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PROPOSALS REGARDING THE IMPROVEMENT OF DISCHARGE OF SOLIDS, USING THE RUBBER CONVEYOR BELT

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Summary: In this work we make a study of the improvement methods of quantity of material transported by conveyor belt. Determination of discharge of solids entail establish of the parameters of the conveyor belt. As a result, we determine the belt speed who provide maximum discharge of solids materials.

1. Introduction

The paper proposes the improvement of technological parameters for band conveyors by the optimization of conveyance report of the movement between the electric motor and the drive drum, through the optimization of the conveyed discharged material and the optimization of the tachogram actuation. In order to determine the optimum capacity of band conveyers we start from the general equation, the vee profile of the material section on band is imposed, its equation is being determined, the bedding coefficient is being found out and its relation is further obtained for a maximum section of the material.

Relations between the band constructive parameters and the material profile are being defined which are graphically displayed. Then, the issue of obtaining the maximum capacity through speed adjustment depending on the gradient is being analyzed. On the base of the equation for the material balance, we obtain the equation of the conveyed material volume under stationary regime and under dynamic regime and the length which ensures the maximum area of the material section on the band.

The material discharge is then calculated depending on the gradient and the time constant of the continuous transport process is being determined, necessary for the selection of acquisition equipments and data processing.

Starting from the mathematical model the optimization of vee diagram conveyer drive is being analyzed. The energetic criterion has been used and the criterion function is being established (only Joule effect loss are taken into consideration), the optimization issue is being enunciated and the optimum working time and the optimum band speed are being determined. It results the establishment of an adjusted speed of band conveyer actuation depending on its charge.

The results obtained allow for the implementation of optimization algorithms for the band conveyers systems.

2. Proposals regarding measurement and control of the sterile/coal transported on high capacity bands

Knowing the area of the section of the current of the transported material *A*, the transportation speed v, the specific weight of the mellow material, or the material weight on linear band meter q_m, for a continuous band transportation plant, the flow is determined bz the general equation of the continuous flow:

$$Q = k_1 A v \gamma = k_2 v q_m \tag{1}$$

The section of the material current is determined by band loaded width *b,* the bed form and the acclivity angle (dynamic) in moving p_0, in order to sustain with three rollers (figure no. 1), the section area of the current material max be maximized through:

- establishing the lucrative parameters for the itinerary structure considered (A_1 section)
- correlating the functioning parameters, mainly the acclivity angle, which depends on the moving speed, appropriate for the A_2 section.

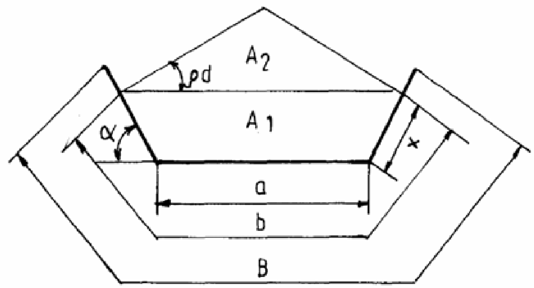

Fig. 1 The section of the material current

From the maximizing condition of the cross section area, we obtain the expression of the bed coefficient *k*.

$$k = \frac{(\sin\alpha + \cos\alpha\ tg\rho)(1-\cos\alpha)}{(2-\cos\alpha)\sin\alpha + tg\rho(1-\cos\alpha)^2} \tag{2}$$

For the continuous transport system with imposed geometrical parameters ($20^\circ < \alpha < 45^\circ$), regarding the lucrative parameters, the maximum value per area is obtained when *a=b/3,* the *k* bed coefficient may be graphically represented, regarding the angles α and p, like in figure no. 2.

Because in practice, the three rollers sockets have the three rollers of equal lengths, and there is a free space between the rollers heads (lucrative), the band has a curve of relatively high radius and when calculating the flow for 2 meters widths bands, we may consider that *a≈0,44b*. Therefore the expression of the area becomes:

$$A = \frac{b^2}{4}\left[(0,44 + 0,56\cos\alpha)^2\ tg\rho + (0,493 + 0,314\cos\alpha)\sin\alpha\right], \tag{3}$$

and allows to obtain the loaded width of the band.

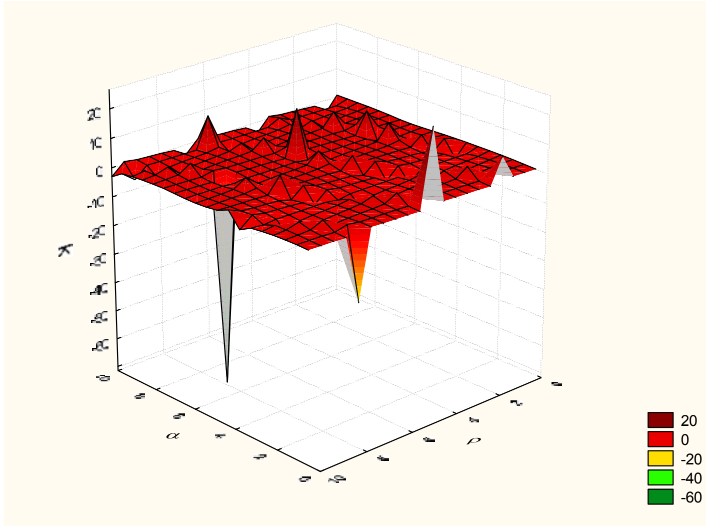

Fig. 2 The dependence of the bed coefficient k by the α and ρ coefficients

The *A* area may be graphically represented regarding *b* and tg*ρ*, with $\alpha = 30^{\circ}$ therefore:

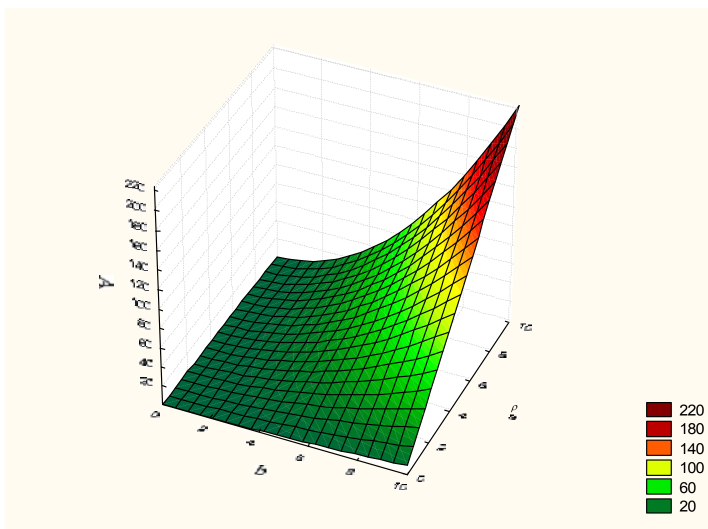

Fig. 2 The dependence of area by b and tgρ

3. Conclusions

Analyzing the transportation process and taking into consideration the flow, it is imposed a maximum cross section condition in order to obtain maximum transported flow. The maximum speed condition cannot be imposed, because when increasing the speed, the material becomes mellow and causes the decrease of the moving acclivity angle, which will cause a decrease of the section of the transported material current and therefore, possibly, of the flow.

The algorithm for determining the optimum flow therefore implies the establishing of the band parameters, a function which will determine the optimum speed that will assure a maximum transported flow.

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