

Modification and Analysis of Existing Label Cutting Machine

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Abstract – New modeling solution for the behavior of packaging machines, and a strategy for maximizing the production rate i.e. increase the speed of the cutting of label. We have to change the power Transmission of the machine for reduce noise of the machine as compare to the current noise of the machine. The modeling solution for the behavior is developed in existing Packaging(cutting) Machine, to overcome some limitations of the machine. The synchronous behavior of the packaging machine is also developed in power transmission, From which the optimization problem is defined. The result of the optimization shows that it is possible to improve the efficiency of packaging machines with new configurations compared to more conventional design. The need for modeling synchronous behavior raises from the built in nature of packaging (Cutting) Machines. The Necessity for a common model to be shared between different domains creates a gap for synchronous behavior modeling. The machine is used to cut the paper and small thickness of sheet. Therefore there may be the chances of increase in production rate by simultaneously cutting the number of sheets in a single pass. Reduction of man power. Reduction in cost as compare to conventional machines is the major advantage of this project.

Key words – Label Cutting Machine, Increase Speed & reduce Noise.

1. INTRODUCTION

Incepted in the year 2001, Akar shrink packs has achieved a niche for itself in this highly competitive industry, Company Has, with shier dedication and honest approach towards our business, achieved immense success in their domain. Company is engaged as a manufacturer of PVC heat Shrink sleeves. Their Product has wide application in the pharmaceutical, Cosmetic, Herbal, Drinking Water, Pesticides Industries, Biotechnology food & agro sector, Chemical Industry, and Many other industries and sectors. Akar shrink packs have an excellent in-house manufacturing facility, which aids in the production of quality products. It is always a conscious effort on our part to offer the goods at competitive prices and deliver them to their respective destinations in time. This organization is blessed with a modernized infrastructure facility, which supports us to carry out all the our business activities in systematic manner. They have divided our facility into various departments which includes manufacturing, QC, R&D unit, Administrative to carry our various manufacturing activities.



Figure – 1.1: A Label Cutting Machine.

A label cutting machine is used for cutting various types of labels in various shape and different sizes. As per the problem regarding the speed is concerned, the company was already using belt, Pulley and chain drive arrangement. As speed of cutting is very low the task is to increase the speed of cutting, so we found our different feasible solutions by which we can increase speed and decrease the noise ultimately the efficiency get increased. By using gear drive arrangement the system is bulky and it will be more economical. Hence we cannot use it in our machine so, another way is to use belt, Pulley and cam arrangement but it also has drawbacks like increase in noise and its having more cost. After that we have also proposed one more concept of belt, pulley and scotch yoke mechanism which was different from the company already using, now we will use this mechanism in our existing cutting machine. These Three are the solutions provided by us to the company. The Company Approved our idea of using scotch-yoke mechanism and finalized for the manufacturing.

LITERATURE REVIEW

G. Arundeesh (et.al)(2017).[1] His Paper contains information about the paper-cutting machine is a recent development in the industrial world. The difficulty of making successful machine of this kind to meet the new demands for

accuracy, Speed, convenience, and safety, has been overcome gradually in recent years and these are now several machines quite efficient and adequate to meet the demands of the modern manufacturer. Rotor arrangement of DC motor will rotate which produces rotating motion of the motor. This arrangement which is connected to DC motor will move forward and backward based on the rotation of DC motor, which is connected to paper cutter blade arrangement is fixed for the purpose of cutting operation. A paper cutter (also referred to as paper trimmer, paper guillotine or simply a guillotine) is a tool often found in offices and classrooms, designed to cut a large set of paper at once with a straight edge.

Sathyamyla Kanthabhabhaja, et al. (2014) [2] He studied complexity in manufacturing industry has increased due to introduction of partial automation and enormous information exchange. Though technological developments are intended to provide a simpler manufacturing environment, it complicates the design and control of manufacturing systems. A common modeling platform is recommended to handle information exchange and to develop a collaborative work, in this paper involving mechanical design and software development. This paper proposes a new modeling solution for the synchronous behavior of packaging machines, and a strategy for maximizing the production rate based on a formal model. Mathematical models of motion profiles are defined to control the servo motors in master-slave relations. The motion profiles are defined by choosing an acceleration profile fitted to the position points of the servo motors (0 to 360°). The motion profile defines velocity curves for the slave motors and hence generates a synchronized motion between different behaviors.

Prashant Borlepwar (et al.) (December 2016) [3] This paper studies the leather cutting operations through various research works and provides the theoretical data for design calculations, fabricate & automate the leather blanking machine in such a way that the required length of leather blank of size 200 x 200 mm can be cut with keeping cost minimum for a sponsored company. Cutting tool must be made of a material harder than the material which is to be cut, and the tool must be able to withstand the heat generated in the cutting process. Components such as spacer, Stopper Plate, Guide plate, etc. where there is relative movements between components, due to this they are under continuous stress which results in wear & tear of parts. Machine structure (i.e. bed, table, etc.) require more compressive strength than tensile strength also it should possess stability, durability and vibrational damping properties for that the materials can be used in casting and fabrication form.

Sunil H V (et al.) (May 2017) [4] The design and fabrication of paper cutting machine using Geneva mechanism is useful to cut papers in equal and accurate dimensions. Geneva drive is an indexing mechanism that converts continuous motion

into intermittent motion. Due to which paper is moved between the equal intervals of cutting period. Then the paper cutting is achieved by crank and lever mechanism. The cutter will be back to its original position by lever crank mechanism. The objective of this concept is to design the Geneva mechanism operated paper cutting machine which eliminates the most time taking process of paper making and helps in feed equal dimension paper in each rotation. This machine is used to reduce the manual work of paper cutting, and also time saving. This machine is very useful for paper manufacturing industry also we can avoid the human errors and also we can use this equipment also in school, colleges, stationary shops etc.

Anupam Chaturvedi (et al.) (2017) [5] Considering the present pneumatic paper cutting machine in the existing market, they take too much time for cutting the paper. Moreover, such machines are also noisy during their operation. The current invention relates to the pneumatic paper cutting machine with an increased torque capacity. The increased torque capacity of the machine will also increase the pressure capacity of air coming out of the compressor. With the help of this high pressure air, we will be able to cut more bunch of paper at one stroke. This will increase the output of machine.

Runqun Liua (et al.) (2017) [6] This paper based on the research the motion mechanism of the rotating transverse paper cutting machine. After this it has been clear about the theory of motion between structure parameters and paper feed parameters. On the premise of a certain roller speed planning, ultimately ideal useless power consumption reach zero in theory by parameter optimization. Rotating transverse paper cutting machine main structure includes two rollers, gears and frame, on each roller along the length direction is equipped with spiral cutting blade, two helix angles of the blades equal and toward contrary, the paper through the horizontal middle of the two roller. Through the analysis of the roller speed planning, we find these parameters relate to each other and the effect of each parameter to the correct cutting is remarkable.

Ju Yi et al. (2017) [7] From this paper it is suggested that the thin-walled stainless steel pipe was easy to be deformed in traditional method of cutting process, which can reduce the dimensional precision and surface quality. Therefore, it was urgent to solve this problem by a pipe cutting machine with high precision and high precision and high efficiency. In the process of stainless steel pipe cutting, the pipe was subjected to bending, shearing, torsion and other loads. In order to ensure its safety, it was necessary to conduct strength calculation and finite element analysis on the core components. Three dimensional model of pipe cutting machine was established by 3D software Pro-E and stress analysis was carried out by ANSYS finite element analysis software.

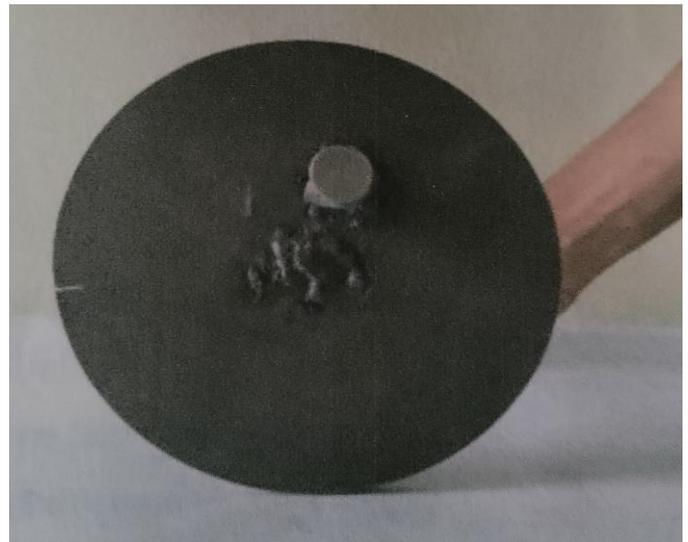
3. DESIGN SPECIFICATION:

Part Name	Part Qty	Size
Bush	3 Nos	Dia. 20 x 30 mm
Circular Plate	1 No	Dia. 80 x 5 mm
L angle	1 No	650 x 50 x5 mm
Bar	1No	Dia. 20 x 120mm
Bearing	3 Nos	P205
Nut	6 Nos	M18x1.5 mm
Bolt	4 Nos	M12 x 1.5 mm
Flat Belt	1 No	1300mm
Pulley	1No	Dia. 200x ID100mm

3.1 Design Parameters:

1. Horizontal Supporting square bar
2. Lever Calculation.
3. Vertical Supporting Rod.
4. Eccentric Rod.
5. Pulley Dimensions.
6. Belt Selection.
7. Shaft Design.
8. Bearing Selection

3.2: Parts Manufacture Photos:



Lever & shaft Assembly photos



4. : ANALYSIS PROCEDURE

1) Geometry:

First generate the geometric model of the Label cutting machine parts from CATIA into Ansys software.

2) Define Materials:

Define a library of materials for Analysis. In this Analysis of parts , selected materials as per requirements for welding. These materials can be selected from the engineering data available in Ansys software.

3) Generate Mesh:

Now generate the mesh. This divides the drawing into finite number of pieces. It will show the number of nodes and elements present in the drawing after meshing is completed.

4) Apply Boundary conditions:

Simply supported boundary conditions are considered for the Parts. In this case both the ends of the parts are given

fixed support and the load on the part is applied at the bottom leaf in upwards direction.

5) Obtain solution and generate results:

Now obtain the solution for the stress, deformation and elastic strain and generate the results.

4.1 Analysis of parts

Now, let us check the results obtained in Ansys for stress, deformation, elastic strain and weight for the specified materials.

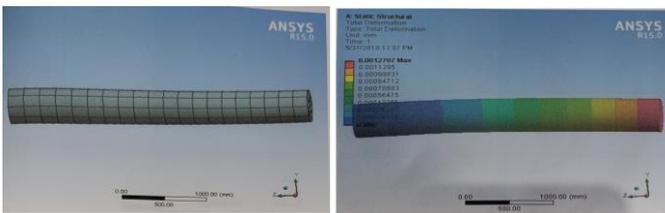


Figure – 4.1 Horizontal Rod Meshing

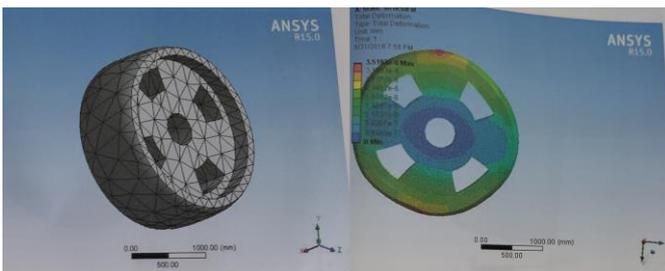


Figure -4.2 : Pulley Deformation

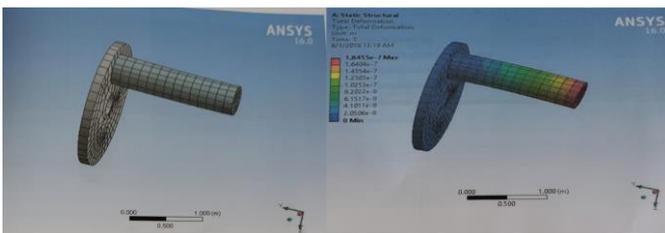


Figure – 4.3 : Equivalent stress of Eccentric plate with rod

4.2 Comparison of theoretical and analysis result

Comparison of theoretical stress, deformation and weight with that of the results obtained from the Ansys software:

Table -4.2.1: Comparison

sr. no.	Parameters	With old mechanism	With New Mechanism
1	Cutting speed	197 PPM	300 PPM
2	Noise Level	90 – 100 db	70 – 80 db
3	Efficiency	25.71%	51.42%

Table-4.2.1 shows the comparison before and after assembly change.

5. CONCLUSIONS & FUTURE SCOPE

1. Thus from this project, we increased the label cutting speed of the machine from 197 pieces per minute to around 300 pieces per minute.
2. We have increased the efficiency of the machine from 25% to 38.07%.
3. The noise of the operation of the machine also has been reduced from 95db To 80db.

5.1 Future Scope:

PVC shrink label cutting machine has wide possibility of future expansion by doing some modifications. Presently the mechanism used has some disadvantages which can be eliminated if we use modern methods of power transmission and it also can be made fully automatic. With help of sensors, electronic DC panels, Distribution Box and transducers the PVC shrink label cutting machine can be semi- Automatic or fully automatic. The machines with superior built quality, Maintenance free design and best in class accuracy. It is also used for paper sheet cutting, Foil roll cutting.

Modern Machines May include following:

1. Servo motor for indexing.
2. Shear cutting by hardened shear blades specially designed to cut labels.
3. Auto conveyor for easy collection of small labels.
4. Microprocessor based controller.

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