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"DESIGN & FABRICATION OF MULTIPURPOSE SIEVING MACHINE"

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Abstract - *This paper presents the design and fabrication of a multipurpose sieving machine used to separate materials of different sizes such as sand and grains. The machine works using an electric motor that provides continuous vibration for sieving. It reduces manual effort and saves time compared to traditional methods. Different mesh sieves are used to obtain required particle sizes. The machine is simple, cost-effective, and easy to operate, making it suitable for small-scale industries. The performance of the machine shows improved efficiency and better output.*

Key Words: **Multipurpose Sieving Machine, Vibration Mechanism, Particle Separation, Low-Cost Machine, Mechanical Design**

1. INTRODUCTION

In today's industrial and agricultural world, separation of materials according to size is a very common and important process. Sieving is one of the simplest and most widely used methods for separating materials such as sand, soil, grains, powder, compost, and other granular materials. From construction sites to small-scale industries and farms, sieving plays a vital role in improving material quality and usability. However, traditional sieving methods are mostly manual, time-consuming, and require more human effort. To overcome these problems, the design of a multipurpose sieving machine has become necessary. A multipurpose sieving machine is designed to perform sieving operations for different types of materials using a single machine. Instead of using separate machines or manual tools for each application, this machine can handle multiple materials by changing the sieve mesh. This makes the system economical, efficient, and suitable for small industries, workshops, rural areas, and educational institutions.

1.1 Background Of Sieving Process

Sieving is a mechanical process used to separate particles based on their size by passing them through a mesh or screen. The material is placed on a sieve, and motion is applied either manually or mechanically so that smaller particles pass through the openings while larger particles remain on top. In earlier times, sieving was done using hand-held sieves, which required continuous manual shaking. This method was slow and caused physical strain to the operator.

1.2 Need for Multipurpose Sieving Machine

In small-scale industries and rural areas, budget and space are major constraints. Buying multiple machines for different sieving operations is not economical. Manual sieving also leads to problems such as low productivity, inconsistent results, and health issues like fatigue and joint pain. There is a strong need for a machine that is:

- Easy to operate
- Low in cost
- Requires less maintenance
- Can sieve different materials
- Consumes less power

2. LITERATURE REVIEW

Various researchers have developed different types of sieving machines to improve material separation and reduce manual effort. Earlier methods were manual and time-consuming, while modern machines use vibration and motor-driven mechanisms for faster and more efficient operation.

Many studies focused on automatic and vibratory sieving machines using mesh screens to separate particles based on size. Some researchers developed multi-layer and multi-sieve systems to achieve better grading and higher efficiency. Advanced designs also include electronic and automated systems for improved performance.

However, most of the existing machines are designed for specific applications such as sand or grain separation and are often costly or bulky. Therefore, there is a need for a compact, low-cost, and multipurpose sieving machine that can handle different materials efficiently.

2.1 Research Gap

In the project *"Multipurpose Sieving Machine"*, it is observed that most existing machines are single-purpose, bulky, and costly. There is a lack of compact, low-cost machines that can handle different materials using adjustable mesh sizes.

2.2 Problem Statement

The project *"Multipurpose Sieving Machine"* aims to overcome the limitations of traditional sieving methods, which are time-consuming and labor-intensive, by developing a machine that provides faster, efficient, and low-cost material separation.

3. METHODOLOGY

Methodology explains the complete procedure followed to design, fabricate, assemble, and test the machine. The main purpose of this machine is to separate or sieve materials using mechanical vibration or rotary motion instead of manual effort. The system uses a motor, pulley-belt drive, and perforated sieve tray mounted on a supporting frame.

The methodology includes:

- Problem identification
- Design planning

  Material selection
- Fabrication process
- Assembly procedure
- Working operation
- Testing and performance evaluation

This systematic approach ensures that the machine works efficiently, safely, and economically.

4. DESIGN OF PROJECT

The multipurpose sieving machine is designed with a simple and compact structure. It consists of a mild steel frame, sieve tray, electric motor, pulley and belt drive, shaft, and bearings. The frame provides support and stability during operation. The sieve tray is made of a perforated plate with different mesh sizes, which can be changed according to the material.

The power is supplied by an electric motor, and motion is transmitted through a pulley and belt system. A crank or linkage mechanism is used to convert rotary motion into oscillating motion of the sieve tray.

4.1 MATERIAL SELECTION

Materials are selected based on strength, durability, cost, and availability. Mild steel is used for the frame for strength and low cost, while stainless steel is used for the sieve tray to resist corrosion. Cast iron or aluminum pulleys provide smooth and lightweight motion, rubber belts absorb shock and vibration, and steel shafts ensure high strength. Overall, the selected materials improve machine efficiency, life, and performance.

- **Frame:** Mild Steel – Strong and economical
- **Sieve Tray:** Stainless Steel / MS – Corrosion resistance
- **Pulley:** Cast Iron / Aluminum – Lightweight and durable
- **Belt:** Rubber – Flexible and shock absorbing
- **Shaft:** Steel – High strength

Material selection is done based on strength, durability, cost, and availability to ensure efficient machine performance. Mild steel is used for the frame to provide strength and stability, while stainless steel or mild steel is used for the sieve tray for durability and corrosion resistance. Cast iron or aluminum is selected for pulleys to ensure smooth and lightweight operation. A rubber belt is used for flexible and shock-absorbing power transmission, and a steel shaft is used for high strength and reliable motion transfer. Overall, the selected materials improve the machine's efficiency, life, and cost-effectiveness.

4.2 Fabrication process

The fabrication of the multipurpose sieving machine was carried out using simple and standard manufacturing processes.

I) FRAME

The supporting frame is the main body or skeleton of the sieving machine. All other components are mounted on this structure.

Construction

Made from mild steel square pipes or angle sections.Designed in a rectangular shape for stability.Welded joints provide rigidity and strength.Four vertical legs support the entire system.

Functions

Supports the sieve drum, motor, and transmission system.
Maintains proper alignment of rotating parts.
Absorbs vibration produced during operation.
Provides stability and prevents machine movement.

Importance

A strong frame ensures safe operation and long machine life.
If the frame is weak, vibration may cause misalignment, noise, and mechanical failure.

ii) Sieve Tray

The sieve drum is the main working component of the machine where separation of particles takes place.

- **Construction**

Circular or cylindrical metal container.
Bottom surface consists of a perforated mesh or sieve plate.
Holes are uniformly distributed.
Made from stainless steel or mild steel sheet.

- **Functions**

Receives raw material to be screened.
Allows smaller particles to pass through holes.
Retains larger particles above the mesh.
Performs separation based on particle size.

- **Working Principle**

When the drum rotates or vibrates:
Material spreads across the sieve surface.
Smaller particles fall through perforations.
Larger particles move outward and are collected separately.

iii) Pulley

The pulley system transfers motion from the motor to the sieve mechanism using two pulleys of different sizes connected by a belt. The motor pulley (driver pulley) rotates first and transmits motion through the belt to the sieve pulley (driven pulley). This controls the speed and produces the required vibration or rotation for proper sieving. The pulley size ratio plays an important role in determining machine speed and improving sieving efficiency

iv) Bearing

Bearings are fitted at rotating joints to reduce friction and support smooth shaft movement. They are usually ball or roller bearings placed inside housings at shaft supports. Bearings help the shaft rotate smoothly, reduce wear and energy loss, and carry radial and axial loads. Proper use of bearings improves machine efficiency and increases the lifespan of the machine.

v) Electric Motor

The electric motor is the prime mover of the machine and provides mechanical power. The electric motor is the main driving component (prime mover) of the multipurpose sieving machine, responsible for providing the required mechanical power for its operation. It is typically a single-phase or three-phase induction motor, mounted on the lower side of the frame for better stability and proper weight distribution. The motor is connected to the pulley and belt drive system, through which rotational motion is transmitted to the shaft and further converted into vibration of the sieve tray.

Machine Used for This Project

In this project, a multipurpose sieving machine is used to separate materials based on particle size. The machine consists of a frame, sieve tray, electric motor, pulley and belt drive, and a vibration mechanism. It works by converting electrical energy into mechanical motion using a motor, which produces vibration in the sieve tray. Due to this vibration, fine particles pass through the mesh while coarse particles remain on the surface. This machine is used for sieving materials like sand, grains, and powders efficiently with less manual effort.

5. **Working**

The machine works on the principle of mechanical vibration and size separation.

1. Material to be sieved is placed on the sieve tray.
2. Electric power is supplied to the motor.
3. Motor starts rotating at a constant speed.
4. Driver pulley rotates along with motor shaft.
5. Belt transfers motion to driven pulley.
6. Linkage mechanism converts rotary motion into oscillating motion.
7. Sieve tray begins vibrating.
8. Smaller particles pass through holes due to gravity and vibration.
9. Larger particles remain on top and move toward the edge.

Continuous vibration ensures quick and uniform separation.
aterial Feeding
Material such as grains, sand, powder, or food particles is manually fed into the tray. Proper feeding ensures:
Uniform distribution Better separation efficiency
Vibration Generation
When the motor runs:
Pulley rotates continuously. Linkage produces periodic motion. Tray vibrates in horizontal and vertical directions .This shaking motion loosens material layers.
4.1 Separation Process
During vibration:
Fine particles fall through perforations.
Medium particles move slowly.
Larger particles remain above.
Gravity and vibration together complete separation.
4.2 Material Collection
Separated materials are collected as:

- Fine material below the tray
- Coarse material on the tray surface

This process reduces manual sorting work.
4.3 Continuous Operation
The machine can run continuously for long periods.
Advantages:
Higher output
Consistent quality
Less operator fatigue

5. Results & Discussion

After fabrication and testing of the sieving machine, satisfactory results were obtained. The machine operated smoothly with proper alignment of the motor, pulley, and crank mechanism. The rotary motion provided by the electric motor was successfully converted into oscillating movement of the sieve tray, which enabled effective separation of materials.

During operation, the material spread uniformly over the perforated sieve surface. Fine particles passed through the holes of the sieve mesh, while larger particles remained on the top and were separated efficiently. The belt and pulley system transmitted power without slipping, and the bearings ensured smooth rotation with minimum friction.

The machine showed the following performance results:

- Efficient separation of particles based on size.
- Smooth and continuous operation with low vibration.
- Reduced manual effort compared to traditional hand sieving.
- Uniform grading of materials.
- Stable structure due to strong welded frame.
- Low noise and minimal power consumption.
- Easy handling and maintenance.

Overall, the fabricated machine achieved the expected performance and proved suitable for small-scale industrial and agricultural applications.

5.1 APPLICATION

- Agriculture Sector – Used to clean and separate grains like wheat, rice, and seeds by removing dust and stones.
- Food Processing Industry – Used to separate flour, spices, and sugar powder for better quality products.
- Chemical and Pharmaceutical Industry – Used to separate powders and granules according to particle size.
- Small-Scale and Rural Industries – Suitable for small workshops because it is simple, low cost, and easy to operate.

6. Conclusion

The sieving machine is a simple and useful machine used for separating materials according to particle size. It works with the help of an electric motor, pulley and belt drive, and sieve drum. The machine reduces manual work and saves time compared to hand sieving.

The fabricated frame provides good strength and stability during operation. The vibration created by the mechanism helps in proper separation of fine and coarse particles. The machine works smoothly, is easy to operate, and requires low maintenance. It is suitable for small industries, agriculture, and workshop applications.

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