International Journal of Computer Engineering in Research Trends
Multidisciplinary, Open Access, Peer-Reviewed and fully refereed
Research Paper Volume-5, Issue-3, 2018 Regular Edition E-ISSN: 2349-7084

Design & Fabrication of Multi-level Screening Machine

[1]D P Jadhav, [2]Harishchandra Ekal, [3]Karan Jambhale, [4]Mahadev Garad

[1]Asst. Professor, [2]Student, [3]Student, [4]Student
Department of Mechanical Engineering
D. Y. Patil College of Engineering and Technology, Kolhapur, India

Available online at http://www.ijcert.org

Received:28/March/2018, Revised: 29/March/2018, Accepted: 02/April/2018, Published: 04/April /2018

Abstract: - Different type of material in powder form or solid form is separated by using two-level screening machines. This machine can be used in different industries like mining, chemical, food & in metallurgical industries to separate component in different sizes. The work can be done by very few people. It requires very less time for completing work. This screening machine is made up of solid material like steel having high strength. It has two opening sides, from which different types of sand are obtained. In that screening machine two screens are placed to separate different size of components. The screens are made up of the wire mesh and come in various grid sizes

Keywords: Sieve, Screen, Machine, Design.

1. Introduction

A horizontal sieving machine is designed to separate the particle according to their mesh size. In many industries for example the pharmaceutical, mining, food, etc. it is often desirable to communicate particulate matter. Sieves are used for sifting flour has very small holes. Depending upon the types of particles to be separated, sieves with different types of holes are used. Sieves are also used to separate stones from the stand. A number used to designate the size of a sieve, usually the approximate number of openings per inch. The size of openings between crosses wires of a testing sieve.

The horizontal sieving machine is handily to construct and can be operated easily. It is very economic for this kind of machines. This project is fabricated with the help of parts like a handle, crank and slotted link mechanism, bearing, rail track, sieving box and a collecting box. The horizontal sieving machine is worked by eccentric pendulum mechanism. The rail track is attached to the base in which the collecting box moves in it. The collecting box is fixed with the shaft to move when the shaft is reciprocated. The sieving box is placed inside the collecting box, and the machine is started. When the collecting box moves in the reciprocating motion, the sieving process is performed.

The various size of coal, coffee powder, sand are separated by eccentric pendulum operated two-level screening machine. The component which is greater in size they stay on the top layer of vibrating screen. The little components fall on the second screen and lesser size of components obtained in the tray. Thus the different sizes of components are separated with the help of screens. There is,

 https://doi.org/10.22362/ijcert/2018/v5/i3/v5i303

of course, a wide range of purpose for the two level-screening. The main purpose in mining industries there are the different type of screens, but in this type inclined used.

2. Screens and There Type

2.1 Circular Screen:

Circular Screen is a kind of screening equipment mostly used in the industries like mining, construction, building materials, water conservancy and hydropower, road, railway, chemical industry, and so on. Improve your product purity and avoided oversized material from your powders and liquids. Eliminate dust and fumes Enclosed screening means total containment. It's having lowers noise levels. A solid rubber suspension gives the machine a quiet operation.

2.2 Rectangular Type Screen:

The rectangular screen is made up mainly of the motor, reducer, roller device, and rack, closures, expected out of the mouth. The rectangle unit is mounted on a rack slope. Motor and the rectangular screen means connected to a gear unit and via a coupling. When the material into the rectangular assembly so that the flip and sliding of the screen surface material. Selected materials removed through discharge port of the rear of the drum at the bottom, substandard materials are removed through the opening of the drum tail. As the material within the drum of the flip, slide, so that the block material can be ejected, to prevent the screen closed.

2.3 Rotary Screen:

The rotary screen is a kind of high-efficiency sieving machine for screening any powder or particle material in many industries.

3. Problem Definition

We had visited company & see their machine sand reclamation system which is required to understand the different sizes of sand. We observe their sand crusher & lamp broker system. The required sand gfn(Grain Fineness Number) given by company & their particle size for sand screening machine.

Generally, in industries, Pharmaceutical labs or construction we use only one layer of screening machine, but it does not give a better output which is required. So, we made two-level screening machine to get better output. In this two-level screening machine, we divide sand or powder into three different sizes & collected in receiver or Tray.

4. Methodology

1. •Problem Identification.
2. •Prepare Layout.
3. •Selection of Mechanism.
4. •Cad Model Preparation
5. •Design Calculation of components.
6. •Material selection.
7. •Fabrication.

5. Working Principle

In a double pendulum, there's an arm connected to a pivot, and it has only one degree of freedom and can move in a single plane. A double pendulum has one more identical arm connected to the bottom of the first arm. This arm too has one degree of freedom. In a simple double pendulum, the mass is distributed through the length; hence the angle between two arms is used to calculate the moment of Inertia. The pendulum undergoes chaotic motion, generating regions where the momentum exceeds the weight + gravitational pull, and the second pendulum rotates fully around its pivot. The regions are generated dependent on the transfer of potential energy to kinetic energy and vice-versa in the rotation before it. Math theories like Lagrangian formulation for the dynamics can be used to calculate these. Chaotic means that infinitesimally close initial conditions lead to arbitrarily large divergences as the system evolves The system is known to be chaotic as the path is randomized every time one rotation is achieved.

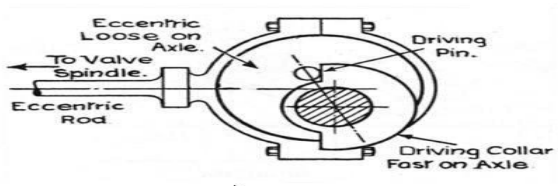

Figure No. 1:- Eccentric Mechanism

 https://doi.org/10.22362/ijcert/2018/v5/i3/v5i303

6. Design Concept

The design of sieve machine must have based on much aspect. The design consideration must be done carefully so that it can be fabricated easily and the system functioning. Then the material used in each design influence the selection thing because absolutely. We need a lightweight material suitable with product size. The design is separated into three phases, firstly choose as many proposed design can be produced then choose four designs and try to improve it functionality and the last one is a new design with detail thing including dimension by using Solid Work software. Besides that, the cost to design and fabricate must reasonable mustn't exceed the budget given try to reduce waste. The criteria that must be considered in designing these machines are Durability: sieve machine must be durable when rotate and vibrate.

Material: The material that will be used must be suitable to fabricate the Sieve machine and easy to get.

Cost: It depends on material and manufacturing processes. It should reduce the cost to the minimum.

7. Design and Calculation

- **Shaft**

Power, P = 0.73KW

Speed, RPM = 1440

$$P = \frac{2\pi \times n \times T}{60}$$

$$T = \frac{60 \times 0.37 \times 10^3}{2\pi \times 1440}$$

$$T = 2.48 \times \frac{10^3 N}{mm}$$

The diameter of a pulley, $D1$=2 inch =50.8mm.

Shaft Pulley, $D2$= 8inch = 203.2mm.

$$\frac{D2}{D1} = \frac{N1}{N2}$$

$$\frac{203.2}{50.8} = \frac{1440}{N2}$$

N2 = 360 RPM.

Reduction ratio:-

$$\frac{1440}{360} = 4$$

$$T = \frac{60 \times 0.37 \times 3}{2\pi \times 360}$$

$$\boldsymbol{T = 9.81 \times 10^3}$$

Shear stress:-45Mpa. (Taking Consideration of Material Steel)

$$T = \frac{\pi}{16} \times \tau \times D^3$$

$\tau = \frac{9.81 \times 10^3 \times 16}{\pi \times 45} = \boldsymbol{10.35mm \approx 20\ MM}$ Standard shaft available in market**.**

$$\frac{T1}{T2} = e^{\mu\theta}$$

$$\frac{T1}{T2} = e^{0.25 \times 3.14}$$

$$\boldsymbol{\frac{T1}{T2} = 2.19}$$

$T = 9.81 \times 10^3$ *This value is taken from above.*

$T = (T1 - T2) \times rp$

$9.81 \times 10^3 = (2.19T2 - T2) \times 101.6$

$\boldsymbol{T2 = 81.38Nmm}$

$\boldsymbol{T1} = 2.19 \times 81.138 = \boldsymbol{177.69Nmm}$

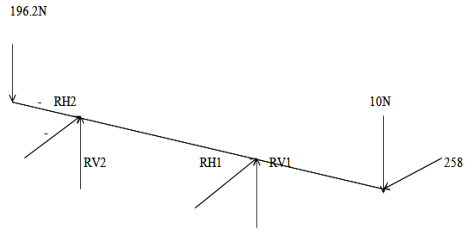

Figure No. 2: Free body Diagram of Shaft

- **Vertical:-**

0 = (-RV1*140)+(10*180)-(196*104)

0 = (-RV1*140-18604.8)

RV1= -132.98N

RV1+RV2 =W+ Wp

- 132.98+RV2=196.2+10

RV2=339.09N

- **Horizontal:-**

0 =RH1*140+(258.94*180)

0 =RH1*140+46609.2

RH1=332.92N

TAKING MOMENT AT POINT,

0 = - RH2*140-(258.94*40)

RH2=73.98N

R1=$\sqrt{RV1^2 + RH1^2}$ = $\sqrt{132.89^2 + 332.92^2}$

R1=358.46N

R2 = $\sqrt{RV2^2 + RH2^2}$ = $\sqrt{339.09^2 + 73.98^2}$

R2 = 347.06N

 https://doi.org/10.22362/ijcert/2018/v5/i3/v5i303

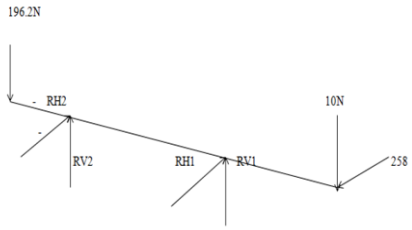

Figure No.3: Loads on FBD

Taking moment at a point

(Vertical)

Mt =(-339.09*104)+(132.89*244)-(10*284)=- **5680.2Nmm**

(Horizontal)

Mt =-258.284-332.92*244-73.98*104 = **33.68Nmm**

The value select from standard design data book

Kb = 1.5 , Kt = 1

$$d^3 = \frac{16}{\pi \times \tau}\sqrt{KbMb^2 + (KtMt^2)}$$

$$d^3 = \frac{16}{\pi \times \tau}\sqrt{(1.5 \times 33.68)^2 + (9.81 \times 10^3 \times 1)^2}$$

D = 10.35mm = 20mm. (Standard shaft.)

- **Bearing:-**

LIFE OF BEARING=$L = \frac{60nLh}{10^6}$

$$L = \frac{60 \times 360 \times 8000}{10^6} = \mathbf{178.2}\boldsymbol{mv\ rev}.$$

From shaft diameter designation of CP204 bearing is selected from standard design data book.

2**04:-** Indicate Bore diameter of bearing.

Code	Diameter
00	10 mm.
01	12mm
02	15mm
03	17mm
04	20mm

So, 4*5=20.

So internal diameter is **20mm**.

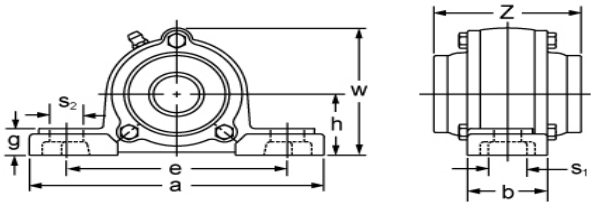

Figure No.4: Ball Bearing Dimension

Specification: -

Shaft Diameter	20mm.
Bolt size	M10
Bearing.	UC204
Housing.	CP204
Lubrication fitting tap.	¼-28UNF

Dimensions:-

h	33.3mm
a	127mm
e-min	86mm
e-max	105mm
b	38mm
S1	13mm
S2	19mm
g	15mm
w	69mm
z	62mm.

8. Fabricated Model as Per Dimension

5. Conclusion

As from the literature review, we referred & we design our own using the references V B Bhandari Book, Shigley Book & various research paper & create the double screening machine at one input power. So select the appropriate motor & then three layers of powder or sand was obtained.

 https://doi.org/10.22362/ijcert/2018/v5/i3/v5i303

6. References

[1] M. Majumder & P. Ghosh, "Finite element analysis of vibration screening techniques using EPS", 2015.

[2] Dr Patel Bhavesh, "Design of Vibratory Screen used in Coal Mining Industry to Prevent Failure". February- 2013.

[3] Zhao Yue -mina, Zhang Cheng-Yong, renting, "Dynamic design theory and application of large vibrating screen", 2009

[4] Song Yan, Jiang Xiao-hong, Song Juan & Zhang Jian-xun, "Dynamic analysis of a chaotic vibrating screen".

[5] Design of machine element by V B Bhandari Book

[6]OLADEJI AKANNI OGUNWOLE of "Construction and Testing of a Dry Sand Sieving Machine Design,"

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

[8] Design standards - Mechanical engineering and Installations, M. Mottier

[9] Workshop Technology,Volume-1.2, Hajara Chaudhari.

[10] Joseph E. Shigley, Mechanical engineering design.

