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Conversion Of Flour Mill Into Pedal-Operated Flour Mill

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ABSTRACT

This project aims to convert a conventional flour mill into a pedal-operated one, providing a sustainable solution for communities without a reliable power supply. Integrating a pedal-powered mechanism reduces the flour mill's energy consumption, making it more accessible and portable. The project involves researching existing literature on pedal-operated flour mills, designing the mechanism, building a prototype, and evaluating its performance. Results show that the pedal-operated flour mill is a feasible alternative to the conventional one, with lower energy consumption and comparable flour quality. The project highlights the potential of pedal power to be used in various applications, especially in areas with limited access to electricity or fuel. The pedal-operated flour mill's low-cost, low-maintenance design makes it an excellent option for improving food security in rural and remote areas. The modification of a flour mill into a pedal-operated flour mill is a sustainable and eco-friendly solution for small-scale flour production. The primary objective of this modification is to reduce the reliance on non-renewable energy sources, such as electricity or diesel, and promote sustainable energy practices. The conversion of a traditional flour mill into a pedal-operated flour mill involves removing the electric motor and replacing it with a pedal mechanism that powers the mill's grinding wheels. The pedal-operated flour mill offers several benefits, including lower operating costs, increased energy efficiency, and improved sustainability. It is also an excellent solution for small-scale farmers, who can use the mill to process their grains and cereals and save money on milling fees. In addition, the pedal-operated flour mill is easy to operate and requires minimal maintenance. Overall, this project demonstrates the practicality and viability of pedal power as a sustainable energy source.

Keywords: ALU, Adders, Subtractors, Borrow

I. INTRODUCTION

The modification of a flour mill into a pedal-operated flour mill is a project that aims to create a more sustainable and environmentally friendly way of producing flour. Traditionally, flour mills have been powered by electricity or fossil fuels, which contribute to greenhouse gas emissions and require a constant supply of energy.

By converting a flour mill to be pedal-operated, the project seeks to create a low-cost, human-powered alternative that can be used in areas without access to reliable electricity or where energy is expensive. Pedal power is a sustainable and renewable energy source that can be used to power a wide range of machines, including flour mills.

From the history of our progress whenever there was an excessive demand there was always a deficiency in the supply. The same things happen nowadays also in some areas. We are achieving our peak in various fields on one side of technical circumstances. But on the same thing, we are unable to provide remedies for the same. Let us take the example of electricity. When we invent or launch luxurious utility products to hike the living standards of general people. But on the same datum, we are facing various busy schedules of power shedding/load shedding in our daily life, in urban as well as rural areas. Also, in this era of competition, everyone tries to save money as well as keep themselves fit.

To full fill the above-listed demand at our native in our daily scheduling. We think of a direction to full fill our demands and try to make as mini as possible dependent on electricity as well as to save some money and keep fit.

The pedal-operated flour mill project involves designing and building a flour mill that is powered by human energy through pedaling, making it an eco-friendly and sustainable alternative. The mill is easy to operate, maintain, and can be used to process various grains such as wheat, corn, and rice into flour for use in cooking and baking.

The use of pedal power has numerous benefits, including reducing greenhouse gas emissions, promoting sustainable and low-carbon food production, and providing economic opportunities for individuals and communities. The pedal-operated flour mill is particularly useful in areas with limited access to electricity, making it an ideal option for small-scale farmers, households, and businesses.

This project has the potential to create a significant positive impact on society and the environment. Promoting sustainable and low-carbon food production can help to reduce the carbon footprint of the food industry and contribute to mitigating climate change. It can also provide economic opportunities for people in rural and underdeveloped areas, promoting social and economic equity.

Pedal-operated flour mills can be used by small farmers, households, or small-scale businesses to produce flour for their use or sale in the local market. The use of pedal power also creates economic opportunities for individuals and communities, especially in areas where access to traditional sources of energy is limited.

Overall, the pedal-operated flour mill is a sustainable and cost-effective solution for producing flour, and its use can contribute to the development of local economies and the reduction of greenhouse gas emissions.

II. LITERATURE REVIEW

Yang Jianhua [1], tell us about a little grinding machine that is powered by labor. A tiny, manually operated grinder is described in the invention. It

includes a frame, a spindle mounted horizontally on the frame, a rotating sleeve attached to the spindle through a bearing, a grinding disc, a sprocket, and a manual driving mechanism. With the aid of mechanical power, it provides grinding force.

R. Subash [2], says that in this work, we developed a pedal-operated hacksaw machine that may be utilized for a variety of tasks, including residential and industrial applications where no fixed amount of input energy or electricity is necessary. This project includes a chain drive, eccentric disc mechanism, and sprocket arrangement. By exerting physical force while pedaling, this design is intended to impart motion to hacksaw blades for conducting cutting operations between the tool and the workpiece.

Karl Kroemer [3], says that depending on the body support and body posture of the sitting operator, we may observe in this article the effectiveness of foot motions or muscle force applied to pedals or between pedals. To make the user comfortable while executing the activity, the frame must be properly aligned and adjusted to the user's sitting posture. As a result, the worker's strength or efficiency will grow.

Songtao Zhu [4], says that the goal of this study was to evaluate sitting posture based on the SGRP (sitting reference point) distance in both the vertical and horizontal directions as a whole pedal assembly. By measuring the posture angle (hip, knee, and ankle) for each posture, the operator's sitting comfort was evaluated during various operation phases and in various sitting postures, and scaled values were obtained.

Prem Shanker Tiwari [5], say that systems require more pedal pressure than motor vehicles. Despite being extensive, the literature on human strength in fully controlled pedal operation is insufficient for designers. The purpose of the study was to evaluate user control operation using human strength.

Maurice Niyigena [6], say that this machine has been updated. Low maintenance costs apply to this device. All people should be able to purchase it because it is affordable and environmentally beneficial. The POGM notion is new. In the market, there are grinding machines with the required specifications.

Dharwa Chaitanya Kirti Kumar [7], says that, the design and development of a machine that doesn't require power to do tasks like grinding and cutting, for example. This machine is powered by humans and operates on chain drives with their cooperation.

Rahil Patel [8], say that We successfully created a human-power grinding machine that can be utilized for a variety of tasks, including grinding, cutting, and washing. The health of people can benefit from this method.

III. METHODS AND MATERIAL

1. Select a suitable flour mill

First, we select a suitable flour mill that can be modified to run on pedal power. This mill has a simple design and is easy to disassemble for modification.

2. Design the base:

We design the strong base for the pedal-operated flour mill by considering all the safety.

3. Design the pedal mechanism

We Design a pedal mechanism that can convert human power into rotational power that can transmit the rotational power to the next mechanism.

3. Build the pedal mechanism

Fabricate the pedal mechanism using metal and scrap Cycle frames, depending on the design. And then Connect the pedals to the next transmitting shaft using a crankshaft mechanism.

4. Install the pedal mechanism:

After building the pedal mechanism we Install the pedal mechanism in the mill base, ensuring that it is securely attached and aligned with the next transmitting system.

5. Test the mill:

We Test the mill by pedaling the mechanism and observing the process properly. And we Measure the output to ensure that the mill is producing flour efficiently.

MATERIALS/COMPONENTS AND THEIR USE:

The materials used for fabricating a pedal-operated flour mill include metal

Such as:

1. **Flywheel**

In a bicycle, the flywheel is typically part of the rear wheel hub and is used to store kinetic energy and smooth out the pedaling motion. It is sometimes referred to as a "rear wheel flywheel" or simply a "bicycle flywheel."

When the rider pedals the bicycle, the chain drives the rear wheel, which in turn rotates the flywheel. The flywheel's inertia helps to maintain the speed and momentum of the bicycle, making it easier for the rider to maintain a consistent cadence and reducing the amount of effort required to keep the bicycle moving.

The size and weight of the flywheel can vary depending on the specific type of bicycle and the desired riding characteristics. Heavier flywheels can provide a smoother and more consistent pedaling motion, while lighter flywheels can allow for quicker acceleration and more responsive handling.

1. **Freewheel:**

A freewheel, also known as a one-way clutch, is typically used in mechanical systems to allow rotation in one direction while preventing rotation in the opposite direction. It is commonly used in various applications, such as in bicycles, automotive engines, and industrial machinery.

In bicycles, a freewheel is used in the rear wheel hub to allow the rider to coast without pedaling while the bicycle is still in motion. The freewheel allows the wheel to spin freely in one direction while engaging with the chain and driving the wheel in the opposite direction when pedaling. This allows the rider to conserve energy and maintain momentum when coasting downhill or on level terrain.

In automotive engines, a freewheel is used to protect the starter motor from damage caused by the engine's rotation. The freewheel allows the starter motor to engage and turn the engine over during starting, but disengages once the engine starts running under its power, preventing the starter motor from being driven by the engine.

In industrial machinery, freewheels can be used to prevent damage to the equipment caused by reverse rotation. They can also be used to maintain the position of a rotating shaft, such as in a printing press or conveyor system.

Overall, freewheels are an important component in many mechanical systems, providing efficient and reliable one-way rotation in a wide range of applications.

2. POWERED TRANSMITTING PULLEY

This is the mechanism of transmitting rpm to the flour mill pully.

3. SPEED ROTOR MACHINE

The speed Rotor machine is used to increase the Rpm of the flour mill.

TOP VIEW SIDE VIEW

2. POWER TRANSMITTING BELT

A power-transmitting rubber belt is typically used to transfer power between two rotating shafts in a wide range of industrial applications. It is often used as an alternative to the power transmitting chains or gears, offering several advantages, including lower noise levels, reduced maintenance requirements, and smoother operation.

The power-transmitting rubber belts consist of a flexible belt made of rubber and reinforced with high-strength fibers, such as polyester or nylon. The belt is typically wrapped around two pulleys, with the driving pulley rotating to transfer power to the driven pulley.

Rubber belts can be designed for various power transmission applications, such as high-speed or high-torque applications, and they come in a variety of sizes and profiles. They are also available in different materials, including natural rubber, synthetic rubber, and polyurethane, to suit different operating conditions and requirements.

The power transmitting rubber belts are commonly used in a range of industrial applications, such as in machinery, conveyor systems, and automotive engines, among others. They offer a reliable and efficient way to transfer power over long distances, with minimal maintenance requirements.

(https://5.imimg.com/data5/FG/JC/UJ/SELLER-1801907/power-transmission-belts-500x500.jpg)

3. POWER TRANSMITTING CHAIN

A power transmitting chain is typically used to transfer mechanical power from one rotating shaft to another. It is commonly used in various industrial applications, such as in conveyor systems, machine tools, and automobiles.

Power transmitting chains consist of a series of links that are connected and designed to fit onto sprockets or gears. As the driving sprocket rotates, the chain moves along it, transferring power to the driven sprocket or gear.

Power transmitting chains come in a variety of sizes and designs, including roller chains, silent chains, and leaf chains, each with its unique characteristics and applications. They are typically made from materials such as steel, stainless steel, or plastic, depending on the specific application and operating environment.

(https://5.imimg.com/data5/SELLER/Default/2022/10/ST/DD/JB/141852411/industrial-roller-chain-r-1278-08b-1-1-2-inch-simple-10ft-box-250x250.jpg)

WORKING PRINCIPLE

The working principle of a pedal-operated flour mill is relatively simple.

1) The operator put the grains into the hopper of the flour mill
2) The operator then begins pedaling, using the power of their legs to turn a flywheel, which is connected to the flour mill mechanism.
3) As the flywheel turns after the pedaling, it rotates the pully of the flour mill and gives rotational energy to the flour mill, which crushes the grains into flour.
4) The flour is collected in a container placed underneath the flour mill mechanism.
5) The operator can adjust the coarseness of the flour by adjusting the distance between the grinding stones of the flour mill.

The pedal-operated flour mill is based on the principle of converting rotational energy into mechanical energy. The operator applies force to the pedals, which turns the flywheel, and this rotational energy is then transferred to the grinding mechanism of the flour mill, which crushes the grains into flour. This simple and effective technology has been used for centuries in rural areas where access to electricity or other power sources may be limited.

The pedal-operated flour mill is a manually operated machine that uses the power of human pedaling to grind grains into flour. The technology is based on the principle of converting rotational energy into mechanical energy, and it is still used in many parts of the world today, particularly in rural areas with limited access to electricity.

DESIGN AND CALCULATION:

1. Design of flour Mill

- **Pedal Power**

$$P = 2x3.14xNT/60$$

Torque,

T = F x D

= 300x9.81x180

= 529740Nmm

T = 529.740 Nm

∴ Torque = **529.740 Nm**

P = 2x3.14 **x** 70x529.740/60

= 3881.22W

P = 3.881 KW

∴ Pedal Power= **3.881 KW**

Where,

Na = Rotational speed of larger sprocket.

Nb = Rotational speed of smaller sprocket.

Ta = Teeth on the larger sprocket.

Tb = Teeth on the smaller sprocket.

T = Torque.

$$\frac{Na}{Nb} = \frac{Tb}{Ta}$$

Here,

Na=70rpm

Tb=18

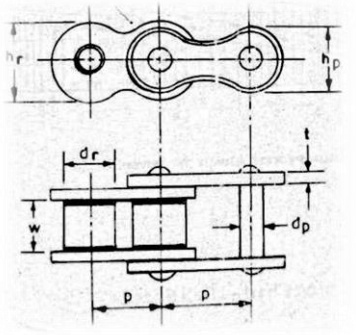
Ta=40

$$\frac{70}{Nb} = \frac{18}{40}$$

∴ **Nb=155.55rpm**

∴ Rotational speed of smaller sprocket **(Nb)=155.55rpm**

2. Design of Chain



Step 1 - Type of chain,

A **roller chain** is selected

Step 2 - Speed ratio maximum

Upto 10:1

Step 3 - **Pitch of Chain**

= **2 x 3.14 x (Ra + Rb) / (Ta + Tb)**

= 2 x 3.14 x (100+45) / (40+18)

= **15.95 mm**

∴ The pitch of Chain = **15.95mm**

- **Roller Diameter** (**dr**) = **5/8 x p**

= 5/8 x 15.95

dr = **9.96 mm**

∴ Roller Diameter (**dr**) = **9.96 mm.**

- **Chain Width (W)** = **5/8 x p**

= 5/8 x 15.95

W = 9.96mm.

∴ Chain Width (**W**) = **9.96 mm.**

- **Pin Diameter (dp) = 5/16 x p**

= 5/16 x 15.95

dp =4.98mm.

∴ Pin Diameter (**dp**) = **4.98 mm.**

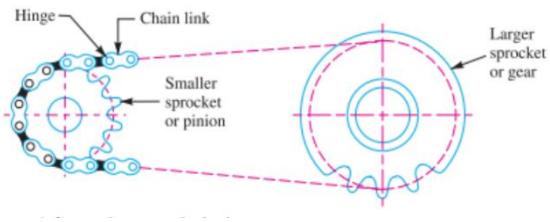
- **Thickness of link plate (t) =1/8 x p**

=1/8 x 15.95

t =1.99mm

∴ Thickness of link plate **(t) = 4.98 mm.**

3. Power Capacity of roller chain



P = p^2 x [V/104 – $V^{1.41}$ / 526 x (26 – 25cos180 / Tb)] x Kc

Where,

p = chain pitch in mm

Tb = No. of teeth on the smaller sprocket.

Kc = Capacity factor for no. of stands
= 1,1.7,2.5 & 3.3 for 1,2,3 & 4 stands.

V = Volume 150 to 450. …….(Refer from Data Book)

$P = 15.95^2 \times [150/104 - 150^{1.41}/526 \times (26 - 25\cos 180/18)] \times 1$

P = 414.05W

∴ Power Capacity of roller chain (**P**) **= 414.05 W**

OBJECTIVES

1) No need for electricity to complete the task.
2) Greater efficiency must be required.
3) Price should be low.
4) It should maintain human health.
5) It can be used by men as well as women.
6) Sustainability,
7) Affordability

APPLICATIONS

1) Pedal-operated flour mills are ideal for use in rural areas with limited access to electricity. The mills can be used to grind grains into flour, which can be used for cooking and baking
2) Pedal-operated flour mills can be used in disaster management scenarios, such as natural disasters or emergencies, to provide a source of food in areas where there is no electricity.
3) Pedal-operated flour mills can be used in humanitarian aid programs to provide a sustainable source of food for people in need.
4) Pedal-operated flour mills can be used in educational settings to teach students about sustainable development and the importance of food security.
5) Pedal-operated flour mills can be used in small-scale businesses to provide a low-cost and sustainable way to produce flour for commercial use.
6) Pedal-operated flour mills can be used in homes to grind grains into flour for personal use.

IV. CONCLUSION

The pedal-operated flour mill was designed and fabricated for households and small businesses in rural areas, where there is an acute electricity shortage. We Modified the flour mill into a pedal-operated flour mill by using scraped components. But our 100% aim is not satisfied which we have decided. Because we are not getting the perfect Rpm as per the flour machine required. That's why the consistency of the flour produced by pedal-operated mills can be inconsistent, which can affect the quality of flour output because of the low Rpm. The developed flour mill would be a boon for the farmers of remote villages and in the villages where there is a scarcity of electricity or no electricity at all. And the farmers can use it for small businesses.

V. FUTURE SCOPE

Increasing its efficiency and output: The current pedal-operated flour mill has limitations in terms of speed and power output, but with further development, it may be possible to increase its efficiency and output. This could make it a viable alternative to electrically powered flour mills, particularly in areas where electricity is scarce or unreliable. One potential solution is to replace or modify the gears or transmission system to increase the efficiency of power transfer from the pedals to the mill.

VI. REFERENCES

[1]. YANG JIANHUA, (CN104369099 A), "International Journal of Engineering and Technology," Volume3, issue 2, 2017.4
[2]. R. Subash, "International Journal of Mechanical Engineering and Technology (IJMET)," Volume 8, issue 6, June 2017, pp. 631-640, Article ID: IJMET_08_06_066.
[3]. KARL KROEMER, "Virginia Polytechnic Institute and State University, VT. Grado

Department of Industrial and Systems Engineering, Doctor of Engineering.
[4]. SONGTAO ZHU, "Advances in Intelligent Systems and Computing," July 2018, Conference: International Conference on Applied Human Factor and Ergonomics.
[5]. Prem Shanker, "International Journal of Industrial Ergonomics 37(4):283-289," April 2007.
[6]. Dharwa Chaitanya Kirti Kumar, "A Research on Multipurpose Machine, International Journal for Technological Research in Engineering," Volume 1, issue 1, 2013.
[7]. Rahil Patel, "International Journal of Engineering and Techniques," volume 3, issue 2, March-April 2017

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