

Design and Fabrication of coconut cutting machine

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Abstract: Coconut shell is the strongest part covered in coconut fruit. The traditional method used in India, for the cutting of coconut is labour intensive. To overcome this problem, a power operated coconut cutting machine was designed and developed. A coconut cutting machine comprising of cutter with belt drive. This project presents the design and analysis activities involved in design and development of a semi-automated coconut cutting machine with coconut grinding attachment. It is semi-automatic machine to eliminate the stress on human or efforts required to cut and grind the coconut. It also provide cutting action on coconut to cut the coconut at the middle. It is easy to transportation and costly effective. The machine developed for this purpose cuts various shapes and sizes of coconut. It also reduces the accidents that may happen during manual coconut cutting. The machine is Eco friendly and ergonomically fit for use and less costly as far as commercial machines are concerned.

INTRODUCTION

Coconut shell is the strongest part covered in coconut fruit. Coconut shell is located in between the coconut flesh and coconut husk. This shell is naturally created to protect the inner part of coconut. This shell is used to produce various handicraft applies and other applications. Most of handmade decorative are created by using coconut shell due to their strength. Coconut shells are also used to made charcoal which is use as fuel and this coconut charcoals are far better than other charcoals. Coconut shell charcoal is widely used to produce active carbon. Normally active carbon is known as the charcoal which has treated with oxygen's. Active carbon is use widely for removing impurities. This coconut shell charcoals are widely used in purification industry and other industries which active carbon are used. The coconut tree (*Cocos nucifera*) is a member of the family Arecaceae (palm family) and the only species of the genus *Cocos*. The term coconut can refer to the whole coconut palm or the seed, or the fruit, which, botanically, is a drupe, not a nut. Coconuts are known for their versatility ranging from food to cosmetics. The coconut also has cultural and religious significance in certain societies, particularly in India, where it is used in Hindu rituals. A full-sized coconut weighs about 1.44 kg (3.2 lb). It takes around 6,000 full-grown coconuts to produce one tonne of copra. 1 cup of coconut water has 45.6 kcal. Traditional areas of coconut cultivation in India are the states of Kerala, Tamil Nadu, Karnataka, Pondicherry, Andhra Pradesh, Goa, Maharashtra, Odisha, West Bengal and, Gujarat and the islands of Lakshadweep and Andaman and Nicobar. As per 2014–15 statistics from Coconut Development Board of Government of India, four

PROBLEM DEFINATION

- 1) To remove the coconut shell from copra in less time and in less efforts Also minimization of human fatigue due to conventional tedious work in less cost.
- 2) This machine is reduce the accidents that may happen during coconut cutting manually.
- 3) Also reduce the time and efforts required to making grated coconut also reduce the injuries happens during making grated coconut.
- 4) This machine eliminates the time required to remove shell of coconut.

WORKING

The above project deals with the coconut cutting machine and make a grated coconut by using machine. Basic fundamental parts of this project as we discussed. There is main part of holding the coconut and to grind it. By the attachment which is coupled to the shaft one side. Firstly machine will started by using electric supply and the coconut is placed on the holding method. The holding is equipped with a circular half hemispherical shaped coconut holder. Which is designed by the various sizes and shapes in the nature available. The coconut is placed horizontally in the circular half hemispherical shaped coconut holder. The cutter is considered as the main mechanism

in this project. There is a handle made to push and feed the coconut towards the cutter. By the help of spring loaded mechanism we are holding the coconut in such a way that to restrict the degree of freedom. After this holder is roll over the angle type channel section as shown in figure. To apply feed motion by hands towards the cutter to cut down coconut into two separate parts. Rotation of the cutter is at opposite direction of the feed motion applied. Feeding of the coconut in forward direction of the cutter. Application of feed force is depends on the size and the shape of the coconut. By applying the feed motion to cut coconut is done manually, the cutting action takes place when the cutter is rotating and coconut is feeder mechanism. After cutting action takes place collection of water inside the tray given below and which is filtered. Then braked coconuts are to be removed separately, the clearance is provided to remove the coconut. And after cutting is completed the coconut hold against the grating cutter which is mounted or attached to another end of shaft and easily make the grated coconut with less effort in less time. And we use the electric motor to drive the shaft with the help motor, pulleys and the belt and on shaft the HSS circular cutter is mounted with the help of bush.

1) MATERIAL SURVEY AND SELECTION:

The project began with selection of standard materials for the project. The material survey of different materials and available in the market was done to find out the most optimal materials available in the market and the following materials were chosen for the purpose of project work. 4.1.1) Selection of frame work : The frame structure is the most important part of the project as it holds all the necessary components onto it. The frame structure provides the structural support to all the components of the project and thus frame structure fabrication should be provided more attention. The frame is the main structure to which all the components attached and which is similar to the skeleton of the organism. They are not only locally available but also economical and can be welded with simple arc welding.



MS PIPES AND L SHAPED ANGLE

2) Selection of motor : The selection of motor is most important task for the machine. We have to consider Several factors for this. First of all we have consider the power, for the better power and easy operation, we select better hp motor. And as per the power requirement we select the 1 hp electric motor. It is having better power as per our requirement and also easily available in market.



Fig. 1 HP Electric Motor

3) Selection of Pulleys: Fig. Pulleys The Pulleys are also one of the important factor in our project, because we have to drive our shaft with the help of motor for this we required the pulleys. One is mounted on shaft on which the cutter is mounted which is called the driven pulley and another is mounted on motor shaft which is called the driver pulley. So we

have to select the proper inches pulley as per RPM requirement and as per belt selection. So we use 2” pulley as driver pulley and 3” pulley as driven pulley. And on which the belt is mounted.



Fig. Pulleys

4) Selection of Cutter And Grating blade: Cutter is the most important component in coconut cutter. There are different types of cutters in market which having different shapes and sizes, but we require the circular cutter which is mounted on shaft and rotates with the shaft. Also require the sharp cutter and require perfect thickness to cutter for cut the coconut because the coconut is hardest outer cover. So we use the 12” circular saw cutter with 100 teeth's, Because its easily available in market in standard size. And the material used to make cutter is high speed steel because its really hard and easily cut the coconut outer hardest part.



fig. Circular Cutter

fig.

5) Selection of belt drive: Belt drive, in machinery, a pair of pulleys attached to usually parallel shafts and connected by an encircling flexible belt (band) that can serve to transmit and modify rotary motion from one shaft to the other. Most belt drives consist of flat leather, rubber, or fabric belts running on cylindrical pulleys or of belts with a V-shaped cross section running on grooved pulleys. To create an effective frictional grip on the pulleys, belts must be installed with a substantial tension. Because of the wedging action of the belts in the grooves, V belts require less tension than do flat belts and are particularly suitable for connecting shafts that are close together. So we have to first calculate the belt tension as per requirement. After calculation we decide to select the V-shaped rubber belt B-54, which is available in market in standard size. Also available in less cost.



Fig. B-54 V-Belt

6) Selection of Shaft: The term shaft usually refers to a component of circular cross section that rotates and transmits power from a driving device, such as a motor or engine, through a machine. Shafts can carry gears, pulleys and sprockets to transmit rotary motion and power via mating gears, belts and chains. During transmission we required shaft to mount our circular cutter also in one end its having driven pulley, and in other end the grated coconut cutter is connected. So we select the shaft length of 900 mm approximately.



fig. Shaft

7) Bearings: Pedestal bearing are widely used for providing support for a rotating shaft with the help of compatible bearings and various accessories. It is also known as pillow block (or) Plummer block. It is used for long shafts requiring intermediate support. It is used to support our shaft. they are easily available in market in standard size.



fig. Pedestal bearing

Applications of Pillow block bearing or pedestal bearing

- It is used to support rollers in rolling process.
- Conveyor belt shafts.
- It can be used for light as well as high load conditions with some minor changes.
- Plummer blocks can be used in corrosive environments with suitable changes. □ To support long shaft

8) Bush

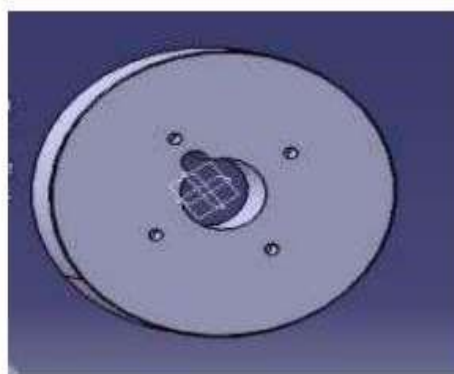
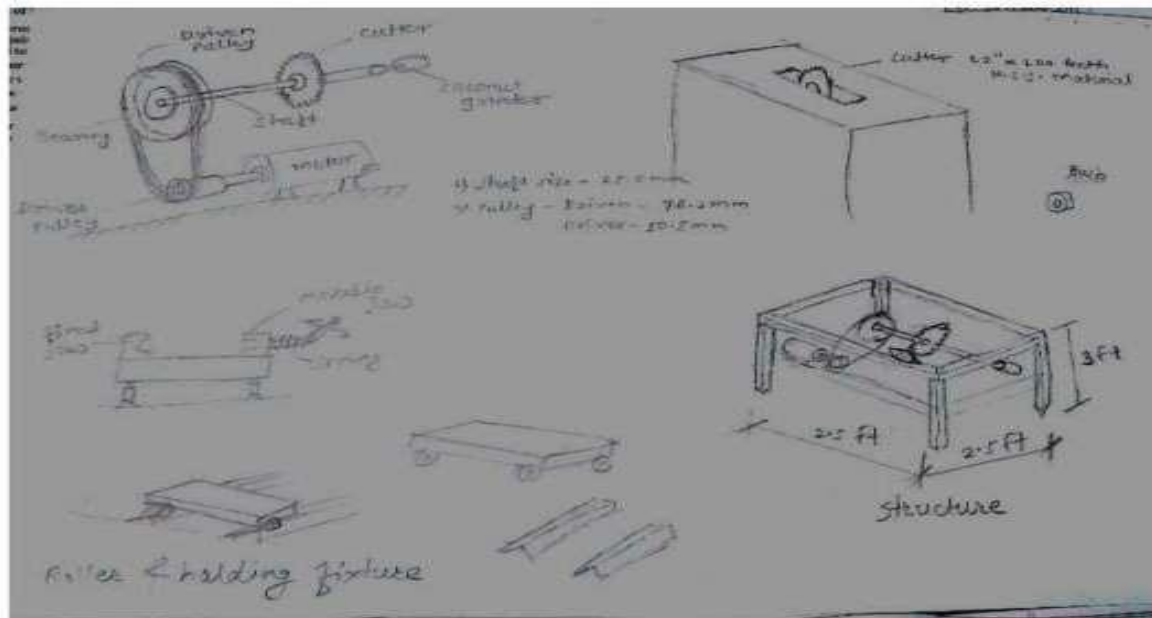


Fig. Bush

We use a bush for mount the circular cutter in the shaft. According as per our requirement we use bush 80mm*40mm of MS material. It is available in market in standard size

METHODOLOGY AND IMPLEMENTATION

Conceptual design of experimental setup:



Concept drawings or sketches are drawings, often freehand, that are used by designers such as architects, engineers and interior designers as a quick and simple way of exploring initial ideas for designs. They are not intended to be accurate or definitive, merely a way of investigating and communicating design principles and aesthetic concepts. Concept drawings can also be used to explore more technical aspects of a design, providing an initial response and possible solutions to problems, constraints and opportunities such as services layout, structure, method of construction, solar paths and shading, prevailing wind, patterns of circulation, relationships between aspects of the site and so on.

MECHANICAL DESIGN

. Design consideration:

Parameters affecting cutting power

1. Density of coconut :- Density of a material is its mass per unit volume. An approximate value of coconut shell density is 1.60 g/cm³. Epoxy resin (ER) are one of the most important classes of thermosetting polymers which are widely used as matrices for fiber-reinforced composite materials and as structural adhesives. Liquid Temperature - t - (°C)
Density - ρ - (kg/m³) Coconut oil 15 924
2. Nature of coconut :- Botanically, a coconut is a fibrous one-seeded drupe, also known as a dry drupe. However, when using loose definitions, the coconut can be all three: a fruit, a nut, and a seed. Botanists love classification. It has round shape, it may also straight in length.
3. Moisture content :- Moisture content in coconut shell is not homogeneous at beginning to end use of coconut. It reduces day by day. Coconut is a perishable fruit, it is usable only at a period of 8 days.
4. Feed rate :- As we feeding coconut manually, Feed rate of coconut cutting is depends upon the person who feeds the coconut through cutter.
5. Cutting depth :- As cutter size is 12" * 100Teeth * 0.9 mm thick, the depth of cut is also depends on person and cutter thickness 0.9mm.
6. Kerf width :- The width of the "kerf" – the slot the blade cuts in the material – is another important consideration. Many blade types are available in both full-kerf and thin-kerf varieties. Full-kerf blades typically cut a 1/8" slot and are intended for use on saws powered by 3 hp (or greater) motors.

CONCLUSION

During market survey, visits were carried out to all sectors covering various temples, hotels, messes, food industries, etc. to study requirement of this project. There is huge demand from small vendors, domestic usage, temples, etc. to cut 200-500 coconuts per day which will not be cut manually due to human fatigue. Keeping the above mentioned facts in mind,

the market survey was carried out to analyze the practices adopted and constraints experienced by the farmers, coconut vendors, etc. and processing units in splitting, de-shelling, grinding of coconut. And conceptual designs were studied on paper and finalized one for actual designing. Component testing such as compression test and hardness test on coconut was carried out to analyses properties of various coconuts and ultimate load sustain by coconut. And also studied moisture content in various coconuts.

FUTURE SCOPE

Much work in the project is constrained because of lack of essential resources and their high-cost.

1. The power operated coconut cutting machine developed can be provided with automatic loading and unloading facility using conveyor belt mechanism.
2. Sensors can be used to calculate the number of coconuts cut per minute or per hour.
3. It can be modified by coconut grinder attachment at both ends of the shaft.
4. Compact size of structure of machine to reduce its weight and area.
5. A vibrator can also be provides for separating the copra and small cuts of shell of coconut.

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