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DETERMINATION OF THE DEPENDENCE OF THE RANGE OF THE ANGULAR VELOCITIES OF THE BELT CONVEYOR ROLLER MECHANISMS ON THE ROTARY MOMENT OF INERTIA

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Abstract. The article presents opinions on the modern condition and economic indicators of belt conveyors in mining, agriculture and light industry enterprises today. The recommended values of the angular speed of the roller mechanisms with the bearing support of the belt conveyor belt element, the vibration coverage, the technological resistance and the dependence of the angular speed on the increase of various loads have been presented.

Keywords. Conveyor, roller mechanism, belt element, deformation, loading, transportation, amplitude, vibration, technology.

Introduction.

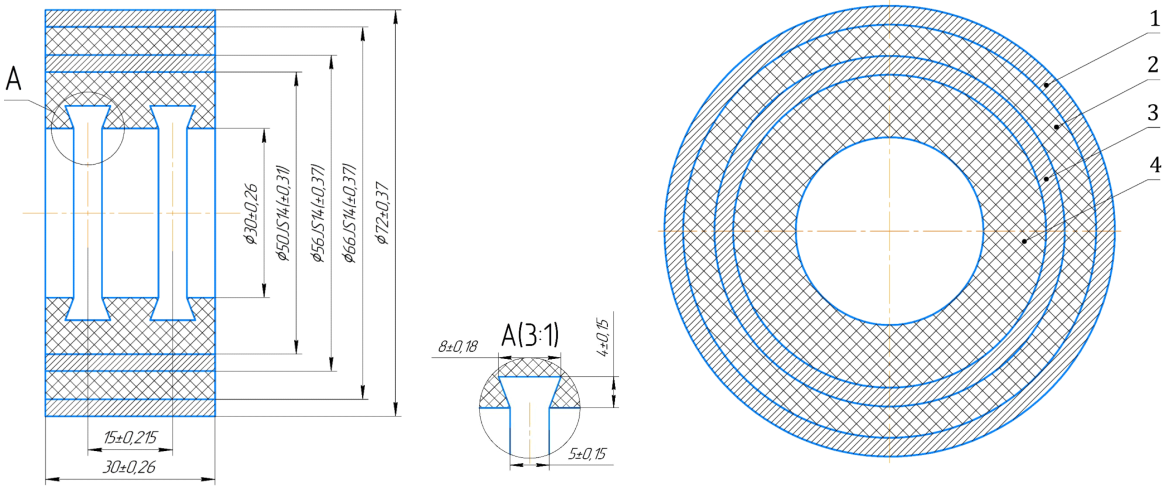
In the conditions of our republic and the world economy, the demand for mechanical engineering, the design of new constructions of high-quality, reliable, competitive and resource-saving machines and mechanisms and their widespread introduction into production remain one of the important tasks. In this regard, the contribution of mining industry enterprises is very large among numerous enterprises. Today, technical updates and modern modernization are carried out at a high level in all branches of mining, agriculture and light industrial enterprises. In particular, a large number of scientific researches are being conducted on the development and improvement of efficient, energy-saving constructions of technological machines and equipment at mining enterprises.

The need for transportation means for continuous supply of minerals in mining enterprises remains very necessary. Then, one of the means of transport is belt conveyors, which are machines that transport mineral resources mainly over a short, sometimes long, distance continuously and at the same rate. Currently, belt conveyors driven by electric drives are widespread, and the main working bodies of these conveyors are electric motor, reducer, drum, belt and roller mechanisms. As a result of high loading,

external shocks, excess dust level and humidity exceeding the norm (96%), the components of the belt conveyor are damaged prematurely. This leads to a decrease in the economic efficiency of mining enterprises [1, 2].

Materials and methods.

In the existing belt conveyor, three rows of guide roller mechanisms installed at a certain angle (20?-40?) to each other are located in the range of 500-600 mm. Roller mechanisms carry out belt tension and rolling bearings. As mentioned above, due to high loads and external shocks, these rolling bearings fail very quickly. In order to eliminate this shortcoming, it is recommended to use rolling bearings with a cushioning belt element support of a new construction (Fig. 1) [3, 4].



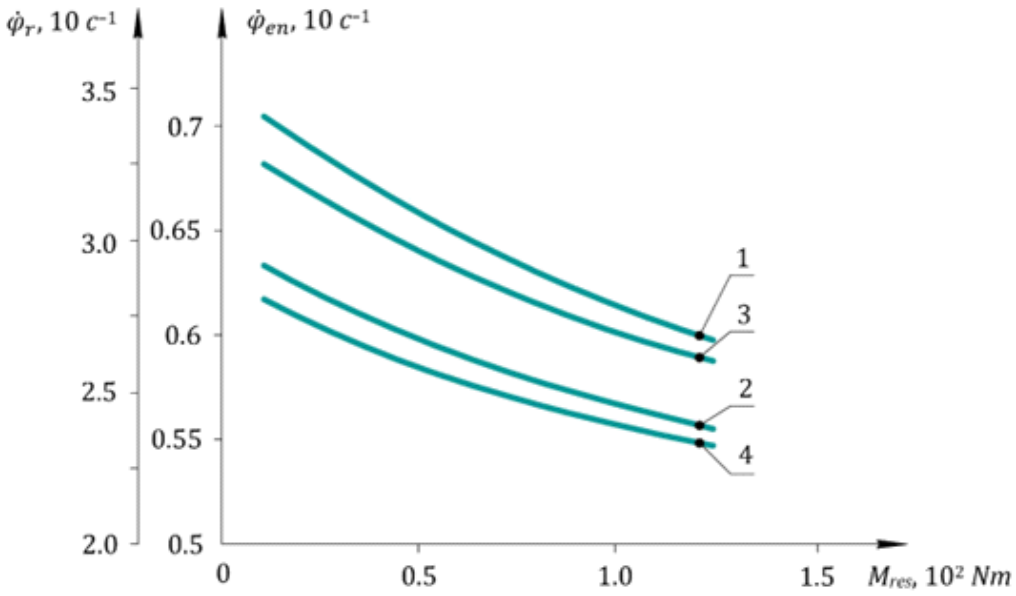
1- outer ring, 2- belt element (7IRP13-48), 3- inner ring, 4-Plastic (graphitocaprolone)

Figure 1. Design of a sliding bearing with a component belt element [5, 6]

The following preliminary data are provided for the calculations: to determine the change in the angular velocities of the electric motor as a result of increasing the loads of the belt conveyor roller mechanism shell and outer flange, and to base the values of the moment of inertia, it is necessary to study the dynamics of the machine unit and analyze it theoretically [7, 8].

Results.

For this purpose, graphic dependences of belt conveyor parameters were created. Fig. 2 shows graphs of the dependence of angular velocities of the rotor and roller mechanism of the electric motor as a result of exceeding the loads coming from the transported mineral.

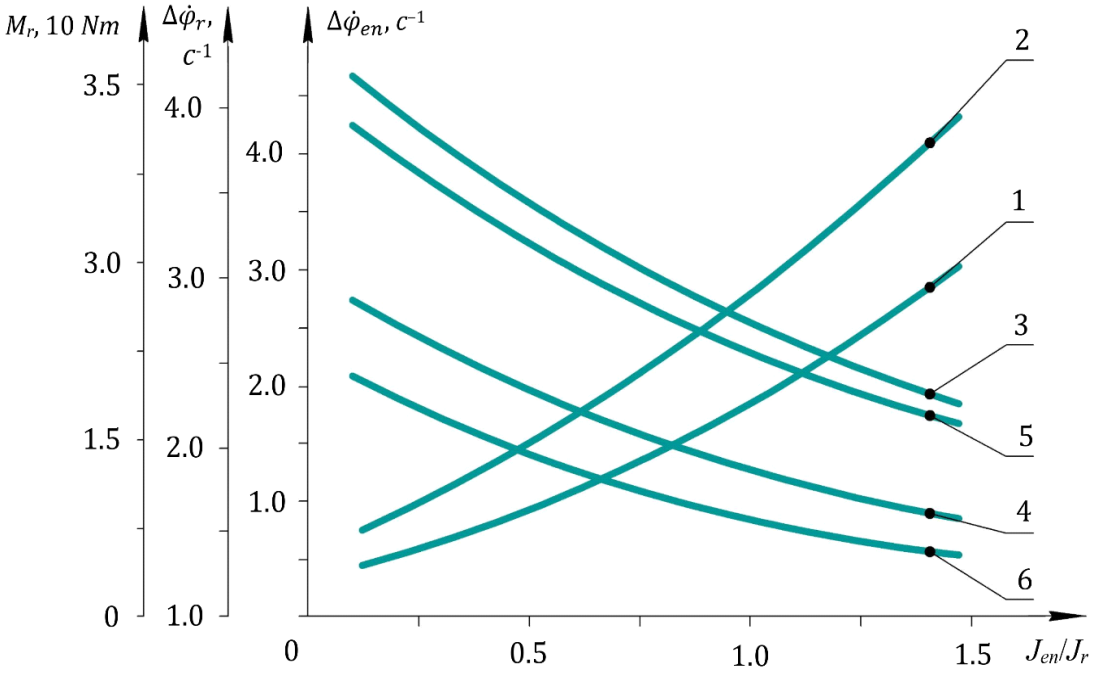


1, 3 – $\dot{\varphi}_r = f(M_{res})$; 2, 4 – $\dot{\varphi}_r = f(M_{res})$; 1, 2 – $J_{en}/J_r = 0.84$; 3, 4 – $J_{en}/J_r = 1.16$; $M_{res} = 34.0$ *Nm*; $\delta\dot{\varphi}_r \leq (4.0 \div 6.0)$ %;

Figure 2. Graphs of dependence of angular velocities of belt conveyor electric drive and roller mechanism on technological resistance

Dependencies are non-linear. With the increase of the resistance torque to 124 *Nm* and the friction force to 34.0 *Nm*, the electric drive rotor and the gear output shaft, respectively, reduce the electric drive angular velocity to 64.2 c^{-1} at $J_{en}/J_r = 0.84$. When J_{en}/J_r increases to 1.16, the angular velocity decreases to 61.1 c^{-1} [9-11].

In Fig. 3, corresponding graphs were constructed to justify the moments of inertia of the rotor of the electric drive and the output shaft of the reducer. It can be seen that the increase of J_{en}/J_r from 0.25 to 1.5 leads to an increase in the load on the driver [12, 13]. In this case, the torque on the drive shaft increases from M_{en} = 48.0 *Nm* to 21.0 *Nm*, and when the load resistance torque increases to 82.0 *Nm*, the torque on the drive shaft increases to 43.6 *Nm*. In this case, the angular speed of the roller mechanism increases to the range of vibration (1.6 ÷ 1.8) c^{-1}, which affects the uniform movement of transported minerals over the belt. According to the results of experimental studies, the recommended values for providing $\Delta\dot{\varphi}_r$ = (1.2 ÷ 1.4) c^{-1} are J_{en}/J_r (0.4 ÷ 0.6).



1, 3 – $M_{en} = f(J_{en}/J_r)$; 3, 5 – $\Delta\dot{\varphi}_{en} = f(J_{en}/J_r)$; 4, 6 – $\Delta\dot{\varphi}_r = f(J_{en}/J_r)$;
1, 5, 6 – M_r = 47.0 *Nm* da 2, 3, 4 – M_r = 82.0 *Nm*.

Figure 3. Connection graphs for the basis of moments of inertia of the rotor of the electric drive and the output shaft of the reducer

The analysis of the received graphs shows that the load on the roller mechanism increases from 82.1 *Nm* to 120.3 *Nm* at M_{en} = 55 *Nm* and M_r = 35 *Nm*. As a result, with the increase of technological load, the moment on the axis of the roller mechanism increases to (1.2 ÷ 1.4) *Nm*. Of course, this is not possible, so the recommended values should be in the range of (0.8 ÷ 1.0).

Summary. Exceeding the range of vibrations in the belt conveyor roller mechanism had a great effect on the smooth movement of the mineral being transported. For this, the moment of inertia J_{en}/J_r (0.4 ÷ 0.6) should not exceed the recommended values. In addition, it is important that the loads do not exceed.

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. 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

3.A.S. Jumaev, A.A. Ashirov, G.I. Salimov. Analysis of the laws of changes of the angular velocities of belt conveyor drums and the torque of the drive shaft at different technological resistance values. British View ISSN 2041-3963 Volume 9 Issue 1 2024.

4.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

5.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.

6.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

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 (IJRTE) ISSN: 2277-3878, Volume-8 Issue-5, January 2020.

8.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.

9.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)

10.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.

11.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.

12.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.

13.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.

14.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.

15.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.