Coconut Dehusking Machine

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Abstract:- **India being the 2nd largest producer of coconut, lack in technology of processing industry. Till date there were many techniques involved to peel the coconut. Even now the basic conventional process is being followed. The traditional method used in India, for the separation of copra and shell from partially-dried split coconuts, is labour intensive. To overcome this problem, a power operated coconut de-shelling machine was designed and developed. Today there is many methods used for de-husking and de-shelling of coconut. These methods are widely used for removing of the coconut husk but these methods have many problems and limitations while operating these machines. These problems affect the production rate of de-husking the coconut. To overcome the limitations and problems occurring in the present machine there is need of the method to be automatic and less harmful to the user .This paper presents the design and development of the automatic coconut de-husking machine.To overcome these limitations, to improve the automation and to provide safety for the operator, a new design of de husking machine is introduced and fabricated. This de husker comprises usage of two horizontal rollers with series of sharp tools which would shear the husk from coconut when rolling against each other. Shear force is required for de husking of mature green coconut and dry brown coconut. Shear force required is more for mature green coconut than dry coconut. A coconut de-shelling machine comprising of cutter with belt drive. Performances test analysis conducted show that the machine de-shelled the fruits without nut breakage. The loading and unloading is done manually. All materials used in the fabrication of this machine are of standard specification and locally sourced. The estimated cost of producing one unit of the machine is six thousand and two hundred and fifty (Rs.6250). 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 de-shelling equipment in the rural area. This machine eliminates the problems and limitations to a greater extent. In this way the production rate increases compared to the conventional coconut de-husking machine.**

Keywords: Copra, shell, coconut dehusking, Shear force, Husking.

INTRODUCTION

Coconut (cocos nucifera) is one of the world most useful and important perennial plants [1].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. 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 oil, which comes under edible-industrial group, is used as a cooking oil, hair oil, massage oil and industrial oil. Coconut oil can be blended with diesel, straight in an adapted engine or turned into biodiesel

The fruit of the coconut (Cocos nucifera) is technically a large, dry drupe (D) composed of a thin outer layer (exocarp), a thick, fibrous middle layer called a mesocarp (F), and a hard inner layer called an endocarp (E) that surrounds a large seed. The endocarp (A) contains three germination pores at one end, one of which the sprouting coconut palm grows through. The "meat" of the seed is endosperm tissue (B) and a small, cylindrical embryo is embedded in this nutritive tissue just opposite the functional germination pore. The seed is surrounded by an outer brown layer called the seed coat or testa. This is the brown material that adheres to the white "meat" or endosperm when it is removed from the endocarp shell. "Coconut water" (C) is multinucleate liquid endosperm that has not developed into solid tissue composed of

FIG:1.1

cells. Copra comes from the meat of dried coconuts, while coir fibers are derived from the fibrous meso carp.

Sprouting fruit of a coconut Cocos nucifera. The hard inner layer (endocarp) contains the actual seed composed of a minute embryo and food storage tissue (endosperm). The base of the embryo (cotyledon) swells into an absorbing organ that fills the entire cavity of the seed as it digests the endosperm. The endocarp has three germination pores, one

functional pore and two plugged pores. [In "blind coconuts" all three pores are plugged.] The three pores represent three carpels, typical of the palm family (Arecaceae). Just inside the functional germination pore is a minute embryo embedded in the endosperm tissue. During germination, a spongy mass develops from the base of the embryo and fills the seed cavity. This mass of tissue is called the "coconut apple" and is essentially the functional cotyledon of the seed The nut varies from 147 to196mm in diameter and 245to 294mm long. Three sunken holes of softer tissue called “eyes” are at one end of the nut. Inside the shell is a thin, white, fleshy layer, about 12.25mm thick at maturity, known as the “coconut meat”. The interior of the nut is hollow and partially filled with a watery liquid called “coconut milk”. The meat is soft and jelly-like when immature and becomes firm at maturity. The coconut milk is abundant in unripe fruits but it is gradually absorbed as ripening proceeds [3]. According to [4], the meat of immature coconut fruit can be made in to 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 is commercially cultivated in 93 countries especially on the small and marginal holdings over an area of 11.8 million hectares and about 10.26 million tons of copra equivalent were produced in the year, India contributes to 15.28% of the global area and 19.44% of global production, and is the largest single market for coconut, consuming almost its entire production of 12.6 billon nuts. Indonesia is the next largest market for coconut, consuming nearly 11.2 billion nuts accounting for about 74% of its production. As much as 50.8% of the total coconut area in India is concentrated in Kerala and the state account for 43.6% of the total production of the country.

Kerala is a small state along the west coast of India, which accounts for only 1.18% of the total land area of the country. Rey (1955) reported a knife-shaped shallow spoon, which moved back and forth upon the rotation of a cam, and in the process, the coconut meat was scooped in fragments. Mix (1957) designed a shelling machine for removing the shell from the fresh coconut meat, while Blandis and Glaser (1973) used water under pressure to separate the coconut meat from the shell. Even in large processing units, about 15-20 labours are used for de-shelling 20,000 to 30,000 nuts (Singh,2004). This is a labour-intensive operation and takes several hours to separate shell and copra. However, no attempt has been made so far to develop a mechanical de-shelling machine, With this objective, an attempt has been made in the present study to develop a de-shelling machine.

1.2 COCONUT CULTIVATION IN INDIA

Traditional areas of coconut cultivation in India are the states of Kerala, Tamil Nadu, Karnataka, Pondicherry, Andhra, Goa, Maharashtra , Odessa , 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 southern states combined account for almost 90% of the total production in the country: Tamil Nadu (33.84%), Karnataka (25.15%), Kerala (23.96%), and Andhra Pradesh (7.16%). Other states, such as Goa, Maharashtra, Odisha, West Bengal, and those in the northeast (Tripura and Assam) account for the remaining productions. Though Kerala has the largest number of coconut trees, in terms of production per hectare, Tamil Nadu leads all other states. In Tamil Nadu, Coimbatore and Tirupur regions top the production list. In Goa, the coconut tree has been reclassified by the government as a palm (like a grass), enabling farmers and real estate developers to clear land with fewer restrictions. With this, it will no more be considered as a tree and no permission will be required by the forest department before cutting a coconut tree

TYPES OF DE-HUSKING MACHINE:

Today there are various techniques are used for de-husking the coconut. These techniques have many limitations in process. Despite of that these techniques are widely used for de-husking. Those techniques are,

1. Manual de-husking:
   a) By using machete or spike
   b) By using traditional tool
2. Pedal operated de-husking
3. Hydraulic operated de-husking
4. Pneumatic operated de-husking.

3.1SEMI AUTOMATIC DE HUSKING MACHINE:

Another twin-blade tool, which appeared to be better than that of Waters, was of the tool developed by Titman and Hickish which is called the Coconut Husking Machine. This was a tool mounted on a wooden platform, and stood upright when placed on the floor. Coconut was held by hand and impaled on the stationary tool. The downwards action of its foot lever each time caused the separation of one sector of the husk. Repetition of these operations to three or four times caused complete removal of the husk. Re juxtaposed upright position, was achieved with from the pedal during downwards action would be causing a quick return of the pedal, and any part of the leg or body coming in the way of its path is bound to get an impact, which ma Moreover, depressing of the pedal in the standing posture of the

FIG:3.1

3.1.1MANUAL
DE-HUSKING MACHINE:
a) By using machete or spike:
De husking with traditional hand tools like machete or a spike depends on the skill of worker and involves training.
b) By using traditional tool:
Coconut dehusking involves removing of the husk from the coconut. Traditional de husking is time consuming and difficult process.

3.2 PEDAL OPERATED DE-HUSKING MACHINE:
Pedal operated de husking machine invented by Siva Kumar.V et al The prototype model is shown in figure 2.2. It is a type of pedal operated husking tool, which appeared in Japan which was called Ce coconut cracker developed by Ce Co Co Japan. This was a tool mounted on a platform, and standing upright when placed on the floor. Coconut was fed by hand and impaled on the stationary tool. The depressing of its foot lever each time caused the separation of one sector of the husk. Repetition of these operations three or four times caused complete removal of the husk. Re-setting of its movable blade on to the stationary blade, to keep them in the upright position, was achieved with the aid of a torsion spring of high spring constant. Slipping of the foot from the pedal when depressing would be causing quick return of the pedal and any part of the leg or body coming in the way of its path was not that advantageous, as this action destabilized the bound to get an impact, which may sometimes be inflicting injury. These disadvantages might have prevented the acceptance of this tool.

3.3 HYDRAULIC OPERATED DE HUSKING MACINE:
The concept involves a hydraulic piston with a three jaw chuck to hold the coconut in place. The spider expander pierces the coconut from the top. As the spider expands under hydraulic pressure the holder piston simultaneously moves upwards facilitating the de-husking process. The extracted coconut shell is directed towards the cutter through a line pathway where it splits the coconut into two thus separating the shell. Then the cut shells will be moved towards the scrapper for the final scrapping process. This mechanism shows an effective and efficient way to de husk, cut and grind the coconut in an automated process from start to finish with minimum time consumption. This machine does not require skilled labour to operate and since the hydraulic piston is separate from the motor, each operation can be carried separately if required. Its low cost of fabrication and simple design which requires low maintenance makes it user friendly and can be easily afforded by small scale farmers and smaller industries. India is an agricultural country. But the increasing costs for living and the unstable agricultural market has made many people to opt out from agriculture. Even the industrialization has made many people to think that in a long run agriculture may not help them to lead a better life. On the basis of these facts the Indian Government have introduced many schemes and projects to help the farmers in trouble and also to welcome the next generation into the agricultural field. For attracting the young people who had no interest towards the conventional methods of farming the Government had taken several initiates for making agriculture more simple and efficient. Coconut Cultivation was one such field wherein the people followed the conventional farming techniques for plucking and processing the fruit. But assigning a person to climb on each tree one by one and plucking the coconut was a tiresome and time consuming job. Researches were done on this and machines which could climb coconut trees were introduced. At the time of inception it had many defects in it and as years passed by engineers came with solutions and those defects was rectified. Now the coconut tree climbing machines have become quite popular even in small villages. Still researches are going on in this field for making these machines more efficient. Not only climbing the processing operations of coconuts which includes the de-husking, Cutting and Scrapping of the fruit were also a difficult job. Many machines were developed for this but those were either less efficient or costly. Now engineers are working for developing a machine which could do all these operations by itself in much more efficient way through which the cost of the machine can be reduced and thereby making it affordable for a common man.

FIG:3.2

3.4 PNEUMATIC OPERATED DE HUSKING MACHINE:

The coconut outer shell is a fibrous husk one to two inches thick. This paper deals with the design and fabrication of pneumatic operated coconut de husking machine. This project is aimed at producing an efficient and more economical machine for coconut industry. The coconut is known for its great versatility as seen in many domestic, commercial, and industrial uses of its different parts. Coconuts are different from any other fruits because they contain large quantity of tender and when immature they are known as tender-nuts or jelly-nuts and may be harvested for drinking. When they mature they still contain some water and can be used as seed nuts or processed to give oil from the kernel, charcoal from hard shell and coir from fibrous husk. One traditional method used for coconut de husking is using a machete. This is done by using human energy. This method is risky and tedious and yet requires skills. Hence an alternative is suggested in our project which reduces time involved in coconut de husking and human effort. Depending upon the survey different

sizes of coconut are determined. The machine is designed to accommodate different sizes of the coconut that are cultivated anywhere in the world.
Many problems occur while operating these machines or methods. In the automatic coconut de-husking machine eliminates or reduces the problems and limitations present in these techniques. These problems might be injurious, hazardous for operator. But in the automatic coconut de-husking machine these problems are eliminated in tremendous amount. This leads to the safety and ease in removing the coconut husk.
The present work involved the design, development and testing of a coconut de-husker which overcomes the drawbacks of the previously reported implements. The design and developmental stages called for a closer look at the magnitude and direction of the de-husking forces and their generation mechanisms. Details of a simple, sturdy and efficient hydraulic de-husker unit, financially beneficial to labours and producers, are given here.. Cost benefit analysis indicates that it should be commercially viable.
Main purpose of manufacturing coconut de-husker is to reduce the human effort and increasing efficiency.

3.5 KEY OBJECTIVE-

- To reduce human effort.
- To increase continuous work capacity.
- To increase efficiency than conventional system.
- Less harmful to the user

of the six faces of the cubic unit cell and eight atoms at its vertices. It is the interaction of the allotropes of iron with the alloying elements, primarily carbon that gives steel and cast iron their range of unique properties.

In pure iron, the crystal structure has relatively little resistance to the iron atoms slipping past one another, and so pure iron is quite ductile, or soft and easily formed. In steel, small amounts of carbon, other elements, and inclusions within the iron act as hardening agents that prevent the movement of dislocations that are common in the crystal lattices of iron atoms.

5.1.1 HISTORY
Steel was known in antiquity and was produced in bloomeries and crucibles. The earliest known production of steel is seen in pieces of ironware excavated from an archaeological site in Anatolia (Kaman-Kalehöyük) and are nearly 4,000 years old, dating from 1800 BC. Horace identifies steel weapons such as the falcata in the Iberian Peninsula, while Noric steel was used by the Roman military.
The reputation of Seric iron of South India (Wootz steel) grew considerably in the rest of the world. Metal production sites in Sri Lanka employed wind furnaces driven by the monsoon winds, capable of producing high-carbon steel. Large-scale Wootz steel production in Tamilakam using crucibles and carbon sources such as the plant Avāram occurred by the sixth century BC, the pioneering precursor to modern steel production and metallurgy.
The Chinese of the Warring States period (403–221 BC) had quench-hardened steel, while Chinese of the Han dynasty (202 BC – 220 AD) created steel by melting together wrought iron with cast iron, gaining an ultimate product of carbon-intermediate steel by the 1st century AD.

5.2 GEARS
A gear or cogwheel is a rotating machine part having cut teeth, or in the case of a cogwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit torque. Geared devices can change the speed, torque, and direction of a power source. Gears almost always produce a change in torque, creating a mechanical advantage, through their gear ratio, and thus may be considered a simple machine. The teeth on the two meshing gears all have the same shape. Two or more meshing gears, working in a sequence, are called a gear train or a transmission. A gear can mesh with a linear toothed part, called a rack, producing translation instead of rotation.

The gears in a transmission are analogous to the wheels in a crossed, belt pulley system. An advantage of gears is that the teeth of a gear prevent slippage.

When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds, and the torques, of the two gears differing in proportion to their diameters.

In transmissions with multiple gear ratios—such as bicycles, motorcycles, and cars—the term "gear" as in "first gear" refers to a gear ratio rather than an actual physical gear. The term describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission.

FIG:5.2

As of 2014, an estimated 80% of all gearing produced worldwide is produced by net shape molding. Molded gearing is usually either powder metallurgy or plastic. Many gears are done when they leave the mold (including injection molded plastic and die cast metal gears), but powdered metal gears require sintering and sand castings or investment castings require gear cutting or other machining to finish them. The most common form of gear cutting is hobbing, but gear shaping, milling, and broaching also exist. 3D printing as a production method is expanding rapidly. For metal gears in the transmissions of cars and trucks, the teeth are heat treated to make them hard and more wear resistant while

leaving the core soft and tough. For large gears that are prone to warp, a quench press is used.

Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided (but usually of special form to achieve a constant drive ratio, mainly involute but less commonly cycloidal), the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts.[11] No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

5.3 BELT AND PULLEY

A belt and pulley system is characterized by two or more pulleys in common to a belt. This allows for mechanical power, torque, and speed to be transmitted across axles. If the pulleys are of differing diameters, a mechanical advantage is realized.

A belt drive is analogous to that of a chain drive; however, a belt sheave may be smooth (devoid of discrete interlocking members as would be found on a chain sprocket, spur gear, or timing belt) so that the mechanical advantage is approximately given by the ratio of the pitch diameter of the sheaves only, not fixed exactly by the ratio of teeth as with gears and sprockets.

FIG: 5.3

In the case of a drum-style pulley, without a groove or flanges, the pulley often is slightly convex to keep the flat belt centred. It is sometimes referred to as a crowned pulley. Though once widely used on factory line shafts, this type of pulley is still found driving the rotating brush in upright vacuum cleaners, in belt sanders and band saws.

Agricultural tractors built up to the early 1950s generally had a belt pulley for a flat belt (which is what Belt Pulley magazine was named after). It has been replaced by other mechanisms with more flexibility in methods of use, such as power take-off and hydraulics.

Just as the diameters of gears (and, correspondingly, their number of teeth) determine a gear ratio and thus the speed increases or reductions and the mechanical advantage that they can deliver, the diameters of pulleys determine those same factors.

Cone pulleys and step pulleys (which operate on the same principle, although the names tend to be applied to flat belt versions and V-belt versions, respectively) are a way to provide multiple drive ratios in a belt-and-pulley system that can be shifted as needed, just as a transmission provides this function with a gear train that can be shifted.

V-belt step pulleys are the most common way that drill presses deliver a range of spindle speeds.A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave.

5.4 AC MOTOR:

An ACmotor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

FIG:5.4

Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.The two main types of AC motors are induction motors and synchronous motors. The induction motor (or asynchronous motor) always relies on a small difference in speed between the stator rotating magnetic field and the rotor shaft speed called slip to induce rotor current in the rotor AC winding. As a result, the induction motor cannot produce torque near synchronous speed where induction (or slip) is irrelevant or ceases to exist.

5.5 PILLOW BLOCK BEARING

A pillow block is a pedestal used to provide support for a rotating shaft with the help of compatible bearings & various accessories. Housing material for a pillow block is typically made of cast iron or cast steel. A pillow block usually refers to a housing with an included anti-friction bearing. A pillow block refers to any mounted bearing wherein the mounted shaft is in a parallel plane to the mounting surface, and perpendicular to the center line of the mounting holes, as contrasted with various types of flange blocks or flange units.

A pillow block may contain a bearing with one of several types of rolling elements, including ball, cylindrical roller, spherical roller, tapered roller, or metallic or synthetic bushing. The type of rolling element defines the type of pillow block. These differ from "plummer blocks" which are bearing housings supplied without any bearings and are usually meant for higher load ratings and a separately installed bearing.

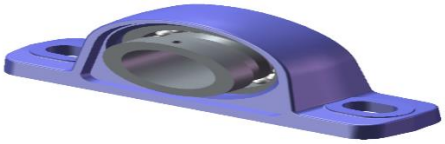

FIG:5.5

The fundamental application of both types is the same, which is to mount a bearing safely enabling its outer ring to be stationary while allowing rotation of the inner ring. The housing is bolted to a foundation through the holes in the base. Bearing housings may be either split type or solid type. Split type housings are usually two-piece housings where the cap and base may be detached, while others may be single-piece housings. Various sealing arrangements may be provided to prevent dust and other contaminants from entering the housing. Thus the housing provides a clean environment for the environmentally sensitive bearing to rotate free from contaminants while also retaining lubrication, either oil or grease, hence increasing its performance and duty cycle.

Bearing housings are usually made of grey cast iron. However, various grades of metals can be used to manufacture the same, including ductile iron, steel, stainless steel, and various types of thermoplastics and polyethylene-based plastics. The bearing element may be manufactured from 52100 chromium steel alloy (the most common), stainless steel, plastic, or bushing materials such as SAE660 cast bronze, or SAE841 oil impregnated sintered bronze, or synthetic materials. ISO 113 specifies internationally accepted dimensions for plummer blocks. A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

5.6 ROLLERS WITH TEETH:

The dimensions of cylinders are designed in a manner to obtain effective mesh with coconut husk. Assumptions used,

1. Coconut contacts with cylinder at an average angle of 30-degree contact sector .

2. The 1/6th of width of coconut should be inserted into the intermediate space between cylinders. (Approximately 30mm).

The adhesion between fibers in the husk is greater than that between the shell and the husk; hence separation occurs at the husk-shell interface. The thickness of fiber is in the range of 20 to 40mm. The dimension of cutting teeth should be so selected that to get effective penetration with coconut. The cutting teeth can be attached to cylindrical rollers either by welding or by using fasteners. The advantage of using fasteners is that the damaged cutting teeth can be easily replaced.

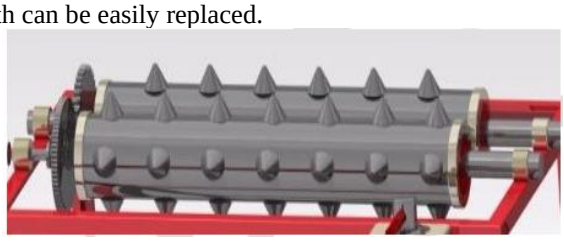

FIG:5.6

5.7 BOLT

The distinction between a bolt and a screw is commonly misunderstood. There are several practical differences, but most have some degree of overlap between bolts and screws.

The defining distinction, per Machinery's Handbook, is in their intended purpose: Bolts are for the assembly of two unthreaded components, with the aid of a nut. Screws in contrast are used with components, at least one of which contains its own internal thread, which even may be formed by the installation of the screw itself. Many threaded fasteners can be described as either screws or bolts, depending on how they are used

FIG:5.7

Bolts are often used to make a bolted joint. This is a combination of the nut applying an axial clamping force and also the shank of the bolt acting as a dowel, pinning the joint against sideways shear forces. For this reason, many bolts have a plain unthreaded shank (called the grip length) as this makes for a better, stronger dowel. The presence of the unthreaded shank has often been given as characteristic of bolts vs. screws, but this is incidental to its use, rather than defining. The grip length should be chosen carefully, to be around the same length as the thickness of the materials, and any washers, bolted together. Too short places the dowel shear load onto the threads, which may cause fretting wear on the hole. Too long prevents the nut from being tightened down correctly. No more than two turns of the thread should be within the hole.

Where a fastener forms its own thread in the component being fastened, it is called a screw. This is most obviously so when the thread is tapered (i.e. traditional wood screws), precluding the use of a nut, or when a sheet metal screw or other thread-forming screw is used.

A screw must always be turned to assemble the joint. Many bolts are held fixed in place during assembly, either by a tool or by a design of non-rotating bolt, such as a carriage bolt, and only the corresponding nut is turned.

Bolts use a wide variety of head designs, as do screws. These are designed to engage with the tool used to tighten them. Some bolt heads instead lock the bolt in place, so that it does not move and a tool is only needed for the nut end.

The first bolts had square heads, formed by forging. These are still found, although much more common today is the hexagonal head. These are held and turned by a spanner or wrench, of which there are many forms. Most are held from the side, some from in-line with the bolt. Other bolts have T-heads and slotted heads.

Many screws use a screwdriver head fitting, rather than an external wrench. Screwdrivers are applied in-line with the fastener, rather than from the side. These are smaller than most wrench heads and cannot usually apply the same amount of torque. It is sometimes assumed that screwdriver heads imply a screw and wrenches imply a bolt, although this is incorrect. Coach screws are large square-headed screws with a tapered woodscrew thread, used for attaching ironwork to timber.

Head designs that overlap both are the Allen or Torx heads; hexagonal or splined sockets. These modern designs span a large range of sizes and can carry a considerable torque.

5.8 NUT

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten two or more parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together.

In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive thread-locking fluid such as Loctite, safety pins (split pins) or lock wire in conjunction with castellated nuts, nylon inserts (Nyloc nut), or slightly oval-shaped threads.

FIG:5.8

The most common shape is hexagonal, for similar reasons as the bolt head - 6 sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. It takes only 1/6th of a rotation to obtain the next side of the hexagon and grip is optimal. However polygons with more than 6 sides do not give the requisite grip and polygons with fewer than 6 sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wingnuts for finger adjustment and captive nuts (e.g. cage nuts) for inaccessible areas.

A wide variety of nuts exists, from household hardware versions to specialized industry-specific designs that are engineered to meet various technical standards. Fasteners used in automotive, engineering, and industrial applications usually need to be tightened to a specific torque setting, using a torque wrench. Nuts are graded with strength ratings compatible with their respective bolts; for example, an ISO property class 10 nut will be able to support the bolt proof strength load of an ISO property class 10.9 bolt without stripping. Likewise, SAE class 5 nuts can support the proof load of an SAE class 5 bolt, and so on.

In normal use, a nut-and-bolt joint holds together because the bolt is under a constant tensile stress called the preload. The preload pulls the nut threads against the bolt threads, and the nut face against the bearing surface, with a constant force, so that the nut cannot rotate without overcoming the friction between these surfaces. If the joint is subjected to vibration, however, the preload increases and decreases with each cycle of movement. If the minimum preload during the vibration cycle is not enough to hold the nut firmly in contact with the bolt and the bearing surface, then the nut is likely to become loose.

Specialized locking nuts exist to prevent this problem, but sometimes it is sufficient to add a second nut. For this technique to be reliable, each nut must be tightened to the correct torque. The inner nut is tightened to about a quarter to a half of the torque of the outer nut. It is then held in place by a wrench while the outer nut is tightened on top using the full torque. This arrangement causes the two nuts to push on each other, creating a tensile stress in the short section of the bolt that lies between them. Even when the main joint is vibrated, the stress between the two nuts remains constant, thus holding the nut threads in constant contact with the bolt threads and preventing self-loosening. When the joint is assembled correctly, the outer nut bears the full tension of the joint. The inner nut functions merely to add a small additional force to the outer nut and does not need to be as strong, so a thin nut (also called a jam nut) can be used.

5.9 WIRES

A wire is a single, usually cylindrical, flexible strand or rod of metal.Wires mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal

through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term wire is also used more loosely to refer to a bundle of such strands, as in "multi standard wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity. Wire comes in solid core, stranded, or braided forms. Although usually circular in cross-section, wire can be made in square, hexagonal, flattened rectangular or other cross-sections, either for decorative purposes, or for technical purposes such as high-efficiency voice coils in loudspeakers. Edge-wound coil springs, such as the Slinky toy, are made of special flattened wire.

Wire has many uses. It forms the raw material of many important manufacturers, such as the wire netting industry, engineered springs, cloth making and wire rope spinning, in which it occupies a place analogous to a textile fiber. Wire-cloth of all degrees of strength and fineness of mesh is used for sifting and screening machinery, for draining paper pulp, for window screens, and for many other purposes. Vast quantities of aluminium, copper, nickel and steel wire are employed for telephone and data cables, and as conductors in electric power transmission, and heating. It is in no less demand for fencing, and much is consumed in the construction of suspension bridges, and cages, etc. In the manufacture of stringed musical instruments and scientific instruments, wire is again largely used. Carbon and stainless spring steel wire have significant applications in engineered springs for critical automotive or industrial manufactured parts/components. Pin and hairpin making; the needle and fish-hook industries; nail, peg, and rivet making; and carding machinery consume large amounts of wire as feedstock.

Not all metals and metallic alloys possess the physical properties necessary to make useful wire. The metals must in the first place be ductile and strong in tension, the quality on which the utility of wire principally depends. The principal metals suitable for wire, possessing almost equal ductility, are platinum, silver, iron, copper, aluminium, and gold; and it is only from these and certain of their alloys with other metals, principally brass and bronze, that wire is prepared.

By careful treatment, extremely thin wire can be produced. Special purpose wire is however made from other metals (e.g. tungsten wire for bulb and vacuum tube filaments, because of its high melting temperature). Copper wires are also plated with other metals, such as tin, nickel, and silver to handle different temperatures, provide lubrication, and provide easier stripping of rubber insulation from copper.

Metallic wires are often used for the lower-pitched sound-producing "strings" in stringed instruments, such as violins, cellos, and guitars, and percussive string instruments such as pianos, dulcimers, dobros, and cimbaloms. To increase the mass per unit length (and thus lower the pitch of the sound even further), the main wire may sometimes be helically wrapped with another, finer strand of wire. Such musical strings are said to be "overspun"; the added wire may be circular in cross-section ("round-wound"), or flattened before winding ("flat-wound").

FIG:5.9

5.10 KEY

In mechanical engineering, a key is a machine element used to connect a rotating machine element to a shaft. The key prevents relative rotation between the two parts and may enable torque transmission. For a key to function, the shaft and rotating machine element must have a keyway and a key seat, which is a slot and pocket in which the key fits. The whole system is called a keyed joint. A keyed joint may allow relative axial movement between the parts.

Commonly keyed components include gears, pulleys, couplings, and washers.

FIG :5.10

WORKING PRINCIPLE

The Coconut De husking Machine can be operated with the help of Motor having AC power supply. The mechanical power has been developed from the AC motor and it is transferred to the pulleys; this is to achieve the required torque and also to reduce the speed of the machine. To obtain the required rotating direction, spur gears are attached in between the pulleys and rollers. By that the rollers are rotated along with the gears this implies the cutting teeth to de husk the coconut.

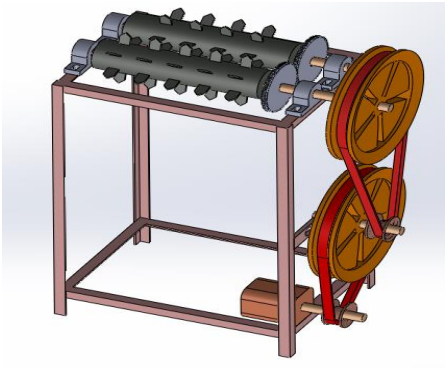

FIG:6.1

PROBLEM IDENTIFICATION

In the present coconut de-husking machines many problems and difficulties are faced during the de-husking operation. These problems cause adverse effect on the working and productivity of the machine. It also affects the operator operating the coconut de-husking machine. Many limitations are present in the previously occurring machine. Those limitations decreases many parameters of the machines such as productivity, durability, efficiency, ease of operation, etc. Also it tends to increase the human fatigue to the operator operating the coconut de-husking machine.

The limitations in present machines are,

1. Possibility of accident: Due to the human interference in the operation of the machine there may be possibilities of accidents. In de-husking the coconut with spike or machete it may cause injury to human because of carelessness.
2. Less production rate: In previous coconut de-husking machines the idle time required is more and takes more time for de-husking operation. Also the interference of the human is more so it takes more time for operation, so that the production rate is less.
3. More time is required for de-husking the coconut.
4. Skilled labor required : To de-husk the coconut manually i.e. by using spike or machete is risky operation. So there is need of concentration during the operation, otherwise it is harmful to the operator. So the skilled labor is required.
5. Idle time is more.

PROBLEM GOING TO BE SOLVED

At present, the de-husking of coconut is carried out by various machines like spike, traditional tool, pedal operated machine, hydraulic and pneumatic machines, etc. From all above methods of coconut de-husking we understood that there are many limitations which creates difficulties during coconut de-husking. To overcome these difficulties and to increase production rate , we have decided to make " Automatic coconut de-husking machine." And also for removing the shell of coconut, the special attachment is provided. The problems or limitations in the present machine and the improvements are represented in the following table.

TABLE

LIMITATIONS OF PREVIOUS MACHINES	IMPROVEMENT
Accident occurs.	Accidents are eliminated.
Less production rate.	Increase in production rates.
More time is required.	Less time is required.
Skilled labour required.	Fool proofing.
Nasty system.	Clean system.
Idle time is more.	Idle time is less.

3D MODEL

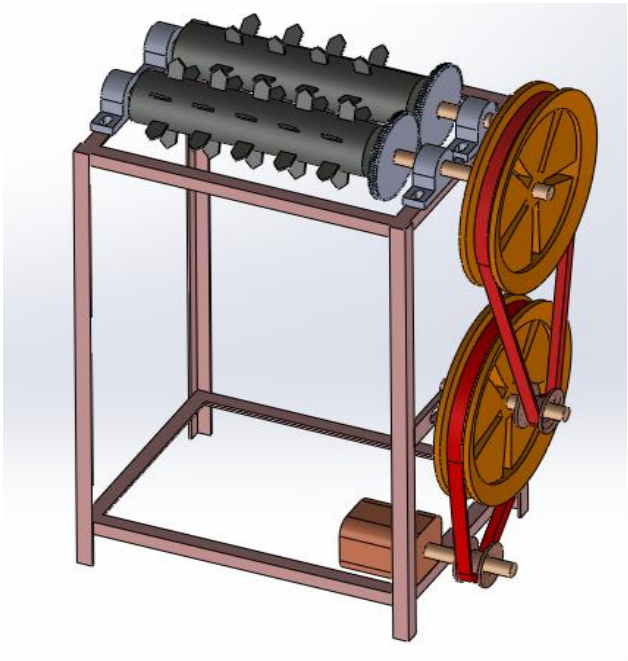

FIG :9.1

DESIGN CALCULATION

Diameter of larger pulley = 30cm = 0.3m
Diameter of smaller pulley = 15cm = 0.15m
Centre distance = 8cm = 0.08m
Dunlop " FORT" 949g fabric belting, using in the construction hard fabric having nominal weight of 949g/m^2, recommended for heavy duty and medium speed. (REFER PSG DESIGN DATABOOK PAGE NO: 7.52)
Arc of contact = 180- (D-d)/C*60°
= 180 –(0.3-0.15)/ 0.08*60°
= 179°
(REFER PSG DESIGN DATABOOK PAGE NO: 7.54)
Load correction Factor= 1.06
(REFER PSG DESIGN DATABOOK PAGE NO: 7.54)
Load rating at V m/s = load rating at 10 m/s * V/10
0.0289* 13/10
= 0.03757
(REFER PSG DESIGN DATA BOOK PAGE NO: 7.54)
5 PLY

Belt Width = 125mm
Standard Belt Width = 140mm
L= 2C+π/2(D+d) + (D+d)^2/4C
(REFER PSG DESIGN DATA BOOK PAGE NO: 7.53)
=2*0.08+π/2 (0.3+ 0.15) + (0.3+ 0.15)^2/4 * 0.08

= 0.93m
Number of Arms = 6
Cross section of Arms = elliptical.

FABRICATION IMAGES

11.1 ADVANTAGES

1. Skilled labor is not required.
2. Easy operation
3. It can be transported easily from one place to another since dismantling and assembling is simple.
4. Maintenance is easy.
5. Investment is very low (below 5000 rupees)

ECONOMIC SPECIFICATIONS

MATERIALS	COST IN RUPEES
STEEL	2000
SPUR GEAR	500
SHAFT	500
PULLEY	500
BELT	500
WORKSHOP RENT	2000

CONCLUSION

A low cost coconut dehusking machine has been fabricated for the small-scale farm holders in the agricultural and rural areas.. The machine is appeared to be feasible, pollution less, economic. Number of nuts produced per hour depends upon the slack time and speed of roller units. The operation of the machine is simple and the maintenance of the machine is also not expensive. The machine can dehusk an average of 200 coconuts per hour. Introducing this machine in the farm areas can reduce the risk involved in the use of spikes in dehusking the coconut and also eliminates the skilled manpower required for dehusking the coconuts. The machine can also be integrated along with the further processing steps of the nuts such as the production of copra.

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