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PARAMETERS OF THE WORKING SURFACE OF AUTOMOTIVE TRACTOR ENGINE PARTS IN THE ENGINE WORKING PROCESS

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Annotation: Parameters of the working surface of parts of automotive and tractor engines play an important role in the efficient operation of the engine. Working surfaces, such as piston, cylinder, and valve surfaces, their smoothness, rigidity, and dimensions determine the engine's performance. Optimal working surfaces contribute to effective control of temperature and pressure in the working medium, reducing friction. Also, the surface parameters increase service life and reduce the risk of malfunctions. Therefore, ensuring the quality of the working surfaces and their correct adjustment guarantees uninterrupted and reliable engine operation.
Keywords: Tractor, engine, working surface, parameters, efficiency
Introduction. It is known that the components that determine the service life of internal combustion engines include the crankshaft, bearing inserts, cylinder liner, and piston ring. One of the convenient and simple methods for increasing their working period is rubbing them together and mutually polishing them under optimal conditions.
Until recently, friction smoothing of friction surfaces was understood as an increase in the contact support surface between the joint parts as a result of mechanical cutting and crushing of micro-roughs on their surfaces. It is said that the increase in this contact surface leads to a decrease in the amount of load on their unit surface during operation and, as a result, a sharp decrease in wear y. Recently, the idea has been put forward that the wear resistance of joint parts e depends not only on the increase in the supporting surfaces but also on the quality of the parts' surfaces [1].
The quality of friction surfaces depends on the type of material, microstructure, physical-mechanical and chemical properties, macro- and microgeometry, the type of heat treatment, and the quality of grinding under optimal conditions [2].
Small contact surface of friction surfacesleads to an increase in the specific load, and as a result, the local pressure and temperature on the friction surfaces increase sharply. According to Professor N.G. Polyushkin [3], who analyzed Bowden's experiments, the local temperature can reach 1000°C without oil friction. As a result, the peaks of the microplatitudes on the rubbing surfaces collide with each other, become spot-welded, and merge in an instant, forming "bridges," but they immediately break under the influence of the friction force, and small particles and even whole grains separate from the rubbing surfaces.
When the pressure between the friction surfaces of the parts is small, elastic collisions occur, and when the pressure is high, the collision becomes plastic. In the latter case, friction leads to plastic displacement of the material of the outer layer of the parts, and as a result, the friction surfaces become polished. For this reason, when the friction surfaces of parts are mutually smoothed, their polishing occurs and an amorphous layer is formed. In this case, as a result of the displacement of the material of the peaks of the micro-roughness on the surfaces into a plastic state, the depressions of the micro-roughness are partially filled.
Result and discussion. Details manufactured on metal-cutting machines have uneven surfaces due to machining. It consists of microscopic heights and depressions invisible to the eye, and

they represent surface roughness [5]. For example, after choning the cylinder liner, the root mean square value of the height of the microplatforms will be Ra=0.4-0.8. In addition, due to the uncertainty of the machine-piece-tool system, the surfaces of the parts deviate from the ideal geometric shape. Its magnitude depends on the physical and mechanical properties of the material from which the part is made, the condition of the machine tool, the cutting regime, the condition of the cutting tool, etc. [4].

When assembling engines, the mutual arrangement of the friction surfaces of the connecting parts - piston and sleeve, piston and piston ring, connecting rod and piston pin, connecting rod and crankshaft journals and bearings - has a deviation from the ideal geometric arrangement.

All these deviations are microgeometric deviations, which lead to a violation of the accuracy of the relative positioning of the cylindrical surfaces of the parts during engine assembly. Such distortions include deviations from the geometrically correct positioning of the parts' axes: non-parallelism, non-perpendicularity, and adjacent beats. [5].

The presence of such deviations leads to the fact that the actual support friction surface, on which the surfaces of the joint parts are in contact with each other, is very small. This, in turn, leads to an increase in the load on the unit friction surface by tens of times. This situation was proven in the experiments conducted by Bowden and Taylor. When studying the influence of pressure on the contact surface of a steel plate with a total surface area of 21 cm^2, they found that at a total load of 3 kg, the contact surface is 1/170000 of the total surface, and at a load of 300 kg, the contact surface is 1/130 of the total surface. As can be seen from the experiment, the contact area of the surfaces increases with increasing load.

K.K. Nuriev stated that when smoothing the friction surfaces of movable joints, the roughness heights of micro-roughnessning decrease by up to 70% compared to the initial value and expressed it as follows:

S_R=1,4·(R_{zD}+R_{zd}) *(1.1.)*

$S_R mkm^2$ where - surface area

R_{zD}, R_{zd} - micro-roughness of the contact surfaces of two parts in a friction pair;

1.4 - a coefficient that takes into account a decrease in the height of micro-roughness of each part of the friction pair by up to 70% compared to the initial value.

In A.V. Makarov's article, the great Leonardo da Vinci, based on his experiments, discovered the basic laws of friction and introduced the concept of the coefficient of friction to science, as a result of which he rejected the idea of creating a perpetual motion machine. He emphasized here that with the development of transmission electron microscopy, it became possible to determine the highly dispersed crystalline structure of the "Baleby layer" discovered by G.T. Beilby in 1921. Such a layer arises during the polishing of metals and the grinding of friction pairs, possessing higher hardness, chemical stability, and adsorption properties compared to the base metal. This "Baleby layer" is much harder than the base metal and has a much smoother friction surface, which in turn creates a larger contact surface. The increase in the contact surface ensures uniform load distribution across the surface and prevents local pressure increases and reduces wear.

At the initial stage of the grinding process, the surface of the metal the growing ends of the roughness are partially cut, then the microscopic sharp edges on the crystal surface are smoothed and transformed into an amorphous surface. In this case, the sharp edges in them fill the depressions in the roughness due to plastic deformation and shear.

The quality of the friction surface depends not only on their geometric position and physical-mechanical properties, but also on a number of factors that have not yet been fully studied (chemical, electrical, diffusion, etc.).

Table 1

Passenger car engine braking stand hardening modes

No.	Hardening stage	Number of crankshaft revolutions per minute	Load, %	duration of hardening, min.
1.	Cold	640-670	-	20.
		740-770	-	15.
2.	At idle	21.00	-	10.
3.	Under load	3100	15.	10.
		3,300	30.	15.
		3,400	45.	15.
		3,500	60.	15.
		4,000	105.	5.
	Total	-	-	95.

Note. With cold grindinglthe number of revolutions per minute corresponds to the gear ratio of the brake stand's gearbox.

As can be seen from the table 1, spolishing is the most accurate processing method. In this case, the surface accuracy is of the 5th quality and higher. When machining cylindrical surfaces, it is possible to achieve an accuracy of 1 μm in diameter. This machining method provides surface roughness equal to 1.25 μm.

When repairing internal combustion engines, grinding and honing operations are used for final machining of the working surfaces of parts. Then these parts are assembled into a joint with a roughness of 0.68-1.0 μm. These roughnesses are cut and plastically deformed during the grinding process. This, in turn, reduces the quality of engine repair and, as a result, leads to a reduction in the inter-repair life of the internal combustion engine.

Conclusion.

1. In the process of machining the crankshaft of an internal combustion engine with a belt and sandpaper , the geometric shape and surface parameters of the parts change, i.e., they wear out due to uneven grinding. This type of friction affects both the part and the tool. The wear resistance of part surfaces depends on their hardness during the period of friction.
2. The wear process depends on the cutting angle of the tool: the concentration of abrasive particles, their shape, hardness, dynamic strength, as well as the physical and mechanical properties of the wear materials affect the wear intensity.

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