

III INTERNATIONAL WORKSHOP
KRASNOYARSK, RUSSIA
11 December 2021



Science and Technology City Hall
KRASNOYARSK, RUSSIA

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«III International Workshop on Advances in Materials Science – AMS-III - 2021»

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«Modern Methods Of Choosing Ways To Restore Parts
When Repairing Machines»

Oleg Leonov, Galina Temasova, Nina Shkaruba and Yulia Vergazova

Problem statement

- During the operation of agricultural machinery, as the operating time of machines increases under the influence of load and the environment, the shapes of working surfaces are distorted and the dimensions of parts change, gaps in surfaces increase and tension in fixed joints decreases; the mutual arrangement of parts is disrupted, which leads to additional loads and vibrations, violation of gear engagement. Elastic and elastic properties of parts and materials decrease, fatigue and corrosion damage appear, etc.
- As a result, machine parts and their connections lose their operability, which requires either their replacement or restoration.



Solution methods

- During the maintenance and repair of agricultural machinery, a large number of methods and means of restoring worn parts are used. The choice of a rational method is influenced by the characteristics of the material of the part, the type of surface, wear, the cost of restoration and processing, and other factors. V.A. Sukhodrishchev developed a method of such a choice based on the consistent application of three criteria [8]:
 - 1) Technological (selection of possible extraction and processing methods);
 - 2) Durability (the ability to provide a certain resource), which is characterized by the durability coefficient K_d ;
 - 3) Technical and economic, characterized by the ratio.



Solution methods

- The decision on the economic feasibility of repairing a part element boils down to the following:
- 1) Analysis of the working conditions of the part and its wear with a description of possible methods of restoration and their availability;
- 2) Evaluation of the material of the restored parts (their working surfaces) in terms of wear resistance and heat resistance, oxidizability, internal tension, macrostructure and microstructure, hardness, fatigue resistance and machinability;
- 3) Accelerated bench tests of restored surfaces;
- 4) Evaluation of the selected methods of production conditions.



Solution methods

- For a final solution, it is necessary to study the organizational and technological issues of restoring parts in full.
- When justifying organizational forms, it is important to take into account: the repair fund, the nomenclature of the parts being restored, the number of parts of each name, the technological uniformity and multiplicity of the resource of parts and the repair interval, the existing network of repair enterprises, the distance to the place of restoration, the type of transport and equipment loading.
- The preliminary choice of possible methods of technological restoration of parts depends on their characteristics: the material of the part and heat treatment; the configuration, size and weight of the part; the availability of grounds for restoration and subsequent processing; surface roughness; types of malfunctions and wear; combinations of malfunctions on one part; the multiplicity of restoration and stock for repair.



Solution methods

- At the Department of Repair and Reliability of machines of MGAU named after V.P. Goryachkin, together with the staff of GOSNITI, the following methodology was developed for choosing a rational way to restore worn parts.
- 1. The choice of method depends on the design and technological features of the working surfaces of the parts (size and shape, material and heat treatment, hardness and surface roughness), conditions (nature of load, type of friction) and wear, as well as the cost of restoration.
- 2. In order to take into account all these factors, it is recommended to consistently use three criteria: Technological, or applicability; Durability; Technical and economic (the ratio of the cost of restoration to the coefficient of durability).



Conclusions

Results, implementation

- 1) The theoretical foundations of the choice of a rational recovery method, proposed by V.A. Shadrichev, are developing in the direction of technical and economic optimization. The resource of the part element in this case is a purely theoretical factor, and in practice the coefficients of relative wear resistance obtained from test data are used. The difference between the concepts of "part resource" and "part element resource" has already begun to form, and in most cases it is unrealistic to achieve the same reliability of all part elements. It is necessary to study all the elements of the part (to determine the economic feasibility of restoring worn-out elements, to identify the residual resources of elements in which the aging process proceeds slowly) in order to predict the reliability for a particular element, to use the possibility of providing various element resources.

Conclusions

Results, implementation

- 2) The operability of assembly units is ensured not by individual parts, but by connections, wear resistance or resistance to the aging process, which are provided by the resource of the assembly unit. The processes occurring in the joint depend not only on the characteristics of one element of the part, but also on many other factors. It may be economically feasible to restore the elements of the part in certain ways, taking into account the resulting connection. Unfortunately, there is currently no methodology for choosing rational ways to restore elements specifically for the formation of a compound.

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