Review of Multi-level Sand screening Machine and Analysis of Vibration mechanism

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ABSTRACT

Construction of buildings requires sand as an important ingredient Sand is used at different stages in construction right from the foundation to the finishing work i.e. plaster. This sand is needs to be screened properly for various stages in construction, i.e. size of sand for construction work is slightly coarse whereas that used for plaster work is fine. Conventionally screening is normally done manually using fixed screens or machines This manual process time consuming and laborious takes a lot of time and cost. It is also observed that the conventional machine prove of no or little help as the sand needs to be manually transported and material handling takes place twice to get different sizes of sand. The paper reviews a few machines and research in the same area then goes onto show the need and utility of an multi-screen machine for fully automatic multi-level screening and automatic vertically transportation with help of vertical screw conveyor mechanism. The critical part of the multi-level screening machine is the vibration mechanism and the input shaft and connecting rod of this mechanism for the given system power have been designed and analysis using Ansys work bench 16.0 has been done to prove the part safety.

Keyword : - *Sand screening , Vibration mechanism, Input shaft , Connecting rod*

1. Introduction

Civil construction cannot be devoid of use of sand as the sand becomes the integral part of the construction process. Sand is used at different stages in construction right from the foundation building work to the finishing work is decorative plaster. It is obvious that requirement of sand size and texture are different at different stages hence the sand that is available at the site is needed to be screened. Presently it is observed that the sand screening activity is done manually or in some cases with the aid of some machine. But these machines are single screen machines and thus only one size will be separated at a time hence it takes a lot of time and labor.

Taking this into consideration a variety of researches and developers have developed a spectrum of machines to solve this problem a few of them have been discussed in the section below.

2. Literature review :

[1] As per Mr. Pranit S. Patil , the research work embodied the design and development of a conceptual model of a machine that was capable of performing multiple operations simultaneously, at the same time the machine should excel in productivity but keeping the cost low .The authors used a scotch yoke mechanism with two bevel gear sets for transmission of power at two locations, . This machine simultaneously operated two shafts from a single source with the objective to conserve electricity (power supply), reduce cost , increase in productivity, reduce floor space required by the machine

[2] As per Mr. Sai Karthik , Automation is the need of the time considering labor shortage , stringent labor laws , and the most labor intensive industry being the construction and foundry industry where sand seiving is must . Thus wither industry have opted for fully automatic sieving machines. But the small scale foundries and low level contractors are cannot afford this high end technology and hence require low cost methods and machine .Authors

describe the sieving process using a rectangular mesh with slight inclination as laborious . Authors not that there are different machines that are being used for sand sieving and cement mixing processes and in their concept both the process will took place simultaneously thereby eliminating the time consumed during the whole process of preparing the concrete is reduced.

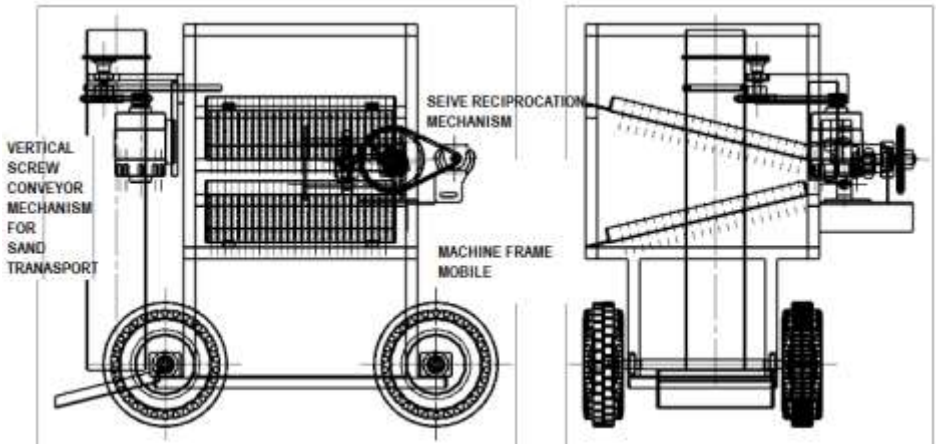
[3] As per Mr. OLADEJI AKANNI OGUNWOLE , Quality of the casting, depends upon the size distribution so a sieve analysis needed to be performed on any type of non – organic or organic granular materials including sands, crushed rock, clays, soil, granite, feldspar and coal, a wide range of manufactured powders, grains and seeds, down to a minimum size depending on the exact method. Author identified the article sizing as the most important parameter and so with the view to expedite the process andl increase the production rate of cast products instead of the use of the manual traditional way of sand throwing method through a mesh tray more over up to six different sand sizes can be sample at a time depending on the arrangement of the trays. The author observed that this design could take four different sizes of sand grains, meaning four different sizes of mesh arranged in layers of preference, from coarse on top to the finest at the bottom.

[4] As per Mr. Nachimuthu A.K , for characterizing the particle size distribution of a sample a sieve is a device for separating wanted elements from unwanted material that uses a woven screen such as a mesh or net. Authors have focused in their design on , fabrication of the mechanical part of machine and the system of the sieve machine. Criteria such as strength, safety and mechanical system needs to concern some other ergonomic design were used to achieve fully fucntional sieve machine body structure

2.1 Literature Gap

From careful stud of the literature pertaining to the problem of sand seiving that variety of solutions have been offered but the research seldom addresses the problem of screening multiple sizes at the same time. Keeping this in view a special machine needs to be designed that will screen at least two or more sizes at a time thereby saving a to of labor and cost.

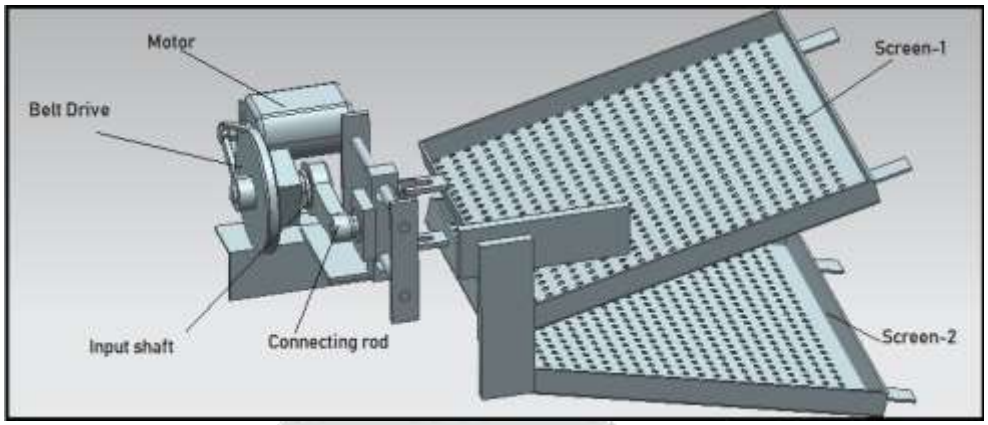
3. Proposal of Multi-level Screening machine with Vertical sand transportation mechanism



The multi level screening machine is proposed with two basic mechanism namely:

a) Multi- Level Vibration mechanism :
b) Vertical Sand transportation mechanism

In this paper major focus has been given on the design development and analysis of critcal components of the multi-level vibration mechanismnamely the crank and connecting rod. The vibration mechanism is as shown below:

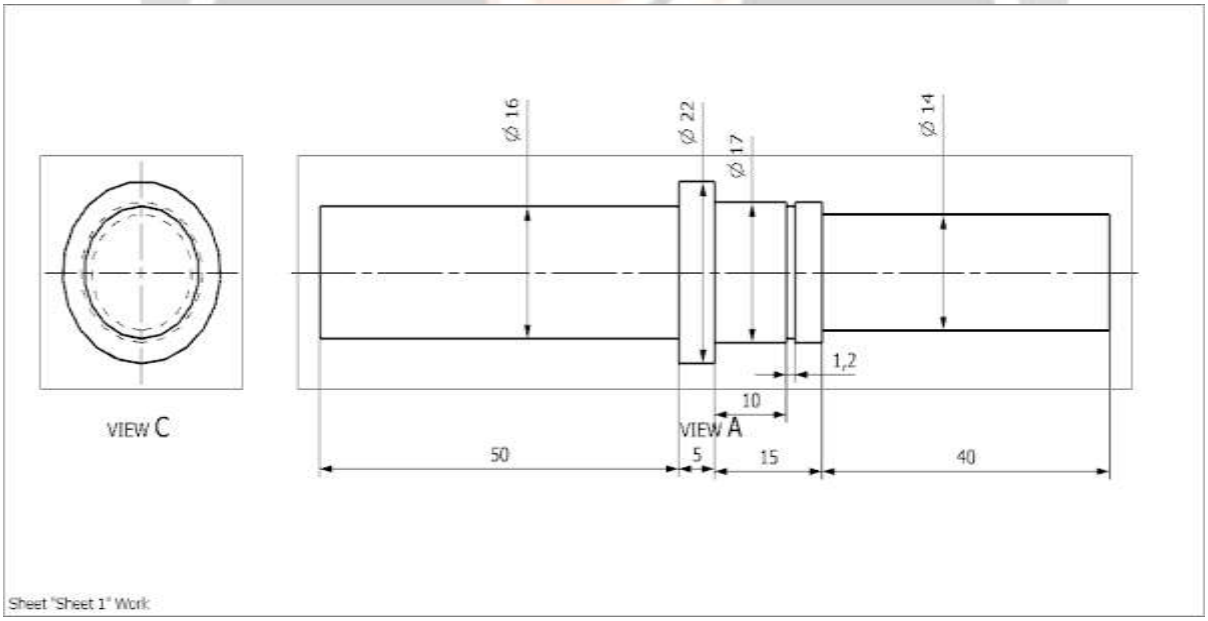


DESIGN

INPUT DATA

ELECTRIC MOTOR DETAILS
POWER= 100 WATT
SPEED = Variable(0-9000)rpm
Design Torque (Tdesign) = 1.28 N.m

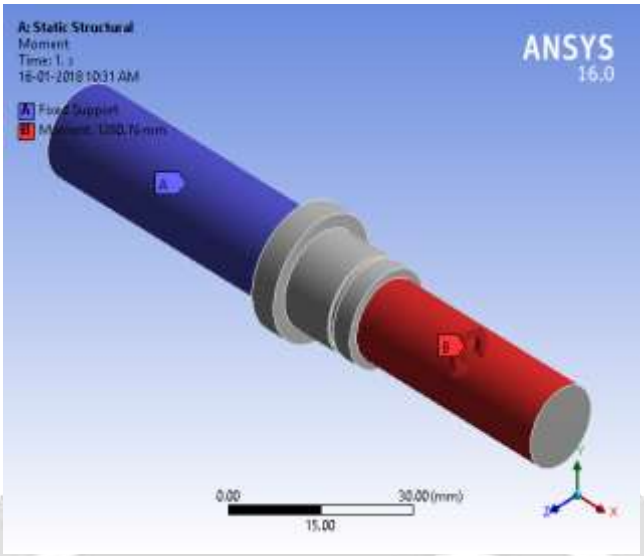
3.1DESIGN OF INPUT SHAFT



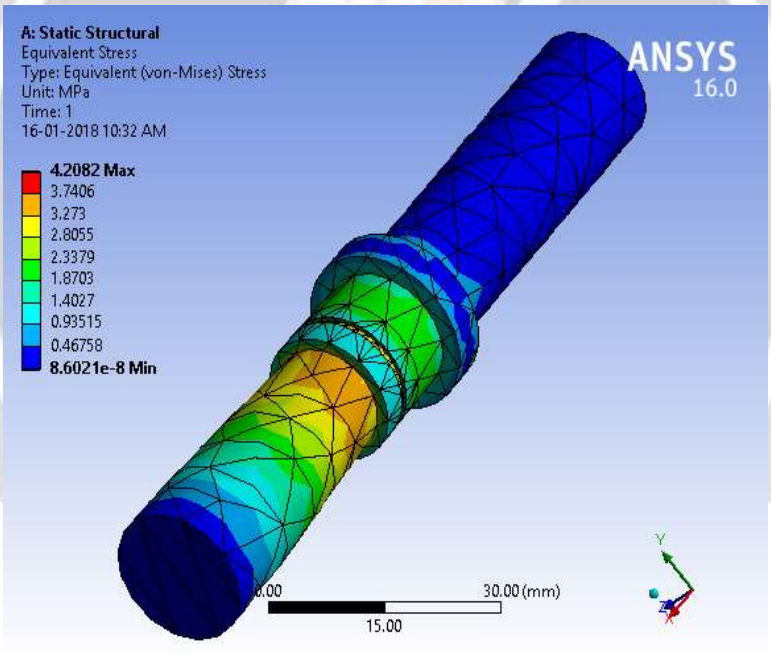
Material of shaft EN24 allowable stress =144 N/mm^2
$\Rightarrow$ T design = 1.28 Nm
Maximum theoretical torsional shear stress (f_{act}) = 2.37 N/mm^2
As; $fs_{act} < fs_{all}$, Input shaft is safe under torsional load.

Analysis of input shaft :

Geometry was developed using Unigraphix Nx-8 and step file was imported to Ansys work bench and loading was applied as below :

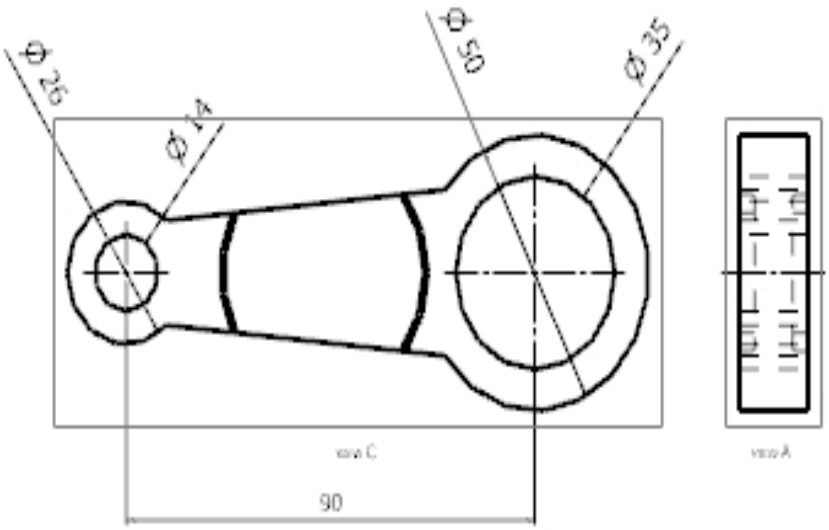


The shaft is fixed at the pulley end and the torque of 1.28 N-m is applied at the end where eccentric is mounted

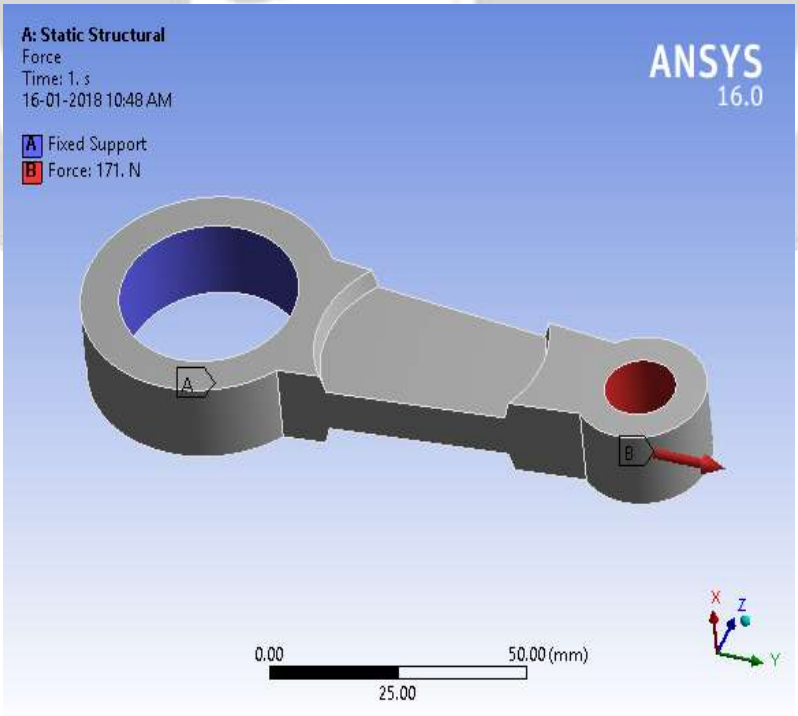


The maximum von-mises stress induced is 4.2 Mpa which is well below the permissible limit hence the input shaft is safe

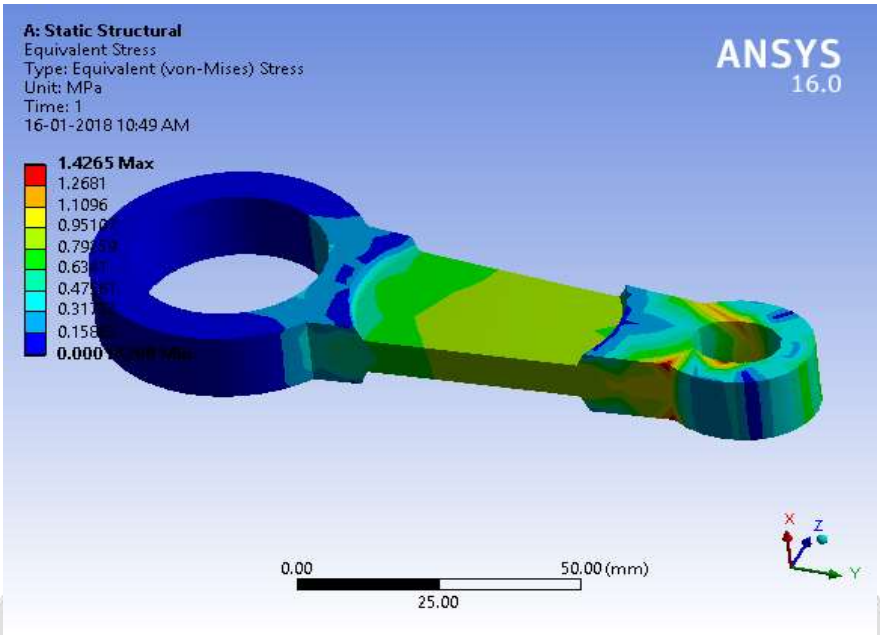
3.2 Design & Analysis of Connecting Rod :



Material of connecting rod EN9 allowable stress =90 N/mm^2
$\Rightarrow$ Force for design =171 N
Maximum theoretical tensile stress (f_{act}) = 1.1 N/mm^2
As; $fs_{act} < fs_{all}$, Connecting Rod is safe under tensile load.



Maximum pull force of 171 N was applied



The maximum von-mises stress induced is 1.4265 Mpa which is well below the permissible limit hence the connecting rod is safe

4. CONCLUSIONS

After careful review of literature it was found that no specific solution to separate different sizes of sand at the same time was not available. Thus a innovative solution in the form of multilevel screening machine was proposed. The machine was categorized into two parts namely the multi-level screening and vertical transportation. The multi level screening mechanism critical components were identified as namely the input shaft and connecting rod. Both parts were designed by either theoreticl method and then static tructural analysis using Ansys Work benh 16.0 , both parts were found to be safe as the actual stress induced by both methods was far below the allowable value.

5. ACKNOWLEDGEMENT

In the due course of project with the valuable guidance of Guide. Prof. Swapnil Bandgar. the project was completed as per schedule and desirable results were achieved.

6. REFERENCES

[1]. Multipurpose Sand Screening Machine
.Mr. Pranit S. Patil1, et.al , International Advanced Research Journal in Science, Engineering and Technology
[2]. Design and Fabrication of Sand Sieving and Cement Mixing Machine Sai Karthik [3]. Design, Construction and Testing of a Dry Sand Sieving Machine, Oladeji Akanni Ogunwole Journal of Multidisciplinary Science & Technology Volume: 01 Issue: 03 | July -2016
[4].. Design and Fabrication of Horizontal Sieving Machine, Nachimuthu A.K et International Research Journal of Multidisciplinary Science & Technology Volume: 01 Issue: 03 | July -2016.