

Design and Development of Pedal Operated Atta Chakki Machine

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ABSTRACT

The Pedal Operated Atta Chakki Machine is an innovative solution designed to provide an energy-efficient and user-friendly alternative to conventional flour milling. Traditional flour mills rely on electrical power or manual labor, which can be costly or physically demanding. This machine integrates a mechanical pedal system that allows the user to operate the mill efficiently without external energy sources, making it suitable for rural and remote areas. The machine offers improved milling efficiency, reduced physical effort, and enhanced flour quality. Its design incorporates ergonomically optimized pedaling mechanisms to ensure ease of use. Additionally, the machine is compact, durable, and cost-effective, making it an ideal choice for small-scale farmers and household users. Future advancements could include automation integration and material optimization for enhanced durability.

Keywords: Pedal Operated Flour Mill, Energy Efficient Milling, Rural Technology, Cost-Effective Mechanism, Sustainable Grinding.

1. INTRODUCTION

In many rural and semi-urban areas, access to electrical flour mills is limited due to inadequate power supply. Traditional stone grinding is labor-intensive and time-consuming, making it inefficient for large-scale use. The Pedal Operated Atta Chakki Machine aims to bridge this gap by providing an energy-independent and user-friendly solution. By utilizing mechanical pedal power, this machine reduces dependency on electricity while maintaining efficient flour milling. The integration of optimized pedal mechanics ensures minimal physical strain, allowing users to grind wheat and other grains effortlessly. The design focuses on sustainability, affordability, and ease of use, making it a viable alternative to electric mills.

2. LITERATURE REVIEW

Research in non-electrical milling solutions has explored various pedal-powered mechanisms to improve efficiency. Studies indicate that:

- Pedal-operated systems significantly reduce human effort compared to manual grinding methods.
- Flywheel-based energy storage can enhance the efficiency of pedal-driven machines.
- Traditional flour milling methods cause significant nutrient loss, while optimized mechanical milling retains essential nutrients.
- Previous studies highlight the need for ergonomic design in pedal-operated machines to ensure user comfort and efficiency.

This research paper incorporates insights from prior studies to improve the design and functionality of the pedal-operated atta chakki.

3. METHODOLOGY

The design and development of the Pedal Operated Atta Chakki Machine followed a structured methodology:

1. **Conceptual Design** – Analyzed traditional grinding methods and identified key areas for improvement.
2. **Component Selection** – Selected durable materials for the frame, pedal mechanism, and grinding components.
3. **Fabrication** – Assembled the system using a reinforced flywheel, chain-drive mechanism, and an optimized grinding stone.
4. **Testing & Optimization** – Conducted trials to refine pedal resistance, grinding efficiency, and user ergonomics.
5. **Performance Analysis** – Measured flour output rate, consistency, and energy efficiency.

4. DESIGN

The Pedal Operated Atta Chakki Machine consists of:

- **Frame:** Made of high-strength mild steel for stability.
- **Pedal Mechanism:** Designed for effortless operation with minimal energy loss.
- **Flywheel:** Enhances momentum and smoothens operation.
- **Chain Drive System:** Transfers mechanical energy efficiently from the pedals to the grinding unit.
- **Grinding Unit:** Uses high-quality grinding stones for fine flour production.

The compact and modular design allows for easy maintenance and transportation.

5. RESULTS and DISCUSSION

5.1 Results

- **Efficiency:** Increased flour output compared to manual grinding.
- **User Comfort:** Ergonomic design reduced physical strain.
- **Cost-Effectiveness:** Lower operational costs compared to electric mills.
- **Sustainability:** No reliance on external power sources.

5.2 Discussion

The machine effectively addresses limitations of traditional grinding methods by integrating an optimized pedal-driven mechanism. Future enhancements could include adjustable resistance, automated feeding mechanisms, and lightweight material alternatives.

6. ADVANTAGES

- **Cost-Effective:** Eliminates electricity expenses.
- **Eco-Friendly:** Zero carbon footprint.
- **Portable & Durable:** Compact design allows easy storage and mobility.
- **Ergonomic:** Reduces physical fatigue during prolonged usage.

7. FUTURE SCOPE

- **Automation Enhancements:** Incorporation of automated feed control for efficiency.
- **Material Optimization:** Use of lightweight alloys for improved portability.
- **Hybrid Power System:** Integration of solar-powered motor assistance.

8. CONCLUSION

The Pedal Operated Atta Chakki Machine presents an innovative, energy-efficient, and cost-effective solution for small-scale flour milling. Its sustainable design makes it a suitable alternative to conventional electric mills, especially in rural areas. Future developments in automation and material engineering can further enhance its usability and efficiency.

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