ANALYSIS OF VIBRATION PHENOMENA OF BELT CONVEYOR ROLLER MECHANISMS

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Annotation. The article analyzes vibration phenomena occurring during the operation of belt conveyor roller mechanisms and examines the process of their formation. It is demonstrated that proper centering of the roller mechanism components, including sliding bearings with a new resource-saving elastic support element, increases the operating periodicity and strength of the mechanism. Ensuring accurate installation and alignment leads to positive improvements in the efficiency of machines and mechanisms. The research results contribute to enhancing the reliability of roller mechanisms.

Keywords: belt conveyor, mechanism, roller, elastic, friction, sliding, base (support), ball, technology, analysis, energy.

Аннотация. В статье проведён анализ вибрационных явлений, возникающих в процессе работы роликовых механизмов ленточного конвейера, а также исследован механизм их возникновения. Показано, что правильное центрирование элементов роликового механизма, включая подшипники скольжения с новым ресурсосберегающим упругим опорным элементом, способствует повышению цикличности работы и прочности механизма. Обеспечение точности монтажа и правильной установки приводит к положительным изменениям эффективности машин и механизмов. Результаты исследования направлены на повышение надёжности роликовых механизмов.

Ключевые слова: ленточный конвейер, механизм, ролик, упругий, трение, скольжение, опора (основание), шар (шарик), технология, анализ, энергия.

Annotatsiya. Maqolada tasmali konveyer rolikli mexanizmlarining ishlash jarayonida yuzaga keladigan tebranish hodisalari hamda ularning paydo bo‘lish jarayoni tahlil qilingan. Rolik mexanizmi qismlarini, jumladan yangi resurstejamkor qayishqoq elementli tayanchi bo`lgan sirpanish podshipniklarini to‘g‘ri markazlash natijasida mexanizmning ish davriyligi va mustahkamligi ortishi ko‘rsatib berilgan. To‘g‘ri o‘rnatish va aniqlikni ta’minlash mashina va mexanizmlar samaradorligining ijobiy o‘zgarishiga olib keladi. Tadqiqot natijalari rolik mexanizmlarining ishonchliligini oshirishga xizmat qiladi.

Tayanch so‘zlar: tasmali konveyer, mexanizm, rolik, elastik, ishqalanish, sirpanish, asos (tayanch), shar (sharik), texnologiya, tahlil, energiya.

The mechanical vibration of the guide roller mechanisms of belt conveyors is caused by the oscillating motion of the conveyor belt. It is recommended to consider the vibration phenomenon from low frequency to ultrasonic frequency. Eccentricity is the disproportion of the rotating masses, the misalignment of the working elements of the guide roller mechanism, including incorrect centering in the installation of the part acting as a sliding tank, which causes the frequent occurrence of low-frequency oscillations (0 to 300 Gts).

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. In a detailed analysis of the spectrum of low-frequency vibrations of the roller mechanism with a guide structure, the quality of the assembly of the working elements in it and the quality of the installation of details acting as a sliding base, as well as the presence of other components that are distinguished by the effect of various operating factors on the details that perform the function of the sliding base [1,2].

The vibration of the part 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 the conveyor guide structure loads as much as possible only on a small area along the body, where the frequency of rotation varies along the outer ring (obeychayka). The said rotational frequency of the parts acting as a sliding base causes vibration not only at low but also at medium frequencies, including, first of all, the high frequency causes the vibration of the parts acting as a guide roller mechanism or sliding base in the vibration of these frequencies.

With lubrication products, the mechanism smooths the asymmetrical edges, with low radial loading as a result of quality lubrication of the sliding parts, which results in a decrease in the mid-frequency vibration of the part acting as the sliding base. However, in details that act as a loaded sliding base, medium-frequency vibration may increase [3,4].

In addition to the harmonic components of the vibration of the part, which acts as a sliding base at medium frequencies, the lubricating layer of the part acting as a sliding base contains random components 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 in which 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 rotation coefficient 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 and components of the machine that act as a sliding base, the random vibration of the part acting as the base in force can be much higher than that of the periodic parts. If there are high-quality resonances in the components and components of the machine that act as a sliding base, the details acting as a sliding base can be much higher than the periodic parts of the random vibrating parts [5,6].

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, random vibration occurs as a result of the shock. Its high energy hydrodynamic origin is several times higher than vibration.

In some cases, such as the effective coefficient of dry friction during vibration, to qualitatively and accurately estimate the effect of vibration on friction systems, the effective dry friction coefficient to be applied to disturb the relative stillness of a solid is defined as the ratio of the lower value of the gravitational force P_* to the normal reaction N [7,8]:

$$f_{эф} = \frac{P_*}{N} \tag{1}$$

In addition to the constant external gravitational force *P* on the body during vibration, the mobile inertial force on the mechanism is affected by:

$$\Phi(t) = -m\xi(t), \tag{2}$$

All of the above vibration direction cases occur in parts that act as a sliding base.

CONCLUSION

As a result of the study, the vibration phenomena occurring during the operation of belt conveyor roller mechanisms and their causes were analyzed. It was found that the correct centering of the roller mechanism elements, especially the resource-saving plain bearings with a rubber support, significantly increases the operational stability and strength of the mechanism. By ensuring the accuracy of installation, friction and overloads are reduced and energy efficiency is improved. Also, constructive and technologically correct solutions ensure long-term and reliable operation of the mechanisms. The results obtained are of great importance in improving roller mechanisms and increasing their operational performance.

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