

AP19578884 “Increase of wear resistance and improvement of tire punching machine tool design” – p.m. Musayev M.M.

Relevance:

Global integration of domestic and foreign manufacturers has led to an increase in the use of foreign machinery in the domestic industry. One of which is tire punching machines.

Manufacturers and suppliers of these machines, as well as technological and tooling equipment for them, are Russian and Chinese manufacturers. It has been revealed that the tool used for tire hole punching wears out quickly and fails more often. The worn out tool is replaced by a new one, which is purchased from foreign manufacturers. Tool consumption is very high and negatively affects the cost of manufactured products.

The results of the study showed that the tool used to punch the hole on tires wears out quickly and fails more often. The worn out tool is replaced by a new one, which is purchased from foreign manufacturers. Tool consumption is very high and negatively affects the cost of manufactured products.

The existing problem dictates the need to develop technology to improve the wear resistance of tire-punching machine tool design and scientific research aimed at solving this problem is relevant.

The project purpose is to increase the wear resistance and improve the tool design of the tire punching machine tool

Expected and achieved results:

Achieved results:

For 2023. To clarify the relevance of the topic, studies were conducted at a number of enterprises in Karaganda and Astana (WEC.kz LLP, Astana Electromechanical Plant LLP, Bolashak Electric LLP, etc.). Studies have shown that tires work in harsh conditions and wear out quickly. When manufacturing tires at these enterprises in the course of the technological process, an average of 2000-2500 holes are punched per day. The durability of a single punching tool is sufficient to punch an average of 500-600 holes. And since almost all the technological equipment performing these operations is foreign-made, the possibility of maintenance and repair of the equipment is difficult. Worn out or failed equipment is often replaced by other equipment without restoration. That is why the cost of tire punching operation increases.

The analysis of the cost of purchasing abroad universal tire-punching, bending and cutting machines has shown that the purchase abroad of technological equipment and tooling necessary for them is costly.

The volume of losses of tire-punching tools was determined due to wear and breakage. The cost and the need of industrial productions of the regions in machines and tools for tire punching have been specified. The review of works of domestic and foreign scientists was carried out.

As a result of researches carried out at domestic enterprises the technological capabilities of tire-punching machines and tools, advantages and disadvantages of their designs were revealed. It is established that the tooling equipment used in punching operation has a complex design, i.e. it is often prefabricated and in case of wear and breakage is completely replaced by another. The disadvantages of tire punching operations on these machines include the fact that it takes a long time to set up, the high cost of parts in production, the need for special tools to obtain a hole of a different shape. The tools of tire punching machines having different designs were chosen as the object of research. The works were completed according to the calendar plan.

The analysis of chemical compositions, mechanical properties of foreign tire-punching machine tools samples received from the enterprises where the research was conducted was carried out. The analyses were performed at the equipment and laboratory complexes of Abylkas Saginov Karaganda Technical University, as well as at the equipment of the Zh. Abishev CMI. In addition, mechanical properties of materials of tire-punching tools were determined.

The works of foreign and domestic scientists on increasing wear resistance and durability of tools operating under shock and dynamic loading conditions have been investigated.

It is established that the works of many scientists are devoted to the study of methods of applying coatings of different composition on the metal surface in order to increase the wear

resistance of parts and tools. The disadvantages and advantages of physical and mechanical methods and ways to improve the wear resistance of tools with the use of wear-resistant materials and antifriction coatings by Russian scientists have been analyzed.

There was also a review of works on improvement of mechanical properties of tools operating under impact conditions using different modes of heat treatment.

As a result of analysis of the methods considered in the works of scientists up to the present time within the framework of the project implementation the task of development of a new design of tire-punching tool was set. Two ways of increasing wear resistance of tire-punching tool were chosen. The first one is the method of cladding of the working part of the tool with wear-resistant cladding material, and the second method is the development of a combined design of the working part of the tool by manufacturing it from carbon steel (U8, U9A). Which of them is the most effective will be determined as a result of experiments, modeling, calculations and production tests. The works have been completed according to the calendar plan.

1 article or review was published in a peer-reviewed foreign or domestic publication recommended by SHEQAC; 1 certificate of state registration of rights to the object of copyright was obtained.

Expected results:

As a result of the project implementation, the technology for increasing the wear resistance of the working part of the tire-punching tool will be created. A prototype of tire-punching tool will be developed and manufactured.

The results of the project will result in the publication of:

- 2 (two) articles and (or) reviews in peer-reviewed scientific publications on the scientific direction of the project, indexed in Science Citation Index Expanded of Web of Science base and (or) having CiteScore percentile in Scopus base not less than 35 (thirty-five);

- 2 (two) articles or reviews in a peer-reviewed foreign or domestic publication recommended by SHEQAC (1 published);

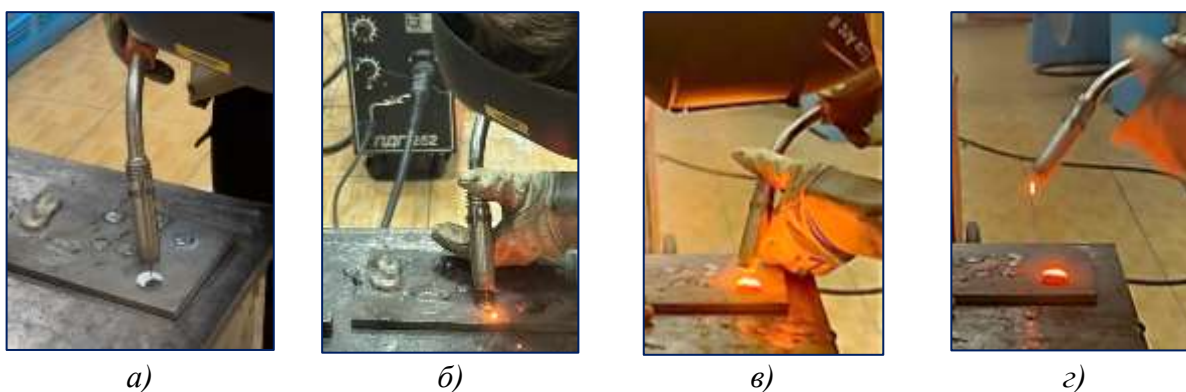
- 1 RK patent for utility model;

- 1 certificate of state registration of rights to the object of copyright (received);

- 1 monograph.

According to the results of the research recommendations will be developed on the use of technology for increasing the wear resistance of the working part of tire-punching tool, as well as on the manufacture of tire-punching tool of a new design.

Doctoral dissertation (PhD) of Kasymbabina D.S. and two master's theses on specialty “Mechanical Engineering” will be defended on the subject of the project.



**Figure 1 - Cladding process of samples:
a,b - beginning of the process; c - cladding process; d - completion of the cladding**

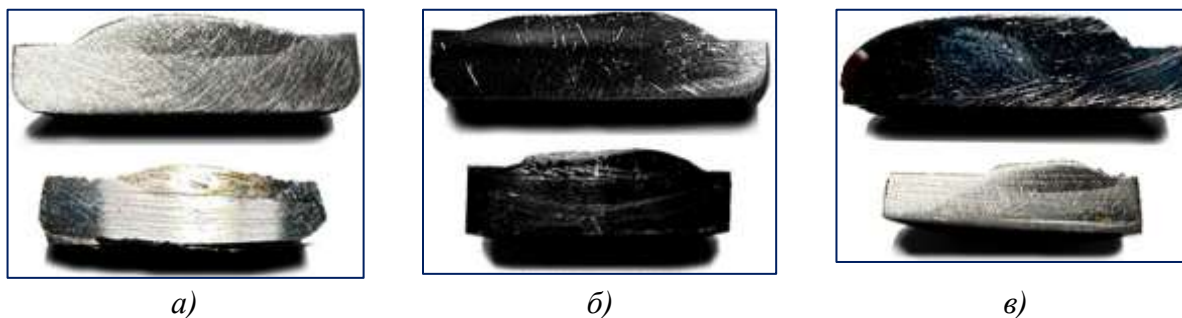


Figure 2 - Specimen slides after hardness measurement

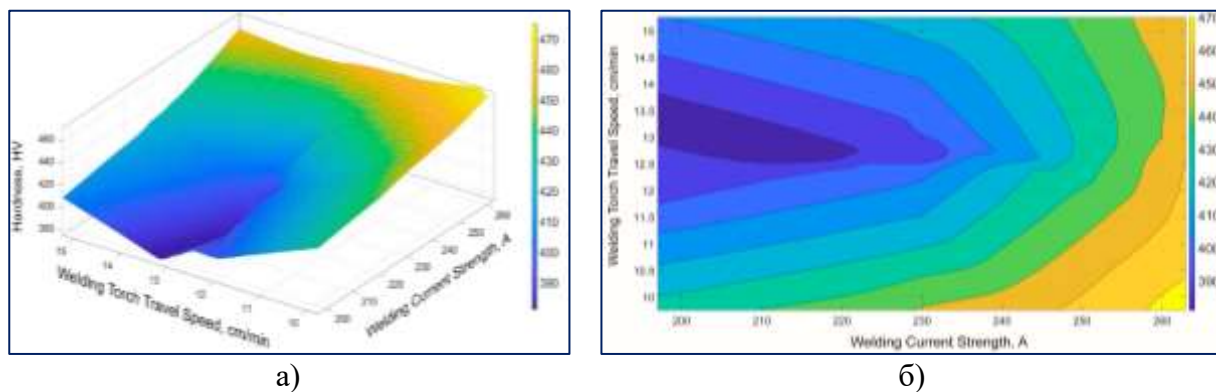


Figure 3 - Dependence of hardness of the welded layer on welding current and welding torch speed (a) and contour plot твердости (b)

List of publications:

1. Musayev M.M., Donenbaev B.S., Sherov K.T., Kasymbabina D.S., Aman I.M. Shinateskish bildekterdın quraldarynyn tozu sipatyn zertteu jane taldau // Science and Technology of Kazakhstan, - Pavlodar: Izdvo "Toraighyrov University", 2023. - No.2. - P. 48-56.

Certificate No. 37787 on entering information into the state register of rights to copyrighted objects. Shinateskish bildekterdın quraldarynyn tozu sipatyn zertteu jane taldau / Kasymbabina D.S., Musaev M.M. Published 04.07.2023.

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Information for potential users:

Potential consumers of the developed technology are domestic industrial enterprises having punching machines. The developed technology of increasing the wear resistance of the working part of tire-punching tool, as well as the combined design of tire-punching tool have a high level of commercialization.

Scope:

The machining branch of mechanical engineering.

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