Design and Development of Lever Engine based Pounding Machine

Kritharth Chaturvedi, Mayank Dubey, Shridhar Ghadigaonkar, Vishal Gupta

Abstract— Many natural resources such as Rock Salt, Chalk, and Charcoal are a gift of nature and are a part of day to day human culture, However, it is important to process these raw materials to put it to conventional usage. Even though most organizations use an Electrical motor based pounding machine, the concern of utilizing Excessive amounts of non-renewable electrical energy which has negative effects on the Environment tends to supersede the value of the profit earned. Hence it becomes important to come up with solutions where minerals and culinary spices can be pounded with the help of a prime mover which is majorly powered by non-conventional sources of energy such as Gravity and Sunlight.

Index Terms— Gravity, Hammer, Lever Engine, Mechanical Advantage, Ozzo-G, Pounding, Solar Powered,

1 Introduction

MATERIALS like Charcoal, Chalk and even exotic spices need to be processed and powdered before putting it to Industrial and Domestic usage. With the advent of Globalization and the rise of industrial competition, the demand for powdered goods has increased drastically. In order to fulfill the demands and satisfy each customer, Many Large and medium scale organizations have taken the aid of Electrically powdered pounding machines in order to meet large customer demands. With the need of energy efficient and low power consuming devices, the lever engine is designed to run a pounding machine with renewable energy sources such as harnessing the energy of
Gravity.

2 Literature Review

Mohd. Shahjad Aspak Sheikh [1] designed and fabricated a Bicycle, provided to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a rod. The pinion gear in sprocket mechanism provides the rotary mo-tion of the rod. This gives rotation motion to the flywheel of approx 10 kg. According to the law of motion, the flywheel will rotate with high speed comparatively the force provided to sprocket mechanism because the weight and momentum of the flywheel are more. It is often a part of a cylinder shaft that strikes a lever at one or more points on its circular path. This cam is used to deliver pulses of power to a steam hammer. This cylindrical hammer moves up and down and helps to crush the chili

Owezieim Uchenna et al [2] focused on the design of an elec-tromechanical yam pounding machine. The machine consists of a shaft, electric motor, trough, propeller (yam beater), pulleys and the frame with vents for adequate cooling of the machine during operation. From experiment carried out in using the ma-chine to pound three different species of yam, it was observed that irrespective of the improvement done on reducing over-heating during pound, it pounds in less time compared to the already existing ones.

Gbasouzor and Mbunwe [3] designed and developed a motorized yam pounder for pounding yam, this research was con-sidered because of the importance of pounded yam in Africa particularly in Nigeria and because of the time and energy wasted using the traditional mortar and pestle method of yam pounding. The research work aimed at eliminating the labor in-volved in the traditional method of pounding. This development work sought to enterprise a yam pounder that pounds yam right from the peeled cooked stage in a pounding vessel with the help of an electric motor that transmits power through rotary motion together with the help of shaft.

Rakesh S. Ambade, et al. [4] developed a machine that requires some initial force to rotate the inconstant loads in circular motion. After that it worked on the gravitational force in which the weights from the higher elevation fall down due to the gravitational effect and hence the lower loads were drawn up due to the drive of upper load and hence the chain continued for some time period. The procedure utilized a gravity energy conversion unit to convert the gravity potential energy into the kinetic energy. The gravity energy conversion unit formed posi-tive torques by the outward spreading single direction swing arms and reduced the negative torques by conjoining with the folding action of the single directional swing arms, so as to perform a long stretch, effective and continuous energy conversion of gravity potential energy into kinetic energy. Next, the kinetic energy was transmitted to a power generating unit to accomplish another energy conversion of kinetic energy into electrical energy. And lastly, a power supply

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system was used to transmit the electric energy out.

Digvijay S Jadhav, et al. [5] studied current inventions and found that the gravity power generation mechanism of the present invention utilized a gravity energy conversion unit which could provide a continuous and stable operation to continu-ously convert the gravity potential energy into the kinetic en-ergy and then into electric energy so as to perform a long-time, effective and stable energy output. The present in-vention not only was independently generating electricity but could be connected in parallel to the Wind power and the solar power gen-eration systems to generate electricity. Thus in their project they studied a power generation mechanism that pro-duced power from gravity having a simplified structure as well as is Eco friendly and which would overcome the present difficulties of pollution and global warming faced by other power generation methods.

Srivastava, et al. [6] by their experiment, found that at high rpm the weight generated huge centrifugal force due to which the generation unit started to wobble. Large amount of energy was lost to overcome this centrifugal force; hence system was advantageous for low rpm generation units. Dnyaneshwar Jagzap [7] researched on Vaibhav Gravity En-gine (VGE), which is gravitational force based engine and it worked on constant gravitational force. The working principle is largely based on fundamental law of "constant force creates or gener-ates constant energy" and "force is directly propor-tional to energy. Vaibhav Gravity Engine (VGE) is based on gravity feedback and gravity shielding technique. Ideally, it can be-come source of constant energy on any of the planets. VGE working also reveals the fundamental physical laws i.e. "Force is directly proportional to Energy" and "Constant force creates or generates constant energy" The engines working also demonstrates any unidirectional force like magnetic force (ei-ther of south or north poles of magnet) can also produce or generate constant energy.

3 The Ozzo-G Engine

Perpetual machines are those machines which run continu-ously or perpetually. As we know that to run any machine continuously, we need to apply a constant force on it; Provid-ed that the input is more than the output. Hence perpetual machines are impossible as per Newton's third law of motion as well as the Second Law of Thermodynamics. But as we know science is far ahead beyond Newton's classical laws; And lever principle provides an output far greater than the input provided by the principle of conservation of moment or Varignon's theorem.[8]

The Ozzo-G lever engine provides a larger output by lifting a weight of approximately 140kg by providing a nominal input of 100-200 watt.

This is possible due to the obtained Mechanical advantage in the lever assembly because of which the machine takes min-imum input to produce a larger output and therefore behav-ing somewhat like a perpetual machine. The elements of the lever Engine are covered in the forthcoming topics.

4 Pounding Machine

Pounding Machines are machines which are also known as Kandap Machine. It is used for pounding spices, minerals and grains. A pounding machine comprises of a set of heavy steel pounds, loosely held straight up in a frame, in which the hammer can slide up and down. They are raised by cams on a flat rotating shaft. In our pounding machine, the camshaft is arranged to lift the pounds from the side, so that it causes the pound to reciprocate. As the camshaft travels from underneath the pounds, the pounds fall onto the substance below, crush-ing anything beneath it (rock, spices, roots, etc.) this process is repeated at the next pass of the cam.

The project focuses of making efficient pounding machines by implementing Renewable Ener-gy Sources

Fig 4.1 Conventional Pounding Machine

Presently the ma-jority of pound-ing machines have lever. The lever fulcrum in existing lever is towards the force arm and at the end of the lever. In the Solar pow-ered Pounding Ma-fulcrum chines we put the towards load arm end to get a mechanical advantage.

The speed is maintained at approximately 100 rpm providing us with 100 pounds every minute. A 100-watt Photo Voltaic Panel is installed in order to provide the required input power to the machine.Pounding has been an important procedure for making powder of any substance. A normal pounding ma-chine takes a lot of energy approx. 1-2 Horsepowers. [3]

5 Pounding System Using Levers

The design of a lever engine based pounding machine consists of the conventional key elements like lever and fulcrum, along with additional components like Motor, Swiveling Drum and Hammer etc. An eccentric Disc and connecting rod is used to convert the rotary motion of the motor to reciprocating motion at one end of the lever.

The lever is an I-beam made of Cast Iron, which is mounted on the supporting structure and connected to the fulcrum. The longer end of the I beam is connected to the motor and the shorter end is connected to the crank which is in turn connect-ed to the Flywheel. Bearings, Nuts, Bolts, Washers, Rods, etc. are auxiliary components required for Assembly.

The Lever based pounding system takes the assistance of a Lever engine whose dimensions are listed below:

TABLE 1
SPECIFICATIONS OF POUNDING SYSTEM

Lever	Structure: I Beam ISO MB 100 Material Used: Cast Iron Free End to Fulcrum Distance: 1155mm Free End to Connecting Rod Distance: 220mm Total Length of Lever: 1560mm
Dead weight	Weight: 70kg
Flywheel	Material Used: Cast Iron Diameter of flywheel: 560mm Weight of flywheel: 70kg Diameter of flywheel shaft: 30mm
Bearing	SKF Pillow Block Bearing P208
Electrical Motor	Siemens IS/IEC 60034-1 3 Phase Induction motor % efficiency: 75.7 % Power: 1.5 kW Max speed: 945 rpm
Structure	I Beam: ISO MB100 C Beam: ISO MC100 L Clamp: ISO 65x65x65 Width: 57.5mm Height: 1310mm Length: 1680mm

The necessary and required elements of the pounding system are:

1. Hammer(s)
2. Hammer Guide plates
3. Cam
4. Cylindrical vessel
5. Linkages
6. Pivot

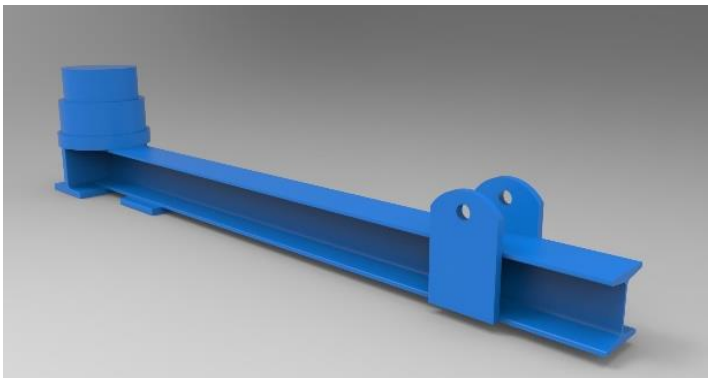
Ozzo – G Engine is a Mechanical Multiplier Gravity Engine which takes less mechanical power and output multiple times more than the mechanical power. It multiplies the input power and gives the output which is higher as compared to the power consumed. This power is then used to obtain the required force to obtain the crushed/powdered material. One of the most im-portant aspects of the design of such a machine is determining the ideal position of the hammer on the lever.

The problem is solved by placing the hammer at the utmost extent on the lever. This is done in order to obtain the maximum speed of pounding along with sufficient pounding weight. A weight of approximately 3 kg is desirable for the hammer in order to obtain the powdered product.

6 MODELLING OF LEVER ENGINE BASED POUNDING MACHINE

6.1 Lever and Dead weight:

The lever and Dead weight plays the most crucial role in pounding mechanism. The dead weight is attached on one end of the lever and is assigned a design weight of 70 kg. The dead



weight is placed on the lever such that its distance from the fulcrum is minimum. This is done such that the force required to lift the weight is minimum. The lever is made from Mild Steel (ISO 2000 I-beam). The length of the lever is 1560 mm with the Dead weight at a distance of 273 mm and the hammer at a distance of 1255 mm from either side of the fulcrum.

6.2 Supporting Structure

The supporting structure, As the name suggests is used to support the system of the lever engine. The material used is Cast Iron as it provides sufficient resistance against vibration. The supporting structure consists of 3 horizontal surfaces. The Motor rests on the topmost surface and is directly connected to the lever via the Connecting rod. The mid-horizontal surface allows space for the fulcrum and its bearings to rest rigidly, and the lowest horizontal surface is used to screw the bearings of the flywheel shaft and therefore provide support. The design is such that the Structure stands rigidly even when subjected to high or moderate load. Triangular supports are provided at intermittent locations to provide support to the vertical columns. The supporting structure is 1680 mm Long, 520 mm wide and 1510 mm high.

6.3 Flywheel

The Flywheel is used in order to store excess Kinetic energy when machine rotates at high speeds. The Angular momentum of the Flywheel increases and reduces fluctuations.

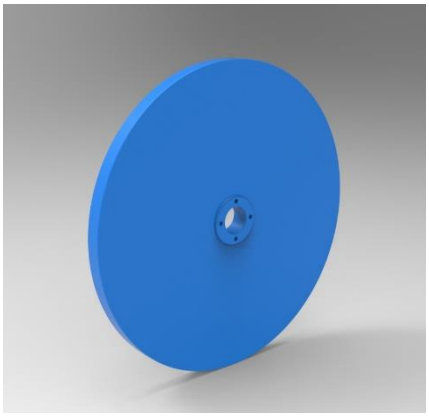


Fig 6.3 a Flywheel

The flywheel also helps in lifting the dead weight upward. The flywheel is made of mild steel and has an inertia of 3.15 Kg.m2.

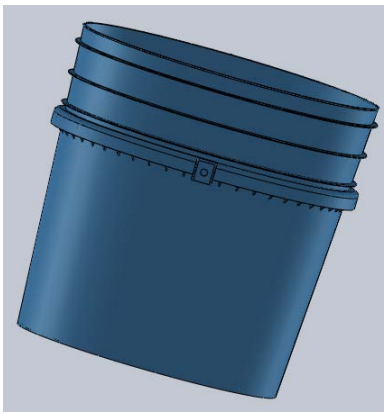
6.4 Hammer

The Hammer is designed such that it can withstand moderate impact for a long period of time. The hammer is made of Hard Vera wood and weighs approximately 3.1 Kgs. The impact surface is riveted with a metal plate in order to avoid granular penetration of powder.

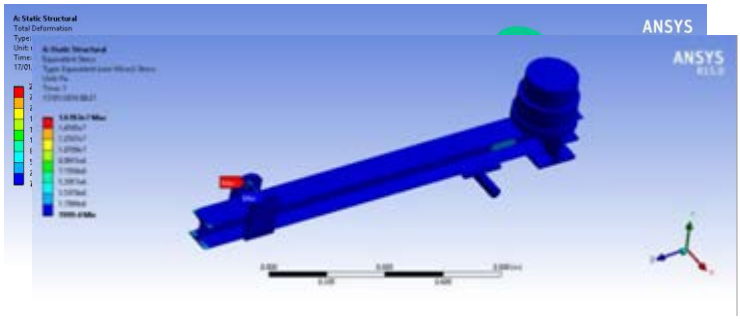
Fig 6.4 a Flywheel

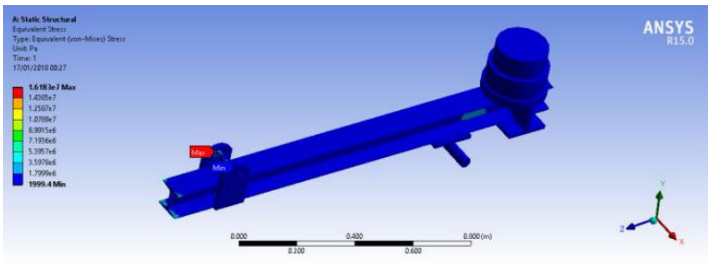
6.5 Swiveling Drum

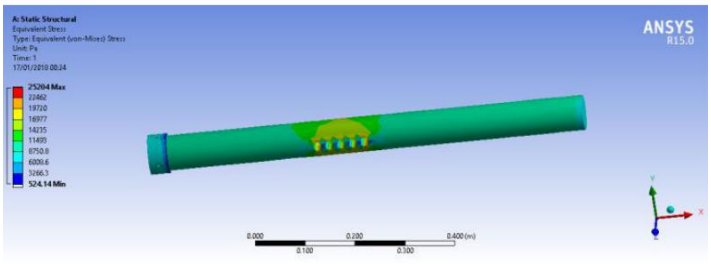
The swiveling drum is complimentary to the wooden hammer and is used to swivel the powdered material during pounding. The swiveling drum rests on a freely rotating disc and is connected to the Lever via a metallic arm which is used to rotate the swiveling drum to-and-fro about its axis of rotation. This swiveling action helps in uniformly pounding the material and obtain a good quality powder.

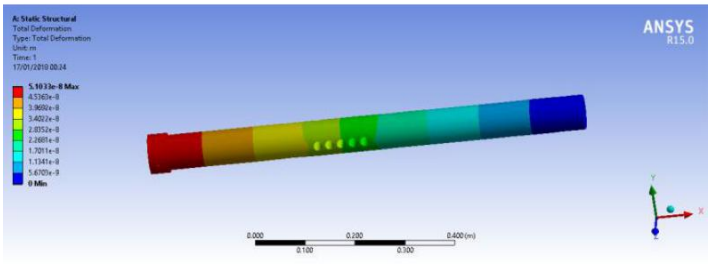


7 Analysis of Lever Engine based pounding Machine









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