

# “DESIGN AND FABRICATION OF MECHANICAL SAND FILTER”

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## ABSTRACT

A sand sieving machine is a machine tool that assists in the separation of sand and stone from a produced mixture. If sand, stone and other large particle are included in the produced mixture, it is not used for further constructional work. As a result, if a worker was sieving the sand in traditional ways without having a machine, sieving machine will helps that worker who sieve the sand in traditional ways with the help of machine mechanism, which is automated by help of motor power and it will increased the efficiency in the terms of time and energy required to screening sand. The aim of this research is to fabricate the best possible machine in terms of design, operating costs, and efficiency. The literature review, objectives, idea generation, idea creation and analysis, design, and research of numerous concepts, computation, and Gantt chart are the steps of design evaluation .For further development into products many concepts of screening machines are chosen during the product evaluation process, depending on the material availability and selection criteria. The end result was a concept for a sand sieving machine that effectively addresses manufacturing costs, capacity, energy, and customization. This study concludes that this sand sieving machine design is environmentally sustainable and has significant benefits, making it a beneficial and worthwhile effort to pursue. It also has a solid safety record. The objective of a safety used in design concept is to keep workers safe from harm.

**Keyword:-**sieving machine, sand, design, and mixture.

## 1. INTRODUCTION

Sand is the most important component in every construction project. Because it normally comes in a mixture form, before used in constructions it required to be removed from unwanted material like stones and other undesired large particles before used in constructions. Similarly, the size of sand changes depending on the stage of building, for example, fine sand is used for plastering and slightly coarse sand is used for wall and slab construction. That’s why, sands need to be appropriately screened as requirements of sand in different stages of construction. As a result, sand sieving machines can be best option for separate sand in required size because they are simple to use and convenient.

We all know that separating sand with a manually operated sieving machine is an old and traditional method. Apart from that, there are many types of sieving machines are used by workers society which are like sand screening cum washing machines, rotatory type sand sieving machines, reciprocating type sand sieving machines, vibratory type sieving machines, and so on.

## 2. LITERATURE SURVEY

S. K. Subramaniam et.al have developed the machine whose title was “Design and fabrication of automated Sand filter and waste separator machine”. The main purpose of this paper to reduce the time and waste material. Author used two horizontal sieve net and operate the machine by the horizontal reciprocating motion

with the help of electrical motor. With using rectangular mesh sieving of the sand is carried out where the mesh is inclined at certain angle. Due to this a relative motion between particles and the sieve take place. This will helps to separation of sand, individual particles pass through the sieve mesh or retained on the sieve surface according to their size[9].

V. M. Magar, et.al have worked on “Design and fabrication of sand sieving machine”. The purpose of the paper is to segregate screws, nuts & bolts, and dust into different mesh sizes based on their size. According to the current state of events, the future of labour society, salary, and the automatic execution of manpower and labour task is critical. In the current condition, this type of arrangement is employed in water treatment plants to remove the faces and undesired stuff from the water. The movable table is connected to a crank that oscillates the tray and acts as a setup using a DC motor. As a result, experiment with designing and producing sieving machines to help industrialists and farmworkers on the global market.

G. Kurnia et.al modified the machine with versatility on , “Design and Fabrication Of Industrial Sand Screening Machine For Green Sand.The purpose of this paper it is possible to conceptualize, design and execute a locally sand screening machine at casting industries for increasing production. This project should be place regularly on service.

Vijay Talodhikar et.al have developed and fabricated sand separator [2022]. he homogeneous mixture of sand and pebbles are fed from the slider which falls on the sieve net fixed on the rotating shaft. Then due to relative motion between particles and rotating sieve, the particles smaller are passed through the net and remaining particles falls on the other side The process will takes place automatically. Thus the time consumed during the whole process of preparing the concrete is reduced [12]

#### **4. OBJECTIVES**

- To design and fabricate the machine which has high productivity as compare to traditional ways.
- Develop the machine which is helpful to the small scale foundries and low level contractors.
- Screening of sand should be low time consuming process.
- Design should have require low maintenance cost and easy to maintenance.
- Design should be fabricate with using locally available material tools and technique.

#### **5. CURRENT TECHNOLOGIES**

Since, many years, it has been the most pressing concern in the human community. The majority of sediments, as well as sand, are made up of particles that form when rock is broken down by wind and rain (weathering). They usually start off as larger bits (gravel), which have broken down as rivers move them downstream; the finer the particle, the further it has travelled. To put it another way, big chunks of gravel abound on the banks of rivers nearing their mouths. Gravel grows finer as it flows downstream, forming cobbles, pebbles, and granules until eventually turning into sand and depositing in the ocean.

However, some fragments break free from the whole and cling to the continental plate that hangs on the wall, once again forming a continent. Accretionary bodies are geological structures that are shaped in this fashion (prisms). Accretionary bodies are found in geologic process zones such as Japan, which conjures up a large portion of the Japanese islands.

Because sand is an essential component of many construction projects and is usually available in the form of a mixture (gravel), several approaches to separating the fine sand particle from the mixture have been developed.

We can see in Fig. 1, the conventional method of sieving and collecting fine sand as desired by the people. The size of the sand is basically depending on the size of sieve net. They used the rectangular sieve net with wooden frame to collect the fine sand. This fine sand is typically used as the basic component for the construction of a any concrete structure. Fine sand is very useful to make high quality work like sand casting and many other. [2]



**Fig 1:** Conventional Method of Screening

Hand-operated Rotary sieve [4] is very good modified method in compare to old traditional ways of sieving sand. It rotates using handles, making the sieving process more effective. It is primarily utilized in tiny manufacturing processes, such as labs. It has now been further modified by addition of electrical motor to reduce the manpower and increasing the efficiency, this modification is known as machine-operated sieve.[5]Because of this automation in machine it is so crucial on construction sites, it has been modified further again and again, so it is now recognized practically everywhere.

The following concepts are examined after reviewing the aim tree for developing a sieve machine. A simple hand-operated reciprocating sand strainer was considered for the first design. The initial sieving process was a simple machine with a mesh strainer, from many year this method is used for sieving up to now. In addition, the reciprocating sand sieve in vertical position is an excellent upgrade. It works by sliding the mesh back and forth, creating a reciprocating action. [6]

The machine became easier to manage and more efficient after the advent of the vertical reciprocating sieve, which included a rotatory mechanism to provide relative motion that will help in screening process of fine and course sand particle. [7]

Because manually machine performance was very good. The equipment hopper, collector, and slider were added, along with limited and completely various sorts of changes in the position of the sieve net, to make it more economical and to produce the best results. [8]

## 6. COMPONENTS OFSIEVING MACHINE

- Motor
- Bearing
- Pulley
- Wire mesh
- Frame
- Shafts
- Controller

We used a single-phase AC motor because the sieving machine required a lot of torque to manage the load. For many years, AC motors have been frequently employed in industry. We used a 375W 1400RPM AC motor.

To assist the shaft rotatory motion, we used the UPC205 bearing with bore diameter of 2.5 cm

To reduce the speed, four pulleys of various sizes are required. On the intermediate shaft, two pulleys with diameters of 7.6 cm and 35 cm are installed, and from another two pulley one is mounted on motor shaft and other one is mounted on the machine shaft with the diameter of 7.6 cm and 25 cm respectively.

Many different methods for sieving have been used in the past, and practically every operation comprises a wire mesh sieve of small size of holes on it. It is varying according to the require size of sand particle.

When a machine is subjected to a load, the frame ensures that the structure will not break. To support all of the loads of machine parts, the frame had to be extremely efficient. Our machine's framework is made of mild steel.

The shaft is used to transfer the rotary motion to the rotatory sieve, we used two shaft one as main shaft on which rotatory sieve is mounted and another as intermediate shaft on which two pulleys are mounted.

We used the speed controller to control the motor's speed since different types and conditions of sand necessitate different speeds. A safety guard is utilized to protect the rotatory sieve, which is covered by a GI sheet.

## 7. METHOD OF CONSTRUCTION

To begin, for a better stability to the structure of a framework we built it with using the MS bars and L-angled support by using the welding processes like TIG welding.

Then the main machine shaft is mounted on the framework with supporting of two flange bearing. This shaft is slightly inclined position, On this shaft rotatory cylindrical sieve is mounted which is made up with the supporting of flat MS bar and sieve net with using the nuts and bolts and TIG welding. At the end of the main machine shaft one large size of pulley of diameter 25cm is mounted.

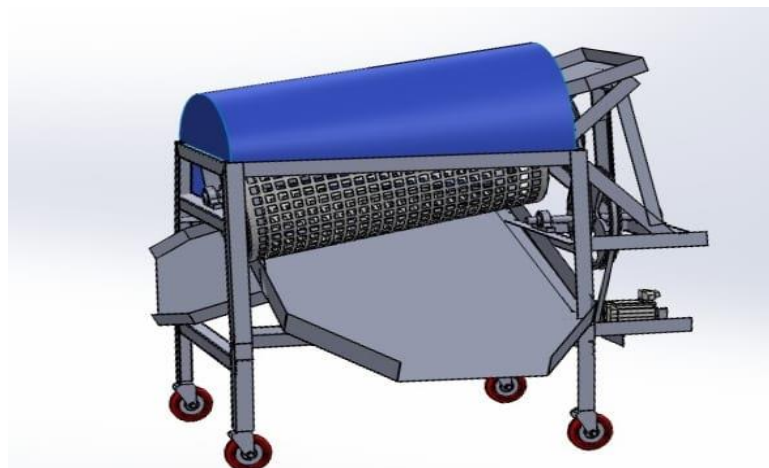
Then the motor is mounted which is fixed to lower side of the framework with the help of nuts and bolt. And one small pulley of diameter 7.5cm is mounted on the motor shaft.

One intermediate shaft is mounted in between the motor shaft and machine shaft on which two pulleys of diameter 35cm and 7.5cm are mounted. This shaft and pulleys are help in the transmission of rotary motion as belt and drive mechanism. This shaft is attached to framework with using the bearing support. This mechanism are also used to reduce the speed of machine shaft.

For power transmission of rotary motion from motor to rotatory sieve net all pulleys and shafts are interconnected with help of B50 rubber v-belt.

Finally, construction is top up with adding the three slider, one is for fed the sand one is mounted lower side for collecting required fine sand and last one is for collecting the waste material. Andfor safety purpose we use PVC pipe for wire and GI sheet for covering rotatory sieve asa safety guard.

Before the final construction we design the each component with using the CAD software and then assemble it in order to better understanding of dimension of final product and to analyzing the construction of machine.



**Fig 2:** Mechanical Sand Filter

## 8. WORKING

A sand sieving machine is used to separates sand from large particles such as stone, rock, and pebbles. In this machine designwe used a sieve net for screening the sand in the form of a rotatory cylindrical sieve which is supported by murga net.

The sieve is a device used to separate desired fine particles of sand elements from undesired material like stone and other large particles.

The rotatory motion generated by the AC motor is conveyed to the intermediate shaft with the help of belt drive to reduce the speed of machine, and from there this rotary motion transfer to the machine shaft at low

rpm. Machine shaft/rotating shaft attached with a sieve net. And with the help of a bearing, both shafts are attached to the framework.

The homogenous mixture of sand and other large unwanted particles is fed into the sieve net with the help of input slider which is fixed to the framework.

The smaller particles are then passed through the net due to relative motion between the revolving sieve and the mixture of sand particles, while the remaining unwanted large particles fall on the other side, where they are collected in a tray beneath the sieve net. Sand which is passed through sieve net collected with the help of slider for further construction work.

## 9. CALCULATION

### 9.1 Machine Efficiency

Let's assume average we use machine for 5 hours a day,

Then power consumption for 30 days (1 month) =  $30 \times 5 \times 0.375 = 56.25$  unit

So Total cost of electricity for one month =  $56.25 \times 10 = 562.5$  Rs.

### 9.2 Manpower Efficiency

Labor cost of a worker = Rs.50/hour

For 1 month working 5 hour per day

It will take around =  $Rs.50 \times 30 \times 5 = Rs.7500$

### 9.3 RPM

Diameter of pulley on motor = 5"

Diameter of larger pulley on intermediate shaft = 14"

Diameter of smaller pulley on intermediate shaft = 5"

Diameter of larger pulley on main shaft = 10"

Speed of the motor shaft = 1400rpm

Speed of the intermediate shaft = 300rpm

So, rpm of the machine = 90rpm

## 9. CONCLUSIONS

To sum up the project thus far, after doing research, many types of sieving machines were imagined in order to select the best one, considering all factors in order to make it more efficient, portable, and easy to operate, as well as having a high safety factor. This craft was created with locally sourced materials and simple workshop techniques. A market study was used to choose the essential materials. This paper also offers a construction approach and a research design. This type of sieving machine, according to the design concept, will be efficient and simple to operate, allowing workers and contractors to learn a modern technique of screening sand.

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