

Development of Foot Powered Laundry Machine

S.P. Tanpure.¹ (Professor) Vikki Kumar Das² Ainan Alam³
Sanjivani K.B.P. Polytechnic Kopergaon Sanjivani K.B.P. Polytechnic Kopergaon Sanjivani K.B.P. Polytechnic Kopergaon

Anmol Kumar⁴
Sanjivani K.B.P. Polytechnic Kopergaon

Md. Faizan Raza⁵
Sanjivani K.B.P. Polytechnic Kopergaon

Abstract:- This paper presents the design and performance evaluation of a foot powered laundry machine aimed at providing sustainable laundry solutions for households. The proposed design integrates human-powered mechanical energy to drive the washing process, offering an eco-friendly alternative to conventional electric washing machines. The design process involved the selection of appropriate materials, mechanical components, and ergonomic considerations to ensure user comfort and efficiency. Performance evaluation experiments were conducted to assess the washing machine's effectiveness in removing stains, water consumption, and energy efficiency compared to electric counterparts. The results demonstrate the feasibility and potential environmental benefits of pedal-powered washing machines for promoting sustainable living practices.

Keywords:- Man Power, Foot Powered Laundry Machine, Sustainable Household, Eco-Friendly, Design, Performance Evaluation, Energy Efficiency.

I. INTRODUCTION

In recent years, the quest for sustainable living practices and the reduction of energy consumption has become increasingly vital. Among the various household appliances, washing machines stand out as significant contributors to energy consumption and environmental impact due to their reliance on electricity and water resources. In response to this challenge, there has been a growing interest in developing alternative solutions that offer both sustainability and practicality.

One such solution gaining attention is the foot powered laundry machine. Unlike traditional electric washing machines that rely on grid electricity foot powered laundry machine utilize human mechanical energy to drive the washing process. This concept aligns with the principles of sustainability by reducing reliance on non-renewable energy sources and minimizing carbon emissions associated with electricity generation.

The concept of human-powered laundry machines is not entirely new, as historical examples exist, particularly in regions where access to electricity is limited. However,

recent advancements in materials, design, and ergonomics have led to the development of more efficient and user-friendly foot powered laundry machine suitable for modern households.

This paper aims to explore the design, functionality, and performance evaluation of a foot powered laundry machine tailored for household use. By analyzing the advantages, challenges, and potential impact of this innovative appliance, we aim to contribute to the discourse on sustainable household practices and inspire further research and development in this promising field.

Overall, the introduction of foot powered laundry machine represents a significant step towards achieving sustainable living standards, offering households an eco-friendly alternative for laundry while promoting energy independence and reducing environmental footprint.

➤ Working Principle

The working principle of a foot powered laundry machine is based on converting human pedal power into mechanical energy to drive the washing process. Typically, the pedal mechanism is connected to a system of gears and pulleys, which in turn rotate the drum of the washing machine. As the user pedals, the rotational motion is transmitted to the drum, agitating the clothes inside and facilitating the washing process. Some designs may incorporate additional features such as a drainage system, rinsing mechanism, or even a separate compartment for soap dispensing. Overall, the key idea is to harness human energy to perform the mechanical tasks involved in washing clothes, making it a sustainable and eco-friendly alternative to electric-powered washing machines.

II. COMPONENTS CONSIST

- Chair
- Bicycle Pedal
- Connecting Rod
- Frame
- Lever Mechanism
- Drum as a washing chamber
- Fins Plate

➤ *Chair-*

In a foot powered laundry machine, a chair can be used as a seat for the person pedaling. It provides comfort and stability during the pedaling process, making it easier for the user to operate the machine for an extended period. Additionally, the chair can also serve as a place to sit while loading and unloading the laundry.



Fig 1 Chair

➤ *Pedal-*

The pedal in a foot powered laundry machine serves as the mechanism for generating power. By pressing down on the pedal with their foot, the user activates the machine's washing cycle. As they pedal, the rotational energy is transferred to the washing drum, agitating the clothes and facilitating the washing process. Essentially, the pedal converts human kinetic energy into mechanical energy to drive the washing machine.



Fig 2 Bicycle Pedal

➤ *Connecting Rod-*

In a foot powered laundry machine, the connecting rod plays a crucial role in transmitting the rotational motion from the pedal to the washing drum. It connects the pedal to the flywheel or other mechanism responsible for driving the washing cycle. As the user pedals, the connecting rod transfers the motion, converting it into rotational energy that powers the washing machine. Without the connecting rod, the pedal's motion would not be efficiently transferred to the washing mechanism, hindering the machine's operation.



Fig 3 Connecting Rod

➤ *Frame-*

The frame in a foot powered laundry machine provides structural support and stability for the entire system. It holds all the components together, including the washing drum, pedal mechanism, connecting rods, and any other necessary parts. The frame also ensures that the machine remains balanced and sturdy during operation, preventing any wobbling or instability that could affect its performance. Additionally, the frame can be designed to be durable and lightweight, making it easy to transport or move the washing machine if needed. Overall, the frame is essential for the functionality and reliability of the foot powered laundry machine.



Fig 4 Frame

➤ *Lever Mechanism-*

A lever mechanism in a foot powered laundry machine is typically used to engage and disengage the washing drum from the pedal power source. When the user wants to start the washing cycle, they would activate the lever mechanism to connect the pedal's rotational energy to the washing drum, allowing the machine to operate. Conversely, when the washing cycle is complete or if the user needs to stop the machine, the lever mechanism can be used to disengage the pedal power, stopping the rotation of the washing drum.

The lever mechanism serves as a convenient and efficient way to control the operation of the washing machine, allowing the user to easily start and stop the washing cycle as needed. It also provides a safety feature by enabling quick disengagement of the pedal power in case of emergencies or malfunctions. Overall, the lever mechanism enhances the usability and functionality of the foot powered laundry machine.

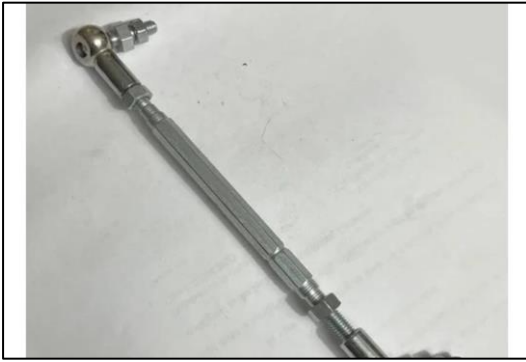


Fig 5 Lever Mechanism

➤ *Drum as a Washing Chamber-*

The drum in a foot powered laundry machine is the central component where the laundry is placed for washing. It rotates within the machine and agitates the clothes, facilitating the washing process. As the user pedals, the rotational energy generated is transferred to the drum, causing it to rotate and move the clothes around, effectively cleaning them.

The drum typically has perforations or holes to allow water and detergent to penetrate and thoroughly wash the laundry. Its design ensures that the clothes are evenly distributed throughout the washing cycle, resulting in efficient cleaning.

Overall, the drum is essential for the functioning of the Foot powered laundry machine, where the cleaning action takes place.



Fig 6 Drum as a Washing Chamber

➤ *Fins Plate-*

Fins in a foot powered laundry machine are typically located inside the washing drum and serve to enhance the washing process. These fins are strategically positioned to help agitate the clothes more effectively as the drum rotates. By creating turbulence in the water and laundry mixture, the fins ensure thorough cleaning by dislodging dirt and debris from the fabric fibers.

The motion generated by the foot powered mechanism, combined with the presence of fins inside the drum, creates a dynamic washing action that helps to lift and separate the clothes, allowing the detergent and water to penetrate more deeply. This results in a more efficient and thorough cleaning process compared to machines without fins.

Overall, fins play a crucial role in improving the washing performance of foot powered laundry machine, ensuring that laundry is cleaned effectively with minimal energy consumption.

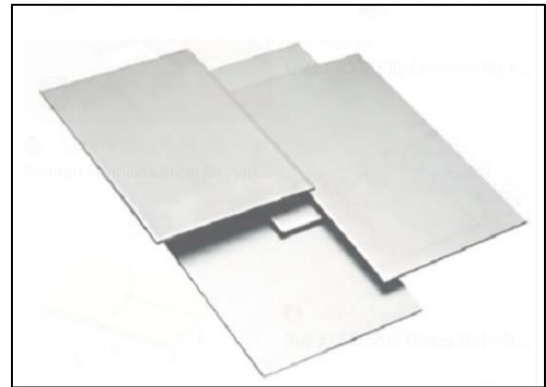


Fig 7 Fins Plate

III. DESIGN OF THE PROJECT

Foot powered laundry machine involves several key components and considerations. Here a comprehensive outline.

➤ *Frame:*

- Start with a sturdy frame made of metal or durable plastic.
- Ensure it can support the weight of the washing drum and withstand the mechanical forces generated during operation.
- Design the frame to be stable and balanced to prevent wobbling or tipping.

➤ *"Washing Drum:*

- Choose a cylindrical drum made of stainless steel or durable plastic.
- Determine the appropriate size based on the desired capacity and space available.
- Include perforations or holes in the drum to allow water and detergent to circulate during the washing cycle.

➤ *Pedal Mechanism:"*

- Design a pedal mechanism that converts rotational motion into mechanical energy to power the washing machine.
- Use a crankshaft or flywheel connected to the pedals to transfer energy to the washing drum.
- Ensure the pedal mechanism is adjustable to accommodate users of different heights and preferences."

➤ *"Connecting Rods:*

- Include connecting rods to transmit the rotational motion from the pedal mechanism to the washing drum.
- Use durable materials such as steel or aluminium for the connecting rods to withstand repeated use"

➤ *"Lever Mechanism:*

- Incorporate a lever mechanism to engage and disengage the pedal power from the washing drum.
- Ensure the lever mechanism is easy to operate and provides a quick way to start and stop the washing cycle"

➤ *"Fins:*

- Consider adding fins inside the washing drum to improve washing efficiency by agitating the clothes.
- Position the fins strategically to create turbulence and enhance cleaning performance.
- Water Inlet and Outlet:"

➤ *"Safety Features:*

- Incorporate safety features such as guards or covers to protect users from moving parts.
- Include emergency stop mechanisms to quickly halt the machine in case of malfunction."

➤ *"User Interface:*

- Design a user-friendly interface with clear instructions for operating the washing machine.
- Include indicators or displays to show the status of the washing cycle."

➤ *"Ergonomics:*

- Pay attention to the ergonomic design of the foot powered laundry machine to ensure user comfort during operation.
- Consider factors such as pedal height, seat position, and accessibility for loading and unloading laundry.

By considering these components and design considerations, you can create a functional and efficient foot powered laundry machine that provides an eco-friendly alternative for laundry washing"

IV. PHOTO OF FOOT POWERED LAUNDRY MACHINE



Fig 8 Fabrication Process and Photo



Fig 9 Conceptual View Backend



Fig 10 Final Model Foot Powered Laundry Machine

➤ *Application*

- Off – Grid Living
- Rural Areas
- Disaster Relief
- Eco Friendly Homes
- Outdoor Activities

➤ *Advantage*

- Energy Efficiency
- Cost- Effective
- Portability and versatility
- Independence from grid infrastructure
- Physical exercise
- Sustainable living

V. CONCLUSION

In conclusion, foot powered laundry machine offer a sustainable, cost-effective, and versatile solution for laundry needs in diverse settings. While they have disadvantages such as being labor-intensive and having limited capacity, their benefits in terms of energy efficiency, portability, and independence from grid infrastructure are significant. By promoting sustainability, providing access to clean clothes in off-grid areas, and encouraging physical activity, foot powered laundry machines play a valuable role in promoting a more environmentally conscious and self-sufficient way of living. With ongoing innovation and improvements, these machines continue to offer practical solutions for individuals, communities, and disaster relief efforts worldwide.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to Prof. S. P. Tanpure for his invaluable guidance, support, and mentorship throughout the process of designing the foot powered laundry machine. We would also like to extend our appreciation to our team members, Mr. Vikki Kumar Das, Mr. Ainan Alam, Mr. Anmol Kumar, and Mr. Md Faizan Raza, whose dedication, collaboration, and hard work have been pivotal in the successful execution of this project. Furthermore, we acknowledge the support and encouragement received from the Head of the Department, Professor G.N.Wattamwar, whose leadership and encouragement have provided us with a conducive environment for innovation and learning.

Lastly, we express our gratitude to the Principal, Mr. A.R.Mirikar, for his continuous encouragement and support towards fostering an environment of research and development within the institution.

This project would not have been possible without the collective efforts and contributions of all individuals mentioned above. We are truly grateful for their guidance, support, and encouragement.

REFERENCES

- [1]. Teresa Baker et al, (2005). Bicilavadora The Pedal-Powered Washing Machine IDEAS Proposal.
- [2]. Gaurang Bhatawadekar et al, "Design and Fabrication of Pedal Powered Washing Machine", International Journal of Engineering Research and General Science Volume 3, Issue 1, pp. 1307-1311, 2015.
- [3]. Whitt, Frank Rowland, Wilson and David Gordon (1983). "Bicycling Science", 2nd ed. Cambridge, Massachusetts: The MIT Press.
- [4]. Darrow, Ken, Pam and Rick (1977), "Energy: Pedal Power," from Appropriate Technology Sourcebook, Stanford, California: Volunteers in Asia, Inc. pp.189-196.
- [5]. Jayachandra Prabhu (2008). Design of transmission elements", pp. 2.1-2.15.
- [6]. Gitin M Maitra, (2002). "Hand book of gear design", second edition, pp. 3.1-3.44.
- [7]. Pal Pandian and Salinpaul Valooran .Design and Fabrication of Pedal Power Top Loaded Washing Machine .
- [8]. Sandip Kumar Singh, Deep Prakash Singh,Aparana Singh.Pedal Powered Washing Machine (PPWM)
- [9]. K.Nick(2006). Washing Machine. Great Brittan: Duckworth
- [10]. "Deepak Y. Dhas, Karthik H. Koundinya, and Harshil K. Patel. (2016). "Pedal operated washing machine." International Journal of Engineering Research & Technology, 5(1), pp. 118-121.
- [11]. Deepak Patil, Mahesh Mali, and Suraj Salunke. (2018). "Design and fabrication of pedal powered washing machine." International Journal of Recent Technology and Engineering, 7(6), pp. 373-377.
- [12]. Shiva Shukla, Harshit Kumar, and Satyam Prakash. (2020). "Design and fabrication of pedal powered washing machine." International Journal of Engineering and Innovative Technology, 10(3), pp. 36-42."