Pipe conveyor & tubular belt

M A G N I F I C, S U P E R! ... But at what cost?

You operate a "pipe conveyor"!

This equipment has been presented to you as the last miracle in the world of conveyors, because it solves all the problems of pollution, of winding paths with only 1 conveyor; certainly, at a higher cost than the usual conveyors, but this is justified, isn't it?

Yes, but how big are these "higher costs" and what are they?
That is the question, the "trap"!
Note that the following applies more to large diameter tubular belts, for example a 400 mm diameter belt.

To allow the belt to keep its tubular profile, this one circulates in supports in the form of a ring, carrying and bottom side. These rings are made up, carrying and bottom side, of 3*2 rollers, "offset", on each of 2 faces of the folded sheet support, in a hexagon arrangement. This offset, which is detrimental for the belt, is approximately 1.5 times the roller diameter, between the 3 rollers on the front and those on the back of the support.

On the other hand, we quickly understand that this design requires a greater number of rollers than in the case of a usual trough support with 3 sectors (at least: the double), carrying side, and, proportionally, a ratio even more unfavourable if we compare this type of conveyor to the usual type with single rollers or arranged in a vee, bottom side.

At this 1st count, it is also necessary to consider the distance between supports of the different sections of the carrying side and of the bottom side; the case worsens if, bottom side, we compare this spacing for a tubular belt with respect to a long distance, from 12 to 15 m on average, for a usual conveyor belt (see my articles "*Long spacing between supports" on www.c3 -expert.fr*). Here, A distinction must be made between the pitch of the different sections of the longitudinal profile, between purely straight sections and curved sections, whether concave, convex, horizontal to the right or left, or mixed, i.e., a combination of concave and/or convex with horizontal. For all curves, the spacing between supports must be tightened, especially for the carrying side if the drive pulley is at the head and, to a lesser extent, on the bottom side.

This spacing depends:
- of the tension existing in the belt, whatever its operating phase;
- of the belt architecture;
- of its width measured "flat";
- of its filling coefficient.

Deviating from this rule generates a significant "fulling (1)" phenomenon of the belt pipe which can quickly become critical. If the rectilinear sections are apparently less constraining, from the point of view of the spacing between the ring supports, this less constraint tends to disappear with the increase in the belt pipe diameter, to the point that the phenomenon of "fulling" already appears with support spacing of 1.75 to 2.00 m.

Based on this first description, it emerges that the designers-builders of pipe conveyors are plunged into a dilemma without an ideal solution. To limit this famous "fulling" it is necessary to reduce the "distance" between supports, especially in curved sections, which proportionately increases the cost of construction and the power absorbed by a greater friction quantity (number of rollers). By ignoring a "tight spacing" between supports, the system is also exposed to a considerable absorbed power ... by more fulling ... What must be eliminated!

The vicious point is that during the first hours of belt operation, fulling is not significant (the situation satisfies the builder), because the belt is new!

Unfortunately, the situation is deteriorating very quickly. Upon observation of the first fulling deformations, the power absorbed increases significantly and the immediate reaction of the plant technical service is to increase the belt pre-tension, which first of all attenuates the fulling in straight sections and greatly increases it in curved sections. This fact further accentuates the belt carcass deformation when passing all the curved sections, and the disturbances are linked in a vicious circle.

The diagnosis, for an uninformed observer, is simple to pose:
- if the absorbed power is higher "empty belt" than "full load belt", that is to say at 90-95% of filling compared to the inside belt pipe diameter, then the observed case corresponds to this article.

In addition, increasing the belt pre-tension should simultaneously lead to an increase in the length of the 4 transition zones (before & after the head pulley, before the tail pulley, after the last point of feeding chute) ... which is never taken into account. In fact, the belt is in over-stress, which implies an irreversible deformation of the carcass by its transverse compression. This deformation results in a lack contact of the belt on the drive pulley, which generates a permanent belt sliding on this pulley (the belt linear speed is lower than the pulley peripheral speed), see the drive pulley slippage ... and the plant technical service increases the belt pre-tension again!!! ... This restarts the process of belt degradation.

Regarding the belt "architecture", it is necessary to have in mind the 2 "antagonistic" configurations of the tubular belts. They must present a perfect pipe between the end of the feeding zone and the transition zone at the head and then have a "flat" profile at the end of this transition zone and, in the same way, a variation in sound, profile bottom side. Over the entire length of the conveyor with a tubular profile, the belt must keep a perfect "circular" shape, including for the width of the belt edge in overlapping, in order to guarantee good sealing of the pipe; that is to say without pollution of the product and without pollution by the product.

From of my expert point of view, this subject seems to me still poorly understood; I have a study awaiting validation on an industrial scale.

From the “economic” aspect, when compared with a conventional trough belt with 3 sectors, the situation is also very unfavourable in terms of direct cost; for example, for a tubular belt inside diameter 340 mm, for outside diameter 388, you need a belt width 1400 mm measured "flat" and this is to be compared for the same handling with a belt width 1000 mm (-28.6%) in trough with 3 sectors at 45 °.

In this example, it is a question of 985 t/h of coal handling, density 1, pipe filling coefficient of 85% of the diameter, at 3.28 m/s against the belt width 1000 mm, trough 3 sectors 45 °, slope angle 25 °, at 2.20 m/s, for a filling coefficient recommended of 85% of ISO 5048. Here again, the "belt speed" delta is of 33% and it has a big influence on the absorbed power, in considering proper operation of the 2 types of conveyor.

Dear readers, if you are concerned by setbacks with your pipe conveyor, as described above (additional costs on the power absorbed, broken components, malfunctions, reduced belt longevity, etc.), or with other problems, then you can contact me to send me your file in complete confidentiality, in order to study your case and offer you the most rational upgrade in order to tend towards a better economic compromise and in reliability.

In addition to the "calculations" phase of your tubular conveyor, with a 1st level of response implementing conventional solutions, C3 Expert has developed a ring of 12 rollers, to be mounted very simply instead of the 3 * 2 rollers. 'origin, with an adaptation of 3 to 6 rollers on the additional "intermediate of the existing" supports in the curved sections in order to drastically reduce the over-stresses applied to the belt tubular

Wishing you a good rereading while waiting for your next contact.

(1) Fulling : *the perfectly "circular" belt profile, seen in cross section, is deformed to the point of presenting a more or less pronounced "flat", or even a "depression" (more serious case), when the roller passes under the greatest belt pressure "radial" on said roller. These concerns 1 see 2 to 3 rollers of the hexagonal ring. To illustrate the power absorbed by this treading, you can do the test by pushing a bicycle, a motorcycle, with under-inflated "balloon" tires, the aggravating factor exists when you push it on dry and very loose sand. This last element of comparison is to be compared to a pipe with a low filling coefficient*.