|| Volume 5 || Issue 5 || May 2020 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

DESIGN AND FABRICATION OF VEDIC FLOUR MILLING MACHINE POWERED BY SOLAR POWER

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Abstract: In India most rural people still use hand milling methods to prepare their daily food. This takes a lot of time and is an arduous work mainly carried out by women and children. Therefore the introduction of motorized mills can improve their living conditions. However, typical diesel-driven mills have a capacity of 25 to 1,800 kg of grain per hour. Therefore a new PV-driven stone mill with a millstone-diameter of 450 mm and a maximum capacity of 3 kg per hour was constructed and optimized. By optimizing the design and operation of the mill the maximum power requirement could be reduced to less than 100 W. Using two 50 Wp PV-panels and a battery of 85 Ah, 35-60 kg of grain can be processed per day at a global radiation of 4-6 kWh/m². This paper describes the influence of the type of grain, the moisture content, the rotational speed of the millstone, the millstone gap and the feed rate on the driving torque and the power requirement of the mill.

Keywords - *PV, Milling, Stone Mill, Solar Power, Grain, Food.*

I INTRODUCTION

India is the second most populous country in the world. With a growing population the needs of people and their usage is also growing, in such cases demand for electricity is very high here. Biomass and other non –commercial fuels constitute around 40% of energy requirements in India. Around 85.49% of the Indian villages are electrified, but many of the remote villages are still without electricity. People in villages mainly use bicycles as their means of transport for small distances, in such places our system is of great use. Solar cells are devices which convert solar energy directly into electricity, either directly via the photovoltaic effect, or indirectly by first converting the solar energy to heat or chemical energy. Assemblies of cells used to make solar modules which are used to capture energy from sunlight, are known as solar panels. The energy generated from these solar modules, referred to as solar power. Cells are described as photovoltaic cells when the light source is not necessarily sunlight (lamplight, artificial light etc).The amount of power available from a PV device is determined by –the type and area of the material, the intensity of the sunlight ,the wavelength of the sunlight.

In many countries many postharvest operations such as threshing, oil extraction and milling are still accomplished manually. In particular, grain milling using saddle stone, pestle or mortar is arduous and time consuming, carried out exclusively by women and children. These milling techniques are more than 3000 years old (Pomeranze, 1986) and allow only low grinding rates of less than 1 kg per hour (Carruthers and Rodriguez, 1992). Therefore, milling 2.5 kg of grain which is the average daily consumption of a family takes about three hours (Chinsman, 1985). Besides that, milling is also done in small commercially operated mills. The most common and widely used types are hammer and stone mills with a capacity of 100 to 1 800 kg/h and 25 to 1 200 kg/h, respectively (Jonsson et al, 1994). These mills are usually operated as customer mills, where people bring their grain and pay for the milling service. However, the available capacity is sufficient for 150 to 10 000 families. Since the flour is only prepared for a couple of days in advance to avoid degradation, such mills are limited to areas with a certain infrastructure and population density. However, in rural areas with a more scattered population distribution, people often have to walk long distances if a motorized mill is available at all. This indicates that

the milling process takes a considerable amount of time, irrespective of the method of milling. Reducing the time and energy spent on milling could increase the time available for other more productive activities. Therefore, the development of inexpensive motorized mills with a low capacity of 2 to 5 kg/h could help to improve the living conditions and the livelihood in rural areas of developing countries.

However, while the power requirement to drive such a mill is 50 to 200 W, the smallest available standard diesel or petrol engines provide 2 to 3 kW. Furthermore the investment and operation costs are high and the fuel and spare parts supply is unreliable. In contrast to this electric drives are cheaper, available at almost any power rating, require almost no maintenance and are simple in operation. However, an electrical grid connection is not available in most cases. Therefore, considering the low power requirement and the typically high daily solar radiation of 5 to 6 kWh per m² in many tropical and subtropical areas, a DC motor with a power supply from a PV-generator is a promising and cost effective alternative for the drive (see also GTZ, 1992; Hulscher and Fraenkel, 1994). Sunlight is made out of tiny energy packets called photons and that each individual solar cell is designed with a positive and negative layer thus being able to create an electric field (similar to the one in batteries).

Need of Solar Cell

The need for cost effective power supplies for people remote from the main electricity grid; eg Aboriginal settlements, outback sheep and cattle stations, and some home sites in grid connected areas.

The need for non-polluting and silent sources of electricity; eg tourist sites, caravans and campers.

The need for a convenient and flexible source of small amounts of power; eg calculators, watches, light meters and cameras;

The need for renewable and sustainable power, as a means of reducing global warming.

II. LITERATURE REVIEW

A. E Beshada, M.Bux and T.Waldenmaier- Design and optimization of photovoltaic powered grain mill solar power can be used for milling of grain. In rural areas with a more scattered population distribution, people often have to walk long distances if a motorized mill is available at all. This indicates that the milling process takes a considerable amount of time, irrespective of the method of milling. Reducing the time and energy spent on milling could increase the time available for other more productive activities.

B.Mr.Prasad,A.Hatwalne-An ergonomic design pedal operated flour mill. Low speed of mill can improve the quality of flour. To make this design of pedal operated flour mill is ergonomically viable the structure (geometry) of the flour mill is made by taking into consideration the anthropometric data so as to provide comfortable posture during its operation.

C. M.S.Giripunje -Human powered food grain crusher. To develop such a food grain crusher which will be cheap and independent of conventional energy.

D. Rahil patel, Meet shah, Dhaval parekh, Zenith patel, Parthesh patel -pedal powered grinding machine is used only for grinding purpose. Also, it requires lots of efforts and limited for single application use. Another problem in existing model is that it consumed more time and also has lower efficiency. Our aim is to design a human powered grinding machine which can also be used for many purposes like pumping, grinding, washing, cutting, etc.

III.CONSTRUCTION

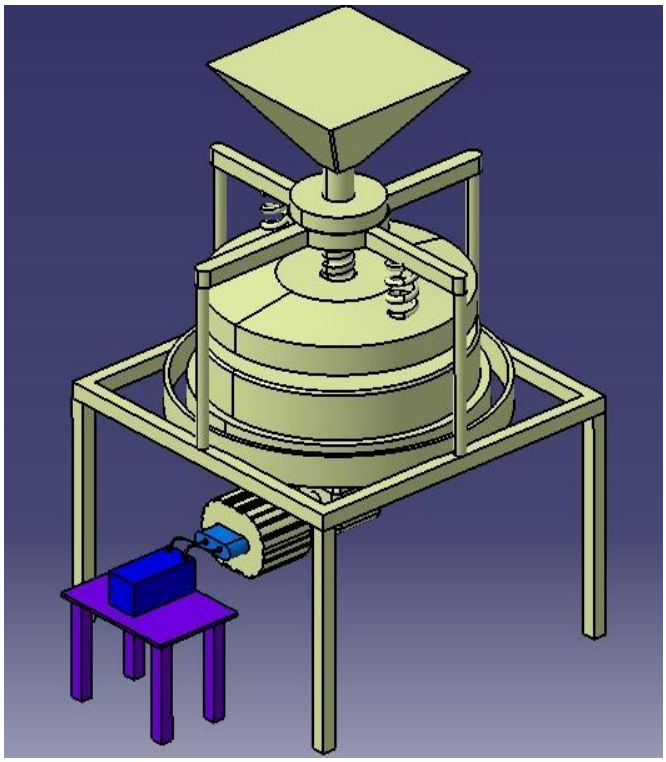

Figure 1: Construction

In construction the solar operated flour mill basically consists of two units namely the drive unit and processing unit. The drive unit mainly concerns transmission of solar power to the processing unit. This transmission of solar power to the processing unit is accomplished in two stages. In the first stage the PMDC Motor fixed a chain ring (sprocket) with the teeth that engaged the continuous chain. The chain then transmits the power to the processing unit through chain drive.

The processing unit essentially consists of stone wheels, hopper, and hemispherical collector. The stone wheels are operated by power from the chain drive where the wheat kernels which are fed into hopper are crushed and powdered wheat flour is collected in a hemispherical collector.

A. Solar Panel-

Photovoltaic principles:

Photovoltaic effects can be observed in nature in a variety of materials that have shown that the best performance in sunlight is the semiconductors as stated above. When photons from the sun are absorbed in a semiconductor, that create free electrons with higher energies than the created there must be an electric field to induce these higher energy electrons to flow out of the semiconductor to do useful work. A junction of materials, which have different electrical properties, provides the electric field in most solar cells for the photon interaction in a semiconductor.

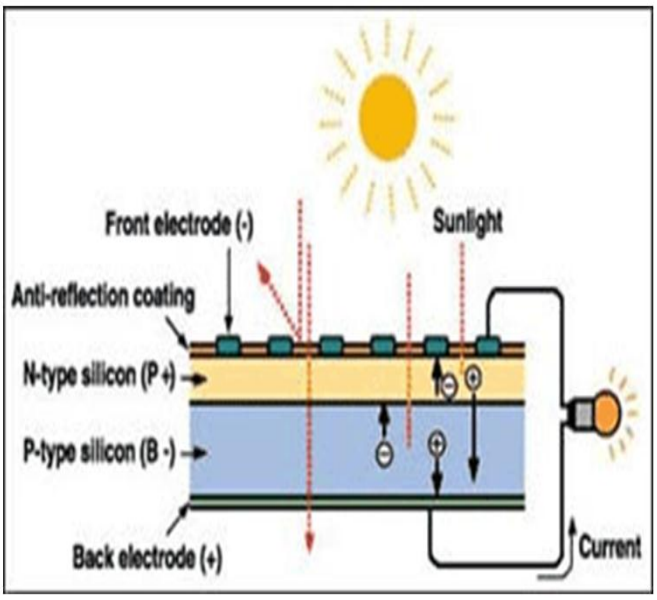

Figure 2 Photovoltaic Effect

A solar cell consists of

(a) Semiconductor in which electron hole pairs are created by the absorption of incident solar radiation.

(b) Region contacting a drift field for charge separation

(c) Charge collecting fronts and back electrodes.

ACKNOWLEDGEMENTS

It gives us an immense pleasure to submit this technical report entitled "Design And Fabrication Vedic flour Milling Machine Powered By Solar." We tried our level best to represent this topic into compact and to the point framework. We wish to express our sincere thanks with profound gratitude to our guide Ms. Shelke S.V. for her valuable guidance and constant encouragement without which it would have been impossible for us to present and complete this project successfully. We would like to extend our sincere and true thanks to our Principal Dr. Gulhane and H.O.D. Prof. R. R. Kharde and all the staff members for inspiring us the best of their knowledge and guidance. Last but not the least, we thank all our friends and family for their assistance and help.

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