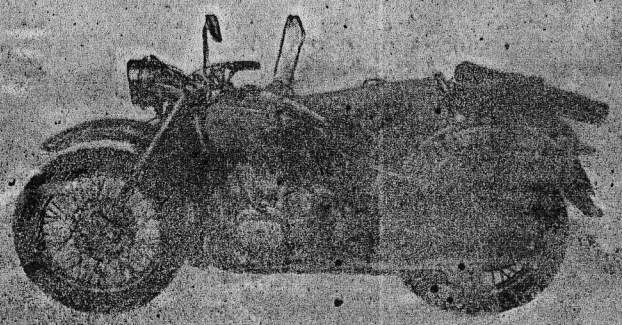
V/O «AVTOEXPORT»
USSR MOSCOW

MOTORCYCLE
URAL-2



МОТОЦИКЛ
УРАЛ-2"
ПАСПОРТ

АВТОЭКСПОРТ · СССР · МОСКВА

MOTORCYCLE УРАЛ-2

SUPPLEMENT TO SERVICE MANUAL

USSR MOSCOW

Attention of Riders!

The following changes have been made in the motorcycle design

1. Type ПМ-11А distributor with automatic advance timer i replaced by type ПМ-302 distinguished for longer service life o the automatic advance timer. In connection with this, the plat with timer weights formerly enclosed in the spare parts is excluded. Distributor ПМ-302 differs from type ПМ-11А by a new design of the automatic advance timer. The method of its attachment to the distributor body, however, remained unchanged. As far as the body construction and the performance characteristics are concerned, the automatic advance timer in the new type ПМ-302 does not differ from that for type ПМ-11А distributor described in the Service Manual.

2. Instead of carburetters К-38, the engine is now equipped with carburetters К-301 displaying a flat throttle and a release spring to compensate for wear of carburetter parts, remedying thereby the throttle noise inherent to the К-38 carburetters.

Simultaneously with introduction of the new carburetters К-301, a corresponding increase was made in the bores of air shutter and air-intake conduits.

FUNCTION OF CARBURETTER К-301

Start-up of engine and idling. Gasoline from the gasoline cock is delivered to the float chamber (Fig. 1) through pipe union *1* pressed into cover *3*. From the float chamber the gasoline via fuel filter *5* flows through passage *a* and idle adjustment fuel passage *b* to the main jet atomizer, settling on the level of gasoline in the float chamber.

Since at starting of the engine, the throttle valve is in lower position and only raised a little by the throttle valve screw *9*, air will flow at great velocity through the slit opening. Influenced by high vacuum beyond the throttle valve, fuel via idling jet *18* rises through passage *b* and, being mixed on the way with air that flows from the suction conduit inlet throat through passage *d* and air filter gauze *20*, is directed in a form of emulsion to the atomizing orifice *e*. Here the emulsion is pulverized by air passing at high velocity through the slit between the throttle valve and the chamber wall. The combustible mixture so prepared enters the engine cylinders. During the idling, the main jet atomizer is not working because of reduced vacuum above it.

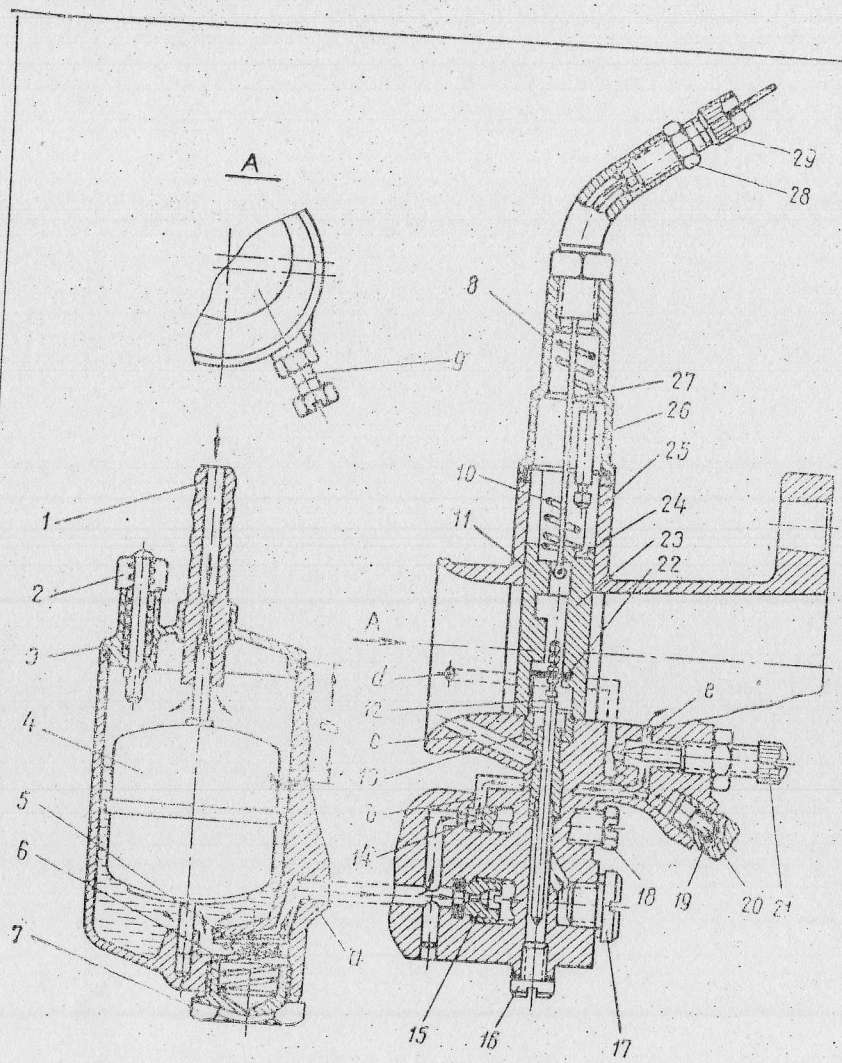


Fig. 1. К-301 Carburetter Diagram:

1 — pipe union; *2* — depressor; *3* — float chamber cover; *4* — float with shut-off needle; *5* — fuel filter; *6* — filter spring; *7* — filter plug; *8* — carburetter cover; *9* — throttle valve screw; *10* — throttle spring; *11* — throttle check; *12* — throttle valve needle; *13* — adapter; *14* — atomizer; *15* — main jet; *16* — atomizer passage plug; *17* — main jet plug; *18* — idling jet; *19* — air filter body; *20* — air filter gauge; *21* — idle adjustment screw; *22* — throttle needle lock; *23* — throttle body; *24* — throttle expansion spring; *25* — carburetter body; *26* — throttle rise stop; *27* — throttle control cable; *28* — locknut; *29* — control cable armour thrust nipple; *a* — fuel passage; *b* — idle adjustment fuel passage; *c* — air passage of main metering-out system; *d* — idle adjustment air passage; *e* — idle adjustment atomizing orifice; *B* — fuel level 22±1.5

Work of carburetter at medium loads. As the throttle is raised, more vacuum is formed above the atomizer. The main system is brought in action. It consists of main jet *8*, atomizer *7* and metering needle *5*. (Fig. 2).

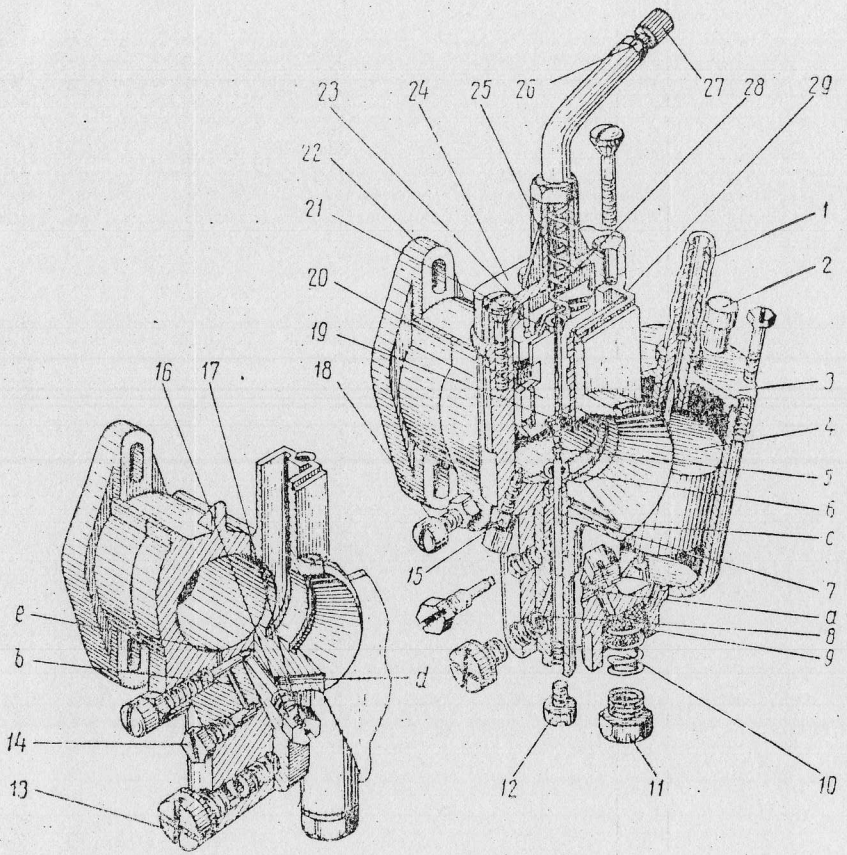


Fig. 2. Carburetter K-301:

1 — pipe union; *2* — depressor; *3* — float chamber cover; *4* — float with shut-off needle; *5* — throttle valve needle; *6* — adapter; *7* — atomizer; *8* — main jet; *9* — fuel filter; *10* — filter spring; *11* — filter plug; *12* — atomizer passage plug; *13* — main jet plug; *14* — idling jet; *15* — throttle valve screw; *16* — air filter body; *17* — air filter gauze; *18* — idle adjustment screw; *19* — throttle neddle lock; *20* — throttle body; *21* — throttle expansion spring; *22* — carburetter body; *23* — throttle rise stop; *24* — carburetter cover; *25* — throttle control cable; *26* — locknut; *27* — control cable armour thrust nipple; *28* — throttle spring; *29* — cheek; *a* — fuel passage; *b* — idle adjustment fuel passage; *c* — air passage of main metering-out system; *d* — idle adjustment air passage; *e* — idle adjustment atomizing orifice

Outflow of fuel is limited by the circular slit between the calibrated portion of the atomizer and the metering needle of the throttle valve.

When the engine is working at medium loads, vacuum at the atomizer is compensated partially with air flowing to the atomizer through passage *c* which connects the atomizer hollow with the suction conduit throat.

Work of carburetter at full-loads. With the throttle raised completely (the last quarter of its travel), the quality of fuel passing through the atomizer is not limited by the metering needle and depends on the throughput of the main jet.

Design of the carburetter is illustrated in Fig. 2.

ADJUSTMENT OF CARBURETTER K-301

In the course of motorcycle operation, the carburetters are checked and adjusted for engine idling in low revolutions, acceleration and for functioning of carburetter controls.

Before proceeding with the adjustment of carburetters, start up the engine and warm it up, because at adjustment made on a cold engine will be disturbed as soon as the engine is warmed up. Adjustment of idling in low revolutions is of a great importance for the engine performance.

Each carburetter is adjusted independently. For adjusting the left-hand carburetter K-301, proceed as follows:

— remove the cap from the spark plug of the right cylinder;

— in the left carburetter slacken the locknut *26* of the throttle control cable armour thrust nipple *27* and screw in the nipple so as to provide for a gap between the cable armour and the nipple;

— slacken the locknuts of throttle valve screw *15* and idle adjustment screw *18*, tighten home the idle adjustment screw. Using throttle valve screw *15*, set the minimum steady revolutions for the engine;

— while turning idle adjustment screw *18* out, set maximum speed for the engine with the throttle valve screw in the given position;

— releasing gradually throttle valve screw *15*, set the minimum steady revolutions.

Having completed the adjustment, tighten up the locknuts on the screws, cut off the left cylinder and proceed to adjust the right carburetter in the same manner.

The carburetters should ensure for the same speed of the engine when idling on either cylinder (left or right). The carburetters are checked after their adjustment on a warm engine. For this job, cut off alternatively the right, then the left cylinder by removing the cap from the respective spark plug. Determine by ear any variation in speed as each cylinder is working alone. If the engine speed, when running on right or left cylinder, is found different, readjust the carburetters by turning the throttle valve screws in or out till uniform speeds are obtained in both cylinders. After that tighten up the locknuts of the throttle valve screws.

When adjusting for idle running see that the idle adjustment screws are not turned in to the limit and **never drive the motorcycle if the idle adjustment screws on carburetters are tightened to the stop.**

Synchronized operation of both cylinders, with the engine running in different duties, is attained when the throttle valves in the left and right carburetters are raised simultaneously. **Non-synchronized operation, even with well adjusted carburetters, will cause overheating and quick wearing of parts in one of the engine cylinders.** To attain the synchronized operation, use the throttle control twistgrip to set the engine revolutions corresponding to the travelling speed of 30—40 km/hr in IV gear, and by removing alternatively the caps from spark plugs of either cylinder, determine by ear any variation in the engine revolutions.

If for the reason of inexperience the engine revolutions corresponding to the respective travelling speed of the motorcycle cannot be determined by ear, make use of the speedometer readings. In such a case, arrange the motorcycle up on a stand, engage IV gear, run the engine working on one cylinder at revolutions equivalent to about 30—40 km/hr on the speedometer. Thus cutting off alternatively the right and left cylinder, follow the readings on the speedometer. If the engine running on the right or on the left cylinder proves different, readjust the carburetters to attain a synchronized operation.

The latter readjustment consists in making the throttle control cable armours either shorter or longer by turning the control cable armour thrust nipple in or out. After completing this adjustment, safety the cable armour thrust nipple in place. With the throttle valve down all the way there should be a clearance from 2 to 3 mm between the throttle control cable armours and their thrust nipples, approximately the same for both carburetters.

The engine performance in the range of medium loads depends on the position of needle in the throttle, consequently, the aim of this adjustment is to set the needle in correct position in each carburetter. If the mixture is too rich due to wearing of atomizer, or if it becomes necessary to increase the engine power at the expense of higher fuel consumption, the carburetters are readjusted by changing the needle position.

The throttle needle has six notches or divisions for setting it in the lock. When the needle lock is set in lower divisions, the combustible mixture is enriched and if the lock is set in upper divisions — it becomes lean.

To check for correct adjustment of carburetters on an engine operating at medium loads, increase abruptly the engine speed by turning the throttle control twistgrip. If backfiring is noticed in the carburetter, enrich the mixture by raising the needles for one or two divisions. If there is no backfire, but the transfer from one working range to another is too slow, it means that the mixture is too rich and the needle must be lowered.

With a certain experience the quality of combustible mixture may be judged by the colour of the spark plug insulator and centre electrode. For this check-up, select an even section of a road, about from 1.5 to 2 km long, engage III gear and ride through this stretch at a speed from 45 to 50 km/hr. At the end of the run stop the engine by switching off the ignition and simultaneously release the clutch. Then bring the motorcycle to a halt, screw the spark plugs out and examine them. A black carbon deposit indicates that the mixture is too rich, which is remedied by lowering the throttle needles. If the colour is light yellow, sandy or whitish, it means that the mixture is too lean and the throttle needles must be raised. When the combustible mixture is of the correct proportion, the colour on the spark plug electrodes and insulators will be brown.

Condition of the throttle control twistgrip cable armours affects the functioning of carburetters. If due to negligence in overhauling the cable armours get stretched out, the carburetters will not ensure the synchronized operation of engine cylinders in all working ranges. Therefore, during any repairs of the motorcycle involving the removal of throttle control cables, take all precautions not to stretch or damage the cable armours in any way.

CARBURETTER MAINTENANCE

For regular maintenance of the carburetters in the course of motorcycle operation clean and wash all parts, fuel and air passages after every 2,000 km. In washing the parts and passages, use clean gasoline, but if the gum residues are abundant, make use of thinner for nitrodyes. After that blow through the washed parts and passages with compressed air.

Never use wire or other metal tools for cleaning the jets or calibrated holes of the carburetters.

If the motorcycle is used daily, pay due attention to condition of the carburetters. Whenever noticing even the slightest leak of fuel, tighten immediately the respective bolts, plugs, nuts, and change gaskets if necessary.

Gasoline leaks through the carburetter air filter usually point to lack of tightness in the float chamber shut-off valve or in the gasoline cock (if leaks are evident with the gasoline cock closed). In these cases grind the float needle to the float chamber pipe union or grind the distributing slide-valve to the gasoline cock body, but under no circumstances plug up the carburetter air filter.

It is also important to wash systematically the fuel filter and blow it through with compressed air.

Do not unscrew the main jet without a reason, because its gasket may get damaged. If the jet gets filthy, undo plugs *13* and *11*, then blow the jet with compressed air through the passage from the plug *13* end.

To disassemble the throttle, disconnect its body from the check, applying a certain effort to overcome the expansion force of the spring which simultaneously serves as a retainer preventing spontaneous separation of body and cheek at the time, when the throttle is being taken out from the carburetter body. It is not advisable to remove the spring out of the throttle body.

Reassemble the throttle after the throttle needle and the control cable tip are set in respective recesses in the throttle body. Here again some effort must be applied to overcome the expansion spring force. Fit the throttle in the carburetter body with its cheek (throttle cutout) facing the inlet branch.

In assembling, be sure that the carburetter cover salient is fitted properly in the carburetter body slot.

Vneshtorgizdat. Order No. 1720CO
Тип. № 3. Заказ № 6379

MOTORCYCLE "УРАЛ-2"

model M-63

SERVICE MANUAL

V/O «AVTOEXPORT»
USSR MOSCOW

The motorcycle "Урал-2" equipped with a side-car is a heavy duty touring model. It is powered with an overhead valve engine and is distinguished for its high roadability, riding comfort and long service life.

The reliability and longevity of the motorcycle operation, however, will depend to a great extent on the riding conditions. A satisfactory and long-life service can be anticipated only if the motorcycle is properly maintained, regularly serviced and its mechanisms are adjusted in due time.

Unless absolutely necessary, do not dismantle the machine or take apart its component units, as this may impair the normal interaction of its parts, cause premature wear or even result in a breakdown.

Before taking the machine on the road it is strongly advised that the present Service Manual is diligently studied.

Due to constant improvements being introduced in the manufacturing of the "Урал-2" motorcycle — some later changes in the construction may not be reflected in the present Manual.

WARNING

In the course of the first 2000 km the parts of all mechanisms in the motorcycle are being bedded-in. During this period do not overstrain the engine and race the machine above travelling speeds specified in section "Running-in". To restrict the motorcycle speed during the running-in period special speed limiters are installed on the carburetter covers, which shorten to the first notch after 1000 km and to the second notch (or remove the limiters) after 2000 km.

It is a bad practice to shorten or remove the limiters prior to the specified periods.

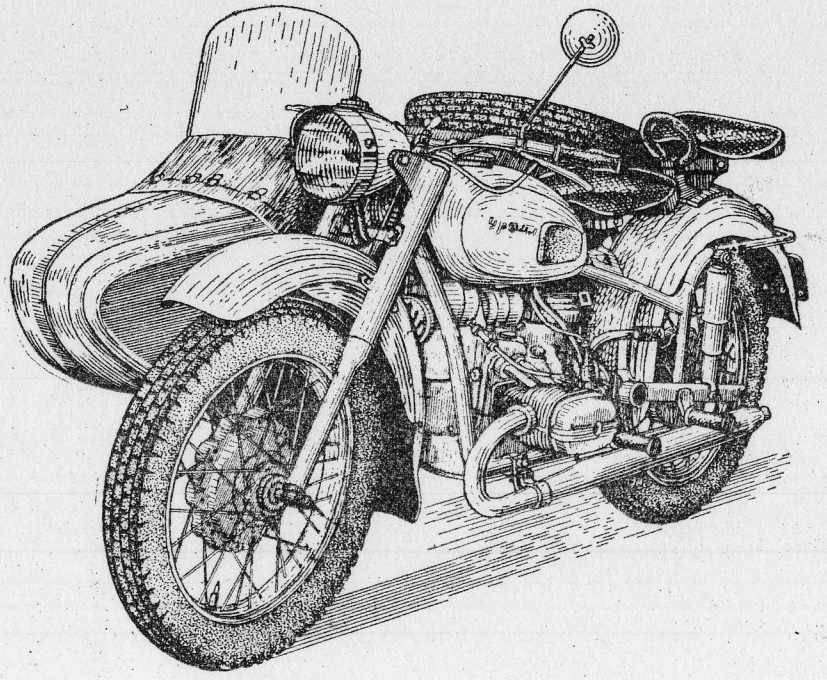


Fig. 1. Motorcycle Ural-2 (general view)

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I. TECHNICAL DATA

Maximum speed of motorcycle with side-car, km/hr	100
Reference consumption of gasoline per 100 km, litres	5.8
Engine	four-stroke, overhead valves, opposed twin
Displacement, cu. cm.	649
Cylinder bore, mm	78
Piston stroke, mm	68
Compression ratio	6.2
Rated power, hp	30
Rated speed, r. p. m.	4800—5200
Rated torque, kgm	4.5
Lubricating system	combined: from gear pump and splash
Holding capacity of fuel tank, litres	20 minimum
Carburetters	type K-38 on each cylinder
Fuel	A-72
Ignition	battery, 6V
Power transmission	two-disc clutch, four-speed gearbox, propeller shaft and bevel-geared final drive
Gear ratios:	
I gear	1:16.65
II gear	1:10.56
III gear	1:7.85
IV gear	1:6.01
Oil priming capacities, litres:	
engine crankcase	2.0
gearbox	0.8
final drive casing	0.13
front fork	0.1
air cleaner	0.2
hydraulic shock absorber	0.105
Rear wheel suspension	swinging-type with hydraulic spring shock-absorbers
Front fork	telescopic, spring-loaded, with hydraulic shock-absorbers
Wheels	interchangeable, fitted with 3.75—19″ (95—484 mm) tyres
Side-car	passenger-type with cushioned body and lever suspension of wheel
Overall dimensions of motorcycle with sidecar as per Specifications, mm	
length	2420
width	1570
height (to ignition key)	1100
wheelbase	1450
tread	1100
ground clearance	150
Dry weight of motorcycle with side-car, kg	320
Load-carrying capacity (three passengers and luggage), kg	255 (maximum)

Note. The reference consumption of gasoline is determined in summertime on a motorcycle which is in good riding order and is used for regular service (i. e. after the running-in), tested under full load while travelling on a horizontal flat asphalt highway at a constant speed from 50 to 60 km/hr in IV gear, without any stop-overs and/or start-ups.

The reference consumption of gasoline is an indicator for the riding qualities of the motorcycle, and it cannot serve as the rate of fuel consumption in actual running.

The rate of fuel consumption under running conditions is not estimated by the Manufacturing Works, since this depends on the prevailing riding conditions, sush as the condition of roads, climatic service conditions, range of travelling speeds, and the driving efficiency of the riders.

Twistgrip *5* (Fig. 2) located on the right-hand portion of the handlebar is used to control the carburetter throttles. By twisting the grip towards you the carburetter throttles are raised thereby increasing the engine speed and power. The same portion of the handlebar accommodates lever *4* which actuates the front wheel brake.

Clutch lever *12* fitted on the left-hand portion of the handlebar is used to disengage the engine from the gearbox. Turn-knob *11* used to switch from far-reaching to "bright" light and vice versa and horn button *10* are also fitted there.

Master switch *1* operated by the ignition key, and speedometer *2* incorporating an odometer are arranged in the headlamp.

The master switch has the following positions:

1) with the key pulled out and the master switch in midway position all instruments are cut off (day-time parking);

2) with the key pulled out and master switch turned to the right the tail lamp, sidecar lamps and headlamp "dim" bulb are "on" (night-time parking);

3) with the key pushed in to the limit and the master switch in midway position, ignition is "on", horn will sound if button is depressed (day-time driving);

Note. With the engine at rest and the key pushed in to the limit, pilot light is on, while with the engine running at accelerated speed it goes out.

4) with the key pushed in to the limit and the master switch turned to the left, ignition, tail lamp, speedometer dial lamp and side-car lamps are on and, depending on the position of turn-knob *11*, either far-reaching light (driving in the country at night) or "bright" light (driving at night on poorly lighted streets) is "on", horn will sound if button is depressed;

5) with the key pushed in to the limit and the master switch turned to the right, ignition, tail lamp, speedometer dial lamp; side-car lamps and head lamp "dim" bulb are "on" (driving at night through well lighted streets), horn will sound if button is depressed.

Pedal *9* operated by the left foot serves for changing gears. To shift from high to lower gears, press on the pedal front shoulder, whereas to shift from low to higher gears — press on its rear shoulder. The neutral position is between the I and II gears and

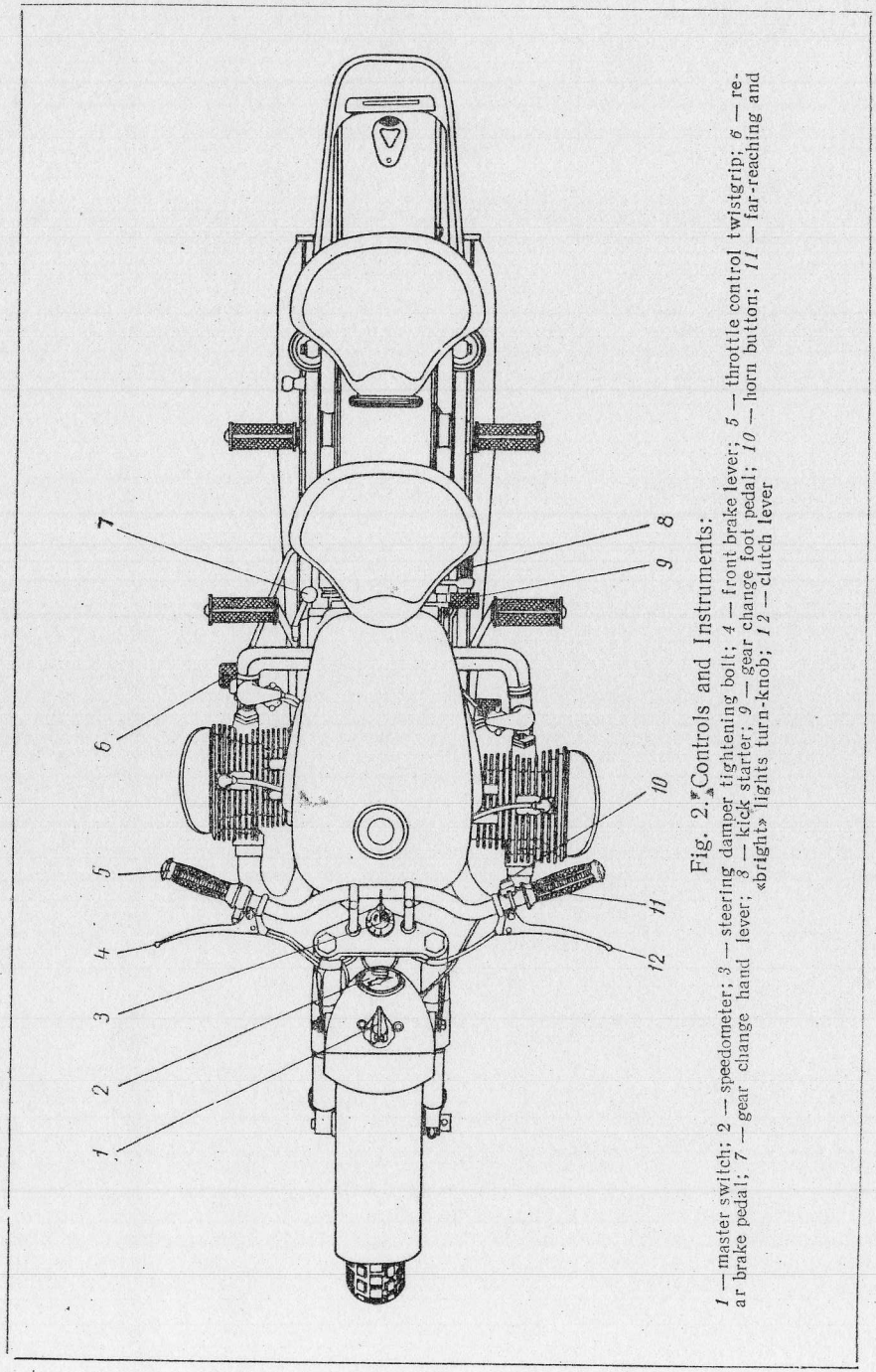

Fig. 2. Controls and Instruments:
1 — master switch; *2* — speedometer; *3* — steering damper tightening bolt; *4* — front brake lever; *5* — throttle control twistgrip; *6* — rear brake pedal; *7* — gear change hand lever; *8* — kick starter; *9* — gear change foot pedal; *10* — horn button; *11* — far-reaching and «bright» lights turn-knob; *12* — clutch lever

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is set by hand-operated gear change lever *7* which is located on the right-hand side of the gearbox.

Rear brake pedal *6* located under the right foot toe serves for applying the rear wheel brake. Kick starter *8* is used to start up the engine. When depressed, the kick starter transmits the motion to the engine crank mechanism through a step-up gear. The kick starter is returned to initial position by force of a spring that is mounted inside the gearbox.

Steering damper tightening bolt *3* is installed in the middle of the handlebar. By turning the bolt clockwise the damper spring washer and friction washers are tightened, restricting the turning of the steering column. This is usually practiced, whenever it becomes necessary to drive fast over bad roads and when a greater effort is required to hold the handlebar in position.

The air control lever is fitted on the air conduit tube which is on the left-hand side of the gearbox. While turning it to the left and up, the air suction passage gets closed.

III. PREPARING NEW MOTORCYCLE FOR USE

Each motorcycle is tested and adjusted at the Manufacturing Works. It is then subject to preservation treatment and boxed if necessary.

To prepare a new machine for the road, proceed as follows:

1. Remove carefully the preservative grease from all outside parts. Never attempt to ride a motorcycle with the preservative grease on as it will be burnt to exhaust pipes and silencers. Use cotton waste moistened in gasoline, kerosene or acetone to remove the preservative grease.
2. Unscrew the spark plugs, wash them in gasoline; by depressing the kick starter several times blow the cylinders through the spark plug holes; reinstall the spark plugs.
3. Charge the storage battery, mount it in place and connect it to the circuit (with negative wire grounded).

Before charging the battery, do not overlook to open the vent holes in cover plugs either by pulling the rubber gags out or piercing through the films closing the vent holes.

4. Prime gasoline into the tank.
5. Check oil in the air cleaner.
6. Check oil level in the crankcase, gearbox and final drive casing. Top up to correct level if necessary.

Note. Units of the motorcycle are primed with oils depending on the season of the year when the manufactured machine is shipped from the Works.

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IV. DRIVING TECHNIQUE

PRELIMINARIES FOR RIDING

A thorough check-up of the machine before taking it out on the road is an assurance for trouble-free and reliable performance of the motorcycle.

Before each trip attend to all the requirements of Daily Maintenance as outlined in the present Service Manual. When priming the motorcycle with fuel and oil, take all precautions to keep things clean. Prime the gasoline only with the tank filter in place, otherwise use a funnel equipped with a strainer. During rain or snow it is advisable to do the priming jobs in a place protected against weather. Gasoline level in the fully primed tank should be by 10 or 15 mm below the lower edge of the tank filler. Be careful not to overfill the tank.

The oil level in the engine crankcase should be not higher than the top and not lower than the bottom mark on the dipstick, with the filler plug unscrewed. In gearbox the oil should be level with the lower threads in the hole, whereas in the final drive casing it should be at a level of 25 mm from the plug bearing surface.

STARTING THE ENGINE

Before starting the engine attend to the following:

a) check neutral position of the gear change hand lever (by pressing on the kick starter the propeller shaft should not revolve; motorcycle should roll freely forward and backward from a push);

b) open gasoline cock (see Fig. 8) by setting its handle in left-hand position opposite letter "O" (Open);

c) push in the carburetter depressors and see that the fuel is running from the tank and filling up the float chambers;

d) in cold weather or with the engine cold close partly the air cleaner shutter, whereas in warm weather or with the engine hot, this is not necessary as the enrichment of mixture is usually unwarranted;

e) twist the carburetter throttle control twistgrip towards you and depress the kick starter several times;

f) move aside the lid and push the ignition key to the limit (here the pilot light will go on if the ignition system is intact);

g) forcibly, but without an impact, depress the kick starter.

Once the engine is started, do not allow it to run at high revolutions, because this is liable to cause abnormal wearing of parts and may lead to seizure of piston pin and pistons in the cylinders, since a cold oil runs with difficulty through the oil ducts and will not lubricate sufficiently the friction parts. Make it a practice to warm up the engine for 20—40 sec at low speed, increasing gradually the engine speed by turning the throttle control twistgrip. In case the air cleaner shutter happens to be shut, open it after the engine is warmed up.

A correctly adjusted engine should run steady at low speed with the throttle control twistgrip fully closed. Start driving the motorcycle only after warming up the engine, viz. with the engine running steady in low revolutions.

DRIVING PROCEDURE

To move the motorcycle from rest, shift only to I gear. To do this, depress fully the clutch lever, then press your foot on the front shoulder of the gear change foot pedal. By turning the carburetter throttle control twistgrip towards you increase the engine speed, releasing simultaneously the clutch lever. The motorcycle will start moving slowly.

Do not race the engine with the clutch released, but keep the speed of revolution such as to prevent engine stalling at the moment the clutch is engaged. Avoid releasing the clutch lever suddenly, because the engine is liable to stall or the motorcycle will start moving in jerks. When shifting to I gear do not use force or knock with your foot on the gear change pedal front shoulder.

After the motorcycle has picked up a speed of 12—15 km/hr, shift to II gear by depressing the clutch lever. Simultaneously with this decrease the engine speed by turning in the throttle control twistgrip and press quickly on the rear shoulder of the gear change foot pedal. Then release smoothly the clutch lever and increase the engine speed.

When the travelling speed reaches 20—30 km/hr, shift in the same manner to III gear and at a speed of 40—45 km/hr — to IV gear. After that the travelling speed is regulated by the position of carburetter, throttle valves by means of the throttle control twistgrip.

Do not travel in III and IV gears at speeds below the recommended. When travelling at lower speeds, use III or even II gear, keeping, however, within the above mentioned speed ranges. At the same time, it is not advisable to use I and II gear for any length of time, unless this is necessary due to road conditions, because in such a case the engine develops high revolutions, while its cooling facilities are handicapped, thereby leading to faster wearing of parts. Besides this, there is quite an increase in fuel consumption when the motorcycle is driven in low gears.

The gear change hand lever is used when starting the motorcycle from rest, in changing gears, at stopping and when applying the brakes. In city traffic, when it becomes necessary to change gears very often, it is a bad practice to change the speed of travel by slipping of clutch, because this will ruin the clutch discs.

To change from high to lower gear, reduce the engine speed. As soon as the motorcycle travelling speed has diminished, release the clutch by depressing the clutch lever. Then shift to lower gear by pressing on the gear change foot pedal front shoulder, engage the clutch and increase the engine speed.

For a quick reduction of travelling speed it will be necessary to apply brakes. There are three ways for braking the motorcycle, i. e. apply the brakes, braking action of the engine, and both, using the engine and brakes together.

The first method may be applied when the motorcycle must be stopped quickly, provided there is proper tyre grip on the road. To apply the brakes, first release the clutch with simultaneous decrease of engine speed and smoothly press on the rear brake pedal and the front brake lever. Application of two brakes simultaneously is more favourable for the motorcycle stability, although either of the brakes may be applied independently.

For engine braking reduce the engine speed, but leave the clutch engaged. As soon as the travelling speed comes down to 12—15 km/hr, release the clutch in order to keep the engine running and, if feasible, apply brakes to stop the motorcycle. The braking action of the engine is usually used on extended downgrades or on flat section of the road, when it becomes necessary to reduce the travelling speed a little on a slippery ground.

To brake the motorcycle by combined action of the engine and the brakes, reduce the fuel feed without disengaging the clutch, then apply smoothly the front brake lever and the rear brake pedal. In this case, however, do not brake fully the front wheel, as this may stall the engine or even derange the parts in power transmission.

The combined braking is usually exercised in riding down a steep slope or in travelling on a slippery terrain to prevent skidding. Be careful in braking, because of the danger of skidding or overturning of the motorcycle if the braking action is too sudden. This is especially true in winter and on wet roads.

When riding upgrade keep a good account of your actions and speed of the motorcycle to avert a forced stopping. Before coming to a long and steep upgrade gather sufficient momentum for the motorcycle to get across the whole of it or at least of its greater part in high gear. If, while climbing upgrade, the motorcycle speed diminishes noticeably, change to lower gear. Here it is not advisable to release the clutch and try to surmount the hill by increasing the engine speed with the clutch slipping, as this method will only cause premature wearing of clutch parts.

If the upgrade cannot be approached with sufficient travelling speed for the motorcycle to climb over, shift immediately to II or I gear and keep it to the end of the climb. Should the engine stall on the upgrade, start up the engine while keeping the motorcycle standing with the front brake lever depressed shift to I gear, releasing at the same time the front brake lever and the clutch lever.

When dry friable sand or loose snow are encountered on the way, shift to II or I gear and cross the area at high speed maintaining it constant and riding in a straight line as much as possible. While crossing the sand do not turn the handlebar sharply, release the clutch shift gears nor pick the engine speed up suddenly. These may cause the rear wheel to slip or halt the motorcycle.

Same applies to driving in thick and sticky mud, if some mud is clogged under the fenders making it difficult for the wheels to turn, stop the motorcycle and remove the mud using tyre irons or a stick.

Remember that in steering the motorcycle to the left and to the right it displays an unequal stability. When turned to the right, i. e. towards the sidecar, the motorcycle looses more of its stability and can overturn more easily than when steered to the left.

Bear also in mind that each travelling speed has its respective maximum turning angle of the handlebar. The latter is reduced with increase of the travelling speed. The handlebar should be turned smoothly, without jerks especially when steering to the right.

Exercise particular care on the road with poor visibility prevalent (at night, in foggy weather, etc.).

In summer time pay due attention to the temperature of engine, power transmission and running gear parts. The engine temperature may be considered normal if the temperature of the cylinder heads is within 180—220° C, with no signs of hot-head ignition noticed.

The symptoms of a normal performance of the engine constitute an easy acceleration of the motorcycle and noiseless work of the crank mechanism. On the other hand, the symptoms of engine overheating are evident from the engine running in hot-head ignition, loss of power, resulting in motorcycle failure to pick up the speed, and sharp metallic knocks in the crank mechanism.

When detecting the cause of engine knocks single out the knocks caused by overheating and knocks due to early ignition. Knocks that take place due to early ignition are audible as a rule, simultaneously in both cylinders, whereas the knocks caused by overheating occur first in the left-hand cylinder. This is explained by the fact that the temperature in the left cylinder (when the

motorcycle is used with a side-car) is always higher by 20—30° C than in the right cylinder.

Normal temperature of oil in the engine crankcase should be from 80 to 100° C. **Never attempt** to drive on continually with the oil temperature higher than 100° C. In this connections remember that riding a motorcycle with an overheated engine for any length of time may lead to derangement of parts and even cause a breakdown.

To prevent overheating, the rider should choose even sections of the road, allowing the motocycle to run without overloading the engine.

To cool off the overheated engine it is best to stop the travel, cut off the engine and let it cool off. Never attempt to cool the engine with water, as this will ruin the cylinders or the cylinder heads.

To stop an overheated engine, park the motorcycle at a spot where the air circulation is most favourable, reduce the engine speed to the minimum, and without switching off the ignition close fully the air conduit shutter. The engine will stall without any knocks or backfire. After this switch the ignition off.

It is not advisable to stop the overheated engine by switching off the ignition, as an overheated engine usually continues to run with the ignition off due to the working mixture being ignited from the red-hot spark plugs, valves and cylinder heads. Moreover, backfiring is possible, as well as some damage to parts in the crank mechanism.

It is harmful for the motorcycle engine, as well as for the power transmission, to run an overloaded engine at low speed. Do not run the engine at high revolutions with the clutch released. Maintain the speed so that the engine is not stalled when the clutch is smoothly released. **Once the engine is stopped, close the gasoline cock.**

Take all precautions to prevent water entering the gasoline tank, engine crankcase, gearbox or the final drive casing. Keep dirt away from the breather pipe. Clean regularly all assemblies of the motorcycle, paying special attention to electrical equipment and instruments, and engine cylinder cooling fins.

In summer time the tyres require special care. Keep them inflated to pressures specified in the Service Manual. Underinflation leads to overheating of tyres and curtails their service life.

Make it a rule to wash the motorcycle after every trip. The best way to clean the engine and gearbox is to use a hairbrush soaked in kerosene. Wash the chrome-plated details with water using a soft piece of cloth and sponge, then wipe dry with cotton waste or chamois skin. Polish the chromeplated details after drying with a chamois skin.

Wash the engine from a water hose only after it is completely cooled off. In so doing, avoid high water pressure, do not direct the water spray on the generator, relay; headlamp, air cleaner, and carburetters, as moisture penetrating inside the units may cause rusting or derangements which are difficult to remedy. Do not drive the motorcycle into the water for washing purpose and do not stop the engine while fording, if the water level is above the exhaust pipes and the silencer openings.

RUNNING-IN

Correct running-in of the new motorcycle will prolong its service life.

The running-in period is divided into two stages: first stage — from 0 to 1000 km and the second — from 1000 to 2000 km. During the running-in period keep the travelling speed within the limits stipulated in Table 1.

The speeds refer to riding the motorcycle with a side-car on an even road.

The carburetters are equipped with limiters which should be shortened after the first 1000 km and removed entirely after 2000 km. It would not be right, however, to rely totally on the limiters and to accelerate the engine to the maximum. The most prudent way to run in the motorcycle, ensuring a rapid and correct bedding-in of the friction parts, is to alternate the wheeling: first by accelerating the motorcycle to a high speed for short distances (say 500 m) to be followed by rolling under its momentum (with the throttle down and clutch engaged, slowing down to minimum allowable speed).

Table 1

Speeds Recommended for Running-in

Gears	Travelling speed, km/hr	
	from 0 to 1000 km	from 1000 to 2000 km
I	10	15
II	20	35
III	35	50
IV	50	70

After the first 2000 km it is not advisable to begin riding continuously at maximum speeds. It is better to increase the travelling speed gradually, as the motorcycle is approaching its 3000 km riding.

Do not exceed the following maximum speeds on the motorcycle with a side-car thoroughly run-in: I gear — 20 km/hr; II gear — 45 km/hr; III gear — 65 km/hr; IV gear — 100 km/hr.

In the course of running-in do not overload the machine, avoid travelling on heavy roads, in mud, sand, climbing steep upgrades, etc., do not race the engine at high revolutions nor overheat it.

It is not advisable to give lessons in driving on a new motorcycle which is still being run in, because some mishandling on the part of a newcomer to motorcycling leads to engine overload-

ing due to mistimed shifting of gears, sudden acceleration, frequent starts, etc.

Pay special attention to lubrication of the engine. Change oil in the crankcase first at 500 km and again at 1000 km, each time washing the crankcase before priming fresh oil. After 2000 km, change again the oil in the engine as well as in the gearbox and final drive.

ENGINE

Motorcycle "Урал-2" is equipped with two-cylinder, four-stroke, carburetter-type air-cooled engine. Opposed arrangement of cylinders in a horizontal plane is its special feature, which ensures proper cooling and balancing of the crank mechanism. The engine valves are arranged in the cylinder heads.

The engine consists of separate mechanisms which are arranged in the crankcase and set in definite interaction.

Since the engine is air-cooled and has no water jackets, the working of piston group, timing drive, valve mechanism and others is distinctly audible through the abundant finning. Therefore, do not take the following noises as signs of derangement:

— uniform engine knocks congregating into common noise;

— periodic noise in valves and tappets, with correct clearances between the valves and rocking arm ends;

— clear knocking in engine, which disappears and reappears as the speed of revolution is varied;

— even (but not sharp) high-tone noise from the timing gear.

The gearbox is attached to the engine crankcase. The clutch is mounted in the flywheel which is fitted on the crankshaft rear journal tapering between the engine and the gearbox. The engine set-up with the clutch and gearbox provide for easy access to the adjusting screws of valve timing; to carburetters, ignition system and gear shift mechanism.

Crank Mechanism

The crank mechanism receives the force of the gas pressure in the cylinder when the combustible mixture is ignited, and converts the reciprocating motion of the pistons into rotary motion of the crankshaft.

The crank mechanism includes the crankcase, cylinders, pistons with rings and pins, connecting rods with bearings, and the crankshaft with flywheel.

Cylinders

The engine cylinders *8* (Fig. 3) are identical in design and interchangeable. In the top portion the cylinders have four holes

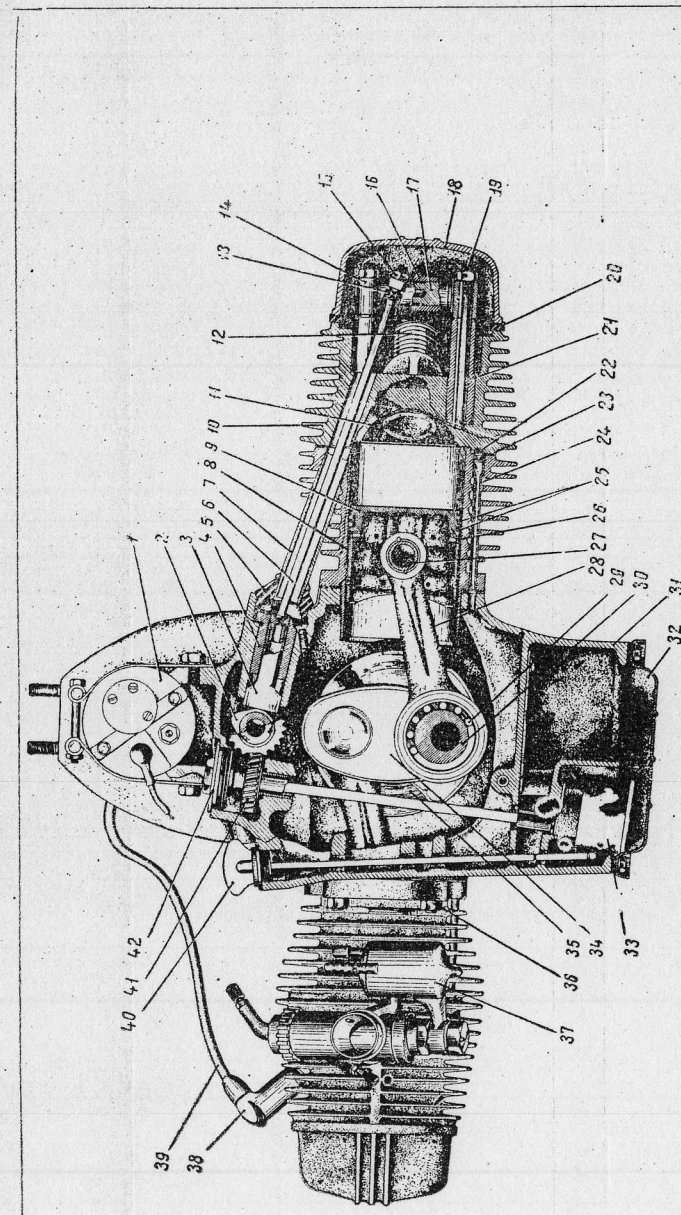

Fig. 3. Engine (cross section):
1 — generator; *2* — camshaft; *3* — tappet; *4* — tappet guide; *5* — sealing collar; *6* — push rod; *7* — push rod tube; *8* — cylinder; *9* — piston; *10* — cylinder head; *11* — valve; *12* — valve spring; *13* — adjusting bolt; *14* — rockshaft bracket; *15* — adjusting bolt locknut; *16* — rocking arm; *17* — rockshaft; *18* — cylinder head cover; *19* — cylinder head stud; *20* — gasket; *21* — rockshaft stay; *22* — oil drain duct from cylinder head; *23* — gasket; *24* — cylinder oil drain tube; *25* — compression rings; *26* — oil control rings; *27* — piston pin; *28* — connecting rod; *29* — roller bearing; *30* — crankpin; *31* — crankcase; *32* — sump; *33* — oil pump; *34* — crankshaft cheek; *35* — oil catcher; *36* — cylinder fastening nut; *37* — carburetter; *38* — spark plug terminal cap; *39* — high-tension wire; *40* — filler plug; *41* — oil pump drive (driven) gear; *42* — oil pump drive plug

for cylinder head studs and two holes for fitting in the push rod tubes *7*. Tube *24* intended for draining oil from the valve box in the cylinder head into the crankcase extends through the cooling fins. The bottom portion of the cylinder is provided with a flange which has holes for the studs fastening the cylinder to the crankcase.

Cylinder head *10* screwed on to the cylinder. Fins are made on the outside surface of the cylinder head to enlarge the cooling surface. The top part of the cylinder head has a threaded well for fitting the spark plug. Cylinder heads are not interchangeable.

A gasket is fitted between the cylinder and the crankcase. **When mounting the left cylinder see that the holes in the gasket are aligned with the crankcase holes, through which the oil is fed for lubricating this cylinder and oil from the valve box is drained.**

Piston, Piston Rings, and Pins

Piston *9* (see Fig. 3) consists of a head, skirt and bosses. It has four grooves for mounting the piston rings.

Two upper are compression rings *25* intended to provide for adequate tightness at adjoining of piston with the cylinder and to prevent escape of gases from the combustion chamber into the engine crankcase. The lower oil control rings *26* serve to remove the surplus oil from the cylinder walls.

To enhance the resistance to wear, the working surface of the top compression ring is made of porous chrome. All rings have straight locks with a clearance from 0.25 to 0.45 mm, when mounted in the piston fitted in the cylinder.

The piston is connected to the connecting rod by means of a floating pin *27*, the axial displacement of which is prevented by two circlips inserted in the circular grooves located on the piston pin bosses.

Crankshaft and Connecting Rod

The engine crankshaft made up of two crank portions arranged in one plane at an angle of 180° has two main journals with counterweights, check and two crankpins *30*. The interior cavity of the crankpin and two radial ducts drilled in the crankpin serve for oil feed to the connecting rod big end bearing. The latter is a single-row roller bearing with a cage. The inner surface of the connecting rod big end and the crankpin surface serve as races for this bearing.

The crankshaft together with connecting rods forms a non-detachable unit. The latter can be dismantled and reassembled only in specialized workshops with the aid of special tools.

The crankshaft is carried in the crankcase on two ball bearings. The front bearing is press-fitted into housing *18* (Fig. 4) which is furnished with a cover. The housing together with its

cover is attached to the front wall of the crankcase. The bearing is held from axial displacements with a shoulder in the bearing housing from one end, by the cover from the other. Rear bearing *30* is mounted in the rear housing with a sliding fit, providing thereby for heat expansion of the crankshaft. Timing drive gear *20* is fixed on the front main journal of the crankshaft, and flywheel *1* is secured on the rear main journal tapering.

Crankcase

The cylinders, timing and auxiliary mechanisms are installed and secured in engine crankcase *24* (see Fig. 4). Besides, it serves as an oil reservoir. The crankshaft rotates inside the crankcase; in the front portion there is the timing gears cover, while the generator is attached through a strap to a pad on the crankcase top. An opening is provided in the crankcase, through which the oil pump drive gear is mounted. From below the crankcase is closed with sump *26*. A gasket is fitted between the crankcase and its oil sump.

In the course of engine operation a part of the combustible mixture and waste gases penetrate through the gaps in piston rings. With the piston downstroke the crankcase volume is reduced and the rising pressure tends to force the oil out through seals and gaskets. Besides this, the gasoline while dripping into oil reduces oil viscosity, whereas the waste gases are liable to cause corrosion. To avert these undesirable after-effects, the crankcase is communicated with the atmosphere.

To ventilate the crankcase during the piston downstroke and to isolate it from the atmosphere in the piston upstroke, there is breather *15* located in the central hole of the timing cover.

When the pistons are moving down (approx. 80° before B.D.C.), the breather revolving together with camshaft *3* communicates the crankcase interior with atmosphere. Since at this moment the opening in the breather aligns with vent duct *23* in timing cover *13* and the gases compressed in the crankcase are forced outside. When the pistons are in upstroke, the vent duct is overlapped, the crankcase interior is cut off from the atmosphere and certain vacuum is formed therein. If the piston rings are in good condition, the breather will maintain permanent vacuum in the crankcase, and the possibility of oil being forced through the sealing joints is excluded.

VALVE TIMING MECHANISM

Valve timing mechanism (Fig. 5) serves to control the mixture inlet and waste gas exhaust to atmosphere. It consists of camshaft *9*, tappets *3*, tappet guides *4*, push rods *1*, rocking arms *18* with adjusting screws *19* and locknuts *20*, valves *10* and *22*

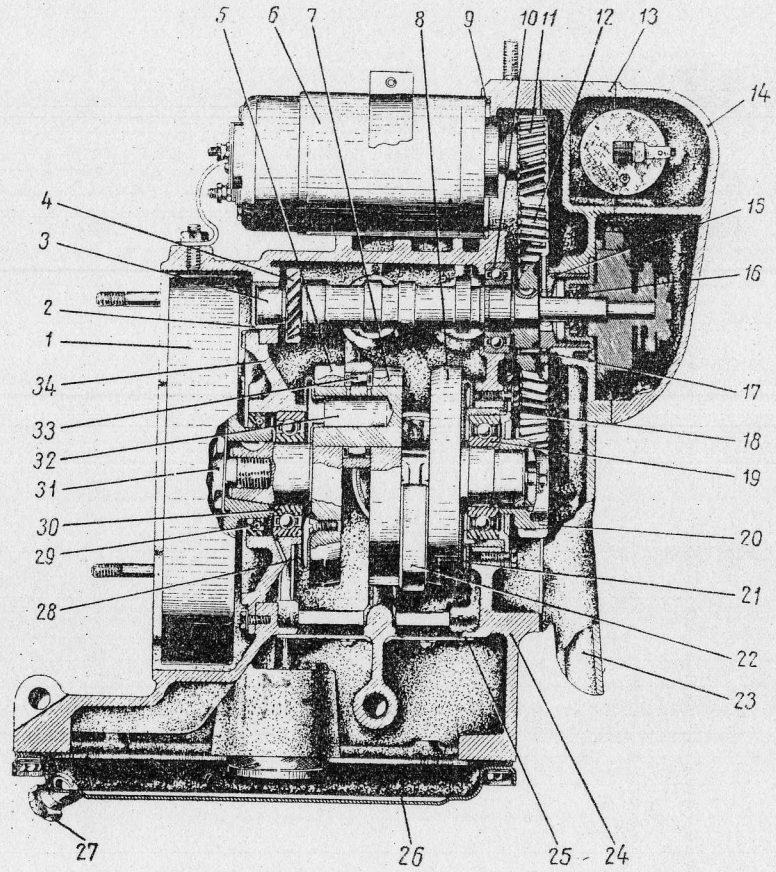

Fig. 4. Engine (longitudinal section):
1 — flywheel; *2* — camshaft bushing; *3* — camshaft; *4* — camshaft gear; *5* — crankshaft rear journal; *6* — generator; *7* — crankshaft cheek; *8* — crankshaft front journal; *9* — generator gasket; *10* — camshaft bearing; *11* — generator gear; *12* — camshaft gear; *13* — timing cover; *14* — crankcase front cover; *15* — breather; *16* — seal; *17* — breather tenon; *18* — front ball bearing housing; *19* — ball bearing; *20* — timing drive gear; *21* — oil catcher; *22* — connecting rod; *23* — breather vent duct; *24* — crankcase; *25* — drained oil filter; *26* — sump; *27* — drain plug; *28* — oil catcher; *29* — seal; *30* — ball bearing; *31* — flywheel bolt; *32* — crankpin; *33* — roller bearing; *34* — rear ball bearing housing

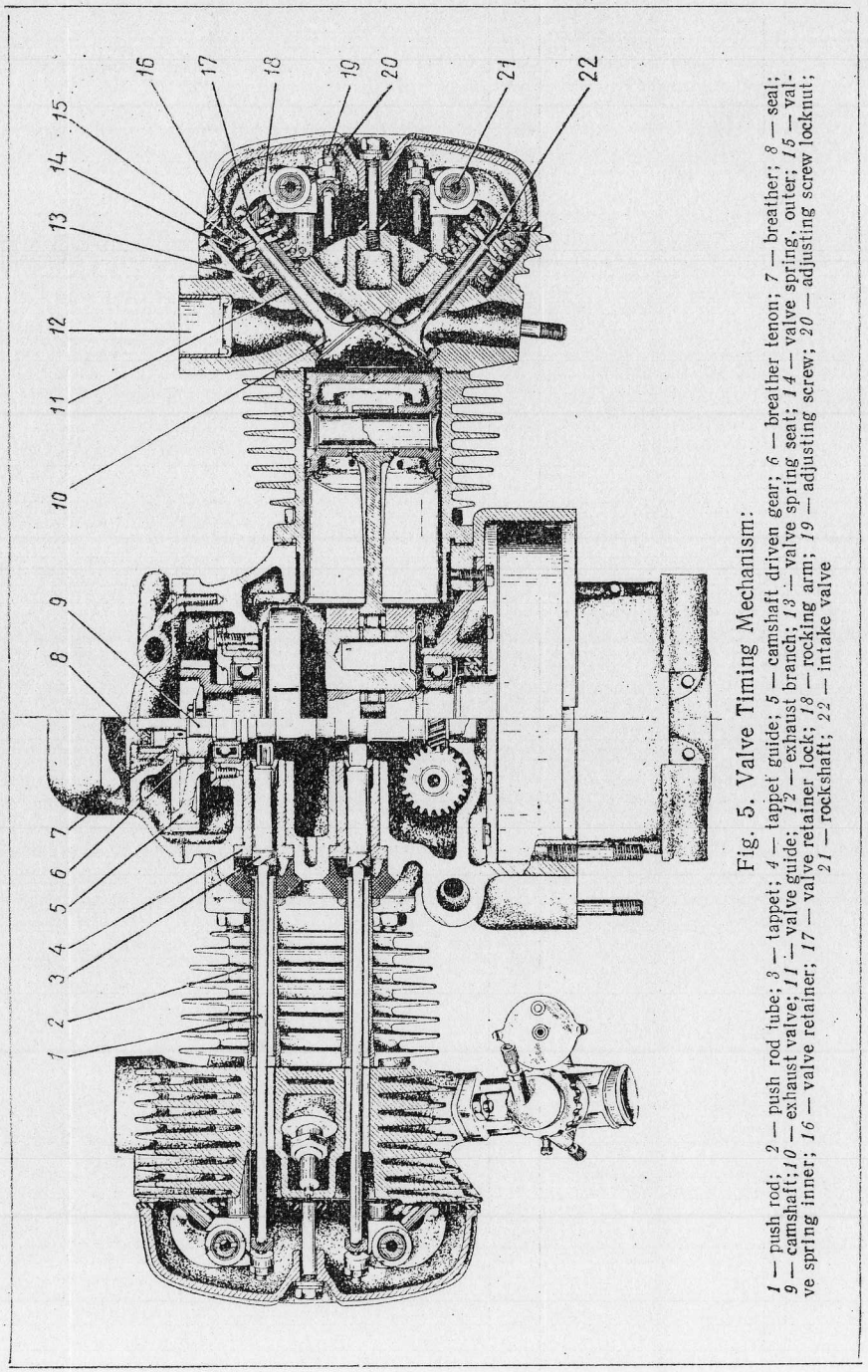

Fig. 5. Valve Timing Mechanism:

1 — push rod; *2* — push rod tube; *3* — tappet; *4* — tappet guide; *5* — camshaft driven gear; *6* — breather tenon; *7* — breather; *8* — seal; *9* — camshaft; *10* — exhaust valve; *11* — valve guide; *12* — exhaust branch; *13* — valve spring seat; *14* — valve spring, outer; *15* — valve spring inner; *16* — valve retainer; *17* — valve retainer lock; *18* — rocking arm; *19* — adjusting screw; *20* — adjusting screw locknut; *21* — rockshaft; *22* — intake valve

with springs *14* and *15*, valve retainers *16* and retainer locks *17*.

Oil pump drive gear is press-fitted on the camshaft rear end. The camshaft front end mounts the driven gear which is meshed with the generator drive gear and the camshaft driving gear fitted on the crankshaft front end.

The camshaft is carried in the engine crankcase on two bearings, one of which is a ball bearing, while the rear is made in a form of a bronze blind bushing.

Correct valve timing is set by aligning the marks on the timing gears. Pay special attention to this when reassembling the engine after a dismantling job.

Valve Adjustment

To ensure tight valve seatings at the time, when some parts of valve mechanism get worn or are expanded on a hot engine, provide for an expansion clearance. In case this clearance is overlooked, the valves will not close tightly, their heads will soon get burnt and eventually ruin the valves. If, on the other hand, the expansion clearance is too large, the valves will not open completely and cause abnormal noise. Maximum power of the engine may be anticipated only if the valve expansion clearances are set right.

For the motorcycle engine the expansion clearance should be 0.05 mm. It will change in the course of operation due to bedding-in and wear-out of certain parts. Therefore, check the expansion clearance after every 500—1000 km. Readjust the clearance on a cold engine.

The engine is furnished with steel tubular push rods. When the engine is hot, the clearances increase due to difference in linear expansion of the cylinder, cylinder head and rods, which, however, has practically no effect on the engine performance, provided the clearances are set as instructed.

It is also important to readjust the clearances after grinding the valves or after partial disassembling of the valve mechanism. To protect the valve head chamfers from excessive burning, be sure to grind the valves once the motorcycle has run 8000 km.

To readjust the clearance on a cold machine put an empty container under cylinder head, remove valve box cover and drain the accumulated oil.

Then turn the crankshaft by the kick starter till the intake valve is fully closed. At this, there should be a clearance between the rocking arm and exhaust valve. If the clearance happens to be more or less than 0.05 mm, release the locknut and by turning the adjusting bolt in or out, set the required clearance, checking it with a feeler. After that safety the adjusting bolt with a locknut. To readjust the intake valve, turn the crankshaft until the exhaust valve begins to open, i. e. to the moment when the clearance between the exhaust valve and the adjusting bolt disappears.

Then set a clearance of 0.05 mm between the rocking arm larger end and the intake valve.

Another method may be used to readjust the valves. Take both cylinder head covers off, turn the crankshaft till both valves are open in one cylinder and set the clearances in both valves of the opposite cylinder. Then set the valve clearance in the other cylinder. The opening of both valves in one cylinder corresponds to position of pistons in T.D.C. To set the pistons in T.D.C., use the mark on the flywheel and a respective notch on the engine crankcase (refer to Section "Ignition Timing").

Engine Maintenance

During the daily inspection clean dust and dirt from the engine, paying special attention to the fins, as their contamination will impair the engine cooling. Check fastening and condition of crankcase, cylinders, cylinder heads (look for leaks of fuel or oil). Check the engine performance on the road.

After every 500—1000 km check over the expansion clearances between the valves and rocking arms and readjust if necessary. After every 7500—8000 km remove the cylinders and cylinder heads, clean them, as well as the pistons and valves, of carbon, but do not disconnect the pistons from the connecting rods.

If the oil consumption surpasses 0.250 litre per 100 km, it is advisable to replace the piston rings.

Note. To remove carbon from the cylinder heads and pistons, first soften it with kerosene, then use a wooden scraper for the job.

Valve Grinding

To grind the valves proceed as follows:

— place a spring on the valve head chamfer (size of spring should be so as to lift the valve head from the seat by 3 to 6 mm);

— smear a thin film of valve grinding compound on the valve head chamfer; put the valve with lifting spring in the guide and set up the valve grinding tool on the stem and to set the valve in rotary motion (brace, drill or similar tools may be used for the job. Also an air sucker or a piece of rubber hose can be set up and revolved between the hand palms);

— turn the valve by means of the tool in both directions so that an alternating motion is imparted to the valve only in one direction. During its rotation, press the valve periodically to the seat

Grind the valve head to the seat carefully not to remove too much metal from the working chamfers, because this will reduce the service period. Toward the end of grinding, decrease the amount of valve grinding compound by adding clean oil, while during the last period of grinding — use oil alone.

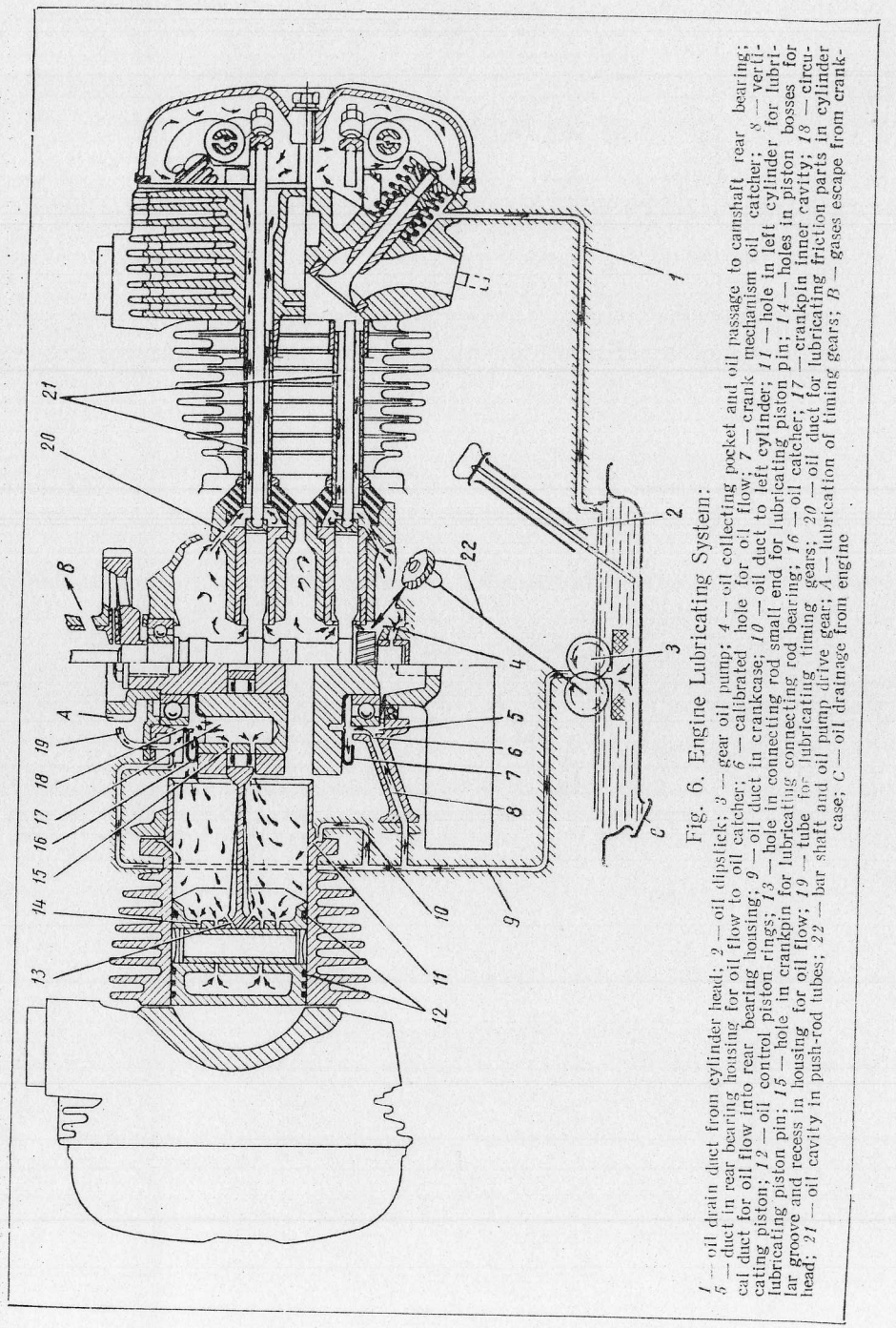

Fig. 6. Engine Lubricating System:
1 — oil drain duct from cylinder head; *2* — oil dipstick; *3* — gear oil pump; *4* — oil collecting pocket and oil passage to camshaft rear bearing; *5* — duct in rear bearing housing for oil flow to oil catcher; *6* — calibrated hole for oil flow; *7* — crank mechanism oil catcher; *8* — vertical duct for oil flow into rear bearing housing; *9* — oil duct in crankcase; *10* — oil duct to left cylinder; *11* — hole in left cylinder for lubricating piston; *12* — oil control piston rings; *13* — hole in connecting rod small end for lubricating piston pin; *14* — holes in piston bosses for lubricating piston pin; *15* — hole in crankpin for lubricating connecting rod bearing; *16* — oil catcher; *17* — crankpin inner cavity; *18* — circular groove and recess in housing for oil flow; *19* — tube for lubricating timing gears; *20* — oil duct for lubricating friction parts in cylinder head; *21* — oil cavity in push-rod tubes; *22* — bar shaft and oil pump drive gear; *A* — lubrication of timing gears; *B* — gases escape from crankcase; *C* — oil drainage from engine

Grinding job can be considered satisfactory if a single-tinted dull-grey colour (free of black spots) is attained on the working surfaces of valve head and seat. After the grinding is completed, wash thoroughly the valves, valve seats, valve guides cylinder head pressed to the seat, pour some kerosene first into intake, of valve grinding compound, then wipe dry with clean cotton waste or a piece of cloth. After that, test tightness of valve seating. For this purpose, put the valves in place and with the valve head pressed to the seat, pour some kerosene first into intake, then into exhaust ports of the cylinder head. There should be no seeping of kerosene during one minute. In case a leak is noticed before the specified time, it means that further grinding must be carried out most carefully.

LUBRICATING SYSTEM

Lubricating system is intended for lubricating the friction surfaces of mating parts in engine mechanisms and for cooling parts of the crank mechanism. The system is of a combined-type, where some parts are lubricated by forced-feed from the oil pump, while others — by splash lubrication (Fig. 6).

The lower portion of crankcase together with the sump serves as the oil reservoir for the engine.

Single-section gear-type oil pump (Fig. 7) is driven from the engine camshaft through gear and bar shaft *22* (see Fig. 6 or Fig. 7, items *7* and *3*).

Functions of Lubricating System

The oil is primed into the engine crankcase through a hole on the left-hand side. The hole is closed with a plug furnished with a dipstick. From here the oil is delivered by the oil pump *3* (see Fig. 6) through a gauze filter along an inclined duct into vertical duct *8* and further to a horizontal pipe which is the main oil line in the system. From the main line oil is fed to two special oil catchers *7* on the crankshaft through ducts made in the crankcase front wall and in the rear bearing housing.

Oil flows to the left cylinder through inclined duct *10* and via a hole in the cylinder. Oil to the crankshaft drive gear teeth is delivered through a circular groove and an oil pipe. The oil catchers screwed to the crankshaft journal outer walls rotate together with them. While the oil catchers are rotated, oil in them is being cleaned to some extent and runs off into the crankpin cavities, from where under the action of centrifugal forces it is rushed through a hole to the connecting rod big end bearings. Surplus oil spilled out of the oil catchers and connecting rod bearings is splashed by centrifugal force over the whole crankcase.

The working surfaces of tappets and camshaft cams are lubricated by oil splashes. Fast-moving parts of the crank mechanism and intensive splashing of oil help forming oil mist within the crankcase, thereby lubricating the working surfaces of the cylinders, piston pins, connecting rod small end, tappet guides, main ball bearings, and other friction parts located in the engine crankcase.

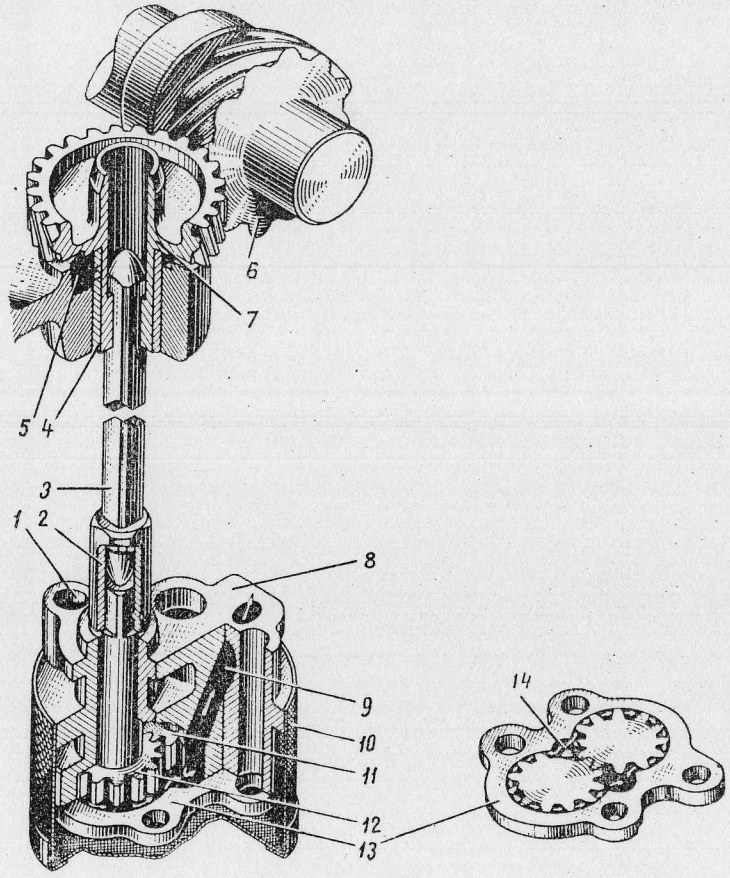

Fig. 7. Oil Pump:
1 — oil pump bolt holes; *2* — coupling sleeve; *3* — shaft bar; *4* — bushing; *5* — oil pocket; *6* — oil pump drive (driving) gear; *7* — oil pump drive gear; *8* — oil pump casing; *9* — outlet duct; *10* — gauze filter; *11* — oil pump driven gear; *12* — oil pump driving gear; *13* — oil pump casing cover; *14* — oil pump inlet port

Atomized oil through holes on the tappet guide ends enters the push rod tubes, settles therein and runs into the cylinder heads. Here oil is splashed by valve springs, lubricating, thus, the valves and rocking arms. Surplus oil is drained through dril-

led passages in the cylinder heads and a pipe fitted in the cylinder fins back into the crankcase.

Excess oil and oil drops accumulated on the crankcase walls drain into the oil sump through gauze filter. The oil sump is separated from the crankcase upper half by pressed gauzes which also act as foam breakers. For proper lubrication of the camshaft rear bearing a special oil pocket is provided in the crankcase. Some of the splashed oil settles in this pocket and runs by gravity to the camshaft bearing. The oil pump drive gear bearing is lubricated with oil accumulated in a similar pocket. Special duct *4* in the rear bearing housing is introduced for draining the accumulated oil deflected by the flywheel seal.

The splashed oil hardly reaches the upper wall of the left cylinder (viewed in direction of motorcycle travel). For this reason an inclined duct is provided, through which oil is forced to the circular groove in the cylinder flange. After that oil flows through three holes to the upper wall which is, thus, amply lubricated.

Oil drained from the oil feed tube *19* gets on the crankshaft gear and is transferred by the large gear teeth to the generator gear. Excess oil drains down and runs back into the crankcase sump through a drain hole in the crankcase front wall. Oil guard ring and rubber seal are provided on the flywheel hub to prevent oil seeping from the crankcase into the clutch. For the same purpose there is a rubber seal to protect the ignition distributor.

Lubricating System Maintenance

During the daily inspection check oil level in the engine crankcase and top up oil if necessary. The oil dipstick has two marks showing the lower and upper oil level limits. In checking wipe the dipstick and sink it into the crankcase as far as it will go, without screwing in the plug.

After every 1000 km of driving change oil in the engine crankcase. In winter warm up the engine before draining the used oil out.

For this purpose:

a) clean carefully the filler and drain plugs of the crankcase of dirt and screw them out;

b) drain used oil, screw in the drain plug and fill at least 0.6 litre of fresh oil (preferably spindle oil grade B-3) or up to the lower mark on the dipstick, and screw in the filler plug;

c) run the engine for 2—3 min, drain the oil out; then prime fresh oil suitable for the season involved, up to the upper mark on the dipstick.

In winter preheat the oil before priming. For changing oil use only clean vessels to prevent dirt, dust or moisture, entering the crankcase together with the oil primed. Capacity of the engine lubricating system is two litres.

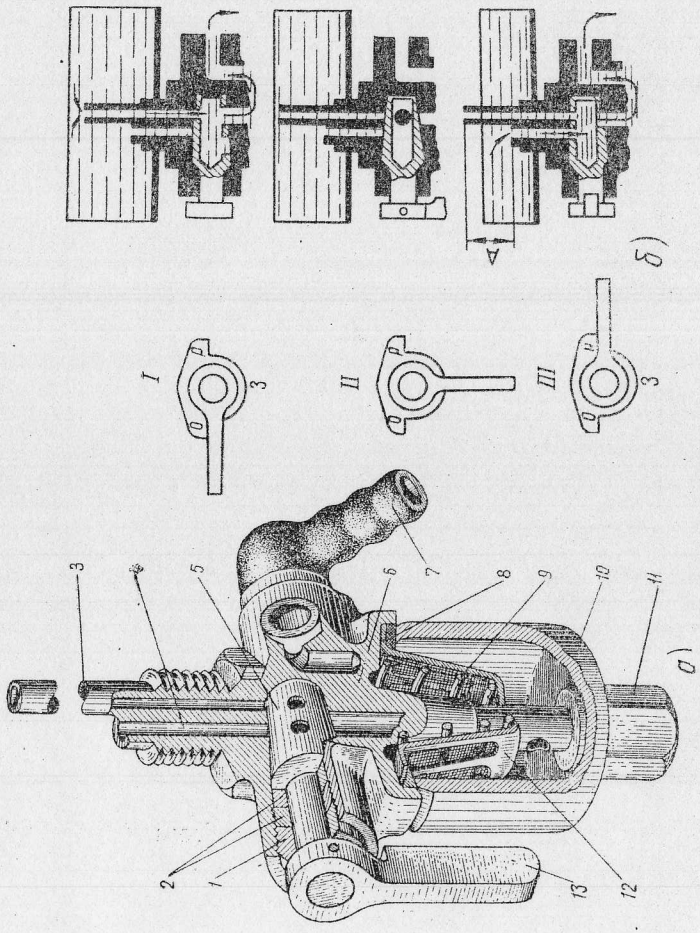

Fig. 8. Gasoline Cock with Settling Bowl (*a*) and Positions of Cock Handle (*b*):
1 — nut; *2* — packings; *3* — inlet pipe; *4* — reserve supply inlet pipe; *5* — slide valve; *6* — cock body; *7* — pipe union; *8* — packing; *9* — spring; *10* — settling bowl; *11* — nut; *12* — filter frame with gauge; *13* — handle

It is important to remember that even a short-time failure in the lubricating system may lead to a serious breakdown of the engine.

FUEL FEED SYSTEM

The fuel feed system includes: gasoline tank, three-way cock with filter and settling bowl, two carburetters, air cleaner, air lines and gasoline piping. The fuel feed system serves to provide combustible mixture for the engine operation.

Gasoline Cock with Settling Bowl

Cock body *6* (Fig. 8) is the framework of the gasoline cock. Its top threaded portion is screwed into the fitting in the gasoline tank, and the lower portion has a screwed-on blind nut *11* which presses settling bowl *10* through a packing to the body. Filter *12* is housed in the bowl. Two inlet pipes *3* and *4*, different in length, are arranged in the top portion of the cock. A horizontal through hole in the cock body carries distributing slide valve *5*. The latter has one axial and two radial holes. One of them — a through hole — is aligned with the long inlet pipe, while the other — a blind hole — aligns with the duct that communicates with the short inlet pipe of the reserve fuel supply. From the other side, the cock body has holes fitted with pipe unions for connecting with two gasoline feed pipes extending to the carburetters.

The cock handle has three positions (see Fig. 8): 1) position *O* — cock open; 2) position *3* — cock closed; 3) position *P* — cock open for reserve supply of fuel.

The fuel reserve stocks about two litres of fuel sufficient for 20—30 km.

Carburetters

The carburetters are intended for preparing the combustible mixture and for metering its delivery to the engine cylinders.

The motorcycle engine is equipped with two type K-38 carburetters which are similar in design, but non-interchangeable.

Functions of Carburetter

Start-up of engine and idling. Gasoline from the gasoline cock is delivered to float chamber *12* (Fig. 9), fuel passage *13*, atomizer hollow, idle speed duct in jet chamber *18* and settles on the level of gasoline in the float chamber.

Since at the engine starting throttle valve *19* is in lower position and only raised a little by the adjusting screw, air will flow at great velocity through the slit opening. Influenced by high vacuum beyond the throttle, fuel rises along the duct in the jet chamber and, being mixed on the way with air that flows from the inlet throat of suction conduit through idle speed air suction passage *14*, is directed in a form of emulsion to the mixing chamber. Here the emulsion is pulverized by air passing at high velocity through the slit between the throttle and chamber wall. The combustible mixture so prepared is delivered to the engine cylinders. During idling the main jet atomizer is not working because of reduced vacuum above it.

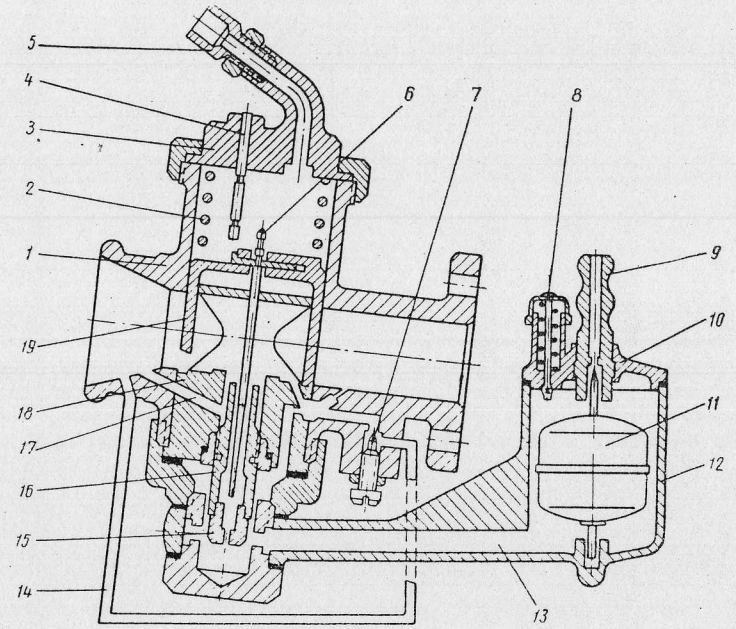

Fig. 9. Carburetter Diagram:
1 — carburetter body; *2* — throttle valve spring; *3* — throttle guide cover; *4* — throttle valve stop screw; *5* — control cable armour thrust nipple; *6* — metering needle; *7* — idle speed adjusting screw; *8* — depressor; *9* — fuel feed pipe union; *10* — float chamber cover; *11* — float with shut-off needle; *12* — float chamber; *13* — fuel passage; *14* — idle speed air suction passage; *15* — main jet; *16* — atomizer; *17* — air passage; *18* — jet chamber; *19* — throttle valve

Work of carburetter at medium loads. As the throttle is raised, more vacuum is formed above the atomizer. The main system is brought in operation. It consists of main jet *15*, atomizer *16*, and metering needle *6*. Outflow of fuel is limited by the circular slit between the calibrated portion of the atomizer and the metering needle of the throttle valve.

When the engine is working at medium loads, vacuum at the atomizer is compensated partially with air which flows to the atomizer through passage *17* connecting the atomizer hollow with the suction conduit throat. Outflow of fuel from the atomizer diminishes, the mixture becomes lean, and the engine consumes less fuel.

Work of carburetter at full loads. With the throttle raised

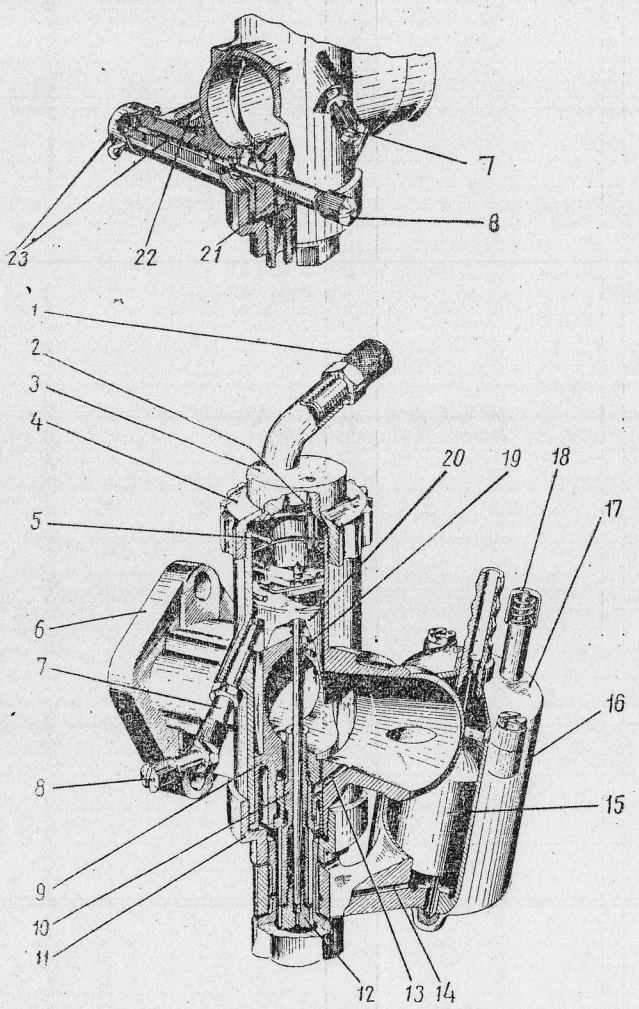

Fig. 10. Carburetter K-38:

1 — control cable armour thrust nipple; *2* — throttle valve stop screw; *3* — throttle guide cover; *4* — cover nut; *5* — throttle valve spring; *6* — body; *7* — throttle valve set screw; *8* — idle speed screw; *9* — jet chamber; *10* — atomizer; *11* — jet chamber holding nut; *12* — main jet; *13* — air passage; *14* — fuel passage; *15* — float; *16* — float chamber; *17* — float chamber cover; *18* — depressor; *19* — metering needle; *20* — throttle valve; *21* — idle speed fuel passage; *22* — idle speed air suction passage; *23* — drain attachment

completely (last quarter of its travel), the quantity of fuel passing through the atomizer is not limited by the metering needle and depends on the capacity of the main jet.

Design of the carburetter is illustrated in Fig. 10.

Adjustment of Carburetter K-38

During the motorcycle operation the carburetters are checked and adjusted for engine idling at low revolutions, acceleration, and for functioning of carburetter controls.

Before proceeding with adjusting of carburetters start the engine and warm it up. This is important, as adjustment carried out on a cold engine will be disturbed when the engine is warm. Adjustment of idling in low revolutions is of a great value for the engine performance.

Each carburetter is adjusted independently. The procedure for adjusting carburetter K-38 is as follows:

a) remove the cap from the spark plug of the right cylinder;

b) slacken the locknut of the armour thrust nipple of the throttle control cable in the left carburetter and screw in the thrust nipple so as to provide for a gap between the cable armour and thrust nipple;

c) slacken locknuts of throttle set screw *7* (see Fig. 10) and of idle speed screw *8*, tighten home the idle speed screw. Using set screw *7* set the minimum steady revolutions for the engine;

d) while turning idle speed screw *8* out set maximum possible r.p.m. of the engine, with the throttle valve set screw in the given position;

e) releasing gradually set screw *7* set minimum steady revolutions.

After adjusting tighten up all lockwashers on the screws, cut off the left cylinder, and proceed to adjust the right carburetter in the same manner.

The carburetters should provide for the same speed of the engine when one (either left or right) cylinder is working in idle running. The carburetters are checked with the engine warm and carburetters already adjusted. Cut off alternatively the right, then the left cylinder by removing the cap from the respective spark plug. Determine by ear any variation in speed, as each cylinder is working alone. If the engine speed, when running on right or left cylinder, is found different, readjust the carburetters by turning the throttle valve set screws in or out till uniform speeds are obtained in both cylinders. After that tighten up the locknuts of set screws. When adjusting for idle running see that the idle speed screws are not turned in to the limit. **Never drive the motorcycle if the idle speed screws on carburetters are tightened to the stop.**

Synchronized operation of both cylinders, with the engine

running in different duties, is attained when the throttle valves in the left and right carburetters are raised simultaneously.

Non-synchronized operation, even with well adjusted carburetters, will cause overheating and quick wearing of parts in one of the engine cylinders. To attain the synchronized operation, use the throttle control twistgrip to set the engine revolutions corresponding to the travelling speed of 30—40 km/hr in IV gear, and by removing alternatively the caps from spark plugs of either cylinder determine by ear any variation in the engine revolutions. If for the reason of inexperience the engine revolutions corresponding to the respective travelling speed of the motorcycle cannot be determined by ear, make use of the speedometer readings. In such a case arrange the motorcycle up on a stand, shift to IV gear, run the engine working on one cylinder at revolutions equivalent to about 40 km/hr on the speedometer. Then cutting off alternatively the right and left cylinder follow the readings on the speedometer. If with the engine running on the right or on the left cylinder prove different, readjust the carburetters for a synchronized operation. The adjustment consists in changing height of the throttle by turning the control cable armour thrust nipple *1* in or out. After completing the adjustment safety the cable armour thrust nipple in place. With the throttle valve down all the way there should be a little clearance between the cable armours and their thrust nipples, about the same for both carburetters.

The engine performance in the range of medium loads depends on the position of needle in the throttle, consequently, the aim of this adjustment is to set the metering needle in correct position. If the mixture is too rich due to wearing of atomizer, or if it becomes necessary to increase the engine power at the expense of higher fuel consumption, the carburetters are adjusted by changing the needle position.

To check the correct adjustment of carburetters for engine operation at medium loads, increase abruptly the engine speed. If backfiring is noticed in the carburetter, enrich the mixture by raising the needles for one or two divisions. If there is no backfire, but the transfer from one working range to another is too slow, it means that the mixture is too rich and the needle must be lowered.

With a certain experience the quality of combustible mixture may be judged by the colour of the spark plug insulator and centre electrode. For this check-up select an even section of a road, about from 1.5 to 2 km long, engage III gear and ride through this section at a speed from 40 to 45 km/hr. At the end of the run stop the engine by switching off the ignition and simultaneously release the clutch. Then bring the motorcycle to a halt, screw the spark plugs out and examine them. A black carbon deposit indicates that the mixture is too rich, which is remedied by lower-

ing the metering needle. If the colour is light yellow, sandy or whitish, it means that the mixture is too lean and the metering needle should be raised. When the combustible mixture is of the correct proportion, the colour on the spark plug electrodes and insulators should be brown.

Condition of the throttle control twistgrip cable armours influences correct functioning of the carburetters. If due to negligence in overhauling the cable armours get stretched out, the synchronized operation of engine cylinders for all working ranges will be disturbed. Therefore, during repairs of the motorcycle involving the removal of throttle control cables take all precautions not to stretch or damage the cable armours in any way.

Carburetter Maintenance

For regular maintenance of the carburetters in the course of motorcycle operation clean and wash all parts, fuel and air passages periodically (after every 2000 km). In washing use clean gasoline, but if the gum residues are abundant, make use of a thinner for nitrodyes. After that blow through the washed parts and passages with compressed air.

Never use wire or other metal tools for cleaning the jets or calibrated holes of the carburetters.

During daily driving of the motorcycle pay due attention to the outside condition of carburetters. Whenever noticing even the slightest leak of fuel tighten immediately the respective bolts, plugs, nuts, and change gaskets if necessary.

Gasoline leaks through carburetter drain point to a lack of tightness in the float chamber shut-off valve or in the gasoline cock (if leaks are evident with the gasoline cock closed). In this case grind the float needle to the float chamber pipe union or grind the distributing valve to the gasoline cock body, **but under no circumstances plug the carburetter drain.**

It is also important to wash systematically the fuel filter and to blow it through with compressed air.

Air Cleaner, Shutter and Air Conduits

Air cleaner shutter and conduits are intended for cleaning the air of dust and feeding it to the carburetters. The air cleaner is mounted on the throat located on the gearbox and is fixed by com- fastening screws (Fig. 11).

A gasket is fitted between the throat on the gear air cleaner off, air cleaner shell. The latter is made in a form ing ring out, re- for oil. ments in succession.

Filter element *8* is placed inside the air the air cleaner and Oil damper *4* is held to the air cleaner shell t dip the washed ele- ring. Air cleaner lid *18* is secured to the shell en reassemble the air and a plate spring.

Air is cleaned in two steps. As it enters the space under the lid, it is baffled into the oil bath. On striking the oil surface larger particles of dust drop out and are submerged in oil (first step), while the air current is directed through the filter elements which, being moistened in oil, clean it of fine dust (second step).

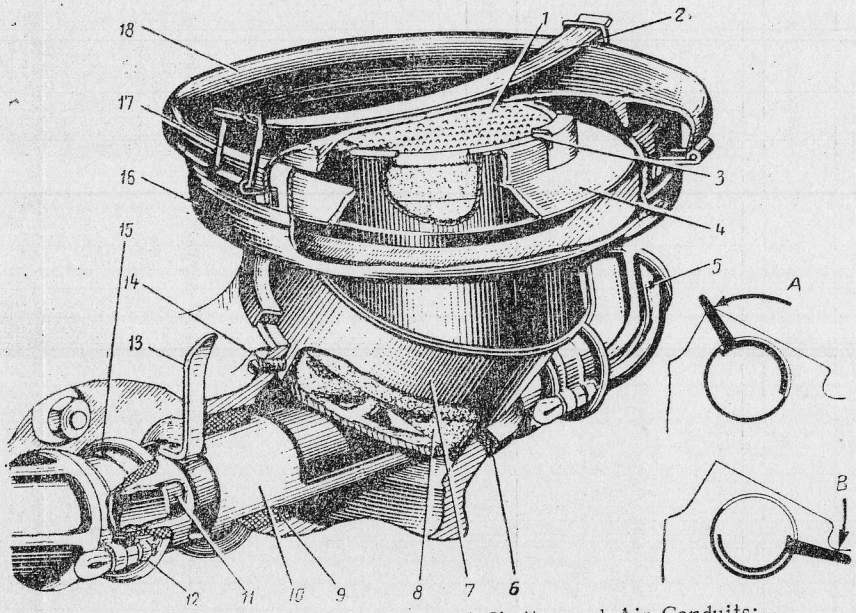

Fig. 11. Air Cleaner, Air-Control Shutter and Air Conduits:
1 — metal gauze; *2* — plate spring; *3* — spring ring; *4* — oil damper; *5*, *15* — air conduits; *6* — gasket; *7* — shell throat; *8* — filter element; *9* — packing ring; *10* — air shutter outer tube; *11* — air shutter inner tube; *12* — band; *13* — air shutter control lever; *14* — fastening screw; *16* — air cleaner shell; *17* — lid fastening hinge; *18* — air cleaner lid; *A* — shutter closed; *B* — shutter open

Thus, only clean air enters the carburetters. As the air cleaner gets contaminated, its filtering properties decline. Therefore, it is important to periodically take the air cleaner off, wash it carefully in kerosene or gasoline, moisten the stuffing with oil and prime the bath with fresh oil.

Filtered air is delivered through the air-control shutter and air electrode. and *15* to the carburettor. Air conduits, shutter and from 1.5 to 2 re joined by means of metal bands. The air shutter section at a sp form of two tubes: inner movable *11* and outer stop the engine b tubes have openings for air to pass through. release the clutch. ever *13*, which may be moved in a slit of outer the spark plugs ou the inner tube. By turning the inner tube indicates that the m fective section of openings in the tubes may ulating the air admission to carburetters.

Waste Gases Exhaust System

The exhaust system consists of left- and right-hand exhaust pipes, connecting pipe, left- and right-hand integral silencers.

The exhaust pipes are fitted in the cylinder head exhaust bores and sealed therein with labyrinth packings. The other ends of exhaust pipes are fitted into the holes in the silencers, and are secured on hangers to the engine front strut. Rear ends of silencers are fastened to the frame on welded brackets.

The connecting pipe helps to discharge the waste gases from each cylinder through both silencers. This method of exhaust reduces the resistance of gas flow through the silencers.

Fuel System Maintenance

When making a daily inspection check the gasoline charged in the tank, regular feed of gasoline to carburetters, tightness of gasoline line joints, proper action of carburetter throttle control linkage.

After riding the motorcycle for 500 km (on dusty roads reduce this interval to 150—200 km):

1. Wash the air cleaner without taking it apart.

In winter, when the ground is covered with snow, the air cleaner may be washed after every 1000 km. To wash the air cleaner, submerge it in a bath of kerosene or gasoline, shake it energetically for better cleaning of the stuffing from dust deposit. After cleaning moisten the air cleaner gauzes with oil.

2. After every 1000 km check condition of the gasoline cock; if need be, remove its settling bowl, wash and blow it through.

Note. Use for the air cleaner the same grade of oil as for the engine. Engine waste oil may also be used after proper filtering.

3. Check safe fastening and condition of carburetters.

4. Run the engine and check for correct adjustment of carburetters in low revolutions, as well as their synchronized operation. If found necessary, readjust the carburetters.

Disassemble the carburetters after every 2000 km, washing them thoroughly and blowing through the fuel ducts, jets and air passages with compressed air.

After every 7500—8000 km disassemble the air cleaner completely, wash and moisten the filter elements in oil.

To do this: undo the fastening screws, take the air cleaner off, remove the lid, drain dirty oil out, take the spring ring out, remove oil damper, metal gauze and filter elements in succession. Then clean the air cleaner shell of dirt, wash the air cleaner and filter elements in kerosene or gasoline, and dip the washed elements in oil. Let the surplus oil run off, then reassemble the air cleaner.

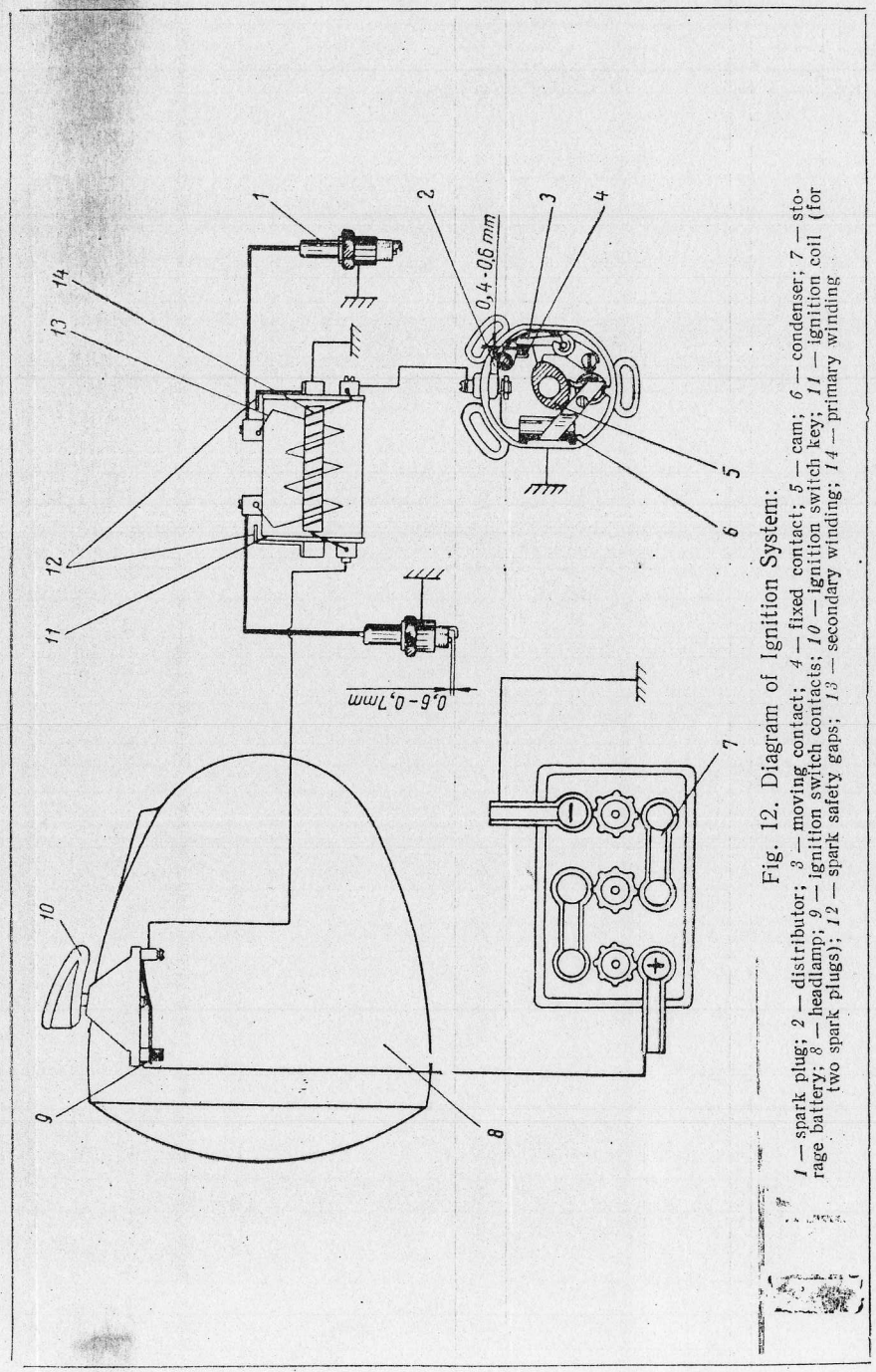

Fig. 12. Diagram of Ignition System:
1 — spark plug; *2* — distributor; *3* — moving contact; *4* — fixed contact; *5* — cam; *6* — condenser; *7* — storage battery; *8* — headlamp; *9* — ignition switch contacts; *10* — ignition switch key; *11* — ignition coil (for two spark plugs); *12* — spark safety gaps; *13* — secondary winding; *14* — primary winding

The ignition system is intended to fire the combustible mixture in engine cylinders with the aid of a high-tension electric current, jumping the gap between the spark plug electrodes.

Ignition system (Fig. 12) includes the sources of electric energy (storage battery 3MT-12 and generator Г-414) and ignition coil *11*, distributor *2* with automatic advance timer, two spark plugs *1*, a set of low- and high-tension wiring, ignition switch *10* with key (in the ignition instrument circuit) for switching on and off the electric energy sources.

Ignition Coil

The ignition coil serves to convert the low-tension (6—7 V) to high-tension current (10 000—15 000 V) necessary for producing a spark between the spark plug electrodes.

Ignition coil Б-201 used on the motorcycle has two leads for high-tension current. Each lead feeds one of the cylinder spark plugs and works in a set with the distributor which has a built-in automatic advance timer.

Ignition coil consists of iron core, primary winding *14* with wire ends to distributor and to ignition switch in the headlamp, secondary winding *13* with leads, and spark safety gaps *12*.

The spark safety gaps and high-tension terminals are spaced 9 mm. In the course of operation, do not increase this clearance, see that the current-conducting wires are not loose, keep the wires and terminals clean.

Distributor with Automatic Advance Timer

Distributor ПМ-11А (Fig. 13) consists of body *12*, cam *10* with automatic advance timer, condenser *14* and a cover.

The body is attached by three screws to the engine timing cover through three lugs with curved slots. The desired ignition is set by slackening the screws and turning the distributor body. The end of distributor shaft extends through a hole in the body centre. The shaft extension has a round neck with two flats at the tip and a threaded hole. The body houses the condenser, the arm with moving contact *4*, and adjustable support carry rest with fixed contact *3*, and stay *13* with felt for lubricating the cam surfaces.

The gap between the contacts within 0.4—0.6 mm is set by the adjusting screw, after having released the fastening screw. Adjusting screw *11* has an eccentric head which enters the slot of contacts support. By turning this screw in one direction or the other the fixed contact is brought closer to the moving contact or is moved away from it.

For rough setting of contact gap the contacts support has an elongated hole for the fastening screw. By slackening the latter it is possible to shift the contacts support to one side or the other.

The distributor cam is fitted freely on the distributing shaft neck and has tenon with holes to accommodate the timer weight pins. Before fitting the cam lubricate the shaft extension with grease УС-2.

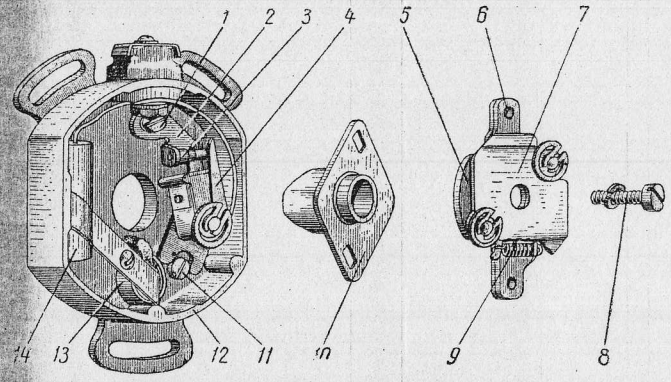

Fig. 13. Distributor with Automatic Advance Timer:
1 — contacts support fastening screw; *2* — contacts support; *3* — fixed contact; *4* — moving contact; *5* — timer weight; *6* — weight pin; *7* — fixed plate; *8* — fastening screw; *9* — spring; *10* — cam; *11* — adjusting screw; *12* — distributor body; *13* — stay with felt; *14* — condenser

The automatic advance timer of a centrifugal governor type consists of fixed plate *7* which carries pivot links with weights *5*. This plate is screwed on the shaft extension flats.

When the shaft is rotating, the weights on links tend to move apart. Turning of the links is limited by gauged springs *9*, as one end of each spring is fastened to the fixed plate and the other — to the link. The pins, that are fitted on ends of pivot links, enter the distributor cam tenon holes. As the engine speed is increased, the links move out and turn the cam in relation to the shaft, thus advancing automatically the ignition.

The springs rigidity and the link weights are selected so that with an increase of engine revolutions the angle of ignition advance is automatically increased. With a decrease of engine revolutions centrifugal forces are reduced, the springs contract and the links are drawn back, resulting in a smaller angle of ignition advance.

Ignition Timing

To facilitate setting of ignition, a hole is provided on the engine crankcase near the oil filler. This hole is closed with a rubber plug. Timing marks are stamped at the crankcase hole, of which the one to the left bears Russian letters BMT (T.D.C.), and the mark to the right — P3 (early ignition).

Once the rubber plug is removed, two arrows marked on the flywheel may be viewed through the hole:

a) one arrow points towards mark P3 (early ignition);

b) second arrow points towards mark BMT (T.D.C.).

The first arrow will align with P3 mark as soon as the countershaft, when revolved, reaches 40° before T.D.C. (or 9.5 to 10.5 mm if judged by the piston travel). At this moment the distributor contacts should break (spark jump), with the advance timer weights pulled apart to the limit. The alignment of second arrow point with the BMT mark corresponds to position of piston in T.D.C.

The moment of contacts breaking may be easily determined as follows: take the front cover off, switch on the ignition, and taking a screwdriver or some metal object put it to one end of the ignition coil core. As long as the distributor contacts are closed, current is flowing through the coil winding, magnetizing the core. The latter attracts and holds the screwdriver. While pushing the kick starter lightly, turn slowly the crankshaft. As soon as the contacts are open, the core is demagnetized and the screw driver will fall off. This will serve as a signal that the contacts are opening.

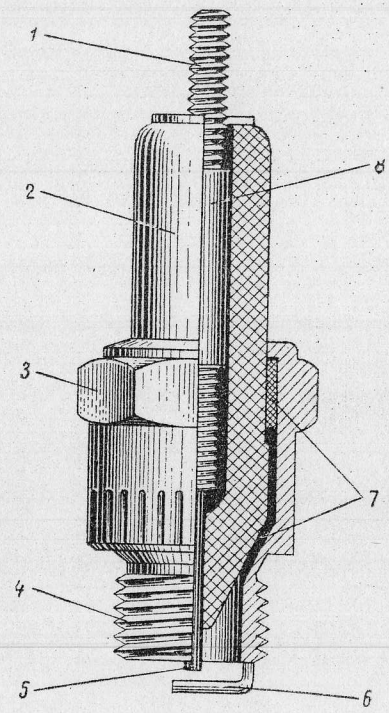

Fig. 14. Spark Plug:
1 — terminal; *2* — insulator; *3* — shell; *4* — thread; *5* — centre electrode; *6* — side electrode; *7* — copper gaskets; *8* — centre rod

To set later ignition, turn the distributor body in direction of its shaft rotation, whereas for earlier ignition, turn it in opposite direction. Never attempt to lessen or stretch the springs used in the automatic timer, as they are specially gauged for the purpose. In case the spring calibration is disturbed, the timer will malfunction, with the result that angles of advance will not correspond with the ignition setting required for the given duty of engine operation.

Spark Plugs

The spark plugs serve to ignite the combustible mixture in the engine cylinders. Spark plugs A-8V used on the motorcycle may be substituted by type A-7.5V. Spark plug (Fig. 14) is made up of steel shell *3*, side electrode *6*, insulator *2*, centre electrode *5*, terminal *1* and two round copper gaskets. The lower portion of the spark plug shell has M14×1.25 thread, 11 mm long. Spark gap of 0.6—0.7 mm is set between the side electrode and the lower end of the centre electrode.

Functions of Ignition System

To switch on the ignition, insert the ignition key into the ignition switch hole as far as it will go. This will close the circuit of ignition coil primary winding and the circuit of pilot lamp which will light up.

The current passing across the coil primary winding creates magnetic flux in its central core, the lines of force of which will close through the engine timing cover. The distributor cam is revolved simultaneously with the engine crankshaft revolution. Whenever the cam lobes run against the moving contact arm heel and pushes it away, the contacts break and the circuit of coil primary winding is interrupted.

At this moment the magnetic lines of force flowing across both windings induce electromotive force in them. The electromotive force in each winding will depend on the number of winding turns, value of magnetic flux and the rate, at which the number of lines of force is diminishing, as these lines are cutting each turn of winding. Since the second winding has a large number of turns, a high-tension current (10 000—15 000 V) necessary for igniting the combustible mixture is induced in the winding.

When the distributor contacts break, the spark is formed simultaneously between electrodes of plugs of the right-hand and left-hand cylinders: one spark is formed when in one of the cylinders compression stroke is ending, while the other — during the period of exhaust stroke, i. e. when valves are closed.

Simultaneously, a self-induction electromotive force reaching about 200—300 V is induced in primary winding and flowing in the same direction as the current in the primary winding. Unless measures are taken, the self-inductive current will cause a strong spark to form between the distributor contacts at the time of their opening, which may burn the contact points. In addition, the voltage in the secondary winding will drop due to a reduced rate, at which the magnetic lines of force are dying away.

To eliminate the harmful effects of self-induction, a condenser is connected in parallel with the contacts. At the moment when the contacts break apart, the induced current is directed to the condenser and charges it. After the primary current dies away, the condenser charged with it is discharged across the primary winding, where the current is flowing in the opposite direction, and when the core is rapidly demagnetized and the voltage in the secondary winding rises.

It is self-understood that if the condenser is out-of-order, the voltage in the secondary winding of the ignition coil will be insufficient for firing the combustible mixture and the engine will stop running.

As soon as the engine is started, the power supply to the ignition coil primary winding will be transferred from the storage battery to the generator after the relay contacts are closed.

To stop the engine, cut off the ignition by pulling out the ignition key or sliding it outward till a click is audible in the lock.

ENGINE TROUBLES AND REMEDIES

Trouble	Cause	Symptoms and Diagnosing	Remedy
1. Engine fails to start	1. No gasoline feed to carburetters	1. Push depressor down. If no gasoline appears from carburetters, it means they are empty	1. Open gasoline cock
	2. Too much gasoline in cylinders (especially when engine is hot)	2. Irregular combustion with backfire	2. Close gasoline cock, raise fully throttle valve, depress kick starter for 5—10 times and, lowering throttle a little, start up engine
	3. Contaminated or clogged-up gasoline cock or its filter	3. Disconnect gasoline pipes from carburetter and check gasoline flow with gasoline cock opened for reserve supply	3. Undo ends of gasoline pipes from carburetters and blow through with compressed air one by one, closing alternatively the second pipe. If after this gasoline is not running at full flow, remove setting bowl and filter and wash them in gasoline
	4. With gasoline feed to carburetter no firing at spark plug: a) no gap between electrodes, carbon deposit or dirt in spark plugs, insulator damaged	a) unscrew spark plug, connect body to "ground" and check spark between electrodes	a) depending on condition set correct gap, clean or replace spark plugs
	b) no gap between distributor contacts, oily or burnt contact points	b) pull wire end out and check spark on it by connecting wire end through a screwdriver to a ground leaving a small gap. If spark appears, look for fault in spark plug. If no spark occurs, check gap between distributor contacts	b) take crankcase outer cover off, set 0.4—0.6 mm gap between contacts. Wipe them and clean with fine file if necessary

Trouble	Cause	Symptoms and Diagnosing	Remedy
	c) loose wires at terminals	c) poor fastening	c) secure properly wires to terminals
	d) wire-to-terminal joints are filthy	d) dirt and dust on wire ends and terminals	d) clean
	e) faulty ignition coil	e) if while checking by method described in b no spark is evident, fault may be in ignition coil	e) replace ignition coil
	f) break in low-tension wiring	f) remove front cover, cut in ignition, close distributor contacts, place screwdriver close to ignition coil core. If low-tension circuit is in order, core will attract screwdriver. If screwdriver is not attracted, it points to break in circuit. To find the fault, use portable lamp connecting one end of its wire to ground, while its other end to low-tension terminals of ignition coil, then — to distributor wire terminal Portable lamp will not light: a) when connected to ignition coil input terminal in case break is in wire from headlamp to ignition coil. b) when connected to ignition coil output terminal in case break is in primary circuit of ignition coil c) when connected to distributor wire terminal in case break is	f) remedy break in wiring

Trouble	Cause	Symptoms and Diagnosing	Remedy
		in wire from ignition coil to distributor	
	5. Low or no compression in engine:		
	a) no clearance in valve timing mechanism	a) when kick starter is depressed, engine crankshaft turns with no sign of compression stroke taking place in both cylinders or in one of them	a) readjust clearances
	b) valves not seating due to carbon or burning-through of valve retainer	b) ditto	b) repair engine, grind-in and repair valves
	c) sticking or broken piston rings	c) smoke emitted through breather	c) repair engine, clean or replace piston rings
	6. Slipping of clutch	6. When kick starter is depressed, engine crankshaft does not turn	6. Readjust clutch controls. If clutch continues to slip repair it
2. Engine missing, runs irregularly, works on one cylinder	1. Weak mixture	1. Backfire in carburetter	1. Same as in paragraph 3, trouble 1
	a) erratic feed of gasoline to carburetter		
	b) carburetter jets are dirty		
	c) water in gasoline		c) prime fresh gasoline
	2. Faulty spark plugs		2. Same as in paragraph 4, trouble 1
	3. Poor connection at battery terminals	3. Pilot lamp is blinking	3. Restore connection at battery terminals, clean terminals, tighten up cable screws
	4. Missing spark	4. Clearance disturbed in safety gaps	4. Set 9-mm clearance by bending the safety gaps a little

Trouble	Cause	Symptoms and Diagnosing	Remedy
	5. Distributor contacts are burnt or their gap is set wrong	5. Intermittent spark between wire ends and a ground	5. Inspect contacts, clean or file; readjust gap
	6. Condenser faulty or connected poorly	6. Backfire in silencer, weak spark	6. Repair distributor. Recondition contacts or replace condenser
	7. Mixture too rich due to overflooding of float chamber:		
	a) float shut-off needle either dirty or leaky	a) engine smokes backfire in silencer, gasoline leaks through carburetter	a) clean shut-off needle
	b) float leaky	—	b) repair or replace float
	c) carburetter jet is loose	—	c) screw jet in place
	8. Carburetters misadjusted	8. Operation of cylinders is not synchronized	8. Readjust carburetters
	9. Piston rings damaged or sticking	9. Lack of compression, engine smokes, oil on spark plugs	9. Repair engine, clean or replace piston rings
	10. Valves not seating due to carbon deposits	10. Lack of compression	10. Repair engine, decarbonize and grind valves
3. Knocks in engine	1. Early ignition	1. Knocks disappear once ignition is retarded	1. Turn distributor body anticlockwise, check contacts gap
	2. Engine overheats	2. Hot-head ignition is apparent, i. e. engine, being switched off, stops with a delay	2. Stop engine and after it cools off, find and eliminate cause of overheating
	3. Piston pins, pistons, cylinders, crankpins and/or crankshaft main bearings are worn	3. Expert mechanic will determine this by listening to engine in operation	3. Repair engine
4. Engine runs well at high revolutions, backfire in carburetter at me-	1. Idle-speed jet is misadjusted	—	1. Blow through idle-speed jet

Trouble	Cause	Symptoms and Diagnosing	Remedy
dium revolutions, and engine stalls when transferred to low revolutions	2. Carburetters misadjusted (no synchronized operation of carburetters)	2. Determined by listening to engine running	2. Adjust carburetters for synchronized operation
	3. Incorrect clearance between valve and rocking arm	3. Check with feeler. Clearance should be 0.05 mm on cold engine	3. Readjust valve clearance
5. Engine fails to develop full power; with throttle fully open the motorcycle is not picking up speed	1. Late ignition or contacts gap too little, or distributor cam is jammed	1. Power increases when ignition is advanced	1. Turn distributor body clockwise. Check contacts gap, eliminate jamming and lubricate cam
	2. Contaminated air cleaner or clogged gasoline tank filler plug vent hole	—	2. Check for clutch slipping and heat in brakes. Remove air cleaner, wash in kerosene, dry and reoil; clean filler plug vent hole
	3. Valves not seating due to carbon deposits	3. Lack of compression	3. Repair engine. Decarbonize or grind valves
	4. Valve springs broken	—	4. Replace springs
	5. Gas leakage at head-to-cylinder joint	5. Backfire, lack of compression	5. Tighten up cylinder head stud nut or replace gasket
	6. Piston rings sticking or broken	6. Lack of compression, engine smokes, spark plugs fouled with oil	6. Repair engine. Clean or replace piston rings
6. Overheating of engine	1. Shortage or no oil in crankcase	1. Check oil level	1. Top up to correct level. If piston is seized or scored, engine calls for repair
	2. Mixture too rich:	2. Engine fails to accelerate in idle running:	2. Clean float chamber of dirt:
	a) carburetter flooded due to float shut-off needle not seating	a) check for gasoline flowing out of float chamber (overflow)	a) repair carburetter including reseating of shut-off needle
	b) filthy air cleaner		b) remove and wash

Trouble	Cause	Symptoms and Diagnosing	Remedy
	c) carburetter metering needle misadjusted		c) readjust carburetter
	3. Mixture too lean:		
	a) metering needle misadjusted	a) engine fails to accelerate under load	a) readjust carburetter
	b) air sucked at carburetter-to-cylinder head joints	b) backfire in carburetter	b) tighten up nuts fastening carburetter to cylinder head. If air suction recurs — replace gasket
	4. Late ignition		4. Turn distributor body clockwise. Check contact gap
7. High oil consumption	a) piston rings sticking or broken		a) repair engine. Replace piston rings
	b) piston or cylinder face outworn		b) repair engine. Rebore or replace cylinders (with simultaneous change of piston and rings)
	c) locating hole for breather in timing cover is out-of-shape		c) repair engine
	d) oil drain duct from cylinder head is clogged up		d) repair engine
8. Oil leaks under generator, oil pump drive gear plug, at engine-to-gearbox joint and under timing cover	1. Breather duct clogged up with snow or ice	1. With engine running gases are blocked up in crankcase	1. Use hot water to melt ice and snow out
	2. Breather jammed or its driving pin sheared	2. Excessive oil leaks through joints, gases cannot escape from crankcase through breather duct	2. Repair engine
9. Annoying squealing sound, varying in tone, in breather area	Water or snow in breather		Using rubber bulb with tube force oil into breather through its pipe. Turn crankshaft with kick starter. Then start engine

Trouble	Cause	Symptoms and Diagnosing	Remedy
			running. Squealing should cease
10. Hanging-up of carburetter valves	Carburetter contaminated with dirt, dust, water or snow	With fuel feed reduced by throttle control twistgrip, one of cylinders races high revolutions	Take valves out, wash in gasoline, wipe with clean cloth, blow through carburetters and valves. Reassemble. (In winter it may be sufficient to warm up carburetter with hot water, with due care that no water enters inside)
11. Engine misses, works on one cylinder only	Water in spark plug insulator		Use a clean piece of cloth and wipe carefully spark plug insulator and cap
12. Engine runs normally in idle and low speeds; it misses or stalls in medium and high revolutions; engine fails to develop high speed	Air cleaner clogged up with snow	Remove air cleaner and inspect it	Clean air cleaner of snow and oil, wash in gasoline. Reassemble, prime fresh oil, moisten filter stuffing with oil. To protect it against snow in winter, envelope all cleaner with a loosely woven cloth
13. Oil leaks under generator	Two coupling bolts of generator got loosened	Coupling bolts turn with no effort	Remove generator, dismantle, wash in gasoline, blow through and dry. Reassemble and reinstall on motorcycle
	During reassembling the engine the generator rubber gasket was fitted wrongly in place	Remove generator, inspect gasket	Replace gasket

VI. POWER TRANSMISSION

The power transmission system in the "Урал-2" motorcycle is a group of interconnected mechanism designed to relay the rotation from the engine *1* (Fig. 15) crankshaft to the rear

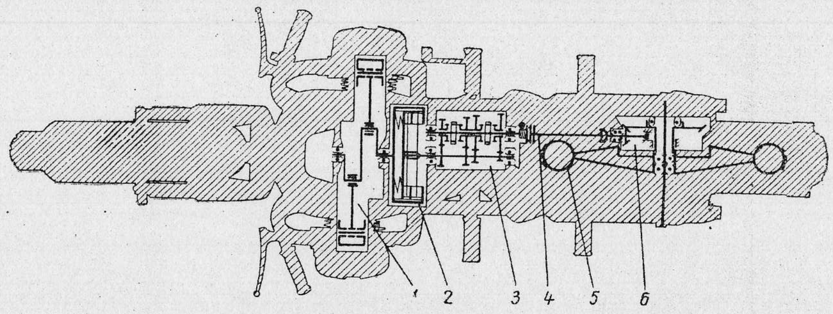

Fig. 15. Diagram of Power Transmission:
1 — engine; *2* — clutch; *3* — gearbox; *4* — propeller shaft; *5* — rear wheel; *6* — final drive (rear)

wheel *5*, to alter the tractive effort on the driving wheel and to vary the speed of its rotation. The power transmission comprises: clutch *2*, gearbox *3*, propeller shaft *4* and final drive *6*.

CLUTCH

The purpose of the clutch is to transmit the torque from the engine to gearbox, to disengage the engine from gearbox at the time when gears are being changed, or when the brakes are applied suddenly. The clutch provides for a smooth movement of the motorcycle from rest. It protects the power transmission and engine parts against breakdown, when the engine r.p.m. or travelling speed is changed all at once.

Clutch Design

The clutch used in the motorcycle is of dry two-disc version made up of driving and driven parts and a release mechanism. Flywheel *17* (Fig. 16) and plates (pressure *16*, intermediate *14* and thrust *13*) belong to the driving parts. The pressure and in-

termediate driving plates are attached on pins to the flywheel. There is a square hole in the pressure plate centre for the square portion of clutch release rod to fit in. The thrust plate is attached on the flywheel pin ends with screws, the heads of which are sa-

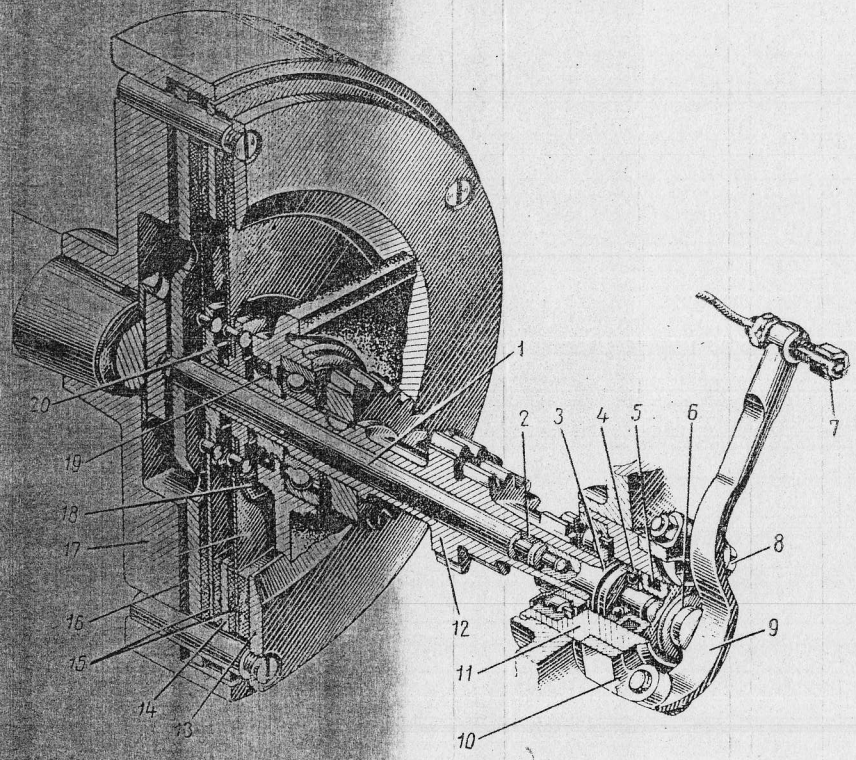

Fig. 16. Clutch:
1 — clutch release rod; *2* — oil seal; *3* — release rod tip; *4* — thrust ball bearing; *5* — slider oil seal; *6* — slider; *7* — adjusting screw; *8* — arm bracket bolt; *9* — clutch release arm; *10* — arm bracket; *11* — clutch shaft bearing housing; *12* — clutch shaft; *13* — thrust plate; *14* — intermediate driving plate; *15* — driven disc; *16* — pressure plate; *17* — flywheel; *18* — driven disc oil baffle; *19* — oil seal; *20* — driven disc hub

fetied in their seats by punching the thrust plate at the spots opposite the screw driver slots.

The clutch driven parts include two driven discs *15*, one of which is mounted between the pressure and intermediate plates, while the second between the intermediate and thrust plates. Both sides of the driven discs are lined with round facings made of friction fabric. The driven discs mesh with the splined portion of the gearbox clutch shaft *12*.

Clutch release mechanism consists of clutch release arm *9*, slider *6*, thrust ball bearing *4*, rod *1* and its tip *3*. The slider and the thrust ball bearing are enclosed in clutch shaft bearing housing *11*, while the rod and its tip — in the interior hollow of the clutch shaft.

Adjusting screw *7* of the clutch lever control cable is turned into the top end of the clutch release arm. The lower end of the release arm is attached through an eye and a pin to bracket *10*, which is mounted on the clutch shaft rear bearing housing and held thereon by means of a coupling bolt with nut. Oil seal *5* preventing oil flow from gearbox is placed in the slider annular recess. The slider end face and the rod tip shoulder serves as working surfaces for the thrust bearing balls. Oil seal *2* is placed in the annular groove on the rod in order to prevent oil flow from the gearbox into the clutch chamber.

Functions of Clutch

The clutch release mechanism is controlled by means of a clutch lever fitted on the left-hand portion of the handlebar, and a control cable. With the clutch lever in released position the clutch is engaged. Under the action of springs the driven discs are compressed between the pressure, intermediate and thrust plates. Friction force developed between the discs and plates forces the driven and driving parts to revolve as one unit, transmitting rotation to the clutch shaft of gearbox.

In case of a sudden pick up in the engine revolutions or in case of load increase on the driving wheel, the torque relayed through the clutch is intensified due to forces of inertia. Should the torque exceed the coefficient of friction between the clutch surfaces, the clutch discs will start to slip, damping thereby the impacts of gear teeth in the gearbox and of the engine parts.

When the clutch lever is depressed, the effort is imparted through a control cable to the clutch release arm and through spider, thrust bearing, rod tip and rod proper to the pressure plate. At this, the plate is shifted towards the flywheel, compresses the springs and frees the clutch discs from the spring pressure. Discs and plates are hereby separated and the friction between them is terminated. Thus, the clutch is disengaged.

Clutch Adjustment

The clutch lever should have a play within 5—8 mm. This play may be measured on the lever end.

If the play is normal, the clutch lever will ensure full engagement and disengagement of the clutch.

If the play is smaller than specified, the clutch will slip, and, if it happens to be greater — the clutch will drag due to incom-

plete release. Adjust the play with adjusting screws of clutch lever control cable. Turn the screws in or out either in the clutch release lever or on the clutch release arm.

GEARBOX

The gearbox is intended for changing the tractive effort on the motorcycle driving wheel in a wider range than it is possible by varying the engine revolutions only. Besides, the gearbox allows for the engine to run idling at starting and to operate when the motorcycle is at rest, with the clutch engaged.

Changing the tractive effort on the driving wheel provides for the motorcycle travelling under diverse road conditions by respective change of speed, as well as to overcome the motorcycle inertia, when moving from rest or when picking up speed on the road. In order to change the tractive effort, alter the transmission ratio by shifting gears.

The gearbox used on motorcycle "Урал-2" is a four-speed, two-step unit equipped with constant-mesh gears, and gear-shift sliding sleeves.

Design of Gearbox

The main parts of gearbox (Fig. 17) include: solid box *13* with covers, clutch shaft *6* and main shaft *9* with gears and shift sleeves, gear shift mechanism, and kick starter.

To facilitate assembling all parts of gearbox units, a window closed with front cover *2* is provided in the box front wall. A square hole is made in the lower portion of the box for draining oil, which happens to seep through into the clutch chamber from engine or gearbox compartment. This hole is closed with a felt plug to prevent dirt and dust entering the clutch chamber.

A boss in the left-hand wall of the gearbox is used to mount the gear shift mechanism. In the middle of this wall there is an oil filler with thread for the filler plug.

The clutch shaft *6* is built integral with the I, II and III gears. The IV gear *3* is a spiral wheel keyed on the shaft. The front splined end of the shaft enters the splined hub of the clutch driven discs. The shaft hollow houses the clutch release rod and its tip. The front end of the shaft is carried on a ball bearing. A ring serving as a working surface for the clutch shaft rubber seal is press-fitted on the shaft from the external end of the bearing. At its rear end the clutch shaft is mounted in roller bearing. An oil baffle is arranged ahead of this bearing.

Main shaft *9* is hollow, with splines cut to fit the main shaft sleeves. The holes made between the sleeves and communicated with the shaft interior hollow are used for oil feed to sliding surfaces of gears which rotate freely on the shaft. The main shaft sleeves *14* have external splines, by means of which the gear shift sleeves *15* are moved. The sleeves have ring grooves for the gear

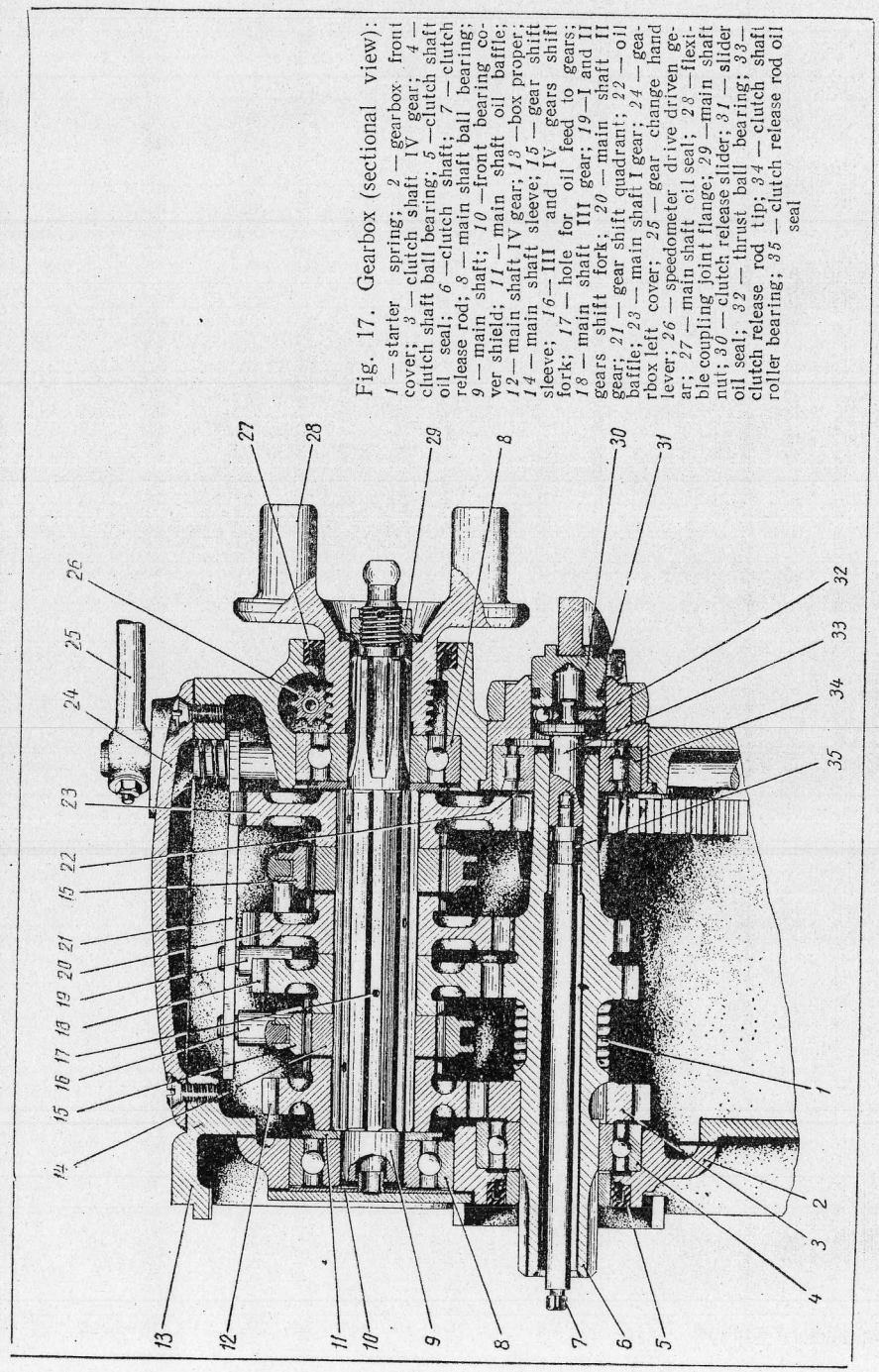

Fig. 17. Gearbox (sectional view):
1 — starter spring; *2* — gearbox front cover; *3* — clutch shaft IV gear; *4* — clutch shaft ball bearing; *5* — clutch shaft oil seal; *6* — clutch shaft; *7* — clutch release rod; *8* — main shaft ball bearing; *9* — main shaft; *10* — front bearing cover shield; *11* — main shaft oil baffle; *12* — main shaft IV gear; *13* — box proper; *14* — main shaft sleeve; *15* — gear shift sleeve; *16* — III and IV gears shift fork; *17* — hole for oil feed to gears; *18* — main shaft III gear; *19* — I and II gears shift fork; *20* — main shaft II gear; *21* — gear shift quadrant; *22* — oil baffle; *23* — main shaft I gear; *24* — gearbox left cover; *25* — gear change hand lever; *26* — speedometer drive driven gear; *27* — main shaft oil seal; *28* — flexible coupling joint flange; *29* — main shaft nut; *30* — clutch release slider; *31* — slider oil seal; *32* — thrust ball bearing; *33* — clutch release rod tip; *34* — clutch shaft roller bearing; *35* — clutch release rod oil seal

shift forks to enter. When gears are changed, the sleeve enters with its splines in mesh with the splines of the gear to be changed. The main shaft is carried on two ball bearings, with oil baffles arranged in front of each bearing.

A flexible coupling of the propeller shaft is fitted on the shaft rear splined end and secured with a nut. A worm thread is cut

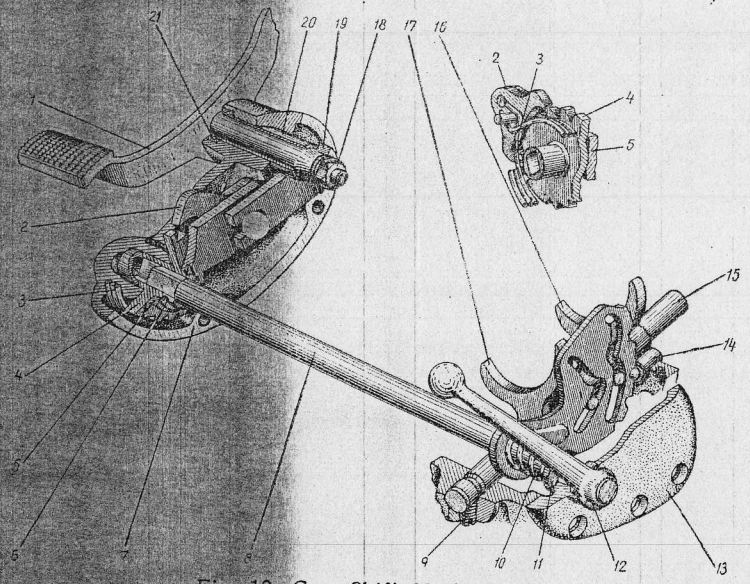

Fig. 18. Gear Shift Mechanism:
1 — gear change foot pedal; *2* — pawl; *3* — return spring; *4* — ratchet; *5* — pawl crank with pin; *6* — check ring; *7* — gearbox left cover; *8* — gear shift quadrant shaft; *9* — fastening screw; *10* — quadrant shaft spring; *11* — washer; *12* — gear change hand lever; *13* — gearbox right cover; *14* — quadrant lock; *15* — gear shift fork shaft; *16* — III and IV gears shift fork; *17* — I and II gears shift fork; *18* — nut; *19* — pawl crank arm; *20* — bushing; *21* — oil seal

on the flange hub for revolving the spiral-type driven gear of the speedometer drive. The gear is held in mesh with the worm by means of a bushing fixed in a hole in the gearbox wall. The rear face of the flange has two pins for connecting the flexible coupling.

The rear ball-shaped end of the main shaft is used for aligning the propeller shaft assy.

Shaft *15* with gear-shift forks *16* and *17* (Fig. 18) is mounted in the gearbox secured therein with fastening screw *9*. The forks provided with lenons enter the ring grooves of gear shift sleeves, while their tenons move in the intricate-shaped gate of the gear-shift quadrant. Five half-round flutes are made on the quadrant outer curve for admitting the balls of lock *14*. The quadrant is welded on to shaft *8* which is arranged crosswise in the gearbox. Spring *10* with its washer *11* installed between the box cover

and the quadrant presses the latter to the gear-shift forks. Gear change hand lever *12* is fitted on the shaft extension that protrudes through the cover, while the opposite square end of the shaft enters a square hole in ratchet *4* of the gear shift mechanism.

Pawl crank *5* is fitted on the ratchet neck and is held in place by check ring *6*. This crank mounts the pin, which enters the slot in crank arm *19*, and pivoting pawl *2*. A pin clamped by the hooks of return spring *3* is press-fitted in the pawl. Return spring is installed on the cover boss and rests with its ends against a cast-in rib on the cover. The crank arm is fitted with its splines in the splines of the shaft of gear change foot pedal *1*.

The kick starter (Fig. 19) consists of shaft *4*, pawl *7* secured on the shaft, kick starter pedal with lever, return spring *1* and gear *3*. The shaft is carried on bushings fitted in the gearbox. The kick starter pedal with lever is fixed on the rear end of the shaft, protruding out of the gearbox, by means of a wedge, nut and washer. The shaft has a thicker part for mounting the pawl with the aid of a pin. The spring and pin are inserted in a hole in the shaft thickening. They press the pawl against the ratchet.

The kick starter gear constantly meshed with the I gear on the main shaft is fitted on the kick starter shaft. On one side of the gear is a recess, wherein on the inside periphery are the ratchet teeth, into which the pawl is made to enter when set in working position. The gear is held on the shaft from axial displacement by the thickening on one end and by bushing *2* on the other. The latter is fixed on the shaft by means of a pin, the protruding end of which is used to fasten the rear end of the return spring. The front end of this spring is fixed in the front bushing of the shaft. The spring is introduced to return the shaft to initial position once the pedal is released after cranking up the engine.

When assembling the kick starter it is important to set the spring so that it can throw back the kick starter pedal with force. To this aim turn the bushing with spring end fitted into its side hole anticlockwise and secure with screws to the gearbox.

For cushioning the impact at the time when the pedal is suddenly released, a buffer made up of pin *10*, a spring and plug *11* are installed at the bottom of the gearbox.

Release *9* screwed on the inside part of the gearbox rear wall is provided to draw the pawl away from the ratchet teeth once the shaft is turned back to initial position.

As soon as the kick starter is depressed, the shaft is turned and together with it the pawl which, at the moment, is demeshed from the release and under the action of spring and pin is meshed with the ratchet teeth, thus dragging the gear along. The kick starter gear, being connected to the I gear on the main

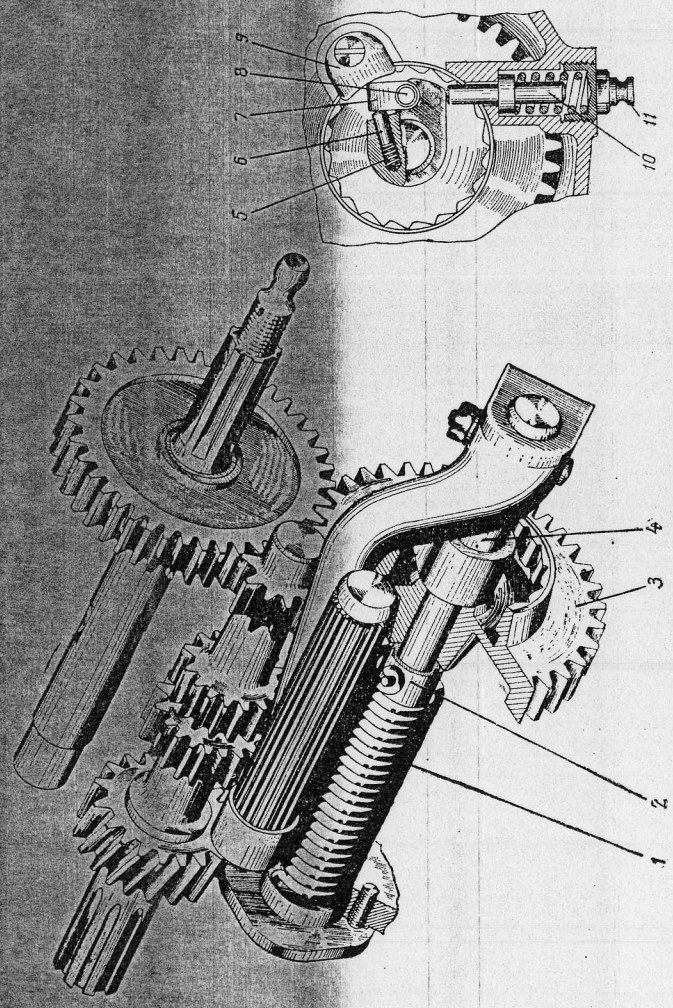

Fig. 19. Kick Starter:
1 — return spring; *2* — shaft bushing; *3* — gear; *4* — shaft; *5* — pawl spring; *6* — spring-loaded pin; *7* — pawl; *8* — pawl pin; *9* — pawl release; *10* — buffer pin; *11* — buffer plug

shaft, revolves the gearbox clutch shaft, the clutch and engine crankshaft. Once the pressure on the kick starter pedal is removed, the gear together with the shaft is returned, under the action of return spring, to initial position, while the pawl is drawn off by the release. The stroke of kick starter pedal is limited at the bottom by a rubber bumper attached to the motorcycle frame and at the top by a spring bumper on the gearbox.

Functions of Gearbox

In the gearbox all the gears of the clutch shaft are always in mesh with the gears fitted on the main shaft. With the engine running, clutch engaged and gearbox set in neutral position, the clutch shaft *15* (Fig. 20) is rotating en-block with its gears, inducing the gears on the main shaft *14*, also to turn, but without giving any motion to the main shaft.

A desired speed may be set in the gearbox by meshing the respective gears when the sleeves, made to slide along the splines, come in mesh with relative splines of the main shaft gear. As a result of this, the gear meshed with the sleeve imparts the torque through a sleeve to the main shaft which is connected through propeller shaft and final drive with the motorcycle driving wheel.

Gear shift quadrant *2* is devised for axial shifting of sleeves along the main shaft splines. The gear-shift forks enter with their tenons the two intricate-shaped gates in the quadrant. Whenever the quadrant is turned, the gate forces the fork to shift and with it the respective sleeve. The gates in the quadrant are so designed that simultaneous displacement of sleeves is excluded. The quadrant shaft is actuated either by the gear change hand lever or by the gear change foot pedal.

The gear change hand lever may be set in five different positions. The I gear is engaged when the gear change hand lever is pulled back to the stop, while by pushing the hand lever forward, the II, III and IV gears are engaged one after another. The neutral position of the gearbox is selected by setting the hand lever between the I and II gears. The hand lever features not only the shifting of gears in succession, but also in a range of variations, for example: from the lowest gear directly to the highest one and vice versa. The main application of this lever is, however, to set the gearbox in neutral position.

The gear change foot pedal is used to shift the gears only in a definite succession. Lower gears are engaged by depressing the front shoulder of the foot pedal, while the rear shoulder of the foot pedal is depressed for higher gears. Once the pedal is released, it is set back in initial position by the force of the return spring.

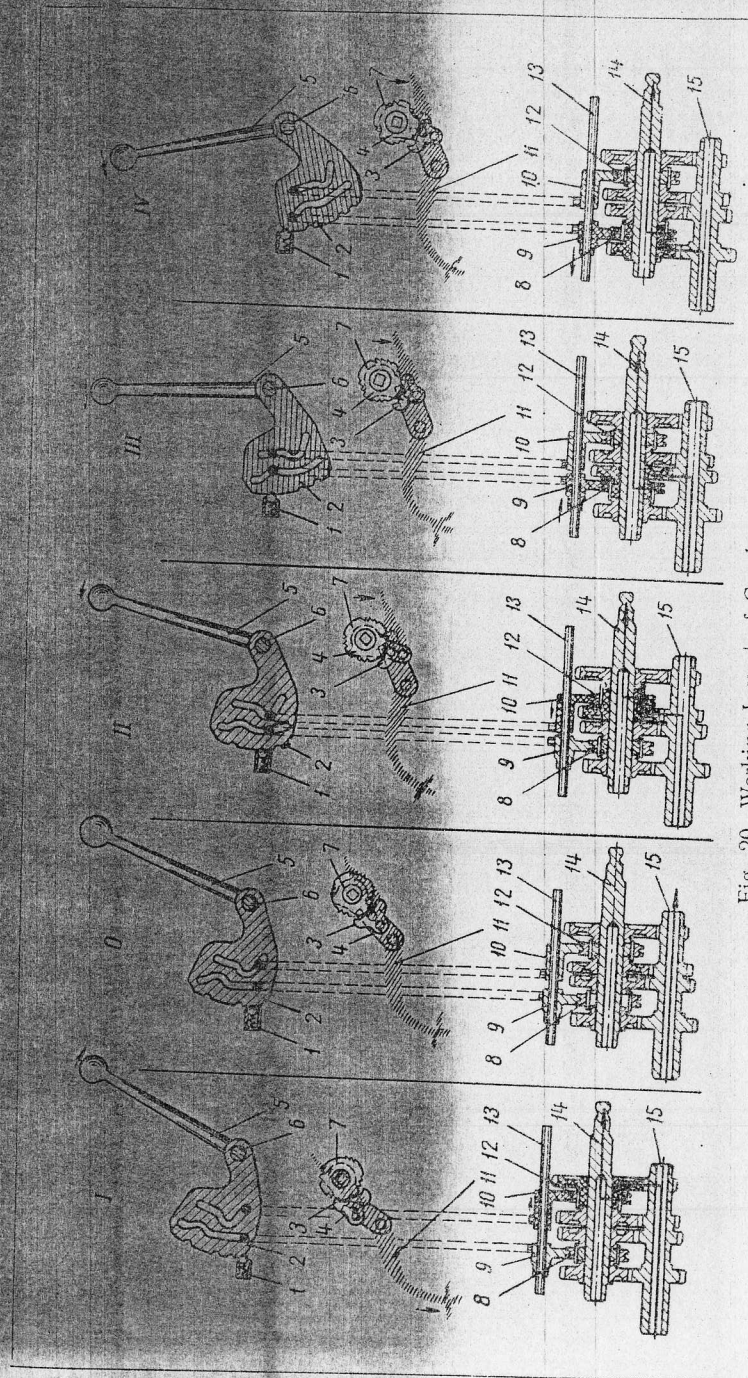

Fig. 20. Working Layout of Gearbox:
1 — gear shift quadrant lock; *2* — gear shift quadrant; *3* — gear shift mechanism pawl; *4* — pawl crank; *5* — gear change hand lever; *6* — quadrant shaft; *7* — ratchet; *8* — III and IV gears shift sleeve; *9* — III and IV gears shift fork; *10* — I and II gears shift fork; *11* — gear change foot pedal; *12* — I and II gears shift sleeve; *13* — gear shift fork shaft; *14* — gearbox main shaft; *15* — gearbox clutch shaft; *I* — in I gear; *II* — in II gear; *III* — in III gear; *IV* — in IV gear; *0* — neutral position

Operation of the gear change foot pedal may be summarized as follows: whenever the pedal is depressed, pawl crank *4* turns, pawl *3* is inclined, and leaning against either top or bottom tooth of the ratchet turns ratchet *7* and its shaft. In this way the ratchet is turned until the pawl crank is rested against the adjusting screw. As soon as the gear is engaged and pedal released, the return spring pushes the pawl crank back to its starting position.

The ratchet is made with two rows of teeth, one row being for spare. In case a tooth is chipped or broken off, turn the ratchet so as to bring the spare pair of teeth in action.

Gear Shift Mechanism Adjustment

Correct and dependable functioning of the gear shift mechanism (refer to Fig. 18) is ensured by timely adjustment of the gear change foot pedal stroke. The gear shift mechanism is adjusted by means of stops (adjusting screws) which restrict the turning of pawl crank, and consequently the stroke of the gear change foot pedal.

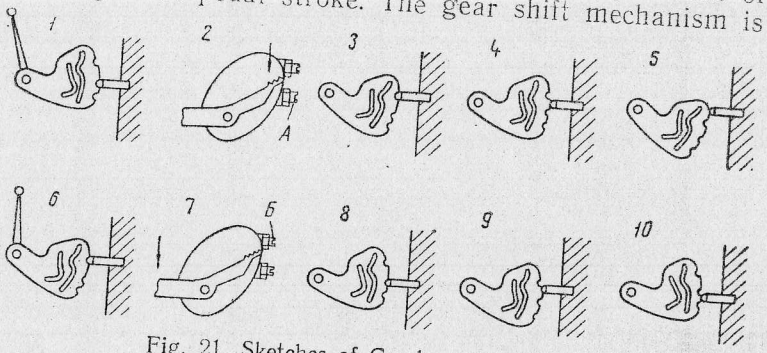

Fig. 21. Sketches of Gearbox Adjustments

For readjusting job, start up the engine and set up the motorcycle on its stand. After that proceed as follows:

1. Adjust the lower stop by turning the quadrant with the gear change hand lever in the II gear, making the lock settle in respective flute of the quadrant (position *1* in Fig. 21).

Press on the rear shoulder of the gear change foot pedal (position *2*) in order to engage the III gear. If the lower stop (adjusting screw) is correctly adjusted, the quadrant is turned to the required angle and is locked in that position (position *3*). In case the stop is misadjusted, the quadrant after being turned by the pedal remains unlocked. This is easily detected by rocking the gear change hand lever back and forth. Here the following alternatives may be possible:

a) angle of quadrant turning is too small (position *4*). The gear change hand lever must be pushed forward a little before

the lock ball enters the flute and locks the quadrant. To remedy, slacken the locknut and turn the lower stop slightly out (adjusting screw *A*, see position *2*). Check the pedal stroke again to attain correct position of the stop;

b) angle of quadrant turning is too great (position *5*). Locking of quadrant is felt only after the gear change hand lever is pulled back a little. To remedy, turn the lower stop in.

2. Adjust the upper stop by turning the quadrant with the gear change hand lever to position corresponding to the III gear (position *6*).

Press on the front shoulder of the gear change foot pedal in order to engage the II gear (position *7*). The quadrant should lock in this position. If no locking action takes place, which is evident when the gear change hand lever is rocked, it means that the upper stop is misadjusted. Here, the following alternatives may be possible:

a) angle of quadrant turning is too small (position *9*). To increase the turning angle, slacken the locknut and screw the upper stop out (adjusting screw *Б*, see position *7*);

b) angle of quadrant turning is too great (position *10*). To reduce the turning angle, screw the upper stop in.

After readjusting of stops is completed, safety the screws with locknuts.

Gearbox Maintenance

When conducting the daily inspection check all fastenings (bolts and nuts) of gearbox.

After every 1000 km check oil level in the gearbox and top up if necessary (oil level should be on one line with the lower threads of the gearbox filler hole).

After every 4000 km change oil in the gearbox. For this job unscrew the filler and drain plugs, and drain used oil out. Then screw the drain plug in place and fill 150—200 cm³ of automotive oil grade AK-10 or AC-9.5 (summer), or AK-6 or AC-5 (winter) into the gearbox, start up the engine, raise the motorcycle on its stand, shift in III or IV gear, and run for two or three minutes, flushing the gearbox. After that drain flushing oil out and prime the gearbox with fresh oil. In winter-time prime hot oil into the gearbox.

Adjust the gear change foot pedal mechanism when necessary.

PROPELLER SHAFT

Propeller shaft (Fig. 22) is introduced to transmit uninterrupted rotational motion from the gearbox to the final drive and driving wheel, when the latter, while following the road contours, is being displaced vertically in relation to the motorcycle frame. It consists of a flexible joint, propeller shaft and universal

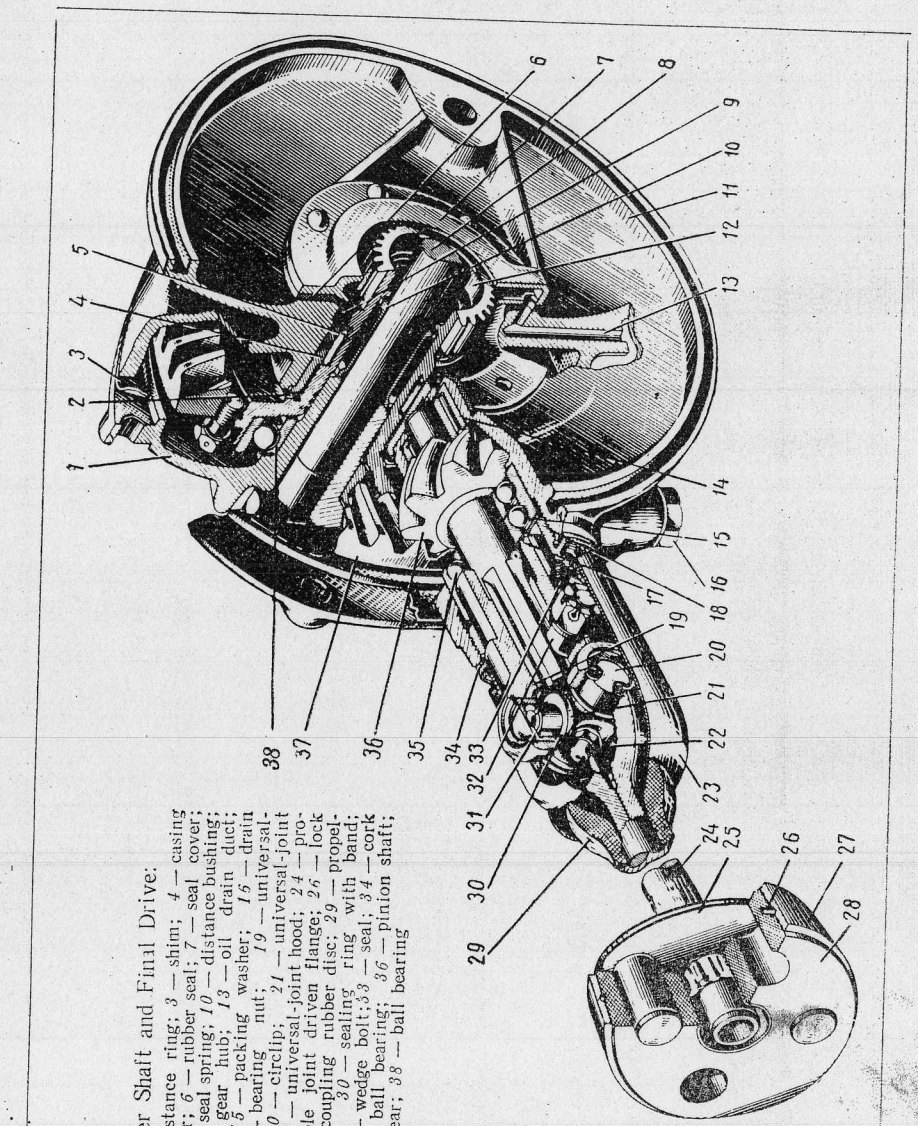

Fig. 22. Propeller Shaft and Final Drive:
1 — casing cover; *2* — distance ring; *3* — shim; *4* — casing bushing; *5* — needle roller; *6* — rubber seal; *7* — seal cover; *8* — rear wheel axle; *9* — seal spring; *10* — distance bushing; *11* — casing; *12* — ring gear hub; *13* — oil drain duct; *14* — needle bearing; *15* — packing washer; *16* — drain plug; *17* — shim; *18* — bearing nut; *19* — universal-joint splined fork; *20* — circlip; *21* — universal-joint cross; *22* — lubricator; *23* — universal-joint hood; *24* — propeller shaft; *25* — flexible joint driven flange; *26* — lock ring; *27* — band; *28* — coupling rubber disc; *29* — propeller shaft sealing collar; *30* — sealing ring with band; *31* — needle bearing; *32* — wedge bolt; *33* — seal; *34* — cork gasket; *35* — double-row ball bearing; *36* — pinion shaft; *37* — ring gear; *38* — ball bearing

joint. The former is made in a form of a coupling equipped with flanges, rubber discs and pins.

Driving flange of the coupling is fitted on the gearbox main shaft extension, whereas the driven flange *25* is fixed on the propeller shaft *24* front splined end by means of a check ring.

Each flange has two pins passing through holes in rubber disc *28* which serves as the flexible member of the transmission. To reduce deformation of this disc in operation, it is enclosed in band *27* which is held by lock ring *26* from axial displacement. Steel bushing inserted in its holes gives the necessary rigidity to the rubber disc.

Propeller shaft *24* is aligned by means of the main shaft ball-end which enters the socket in the propeller shaft front end. Universal-joint fork is fitted on the propeller shaft rear end.

The universal joint is made up of two forks and cross *21*. Fork *19* is fitted on the final drive pinion shaft splines and held from axial displacement by wedge bolt *32*. The cross pins are fitted on needle bearings in the eyes of both forks. The bearing outer races are secured with circlips. Bearing lubricator *22* is screwed into the universal-joint cross body. Appropriate holes and face grooves are made in the cross pin for lubricant distribution.

The universal joint is enclosed in hood *23* and has rubber sealing collar *29* to protect it against dust and dirt.

FINAL DRIVE

The purpose of the final drive is to increase the torque on the driving wheel, transmitting it from the propeller shaft at right angle to this wheel. The final drive is devised as a pair of spiral-toothed bevel gears housed in casing *11* (see Fig. 22), which serves at the same time as a plate for brake shoes, as an oil reservoir and a support for the right-hand end of the rear wheel axle. The casing has an oil drain hole at the bottom closed with a plug. Cover *1* attached to the casing has a slot and four sturdy studs used to fasten the whole drive to the rear suspension swinging fork arm. A hole is provided in the cover for priming oil into the casing.

Rubber seal *6* with spring *9* is mounted in the gear hub in order to block off the oil from the brake shoes. This seal is retained in place with the aid of cover *7*. Oil penetrating from bushing *4* to seal *6* is diverted through a hole back into the casing, while, if a part of it should pass through the seal, it is collected on the seal cover and directed outside along an oil drain duct.

Driving pinion *36* made integral with its shaft is fitted in the casing throat on needle bearing *14* and double-row ball bearing *35*. **Left-hand** threaded nut *18* screwed in the casing rests against the ball bearing outer race through star-shaped packing washer *15*.

Cork gasket *34* is placed between the nut edge and casing boss end face. To avert oil leaks, a seal is installed between the nut and universal-joint fork *19* fitted on the splines of the pinion shaft. Spacer shims *17* are inserted between the fork butt and the ball bearing inner race.

The driven gear consists of ring gear *37* and hub *12*. The ring gear is bolted to the hub flange. The other end of the gear hub is splined for connecting with inner splines of the wheel hub.

Oil conducting thread is cut inside the hub from the flange end. The hub together with the ring gear is carried on two bearings. The left-hand bearing is made up of needle rollers *5*, with the driven bevel gear hub serving as its inner race, and a steel bushing press-fitted in the casing acting as the outer race. The right-hand ball bearing *38* is fitted in the casing cover boss, entering tightly the hub hollow.

Before installing the hub in the casing cover boss it will be necessary to fit distance bushing *10*, against which is rested the rear wheel distance bushing. The final drive in assembly with the rear wheel is mounted on a common axle, linking both units with the rear suspension of the motorcycle.

Between the side portion of casing cover *1* and the inner race of bearing *38* is installed a shim for adjusting the backlash between teeth of final drive gears. For proper performance of the final drive it is important to set the backlash between working surfaces of gear teeth within 0.1—0.3 mm. This is done during assembling by means of the mentioned shims.

Maintenance of Propeller Shaft and Final Drive

At the time of daily inspection, check tightening of nuts at the joint of final drive to swinging fork arms. If these nuts are not tightened in time, their loosening may disturb adjacent joints and lead to derangement of the final drive casing cover.

After every 4000 km lubricate the universal-joint cross needle bearings. For this purpose dismantle the final drive, move the rubber ring forward along the shaft (see Fig. *22*), roll up the hood, and using a grease gun pack grease into the cross through the lubricator. Check oil level in the rear drive casing and top up if necessary, as the oil should be on 25 mm level from the plug bearing surface.

After every 4000 km change oil in the final drive casing. To do this, unscrew the filler and drain plugs, and drain used oil out. Fill 100—150 cm^3 of oil of the same grade as used for the engine, flush the final drive by turning the rear wheel a few times, drain this oil out and prime fresh oil of the required grade to correct level.

POWER TRANSMISSION TROUBLES AND REMEDIES

Trouble	Cause	Diagnosis	Remedy
Clutch slips	1. Clutch fails to engage fully due to misadjusted controls	1. Check for required play of clutch lever	1. Readjust by turning adjusting screw so that play in clutch lever is within 5—8 mm
	2. Oil on facings of driven discs	2. Check when dismantling or during inspection	2. Wash in gasoline and dry
	3. Driven disc facings are worn or burnt	3. Ditto	3. Replace facings or disc assy
Clutch fails to disengage fully (drags)	Misadjusted clutch lever (too much play)	Check the play of clutch lever positioned on handlebar	Readjust by turning adjusting screws so that clutch is fully released, with clutch lever play within 5—8 mm
When kick starter is depressed, its pedal moves down, but engine crankshaft fails to turn	1. Pawl, pawl pin or teeth of kick starter ratchet are either worn out or broken; clutch slips	1. Put motorcycle in gear and depress kick starter. If motorcycle refuses to move — kick starter is out-of-order; if motorcycle is moving, but crankshaft does not turn, then clutch is slipping	1. Replace pawl or reverse its position. Replace pawl pin. Replace gear with ratchet. Check adjustment of clutch lever. If necessary readjust
	2. Pawl spring is broken or lacks resilience		2. Replace pawl spring
	3. Oil has thickened due to cold weather (pawl fails to mesh with ratchet gear teeth)		3. Warm up gearbox
Kick starter pedal fails to return in top position or returns very slowly	Kick starter return spring is weak or broken, or spring-loaded pin is sheared. Grease is too thick	Kick starter pedal should return without hindrance in top position	Replace spring or pin. Warm up gearbox
I gear cannot be engaged with gear change foot pedal, but engages with hand lever	Upper screw of gear change foot pedal crank is misadjusted	With gear change foot pedal depressed to stop, gear change hand lever fails to reach position for engaging desired gear	Readjust by turning upper adjusting screw out

Trouble	Cause	Diagnosis	Remedy
IV gear cannot be engaged with foot pedal, but engages with hand lever	Lower screw of gear change foot pedal crank is misadjusted. Ratchet tooth is broken	While engaging IV gear with foot pedal, gear change hand lever fails to reach position for engaging desired gear	Readjust by turning lower adjusting screw out. If this cannot remedy the trouble, disassemble gear shift mechanism and replace ratchet
Gear change foot pedal does not come back to initial position	Return spring is weak or broken	Gear is engaged without difficulty, but pedal — after being depressed — is not returned to starting position	Replace spring
Gear jumps out of mesh spontaneously, with motorcycle on the run	1. Grear change foot pedal is out-of-adjustment	1. Take crankcase right-hand cover off and make visual inspection	Replace worn-out parts 1. Readjust
	2. Gear shifting is difficult due to wear in quadrant indexing flutes or due to bent gear shift quadrant	2. Ditto	2. Repair flutes; straighten out quadrant or replace it together with its shaft
	3. Foot pedal bushing is outworn	3. Ditto	3. Replace bushing
Noise in gearbox	1. Shortage of oil in gearbox	1. Check oil level	1. Fill up oil
	2 Wearing away of gears	—	2. Replace worn gears
Runout of propeller shaft	Play in universal-joint cross due to falling out of circlip that holds needle bearing in place	Roll up hood and check condition of circlip	Dismantle propeller shaft. Check condition of universal-joint cross. Wash cross, bearings and universal-joint forks, pack with grease and reassemble
Noise in final drive	1. Shortage of lubricant in final drive casing	1. Check lubricant in casing	1. Add lubricant

Trouble	Cause	Daignosis	Remedy
	2. Backlash between teeth of gears is either too small or too great (permissible backlash being within 0.1—0.3 mm)	2. Remove final drive and send it to repair shop for check-up	2. Readjust backlash. If necessary, replace final drive assy or any of its component parts
Overheating is felt in final drive casing	1. Lack of improper lubricant 2. Parts worn away or broken 3. Misadjusted play of brake pedal	1. Check quantity and quality of lubricant 2. Remove final drive and send it to repair shop for check-up 3. No or too little play in brake pedal	1. Add or renew lubricant 2. Replace final drive assy or its worn-out parts 3. Readjust play of brake pedal
Poor action of rear wheel brake	1. Too much oil in casing 2. Damaged or broken seal	1. Oil leaks from drain hole in casing, staining brake shoes and drum	1. Drain oil and refill 130 cm^3 2. Replace the seal

VII. RUNNING GEAR

Running gear of the motorcycle comprises the following units: frame, front fork, rear wheel suspension, wheels, front and rear saddles, and mudguards.

MOTORCYCLE AND SIDE-CAR FRAMES

The frame is the principal carrying element of the motorcycle, whereto are attached all the basic and subsidiary units of the motorcycle outfit. The motorcycle is furnished with a tubular, double-standard, compact frame of welded construction.

Design features and principal parts of the motorcycle and side-car framing are illustrated in Fig. 23.

The side-car frame rectangular in shape is connected with the motorcycle frame by clamping holders *3* and *23* and tie-rods *9* and *37*. Special hangers are welded to the frame in the rear for mounting quarter-elliptic springs.

The side-car wheel is connected to frame *11* through an overhung axle lever articulated to the frame. To protect it against mud, the inner hollow of wheel brake drum is covered with guard plate *17*.

Vertical road jolts are taken up by the spring-loaded hydraulic shock absorber (similar in design to the shock absorber used in the motorcycle rear wheel suspension). The shock absorber is rubber-bushed on the frame tubing and on the wheel axle lever, with the lower bushing press-fitted when assembling the axle lever, while the upper bushing is mounted at the time of fastening the shock absorber to the frame.

Wheel axle lever *6* (Fig. 24) is connected to the frame by means of two silent blocks (items *7*, *8* and *9* in Fig. 24) similar to the silent blocks used in motorcycle frame swinging fork arms. Such connection ensures noiseless running, requires no special care in service and is practically wearproof.

To protect the shock absorber from very hard jolts when travelling fully laden on bad roads, an arrester of the shock-absorber back-stroke is installed on the right-hand longitudinal tube of side-car frame. This arrester is furnished with a rubber bumper and serves to take up the shocks, when the wheel axle lever is forced all the way down.

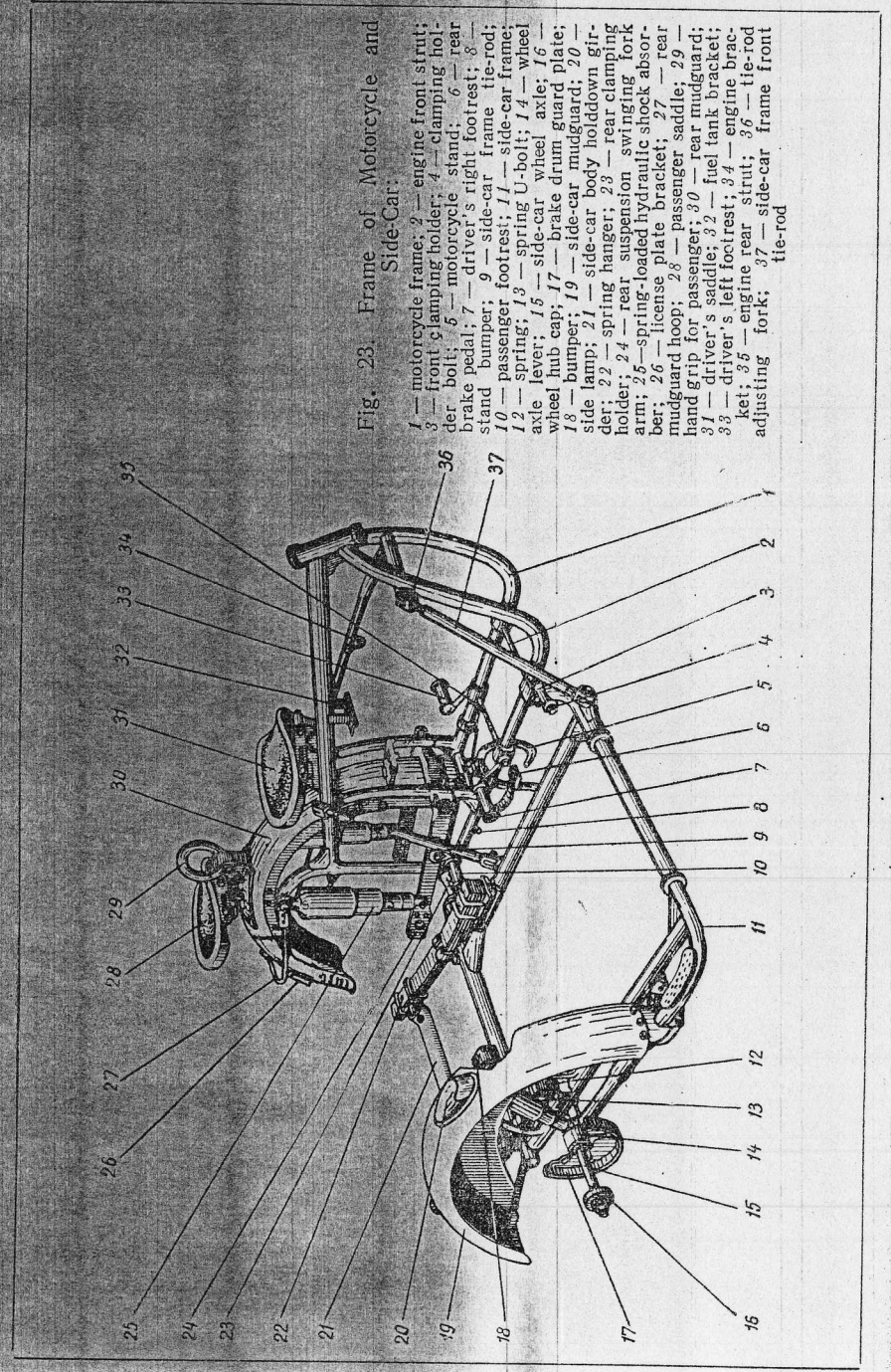

Fig. 23. Frame of Motorcycle and Side-Car:
1 — motorcycle frame; *2* — engine front strut; *3* — front clamping holder; *4* — clamping holder bolt; *5* — motorcycle stand; *6* — rear brake pedal; *7* — driver's right footrest; *8* — stand bumper; *9* — side-car frame tie-rod; *10* — passenger footrest; *11* — side-car frame; *12* — spring; *13* — spring U-bolt; *14* — wheel axle lever; *15* — side-car wheel axle; *16* — wheel hub cap; *17* — brake drum guard plate; *18* — bumper; *19* — side-car mudguard; *20* — side lamp; *21* — side-car body holddown girder; *22* — spring hanger; *23* — rear clamping holder; *24* — rear suspension swinging fork arm; *25* — spring-loaded hydraulic shock absorber; *26* — license plate bracket; *27* — rear mudguard hoop; *28* — passenger saddle; *29* — hand grip for passenger; *30* — rear mudguard; *31* — driver's saddle; *32* — fuel tank bracket; *33* — driver's left footrest; *34* — engine bracket; *35* — engine rear strut; *36* — side-car frame front adjusting fork; *37* — side-car frame front tie-rod

While the motorcycle is running under maximum load, then in adjusting the degree of spring compression in the motorcycle shock absorbers (refer to section "Rear Suspension Shock Absorbers"), readjust likewise the spring of the side-car wheel shock absorber.

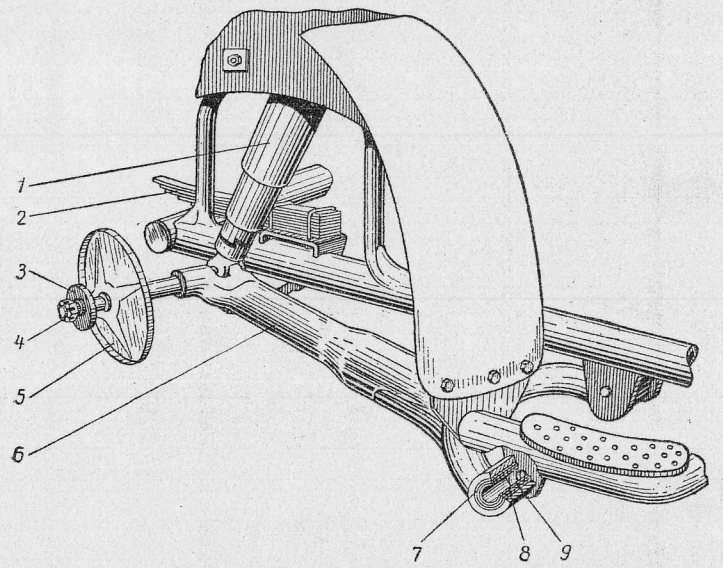

Fig. 24. Side-Car Wheel Suspension:
1 — spring-loaded hydraulic shock absorber; *2* — springs; *3* — wheel hub cap; *4* — wheel axle nut; *5* — brake drum guard plate; *6* — wheel axle lever; *7* — outer bushing; *8* — distance bushing; *9* — silent block bushing

Side-car mudguard *19* (Fig. 23) is fixed on a hoop and two brackets of the frame.

Adjustment of Side-Car Setting

The side-car should be set in a strictly definite position in relation to the motorcycle. The position is determined by the camber and toe-in of the motorcycle and side-car wheels (Fig. 25). A motorcycle with a side-car set correctly "keeps" the road well and is easy in steering. On the other hand, incorrectly set side-car will "drag" the motorcycle to either side and cause intensive wear of wheel tyres. If the motorcycle is not stable on the road and is difficult to steer, check camber and toe-in of the wheels. Checking and measuring should be carried out on level ground.

Toe-in of the motorcycle and side-car wheels is checked with the help of two straight bars 2000—2100 mm long applied to the side surfaces of the wheels at the height of 90—100 mm. The value of the toe-in on the length of the motorcycle wheelbase should

be within 10—12 mm, i. e. the distance on the line of the front wheel axle should be shorter by 10—12 mm than that on the line of the rear wheel axle. When adjusting, disconnect the slanting tie-rods fastening the side-car to the motorcycle, slacken two clamp bolts clamping rear crank lever, pull the lever out (if the distance is less than 10—12 mm) from the side-car frame rear tube or push it in (if the distance is greater) to obtain the necessary toe-in of the wheels, then tighten the clamp bolts fastening the lever.

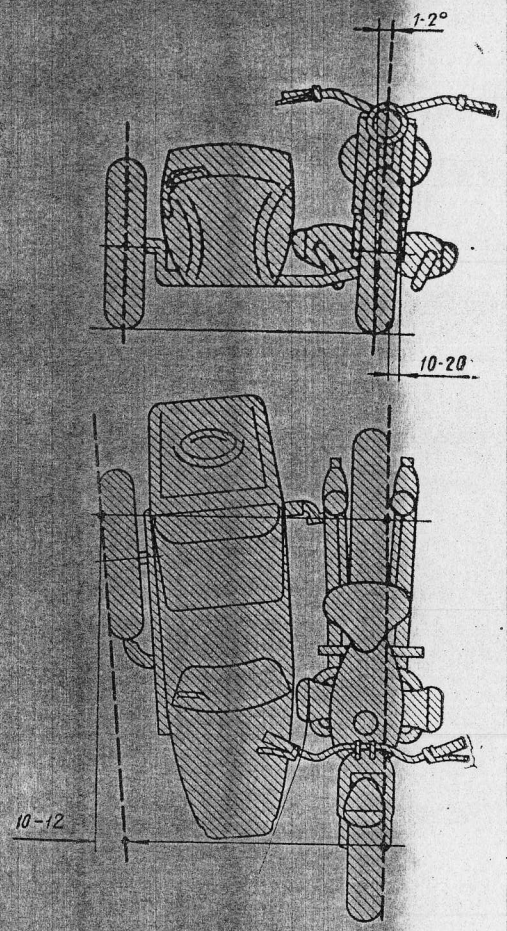

Fig. 25. Setting Side-Car Relative to Motorcycle

Angle of the motorcycle inclination in relation to the vertical plane (camber angle) should be equal to 1—2° (or 10—20 mm when measuring the distance between points of projection of the top and bottom side portions of the motorcycle front or rear wheel tyre, see Fig. 25).

The inclined position of the motorcycle is checked with the aid of a protector with plumb or with a plumb and a rule.

To adjust the angle of wheel camber, disconnect the two tie-rods on top, i.e. at the place of their jointing with the adjusting forks and unscrew the locknuts. Set the motorcycle inclined to the side-car within 1—2° (10—20 mm between points of projection of the top and bottom side portions of the motorcycle front or rear wheel tyre). Turning the forks in or out, select the required length of the tie-rods. Joint the tie-rod forks with frame brackets, secure them with bolts and screw on the locknuts. Then check this when the motorcycle is on the run. If the chamber is correctly adjusted, the motorcycle will not pull to the side when travelling.

FRONT FORK

Telescopic-type front fork with inside spring and single-action hydraulic shock absorbers ensures great riding comfort and easy steering of the motorcycle.

Front fork (Fig. 26) consists of steering column stem *8* with bridge *16*, fork cross-piece *3*, two fork legs with shock absorbers, and a steering damper.

Steering column stem serves to fasten the fork to the frame head on two supporting bearings. Bottom end of the stem is press-fitted in the bridge, whereas its top end is held in the frame head by a nut used to tighten up the bearings.

The fork cross-piece is fitted from top on the taper ends of fork leg tubes *24* and is secured by nut to the stem. The fork leg tubes are fitted in two side slitted holes of the bridge and fastened therein by means of clamping bolts.

The fork spring is introduced for damping the jolts transmitted from the wheel to the frame. Bottom end of the spring is screwed in shock absorber body nut *35*, and its top end is screwed in the spring top end *12* located on the rod between the limiting nuts. Spring connects the moving portion of fork — the fork leg tip *25*, and its fixed portion — the fork leg tube *24*.

Hydraulic shock absorber intended for damping vibrations is fitted in each leg of the front fork. It consists of body *27*, rod *34*, body nut *35* and rod lower guide *32*. Fork leg tip *25* is filled up with oil, the level of which should be above the lower guide.

The shock absorber body is attached to the fork leg tip with bolts *29*. Holes are provided in the body bottom for oil to enter the shock absorber interior.

The top end of the shock absorber rod is screwed in the leg tube tightening nut *11*. Square-shaped lower guide *32* with rounded corners is attached to the rod bottom by means of a nut. Piston 33 arranged on top of the guide is made in a form of a disc with hole in the centre. Piston periphery is tightly adjointed with the shock absorber body inside surface. The piston upstroke is limited by pin *26*. At the moment when the piston is resting against the pin, oil is free to flow from below upwards through a gap between the piston hole and the rod.

Shock absorber body nut *35* serving as the upper guide of the rod has a form of a cup with a gauged hole. In its movements the shock absorber body follows the wheel axle.

Working layout of the front fork shock absorber is shown in Fig. 27. When the motorcycle front wheel runs over obstructions in the road the wheel with axle, fork leg tips and shock absorber body *27* is pushed upward, compressing front fork spring *18*. The space of cavity *A* under the piston is reduced, forcing oil out of it partly through the hole in shock absorber body bottom and mainly through gaps between rod lower guide *32* and the shock absorber

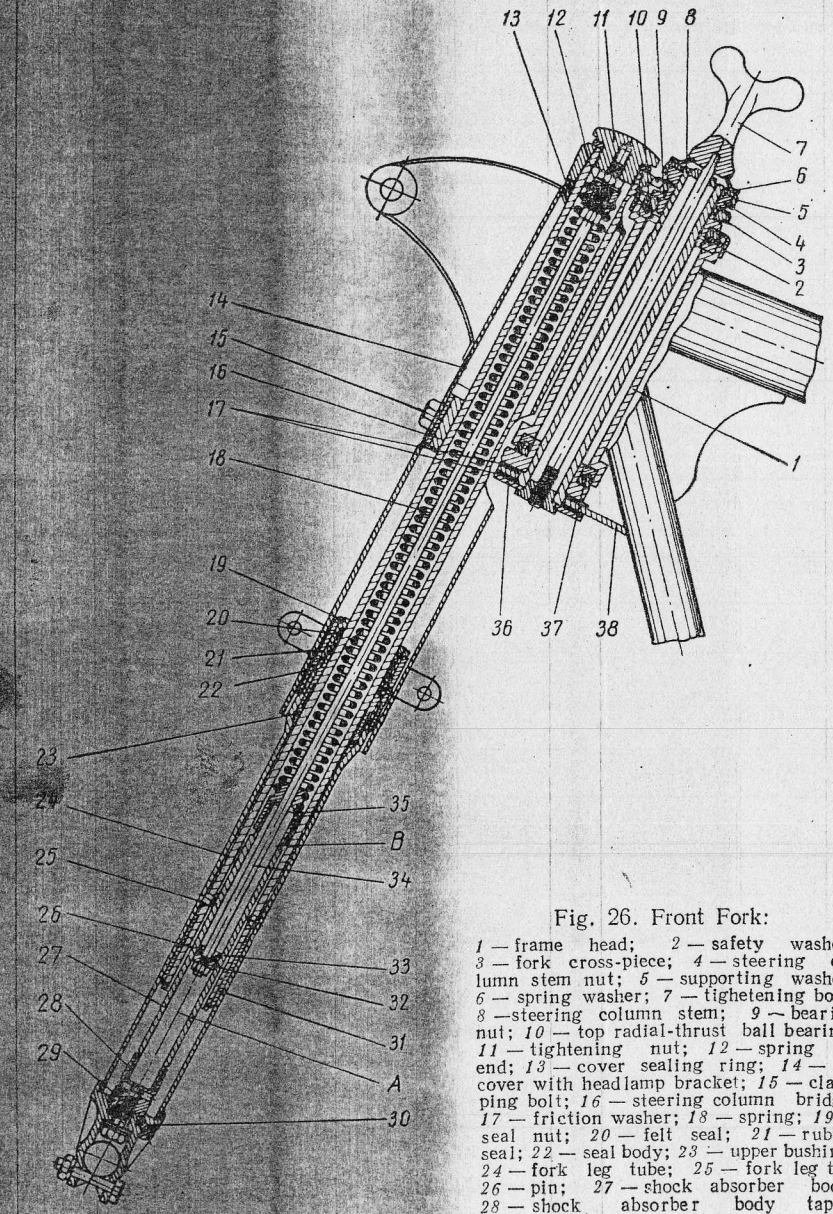

Fig. 26. Front Fork:

1 — frame head; *2* — safety washer; *3* — fork cross-piece; *4* — steering column stem nut; *5* — supporting washer; *6* — spring washer; *7* — tighetening bolt; *8* —steering column stem; *9* — bearing nut; *10* — top radial-thrust ball bearing; *11* — tightening nut; *12* — spring top end; *13* — cover sealing ring; *14* — leg cover with headlamp bracket; *15* — clamping bolt; *16* — steering column bridge; *17* — friction washer; *18* — spring; *19* — seal nut; *20* — felt seal; *21* — rubber seal; *22* — seal body; *23* — upper bushing; *24* — fork leg tube; *25* — fork leg tip; *26* — pin; *27* — shock absorber body; *28* — shock absorber body taper; *29* — shock absorber bolt; *30* — drain hole screw; *31* — lower bushing; *32* — rod lower guide; *33* — shock absorber piston; *34* — shock absorber rod; *35* — shock absorber body nut; *36* — movable plate; *37* — bottom radial-thrust ball bearing; *38* — steering damper fixed plate; *A* — hollow under the piston; B — hollow above the piston

body. Under oil pressure piston *33* is raised up to pin *26*, when through the gaps formed oil flows into cavity *B* above the piston, without encountering noticeable resistance.

As soon as the motorcycle crosses over the obstruction, spring *18* begins to expand. Now the shock absorber body starts moving downward, space in cavity *A* enlarges, whereas cavity *B* reduces. With a sudden pressure rise in cavity *B* above the piston, piston *33* is forced by oil pressure to lower, and resting against the end face of guide *32* closes oil inlet to cavity *A*.

It is obvious that piston *33* plays a part of a non-return valve, for it allows free flow of fluid from cavity *A* to cavity *B*, but blocks off its return. Oil may be forced from cavity *B* only upward into circular gap, between the rod and shock absorber body nut *35*. As this gap is small, so oil passes through it with great difficulty, thereby creating considerable resistance for the front fork in its downstroke.

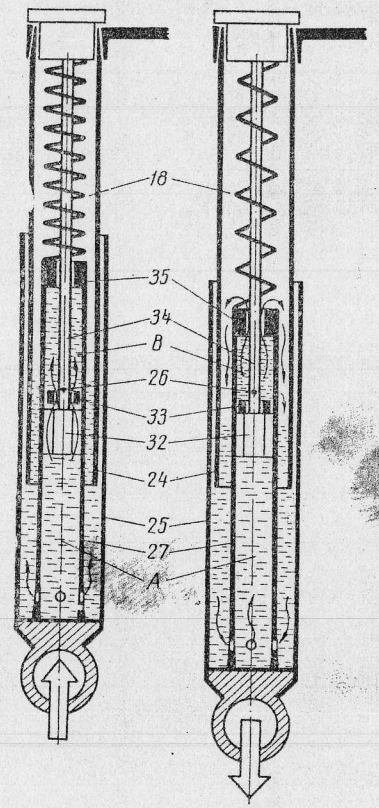

Fig. 27. Working Layout of Front Fork Shock Absorber: to the left — spring compressed; to the right — spring released (component parts itemized as per Fig. 26)

By virtue of this the shock absorber is damping the vibrations of the spring, front fork and the whole motorcycle travelling over rough roads. It must be also noted that at an interval of 60 mm from the upper end of shock absorber body tube there is a gauged hole which ensures a progressive rate of shock absorber operation and the fork as a whole: under light and moderate working conditions the hydraulic system of shock absorber will offer less resistance than when the conditions are difficult.

Each fork leg is primed with 100 cm³ of oil. When assembling the front fork, be sure to leave a gap of 0.2—0.5 mm between the spring top end and the nut that locks the fork leg tube so as to allow free rotation for the tightening nut with rod.

The steering damper absorbs the side of the wheel which take place when the motorcycle is travelling on rough roads. On motorcycle "Урал-2" this damper is of the friction type (see

Fig. 26). It consists of two steel plates — movable *36* and fixed *38*, two friction washers *17* and tightening bolt *7* topped with winged head. Friction between washers *17* makes the turning of front middle fork difficult.

The degree of tightening of the steering damper is selected depending on the road conditions and the speed of travel. When driving at high speeds, especially on uneven roads, screw the bolt tighter, whereas when travelling slowly or when encountering numerous curves on the way, make the bolt less tight, because steering will be difficult if the damper is too tight.

In the course of operation be sure to keep the steering column bearings well adjusted. Tighten them so as to eliminate axial displacement (play) in the steering column stem, at the same time be careful not to make the turning of the handlebar difficult.

Adjust the tightening of bearings in the following order:

1. Jack up the motorcycle front so that the front wheel is off the ground.

2. Unscrew the steering damper tightening bolt (see Fig. 26), remove the spring and supporting washers, holding in the meantime the damper washers with your hand.

3. By jerking the front fork up and down with the handlebar or with the fork leg tips determine if there is any play.

If the play in bearings is evident, slacken steering column stem nut *4*, release fork leg tightening nuts *11*, push cross-piece *3* with nut upwards, tighten up bearing nut *9* as far as it will go, then slacken it for $^1/_8$—$^1/_6$ of a turn. After that, check once again for play in the bearings, remembering that a properly adjusted front fork should turn with moderate effort and without jamming. After the adjustment is found satisfactory, push the cross-piece in place, tighten up the nut and reinstall all other parts of the steering damper.

REAR WHEEL SUSPENSION

Rear wheel swinging suspension on spring-loaded hydraulic shock absorbers ensures great riding comfort.

Rear wheel and final drive are articulated on swinging fork *5* (Fig. 28) hinged to the frame. The swinging fork is made up of two arms interconnected by a cross-member.

Forces developed when the motorcycle is travelling on uneven road are taken up by the wheel and transmitted through the swinging fork and suspension springs to the frame. The springs absorb the shocks transmitted to the frame, while shock absorbers damp vibrations of the suspension. Side strains from the wheel are transmitted to the frame through swinging fork mounted in the frame brackets on silent block bushings. The shock absorbers are articulated to the frame and the swinging fork through rubber bushings. Lower bushing is press-fitted in the ends of swinging fork at the time the fork is being assembled, and the lower is fitted when the shock absorber is coupled to the frame.

Rubber and metal-rubber joints are noiseless and durable in operation. No special maintenance is required except that their fastenings should be periodically checked for proper tightening.

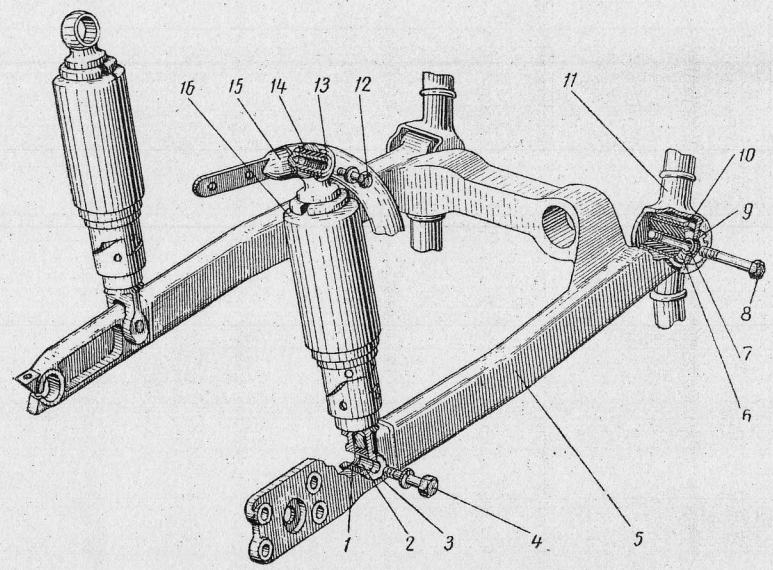

Fig. 28. Rear Wheel Swinging Suspension:
1 — swinging fork silent block bushing; *2* — distance bushing; *3* — shock absorber lower end fork; *4* — lower end holding bolt; *5* — rear suspension swinging fork; *6*, *7*, *10* — silent block assy; *8* — swinging fork bolt; *9* — shake-proof washer; *11* — motorcycle frame; *12* — upper end holding bolt; *13* — washer; *14* — rubber bushing; *15* — frame stay with pin; *16* — shock absorber barrel

Rear Suspension Shock Absorbers

The spring-loaded hydraulic shock absorber (Fig. 29) is actually the suspension unit made up of a spring and a hydraulic shock absorber, housed in a common shell. Both units — right and left — are easily detachable and interchangeable.

Carrier spring *10* is the main carrying flexible member. Double-acting hydraulic shock absorber arranged inside spring *10* damps the swinging motions of the spring.

Shock absorber body *7* is an air-tight vessel closed from top with nut *5* and seal *38*, through which is passed rod *8* of 12 mm in diameter. Piston *29* attached by nut *22* to the rod is reciprocating in cylinder *9* located inside body *7*. Full stroke of the shock absorber is set within 70—83 mm.

Suction valve *19* and compression valve *17* are positioned in the lower end of shock absorber cylinder. In the lower end face of piston *29* is the rebound valve which consists of throttle

disc *28*, disc *27*, collar *25*, spring *24*, nut *22* and a set of shims *23*. By-pass plate valve *30* is installed on the piston upper end face.

Rod cerametallic guide *34* is installed in the upper portion of the cylinder. When the shock absorber is on rebound (expanding), hydraulic fluid is sucked through suction valve *19* into the lower space of shock absorber cylinder. Fluid, being above by-pass valve *30* which is closed, is able to pass into the cylinder lower space only through the calibrated rebound valve or holes in the piston compressing thereby spring *24* in the rebound valve.

The strength of rebound valve spring is so selected that, due to overflowing of hydraulic fluid, a force is created necessary to damp vibrations arising during the shock absorber rebound stroke. Fluid seeping through the gap between the rod and guide *34* runs down through a hole in the slide guide body.

When the shock absorber is compressed, by-pass plate valve *30* in overcoming resistance of spring *31* rises, allowing the fluid to flow into the upper cavity. Suction valve *19* blocks off the fluid flow from cylinder to outside cavity, forcing the fluid to make its way only through compression valve *17* by compressing spring *16*. Rubber buffer *4* is provided for additional cushioning at the end of the shock absorber compression stroke.

To alter the degree of precompression of carrier springs depending on the load and road conditions, an adjusting device is introduced in a form of two lugs *12* and *13*. The degree of spring compression may be readjusted in two positions. First (lower) position will take care of the weight of motorcycle proper, weight of the driver and one passenger (in side-car), whereas the second (upper) position of lug *12* corresponds to the maximum load.

Dismantling, Assembling and Maintenance of Shock Absorbers

For dismantling take the suspension unit off the motorcycle and set it up in upright position on a vise, clamping the lower end in vise jaws (if vise is not available, then leave the lower end in the swinging fork arm).

Then proceed to disassemble the shock absorber in the following order (refer to Fig. 29):

1. Lower lug *12* in lower position.

2. By pressing on upper barrel *3*, lower it for 5—10 mm, free retainer *2* and take it out. Then remove upper barrel *3*, spring *10*, lower barrel *6* and check ring *11* together with lug *12*.

3. Unscrew nut *5*. Remove rod *8* together with the piston, guide cylinder and lower valve body. In this connection take care not to damage sealing ring *36*.

4. Submerge the rod in assembly with cylinder and lower valve body in a bath with kerosene or clean gasoline, pumping

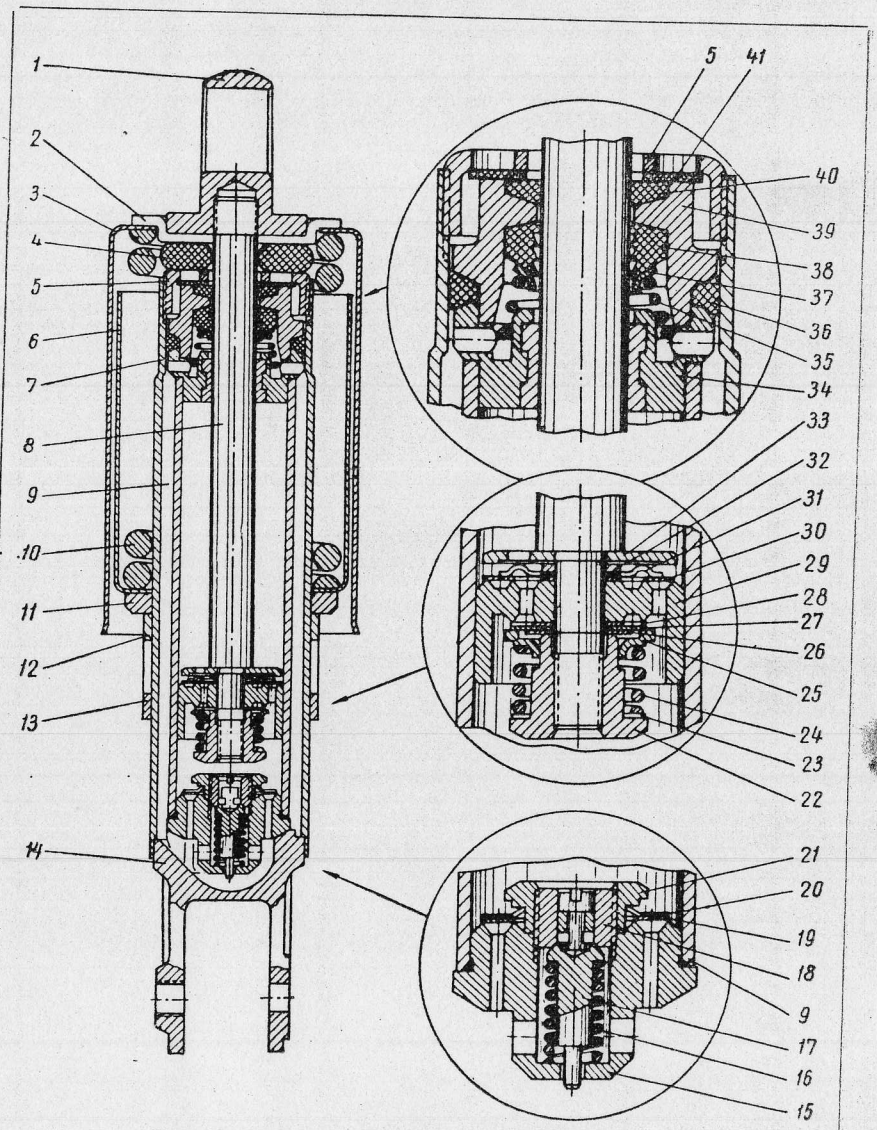

Fig. 29. Spring-Loaded Hydraulic Shock Absorber:
1 — upper end; *2* — retainer; *3* — shock absorber upper barrel; *4* — buffer; *5* — collar nut; *6* — shock absorber lower barrel; *7* — shock absorber body; *8* — rod; *9* — cylinder; *10* — spring; *11* — check ring; *12* — sliding lug; *13* — fixed lug; *14* — lower end; *15* — compression valve body; *16* — compression valve spring; *17* — compression valve; *18* — compression valve seat; *19* — suction valve; *20* — suction valve spring; *21* — compression valve nut; *22* — rebound valve nut; *23* — shim; *24* — rebound valve spring; *25* — rebound valve collar; *26* — washer; *27* — rebound valve disc; *28* — rebound valve throttling disc; *29* — piston; *30* — by-pass valve; *31* — by-pass valve spring; *32* — distance washer; *33* — supporting plate; *34* — rod guide; *35* — seal spring; *36* — sealing ring; *37* — seal retainer; *38* — rubber seal; *39* — seal holder; *40* — felt seal; *41* — packing washer

through for several times until the piston starts to move freely. After that take the rod with assembled parts out.

Note. Further dismantling may be undertaken only in exceptional cases, preferably in a specialized repair shop.

5. Drain the hydraulic fluid out of body 7, wash all parts in kerosene and blow through with compressed air.

To reassemble, reverse the sequence of operations given above.

Each shock absorber contains 105 cm³ of hydraulic fluid. Industrial oil 12 (spindle oil 2) or a mixture of turbine and transformer oils in proportion of 1 : 1 may be used as the working fluid. It is important that only absolutely clean oil is primed into the shock absorbers.

In reassembling certain technicalities must be observed. After priming the fluid let the rod with piston in lower position in order to force the air out; then reinstall guide *34*, fit carefully sealing ring *36*, screw in nut *5* to the limit, and only then pull the rod up and proceed to assemble the rest. The rod should move smoothly with some effort from hand, but without jamming.

It is advisable to change the hydraulic fluid after every 5000 km.

In the course of every maintenance job check for proper tightening of upper and lower ends *1* and 14.

WHEELS AND TYRES

The motorcycle is equipped with easily demountable and interchangeable wheels (Fig. 30) with pressed steel drum *4* and hub *13* which is riveted to the drum. Two adjustable taper roller bearings No. 204 are press-fitted in the hub. Position of bearings is fixed by the hub ledge, distance bushings *7* and *9*, intermediate bushing *8* and nut *11*. Inside splines are made on the right-hand end of the hub for meshing with the splined end of final drive hub (in case the wheel is used as the driving wheel). The bearings are packed with calcium-sodium grease. Throw-out of grease from bearings is prevented from inner end by circular grooves made on inside surface of thrust washer *6*, and from outer end — by double-edged rubber seal *10* press-fitted in nut *11*. This arrangement also safeguards the bearings against dirt and moisture.

The brake drums have a labyrinth sealing at their joints with the front wheel brake drum cover, final drive casing and with the guard plate on the side-car wheel axle.

The wheel rim is made in a form of a shaped ring with a well for mounting the tyre. The wheel rim and hub are connected through spokes which are held in the rim with the aid of nipples screwed on the threaded ends of the spokes.

Rubber tyre consists of straight-side casing, inner tube and a flap. The tyre beads are reinforced with bead wires to ensure safe and reliable mounting of tyre on the wheel rim. The inner tube has an air-inflating valve which passes through a hole in the rim and is secured in place with a nut. Tyre flap is laid between the wheel rim and inner tube for protecting the tube against mechanical injuries which may be caused by the protruding spoke ends and nipples.

Adjustment of Wheel Bearings

To ensure long service life for the wheel bearings, readjust them, as their races are being worn in operation.

After 2000 km, be sure to wash the bearings and pack with fresh grease. Then check condition and adjust the tightening of bearings. For adjusting follow this order:

1. Take the wheel off the motorcycle.
2. Fit and tighten the axle (less hub cap) with the aid of a set of bushings and a nut.
3. Turn the axle (but not the wheel) and rocking it, determine whether there is a play.
4. Slacken the locknut.
5. Screw the seal nut to the limit, then release it by $^1/_6$—$^1/_8$ of a turn so that the axle-bushing system is revolving without any play, freely without jamming. Remember at this that overtightening is harmful for the bearings.

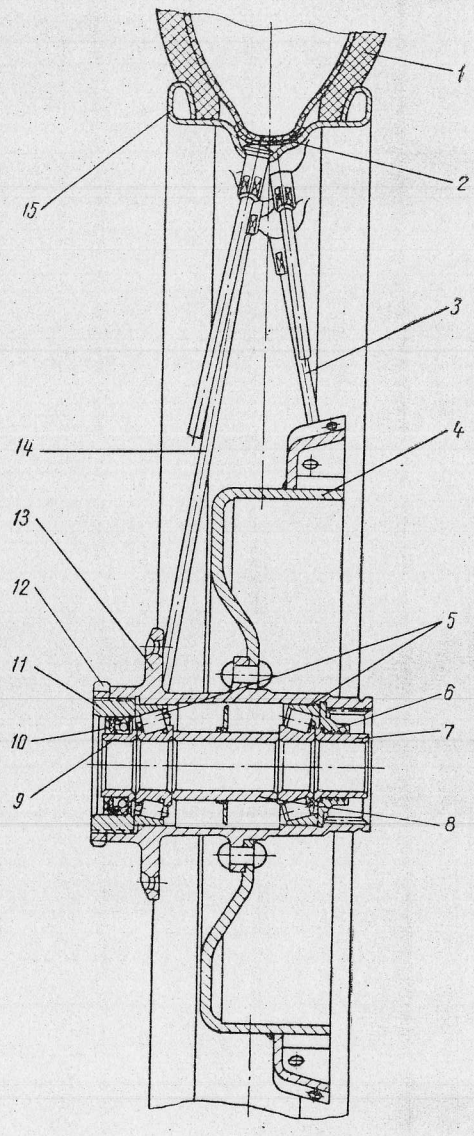

Fig. 30. Wheel:
1 — tyre; *2* — tyre flap; *3* — short spoke; *4* — brake drum; *5* — roller bearings; *6* — thrust washer; *7* — distance bushing, right; *8* — intermediate bushing; *9* — distance bushing, left; *10* — seal; *11* — seal nut; *12* — locknut; *13* — hub; *14* — long spoke; *15* — wheel rim

6. Tighten up the locknut but be careful not to disturb the bearing adjustment.

7. Pull the axle out.

8. Reinstall the wheel on the motorcycle.

Demounting of Wheels and Tyres

To remove the front wheel:

1. Set the motorcycle up on its stand, lift the motorcycle by the front wheel and put a rest under the front portion of the motorcycle frame.

2. Tighten the front brake cable adjusting screw home and set it so that the screw slot is in line with the slot on the bracket end.

3. Pull the brake cam lever up, take the cable armour end out of the notch in adjusting screw and bring the cable out through the slots of screw and bracket.

4. Take the front brake cable end out of the brake lever hole while aligning the cable with lever slot.

5. Slacken the clamping bolt nut of front fork left leg. Place a wrench bar in the front wheel axle hole, screw the axle out by turning it clockwise (left-hand thread), and take the wheel off together with front brake.

To reinstall the wheel, proceed in reverse order, making sure that the counteracting stop on the brake cover is clasping the front fork right leg. Before final tightening of coupling bolt in the fork left leg lower end press with force on the handlebar and shake up the motorcycle front a few times.

To remove the rear wheel:

1. Set the motorcycle up on its stand.

2. Unscrew the rear wheel axle nut and remove it together with the washer.

3. Slacken the nut of left suspension fork arm coupling bolt and, using a wrench bar, push the rear wheel axle out. Then remove the wheel.

To reinstall the wheel on the motorcycle, follow the above operations in reverse order. For this job it is also important to clean the axle thoroughly and lubricate it before reassembling. When fitting the rear axle, turn it constantly to avert jamming. Before tightening the coupling bolt, shake up the motorcycle rear end a few times.

To remove tyres:

1. Let all air out of the inner tube.

2. Unscrew the nut of tube valve and push the valve inside the tyre.

3. Put the tyre on the floor (or ground), step on the tyre on the side opposite the valve and press its bead in the rim well.

4. Insert tyre irons between the tyre bead and rim shoulder on both sides of the valve at a distance of about 10 cm.

5. Get hold of the tyre bead with irons and twist it outside the rim shoulder. Then by moving both irons along the rim bring the whole tyre bead outside.

6. Take the inner tube out, and if necessary remove the tyre off the rim, making use of tyre irons for the job.

Repairing Inner Tubes en Route

Whenever the inner tube gets punctured, the damaged spot may be detected by hissing sound of air escaping through the hole. If the hole is very small, submerge the tube into water and the air bubbles will show the punctured spot.

To repair, wash the damaged spot with clean gasoline and clean using a file or emery cloth. In case no special patches on hand cut out a patch of rubber of a suitable size, wash it in gasoline and clean with file or emery cloth. Then coat the damaged spot and the patch with a thin film of rubber glue so that the glued area is a little larger than the patch. Let the glue dry for 10—15 minutes, then coat the tube and patch with glue again, let them dry; place the patch over the damaged spot and press it tight. It is advisable to chamfer the patch edges flush with the tube surface. Before placing the tube inside the casing, powder the tube with talcum.

In case special tube repair patches are available either with a film of rubber cement and special protective fabric or cellophane lining, remove the lining and put the patch on the tube punctured spot, after cleaning it, coating with rubber glue and drying. In this case it is not necessary to coat the patch with rubber glue.

Bear in mind that patching the tubes en route is but a temporary remedy, because once the tyres get heated up, the patch is liable to unglue. Therefore, upon return from the trip, repair the tube in question by applying hot vulcanization, which is a more reliable method.

If the valve core is leaky, renew it. If there is air escaping between the valve and the tube, tighten up the valve securing nut.

Tyre Mounting

To mount the tyre on the wheel proceed first by examining that tyre casing is free of foreign matter to prevent damaging the inner tube. Arrange the tyre flap so that its hole coincides with the hole in the rim well and see that it covers entirely all the nipple heads.

By pushing a portion of tyre bead into the rim well use tyre irons to slip the whole bead inside, moving it against the rim shoulder. Then powder with the talcum the tyre casing interior,

insert the tube valve into the hole in the rim, screw on the nut for 2—3 threads and arrange the partially inflated tube inside the casing so that it is uniformly spread, without any wrinkles.

Before slipping the second tyre bead inside press the tube valve to the stop so as to allow the first tyre bead to settle at this place properly in the rim bed. Then slip in the second tyre

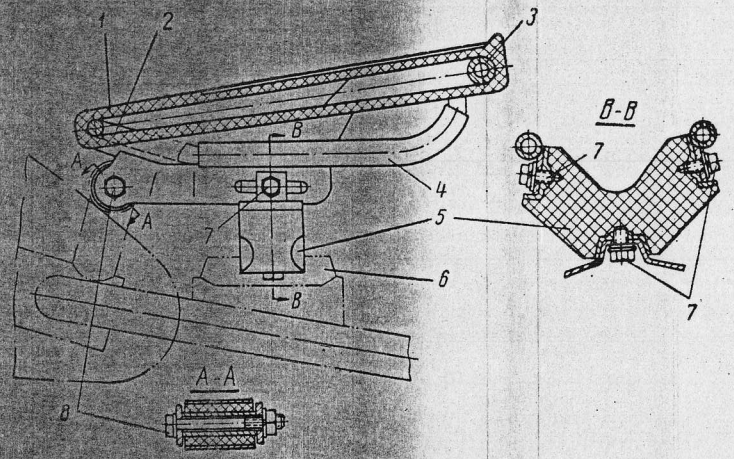

Fig. 31. Saddle:
1 — upholstery; *2* — bail; *3* — hoop; *4* — saddle-tree; *5* — cushion; *6* — support; *7* — cushion holddown bolts; *8* — saddle front end bolt

bead from the side opposite the valve and hold the tyre in this position with both feet. Push the tyre bead on the rim by hands alternating them by turns to twist the bead in about the casing periphery. After pushing about two thirds of the bead length inside, press on the casing so that the pushed-in portion of bead enters the rim well, and using tyre irons, slip the entire bead inside.

Sink the valve in casing, inflate tube and tap with hammer along the tyre circumference until the tyre is settled uniformly along the whole periphery of the rim. Screw the valve nut in to the stop, inflate the tube to the required pressure, tighten up the valve inside and screw on the valve cap.

In mounting the tyre, take all precautions, because if too much force is applied, the tube or tyre may be damaged, or the tyre bead metal wire may be broken.

DRIVER AND PASSENGER SADDLES

The motorcycle is equipped with rocking-type rubber-upholstered saddles (Fig. 31). Damping of saddles is ensure through elastic action of upholstery and rubber cushions. Stiffness of saddles

depending on the weight of driver and passenger may be adjusted by rearranging the cushions. To do this, slacken the cushion holddown bolts and move the cushion forward to reduce the stiffness, or backward to increase it.

After every 2000 km check tightening of saddle fastenings.

If the motorcycle must be moved manually, do not pull it by the saddle or the saddle hand grip. Whenever necessary use the rear mudguard hoop for the purpose.

RUNNING GEAR MAINTENANCE

During the daily inspection, or before going out on a trip, check inflation of tyres as the pressure in front wheel and side-car wheel tyres should be from 1.5 to 1.6 atm, and from 2.6 to 2.7 atm in the tyres of rear and spare wheels.

Upon return from a trip clean thoroughly the motorcycle of dust and dirt; wash it if necessary. Do the washing only after the engine is cooled off. In washing close the air cleaner shutter, and avoid directing the water spray on units and parts of fuel feed, ignition and/or electrical equipment.

After cleaning and washing is completed, proceed as follows:

1. Check for proper attachment of front fork in frame head; if some play is noticed, readjust the steering column bearings. In case of abnormal tightness in the front fork and difficult steering, disassemble the steering column. If cracks, chips and dents are noticed on the bearing races and balls, replace the bearings.

2. Check fastenings of side-car and springs, tightening of wheel axles, fastening of license plate, condition of steering damper, action of front fork shock absorbers, end play in wheel hubs (by rocking jacked-up wheels), condition of wheels and tyres, fastenings of wheel mudguards, mounting of spare wheel, condition and proper tightening of wheel spokes (make this check-up with wheels jacked up).

3. Check fastenings of saddles, stand and footrests, condition of motorcycle and side-car frames, proper attachment of side-car to the motorcycle frame, tightening of nuts and clamping holders, and see that the suspension of rear and side-car wheels is intact.

After every 1000 km lubricate steering column bearings and spring hangers.

After every 2000 km check toe-in of wheels, angle of camber of motorcycle and side-car vertical axes; renew oil in the fork shock absorbers; remove wheels, take used grease out of hubs, wash bearings in kerosene and blow through with compressed air, pack fresh grease, and change places of all tyres including the spare (exchanging them in clockwise manner); lubricate side-car body cover hinges.

After every 4000 km dismantle the motorcycle; check condition and if necessary disassemble, clean and lubricate the springs, side-car clamping holder joints.

RUNNING GEAR TROUBLES AND REMEDIES

Trouble	Cause	Diagnosing	Remedy
Noise in front fork	1. Play in steering column bearings	1. Apply front wheel brake and, while pushing motorcycle manually back and forth, look for play in lower thrust bearing	1. Eliminate play by tightening bearings
	2. Play of fork leg tapered tips due to loose nuts	2. Hold the wheel with your knees and determine degree of loosening by turning fork by handlebar	2. Eliminate play by screwing nuts tight. If of no effect, refer to p. 4.
	3. Attachment of front mudguard or headlamp is disturbed	3. Examine and check nut tightening with wrench	3. Eliminate by tightening nuts
	4. Fork leg tube bushings are worn away or lower bushing became loose	4. Set motorcycle up on rear stand, raise front wheel. If excessive play is evident when legs are moved up-and-down, it means front fork is deranged	4. Disassemble fork leg, check condition of parts, replace bushing
Repeated hard knocks in front fork (poor damping action)	1. Shortage or no oil in front fork due to leakage	1. Unscrew drain screw at bottom of fork leg tip, check quantity of oil (it takes 100 cm^3 per fork leg). Examine and find out place of oil leaking	1. If oil leaks through drain screw, clean packing washer and tighten up screw. Unscrew fork leg tube nut, fill oil into fork and look for oil leaks. If oil leaks appear under axle, disassemble partially fork (take wheel off, unscrew binding nut on cross piece, unscrew union nut on fork leg tip, remove tips together with shock absorbers. Leak may also be possible from under shock absorber bottom. Eliminate by tightening

Trouble	Cause	Diagnosing	Remedy
			bolt. Check for proper tightness, using kerosene. Reassemble front fork, prime with oil and check again for leaks
	2. Front fork spring lacks resilience	2. Disassemble fork, take spring out and check up	2. Replace spring
	3. Springs broken	3. Ditto	3. Ditto
Squeaks in shock absorber	1. Rod unscrewed from end piece	1. Cocking of upper barrel. Dismantle shock absorber and check condition of parts	1. Screw rod in as far as it will go and punch for safety
	2. Bending of rod	2. Ditto	2. Replace rod
	3. Upper barrel is bent	3. »	3. Straighten the barrel
	4. Carrier spring broken	4. »	4. Replace spring
Stiffness of suspension (bumpy)	1. Shock absorbers primed with thick fluid	1. »	1. Prime shock absorbers with fluid of required viscosity
	2. Sigging of carrier spring	2. Check condition of spring	2. Replace spring
	3. Too much effort required for shock absorber to expand or contract	3. Dismantle shock absorber, check for clogging of gauged ducts in piston and in lower valve	3. Wash parts and prime shock absorber with fresh fluid
Front fork is difficult to turn	1. Overtightening of steering damper tightening bolt		1. Loosen by turning adjusting bolt anticlockwise
	2. Steering damper friction washers are damaged (scored)	2. Disassemble steering damper and examine it	2. Reface or replace friction washers
	3. Steering column bearings are overtightened	3. By changing tightening try to obtain easy turning of fork	3. Reduce tightening of bearings
Steering damper is loose (fails to be tightened)	Steering damper friction washers are oiled or dirty	Disassemble damper and examine washers	Clean friction washers, check for buckling on washer faces
Oil leaks from front fork	1. Front fork leg seals are worn or damaged	1. Oil stains on fork leg tips. Check condition of seals	1. Replace seals
	2. Fork leg tip seals or their nuts are loosened	2. Check tightening of nuts and seals	2. Screw in nuts and seals

Trouble	Cause	Diagnosing	Remedy
Wheel spokes are broken	Spokes are not tight or tightening is irregular	Examine and check tension of wheel spokes by setting motorcycle on stand, turning rapidly wheel, while holding a wrench lightly pressed against spokes. Listen and determine by sound regular tension of spokes	Replace broken spokes and readjust tension of all wheel spokes
Play of wheel on axle and wobble of wheel in frame plane	1. Axle was not tightened when wheel was reinstalled	1. Set motorcycle up on its stand and check	1. Eliminate play in rear wheel, tighten axle nut, slacken fastening bolt in front wheel and screw axle in right-hand fork threaded end, then tighten up bolt again with nut
	2. Seal nut is loose and out-of-position	2. Check by visual inspection	2. Screw seal nut in and safety it
	3. Wheel roller bearings are worn	3. First be sure that cause of trouble is not as described in clauses 1 and 2. Without removing wheel check for wobble	3. Readjust bearings. If bearings are replaced, pack them with grease
	4. Wheel spoke tension disturbed due to continuous operation	4. Set motorcycle up on its stand and turn wheel. Check for runout which should be within 3 mm on wheel rim	4. Readjust tension of all wheel spokes
When assembling rear wheel it is difficult to install its axle	Misalignment of wheel hub inner splines with outer splines of final drive hub	Axle cannot be passed through	Turn wheel and by pushing it into hub splines align splined joint so that axle can be passed through easily. When installing axle turn it, but never drive it in with hammer
When assembling front wheel it is difficult to install its axle	Front wheel fork is cocked due to incorrect assembling	Wheel axle cannot enter with its threaded end the thread of fork end	Set up motorcycle on its stand, raise motorcycle front so that front wheel with fork is in

Trouble	Cause	Diagnosing	Remedy
			suspension, then mount the wheel
Saddle upholstery slides off and sags on saddle-tree	Upholstery is torn from below	Examine, especially from underneath	Renew saddle upholstery. Put it on carefully, pulling it uniformly to avoid damage by tearing
Noise in articulated fastenings of side-car to frame	1. Side-car frame tie-rod bolts are worn on top	1. Test by rocking motorcycle standing at rest	1. Replace bolt
	2. Side-car frame tie-rods are loosely connected to motorcycle frame	2. Check by means of wrench	2. Tighten up nuts
	3. Clamping holders are not tightened properly	3. Test by rocking motorcycle standing at rest	3. Tighten up clamping holder
Side-car wheel rubs against inside surface of mudguard	Side-car axle is bent	Remove wheel and examine axle	Replace axle

VIII. CONTROL MECHANISMS

Control mechanisms of the motorcycle include the handlebar, controls and brakes.

HANDLEBAR AND CONTROLS

Handlebar serves for turning the motorcycle front wheel. Fabricated of steel tubing, the handlebar is connected with the front fork through two brackets secured in the openings of front fork cross-piece. The handlebar may be secured rigidly in the brackets by means of bolts and nuts in any position convenient for the driver.

On the right and left portions of the handlebar are arranged certain controls of the motorcycle, such as carburetter throttle control twistgrip, front brake lever, clutch lever, horn button and lights turn-knob.

Throttle control twistgrip is connected through flexible control cables with the carburetter throttles.

Play of the twistgrip and synchronized raising of the throttles are adjusted by screwing in or out the thrust nipples fitted on the carburettor throttle covers.

Clutch lever is connected with the clutch release arm through a cable enclosed in armour. The cable tension and clutch lever play are adjusted by means of adjusting screws.

Front brake lever is connected through a cable with a lever mounted on the front brake cover. The cable tension and, consequently, the play of the front brake lever are adjusted by a screw located on the front brake drum cover.

Control cables used in the motorcycle (except for the rear brake pedal link) are flexible. The control cables made of steel are enclosed in armours made of twisted steel wire. Ends of control cables are provided with tips which are inserted in respective stops and adjusting screws.

Tips soldered to the cables are secured in control levers and twistgrip and in parts of controlled units and mechanisms.

The horn button has one moving grounded contact and one fixed contact connected by wire to one of the horn terminals. Whenever the horn button is depressed, the horn contacts make closing the horn circuit.

The motorcycle is equipped with two shoe brakes arranged on front and rear wheels. Brake consists of a drum, drum cover, shoes and controls.

Drum is the revolving member of the brake. The front brake drum cover is fixed to the front fork by a special stop from the outside. Cover of the rear brake drum is made en-block with the final drive casing. Covers mount the brake shoes with linings made of friction material for increasing the friction between the drum and shoes.

For normal performance of the brakes there should be a gap between the drum and shoes. If there is no such a gap, then during the motorcycle travel brakes will heat up and linings will wear away. On the other hand, if the gap is too great, the shoes will not contact properly the drum surface, resulting in poor braking action.

The hand-operated front brake is adjusted by means of an adjusting screw on the drum cover, whereas the foot-operated rear brake is adjusted by a wing nut located on the brake link front end.

ADJUSTMENTS OF CONTROL MECHANISMS

Control mechanisms are adjusted by lengthening or shortening the control cable of each mechanism. In principle the adjustments may be summarized as follows.

With the control levers released and the grip twisted in to the limit:

a) for the clutch — full engagement, which may be checked by a play at the clutch lever end equal to 5—8 mm;

b) for the brakes — gap of 0.5—1.0 mm between brake shoes and brake drums, further, there should be a play of 5—8 mm at the front brake lever end, while in the rear brake pedal it should be equal to about a quarter of full pedal stroke;

c) for the carburetters — both throttles should be raised to the maximum and identical height.

With the control levers full depressed and the grip twisted out:

a) for the clutch — driven parts fully disconnected from the driving ones; symptom of a well adjusted clutch lever is the noise less shifting of gears;

b) for the brakes — effective braking of motorcycle by both brakes; brake adjustment is considered satisfactory if the braking distance for the motorcycle travelling at 30 km/hr on a dry asphalt road is within 7.2 m (without skidding);

c) for the carburetters — both throttles raised to the maximum and identical height.

SPEEDOMETER

The speedometer СП-102 is an indicator of speed, at which the motor-cycle is travelling. It incorporates an odometer and is accommodated in the headlamp shell. Readings marked on the speedometer and its odometer are in kilometres.

The speedometer is driven from the gearbox main shaft through a flexible shaft enclosed in the casing. Flexible shaft ГВ-1 is made up of steel cable with tips.

A lamp is installed in the speedometer to illuminate its scale.

CARE OF CONTROL MECHANISMS

During the daily maintenance check for proper action of control mechanisms, condition and safe fastening of linkage and control cables, testing braking action with the motorcycle running.

After every 2000 km check condition of brakes, clean brake shoes and working surface of brake drums. If brake shoe linings are worn, renew them. Lubricate the throttle control twistgrip (when getting ready for the winter season, disassemble the twistgrip, wash and lubricate with automotive oil АК-6). Lubricate also the front brake lever pin, brake shoe hinge pins and brake cams, pedal joint, rear brake linkage.

After every 4000 km wash and lubricate the front brake and throttle control cables (grade АК-6 oil).

After every 8000 km wash and lubricate speedometer drive flexible shaft (grade АК-10 oil in summer and grade АК-6 in winter).

TROUBLES AND REMEDIES OF CONTROL MECHANISMS

Trouble	Cause	Diagnosing	Remedy
Carburetter throttle control grip is difficult to twist	1. Slide is jammed	1. Lubricate it and see if this helps	1. Lubricate slide. If twisting is still difficult, remove twistgrip and clean it of dirt
	2. Armour is out-of-shape or control cable is damaged	2. Check armour by outside inspection. For checking pull control cable tip out of throttle and by moving armour to-and-fro inspect cable tips and check for jamming of cable in armour	2. Replace damaged control cable or armour. When soldering new cable to tip spread cable end in a form of a bunch
When grip is twisted, carburetter throttle is not moving	1. Twistgrip is slipping	1. Examine it from butt end	1. Place some insulating tape under rubber grip. If this does not help, replace twistgrip
	2. Cable broken at place of soldering; cable damaged or armour is out-of-shape	2. Examine armour and control cable	2. Do as instructed in clause 2 above
Once hand is taken off twistgrip, it turns spontaneously	1. Adjusting screw is loose	1. Fault is corrected as soon as adjusting screw is tightened up	1. Readjust and safety
	2. Spring that holds twistgrip is broken	2. Tightening of adjusting screw does not eliminate fault	2. Remove twistgrip and replace spring
Clutch and front brake lever brackets are loose on handlebar	Bolts holding brackets on handlebar are not tight	Try to eliminate by tightening up bolt	Tighten up bolt
No braking action on rear wheel	1. Play in rear brake pedal is misadjusted	1. Try to restore by alternating adjustment	1. Reduce play of brake pedal by turning wing nut on brake link clockwise, checking at the same time rotation of wheel. Leave a little extra play to take care of heat in braking. After adjusting check brake action

Trouble	Cause	Diagnosing	Remedy
	2. Brake shoe linings are dirty or oil stained	2. After adjusting, as instructed in clause 1, brake is still out-of-action	2. Remove wheel, wash brake shoes in gasoline and wipe dry. If oiling persists, check quantity and quality of oil in final drive and condition of seal
	3. Brake shoe linings worn	3. Ditto	3. Either replace linings or shoe assemblies
No braking action on front wheel	1. Same as for rear wheel	1. Same as for rear wheel	1. Reduce play of brake hand lever by turning adjusting screw out in brake cover, checking at the same time rotation of wheel. Leave a little extra play to take care of heat in braking. If thread on adjusting screw is used up, remove brake lever and turn it to a certain angle in brake cam splines
	2. Cable at place of soldering to tip is broken; cable or armour is damaged	2. Test by depressing hand lever on handlebar to stop, checking whether brake lever is moving at this. If no reaction, remove cable	2. If cable is broken at place of soldering, spread cable ends apart and solder properly. If cable or armour is damaged, replace
Overheating of brakes	1. No play in rear brake pedal or front brake lever, resulting in brake shoes being constantly pressed to drums	1. Set motorcycle up on its stand, check rotation of wheels without applying brakes	1. Set motorcycle up on its stand. Turn wing nut anti-clockwise till rear wheel is revolving freely. Turn adjusting screw on brake cover in till front wheel is revolving freely. Upon completion, check again brake performance

Trouble	Cause	Diagnosing	Remedy
	2. Brake cam pin is seized due to irregular lubrication, and brake shoes remain pressed to drums	2. Cam is stuck in braking position	2. Lubricate. If trouble still persists, take wheel off, remove brake cam, wash it or reface it if necessary
	3. Cam is jammed as its turning angle is increased due to wearing of brake linings	3. Cam is stuck in position corresponding to maximum spread of brake shoes and fails to return to its starting position	3. Replace either brake linings or brake shoe assemblies

Electrical equipment of the motorcycle (Fig. 32) consists of units which are sources of electric energy, units which use up this energy, auxiliary instruments and electric wiring.

The electrical equipment is used in the motorcycle for igniting the fuel charge within the engine cylinders, to furnish the light, to operate the horn and for light signalling.

Units which are sources of electric energy include the storage battery and direct current generator with regulating relay.

Units which use up the electric energy are those connected with ignition, lighting and signalling systems. Signalling and lighting systems include: headlamp with two bulbs, motorcycle tail lamp, side-car tail lamp, side-car front side lamp, and horn. Ignition system consists of ignition coil, distributor with automatic advance timer, spark plugs and high-tension wiring.

Master switch with ignition key, safety fuse and pilot lamp, far reaching and "bright" lights turn-knob, and horn button belong to auxiliary equipment.

Low-tension wiring is a part of the electric circuit which is laid according to a single-wire system, whereby a single wire is laid from the units which produce electric energy to the units using it (i. e. from positive terminals of storage battery and generator), whereas the frame and other metal parts of the motorcycle and instruments proper serving as the second wire or the ground. Negative poles of the storage battery and generator are grounded.

STORAGE BATTERY

Storage battery *10* (see Fig. 32) supplies electric energy to all motorcycle units requiring same when the engine is at rest or running at low revolutions. Once the engine picks up speed over 1000—1200 r.p.m., the load from the battery is transferred fully or partially to the generator, from which the battery is recharged.

Storage battery 3MT-12 * has rated 6 V tension and a capacity of 12 A/hr (figured at a 10-hour discharge rate). Electrolyte for the battery is a solution of water and "battery" pure sulphuric acid.

* Symbol 3MT-12 marked on the storage battery means: motorcycle 3-cell battery, capacity 12 A/hr.

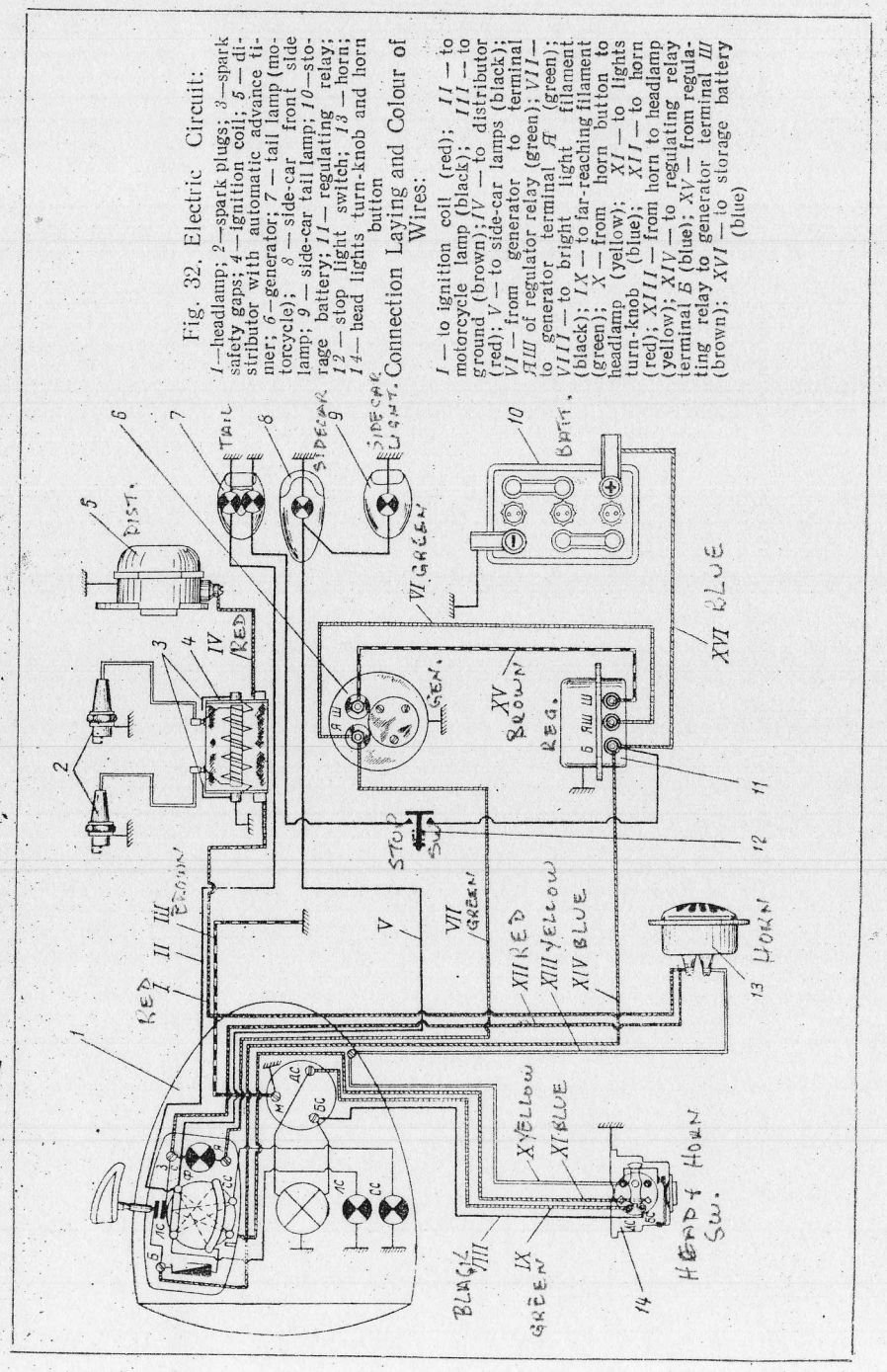

Fig. 32. Electric Circuit:
1—headlamp; *2*—spark plugs; *3*—spark safety gaps; *4*—ignition coil; *5*—distributor with automatic advance timer; *6*—generator; *7*—tail lamp (motorcycle); *8*—side-car front side lamp; *9*—side-car tail lamp; *10*—storage battery; *11*—regulating relay; *12*—stop light switch; *13*—horn; *14*—head lights turn-knob and horn button

Connection Laying and Colour of Wires:
I—to ignition coil (red); *II*—to motorcycle lamp (black); *III*—to ground (brown); *IV*—to distributor (red); *V*—to side-car lamps (black); *VI*—from generator to terminal *A III* of regulator relay (green); *VII*—to generator terminal *A* (green); *VIII*—to bright light filament (black); *IX*—to far-reaching filament (green); *X*—from horn button to headlamp (yellow); *XI*—to lights turn-knob (blue); *XII*—to horn (red); *XIII*—from horn to headlamp (yellow); *XIV*—to regulating relay terminal *B* (blue); *XV*—from regulating relay to generator terminal *III* (brown); *XVI*—to storage battery (blue)

The battery consists of three cells interconnected in series. Each cell houses an element of positive and negative plates partitioned from each other by separators. Cells are topped with ebonite covers provided with holes, wherein ebonite vent plugs are screwed in.

The vent plug ducts on new batteries are closed with rubber stoppers or a film (refer to section: "Preparing New Motorcycle for Use").

Table 2

Characteristics of Storage Batteries at Various Rates of Discharge

Rate	Drain, A	Capacity, A/hr	Cut-off voltage, V	
			battery	cell
20-hr	0.7	14	5.10	1.70
10-hr	1.2	12	5.10	1.70
3-hr	3.4	10.2	4.95	1.65
30-min	12	6	4.65	1.55

The above characteristics (Table 2) are guaranteed under the following conditions:

a) specific gravity of electrolyte at the beginning of discharge shall be 1.280±0.005, relative to 30° C;

b) average temperature of electrolyte during an extended rate of discharge and initial temperature during a 30-mm rate of discharge shall be maintained within 30±2° C;

c) electrolyte level in the cells shall be 10—12 mm above the safety shield.

Storage batteries are put out in dry charged state, and must be charged before the use. To do this, fill the battery with a solution of "battery" sulphuric acid of 1.28 specific gravity. Temperature of electrolyte, however, should not exceed 25° C.

Under no circumstances use industrial grade of sulphuric acid for preparing the electrolyte.

In preparing the electrolyte, pour the battery sulphuric acid in distilled water (but not vice versa). If no distilled water is available, make use of water obtained from clean snow or rain water, but not collected from meal roofs nor out of metal containers.

Prepare and store the electrolyte only in acid-resistant containers (porcelain, ceramic, ebonite, etc.). Never use metal vessels for this purpose.

For preparing electrolyte of 1.28 specific gravity, it will take 0.323 litre or 0.600 kg of concentrated battery sulphuric acid (1.83 specific gravity) per one litre of distilled water.

Do not attempt to use any other acids except the battery pure sulphuric acid for the battery solution.

Having filled the battery with electrolyte, let it stand for two hours, then put it on charge. Connect the battery positive post

to the positive terminal of current supply, and the negative post to negative terminal. Use direct current for charging.

Duration of the initial charge takes about five hours, the second and following charges — about 24 hours. During charging, the temperature of electrolyte should not exceed 45° C: if it does, make an interval to cool down to 30—35° C. After this resume the charging.

At the end of second and third charges, bring the specific gravity of electrolyte to 1.280±0.005 in all cells. Do this without interrupting the charging process and taking a rubber bulb syringe, suck some electrolyte out of each cell and add either distilled water or 1.4 specific gravity electrolyte depending on whether the specific gravity of electrolyte is to be reduced or increased. After 30—40 minutes check specific gravity of electrolyte by means of a hydrometer. If the reading is not equal to 1.280±0.005, repeat the operation.

After the initial charge is completed, it is advisable prior to installing the battery for use on the machine to give one or two the so-called discharge-and-charge cycles, when the discharge is conducted with a 10-hr rate of current (see Table 2), while for charging refer to Table 3.

Table 3

Current Rate Used for Charging Storage Batteries (Initial and Following Charges)

Charging stage	Current rate, A	Symptoms of full charge
First	3.0	Voltage reading is from 2.38 to 2.4 V in most cells. Continue charging with current of the second stage
Second	1.5	Gassing is vigorous in all cells; constant specific gravity of electrolyte and voltage reading in all cells during two hours (with three readings taken)

Although the batteries may be used on motorcycles at different fluctuations of temperature, it is important to remember that the capacity of a battery drops sharply at low (minus) temperatures, while the electrolyte in a discharged battery is liable to get frozen and break open the ebonite walls of battery case (see Table 4).

The temperature in premises, where batteries are prepared for service and undergo the charge-and-discharge cycle, should not fall below plus 10° C and should not rise above plus 35° C.

Once the batteries are in service, the following requirements must be observed:

1. Irrespective of the degree of charge, recharge the battery after every 30—35 days with current rate of the second stage as shown in Table 3.

Table 4

Tentative Degree of Charge in Storage Battery

State of Battery							
fully charged		discharged by 25%		discharged by 50%		run-down	
specific gravity of electrolyte at end of charge reduced to 15° C	freezing point, ° C	specific gravity of electrolyte at end of charge reduced to 15° C	freezing point, ° C	specific gravity of electrolyte at end of charge reduced to 15° C	freezing point, ° C	specific gravity of electrolyte at end of charge reduced to 15° C	freezing point, ° C
1.29	—74	1.26	—54	1.23	—40	1.16	—16
1.27	—58	1.24	—42	1.21	—28	1.14	—12

2. Once in three months carry out the discharge-and-charge cycle, i. e. recharge with current of the second stage, discharge at current of a 10-hr rate, then charge as outlined in Table 3.

3. After every 10—15 days use hydrometer to take readings of specific gravity of electrolyte in order to estimate the degree of discharge in a battery. In winter the battery should not be discharged by more than 25% to prevent freezing of electrolyte, whereas in summer by no more than 50% to avoid sulphation of battery plates.

4. Keep proper level of electrolyte by adding water into cells. As a rule, adding of acid must be avoided unless it is evident that the drop in electrolyte level is due to spilling out. In this case fill the cell up with a solution of sulphuric acid of the same specific gravity as the electrolyte in this cell.

5. Keep the battery always clean. Wipe its outside surfaces with cotton waste soaked in a 10-percent solution of aqua ammonia or washing soda. Then go over the surfaces with a wet cloth and wipe dry. Make it a regular practice to clean the holes in vent plugs.

6. Coat the battery posts and the wire ends connected to them with petrolatum or grease. Remove the oxidation film off the battery posts and tighten properly the wire terminals. For the later job use two wrenches so as not to damage the battery posts.

7. If the battery is discharged, put it on charge as soon as possible, but not later than within 24 hours.

8. It is wrong practice to interconnect the battery posts for testing the spark.

In the case of necessity used storage batteries may be stored in charged condition with electrolyte of proper specific gravity. In this case it will be necessary to recharge them once a month with current rate of the second stage during two hours until symptoms of full charge are evident, and after three months storage

or before reinstalling on the machine, subject the batteries to discharge-and-charge cycle, to be followed by final charge as shown in Table 3.

Used batteries that are not intended to be used for sometime may be stored in discharged condition without the electrolyte. To prepare these batteries for storage, proceed as follows:

1. Depending on the degree of discharge in the battery, recharge it or discharge with current of a 10-hr rate until voltage in one of the cells is 1.7 V.

2. Remove vent plugs and overturning the battery, let the electrolyte drain out during two hours (without washing with water).

3. Reinstall the vent plugs (it is advisable to close the vent holes with tar putty for the period of storage). Using cotton waste, wipe thoroughly the battery exterior and place it in storage.

Batteries in this condition may be stored at the most for six months. If the batteries are stored with wet plates during a longer period, the lead sulphate tends to change into an inert from which takes in the charge with great difficulties and the metallic lead on the negative plates gets partially oxidized. Therefore, the capacity of batteries is not easily restored by charging after a long-term storage.

To put the battery in working condition, fill it with electrolyte having specific gravity from 1.05 to 1.06, measured at 15° C. The temperature of electrolyte filled should not exceed 25° C. Charge the battery with current of the second stage till the symptoms of a full charge are evident (see Table 3). Discharge with current of a 10-hr rate until voltage in one of the cells is 1.7 V. Then proceed in the manner adopted for charging new batteries.

GENERATOR AND REGULATING RELAY

Generator is introduced for recharging the storage battery and for supplying electric energy to electrical equipment when the engine is running.

Regulating relay *11* (Fig. 32) connects the generator with the storage battery and, at a variable speed of the generator armature, maintains a constant tension in the generator within 6.5—8.0 V (depending on the armature speed and load).

The generator Г-414 is a single-pole d. c. machine with shunt excitation. It is rated for maximum load of 10 A at 6.5 V tension. It is mounted in the upper portion of the engine crankcase in a special hollow, held by means of a strap and pressed by a stay through a gasket to the inner flange of the engine crankcase.

Rotation to the generator armature is relayed from the engine camshaft through a train of gears. Transmission ratio from the engine crankshaft to the generator armature is equal to 1.5. Therefore, at maximum revolutions of the engine the generator is able

to develop up to 7500 r.p.m. The generator armature shaft is positioned eccentrically in relation to the frame, so the backlash between gear teeth is adjusted by turning the generator frame in the engine crankcase hollow. In case of slackening in the generator fastenings, there may be jamming of gear teeth of the generator and camshaft. To avoid this, arrange the generator so that the armature shaft is to the right from the frame centre line, if viewed from the commutator end.

The generator equipped with the regulating relay should develop 6.5 V tension at 1350—1450 r.p.m. It will deliver full power of 65 W beginning from 1950 r.p.m. of the armature.

The principal parts of the generator include: cylindrically shaped steel frame, pole shoe with exciting winding, armature with commutator, front end shield, rear end shield with two brush-holders carrying two carbon brushes.

The frame and pole shoe with exciting winding from the magnetic system of the generator. One end of exciting winding is connected to generator terminal *Я*, the other — terminal III; both terminals being arranged on the generator rear end shield, duly insulated from it.

The negative brush is connected to generator frame (grounded), while the positive brush is insulated from the frame and connected to generator terminal *Я*. As an access to the brushes, ports are made in the rear end shield, which are closed with steel band for protection.

The generator gear is keyed on the armature shaft, resting with its edge against the inner race of ball bearings. When installing this gear, fit it so that it rests against the bearing. If the gear has a tight fit on the shaft, then remove the end cover, set up the generator shaft (from the commutator end) on some rest and tapping lightly with a hammer, force the gear on.

The regulating relay PP-302 is made up of two electromagnetic devices: reverse-current relay and voltage regulator. Both are housed in a common box and serve for automatic cut-in and -out of generator from the circuit, for automatic regulation of generator voltage and to protect the generator against overloading, as well as to protect the storage battery against excessive charging current.

Reverse-current relay is an electromagnetic cut-out used for parallel work of the generator with the storage battery. Generator is cut into the circuit automatically with the aid of this relay, whenever voltage on generator terminals reaches 6.0—6.5 V, i.e. when the latter voltage is higher than the voltage in storage battery. Generator is cut off from the circuit whenever its voltage drops below the voltage of storage battery, and current from the battery begins to flow through the generator. The value of reverse current at which the generator is disconnected from the circuit equals to 0.5—3.5 A.

Voltage regulator is an electromagnetic vibrator which periodically cuts in an added resistance into the circuit of the generator exciting winding, thereby providing for an automatic voltage control at variable loads on the generator and speeds of the armature. The voltage regulator reacts not only to the value of voltage, but also to the value of generator load, preventing overloading by bringing down the variable voltage as soon as the load on generator is increased.

The regulating relay has been adjusted at the factory and requires no further maintenance. The factory adjustment, however, must never be disturbed.

When mounting the regulating relay on the motorcycle, pay particular attention to its grounding. Although the box regulating relay serves as a ground for the unit and is connected to the motorcycle grounded parts with the screws that fasten the regulating relay in place, a special terminal is provided for better contact. This terminal is located on the right-hand side of the unit and is connected through a bus-bar with the frame.

ELECTRIC HORN

The motorcycle is equipped with type C37-A vibrating horn without a trumpet. It will sound when the ignition key is pushed in to the limit and after the horn button fixed on the left-hand portion of the handlebar is depressed.

The horn is adjusted with an adjusting screw located in the horn body rear end.

HEADLAMP

The motorcycle is equipped with a headlamp ФР-116 which houses, besides the double-filament (far-reaching and "bright" light) lamp and the "dim" (or parking) lamp, also the speedometer with odometer and the master switch with ignition key.

When parking the motorcycle never leave the key pushed in to the limit, because the storage battery is liable to be discharged through the ignition coil primary winding. This may not only run the battery down, but may ruin the ignition coil. If the pilot lamp is on, it means that electric energy is supplied to all units from the storage battery. The pilot lamp will go out as soon as the relay contacts are closed and the generator is cut into the common circuit.

To set the headlamp in proper position, proceed as follows (Fig. 33):

1. Park the motorcycle (with a load) on a flat ground in front of a white wall or a screen at a distance of 10 metres from the wall to the headlamp glass.

2. Slacken the headlamp bolts and set the headlamp so that the centre line of the far-reaching light filament beam is hori-

zontal, i. e. when the centre of light spot on the wall and the headlamp centre are equidistant from the ground level.

3. In checking the "dim" lamp see that the upper border of light spot on the wall — with the "dim" light filament switched on — is below the headlamp centre by at least 10 cm.

4. Tighten up the headlamp bolts.

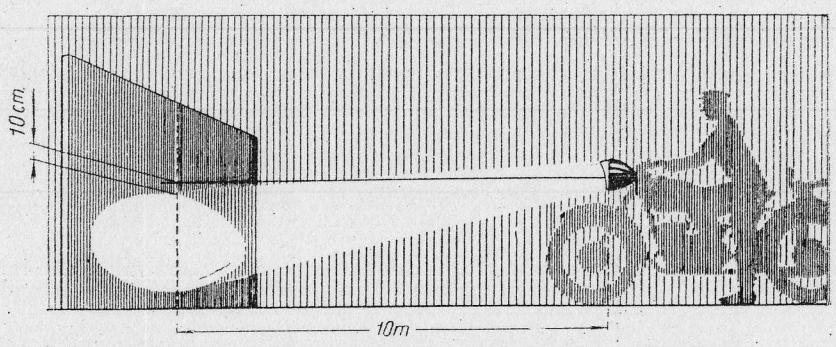

Fig. 33. Wall Diagram for Headlamp Adjustment

MASTER SWITCH AND IGNITION LOCK

Master switch is integral with ignition lock and has common parts with it. The master switch serves to switch on the lights of headlamp, front side and tail lamps, as well as for connecting in the horn and ignition system. It includes a safety fuse and a pilot lamp.

On the contact board bottom (Figs 32 and 34) are numbered terminals for connecting respective wires:

З/С — from ignition coil and horn;
Б — from regulating relay terminal *Б*;
СС — from headlamp "dim" light (parking) lamp;
П — from far-reaching and "bright" lights turn-knob;
Ф — from front side and tail lamps;
Я — from generator *Я* terminal;
ЛС — from speedometer lamp.

TAIL LAMPS AND STOP LIGHT SWITCH

The motorcycle is equipped with tail lamps, ФП-220 and ФП-8Б, one of which is arranged on the rear wheel mudguard and the other — on the side-car wheel mudguard.

A side lamp ПФ-200 is located on the front end of the side-car wheel mudguard.

The tail lamp ФП-220 mounted on the motorcycle rear mudguard has two lamp bulbs: top — stop light bulb (A18, 6 cd);

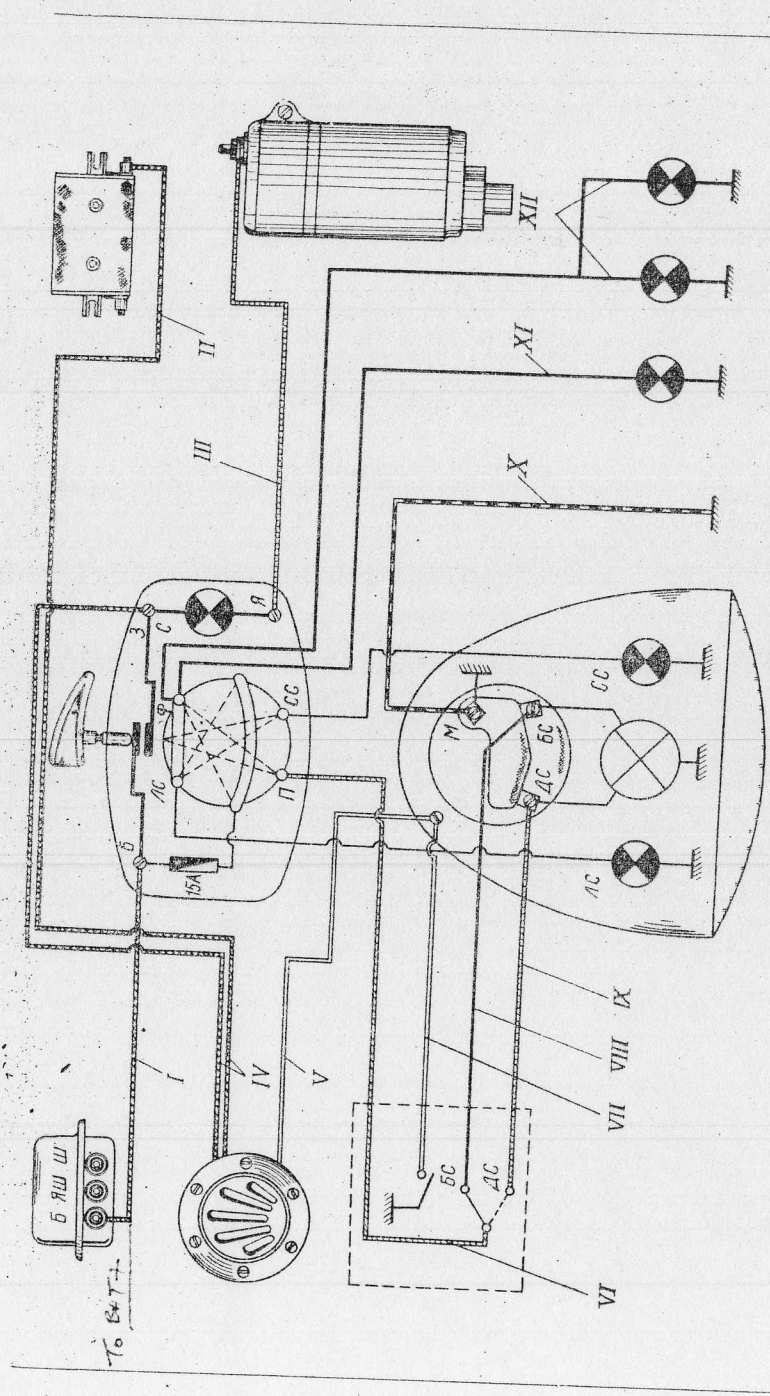

Fig. 34. Headlamp Wiring Diagram:
I — to regulating relay terminal Б (blue); *II* — to ignition coil (red); *III* — to generator terminal *Я* (green); *IV* — to horn (red)
V — from horn to headlamp (yellow); *VI* — to lights turn-knob (blue); *VII* — from horn button to headlamp (yellow); *VIII* — to bright light filament (black); *IX* — to far-reaching light filament (green); *X* — to a ground (brown); *XI* — to motorcycle lamp (black); *XII* — to side-car lamps (black)

bottom—side lamp bulb used also for lighting the license plate (A17, 3 cd).

The stop light switch is screwed in a threaded hole made in the rear brake pedal shaft bearing. Two wires lead from the switch: one (longer) from switch terminal under the rear mudguard to top terminal of stop light bulb located in the motorcycle tail lamp, the second (short wire) — to relay terminal *Б*.

Whenever the brake pedal is depressed, the switch follower under the action of a spring slides along the brake pedal shaft cam and in lowering closes the switch contacts, thus lighting the stop light bulb.

In case a fault is noticed in the stop light and must be rectified, then disconnect wire from the switch and screw the switch out. Undo carefully the punched spots on the switch top, take the terminal block out and make the necessary repairs. After reassembling and punching for safety, fill the circular gap between the switch body and the terminal block with thick paint as a protection against moisture.

The switch is set and adjusted as follows. Screw the switch body by about $^2/_3$ of its thread length and depress the brake pedal. At this the lamp bulb should light. Secure the wires, put on the cap and check the switch performance, as with a stroke of brake pedal within the range of 10—15 mm the lamp bulb should go on: with further pressure on the pedal it should stay on with a steady light. If the lamp bulb goes on too late (requiring a longer stroke of brake pedal), then unscrew the switch out a little. If the lamp bulb goes on too soon (i. e. at a touch of the brake pedal), then screw the switch in a little.

After the adjustment is found satisfactory, safety the switch with a locknut, lubricate with petrolatum or grease and slip on the cap.

ELECTRIC WIRING

Grade АОЛ wire with rubber insulation in lacquered braiding or grade ПГВА wire with insulation made of polyvinyl chloride are used to interconnect all units which use or supply the electric energy, as well as the auxiliary instruments. For convenience in laying the wires (except high-tension wires) are connected into bundles. Clips are used to fasten the wires to the motorcycle and side-car frames. All wire ends are provided with rubber caps to protect them against incidental short-circuiting.

ELECTRICAL EQUIPMENT MAINTENANCE

During the daily maintenance check holddown of storage battery, working condition of headlamp, tail lamp, horn and side-car lamps; examine safe fastening of electric wiring, condition of

storage battery, generator, headlamp, lamps, horn, ignition coil, spark plugs and wiring.

If the strap fastening the generator to the engine crankcase is loose tighten it up and, if necessary, adjust the backlash between gear teeth. For this adjustment, release somewhat the generator strap bolt, start the engine running, and by turning the generator by its frame set such a backlash when the gears are running noiselessly. Then tighten up the strap and check again to be sure there is no noise in gearing.

In case the headlamp bulbs are found faulty, replace as follows: turn out the screw that holds the headlamp rim to the shell, separate the rim together with lens and reflector from the shell. Then remove the bulb socket by pressing and turning it to the left. After that take the bulb out of the reflector hole. To install the new bulb, reverse the sequence of operations.

To replace the "dim" light bulb, take the socket out together with the bulb, separate bulb from the socket and insert a new bulb in its place.

Having replaced the lamp bulbs, reinstall the lens and the reflector. For this job it is not necessary to separate the reflector from the rim and lens.

When changing broken lens or repairing the headlamp, the reflector should be cleaned first with an air blast and wiped very carefully with a clean soft cloth or a soft brush. Take the lens and reflector apart only in exceptional cases, because frequent dismantling is harmful to the reflector. When assembling the unit, pay special attention to correct setting of the lens in place.

To replace faulty bulbs in tail lamps, turn the screw out, remove the lamp shell, and by pressing a little turn the bulb to the left and take it out of the socket. To install the new bulb, reverse the sequence of operations.

To improve the sound of horn, adjust it by turning the adjusting screw to one side or the other.

After every 1000 km wipe the glasses in side and tail lamps, clean the storage battery of dust and dirt, clean vent plug holes, clean battery posts of oxidation and coat them with a film of petrolatum, check the battery electrolyte level, check the specific gravity of electrolyte with a hydrometer.

In hot summer check the specific gravity of electrolyte every 5—6 days, and at other time — every 10—15 days. Level of electrolyte in battery cells should be 10—12 mm above the safety shield. If it happens to be lower, add distilled water into the cells (as water evaporates in the process of battery service). Electrolyte may be added only if the shortage was caused by spilling out.

Regular check-up of the specific gravity of electrolyte helps to ascertain the degree of charge in the battery, which in turn reveals its condition for service. This is specially important in

winter-time, because a run-down battery is liable to freeze. Batteries may be used in winter if the degree of discharge is within 25%, and in summer — within 50%.

Irrespective of its condition — whether in service or under storage — send the battery for recharging to a repair shop once a month, and subject it to the discharge-and-charge cycle once in three months.

After every 2000 km check condition and fastening of electric bulbs in headlamp and lamps; if necessary, clean the headlamp reflector of dust; lubricate distributor moving contact pin and felt oiler (wash, then drip two-three drops of engine oil on the pin and one-two drops on the felt).

After every 4000 km check condition of generator commutator, brushes and springs. For this job remove the protective steel band, raise the brush spring and check for free slide of brush in the holder; check also for wearing of the brush (brush length should be at least 11 mm). If brush gets jammed in the holder, wipe the holder with a piece of cloth moistened in gasoline, replace wornout brushes with new which should be refaced with a glass paper to suit the commutator curve; wipe the commutator of dirt and oil with a piece of cloth moistened in gasoline. Remove the end shield (from the commutator end) and renew the grease in the generator bearing. Clean carbon off the spark plugs and check the gap between electrodes (this gap should be within 0.6—0.7 mm). To readjust the gap, bend the side electrode in or out.

Check condition of distributor contacts and the gap between them. If necessary, clean the contacts and set a gap of 0.4—0.6 mm. If the contacts are worn or burnt, then remove the moving and fixed contacts, file the contact points and wash in gasoline. Check whether the felt oiler is in touch with the distributor cam. If there is a gap, bend the felt carrying plate so that the felt is rubbing lightly against the cam lobes.

Check condition and safe connection of high-tension wires.

If in the course of operation it is revealed that with the maximum advance angle the engine is not able to develop full power in high revolutions, increase the angle of ignition advance. In this case check for correct setting of ignition timing.

ELECTRICAL EQUIPMENT TROUBLES AND REMEDIES

Trouble	Cause	Diagnosing	Remedy
With ignition key completely pushed in, pilot lamp fails to light. When depressing horn button no sound is audible	Poor connection on battery posts, on regulating relay terminal *Б*, on master switch terminal *Б*, or ignition lock contacts are fouled		Clean thoroughly wire ends and tighten up. Clean ignition lock contacts
With ignition key completely pushed in, pilot lamp fails to light. When button is depressed, horn sounds	Lamp bulb is burnt out. Poor connection on generator terminal *Я* or on master switch terminal *Я*		Replace lamp bulb. Tighten up terminal connections
With ignition key completely pushed in, pilot lamp is on. Once ignition key is turned to right or left, there is no light	Safety fuse in headlamp is blown		Replace safety fuse
With parking lamp on, there is no light in side-car side lamps	1. Poor connection in coupling	1. When wires are connected directly (eluding coupling), lamps go on	1. Repair connection in coupling
	2. Break in circuit from master switch terminal *Ф* (black wire) to coupling	2. When wires are connected directly (eluding coupling), lamps fail to light	2. Find and repair damaged wire
With parking lamp on, there is only light in either side-car side lamp or its tail lamp	1. One of lamp bulbs is burnt out	1. Remove lamp bulb, examine its filaments or check by connecting it directly to battery through wire	1. Replace defective lamp
	2. Break in wires from coupling to lamps	2. When examined, lamp bulbs found intact	2. Find place of break and repair

Trouble	Cause	Diagnosing	Remedy
Although "bright" and far-reaching lamp is cut-in, only one of filaments reacts to switching-over	1. No contact in turn-knob wires or turn-knob is faulty	1. Remove headlamp rim with lens and reflector. Check wire connections and operating condition of turn-knob	1. Tighten up wire ends in terminals; replace turnknob
With ignition key pushed in, horn sounds without any pressure on its button	2. Lamp bulb is burnt out Horn button is sticking		2. Replace lamp bulb Disassemble horn button and readjust it
With engine running at variable speeds, pilot lamp keeps on burning with steady light	1. No contact on generator terminal *Я*		1. Clean wire end and tighten up terminal connection
	2. No contact on regulating relay terminal *III*	2. When generator terminal *III* is grounded (with engine running), lamp should go off	2. Ditto
	3. Internal derangement of regulating relay	3. In grounding wire disconnected from terminal *III*, pilot lamp goes off	3. Replace regulating relay or send it for repairs
While motorcycle is running, pilot lamp goes on and off	Poor connection to battery or poor contact of battery ground wire		Clean wire ends and battery posts, then tighten up properly
Battery is quickly discharged with engine running	Wrong connection of wires to battery	Take voltmeter and check connection of generator and battery to circuit, see that their minus terminals are connected to ground	Exchange wires on battery posts
When engine is accelerated, pilot lamp overheats and blinks	Battery poles have been mixed up during its charging	—	Recharge battery correctly

Trouble	Cause	Diagnosing	Remedy
Violent sparking of relay contacts	Change over generator poles	—	Put battery in correct position, connect properly its posts (plus to circuit), and while running engine below average speed for a short time (1 or 2 sec.) close terminals and of the regulating relay
Pilot lamp looses gradually its incandescence, going out only at high speeds	Low voltage developed by generator due to break in its commutator segments. Regulating relay is out-of-order	Send generator and regulating relay to repair shop for check-up	Make repairs to generator and regulating relay, adjusting the latter

X. CARE OF MOTORCYCLE

Each maintenance work should be performed after the motorcycle has covered the specified number of kilometres irrespective of the working conditions, season and/or serviceability of the machine. The care for the motorcycle includes the daily maintenance which is a preventative routine, and a schedule of maintenance work to be carried out at intervals of 1000 and 2000 km.

Lubrication chart of the motorcycle with indication of points to be lubricated is given in Fig. 35. For the motorcycle units and parts the scope of maintenance jobs and the time for their execution are described in various sections of this Manual and summarized in the tables.

It is self-understood that besides the job listed for the maintenance work it is necessary to repair all derangements noticed.

As a general guide to maintenance work follow the order below.

1. Wash the motorcycle and wipe it dry.
2. Check the level of oil and, if necessary, top up or change it.
3. Tighten up the threaded connections.
4. Lubricate the respective points with a grease gun.
5. Check the function of all units and parts of electrical equipment and ignition system, attending to the jobs outlined in the instruction.
6. Check pressure in the tyres and bring it up to the correct value.

In the summer-time keep the pressure within the lower limits, whereas for the winter — within the higher limits.

Rectify immediately all faults noticed in the parts or units of the motorcycle.

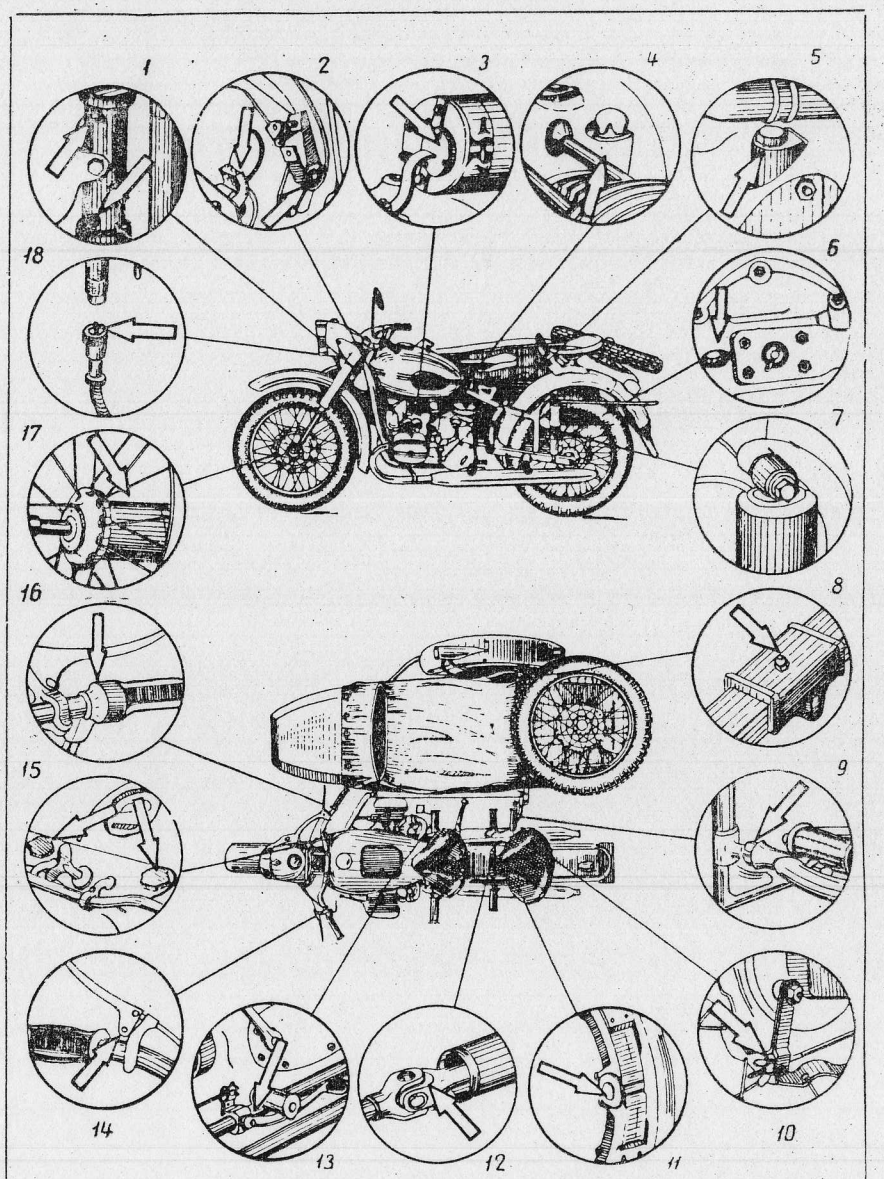

Fig. 35. Lubrication Chart:

1 — steering column bearing lubricators; *2* — moving contact pin and felt oiler; *3* — generator rear bearing; *4* — engine crankcase filler neck; *5* — gearbox filler neck; *6* — final drive filler neck; *7* — rear suspension shock absorbers; *8* — spring hanger lubricator; *9* — side-car clamping holder; *10* — brake system hinge joints; *11* — brake cam; *12* — universal-joint lubricator; *13* — brake pedal shaft; *14* — clutch lever pin and brake lever pin; *15* — front fork shock absorber oil priming points; *16* — carburetter throttle control twistgrip; *17* — wheel hub; *18* — speedometer drive flexible shaft

Daily Maintenance
(Examine the machine before and after the trip)

Description of work	Materials used
Check for correct levels of oil and gasoline, proper feed of gasoline to carburetters, functioning of controls, condition of bolt and hinge joints, pressure in wheel tyres, operating condition of headlamp, tail lamp, side-car lamps and horn	Gasoline A-72. May be substituted by A-66, A-76, B-70
At stopovers en route check to hand touch the temperature of wheel hubs, brake drums, gearbox and final drive casing. In case of overheating, remedy immediately or upon return from the trip	Summer oil AK-10, AK-15, AC-9.5; Winter oil AK-6, AC-5
Clean the machine of dirt and dust, wash it if necessary, but only after the engine has cooled off. In this connection, close the air cleaner shutter and avoid directing the water spray on ignition, fuel-feed and electrical equipment	For the engine lubrication use aviation oils MC-14 in winter, MC-20, MC-20C, MK-22 in summer and diesel oils Дп-8 in winter, Дп-11, Дп-14 in summer
Check for proper attachment of front fork in the frame head. See that the springs, steering damper are intact. Check functioning of front fork shock absorbers; examine size of end play in wheel hubs by rocking jacked-up wheels; condition of wheels and tyres (correctly inflated wheel tyres should have a pressure of 1.5—1.6 atm. for the front wheel and side-car wheel and 2.6—2.7 atm. for the rear wheel). Check for proper fastening of mudguards, spare wheel; condition and proper tightening of wheel spokes; condition and fastening of engine crankcase, cylinders, cylinder heads, carburetters, exhaust pipes, silencers, propeller shaft and tightening of nuts that fasten the final drive to the swinging fork arms	Do not use any other grades of fuel and oil
Examine for oil or fuel leaks. Check condition and fastening of storage battery, generator, horn, headlamp, lamps, wires, ignition coil and spark plugs; tightening of gearbox bolts and nuts; condition and attachment of control cables and linkage; performance of the clutch (play at clutch lever end should be within 5—8 mm); holddown of saddles; fastening of motorcycle stand and footrests. See that the rear wheel suspension springs are intact. Check condition of motorcycle and side-car frames, attachment of sidecar to motorcycle and springs to side-car frame, tightening of nuts and clamping holders. See that the rear wheel suspension is intact and that the wheel axles are properly tightened. Then check the engine performance and action of brakes on the run	
Wash the air cleaner and coat the gauzes with oil (in summer after every 500 km, under extremely dusty conditions — every 150—200 km, in winter — every 1000 km)	Summer oil AK-10, AC-9,5 winter oil AK-6, AC-5
If the motorcycle is operated on dusty roads, lubricate the spring hangers (refer to Fig. 35, item 8)	Grease УС-2

Schedule of Maintenance Works
(depending on the kilometerage)

Item No. in Fig. 35	Description of work	Materials used
	Every 1000 km	
	Check functioning of gear change foot pedal, readjust it if necessary Check condition of gasoline cock, if necessary remove its settling bowl, wash and blow it through Wipe the storage battery, clean its posts of oxidation and coat with petrolatum; check the level and specific gravity of electrolyte. Once a month send the battery for recharging to a repair shop; once in three months the battery should undergo the discharge-and-charge cycle Start up the engine and check adjustment of carburetters, running the engine at low and medium speeds. Check also synchronized operation of carburetters, readjust if found necessary Check clearances between the valves and rocking arms, readjust if necessary (as this clearance should be 0.5 mm)	
5	Check oil level in gearbox, top up if necessary	Summer oil AK-10, AK-15, AC-9.5; winter oil AK-6, AC-5
4	Change engine oil	Ditto
	Every 2000 km	
	Check carburetter adjustment. Dismantle them if required, wash in gasoline and blow through the jets, ducts and air passages with compressed air. Adjust the carburetters	
1,8	Lubricate steering column bearings, spring hangers.	Grease УС-2
17	Remove wheels, take used grease out of hubs, wash bearings in kerosene and blow through with compressed air, pack fresh grease, reassemble and adjust bearings, and change places of wheels. Check for play in steering column (if noticed, tighten up)	Grease 1-13, 1-13C, ЯНЗ-2
11,6	Check condition of brakes, clean brake shoes and drum working surfaces. If brake lining is worn, replace. Lubricate brake shoe cams and pins; check toe-in of wheels, camber angle of motorcycle and side-car vertical axes (toe-in should be 10—12 mm, angle of camber — 2°); check oil level in final drive casing (top up if necessary)	Grease УС-2. Automotive transmission oil for summer and winter

Item No. in Fig. 35	Description of work	Materials used
15	Dismantle completely the air cleaner, wash filter elements and oil them Change oil in front fork shock absorbers	Oil AK-10, AK-6 AK-10 or AC-9.5 oil in summer; AK-6 oil or mixture of 50% turbine and 50% transmission oils in winter
16	Lubricate carburetter throttle control-twistgrip (for winterization — disassemble it)	Summer grease УС-2; winter oil AK-6
14	Clutch and hand-brake control lever pins	Grease УС-2 in summer, oils AK-10 or AK-6 in winter
2	Moving contact pin and felt oiler	Ditto
13	Foot brake pedal shaft	"
11	Brake expansion cam, side-car body lid hinges	"
	Every 4000 km	
	In addition to above, check condition of generator brushes springs and commutator (if necessary, clean commutator). Clean spark plugs of carbon and check the gap between electrodes (correct gap should be 0.6—0.7 mm)	
	Check condition of distributor contacts and their gap (0.4—0.6 mm), clean contacts and readjust if necessary	
3	Change grease in generator rear bearing. Check condition and proper connection of high-tension wires	Grease УТ-1 (konstalin)
	Wash in kerosene and lubricate the brake, clutch and throttle control cables	Oil AK-6
8,9	Check condition and if necessary disassemble, clean from dirt and lubricate springs and side-car clamping holder joints	Grease УС-2
12	Lubricate the universal joint	Ditto
	Change oil:	
5	in gearbox	Summer oil AK-10, AK-15, AC-9.5; winter oil AK-6, AC-5
6	in final drive casing	Automotive transmission oil for winter and summer
	After 5000 km	
7	Disassemble, wash and prime with fresh fluid rear suspension shock absorbers	Industrial oil 12 (spindle oil 2) or mixture of turbine and transformer oils in 50—50 proportion

Item No. in Fig. 35	Description of work	Materials used
	After 8000 km	
18	Remove cylinders and cylinder heads. Grind valves. Clean cylinders, cylinder heads, pistons and piston rings. If the oil consumption in the engine is high (exceeds 0.250 litre per 100 km), change the piston rings Wash and lubricate speedometer drive flexible shaft Disassemble the air cleaner completely, wash its filter elements and moisten them in oil	Summer oil AK-10; winter oil AK-6

Care for Motorcycle Paint

Regular care for the painted surfaces will prolong the service life of the paint coat, giving in the meantime an attractive appearance.

For washing the painted surfaces, use a weak stream of cold or slightly warm water. Never clean dust and dirt by wiping with dry cloth, as sand particles will injure the surface and paint will lose quickly its brilliance. Also do not use washing soda, kerosene, gasoline, mineral oils and sea water for washing the motorcycle.

If surface is stained with mineral oil, remove it by wiping with a dry piece of cloth, or moistened a little in gasoline, then wipe off the gasoline till surface is perfectly dry.

If after washing dirt and dust off with water, some grit still remains on the surface, remove this by pouring over with water and drying instantly with a sponge, soft hair brush, chamois skin or flannel so that no water drops are allowed to dry on the surface. Finally, polish lightly the paint surface with dry soft flannel.

Motorcycles "Урал-2" are painted with grade МЛ-12 enamels (auto-enamel on alkyd-melamine base).

Painting Job

To restore damaged spots the equipment of each motorcycle includes a tin of grade МЛ-12 enamel.

To use it proceed as follows:

1) clean the surface with a piece of cloth wetted in gasoline or turpentine;

2) rub the damaged spot with waterproof abrasive cloth (No. 230—280) and water (if necessary first put a layer of ground coat grade ФЛ-03К or ПФ-00-2);

3) rub thoroughly;

4) paint using a soft brush (Nos 12—15) or a spray gun.

After painting give the surface a natural drying for 15 minutes, then proceed to dry at a temperature of 100 to 120° C with the aid of a heat reflector or an electric drying lamp until the enamel is perfectly dry.

If the enamel has thickened and causes difficulty in coating the surface, dissolve it with solvents Nos 651, 646, coal solvent, turpentine oil or acetone.

Bear in mind that the enamels are inflammable.

As a substitute — the nitroenamels may be used for paint jobs, because they dry quickly, when exposed to air of ambient temperature, and are dissolved readily with solvents Nos 646, 647 or acetone.

The painted surface of the motorcycle have a natural gloss. In case some dull spots appear, remedy these as follows:

Take a well-mixed solution of wax polishing compound No. 2 and, having washed thoroughly the dull spots, smear a thin layer of compound with a soft wag (cotton, cotton gauze or flannel) over the surface. Rub the polishing compound in, making circular motions with the wag.

Then after three- or five-minute drying, wipe the surface dry with a clean baize or flannel until the gloss is restored.

Storage and Preservation

In case the machine is to be put in storage for the season, jack up and put the motorcycle and side-car on wooden blocks, then attend to the preservation treatment.

Tyre pressure should be within 0.5 to 1 atm.

Store the machine away from acids, alkalines mineral fertilizers and other harmful substances.

When placing the machine in storage, clean it thoroughly, start the engine running with the gasoline cock closed so as to get all gasoline out of the carburettor float chambers. Fill 50 cm³ of automotive oil into each cylinder through the spark plug hole. By pressing on the kick starter pedal, turn the crankshaft to distribute lubricant on the cylinder interior surfaces.

Smear the surfaces of chrome- or zinc-plated parts with pre heated acidless vaseline or with the following preservating composition: rosin — 20%, varnish No. 177—30% and white spirit — 50%.

Lubricate with petrolatum all points furnished with grease nipples.

Wrap up the outlet hole in the silencers with oil paper.

At the end of storage period, before taking the motorcycle on the road, attend to all jobs mentioned in section: "Preparing New Motorcycle for Use".

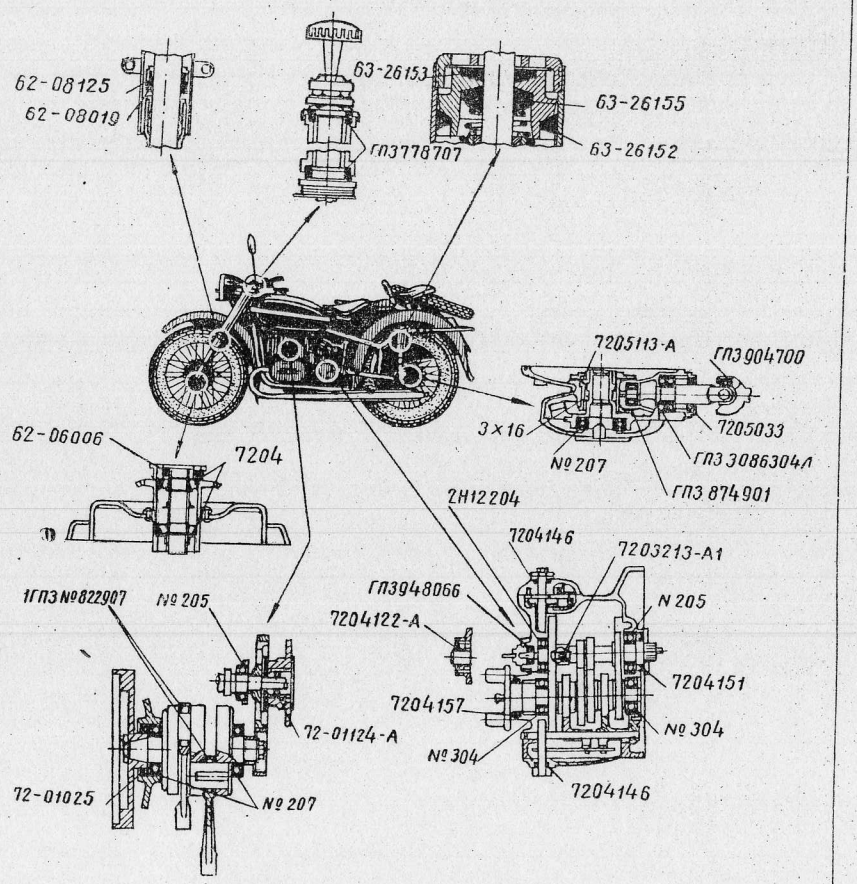

Fig. 36. Layout of Bearings and Seals

Bearings Mounted on Motorcycle «Урал-2»

SUPPLEMENT 1

Bearing No. adopted at:		Name	Place of mounting	Qty
Bearing factory	Motorcycle Works			
205	205	Single-row radial ball bearing	Gearbox clutch shaft Camshaft	1/1 2/1
207	207	Ditto	Crankshaft Final drive ring gear hub	2 1
304	304	»	Gearbox main shaft	2
7204	7204	Taper roller bearing	Wheel hub	8
12204	12204	Radial roller bearing	Clutch shaft	1
778707	72081-2	Radial-thrust ball bearing	Steering column	2
822907	7201208 7201209	Radial roller bearing (cupless)	Connecting rod big end	2/2
874901	72052-1	Needle bearing	Final drive driving pinion	1
904700	72053-2	Ditto	Universal joint cross	4
948066	7203209	Thrust ball bearing (without races)	Clutch release mechanism	1
3086304-Л	72052-2	Double-row radial-thrust ball bearing Needle roller 3×16	Final drive driving pinion Final drive driven gear hub	1 45

Seals mounted on motorcycle «Урал-2»

SUPPLEMENT 2

Part No.	Name	Place of mounting	Qty
7201025	Crankshaft seal and spring, assy	Rear main bearing housing	1
7201124-A	Camshaft seal and spring, assy	Crankcase front cover	1
7203207-A	Clutch release slider seal	Clutch release slider	1
7203213	Clutch release rod seal	Clutch release rod	1
7204048	Kick starter shaft seal and spring, assy	Kick starter shaft	1
7204151	Clutch shaft seal and spring, assy	Clutch shaft	1
7204157	Main shaft seal	Gearbox main shaft	1
7204146	Seal and spring assy of gearbox left and right covers	Gearbox left and right covers	2
7205113-Б	Final drive casing sealing collar	Driven gear hub	1
7205033	Universal-joint fork seal and spring, assy	Universal-joint fork	1
6206006	Seal and spring, assy	Wheel hub	4
6208019	Seal and spring, assy	Front fork leg tip	2
6208125	Felt seal	Front fork leg tip	2
6326152	Sealing ring	Shock absorber barrel nut	3
6326153	Rod felt seal	Shock absorber rod	3
6326155	Rod rubber seal	Shock absorber rod	3

TRY 4TH .6 - 1 mm
POINTS II .4 - 5 mm
SET II (.05 mm) WHEN ENGINE IS COLD
2 TH OV.

CONTENTS

Vneshtorgizdat. Order No. 295CO
Тип. № 1. Заказ № 528