

Design And Fabrication of Human Powered Flywheel Motor Pulverizer Machine

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Abstract- The Human Power Flywheel Motor (HPFM) pulverizer machine is a sustainable technology used for pulverizing different materials such as grains, spices, and herbs. The machine's design consists of a flywheel motor and pulverizer, which work together to grind materials into fine particles. The machine is affordable, portable, and easy to use, making it suitable for small-scale applications in agriculture, food processing, and medicine. However, its capacity and output quality are limited, and it requires regular maintenance. Future developments of the HPFM pulverizer machine include increasing its capacity, improving its output quality, and automating its operation.

Keywords- mechanism, ergonomics, flywheel

I. Introduction

HPFM (human powered flywheel motor) is invented by Dr. JP Modak during 1979 to 1982 through one sponsored project by MHADA (Maharashtra Housing and Area Development Authority), Bombay for evolving a Human Powered machine for manufacturing bricks. The system comprises of bicycle like system with speed Increasing gear pair and flywheel (FW) about 80 to 100 CM rim diameter, 6 to 8 CM rim width, and 2 CM rim thickness. A young lad (20-25 years), slim stature, middle height peddles the bicycle like system for 1 minute and speedups the flywheel to the speed of 500-1000 RPM. The energy stored in the flywheel is 3500-4000kgf-m Upon Flywheel reaching the rated speed Torsionally Flexible Clutch (TFC) is engaged and the energy stored in the FW is made available to the process unit. The energy stored in the FW is exhausted in 5 to 15 seconds depending on the process unit. This comes to processes needing 11 HP to 3 HP can be energized by this HPFM.

II. Historical Review

The concept of using flywheels for energy storage and power transmission dates back to ancient times. In the 4th century BCE, the Greek philosopher Aristotle described the use of flywheels in a device called a "periaptis," which was used for grinding grain.

In the 19th century, flywheels were used in early steam engines to store energy and provide a smooth power output. As technology progressed, flywheels were also used in early automobiles to help smooth out the power output of the engine. In the early 20th century, human powered flywheel motors were developed as a way to power bicycles and other small vehicles. One of the earliest examples was the "Hercules" flywheel bicycle, which was developed in the 1920s in England. This bicycle featured a large flywheel mounted on the rear wheel, which could be spun up to high speeds by pedaling. The stored energy in the flywheel could then be used to power the bicycle for short bursts of speed.

In the 1950s and 1960s, human powered flywheel motors were further developed for use in racing bicycles. These systems typically used a small, lightweight flywheel mounted on the rear wheel, which could be spun up to high speeds by pedaling. The stored energy in the flywheel could then be used to provide an extra burst of speed during sprints or hill climbs. In recent years, human powered flywheel motors have been used in a variety of applications, including electric bicycles and hybrid vehicles. These systems typically use a small, lightweight flywheel coupled to an electric motor, which can be charged up by pedaling or regenerative braking. The stored energy in the flywheel can then be used to provide an extra boost of power when needed. Overall, the history of human powered flywheel motors is one of continuous innovation and development, with new applications and technologies being explored and developed over time.

III. Global Status Of HPFM

The use of human powered flywheel motors is still relatively niche, with most applications being limited to specialty bicycles and hybrid vehicles. However, there is growing interest in the technology as a way to increase the efficiency and range of electric bicycles and other small vehicles. In recent years, several companies have developed commercial products based on human powered flywheel technology, including the Fleetly Smart Wheel and the Schwinn Tailwind electric bicycle. These products have received positive reviews for their performance and efficiency, and are seen as a promising alternative to traditional battery-powered electric vehicles. In addition to commercial applications, human powered flywheel motors are also being explored for use in developing countries, where access to electricity and transportation can be limited. Projects such as the Flywheel Energy Storage System for Rural Electrification (FESRE) are working to develop low-cost, human-powered flywheel systems that can be used to provide electricity and power small appliances in rural communities.

Overall, while the use of human powered flywheel motors is still limited, there is growing interest in the technology as a way to increase efficiency and reduce reliance on traditional energy sources. As research and development continue, it is likely that we will see more innovative applications of this technology in the future.

IV. Key Design Features of HPFM Pulverizer Machine

1. High-speed rotating blades: The HPFM pulverizer machine is designed with high-speed rotating blades that are capable of pulverizing a wide range of materials, such as bamboo leaves.
2. Adjustable grinding gap: The grinding gap of the HPFM pulverizer machine can be easily adjusted to achieve the desired particle size and consistency.
3. Heavy-duty construction: The machine is built with high-quality materials and components that can withstand the rigors of continuous operation in industrial settings.
4. Easy maintenance: The HPFM pulverizer machine is designed with easy-to-access parts and components, making it easy to perform routine maintenance tasks such as cleaning, lubrication, and part replacement.
5. Safety features: The machine is equipped with safety features such as safety guards, and interlocks to prevent accidents and injuries.
6. Energy-efficient operation: The HPFM pulverizer machine is designed to consume less energy while delivering high-performance grinding and pulverization capabilities.

V. Research Methodology

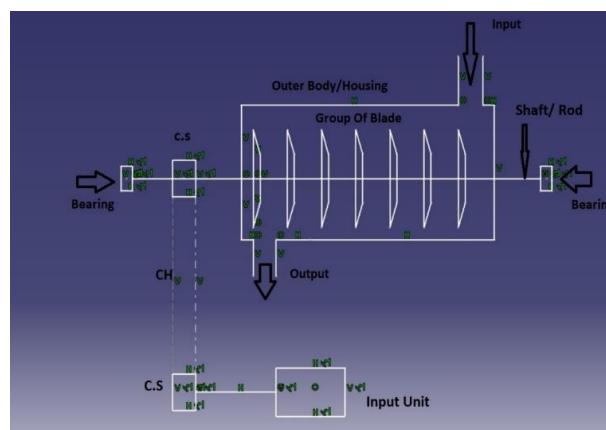
A human powered pulverize machine consist of bicycle, speed increasing gear pair, flywheel torsional clutch

Working principle: - The Principal is just like bicycle. Rotates the paddle and with the help of gear Flywheel. Stored energy in flywheel is transferred to pulverize machine with help of Clutch and Gear mechanism.

Flywheel: - flywheel is energy storing device. 1 min of pedal can speed the flywheel up to 500 to 1000 rpm.

1. Define the research objectives: The first step is to clearly define the research objectives, which could include understanding the machine's features, applications, benefits, limitations, and customer satisfaction.
2. Conduct a literature review: A thorough literature review can be conducted to gather information on the HPFM pulverizer machine from various sources such as manufacturer websites, industry publications, academic journals, and online forums.
3. Collect primary data: Primary data can be collected through surveys, interviews, and observations of machine operators and users. This can provide insights into their experiences with the machine, its performance, and any issues they may have encountered.
4. Analyze the data: The collected data can be analyzed using statistical techniques and qualitative methods to identify patterns, trends, and themes. This can help in drawing conclusions and making recommendations.
5. Draw conclusions and make recommendations: Based on the analysis of data, conclusions can be drawn about the HPFM pulverizer machine's effectiveness, efficiency, and safety. Recommendations can be made for improvements or modifications to enhance its performance or address any issues identified.

VI. Schematic Diagram:



VII. Observational Calculations:

The system comprises of bicycle like system with speed Increasing gear pair and flywheel (FW) about 80 to 100 cm rim diameter, 6 to 8 cm rim width, and 2 cm rim thickness. A young lad (20-25 years), slim stature, middle height peddles the bicycle like system for 1 minute and speedups the flywheel to the speed of 500-1000 RPM. The energy stored in the flywheel is 3500-4000kgf-m. Upon Flywheel reaching the rated speed Torsionally Flexible Clutch (TFC) is engaged and the energy stored in the FW is made available to the process unit. The energy stored in the FW is exhausted in 5 to 15 seconds depending on the process unit. This comes to processes needing 11 HP to 3 HP can be energized by this HPFM.

Pulverizer Machine:- Pulverizer drum : Diameter= 12-inch, Length= 19 inches.

Shaft (1) : Length= 27-inch, Diameter= 30 mm.

Shaft (2) : Length= 6-inch, Diameter= 30mm.

Shaft (3) : Length= 8-inch, Diameter= 30 mm.

Base parts: Length= 38-inch, Angle size = 50x5mm (C channel), B1 (top) = 4x22 inch, B2 (base) = 4x26.5 inch.

Hopper: Length= 11-inch, Height= 7inch, Width= 9 inch.

Inlet door of hopper = 10x6 inch, Outlet door of hopper = 17x8-inch, Hinges = 3-inch x (3 pieces).



VIII. Conclusion

The HPFM pulverizer machine is a sustainable and eco-friendly technology that has the potential to revolutionize the grinding industry. The machine utilizes human energy to grind various materials, eliminating the need for electricity or fuel. Although the technology has some challenges, its potential for future development and applications makes it an exciting innovation for the future.

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