ISSN : 2046-8423

Indexed by:
ROAD zenodo Universal Impact Factor SJIF

Q1 TECHNOLOGY NEWS AND REVIEWS

Publisher:
Millbank, London, SW1P 4RG

Medium:
Online

Country:
United Kingdom

Q1 technology news and reviews

Volume 1, No. 1, February 2024

Requirements for the authors.The manuscript authors must provide reliable results of the work done, as well asanobjective judgment on the significance of the study. The data underlying the workshouldbe presented accurately, without errors. The work should contain enough detailsandbibliographic references for possible reproduction. False or knowingly erroneousstatementsare perceived as unethical behavior and unacceptable.Authors should make sure that the original work is submitted and, if other authors'worksor claims are used, provide appropriate bibliographic references or citations. Plagiarismcanexist in many forms - from representing someone else's work as copyright to copyingorparaphrasing significant parts of another's work without attribution, as well as claimingone'srights to the results of another's research. Plagiarism in all forms constitutes unethicalactsand is unacceptable. Responsibility for plagiarism is entirely on the shoulders of theauthors.Significant errors in published works. If the author detects significant errors orinaccuraciesin the publication, the author must inform the editor of the journal or thepublisher aboutthis and interact with them in order to remove the publication as soon aspossible or correcterrors. If the editor or publisher has received information from a thirdparty that thepublication contains significant errors, the author must withdraw the work orcorrect theerrors as soon as possible

Internet address: https://ejournals.id/index.php/QTNR/index
E-mail: info@ejournals.id
Published by Millbank Lomdon SW1P
Issued Bimonthly

DETERMINATION OF TORQUE AND VIBRATION AMPLITUDE OF ROLLER MECHANISMS WITH BEARING SUPPORT WITH BELT CONVEYOR

Juraev Nodirbek Normuradovich
Navoi State University of Mining and Technology
Doctor of Philosophy in Technical Sciences (PhD)
Nodirjura@mail.ru
Jumaev Akbarjon Sayfullaevich
Almalyk branch of Tashkent State Technical University named after Islam Karimov
Doctor of Philosophy in Technical Sciences (PhD), Associate Professor
akbarjon.jumaev@mail.ru
Beknazarov Jasur Kholmamatovich
Navoi State University of Mining and Technology
Doctor of Philosophy in Technical Sciences (PhD), Associate Professor
j-beknazarov@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 belt conveyor performance. As a result, the analysis of scientific studies about the possibility of increasing the UWK compared to the traditional one has been presented.

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

Introduction

Today, large-scale scientific and research work is being carried out to improve resource-saving techniques and technologies of mining enterprises and to create their improved constructions. In this regard, including increasing the efficiency and productivity of belt conveyors, which are considered the main transport vehicles of mining enterprises, equipping their components with resource-efficient structures, increasing their durability, improving the operational reliability of the equipment, ensuring the process, developing and optimizing mathematical models. transportation of minerals using these methods is gaining importance. At the same time, it is important to develop the construction of roller mechanisms with a bearing support of a resource-efficient belt conveyor of a new design, justify its parameters, and reduce energy consumption.

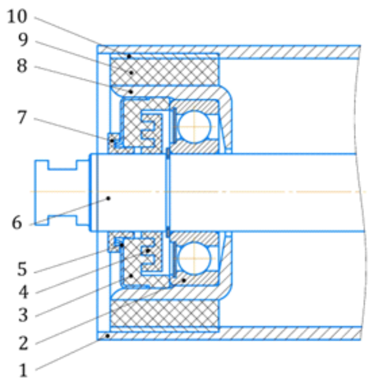
Literature review

In a series of experimental and theoretical researches, it is aimed to calculate the dynamic loads on the belt conveyor belts that work at high loads in mining enterprises, i.e., transporting large lumps, as a result, two approaches to eliminate the causes of dynamic loads have been formed. In the first approach, external shocks are considered as the main mechanism of impact of large load parts on the rollers due to the fact that the direction of the particle velocity vector and the tangent do not coincide with the roller surface at the point where the load vector is laid on the guide roller mechanisms

[1].
In addition to vibration contact repair of bearings installed in belt conveyor roller mechanisms, abrasive and friction repair types are also characteristic. This type of surface wear is predominant for the bearing supports of roller mechanisms. These types of wear determine the technical source of the bearings. The cause of this phenomenon is considered to be low-quality production of protective covers and sealing elements of the roller mechanism. However, belt conveyor roller mechanisms are such a mass product that perhaps the cost savings on protective cover elements justify themselves, so a type of wear not typical of bearings should be considered [2].
One of the popular studies in the field of determining the resistance to rotation of belt conveyor roller mechanisms is to determine the type of rotation resistance of roller mechanisms; to the quality and quantity of lubricants; to the rotation speed of the rollers; to the radial load on the roller; it was determined that it depends on the air temperature. After increasing the temperature of the bearing parts of the roller mechanisms, it was found that the power consumption and resistance to movement decreased. To take into account the effect of ambient temperature, an average value coefficient was proposed, the value of which depends on the type of lubrication and rotation speed [3].

Discussion

Based on the study of the structural parameters of the belt conveyor roller mechanisms, the construction schemes of the belt-supported roller mechanisms were developed (Fig. 1).



1-shell, 2-bearing, 3, 4, 7-labyrinth cover, 5-protective washer, 6-axle, 8-bearing shell, 9-belt element bushing, 10-outer ring

Figure 1. Construction of roller mechanism with elastic element bearing support (Belt conveyor)

During the technological process, roller mechanisms are affected by the following forces: driving torque, gravity, inertia of unbalanced masses, frictional forces, technological pressures, etc. The forces forming the resultant force are directed radially and axially. These forces affect the bearing 2 through the bearing 2 and belt bushings 9 and 10 [4, 5, 6].
In this case, the presence of 9 belt bushings significantly reduces the effect of these forces on the bearing 2. In addition, due to the radial component of forces, the bending of axis 9 is significantly reduced. 9- the outer and inner rings of the belt bushing are made in the form of cones with the diameters of the bases d and d cut, which allows to extend the impact forces along the axis. The use of supports with belt elements of the axles reduces the effect of vibrations on the housings of the roller mechanism due to the vibration of the rotating axle. Therefore, the vibration characteristics of these roller mechanisms are significantly reduced.

Loads of roller mechanisms with a bearing support with a recommended belt element mainly depend on the laws of change of the mass of raw materials transported on the conveyor belt. It should be noted that the mass of raw materials transported on a belt conveyor has random patterns in time [7, 8, 9]:

$$m_{rm} = m_1 + m_0 \sin \omega t \pm \delta m_0$$

where m_1 – is the average mass of transported raw materials; m_0 – is the amplitude of raw material mass change values; ω – is the mass change frequency; δm_0 – is a random generator.

The change in the mass of the raw material affects the bearing flange and main part support bushing. In this case, its friction force also changes, leading to feeding. In this case, it is important that the main rubber bushing-shock absorber with a strap element located between the outer flange of the composite bearing and the inner metal bushings is sufficiently absorbed from the loads. Therefore, the analysis of the vibrations of the bearing shell and the outer flange attached to it under the influence of external loading, and the justification of the parameters of the rubber bushing to reduce them are considered to be one of the main issues [10, 11].

Results

It can be seen from the resulting connection graphs in Figure 2 that when the load increases from 0.26 N to 1.9 N and the mass of the bearing shell is $0.3 \cdot 10^2$ kg, the vibration amplitude of the roller mechanism is increases from $0.4 \cdot 10^{-3}$ m to $0.250 \cdot 10^{-3}$ m. If the mass of the bearing shell decreases to $0.275 \cdot 10^2$ kg, the displacement amplitude of the roller mechanism reaches from $0.5 \cdot 10^{-3}$ m to $0.74 \cdot 10^{-3}$ m. Therefore, to ensure that the vibration amplitude of the roller mechanism does not exceed $0.4 \cdot 10^{-3}$ m, it is advisable to make $m_s \leq (0.275 \div 0.325) \cdot 10^2$ kg and $F_0 \leq (1.02 \div 1.25)$ N.

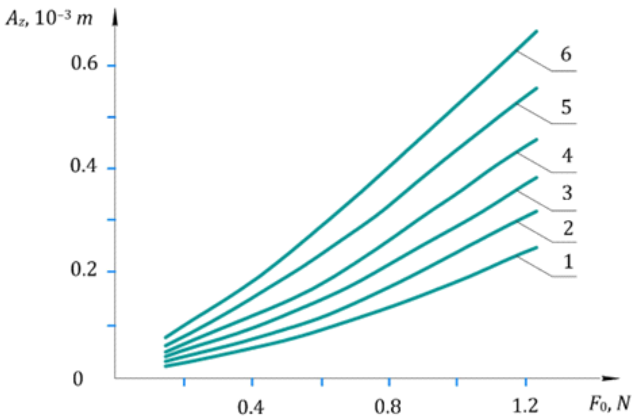
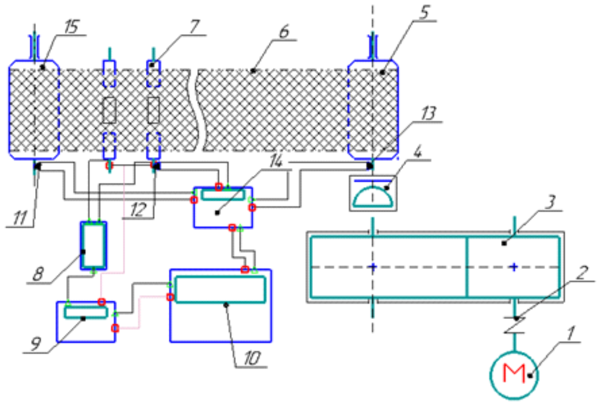


Figure 2. Dependence graphs of the influence of the change in the vibration amplitude of the roller mechanism on the bearing flange and the shell of the roller mechanism

Studies have shown that an increase in the coefficient of uniformity of the bearing belt bushing not only decreases the vibration amplitude z and $\dot{z}$, but also causes an increase in the vibration frequency of the roller mechanism. When the force increases to 1.8 N, the value of A_z decreases linearly from 0.59 10^{-3} m to 0.24 10^{-3} m. Accordingly, the vibration amplitude of the speed of the roller mechanism also decreases nonlinearly, and the coefficient of uniformity of the belt element support of the roller mechanism bearing increases (see Fig. 2). The recommended values of the uniformity coefficient of the bearing belt support are $c_1 = (5.0 \div 5.5) \cdot 10^4$ N/m; $c_2 = (0.1 \div 0.12) \cdot 10^4$ N/m, where the vibration amplitude $A_z = (0.09 \div 0.14) \cdot 10^{-3}$ m/s, $A_{\dot{z}} = (0.08 \div 0.11) \cdot 10^{-3}$ m/s it is guaranteed to be between [12, 13].

Special sensors and the tensometric method were used to experimentally determine the torque on the shaft of the roller mechanism with a belt bushing, the frequency of rotation and the amplitude of vibration of the shaft. A special experimental copy of the belt conveyor was prepared and its parameters were measured based on the electrotensometric scheme. Based on experimental research, oscillograms and connection graphs were obtained [14, 15, 16].



1-engine; 2, 4-belt element coupling; 3-reducer; 5-leading drum; 6-strip; 7-roller; 8-UZB cable electronic thermocouple; 9, 14-vibXpert special number changer device (laboratory equipment); 10-computer, 11, 12, 13-strain gauges; 15-lead drum [17]

Figure 3. Electrotensometric scheme of the experimental stand of the guide roller mechanism with a belt conveyor

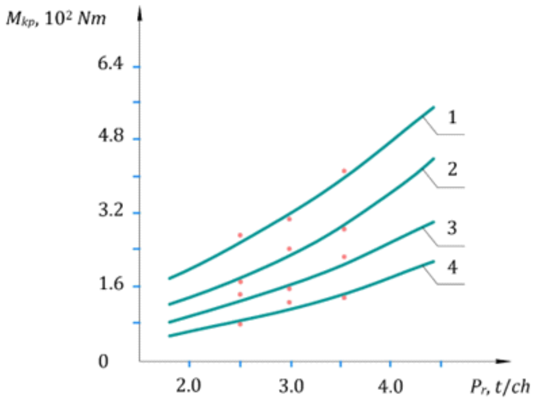


Figure 4. Graphs representing the dependence of the torque on the axis of the roller mechanism on the change in the performance of the belt conveyor

If the torque and vibration amplitude are reduced in the range of (50÷55) *Nm* when using a strap support, the torque is reduced by (35÷40)% on average. (Figure 4). The performance increases from 3.51 10^2 *Nm* to 6.23 10^2 *Nm*, when using 7B-54MBC rubber, the torque increases from 3.82 10^2 *Nm* to 4.1 10^2 *Nm* in roller mechanism, these results are, when 7IRP13-46 rubber is used. increases to $1.22 \cdot 10^2$ *Nm*. This means that in order to reduce the torque in the roller mechanism, it is possible to use a rubber brand with a small rotational speed for the rubber bushing of the bearing, in which case it is advisable to choose the 7IRP13-48 brand rubber as the optimal option.

Conclusion

As a result of the analysis of the operation process of belt conveyor roller mechanisms, it was found that the bearing support, which is the main working organ of the roller mechanism, quickly fails during operation, which has a negative effect on the conveyor technology. Due to the vibration of the roller mechanism, the support bearings quickly fail. The use of bearing supports with belt elements provides significant absorption of vibrations in the roller mechanism and increases the service life of the roller mechanism and bearings.

References:

1.Шахмейстер Л.Г. Теория и расчет ленточных конвейеров / Л.Г. Шахмейстер, В.Г. Дмитриев // М.: Машиностроение, 1978. 392 с.

2.Шаяхметов Е.Я., Мендебаев Т.М., Темиртасов О.Т. Анализ неисправностей роликов ленточных конвейеров в ходе эксплуатации на предприятиях восточного казахстана // Вестник СГУ. - Семипалатинск, 2015. - №4(72). - С. 58-63.

3.Справочник технолога -машиностроителя // В 2 т. / под ред. А.М.Дальского, А.Г.Суслова, А.Г.Касиловой, Р.К.Мещерякова. - 5-е изд., перераб. и доп. - М.: Машиностроение - 1, 2001. - Т. 2. - 766 с.

4.Jumaev Akbarjon Sayfullaevich, Ashirov Alisher Abdujapparovich, Salimov G`iyosiddin Ilyosovich. 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.https://scholar.google.com

5.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.

6.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.

7.Akbarjon Jumaev, Fevzi Istablaev, Mehriniso 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

8.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

9.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

10.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.

11.Jumaev Akbarjon Sayfullaevich, Juraev Anvar Juraevich, Juraev Nodirbek Normuradovich, Qayumov Bahodir Babakul o`g`li. Parameters of Choice and

Calculation of Materials By The Guiding Composite Roller Mechanisms of Tape Conveyors. International Journal of Engineering and Information Systems (IJEAIS) ISSN: 2643-640X Vol. 4, Issue 8, August - 2020, Pages: 235-240.

12.Jumaev Akbarjon Sayfullaevich, Djuraev Anvar, Abduraxmanova Muattar Musurmankulovna. 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.

13. 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. Vol. 6, Issue 6, June 2019.

14.Jumaev Akbarjon Sayfullaevich, Turdaliyeva Makhliyo Yo'ldoshevna, Ibragimova Nodira Ilkhomovna. 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.

15.Jumaev Akbarjon Sayfullaevich, Djuraev Anvar, Pushanov Akbar Nurlan oglu. 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.

16.Jumaev Akbarjon Sayfullaevich, Ibragimova Nodira Ilkhomovna, Turdaliyeva Makhliyo Yo'ldoshevna. 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.

17.Beknazarov Jasur Kholmamatovich, Jo'rayev Nodirbek Normuradovich. Determination of gear extension parameters of a composite flexible element. Journal of northeastern university. Volume 25 Issue 04, 2022 ISSN: 1005-3026 https://dbdxxb.cn/ Original Research Paper.

18.Anvar D. Juraev, Bahtiyordjan N. Davidbayev, Nodirbek N. Juraev, and Jasur Kh. Beknazarov. Results of dynamic analysis of double-inlet screw conveyor machine assembly. E3S Web of Conferences 417, 06005 (2023) https://doi.org/10.1051/e3sconf/202341706005. Geotech-2023.

19. Rashid Muminov, Sherali Yakhshiev, Jamshid Ravshanov, Zayniddin Oripov, Nodirbek Juraev, and Mahbuba Maxmudova. Development of technical solutions for modernization of the rotary feed mechanism of a quarry drilling rig. E3S Web of Conferences 486, 05007 (2024) https://doi.org/10.1051/e3sconf/202448605007 Agritech-IX 2023