Measurement of energy flow on the conveyor belt

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Abstrakt

During transport using belt conveyor is needed to overcome a resistance against the movement of the material. This thesis deals with mapping them and their behavior depending on the load by measurement at the measuring stations and loading according a real conveyor.

Key Words: STČ; Belt; Power; Efficiency; Energy Flow

1. Resistance

During transport using belt conveyor is needed to overcome a resistance against the movement of the material. These resistance are divided into primary, secondary and additional. The research these resistors and the possibility of their reducing included measurement of resistance on various assembled station.

Primary resistance are resistance in the bearing of pulley, fulling resistance between grains of the material, and crimp resistance between belt and rollers.

Secondary resistance are resistance in a hopper when accelerating material, resistance due to bending of the belt over the pulley, and resistance in ghe rupporting rollers.

Additional resistances are lifting to a height, resistance of deflected side rollers, belt cleaner, scraper, by beltr tripper, and optionally the friction resistance of the material on the side lines of the hopper.

Measurement of resistance of deflected side rollers took place in previous years. Created new proposals centering idler, one for testing various settings sizes and the other for centering the belt by reducing the resistance.

2. Four variants Measuring Station

The research these resistors and the possibility of their reducing included measurement of resistance on various assembled station.

2.1. Variant 1

It is a conveyor which has been involved in a closed transport loop, in which was changed the mass flow and speed of the belt. From here it is obtained a load map to approach a real condition in laboratory. Use this map are simulated load on other variant and the results are mutually compared.

In laboratory is simulated the conveyor load operation using two engines with gearboxes connected to inverters. The first engine determines the speed of rotarion, i.e. the speed of the conveyor. The second engine controls the stressful moment, i.e. load. There is also the possibility to change the prestressing of the belt to simulate conditions during slippage of the belt. The station was also used to test new types of centering roller mills.

Fig. 1. *Variant 1*

2.2. Variant 2

The construction of this staion is designed to measure resistance in bearing depending on the radial load operation resulting tensile stress in the belt of the operating load set preload.

This force is maintained on station by a hydraulic cylinder at a constant size and subsequently running load map obtained from the measurement of the whole system of conveyors. Obtained resistence are partly in bearings, but also from rolling two rubber rollers each other. They can be calculated, but we will try to minimize them primarily, to dimished their influence as much as possible. Then would be left resistance in bearings and other parts of the drive.

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Fig. 2. *Variant 2*

2.3. Variant 3

This configuration is aimed at measuring resistance without support rollers. The design utilizes the same supporting structure as the frame variant 2, but will be added a piece of welded belt 3 meters long and 500 mm wide.
Unlike the resistance this and the first option is the size of resistance in the support rollers. It will also get resistance caused by bearings and bending with rolling belt.

After deduction of resistance in the bearing of variant 2, we will get resistance of bending and rolling belt.

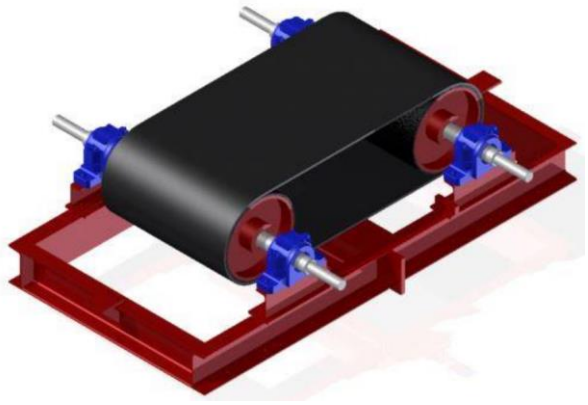

Fig. 3. *Variant 3*

2.4. Variant 4

In this variant we measure resistance in the drive without the influence of radial loads from the belt and without bending the belt. We get the resistance gearboxes and bearing in the main store of pulley. Due to the remooval of oher large resistance, will take a greater part of resistance obtained inacuracies assembly etc.

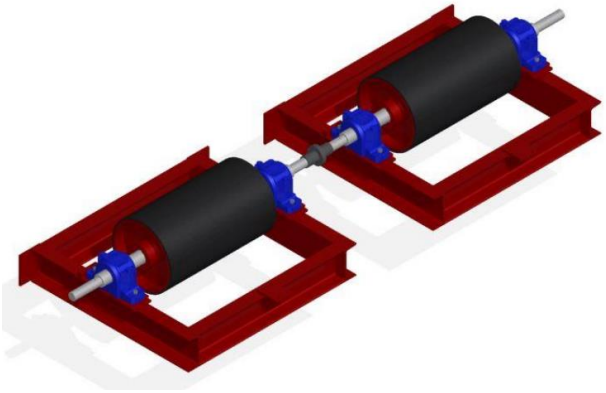

Fig. 4. *Variant 4*

3. Knowledge of the variants

The advantage of the last three variants is their constructional simplicity, as composed of two frames, only differently positioned. In variant 2 are added only two beams and a hydraulic unit for controlling the pressure. Variants are designed for belt wide 500mm and 340mm pulley diameter and a length of 600mm.

Yet held measuring and comparing the performance difference at the inlet and at the outlet of the conveyor and test variant no. 2. Tested conveyor was equipped with a hydraulic cylinder. Measurements were carried out with the same force burdensome for both variants, ie. biasing force of 3000N, respectively 2,2MPa pressure, which supplied pump into the cylinder.

As expected, it was compared the values found that for the same load in both variants produced greater losses at the conveyor 1. One contains multiple components, which adds losses. This is essentially a statement when the resistance between the conveyor belt and the conveyor pulleys and in bearings of rollers established in the frame.

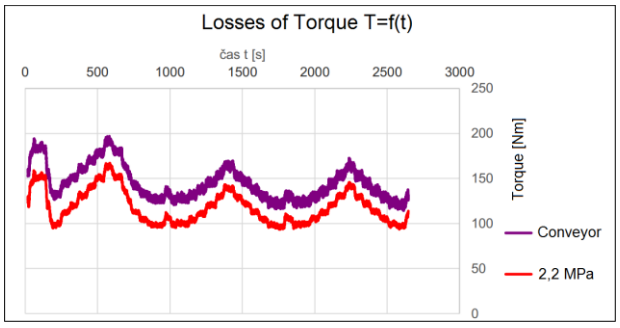

Fig. 5. *Losses of Torque on Variant 1 (conveyor) and Variant 2 (2,2MPa)*

The chart shows that for a complete conveyor leads to greater losses. It is clear that this is a concequence of the larger number of omponents.

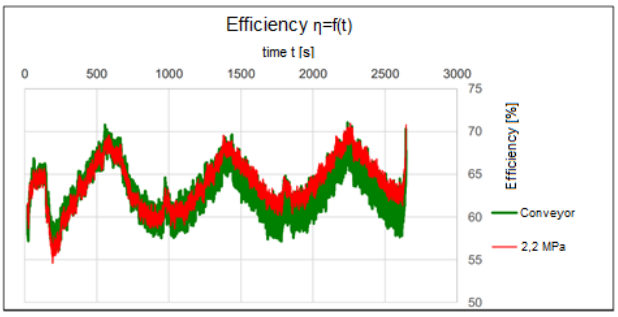

Fig. 6. *Efficiency on Variant 1 (conveyor) and Variant 2 (2,2MPa)*

Because of the arrangement for measuring station to a second variant, it was necessary to start with cold oil in the hydraulic circuit. Otherwise it would overheat the oil. Therefore, the gearbox and the beginning of the cold. After heating, at the second station to improve efficiency, which confirms the hypothesis of the losses are lower for a smaller number of components. Also still going into the new bearing. Increased losses occurred as a result of traction adjustment rollers, rubber coated diamond pattern.

4. Conclusion

The measured data will be part of the work of all habitats and will form a map of the energy flow. It is prepare re-measuring the results with rollers with a smooth surface and the assembly of other variants.

Symbols

f function
t time (s)
T Lossed torque (N·m)

η efficiency (%)