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WAYS TO INCREASE THE WEAR RESISTANCE OF TILLAGE MACHINES

The working bodies of tillage machines are mainly subject to abrasive wear as a result of friction of the surfaces of parts. The work of a number of scientists has established the nature of abrasive wear and its patterns of abrasive wear. According to these authors, the process of abrasive wear is characterised by micro-cutting by hard abrasive particles. They have established the laws of wear as a function of hardness and pressure.

During operation, the blade of tillage tools loses its efficiency and performance due to abrasive wear and therefore needs to be restored to eliminate the wear, i.e. to restore its performance and thereby extend its durability.

All known methods of maintaining performance are aimed at reducing the rate of by using more wear-resistant materials or creating self-sharpening blades. As early as 1926, the inventor A.M. Ignatiev proposed a a multilayer blade. This method was used in mechanical engineering, especially after the development of of induction surfacing with powdered hard alloys.

It should be noted that due to the high complexity and cost of hard alloys, they have not yet have not yet found proper application in agricultural production for the restoration of working bodies of agricultural machinery.

To increase the durability of the cutting elements of agricultural machinery (ploughshares, cultivator tines, beet harvester knives, etc.), the latter are subjected to by induction hardening. The disadvantage of this method is that with a decrease in the thickness of the surfacing to 0.2 mm, the quality decreases due to deformation of the part due to strong thermal effects.

New surfacing methods are being developed: friction hardening, a method of applying wear-resistant tapes made of tool steels. However, they are highly complex and therefore, are not widely used in the restoration of the above-mentioned parts in the repair production.

The study of abrasive wear in conditions simulating the operation of an element in soil, cast steel industrial melting after heat treatment (martensite hardening and tempering at a temperature from 220 to 650 °), it was found that the abrasion resistance of hardened and tempered material correlates with its hardness. With the same hardness of a material improved by heat treatment or or normalised by annealing, cast steel with a ferrite-pearlite structure has a higher abrasion resistance.

Studies have shown that the use of structural wear resistance, the theory of abrasive wear, the use of modern wear-resistant materials and technological methods of strengthening, in most cases, can significantly increase the service life of of machine parts and working bodies. In particular, through the use of calculation and experimental methods of optimising structural parameters, it is technically possible to increase the service life of ploughshares, blades, tines, harrow teeth and other working parts of tillage machines by 2-4 times or more, while reducing specific material consumption by up to 3-5 times. Comparative resource tests of experimental and and production ploughshares have shown that increasing the wear resistance of the toe allows to maintain the original shape and functional qualities of the ploughshare and, thus, significantly increase its service life. According to the results of tests, the service life of the ploughshares was 55-67 hectares, and the service life of the serial welded ploughshares before rejection was 31-39 hectares. The ploughshares with a reinforced toe did not reach the limit state of wear by the end of the tests reached the wear limit and were suitable for further use. Preservation of the original shape of the ploughshare during its operation, which is achieved by zonal strengthening of the toe and by levelling the wear rate of the toe and blade, allows us to significantly extend the of the ploughshare in width, making fuller use of the metal embedded in the part.

To increase the strength and wear resistance of the boom tines, the method of surface hardening of materials in high-frequency plasma was tested at the Plasma-401 installation. In the discharge chamber of the high-frequency plasma torch, a bundle of quartz rods was introduced into the plasma flow at atmospheric pressure, which evaporated in the high temperature zone and were transported by the plasma flow transported to the surface of the product. The vapour of the material being sprayed condenses on the surface of the product with a thickness of 2-3 mm in three sputtering periods. The time of one period is no more than 15 seconds. To evaluate the increase in the service life of the tines as a result of their surface hardening, comparative field tests of serial and experimental tines were carried out [3]. It was found that the linear wear of serial tines is characterised by a large unevenness along the length of the blade, while the wear of the experimental tines is uniform [1]. The experimental paws have greater wear resistance (up to 1.5 times) and provide significantly better self-sharpening than the serial paws. The wear of the toe of both serial and experimental blades is 2-3 times higher than their wear along the length of the blade, but the wear of the experimental blades is slightly lower than that of the serial ones.

As a result of freezing surfacing followed by heat treatment on the surface of of 65G steel tillage tools creates a layer of increased wear resistance, the structure and properties of the base metal change due to thermal effects.

Freeze surfacing is carried out from the melt at a temperature above 1273 ° K, which leads to the formation of a coarse-grained structure of the base metal, reducing its operational properties. Comparative tests of loosening tines (65G steel) were carried out of the KShP-8 cultivator confirmed the feasibility of using them after freeze welding quenching in a polymer quenching medium and subsequent medium tempering. It was found that the service life of parts hardened by freeze surfacing with post-blowing heat treatment is on average, 1.4 times higher than the service life of parts hardened by freeze-deposition without heat treatment. The use of quenching and subsequent tempering to harden parts of agricultural machinery by hardfacing does not require significant capital expenditure [2].

The study of various variants of thermomechanical treatment of ploughshares revealed that after such treatment, the material was characterised by a martensitic structure; differences in the technological process of treatment did not lead to changes in the hardness of the material; with a delay of more than 40 seconds from the moment of completion of the ploughshare formation to the moment of its cooling in water, the impact strength of the material was significantly reduced. Thermomechanical processing of ploughshares can be successfully used instead of heat treatment; a significant increase in impact strength can be achieved by maintaining the correct rhythm of the production process and compliance with technological requirements.

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МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

ЖИТОМИРСЬКИЙ АГРОТЕХНІЧНИЙ ФАХОВИЙ КОЛЕДЖ

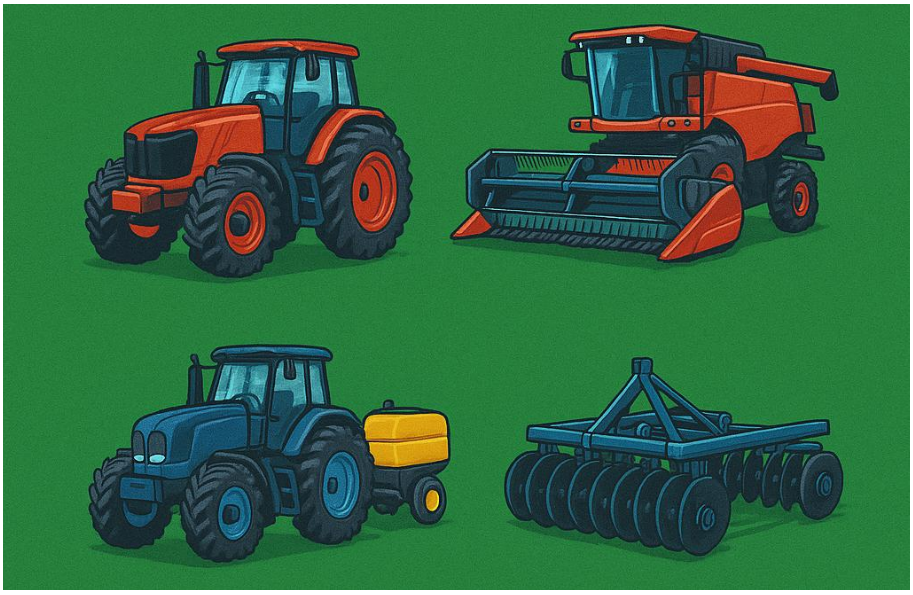
ЗБІРНИК ТЕЗ

XI Міжнародної науково-практичної конференції

«Перспективи і тенденції розвитку конструкцій

та технічного сервісу сільськогосподарських машин і знарядь»

https://doi.org/10.64165/proceeding-ptdstsamt.2025



11 квітня 2025 року

м. Житомир

https://doi.org/10.64165/proceeding-ptdstsamt.2025

УДК 631.2:621.017:615.281:340(477)

Збірник тез доповідей XI Міжнародної науково-практичної конференції «Перспективи і тенденції розвитку конструкцій та технічного сервісу сільськогосподарських машин і знарядь. PTDSTSAMT-2025» з нагоди 30-річчя започаткування підготовки ОС «Бакалавр» за спеціальністю «Агроінженерія». 11 квітня 2025 року. МОН України. Житомирський агротехнічний фаховий коледж. Житомир. 2025. 333 с. https://doi.org/10.64165/proceeding-ptdstsamt.2025.

Рекомендовано до друку методичною радою Житомирського агротехнічного фахового коледжу МОН України (протокол від 10.04.2025 р. № 6)

Proceedings of the XI International Scientific and Practical Conference "Prospects and Trends in Development of Structures and Technical Service of Agricultural Machinery and Tools. PTDSTSAMT-2025." on occasion of the 30th anniversary of the initiation of the preparation of the Bachelor's Entity in the specialty "AgroEngineering". April 11, 2025. Ministry of Education and Science of Ukraine. Zhytomyr Agrotechnical Professional College. Zhytomyr. 2025. 333 p. https://doi.org/10.64165/proceeding-ptdstsamt.2025.

В збірнику представлені тези доповідей науково-педагогічних працівників, наукових співробітників, аспірантів та студентів Житомирського агротехнічного фахового коледжу, провідних вітчизняних і закордонних закладів вищої освіти та наукових установ, в яких розглядаються завершені етапи розробок.

The collection presents abstracts of reports by scientific and pedagogical workers, researchers, postgraduates and students of the Zhytomyr Agrotechnical Professional College, leading domestic and foreign higher educational institutions and scientific institutions, which consider the completed stages of development.