

Pedal-Operated Grain Winnowing Machine

A human-powered winnower: bicycle-pedal drive, belt-driven fan, hopper and chute that separate chaff from grain with an air stream — no electricity needed. Delivered built-to-order with the working machine, fabrication drawings, operation manual, report, PPT and viva kit.

01. Title

Pedal-Operated Grain Winnowing Machine

02. Introduction / Background

After threshing, grain must be winnowed: the lighter chaff separated from the heavier kernels. Villages still do this by tossing grain in the wind — slow, weather-dependent and laborious — while electric winnowers are unaffordable or unusable where power is unreliable. A pedal-operated winnower is the appropriate-technology answer: the operator pedals like a bicycle, a belt drive spins a fan, grain falls from a hopper through the air stream, chaff blows aside and clean grain drops into a bin. It is mechanical engineering in direct service of rural life.

03. Problem Statement

Small farmers need winnowing that does not depend on grid power or diesel, and engineering students need a machine-design project with visible social value. The project addresses both with a pedal-powered winnower the student designs, fabricates and tests: pedalling effort, fan speed, grain throughput and cleaning efficiency are all measurable on the finished machine.

04. Objectives

- Fabricate a pedal-crank drive with chain and belt transmission to a centrifugal fan.
- Provide a feed hopper and sloped chute delivering grain across the air stream.
- Separate chaff into a side tray while clean grain falls into a collection bin.
- Achieve a design throughput target (approx. 30–40 kg/hour) at comfortable pedalling effort.
- Supply an operation manual with throughput and cleaning-efficiency test procedure.
- Deliver fabrication drawings, report, PPT and viva Q&A.;

05. Proposed Methodology

The machine is fabricated from angle iron, wood and sheet metal: a bicycle crank and chain drive the fan shaft through a stepped belt pulley for speed multiplication. The fan housing directs air across the falling grain curtain from the hopper chute. The student tests the machine with a weighed grain–chaff mixture: pedalling at a steady cadence, they collect the outputs, weigh clean grain vs remaining chaff, and compute cleaning efficiency and throughput. Pulley ratios and chute angle are tuned from these trials.

06. System Architecture / Working

The operator pedals the crank; the chain and belt step up the speed to the fan. Grain poured into the hopper flows down the chute as a thin curtain through the horizontal air stream. Aerodynamic drag carries the light chaff sideways into the chaff tray while the denser kernels fall nearly vertically into the grain bin. The student varies pedalling cadence and chute opening, weighs each output fraction, and reports throughput and cleaning efficiency from the trials.

07. Hardware / Software Requirements

- Angle-iron/wood frame, bicycle crank, chain and belt drive (fabricated)
- Centrifugal fan in sheet-metal housing
- Feed hopper and sloped delivery chute
- Chaff tray and grain collection bin
- Weighing scale for trial measurements
- Operation manual with test procedure
- Fabrication drawings

08. Expected Outcomes

- A working pedal-operated winnower separating chaff from grain without electricity.
- Student-measured throughput and cleaning-efficiency figures from weighed trials.
- A documented tuning procedure for pulley ratio and chute angle.
- A complete report, PPT and viva Q&A; on winnowing theory and the machine's design.

09. Applications

- Appropriate-technology demonstrations for rural engineering programs.
- Machine-design teaching: belt drives, fans, and separation principles.
- Final-year studies on human-powered agricultural machinery.

10. Future Scope

- Sieve shaker attachment for size grading in the same machine.
- Solar-assisted fan for reduced pedalling effort.
- Foldable frame for transport between farms.
- Dust-collection hood for operator comfort.