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VARIABLE PIPE CONVEYOR.

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Abstract: *Belt conveyors have wide range of application in various industries. Development of belt conveyors is from the time of the first application to the present time. There are always new designs, present and certified realizations are modified and advanced (Seňová et al., 2008). What was at the beginning of the development of belt conveyors unrealistic, now it is often already a reality. Classic belt conveyors are nowadays in some places replaced, for example by their younger modification – by pipe conveyors.*
Key words: *pipe conveyor, variable, transport*

1. INTRODUCTION

Pipe conveyor (Fig. 1) was constructed the first time in Japan, in the 70th years of the last century. On the present there are a few hundred pipe conveyors in the world, most often in building, extractive and energy industry (Sobotová et al., 2009). Slovakia and Czech Republic are not exceptions. Pipe conveyors became rooted in these countries, above all in energy and cement enterprises.
Pipe conveyors, as we know it, will be soon next modified.

There are for example first designs, where the track of pipe conveyor is placed by atypical way – it would be hung on the rope and it provides more simply repression of terrain irregularities or natural obstacles (Mareš et al., 2008). The other still braver possibility is creation of crossbreed between pipe conveyor and freight ropeway. Very interesting solution is for example routing of both branches of pipe conveyor in one idler. In this case we discuss about coaxial pipe conveyor. Prototype of this pipe conveyor exists already in Australia (Spišák et al., 2009). Other very interesting design is pipe conveyor, which has not construction fast fixed in foundations, but it is free moveable and it provides its displacement.

This design is very interesting. Application of this conveyor is above all in places, where it is needed to spill material equally, eventually it is needed to change the place of material dumping in a certain range. The first type of this construction is in operation in Finland and the firm KOCH created it.


Fig. 1. Pipe conveyor

2. VARIABLE PIPE CONVEYOR

Principle of this pipe conveyor consists in placing of supporting structure with idlers on the carry plates. Carry plates provide free sliding of the complete construction on the moderate grade and by that it makes a possibility of fluent change of the pipe conveyor track position and the places of filling and dumping, too (Fabián et al., 2009). The filling and dumping parts of pipe conveyor are realized very interesting, these are located on the moveable gears which have caterpillar drive (Fig. 2). But over time it proves definite limitations of this system of material transport (it does not provide to copy the terrain in vertical way).

In co-operation with the firm KOCH and TU Košice it was analyzed structural modification of moveable (variable) pipe conveyor. Development of the conceptual design was realized by the help of CAD system AUTODESK Inventor. Task setting demanded proposal and calculation of pipe conveyor parameters, which will transport 500 $t.h^{-1}$ of fly ashes, which powder density is 0,5 $t.m^{-3}$. Volume transport output is 378 $m^3.h^{-1}$. Conveyor has length 200 m and the transport will be realized to the gradient 4°. Speed of conveyor belt is 2,5 $m.s^{-1}$. Conveyor will work in heavy operation conditions.
Ability of the variable conveyor equally to copy the surface is the main criterion for the design of solution (Fabian et al., 2008). Material will transport by pipe conveyor. Dump station will be powered by electric motor and it will be placed on the creeper undercarriage. By selection a suitable design elements, it deliberated needed fortress of individual parts and rigid connection among them, too. By conveyor belt drawing which is coiled to the hose, heavy forces are generated in every ways. Service footbridge is not needed in this conveyor, because it is drawing by land and service operations can perform from the land.


Fig. 2. Variable pipe conveyor

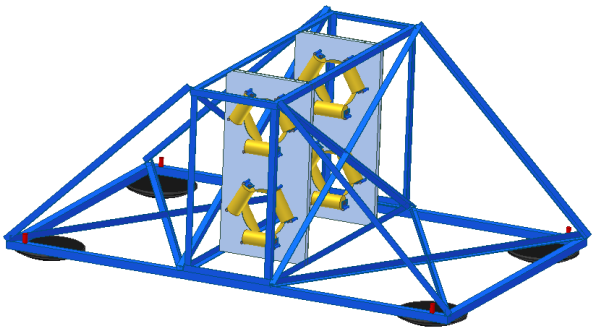

Fig. 3. Created base plate

By idler design it arises from the assumption, that idlers will be sequenced on the base plate in such a way that three will be on the one hand and three from opposite hand of the base plate. This solution is verified by now and it uses the aspect of the support of correct pressure of idlers to the conveyor belt.

The dimensions of the plates are 580 x 1160 mm. Created base plate was then placed into the frame of idler (Fig. 3).

It was needed to regulate the movement of the pipe conveyor to the sides from the reason of conveyor belt support against the damage (Fabian et al., 2008). By calculation it was specified the limit, that the curvature of the conveyor track can be maximum by the radius 60 m. For determination of radius of conveyor arc it will be used distance chains which hinder to greater curvature.

Support of the conveyor stability (Fig. 5) to the overturning of the construction by moving along the store will be realized by large-area plates which provide drawing on soft modified surface. Plates will be remote from each other 3000 mm, so that it will be bigger spacing distance and centre of gravity of idler construction will be favourable. Idler will be attached to the welder triangular frame. Frame construction of idler clamping in the place of clamping is symmetric to the vertical axis of conveyor`s belts and in this place it creates trapezoidal form (Senderská et al., 2009).

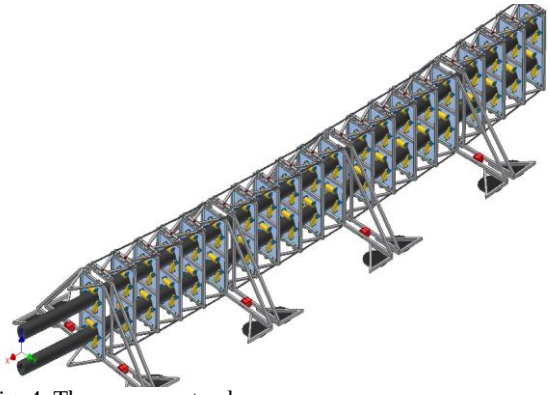

Fig. 4. The conveyor track

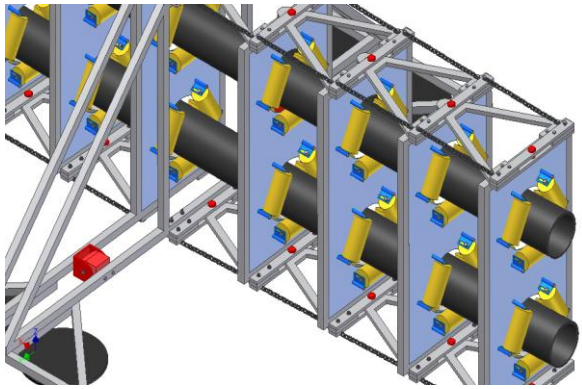

Fig. 5. Support of the conveyor stability

3. CONCLUSION

Variable pipe conveyors (Fig. 6) present important step in the development of belt transport (Mareš et al., 2008). According to the presented solution, the belt transport can be applied in the places and technological operations, where it was not possible till now and where it was till now complemented and replaced for example by automobile transport. Even if the idea of variable (moveable) belt conveyors is not new, mostly it was limited by conveyor track length (most often few ten meters) (Ižol et al., 2004). Asset of this construction is:

- routing of the route in curve,
- raw material transport in unlimited length of the route,
- excellent copying of vertical granding of track,
- possibility to change the conveyor location,
- transfer of feed and dumb part of the conveyor.

The result of the work is new, modified construction of belt conveyor with own way of rollers connecting.

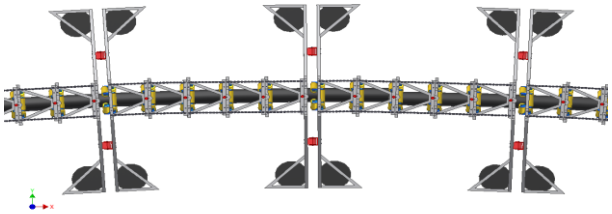

Fig. 6. Variable pipe conveyors

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