Design and Fabrication of Cam Operated Multiple Vibrating Screening Machines

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Abstract— This paper includes use of operated on cam as well as follower multi-level vibrating screening machine. Cam & follower is used to give reciprocating motion for screens. Generally, in vibrating machine only one screen is used, but in this phenomenon more than two screens are used for improving the performance. The amplitude of vibration or the frequency i.e. the number of stroke of vibration per minute can be varied which helps to apply desired vibration to the given grit; this improves the quality of powder produced as well as the rate of production. Machine is compact hence occupies less space as compare to the conventional machines.
Keywords: Design and Fabrication, Cam Operated Multiple Vibrating Screening Machines

I. INTRODUCTION

A vibrating screen is a mechanical tool used to separate solids, liquids and powders. Industries such as mining, chemical companies and construction firms utilize these tools to sort and clean items. Using gravity, motion and mesh screens, these tools perform the work of several people in a fraction of time.

A vibrating screen separator is roughly the size of a metal garbage dumpster. It is constructed, many times, of a solid metal such as steel and has two open sides so users can visually monitor the progress of the screen. Most vibrating screens have four or more levels of screens stacked on top of one another. The screens are made of wire mesh and come in a variety of sizes in order to accommodate different jobs.

The mining industry is one of the biggest users of vibrating screen technology. Taking ore and minerals from the ground results in many impurities, so these organizations load goods into a screen until dirt and non-valuable rocks are shaken from material such as coal, iron and ore. Screens also are utilized in manufacturing, especially when metal items, such as ionized bolts and screws that need to be submerged in a bath, need to be dried. Here, full containers of liquid and metal can be poured through the screen and separated with the vibrations to ensure that they dry completely. Disparate industries such as archaeology, metallurgy and construction also utilize vibrating screen technology to get their jobs done.
Types of Vibrating Screen:

1) Circular Vibrating screen.
2) Drum type Screen.
3) Rotary Vibrating Screen.

A. Objectives of Project:

1) To design cam operated vibrating screen machine`
2) To check performance of cam operated vibrating screen machine.
3) Analysis of cam operated vibrating screen machine.

II. WORKING

When motor is started input shaft rotates, this rotates Cam shaft about the axis by the application of belt power transmission. Thus the Cam which is connected to the shaft pushes the follower. The end which is connected to the slider causes the slider pin to reciprocate on the slide.

The slider pin carries the strokes from bar mounted on the one end. As the slider pin slides on the slider the Screens are oscillates by the Cam motion thereby imparting vibrations to the grit connected at the other end. The amplitude and frequency of vibrations to the grit can vary by changing the speed of cam rotation speeds. Provision can be made to operate one or more grits simultaneously.

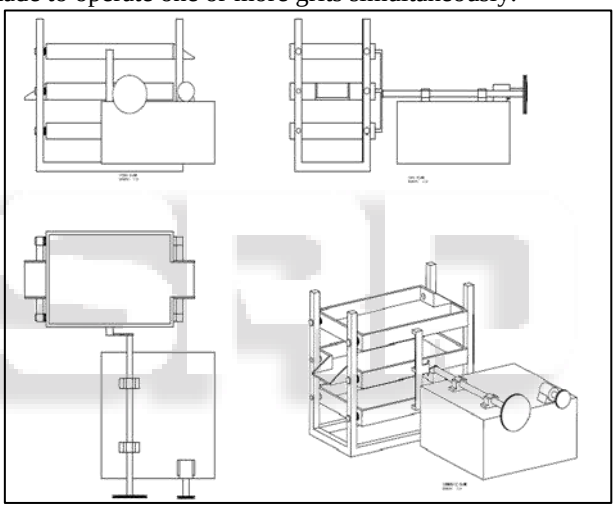

Fig. 1: Schematic Diagram of Model.

III. CONSTRUCTION

A. Motor

The electric motor used in the machine has the following specifications.
230 V, 50Hz
Power= 1/15hp (50 watt) SPEED = 0-8600RPM
Motor Torque T = 0.0555N-m.
Motor pulley diameter = 20 mm
Input shaft pulley diameter = 60 mm
Reduction ratio = 3
Speed of IP shaft pulley = 8600/3 =2866.67 rpm

In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and winding currents to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.

B. Pulley

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt along its circumference. Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power. In nautical contexts, the assembly of wheel, axle, and supporting shell is referred to as a "block."

The pulley used is a standard FZ section pulley selected as per the belt. The pulley acts as a reduction pulley i.e., it reduces the speed for the motor pulley to the input shaft thereby amplifying the torque

C. Main Shafts

As torque carriers, drive shafts are subject to torsion and shear stress, equivalent to the difference between the input torque and the load. They must therefore be strong enough to bear the stress, whilst avoiding too much additional weight as that would in turn increase their inertia. Material of shaft is MS. M.S. has carbon content from 0.15% to 0.30%. They are easily weld able thus can be hardened only.

To allow for variations in the alignment and distance between the driving and driven components, drive shafts frequently incorporate one or more universal joints, jaw couplings, or rag joints, and sometimes a splinted or prismatic joint.

The main shaft is steel member that carries the reduction pulley at one end and the Cam shaft. The shaft is supported in two pedestal bearings at the two ends.

D. Springs

The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.

E. Screen

Screen is nothing but a net with holes smaller than the size of the powder that we desire to screen. This screen will hold the desired powder and drop the undesirable small size powder on top the next screen

F. Belts

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel.

Velocity of belt is given by;
V=11.257m/s
To find out tension in the belt is
F1= 1.9568F2
F2 = 4.6416 N
Mass of belt per unit length is given by
m= 0.0285 kg/m
Centrifugal force in belt is given by,
Fc = 3.61152 N

G. Frame

This is the base of the machine on which the entire arrangement is fitted. This is made from MS (Mild Steel)

H. Grit

Grit is nothing but a net with holes smaller than the size of the powder that we desire to separate. This grit will hold the desired powder and drop the undesirable small size powder on top the next grit.

M.S. has carbon content from 0.15% to 0.30%. They are easily weldable thus can be hardened only

I. Cam With Flat Follower

Least radius of cam = 20 mm
Ascent lift = 20 mm
N1= speed of motor shaft=8600 rpm
N2=speed of shaft pulley=2866.67 rpm
D1=diameter of motor pulley=20mm
D2=diameter of shaft pulley=60 mm
Speed of cam shaft = 2866.67 rpm

IV. ADVANTAGES AND APPLICATIONS

A. Advantages:

1) The level of vibration is changed in the machine which enables to vibrate the grits
2) Placed at different levels one by one or at the same time.
3) The amplitude vibration or the frequency i.e., the number of strokes of vibration per Minute can be varied which helps to apply desired vibration to the given grit; this improves the Quality of powder produced as well as the rate of production.
4) Machine is compact hence occupies less space as compared to the conventional machines.
5) Low cost of machine.
6) Fast production rate.

B. Applicable industry &application example

1) Food:
sugar, salt, alkali, gourmet powder, starch, milk powder, yeast powder, pollen, food additive, bean milk, juice, coffee, flour, seeds, grain, etc.

2) Chemical:
Resin pigment, medicine, grease, paint, palette, etc.

3) Abrasive material and ceramic:
Building sand, mica, alumina, abrasive, refractory material, slurry, etc.

4) Paper-making:
Coated slurry, exhaust liquid, paper making liquid and waste water reclamation, etc.

5) Metallurgy and mining:
Quartz sand, ore, titanium oxide, zinc oxide, etc.

6) Mechanical:
Casting sand, powder metallurgy, electromagnetic material and metal powder, etc.

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