

Pedal-Powered Grain Mill

A human-powered grain mill coupling a bicycle pedal drive through chain and belt to adjustable grinding burrs, with a feed hopper and collection bin.

1. Introduction / Background

Human power is the oldest prime mover in food processing — and a pedal drive is its most efficient form, letting leg muscles do steady work hands-free.

This project couples a bicycle pedal drivetrain through chain and belt to a pair of adjustable grinding burrs: the rider pedals, the burrs grind grain from the hopper into the collection bin.

2. Problem Statement

Off-grid and low-resource settings need grain milling without electricity or fuel. The engineering is in the transmission: gearing a comfortable cadence up to burr speed, keeping the drive efficient through chain and belt, and making fineness adjustable — a complete machine-design exercise in human power.

3. Objectives

- Transmit pedal power to grinding burrs through chain and belt with suitable overall ratio.
- Provide adjustable burr gap for coarse-to-fine grinding.
- Demonstrate safe, sustained milling with feed control and guarding.

4. Proposed Methodology

The rider drives a chainring; a chain carries power to an intermediate shaft, and a belt steps it up to the burr spindle. Grain meters from the hopper into the adjustable burr pair, which shear it to flour collected in the bin below. Burr gap is set by a handwheel; a feed gate controls throughput; chain and belt guards plus a stable frame keep the rider safe.

5. System Architecture / Working

- Drive: bicycle pedals, chainring, chain to countershaft, belt to burr spindle.
- Milling: feed hopper, adjustable burr pair with handwheel, collection bin.
- Safety: chain guard, belt guard, stable braced frame, feed-gate control.

6. Hardware / Software Requirements

- Bicycle pedal set and chainring, chain, countershaft, belt and pulleys, grinding burrs with adjustment handwheel, hopper, collection bin, MS frame, guards.
- No firmware; purely mechanical build.

7. Expected Outcomes

- A working pedal mill grinding grain to buyer-adjustable fineness.
- Demonstrated throughput at comfortable cadence (expected ~3–5 kg/hr).

- A complete report, PPT and viva Q&A; on human power, transmissions and milling.

8. Applications

- Off-grid grain processing demonstration.
- Appropriate-technology teaching.
- Human-power and ergonomics studies.

9. Future Scope

- Flywheel for smoother torque.
- Interchangeable burr sets for different grains.
- Direct-coupled winnowing fan from the countershaft.

10. Conclusion

The mill is honest appropriate technology: no motor, no fuel, just geared human power — with throughput stated as an expectation, not a promise.