

ABSTRACT

**of the dissertation on the topic: «Development of the interconnected multi-motor frequency controlled electric drive of the plate conveyor taking into account the elastic bonds»,
submitted for the degree of doctor of philosophy PhD in the specialty 6D071800 «Electric power engineering»**

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Actuality of work. The use of plate conveyors in deep cuts and quarries will reduce the volume of overburden operations due to the possibility of working these types of conveyors in steeply inclined workings with a lifting angle of up to 30° . The high strength of the traction-bearing body of the plate conveyor, the ability to transport minerals along curved workings over long distances along a curved route, and the ease of increasing the length of the conveyor are its advantages compared to other types of conveyors.

The use of frequency-controlled AC electric drives in conveyor transport, including plate conveyors, based on asynchronous electric motors mass-produced for the mining industry, will provide speed control of the load-bearing web, control of load distribution between the drives, elimination of equalizing forces in the conveyor traction circuit, automatic start of the multi-drive conveyor, taking into account the elastic-viscous properties of the traction-bearing web, and a number of other factors.

Thus, the use of in-line technology with the use of plate conveyors with a multi-motor frequency-controlled electric drive will reduce the cost of mining operations and, accordingly, reduce the cost of mining by open-pit mining, which confirms the relevance of the research.

The purpose of the work is to develop an interconnected multi-motor frequency-controlled electric drive of a plate conveyor, taking into account the design features of its traction-bearing body.

The idea of the work is to control the performance and maintain a functional static and dynamic state of the traction-bearing body of the main plate conveyor and, accordingly, increase its resource in difficult mining and geological conditions of open-pit mining by using a multi-motor frequency-controlled electric drive.

Method of work execution

1. Analysis of the main directions of research and development in the field of electric drive development;
2. Development of mathematical models of starting and setting modes of operation of a multi-drive plate conveyor;
3. Development of the given scheme of a multi-drive plate conveyor;
4. Development of a method aimed at upgrading the starting modes of operation of the electric drive of a multi-motor plate conveyor;

5. Development of a method aimed at upgrading the installed operating algorithms for the electric drive of a multi-motor plate conveyor;

6. Development of technical solutions to ensure smooth start of an interconnected frequency-controlled multi-motor electric drive of a plate conveyor, taking into account the elastic properties of the traction-bearing body.

7. Development of technical solutions for load balancing and distribution in an interconnected frequency-controlled multi-motor electric drive of a plate conveyor, taking into account the features of the traction-bearing body

Scientific novelty:

1. A mathematical model of an interconnected asynchronous frequency-controlled electric drive of a plate conveyor has been Developed;

2. The proposed method soft start multimotor asynchronous frequency-regulated electric drive of plate conveyor, based on preliminary SAG of its traction-carrying body (patent of the Republic of Kazakhstan for utility model No.3982 from 05.03.2019, No. 5122 from 03.07.2020);

3. A method for controlling and distributing loads between frequency-controlled drives of a single-motor plate conveyor is Proposed, taking into account the actual load of its traction-bearing body (patent of the Republic of Kazakhstan for utility model No. 4896 of 02.04.2020). Теоретическая и практическая значимость полученных результатов:

A set of technical solutions for the implementation of systems for smooth start-up and load distribution in a multi-motor asynchronous frequency-controlled electric drive of a plate conveyor is proposed;

Basic scientific principles and research results to be defended:

1. Method soft start frequency-regulated electric drive of plate conveyor based on the control procession prefetch SAG trailer carrying a body and its tension reducing loads on the traction-bearing body, and increase its resource.

2. Method of load distribution between variable frequency drives multi-plate conveyor according to the actual load of the traction-supporting body of the conveyor consists in the management of the dynamic state of the idle branch of the traction-bearing body, reducing the load and providing an increase in resource.

The validity and reliability of scientific statements, conclusions and recommendations is due to the use of experimental planning techniques, electric drive theory, methods of traction calculations of plate conveyors, theoretical mechanics, patent search for the development of technical solutions aimed at improving existing technical solutions.

Relation of the dissertation topic to state programs, grants, and contractual works:

Participated as a responsible performer in the design and submission of applications from the University for grant funding for scientific and (or) scientific and technical projects for 2018-2020 (MES RK). Project on "Research,

development and justification of the main parameters of a steeply inclined conveyor with linear drive for open-pit mining".

Approbation of the dissertation work.

Annual scientific and technical seminars of the University.

Presentation at a joint meeting of the Corporate University of the personnel Service and the Secretariat of the Scientific and technical Council of Kazakhmys Corporation LLP. The intermediate results of the dissertation work that are included in the discussion Protocol (2018, 2020) are considered.

Publications in conference proceedings: the International scientific-practical conference "Integration of science, education and industry as the basis for the implementation of the national Plan" (Saganowski reading No. 10), 14-15 June 2018.), in the International scientific-practical conference "Integration of science, education and production as the basis for implementation of the national Plan" (Saganowski read No. 11, 14-15 June 2019); in the International scientific-practical conference "Integration of science, education and production as the basis for implementation of the national Plan" (Saganowski read No. 11 June 16, 2020)Реализация работы в промышленности.

A trip to "Razrez Molodezhny" LLP was made for the purpose of making a report on the research work carried out. According to the results of the report, positive feedback and acts of implementation of the results of the dissertation work were received (2018, 2020).

Patents for utility models of the Republic of Kazakhstan were obtained:

- received the patent of the Republic of Kazakhstan for utility model No. 3982 dated 05.03.2019.

- received the patent of the Republic of Kazakhstan for utility model No. 4896 dated 01.05.2020.

- received the patent of the Republic of Kazakhstan for utility model No. 5122 dated 03.07.2020.

Basic scientific results: On the topic of the thesis published 19 scientific works, including 5 publications in the editions recommended by Committee on quality assurance in education and science of RK (3 of them are patents for utility model); 4 publications are in journals included in the company's database Scopus, including 3 publications in periodicals with a percentile not less than 25; 10 publications in international scientific conferences, including 2 abroad.