black-out device base, the light body via a rubber seal on the bracket and fix them by screws to the bracket;

connect the wires;

install the bracket with the light on the sidecar wheel mudguard;

install the gasket of the lenses;

install the lenses;

mount the black-out device cover on the light, fastening it in the lugs of the lower part of the black-out device base and clamping by a screw from above.

TROUBLE SHOOTING

Trouble	Cause	Remedy
	Engine	
Engine fails to be started	No spark on sparking plug electrodes:	
	incorrect gap or burnt breaker contact points;	Set gap, trim contact points;
	failure of sparking plugs;	clean sparking plugs, set gap; if necessary, replace sparking plugs;
	ignition coil burnt;	replace coil;
	capacitor broken through;	replace capacitor;
	poor contact in wire connections or in emergency ignition switch;	connect wires properly;
	no clearance in valves; gasoline fails to be supplied to carburetors;	restore contact adjust valves;
	clogged hole in gasoline tank cap;	clear hole;

Continued

Trouble	Cause	Remedy
	clogged cock or its sediment cup;	clear, wash cock or sediment cup;
	clogged carburetors (jets, ducts, additional air filter, fuel filter);	clear, wash carburetors;
	slackened attachment of the carburetor;	tighten attachment;
	poor quality of gasoline	replace gasoline
Engine is overheated	Wrong setting of ignition timing;	Set ignition timing according to this manual;
	failure in synchronous operation of carburetors;	adjust carburetors;
	rich or lean combustible mixture;	adjust carburetors;
	clogged air cleaner;	wash air cleaner;
	air inflow in joints;	remedy air inflow;
	poor cooling due to soiling of spaces between fins on cylinders and their heads	clean engine of dirt
Engine misses, operates on one cylinder	Breaker contact point gap is misadjusted;	Set gap;
	misadjusted gap in ignition coil discharger;	set gap;
	one of sparking plugs fails to operate;	replace sparking plug by new one;
	insulation of high-voltage wires is broken through or poor contact of them in connections;	check condition of wires and their connections; if necessary, replace wires;
	valve clearances are misadjusted;	adjust valve clearances:
	carburetors are misadjusted	adjust carburetors adjust valve clearances.
Engine pings	Wrong setting of ignition timing (early ignition);	Set ignition timing according to this manual;
	valve clearances are misadjusted;	adjust valve clearances;
	carburetors are misadjusted;	adjust carburetors for synchronous operation of cylinders;
	low-grade gasoline is filled;	replace gasoline;
	much carbon deposit on pistons and heads;	clean parts of carbon deposit;
	wear of cylinder-piston set	replace worn-out parts
Engine fails to develop power	Wrong setting of ignition timing;	Set ignition timing according to this manual;
	carburetors are misadjusted or clogged;	adjust carburetors for synchronous operation and combustible mixture air-fuel ratio, clear and wash them;
	incomplete fitting of valves;	clean valves of carbon deposit and grind them;
	clogged air cleaner;	wash air cleaner;
	engine is overheated;	let engine cool down

Continued

Trouble	Cause	Remedy
Engine consumes much gasoline	Wrong setting of ignition timing;	Set ignition timing according to this manual;
	carburetors are misadjusted;	adjust carburetors;
	wrong setting of motorcycle wheel camber and toein;	set them according to this manual;
	low air pressure in tires;	inflate tires;
	wheel brakes are misadjusted;	adjust wheel brakes according to this manual;
	wear of piston set	replace worn-out parts
Clutch		
Clutch slipping	Incomplete engagement due to misadjustment of clutch control linkage;	Adjust clutch control linkage;
	driven disk linings are oiled;	wash linings in gasoline and dry them;
	wear of driven disk linings	replace linings
Clutch fails to be released completely	Misadjustment of clutch control linkage	Adjust control linkage
Gearbox		
Oil leakage on primary shaft splines	Primary shaft seal sleeve withdrew from bearing	Press-fit sleeve as far as it will go
Oil leakage from gearbox breather	Excessive quantity of oil in case	Drain oil to the required level, clear breather
Noise and jerks in gear shifting	Clutch release mechanism is misadjusted	Adjust mechanism with the aid of adjusting bolt
Noise in gearbox during driving of motorcycle	Wear of gears;	Replace gears;
	insufficient level of oil in case	add oil to the required level
Self-disengagement of gears	Wear of teeth on gearshift sleeves;	Replace worn-out gearshift sleeves;
	slackening of gear-shift disk fixing;	replace spring of catch;
	clutch release mechanism is misadjusted	adjust mechanism
Final Drive and Differential		
Oil leakage from case drain hole or labyrinth seal between wheel and final drive	Excessive level of oil in case;	Drain oil to the required level;
	collar seal is damaged;	replace seal;
	wheel axle nut is not tightened	tighten nut
Excessive heating of final drive case	Insufficient oil level in case;	Add oil;
	brake shoes rub on wheel brake drum	adjust brake
Front Fork		
Knocking in front fork	Clearance in steering column bearings;	Remedy clearance by tightening of bearings;
	clearance in joint by pipes of fork blades in traverse due to unscrewing of fastening nuts;	remedy clearance by tightening of nuts;

Continued

Trouble	Cause	Remedy
	absence or insufficient quantity of oil in fork shock-absorbers;	determine cause of oil leakage. Remedy failures in tightness. Fill oil in shock-absorbers;
	great clearance between jam nut and upper cap of spring;	set clearance according to this manual;
	great wear of sleeves of fork blade pipes	replace sleeves
Shock-absorbers		
Leakage from shock-absorbers	Wear of rod seal;	Replace rod seal;
	sealing ring is broken;	replace ring;
	wear of rod	replace rod
Excessive swinging of rear suspension	Insufficient quantity of oil in shock-absorbers;	Overhaul shock-absorbers, wash them and fill with appropriate quantity of oil;
	upper valve of piston fails to fit tightly or shock-absorber lower valve fails to fit to its seat;	overhaul shock-absorber, wash, if necessary, grind valve and piston end face;
	wear of piston, rod, pipe	replace worn-out parts
Stiff operation of rear suspension	Metering ducts on piston or shock-absorber lower valve are clogged	Disassemble shock-absorbers, wash and fill with oil
Electrical Equipment		
Ignition key is fully inserted and turned to position I:		
pilot lamp of operation of generator and generator regulator, pilot lamp-indicator of neutral position in gearbox and emergency oil pressure pilot lamp (with non-operating engine) fail to light up, horn fails to operate	Fuse blown in fuse unit;	Replace fuse;
	failure in contact of specified instruments circuit;	remedy contact;
	pin of ignition lock terminals "2" or "3" disconnected	connect pin
Upon variation of engine crankshaft revolutions from low to high ones pilot lamp of operation of generator and voltage regulator fails to go out (its light does not flicker up)	Generator fails to generate the required voltage, regulator fails to operate, loose contact of storage battery terminals	Check reliability of connection of wires of generator and generator regulator, check serviceability of generator and voltage regulator, check generator and voltage regulator for serviceability, trim and tighten terminals
When great lamp in headlight is switched on (upon action of distance light and dim light switch), only distance light or dim light is switched on	One of filaments in lamp burnt out;	Replace lamp;
	failure of contact in light switch	remedy contact

Continued

Trouble	Cause	Remedy
Continuous lighting of stop tail lamp	Great tension of spring of stop-light switch; rod external end is dirty	Adjust spring tension by shifting of switch; remove dirt
When turn indicator switch is switched on, turn indicator lamps fail to light up	Lamps burnt out or failure of contact in connections; turn indicator blinker is defective	Replace lamps, remedy contact; replace blinker
Reduction Gear		
Oil leakage from wheel side	Excessive level of oil; worn-out final drive seal	Drain oil and pour 200 cm³ of fresh oil; replace the seal
Great cardan shaft play as viewed from differential end	Slackened tightening of weight	Tighten the wedge

MAINTENANCE

The service life of the motorcycle depends on the quality of maintenance and materials used in the process of its operation. The maintenance of the motorcycle consists in regular cleaning and washing, checking of technical condition of the units and assemblies, adjustment and lubrication.

The kinds of maintenance of the motorcycle are as follows: check inspection and daily maintenance (ETO); maintenance after the run of the first 2500 km; maintenance No. 1 (TO-1) after the run of every 5000 km; maintenance No. 2 (TO-2) after the run of every 10000 km; seasonal shifting of the motorcycle from an autumn-winter service to a spring-summer one and vice versa.

The above-mentioned maintenance intervals are recommended for operation of the motorcycle on the roads with small quantity of dust. In the event of operation on the dusty or dirty roads the maintenance intervals must be reduced. In the process of each kind of maintenance in addition to the compulsory list of jobs all discovered faults are to be remedied.

The list of jobs for the maintenance of the motorcycle depending on its run is given in Table 1. The list and intervals of lubrication jobs are given in Table 2 and the lubricants to be used are specified in Table 3.

Table 1

List and Intervals of Maintenance Jobs

Job	Kind of maintenance		
	2500 (running-in period)	M-1	M-2
Engine			
Tighten nuts of cylinder head fastening studs	×		×
Tighten nuts and carburetor fastening screws	×		×

Continued

Job	Kind of maintenance		
	2500 (running-in period)	M-1	M-2
Check and, if necessary, adjust expansion clearance between valve rods and rocker ends	×	×	×
Wash sediment cup and fuel filter of gasoline cock, remove and wash carburetors and blow off jets and valves with compressed air			×
Check and, if necessary, adjust carburetors for minimum stable rotation frequency of crankshaft at idle running and synchronous operation of cylinders	×	×	×
Blow through air filter element		×	
Replace air filter element			×
Remove carbon deposit from surfaces of combustion chambers of cylinder heads, pistons, piston rings and valves. Check valves for tightness and, if necessary, grind them			×
Remove centrifuge, disassemble and clean of dirt			×
Power Transmission and Running Gear			
Check reliability of attachment of engine, gearbox, final drive, front fork, handlebars, shock-absorbers, gasoline tank; silencers, generator, sidecar to motorcycle and sidecar body to running gear, headlight, etc. If necessary, tighten attachments	×	×	×
Check and, if necessary, adjust clutch release mechanism and brake control linkages	×	×	×
Check tension of wheel spokes and, if necessary, tighten them	×	×	×
Check and, if necessary, adjust tightening of wheel bearings	×		×
Check and, if necessary, adjust tightening of steering column bearings	×		×
Disassemble brakes of all wheels, wash parts in kerosene, wipe and check their technical condition			×
Check and, if necessary, tighten body travel limiter rod and sidecar rubber spring attachment	×		×
Check and adjust the amount of toe-in and camber of wheels of motorcycle and sidecar	×		×
Exchange wheels and check pressure in tires		×	×
Electrical Equipment			
Check operation of all electric devices, check the condition of insulation in electric circuits. Remedy all discovered faults			×
Check timing angle and, if necessary, adjust it	×		×
Check and, if necessary, adjust breaker contact point gap	×		×
Remove breaker from camshaft, clean parts of dirt deposit, lubricate friction surfaces. Check condition of contacts, if necessary, trim them, adjust gap and timing angle			×

Continued

Job	Kind of maintenance		
	2500 (running-in period)	M-1	M-2
Clean sparking plugs of carbon deposit, check and, if necessary, adjust sparking plug gap			×
Remove generator, perform its incomplete disassembly, clean generator inner chamber of brush and copper dust			×

Notes: 1. The sign "x" indicates the necessity of performing the job at the given run of the motorcycle. The deviation of the intervals for performing the jobs is admissible for not over 200 km of the run. 2. In the process of operation as a result of different causes the necessity can arise of performing any of the jobs specified in Table 1 irrespective of the run of the motorcycle. The carrying-out of such a job is not to be postponed until the next kind of maintenance. 3. Maintenance of the storage battery is to be performed in accordance with its operating instructions supplied with the motorcycle.

Table 2

List and Intervals of Lubrication Jobs

Ref. No. in Fig. 44	Unit or assembly	Number of lubrication points	Lubrication job	Kind of maintenance		
				Daily maintenance	M-1	M-2
5	Engine crankcase	1	Check oil level, if necessary, add oil	×		
			Replace oil		×	
6	Gear case	1	Check oil level, if necessary, add oil	×		
			Replace oil		×	
12	Final drive and differential gear case	2	Check oil level, if necessary, add oil	×		
			Replace oil		×	
8	Front fork	2	Ditto			×
2	Motorcycle rear wheel and sidecar wheel suspension shockabsorbers	3	Ditto			×
3	Breaker:					
	lever axle	1	Apply 1—2 drops of oil		×	×
	felt	1	Apply 2—3 drops of oil		×	×
	plate axles	2	Lubricate with oil		×	×
	cam hole	1	Ditto		×	×
1	Steering column bearings	2	Disassemble steering column, wash supporting bearings, fill fresh lubricant, assemble steering column			×
4	Wheel hub bearings	3	Dismantle wheel, remove bearings, remove old lubricant from hub, wash bearings in kerosene and lubricate them			×

Continued

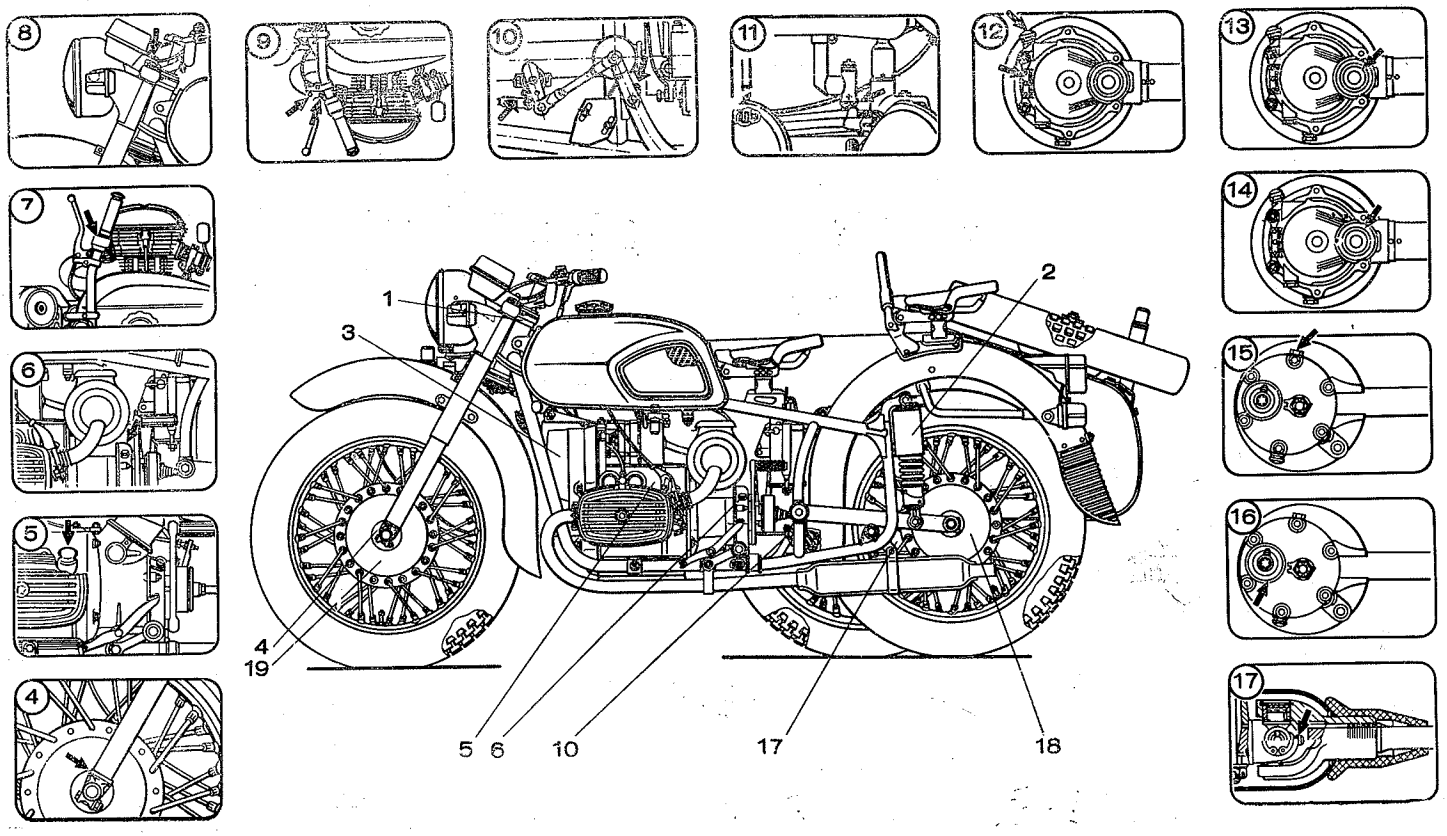
Ref. No. in Fig. 44	Unit or assembly	Number of lubrication points	Lubrication job	Kind of maintenance		
				Daily maintenance	M-1	M-2
14	Speed reducer cardan shaft splines	1	Lubricate splines		×	×
15	Speed reducer case	1	Check oil level, if necessary, add oil	×		
			Replace oil		×	×
13, *16*, *17*	Cardan shaft universal joint	1	Lubricate with the aid of lubrication gun			×
18,19	Wheel brake cams	6	Dismantle wheel, disassemble brake, wash cams and holes in disk, apply fresh lubricant onto axle and working surface of cams			×
			Apply lubricant onto taper thread. Remove excessive lubricant	×		×
10	Rear wheel brake control linkage hinges	2	Lubricate with the aid of lubrication gun		×	×
9	Axles of clutch operating lever and front brake operating lever	4	Apply 2—3 drops of oil to each axle		×	×
	Clutch and brake control cables	4	Fill 2—3 cm³ of oil into cable sheath		×	×
7	Throttle control handle and cables	1	Lubricate slider and chain		×	×
11	Collet joints of sidecar attachment to motorcycle	2	Lubricate thread of collet bolts			×
	Nuts intended for fastening of exhaust pipes	2	Lubricate nut thread	When dismantling and mounting exhaust pipes		

Note. The sign "×" indicates the necessity of performing the job at the given run of the motorcycle. The deviation of the intervals for performing the jobs is admissible for not over 200 km of the run.

Table 3

Lubricants to Be Used

Ref. No. in Fig. 42	Unit or mechanism	Lubricant
5	Engine crankcase	Oil М-6$_3$/10В or М-8В$_1$
6	Gear case	Oil ТСп-15К or ТАП-15 В in summer, ТСп-10 in winter
12	Final drive case and differential gear case	Ditto



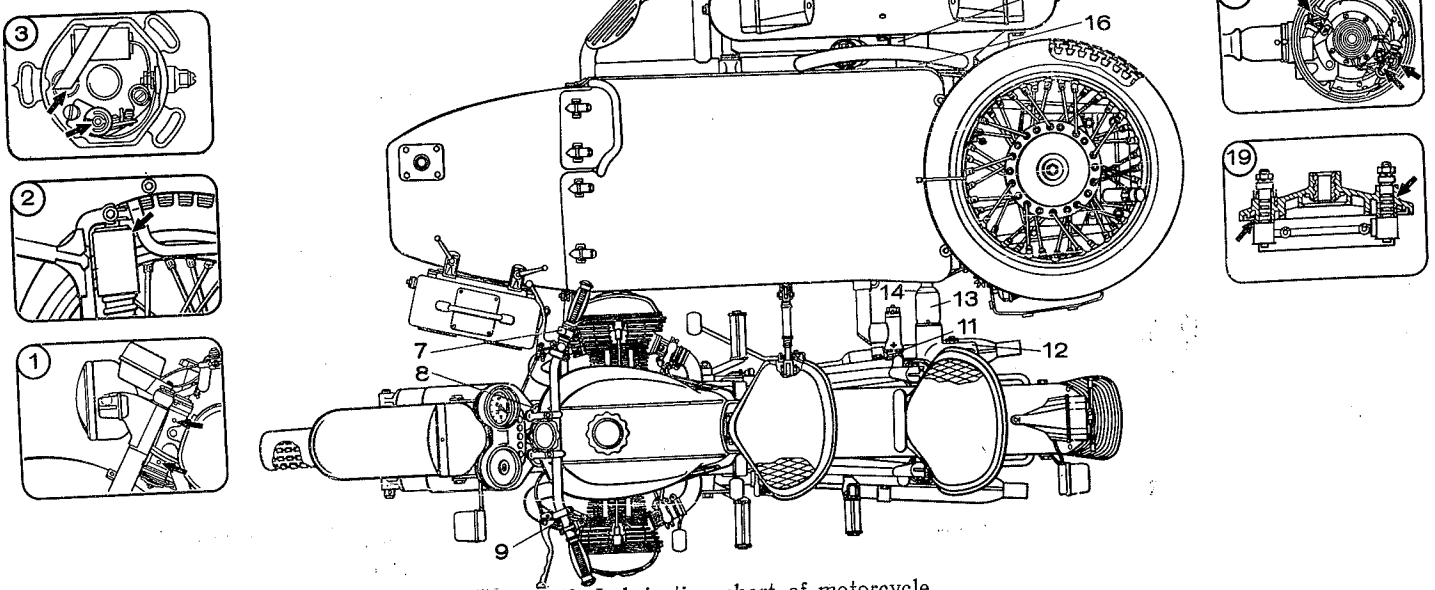


Fig. 42. Lubrication chart of motorcycle

Continued

Ref. No. in Fig. 42	Unit or mechanism	Lubricant
		Oil M-6$_3$/10B or M8B$_1$ Oil TCп-15 K or TAП-15 B in summer, TCп-10 in winter
15	Speed reducer case	
1	Steering column bearings	Lubricant Lithol-24
4	Wheel hub bearings	Ditto
13, 16, 17	Cardan shaft universal joint bearings	Ditto
18, 19	Axles and cams of brake shoes, adjusting taper and pushers	Ditto
14	Speed reducer cardan shaft splines	Ditto
10	Brake control linkage hinges	Ditto
11	Sidecar attachment collet joints	Ditto
7	Throttle control handle	Ditto
3	Breaker: arm pivot, felt, weight axle, weight journal and cam sleeve	Oil M-6$_3$/10B or M-8B$_1$
9	Axles of clutch and brake control levers. Clutch and brake control cables	Oil M-6$_3$/10B or M-8B$_1$
8	Front fork shock-absorbers	Oil M-6$_3$/10B or M-8B$_1$, shock absorber fluids АЖ-12Т, АУП
2	Shock-absorbers of motorcycle rear wheel and sidecar wheel suspension	Shock absorber fluids АЖ-12Т, АУП
	Nuts intended for fastening of exhaust pipes	Graphite grease УСсА

CHECK INSPECTION

The check inspection is to be carried out before a trip with the aim of checking the motorcycle whose technical condition must correspond to the traffic rules and to the requirements set forth in the present manual.

In the process of the check inspection you are to check: presence of gasoline in the tank and oil level in the units; operation of brakes and steering gears; air pressure in the wheel tires; operation of the headlight, stop light, horn, turn indicators of the motorcycle. All discovered faults are to be remedied.

DAILY MAINTENANCE

The daily maintenance is to be performed after a trip and comprises: filling of the motorcycle with gasoline and oil; cleaning of the motorcycle of dust and dirt and, if necessary, washing; checking the attachments for condition. In this case pay special attention to the attachment of the handlebars, front fork to the steering column, sidecar to the motorcycle, tightening of the wheel axles; checking of the wheels and tires for condition; serviceability of the brakes, light and sound signalling, headlight, instrumentation and controls of the motorcycle.

The operation of the brakes is to be checked on the move. The discovered faults are to be remedied. The engine, gearbox and final drive are to be cleaned best of all with the aid of a hair brush moistened in kerosene.

Only the cooled engine can be washed from a hose. In washing the motorcycle you are to avoid a great head of water, do not direct the water jet straightly onto the generator, generator regulator, storage battery, headlight, air cleaner, carburetors, breather plugs of the gearbox and of the final drive. The moisture which has got inside the separate units can cause corrosion and can involve some hardly removable defects. Prior to washing the air choke of the air cleaner is to be closed.

SEASONAL MAINTENANCE

In autumn: wash the tank with clean gasoline after draining the sediment from the tank and throughly check the ignition system so as to avoid the difficulties in starting the cold engine in winter.

In autumn and spring change the electrolyte density in the storage battery, if this is required by the climatic conditions for operation of the motorcycle.

MAINTENANCE IN LONG-TIME STORAGE

The motorcycle is to be stored best of all in the dry well-ventilated room at a temperature of not below 5 °C and relative humidity of 50—70 %.

The storage battery is recommended to be removed from the motorcycle and to be stored separately in accordance with its operating instructions.

When the motorcycle is stored in the room in which the solar radiation is available, the tires are to be covered with the cases made of moisture-penetrable material. The use of the cases made of a moisture-proof material facilitates the moisture condensation which in the event of a long-time storage can result in corrosion of the parts.

The storage of the motorcycle near the acids, alkalies, chemical fertilizers and other aggressive media is inadmissible.

To prepare the motorcycle for a long-time storage, proceed as follows: thoroughly clean the motorcycle of dust and dirt and wash it; the washing over, wipe the motorcycle dry, remove the corrosion traces and re-paint the spots with defective paint coat; fully fill the motorcycle tank with gasoline and shut off the cock.

Start the engine and fully consume the gasoline from the carburetor float chambers; unscrew the sparking plugs and fill 25—30 cm^3 of motor oil heated to 70—80 °C into each cylinder; rotate the crankshaft through 10—15 revolutions by pressing on

the pedal of the starting gear lever and screw the sparking plugs into the cylinders; lubricate all chromium-plated surfaces with preservative oil.

Close the inlet holes of the silencers by waste or oiled paper.

Install the motorcycle on the supports (props) and decrease the tire air pressure to 0.05—0.1 MPa (0.5—1.0 kgf/cm²).

Lubricate the set of tools with preservative oil and wrap into oiled paper.

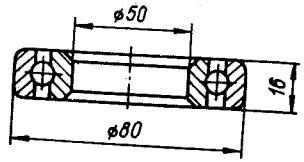
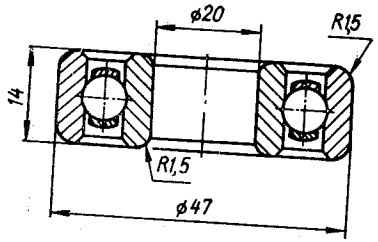
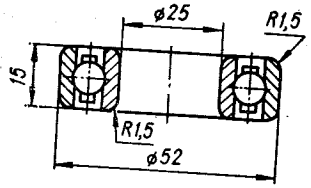
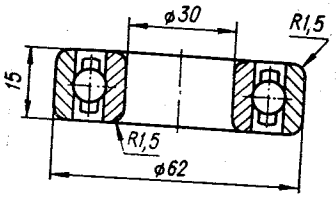
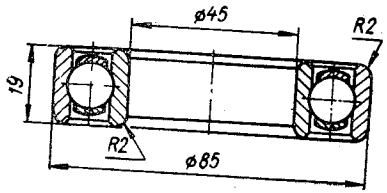
In the process of storage the maintenance of the motorcycle consists in the following: remove the cover from the motorcycle once per two months and inspect the motorcycle, if the corrosion traces are discovered, trim the corroded spots and repaint them; unscrew the sparking plugs, engage the first gear, rotate the crankshaft through 10—15 revolutions with the aid of the starting gear lever and screw the sparking plugs into the cylinders again: turn the handlebars 2—3 times to this and that side; press on the pedal and levers of the brake and of the clutch 3—5 times, turn the throttle control handle.

Represerve the article as specified in the log.

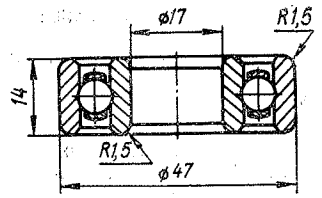
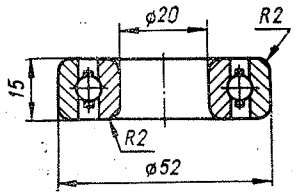
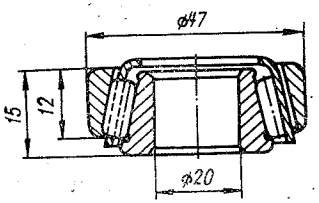
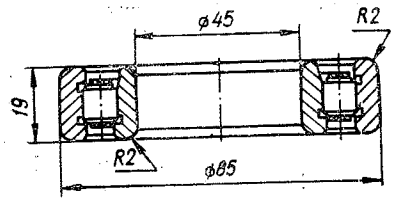
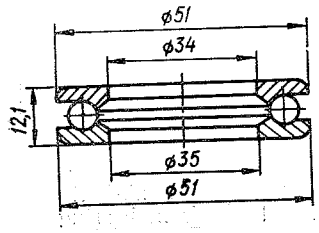
APPENDICES

ANTIFRICTION BEARINGS

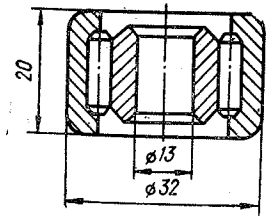
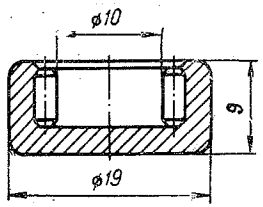
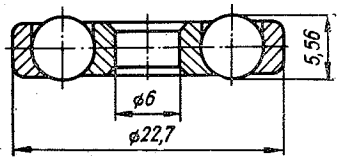
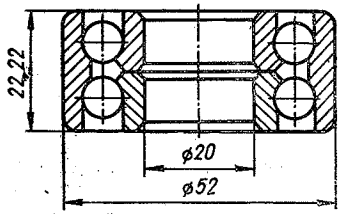
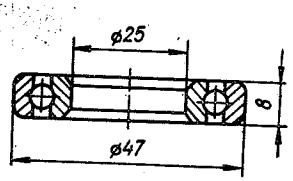
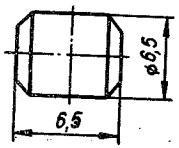
APPENDIX 1

Sketch	Bearing No. and type	Place of installation	Quantity per motorcycle, pc
	110 Radial ball bearing	Differential cup. Right-hand cover of speed reducer	2
	204 Radial ball bearing	Differential cover. Left-hand cover of speed reducer. Camshaft rear bearing	3
	6-205 Radial ball bearing	Camshaft front bearing. Gearbox primary shaft	2
	206 Radial ball bearing	Left-hand cover of speed reducer	1
	209 Radial ball bearing	Crankshaft front bearing	1

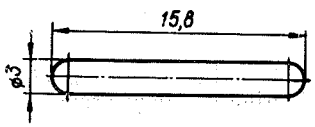
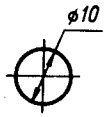
Continued

Sketch	Bearing No. and type	Place of installation	Quantity per motor-cycle, pc
	303 Radial ball bearing	Gearbox primary shaft	1
	304 Single-row radial ball bearing	Gearbox main shaft	2
	6-7204A Single-row tapered roller bearing	Wheel hub	8
	6-42209 Radial roller bearing with short cylindrical rollers	Crankshaft rear bearing	1
	778707 Radial-thrust ball bearing	Steeering column of motor-cycle frame	2

Continued

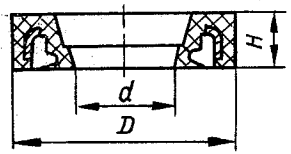
Sketch	Bearing No. and type	Place of installation	Quantity per motor-cycle, pc
	874901 Needle bearing	Driving gear of final drive	1
	904700УС17 Needle bearing	Universal-joint centre-cross	13
	948066 Thrust ball bearing	Gearbox clutch release mechanism	1
	3086304Л Double-row radialthrust ball bearing	Driving gear of final drive. Differential cover, speed reducer lefthand cover	3
	7000105 Radial ball bearing	Differential left-hand hub	1
	Roller ДУ 6.5× ×6.5 КВР	Final drive case	29

Continued

Sketch	Bearing No. and type	Place of installation	Quantity per motorcycle, pc
	Roller 3×15.8	Final drive case	90
	Ball IV10 H	Oil pump body	1

APPENDIX 2

RUBBER SEALS



Part number	Part or unit to be sealed	Quantity per motorcycle, pc	Dimensions, mm		
			D	*d*	*H*
7201124-Б	Camshaft	1	30	15	7
MT801190	Crankshaft	1	85	59.7	12
75004122	Starting gear shaft	1	34	19.5	8.5
7204151	Primary shaft	1	45	31.5	7
КМ3-8.15204156	Main shaft	1	48	36	8
7205113-Б	Final drive case, speed reducer cover	2	93	44	12.5
7205033	Cardan shaft fork	6	49.3	33.8	8
75006350-A	Wheel hub, differential speed reducer	6	38	24.8	8
MT804130	Shaft of gearbox crank	1	30	15.8	7
75008121	Front fork	2	45	34.5	16.6
75008159	Steering column	2	59.6	51	5
63-26155	Suspension shock-absorber	3	24	11.1	8
MT803605	Clutch control rod	1	10.3	4.4	8

APPENDIX 3

CONTENT OF PRECIOUS METALS IN THE MOTORCYCLE DEVICES

Device	Quantity per motorcycle	Silver, g
Generator Regulator PP330	1	0.347606
Blinker PC427	1	0.026139
Emergency oil pressure transmitter MM126	1	0.0375
Stop-light switch ВК854Б	1	0.0259

APPENDIX 4

DIRECTIONS ON INSTALLATION OF REMOVABLE EQUIPMENT

Installation of Rear-View Mirror

To install the rear-view mirror on the motorcycle proceed as follows:

unscrew nut *1* (Fig. 1) and remove washer *2* from post *3* of the mirror;

insert post *3* into hole *4* of left bracket *7*;

mount the washer and the nut and lightly tighten the latter;

by turning post *3* and mirror *6* (having preliminary slackened screws *5*), set the mirror to such a position as to enable the driver to see the vehicles following the motorcycle without moving his body;

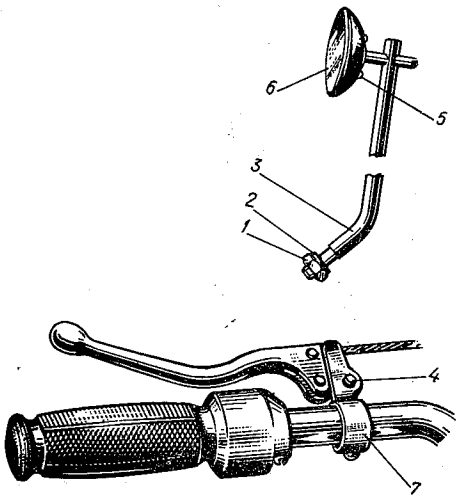


Fig. 1

draw up the post nut and screws *5* of the mirror ball joint tight.

Installation of Storage Battery

In case the motorcycle is supplied together with the 6MTC9 storage battery placed in the boot, install the storage battery on the motorcycle, to do so proceed as follows.

Put liner *1* (Fig. 2) on the storage battery platform, install the storage battery on it and fasten the battery with strap *2*, in so doing hook one of the strap ends over the projections of bracket *3* and pass the other one through a hole in the storage battery platform following which secure the strap ends by nuts *4* and *5* preliminary putting washer *6*.

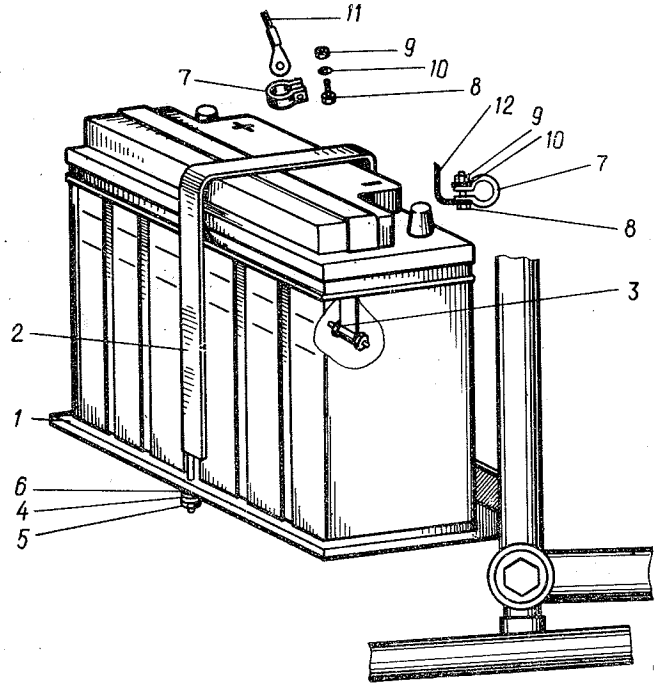


Fig. 2

Connect lugs *7* to wires *11* and *12* with the help of bolts *8*, nuts *9* and washers *10* (Ref. Nos *7, 8, 9, 10* are to be found in the boot together with the SPTA bag).

Connect the wire lugs to the storage battery terminals (wire *11* running from the main cable — to the "+" terminal and wire *12* running from the "frame" switch — to the "—" terminal). Tighten up bolts *8*.

Installation of Mudguards

To install the left-hand mudguard (or the right-hand one) on the motorcycle, proceed as follows:

take the left-hand mudguard (or the right-hand one) in assembly out of the boot;

unscrew one bolt *1* (Fig. 3) intended for fastening of clamp *2* and slacken the other one;

install mudguard *3* on front sidepipe *4* of the motorcycle frame, in doing so put the clamp on the sidepipe and mount the previously unscrewed fastening bolt, then position the mudguard in such a manner so that it would not touch gasoline tank *5* and engine *6;*

draw up nuts of the clamp fastening bolts tight.

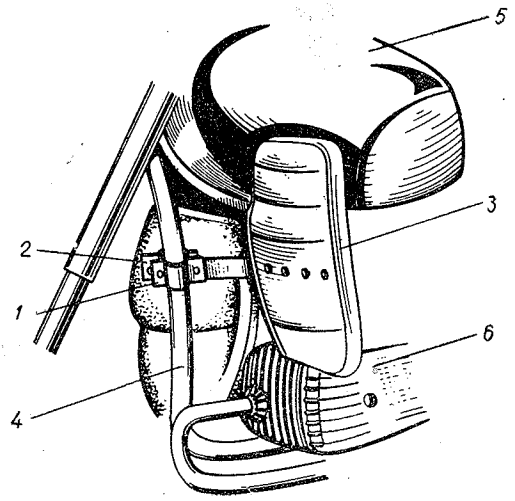


Fig. 3

Installation of Driver's Windshield

Stand up before the motorcycle facing its headlight and holding the windshield in your hands.

Attach the windshield to its place of installation holding up glass *2* (Fig. 4).

Swing up apron *1* over glass *2*.

Unscrew one bolt of the headlight fastening.

Advance support *3* to the external side of the headlight fastening bracket and insert a bolt, sleeve and washer into the support hole.

Fasten support *4* likewise.

The other ends of the windshield supports are to be secured to the motorcycle handlebars pipe with the aid of binding clips *5* that are part of the windshield set.

Ensure a reliable windshield fastening by tightening in turns the headlight fastening bolts and the nuts of the support binding clips.

Lower the apron and fit it over the headlight through a hole in it. Secure side pullers *6* of the apron alternately on the left and on the right under forward bolts *7*.

Having released brackets *8* on rear bar *9* of the windshield, lower or elevate the windshield in order to provide for the most convenient postion of the driver.

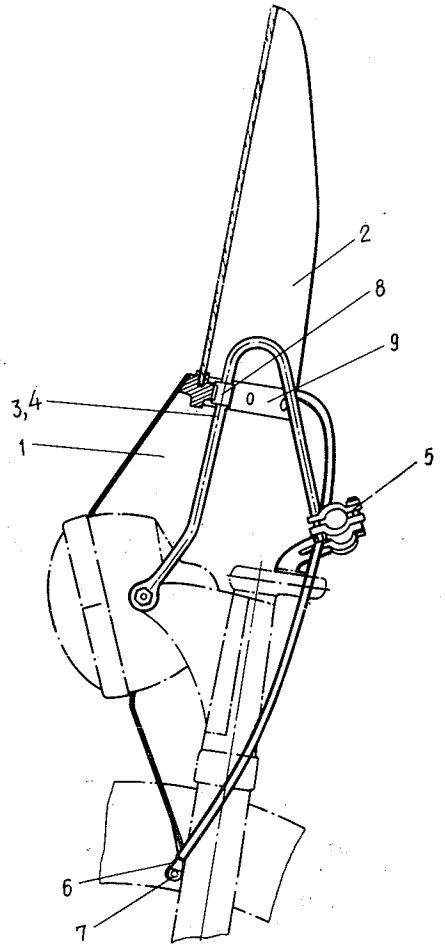


Fig. 4

Installation of Swivel

To install the swivel in its working position, proceed as follows:

fold the back of the sidecar body seat, release two clips fastening the swivel and take it out of the boot;

make sure that binding clip *2* (Fig. 5) of the swivel is positioned correctly. Teath *3* of the binding clip must face the end of rod *1* of the swivel;

remove the rubber plug from pole *4* of the sidecar body. Insert rod *1* of the swivel into the pole. In so doing the binding

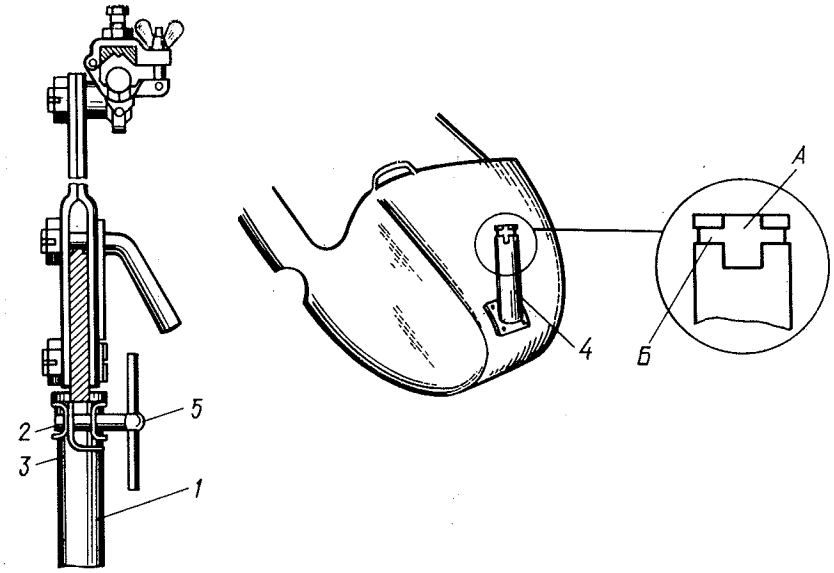


Fig. 5

clip teeth must travel over vertical flat *A* on the external surface of the pole. By turning the binding clip, introduce teeth *3* into annular groove *Б* of the pole;

having released the clip by slackening screw *5*, set the required hight of the swivel following which tighten the clip by screw *5*.

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