Design of a new lifting device in a filling line

Tetra Pak's filling line R1 includes a lifting device which needs a design change. Current design of the lifting device was observed to have different problems causing unnecessary costs for the company. That is all about to change, however...

Tetra Pak R1 is a filling line which folds, fills and seals packages of the type Tetra Recart®. The machine is the fastest of Tetra Pak's machines for this type of package, it can produce up to 24000 packages per hour and has a continuous speed throughout the whole process.

In the filling machine, there are specially designed carriers, in which the packages are inserted into at the start of the production. The package stays inside this carrier until it is filled and sealed. At the last step of the production, the package must be separated from the carrier in order to be folded into its final shape. This is where the lifting device comes in. The task of the lifting device is to lift the packages out of the carriers and place them at the next part of the production line, see Figure 1.

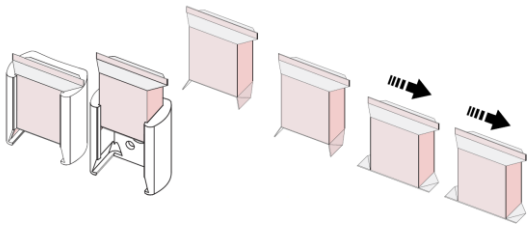

Figure 1. Illustration of the lift.

The goal of the project has been to develop a new solution for the lifting device, which also solves different problems related to the current design.

To summarize the mission, we were tasked with a problem were packages must be removed from plastic carriers, while moving at high speed, raise them up and place them at the following part in the production line. All this must be completed at the same time as problems with the current design are solved.

To identify the problems related to the current design, several interviews where held with people with great experience of the machine. The main identified problems were time-consuming reconfigurations, resistance of environment, weight of the device and manufacturing costs.

By solving these problems, the production will be more efficient, and the company will save money.

The new solution consists of two main parts; a lifting part and a stabilizing part. The task of the lifting part is to push the package vertically out of the carrier at the same time as it moves along the production line. The stabilizing part is responsible for supporting the package during the lift and make sure it is safe and stable.

The lifting part, seen in Figure 2 consist of two identical timing-belt set-ups, mounted parallel with a distance between each other. Each belt set-up consists of four gears and one belt, which together creates the necessary motion of the lift. Between the two belts, there are lifting arms mounted together with lifting plates. The lifting plates will push the package from the bottom and out of the carrier, until it reached its final destination.

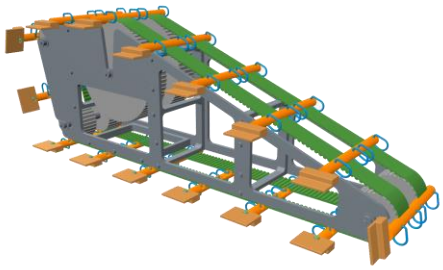

Figure 2. Lifting part.

The stabilizing part is a timing-belt set-up, with three gears and one belt. On the belt, there are support bars mounted which are stabilizing the package during the lift. Two of the gears are moveable to be able to adjust the machine for different package sizes.

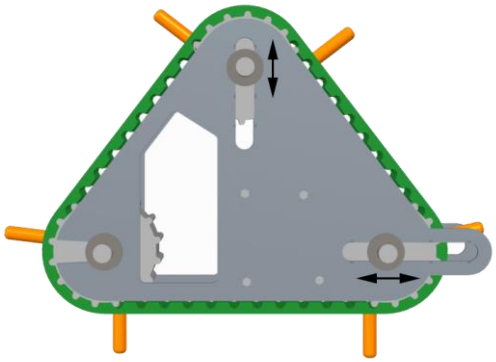

Figure 3. Stabilizing part.

During the entire development process many different concepts were investigated and reviewed. In the end, a final concept was chosen which proved to be a major improvement from the solution used today. Manufacturing costs were lowered with ~33%, the weight with ~48%, the different number of parts and complexity of the machine were also lowered.

The new concept has been developed to include as many standard parts as possible. Tetra Pak already has a lot of different components in different parts of their machines which has been reused. This is beneficial regarding lower developing costs.

Another improvement is the simple and open design of the lifting device. This will make the service and cleaning of the machine both easier and quicker. The design is seen in Figure 4.

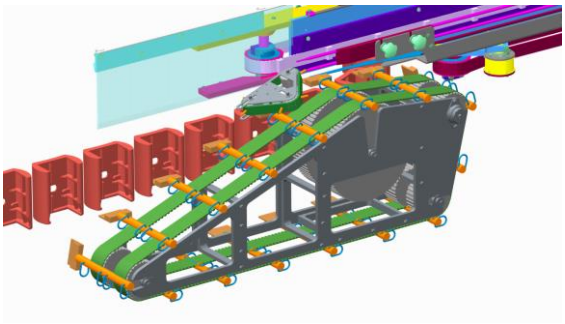

Figure 4. Lifting device assembled in the production line.

Before making a final conclusion, the concept need to be tested to verify its functions. If the concept proves true, it will be a major improvement from the current solution. If Tetra Pak decides to incorporate it into their machine, both the company and their customers will save a lot of money. Tetra Pak with lowered manufacturing costs and customers with a more efficient component replacement and quicker service, which equals to shorter downtimes.

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