COCONUT DEHUSKING MACHINE BY USING BICYCLE

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ABSTRACT

India is the world's third largest producer of coconut after the Philippines and Indonesia. India alone accounts for about 70% of the world production of coir and coir products. The total output of coir and coir products in India is estimated to be around Rs.1500.00 crore including exports of Rs.350.00 crore. All the parts of coconut orchard such as coconut husk, shell, copra, coconut water are useful. Coconut husk is used in coir industry, shell as a fuel, copra as food, coconut water as nutritious liquid. There are many farm equipment's and tools which are developed for the post harvesting operation of horticultural crops. The dehusking of a coconut is regarded as the most time consuming, tiring, and difficult operation to perform and involves much human drudgery. Many attempts has been done to perform coconut dehusking manually as well as mechanized. Dehusking with traditional hand tools like machete or a spike depends on the skill of worker and involves training. Nowadays there is shortage of such skilled workers. The mechanized or the power operated machines are developed to eliminate the drawbacks of manual tools. Such manual tools and machines are developed all over the world and a very few have become popular, rest got vanished due to their limitations. The reasons for the failure of these tools include unsatisfactory and incomplete dehusking, breakage of the coconut shell while dehusking, spoilage of useful coir, greater effort needed than manual methods, etc. This present work aims to design and develop a semiautomatic coconut dehusking machine with eliminating the above mentioned drawbacks of the existing tools and machines. The machine conceived shall have main parts like deshuking unit mounted on a frame with electric motor as a power source along with speed reducing unit. The dehusking unit shall have A pair of cylindrical rollers with tynes (cutting pins) on its surface. These rollers will rotate in opposite direction with different speeds so that the tynes will penetrate into the husk and tear it away from the shell. The proper tearing of husk from shell occurs when the coconut offers good mesh with the tynes and it depends on the depth of insertion of nut into rollers and profile of tynes. As coconuts varies considerably in size and shape there is a need of adjustment in distance between pair of rollers for desired depth of insertion.

Keyword: - *Dehusaking, coconut , bicycle, roller, gear, chain drive,shaft*

1. Introduction:

Coconut (cocos nucifera) is one of the world"s most useful and important perennial plants. The coconut fruit is made up of an outer exocarp, a thick fibrous fruit coat known as husk; underneath is the hard protective endocarp or shell.

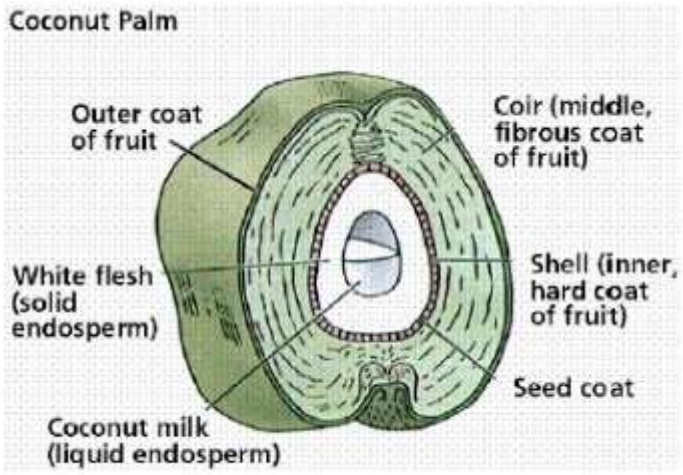

Fig:- Parts of Coconut

The coconut palm is widely cultivated in the tropics. India is the world‟s third largest producer of coconuts after the Philippines and Indonesia. Other producers are Thailand, Malaysia, Papua New Guinea and the Pacific Islands. With coconut plantations extending over more than a million hectares, India produces about 5500 million nuts a year. Copra produced in the country is about 0.35 million tons and India accounts for about 50% of the world trade in coir. Coconut plantations are mostly concentrated in the coastal and deltaic regions of south India. In India, the crop is produced mainly by small and marginal farmers who number about 5 million. The average size of holding is as small as 0.25 hectares. With agricultural labour problems worsening and water resources dwindling, more and more plantation acreage is being converted from arca to coconut since the latter is easier to grow and more remunerative. Coconut production plays an important role in the national economy of India. Almost all the parts of coconut are useful. The meat of immature coconut fruit can be made into ice cream while that of a mature coconut fruit can be eaten fresh or used for making shredded coconut and livestock feed. Coconut milk is a refreshing and nutritious drink while its oil is use for cooking and making margarine. Coconut oil is also very important in soap production. The shell is used for fuel purpose, shell gasifier as an alternate source of heat energy. The husk yields fibres used in the manufacture of coir products such as coir carpets, coir geotextile, coir composite, coir safety belts, coir boards, coir asbestos and coir pith [2]. Coir is a versatile natural fiber extracted from mesocarp tissue, or husk of the coconut fruit. Generally fiber is of golden color when cleaned after removing from coconut husk. Coir is the fibrous husk of the coconut shell. Being tough and naturally resistant to seawater, the coir protects the fruit enough to survive months floating on ocean currents to be washed up on a sandy shore where it may sprout and grow into a tree, if it has enough fresh water, because all the other nutrients it needs have been carried along with the seed. Although coconut is of immense economic importance to both the industrialist and rural dwellers, separation of its husk from the nut (dehusking) constitutes the first, most difficult and dangerous operation in its processing. The use of cutlass which is the popular traditional method for coconut dehusking poses threat and danger to the life of people involved, since on the process of dehusking, some cut their hands, and face as the cutlass usually bounces back on hitting the husk. The use of metal spike was later developed to overcome these negative features of dehusking of the fruit with matchet but this later development focused only on extraction of coconut meat even though accident, time and energy consumption was reduced . The search for a device that will enable effective recovery of other products of this fruit such as the milk, shell and fibre continued due to the importance of these coconut by-products in modern technological applications. However, rural small scale farmers constitutes the major source of coconut fruits to the nation and the budget of this category of farmers cannot carry the huge investment requirement in both electric generator and costly motorized coconut dehusking equipment which are mostly of foreign origin. Also, the problem scarcity of petroleum based fuels such as petrol and diesel in this country since 1993 makes the operation of this electric powered equipment difficult.

MANUAL TOOLS FOR DEHUSKING A COCONUT

1. The coconut spanner**:** the coconut spanner resembles the smithy tongs. Its structure is modified from that of a smithy tongs by expanding its legs. These elongated legs acts like a handle. These are hold into the hand and force is applied on it so that the other two ends which are inserted into the coconut moves away and loosens the coconut fiber. By using this tool the coconut can be dehusked in three to four repetitions. The coconut may be placed on the ground level and the further part of tongs which are blades can be inserted into the fiber of coconut and then by applying force the blades are separated from each other and dehusking takes place. But it is tiring operation as it involves reinsertion of tong blades. Also it consumes a lot time. So it is not suitable for mass dehusking.
2. Mini Coconut Dehusker**:** Mini coconut dehusking is like that of coconut spanner. It can be regarded as the further version of coconut spanner. Similar to coconut spanner it has long legs which are bend at the end. This bend in legs helps to hold it proper and force can be applied easily. It also consists of the pillar to which the tongs are connected.

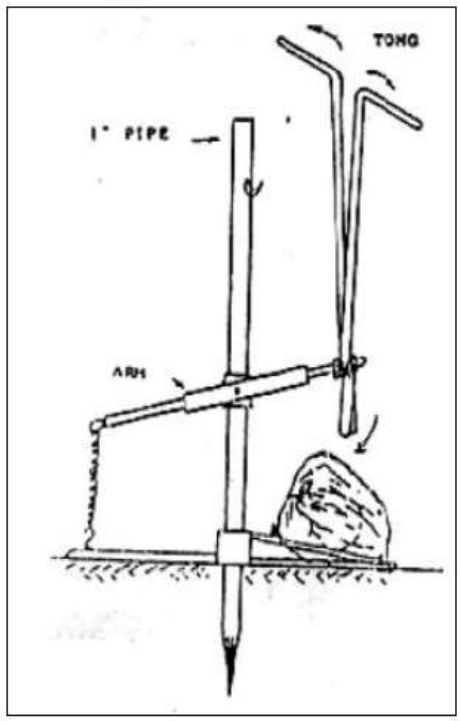

Fig. Mini Coconut Dehusker

Also a spring is attached to the link which is hinged to pillar. The blades are impaled into the fibre of coconut and outward force is exerted on blades which leads to loosening of the husk from coconut. Such a operation has to be repeated three to four times so that the complete coconut is dehusked. The spring helps to regain the original position of handles so that the operation can be repeated quickly. Again this operation involves the bending of operator and straighten up which is not acceptable.

3. Foot operated coconut dehusking tool: It is also called as coconut cracker which was developed in Japan. It is tool consisting of two blades. The coconut has to be impaled into blades. The blades are operated on the force exerted by foot. The blades are also attached to the torsion spring. When the force is released the blades goes to their own position. It requires four to five repetitions for complete dehusking the coconut. Firstly the coconut is striked onto the blades and then by foot the forced is applied so that the blades are opened i.e. moves away tearing the husk from the shell of coconut. When the force is removed due to inertia in spring the blades are forced to return to the original position. Such operation is a tiring and time consuming operation. Also when force has to apply by foot hence the operator is destabilized and it may lead to accident.

4. Coconut Fiber removing Apparatus: The coconut fiber removing apparatus consists of the blades which are located at the top of coconut. These blades are movable, they can move downwards as well as outward. They are moved towards and away simultaneously upto 90 degree. These blades are attached to the rod and the rod can be lowered and raised with a handle. The coconut is placed on the lower part of machine which has bladed on it. These blades at the bottom can also be adjusted and hence it helps in proper positioning. The process of dehusking involves the impale of blades into husk of coconut by lowering the rod with the force and then moving the blades away from the centre. In this way the dehusking is carried out. But it involves large force to impale the husk at eye and some other parts. So manually to generate such a huge force is limitation of this apparatus.
5. Coconut Dehusking Machine: A Coconut dehusking machine involves or consists of two rollers which has spikes over them. The coconut is placed onto these rollers, the rollers rotates in opposite direction. The spikes on one roller holds the husks while spikes on other tears the husk from the shell. Such a machine is bigger in size due to its long rollers. Large force is required due to small mechanical advantage.
6. Coconut husk removing tool: This tool works on the principle of twin blades having wedge. It consists of two blades one is stationary and the other is movable. These blades are attached to a rod. The movable blade has a handle on it. The tearing force can be applied with the help of this handle. The impale of coconut is difficult of this tool. This is the main problem associated with coconut husk removing tool. The coconut is placed in the bowl and the blades are impaled into husk.

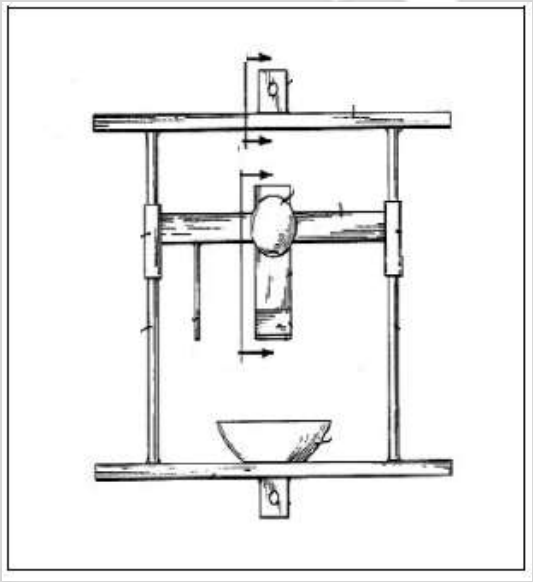

Fig. Coconut husk removing tool

7. Coconut Husking Machine:Titmas and Hickish developed a machine to dehusk the coconut is called as coconut husking machine. It consists of twin blades which are mounted on the wooden support and it stands upright when placed over a floor. The coconut is impaled onto the blades with hands and then the force is applied by a lever on which force can be applied with the foot. For the complete removal of husk such a operation has to be repeated three or four times. A tension spring attached with the movable blade helps in retaining the original position. Such a springing action can lead to injury if the foot is slipped while applying force. While applying the force the operator has to stand on one foot and this destabilizes his posture which is not accepted. Such a limitation of this machine prevented its popularity and use.

2. OBJECTIVE

1. To Design and develop a prototype model of showing the concept of coconut dehusking machine
2. To fabricate the model of the same this will show the working desired by coconut dehusking machine.

3. To reduce cost of machine.
4. To test the model under different conditions.

3. SCOPE OF THE PROJECT

This machine is useful to the coconut estates and co-operatives, coconut growers and coconut processing factory. The machine can provide faster work rate and less human interaction. This machine is expected to increase the coconut production, hence an additional income to coconut growers. It is useful to the coconut growers by many ways. Also the coconut of any size and shape can be dehusked easily. It is easy to operate, does not need skilled labour, rapid, safe operation and simple maintenance.

4 . METHODOLOGY

Methodology of our project is as follows:

1. Project topic finalization
2. Literature review for the topic.
3. Finalizing the methodology.
4. Designing of prototype.
5. Drawing in Suitable drawing software.
6. Manufacturing of frame and welding of spikes on rollers
7. Mounting of rollers with spikes.
8. Mounting of operating handle and sprocket chain mechanism on assembly.
9. Testing

5. LITERATUE REVIEW

1 ERGONOMICAL STUDY AND PERFORMANCE EVALUATION OF DIFFERENT TYPES OF COCONUT DEHUSKERS:

M.K. Ghosal and S.K. Mohanty

The performance and ergonomical study of a power operated coconut dehusker and other manually operated coconut dehuskers was carried out at College of Agricultural Engineering and Technology, OUAT, Bhubaneswar for its suitability among the farmers on the basis of dehusking efficiency and ergonomical considerations like heart rate, oxygen consumption rate etc. during operation. Dehusking of coconut is a very tedious job and many of the labourers show reluctance for this work as it causes injury to them by following traditional method. Development of a suitable coconut dehusker is, therefore, very much important in the state Odisha where there is a great potential for coconut cultivation and marketing of commercial products like copra and coir from coconut husk. Hence, the aim of the study was to develop a power operated coconut dehusker which would become safe and easy to operate, simple to fabricate, commercially feasible and economically viable compared to other manually operated coconut dehuskers. It was observed that the power operated dehusker worked well in terms of number of nuts dehusked per hour, dehusking efficiency, cost of use and with ergonomical considerations.

Performance evaluation of coconut dehusking machine:

A. Mohd Taufik and H. Md. Akhir.

Dehusking coconut manually is a laborious and back-aching task. Coconut dehusking machine was developed to reduce these problems. This machine consists of a 4.1 kW (5.5 hp) petrol engine that generates power to operate a hydraulic system, which controls the movement of the double spike rollers by moving forward, reverse or stop using an operation lever. A hydraulic motor connects to the double spiked rollers using a chain and sprockets. Coconuts

are fed between the spiked rollers to start-off the dehusking process. An experiment was conducted to evaluate the effects of machine settings on dehusking time and the damages of coconuts. The machine setting variables were different roller spike gaps, different coconut orientation and different rotational speeds. Three coconut varieties were used, namely Malayan Tall, MAWA and MATAG. The MAWA variety produced the fastest dehusking time of 5.39 s using the smallest spiked roller gap of 2.5 cm. There was a statistical evidence that rotational speed had an effect on MAWA dehusking time. Significant differences were obtained in dehusking time across coconut orientation for Malayan Tall. All varieties sustained no damages while dehusking, except for MAWA when the largest spiked roller gap of 5.1 cm was used.

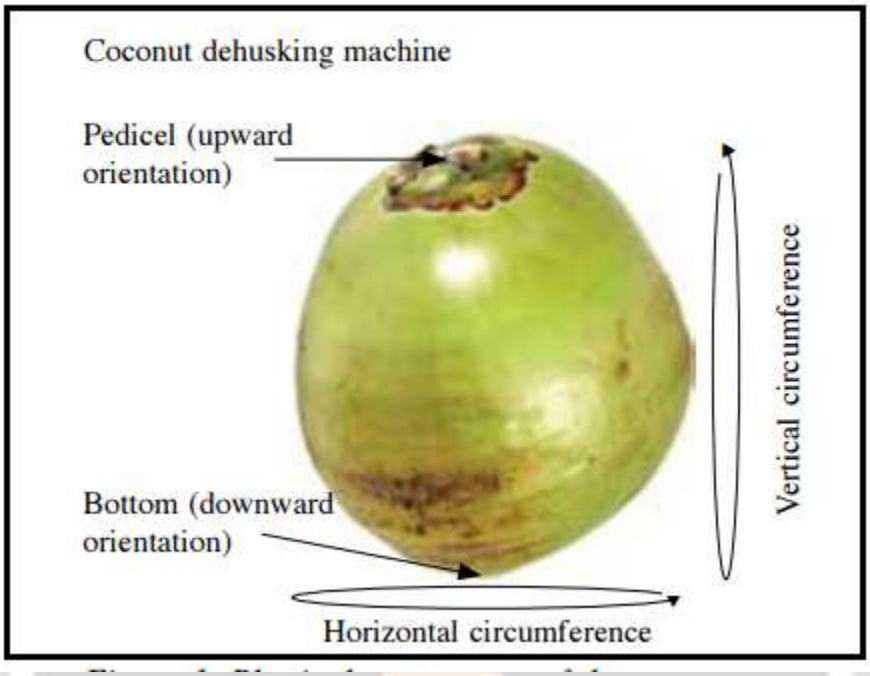

Fig. Physical parameters of the coconut.

From the experiment conducted and analysis done, it can be concluded that:

- The three coconut varieties (MT, MATAG and MAWA) had significant differences in terms of mass, horizontal circumference and vertical circumference. These parameters have an influence on the performance of the coconut dehusking machine.
- Between the two spiked rollers gaps, the MAWA variety produced the fastest dehusking time of 5.39 s using the smallest spiked roller gap of 2.5 cm.
- There was statistical evidence that rotational speed had an effect on MAWA variety dehusking time. This variety showed the fastest dehusking time of 9.32 s at the highest rotational speed. However, coconut orientation did not show any effect on dehusking time for this variety. This variety should avoid using the 5.1 cm spiked roller gap to prevent damage to the dehusked coconuts.

2 COCONUT WATER EXTRACTING MACHINE:

Vaibhav Y. Potraj, Aman S. Attarde, Prof. G. D. Gosavi, Swapnil D. Nimkar Sagar, M. Kubde

The increase in work load on every individual in today's era requires a lot of energy. Health drinks are the biggest and most useful energy sources. One of these thirst quenching health drinks is Coconut water. The person selling the coconut water at road sides or at the beaches takes lot of efforts to cut off the top portion of the coconut. This paper is based on the designing methodology of a coconut water extracting machine which requires less human efforts. This machine does not require any skilled person to operate. Any common human being can use this machine to extract the coconut water.

The construction steps for our coconut water extracting machine are as follows: – The frame of machine is made up of mild steel.

- The punching tool is connected to the lever.
- The punching tool is made sharp pointed at one end and is made up of mild steel.
- The movement of tool is guided by the metal guide.
- The splitting tool is also made up of mild steel.
- The splitting tool is placed separately on the working bed.
- To place the coconut on the bed a holding device is used.

The working principle of the coconut water extracting machine is as follows:

- The coconut is kept on the holding device.
- The punching tool will be moved upward and downward as per the need with the help of liver.
- While making the hole in the coconut, move the lever downward. This will make a hole on the coconut.
- Now move the lever in upward direction in order to remove the punching tool from coconut.
- Now the coconut is ready to serve. In case of cutting the coconut into two halves, the splitting tool will be used.

The fabrication and calculation related to mechanism as well as bill of material has been carried out for coconut water extraction machine. The total system is divided into two units: Power input: Effort is applied to lever by hand and Output of machine: punch the hole in coconut.

1) Input: Input to the machine is given through human power by hand at about 5Kg.
2) Output- Mechanical advantage of=3. 5

3 DESIGN AND FABRICATION OF DRY COCONUT SHELL BREAKING MACHINE:

Ranganath.P Sujay.B.S Vinaykumar.K.S Yashwanth.K.S

Coconut plays an important role in the economic, social and cultural activities of millions of people in our country. India is a major producer of coconut in the world. Coconut provides food, edible oil, industrial oil and health drink to humanity. Native to the tropics, the palm seems to have found its way across the continents. All parts of coconut tree is useful in one way or other and the crop profoundly influences the socio-economic security of millions of farm families. Coconut is an important source of vegetable oil used for both edible and industrial applications. Coconuts are harvested from a tree at varying intervals in a year. The frequency differs in different localities. Tender coconuts are picked as and when required. Coconuts become mature in about twelve months after the opening of the inflorescence or flower bunches. The slight reduction in the quantity of copra and oil will be easily compensated by the additional income from the fibre. In order to obtain the copra from the dry coconut, there are number of process to be done. The processes are coconut plucking, de-husking, breaking shell. At present the shell breaking is performed manually. Insufficient labour strength, skill full work requirement makes the process tedious and time consuming. There is a chance of accidents during manual process. The labour cost also collectively adds up to the cost of the product. Since we have varieties of de-husking machines, so we are intending to introduce a machine to break coconut shell.

4 DESIGN AND DEVELOPMENT OF COCONUT FIBER EXTRACTION MACHINE:

Y. Prashant, C. Gopinath, Vignesh Ravichandran

COCONUT : Coconut (Cocos) grows in more than 80 countries in southern and south-western Africa, Latin America and Asia. “Cocos” is old Spanish/Portuguese language and means “grinning face”, which refers to the facial expressions at the “top” of the coconut’s hard shell from which it sprouts. Coconut palms have a total production of coconut fruits of more than 60 million tons per year. The Philippines is the largest producer followed by Indonesia and India, but also Thailand, Malaysia, Sri Lanka, Ghana, Ivory Coast, Tanzania and Brazil are major producers of coconuts. The parts of the coconut are as shown in Figure.

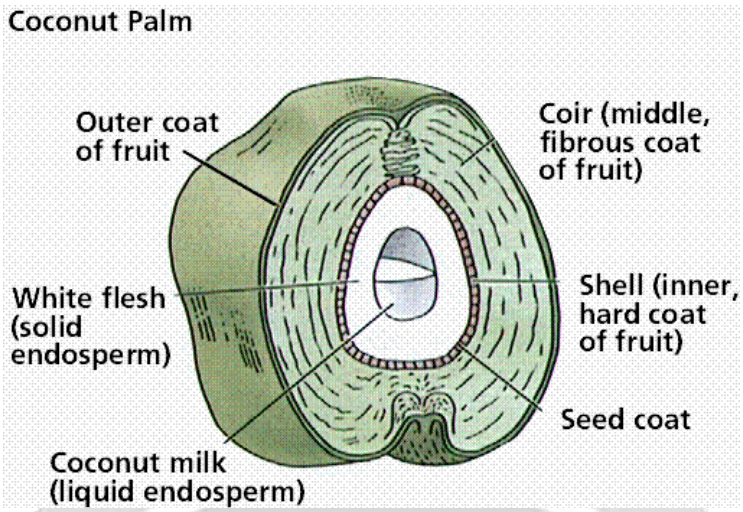

Fig: Coconut and its parts

The scope of this project was to design and develop a coconut fiber extraction machine for farmers and small scale coir industries in India to provide an effective solution to the difficulties in existing process, reduce time and labour cost and to develop a compact coconut fiber extraction machine which could be used in remote villages so that unutilized husks from such areas could be tapped and fiber could be made available to the Coir Industry directly. This project was taken up to develop a promotional strategy for a new innovation and generate public awareness regarding the availability of a coconut fiber extraction machine in the market at a reasonable cost. The project began with collection of information and data on user lifestyle and current process by which they perform their job. The current difficulties were analyzed. Interviews were held with users. A comparative bench marking study was done on similar processes used in other similar extraction processes. Along with this an ergonomic simulation was made to understand the user difficulties and manufacturing methods to get an overview to provide solution to the user to suit their requirement. Concepts were generated keeping benchmarked product in view. Five concepts were generated with different functions and operating processes for coconut fiber extraction machine. Final concept was selected by considering the users' operating environment and maintenance, which could be used in small scale coir industries and in the farm sector.

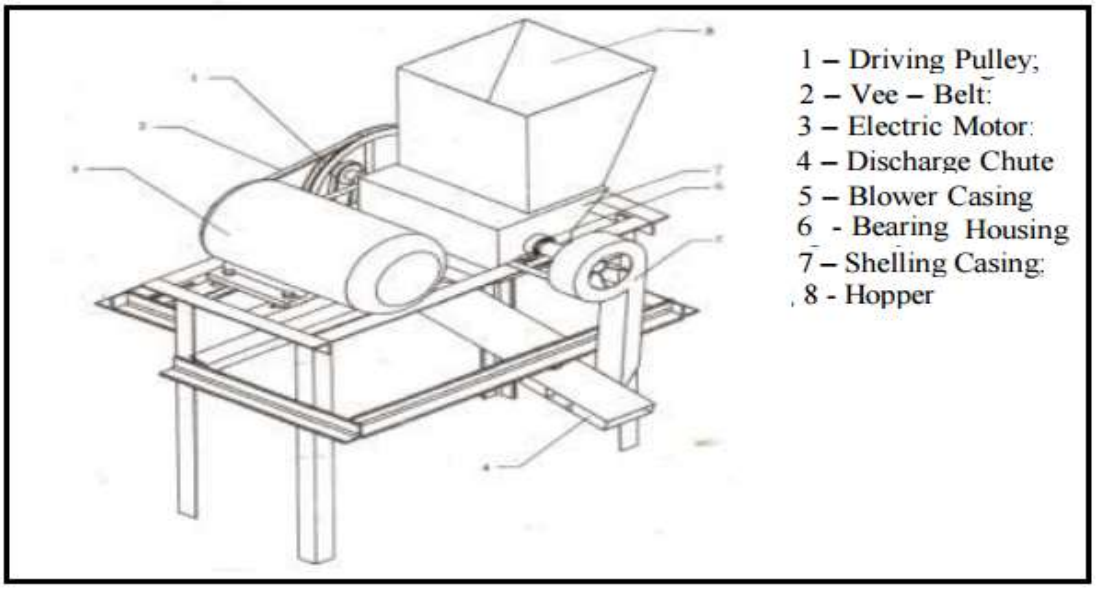

Fig. Castor Dehusking and Shelling Machine

Considering the users' needs and buying capacity, a prototype was fabricated. This machine works with gear mechanism, in which 2 barrels rotates in opposite direction to extract fiber from coconut. Cutting pins are inserted in indexed holes to separate fiber and to give linear motion to coconut shell.

Coir industry in India provides employment to the tune of five lakhs people approximately of which 3.60 lakhs people belong to Kerala alone. About 80% of them are women. The women are mostly engaged in fiber extraction and spinning and men work in the coir products sector. The industry concentrated in Kerala but spread over in other States like Tamilnadu, Karnataka, Orissa, Andhra Pradesh etc. The development of industry is mainly concentrated in the area of coconut cultivation and availability of coconut husk. Production of coir fiber is of the order of 4.2 lakhs metric tons and production of coir yarn is of the order of 2.8 lakhs. The coir products and rope account for 2.00 lakhs tones. The white coir fiber produced in Kerala is of superior quality to brown coir fiber produced in other States mainly Tamilnadu. The cost of white fiber is double to the cost of brown fiber. In view of this consumption of white fiber is declining. The total output of coir and coir products in India estimated to be around Rs.1500.00 crore including exports of Rs.350.00 crore.

5 PERFORMANCE EVALUATION OF A DEHUSKING AND SHELLING MACHINE FOR CASTOR FRUITS AND SEEDS:

Balami, A. A., Adgidzi, D., Kenneth, C. A., and Lamuwa, G.

The performance evaluation of a locally developed castor fruits and seeds dehusking and shelling machine was carried out. The development of the machine was embarked upon in order to reduce the drudgery associated with the processing of castor oil. The machine consists of two major compartments, the shelling unit and the dehusking unit. A blower was incorporated to facilitate easy and proper cleaning and separation of the seeds from the chaffs. Performance tests were carried out using two different accessions of castor seeds (the large and small castor seeds at three different drum speeds of 240 rpm, 320 rpm and 400 rpm, using 1000 g, 2000 g and 3000 g of both castor seeds, each one replicated three times. The results show that the shelling efficiency and seed recovery rate of the machine decreased as the speed of the drum increases (at 240 rpm - 80.34 % and 99.50 %), respectively and at 400 rpm - 76.28 % and 99.18), respectively, while the percentage losses in seeds, cleaning efficiency and mass flow rate of the material increased as the speed of the drum increases (at 400 rpm - 0.98 %, 51.23 % and 23.18 g/s and 240 rpm - 0.50 %, 50.63 % and 15.21 g/s), respectively. The results of the ANOVA indicate that the shelling efficiency of the machine differs significantly at the three drum speeds. The analysis also shows that the machine performed better at 240 rpm compared to the other two speeds. It can be concluded, that the developed machine could reduce the drudgery involved in manual shelling with saving in operating time of about 70 %.

The materials used for constructing the dehusking and shelling machine were chosen on the basis of their availability, suitability, economy, viability in service among other considerations (Sharma and Aggarwal, 1998; Gupta and Das, 1997; Sahaya and Singh, 1994; Mohsenin, 1984). The machine consists of two major components: the shelling unit which breaks and separates the seed from the fruit and the dehusking unit which cracks and dislodges the inner shell from the nut. A blower was incorporated to facilitate easy and proper cleaning and separation of the seeds from the chaffs. The machine is operated by a 3 hp electric motor.

6 REVIEW OF COCONUT FIBER EXTRACTION MACHINES:

Rahul Sabale, Dr. K. P. Kolhe

There are many farm equipment's which are developed for the post harvesting operations. Mostly all the post harvesting operations are tedious jobs to perform. The dehusking of a coconut is regarded as the most time consuming, tiring, and difficult operation to perform. Many attempts has been done to perform this task of dehusking manually as well as mechanized. Traditionally this task of dehusking was performed by using different hand tools. By hand tools the dehusking depends on the skill of worker and involves training. The mechanized or the power operated machines are also developed to eliminate the drawbacks of manual tools. Such a tools and machines are developed all over the world and a very few have become popular, rest got vanished due to their limitations. This work is aimed to list such tools and machines which are used for the post harvesting i.e. dehusking of coconut.

The coconut fiber removing apparatus consists of the blades which are located at the top of coconut. These blades are movable, they can move downwards as well as outward. They are moved towards and away simultaneously up to 90 degree. These blades are attached to the rod and the rod can be lowered and raised with a handle. The coconut is placed on the lower part of machine which has bladed on it. These blades at the bottom can also be adjusted and hence it helps in proper positioning. The process of dehusking involves the impale of blades into husk of coconut by

lowering the rod with the force and then moving the blades away from the centre. In this way the dehusking is carried out. But it involves large force to impale the husk at eye and some other parts. So manually to generate such a huge force is limitation of this apparatus.

Coconut Fiber removing Apparatus:

The coconut dehusking is one of the most difficult post harvesting operation. In India coconut is cultivated on a large scale. To process such a large number of production of coconuts some suitable mechanism needs to be identified or developed. Several attempts have been made to mechanize the dehusking of coconut. Some of them were manually operated and others were power operated. These mechanisms have their own advantages and disadvantages. Few of them required skill worker. Some of them were bulky, time consuming, power consuming, uneconomical. There is a need to develop some mechanism which would work satisfactory and must be economical. Depending upon the necessity the suitable mechanism needs to be selected.

7 DESIGN AND DEVELOPMENT OF A COCONUT DEHUSKING MACHINE (MACHINE COMPONENT DESIGN):

H. Azmi , A. B. Sanuddinb , M. Z. Zakimic , M. S. Jamalid , H. Radhwane , A. N. M. Khalilf , A. N. A. Akmalg and A. F. Annuar.

A coconut de-husking machine comprising of two rollers with spikes, chain drives, presser, clearers, shafts and belting system was developed for small-scale production in rural areas. Performance test analysis showed that the machine de-husks coconut fruits without any nut breakage or distortion of the extracted fibre length. The objective of this project is to improve the efficiency and productivity in producing coconut fruits without husks by using the best selection of mechanical mechanisms with minimum costs. One electric motor (2hp, 1500rpm) is used to drive two shafts using a combination of pulley and belt. In between the motor and the shafts, one box of worm gears is used to reduce the rotation speed from 1500rpm to 21rpm (ratio 70:1). Two metal cylinders with a series of spikes are used to remove the husks from the coconut fruit and are attached to the rotary shaft. The machine's average de-husking efficiency and capacity are 90.42% and 222 coconuts per hour, respectively. In addition, the development of the machine is also a solution to the constraint of space, whereby a compact-size machine is more suitable for small and medium enterprises (SME's). Plus, it operates with lesser noise, which also contributes to a more viable operating condition for the environment.

The frame is the main supporting structure upon which the other components of this machine are mounted on. The frame is a welded structure, constructed from 50x50x5mm angle iron with dimensions of 933mm in length, 515mm width and 845.1mm height. The drive mechanism comprises of a motor, worm reduction gears with a belt drive system and a rotating shaft with chain drive system. A single phase 2hp induction motor with speed of 1500rpm is used to drive the components. The machine also uses a gearbox with a 70:1 ratio and connected to a shaft, which is a long rotating cylinder that transmits power from one place to another. For the holding mechanism, bearing blocks function by reducing vibrations or wobbling caused during shaft rotation at longer lengths due to heavy loads. Therefore, to reduce machine vibration, two bearing blocks were used between the reduction gear box and the roller blades while another two is placed at the right end of the roller shaft.

The roller type mechanism can be explained as two rollers, each having an elongated configuration, are disposed by spacing the pieces apart, substantially parallel to one another with respect to the base and in a readily accessible configuration. Each roller is formed by welding thirty-two metal spikes (2 x 20 x 5mm) on a 115mm diameter mild steel pipe, mounted on a roller shaft. Each roller shaft is made from a mild steel rod of 40mm diameter, with 890mm length for the main shaft and 644.87mm length for the parallel one, supported at both ends by ball bearings with a sprocket mounted at the left end. The clearer is constructed by cutting u-notches on one edge of a mild steel plate of 2mm thickness. The clearers were fastened onto the frame above the rollers. The developed coconut de-husking machine is very easy to operate and requires only one operator. When the switch is turned on, the rollers with spikes rotate in opposite directions towards the centre, causing both gripping and tearing of the husk of the coconut fruit placed in between the rollers. The system was designed for an efficient dehusking process where the nuts will be de-husked without any break off and thus, ensures a proper discharging of the de-husked nuts.

In the development of the coconut de-husking machine, a mechanism which de-husks coconuts by switching out nut breakage and distortion of the extracted husks has been developed for small scaled farm holders in rural areas. The machine is easy to operate and performs with an average de-husking efficiency and capacity of 90.42% and 222 nuts

per hour. The introduction of this machine will not only eliminate the problem of limited manpower but also increases the productivity of de-husking coconuts.

8 DEVELOPMENT OF A NEW COCONUT DEHUSKING AND CUTTING MACHINE:

Sooraj SJ, Vaisakh VS, Sibin Raj PS, Jyothish JS, Jinto Cheriyan, Vishnu V Chandran
This paper presents a new innovative machine for Dehusking and Cutting a coconut. It consist of two units- a dehusking and a cutting unit coupled to each other by an elliptical path. Two rollers with spikes does the dehusking and after that the dehusked coconut moves with the assistance of gravity towards the cutter. The cutter is controlled using a cam. A detailed literature survey on the existing technologies is done and calculations supporting the construction are made.

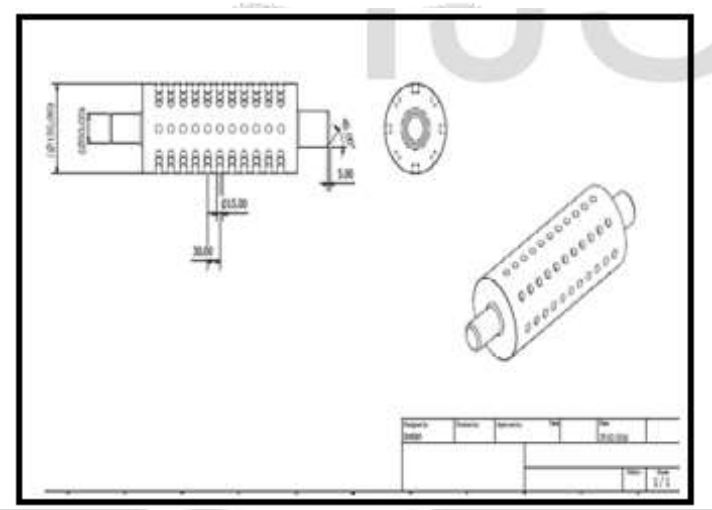

Fig: Schematic diagram of roller

Coconut husk is used for many applications such as coir industry, mat industry, for cultivation of certain plants etc. Coconut shell earlier used as spoons now finds application in handicraft items, use as reinforcement along with cement instead of gravel for high strength and durability. Thus all parts of the coconut is a gift from nature.

We began to think the idea of coconut de-husking and cutting machine when we realized the effort in de-husking and cutting of coconuts in coconut oil making industry. Our machine consists of two main units a de-husking and cutting unit a and channel connecting them. Several machines were developed earlier and they has some disadvantages such as an operator is necessary for removing de-husked coconuts, non-safe, uneconomical etc.

Coconut De-husking Machine for rural small scale farm Holders comprise of two rollers with spikes, screw conveyor, barrier plates, conveyor belt, two spur gears and a handle was developed for small scale production in the rural areas.

Hydraulically operated coconut de-husking machine mainly consists of hydraulic cylinders, de-husking mechanism, hydraulic power pack, fruit gripping mechanism, and frame.

Coconut water is rich in minerals, nutrients and other enzymes. Various de-husking machines like coconut husk re-moving tool, coconut husking machine, coconut spanner, keramithra coconut dehusking machine etc , their working and proper-ties are studied.

Cam design and gear design for the machine are studied as both of these are integral parts for our two units. Cams are mechanical devices simple in operation but gives more complex movements like lifting of valves and other parts. Worm and pinion gear design is studied and this is used in first unit for speed reduction.

Coconut and its properties and physical characteristics are studied as our processing product is coconut.Some of the commonly available manually operated and external power assisted dehusking machines are mentioned be-low.

Manually Operated Dehusking Machines:

Mini Coconut Dehusker shown in Fig. consist of a tong- like tool mounted on a pillar. The coconut was kept on a platform and was impaled from the top with sharp jaws of the tool swinging downwards about the pillar. After penetration, the handles of the tool were pulled outwardly to separate the jaws. This ripped of the husk into one sector. The operations were repeated till complete dehusking. Since it is completely operated by the man, it didn't become popular.

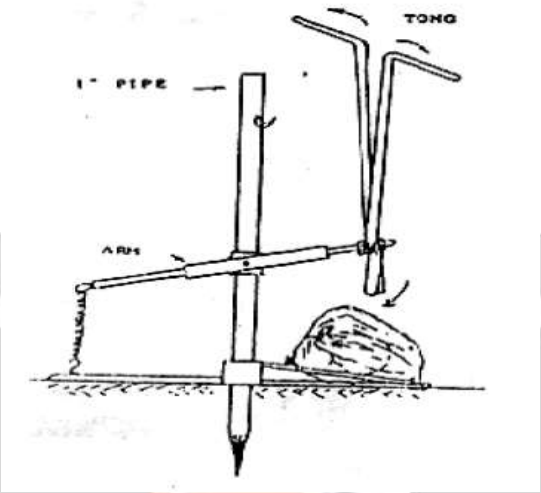

Fig: Schematic Diagram of Mini- Coconut Dehusker

9 CONCEPTUAL DESIGN OF COCONUT DEHUSKING MACHINE

Stephen Kwasi Adzimah Samuel Oppong Turkson

Generally, coconuts are dehusked manually using a machete. These methods require skilled labour and are laborious to use. Attempts made so far in the development of dehusking tools have only been partially successful and not effective in replacing manual methods. The reasons stated for the failure of these tools include unsatisfactory and incomplete dehusking and breakage of the coconut shell while dehusking. Based on this a hand - operated coconut dehusking machine is being designed to solve this problem. This machine takes into consideration the dangers, hazards and risks involved in dehusking the coconut which will be efficient, productive, environmentally friendly, less laborious, easy to use and ergonomic, easy to assemble and disassemble, and most importantly, cost effective in production, maintenance and repairs .The machine will use hydraulic system, including a ram, fed from a pump, which does the dehusking at a rate of 70-80 coconuts per hour.

The main expectation of coconut customers is to have high quality products. Along with the quality, the farmer also needs high capacity and most efficient equipment for more productivity. Therefore, the design of the machine should involve the use of hydraulic mechanism and application of force with leverage; it should be user - friendly, rapid and can be operated safely; it should be small enough to be either carried by at most two workers or rolled into place; should be conveniently assembled or disassembled; it should be able to removes husks of various shapes and sizes; the coconut shell of any thickness and hardness can be removed easily. it should be operated by anyone regardless of age; it should be simple and easy maintained; it should not require lengthy training for the operation and the machine can be understood easily; it should be portable; it should be able de-husks about 70 to 80 coconuts per hour.

This coconut dehusking machine peels off the coconut husk from coconut fruit to obtain dehusked coconut fruit via mechanically controlled dehusking devices. It consists of a hand-operated hydraulic pump, which pumps the oil to the cylinder for the downward movement of the ram. The ram is connected to the poker directly. The coconut is placed on the holder in vertical position. The coconut holders are made of mild steel material. The ram is moved down by the hand pedal operating the hydraulic pump by the hand lever. The actual force on the plunger will be around 30 kg but we feel only about 5 kg of force. This is due to the length of the hand lever provided to operate. But the force produced from the hydraulic cylinder will be around ten times the force we apply to the hand lever i.e. around 300 N force can be obtained from the cylinder. At the upward movement of the hand lever plunger, it will

suck the oil from the tank into the pump chamber through the non-return valve provided, which makes the oil to be sucked into the pump cylinder. At this time the release valve is in closed position. The downward stroke of the hand lever plunger will push the oil out through another non-return valve which passes through the hydraulic tubes into the cylinder. These tubes are properly sealed and fitted so that no oil will be leaked through the joints. The oil entering and filling the cylinder chamber makes the ram to move out of the cylinder effecting the downward slide of the ram. Since we have used the hydraulic systems we can get about 300 N of force at the ram end from the force of 30kg that applied to the hand lever plunger. The ram is connected to the poker directly. So during the downward stroke of the hand lever the pump pushes the oil to the hydraulic cylinder which forces the ram to move out of the cylinder. The coconut will be placed in the coconut holder which will be at a fixed point. As the ram moves downwards the poker also moves downwards.

10 DESIGN AND ANSYS ANALYSIS BASED ON COCONUT DEHUSKING MACHINE

Guangyue Jiang

As the main cash crop in Southern China, coconut enjoys a high commercial value. However, coconut flesh suffers a high loss from the difficulty in dehusking process, and thus reducing the dehusking efficiency and value. This paper gives an ANSYS analysis of the newly designed coconut dehusking machine to testing its stability and reliability.

The design of the trigonal pyramidal nose of the special cutter is out of the convenient of poking. The arc nut and the support bar coordinate with each other at the place of the screw thread to limit the depth of poking and adjust automatically in accordance with the thickness of the coconut shell. The arc nut rotates up and down, and the distance between the arc nut and the nose of the knife is controlled within 1.5-2.0mm. The arc nut remains in the inner shell of the coconut and thus prevents the cutter from poking deeper inside the coconut. The spring of the cutter will compress or stretch itself in accordance with the force while the nose of the knife is moving. That is how it helps to protect the coconut flesh from being damaged.

During the work, a supporting barwithout the screw thread keeps making telescopic movement. For this reason, changes in the length of the spring (e.g. become shorter or longer) will happen when facing uneven force. The back and forth movement of the supporting bar without the screw thread will lead the nose of the knife to move along cutter moves gradually under the force the clamping. The three-D schematic diagram of the special the trajectory.

When performing the stress force analysis, the first step is to fix the bottom of the cutter directly with clamping apparatus. In the process of dehusking, the high speed revolution force comes from the rotating mechanical hand. At the same time, the cutter keeps moving downwards. The applied force of cutting is 1.0*104N. It was found by the stress detection that the nose of the knife suffers the strongest force at this moment. Besides, under the influence of the force, the nose of the knife bends, but not very obviously. As the cutter keeps moving downwards, the closer it gets to the bottom, the weaker the force become. In order to make the intensity of nose of the knife to comply with the standard, the study chooses steel Q345 as the material of the cutter in this experiment.

Dehusking experiment was carried out after stress force analysis. 50 coconuts were chosen for this experiment andwere divided into two groups. The two groups are control group and study group. 25 coconuts in control group weredehusked by hand, while the other 25 coconuts in study group were dehusked by the machine. Thus damage rates andefficiency of the two groups were compared with each other. As for the experiment criteria, coconut flesh damage rateexceeds 10% was regarded as non-conformity. Besides, factors like the number of successfully dehusked coconuts ware alsotaken into consideration.

11 DEVELOPMENT OF A COCONUT DEHUSKING MACHINE FOR RURAL SMALL SCALE FARM HOLDERS

B. N. Nwankwojike, O. Onuba, U. Ogbonna

A coconut dehusking machine comprising of two rollers with spikes, screw conveyor, barrier plates, conveyor belt, two spur gears and a handle was developed for small scale production in the rural areas. Performance test analysis conducted shows that the machine dehusks coconut fruits without nut breakage and distortion of the extracted fibre length and also that its average dehusking efficiency and capacity are 93.45% and 79 coconuts per hour. All materials used in the fabrication of this machine are of standard specifications and locally sourced. The estimated cost of producing one unit of the machine is thirty five thousand, six hundred and sixty-five naira (N35,665.00). The machine also eliminated dependency on the epileptic public electric power supply in our rural areas which constitutes the major obstacle in the use of other mechanized coconut dehusking equipment in the rural areas.

The frame is the main supporting structure upon which other components of this machine were mounted. The frame is a welded structure constructed from 50x50x5mm angle iron with dimensions of 920mm length, 480mm width and 400mm height. The dehusking unit comprises of two rollers, two roller shafts and two spur gears. Each roller was

formed by welding thirty-two metal spikes (2 x 20 x 5mm) on an 80mm diameter mild steel pipe mounted on a roller shaft. Each of the roller shafts is a mild steel rod of 55mm diameter and 920mm long supported at both ends by ball bearings with a gear mounted at right ends.

Fig -1 Experimental Setup

Fig. Diagram of the developed coconut dehusking machine

Also mounted at the right end of the driving roller shaft is the driving handle while driven roller shaft drives the conveying unit of the machine through a driving pulley mounted on it. The conveying unit consists of a screw conveyor, shaft, two clearers, pulley and belt. The screw conveyor was formed by scrolling and welding a 10mm diameter mild steel rod on a 75mm diameter mild steel pipe with a pitch of 92mm. The conveyor shaft is a mild steel rod of 30mm diameter and 920mm long supported at both ends with ball bearing. The conveyor shaft is driven by a v-belt pulley of 100mm diameter which runs at the same speed with the low speed roller (57 teeth gear). The clearer was constructed by cutting u-notches on one edge of a mild steel plate of 2mm thickness. The clearers were fastened on the frame adjacent to the rollers. The developed coconut dehusking machine is very easy to operate and requires one operator. When the handle is wound, the rollers with spikes rotate in opposite directions towards the centre causing both the gripping and tearing of husk of coconut fruit placed in between the rollers. While the rollers rotate, a screw conveyor mounted between them 70mm below rotate in the same direction and speed as the driven roller with the help of a pulley-belt system to ensure proper discharging of dehusked nuts.

12 DEVELOPMENT AND PERFORMANCE EVALUATION OF A POWER OPERATED COCONUT DEHUSKER

M K Ghosal, Madhusmita Mishra and N C Sutar

The present study was conducted at College of Agricultural Engineering and Technology, OUAT Bhubaneswar to develop and evaluate the performance of a power operated coconut dehusker suitable among the coconut growers of the state, Odisha. Dehusking of coconut is a very tedious job and many of the laborers show reluctance for this work as it causes injury to them by following traditional method. Development of a suitable coconut dehusker is therefore very much important in the state of Odisha where there is a great potential for coconut cultivation and marketing of commercial products from coconut husk. Hence the aim of the study was to develop a power operated dehusker which would become safe to operate, easy to fabricate, commercially feasible and economically viable. It was observed that the dehusker developed could dehusk 300 numbers of nuts per hour with a dehusking efficiency of about 92 percent.

A coconut dehusker was developed which was operated by an electric motor with a reduction unit for actuation of sharp edged metallic fingers (one fixed and other movable) with the help of a movable cam to dehusk the manually fed coconut. The various components of the dehusker were: a prime mover - l hp motor, reduction unit (for reducing speed of motor), belt and pulley, shaft, cam, lever and knife, hand protecting cover (safety ring), and concave chute. The prime mover used for the study was an electric motor of 1 hp capacity running with 1440 rpm and fitted at the bottom of the experimental set up. The reduction unit was used to reduce the rpm of motor to 25 rpm so that coconut could be easily fed to the fingers by their slow movement. Power was available at the pulley connected to the prime mover. With the help of belt and pulley arrangement, the power was transmitted to the shaft of the coconut dehusker.

An idler pulley was used to maintain the belt tension. The pulley at theend of the shaft of dehusker revolved with 15 rpm and the power was finally transmitted to the cam. The cam was attached to the other end of the shaft of the coconut dehusker. This cam transmitted the rotary motion to the linear motion of the movable finger through a lever. The two fingers were hinged in such a way that one finger was fixed and other one moved forward and backward periodically to make a separation of approximately 5 cm between them. After switching on the motor, the operator was to feed the coconut on the sharp edge of the knives when both the knives were closer to each other. When the knives were separated from each other, the husk in the coconut was loosened and then the coconut was again put on the knives when both the knives were closer to each other for second time for further loosening of the husk at the other portion of the nut. This practice was repeated 3-4 times for complete loosening of the husk. Then the loosened coconut was handed over to the helper who was to completely remove the loosened husk from the nut and the nut was now in dehusked condition for its easy transportation and for use in some other purposes.

6. CONCLUSIONS

The machine is easy to operate and performs with an average de-husking efficiency. The introduction of this machine will not only eliminate the problem of limited manpower but also increases the productivity of de-husking coconuts and solved the problem of money issue about purchasing the machine.

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