International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.01, March 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

DESIGN AND FABRICATION OF SUGARCANE PEELING MACHINE

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ABSTRACT

India is a land of agriculture. With wide variety of agricultural crops cultivated, the sugarcane is one of the most important production crops in India. This project deals with the concept of sugarcane peeling attachment. The number of sugarcane small scale juice setups need to clean the sugarcane manually. This not only requires time but also is a tiresome task since the sugar cane needs to be cleaned and then fed into the machine for juice extraction. This project deals with development of sugarcane peeling attachment which can help to peel the sugarcane automatically when fed into this attachment. This project aims to reduce the total time required due to manual peeling and reduction in operator fatigue due to the tiresome peeling operation. The proposed machine is expected to peel sugarcane at a faster rate without much fatigue.

Keywords—Cutting Peeling, Agriculture, Sugarcane, fatigue, time etc.

I.INTRODUCTION

India is the land of villages. This being said the major occupation of majority of villages in India is agriculture. Near about 70% people are dependent upon agriculture. Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It has to support almost 17 per cent of world population from 2.3 per cent of world geographical area and 4.2 per cent of world's water resources. The economic reforms, initiated in the country during the early 1990s, have put the economy on a higher growth trajectory. Annual growth rate in GDP has accelerated from below 6 percent during the initial years of reforms to more than 8 percent in recent years. This happened mainly due to rapid growth in non-agriculture sector. The workforce engaged in agriculture between 1980-81 and 2006-07 witnessed a very small decline; from 60.5 percent to 52 percent.

Indian agriculture is characterized by agro-ecological diversities in soil, rainfall, temperature, and cropping system. Besides favorable solar energy, the country receives about 3 trillion m3 of rainwater, 14 major, 44 medium and 55 minor rivers share about 83 per cent of the drainage basin. About 210 billion m3 water is estimated to be available as ground water. Irrigation water is becoming a scarce commodity. Thus proper harvesting and efficient utilization of water is of great importance.

The nation is striving to find ways and means to keep its burgeoning population adequately fed. On the one hand it is facing the problem of declining productivity and on the other, challenges posed by liberalization. In such a scenario, leveraging the available natural resources and existing infrastructure is the only way to make the ends meet. Management of the already built infrastructure in harmony with natural systems is the clarion call of the day. Knowledge of the extent of existing infrastructure and natural resources is one of the most basic pre-requisites to utilize them effectively and in a sustainable manner. The discipline of agricultural engineering endeavors to develop technologies for enhancing productivity.This paper deals with development of sugarcane peeling attachment for juice extraction machines which will take sugarcane clean the outer cover and give a peeled sugarcane which can be fed to juice extractors

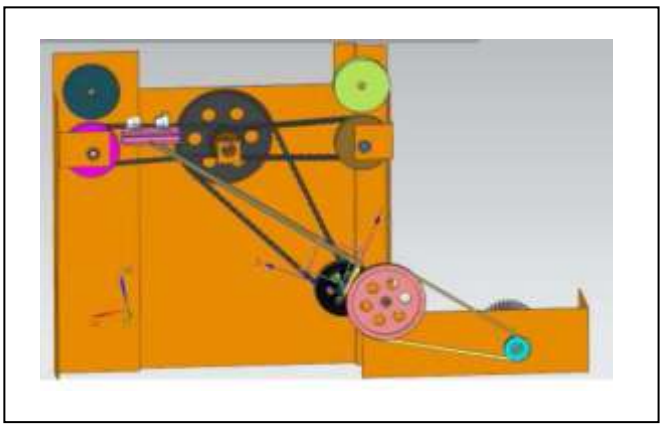
The research work carried out on this particular concept is properly documented in this paper. This paper consists of the below mentioned main parts. These are:

1) Abstract
2) Introduction
3) Literature findings
4) Proposed model
5) Working Methodology
6) Conclusions

II.CURRENT RESEARCH AND LITERATURE REVIEW

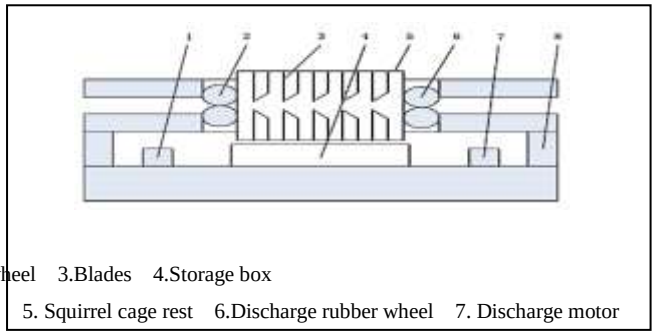
The current research work on this particular topic was broadly studied by referring to the research work carried out by number of research scholars and their findings were thoroughly studied to arrive at the main objective of the research work. The following research work was studied before laying the objectives of our research.

Ge Xinfeng[1]worked on design of sugarcane peeling machine. In order to solve the problem that appeared in hand peeling sugarcane, the sugarcane peeling machine is designed, the sugarcane peeling machine includes motor, groove wheel, cutting room, slider crank mechanism, reducer (including belt drive, chain drive) and so on. The designed sugarcane peeling machine is simulated, the results show that the sugarcane peeling machine can peel sugarcane successfully with convenient, fast and uniform.



“fig.1.overall structure of sugarcane peeler”

Zhang Dehui[2]carried out extensive research work on sugarcane peeling based on motion controller. According to him Sugarcane is a common raw material for sugar, but in the process of machining, there will be suspended solids in the cane juice, in order to process better, the sugarcane should be peeled. Traditional way of peeling is by man, production efficiency is low. In this study, a kind of sugarcane peeling machine was designed based on motion controller, it can realize the automation of input, peeling and output. It can make certain contribution for sugarcane processing. The figure below shows the design proposed by him.



1. Feed Motor 2.Feed rubber wheel 3.Blades 4.Storage box
5. Squirrel cage rest 6.Discharge rubber wheel 7. Discharge motor
8. Body frame

"fig.2. design of the sugarcane peeler"

M.M. AhmatAsim, N.N Hisyamudin, S.R.Masrol[3]: He developed Sugarcane Bark/Skin Peeling Machine, Due to increasing demand of sugarcane product and development of sugarcane industry a problem was found out that conservative peeling method of sugarcane would take times to cope with the increasing demand. The problem was based on our customer Sugarcane World and Natural Organic Sugarcane. A new design was proposed to solve the peeling method by designing a new blade installed with rollers to push in and out the sugarcane stalk in blade compartment. By following engineering design process the idea was transformed into CAD data and prototype was built. The newly developed prototype was tested and few data obtained gain for improvement.

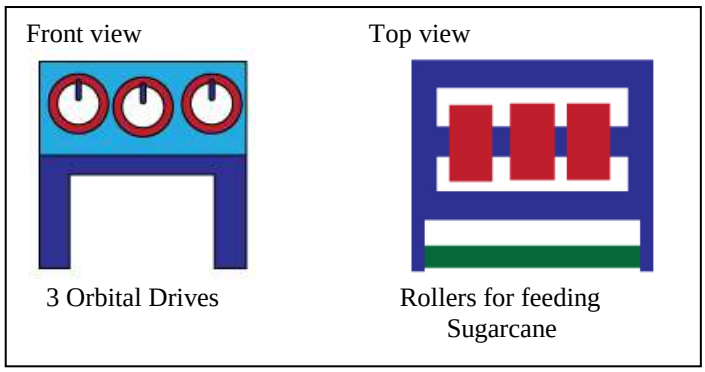
BunditJarimopas et al (Oct 8, 2008)[4]:He constructed a prototype automatic young coconut fruit trimming machine. The fruit consists of a husk enclosing shell, flesh and juice. Normally, the fruit is manually trimmed requires considerable physical strength and a very large sharp knife, and thus is a dangerous procedure. Other problems associated with manual trimming are the shortage of skilled labor and the considerable amount of time that the trimming procedure takes. So, they developed a prototype of young coconut fruit trimming machine which appeared to have more potential.

FaraFarhanaBinti Abdul Basek[5]: He designed and developed orange peeler. An orange is a type of citrus fruit which people often eat. Oranges are a very good source of vitamins, especially vitamin C. Orange juice is an important part of many people's breakfast. Peeling orange is not an easy process. There are several problems that need to be encountered during peeling orange process. Common method of peeling orange is using bare hand and a sharp knife. Peeling orange is not very appropriate due to its high risk of causing injury, many of people start to develop a new technique to peel orange. This thesis deals with the design and development of an orange peeler with an ergonomics approach. The objectives of this thesis are to design an orange peeler with an ergonomics approach by using Solid Work and simulate by using ALGOR.

III.SUMMARY OF LITERATURE FINDINGS

After conducting the detail study of currently existing systems as well the research papers we conclude that not much of research work or data is available on the current topic. Most of the peeling attachments developed are for single peeling and require multiple passes. Hence it is not efficient. Also the research work available as well as data available on the current topic is very less or not existing. Thus this is the topic of innovation and this motivates us to develop the sugarcane peeling attachment/machine

IV.PROPOSED MODEL



"fig.3.proposed model of the machine"

The peeling action takes place in orbital fashion. The figure above shows the conceptual diagram of the second proposed concept. In this the sugarcane will be fed by rollers into the orbital drives, the orbital drive consists of brushes on the inner periphery as shown in the conceptual diagram. Once the sugarcane is fed into the rollers. The rollers pull the sugarcane using the drive from the motors and fed into an orbital drive brush cleaner. As it moves across the orbital drive, the brush cleans the sugarcane on the outer surface thereby peeling it. After the sugarcane comes out of the orbital cleaner, the horizontal brush in front clean it thereby providing multistage cleaning in single pass. This proposed concept will be implemented if the concept one fails. However, the cost of fabrication of this machine is more compared to the first concept as it included complex drive trains.

V. WORKING METHODOLOGY

The following methodology is implemented as a part of project. The entire approach to theproject is divided into number of phases which are carried out as we approach the completion ofproject work. This not only sets the proper plan but also reduces the possibilities of errors aseverything is planned in advance. The entire approach to the project is divided into followingphases.

6.1. Literature study:

In this phase the brief study of the currently existing systems is done. This involvesstudying the conventional systems, drawing out the drawbacks of those, studying outvarious research papers, extensive study of research work by various scholars and finallya study to arrive at the real world problems faces. Based on the study the problemdefinition is derived and the objectives are set.

6.2. Concept outline:

After the problem definition the next step is to arrive at the concept outline of the project.

Since the number of research papers are not at all available on the current topic theconcept outline is drawn based on assumptions of the project. The concept out line isproposed roughly in this phase and work is started accordingly.

6.3. Initial Sketches and Trials

After the concept outline is proposed the initial sketches are drawn and the design andfabrication work is started. Since no material is available for reference most of the part ofthis project would be trial and error based result driven approach.

6.4. Material Survey and selection

Based on the proposed concept the material survey is done to find the most suitable materials available for the project. The materials chosen should be suitable as well aslight weight.

6.5. Trial one Execution

Currently as per the concept outline, two methods of sugarcane peeling are proposed. The first one with maximum probability to yield successful results. So the first of theproposed concept will be executed and machine will be designed and fabricatedaccording to concept number one. After completion of machine, the tests would becarried out to check for feasibility and efficiency. If the method fails then we will proceedto designing the machine according to the second concept.

6.6. Trial 2 Execution if trial one fails to clean:

The trial number two is for second proposed idea. If the trial one fails to give results, thetrial two will be implemented.

6.7. Testing

After successful fabrication of machine it will be tested for efficiency and reliability

6.8. Modification if required

Based on the tests conducted and the output obtained, the modification will be done toimprove the efficiency if required.

VI. CALCULATIONS

The centre distance between the pinion and the driven gear is given by:

$$L = 68\text{mm}$$

Since the Sugarcane peeling operation is assumed to impose no operating loads on the system while sugarcane peeling is done, the machine should be designed for higher speeds.

The test iterations before the start of the project give the single sugarcane peeling effective at speeds of almost

1200 rpm

The standard pressure angle

$$\emptyset = 20 \text{ degrees}$$

So the selected speed of the driven gear is

$$N_g = 1200\text{rpm}$$

The motor chosen is 100 Watt DC motor

Therefore,

$$P = 100 \text{ Watt}$$

The speed rating of the motor from the data sheet of the motor is given by:

$$N_p = 2800\text{rpm}$$

Therefore the gear ratio is given by

$$G = \frac{N_P}{N_g}$$

$$G = \frac{2800}{1200}$$

$$G = 2.333$$

Minimum Number of teeth on pinion to avoid interference:

$$T_p = \frac{2A_w}{G\left(\sqrt{1 + \frac{1}{G}\left(\frac{1}{G} + 2\right)\sin^2\emptyset - 1}\right.}$$

Substituting in the above formula:

$$T_p = 18.85$$

$$T_p = 19$$

Number of teeth on the on the Gear

$$T_G = G \text{ x } Tp$$

$$T_G = 2.33 * 19$$

$$T_G = G \text{ x } Tp$$

$$T_G = 44.44$$

$$T_G = 45$$

It is given as

$$L = \frac{Dg}{2} + \frac{Dp}{2}$$

$$L = \frac{2.33Dp}{2} + \frac{Dp}{2}$$

$$L = 1.665Dp$$

$$68 = 1.665Dp$$

$$Dp = 40.84 \text{ mm}$$

From the above relations

$$Dp = m * Tp$$

$$m = \frac{Dp}{tp}$$

$$m = 2.1419$$

Therefore form standard modules a module of 2.25 are selected.

VII.CONCLUSION

At the end of an intensive literature research, construction and testing, satisfactory sugarcane peeling machine with efficiency of 80% was fabricated using the available raw materials and techniques. The approximately linear sugarcane was loaded and conveyed by hand to the bearing attached with brushes. The overall performance of the machine is more efficient compared to already existing ones. The cost of production and maintenance is relatively cheap. Hence, the machine will be welcomed by industries given its performance, affordability and simplicity.

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