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APPLICATION OF FLEXIBLE ELEMENTS TO INCREASE THE SERVICE LIFE OF BELT CONVEYOR ROLLER MECHANISM BEARINGS

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Annotatsiya: Ushbu maqolada tasmali konveyer rolikli mexanizmlarida podshipniklarning ishlash davriyligini oshirish masalalari ko‘rib chiqilgan. Tahlillar shuni ko‘rsatadiki, rolikli mexanizmlarda titrashni kamaytirish uchun turli qayishqoqlikka ega bo‘lgan ko‘p qavatli yostiqchalarni qo‘llash orqali samarali natijalarga erishish mumkin. Shuningdek, mashina poydevorini birlashtirish boltlarini tarkibli holatda loyihalash orqali titrash ta’sirining uzatilishini kamaytirish imkoniyati mavjud. Biroq, titrashni butunlay so‘ndirish muammosining ilmiy asoslari hozirgi kunda o‘z yechimlarini to‘liq topgani yo‘q. Mazkur muammoni hal etish uchun yangi ilmiy izlanishlar olib borilishi zarur. Tadqiqot natijalari tasmali konveyerlarning ishonchliligi va xizmat muddatini oshirishga xizmat qiladi.
Kalit so‘zlar: tasmali konveyer, rolikli mexanizm, podshipnik, qayishqoq element, titrash, ko‘p qavatli yostiqcha, poydevor boltlar, ishlash davriyligi, tebranishni kamaytirish, dinamika
Аннотация: В статье рассматриваются вопросы повышения долговечности подшипников роликового механизма ленточного конвейера. Показано, что снижение вибраций в роликовых механизмах ленточных конвейеров может быть достигнуто за счёт применения многослойных прокладок с различной упругостью. Также установлено, что использование составных крепёжных болтов при соединении машины с фундаментом позволяет уменьшить передачу вибрационного воздействия. Однако научные основы проблемы полного гашения вибраций до настоящего времени не нашли окончательного решения. Для устранения данной проблемы необходимо проведение новых научных исследований. Полученные результаты способствуют повышению надёжности и срока службы ленточных конвейеров.
Ключевые слова: ленточный конвейер, роликовый механизм, подшипник, упругий элемент, вибрация, многослойная прокладка, фундаментные болты, долговечность, снижение вибраций, динамика

Abstract: This paper addresses the issue of increasing the service life of bearings in the roller mechanism of a belt conveyor. It is shown that vibration reduction in belt conveyor roller mechanisms can be achieved by using multilayer pads with different elastic properties. In addition, the application of composite fastening bolts in the machine–foundation connection makes it possible to prevent the transmission of vibration effects. However, the scientific foundations of the problem of complete vibration suppression have not yet been fully resolved. Therefore, further scientific research is required to solve this problem. The results of the study contribute to improving the reliability and operational durability of belt conveyor systems.
Keywords: belt conveyor, roller mechanism, bearing, elastic element, vibration, multilayer pad, foundation bolts, service life, vibration reduction, dynamics

The comprehensive development of the mechanical engineering industry, mining, chemical industry and other sectors, increasing labor efficiency, and improving product quality depend on scientifically based techniques and technologies. To ensure the vibration resistance of parts, it is necessary to eliminate the causes that cause the resonance phenomenon. As is known, the resonance phenomenon occurs when the natural vibration frequency generated in the part itself and the vibration frequency caused by an external force become the same. Therefore, it is necessary to calculate these two frequencies and ensure that they are not equal to each other. To reduce vibration in machines, static and dynamic balancing, as well as the use of vibration dampers, i.e. special elastic elements, are recommended.

In belt conveyor roller mechanisms, vibration can be reduced by using multi-layer pads with different elasticity. It is also possible to eliminate the effect of vibration by making the bolts connecting the machine base composite. However, the scientific basis for the problem of completely eliminating vibration has not yet found its full solution. New scientific research is needed to solve this problem.

When the rotational speed of the shaft on which the bearing is installed is $P > 10$ min^{-1}, the dynamic load capacity S is calculated and the required bearing is selected from the table, i.e. the condition $S_x < S$ must be met. S_x is the calculated dynamic load capacity; S is taken from the table for each bearing (Figure 1) [1].

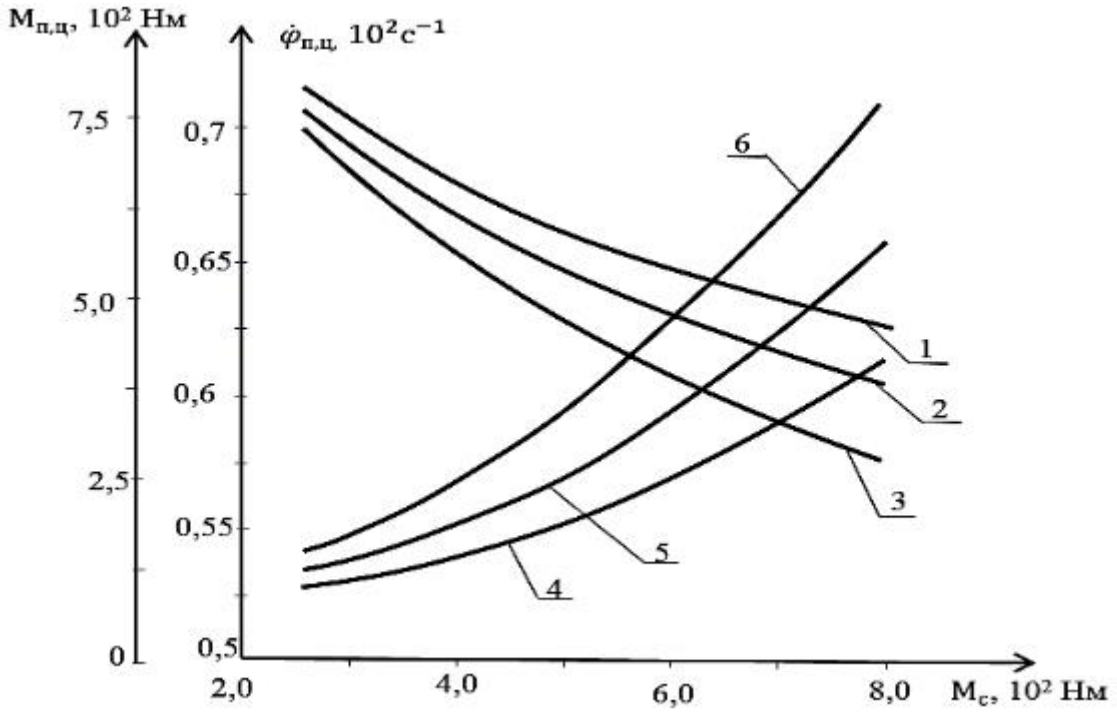
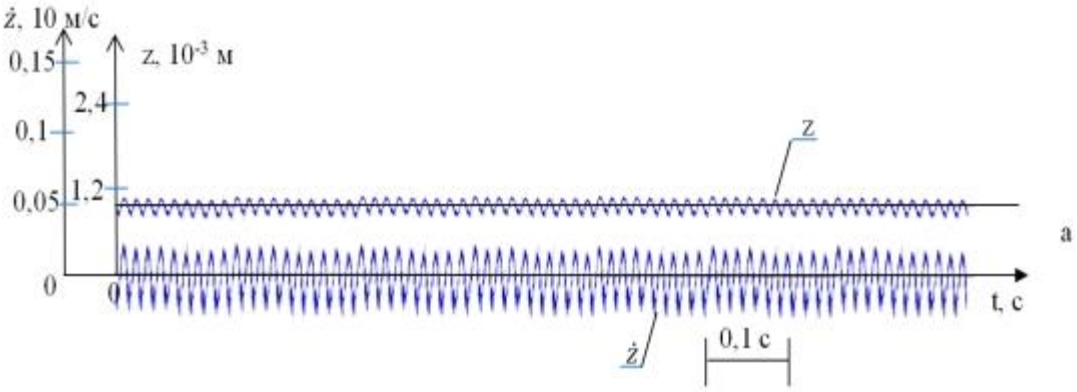
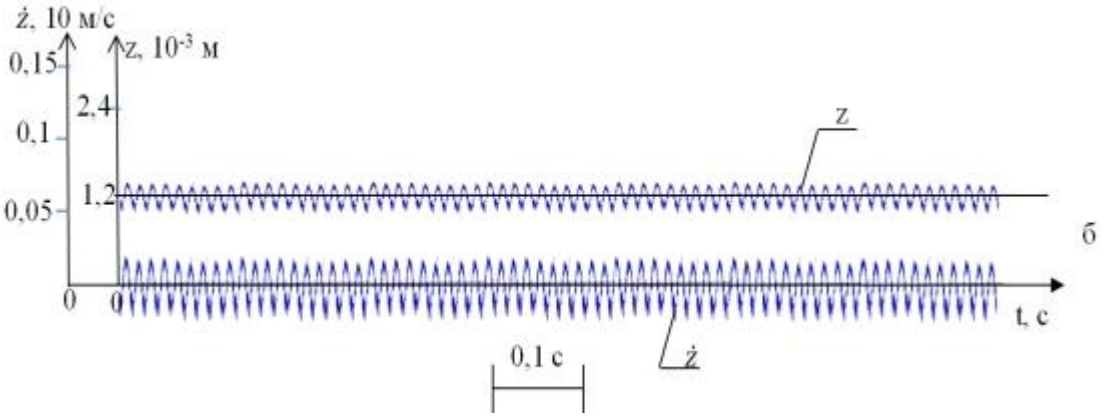


Figure 1. Graph of the angular velocity, torque change, and load on the mechanism of the belt conveyor roller mechanisms

As a result of vibration during operation of the belt conveyor, additional dynamic forces are created in the parts, which causes their fatigue and accelerates their failure (Figure 2).





where, for *a* – F_0 = 1,2 N ± (0,05 ÷ 0,12) N; for *b* – F_0 = 1,5 N ± (0,08÷0,15) N;

Figure 2. Patterns of variation of vertical vibrations of belt conveyor roller mechanisms

In order for the elastic deformation of the part during operation not to exceed the permissible value, its rigidity must be ensured to a sufficient extent. For example, a shaft rotating under the influence of a certain force and torque, despite its rigidity, may bend more than the permissible value. Bending the shaft beyond the permissible value causes premature failure of the parts mounted on it. Therefore, in addition to the rigidity of such parts, their rigidity must also be ensured. Excessive rigidity of some parts has a negative effect on their durability [2, 3].

The results of the study show that vibrations occurring in the roller mechanisms of belt conveyors directly affect the rapid wear of bearings and the reduction of their service life. By using multi-layer pads with different elasticity, part of the vibration energy is absorbed and the dynamic loads transmitted to the elements of the roller mechanism are reduced. This reduces contact stresses in the bearings, increasing their reliability and service life. Also, the correct selection of the mechanical properties of the belt elements is an important factor in ensuring the stable operation of the conveyor [4].

In addition, it has been found that the design of the bolts connecting the machine to the foundation in a composite (combined) position significantly reduces the transmission of vibration to the foundation and the environment. However, the conducted analyses show that the problem of completely damping vibration has not yet been scientifically fully solved. Therefore, it is necessary to develop new structural forms of flexible elements, to study their dynamic properties in depth, and to expand experimental and theoretical research. Future scientific research will serve to ensure the efficiency and long-term operation of belt conveyors.

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