CREATION OF MODERN TECHNOLOGIES FOR STRENGTHENING THE WORKING SURFACE OF THE DETAILS OF THE BELT CONVEYOR ROLLER MECHANISM

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Annotation. This article discusses the development of modern technologies for strengthening the working surface of roller mechanism components of belt conveyors widely used in the mining industry. Friction processes occurring in sliding bearings with elastic elements and their influence on structural parameters are analyzed. The study substantiates the possibility of increasing wear resistance, resource efficiency, and creating lightweight structures with high strength. The proposed technological solutions ensure reliability and long-term operational efficiency of the conveyor system.

Keywords: belt conveyor, roller mechanism, belt element, sliding bearing, friction, design parameter, resource efficiency, wear, working surface, strength.

Annotatsiya. Ushbu maqolada tog‘-kon sanoatida keng qo‘llaniladigan tasmali konveyer rolik mexanizmi detallarining ishchi yuzasini mustahkamlash bo‘yicha zamonaviy texnologiyalarni yaratish masalalari ko‘rib chiqilgan. Rolikli mexanizm tarkibidagi qayishqoq elementli sirpanish podshipniklarda yuzaga keladigan ishqalanish jarayonlari va ularning konstruktiv parametrlariga ta’siri tahlil qilingan. Ishchi sirt mustahkamligini oshirish orqali yeyilishni kamaytirish, resurs tejamkor va yengil, mustahkamligi yuqori konstruksiyalarni shakllantirish imkoniyatlari asoslab berilgan. Taklif etilgan texnologik yechimlar konveyer tizimining ishonchliligi va uzoq muddatli ishlash samaradorligini ta’minlashga xizmat qiladi.

Tayanch so‘zlar: tasmali konveyer, rolikli mexanizm, qayishqoq element, sirpanish podshipnik, ishqalanish, konstruktiv parametr, resurs tejamkorlik, yeyilish, ishchi yuza, mustahkamlik.

Аннотация. В статье рассмотрены вопросы разработки современных технологий упрочнения рабочей поверхности деталей роликового механизма ленточного конвейера, широко применяемого в горнодобывающей промышленности. Проанализированы процессы трения в скользящих подшипниках с упругими элементами и их влияние на конструктивные параметры механизма. Обоснована возможность повышения износостойкости, ресурсосбережения и создания легких конструкций с высокой прочностью. Предложенные технологические решения направлены на обеспечение надежности и долговечности конвейерной системы.

Ключевые слова: ленточный конвейер, роликовый механизм, элемент ленты, подшипник скольжения, трение, параметры проектирования, ресурсоэффективность, износ, рабочая поверхность, прочность.

In our republic, a number of measures are being implemented to improve the design and construction of mining, mechanical engineering, textile and light industry machinery, to conduct in-depth theoretical and experimental research on the creation of new innovative generations of machines and mechanisms, in particular, to develop new generations of highly efficient and resource-saving mechanisms for technological machines.

In a belt conveyor, guide roller mechanisms are an important functional part that performs all the functions. Depending on their technical characteristics and location, they can act as an auxiliary or main assembly of the unit. However, due to constant loads, the service life of the rollers is limited and they are regularly repaired or replaced. In order to avoid defects during the repair of a belt conveyor, it is recommended to use only original parts.

The technical task of this implementation is to further reduce the requirements for the quality of the processed parts, increase the ease of replacement and increase the service life of the roller mechanism. In addition, the task of creating a composite roller support that can be used in a belt conveyor without significant changes, and the use of

parts that act as a sliding support made of plastic and elastic elements instead of a rolling bearing that provides rotational movement of the mechanism, is considered an important innovative innovation today.

When various units and mechanisms operate, the contacting surfaces of the parts move relative to each other, which results in friction. Since the forces arising during friction are opposite to the direction of motion, they are considered destructive forces. A certain amount of energy is spent to overcome these forces, which negatively affects the efficiency of the mechanism, and the wear of the surfaces and the service life of the mechanisms change depending on the nature of the friction.

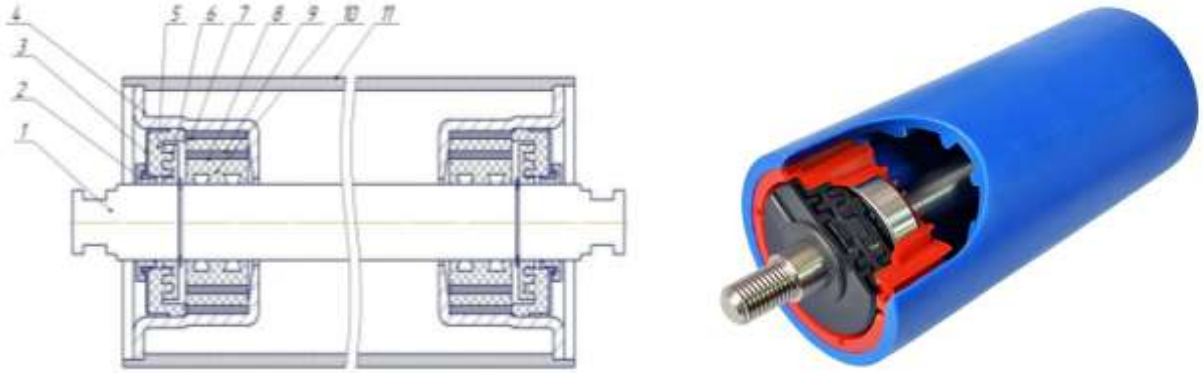

Figure 2. Roller support (Belt conveyor)

1 - shaft, 2 - labyrinth sleeve, 3 - cover, 4 - hub, 5 - labyrinth cover[1], 6 - labyrinth cover[2],
7 - ring[1], 8 - ring[2], 9 - belt element, 10 - sliding support (graphitocaprolon), 11 - shell

In the roller device shown in the figure above, instead of a rolling bearing, we use a sliding support (10) made of plastic (graphitocaprolon) material, which provides smooth rotational movement and acts as a support. We chose this material because graphitocaprolon (10) is hard, wear-resistant, and heat-resistant.

As we know, sliding bearings have a higher coefficient of friction (f = 0.0015 – 0.006) and a higher torque (5...10 times) than rolling bearings, so we make two

trapezoidal grooves along the circumference of the inner surface of the part made of graphite-caprolon that fits into the shaft. It goes without saying that this leads to a decrease in the coefficient of friction and torque of the part made several times [1-4].

The performance of our part when sliding relative to a shaft or axle is mainly determined by the wear pattern. That is, depending on the state of the fluid on the surface, the rubbing surfaces are separated from each other by a viscous oil layer. The most favorable condition for our part when sliding in the normal mode is friction in a liquid. When rubbing in a liquid, the surfaces are separated from each other by oil.

Two trapezoidal grooves are opened on the inner surface of the part acting as a sliding support for normal operation during sliding. A viscous liquid is applied to these trapezoidal grooves in a certain thickness. In this case, the thickness of the oil layer h – must be greater than the sum of the irregularities formed by the processing of the surfaces, that is, the following condition must be met $h > R_{z1} + R_{z2}$ [5, 6].

Based on the above, lubricants should generally have sufficient viscosity and viscosity index; be resistant to high temperatures and have anti-corrosion properties, and be able to be driven regardless of ambient temperature and conditions [7].

In this study, modern technologies for strengthening the working surface of belt conveyor roller mechanism parts used in the mining industry were developed and their effectiveness was substantiated. The friction processes occurring in the sliding bearings with a rubber element in the roller mechanism and the influence of design parameters on wear were analyzed. The possibilities of extending the service life and ensuring reliability of the parts by increasing the strength of the working surface were shown. The proposed technological solutions serve to create resource-saving, lightweight and high-strength structures. As a result, the operational efficiency of the conveyor system increases, ensuring uninterrupted and stable operation of the production process.

REFERENCES

[1]. Djuraev, A., Jumaev, A.S., Ibragimova, N.I., Turdaliyeva, M.Y. Analysis of the dynamics of a belt conveyor with composite guide rollers and elastic elements. Journal of Physics: Conference Series, 2023, 2573(1), 012026. https://api.scienceweb.uz/storage/publication_files/9737/26378/666ad94ba5c1b

[2]. Abduvaliev, U., Jumaev, A., Nurullaev, R., Ashirov, A., Abdurafikov, B. Influence of the Sectional Shape of the Grabbing Element of a Screw Composite Spindle on Agricultural Performance and Stability of Operation of a Cotton-Picking Machine. Lecture Notes in Networks and Systems, 2024, 1129. https://link.springer.com/chapter/10.1007/978-3-031-70670-7_25

[3]. A. Djuraev, B.N. Davidbaev, A.S. Jumaev. Improvement of the design of the belt conveyor and scientific basis for calculation of parameters. Global Book Publishing Services is an International Monograph & Textbook Publisher. Copyright 24 may 2022 by GBPS. 10.37547/gbps – 03. 1211 Polk St, Orlando, FL 32805, USA. – 151 p.

[4]. Djuraev, A., Jumaev, A.S., Abduraxmanova, M.M. Analysis of the results of physical and mechanical experimental studies of the modernized belt conveyor. Journal of Physics: Conference Series, 2023, 2573(1), 012012. https://iopscience.iop.org/article/10.1088/1742-6596/2573/1/012012

[5]. A. Djuraev, Sh. S. Khudaykulov, A. S. Jumaev. Development of the design and calculation of parameters of the saw cylinder with an elastic bearing support jin. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-5, January 2020. https://www.ijrte.org/portfolio-item/E6952018520/

[6]. Jumaev, A., Istablaev, F., Dustova, M. Development of the theory of calculation of constructive and rational parameters of belt conveyor roller mechanisms. AIP Conference Proceedings, 2022, 2467, 060025. https://api.scienceweb.uz/storage/publication_files/9737/26397/666af69e34968.

[7]. Abduvaliev, U., Jumaev, A., Nurullaev, R., Jakhonov, S., Investigation of the process of the influence of winding spindles with cotton fiber on the performance of a cotton picker. E3S Web of Conferences, 2024, 548, 04013. https://www.e3s-conferences.org/articles/e3sconf/abs/2024/78/e3sconf_agritech x_04013/e3sconf_agritech-x_04013.html.

[8]. Tilabov, B., Jumaev, A., Sherbutaev, J., Normurodov, U., Salimov, G. Testing of heat-treated surfaced samples and machine parts for hardness and wear resistance. E3S Web of Conferences, 2024, 548, 03014. https://www.e3s-conferences.org/articles/e3sconf/abs/2024/78/e3sconf_agritech-x_03014/e3sconf_agritech-x_03014.html

[9]. Jumayev A.S., Abduraxmanova M.M. Modernizatsiya qilingan tasmali konveyyer rolikli mexanizmlarining tajribaviy tadqiqot natijalari tahlili. Scientific Journal of Mechanics and Technology. ISSN 2181-158X, volume 6, Issue 1, 2025.

[10]. Djuraev, A. Jumaev. Providing the development of new designs for the design of the roller mechanism transmitting rotational motion in belt conveyors. International Journal of Emerging Trends in Engineering Research. ISSN 2347 – 3983. Volume 8. No. 9, September 2020.

[11]. A.S. Jumaev, A. Djuraev, M.M. Abduraxmanova. Analysis of the influence of the properties of oil products on the performance of belt conveyor guide roller mechanisms. Harvard Educational and Scientific Review International Agency for Development of Culture. Vol.2. Issue 2 Pages 44-52. 2020.

[12]. A.S. Jumaev, A. Djuraev, A.N. Pushanov. Development of models of recression of defatory states of components as a result of external loads of belt conveyor drums. Harvard Educational and Scientific Review International Agency for Development of Culture. Vol.2. Issue 2 Pages 36-43. 2020.

[13]. A.D. Djuraev, A.S. Jumaev. Study the influence of parameters of elastic coupling on the movement nature of support roller and rocker arm crank-beam mechanism. International Journal of Advanced Research in Science, Engineering and Technology Vol. 6, Issue 6, June 2019.

[14]. A.S. Jumayev. Tasmali konveyer rolikli mexanizmlarini resurstejamkor konstruksiyalarini ishlab chiqish va nazariy tahlil qilish. Scientific journal of mechanics and technology ISSN 2181-158X, volume 5, Issue 1, 2024.