Study on the development of a conveyor with reorientation system

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SUMMARY: The study wants to identify, model and automate the way, which will lead to the development of a new conveyor with a system for reorienting the boxes, to be integrated in the palletizing process. Such an automated system must shorten the palletizing time and reduce certain costs in this process. Together with other colleagues, I want this study to materialize in the creation of a teaching stand for the Industrial Logistics specialization laboratory within the faculty. On a personal level, I want to improve this system next year as well, for the completion of my bachelor's thesis.
KEYWORDS: conveyor, reorientation system, palletizing

1. Introduction

Following the manufacturing flow of a product, after the packaging stage, a chaining of equipment used in the palletizing process is defined.

Palletizing is the process of placing the boxes on a layered pallet, where a system of reorientation of the boxes is used so as to obtain, at the end, a pallet consisting of 4 or 5 layers. The layers are oriented so as to create a link between them for a better stability of the boxes on the pallet.

The boxes, already formed and containing products, are taken over by a belt conveyor, type Z. The conveyor has two roles: the first is to transport the boxes over a certain distance, and the second is to climb them to a certain height, which is necessary to start the palletizing process.

At the top of the conveyor there is the system of reorientation of the boxes, it has the role of orienting the boxes, so that when creating a layer, it is oriented opposite to the previous one, forming a connection between two different rows on the pallet.

2. Development of a conveyor with a reorientation system

2.1 Belt conveyor, Z-type

It can be used in the food industry, warehousing and logistics industry (Figure 1a), packaging industry, delivery industry (Figure 1b), electronics and electrical industry, pharmaceutical and other industries, and it can improve the efficiency of transportation and loading and unloading of various goods.

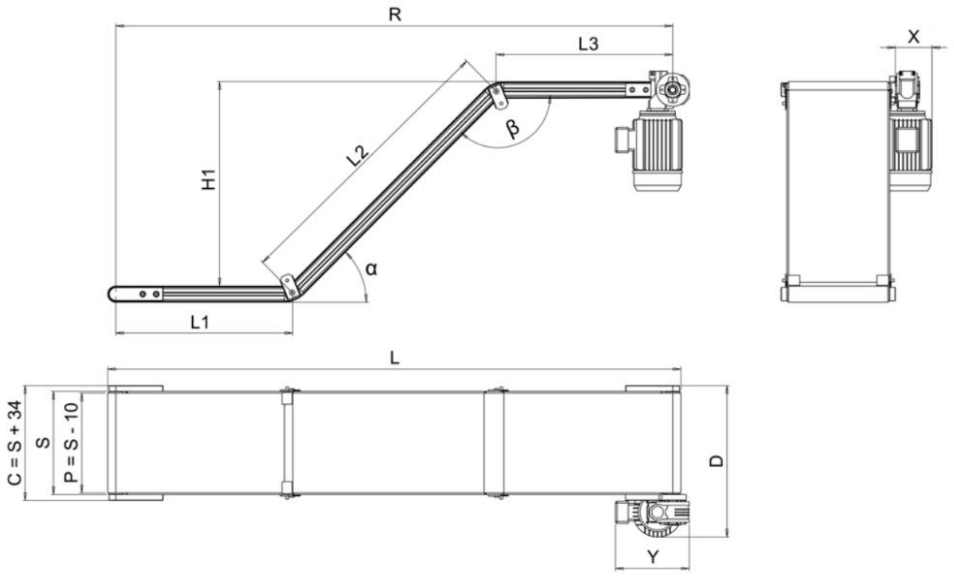
Fig. 1 a. logistics industry

b. delivery industry

The development of such a conveyor must take into account certain parameters that satisfy the needs of the manufacturing flow. These parameters are illustrated in the diagram (Figure 1).

In addition to dimensional parameters when configuring a conveyor, there are some other criteria that help automate the flow matter, such as:

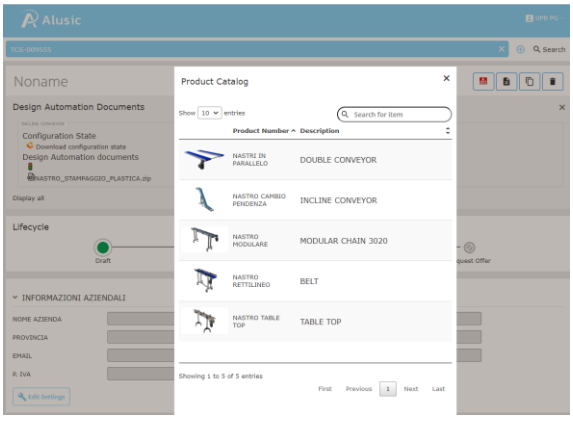
a. Lane movement speed
b. Weight of the box transported
c. Engine power and type
d. The height at which the transport of the box begins
e. Height to which the box must be raised



R – Pulleys Axial Distance; **L** – Conveyor Total Length; **L1, L2, L3** – Conveyor Sections Length;
α, β – Angle between Conveyors Sections; **H1** – Elevation Gain; **S** – Conveyor Width; **P** – Belt Width;
C – Conveyor Width over Brackets; **D** – Total Conveyor Width including the Drive; **X, Y** – Drive Dimensions

Fig. 1 Diagram of presentation of construction parameters

For the realization of the conveyor in 3D CAD, an online configurator, Alusic, was used by choosing the model (Figure 2a):

a. 

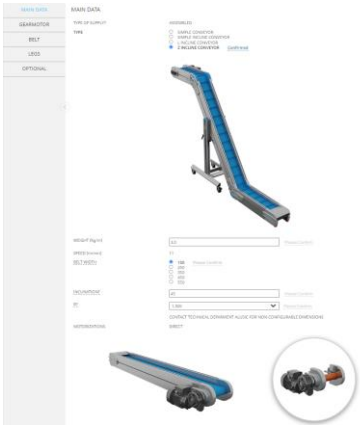
b. 

Fig. 2 Online configurator: a. Choice of model b. Entering parameters

Following the steps in the configurator (Figure 2b), at the end you get the 3D format (Figure 3):

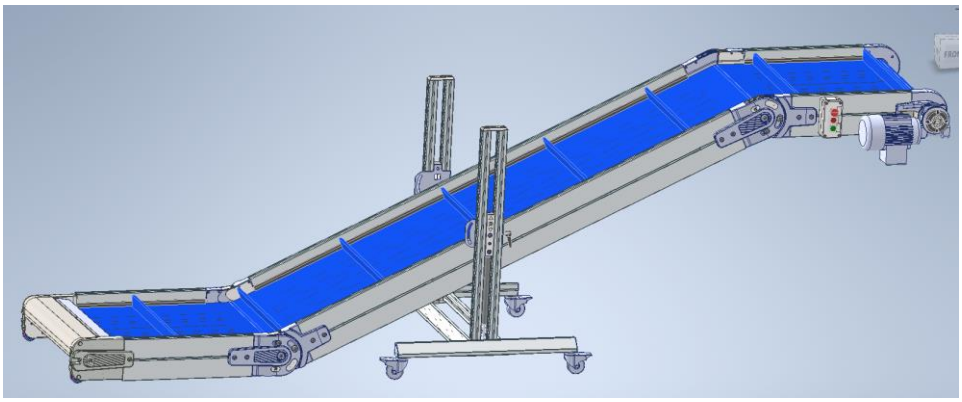


Fig. 3 Belt conveyor, type Z, 3D CAD

2.2 Reorientation system

The reorientation of the boxes can be done depending on the size, weight, and specifications of the boxes (Figure 4).

Fig. 4 Orientation of boxes

2.2.1 Types of re-guidance systems

Taking into account the needs of the palletizing process, there are several types of reorientation systems:

a. Fixed systems (uneven reorientation) that can be mounted / disassembled on the conveyor belt. These systems are frequently used in applications at low speeds and have a low implementation price (Figure 5).

b. A turning system using two conveyor belts, operating at two different speeds. The belts are adjusted according to the size and weight of the boxes (Figure 6).

c. Pushing reorientation system is a side guide that rotates the box 90° and helps to reorient them (Figure 7). The system is pneumatic with air consumption per cycle at 6bar of 1.3 liters and it is fully automated.

Fig. 5.
Bumpy return system

Fig. 6.
Two-band reorientation system

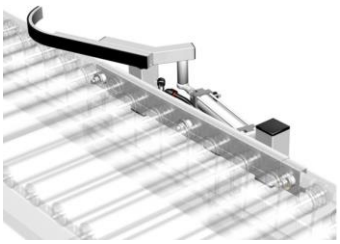


Fig. 7.
Push refocusing system

2.2.1.1 Pneumatic pushing system for refocusing boxes (Figure 8).

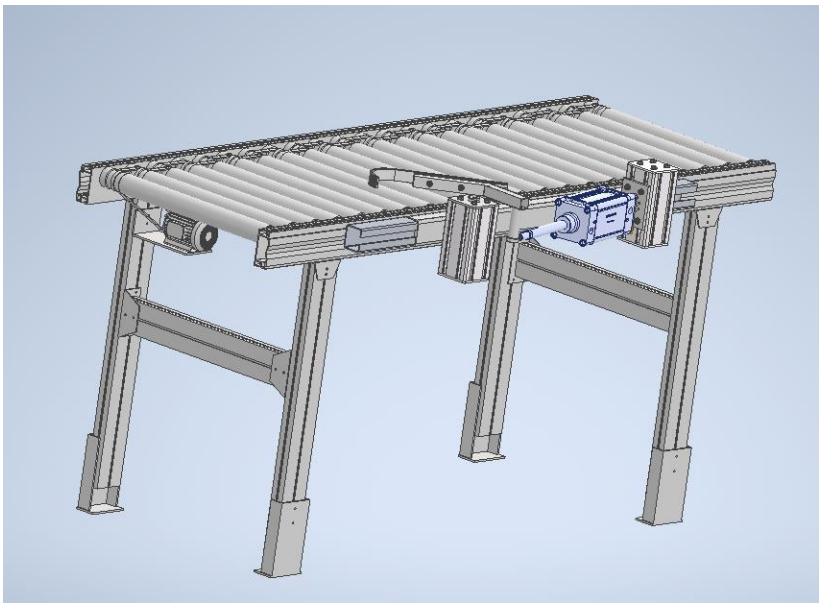


Fig. 8 Pneumatic pushing system

The system uses a rod driven (Figures 9: a and b) by a pneumatic motor, which together with the sensor operates according to a certain algorithm.

a. 

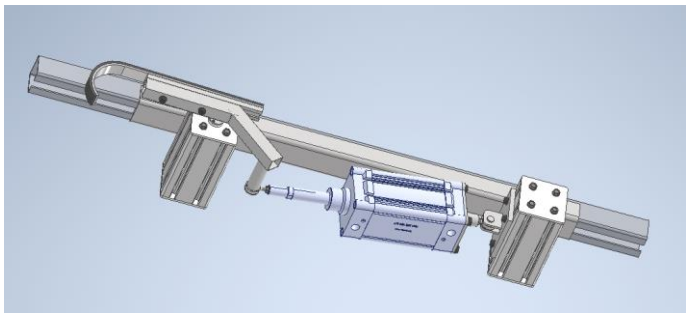
b. 

Fig. 9: a. Real picture b. 3D CAD modeling

The command program algorithm is:

a. Configure the sensor to detect four boxes. This can be done using the compare statement or the counting statement.

b. Pneumatic motor trigger: after the sensor detects four boxes, the pneumatic motor is triggered to action the push rod. This can be done by means of output instructions.

c. After the pneumatic motor has been triggered, configure the sensor to detect two series of three boxes passing by its right. This can be done by means of the counting instruction.

d. Configuring the mirror sensor: in the next cycle, configure the sensor to work in the mirror so that it first detects the two series of three boxes, followed by the last series of four boxes. This can be done by means of the counting instruction.

2.2.1.2 System of reorientation of boxes using the different rotation speed of the reels on the same conveyor (Figure 10).

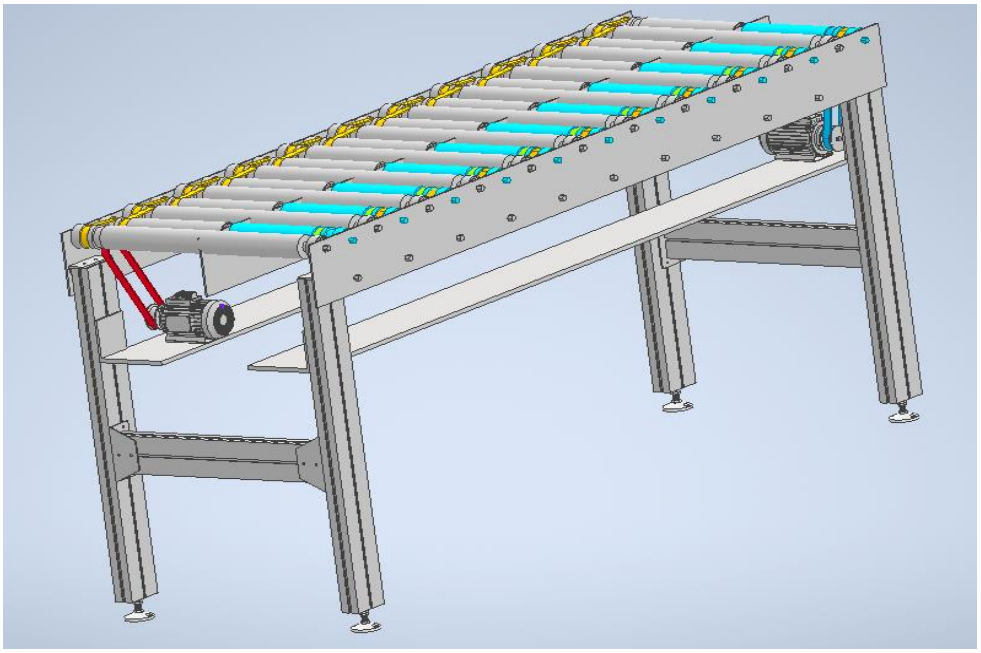


Fig. 10 Roller system that rotates at different speeds

The system also uses two engine systems that act differently on certain rollers of the conveyor. One works normally (Figure 11), thus moving the boxes along the entire length of the conveyor. The colored reels (Figure 12) are inactive (free rotation) when it is not desired to reorient the boxes and run at a different (higher) speed than normal.

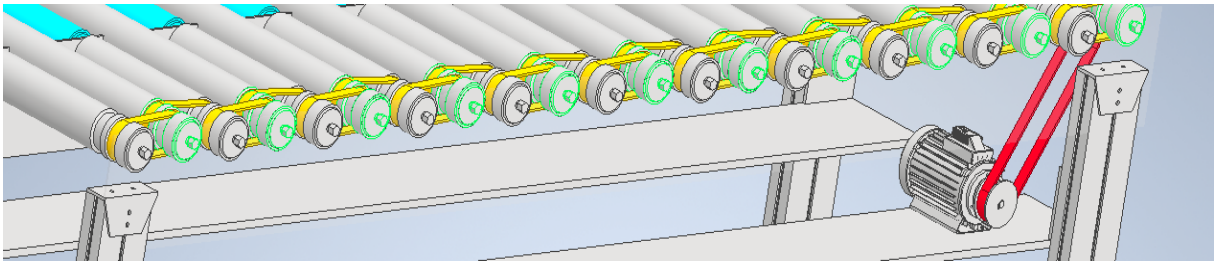


Fig. 11 Normal speed

It is noted that a normal transport speed the transmission is carried out by tying the strap in series, so the transmission is strung from roller to roller.

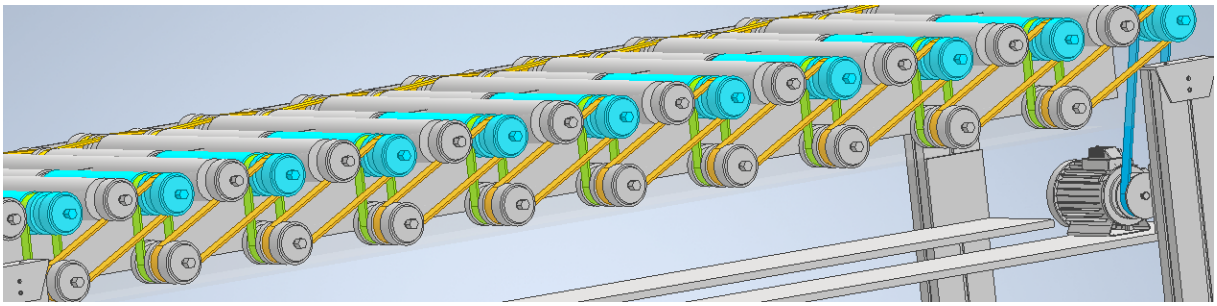


Fig. 12 Different speed

By a separate command to change the frequency, a different speed is obtained. It could be seen that the transmission through the straps is carried out by jumping over a row of rollers, and it is said that they are tied in parallel.

3. Conclusions

As a result of the study, for the first time we used a configurator used in the construction of conveyors, which helps a lot in regarding certain aspects of how they are made.

We have identified ways to achieve the reorientation of the boxes, which led to the realization of two 3D CAD models: the first, that uses a pneumatically operated rod for reorientation of the boxes, and the second one that uses the speed difference between two rows of rollers on the same conveyor.

I want to develop a system to support any graduation work (paper, thesis) and to build a teaching stand with my colleagues.

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