RATIONALE methods and technologies ZMITSNENNYATA RESTORATION WORKING MACHINES ORHANIVSILSKOHOSPODARSKYH

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Structural-energy approach to ensure the longevity of agricultural machines. An author of the best options to strengthen spot, manufacturing of parts made of composite materials leading to a significant decrease in the intensity of wear parts and components farm machinery in their technical operation.

Durability, abrasive wear, the effect samozahostryuvannya blade Blades, paw cultivator, hammer mill, composite materials, strengthen the point.

Formulation of the problem. To machine parts that spratsovuyutsya friction in the mass of particulate matter include many large group of working parts and tools for agricultural, construction and road machines. When contacting machine parts from moving mass of particulate matter is intense destruction of the surface layer, resulting in a term of several hours.

Analysis of recent research. In agriculture abrasive wear processes are widespread. Indeed, experts estimate more than 50% due to abrasive wear mechanisms [1]. The inevitability of osculation machine parts with a given environment eliminates the possibility of substantial improvement in external conditions of friction.

Wear resistance materials and process management changes in the shape of parts in operation are the main factors that determine the service life of parts in these conditions. In agricultural machines such details are blades plows, cultivators paws, knives milling machines and shredders, mowers segments cutting machines, cutting a pair of clippers sheep. The relatively short lifespan of these parts vyzyvaye need a large number of them as emergency vehicles and significantly reduces productivity machines. Between maintenances lifetime working parts of agricultural machines are not counted for years and months and hours.

For example, the threshold triggering pairs stryhalnyh cutting machines is 1.5-2 hours. Continuous operation segments mowers, 4-6 hr., paws cultivators 6-8 hr., after which the field should be implemented sharpening blades. Increased longevity of parts and assemblies agricultural machines control their technical condition is a promising area of modern agricultural engineering, technical operation and maintenance.

The purpose of research - Justification of methods and technologies to strengthen and restore the working of agricultural machines to abrasion damage.

Results. The main goal with the technical operation of machines is expanding the range of normal friction and wear and optimize parameters as surface friction and wear in this range, while the technological processing operations, increase processing performance while ensuring high surface quality and normal operation of the instrument.

The complexity of the processes that formed in friction and wear, needs to study them using complex techniques and research complex mechanochemical processes at the macro, -Micro, -submikrorivnyah [2]. The idea of this method lies in the following: studying the complex processes in the contact surface, reproduce them in the laboratory, then summarize the results and conclusions of a review of production conditions. In vitro reproduced the process of mechanochemical abrasive wear shape formed in the operating conditions of friction machines. The influence of individual factors on the patterns of development carried differentiated at constant sense of other factors. Based on a comprehensive study of possible methods of structure and properties of the surface layers of materials tribosystems, since visual assessment of the use of metallurgy and methods of experimental physics.

This analysis allows you to compare parameters of heterogeneity of material energy characteristics of the process of mechanochemical wear and complex processes that occur at the contact surface, and analyze these processes from the structural and energetic approach of self tribosystems conditions. To investigate the mechanisms of abrasive friction and surface destruction and the kinetics of secondary structure features used modern methods of fine physical experiment.

For a comprehensive study of abrasive wear to work the more than 250 parts and machines working bodies of three main groups operating in abrasive environments, working bodies of machines; interface running friction without lubrication; conjugation working conditions in the presence of friction lubrication.

In developing machines important in terms of reliability and durability, and simplicity are the requirements of a rational layout of major components, manufacturability and maintainability design. The design of friction should choose this kind of friction in the bearings, the shape and size of working surfaces, rational combination of friction materials unit, so that durability of this unit has been increased, and damage-no. The main structural measure against a mechanical form of abrasive wear is to protect the unit from ingress of abrasive friction. This type of damage produced at work and working parts of the machine in

contact with the abrasive mass. In this case through proper selection of materials to achieve in order to detail spratsovuvalasya at less damaging form mechanochemical wear. Most wear parts until the complete loss of the ability of employers lose a small portion of its mass. For some parts of the work it is advisable to make a variable that allows for relatively small expenses easily recover details in the maintenance. Variable elements are widely used in the construction work of tillage, forage machines for livestock and feed production. Fig. 1 shows the design of a hammer mill DB-5 (DCM-5). Variable elements are made from wear resistant materials: composite powder materials, strengthening of hard alloys welding methods, strengthening point consumable electrode (cored wire), use large eutectic coating thickness. One method of achieving high wear resistance is the use of hard alloys. They consist of carbide and binder phases and produced by powder metallurgy. The presence in the deposited layer of carbides of refractory metals (VC, TiC, NbC, MoC, WC) increases hardness and wear resistance of the surface layer, which in turn increases the service life of the working bodies of agricultural machines.

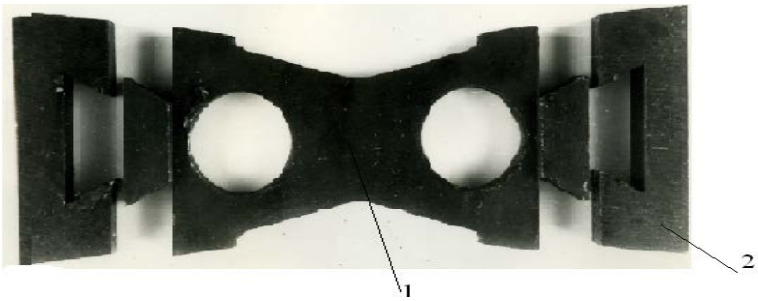
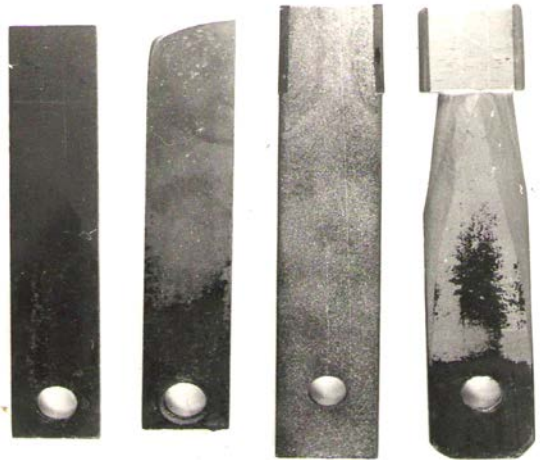


Fig. 1. The design of hammer crusher DB-5 (DCM-5): 1 - the basis hammer, steel, Art. 3; 2 - operating (variable) part of the wear-resistant material.

In the rational distribution of working material stock to abrasive wear and service life under the hammer significantly increased weight gain without additional details.

Currently, the friction in machines using metallic, non-metallic and composite materials, solid and porous, which have both homogeneous and heterogeneous structure. The material is produced by casting, powder metallurgy, welding, spraying. For maximum durability necessary to use means to reduce activation (deformation) surface layer (reinforcing technology, high-strength materials, hard alloys), means reducing the work of friction (friction materials, optimum combination of materials, lubricants environment) regulations of passivation (modifying additives to lubricating medium) and temperature control. Working bodies of machines and equipment for livestock farms is friction parts

which, by their number several times dominated by a pair of friction. Mass loss of metal due to abrasive wear big technological materials and reach 10 to 50% of their mass, and sometimes more, then the loss of weight in the metal parts wear conjugated friction lubrication conditions ranges from 0.1-1.0%. Practice operation of machine kormopryhotuvalnyh found that the durability of their serial work items does not exceed 100-150 tons of operating time on one facet hammer compact feed mill installations CMD-F-2 reaches operating time to failure for a working verge of 15-20 hours. Has significant theoretical and practical experience as well as our research confirms that one of the possible methods for improving the durability of wear parts kormopryhotuvalnyh machines are making their Composite [3]. Fig. 2. The design shown off installation CMD-F-2, workers whose faces wear-resistant elements reinforced with powder composite material based on chromium and titanium carbides.



a b c d

Fig. 2. Hammer feed mill small-sized installations CMD-F-2, and - serial 65G steel; b - serial 65G steel, wear working faces after an operating time of 20 tonnes; s - an experimental basis - steel, Article 3, working facets reinforced composite materials based on chromium carbide, boron and titanium; d - experimental operating time after 200 tonnes.

Increased durability due to the use of various methods of strengthening and restoration is achieved by increasing the hardness and ductility decrease in the surface layer, and in some cases, by changing the chemical and phase composition of this layer. Compatible must be considered such a combination of materials that are in a given range of loading and speed, friction factors and environmental conditions ensuring minimal friction and optimal wear a pair. Thus, compatibility

should be considered in a complex system, material-material medium-load conditions. Wear loose surfaces under the influence of abrasive, which is in the friction zone two solids, attracted the attention of many researchers. It should be noted study author, summarized in the monograph [4]. Durability in this case is not only the mechanical properties of solids, but also the behavior of the abrasive in the gap. If the effort to load the particles in a soft material smaller than a destructive force in this case will be determined by the terms of durability sharzhuvannya and abrasive properties of a solid material that is already fixed abrasive wear. But the abrasive popadayuchy the gap may collapse. In this case, the abrasive effect will depend on the depth of implementation, in which the destruction occurs abrasive, as well as the nature of the destruction of the abrasive. Consider a general way the factors that determine the ability of abrasive material for different machine parts wear, thinking that the intensity of the surface layer of detail depends on the properties of the abrasive material and from its original state. Let the abrasive particle or performance monolithic piece of indeterminate shape and different size flat surface in contact with the rigid body. Due to the small size of the contact surface you can conditionally assume a spherical radius Ri.

$$q = 0{,}459, (1)\sqrt[3]{\frac{E^2 P_i}{R_i^2(1-\mu^2)^2}}$$

Where: E - modulus material abrasive particles; μ - Poisson coefficient; Ri - conditional particle radius at the site of contact with the plane; PI - limit value of the normal load, which can withstand the destruction of particle contacting speech.

Applied to the particles of the normal load and it will increase as long as the tension on the contact platform not reach destructive values. Since the abrasive particles mainly mineral origin and their destruction has brittle nature (it is not preceded by any substantial plastic deformation), in particular for the calculation of maximum stress on the contact platform q may use the formula of Hertz.

The value of PI ceteris paribus depends on the hardness of the material in contact with the abrasive particles. Therefore, to achieve certainty in assessing the strength of abrasive particles need to introduce the condition of absolute rigidity contacting body.

The value of q is conditional indicator of the ability of abrasive grains to create tension in the surface layer parts. This ability depends on the form of grain and its strength. The higher the value q, the more damaged the material details of this grain. For engineering purposes as an approximate assessment of adverse abrasive grains can be used at the microhardness indentation. The actual contact stresses created this abrasive grain, depending on normal operating load. The latter is due to

particle size and density abrasive mass; monolithic piece or weight load on the workpiece; rigidity of contacting bodies.N_i

The process of destruction of abrasive grain and character of established products greatly affect the performance of abrasiveness, ie the size of the destruction of the surface layer of machine parts.

By MM Severnyevym [5], in general, the magnitude of the destruction of the abrasive material in the soil expressed function variables:

$$\Delta G = f (p, L, S, m, H), \quad (2)$$

where: p - ground pressure, Pa; L - way friction m; S - area of friction m²; m - the ability to measure soil that wears out; H - hardness material, HV.

Abrasive particles ground under the influence of an applied them to normal pressure and shear force leads to uneven wear of the working body that also depends on the hardness of the surface of the blade. The intensity of the wear parts in the soil by soil cutting force and friction road

$$\frac{\Delta G}{\Delta S} = KP, \quad (3)$$

where: - the value of abrasion, m; - Way of friction, m; P - layer soil cutting force, N; k - coefficient of proportionality.$\Delta G \Delta S$

The dependence of the intensity of abrasive wear on the hardness of the material as follows:

$$\frac{\Delta G}{\Delta t} = K \cdot. \quad (4) \frac{P \nu_{від}}{H}$$

where: - the rate of relative movement of contacting particles in the wear areas; - Hardness of metal; - The impact abrasive.$P \nu_{від} H \Delta t$

The basis of our work has been used "to strengthen point." The essence of this process of strengthening this: by makrovkraplennya carbide made to strengthen sections of workers tillage machines that wear out quickly. Cored wire, for example, type PP-AN170, 130, 135, with a diameter of 3.2 mm melts under the influence of an electric arc, forming cones penetration, as a result of active diffusion of hard metal with base metal, held firmly to the surface of the part, increasing their durability. Points strengthen formed by the rapid introduction of metal parts such as the amount of heat needed for penetration cone crater filling it with molten base metal and carbide formation and head points. Optimal height in terms of strengthening (head height) choose depending on the functional purpose of the working body.

It must ensure the protection of the base metal from abrasive wear. The height of the point should be the strengthening, in order to defend the wearing surface without creating significant resistance to movement of the working body in the ground. In blades, for example, surfacing Blade height should not exceed 2 mm, and at loggerheads grape cars - 0.5 mm, increasing traction resistance is sticking soil and agronomic requirements are not met by weed cutting. At a point hardening of one of

the main conditions that ensure consistent quality strengthening, coordination weld current and voltage curves. Direct current polarity reduces resistance arc process leads to the formation of spray reduces the depth of penetration and increases the height of the head point.

Therefore, strengthening technology practiced in point inverse polarity. Welded current has the greatest influence on shaping opinions strengthening. By adjusting the depth, height and frequency welding, and the ratio of hardness of deposited metal and base stations determined optimum wear resistance, and if necessary, samozatochuvannya product. Penetration weld station cones in the base metal with the release of base of the cone at the front side parts. Polling stations surfacing appear above the face value of 1 for details ... 3 mm and penetrating the base metal to a depth of 4 ... 6 mm, forming on the surface of the face parts firmly floating point diameter 18 ... 25 mm and hardness NRS 60 ... 66. Experimental blades with point and strengthening blade mounted on the bow of the serial plows are PLN-5-35 and ahrehatuvavsya tractor T-150K. Traction resistance unit PLN-5-35 with experimental blades at a speed of 2.08 m / s was 32.7 kN, compared with the same serial Blades (33.5 kN). Plowing was done to a depth of 25 ... 27 cm after harvesting crops. During the tests carried out regular measurements of parameters of working bodies. The criteria adopted by the full limit state and blunt blades wear, or breakage and bending the toe.

Before consolidation cored wire for removal of moisture (dry) at 300-350°C for an hour. After working out blades 15-19 hectares of black soil on metal wear at the points of penetration less intense forms sawtoothed profile and appears samozatochuvannya effect.

In the subsequent operation of the wear occurs mainly in metal, and on the cutting edge samozahostryuvannya improved. During the comparative tests used commercially manufactured blades, weld sormaytom. Serial blades during operation to wear socks, but no samozatochuvannya Blade and practices at 29.9 ha, there it blunt. The comparative test with black soil (Odessa region.) Showed that the blades point of consolidation has several advantages compared to serial and enables increased durability 2-3 times (Fig. 3).

Fig. 3. ploughshare with a point after hardening operating time 102.3 ha.

As a result samozahostryuvannya formed wavy blade-speed, stability go tillage machines is constant over the long term remains state of dynamic equilibrium aggregates. Spot strengthening of working blades provides little resistance to movement, faster work units, with a small, power requirements and fuel consumption.

The largest operating time (140 hectares) have blades with point hardening. Of the 9 subjects ploughshare blades, only one reached the limit wear on the toe. The general operating time for all blades, blades with point serial strengthening prevail in 2,8 times. To determine the relative durability by weight and length sock graphs (Fig. 4).

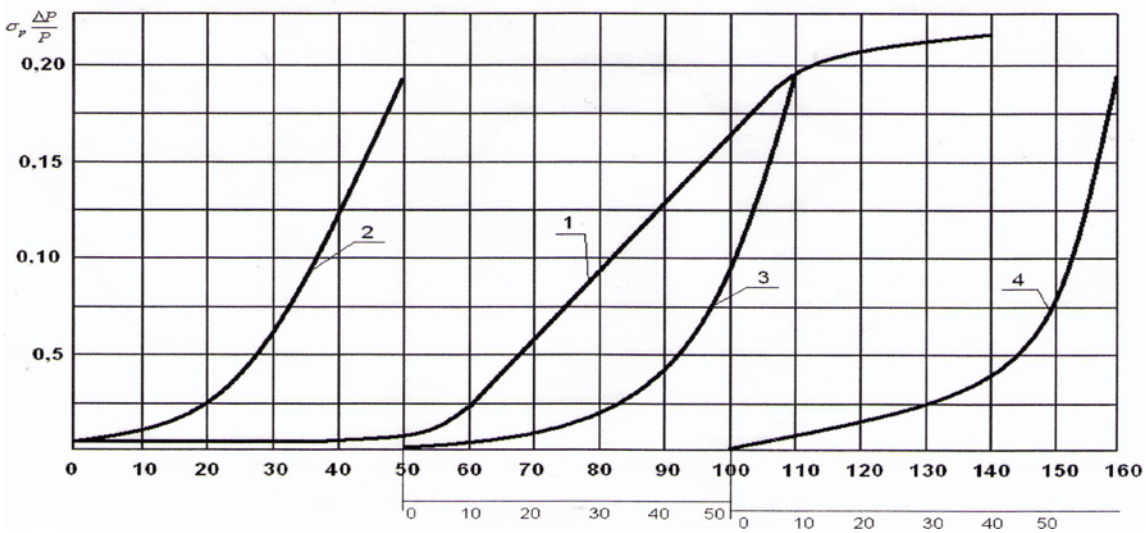


Fig. 4. Relative wear in mass and serial hardened blades 1 - point ploughshare of consolidation; 2 - serial opener (first installation); 3 - serial ploughshare (second unit); 4 - serial ploughshare (third unit).

Relative wear resistance hardened blades by mass 2.2 times the mass, and the relative durability toe 2.8 times the mass. Thus, the ploughshare point of strengthening operating time can be replaced by three serial blades. Value of the average deviation and coefficient of variation of the dot indicates the strengthening of the stability of the process of their manufacture. Increased resistance against abrasion destruction of parts can be achieved using such methods enhancing technologies to increase the hardness of the surface layers of parts abrasive particles of higher hardness environment. Processes minimize plastic deformation implemented widely enough in the normal friction machines due to structural adjustment and minimum values characterized by speed operation and the lack of odors types of damage.

Conclusions

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2.
3.

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Rassmotreno structural approach and energy to Increase Durability agricultural machines. Author optymalnыe proposals parameters of the resistance spot uprochnenyya, Production of details IZ kompozytsyonnыh pryvodyat materials for Significant Reduction yznashyvanyyu details and nodes agricultural machines in the process Tehnicheskoe s operation.

Durability, abrazyvnoe yznashyvanye, samozatachyvanyya effect, blade Lemekh, paw cultivator, hammer kormodrobylky, kompozytsyonnыe materials, tochechnoe uprochnenye.

Examine of structure and energetic approach for increase durability of agricultural techniques. Propose of author of the optimal parameter hardening point consumable and electrode are welding of flux cored electrode, produce detail of cermet's material cause to important diminish intensive of wear detail and assembly agricultural techniques at process of technical operation.

Durable, abrasive wear, effect, self-sharpening, blade share, cultivator tooth, hammer grinding, hardening, point wise consumable, cermet's material.

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EXPERIMENTAL RESULTS DOSLIDZHENSCHODO ENSURING QUALITY OF ITS TSYKORIYUKORENEVOHO drying

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