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Rubber Tapping Machine

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Abstract - *A labour has to apply force many times on each tree to get the desired path for the harvesting of rubber so, this makes the labour tired and they to do this job for so many trees in a short duration at early morning on every day. This leads shortage in labour for rubber tapping in India. Hence a motorized concept of tapping knife is needed to reduce their effort. Our proposed machine will satisfy and full fill the above problem. The main aim of this project is to rubber tapping in rubber trees. This equipment is having rack and pinion, battery, motor arrangement, in the rubber tapping machine. In this project the components are modeled by CREO Software and animation also done by CREO software.*

Key Words: India, Rubber, CREO Software, Equipment, Machine, Problem.

1. INTRODUCTION

Two natural rubber (*Hevea brasiliensis*) most popular and widely planted clones RRIM 600 and RRII 105 in the traditional region of India, were evaluated for immature growth performance in warm dry climate of Bastar region in chattisgarh state. The state is a non-tradional rubber growing region and the crop experiences severe drought in the summer months. Prolonged high temperature, low rainfall and soil moisture are the major environmental constraints affecting the performance of clones in the region. Growth performance, effect of seasonal changes on the growth in terms of girth and morphological characters of the clones was assessed. Both the clones observed satisfactory growth in the region [1]. Natural rubber price volatility can have a long run impact on the incomes of many producers and can make planning production more difficult. It has been argued that agricultural commodity prices are volatile because the short run supply and demand elasticities are low. High volatility in natural rubber prices is the result of international trade policies, fluctuations in demand and supply of natural rubber, fluctuations in oil prices and political changes. There is no adequate mechanism to reduce or manage risk to natural rubber producers in most of the producing countries including India. The area under rubber plantations has been increasing significantly during the last five decades. However the decline in prices of natural rubber has significantly affected the growth of area under production in the producing countries [2]. Total NR cultivation in India was *ca* 0.74 million ha till 2012. According to Rubber Board of India (RBI)1, India now occupies the first rank in terms of productivity, which are presently at 1819 kg/ha2. NR is used as raw material in the production of 35,000 items of industrial importance in India, 50% of total NR consume by automobile industry. Although, 89% of area and 92% of production came from small holding with an average size of 0.50 ha. The total area of natural rubber cultivation is sub-grouped into traditional (0.53 Mha) and nontraditional regions, where the traditional regions have the lion share. The state of Kerala and Kanyakumari district of Tamil Nadu are the traditional NR cultivating regions, whereas the non-traditional region are in the states of Maharashtra, Karnataka, Goa , Andhra Pradesh and Odisha, as classified by RBI [3].

1.1 Uses & Importance of Rubber

- Natural rubber is used extensively in many applications and products, as is synthetic rubber.
- The use of rubber is widespread, ranging from household to industrial products entering the production stream at the intermediate stage or as final products.
- Tires and tubes are the largest consumer of rubber.
- The remaining 44% are taken by the general rubber goods(GRG) sector, which includes all products except tires and tubes.
- The first use of rubber was by the Olmecs, who centuries on the knowledge of natural latex from the Hevea tree in 1600BC to the ancient Mayans.
- They boiled the harvested latex to make a bail for sport.

1.2 Conventional Rubber tapping method

The latex, which is processed into rubber sheets, is extracted from rubber trees which grow in tropical regions. To tap a rubber tree, a skilled rubber tapper uses a gouge to make an initial spiral cut 180 degree around the tree and two feet down the tree. The cut is 3-5 mm deep to open latex containing vessels in the bark without damaging the cambium layer of the tree. The raw latex flows down the spiral cut into the collection cup.

After the initial incision is made, a skilled worker removes the congealed latex from the bark and reopens the cut by removing a small strip of bark everyday to collect more latex. All cuts are made in the morning when the internal pressure of the latex containing vessels is the highest, and workers return to collect the filled cups in the afternoon.

Natural rubber is tapped from rubber trees as latex. The trees are grown on plantations in Southeast Asia and other parts of the world. Latex is a colloidal dispersion of solid particles of the polymer polyisoprene in water. Polyisoprene

is the chemical substance that comprises rubber, and its content in the emulsion is about 30%. The latex is collected in large tanks, thus blending the yield of many trees together.

1.3 Objective of the Study

- Main objective of this study is to design and develop an adjustable tool for rubber bark grooving (rubber tapping) machine.
- Use of improved rubber tapping knife that can deliver a thinner cut into a rubber tree bark
- Make use of Rack & pinion mechanism for tool movement in around the tree bark .
- To maximize the rubber tree life cycles and in turn, reduce farmer payback periods and generate increased revenues

2. RUBBER TAPPING PROCESS

Each night a rubber tapper must remove a thin layer of bark along a downward half spiral on the tree trunk. If done carefully and with skill, this tapping panel will yield latex for up to five years. Then the opposite side will be tapped, allowing this side to heal over. The spiral allows the latex to run down to a collecting cup. The work is done at night or in the early morning before the day's temperature rises, so the latex will drip longer before coagulating and sealing the cut.

Depending on the final product, additional chemicals can be added to the latex cup to preserve the latex longer. Ammonia solution helps prevent natural coagulation and allows the latex to remain in its liquid state. Plastic bags containing a coagulant have replaced cups in many plantations in Malaysia. This form of latex is used as the raw material for latex concentrate, which is used for dipped rubber products or for the manufacture of ribbed smoke sheet grades.

Naturally coagulated latex, sometimes referred to as cup lump, and is collected for processing into block rubbers, which are referred to as technically specified rubbers (TSRs). The serum left after latex coagulation is rich in quebrachitol, a cycloidal or cyclic polyol.

Fig -1: Conventional tools

3. DESIGN OF TAPPING MACHINE

Creo Elements/Pro offers a range of tools to enable the generation of a complete digital representation of the product being designed. In addition to the general geometry tools there is also the ability to generate geometry of other integrated design disciplines such as industrial and standard pipe work and complete wiring definitions. Tools are also available to support collaborative development. A number of concept design tools that provide up-front Industrial Design concepts can then be used in the downstream process of engineering the product. These range from conceptual Industrial design sketches, reverse engineering with point cloud data and comprehensive free-form surface tools. We created model of Rubber Tapping Machine by using CREO software. The models are shown below.

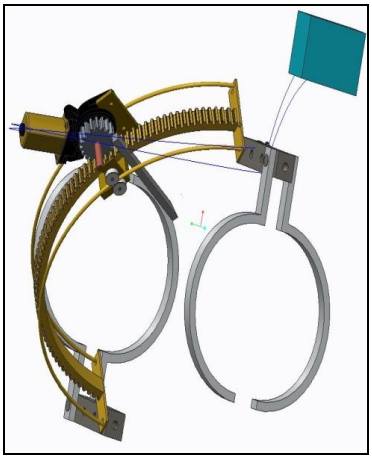

Fig -2: CREA Model (Top View)

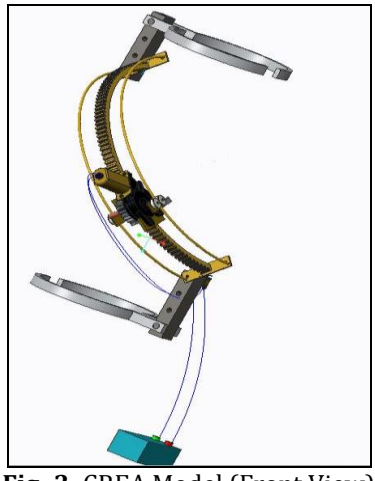

Fig -3: CREA Model (Front View)

4. WORKING PRINCIPLE

The rubber tapping is the process of extraction of latex from the rubber trees. Latex is a white or slightly yellowish liquid composed of rubber, protein, sugar, water etc. This latex is concentrated, compounded and then used in different forms for the manufacture of various goods like the

commonly seen rubber bands, gloves, condoms, foam beds, tyres etc.

For the manufacturing of these above given products we have all necessary mechanisms, from the manually operated machines to the highly sophisticate automated machines which can produce large tones in few seconds. But the primary level procedure, i.e. the tapping operation is still carried out manually and requires skilled labor. It is done with the help of specially made knifes. Malaysian knifes and Indian knifes are mainly used. In the coming future the world is going to face a great shortage in availability in labors.

Taking these problems into consideration engineers all around the world is trying to develop alternative ways for the tapping process. We have studied about the various situations of tapping and other required data and have come with a design for rubber tapping machine. This has helped us in developing a prototype of a mechanized system. Experiments carried out with this machine have revealed that it will be the best possible alternative to traditional tapping. This can help even the unskilled ones to carry out operation. We also expect it could make a great revolutionary change in the field of tapping.

In our project is fixed to the rubber tree with the help of belt arrangement. The battery power is used to operate this machine. In our project, the Permanent Magnet D.C motor is used to tapping the rubber tree automatically with the help of Rack and Pinion arrangement. The knife is fixed on this movement of D.C motor so that the rubber tree to be tapped quickly. The motor direction is controlled by the forward and reverse switch. The depth of cutting is adjusted by the knife with the help of bolt and nut arrangement.

Fig -4: Working Model

5. TESTING

The rubber tapping machine has been tested on a large rubber plantation in Naravi, owned by Mr. Shaji. Initially, the machine was fixed to the tree using clamp and belt arrangement. Then, the tapping process was done successfully by coupling the motor with the battery. The machine took about ten to fifteen seconds to tap one rubber tree. We could observe that the tapping done by the machine had not caused any harm to the bark of the tree. This proves that the machine can be successfully implemented in rubber tapping process. The major problem associated was the variation in the size of the tree due to which fixing of the machine to the tree becomes a tedious job. When one rubber tree gets tapped, the machine has to be removed and fixed to the other tree. This is a total waste of time and effort when compared with conventional method.

6. RESULTS & DISCUSSION

1) TIME
(a) FIXING TIME: The Rubber Tree Tapping Machine requires 15-20 seconds to fix it to the tree whereas in conventional methods the fixing time is nil.
(b) TAPPING TIME: The Tapping time required to tap a tree is about 10-15 seconds and for the conventional methods it is almost the same.
Hence,the total time required to tap 100 trees would be 45-50mins.

2) DEPTH OF CUT: The depth of cut measured for the conventional methods and Rubber Tree Tapping machine is 3-5 mm. The Machine provides a constant depth of cut along the bark of the tree.

3) HANDLING: The taper experiences pain in his arms after tapping a large number of trees so this machine helps in avoiding such physical problems faced by taper.

7. ADVANTAGES, LIMITATIONS AND APPLICATIONS

7.1 Advantages

- The machine is portable hence can be carried to any work places.
- This machine is safer in operation.
- The parts of the machine are highly reliable and durable.
- Rechargeable batteries are used hence it lasts longer.
- Skilled workers are not required since operation is simple.

7.2 Limitations

- Since it's operated on a single battery source, it can be worked for 2 hours.

7.3 Applications

Can be used for rubber tapping in rubber plantations to extract latex from tree.

8. CONCLUSION

This project can be readily commercialized in the market due to its efficient operation and competitive cost. Since a number of operation can be performed in a single and simple unit, it is efficient and economical. Considering its uses and cost of this project, it becomes relatively cheap when compared to other units. Moreover, to tap a rubber tree, a skilled rubber tapper uses a gouge to make an initial spiral cut 180º around the tree and two feet down the tree. After the initial incision is made, a skilled worker removes the congealed latex from the bark and reopens the cut by removing a small strip of bark everyday to collect more latex. All this hectic jobs can be reduced with the use of this project. Also, the latex from the rubber tree causes some serious allergies to the worker. With the use of this project, we can overcome such issues.

9. SCOPE FOR THE FUTURE

- The project work done by us can be used in various fields. However the weight of the handling unit can be reduced by using aluminium or fibre instead of mild steel.
- The controlling of the unit is slightly difficult for a single man. If the air flow control valve is fitted to the handle it will be easier.
- The outlet air from the top can be forced at the machining point to remove the chips while machining.
- It is suggested to use automatic type of control system or with better mechanism and good quality durable battery.
- With some modification in design it can be used for wood designs.

The above modifications can be made. Due to very short period, we could not carry out further. However this project is a successful one because we have tested it for the fullest satisfaction.

REFERENCES

[1] Krishna B, "Growth assessment of popular clones of natural rubber under warm dry climatic conditions of Chhattisgarh state, central India", Journal of experimental Biology & Agriculture science, Vol. 3, No. 2, March 2015, pp. 157 -161.

[2] K V Raju, "Instability in Natural rubber prices in India: An Empirical Analysis", Vol. 7, Issue 03, June 2016, pp. 24-28.

[3] A. Majumder S. Datta, B. K. Choudhary & K. Majumdar, "Do Extensive Rubber plantation influences local Environment?A case study from Tripura, Northeast India", Vol. 9, issue 03, 2014, pp. 768 – 779.

BIOGRAPHY OF THE AUTHOR

Raghavendra Prasada S.A was born in Mangalore, Karnataka, got his BE in Mechanical Engineering in 2012 received from Shree Devi Institute of Technology, Mangalore. He did his M. Tech in Thermal Power engineering from Alva's institute of engineering & technology, Mangalore. He has 6 years of work experience in teaching field. He worked as Assistant lecturer in NITK, Surathkal, Mangalore. From 2018 to 2019. He is presently working as an Assistant professor in St. Joseph engineering college, Mangalore, Karnataka, India. He has many publications in National & International journals covering the area of Alternative fuels, Biodiesel & Solar Energy Conversion.