

Design and Fabrication of Paper Bag Manufacturing Machine

Sanket Nikumb¹, Vrujesh Panchal², Shreyas Naik³, Parth Vyas⁴, Prof. Dipak Chaudhari⁵

^{1,2,3,4,5} Department of Mechanical Engineering
^{1,2,3,4,5} Vidyavardhini's College of Engineering and Technology, Vasai

Abstract- Paper bags are very much common these days. We can see women and children carrying paper almost everywhere They can be seen in malls, showrooms, schools, groceries etc. Paper bag is an essential commodity of our current generation. Paper bags are famous more than ever now. Also the biggest reasons why the use of paper bag is advantageous are that they are recyclable, biodegradable, environmental friendly, inexpensive and practical to use. Paper bag use wood as a raw material which can reused to greater amount without huge expenses. The work presented in the paper below includes designing and manufacturing of a machine that produces paper bag of a newly developed folding technique. The machine has been downsized owing to many reasons such as space constraint, reducing the lead time and reduction in capital cost of the actual machine. We were able to down size the machine using a completely different template for paper folding and introducing the new folding technique to reduce the entire cycle time manufacturing machine.

I. INTRODUCTION

Paper bag Machine is an assembly of various individual machinery to form a single unit to cut paper templates/bag within the given range of dimensions into specified design to be used for further application. The objective is to make a ready-to-carry package, for fast & easy paper bag production. In this field we have attempted to be innovative and have designed a new method that has not been tried before. We have designed a new method of folding which is much more convenient and occupies less space. Our design includes combination of two separate paper carrying conveyor made up of canvas or rubber which provide enough length and flexibility for folding paper. Gluing function has accommodated in a very innovative way so that it does not interfere with any moving part. Bag is made from a simple rectangular template which can be of any size according to the need of customer. In our case the size of bag is A4 which is selected because it is readily available. The manufacturing process starts with feeding A4 size paper to the first conveyor on which paper undergoes gluing and folding operation. The direction of the second conveyor is a right angle to the first for the purpose of final folding operation. Our design completes the manufacturing of the bag in just two folding operations thus facilitating faster production rate. Paper thus produced

can be used commercially for many daily applications. Since paper bags can be recycled our project also aims towards promoting use of paper bags as much as possible to reduce the harmful effects on environment.

II. LITERATURE REVIEW

Design and selection of proper conveyor belt – A paper by Konakalla Naga Sri Ananth, Vaitla Rakesh Pothamsetty, Kasi Visweswarao. This paper gave us the idea about selecting the proper conveyor belt. Accordingly, we selected the conveyor belt material and thickness.

III. DESIGN

1. Paper Bag Template

Template for preparing bag can be defined as a shaped pattern of paper precut to facilitate the folding operation. Thus for reducing time and ameliorating the machine we selected a very basic template of rectangular shape sized (210 × 297 mm). Size of this template can vary according to customer requirement.

2. Folding Technique

Since the template for the paper bag is simple as showed above the folds used for making bag are much simpler and reduced in numbers. Folding is accomplished by metal rod of 6mm arranged as shown in diagram below. Bearing setup is used to hold the paper on to the conveyor at the same time carrying the paper in forward direction.



Figure 1.



Figure 2.

3. Conveyor Design

- a) According to our folding technique we identified that we would require two separate conveyor placed at an angle of 90degrees to each other. After performing analysis on cycle time and paper bag production rate we arrived at design specification given below.

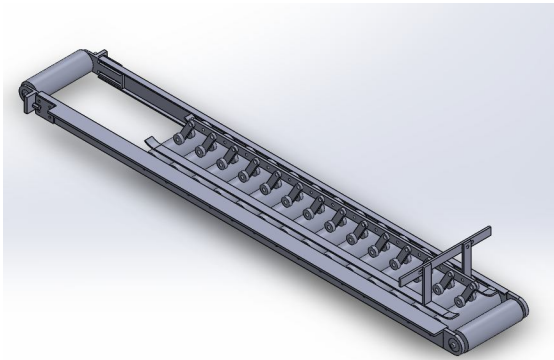


Figure 3.

- b) For keeping the paper onto the conveyor so that it does not fly away and also to guide the paper for folding we designed the bearing support as shown below.

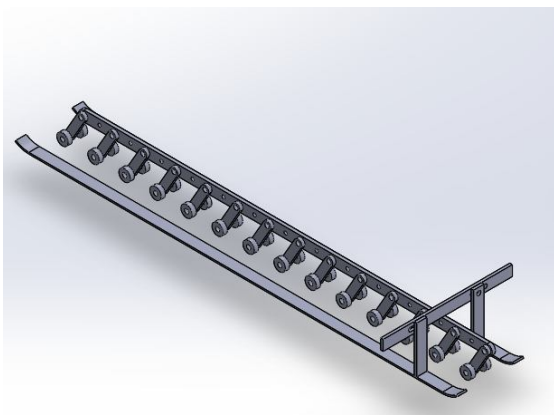


Figure 4.

- c) For adjusting the tension in the conveyor belt so that proper conveyor belt tracking can be performed we designed the adjuster plate as shown below.

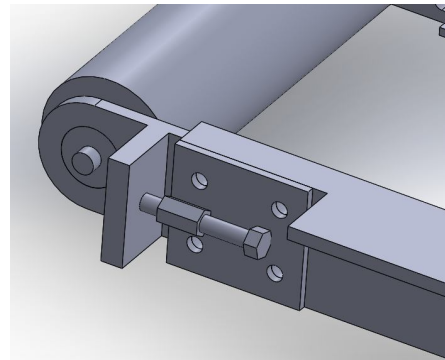


Figure 5.

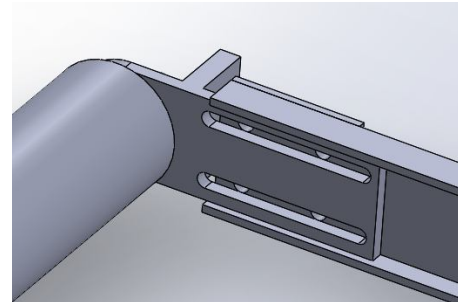


Figure 6.

IV. FABRICATION

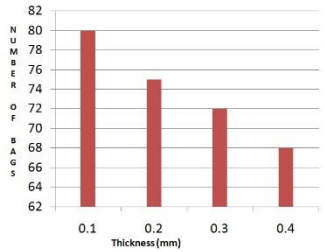
Fabrication of the machine was done in house by the authors of this paper. It took us 3 months to build the successful running machine which is shown in figure below. The material procurement list for each and every part used in the machine is also given below

Table 1. Specifications of the system

Specifications	Conveyor (1)	Conveyor (2)
Length	1219mm	1524mm
Width	150mm	300mm
Belt Material	PVC	PVC
Driven roller(DIA)	48.23mm	48.23mm
Driving roller(DIA)	48.23mm	48.23mm
Motor	50watts	200watts
Speed	100rpm	100rpm

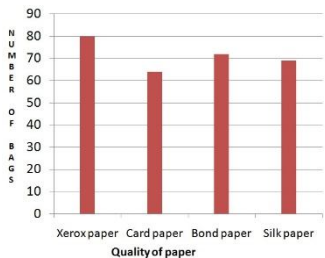
V. RESULTS

The machine after being built completely was rigorously tested and various tests were performed on it. This test included test like running the conveyors at various rpm and then feeding papers of different dimensions, shape, and thickness for each of that rpm respectively. Using those results various graphs were plotted. Thus this helped us to verify the reduced cycle time as well as calculate the efficiency of the machine. The results are showed below using various graphs.



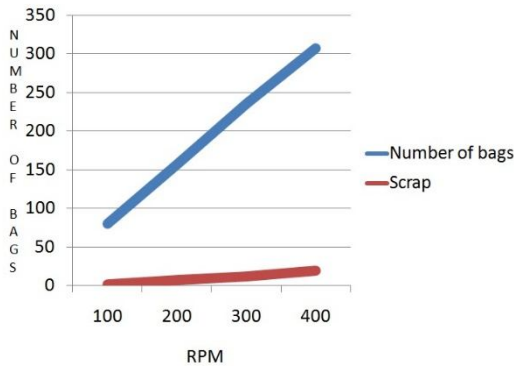
Thickness vs number of bags in a minute

Figure 7.



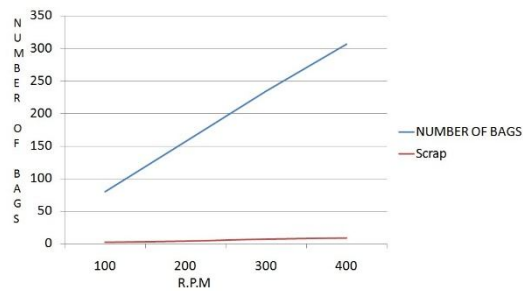
Quality of paper vs number of bags in a minute

Figure 8.



RPM vs Number of bags & scrap

Figure 9.



R.P.M vs Number of paper bags & Scrap

Figure 10.

Table 2. Result Table

Property	Traditional Diamond fold	New Template
No of folds	6folds	3 folds (2 sub folds)
No of bags per minute	40-50	80-100
Bags gluing side	Bottom	Side
Area occupied by the machine	Large	Comparitively less
Volume(l)	0.87	0.93
Capacity (kg)	0.4-0.5	0.6-0.7
Creasing	Mandatory	Optional

VI. CONCLUSION

1. Machine successfully completes the manufacturing of single paper bag.
2. Manufacturing rate of the machine is 80 bags per minute with current setup which can be increased according to requirement with larger setup but keeping the mechanism same as ours.
3. Bags thus produced due to new folding technique has a capacity of 0.93litre as compared to old template bag which has a volume of 0.87litre

REFERENCES

- [1] R.S. Khurmi, J.K. Gupta, Theory of Machines, 6th ed. 2008.
- [2] Kalaikathir Achchagam, PSG Data Book.
- [3] V.B. Bhandari , Design of Data Elements ,3rd ed. 2010.