VIBRATION ANALYSIS EVENT OF GUIDE ROLLER MECHANISMS FROM BELT CONVEYORS

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Annotation. This article analyzes the vibration phenomenon in guide roller mechanisms of belt conveyors used in mining industry enterprises. Particular attention is given to dynamic processes caused by loading during the transportation of gold ore. The vibration range and its impact on structural elements are studied through theoretical and experimental approaches. The effectiveness of roller mechanisms with elastic elements in reducing vibration effects is evaluated. The obtained results contribute to improving the reliability and operational performance of belt conveyor systems.

Keywords: loading, vibration range, transportation, gold ore, mining industry enterprises, belt conveyor, roller mechanism.

Annotatsiya. Mazkur maqolada tog‘-kon sanoati korxonalarida qo‘llaniladigan tasmali konveyerlarning yo‘naltiruvchi rolik mexanizmlarida yuzaga keladigan tebranish hodisasi tahlil qilinadi. Ayniqsa, oltin rudasi transportirovkasi jarayonida yuzaga keladigan yuklanish ta’sirida hosil bo‘ladigan dinamik jarayonlar o‘rganilgan. Tebranish qamrovi va uning mexanizm elementlariga ta’siri tajribaviy hamda nazariy jihatdan asoslab berilgan. Qayishqoq elementli rolikli mexanizmlarning tebranishni kamaytirishdagi samaradorligi baholangan. Olingan natijalar tasmali konveyer tizimlarining ishonchliligini oshirish va ekspluatatsion ko‘rsatkichlarini yaxshilashga xizmat qiladi.

Tayanch so‘zlar: yuklanish, tebranish qamrovi, transportirovka, oltin rudasi, tog‘-kon sanoati korxonalari, tasmali konveyer, rolikli mexanizm

Аннотация. В статье проведён анализ вибрационного явления в направляющих роликовых механизмах ленточных конвейеров, применяемых на предприятиях горнодобывающей промышленности. Особое внимание уделено динамическим процессам, возникающим под действием нагрузок при транспортировке золотой руды. Исследованы амплитуда и диапазон вибраций, а также их влияние на элементы механизма. Оценена эффективность роликовых механизмов с упругими элементами в снижении вибрационных воздействий. Полученные результаты направлены на повышение надёжности и долговечности ленточных конвейеров.

Ключевые слова: нагрузка, диапазон вибраций, транспортировка, золотая руда, горнодобывающие предприятия, ленточный конвейер, роликовые механизм.

Belt conveyors play a crucial role in ensuring continuous and efficient transportation of minerals, particularly gold ore, in mining industry enterprises. However, under operational loading conditions, various vibration phenomena occur in the guide roller mechanisms of belt conveyor systems. The vibration range leads to accelerated wear of mechanical elements, increased energy consumption, and reduced operational reliability. Especially roller mechanisms with elastic elements require detailed scientific analysis under dynamic loading conditions. Therefore, this study is aimed at investigating vibration processes in roller mechanisms of belt conveyors and developing effective methods for their reduction.

The mechanical vibration of the belt conveyor guide roller mechanisms is caused by the vibrational motion of the conveyor belt. It is recommended to consider the vibration phenomenon from low frequency to ultrasonic frequency. The disproportion of the eccentric rotating masses, incorrect adjustment of the working elements of the guide roller mechanism, including incorrect centering in the installation of the part acting as a sliding tank, causes frequent occurrence of low frequency oscillations (0 to 300 Hz). The occurrence of medium-frequency oscillations (from 200 to 2000 Hz) [1,

2] is observed as a result of the interaction of rotating and stationary elements of the sliding base, as well as due to the high vibrations that occur during the transport of loads.

The main reason for the low frequency vibration of the roller mechanism with a belt conveyor guide structure, including the vibration of the parts acting as a sliding base, is carried out by various vibration components. A detailed analysis of the low-frequency vibration spectrum of the guide roller mechanism revealed that it contained other components that differed in the quality of assembly of the working elements and the quality of installation of the sliding bearing parts, as well as the influence of various operating factors on the sliding bearing parts [3].

The vibration of the parts acting as a sliding base also depends on its overall size, due to periodic changes in the stiffness of the part, in particular, the roller mechanism with conveyor guide loads as little as possible only on the outer ring (obeychayka). The said rotational frequency of the parts acting as a sliding base causes vibration not only at low but also medium frequencies, including, first of all, the high frequency causes the vibration of the guide roller mechanism or the parts acting on the sliding base to vibrate at these frequencies. The medium-frequency periodic parts of the vibration of the guide roller mechanism often have dynamic properties, but they occur with a small symmetry with sharp edges, rather than with a long and smooth unevenness of the sliding surfaces. With lubrication products, the mechanism smooths the asymmetrical edges with low radial loading as a result of quality lubrication of the sliding parts, which leads to a decrease in the mid-frequency vibration of the detail acting as a sliding base. However, in the details acting as a loaded sliding base, the mid-frequency vibration may increase [4, 5]:

with:

- deterioration of oil properties;

- installation defects, which lead to an increase in static or rotating loads on the part, which acts as a sliding support;

- when the clearance of at least one of the components of the sliding base or their combinations of vibrations corresponds to at least one of the many resonances of the elements of the conveyor belt or the sliding base.

In addition to the harmonic components of the vibration of a part acting as a sliding base at medium frequencies, there are random components in the lubrication layer of the part acting as a sliding base that are determined by the hydrodynamic effect. These are both hydrodynamic friction, turbulence of the oil layer, and nonlinear effects. The spectral high level of a random pressure wave with an ideal oil layer occurs at frequencies where the wavelength in the oil is comparable to the size of the part acting as a sliding base, but this high value also depends on the rotor speed. In addition, it must be taken into account that the coefficient of rotation of the pressure wave depends on the vibration of the part acting as a sliding base. As a rule, in units operating at low rotational speeds, high random oscillations caused by hydrodynamic effects on sliding bearings reach 2–5 kHz, and at high speeds - 10–25 kHz. If there are high-quality resonances in the components of the sliding base and the components of the machine, the power can be much higher than in the periodic parts of the random vibration parts of the base. While there are high-quality resonances in the components that act as a sliding base and in the components of the machine, the parts that act as a sliding base can be much higher than the periodic parts of the random vibration parts [6].

The origin of the hydrodynamic vibration of the vibration contributes greatly to the high-frequency vibration of the parts that act as the sliding base. However, if the parts acting as a sliding base sometimes come out of the oil due to a certain crack during operation and the rotating body touches the fixed ring, an accidental vibration will occur as a result of the shock. Its high energy hydrodynamic origin is several times higher than

vibration. In the presence of asymmetries on the vibrating surfaces, the impact interaction of the vibrating surfaces has an effect on the oil leakage from the cracks. In this case, the high frequency of the vibration energy will be in the middle. As a rule, the vibration of the parts acting as a sliding base with various shocks during the exit of the oil from the crack means the vibration that occurs at a high energy frequency of 30-60 kHz [7, 8].

All of the above vibration direction cases occur in details that act as a sliding base. The analysis of vibration phenomena during the operation of belt conveyor roller mechanisms and the process of their occurrence are considered. Increased periodicity and durability of the mechanism as a result of proper centering in the installation of the parts of the guide roller mechanism, including the part that acts as a sliding base, leads to a positive change in the machine-mechanisms.

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