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Research and Development of Motion Control System of Mine Hoisting Installation

The problem of the optimization of technological processes has always been very important for the mining industry. The process of the development of mineral resources is a very complicated and requires constant monitoring and analysis. Any emergency situation leads to costly breakdowns. Shafts and tunnels are located on a significant distance from transportation hubs, so delivery of necessary equipment and spare parts significantly increases company expenses and sabotages a scheme of reaching planned performance.

Developed system is used to form the diagrams of such stages as acceleration and braking. The point, where the process of braking starts, is considered to be the factor of beginning to form the diagram of safety braking. Statistical information on the safety brake diagram should contain such information as values of current and voltage circuits, motor speed, the state of control signals, current horizon of cargo, distance traveled and energy consumption, braking distance (Lbd), braking deceleration (abd), car speed at the beginning of braking (V bd).

Deceleration rate is calculated by the following formula:

abd = (V bd)^2/(2*(Lbd - V bd * 0.3))

The analysis of the cycles and the diagrams of the safety brake allow monitoring the performance dynamics of the control circuits of hoisting equipment. In the case of abnormal or emergency situations the information concerning the hoisting cycle promotes immediate reconstruction of the accident and helps identify circumstances having caused it. This prevents the occurrence of such events in the future. Applying gentle acceleration and braking excludes the cases of rope deformation and optimizes the consumption of electrical energy. Counting the number of lifted load makes the process of obtaining statistics automated and promotes the simplification and speeding up of the decision-making.

All these factors result in decreasing operating costs needed for unit maintenance, reducing unplanned downtime and, consequently, provide the increasing of cargo volumes as well as reducing production costs.

The next stage in the development of software systems is MSE semi-automatic control of cargo delivery to increase productivity and improve efficiency of installation. Providing loop motion of hoisting equipment is supposed to be carried out in accordance with optimally calculated velocity diagram. In addition, it is planned to make the system function as a speed restrictor having specific protective diagrams for different modes of hoisting installation performance.