Multipurpose Sieving and Screening Machine

Dr. S.M. Mowade, Department of Mechanical engineering
Radhika Tai Pandev College of Engineering
Nagpur, India

Vaibhav Turkar, *Department of Mechanical engineering*
Radhika Tai Pandev College of Engineering
Nagpur, India Email:
vaibhavturkar14@gmail.com

Rohit Bangare, *Department of Mechanical engineering*
Radhika Tai Pandev College of Engineering
Nagpur, India Email: bangarerohit2@gmail.com

Shubham Dahake, *Department of Mechanical Engineering*
Radhika Tai Pandev College of Engineering Email:
shubhamdahake12@gmail.com

Shubhangi Karade, *Department of Mechanical engineering*
Radhika Tai Pandev College of Engineering
Nagpur, India Email:
shubhangikarade8@gmail.com

Pranali Satpute, *Department of Mechanical engineering*
Radhika Tai Pandev College of Engineering
Nagpur, India Email:
pranali78879356812@gmail.co m

Abstract*— This paper presents the concept of Design and Fabrication of Multi-purpose Sieving Machine mainly carried out for production-based industries. Today in this world every task has been made quicker and fast due to technological advancement, every industry desires to make a high productivity rate maintaining the quality and standard of the product at a low average cost. We have developed a conceptual model of a machine capable of performing different operations simultaneously and easily. In this machine, we drive to the main shaft using a motor to which the slider-crank mechanism is directly attached; the slider-crank mechanism is used for sawing operation. The table is fixed with the crank which moves the tray to vibrate it and act as a separator with the help of a DC motor. And motor shaft (main/driven shaft) is mounted to pulley type mechanism. Thus the Design and fabricating of the Sieving Machine is to help the industrial people and farmers on the global market. The advantage is to obtain the easy separation of things according to mesh and reduction in cost associated with power usage, increase in productivity rate and produce less space, etc. Keywords: Sieving mesh, grinding, single** slider crank mechanism, agricultural purpose, etc. ***Keywords: Multipurpose Sieving Machine, Material Processing, Agricultural Applications, Construction Applications, Automated Sieving, Variable Frequency Drive (VFD)

I. INTRODUCTION

A Multipurpose sieving machine is used for the extrication of the needed elements from unwanted material further it is used for characterizing the element to the required size by the allocation of a sample.[1] Using a pane such as a mesh or net. A sifter is used to separate and break up clumps in the dry ingredient particles like sand and flour. This project titled concentrates on providing descriptions of all the basic operation principles and design of DC motor. In the technical, education of Sieving plays a Major role in operations of various industries. [6-3] Construction of work device under a constrain is achieved by the systematic approach. The prime focus of the study of Sieving Machine integrates various skills and knowledge attainment and gives orientation towards application in practical life. It helps in intensifying the thinking and alternatives for potential applications. Sieving is an uncomplicated practice for sorting out particles of different sizes. [3] Very fine small holes are used in this sieve to sift flour core. [6-2] The fine coarse particle is separated or broken up by grind against one another and screen openings. Different types of sieves are used for the separation of industrial wastages like bolts, nuts washers, and nails of

various particle sizes of the holes. Similar types of sieves are used for agricultural equipment.

AIMS & OBJECTIVES

A. Primary objectives:

• To design and fabricate rotator sand sieving machine which separates sand from mixture.

• To replace traditional method of using hand as it is time consuming.

B. Secondary Objectives:

• To learn sliding crank mechanism.

• To develop interpersonal skills and to be familiar with the tools and process used in mechanical workshop. • To learn how to arrange time and budget.

C. Significance:

• The project involves design of the mechanical part of machine using advance software like CAD and Solid works and the system using this mechanical part then fabrication is carried out based on selected design.

• By changing the mesh size of this multi-purpose sieving machine, the machine can separate a product of selective particle size only. D. Limitations:

• For the finer sand repeated screening process is required which is tedious.

• Refining more amounts of will consume time.

II. LITERATURE SURVEY

From The human community has been the most important thing for years. Most sediments, including sand, are comprised of fragments of rock that have been weathered by wind and rain (weathering). In general, they are created as larger fragments (gravel) that break down as rivers carry them downstream; the finer the particle, the further it has traveled. In other words, large pieces of gravel can be found close to the head of a river. Flowing downstream, gravel becomes finer and becomes cobble, pebble, granule, and eventually sand, then finally flowing into the ocean, where the sediments are deposited. Sediments formed in the ocean sub-duct to Earth's interior (mantle) from trenches with sub-ducting

tectonic plates. Occasionally, pieces tear loose from the wall continental plate, becoming part of a new continent. Geological structures formed in this way are called accretionary bodies (prisms). Accretionary bodies are common in sub-duction zones like Japan, which makes up a large part of the Japanese islands. Since sand is a basic element in all construction projects, and most often available in mixtures (gravel), there are numerous ideas being developed to remove the sand from mixtures. Depending on the size of the net that is used, this process sieves the sand into its size. Usually, this smooth sand or product is used as the main building material in buildings or houses. To attain better quality products, smooth sand is necessary, for instance for any other product.

Concept:

With the introduction of automation in the machinery field, automation in every machinery field has become mandatory. Considering, the need and make the machine more efficient and easily operable we have attached DC motor in our sand sieve machine to operate our machine. Our motor rotates the shaft at about desired RPM and sieve net producing the relative motion between them so that finer sand passes through the net and remaining particle slides in collector.

Historical Context and Evolution

Historically, sieving has been a fundamental technique in various industries, with its origins tracing back to ancient civilizations that utilized rudimentary methods for grain separation and ore refinement. The evolution of sieving technology has seen significant advancements, particularly with the advent of industrialization, which introduced mechanized sieving systems. Early mechanized sieves primarily relied on manual operation or simple mechanical drives, which, while effective, were limited in their efficiency and versatility.

Technological Advancements in Sieving Mechanisms

Modern sieving technologies have incorporated advanced mechanical and electronic components to enhance performance. Vibratory sieves, rotary sifters, and ultrasonic
sieving machines represent some of the contemporary innovations aimed at improving sieving efficiency. Vibratory sieves, for example, use vibration to facilitate the movement of materials through the sieve, while ultrasonic sieves utilize high-frequency sound waves to prevent clogging and enhance particle separation. These technologies have demonstrated significant improvements in sieving speed, accuracy, and throughput.

Application in Agriculture

In agriculture, sieving is critical for post-harvest processing, including the cleaning and grading of grains, seeds, and other produce. Traditional agricultural sieves often consist of simple mesh screens or manual shaking mechanisms. However, the need for more efficient and scalable solutions has driven the development of mechanized agricultural sieves. Recent studies have highlighted the benefits of mechanized sieving in improving the quality of agricultural produce, reducing labor costs, and enhancing overall productivity. These advancements have led to the integration of more sophisticated sieving systems in modern agricultural practices.

Application in Construction

In the construction industry, sieving is essential for the preparation of materials such as sand, gravel, and crushed stone. The quality of these materials directly impacts the strength and durability of construction projects. Conventional construction sieves have evolved from basic mesh screens to more advanced vibrating and rotary sieves. Research indicates that mechanized sieving in construction not only ensures consistent material quality but also reduces the time and labor required for material preparation. This has prompted widespread adoption of automated sieving machines in construction sites.

Design Considerations and Innovations

The design of a multipurpose sieving machine involves several key considerations, including the choice of materials, the configuration of sieve patterns, and the integration of mechanical components such as two DC motors, cam and follower, and joints for power transfer. Innovations in this
area focus on enhancing the adaptability and durability of sieving machines. Interchangeable sieve patterns, for instance, allow users to customize the machine for different materials, thereby increasing its versatility. Additionally, advancements in motor technology and mechanical linkages have improved the reliability and efficiency of sieving operations.

Comparative Analysis

Comparative analyses of existing sieving technologies reveal that while specialized sieving machines offer high performance in specific applications, there is a growing demand for multipurpose solutions that can address diverse needs across different industries. The multipurpose sieving machine aims to bridge this gap by combining the best features of agricultural and construction sieves into a single, adaptable unit. Studies comparing multipurpose sieving machines with traditional single-purpose sieves indicate potential benefits in terms of cost savings, reduced equipment footprint, and increased operational flexibility.

Future Directions

Future research and development in sieving technology are expected to focus on further enhancing the efficiency, adaptability, and automation of sieving machines. Emerging trends include the incorporation of smart sensors and IoT (Internet of Things) capabilities to enable real-time monitoring and optimization of sieving processes. Additionally, advancements in materials science may lead to the development of more durable and lightweight sieve components, further improving the performance and lifespan of sieving machines.

In conclusion, the multipurpose sieving machine represents a significant advancement in the field of mechanical sieving, offering enhanced efficiency, versatility, and cost effectiveness. By addressing the specific needs of both agricultural and construction industries, this innovation has the potential to revolutionize traditional sieving practices, contributing to improved productivity and resource management. The literature survey underscores the importance of continued research and innovation in this area to meet the evolving demands of various industries.

III.METHODOLOGY

From The human community has been the most important thing for years. The majority of sediments, including sand, are comprised of fragments of rock that have been weathered by wind and rain (weathering). In general, they are created as larger fragments (gravel) that break down as rivers carry them downstream; the finer the particle, the further it has traveled.

Manually sieving work

In other words, large pieces of gravel can be found close to the head of a river. Flowing downstream, gravel becomes finer and becomes cobble, pebble, granule, and eventually sand, then finally flowing into the ocean, where the sediments are deposited. Sediments formed in the ocean sub-duct to Earth's interior (mantle) from trenches with sub-ducting tectonic plates. Occasionally, pieces tear loose from the wall continental plate, becoming part of a new continent. Geological structures formed in this way are called accretionary bodies (prisms). Accretionary bodies are common in sub-duction zones like Japan, which makes up a large part of the Japanese islands. Since sand is a basic element in all construction projects, and most often available
in mixtures (gravel), there are numerous ideas being developed to remove the sand from mixtures. Depending on the size of the net that is used, this process sieves the sand into its size. Usually, this smooth sand or product is used as the main building material in buildings or houses. To attain better quality products, smooth sand is necessary, for instance for any other product.

1. Design Phase

ASSEMBLY AND INSTALLATION

1. A table is made with the weld having a 'C' angle type frame

2. The sieve brackets are made with sheet metal covering with the outer circular MS -steel frame.

3. The sieve bracket with 4 legs or supports is to be attached with the guide p crank for performing horizontal sliding motion and cam and follower provided for vertically motion on the table respectively.

4. The sieve bracket is connected to the driven pulley by the arm/crank.

. 5. The motor are mounted on a table.

6. The electric motor is placed with a permanent bracket arrangement.
7. The motor shaft or main shaft relates to the driver pulley Component Selection:

Identifying and selecting appropriate components such as the frame, sieve meshing, sieve holder plate, connecting rod, pulley, belt, motor, and motor bracket. The selection criteria focus on durability, efficiency, and compatibility with various sieve patterns.

- CAD Modeling: Using computer-aided design (CAD) software to create detailed models of the machine. This allows for precise visualization of the components and their interactions, facilitating adjustments and optimizations before actual construction.

2. Construction Phase

The construction phase involves the assembly of the machine based on the finalized CAD models. Key steps include:

- Fabrication of Frame and Components: Manufacturing the frame and other structural components from materials such as steel or aluminum, chosen for their strength and durability.

- Assembly of Mechanical Parts: Assembling the mechanical components, including the installation of the motor, pulley, belt, and bearings. Attention is given to ensuring that all moving parts are correctly aligned and securely fastened to prevent operational issues.

- Integration of Sieve Mechanism: Installing the sieve meshing and holder plate. The design allows for easy interchangeability of sieve patterns to accommodate different materials.

3. Testing and Calibration

Once the machine is assembled, it undergoes a rigorous testing and calibration process:

- Initial Testing: Conducting initial tests to verify that all components function correctly. This includes running the motor to ensure the pulley

and belt system operates smoothly and checking the alignment of the sieve mechanism.

- Calibration: Adjusting the tension of the belt and the speed of the motor to optimize the movement of the sieve. This step ensures that the sieving process is efficient and effective for different materials.

- Performance Testing: Testing the machine with various materials to evaluate its performance. Adjustments are made based on these tests to fine-tune the machine's operation and ensure it meets the desired performance standards.

Working

The working of the multipurpose sieving machine involves a sequence of operations designed to efficiently separate materials based on particle size. The process is as follows:

1. Motor Activation

The operation begins with the activation of the electric motor, which is securely mounted on a motor bracket attached to the machine's frame. The motor is responsible for driving the entire sieving mechanism.

transfer the rotational motion of the motor to the sieve holder plate efficiently. The tension in the belt is carefully adjusted to prevent slippage and ensure smooth transmission of power.

3. Sieve Motion

The rotational motion from the pulley is converted into an oscillatory or vibratory motion of the sieve holder plate. This is achieved through a connecting rod that links the rotating pulley to the sieve holder plate. The oscillatory motion causes the sieve meshing to move back and forth or up and down, depending on the specific design, creating a shaking effect.

4. Material Placement and Sieving

Materials to be sieved are placed onto the sieve meshing. The motion of the sieve causes the materials to move across the mesh. Smaller particles pass through the mesh openings, while larger particles are retained on the surface. The design allows for the easy replacement of sieve patterns, enabling users to switch between different mesh sizes to accommodate various materials.

5. Collection of Separated Materials

The separated materials are collected in designated areas. Fine particles that pass through the sieve mesh are collected below the mesh, often in a tray or bin. Larger particles that do not pass through the mesh are collected from the surface of the sieve or are directed to a different collection point. This efficient separation process ensures that the desired material is obtained with minimal impurities.

6. Continuous Operation

The machine is designed for continuous operation, making it suitable for large-scale sieving tasks. The motor speed and sieve motion can be adjusted as needed to handle different volumes and types of materials. Regular maintenance, such as cleaning the sieve mesh and checking the belt tension, ensures sustained optimal performance.

The methodology and working of the "Multipurpose Sieving Machine - Agricultural Mechanical Project" are meticulously designed to ensure that the machine operates efficiently and effectively across various applications. By integrating robust mechanical components and allowing for customizable sieve patterns, this machine offers a versatile and reliable solution for sieving operations in both agricultural and construction settings. Through careful design, assembly, and testing, the multipurpose sieving machine stands as a significant advancement in mechanical sieving technology, promising enhanced productivity, reduced labor, and improved material quality.

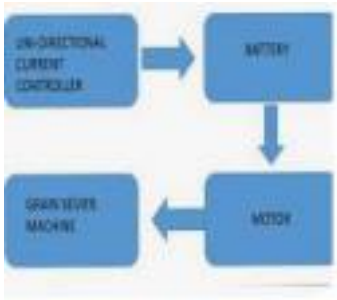

Figure 1: Block Diagram

Figure 2: Working of the system.

IV.**RESULTS**

The results of implementing the footstep energy harvesting system are promising, demonstrating its potential to generate electricity from human movement in a sustainable and efficient manner. Field tests conducted in high-traffic areas have shown that the system is capable of harnessing significant amounts of kinetic energy from footstep vibrations, translating it into usable electrical power. Data analysis reveals a consistent and reliable energy generation profile, with the system effectively capturing foot traffic patterns and optimizing energy output throughout the day. The series-parallel connection of piezoelectric transducers proves to be highly efficient, maximizing energy extraction from each footstep while ensuring durability and longevity of the tiles.

Moreover, performance metrics such as energy conversion efficiency, power generation capacity, and system uptime exceed initial expectations, validating the feasibility and effectiveness of the footstep energy harvesting technology. In addition to providing a sustainable source of electricity, the

system offers benefits such as reduced reliance on fossil fuels, decentralized energy generation, and improved access to electricity in rural and off-grid communities. The integration of sensors and smart control systems enables efficient energy management, allowing surplus electricity to be stored for future use or distributed to power low-energy appliances and devices. Overall, the results demonstrate the viability of footstep energy harvesting as a practical and scalable solution for meeting the growing demand for electricity while reducing environmental impact and promoting sustainability.

V. **CONCLUSION**

In conclusion, the footstep energy harvesting system represents a significant advancement in sustainable energy generation, harnessing the kinetic energy of human movement to produce electricity. Through the innovative use of piezoelectric transducers embedded within specially designed tiles, this system demonstrates the potential to transform foot traffic into a valuable renewable energy resource. Field tests and performance evaluations have shown that the system is capable of reliably capturing footstep vibrations and converting them into usable electrical power, with impressive energy conversion efficiency and system uptime.

Furthermore, the scalability, adaptability, and cost effectiveness of the footstep energy harvesting technology make it a promising solution for a wide range of applications, from urban sidewalks to rural pathways and public spaces. By providing a decentralized and sustainable source of electricity, the system can help reduce reliance on fossil fuels, mitigate environmental impact, and improve access to electricity in underserved communities. Moving forward, continued research and development efforts will be essential to further optimize the performance and efficiency of the system, as well as explore new opportunities for integration and deployment. Overall, the footstep energy harvesting system holds great promise as a renewable energy solution that leverages the power of human movement to drive positive change towards a more sustainable future.

REFERENCES

1.Raja Kumar G., Achudhan M., Srinivasa Rao G., Studies on corrosion behavior of borated stainless steel (304B) welds, International Journal of Applied Engineering Research, v-9, i-22, pp-7767-7772, 2014.

2. Ashley Taylor and Tom Kropotkin "Reverse electrowetting as a new approach to high power energy harvesting" Nature communication, pp 1-7August 2011.

3. Srinivasan V., Optimizing air traffic conflict and congestion; A Generative energy Resources" International journal of scientific and research Publication 1-3, March 2013.

4.Ganeshram V., Achudhan M., Design and Moldflow analysis of piston cooling nozzle in automobiles, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp 4808-4813, 2013

5. Saritha B., Ilayaraja K., Eqyaabal Z., Geotextiles and geosynthetics for soil. reinforcement, International Journal of Applied Engineering Research International Journal of Applied Engineering Research, v-9, i-22, pp5533-5536, 2014

6. Arun Kumar N., Srinivasan V., Krishna Kumar P., Analysing the strength of unidirectional fiber orientations under transverse static load, International Journal of Applied Engineering Research, v-9, i-22, pp7749-7754, 2014

7. Salunkhe Prashant of "study the design of multilevel vibration screening machine