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ANALYSIS OF RANDOM VERTICAL VIBRATION OF BEARING MOUNTS WITH STRAP ELEMENT OF BELT CONVEYOR ROLLER MECHANISMS

Akbarjon Jumaev
Almalyk branch of Tashkent State Technical University
named after Islam Karimov
(PhD), associate professor
Sherzodjon Raximboev
master
Jasurbek Madatov
student
akbarjon.jumaev@mail.ru

Abstract: The article presents ideas about the reliability and durability of belt conveyors in mining enterprises today, as well as the constantly increasing requirements for equipment. The recommended values are presented through graphs representing the influence of the change in the vibration amplitude of the belt conveyor roller mechanism on the bearing flange and the roller mechanism shell, as well as the dependence of the torque on the axis of the roller mechanism on the change in the performance of the belt conveyor. As a result, the analysis of scientific studies about the possibility of increasing the FIK compared to the traditional one has been presented.
Keywords. Conveyor, roller mechanism, belt element, deformation, loading, transportation, amplitude, vibration, technology.

Today, belt conveyors are one of the most convenient vehicles for continuous delivery of products in various sectors of the economy. In the field of mining, several sets of belt conveyors, which extend several meters in length, are used to transport minerals from deep quarries, as well as underground and surface mineral ores. One of the main factors that determine the reliability of the belt conveyor is determined by the precision and durability of its components. One of these important mechanisms is roller mechanisms, the share of work in the equipment is 30-35%.

The main structural elements of belt conveyors are a guide roller mechanism, a guide drum and a belt that surrounds them. Conveyor also includes other parts: belt compression and cleaning devices, handles, special roller mechanisms, automatic control and belt movement [1].

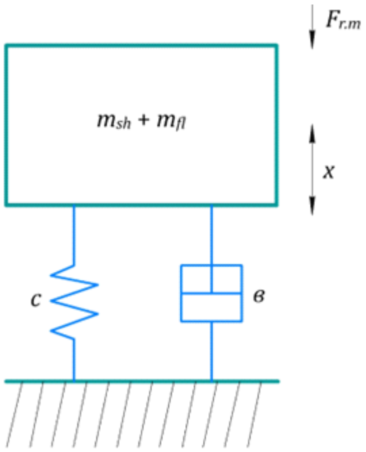
The cost of maintenance of the roller mechanism is 40%. The service life of the roller mechanism on the conveyor is 2-2.5 years, and the rollers working in the places where loading devices work are reduced to 1-3 months compared to those installed in other places. The reason is that due to the presence of external shocks, constant dust, and moisture in the mineral receiving areas, the periodicity of the roller mechanism decreases [2, 3].

When bearing supports with belt elements are used in the belt conveyor roller mechanism, as a result of the resulting deformation, the periodicity of the bearings increases. But in this case, vertical vibrations occur in the roller mechanism. Exceeding the vibration amplitudes in roller mechanisms can shorten the service life of the mechanism. We assume that during the continuous operation of the roller mechanism, the loads falling on its belt element supports are the same, so the vibrations in it are in the vertical direction. We use the Lagrange-II order equation to create a mathematical model of vertical oscillations of roller mechanisms with a belt element bearing support [4-6].

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{q}}\right)-\frac{\partial T}{\partial q}+\frac{\partial \Pi}{\partial q}+\frac{\partial \Phi}{\partial \dot{q}}=Q(q)$$

here, q, $\dot{q}$ are the generalized coordinate and its time derivative; T, Π - kinetic and potential energies of the vibration system; Φ - dissipative function; $Q(q)$ is the generalized force depending on the generalized coordinate [7-9].

Figure 1 shows the calculation scheme characterizing the vibration of the mechanism, taking into account the generalized coordinate axis (x) of the potential and kinetic energy during the vertical vibration of the belt conveyor roller mechanism [7, 8].



where $F_{r.m}$ – is the impact force of raw materials; direction of vibration; m_{sh} – bearing shell mass; m_{fl} – the mass of the outer metal flange; c, $в$ are coefficients of elasticity and dissipation of rubber bushing.

Figure 1. Calculation scheme representing the vibration of the shell and flange of the recommended belt conveyor roller mechanism

$$\Pi=\frac{1}{2}c_n z^2,\quad c_n=c_1+kc_2, T=\frac{1}{2}m_{r.m}\dot{z}^2 \qquad (2)$$

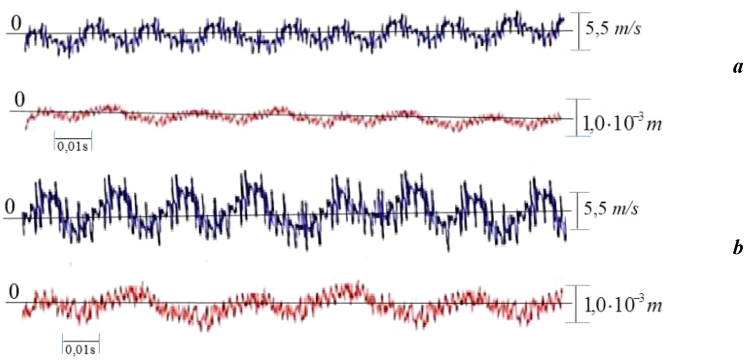
where, c_n – is the stiffness coefficient of the strap element support, c_1 – is the linear component of the stiffness coefficient, kc_2 – is the non-linear component of the stiffness coefficient, $m_{r.m}$ – is the weight of the raw material.

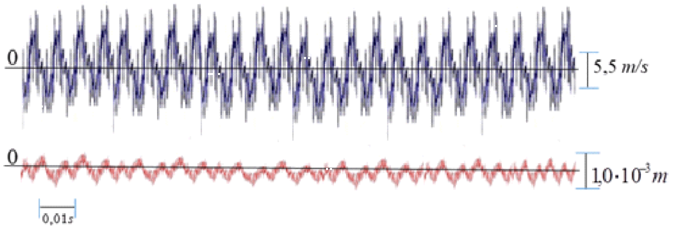
This formula gives the dissipative function of the vibration system [9-11]:

$$\Phi=\frac{1}{2}b_n\dot{z}^2 \qquad (3)$$

where, b_n – is the dissipation coefficient of the belt-element bearing support of the pulley mechanism.

Figure 2 shows the diagrams of changes in the vertical vibrations of the bearing support of the roller mechanism with a belt element at different values.





a – ΔF_0 = 1.2 *N* ± (0.05 ÷ 0.12) *N*; *b* – F_0 = 1,5 *N* ± (0.08 ÷ 0.15) *N*;
c – ΔF_0 = 1.8 *N* ± (0.1 ÷ 0.18) *N*.

Figure 2. Diagrams of changes in vertical vibrations of the roller mechanism bearing support with a belt element at different values

The analysis shows that the vibration amplitude increases with the increase of loading during raw material transportation (Fig. 2, *a*, *b*, *c*). In addition, the greater the external load, the greater the static movement of the roller mechanism. During this movement, with a load of 1.4 *N* ± (0.06 ÷ 0.14) *N* by $1.2\cdot10^{-3}$ *m*, with a load of 1.6 *N* ± (0.12 ÷ 0.16) *N* by a load of 1, It reaches $5\cdot10^{-3}$ *m* [12-14]. Based on the laws of processing the vertical vibrations of the roller mechanism, the dependence of the above graphs was considered and constructed.

Figure 3 presents graphs of the dependence of the change in the amplitude of the vibrations of the roller mechanism on the rotational force. From the analysis of these graphs, it can be seen that the vibration amplitude of the roller mechanism increases from $0.3\cdot10^{-4}$ *m* to $0.254\cdot10^{-4}$ *m* when the load of $4.5\cdot10^{-2}$ *kg* is reduced from 0.24 *N* to 1.6 *N*. By reducing the mass of the shell and flange of the roller mechanism to $3.55\cdot10^{2}$ *kg*, the amplitude of movement of the roller mechanism increases from $0.4\cdot10^{-4}$ *m* to $0.72\cdot10^{-3}$ *m*. The vibration amplitude of the roller mechanism does not exceed $0.3\cdot10^{-3}$ *m*. It is considered appropriate to choose $m_r \leq (3.74 \div 4.24)\ 10^2$ *kg* and $F_0 \leq (1.0 \div 1.2)$ *N*.

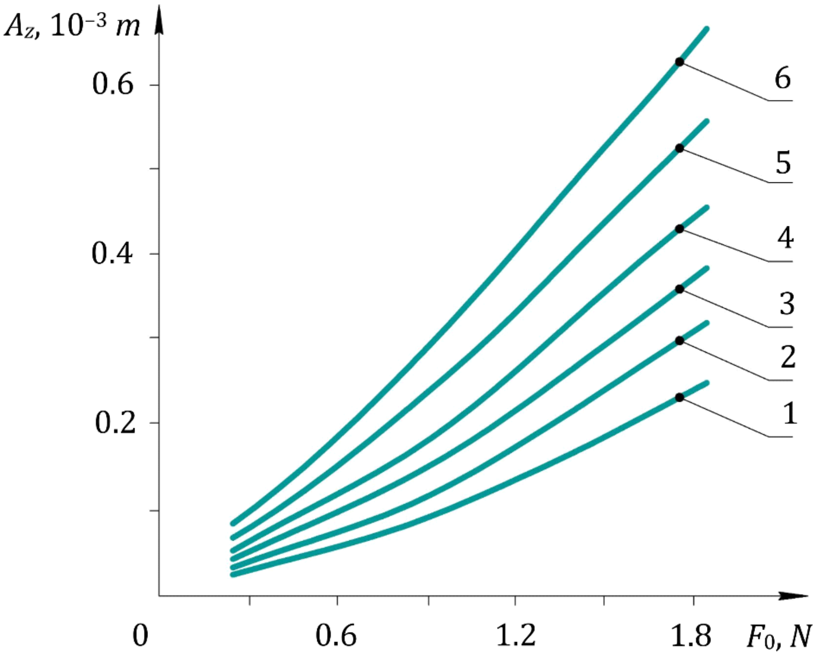


Figure 3. Graphs of the dependence of the change in the amplitude of the vibrations of the roller mechanism on the rotational force

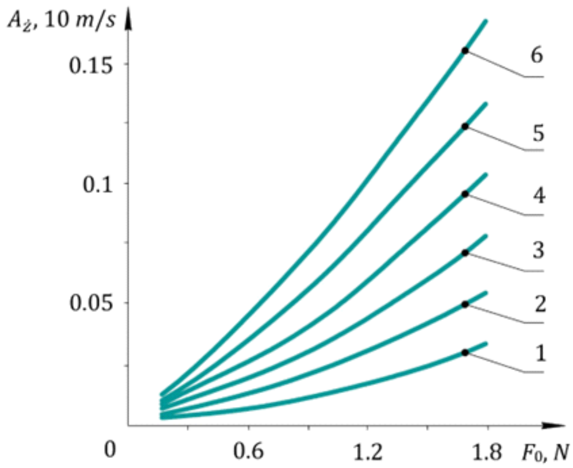


Figure 4. Graphs of the dependence of the change in the amplitude of vibrations at the speed of the belt conveyor roller mechanism on the change in the falling loads

It is important to determine the amplitude of the speed fluctuations of the belt conveyor roller mechanism. Fig. 4 shows the graphs of the dependence of the change of the amplitude of vibrations at the speed of the roller mechanism on the change of the falling loads. Analysis of graphs shows that an increase in F_0 from 0.24 N to 1.6 N at $m_r = 3.74 \cdot 10^2$ kg can increase the amplitude of speed fluctuations of the roller mechanism up to 2.4 m/s. Taking into account the results of experimental studies, $m_r \leq (3.74 \div 4.26)\ 10^2$ kg and $F_0 \leq (1.2 \div 1.4)$ N values are recommended to ensure (0.09 ÷ 0.12) m/s [15].

Summary. The analysis of vertical vibrations of the roller mechanism with belt conveyor belt element bearing support, taking into account the technological loads applied to it, was considered. Graphs of the dependence of the vibration amplitude of the roller mechanism on the change of the force coming from the transported raw material were obtained and recommended values were developed.

References:

1.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. ISBN 978-1-957653-03-7 1211 Polk St, Orlando, FL 32805, USA. 151 p.

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

3.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. Volume 8. No. 9, September 2020.

4.A. Jumaev, F. Istablaev, M. Dustova. Development of the theory of calculation of constructive and rational parameters of belt conveyor roller mechanisms // Cite as: AIP Conference Proceedings 2467, 060025 (2022).https://pubs.aip.org/aip/acp/article-abstract/2467/1/060025/2826524

5.A. Djuraev, A.S. Jumaev, N.I. Ibragimova, M.Y. Turdaliyeva. Analysis of the dynamics of a belt conveyor with composite guide rollers and elastic elements // Journal of

Physics: Conference Series 2573 (2023) 012026. https://iopscience.iop.org/article/10.1088/1742-6596/2573/1/012026

6.A.S. Jumaev, A.A. Ashirov, M.M. Abduraxmanova. Analysis of relationships of angular velocities of belt conveyor drums of driver load on technological resistance and friction force of resistance moment. Journal of Advanced Scientific Research (ISSN: 0976-9595) Vol.5. Issue 1 page 78. https://scholar.google.com/

7.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. ISSN: 2277-3878, Volume-8 Issue-5, January 2020.

8.J.Kh. Beknazarov, A.S. Jumaev, N.N. Juraev. Theoretical principles of calculating parameters and amplitude of vibration of belt conveyor roller mechanisms of strap element bearing supports. Journal of Advanced Scientific Research (ISSN: 0976-9595)

9.N.N. Juraev, A.S. Jumaev, J.Kh. Beknazarov. Determination of torque and vibration amplitude of roller mechanisms with bearing support with belt conveyor. Q1 technology news and reviews. Volume 1, No. 1, February 2024.

10.A.S. Jumaev, A.A. Ashirov, N.I. Ibragimova. Analysis of angular velocities of belt conveyor drums and conveyor load change dependence on technological resistance. Q1 technology news and reviews Volume 1, No. 1, February 2024.

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. Har. Edu.a.sci.rev. 0362-8027 Vol.2. Issue 2 Pages 44-52. 10.5281/zenodo.7181271.

12.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.

13.A.S. Jumaev, M.Y. Turdaliyeva, N.I. Ibragimova. Dynamic analysis of machine assembly of belt conveyor with roller mechanisms with composite belt elements. British View ISSN 2041-3963 Volume 7 Issue 3 2022 DOI 10.5281/zenodo.7139012 Universal impact factor 8.528 SJIF 2022: 4.629.

14.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. Har. Edu.a.sci.rev. 0362-8027 Vol.2. Issue 2 Pages 36-43. 10.5281/zenodo.7170607.

15.A.S. Jumaev, N.I. Ibragimova, M.Y. Turdaliyeva. Analysis of vertical and flushing vibration of belt element bearings of belt conveyor roller mechanisms.Academic leadership. ISSN 1533-7812 Vol: 21 Issue 3 http://academicleadership.org/ DOI 10.5281/zenodo.7138635.