The Manufacturing Processes for Encasement of Boxes

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Abstract – The author describes the process of wrapping and unloading boxes on a production line. With the evolvement of drink industry, package requirements become more and more important for all companies. Packaging machine applies to the carton encasement. It can be a single machine, as well as assembled as a production line. It usually applies to the drink, food, medicine industry etc. Packaging machine usually consists of loading, bottom closing, tag posted, and top closing and unloading. This project demonstrates a whole production line for automatic packaging machine.

Keywords: Automatic package machine Production line Carton

1. INTRODUCTION

The development of packaging machine promotes economic development all over the world. The use of carton also gets a great improvement. Undoubtedly, these automatic machines play a prominent role in most companies.

The design of the encasement machine of this paper picks a single piece from stack of folded carton, erects and fills it with certain number of products horizontally through an open end and sealed by either tucking the end flaps of the carton or applying adhesive. The product then is pushed into carton either through mechanical sleeve or by pressurized air. This type of machine described is called a “top-end encasement” machine, which is widely used for packaging bottled foodstuffs, confectionery, medicine, cosmetics, etc.

However, most of current encasement machines may either crash boxes or damage put-in products when sealing boxes. The reason comes that when machine takes out boxes and try to open them at standard rectangular shape, boxes don’t follow the rule, which means boxes may become parallelogram shape rather than rectangular shape. This causes imperfectly sealing. The author of this paper designs a new box-opening mechanism to ensure that when being opening, boxes shape is like the standard rectangular. Furthermore, the author designs other mechanisms to assure that boxes can be easily taken out, sealed, and off-load. In the end, the author lists the cost of the machine and points out that it has cost or price advantage when comparing other current machines.

2. LAYOUT OF PROJECT

2.1 Layout of Whole Production Line

This is the production line for bottle of water as below (Figure 1), including carton opening and sealing, tag posting, and unloading. Each part has its position in the whole line. The standard dimension of carton is 35*30*25cm.

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2.2 Box Loading

The adhesive disc (Figure 2) pulls out carton from the pile. There is a back plate (Figure 3) on the right side of carton so that the adhesive disc can pull out directly, and a soft spring leaf (Figure 4) at the other side at the same time, which to guarantee the carton between can become a square.
In the closing part (Figure 5), the separating (Figure 6) goes down first to open the longer ones at bottom. Otherwise the shorter ones would press the longer. Two push plates move upward to flatten shorter ones (such as Figure 7), then move separately to flatten the longer. In the next step two push plates move left and right (such as Figure 8), to close the bottom, then sealing.

![Figure 5: Bottom of Box Closing System](image1)
![Figure 6: Separating](image2)

![Figure 7: Mobile Push Plates Move Upward](image3)
![Figure 8: Mobile Push Plates Move two sides](image4)

### 2.4 Tag Posting

After finish sealing the bottom, a push plate at the left will lead to the next step, tag posting (Figure 9).

![Figure 9: Tag Posting](image5)
At the two sides of tag posting channel, there are two labeling. At the top, the back plate can make sure the two-side tags are horizontal.

### 2.5 Top Closing

Top closing part (such as Figure 7), can be divided into three parts: unfolding, pressing and closing. The carton comes from left to right. The separating helps the longer ones come to outer side. When the bottles loaded, the separating will go down and let the longer ones unfolded.

It is used for keeping two lengths stay with the wall and do not let the shorts touch them. Then, boxes continue moving until the mix curves touch them.

Mix curves are used for finishing rest closing of box top. It uses transformation of curves to make box top close automatically. There are two curves insert the mix curves, front curve and back curve (figure 11).
Figure 11: front curve and back curve

Front curve (figure 12) is aimed at pressing down one of the shorts and separating the longer ones. The curve is mixed by two curves change in vertical gradual and one curve change in horizontal gradual. The carton will meet the back curve after pass the front one. The back curve (figure 13) can help close the rest two longer ones because of its full gradual change.

There is a labeling machine (figure 14) after the mix curve to post the label. The labeling machine connects to a spring and faces bottom.
Figure 14: labeling

When boxes pass the bottle loading part, a press machine (figure 15) will fall and press the left shorts. It is used for matching up the mix curve.

Figure 15: press machine

2.6 Unloading

Unloading system (figure 16) is located in the last step of the whole system.

Figure 16: unloading system

When boxes finish processing and touch the wall in the last step. A pusher will unload the box from the production line.
3. COST KEEPING

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Cost Keeping of Whole System

4. POSSIBLE FUTURE IMPROVEMENT OF PROJECT

Curve is hard work when it comes to the real product. So, when we engage in the real question of the box encasement, we should use other ways to solve the similar problem. Besides, layout of the product line of this system doesn’t have enough details. It also needs details in the future design.

5. CONCLUSION

This design helps to learn a lot of detailed knowledge, which cannot be found in textbook or class. Although this result may be not appropriate applied in real manufacturing, the process is more important. My professor gives a lot of useful advice in research, and my team member also helps a lot. I will focus on this topic and try to prove it.

REFERENCES


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Dr. Zheng(Jeremy) Li is an Associate Professor of Mechanical Engineering in School of Engineering at University of Bridgeport. He has the extensive industrial, engineering and research experiences in US different industries before join UB. He worked as a principal/senior engineer in different US industries including biomedical instrument and product, solar and wind power system, automated machinery, automation control in manufacturing, precision mechanism, HVAC system, US Air Force and Army contract. He had four patents while worked in different industries. His research interests are Biomedical Engineering & Instrument Design, Nano-material Technology & Processing Techniques, Automated/High Speed Mechanical & Assembling System Design, Automated Manufacturing System Design, Fluid & Flow System Design, Mechanical Structure Analysis/FEA, and etc.