Italian equipment manufacturers

Fig. 1: Sealtex belt installed over the proper conveyor belt seals the handling structure, avoids dust spillage and protects the material from rain; meanwhile, it can be lifted to obtain opening suitable for movable loading and unloading of the material.

Jay Venter

Rubber conveyor belts for sealing purposes

Company profile

SIG Società Italiana Gomma SpA is a renowned Italian manufacturer of rubber conveyor belts. More than 50 years of experience in this industry means that the company is at the forefront of the industry, with excellent references in the majority of the world.

The customer-oriented approach that distinguishes SIG SpA means that it is possible for it to meet its customers needs in an extremely flexible way, especially when customization and the development of new products is required.

The entire manufacturing activity is located at SIG's factory close to Milan in Italy where the company's sales and R&D resources are also located.

Introduction

For decades, conveyor belts have been the most suitable method to convey loose materials over variable distances, from a few metres to a few kilometres. The application fields are varied; more often, rubber conveyor belts are used in non-conventional sectors, such as the one that is described in this article.

Indeed, there are specific applications where rubber conveyor belts are not even used for handling purposes, but to protect and prevent the material conveyed by another belt from being scattered. This is the sector in which Sealtex belts, which are characterized by high crosswise stiffness and longitudinal flexibility, offer performances that were inconceivable up to a few years ago.

Environmental protection requirements, which are increasingly included in project specifications of modern conveyor systems, allowed significant development of the aforesaid technology in the last few years. Thanks to its mechanically simple system, it offers striking solutions to different problems.

Applications of the Sealtex belt

The picture (*Fig. 1 above*) schematically shows the effectiveness of a Sealtex belt. It is installed above another conveyor belt and allows for the displacement of material loading and unloading points as required, as well as keeping the conveyor structure sealed in the remaining part of its development.

Thanks to their flexibility of use, Sealtex belts are typically installed along port quays. Here, the need to empty ship holds or to unload the material into different points within the storage area, requires the presence of movable openings along the entire development of the conveyor.

There are different technologies to meet the aforesaid requirements, but it is unquestionable that the use of a rubber belt offers incomparable simplicity of use, reduced maintenance, perfect sealing and essential absence of mechanical interferences.

So, for example, next to the loading hopper that receives the material from a continuous ship unloading system, it is possible to lift the Sealtex belt to offer suitable space and, by means of suitable chutes, the material can correctly reach the conveyor belt below.

Similarly, if you need to load a set of tanks or a large storage area, the Sealtex belt passes over the unloading movable carriage (tripper) and then it goes back to the original position after having surpassed the obstacle.

In both cases, loading and unloading carriages are equipped with suitable roller ways to allow lifting and re-positioning the Sealtex belt.

There are also simpler applications to cover the tunnels that pass on the side of the conveyor and that usually connect lower silos or contain pipes and service cables. Often, in the aforesaid cases, it is enough to adopt belts with reduced performances compared with Sealtex; however sometimes the use can be compared with the above-mentioned cases, for example when the project includes specific safety requirements because people may have to walk directly on the Sealtex belt.

The last evolutions of this covering and sealing technology provide for the use of the Sealtex belt in conveyor systems with telescopic belt. In the aforesaid projects, the Sealtex belt has to be fixed to the movable unloading end, while the fixed part of the conveyor includes a winder that recovers the exceeding part

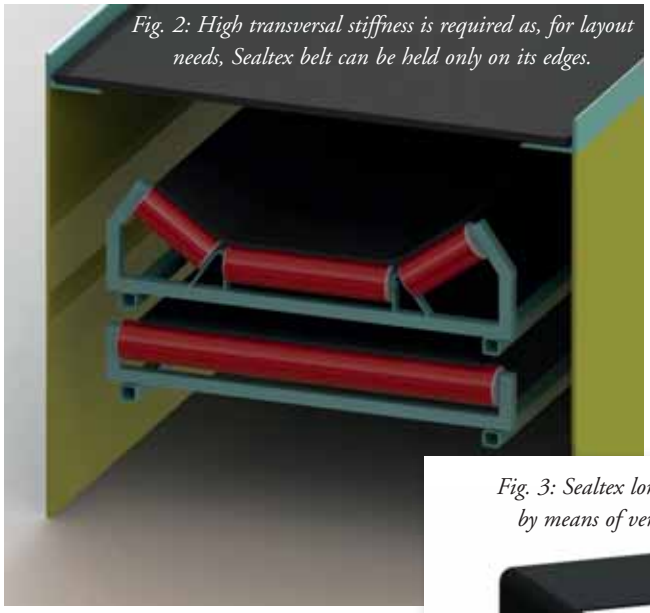

Fig. 2: High transversal stiffness is required as, for layout needs, Sealtex belt can be held only on its edges.

when the conveyor is shortened.

The Sealtex belts are usually manufactured starting from 600–800mm widths for silo channels and openings, up to widths of more than 2m to cover and seal high-capacity belts being used for continuous loading or unloading of ships.

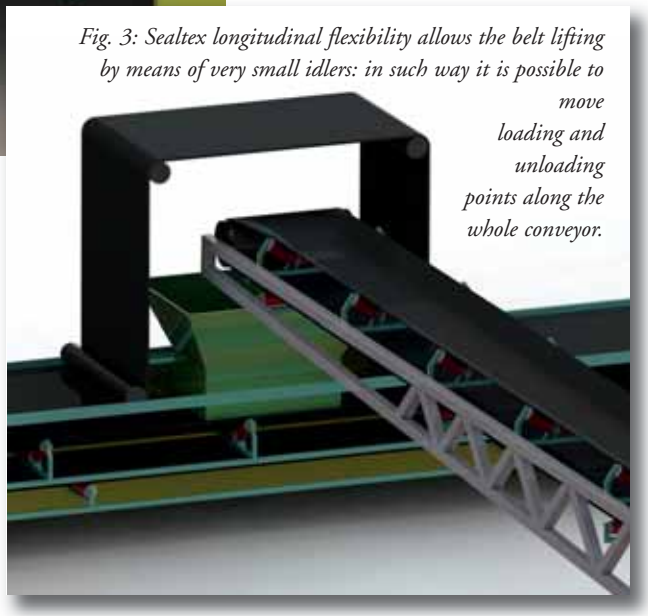

Fig. 3: Sealtex longitudinal flexibility allows the belt lifting by means of very small idlers: in such way it is possible to move loading and unloading points along the whole conveyor.

Construction details

The Sealtex belt is self-bearing because, for layout needs , it can be held only on its edges by means of specific side supports(*Fig. 2*). Indeed, to allow the passage of hoppers or movable unloading systems, it is not possible to support the belt in crosswise direction by means of nets or metal crossbars. This project restriction adds to the need to be able to lift the belt next to loading and unloading openings by means of very small diameter rollers. *Fig. 3* clearly stresses these needs.

So, it is possible to understand the peculiarity of this type of belt that has to oppose suitable longitudinal flexibility to high crosswise stiffness. The manufacturer of the Sealtex belt is in charge of designing a product that, as a consequence, must be able to exploit the elasticity of rubber and of synthetic fabrics, and steel stiffness, as well.

Fig. 4: Sealtex transversal bending test clearly shows how abnormal and not linear the deformation of the sample is, with respect to the behaviour of a simple steel beam.

At historical level and, for some manufacturers it is still a topical technology, the belts for the aforesaid applications were manufactured by dipping a set of steel bars into the rubber. The aforesaid bars had a suitable cross-section, which allowed obtaining the desired stiffness. At present, the available materials make it possible, on the contrary, to obtain the same results by using less steel quantities and automated manufacturing methods.

The design of the Sealtex belt provides for two layers of high elastic-modulus steel cables in the peripheral areas of the belt cross-section, thus allowing maximizing the inertia modulus of the system and the subsequent 'beam effect'. This way, if you define the diameter and the density of steel cables and the distance between the two respective layers, you can obtain the stiffness level that is required by design specifications.

The method to calculate the stiffness of the Sealtex belt derives from well-known elastic deformation equations for steels, with empirical (*Fig. 5*) and non-linear corrections to the model due to the presence of a different elastic means, rubber, which binds the two layers of steel cables one to the other in a non-homogeneous way. *Fig. 4* is representative, as it shows the result of a bending test where you can clearly see an abnormal deformation in the test piece, with respect to the behaviour of a simple steel beam.

It was previously mentioned that people may have to walk on the Sealtex covering belt: it is a crucial requirement to establish the stiffness level of the same belt. However, you cannot omit specific phenomena, such as the accumulation of water, the possibility of snow falls at a port, even if it is a remote possibility. In particular, slight differences in height for the two side supports are used to prevent water stagnation.

On this subject, particular importance is given to the size of side supports: they must be sufficiently large as to provide for a stable support to the belt, without allowing excessive side displacements that, on their turn, may cause the belt to fall from the supports.

Last but not least, it is absolutely necessary to supply the correct longitudinal tension to the belt to prevent twisting due to inevitable frictions that are generated during the movement of loading and unloading carriages. To assure it, an end of the belt is firmly fastened to the structure of the conveyor, while the other end is tightened by using a gravity counterweight.

Conclusions

Modern belt conveyor systems must preserve the features of the conveyed material and prevent it from being scattered within the relevant areas.

Particular loading and unloading needs not always allow using fixed enclosing structures; it is the typical application of Sealtex covering and sealing belt. It is a valuable component that comes

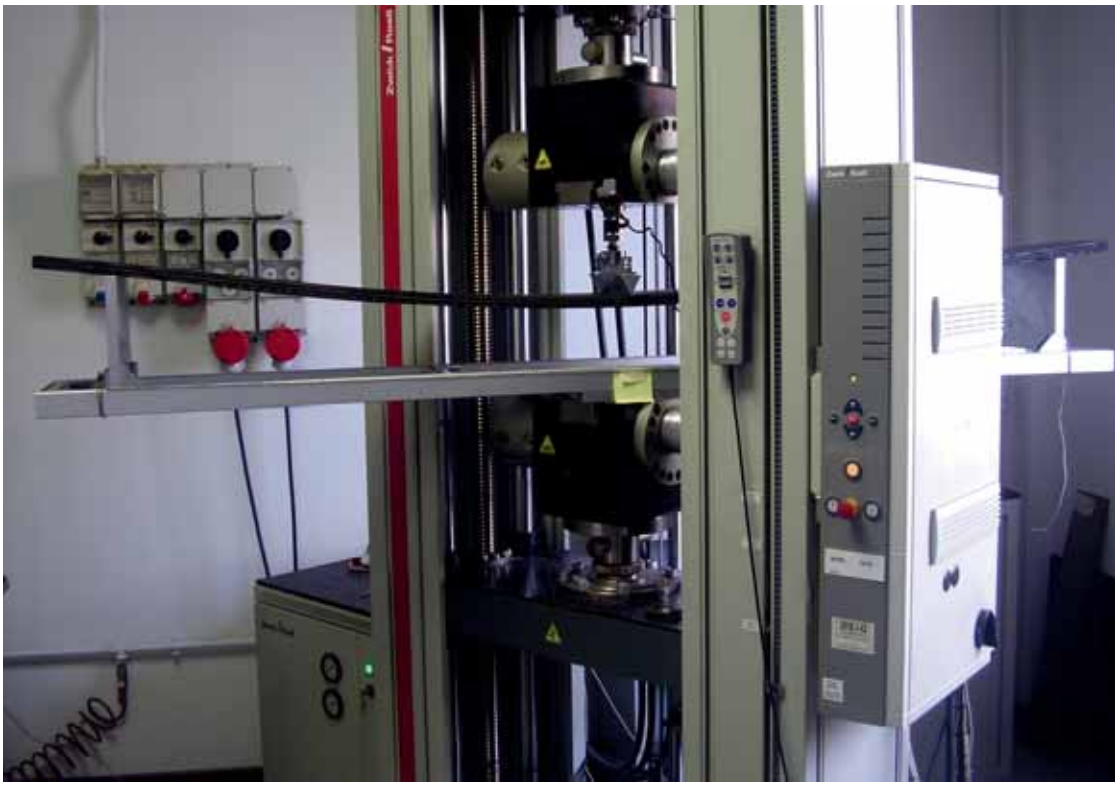

Fig. 5: Deflection tests on real scale samples are performed to define empirical and non-linear corrections to the well-known elastic deformation equations for steel. This is due to the non-homogeneous structure of the belt where an elastic mean, rubber, binds two layers of steel cables one to the other.

from the same construction technology of rubber conveyor belts, which is expressly designed to be self-bearing and, at the same time, flexible to allow creating temporary material loading and unloading openings.

So, it is a simple solution that requires a thorough analysis of the requirements and the conditions of use, as well as a suitable design of the bearing structure, of tensioning and displacement systems, with special attention to the construction of the belt.