DEVELOPMENT OF CONSTRUCTION PARAMETERS OF ROLLER MECHANISMS WITH BELT CONVEYOR STRUCTURES

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Annotation. This article presents the development of constructive parameters of roller mechanisms with elastic elements for belt conveyors. The interaction between rollers and elastic components and their influence on load distribution are analyzed. Optimal geometric and technical parameters are determined to improve the efficiency of the mechanism. The proposed design enhances the reliability and durability of conveyor systems. The obtained results are recommended for industrial application.

Keywords: conveyor, roller, mechanism, parameter, elasticity, load, structure, efficiency, stability, motion

Annotatsiya. Mazkur maqolada tasmali konveyer tarkibida qo‘llaniladigan qayishqoq elementli rolikli mexanizmlarning konstruktiv parametrlari ishlab chiqilgan. Tadqiqot davomida roliklarning elastik elementlar bilan o‘zaro ta’siri va yuk taqsimotiga ta’siri o‘rganildi. Mexanizmning samaradorligini oshirish maqsadida optimal geometrik va texnik parametrlar aniqlangan. Shuningdek, taklif etilgan konstruktsiya konveyer tizimlarining ishonchliligi va xizmat muddatini oshirishga xizmat qiladi. Olingan natijalar sanoat korxonalarida qo‘llash uchun tavsiya etiladi.

Tayanch so‘zlar: konveyer, rolik, mexanizm, parametr, elastiklik, yuklama, konstruktsiya, samaradorlik, barqarorlik, harakat

Аннотация. В данной статье разработаны конструктивные параметры роликовых механизмов с упругими элементами для ленточных конвейеров. В ходе исследования изучено взаимодействие роликов с упругими элементами и их влияние на распределение нагрузки. С целью повышения эффективности механизма определены оптимальные геометрические и технические параметры. Предложенная конструкция способствует повышению надежности и долговечности конвейерных систем. Полученные результаты рекомендуются для применения в промышленности.

Ключевые слова: конвейер, ролик, механизм, параметр, упругость, нагрузка, конструкция, эффективность, надежность, движение

Belt conveyors play an important role in mining enterprises and are an integral part of the production process. These devices are highly efficient in the continuous delivery of minerals from one point to another. With the help of belt conveyors, the transportation process is automated and human labor is significantly reduced. In modern industry, reliability and uninterrupted operation of conveyor systems are considered an important requirement. Therefore, improving their structural elements is one of the urgent issues. The main component of a belt conveyor is a roller mechanism that supports the movement of the belt. The correct operation of roller mechanisms directly affects the efficiency of the entire system.

Currently, much attention is paid to improving the design parameters of roller mechanisms to increase their efficiency. In particular, roller mechanisms with belt elements play an important role in evenly distributing loads. Such mechanisms have the property of reducing vibrations and absorbing dynamic loads. As a result, the service life of the conveyor system is extended and maintenance costs are reduced. At the same time, determining the optimal design parameters is of scientific and practical importance. This article considers the issues of developing the design parameters of roller mechanisms with belt elements as part of a belt conveyor. The results obtained allow for their effective use in industrial enterprises.

In belt conveyors, rollers mounted on rolling bearings quickly slip out of alignment due to high structural loads [1]. To reduce slippage or friction and absorb loads, a new roller support design is recommended, as shown in Fig. 1.

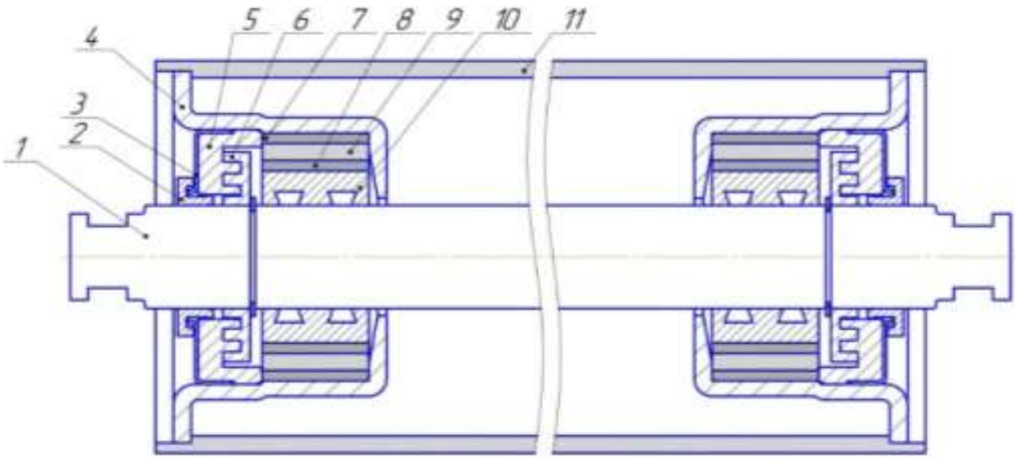

Figure 1. Roller mechanism (Belt conveyor)

1- shaft, 2- labyrinth bushing, 3- cover, 4- stop, 5- sealing labyrinth[1], 6- sealing labyrinth[2], 7- sleeve[1], 8- sleeve, 9- spring element, 10- sliding support (graphitocaprolon), 11- body

Here we see (Fig. 1), that to create new types of components from composite elastic elements that perform the role of a sliding support (1) in roller mechanisms, we must master the methods of structural, dynamic, and kinematic calculations. This requires studying the results of research related to the development of calculation methods, optimization of performance characteristics, synthesis and analysis of mechanisms, roller mechanisms from flexible composite and elastic elements, as well as the modeling and design of new machine and mechanism designs.

To prevent such situations, instead of rolling bearings, we use composite elastic elements and plastic materials (graphite-caprolon) to act as a sliding support relative to the axis. (Figure 1) Tables 1 and 2 provide the characteristics of graphite-caprolon, which is not recommended for roller bearings.

Table 1

Physical Properties of Graphite-caprolon

Name of the indicator	Kaprolon (Gubakha) graphite-caprolon rods	Caprolon (China) extrusion rods graphite caprolon	Caprolon (China) graphite-caprolon rods	Caprolon (Anion) graphite caprolon plates
Density, kg/m³	1170	1140	1150	1170
Operating temperature	from -40 to +100	from -40 to +95	from -40 to +95	from -40 to +100
Melting point, °C	+220	+220	+220	+220
Water absorption in 24 hours,%	7-10	9	7	7 - 10

The selected parameters for the material acting as a sliding support instead of a rolling bearing are listed in the table. The reason for studying these parameters is that this material transmits rotational motion about the axis in the roller mechanism. We know that rotational motion generates friction. After studying the physical properties of graphite capralon, we must examine mechanical properties such as tensile stress at break (MPa), elongation at break (%), coefficient of friction against steel, and Brinell hardness (Shore ball indentation) (MPa).

Table 2

Mechanical properties of graphite caprolon

Name of the indicator	**Caprolon (Gubakha) graphite-caprolon rods**	**Caprolon (China) extrusion rods graphite caprolon**	**Caprolon (China) graphite-caprolon rods**	**Caprolon (Anion) graphite caprolon plates**
Tensile strength at break, MPa	75	75	75	75
Relative elongation at break, %	5	6	6	5
Coefficient of friction on steel	0.22	0.45	0.45	0.22
Hardness, MPa according to Brinell (with ball indentation according to Shore)	79-80	85	88	80

The law of motion of transport units shows that in roller mechanisms without elastic elements (9) in the support part where rotational motion occurs, the oscillation amplitude reaches 0.46 rad, while with elastic elements with a unit coefficient of 1.2 102 Nm/rad, it reaches 0.41 rad. In this case, the unit coefficient of the sliding support (10) with a roller mechanism increases by 3.0 203 Nm/rad, and the rotation angle displacement by 0.16-0.21π.

Conclusions. Based on the analysis of belt and roller conveyor designs, an effective conveyor design with composite rollers with elastic shock absorbers has been developed, and the main characteristics have been substantiated.

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