

Study on a New Mechatronic Design for Toothbrush Packing Machine System

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Abstract: Due to a Chinese factory's need to increase the speed of toothbrush packaging and decrease operating costs, according to estimated one factory produce 100000 pc toothbrush per day. I'm assigned to design a machine that would Using Mechanical and different conveyer system. According to the Chinese manufacturing factories are basically profit form their speed of manufacturing. First of all, we analysis about other factories methods, each factory using the same methods to packing their production. The advantage of using this kind of mechanism, electrical and conveyor system every factory can speed up their production lines, low cost and less man power, avoiding regular stops. In this paper describes all the methods and designs (auto CAD, Pro E) Mechanical parts to well understand. This kind of design we can provide for the other kind of packing items, according to the items size the mechanism parts can be replacing with very low cost. Understanding about the mechanical parts and electrical parts in this project is our main target. In our design the Increase of the production can be more than 80%. Even though this can use for the small-scale production line. Our main target of this theses gets higher production line with low cost. currently their local market production is 40%and export market 60%.all the factories are willing to get their advantage of this kind of design to increase their production.

Keywords: *Toothbrush Packing Machine System; Mechatronic Design.*

1. INTRODUCTION

A Chinese factory (Yangzhou Lucky Tourist products Co.Ltd) currently packages a variety of toothbrush. Their means of operation of packing is a group of about five women who do the job manually. The women stand around a table and take toothbrushes and put it to the correct order in manually. They proceed to take toothbrushes to PPT malt, load five toothbrushes into each, and pass them outer layer (printed cardboard). They package an estimated 10000 of toothbrush every day. There are several types of boxes for several types of toothbrush. The dimensions of

each type vary slightly, but they are all of similar shape. The pictures below show one type of box in its partially folded and completely folded states.

The factory would like to increase the speed of packaging and decrease its costs as much as possible. Its current operating cost primarily consists of the salaries of the five workers. The factory has requested that we automate their process as much as possible in order to reduce the number of paid workers to the smallest number while maintaining or improving upon the speed of the current operation. [1].

2. PROPERTIES

The table 1 shows flow diagram in the mechanical parts we use screw conveyers, indexing conveyer system, And the most import part in this Research turning the brush to different sides, in our mechanical part can be change to sides and move it in screw conveyor in accuracy. The objective of the research these all the comportments, mechanical parts can easily install to the industrial production.

The approaches are changing the side of forming station; in this situation normal forming station we design to change side. It will keep running and accuracy with the brushers.

Table 1. Flow Diagram of Processing

Injection Modeling	Tufting Machine	Finishing line to conveyor	Indexing conveyor	Screw conveyor	Blister Packaging Machine
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Fig. 1 Injection molding machine, also known as injection molding machine or injection machine. It is the main molding equipment for making plastic products of various shapes from thermoplastic plastics or thermosetting plastics using plastic molding dies. Divided into vertical, horizontal, all-electric. The injection molding machine can heat the plastic, apply high pressure to the molten plastic, and eject it to fill the mold cavity

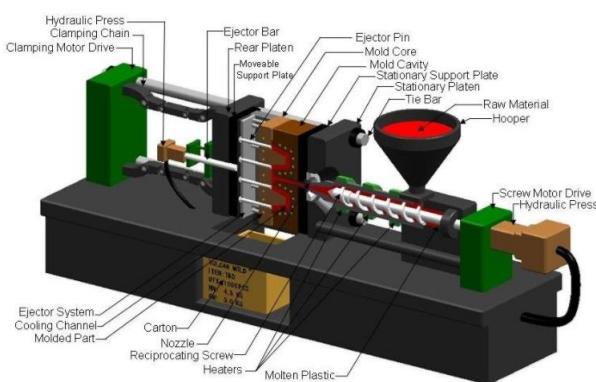


Fig.1 Injection Molding Machine

Fig 1 shows Injection molding machines usually consist of injection systems, mold clamping systems, hydraulic transmission systems, electrical control systems, lubrication systems, heating and cooling systems, and safety monitoring systems.

3. FINAL PRODUCT IN CONVEYOR

3.1 Plastic Belt and Chain Conveyor

In this chapter, design conveyor to collect all the brushers from the tufting section. This conveyor we expecting well accuracy to the next indexing section. So, we take Radius, RPM (Angular Velocity), Linear Velocity for calculate of time.

The Angular to Linear Velocity formula is:

$$v = r \times \omega$$

Where:

v: Linear velocity, in m/s

r: Radius, in meter

ω : Angular velocity, in rad/s

The RPM to Linear Velocity formula is:

$$v = r \times \text{RPM} \times 0.10472$$

$$0.05=0.05*\text{RPM}*0.10472$$

$$\text{RPM}=9.54\text{Hz}$$

Where:

v: Linear velocity, in m/s

r: Radius, in meter

RPM: Angular velocity, in RPM (Rounds per Minute)

3.2 Indexing Conveyor

The indexing conveyor used to be keep the accurate distance and the proper pick up from the first conveyor. Introduce the overall design and algorithm design of the positioning system, including the research of without using man power machine, the selection of the development tools and the design of the algorithm. By analyzing the performance simulation results of several algorithms, an improved algorithm based on design by method is proposed as the algorithm adopted by the positioning system.

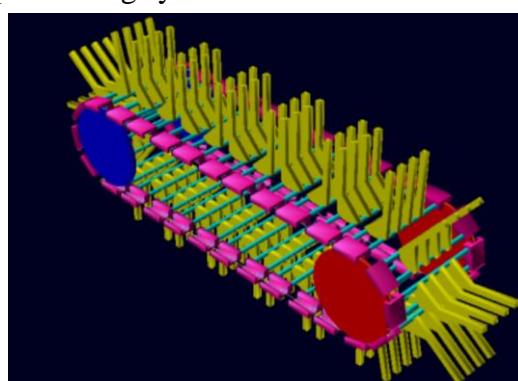


Fig.2 Indexing Conveyor

3.3 Screw Conveyors

[6] Screw conveyors are volumetric conveying devices. Every revolution of the screw discharges a fixed quantity of material. The purpose of a screw conveyor is to transfer product from one point to the subsequent. Screw conveyors are generally controlled by a motor via each other conveyor or metering device. Rotary valves, screw feeders, belt conveyors, grinders, or even other [27] screw conveyors typically hook up with the inlet of a screw conveyor. Screw feeders are much like screw conveyors besides that screw feeders are usually flood loaded or one hundred percent full inside the Intel location. Screw feeders are designed to volumetrically meter fabric from a hopper, bin or silo at a managed price. Many screw feeders make use of adjustable pace drives to allow for varying the material drift charge

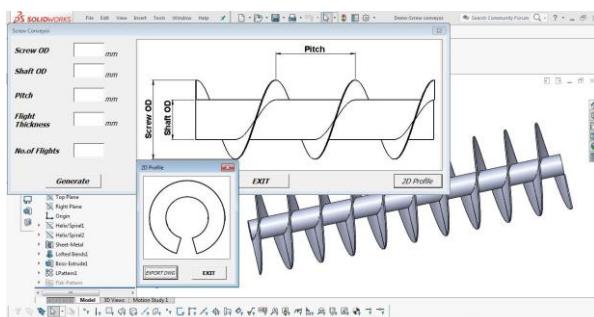


Fig.3 Screw Conveyor

Screw Feeders are generally prepared with a shroud (curved) cover for a short distance beyond the inlet beginning. This prevents flooding of the conveyor with material. While handling very freely flowing materials, extended shroud covers, tubular housing production or quick pitch flights are every now and then required for fine management.

3.4 Holding Side Bars

The machine offers rapid and smooth resetting of product guiding systems in manufacturing flows. The effect is improved line efficiency and safe product distribution at some point of the line. The system has a modular design and consists of instantly guide devices for directing the aspect guides on the immediately sections, and bends units for controlling the facet manual widths on undeniably bends. Guide rails are used to manually move the goods being conveyed and additionally to save them from falling off the conveyor. The easy Conveyors machine includes a flexible machine of guide rails and guide rail brackets which make it viable to house many extraordinary product dimensions and shapes. Keep the brush accuracy we the usage of facet bars for holding the brush tightly to until turn to the vertical facet

3.5 Linear Actuator

The term “linear actuator” covers a massive range of products. A linear actuator is a mechanical device that converts electricity (power from air, strength or liquid) to create movement in an instant line; contrasted with circular movement of a traditional electric powered motor. It is able to moreover be used to use a force. In this design we use this mechanism for the turn the brush to vertical facet. According to the pressing continuously, the

brushers are push through the screw conveyor. The cease of the factor we use two sliding tips. While its downward if the brush come through facets can be turn to both aspects.

3.6 Conveyor Side Guide Rail

The distance of the guide rail depends on the height of the brush head. However, it need to be lower than any brush head within the production line. So, this is an adjustable element that could modify the distance of the guide rail.

The design we use in right here, turn the position of the brush. On this mechanism allows to turn left side until visit the final stage.

After installing side guide inside the screw conveyor all of the brushers will hit up on the edge of the brush and it's going to turning to horizontal position, so this mechanism will maintain same distance and the expected position, Until to Blister packing machine.

3.7 Control System PLC

There are five basic components in a PLC system:

The PLC processor or controller

I/O (Input /Output) modules

Chassis or backplane

Power supply

Programming software that runs in a PC

Network Interface the PLC processor.

It stores the control program and information in its memory. Reads the status of related input gadgets. Executes the control application. Instructions related outputs to alternate nation primarily based on software execution for instance: flip a light on, start a fan, regulate a speed, or temperature and springs in various physical bureaucracy

4. CONCLUSION

This thesis based on design without man power packing system. First of all, the main point of this theses about factory based in Yangzhou Lucky Tourist products Co. Ltd. When we visited to this factory main problem was speed of the production line. And Analyzing around Yangzhou tourist production factories they also have the same issue.

According to the production line every factory using simple methods to get pack all the productions. According to their requirement we based on new packing design without man power. The first obstacle is all the workers collect brushers form the final product of tufting machine. Here after that they take all the brushers to packing area. Most of the factories are using same methods. Some of the factories first make all the PET form according to their toothbrush design, here after workers will take all the brushers and keep one by one in to the PET form with correct order. In our conclusion is for this method will take more than 20 minutes to finish around 500 brushers.

Our design main target design without man power packing machine. After the tufting machine we directly set of one of bucket to collect all the brushers with correct order. In their using mechanism to get one by one to conveyor. This design most important part is time.

Second stage is conveyor; this will keep proper way to the next step of indexing conveyor area. Our design of the hooks will take (brush) one by one in to indexing point. Indexing point will keep the same distance and forward to the screw conveyor. The screw conveyor is a special design of this theses. To get proper distance and make three turns from another mechanism screw conveyor is the most suitable in this arrangement.

Side rail guide is the third main design in this thesis. While forwarding though the screw conveyor there have two side bars to hold them up in accuracy. While moving forward the side rail guide will help to turn the brush head to left or right. After passing through the rail guide, linear actuator will be working with piston to get vertical side of brush head. Here after we using another side rail guide to turn brush head right side. While ending of the screw conveyor the Blitzer PET form will connect, after the malting one by one brushers will drop to the whole of PET and to the final stage.

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