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Using Ferro Probe to Monitor the State of Joints of Rubber-Fabric Conveyor Belts

Conveyor transport having great capacity is widely used at the enterprises of mining and metallurgical industries. It is considered to be the most cost efficient to transport great volumes of material goods. Nowadays belt conveyor is the main type used in mining industry, However, the reliability of conveyors and mainly of those used in complex conditions of mining production is not sufficient. Emergency downtime of main mining equipment caused by conveyer transport failure reaches up to 30% of the total downtime. Thus, a steady operation of conveyor transport is largely stipulated by the construction and durability of butt joints.

Currently, the control of the belt condition is mainly carried out by mining enterprise workers. In this case subjective and time factors have great affect. Studies are under way to develop a system of automatic monitoring the joints of rubber conveyor belts. One important aspect of the research is to develop electromagnetic sensors used to measure nonuniformity and the gradient of the secondary magnetic field (ferroprobes). Rod differential ferro probe is used as a sensor, which is two parallel-mounted rods made from ferrite or permalloy materials having a high rate of magnetic permeability. Any item made from ferromagnetic distorts a natural magnetic field of the Earth. Such items include anything made from iron and steel. To a large extent the own magnetization of the object can influence on the distortion of the magnetic field. After recording the deviations in the magnetic field intensity taking into consideration background values we can make the conclusions about the presence of an object made from ferromagnetic material close to measuring device. Ferromagnetic sensor coil is excited by an alternating sinusoidal signal with a frequency of 4 kHz. The windings on ferrite rods are turned on opposite coils. Buckling of the electromagnetic field allows specifying a strongly pronounced diagram of the sensor direction. The secondary winding is placed over the coils on the rods and is used to register the second dipole created on the metal joints of conveyor belts. Ferro probe is used in the second mode which involves the work on alternating current and registration of the desired signal at the second harmonic.

Compensation system is used to make a sensor react only on ferromagnetic materials. A signal removed from the sensor is obtained with a band pass filter. Then it is amplified and detected by a synchronous detector which is a balanced modulator, integrator and a differential amplifier. Afterwards the signal is limited and digitized by an analog-to-digital converter. Then a discrete signal is transferred to a digital signal processor where mathematical treatment is applied.

The advantages of using ferroprobes for a given task compared to conventional inductive sensors are a distinct pattern and noise immunity.