Student Design Projects

Project Brief:
Low Cost Sanitary Napkin Making Machine
MSME Unit:
NA

Salient Features of New Design:
- Increasing productivity to great extent and providing a quality product at affordable price.
- The biggest barrier to using a sanitary napkin is affordability. Around 70% of women in India say their family can’t afford to buy them.
- These are the findings of the latest study, “Sanitary Protection: Every Woman’s Health Right”, undertaken by AC Nielsen and revealed by times of India thus this machine will help in producing napkins at low cost thus will help in providing a hygienic way of living.
- It will also provide labour to women in rural areas
- Improvement in way of life especially for poor and rural women.

Commercial Viability:
The machine is functionally tested and ready to be adopted by a manufacturer
LOW COST SANITARY NAPKIN MAKING MACHINE

A Report by

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Chapter 1 – Introduction

If the point of contact between the product and people becomes a point of friction, then the industrial design has failed. On the other hand, if people are made safer, more efficient, more comfortable—or just happier—by contact with the product, then the industrial design has succeeded.

- Henry Dreyfuss [1]

Machine design is defined as the use of scientific principles, technical information and imagination in the description of a machine or a mechanical system to perform specific functions with maximum economy and efficiency.

The machine maybe entirely new in concept, performing new type of work or it may more economically perform the work that can be done by an existing machine. It may be an improvement or enlargement of an existing machine for better economy and capability. [2]

According to the present surveys, the total population of India is 122 Cr and the total population of Rural India is 83Cr, i.e. 68.84% of total population. The total population of females living in rural areas is 48.6% of rural population, i.e. 40.33 Cr. And our main target is total female population of age group 13-35yrs living in rural areas, i.e. about 9.27Cr.[3]

The main motive of the project comprises of (1) Sanitary Napkin, A universally needed product. In rural India, large number of health problems in women is due to unavailability or high cost of Sanitary Napkin. (2) Conventional method of making the sanitary napkin is very costly. Rural female population is not able to afford these products. (3) Low cost sanitary napkin making machine, to revolutionize this process wholly and to sell it in rural and remote areas at a much lower price.

Nowadays, because of inflation the prices of commodities which are needed in day to day life are going up and it is being difficult for a person of lower income group and even lower middle class family to buy these items of personal hygiene and care, especially for those living in rural areas. Health problems in India and mainly in the rural areas are a great challenge, the health problems in females are serious because of improper facilities available in the rural areas and if available, they are unaffordable for them.

When we came to know about this issue, we decided to solve this issue. Here, our project focuses on the design and fabrication of a Low cost sanitary napkin making machine, so that, the sanitary napkin making
process gets revolutionized wholly and can be sold in rural and remote areas at a much lower price than available in the market.

Applications

- The machine we are making can be used to run small and medium size industry producing sanitary napkins having several advantages.
- Semi auto-controlling system with high automation while the machine can be also upgraded as per customers’ reasonable requirement.
- Increasing productivity to great extent
- The biggest barrier to using a sanitary napkin is affordability. Around 70% of women in India say their family can't afford to buy them.
- These are the findings of the latest study, "Sanitary Protection: Every Woman's Health Right", undertaken by AC Nielsen and revealed by times of India thus this machine will help in producing napkins at low cost thus will help in providing a hygienic way of living.
- It will also provide labour to women in rural areas.
Chapter 2 – Literature review

The conventional method of making the sanitary napkin is very costly. Also the products of these units are costly and the rural people are not able to afford these types of products.

2.1 Conventional Method of Sanitary Napkin production

A. Raw Material of Sanitary Napkins:

- Nonwoven
- Pulp
- Super absorbent
- Plastic film
- Elastic materials
- Fastening devices
- Packaging

B. Specification of the Raw Material of the Sanitary Napkins:

- **Pulp**: fluff pulp, thickness 1-2mm, width 280-410mm (500gm2 up)
- **Tissue**: so called tissue 18gm/square meter standard width 180mm
- **P.E. Film**: the thickness 0.0015mm, width 85-105mm
- **Non-woven fabric**: good thermo-bonding 16-18gm/square meter, standard width: 175-180mm
- **Hot melt gum**: it is pressure sensitive and endurance, good stickiness, white solid adhesive.
- **Release paper**: paper: good release, width 19-50mm (standard)

![Figure 1: Sanitary Cotton press line](image)
We explored various other designs which could be semi-automated. These designs include scissor lift configuration and guided rail mechanisms which are mated with hydraulic system to enhance the output impact force. Finally, after arduous brainstorming the final design was prepared in which we integrated the press plates and sealing mechanism along with hydraulic cylinder for simultaneous operations.
Figure 7: Final design

Parts of machine:

1. Base Table
2. Top Frame
3. Cutting die
4. Flange
5. Pneumatic Cylinder
6. Air Hoses
7. Bed Plate
8. Top Plate
9. Guide
10. Cylinder mounting
11. Air compressor
Chapter 5- Validation and Simulation of Design

The basic procedure of machine design consists of a step by step approach from given specifications about the functional requirements of a product to complete description in the form of drawings of the final product [6]. We have followed a logical sequence of steps, usually common to all design projects:

1. Market Survey
2. Define Specifications of product
3. Select Proper Mechanism
4. Prepare General Layout Of Configuraion
5. Design Individual Components
6. Prepare Assembly and Detail Drawings

According to the calculations done, we found that 1000N force will be required for pressing the wood pulp into a pad. These calculations were made by taking some of the assumptions while the worker was working on the manual machine. It was clear that the worker was facing a lot of problem and also the quality of the product was poor. So in order to improve the quality of the product and increase the production, certain design considerations have been kept.
Simulation

The virtual testing of the assembly was done in Solidworks under the Simulation section. We opted for the static study. As the assembly is very heavy with large number of components and mates applied to them, so some of the parts were not included in the testing, and this made our assembly light and helped us in getting the results accurate.

1. First, the Top frame and the bed plates were fixed to the base table by giving the component contacts between the parts.
2. Then, the base table was fixed to the ground using the fixed geometry command.
3. Then the connectors were applied at the required places.
4. Finally, the external load was applied on the bed plates and following results were calculated:

   a) Factor of safety
   b) Static Displacement
   c) Static stress
   d) Static strain

![Figure 8: Factor of Safety](image-url)
5.3 Fabrication

The machine parts are fabricated according to the proper dimensions using the high precision machine tools and the processes. The 2-D drawings of all the machine parts were generated.(Annexure-1) The fabrication of parts of this machine and their assembly required many simple machining processes and almost all the tools.

Parts Fabricated:
1. Base table
2. Bed plates
3. Pair of dyes connected to each other with nuts and bolts (lower plate with embedded sealing element)
4. Outer casing of the above mentioned pair of plates (this will act as a cutter)
5. Guide mechanism
6. Wiring, Hoses, etc
7. Pneumatic cylinder head and its mounting

1. Base table

- Angled Mild Steel(35x35x6mm) has been used for making table frame
- 975x775x20mm size MS slab used as table top.
Final Assembly:

The assembly of the manufactured parts is done and has been checked for the working of machine.
Chapter 7- Conclusions and Recommendations for Future Work

**Testing:** After fabrication and assembly, the machine will be tested for **endurance, production quality of the product and the efficiency of the production unit.**

**Application and installation:** After completing all the fabrication, assembly and testing part, the machine will be handed over to the MSME and will be installed in the Devprayag unit and its working will be analysed.

Before finalizing the design, various design explorations were made and tested on Solidworks and then the design was finalized and various improvements were done on that design.

The sealing and cutting machine is a simple pneumatic based machine which will seal the material and cut the unwanted part from the sides to give it a required shape.

According to the calculations done, we found that 1000N force will be required for pressing the wood pulp into a pad. These calculations were made by taking some of the assumptions while the worker was working on the manual machine. Simulation is done on this force and FOS 5.5 was achieved.

The Compressor we have selected is BLACK AND DECKER CP-50-50 SERIES which has the capacity to produce 8-10 bar of pressure.

The material required for the fabrication has been surveyed and be procured according to the requirement.

**Benefits:**

- Increasing productivity to great extent and providing a quality product at affordable price.
- The biggest barrier to using a sanitary napkin is affordability. Around 70% of women in India say their family can't afford to buy them.
- These are the findings of the latest study, "Sanitary Protection: Every Woman's Health Right", undertaken by AC Nielsen and revealed by times of India thus this machine will help in producing napkins at low cost thus will help in providing a hygienic way of living.
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