

Design of an Innovative Coconut Grating Machine Using Tinkercad

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International Journal of Research in Mechanical Engineering

Volume 4, Issue 3, May-June, 2016, pp. 178-182

ISSN Online: 2347-5188 Print: 2347-8772, DOA: 27052016

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ABSTRACT

Increasing advancement and innovation in technology tends to change the existing products by improved ones. The ultimate objective here is to design a machine that can perform coconut grating operations in a quick and safe manner. The currently available coconut scrapers in the Indian market are time consuming, laborious and are less safe as people need to hold the coconut near the blade. The paper aims at evaluating the existing coconut scrapers in the Indian market and proposing a compact design for coconut scrapers in such a way that it is safer and easily operable for common people. The proposed coconut scraping machine is designed in such a way that it is easy, safe and quick to grate coconuts. The design could help the society in a better way by reducing the time and by increasing the safety of people. The product is designed using Tinkercad, a web based 3D design application software.

Keywords: Grate, Scrapers, Tinkercad.

1. INTRODUCTION

Malayalis' craving for grated coconut is a stuff of legend. But grating coconuts has turned out to be a daunting task for the ever-busy, on-the-move neo nuclear family, leaving them to depend on packed products that are easily available in the market. There has been no change in the way coconut is grated, for several decades. The only change being the introduction of a motorized blade. But still, one has to hold the coconut. But all that is set to change with the invention of an innovative coconut grater which can do the job in just few minutes with improved safety and convenience.

2. LITERATURE REVIEW

2.1 Coconut Graters

The figure below shows some of the coconut graters discovered till now. The problem with all these designs is that someone should hold the coconut near the blade all the time. Also scraping coconut using these machines are really time consuming and laborious. Also there is less safety while using these scrapers. The innovative design of the grating machine presented here solves all the above problems.



Fig.1- Traditional Grater



Fig. 2 – Modern Coconut Grater



Fig. 3- Electric Grater

2.2 Tinkercad

Tinkercad is an easy to use, web-based 3D design application, which does not need any design experience to work with. Tinkercad can be used by anyone. In fact, kids are Tinkercad's target audience. The cool thing about Tinkercad is that it's ideal for creating things that can be printed. Tinkercad is made for producing actual objects: we can easily send our model to a 3D printer and end up with an actual object we can hold in our hand. All work is done and saved on the web; there's nothing to install onto our computer.

3. DESIGN PROCESS

The engineering design process is a methodical series of steps that engineers use in creating functional products and processes. The process is highly iterative - parts of the process often need to be repeated many times before another can be entered - though the part(s) that get iterated and the number of such cycles in any given project can be highly variable. Different authors (in both research literature and in textbooks) define different phases of the design process with varying activities occurring within them. The most common phases are dealt in detail below [2].

3.1 Problem Identification/Need Gap

Coconut scrapers are time consuming, laborious and have less safety as people need to hold the coconut near the blade

3.2 Problem Definition

People need an easy, safe and quick way to grate coconuts.

3.2.1 Need Tree

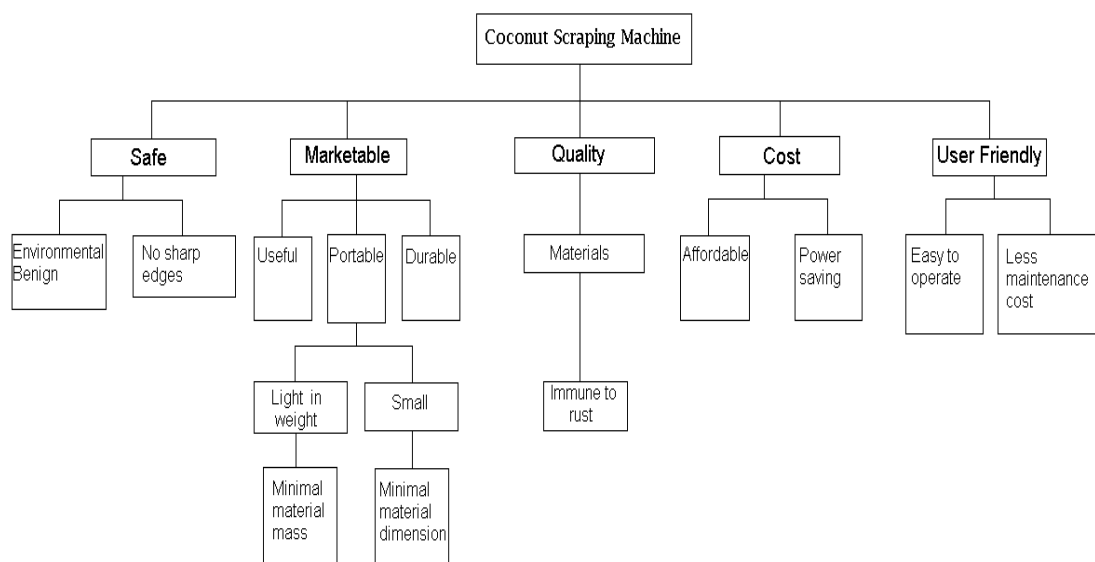


Fig. 4- Need Tree for Design of the Coconut Grater [2]

3.2.2 Design Objective

Design should be safe, useful , portable , affordable and user friendly.

3.2.3 Design Function

The scraper should grate the coconuts in an efficient manner.

3.2.4 Design Means

Electricity, Motor, Blades etc.

3.2.5 Design Constraints

- Should consume less space , less energy and have less weight (*Functional constraints*)
- Operation of the machinery should be safe for the people involved with (*Safety constraints*)
- Production of components ,purchase of components, assembly, transport, processes etc to be taken care of (*Manufacturing constraints*)
- Should be cost effective – construction cost/operation cost (*Economic constraints*)
- Should save time for the persons involved with (*Time constraints*)
- Should have high quality and should be reliable(*Quality constraints*)
- Should have a very good appeal(*Aesthetic constraint*)
- Should be environment friendly(*Environment constraint*)
- Should be user friendly(*Ergonomic constraint*)
- Should be as per regulations and should avoid usage of cheaper materials (*Legal & Ethical constraints*) [1]

3.3 Conceptualization

In this phase, various concepts are generated using methods like synectics, thinking outside box, brain storming ,functional analysis, market analysis etc. and the most feasible method is selected after evaluating the ideas based on its merits/demerits. The best and the most feasible concept selected is explained in detail in the next phase of design.

3.4 Detailed Design

The detailed design phase is the final phase in the design process before manufacturing. The main goal of detailed design is to produce drawings that contain the information needed to manufacture the product [4]. This phase further elaborates each aspect of the project/product by complete description through solid modeling. Computer-aided design (CAD) programs have made the detailed design phase more efficient. For example, a CAD program can provide optimization to reduce volume without hindering a part's quality. The innovative coconut grating machine designed using Tinkercad, its construction, parts used, working etc. are described in detail in the following section.

3.4.1 Parts of Coconut Grating Machine Modeled Using Tinkercad



Fig.5. Clamp

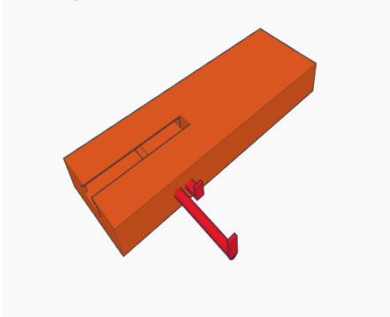


Fig.6. Bench

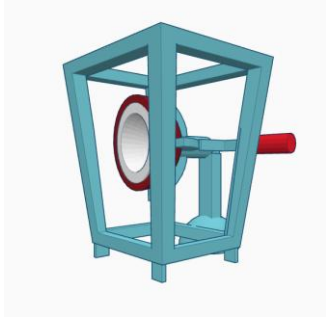


Fig.7. Coconut and Holder

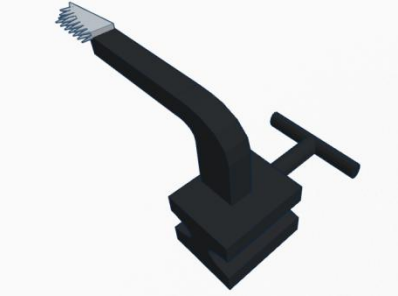


Fig.8. Mover 1

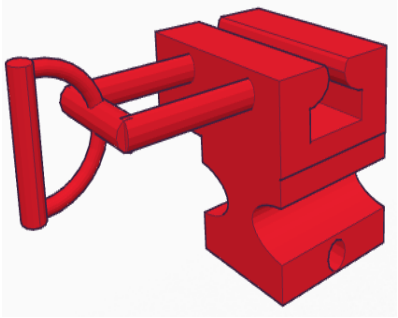


Fig.9. Mover 2

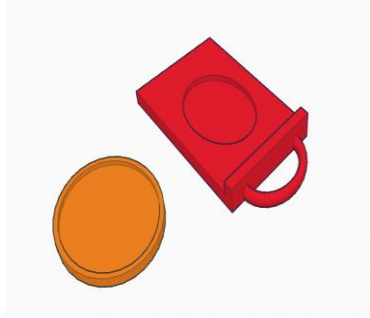


Fig.10. Plate and Plate Holder

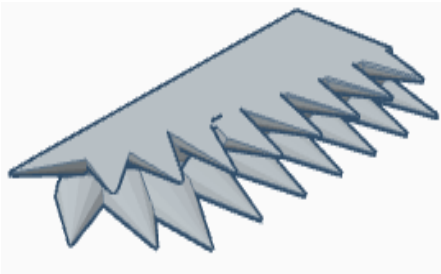


Fig.11. Blade

3.4.2 Coconut Grating Machine Assembly Using Tinkercad

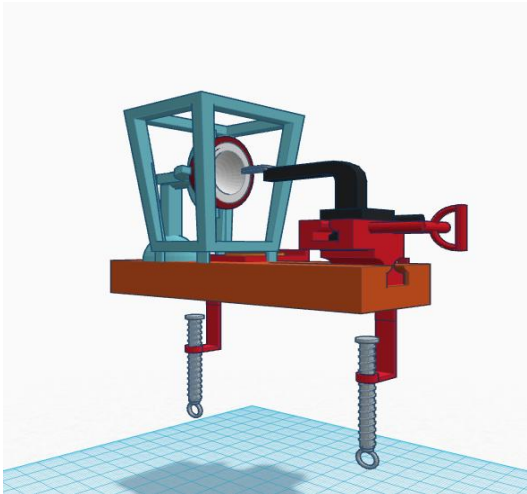


Fig.12- 3D View of the Designed Grater

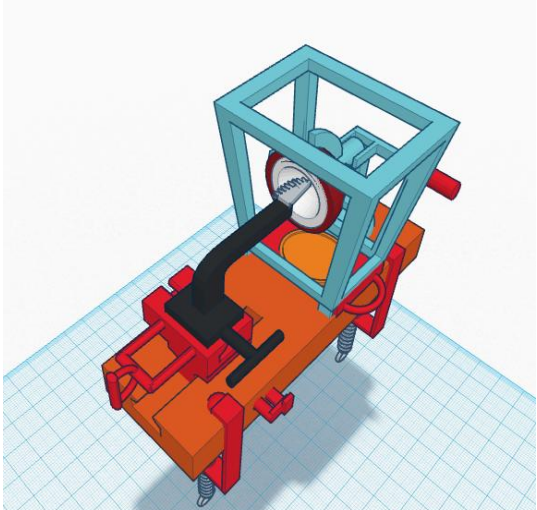


Fig.13- Top View of the Designed Grater

3.4.3 Constructional Details of Coconut Grating Machine

- The clamp (5) consist of two cylindrical screws which are used for locking the arrangement.
- Mover 2(9) is used for forward feed and mover 1(8) is used for lateral feed.
- A coconut holder(7) is fixed on the other side of the bench. At the neck of the holder, a motor is fixed so that the holder can rotate. When the holder rotates the coconut also rotates. A handle can be connected to the neck to tilt the holder sideways.
- A plate holder (10) is also attached to the bench(6), which can be can be slided inwards and outwards.
- Blades(11) attached to mover 1 scrap the coconut completely(two sets attached).The coconut and the holder can be enclosed in a glass container to avoid scattering of coconut

3.4.4 Working of Coconut Grating Machine

Step 1:

Fix the machine to the table using clamps.

Step 2:

Place the coconut on the coconut holder and the plug the machine. When we switch on the machine the motor at the neck of the holder starts rotating and thus the coconut rotates.

Step 3:

Place a plate on the plate holder and slide the holder inwards.

Step 4:

Push the Mover 2 inside and lock the mover using the lock attached to the bench.

Step 5:

Slide the Mover 2 until the blade touches the kernel of the coconut. Now slide the Mover 1 and scrap the coconut completely. Keep moving it till the coconut is scrapped completely. The neck of the coconut holder can be turned sideways using the handle attached to it to completely grate the coconut as different coconuts have different shapes.

Step 6:

The scraped coconut is collected in the plate placed below. The plate holder is slided outside and the scraped coconut is taken.

4. CONCLUSION

The innovative coconut grating design is really time saving, less power consuming, safe and cost effective. It can grate coconuts within seconds. The only power it consumes is for rotating the motor. Also it is portable and simple. The coconut will be scraped completely. The materials used for making this machine are safe and long lasting.

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