U S S R –
Ministry for mechanical engineering

Irbit Motorcycle Works

Manual for a Motorcycle with Sidecar M - 72

City of Irbit 1954

Translated 02/2006 Curt Peredina: Edited 01/ 2007 Charles Harvin

Attention Driver:

During the first 2000 km all parts of the engine and drive train must wear in thoroughly. In this time any overloading or lugging of the engine or excess of the speeds indicated in the chapter "test run of a new motorcycle" must be avoided.

In order to prevent this, the carburetors are lead sealed and may only be broken after 1000 km. Upon breaking the lead seals, times are to be recorded in the presence of the responsible motor vehicle officer.

These times are atta hed to the Kfz. documents if a complaint should be necessary. Breaking the lead seals before the prescribed time is strictly forbidden.

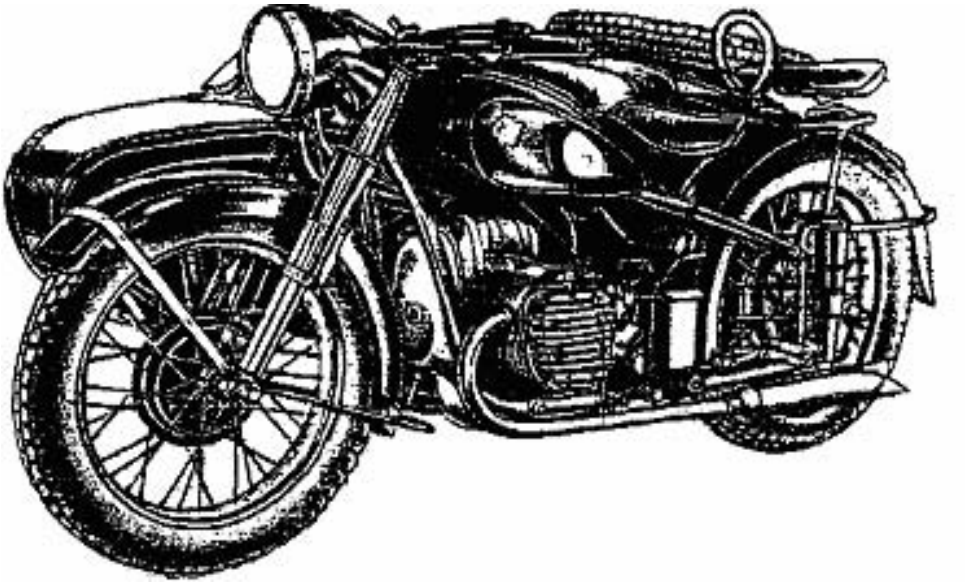


Fig. 1
The M-72 Motorcycle

Introduction

If one does not understand the construction of the motorcycle or adhere to the maintenance schedules one cannot depend on its trouble free operation. This document outlines the maintenance and operation procedures for the M-72 motorcycle and describes the construction of the mechanisms of the motorcycle.

The care, adjustment and lubrication of the motorcycle should be systematically carried out according to the information provided in this manual. If the driver follows these instructions the motorcycle will provide extended, trouble free operation.

In order to operate the machine correctly one must know its construction, functions and adjustment procedures.
With a motorcycle there are no "small things" or unnecessary parts. Without a specific reason one should not disassemble the motorcycle: the correct interaction of parts can be altered through unnecessary dismantling and/or reassembly of machine parts, causing premature wear or breakage.

Technical examinations must be made systematically to avoid the need for extensive repairs.

Technical Characteristics of the Motorcycle

General Data

Wheel base of the motorcycle. 1400mm
Chassis clearance. . . . . 130 mm
Exterior size of the motorcycle (with sidecar):
Length. . . . . 2420 mm
Width. . . . . 1600 mm
Height. . . . . 980 mm
Saddle Height. . . . . 720 mm
Weight (with full fuel tank):
without sidecar. . . . . 220-225 kg
with sidecar. . . . . 340-350 kg
Load-carrying capacity (incl. full crew of three persons)
(with sidecar)…….. . . . . 300 kg
Maximum speed with sidecar. …….. . . . . 85 km/hr.
Fuel consumption over 100 km with sidecar (on even highway route at a
speed of 50 to 60 km/hr).. . . . . 7 l
Approximate distance coverable in 1 tank of fuel. . . . . 300 km
Oil consumption over 100 km. . . . . 0.25 l

The Engine

Engine type: Four Cycle
Number of cylinders: two
Cylinder alignment: horizontal in the angle of 180 degrees
Bore: 78 mm
Stroke: 78 mm
Capacity: 746 ccm
Compression: 5.5 ±0,2
Maximum output with 4450 4800 U/min: at least 22 HP
Cooling: Air cooling
Valve situation: lower
Lubrication system: combined gear wheel pump and spraying system
Oil tank capacity: 2 l.

The Fuel Supply System

Gasoline tank capacity: 22 l
Number of carburetors: two
Carburetor type: K - 37
Fuel: 66 (A 66 - A 70) octane Gasoline
Fuel filters: Mesh filter in the body of the gasoline cock
Air cleaner: two-stage oil cleaning.

Electrical Equipment

Ignition system: Battery ignition
Ignition coil: UG - 4085 - B
Distributor: PM - 05
Spark plugs: Well 11/11 A U
Ignition advance: Setting lever on steering bars
Battery: SMT 14 - 6 V 14 Ampere
Ampere of generator: G - 11 - A 6 V 45 Watts
Relay automatic controllers: RR - 31
Signal (horn): S 35 A
Headlights: FG - 6
Other accessories: Tail light on rear fender, side light on the sidecar, tail light on the sidecar, signal button, dimmer switch.

Power Transmission

Clutch: Dry two-disk friction clutch
Transmission: Two-speed four-stage transmission
Gear shift: Foot pedal and gearshift lever
Transmission oil capacity: 0.8 l
Drive: cardan shaft
Reduction in the rear-wheel drive: 4.62
Final drive oil capacity: 0.175 l

Gear reductions:
1st Gear: 3,6
2nd Gear: 2,28
3rd Gear: 1,7
4th Gear: 1.3

Entire reduction ratio:
1st Gear: 16,65
2nd Gear: 10,55
3rd Gear: 7,85
4th Gear: 6,01

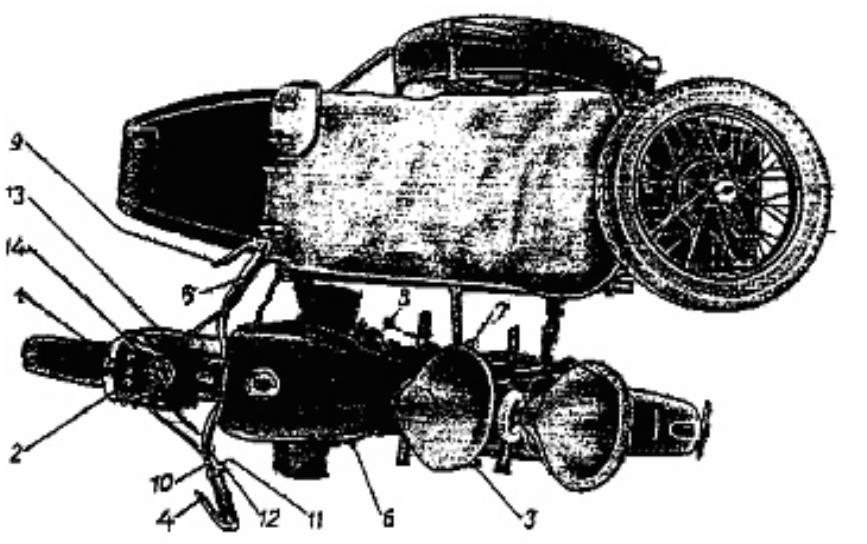


Fig. 2
The Control Mechanisms

1. Central switch 2. Indicator light 3. Starter pedal 4. Clutch 5. Throttle 6. Foot shift lever 7. Gearshift lever 8. Foot (rear) brake pedal 9. Hand (front) brake lever 10. Ignition setting lever 11. Low beam shift lever 12. Signal button 13. Steering Damper 14. Speedometer

The Control Mechanisms of the Motorcycle

The ignition key and central switch (1) are mounted on the headlight and allow for the following settings:

I. The ignition key is out, the switch is in central position, and all functions are switched off.
2. The key is out; the central switch is turned to the left: headlight with parking light, the tail light of the motorcycle and the lights of the sidecar.
3. The key is inserted; the switch is in the central position: the ignition is activated. The indicator light (2) illuminates. (After starting the engine the indicator light is off.)
4. The ignition key is inserted, the switch is turned to the left: the ignition is activated; headlight with parking light, the tail light of the motorcycle and the lights of the sidecar. (Setting for travel at night on well illuminated roads or d rin day i ht if head i ht is re ired).
5. The ignition key is inserted, the switch is turned to the right: the ignition is switched on, the tail light and the sidecar lights illuminated. When pressing on the button the signal sounds. High or low headlight beam is selected by the dimmer switch on the steering bars. (Setting for travel at night on badly lit roads).
The starter pedal (3) is located on the left side of the motorcycle. Starting occurs by sharply pressing the pedal downwards with your foot. The pedal then returns by a spring to the original starting position.

The clutch lever (4) is on the left side of the steering bars. While pulling in the lever the clutch is disengaged and the crankshaft of the engine is separated from the drive train. The transmission must be in neutral while starting.

The rotary hand throttle (5) is on the right side of the steering bars. With rotation of the throttle toward you the engine increases RPM. Rotate away and the engine RPM decreases. The tension of the throttle cables is limited in a new assembly: if you experience overly difficult throttle rotation inspection is necessary to prevent possible damage or failure in the cables.

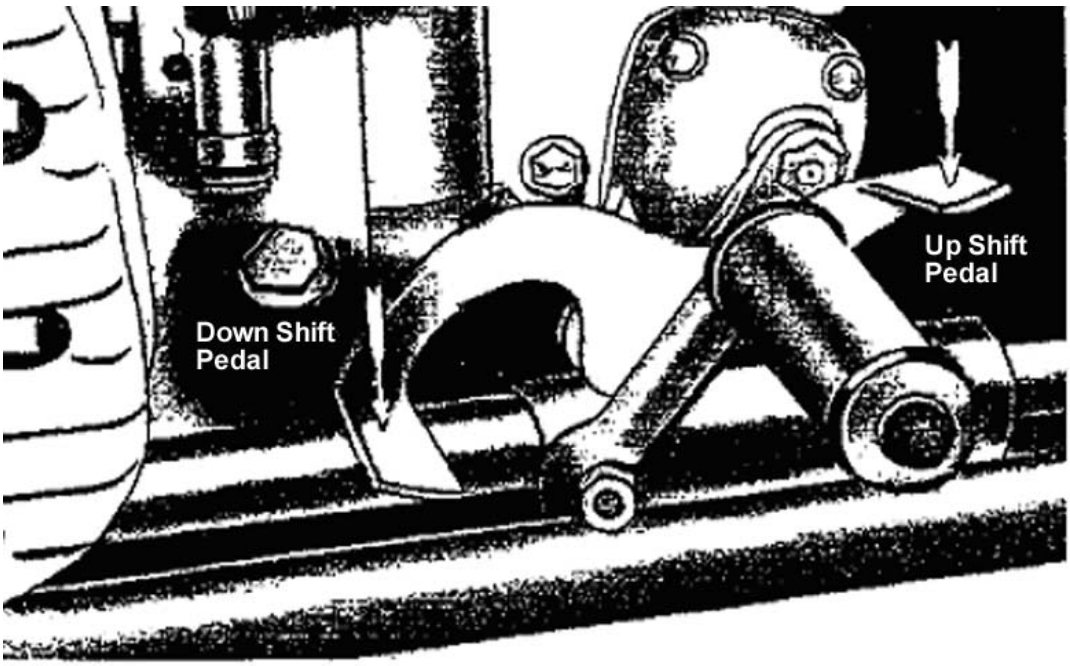


Fig. 3
The Foot Shift Lever

Shifting Gears

The foot shift lever (Fig. 3) lies under the left foot of the driver and is a double-armed lever with two pedals. The transmission is shifted by pressure on the front or rear pedal of the lever. After every shift the pedal goes back to the ori ina position.
To shift into the first gear one must depress the forward pedal of the lever. When switching to 2nd gear one must depress the rear pedal. When switching to the 3rd gear one must again step on the rear pedal, and when switching to 4th gear the rear pedal is depressed once more.
The neutral gear is between the 1st and 2nd gear. To switch from 1st to neutral the rear pedal is depressed by a half gear, and when switching from 2nd gear the front pedal is likewise depressed 1/2 gear. The idle position may be located more conveniently by using the gearshift lever (7, Fig. 2) located on the right side of the transmission (the lever is slightly curved for this).

Manual Preparations for Driving

A careful examination of the machine before driving is an absolute condition for trouble free operation of the motorcycle and to avoid incidents on the road. Before traveling one must make an inspection of the motorcycle and ensure that it is in roadworthy condition. Furthermore, one must test the presence and security of all bolts and connections. Show special attention to the connection of all nuts/bolts on the axle of the rear wheel, the engine and the sidecar; also inspect the saddle and the steering bars as well as the effectiveness of the brakes. When refueling the motorcycle, absolute cleanliness must be observed in order to avoid any foreign objects which could clog the passages of the carburetors. In strong rain or snow it is advisable to refuel the motorcycle in a protected place. Gasoline should not be overfilled.

DO NOT SMOKE WHILE REFUELING.

One must also check that sufficient oil is present in the crank case. This is monitored by unscrewing the dipstick then replacing it to rest on the threads (do not thread the dipstick back into the case when checking oil levels). The oil level should reach but not exceed the highest mark of the dipstick. Finally the tire pressure is to be examined and, if necessary, the tires inflated. After completion of the inspection and refueling one can start the engine.

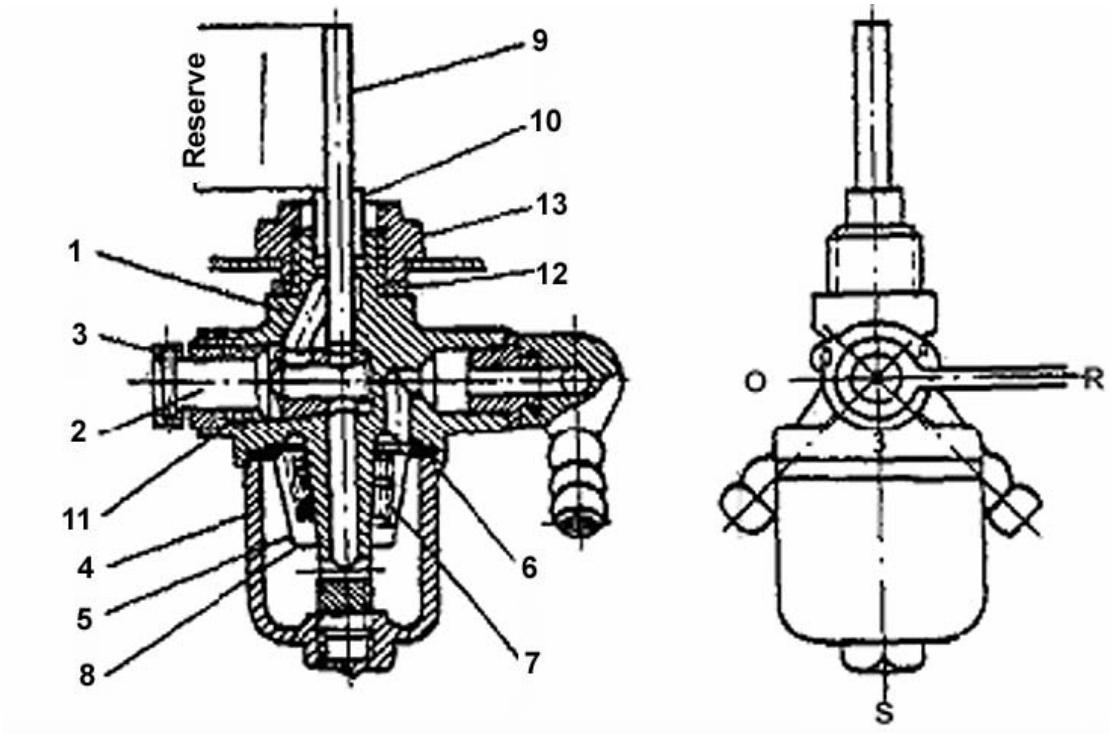


Fig. 4 The Fuel Petcock

1. Housing, 2. Gate valve, 3. Hand lever, 4. Bowl, 5. Filter cup,
6. Bowl Washer, 7. Filter screen, 8. Filter feather/spring, 9. Main gasoline line,
10. Reserve gasoline line, 11. Gate valve seal, 12. Gasoline housing seal, 13. Body

S - Cock closed, 0 - cock open, R - cock on reserve consumption.

Starting the Engine

The following procedure is used to start the engine:
1. The shift lever is set to neutral.
2. The gasoline petcock open, (with lever turned to the right on the letter 0 - open - (fig. 4).
3. **With cold engine**: adjust the ignition setting lever (the lever on the handlebar) to spark advance, open the throttle slightly, press the carburetor tickler to overfill the bowl, close the air flap (choke) and step several times on the starter to suck in the gas mixture in the cylinders.
4. **With warm engine**: the ignition setting lever and the throttle are adjusted as in point 3. The float bowl of the carburetor does not need to be filled, the choke is not to be closed and the mixture needs not to be sucked in (no pre-kicking necessary). The ignition key is to be inserted completely. If the position is correct, the red indicator light illuminates.

5. Sharply, but not too forcefully, the kick starter is to be pressed down. After starting, the engine **must warm up**. This is necessary because the oil must be warmed to properly lubricate. The engine must warm up with an average RPM, one should never use full or open throttle. Once the engine is warm, the choke can be opened.

Driving Rules

When starting one must disengage the clutch completely and switch to 1st gear by pressing the front pedal of the foot shift lever. One turns the throttle lever to increase the number of revolutions of the engine and engages 1st gear evenly at the same time. The motorcycle should move slowly from the starting position: do not release the clutch quickly or the transmission will be overloaded and the engine will stop. Also one must not disengage the clutch at high RPM, although the RPM must be high enough that the engine does not stop when engaging the clutch. If the motorcycle in 1st gear reaches a speed of 10 to 15 km, one must shift into 2nd gear. For this disengage the clutch and ease off the throttle, quickly pressing on the rear pedal of the foot shift lever to change gear then evenly again engage the clutch and give more throttle as necessary.

After one reaches a speed of 20 to 30 km, one switches the same way into 3rd gear, and at a speed of 35 to 40 km the 4th gear. Afterwards the speed is adjusted by the throttle. Shifting into 3rd and 4th gear with a lower speed is not permitted, as the engine will become overloaded.
One should also not drive at higher speeds in the 1st and 2nd gears because the engine develops high RPMs, is cooled poorly, is subjected to abnormal wear and has an increased consumption of fuel.

To start one may only use the 1st gear. With lower driving speeds and when driving in the city one must use 3rd. or even the 2nd gear holding below the speeds indicated.

One uses the clutch only when starting and when changing the gears. Coupling is to take place calmly and evenly. Do not partially disengage the

clutch in order to overcome an upward gradient or let it slip to increase the RPM. In urban traffic conditions where the driving speed is often changed, one must shift and adjust the throttle, but do not adjust speed by slipping the clutch. Slipping the clutch causes abnormal wear of the clutch disks.

When braking one must throttle down and step on the brake simultaneously. One must brake carefully, because the possibility of hurling or tilting the motorcycle is very high with sharp braking. Sharp braking is particularly dangerous in the winter and/or on wet roads.

When riding the motorcycle the ignition advance must be increased at the same time as the increase of the RPM, since one cannot otherwise achieve full power of the engine. One must make note however of the fact that with too much spark advance the power of the engine is reduced. If the spark advance is too advanced, then bright metallic ringing sounds (pinging) with an increase of load or sudden opening of the throttle. In this case one must set the ignition lever to ignition retard.

Too much ignition retard causes an overheating of the engine and power loss. In order to adjust the ignition correctly, each driver must study and know the motorcycle engine intimately.

During travel on an upward gradient one must plan ahead and adjust the speed of the machine in such a way that stalling is avoided. If during travel the engine becomes overloaded, then one must shift into a smaller gear and adjust the ignition.

During acceleration it is extremely important to pay attention to the condition of the road since large holes can be the cause of accidents. If a motorcycle drives near sufficient speed on a strong upward gradient and is in a high gear, then switch to 2nd or 1st gear to the end of the hill. If the engine stops on the upward gradient, one must hold the motorcycle with the hand (front) brake, start the engine, switch to 1st gear, then release the clutch and the brake at the same time.

With steep downward grades 2nd or 1st gear is to be used along with the brake.

Short distances of dry, loose sand should be transversed in 2nd or 1st gear with enough speed to drive through while maintaining even RPMs.

One must be reminded of the fact that extended travel in 1st and 2nd gear can cause engine overheating. Therefore you must occasionally stop in order to assist engine cooling.

In thick, rough dirt one must drive the same as with loose sand. If much dirt has accumulated under the fenders the rotation of the wheels becomes difficult, and it must be removed.
One must drive over furrows and holes slowly and brake beforehand while driving over them. One crosses deep ditches diagonally at an angle, and at

slow speed in 1st gear. When driving out of the ditch, give it throttle.

Cross railroads and streetcar crossings at a right angle. If one approaches a railway crossing one must slow down and switch to 1st or 2nd gear before crossing the rails.
During travel with poor visibility (at night or fog) extreme caution is to be practiced and remember that the braking distance depends on the driving speed and on the condition of the brakes and roads. Consequently one is to limit the speed according to the view.

If one must stop on the road, stop on the side rather than in the roadway. In order to avoid running out of gasoline the petcock is to be closed when switching the engine off. In order to prevent draining of the battery, remove the ignition key.

When shutting down the machine you must make a daily inspection.
It is particularly important to make certain that there are no oil or battery acid leaks.

Breaking In a New Motorcycle

Correct breaking in of a new motorcycle increases the life span of the machine. Breaking in is divided into two time periods, driving from 0 to 1000 km and driving from 1000 to 2000 km. When breaking in one may not exceed the following speeds:

Gear	from 0 to 1000 km	from 1000 to 2000 km
1	10 km/hr	15 km/hr
2	20 km/hr	35 km/hr
3	35 km/hr	50 km/hr
4	50 km/hr	70 km/hr

These speeds refer to the travel of a motorcycle with sidecar on an even road surface. Automatic controllers are attached to the carburetors, which must be shortened after the first 1000 km and be removed completely after 2000 km. One is not to completely rely however on the automatic controllers but rather limit the speed. The best breaking in method which ensures the fastest and most correct alignment of parts is an alternating driving acceleration up to the maximum permissible speed on short distances (500 m) and a following decelerating run with throttle back. After the first 2000 km one is not to go into a longer travel distance yet on full power: one should increase to the maximum speed gradually as one approaches 3000 km.

With a broken in machine (with sidecar) one may not exceed the following maximum speeds:

Gear	Km/hr
1	20
2	45
3	65
4	95

A new motorcycle requires increased attention during breaking in, as the parts gradually wear. In this period one should not overload the machine or drive on difficult roads.

One may not let the engine run with a high RPM and overheat. It is necessary to occasionally tighten the cylinder head bolts for better seating of the gaskets.

During breaking in much attention must be paid to lubricating the engine. After the first 500 km the used oil is emptied, the oil pan is washed and fresh oil up to the necessary height is again filled up.

The sequence with the oil change is:
Empty the oil only with a warm engine
Tighten the oil plug and fill up to the appropriate level.

During breaking in one must change the oil again at 1000 km.
At the conclusion of breaking in (after 2000 km) the oil in the engine, the transmission and in the rear transmission must be changed.

The sorts of the oils and quantities which can be used are indicated in the Lubrications Table (page 55).

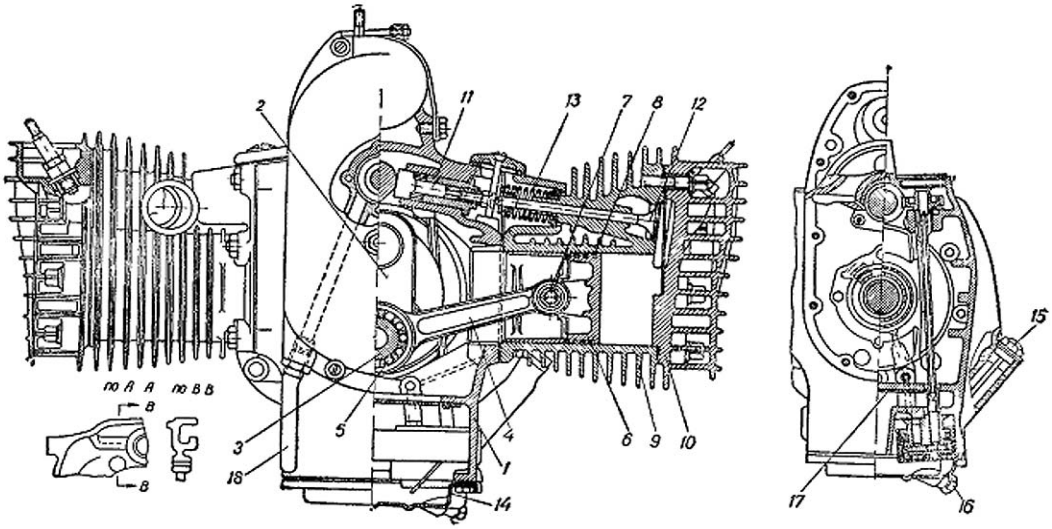


Fig. 5
The Engine

1. Housing 2. Crank cheek 3. Crankpin 4. Piston rod 5. Lower piston rod head bearing
6. Piston 7. Gudgeon pin 8. Piston rings 9. Cylinder 10. Cylinder head 11.Tappet
12. Valve, 13. Valve spring 14. Oil pan 15. Oil filler neck threads
16. Drain screw connection 17. Filter 18. Oil filler neck vent pipe

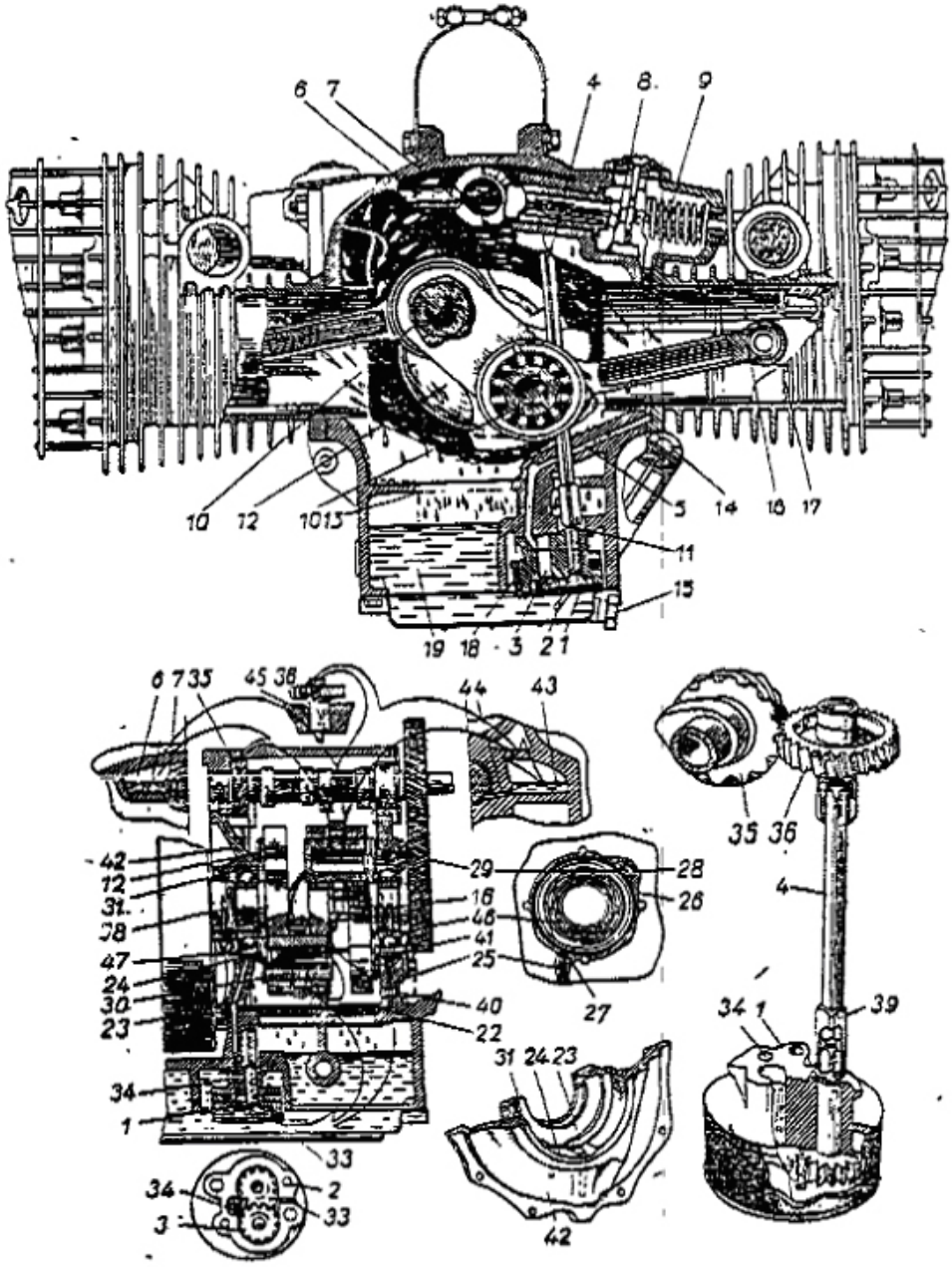


Fig. 6
Engine Lubrication Schematic

1. Oil pump housing 2. Drive gear 3. Propeller gear 4. Tie bar 5. Left cylinder oil line 6. Oiling line 7. Oil line valve 8. Hole in valve housing 9. Hole in the left cylinder 10. Crankpin 11. Oil pump housing seal 12. Oil cup 13.Oil discharge filter 14. Charging hole screw connection 15. Outflow hole screw connection 16. Opening for gudgeon pin lubrication 17. Oil wiper ring 18. Oil pump filter 19. Oil reservoir 22. Main line 23. Oil channel to rear bearing 24. Oil seeping channel 25. Front clamp channel 26. Enular groove 27. Bearing house oil channel 28. Recess for the expiration of oil 29. Oil line pipe 30. Radial openings in the crank ring 31. Crank shaft lubrication channel 33. Oil pump inlet port 34. Oil pump discharge opening 35. Drive gear 36. Oil pump drive gear 38. Oil stripping groove 39. Drive gear coupling sleeve 40. Outflow hole 41. Radial recess in the bearing house 42. Housing of the rear clamp 43. Oiling ash 44. Oil line channel 45. Lubricating recess for oil pump drive gear 46. Front supporting ball bearing 47. Rear supporting ball bearing

One characteristic of this engine is the horizontal situation of the cylinders, which ensure good cooling and even operation. The presence of a carburetor on each cylinder serves to increase the performance of the engine: the fuel intake is balanced and it is necessary to have even adjustment of both carburetors.

The lubrication system of the engine is a combined pressure and spraying system. A total lubrication pattern of the engine is shown in fig. 6. The steel oil pan forms the main oil reservoir. The oil is carried from the oil pan by means of a gear pump through the mesh filter (18).
The oil pump is propelled by the cam shaft by a pair of spiral toothed gears. The oil pump has only one compression phase, which consists of a pair of attached gear wheels in the pump housing.

The gears press the oil into the main line (22). From the main line the oil runs under pressure to four places: to two oil cups (12) via the channels (23) and (25), to the left engine cylinder by the channel (5) and to the teeth of the crankshaft drive gear by the connecting pipe (29).

The oil, which runs out of the connecting pipe, arrives at the gears of the crankshaft and lubricates the gear teeth of the cam shaft and the generator.

The surplus oil runs off and flows back into the oil pan of the housing.
The oil comes from the slots into the oil cups, which are in the seats of the crankshaft ball bearings.

From the oil cups the oil runs into the holes of the crankpins and from there, under the effect of the centrifugal force, through the openings to the ball bearings of the large piston rod heads.

The surplus oil runs out of the oil cups and connecting rod bearings and is distributed around the inside the housing.

The intense pressure of the oil and the high temperatures promote the spraying of a fine oil mist in the housing, lubricating the work surfaces of the cylinders, the gudgeon pins, the sockets of the small piston rod heads, the cams, the crankshaft ball bearings, the tappet guides and the valves.

In order to ensure better lubrication of the camshaft, there are special oiling holes (6), in which part of the misted oil collects.
From these oiling holes the oil runs automatically to the bearings.
In a similar way the bearing of the oil pump drive gear is lubricated.

The sprayed oil arrives only in small amounts to the upper wall of the forward link cylinder as it is blocked by the crankshaft turning in the clockwise direction.

The oil mist does not ensure necessary lubrication: therefore the channel (5) directs the oil to an enular groove at the cylinder flange and from there through three openings in the upper wall of the left cylinder to the left cylinder.

In order to prevent compression of oil by the mutual approximation of the pistons in both cylinders and to prevent an unnecessary drop of the air pressure in the housing, a breather tube (6) is mounted at the end of the cam shaft (fig. 10).

During the mutual approximation of the pistons the opening in the tube end coincides with the opening of the ventilation pipe (18, fig. 5), so that the housing is connected with the outside air.

During the outstroke of the pistons the tube end terminates the connection of the housing with outside air, it develops negative pressure, and the oil mist is sucked off by the distribution gears into the housing. Vibrating the oil prevents clogging and the filter attached in the lower part of the housing assists in limiting foam.

The oil is routed to the crankshaft housing through the filling hole locked on the left side with a bolt (15, fig. 5).

In order to check the oil level a dipstick with two marks is attached at the threaded end of the filling hole. The oil level is to go up to the upper mark. It is not to exceed this and in no case should it fall under the lower mark.

While checking the oil, one is not to screw in the dipstick. Used oil is removed by the drain in the oil pan bottom, locked with the threaded plug (16, fig. 5). With this lubrication system one must not rev the engine in the first few minutes of operation. One must pay serious attention to the lubrication because short suspension or insufficient lubrication can lead to serious damage. Signs of insufficient lubrication are loss of performance and knocking in the engine.

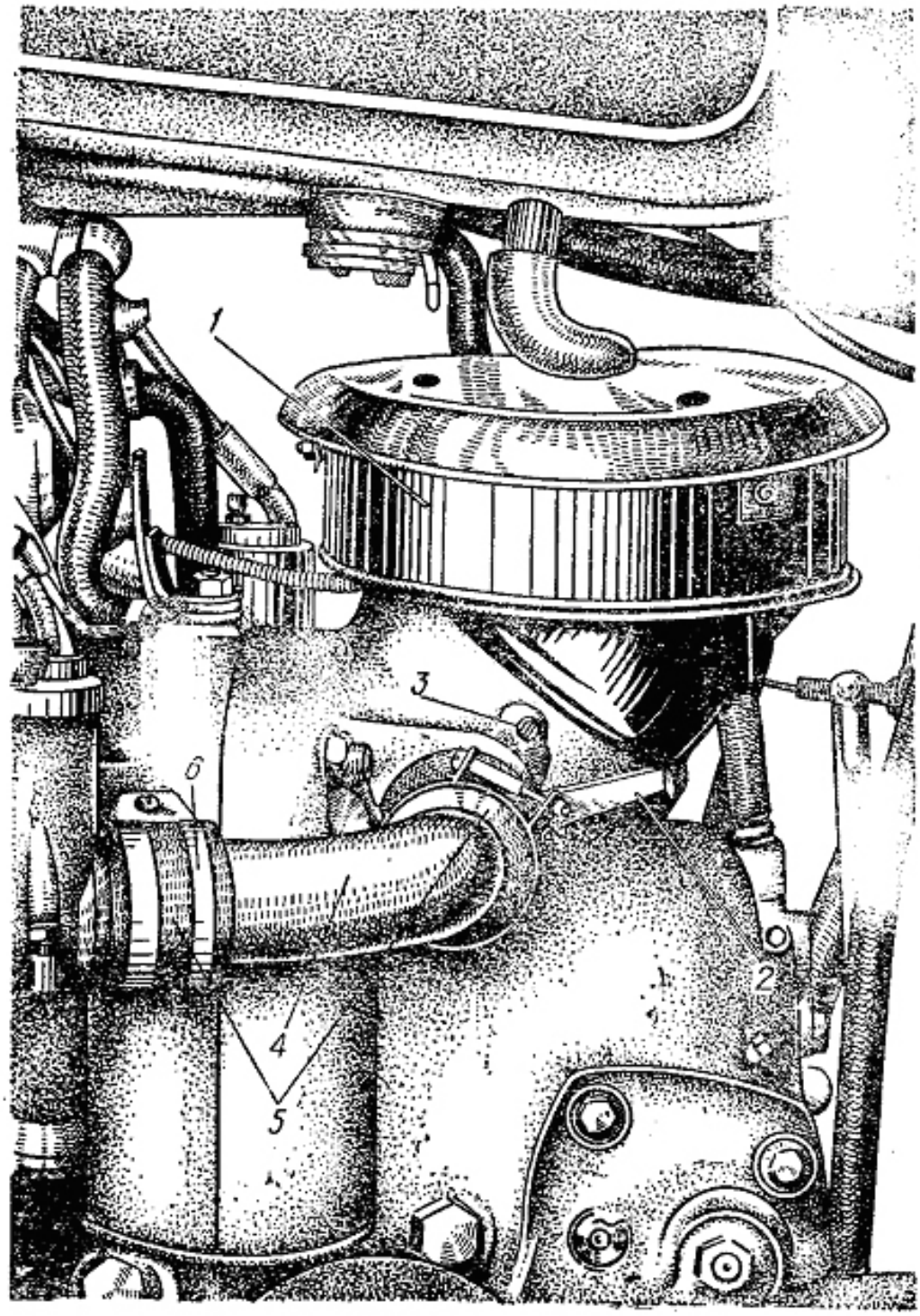


Fig. 7
The Air Cleaner

1. Air cleaner 2. Choke 3. Lock screw 4. Left carburetor intake 5. Rubber seals 6. Gasket clamps

The fuel system supplying the engine takes place via two carburetors model K - 37, which are directly attached at the cylinders. The fuel is supplied to both carburetors from the fuel tank by a petcock and fuel piping.

Both carburetors have a common air cleaner (fig. 7), which is installed at the transmission case by a coupled slide gate valve. The air cleaner is provided with a choke, which facilitates the starting and warming up of the engine in cold weather.

The main cause of wear to the cylinders, pistons, piston rings and all other rubbing parts of the engine are dust and sand which pass through the carburetors into the engine.

The life span of the engine depends on the perfect condition of the air. The air purification process takes place in two stages:
Air passing under the filter cover is directed by the fastened reflector into the oil pan. It then takes a sharp change of direction into the neck of the air cleaner, which has a wire screen. Larger dust particles are caught in the surface of the oil and passed into the pan of the air cleaner. Smaller dust particles, which are pulled along by the air flow, remain stuck in the oiled metal wire of the filter neck.

From the filter neck clean air arrives through the air ducts of the carburetors. In the housing of the air cleaner a disk is attached, which serves as gasket.

Before starting the motorcycle the air cleaner must be checked and if necessary soaked with oil.
1. The lock screws are loosened and the air cleaner is removed from the neck at the transmission case.
2. The upper cover of the air cleaner is removed. If there is no oil present in the air filter one must loosen the lock nut.
4. The oil on the exterior surface of the oil filter is wiped off.
5. Pour oil up to the ring in the oil pan (200 ccm). When pouring the oil the top margin of the tub of the air cleaner must be horizontal.
6. The upper cover of the air cleaner is remounted and the filter is fastened in place.

Note:
1. The air cleaner will use the same oil as the engine. One can recycle used engine oil for the air cleaner if it is filtered first.
2. If one received the motorcycle from the manufacturer, one needs only to check for oil in the air cleaner.
If the motorcycle is in heavy use, one must check daily the oil level in the oil pan and the amount of contamination. It is advisable to make the following periodic washing of the air cleaner and an oil change:

If the motorcycle is driven in particularly dusty conditions, the air cleaner must be washed (without disassembly) every 150 - 200 km. Under normal conditions it should be washed every 500 km.

Washing the air cleaner should be done by immersing it in gasoline and strongly vibrating the wire filling to remove any dust.
Complete disassembly of the air cleaner and washing of the wire filling is necessary every 2000 km.

To disassemble and clean the air filter:
1. The lock screw is loosened and the air cleaner is removed from the transmission case.
2. The upper cover of the air cleaner is removed.
3. The dirty oil is discharged.
4. The lock washer is taken out and the oil absorber disk is removed.
5. The protecting filter and the filling packages are taken out in sequence.
6. The filter housing is cleaned of dirt. The filter and the filling are washed in gasoline, then dried and soaked in oil. The filter is reassembled.
7. Reassembling the air cleaner takes place in the reverse order.
8. The filter is soaked with oil according to the instructions indicated above.
9. After the air cleaner is soaked with oil, one remounts the upper cover, fastens it, puts the air cleaner on the neck at the transmission case and secures it with the lock screws.

For easier starting of the engine a choke is built into the air lines of the carburetors.

With a fully opened flap the lever is in the lowest position, with a closed flap in outermost forward position (with the lever at top.) One should use the choke only for starting the cold engine.

The cold engine is started in the following way:
1. The choke is closed.
2. The float bowls are overfilled.
3. Depress the kick start three or four times to suck in the fuel and air mixture.
4. The ignition switch is turned on and by sharply depressing the starter pedal the engine is started.
5. The engine should be allowed to warm up and then gradually the choke is opened.

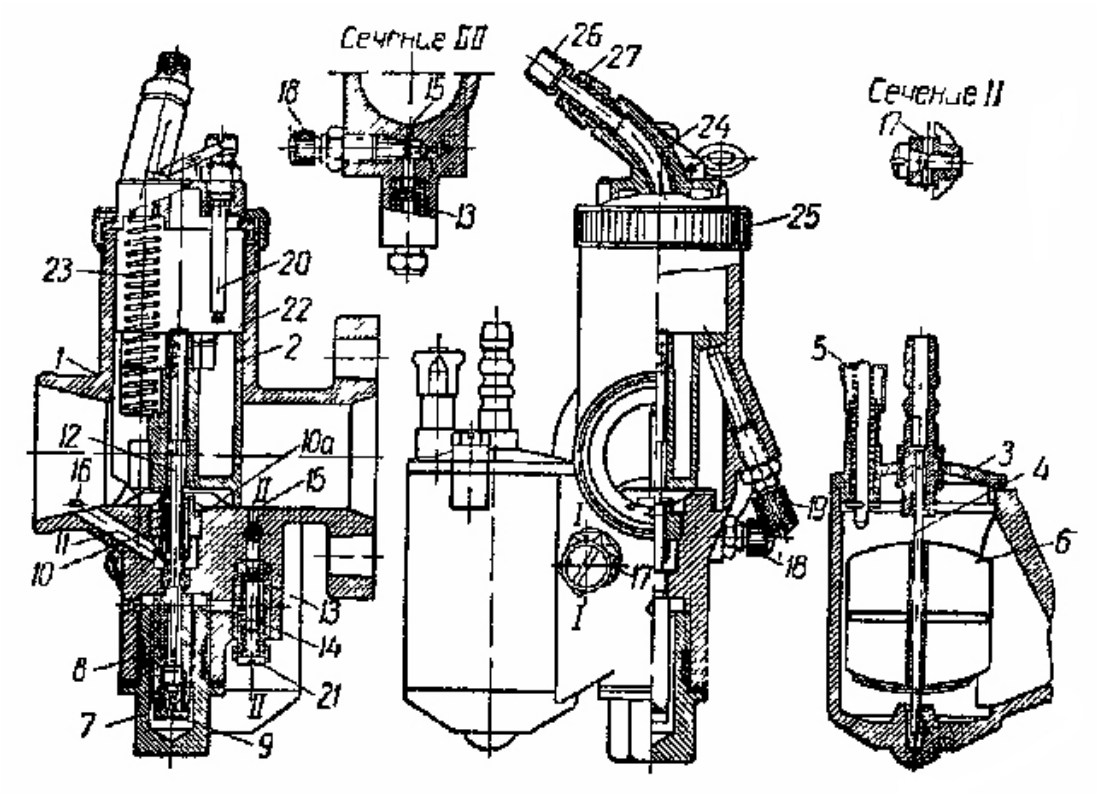


Fig. 8
K37 Carburetor

1. Carburetor Housing 2. Throttle Slide 3. Float frame cover 4. Float Needle 5. Tickler 6. Float 7. Lower filter housing 8. Filter screen 9. Main jet 10. Atomizer 11. Atomizer air duct 12. Slide needle 13. Jet 14. Fuel channel for jet 15. Idle nozzle atomizer l6. Idle nozzle air duct, 17. Auxiliary air duct filter 18. Idle Mixture Adjustment 19. Slide stop screw 20. Break in slide controller 21. Idle nozzle lock screw 22. Attachment pin 23. Spring 24. Frame cover 25. Union nut 26. Cable setting screw 27. Cable screw lock nut

In order to prevent contamination of the fuel supply, a filter screen is inserted in the filler neck of the gasoline tank. In addition the gasoline petcock (fig. 4) has a mesh filter and a sieve (4) and the carburetor connector has small metal filters.

The Carburetors

At 1000 km it is recommended to clean the sieve, wash and clean the fuel filters at the gasoline cock and at the carburetors, wash the carburetors with gasoline and to blow through the nozzles and channels with pressurized air. The signs of contamination of the nozzles or an insufficient fuel supply show up in a sudden and sharp power loss, slamming in the carburetor, and/or in inappropriate RPMs. In this case one must first check whether the pinhole opening is blocked in the gasoline tank cap, which prevents the tank from developing a vacuum. Then one must close the gasoline cock, remove the case and wash the internal filter. After the case is reassembled, one must open the gasoline cock briefly and with a pump blow compressed air through the openings. If the carburetor (fig. 8) is dirty it must be disassembled and

cleaned. For this one must unscrew the lower housing (7), wash the soldered on filter and blow compressed air through the main jet. In no case should one use a steel wire to clean the nozzle as this may alter the nozzle bore and damage the carburetor.
For cleaning the idle nozzle one must loosen the screw (21), take the nozzle out and blow compressed air through it.

By adjusting the idle mix screw (18) one can change the passage of the air duct and adjust the quality of the mixture under low RPMs: by turning screw in the mixture becomes richer, and by unscrewing it the mix becomes leaner.

The slide needle (12) is connected with the slide (2), and goes into the internal channel of the main atomizing nozzle. In this way the fuel arrives at the atomizer by a circular gap between the channel wall of the atomizer and the needle. The needle is conical at the lower end so that when it is pulled upwards the circular gap becomes larger, the atomizer is given an increased supply of gasoline and a richer mixture results .

The adjustment needle is connected with the slide by the split pin (22), which goes crosswise through the openings in the throttle slide and the top of the needle. The needle has four such openings and the slide has two, with the distance between the latter being one and a half times larger than the distance between the openings in the needle.

By advancing one of the openings in the needle to one of the openings in the slide, one can select eight different positions of the needle. The more deeply the needle sits, the richer the mixture; the further out, the leaner the mixture.

The even operation of the two engine cylinders is ensured by the simultaneous function of the carburetors. For this each carburetor is separately tuned in the following order:

1. Clean the carburetor
2. Start, and warm up the engine
3. Set the ignition setting lever to spark retard
4. The lock nut and the fixing bolt (19, fig. 8) are loosened and adjusted so that the slide (2) is easily lifted and the engine increases RPM
5. Use the screw (18) for the adjustment of the mixture after the engine RPMs decrease.
6. Idle adjustment: adjust the screw (18) to balance the mixture to the point at which the engine works evenly with a high RPM. Then unscrew (19) until the RPMs are reduced to the lowest even point. As soon as the adjustment has been completed one must secure the screws (18) and (19) by their lock nuts.
7. Raise the slide of the carburetor by hand at the cable to ensure an increase of RPMs is reached. Adjust the second carburetor in the same manner.

In order to ensure an even synch of the carburetors, one must jack up the rear wheel of the motorcycle, start the engine and shift into 4th gear. Loosen the cable adjustment lock nuts (27). Then switch a cylinder off (remove spark plug cable) and increase the RPM until the pointer of speedometer reaches

30 km. Hold a few minutes at this point, then reconnect the spark plug cable and disconnect the other cylinder. Adjust the cable setting screws so that both cylinders have even RPM. Since such an adjustment is time consuming, one must be careful not to overheat the engine.

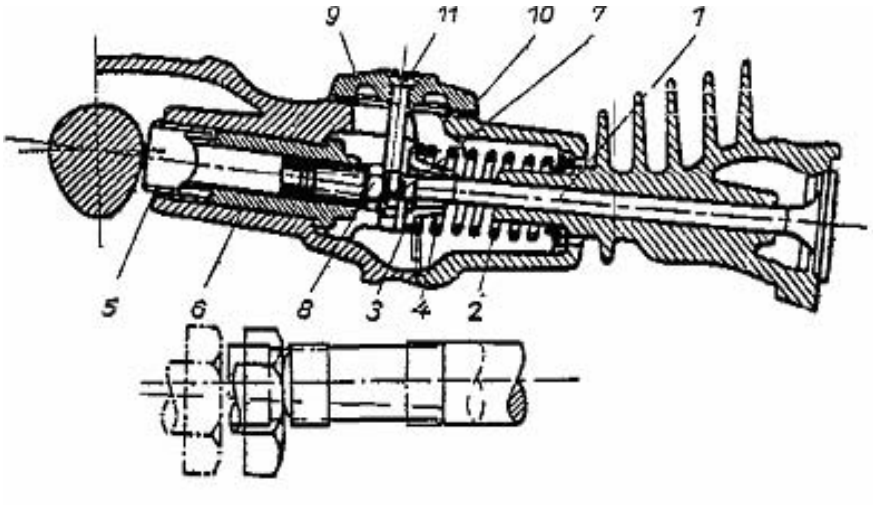


Fig 9
Valve Adjustment
1. Valve 2. Valve spring 3. Valve disk 4. Valve key 5. Tappet 6. Tappet guide
7. Adjusting screw 8. Lock nut 9. Cover 10. Seal 11. Cover screw

Adjusting Valve Clearance

The normal operation of the engine is due to a large extent of a correct valve adjustment. The correct adjustment of the play is an absolute condition for the maximum output of the engine. The adjustment of the play between the valve stems and the tappets takes place after grinding the valves in. The size of the play must after each 500 -- 1000 km to be controlled. The adjustment of the play must be made in the following way with a cold engine:

1. Remove the screw (11, fig. 9) and the covers as well as the seal.
2. The crankshaft is turned until the intake valve closes (a gap should be visible between the tappet and the shank of the exhaust valve.) In this position the play of the exhaust valve is to be adjusted.
Likewise, turn the crankshaft of the engine up to the moment that the exhaust valve begins to close, at which point intake valve is adjusted.
3. For the adjustment of the gap one must loosen the lock nut (8) and turn the adjusting screw (nut) (7) of the tappet in the direction necessary to increase or decrease the gap between the shank & tappet to 0.1mm.
If a gap is not present or is under 0.1mm, then the valve will not seat firmly.
4. Retighten the lock nuts (8), replace the seals, covers and cover screws and repeat the procedure on the other cylinder.

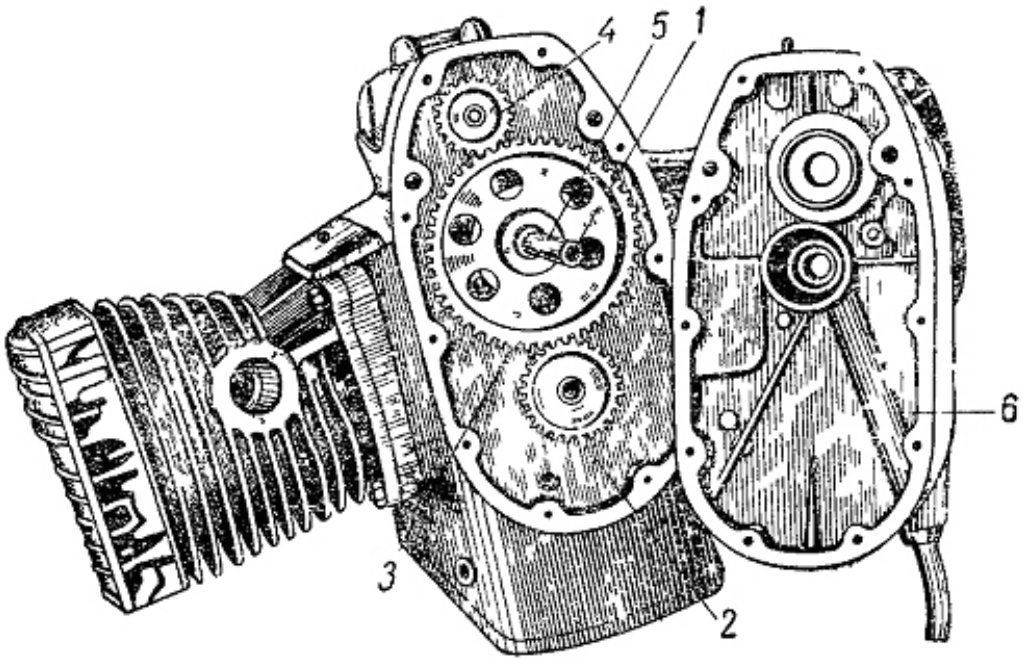


Fig 10
Camshaft
1. Cam shaft 2. Crankshaft gear 3. Cam shaft gear 4. Generator gear 5. Ignition tap
6. Filler neck channel

If dismantling the engine the correct adjustment is determined by meeting the adjusting markings (fig. 10) at the gears of the crankshaft and the cam shaft. Every 7500 to 8000 km the valves must be ground in and the cylinders and pistons cleaned of carbon deposits.

You must not drive with a slipping clutch. When starting and when shifting gears one must engage the clutch evenly and softly. Hard coupling with high RPM leads not only to abnormal wear of the linings of the clutch disks, but also overloads the drive unit and increases tire wear. With the help of a thumbscrew (2, fig. 11) the tension of the clutch cable is adjusted. The cable tension must be adjusted in such a way that the clutch lever (the left lever at the steering bars) has 4 - 5 mm of free play in order to work reliably.

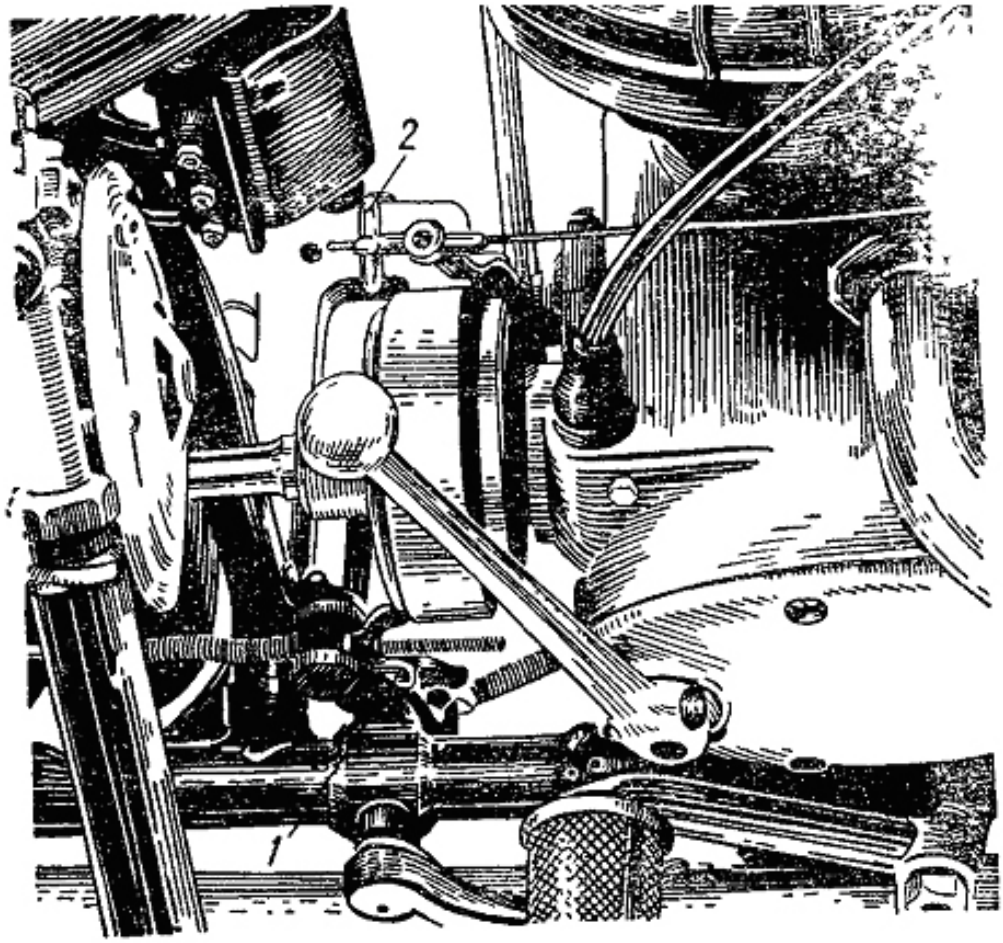


Fig 11
Attitude of the clutch cable and the rear wheel brake
1. Adjusting screw for the rear wheel brake cable 2. Adjusting screw for the clutch cable

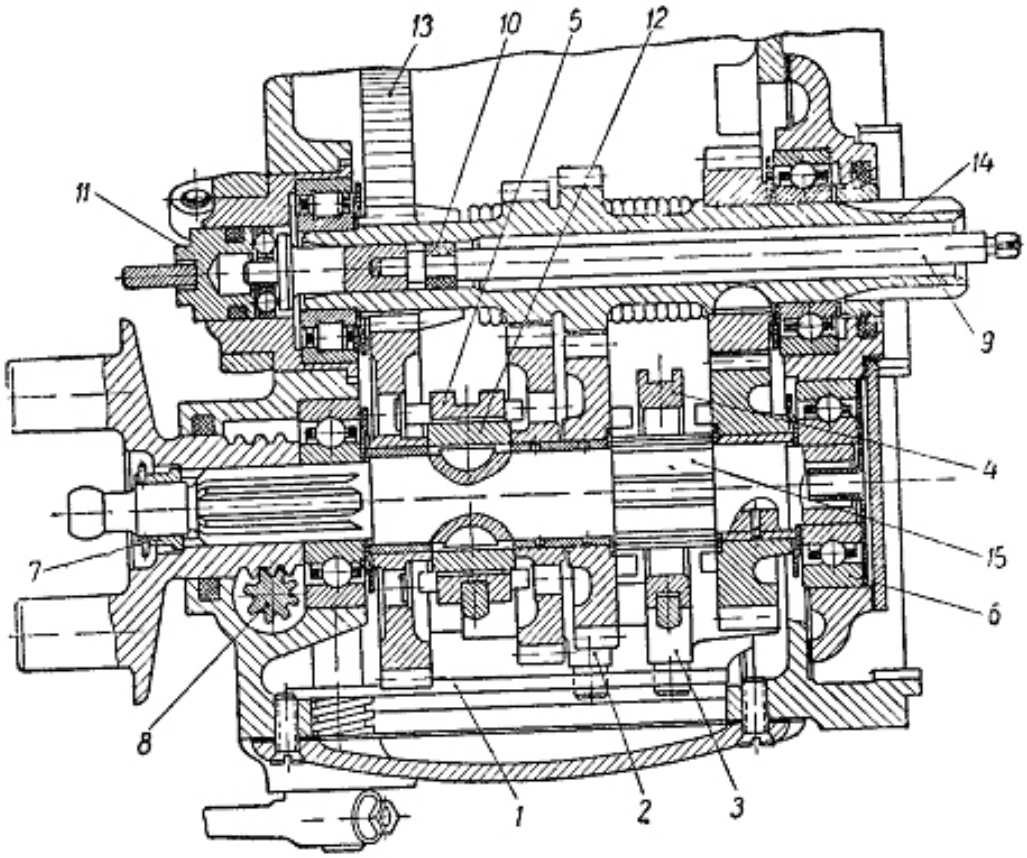


Fig 12
The Transmission

1. Transmission segment 2. 1st & 2nd gear shift fork 3. 3rd & 4th gear shift fork
4. 1st & 2nd gear shift clutch 5. 1st & 2nd gear shift clutch 6. Countershaft housing
7. Countershaft nut & bolt 8. Speedometer drive gear 9. Clutch rod
10. Lubrication head for clutch shifter rod 11. Sliding head of the clutch circuit
12. Slot clutch of the countershaft 13. Starter gear 14. Main shaft 15. Countershaft

The Transmission

The care of the transmission (fig. 12) is generally limited to the punctual refill and/or changes of the oil (see chapter "lubricating of the motorcycle"). The oil level is to go up to the lower thread of the oil filler screw plug. When shifting the transmission or during operation it may be necessary to adjust the shift mechanism for the even operation of the foot shifter, hand shift lever and hand clutch. The adjusting screws must be set in such a way that the transmission shifts smoothly and evenly. An uneven operation of the foot shift lever and hand clutch is determined in the following manner:

1. During the transition from a smaller to a larger gear, the transmission shifts insufficiently and the gears do not engage properly. One can recognize this easily if the hand gearshift lever is difficult to operate. With the foot pedal shifted up one will notice that the hand lever moves

consecutively, the position of the clutch lever is slightly forward and only loosely held in place. In this case one must loosen the lower lock nut at the rear of the transmission and unscrew the lower adjusting screw of the shift mechanism accordingly.
2. During the transition of a smaller gear to a larger the transmission is shifted too far and the gears do not engage properly. In this case one must loosen the lower lock nut at the rear of the transmission and tighten the lower adjusting screw of the shift mechanism accordingly.

3. During the transition of a larger gear to a smaller, the transmission shifts insufficiently and the gears do not engage properly. In this case one must loosen the upper lock nut at the rear of the transmission and unscrew the upper adjusting screw of the shift mechanism accordingly.
4. During the transition of a larger gear to a smaller the transmission is shifted too far and the gears do not engage properly. In this case one must loosen the upper lock nut at the rear of the transmission and tighten the upper adjusting screw of the shift mechanism accordingly.

The adjustment technique is shown in fig. 13.

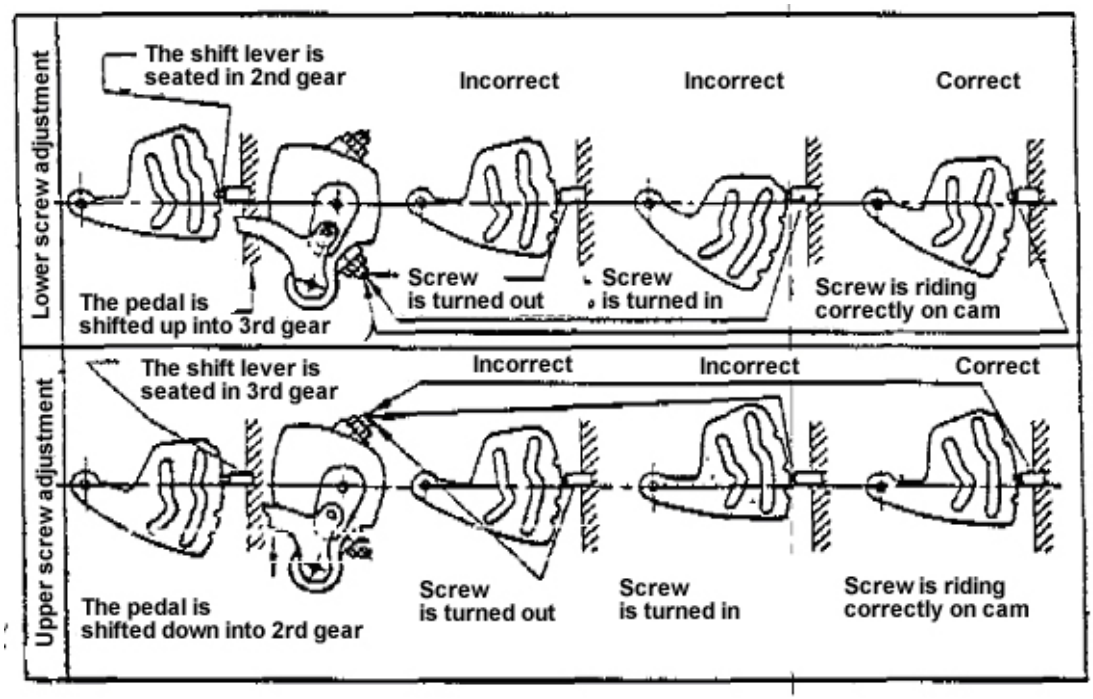


Fig. 13
Adjusting the Foot Shift Lever

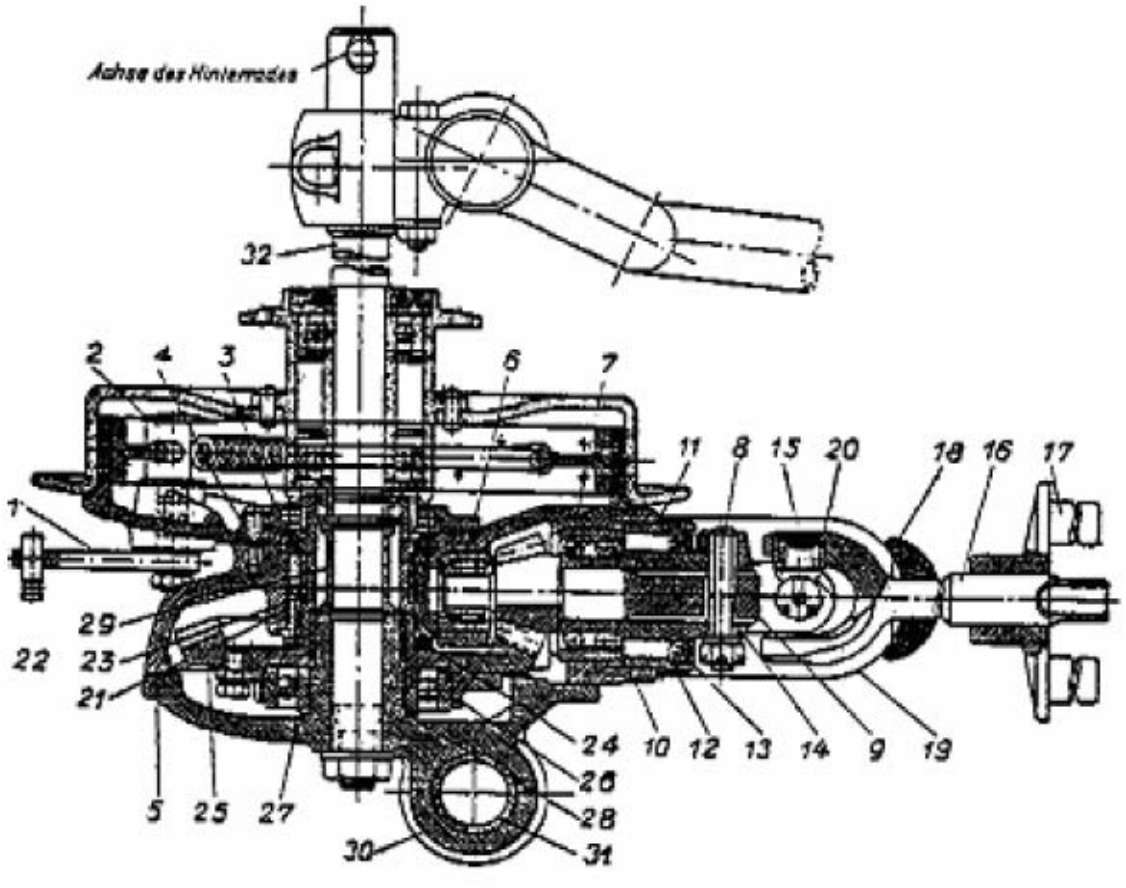


Fig. 14
Cutaway of the Cardan and Final Drive M – 72

1. Brake lever 2. Brake tap 3. Lubricator cover 4. Lubricator 5. Housing 6. Needle bearing 7. Double race ball bearing 8. Keyway 9. Drive gear 10. Adjusting screw 11. Sealing disk 12. Bearing nut 13. Lubricator, 14. Cardan yoke 15. Crosshead 16. Cardan shaft 17. Cardan shaft disk 18. Rubber gasket 19. Cardan housing 20. Locking ring 21. Housing socket 22/23. Support bearing bushings 24. Adjustment disk 25. Drive gear 26. Gear hub 27. Ball bearing 28. Adjustment disk 29. Clamping chuck 30. Frame cover 31. Rear wheel suspension 32. Rear wheel axle

The Power Transmission (Drive Unit)

In no case should one disassemble the power transmission mechanism (fig. 14) unless absolutely necessary. If for any reason dismantling is required, then it is extremely important when rebuilding to use the same adjustment disks which were installed by the factory. These disks control the play between the gear teeth and are to be adjusted after tightening all nuts/bolts in order that the gears operate without seizing. One must be able to feel the gap between the gear teeth when rotating the drive shaft by hand. If during rotation of the shaft the gap in the teeth increases, then one must add an adjustment disk of appropriate dimensions.
The periodic lubricating of the power transmission is outlined in the chapter "The Lubricating of the Motorcycle".

The oil level in the power transmission should be filled to the lower threads of the oil filler plug.

There is a stuffing box in the Cardan crosshead (15, fig. 14).

For lubrication of the universal joint one must move the rubber gasket (18) on the center of the cardan shaft and unscrew the cardan with a key. Note that the cap has a left-hand thread and one must turn it in a clockwise direction.

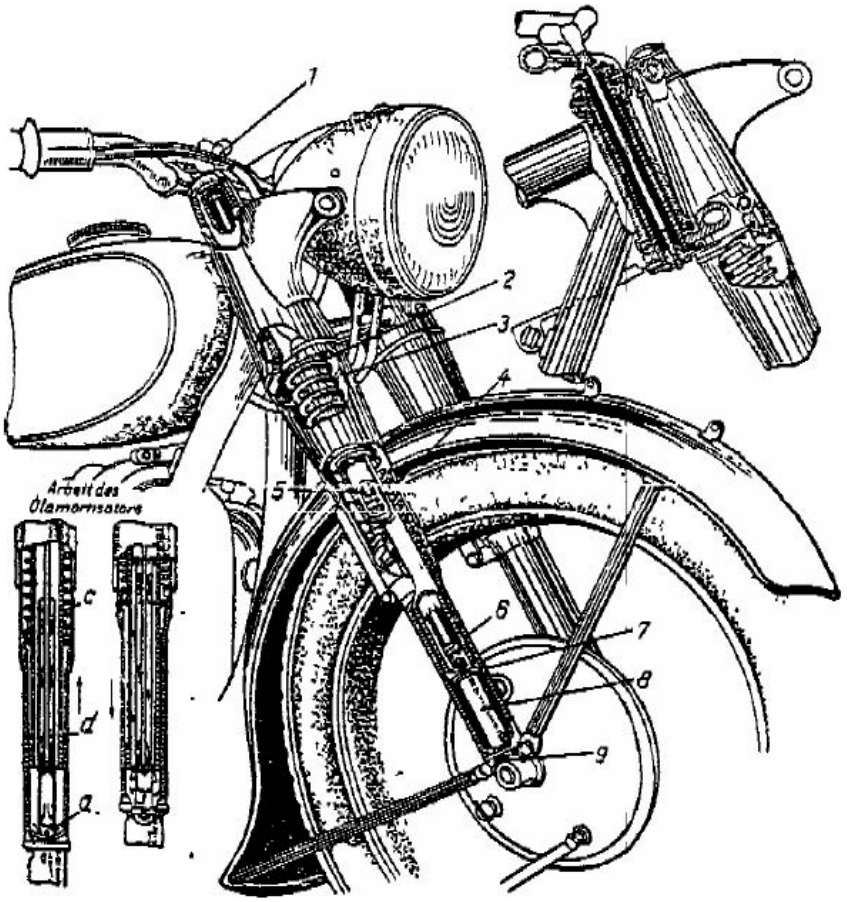


Fig 15
The Front Forks

1. Dampener nut 2. Spring 3. Spring tube 4. Shock absorber guide 5. Shock absorber seals 6. Shock absorber piston 7. End cap 8. Shock absorber housing 9. Discharge screw

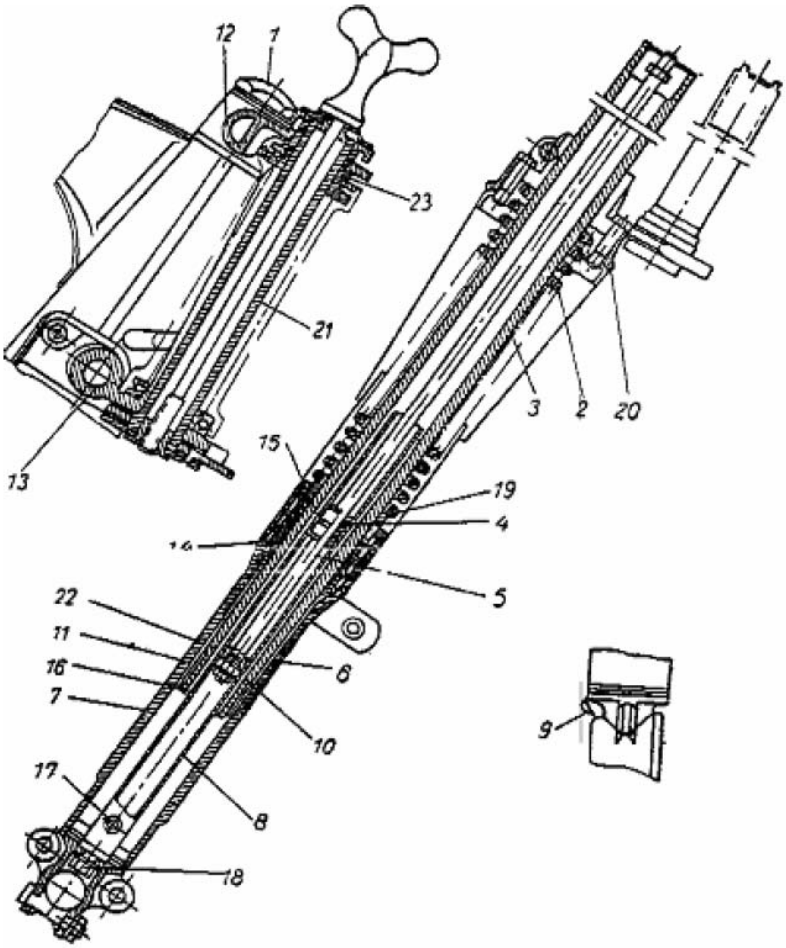


Fig 16
The Front Forks (profile)

1. Tightening nut 2. Spring 3. Spring tube 4. Shock absorber bar guide 5. Shock absorber bar 6. Shock absorber piston 7. Spring cap 8. Shock absorber housing 9. Discharge screw, 10. Shock absorber guide 11. Spring tube lower socket 12. Cross beam 13. Steering shaft bridge 14. Spring tube upper socket 15. Lock bolt bushing 16. Fork lock washer 17. Opening in shock absorber housing 18. Lock nut for housing 19. Lower end cap of spring 20. Upper end cap of spring 21. Steering shaft 22. Banking pin 23. Steering shaft bearing

The Front Forks & Suspension

The M -72 motorcycle has a telescopic front fork with both springs and oil dampeners. The oil dampener serves to soften vibrations which develop in the forks during travel on uneven roads.

This fork system is characterized by its unique softness. The general overview is shown in fig. 15, and in detailed profile in fig. 16. Two fixed steel tubes (3, fig. 16) are connected to each other in two places: above by the cross beam (12) and lower by a bridge at the steering shaft (13). The bar of the steering shaft (21) is pressed into the bridge which connects the fork with the framework. Inside the upper tubes the ends of the fork springs (7) are secured in the sockets (14) and (11).

The lower sockets (11) are fastened to the rigid tubes, while the upper are pressed onto the ends of the springs. These springs (2) comprise the main shock absorbers of the fork.

In the lower fork tubes there is hydraulic (oil) steering damper which is intended to improve absorption of strong impacts and to dampen vibrations in the fork. The upper ends of the shock absorbers have seals (5, fig.15) secured by the tightening nuts (1, fig.14), while at the lower rod ends slotted guides (10, fig. 15) are mounted. Between the guides and the banking pins steel pistons (6) are inserted. The bars are inserted into tubes, which are fastened to the spring end caps by nuts/bolts (18). At the top of the tubes the sockets (4) are fastened by lock rings, which serve for the adjustment of the bars and for the oil, which goes through the gap between socket and bar. In the lower part of the pipes are also openings for oil flow.

When the wheel encounters an obstacle the springs compress, the oil in the tubes press on the pistons (6) and, by rising up to the banking pins (22), runs through the gap between the pistons and the bars and partly flows off through openings. With very hard impacts the oil is compressed and creates a hydraulic resistance for the springs. The compressed springs push downward again and try to expel the oil above the pistons; the pistons then compress against the guides (10). The oil, which is squeezed out of the gap between the bars (5) and the sockets (4), as well as from the gap between the exterior surfaces of the pistons (6) and tubes (8) then flows into the oil reservoir.

In this manner the hydraulic shock absorber softens not only the impacts taken by the fork, but also stops the loss of control of the motorcycle. The shock absorber also prevents jumping of the motorcycle and the emergence of longitudinal vibration.

Each fork spring takes 80 -- 100 ccm of oil. To add oil, the tightening nut (1) must be unscrewed. The oil is drained from the fork springs by outflow holes which sit in the lower part of the end caps and are locked by the drain bolts. In order to take the shock absorbers out of the fork it is necessary to remove the nut/bolt (18) and the tightening nut (1).
In the center of the fork is the wing nut of the shock dampener, which must be tightened or loosened dependent upon the condition of the road and the driving speed. Additional lubricating of the suspension is not necessary. The dead point in the steering shaft can be adjusted by tightening the nut (23) under the cross beam. This nut must be checked every 1000 km. The steering bars of the motorcycle are firmly connected to the fork, and therefore all movements of the steering bars are transferred by the fork to the front wheel.

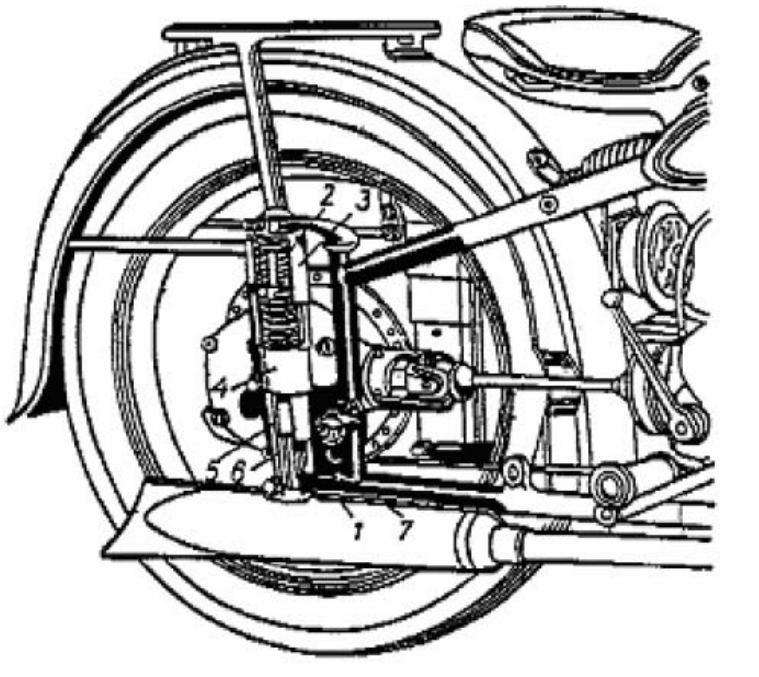


Fig 17
The Rear Wheel Suspension

1. End caps of the rear fork 2. Spring 3. Spring housing 4. Right suspension support 5. Guide sleeve 6. Bar 7. Buffer

The Rear Wheel Suspension

The suspension of the rear wheel (fig. 17) works in connection with the telescopic front forks to offer driving comfort even on bad roads. The principle of the rear wheel suspension is the same as with the front suspension. The whole load, which is set on the rear wheel, is transferred by spiral springs which weaken the impact in the case of collision into an obstacle. Strong shocks are caught by the rubber buffers (7).

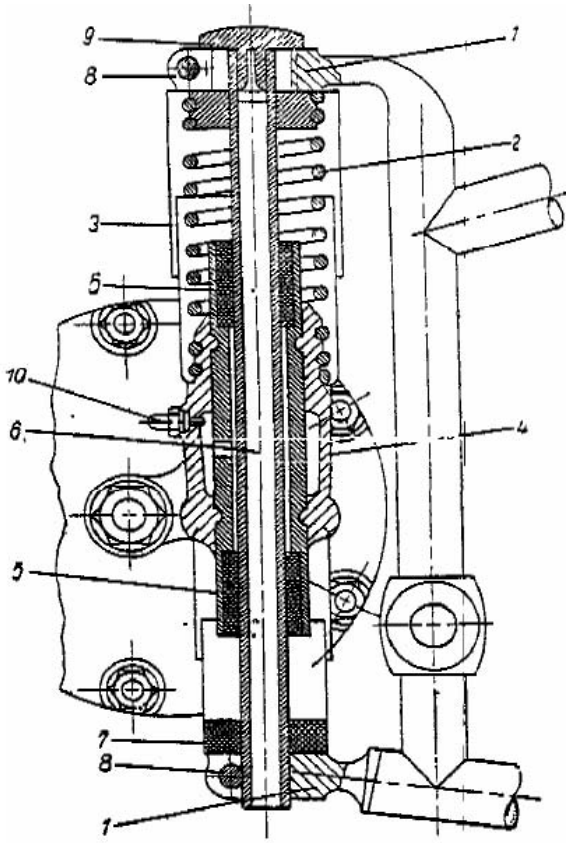


Fig 18
The Rear Wheel Suspension (cutaway)

1. Rear fork base cap 2. Spring 3. Spring housing 4. Right suspension support 5. Guide sleeve 6. Bar 7. Buffer 8. Lock screw 9. Absorber 10. Stuffing box

The support (4) of the right suspension is connected to the frame cover of the power transmission. Therefore the power transmission can only be removed together with the right suspension.

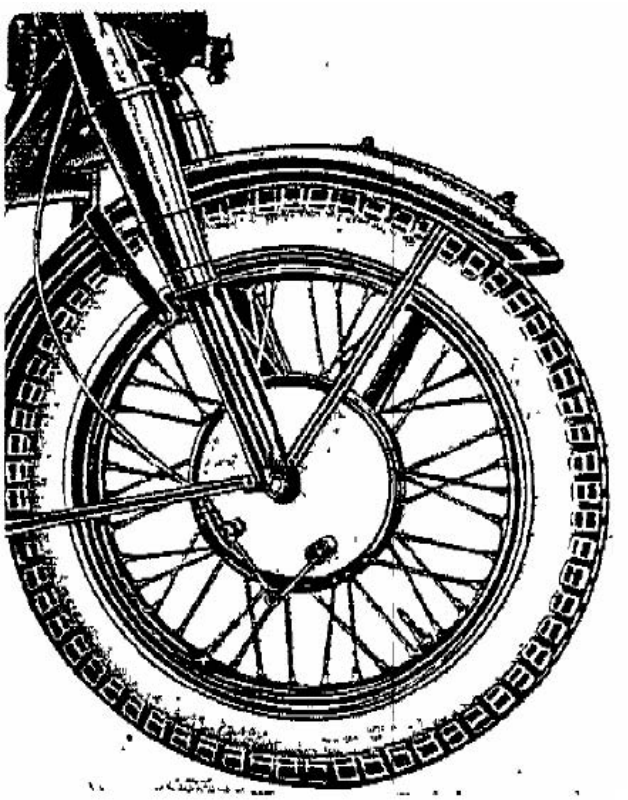


Fig 19
Adjusting the Front Wheel Brakes

The Brakes

The brakes are very important parts of the motorcycle. Both the hand and the foot brake are drum & shoe brake systems. They are housed in aluminum drums with replaceable friction washers.

The quality of driving depends to a considerable degree on the perfect condition of the brakes, and they must be systematically inspected.

The foot brake cable wears gradually through heavy use, and the friction pads of both the hand and the foot brake shoes become worn with use. With wear, the play of the hand brake lever and the foot brake pedal is increased and the brakes worsen gradually.

For adjustment of the front hand brake there is a special screw at the brake drum (fig. 19). When unscrewing this screw the dead play of the hand brake handle is reduced. The hand brake should be adjusted so that braking with a pull of the lever begins at 5 - 10 mm.

The foot brake must be adjusted so that when pressing the foot brake pedal down braking begins at 10 - 15 mm. The adjustment of the foot brake is made with the wing nut (1, fig. 11), which is at the end of the brake cable.

A slight play is absolutely necessary with both the hand brake and the foot brake, since otherwise the brake drums heat up continuously and wear out as the friction increases at the brake shoes. If these brake linings are exposed to oil they will not operate correctly, and one must wash and dry them carefully with gasoline. In the case of extended braking the wheels must be braked alternating with the hand and with the foot brake in order to prevent overheating of the brakes. On steep downward grades one must also brake with the engine by switching to a lower gear.
One must brake softly and only gradually increase the pressure on the lever and pedal. One obtains the best braking action as the wheels are still turning, therefore one should not lock the wheels when braking. This is particularly important on a wet or icy road.

The Wheels

The wheels of the motorcycle M - 72 are easily removed and replaced.
The wheel spokes must be even and firmly tightened. Occasionally one must adjust the tension of the spokes after inspection, which may be done without removing the tires.
The wheel bearings are lubricated by grease fittings which are screwed in into the wheel hubs.

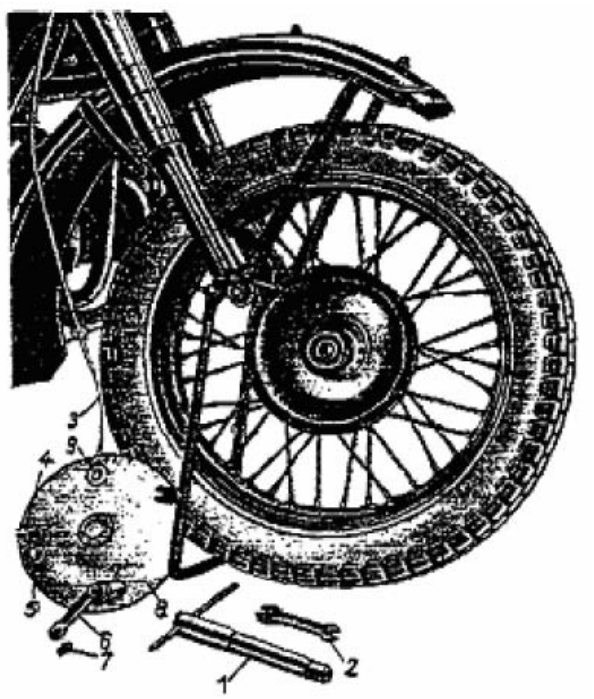


Fig. 20
Removing the Front Wheel

1. Axle 2. Key 3. Cable 4. Adjusting screw 5. Adjusting screw arm
6. Brake cam lever 7. Finger of the brake lever 8. Brake drum cover 9. Wear indicator

The following procedure is followed in order to remove the front wheel,:
1. Remove the nuts and bolts which hold the wheel brace to the fender and jack up the machine.
2. Turn the adjusting screw (4) of the front wheel brake cable so that the slot of the screw coincides with the slot of the head of the support (5).
3. Raise the brake cam lever (6), remove the end of the cable from the adjusting screw and remove the cable (3) from the screw and support.
4. Remove the cable from the brake lever pin and take the pin out.
5. Loosen the tension bolt of the left fork housing.
6. Unscrew the axle nut (left-hand thread), and remove the wheel and the brake.
Replacing the front wheel is done in reverse order, making certain that the wear indicator (9) at the brake cover goes into the groove at the right fork housing.

Before final tightening of the bolt on the lower end of the left fork tube one must push down on the front end of the motorcycle several times to securely seat the axle.

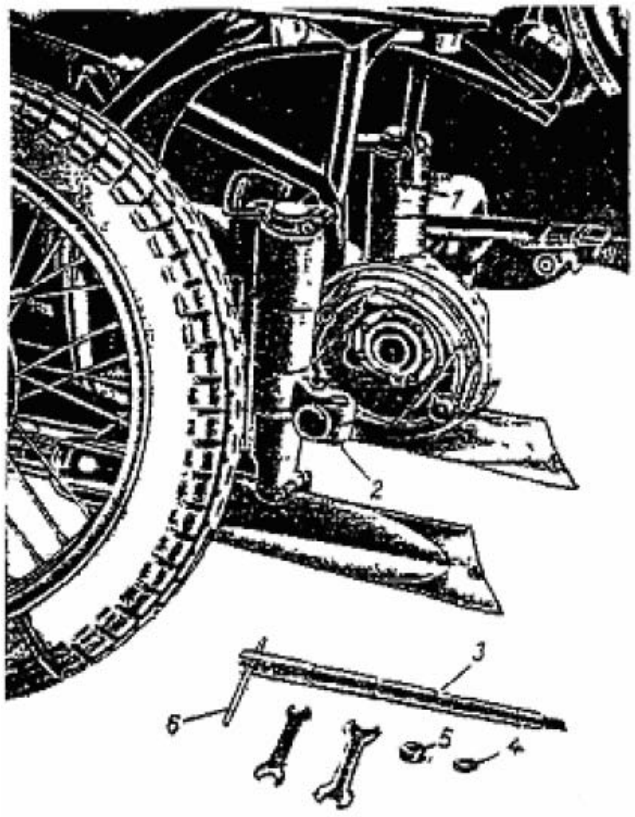


Fig 21
Removing the Rear Wheel

1. Hinged part of the fender 2. Tension bolt 3. Rear wheel axle 4. Disk 5. Nut 6. Lever

To remove the rear wheel (fig. 21) the following procedure is used:
1. The wheel is jacked up.
2. The bolts of the rear fender supports are removed and hinged section of the fender is raised.
3. The rear axle nut (5) and washer is removed.
4. The tension bolt on the left support of the rear suspension is removed and the rear wheel axle is pulled out with the help of a lever (3).
5. The rear wheel is removed from the framework.
Assembling the wheel is done in the reverse order. One must rotate the wheel continuously when tightening the axle nut in order to prevent seizing. Before tightening the tension bolt, firmly push down on the rear part of the motorcycle several times to seat the axle. When disassembling the parts should not become dirty, and before reassembly they must be wiped off and greased carefully.

The Tires

The care of the tires is limited to daily control of the air pressure in the tubes (see the chapter "technical data"). The rear tire is subject to more wear than the others and must be inspected regularly. In order to ensure even wear of all tires one should rotate the wheels every 2000 km; i.e. the rear wheel to the front wheel, the sidecar wheel to the spare wheel and the spare wheel to the rear wheel.

Removing the tires:

I. Release all air pressure from the valve.
2. Unscrew the valve and push it into the wheel rim.
3. With both feet press on the tire to create a bulge in the lower bed of the rim.
4. Beginning at a point on the wheel about 1/4 of the distance from the valve lever the tire bulge over the wheel rim.
5. Gradually move the two assembly levers around the circumference until the whole bulge is taken out of the rim. The tube is then removed.
If the tire must be removed completely repeat the above procedure on the opposite side of the wheel.

Patching the Tubes

A hole in a tube is recognized by the sound of escaping air. If the hole is very small one may place the tube in water or alternatively brush liquid dish soap onto the area and check closely for bubbles. Wash the area with pure gasoline and roughen it with a file or sandpaper. If one does not have special patches then cut a piece out rubber, likewise wash it with gasoline and roughen it. Coat the damaged area and patch with adhesive: after approximately 10 minutes coat them a second time, let both dry, place the patch on the damaged area and press it firmly in place.

If factory patches are present in the repair box of the motorcycle one must remove the protective coating, clean and dry the area to be patched and press the patch firmly in place. In this case no adhesive needs to be applied. A defective valve insert is to be replaced immediately.

If air is escaping between the valve and the hose one must reseat the valve rim nut.

Tire Assembly

1. Check to ensure that any foreign particles which could cause damage to the tube are removed from the tire.
2. If the rim liner was also removed during removal of the tire then insert it when reassembling. The hole in the liner must fit exactly to the hole in the rim. The rim liner is to cover all of the spoke heads.
3. After pulling one side of the tire bead into the rim, draw the whole bulge into the rim with the help of the assembly levers.
4. The inner surface of the tire should be coated with talcum powder. Insert the valve into the rim hole and replace the nut. Insert the tube into the tire checking that it does not have any folds.
5. Before drawing the other bulge up onto the rim, check that the valve is well seated.
6. Hold the other bulge of the tire with the feet.
7. The bulge of the tire is arranged in the rim by hand, working gradually around the circumference.
8. Once 2/3ds of the bead slips into the bed of the rim the remaining bulge is crimped in with the assembly levers. If the tire sits correctly in the rim one can complete the whole process with the two assembly levers, but if too much force is used one can damage the tire and the belting in the bulge.
9. The valve is now checked, the tube is inflated slightly and the tire is tapped around the circumference with a hammer or other blunt, heavy object until it is evenly seated on the rim.
10. The valve nut is firmly tightened, the tube is inflated to the required tire pressure, and the valve cap is screwed on.

The Sidecar

The M - 72 motorcycle is a sidecar machine. There are two models of sidecar for the M – 72, one with a rigid attachment of the wheel on a double stored axle and the other with a torsion suspension of the wheel on a console axle. Since 1954 the Kiewer motorcycle factory manufactures sidecars with the torsion suspension. The sidecar is fastened to the front crossbar with two clips with rubber linings. At the rear part of the framework plates are welded to the lateral pipes, on which the leaf springs are fastened. The sidecar is attached to the springs by shoes, which can move along with the springs. The shoes are connected with a cross beam, which is fastened with rubber bushings to the sidecar body. Stuffing boxes are attached for the lubricating of the shoes. Vibrations and shocks to the sidecar are absorbed by two buffers which are fastened to the rear crossbar. The spare wheel is installed on the lid of the baggage compartment.

The sidecar is fastened to the motorcycle at two points (fig. 22).
The lower fastenings consist of two pliers hinges (fig. 23), which cover the ball joints of the framework and the lock bolts of the engine. The rear pliers hinge is fitted with a lever and is held by two tension bolts onto the sidecar framework. With the tension bolts loosened the lever can be turned to adjust the lateral angle of the car.

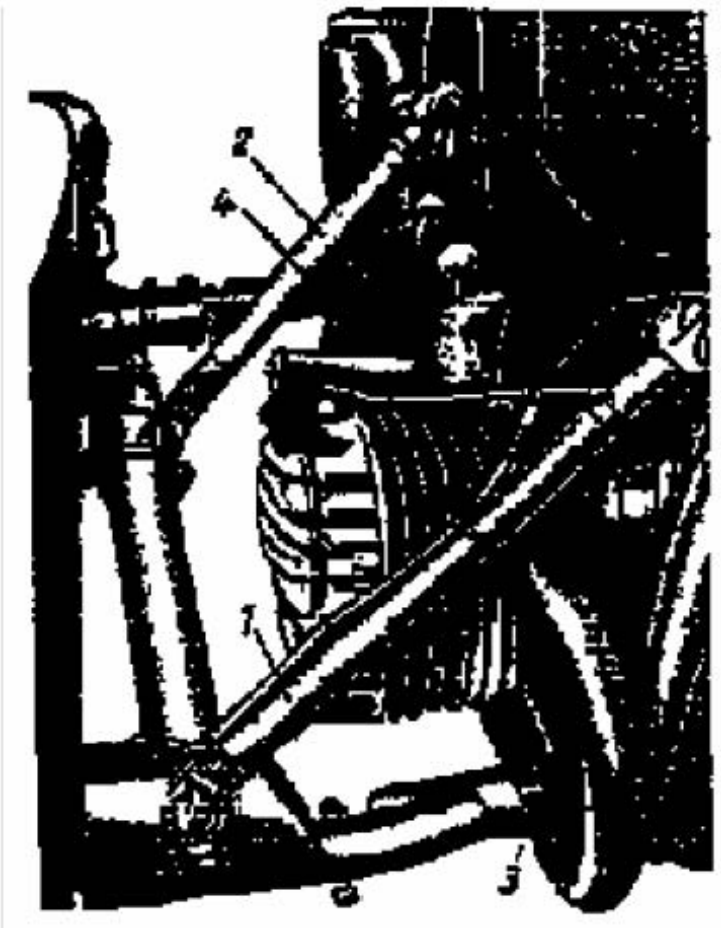


Fig 22
Sidecar Attachment

1. Front tie bar 2. Middle tie bar 3. Front joint 4. Rear joint

The upper attachment consists of two tie bars, which are adjusted for length. The front tie bar has a ball joint connection with the sidecar frame and with the frame support of the motorcycle. The middle tie bar is connected with the crossbar of the sidecar by clips and has the same ball joint connection to the motorcycle frame as the front tie bar.

Sidecars with torsion suspension are characterized by a softer ride and by better longevity. These side cars have a slide connector with a torque shaft built into the rear transverse pipe of the framework.

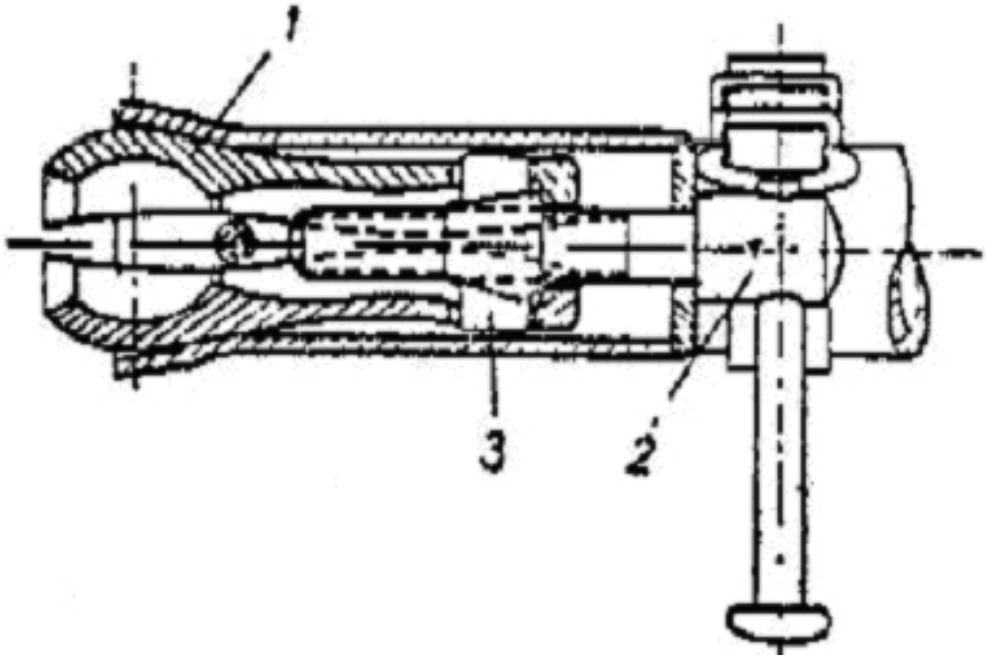


Fig 23
Sidecar Attachment Pliers Hinge

1. Pliers 2. Hinged screw connection 3. Nut

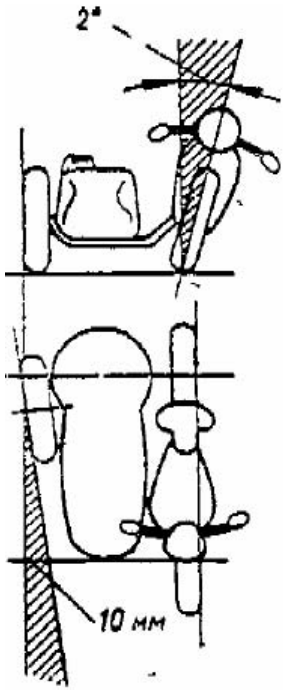


Fig 24
Sketch for adjustment

The internal end of the crossbar goes into an immovable, slotted socket and the outside end passes through a supporting socket. There is a support on the forward shaft which is tightened by clamps. At the opposite end of the support the console axle of the wheel is mounted. The wheel is fitted with springs to absorb road shocks. With an increase in load the torque shaft and the wheel lift toward the body. With a decrease in load the shaft frees itself due to its flexibility and the wheel lowers.
The sidecar and the motorcycle operate the same as with a rigid attachment, but the wheel shocks and vibrations are dampened. Adjustment in the tension of the torque shaft takes place via an adjusting screw.

A motorcycle with a correctly installed sidecar travels well on the road, otherwise the motorcycle is pulled to the left or right. The sidecar attachments are adjusted according to the load and the road condition, but generally are set to standard driving conditions.

The allowed deviation of the wheel angle is 10 mm on the length of the wheel base. When measuring one must set the line as close as possible to the point of contact of the wheel hub (fig. 24).

The lateral angle of inclination of the motorcycle axle to vertical can amount to 2°. When adjusting sidecar all joints must be greased. To adjust the deviation of the wheel angle one must loosen the tension bolts which hold the lever in the pliers joint. One finds the correct deviation of the wheel angle by using two parallel straight wood slats or strings placed 90 -- 100 mm from the wheels, and by pushing or pulling the framework cross beam until the correct angle is achieved. The lateral angle of inclination is adjusted by an extension or a reduction in the length of the upper tie bars.

The correct adjustment of the sidecar is checked by driving on a straight, level road. The motorcycle should drive straight and even with no pulling to either side.

The Electrical Equipment

Until 1949 the M -72 motorcycles were equipped with automatic relay controllers of the type RR-1. RR-31 automatic relay controllers are currently used.
Fig. 25 is a wiring diagram of the electrical equipment with the automatic relay controller RR-1 and fig. 26 with the automatic relay controller RR-31.

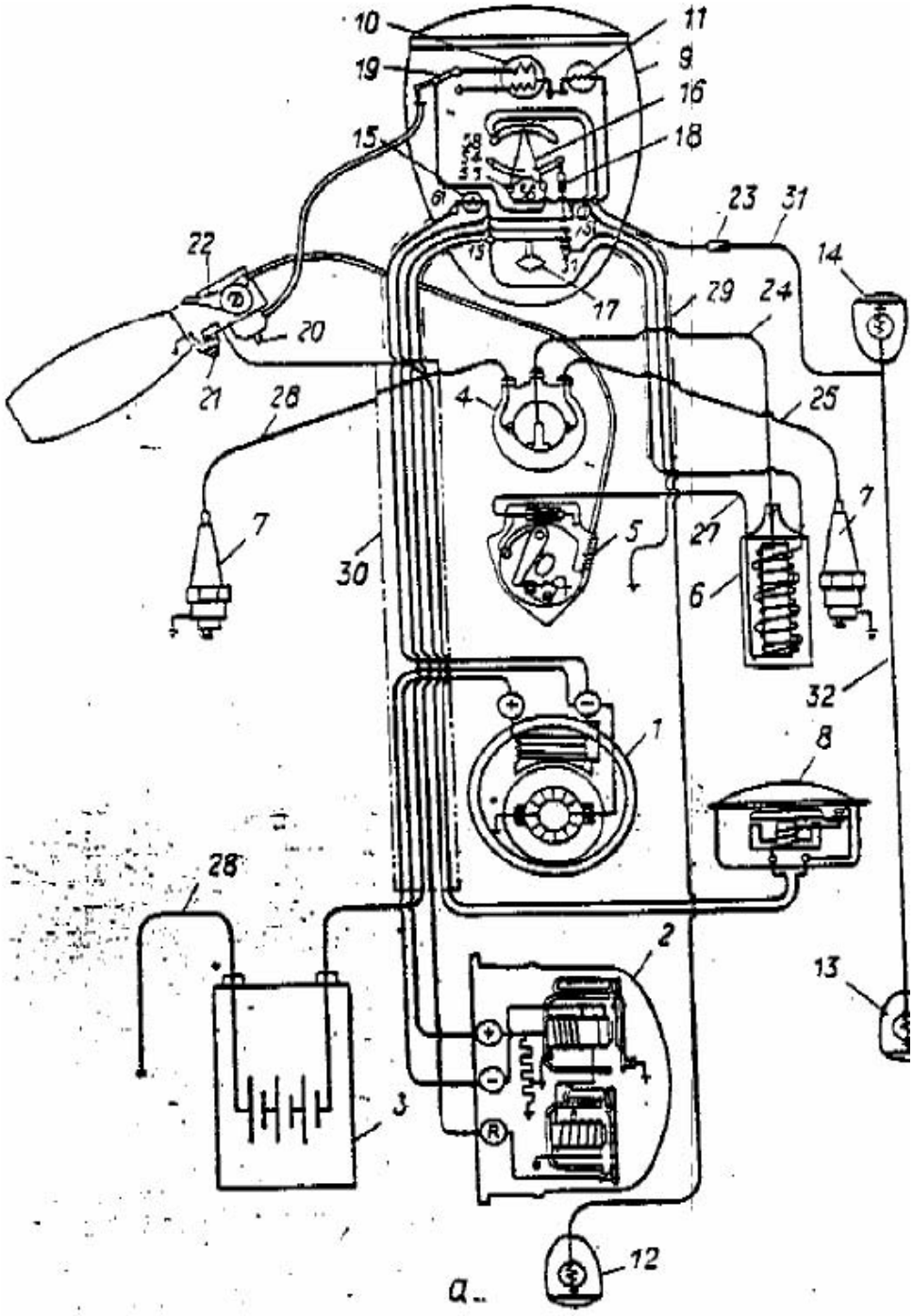


Fig 25
Wiring Diagram With the RR–1 Automatic Relay Controller

1. Generator 2. Automatic relay controller RR-1 3. Battery 4. Distributor 5. Circuit breaker, 6. Ignition coil 7. Spark Plug 8. Signal (horn) 9. Headlight 10. Bulb for high/low beam 11. Parking light bulb, 12. Taillight 13. Sidecar taillight 14. Sidecar front light 15. Indicator light 16. Central switch 17. Ignition key 18. Fuse 19. Dimmer switch mechanism 20. Dimmer switch 21. Signal button 22. Ignition setting lever 23. Fuse for sidecar lights 24.-26. High voltage lines 27.-30. Low voltage lines 3l.-32. Sidecar lighting leads

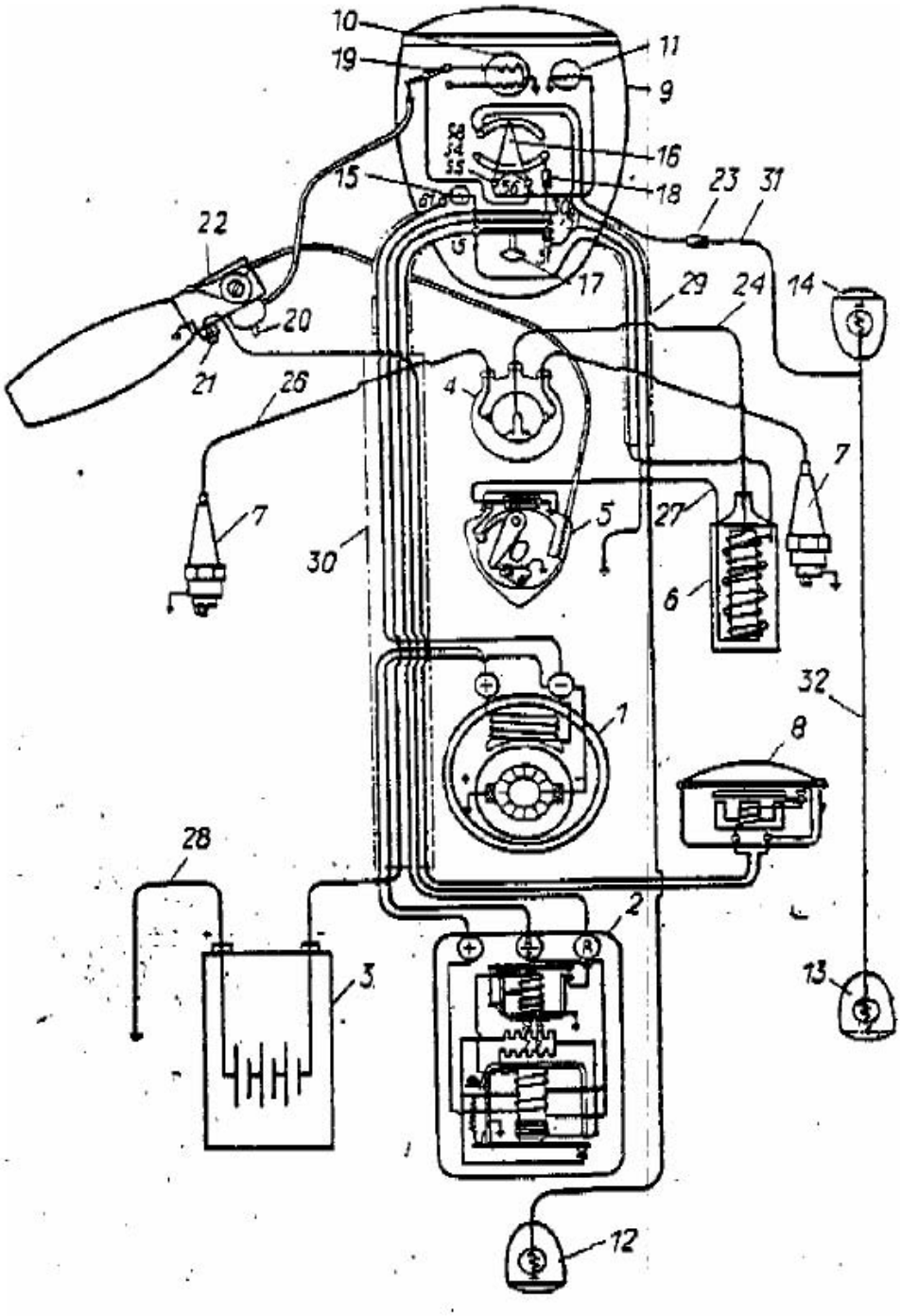


Fig 26

Wiring Diagram With the RR- 31 Automatic Relay Controller

1. Generator 2. Automatic relay controller RR-31 3. Battery 4. Distributor 5. Circuit breaker, 6. Ignition coil 7. Spark Plug 8. Signal (horn) 9. Headlight 10. Bulb for high/low beam 11. Parking light bulb, 12. Taillight 13. Sidecar taillight 14. Sidecar front light 15. Indicator light 16. Central switch 17. Ignition key 18. Fuse 19. Dimmer switch mechanism 20. Dimmer switch 21. Signal button 22. Ignition setting lever 23. Fuse for sidecar lights 24.-26. High voltage lines 27.-30. Low voltage lines 3l.- 32. Sidecar lighting leads

These diagrams give a sufficiently clear concept of the working principles of the electrical components and wiring.

Generator and Automatic Relay Controller

The M72 motorcycle has a direct current generator of the type G-11-A. The generator has a nominal tension of 6 V and a nominal amperage of 7 ampere. It is intended to work with the automatic relay controller RR-1 or RR-31 according to the wiring diagrams. At the generator housing are two connecting terminals, + and -. The positive connection of the generator is connected to the battery.
The generator is the supplies all power and also serves to charge the battery while driving. The generator is driven by the cam shaft with a reduction ratio of 1:3 set in turn. The generator coil turns 11/2 time faster than the crankshaft.

Without load the generator produces 6.5 V at no more than 1350 U/min, which is sufficient to supply power to the entire system. With a normal load of 7 ampere the generator gives a tension of 6.5 V at 2000 U/min.

The automatic relay controller consists of two electromagnetic fields, the reverse current relay and the voltage regulator. They are in a single housing and serve for the automatic connection and disconnection of the system, for the automatic voltage regulation of the generator and for protection from overloading as well as for the protection of the battery from current surge.
The reverse current relay is a switch necessary for the parallel operation of the generator and the battery. The generator switches itself on automatically with the help of the relay if the current at the contacts reaches 6.5 -- 7.2 V; i.e. if the current of the generator is higher than that of the battery.
The generator switches itself off if its current is lower than the battery and the current of the battery begins disperse. The strength of the current reversal, at which the generator switches itself off, is equivalent 0,5-3.5 ampere.

The voltage regulator is an electromagnetic pulse relay. It periodically switches additional resistance into the generator winding, allowing automatic voltage adjustment of the generator with a change of the number of revolutions of the core and the load of the generator. The voltage regulator reacts not only to the amount of the voltage, but also to the amount of the load while protecting against an excessive load. This is done by a decrease of the voltage which can be regulated with an increase of the load of the generator.

The automatic relay controller is set by the manufacturing firm and requires no care. The housing is lead sealed, and if the seal is removed no defect complaints will be recognized by the factory.

When connecting the automatic relay controller on the motorcycle one must make certain that there is a reliable connection with the battery. This is established by a special metal panel under the connecting plate. This panel must not be damaged when attaching the controller. The apparatus housing of the automatic relay controller RR-31 is connected with the battery of the motorcycle by the lock screws.

In addition a special clamp is used as ground contact on the right side of the apparatus.

The generator G-11-A is installed at the top of the crankshaft housing and protected against shifting by a special lock bolt. The generator is fastened by a band. Since the armature shaft of the generator is eccentrically mounted to the housing, gaps between the gear teeth are adjusted by a turn of the generator. The gaps should be sufficient that the gears do not make noise after starting the engine, on the other hand they should not be tight enough to seize.
If the locking band stretches the generator can turn in place. In order to prevent grinding of the teeth, the generator must be installed on the crankshaft housing so that its wheel is to the right of the housing axis.

The drive gear of the generator is fastened on the armature shaft with the help of a set screw and the shaft is supported by bearings. When adjusting the band one must clamp it firmly. If the bearings are tightly seated on the shaft one must remove the quill (2, fig. 27), place the generator housing (from the side of the collector) on any support and tap out the wheel with an easy hammer blow.

Every 500 km. one must check the generator attachment at the crankshaft housing and the attachment of the wires at the contacts. If the band has become stretched it must be pulled tight. If required one must adjust the gap air in the gear wheels as indicated above.

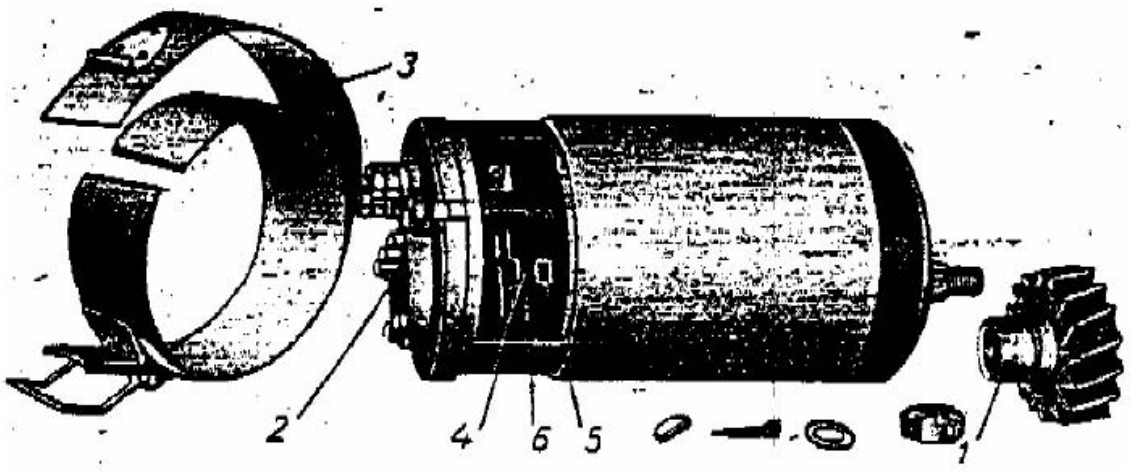


Fig 27
The Generator G -- 11 A
1. Drive gear 2. Quill 3. Band / clamp 4. Brush housing 5. Brush 6. Collector

Every 3000 to 5000 km one must examine the condition of the brushes and the collector. For this one must remove the clamp (3), then raise and check the brush housing to determine whether the brushes shift into position easily and that they are not worn.
If the brush sticks, one must abrade it and the lock screw with a rag soaked with gasoline.

If one or both brushes are badly worn they have to be replaced. New brushes must be ground in at the collector elbow with emery cloth before use. In the case of contamination or oil on the collector one must wipe it with a rag dampened in gasoline. Also the shaft must occasionally be lubricated on the side of the collector, which requires removal of the quill.

In order to avoid short circuits when working with the generator or other electrical equipment the battery should always be disconnected. If the indicator light goes out or dims while driving with high RPM, then it is necessary to check the generator and the automatic relay controller as follows:

1. The wiring is to be examined for shorts or bad connections.

2. Start the engine and remove the + and – wires from the generator are removed, the + contact connected to the battery and connect a portable 6v test light between the - contact and the battery. If the light is on then the generator is correct. One should not let the engine run at high RPM while testing otherwise, if the generator is correct, the test light will quickly burn out. After testing the wiring must be reconnected.

3 If the generator is correct, one must remove the wire from the R contact of the automatic relay controller and connect a test light between this line and the battery. If after starting the engine the light is out or burns very weakly then the automatic relay controller is defective.

The Battery

The motorcycle has a 6 Volt battery with a capacity of 14 Amp./Std, type SMT-14.
The negative terminal is attached to ground, the positive pole to the wiring. The battery is the only power source of the motorcycle while stationary and with the engine at low RPM. During night driving at slow speeds with all lights the generator is also supplemented by the battery. In order to avoid discharging the battery it is advisable to use only the small light when there is good road lighting.

While driving one must be careful that the battery does not drain excessively. Draining of the battery causes sulfur buildup on the plates which likewise causes poor charging and fast discharge.

One can judge the amount of charge in a battery by the voltage and the density of the electrolyte. The voltage of each element of a fully charged battery is equivalent 2.1-2.2 V. When discharging the voltage falls fast to 2 V and then gradually drops to 1.7 V. In no case should the voltage go under this limit.

The measurement of the degree of charge is better gauged by the density of the electrolyte, which is measured with a specific gravity gauge.

The density of the electrolyte in the fully charged battery is 32° Baum, which corresponds to a specific weight of 1,285. In the winter one must bring the specific weight of the electrolyte up to 1,3 -1.32 (33 - 35° Baum). If the specific weight is reduced up to 1,25 when the motorcycle is running then the battery is empty and must be refilled.

A decrease of the specific weight under l.25 is inadmissible. The density of the electrolyte should be checked every 1500 km or every two weeks. The density of the electrolyte should be particularly noted in the winter: a fully charged battery only freezes at a temperature of minus 50°, while a drained battery will freeze at minus 6°.

The conditions of the electrolyte in the battery are to cover the upper plate edges around 10-15 mm. During service the water evaporates, so if the level of the electrolyte is lower in the battery than the level indicated the elements must be refilled with distilled water.

One must make certain that the battery is always kept clean and that the openings in the fillers do not get clogged.

In the case of long periods without charging the battery gradually discharges. If the battery is not used one must load it about 2 hours or so monthly with a1 ampere charge. If the battery will be stored for long periods the electrolyte should be poured off, the elements rinsed with warm water and the battery stored in dry condition. If loaded batteries are stored for extended periods one must recharge, discharge and again recharge them every 6 months.

If the battery is in service, the contacts should always be coated with a thin layer of Vaseline or technical grease.

New motorcycles may be shipped with either loaded or dry, uncharged batteries. Dry batteries must be filled with electrolyte (GOST 667-53) with a specific weight of 1,120 and a temperature of 20-25° before starting. In order to manufacture electrolyte, one must pour the sulfuric acid into distilled or rain water, but never in reverse. The first charge begins 2-3 hours after filling the elements with electrolyte and should have an amperage of 2 ampere. If the voltage in each element reaches 2.38-2.42 V, the amperage is lowered to 1 ampere and charging is continued. First charging takes approximately 35-45 hours. The signs of complete charge are: A) plentiful gas elimination in all elements, b) stability of the voltage to the poles of the elements within 2 hours, C) stability of the density of the electrolyte in within 2 hours.

When charging the temperature of the electrolyte is not to exceed 45°. If the temperature is higher then charging must be interrupted, the electrolyte cooled to 30-35°, and only then may charging be continued. After first charging it is advisable to discharge and then recharge it twice again before the battery is inserted. The charging takes place within a ten-hour regime according to the table for the batteries Smt:14.

Regime	Current Strength Amperes	Capacity in Amp/Hours		Final tension in the element in volts
		Nominal	Guaranteed	
10 hours	1	10		1.7
3 hours	3		3.4	1.65
30 minutes	11		5.5	1.55

The voltage at the conclusion of the charging is brought up to 1.7 V in each element. The second and third charging takes place with a current of 2 ampere. As soon as the voltage of each element is up to 2.38-2.42 V, the amperage is lowered to 1 ampere until finished.

At the end of the second and third charging the specific weight of the electrolyte is brought to1,285 by addition of distilled water or of acid with a specific weight of 1,40, according to whether the density of the electrolyte is to be increased or reduced. After 15-20 minutes the density of the electrolyte is tested, and if it not at 1,285 the process is repeated (electrolyte is removed and water or acid added).

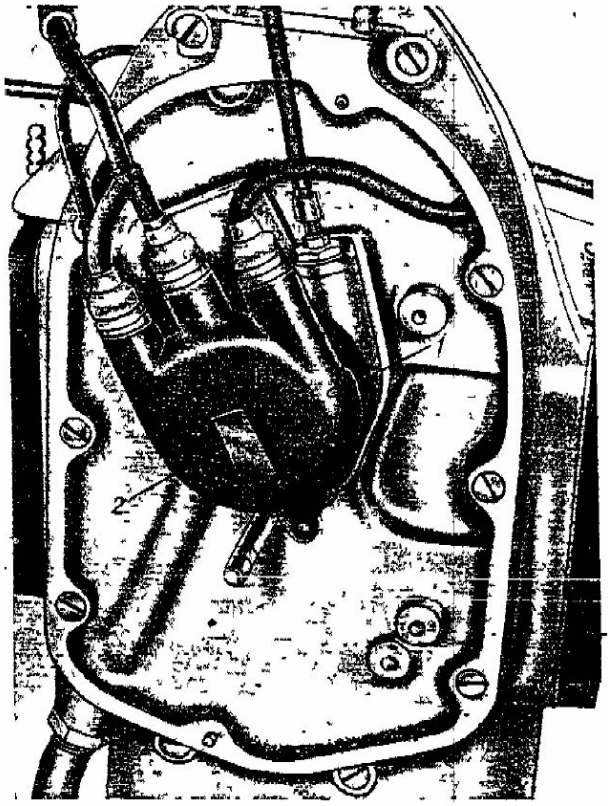


Fig 28
The PM-05 Distributor

1. Circuit breaker & distributor 2. Attachment spring

Circuit Breakers, Distributor & Ignition Coil

To produce high voltage current to the spark plugs the M-72 motorcycle currently uses the Pm-05 circuit breaker distributors and the Ig-4085-b ignition coil

The situation of the distributor is shown in fig. 28 and the ignition coil in fig. 29. The distributor Pm-05 (fig. 30) consists of the cover of the distributor, the circuit breaker disk and the circuit breaker.

The distributor cover has three connections for high voltage transmission lines: the center which connects ignition coil to the distributor and two lateral connections by which the voltage is led from the distributor to the spark plugs. On the circuit breaker disk there is a center contact in the form of a metal cap with a spring as well as a lateral contact plate.
The circuit breaker disk is fastened to the end of the distributor shaft by a special wedge with a set screw. The high voltage current goes from the center connection of the cover to the center contact of the circuit breaker disk and over the lateral contact plate, alternating to the carbon contacts of the lateral connections of the cover, where it passes through the spark plug wires to the plugs.

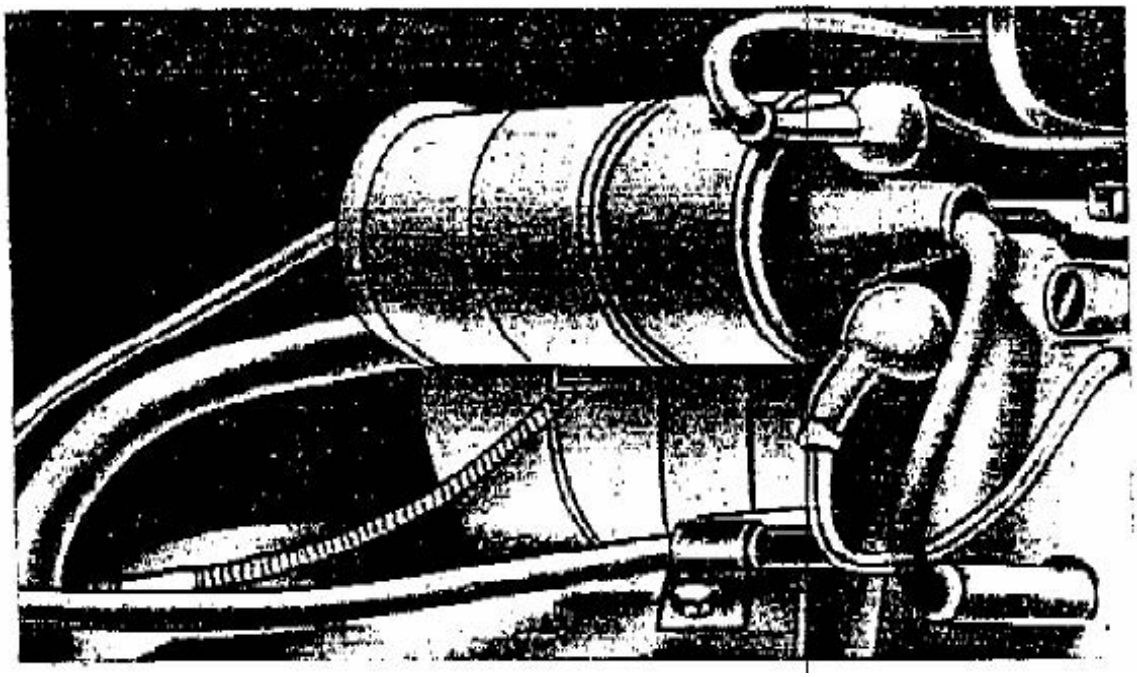


Fig 29
The Industrial Union-4085 B Ignition Coil

The circuit breaker consists of a housing and a disk on which the hammer and the anvil are fastened. With a movement of the ignition hand lever on the left side of the steering wheel the cable pulls on the disk and turns it, advancing or retarding the spark. On the disk a screw (3) is fastened with an eccentric head (eccentric cam adjustment), which goes in into a cutout in the housing.

The maximum angle in which the circuit breaker disk can turn is dependant on the position of the eccentric cam. With the outermost position of the eccentric cam the plate can turn around 15°, with the second position around 20°, developing an enlargement of the maximum angle of the spark advance.
The minimum angle of the points remains unchanged. As soon as the adjustment has been completed the eccentric cam must be secured with the screw.

In the top of the circuit breaker housing a condenser is inserted, which serves to decrease sparking and protect the breaker points from burning.

The distance between the breaker points during full interruption should be 0.4-0.5 mm. For adjustment one must loosen the locking screw which holds the anvil (12, fig. 30), and by turning the screw with the eccentric cam head (13) tighten or widen the gap. After retightening the locking the screw (12) the distance between the contacts should be examined again.

An arm with a spring and felt is mounted on the circuit breaker disk to lubricate of the circuit breaker shaft. The felt should be soaked with oil, according to the chapter "lubricating of the motorcycle".

The circuit breaker disk (20) is assembled on the shaft or down-taken in a position where the screw is opposite the cutout in the circuit breaker housing. The disk is set as deeply as possible on the end of the shaft, but not so deeply that it can wedge the hammer of the circuit breaker.

When replacing the circuit breaker cover always replace the spring clip and check the seal in the cover.
The M-72 uses WELL 11/11 A-U spark plugs with a thermal value of 145. The distance between the plug electrodes should be 0.5-0.6 mm. This distance is adjusted by bending the lateral electrode.

After each 1500 km the motorcycle requires the following checks:

1. The condition of the circuit breaker contacts and the size of the gap is to be examined. If the contacts are pitted or burned then one must remove and clean the hammer and the anvil with gasoline, and abrade the faces with a small file or Emory paper.
2. One must examine the gap of the spark plug electrodes and if necessary clean any carbon buildup.
3. Every 3000-5000 km one must examine all the connections of the wiring for security. Defects or poor contacts in any of the ignition components can result in engine malfunction.

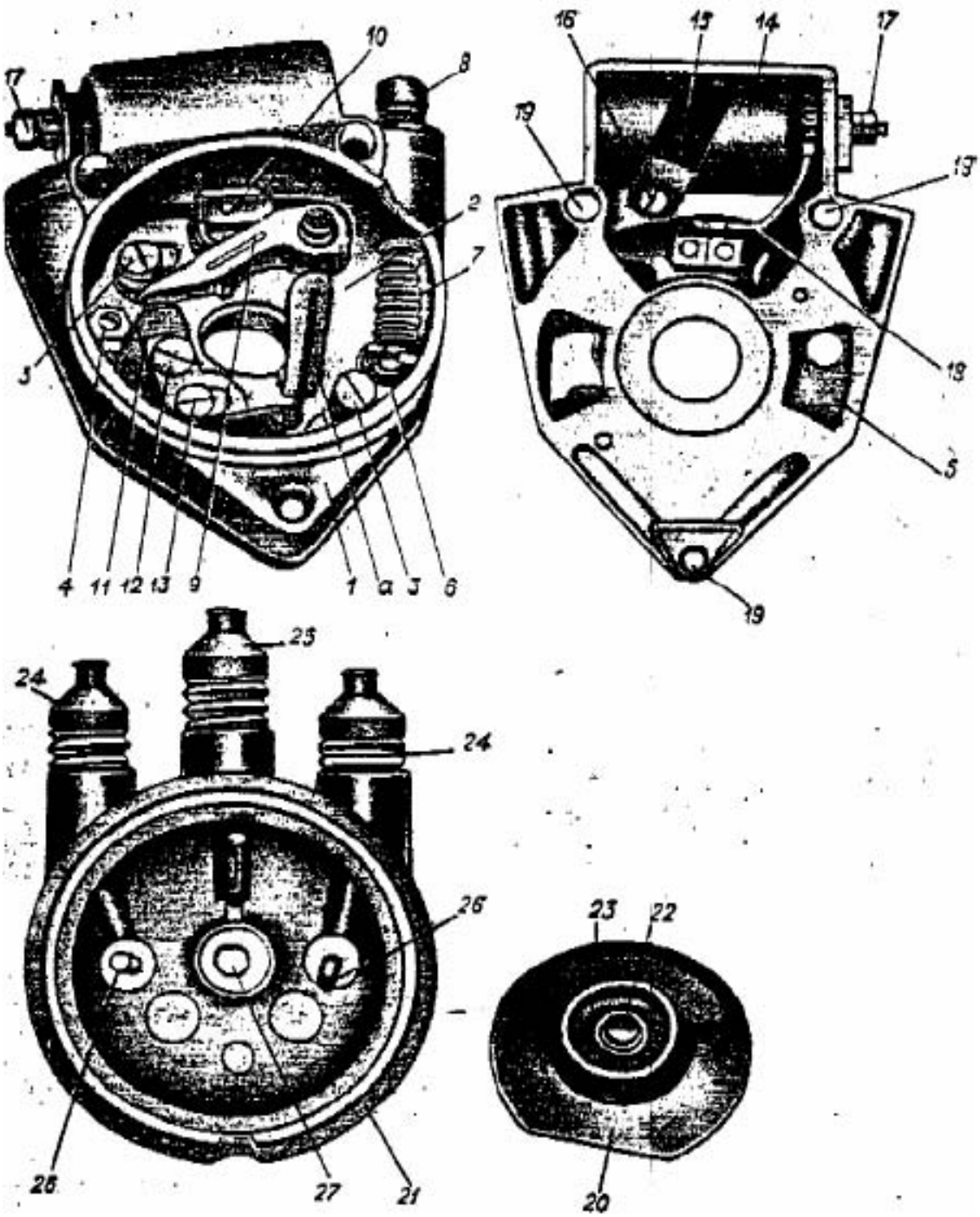


Fig 30
PM – 05 Circuit Breaker / Distributor

1. Housing 2. Disk 3. Cam head screw 4. Locking screw 5. Cutout in the housing 6. Block 7. Spring 8. Cable head 9. Hammer 10. Anvil 11. Circuit breaker hammer 12. Locking screw 13. Screw, 14. Condenser 15. Clip 16. Screw, 17. Isolated clamp 18. Line 19. Hole for the screw 20. Circuit breaker disk 21. Cover with contacts 22. Cap with spring 23. Contact plate 24.- 25. Connections for wires 26. Carbon contact 27. Central contact, A) felt brush

Common ignition system problems:

1. Oil at the breaker points; clean the points with a cloth dipped in gasoline, then dry the breaker and gently abrade the points if necessary.
2. Frozen circuit breaker hammer.
3. Burned or dirty breaker points.
4. Short-circuit in the condenser (the condenser is pierced).
5. Excessive carbon on spark plugs.
6. Cracks in plug insulation.
7. Broken winding in the ignition coil.
8. Discharged battery.
9. Wiring damage.

The engine may overheat due to wedging of the cable of the ignition setting lever or by wedging the circuit breaker hammer.

The Signal (horn)

The motorcycle is equipped with a vibration signal of the type S-35-A, which is activated by a button on the steering bars. The adjustment of the signal takes place with a screw at the rear part of the signal.

The Headlight

The M-72 motorcycle uses an fG-6 headlight which houses a switchable high / low beam bulb, a parking light, the speedometer/odometer, the central ignition switch and the dimmer switch.

The central ignition switch is fastened to the top of the headlight with three screws. In the left part of the central ignition switch there is an indicator light, in the right there is a 15-Amp fuse.

To replace a burned fuse one simply needs to unscrew the fuse holder. The motorcycle should never be left standing with the ignition key completely inserted in the starter lock or the battery may discharge through the ignition coil, not only draining the battery but also burning out the coil.
If the indicator light comes on it signals that the power supply is running off the battery. The indicator light will go out as soon as the relay contacts are closed and the generator switches itself on.

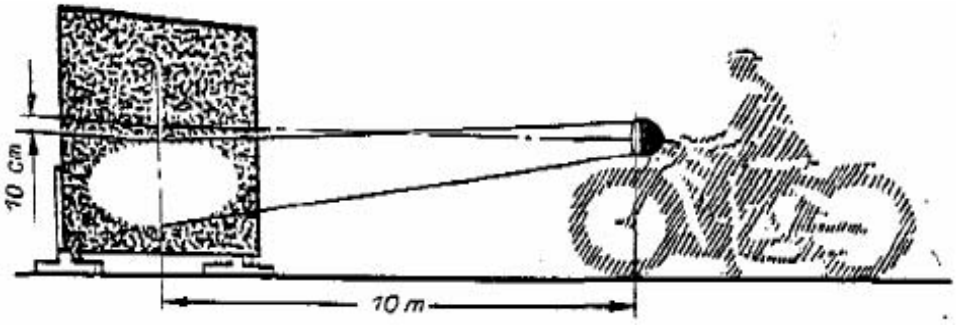


Fig 31

Sketch for Adjustment of the Headlight

To adjust the headlight beam:

1. The motorcycle running at idle is set up on flat ground facing a white or light colored wall at a distance of 10 m from the headlight glass (fig. 31).
2. The headlight is adjusted so that the axis of the light cone of the large light is horizontal, e.g., if the center of the light spot on the wall and the center of the headlight is the same distance from the ground.
3. The light is then adjusted so that the top margin of the reflection on the wall is not less than 10 cm below the actual height of the center of the headlight.

The Wiring

The motorcycle wiring schematic is shown in fig. 25 and 26. The low voltage lines are combined into bundles and have different colors to assist in identification.
Every 3000-5000 km one must check the condition of the wiring and their connections. The motorcycle depends on the good condition of the electrical equipment. Regular checks of the battery, the distributor, the spark plugs, the generator and the wiring ensure a trouble free operation of the electrical installation.

Cleaning the Motorcycle

After driving the motorcycle it should be subjected to a thorough cleaning. After sufficient cooling the engine and transmission case should be wiped with a clean rag dipped in gasoline. Painted and chrome plated areas are washed with a soft rag and a sponge then dried with a soft cotton rag.

To polish painted and plated parts a soft piece of leather should be used. Never use water or gasoline to clean a hot engine.

When washing one must avoid excessively strong water pressure and never spray water directly on the generator, automatic relay controller, headlight or carburetors since the humidity may penetrates into these parts causing rust or other problems.

After drying it is advisable to lightly lubricate the hinge of the rear fender and the external brake mechanisms with a few drops oil in order to prevent corrosion.

Chrome plated parts should be lightly greased to prevent rust. If a motorcycle is stored for extended periods all parts should be kept well lubricated with Vaseline.

The Lubrication of the Motorcycle

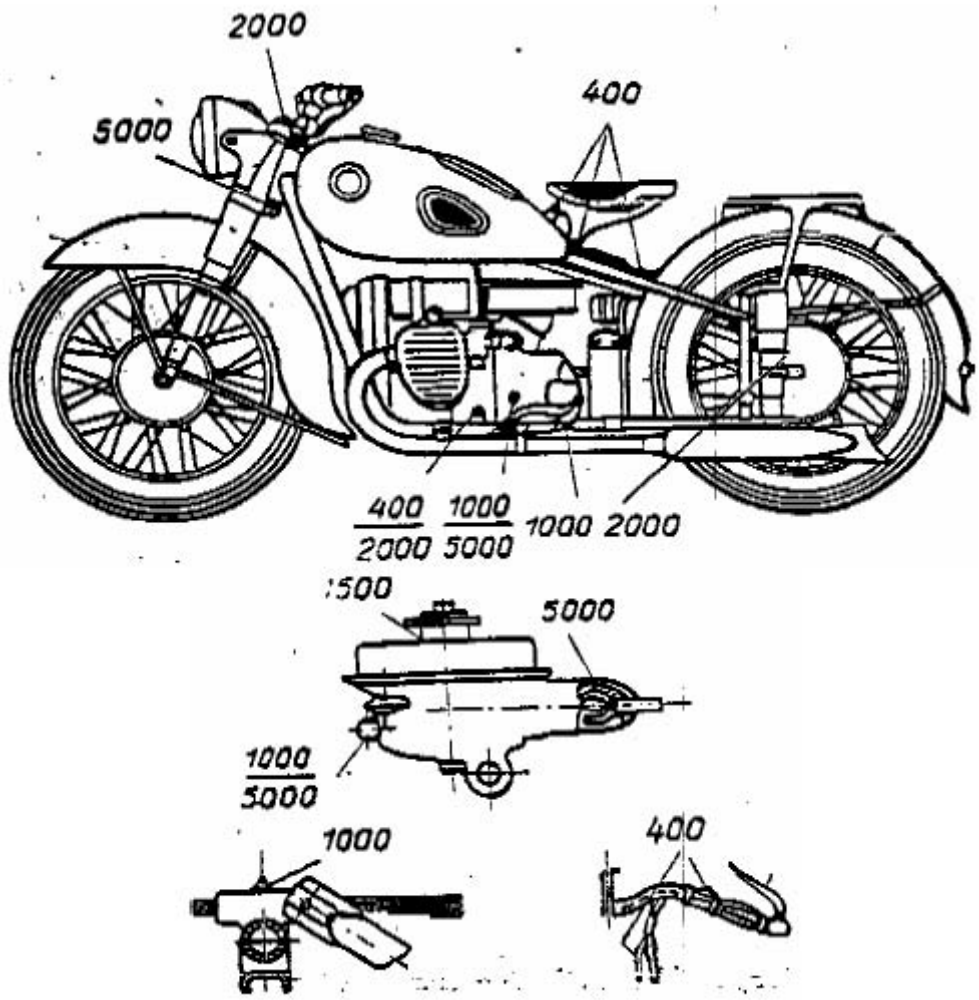


Fig 32
Operating Lubrication Pattern (numbers represent kilometers driven)

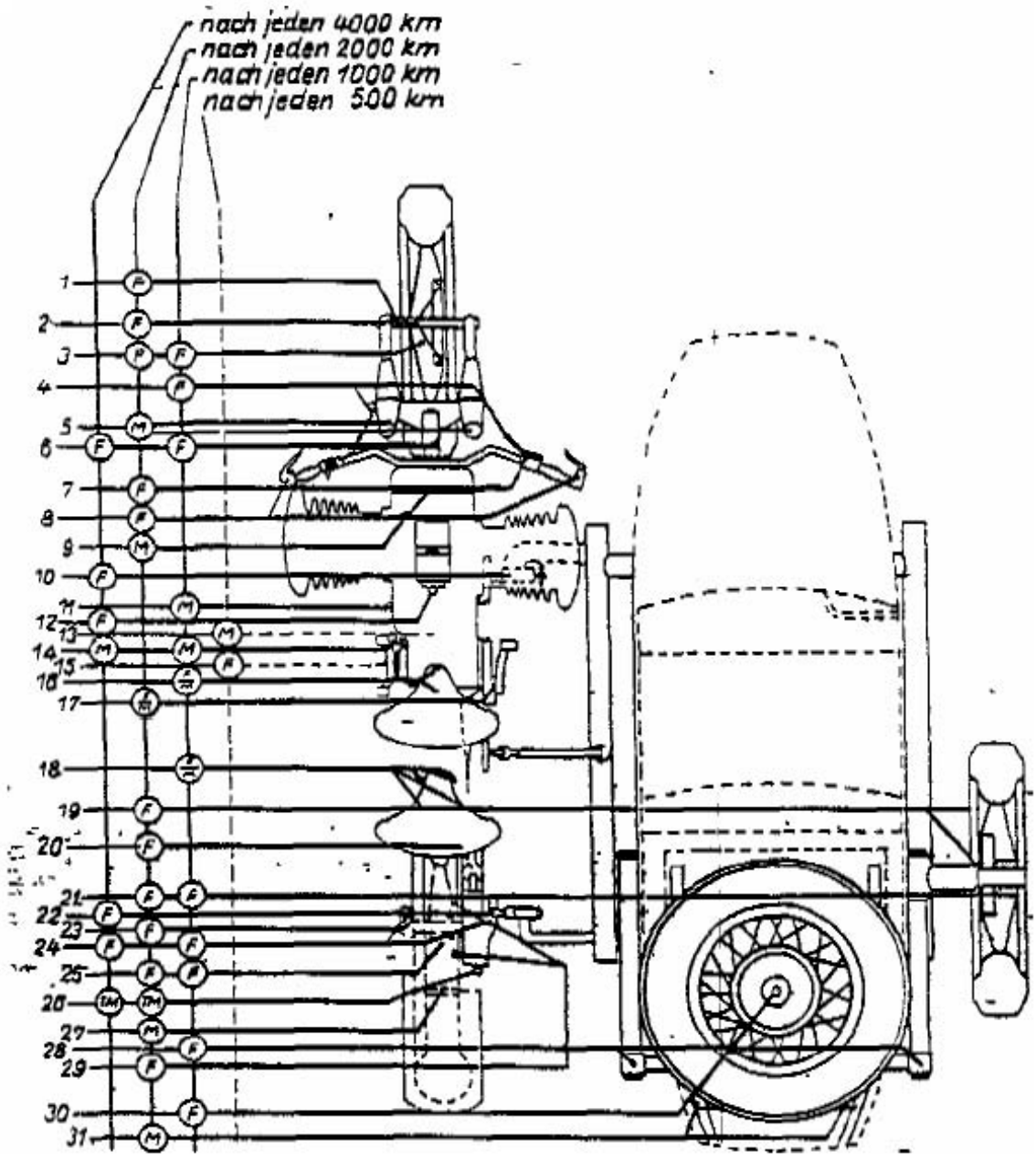


Fig 33
Lubrication Map for the M-72 Motorcycle

The lubrication of the motorcycle is to take place regularly, carefully and on schedule, since any omission of the lubrication schedule can cause serious wear and damage to the machine.

This table shows the lubrication fittings, the times at which the lubrication must be checked as well as the type and mark of the oil which should be used according to the season. When lubricating the main parts of the motorcycle that require disassembly the old oil and/or grease must be removed.
Fig. 33 shows the sketch of a motorcycle with all lubrication points.

Lubrication Points for the M72

Position on the Lubrication Map	Designation of the lubrication fittings	Number of points	Lubrication Times	Lubricant Type	
				Summer +5 and above	Winter +5 and below
1	2	3	4	5	
1,19,23	Wheel Axles	3	Every 2000km. When changing a tire wipe off and lubricate with fresh grease.	Grease	Grease
2,29	Axles and cams of the brake shoes	2	Every 2000 km disassemble, wash and lubricate with fresh grease.	Grease	Grease
3, 21, 25, 30	Wheel hubs (reserve if necessarily)	4	Grease every 1000 km. After 2000 km remove wheels, wash hubs and lubricate.	Grease	Grease
4	Clutch and brake cables	2	Grease every 1000 km. During winter wash off grease and lubricate with engine oil.	Grease	Motor Oil 10-18
5	Shock absorber of the front forks	5	Every 2000 km wash and pour 0,1Ltr. Fresh oil on each spring.	Motor Oil 10-18	Motor Oil 6
6	Thrust bearing of the steering shaft	2	Grease every 1000 km. Remove not less than once a year or after 8000 km, wash and grease.	Grease	Grease
7	Throttle guide lever	1	Every 2000 km with grease. Disassemble during winter operation, wash and grease.	Grease	Motor Oil 6
8	Clutch and brake lever	2	Take out the axles every 2000 km and lubricate.	Grease	Grease
9	Circuit breaker	1	Wash every 2000 km and use 2-3 drops engine oil on the circuit breaker axle and l-2 drops on the felt brush.	Motor Oil 10-18	Motor Oil 6
10,22	Hinge of the sidecar struts	2	After 4000 km take apart, wash and lubricate.	Grease	Grease
11	Crankshaft housing	1	Daily and up to the mark, Every 1000 km change oil.	Motor Oil 10-18	Motor Oil 10-18
12	Generator, rear housing	1	Renew grease of the rear rotor housing after 4000 km.		

Position on the Lubrication Map	Designation of the lubrication fittings	Number of points	Lubrication Times	Lubricant Type	
				Summer +5 and above	Winter +5 and below
1	2	3	4	5	
13	Air Filter	1	Wash and change oil after 500 km. On particularly dusty roads change every 150 -- 200 km.	Motor Oil 10-18	Motor Oil 6
14	Transmission Case	1	After 1000 km check and refill	Motor Oil 10-18	Motor Oil 6
15	Foot shift pedal	1	Lubricate daily	Grease	Grease
16	Front saddle joint	1	Lubricate every 1000km	Grease	Grease
	Spring joint	2	Lubricate every 1000km	Motor Oil 10-18	Motor Oil 6
17	Emergency Brake joint	2	Disassemble every 2000 km, wash and lubricate	Motor Oil 10-18	Motor Oil 6
	brake pedal joint of	1	Every 2000 km disassemble, wash and lubricate	Grease	Motor Oil 6
18	Rear saddle joint	1	Lubricate every 1000km	Grease	Grease
	Spring hinges	4	Lubricate every 1000km	Motor Oil 10-18	Motor Oil 6
20	Cardan shaft joint	1	Every 2000 km lubricate. If dirt is under the cap, wash	Grease	Grease
24	Left and right suspension	2	Lubricate every 1000 km . After 4000 km, but not less than once in the year disassemble, do not wash and lubricate.	Grease	Grease
26	Housing of the power transmission	1	Every 2000 km check and refill. Discharge after 4000 km, wash and fill with fresh oil.	Transmission oil	Transmission oil
27	Eyes rear shield of the hinge	1	Lubricate every 2000km	Motor Oil 10-18	Motor Oil 6
28	Shoes	2	Lubricate every 1000 km, daily with particularly dusty roads	Grease	Grease
31	Hinges of the baggage compartment cover	2	Lubricate every 2000km	Grease	Motor Oil 6
32	Speedometer spiral	1	Clean and lubricate every 2000km	Motor Oil 10-18	Motor Oil 6
33	Axle bearing of the lever of the torque shaft	1	Lubricate every 1000km	Grease	Grease

Possible Engine Problems and Solutions

Cause of problem and how to remedy	Trouble Signs							
	Engine operates poorly	Engine uses too much fuel	Engine does not have compression	Engine overheats	A cylinder does not work	Engine knocks	Engine does not start	Engine Stops Suddenly
1	2	3	4	5	6	7	8	9
Lean mixture - carburetors adjust	X							
Grease mixture - carburetors adjust	X	X	X					
Gasoline is empty - refill							X	X
Fuel Petcock closed - open							X	
Vent of the gasoline tank screw connection is dirty – cleans							X	X
Gasoline line of a carburetor is dirty - blow through					X			
Water is in the gasoline - new gasoline fill in							X	X
The nozzle of a carburetor gets dirty - nozzle clean					X			
Carburetor not correctly adjusted - regulate again	X	X	X	X			X	X
The distance between the breaker points is not correct - distance regulate							X	
Ignition is not correctly adjusted - adjust correctly						X	X	
Condenser is pierced – replacement							X	X
High voltage transmission line has itself solved - again to attach							X	X
Too much spark advance – retard ignition						X		
Ignition is defective - repair							X	
It works only one cylinder	X							
Piston rings broke – replace	X	X						
At the cylinder head gas steps out - cylinder head pins tighten or seal replacement	X	X						
Valves do not close closely - clean of oil carbon and grind in	X	X					X	

Cause of problem and how to remedy	Trouble Signs							
	Engine operates poorly	Engine uses too much fuel	Engine does not have compression	Engine overheats	A cylinder does not work	Engine knocks	Engine does not start	Engine Stops Suddenly
1	2	3	4	5	6	7	8	9
Piston rings are worn - replacement or slots and rings of oil coal clean	X	X						
Piston rings or cylinders are badly seated - piston rings replacement	X	X						
Formation of oil carbon on the pistons and in the cylinder heads - clean	X					X		
Float chamber vent is clogged - clean					X			
Valve clearance is incorrect – adjust	X			X			X	
Oil is too thin – change oil			X	X				
Defective oil pump - repair				X				X
No oil is coating the cylinders when starting due to cold engine - by the spark plug opening add clean, fresh, warm oil			X					
The engine is overheated - 10-15 minutes cooling time	X							
The gaps between the cylinder fins and cylinder heads are extremely dirty - must be cleaned				X				
Too much late ignition - ignition correctly stop				X				
Formation of oil carbon at the spark plug - clean and with denatured white spirits wash					X			
Formation of oil carbon at the spark plug electrodes - clean					X		X	
Spark electrodes are isolated - replacement					X		X	

Cause of problem and how to remedy	Trouble Signs							
	Engine operates poorly	Engine uses too much fuel	Engine does not have compression	Engine overheats	A cylinder does not work	Engine knocks	Engine does not start	Engine Stops Suddenly
1	2	3	4	5	6	7	8	9
Wear of the gudgeon pins, pistons and piston rod pins – replacement						X		
Valve tappet clearance too loose -- adjust	X	X				X	X	
Wrong gear chosen, switch to smaller gear						X		
Exhaust pipe clogged - clean	X							
No oil – refill				X				

Technical Characteristics (II)

I. Main data

1. Motorcycle wheel base (unloaded): 1430 mm
2. Clearance: 130 mm
3. Length of the motorcycle without sidecar: 2230 mm
Width of the motorcycle with sidecar: 1600 mm
Height (up to the ignition key): 1000 mm
4. Fueled Weight of the motorcycle: 370 kg
5. Maximum speed: 85 km/hr.
6. Gasoline tank capacity: 22 l
7. Gasoline consumption over 100 km travel with sidecar on even road with a speed of 50-60 km/hr: 7 l
8. App. Distance covered in 1 tank of fuel: 300 km

II. The engine

9. Engine: Two-cylinder horizontal
10. Bore: 78 mm
11. Stroke: 78 mm
12. Capacity: 746 ccm
13. Compression: 5,5
14. Cooling: Air cooled
15. Valve situation: down
16. Maximum output with 4600 U/min: 22 HP
17. Lubrication system: combined
18. Contents of the oil reservoir: 2 l
19. Carburetor: K-37

20. Number of carburetors: 2

III. Power transmission

21. Clutch: dry two disk friction clutch
22. Transmission: Two-speed, four-stage transmission
23. Power transmission to the rear wheel: cardan shaft
24. Speed ratio:

Gear	Transmission	Total
I.	3,6	16,65
2.	2,28	10,55
3.	1,7	7,85
4.	1,3	6,01

25. Quantity of oil in the transmission: 0.8 l
26. Quantity of oil in the power transmission: 0.175 l

IV. Chassis

27. Framework: tubular steel
28. Front End: Telescopic forks with hydraulic shock absorbers
29. Rear wheel suspension: springs
30. Wheels: replaceable
31. Tire size: 3,75X19 32.

Tire pressure:
Front wheel: 1.5 atmospheres
Rear wheel: 2.5 atmospheres
Sidecar wheel: 1.5 atmospheres

33. Sidecar: Passenger vehicle type for I person

V. Electrical equipment

34. Ignition system: Battery
35. Battery: Smt-14 6 V with 14 Amp./Std.
36. Generator: G 11 A 6 V 45 Watts of
37. Automatic relay controller: Rr-31
38. Distributor: Pm-05
39. Headlight: Fg-6
40. Signal: S-35
41. Taillight
42. Front sidecar lamp
43. Rear sidecar lamp

The M 72 motorcycle is delivered with the following accessories:
1 Maintenance and operating manual

Tools:

1. Tool kit.. . . . . 1 piece
2. Screwdriver.. . . .. 2 pieces
3. Flat-nose pliers. . . . . 1 piece
4. Wrench 8 X 10. . . . . 1 piece
5. Wrench 12 X 14. . . . . 1 piece
6. Wrench 14 X 17. . . . . 1 piece
7. Wrench 19 X 22. . . . . 1 piece
8. Wrench 36 X 41. . . . . 1 piece
9. Wrench. . . . . 1 piece
10. Box spanner 10 X 11. . . . . 1 piece
11. Box spanner 12 X 19. . . . . 1 piece
12. Box spanner 14 mm. . . . . 1 piece
13. Spark plug wrench 22 X 22. . . . . 1 piece
14. Match key. . . . . 1 piece
15. Thorn. . . . . 1 piece
16. Box spanner. .. . . . . 1 piece
17. Air pressure gauge. . . .. 1 piece
18. Assembly lever. . . . . 2 pieces
19. First aid kit. . . . . 1 piece
20. Tire pump. . . . . 1 piece
21. Grease gun. . . . . 1 piece
22. Eccentric cam and nozzle key…..... .. . . . . 1 piece
23. Hammer with handle. . . . . 1 piece
24. Contact file. . . . . 1 piece
25. Feeler gauge 0.1 and 0.5 mm. . . . . 1 piece
26. Key 11 on one side. . . . . 1 piece

Spare Parts

1. Candles. . .. . 2 pieces
2. Spare wheel complete. . . . . 1 piece
3. Short spokes. .. . . . . 20 pieces
4. Ignition key. . . . . .. 2 pieces
5. Key to the toolbox. . . . . 1 piece
6. Long spokes. . . . . 5 pieces .
7. ET box for generator. . . . . 1 piece
8. Cylinder head gaskets. . . . . 2 pieces
9. Fuse box for headlight. . . . . 1 piece
10. Speedometer spiral. . . .. 1 piece
11. Oil rings. . . . . 2 pieces
12. Compression rings. . . . . 4 pieces
13. Nipple. . . . . 10 pieces
14. Gasoline hose, long. . . . . 1 piece
15. Gasoline hose briefly. . . . . 1 piece
16. Clutch cable. . . . . 1 piece

USSR
MINISTRY FOR MECHANICAL ENGINEERING HEAD OFFICE ENGINE INDUSTRY NATIONAL IRBITER
Union motorcycle factory

The motorcycle M-72 with sidecar is manufactured according to the designs and technical conditions, it is tested and removed from the department of technical control.

The motorcycle can be operated in enterprise.
Framework NR.
Engine NR.
Transmission NR.
Sidecar NR.

Distribution date 1954

The speedometer of this motorcycle shows _____km.
Date stamp:

Signatures as required:

Before one uses the motorcycle, one must read the enclosed maintaining and operating instruction attentively.

The exact observance of all regulations, which are specified in the operating instruction, ensures a long and trouble free work of the motorcycle.

If questions emerge, which are not mentioned in the maintaining and operating instruction, one turns with further inquiries to the factory.

Because of all missing explanations and possible suggestions on the improvement of the machine or individual aggregates one turns to the factory:

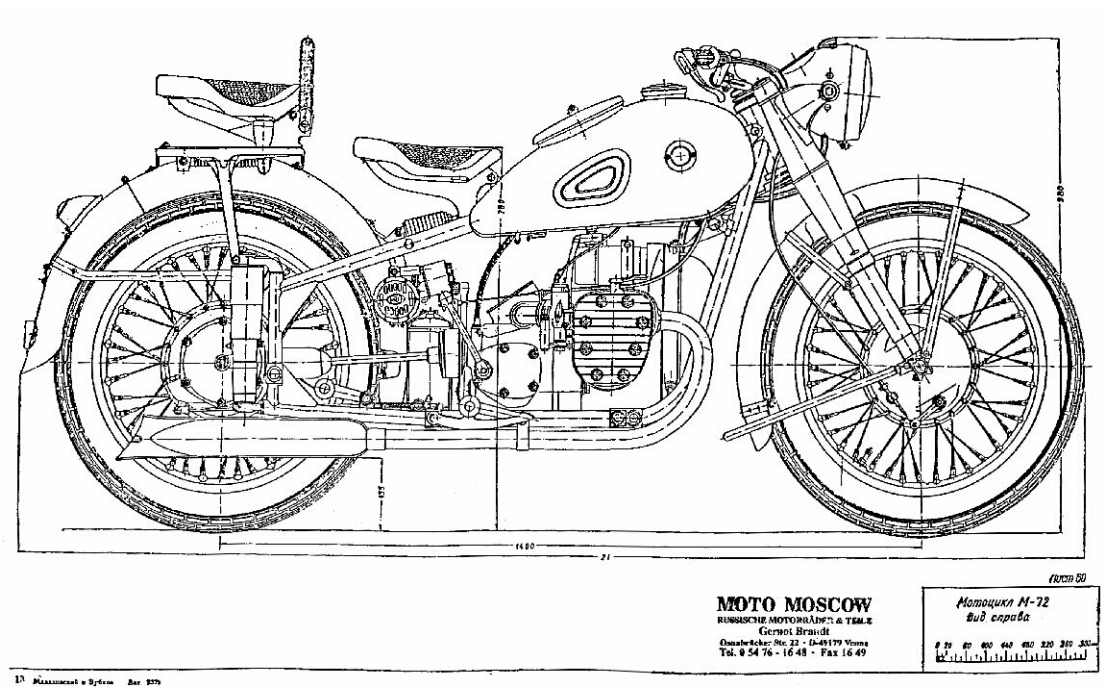
City Irbit, Swerdlowsker area,
Irbiter motorcycle factory.

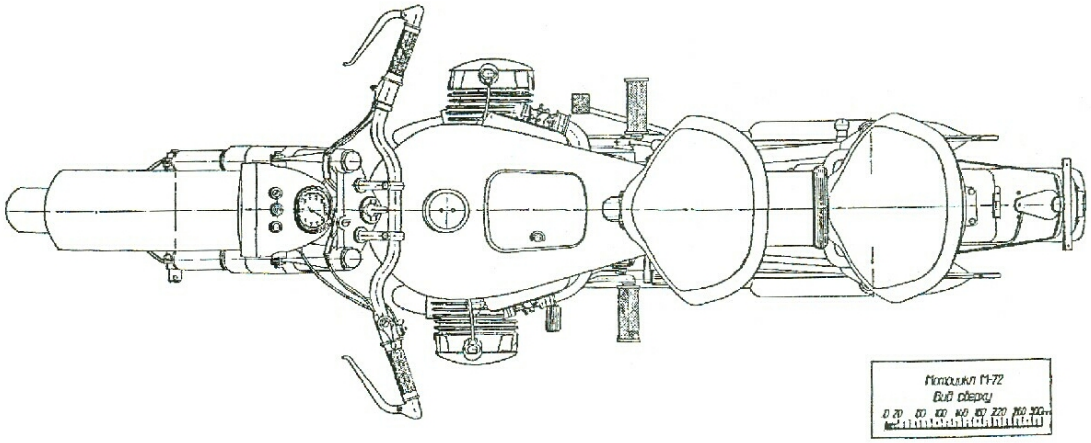
Approved

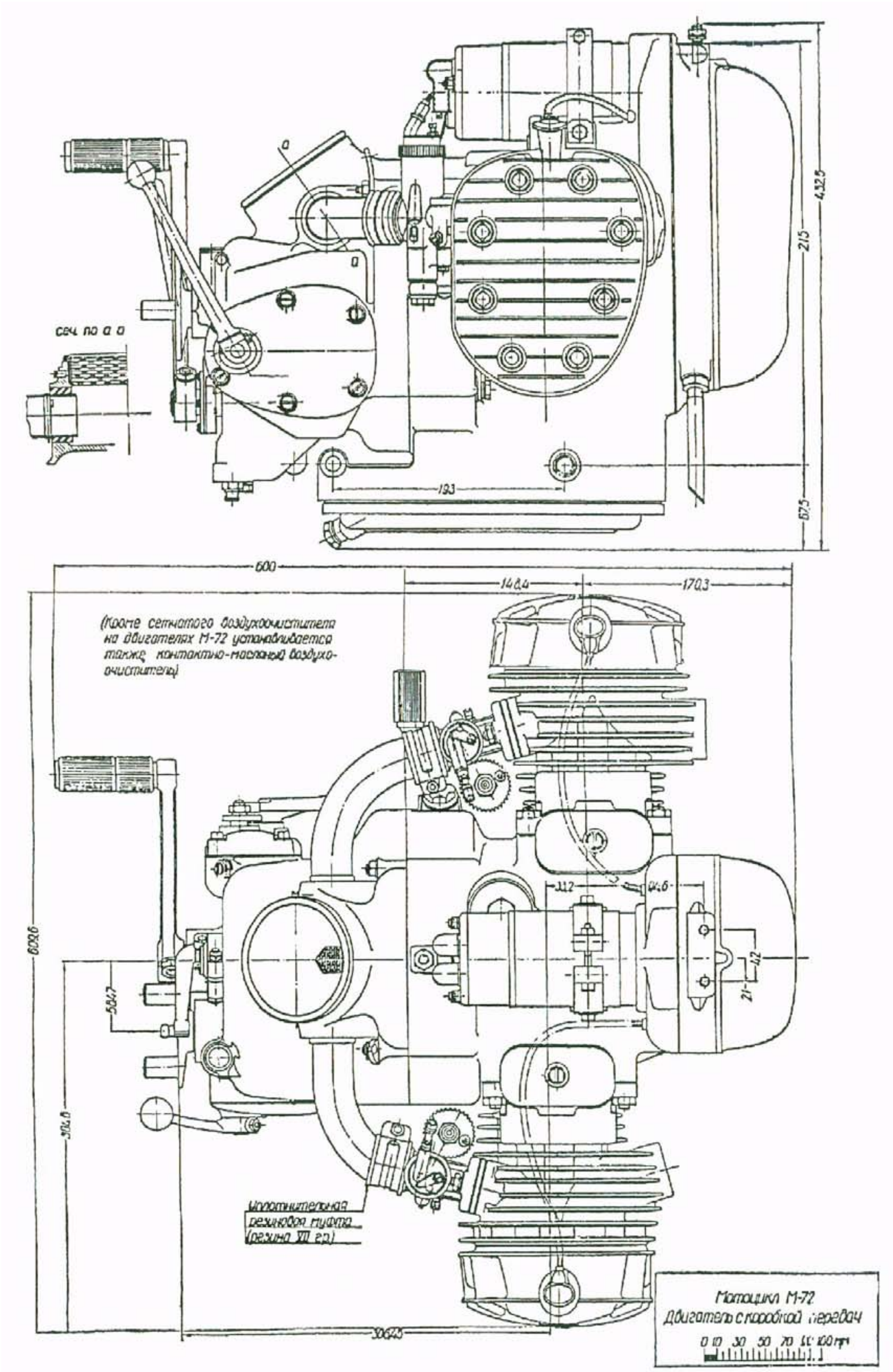
Lead engineer of the Irbiter motorcycle factory
signed.: *Ign. tjew*
3 October 1953

Appendix A:

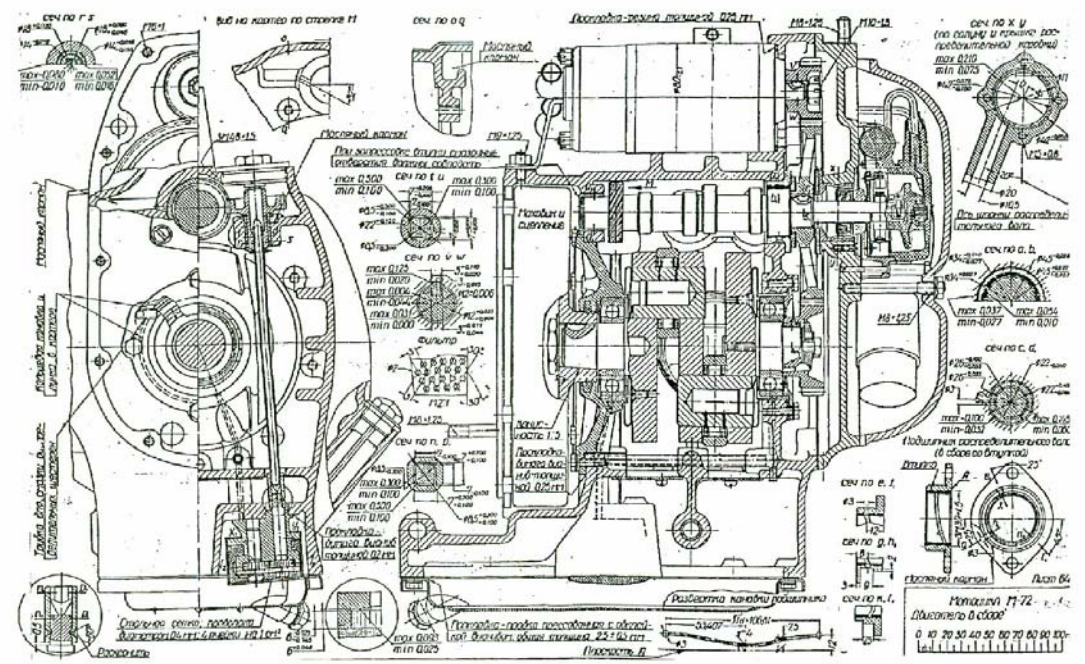
Additional Diagrams

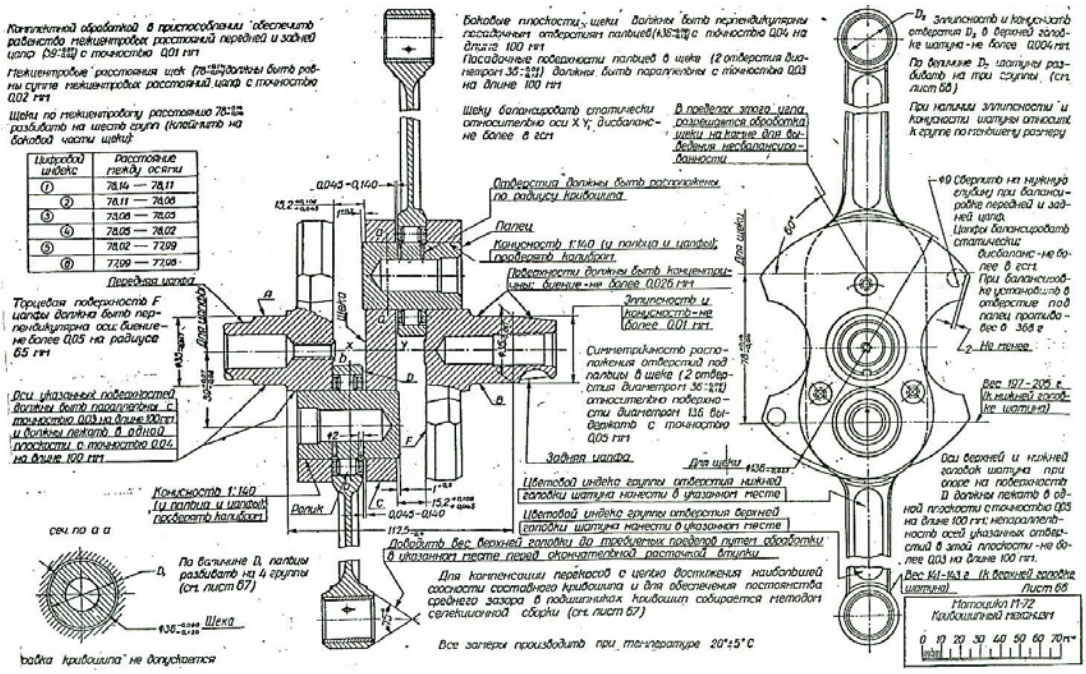






сеч. по а а
600
148,4
170,3
(Кроме сетчатого воздухоочистителя на двигателях М-72 устанавливается также контактно-масляный воздухоочиститель)
Уплотнительная резиновая муфта (резина XII гр.)
Мотоцикл М-72
Двигатель с коробкой передач
432,5
215
193





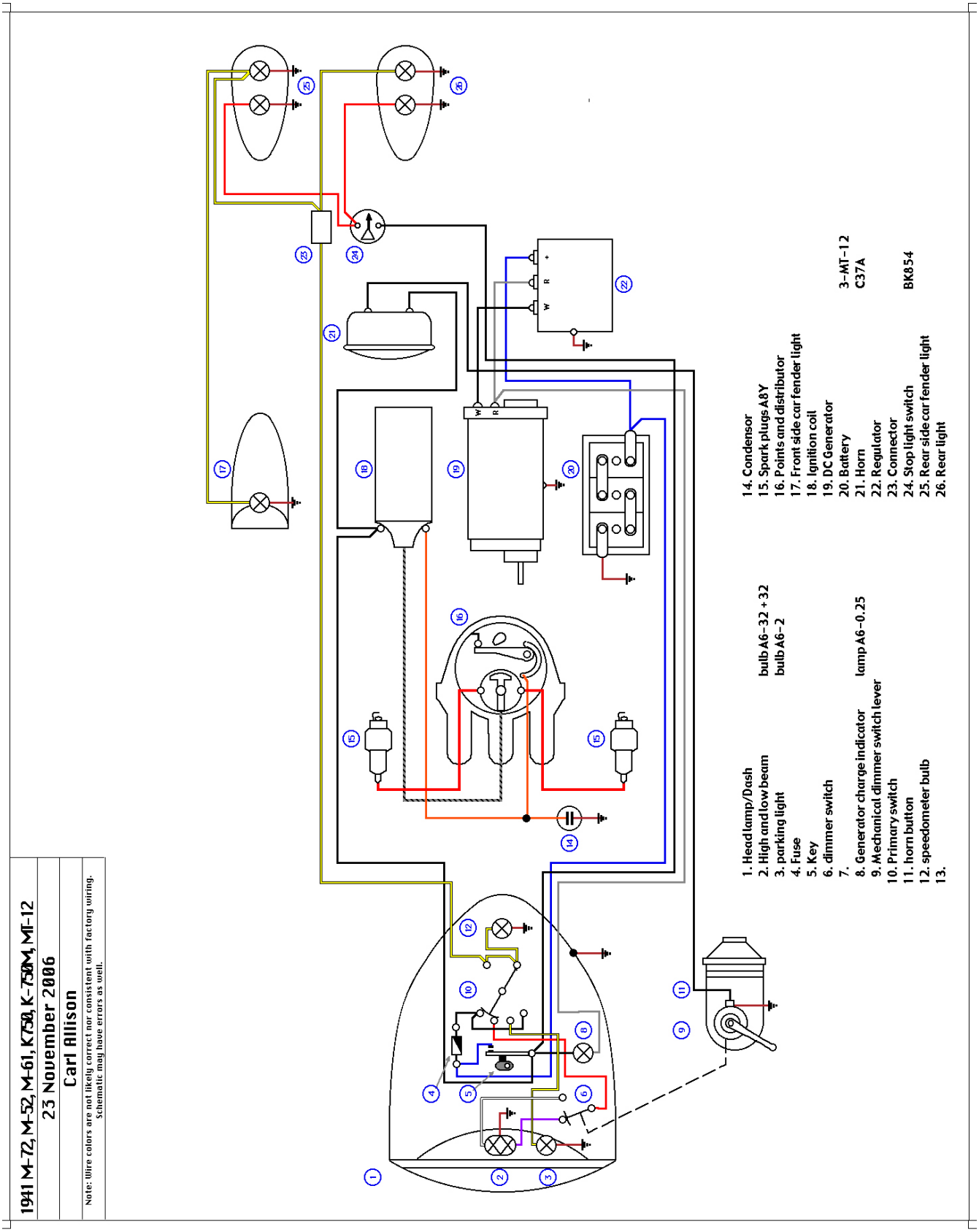


Diagram courtesy of Carl Allison.

Appendix B:

History of the M-72 Motorcycle

In 1939, the Soviet Union was preparing for war against Nazi Germany despite the Molotov-von Ribbentrop Pact. Stalin had ordered full military preparation for the defense of the Motherland and ground mobility was an important aspect. The Russian Defense Ministry began studies of plans for modern vehicles, and chose the German BMW R71* motorcycle design for their military model. According to "official reports" 5 units were covertly purchased through either Swedish or Scandinavian intermediaries and Soviet engineers then duplicated the BMW design, creating facilities to produce their own engines and gearboxes in Moscow.

An alternative version of this acquisition suggests that the BMW factory actually supplied the construction drawings and casting moulds as a result of the Molotov-von Ribbentrop Pact. Soviet engineers had previously been allowed to tour German factories, and as BMW began series production of the R75 in 1941 supplying the Soviets with the older R71 model would not have been unlikely. This could also explain why the Soviets also duplicated the Wehrmacht sidecar. In either case, the entire motorcycle was reversed engineered and early in 1941 the first trial M-72 motorcycles were reviewed by Stalin, who approved production, and a factory was built in Moscow for military production (MMZ models), rolling out 1753 bikes prior to evacuation.

After the Germans invaded Russia in late summer of the same year the factory was moved east for security reasons, eventually relocating to the small town of Irbit on the edge of the Siberian steppes. On October 25, 1942 the first M-72 motorcycles went to the front and during WWII a total of 9,799 M-72 motorcycles were delivered to the front for reconnaissance detachments and mobile troops, although production during the war also took place at Gorky where all sidecars were produced, both for the M-72 and Lend-Lease motorcycles. The M-72 was available mainly to the authorities up until 1951 when the KMZ plant in the Ukraine took over Red Army production. The IMZ plant supplied military bikes to the PRC up to the transfer of a M-72 production line in 1957 and continued to supply parts to the PRC until 1960. At this time the Irbitski Motozykletny Zavod (Ирби́тский мотоцикле́тный заво́д) (IMZ) began to concentrate on bikes for domestic consumption and by the 1960's the full production of the plant was turned over to non-military production. The Irbit plant became known as the "URAL" plant due to its location in 1961. This factory continues to produce motorcycles under the Ural name.

The Kiev Motorcycle Zavod (KMZ) began production of the M-72 in 1951. It began production of the M-72N in 1956 and commenced production of the K-750 in 1958. (The cyrillic letter shaped H is the latin letter N.) . As increasing numbers of K-750s were turned out, KMZ' s M-72H production began to wind down. The K-750 had a slightly higher HP output and a more conventional swing arm rear suspension instead of the original plunger type. As with most USSR factories KMZ's product also had no official name until marketing was allowed, but as the KMZ was located near the "Dnepr" river which runs through the capital of Kiev, the name Dnepr was eventually attached to these bikes. This factory also continues limited production although it is rumored to be closed in 2007.

MMZ - produced 1753 motorcycles prior to evacuation in 1941
LMZ - no complete machines produced prior to evacuation to Gorky
KhMZ - 233 machines believed assemble with parts from LMZ and KhMZ (possibly assembled at Gorky).
IMZ - 1942/3 3780 machines, 1944/5 3993 machines
GMZ - 1942/3 2694 machines, 1944/5 2882 machines
Total production 1941 to end of Great Patriotic War 15,335 units. All sidecars produced by GMZ. First bikes produced at IMZ in February 1942. Production at GMZ ceased 1949 and production facilities transferred to KMZ.
First bikes produced at KMZ in 1951 with the delivery of 500 engines from IMZ.
In 1956 IMZ introduced the M-72M with torsion bar suspension for the sidecar, a ball bearing for the front of the camshaft and new pressed steel - half hubs permitting the use of straight spokes.
In 1957 an IMZ production line was transferred to the PRC where it became the 1957 model, later the M1M and now commonly known as the Chang Jiang .
In 1956 KMZ introduced the M-72N with short leading link forks and full width aluminum wheel hubs.
In 1958/9 KMZ introduced the K-750 with a awing-arm frame. IMZ models were badged as IMZ in the post-war period until the late 1950's when they were badged as "Irbit". With the introduction of the M-62 in 1961 they were badged as "Ural" a name which continues to the present.

Much thanks to Stephen Wiggins for revisions & historical timeline.

* Harley-Davidson also copied the BMW design and delivered about 1,000 Harley-Davidson XA (Experimental Army) flat-twin shaft drive motorcycles to the US Army during World War II.

Appendix C:

Photos