ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAY127

# Design and Fabrication of Automatic Multipurpose Sieving Machine

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**Abstract:- The Multipurpose Sieving Machine is a versatile and efficient mechanical device designed for the classification and separation of diverse particulate materials. This innovative equipment integrates advanced sieving technologies to accommodate a wide range of applications across various industries. The key features include a robust frame supporting a customizable sieving deck, a dynamic vibration mechanism for effective particle separation, and an adjustable inclination for enhanced flexibility. The machine is designed to handle different types of materials, from granular substances to powders, offering a scalable solution for industrial processes. The user-friendly control interface ensures ease of operation and allows for real-time adjustments, optimizing the sieving performance. With its adaptability, efficiency, and user-centric design, the Multipurpose Sieving Machine stands as a reliable solution for sieving and classification requirements in industries such as agriculture, pharmaceuticals, chemicals, and construction. Construction work of buildings requires sand of different gradings. Presently the sand sieving is done manually by labours. This makes it a time-consuming process. Same mesh cannot be used for obtaining different sand grades. Sieving of grains is done manually and consumes lot of time. Our research work proposes an idea of motorized sieving machine that uses a 12-volt DC motor to vibrate the mesh. The machine shall have changeable mesh based on the sand grading requirement/grains to be sieved.**

***Keywords:-*** *Sieving, Sand, Grains.*

## I. INTRODUCTION

Sand is a simple material used on the construction site. Only stone, martar, plaster, cement, etc. It helps to add volume, strength and stability to other materials such as. Sand is also used as the so-called "blind layer". It is also difficult to provide a flat and dry surface for the building. Sand is the most important material in construction, so sand has many uses in many ways. Different types of sand have different uses, especially on construction sites. Fine sand (0.07mm-0.25mm) is required for plaster and fine sand (0.25-5mm) is required for flooring. The sand needs to be analyzed, according to the needs of the field. Depending on the job, specific grades of sand are examined. Sand curtains with sieve plates are used only on construction sites, which cannot work and sand supply requirements vary depending on the job. Although there are few machines capable of sand analysis so far, they are rarely used on construction sites. Nowadays, a significant part of the sand sifting process is done with old equipment or manually. Using sand analysis technology requires more time to analyze, the quality of sand. Since this will increase the number of workers on the construction site, it will also increase labor, costs. This machine is suitable for processing works, resin industry, powder and ceramic tile industry, marble powder industry etc. It can be used in many industries and various activities. Rice sieves are mainly used for the inspection and determination of rice and oilseeds. They are suitable for the analysis of different sizes of rice seeds, rice seeds and impurities, rice seeds and other rice seeds. The model developed in our research project is a compact and simple, portable, battery powered testing machine. This machine takes up very little space and consumes very little electricity. The machine requires little maintenance. The machine can be equipped with sieves of the desired pore size to obtain the desired level of sand/sieve granules. Today the world must be fast everywhere. Therefore, speed and working speed are most important. Now is the time for the search for speed and many machines and devices have been invented. In such a modern era of liberalization, small industries have contributed to the development of our country. New machines and technologies are constantly being developed in order to produce more products at cheaper prices and quality. The aim of this project is to design and manufacture the mechanical components of the machine and analyze the machine. Screening machines rely solely on AC motors to change motion. The rotation is converted into forward and backward motion with the help of connecting rods and wheels with the help of pulleys connected to the engine. Horizontal sieve machine works on the principle of crank-scroll mechanism. Place the sieve box on the rail and start the machine. The screen will appear when the screen moves reciprocally. Sifting is a simple method used to classify different products. Most often, when preparing concrete for construction, sieving is done manually. Sand is screened using a mesh tilted at a certain angle. In the sand analysis method of the existing structure, the simple is moved horizontally according to the selected method. This results in a close relationship between the material and the screen. Depending on its size, someone talks on the screen or it stays on the screen. There are many machines available for sand analysis, but we offer the design and manufacturing of low-cost and easy-to-use automatic sand analysis machines. For small-scale farming in rural

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areas, the main aim of growers is to use it at home. Crops are generally small. For this reason, they are not placed in large refineries to be refined. Here we came up with an idea to solve the problem of filtering water or producing better crops (just grains, cardamom etc.). This product is a household screening machine that can be used to separate or sift or filter unwanted and undesirable soil in crops. The machine is compact and requires only limited space. The machine can also separate stones and other unwanted materials from purchased or stored items. In the field of education, educational analysis plays an important role in the work of many industries. Use different types of screening to separate waste products such as bolts, nuts, washers and nails of different sizes. A functional method is used to create functional objects within constraints. Sieving is a simple method of separating different particles. Fine and coarse grains hit each other and are sieved and separated or broken. This sieve has very good holes to sift flour kernels. Agricultural products also use the same type of analysis. It helps create new ideas and has implementation potential. The main purpose of Sieve Machine Learning is to integrate knowledge and data and guide students towards practical application.

➢ *Problem Statement*

Demand for high-performance, versatile analytical equipment is increasing across many industries. Current screening systems often lack the flexibility needed to process different materials and different particle sizes. The goal is to design and build a multi-purpose inspection machine. Many businesses need on-site analysis solutions. The multi-purpose screening machine should be designed to be compact and portable so that it can be easily carried and used in many places. Construction must have different levels of sand and chemical analysis. The process is carried out manually, which requires a lot of energy and often creates work fatigue. The lack of labour also caused many problems in terms of construction. Current equipment is only suitable for one level of sand. Sifting rice is done manually and requires a lot of time and work. The screening machines on the market are large, difficult to transport and require a lot of investment.

## II. LITERATURE SURVEY

- Swapnil Bhote et.al. Title -**Design and Fabrication of multi-purpose sieving machine.** In the above research work a motorized sieving machine was designed and fabricated. The machine used a 1 HP motor. Pulley and belt assembly was used to transmit the power from motor to the sieving plate. The sieving plate was vibrated to sieve the sand. However, the machine was designed for only type of mesh.
- Sohan Hapsenkar, et.al. Title -**Design and fabrication of industrial sand screening machine for green sand** in this research work a cylinder was used to sieve the sand. The walls of the cylinder were fitted with mesh of required grid size. The cylinder was mounted on the frame with some inclination. The cylinder shaft and motor shaft were linked through belt and pulley mechanism. When the motor rotated, the cylinder also rotated. The operator was supposed to load one side of the cylindrical opening with sand.
- Mr. Avadhunt Tigadikar.et.al.Title -**Design and fabrication of Semi-automated solar powered sand sieving machine.** In this project work a solar operated sieving machine was designed and fabricated. The machine had a vibrating sieving plate. The vibration was produced using the DC motor. The seving plate would sieve the sand due to vibrating action. This machine had a drawback i.e. it would not work in cloudy weather. The machine was also bulky and quite hard to transport.
- Swapnil Bandgar. et.al. Title -**Review on multi-level sand screening machine and analysis of vibration mechanism.** In the above research work a multilayer sieving machine was designed and developed. The system had two meshes in order to reduce the sieving time. Both the mesh frames were aligned in v shape with the each other and was vibrated by the same motor.
- Prasenjeet Mahure.et.al.Title -**Review on multipurpose sieving machine.** In the above research work a multipurpose sieving machine was designed and fabricated. The machine used slider crank mechanism to vibrate the tray. The vibrating tray was fitted with rollers so as to reduce the effort of the motor and to reduce the friction between the guides and the roller. The machine had provision to change the mesh according to their requirement of sand grade.
- Eyre Emagbetere et.al. Title -**Design, construction and performance evaluation of a horizontal sand sieving machine and heating machine.** The above research work had a reciprocating tray that was fitted to the main frame. The reciprocating tray was fitted to the motor for vibrating it. A hopper was provided on top of the machine to load the sand. The vibrating action of the tray sieved the sand and expelled the coarse waste particles.
- Pradeep Kumar Krishnan. et.al. Title -**Design and development of an electronic sieving for sand separation using node MCU system** in the above research work the microcontroller was used in the sand sieving machine. The machine was fitted with load cell to detect the sand when the tray is loaded. The microcontroller activated the motor to vibrate the tray when it was triggered by the load cell. It vibrates only for few seconds and turns off automatically. This system helped to save battery power and increase the efficiency of the machine.

➢ *Objectives*

- To mechanize the process of sand sieving and grain sieving so as to reduce dependency on manual labour
- To cut down the cost of the process and to increase the efficiency of the process.
- To design the machine so as to manufacture it at a very low manufacturing cost.
- To make the machine interchangeable with mesh grids and to obtain sand of desired grade /to sieve desired grains.
- This can be applied in various industries including agriculture, food processing and construction.

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## III. COMPONENT'S SPECIFICATION

➢ *GI Pipes (Galvanized Iron Pipes)*

- GI pipes are steel pipes that are coated with a layer of zinc to protect them from corrosion.
- The galvanization process involves applying a protective zinc coating to the steel to prevent rusting and increase the longevity of the pipes.

➢ *Guage Sheet Metal*

- The term "gauge" refers to the thickness of sheet metal. It is a numerical value assigned to the thickness of a metal sheet, usually ranging from higher values for thinner sheets to lower values for thicker sheets.
- The most common systems for measuring sheet metal thickness are the American Wire Gauge (AWG) and the Standard Gauge (SWG).

➢ *Mild Steel Bar*

- The bar could be made of various materials, such as steel, stainless steel, aluminium, or other metals, depending on the intended use and application.
- The specifications of the 1-inch bar, such as its tensile strength, yield strength, and other mechanical properties, would depend on the material it is made from. Different materials have different properties.

➢ *DC Motor*

- DC motor is an electric motor that works with direct current (DC) electricity. They are frequently used in many applications due to their simplicity and ease of management.
- The voltage and power requirements of the motor depend on its design and use. DC motors can be designed with different levels of torque and power ratings to meet specific needs.

Fig 1 DC Motor

➢ *Battery*

- The capacity of the battery is measured in ampere hours (Ah) or milliampere hours (mAh). It shows how much power the battery can provide over a period of time. Higher capacity batteries provide more power
- The nominal voltage of an 18-volt battery is usually 18 volts. Actual voltage may vary depending on charging state, temperature, etc. It will change accordingly.


Fig 2 Battery

➢ *Chain*

- Some screens use vibration to separate particles. Chains may be involved in transmitting vibrations to the screen or floor. A motor or eccentric shaft can move the chain, causing the screen to vibrate and separate fine particles.
- A chain should be used to remove the sieve pan from the lower frame. This will help the bowl vibrate less forcefully. This facilitates the oscillatory movement of the sieve discs.

Fig 3 Chain

➢ *Nuts and Bolts*

- The word "5mm" usually refers to the diameter of the bolt or the inner diameter of the Nut. It is important to ensure compatibility between nut and bolt size.
- Nuts and bolts can be made from a variety of materials such as iron, stainless steel, brass or other alloys. Material selection depends on factors such as application, environment and desired properties (such as corrosion resistance).

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Fig 4 Nuts and Bolts

## IV. WORKING PRINCIPLE

The machine has a base made of GI hollow pipes. The vibration plate is made of 30 mm rod and14 gauge steel plate. The vibration plate is removed from the chassis and can be easily vibrated using a DC motor. The DC motor is mounted on the chassis. The DC motor and the screen plate are connected by a crank, which converts the rotation of the motor into movement of the screen plate. A 18-volt lead acid battery is used in the system to start engine. Initially workers should install the desired mesh frame for the screening frame according to the required sand level. Now the worker needs to rotate the machine and load the sand into the box using shovel Finer sand will pass through the sieve, while coarser sand will come out of the box due to vibration. When the pile is full, workers move the machine to another location and repeat the process.

## V. DESIGN CALCULATIONS

➢ *Frequency of Vibration of Sieving Tray*

- Rpm of the motor = 90rpm
- Period of oscillation of sieve tray = 0.67seconds
- Frequency of vibration = 1/ $period$

$$\frac{1}{0.67}$$

$$= 1.49\text{Hz}$$

➢ *Force Exerted by the Motor Arm on the Sieve Tray*

T = F * d

where d = length of the crank

T = torque of the motor

3.4 N-m = F * 0.02 m

F = 170 N

This force is transmitted through connecting rod

➢ *Maximum Momentum Attained by the Sieve Tray*

P = m* v

Where m = mass of the tray

v = velocity of the tray

P = 2.9 Kg * 0.119 m/s

P = 0.345 Kg m/s

➢ *Maximum Shear Stress Developed in the Shaft*

$$\frac{T}{J} = \frac{q}{r}$$

Where $T$ = applied torque

$J$ = polar moment of inertia

$q$ = shear stress

$r$ = radius of shaft

$$J = \frac{\pi d4}{32}$$

$$J = \frac{3.14*8^4}{32}$$

$$J = 401.9\ mm^4$$

$$q = \frac{(3.4\ \text{N–mm} * 1000 * 4\text{mm})}{401.9}$$

$$q = 33.8\ \text{Mpa}$$

## VI. PROPOSED SKETCH

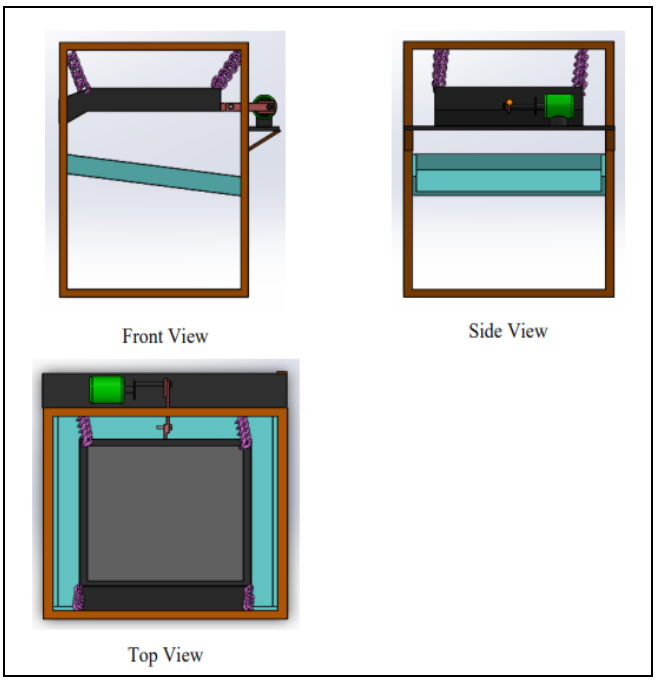


Fig 5 Proposed Sketch

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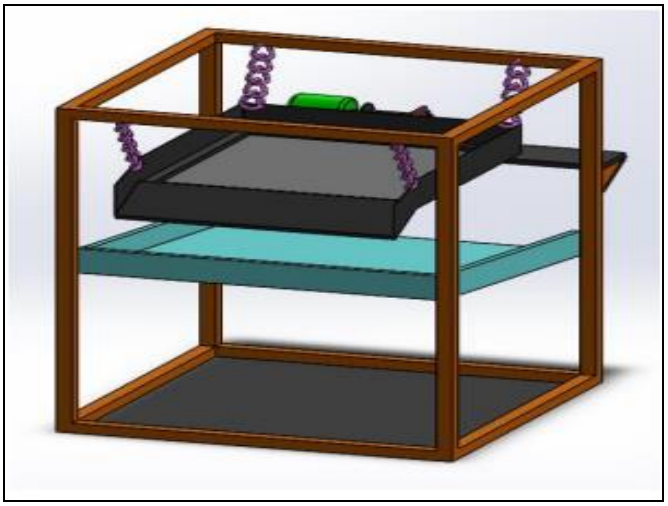

Fig 6 Proposed Sketch

## VII. APPLICATIONS

- This machine can be used in construction, fine panel making and other construction.
- This machine can be used to inspect grain in factories and farms.
- Milling: Screening machine is used to separate foreign substances in the powder. And make sure the particle size is the same
- Grain sorting: Separating different products according to their sizes is important for quality control in the food industry.
- Separation: Screening machines are used to separate aggregates according to their sizes in concrete and asphalt production
- Sand Grading: Levelling is essential for grading and separating different grades of sand used in construction. Sorting the seeds. Sifting is used to separate the seeds according to their size and ensure uniform sowing
- Cultivation. Use screening machines to remove impurities from crops and break grains.

## VIII. CONCLUSION

The development of multidisplay systems is a major effort to solve problems associated with traditional scanning tools Multi sieve machine has achieved the ability to process a wide range of materials, including powder, granules and various sizes. Its adaptable design allows seamless transfer of different materials, thus contributing to its usability in different industries. User friendly design elements included for easy cleaning and maintenance. Quick release of the sieve and removal of the product ensures that downtime is reduced and therefore high efficiency is achieved Multidisplay system is optimized for power consumption without compromising scanning capabilities. The combination of intelligent management and high engine performance results in a stable and profitable operation. The compact and portable use of the screener increases its versatility and allows onsite application in a variety of settings. Thanks to its lightweight design and solid structure, it is durable and easy to carry. Multifunctional screening machines represent a major advance in screening technology and of fer a variety of effective solutions for various industries. Its innovative features combined with user friendly design elements make it useful for applications requiring flexibility, flexibility and high-performance analysis capabilities.

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