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To Redesign Magnetic Conveyor System into Oscillating System for Thermoset Powder Coating Machine to Overcome its Various Problems in Mild Steel Buckles

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Abstract:
Our area of interest is in the field of design and development of the oscillating material handling system to thermoset powder coating of mild steel buckles. It is very broad field encompassing many aspects of science and engineering especially in industries. This research paper shows the mechanical design of thermosetting powder coating machine. In this first of all the magnetic conveyor system in replaced by the oscillating material handling system in which two problems of magnetic systems are overcome and by doing some differences we can get powder coating in the oscillating material handling system. The mild steel buckles are first come from heaters which are heated about 350C-400C then they are going to the oscillating material handling system and powder is coated there. The oscillating material handling system is mainly run by the vibratory shaft is fitted in the bucket. By the vibratory shaft the vibration and noise occurs to prevent that the base in jointed with springs. We have opportunity to work with a faculty on a wide range of topics and to make fundamental contributing to this evolving field. For the oscillating material handling system, the circular vibrator is used. The circular is the type of mass finishing manufacturing process used to deburring, radius, descale, boorish, clean and brighten a large number of relatively small workpieces.

Keywords: Oscillating Material handling system, Vibratory motor, Heat treatment, Powder coating, Mild steel buckles

I. INTRODUCTION

Now days, oscillating transmission machine are widely used in metallurgy, coal, chemical building material, mining, machinery manufacturing industries, light industry, food. Material handling equipment plays an irreplaceable role in industrial automation. Oscillatory conveyor is a mechanical vibration system controlled by inertia vibrator. Although the oscillatory type vibrating machine has high efficiency, the slop of the curve is very deep. In regular operation the load of the vibration can be changed from 0 to 100%, sometimes it can be overloaded. The numbers of motor revolutions can also be varying. The changes of the stiffness main spring cause vibration are also hard to avoid. Vibratory finishing is a type of mass finishing manufacturing process used to descale, clean, brighten a large number of relatively small workpieces. In this batch type operation specially shaped pellets of media and the workpieces are placed into the tub of a vibratory tumbler. Heat treatment is group of industrial and metal working process used to alter the physical and chemical properties of material. Heat treatment process includes annealing, case hardening, tempering, normalizing and quenching. In this paper we carried out the heat treatment on the mild steel buckles. The heat treatment process used for the powder coating process in the thermostat powder coating process.

II. PROBLEM DEFINATION

Here in the problem definition first used system is magnetic conveyor system and in this system there are two problems i) buckles are stick together in powder coating process due to heating of buckles shows in fig.1 and, ii) the drawback of buckles are done due to magnetic conveyor belt shows in fig.2. In this research paper we know how to overcome this problem.

Figure.1. Slicked Buckles

Figure.2. Drawback of Buckles by Magnetic Conveyor System

III. DESIGN OF OSCILATING MHS

a. Design Calculation of spring

Input parameters: -

Load P=200kg=2000N (Including powder + Motor)
No. of spring N=8
Spring Index C=D/d=6
No. of Turns n'=9+1=10

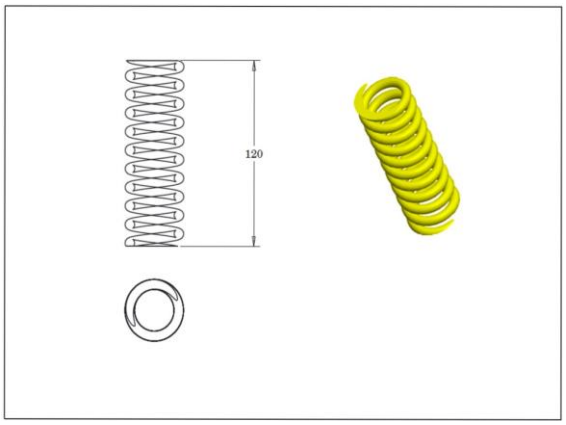


Figure.3.-Design of Spring

Load Per Spring p'=P/N=2000/8=250N
K_S = (4C-1)/ (4C-4) + (0.615)/C
Shear stress $\tau = K_s 8PC / \pi d^2$
$d^2 = Ks8PC / \pi \tau = 6.18mm$
Now,
D = 36 mm
D_0 = 36 + 6 = 42 mm
$\delta = 8PD^3n / Gd^4$
$G = 8PD^3n / \delta d^4 = 64{,}800\ N/mm^2$
As per standard size of spring,
d = 6mm
Pitch = 13mm
n =10

b. Design Calculation of Vibratory Shaft

Converting above unbalance part into balance part, we have to add balancing mass m_b at the center of the shaft at distance r = 100 mm,

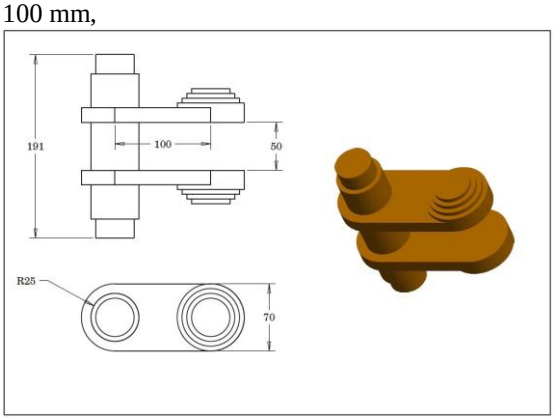


Figure.4. Design of Vibratory Shaft

$m_b\omega^2 r = m_1\omega^2 r + m_2\omega^2 r$
$m_b = m_1 + m_2$
$m_b = 0.5 + 0.5 = 1kg$

Where,

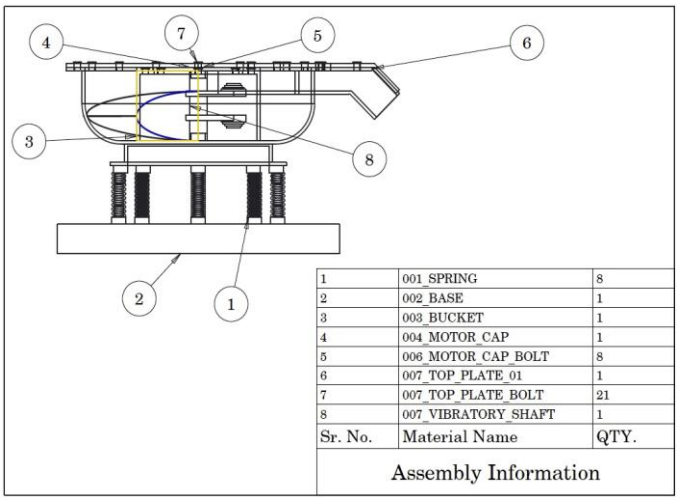
m_1=Unbalance mass 1, kg= 0.5 kg
m_2=Unbalance mass 2, kg= 0.5 kg
m_b=Balancing mass, kg
ω = Angular velocity, rad/sec
r= Radial distance for center line
K=damping factor

Taking frequency f_n= 15Hz
m = balancing mass = m_b = 1kg
$K = 4\pi^2 m f_n^2$
K=98.69 N/mm

For that much Frequency angular velocity will be
$f_n = (1 / 2\pi) * (k/m)^{1/2}$
$\omega = 2\pi f_n = 314.15$ rad/s
and rpm will be
$\omega = 2\pi N / 60$
N=3000rpm

We required frequency only
20Hz to 30Hz
ω will be 1200 rpm to 1800rpm
K will be 15.79 N/mm to 35.53 N/mm

IV. BILL OF MATERIAL



Sr. No.	Material Name	QTY.
1	001_SPRING	8
2	002_BASE	1
3	003_BUCKET	1
4	004_MOTOR_CAP	1
5	006_MOTOR_CAP_BOLT	8
6	007_TOP_PLATE_01	1
7	007_TOP_PLATE_BOLT	21
8	007_VIBRATORY_SHAFT	1

Assembly Information

Figure.5. Bill of Material

V. 3DIMENSIONAL MODELLING

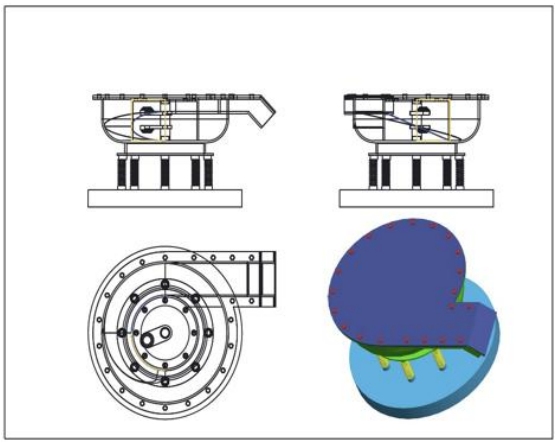


Figure.6. 3d Model

VI. RESULT & DISCUSSION

In existing machine we can produce 10000 buckles per hour compare to that in new machine we can produce 13500 buckles per hour. In old machine we can produce 80000 buckles per day compare to old machine in new machine we can produce 108000 buckles per day.

After all the wastage of powder in old machine per day are 8000 buckles and for the new machine the wastage of powder in 5400 buckles per day. The powder use per day in old machine is 8000gram and powder used per day in new machine is 4500gram per day

Table.1. Result and Discussion

	Production Per Hour	Production Per Day	Waste Per Day	Powder Use Per Day in Grams
Old Machine	10000	80000	8000	8000
New Machine	13500	108000	5400	4500

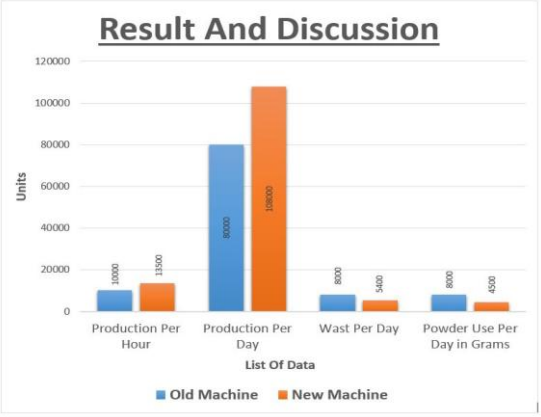


figure.7. Result And Discussion

figure.8. Existing Magnetic Conveyor System

Figure.9. Redesigned and developed system

VII. CONCLUSION

From this project we learn design of spring and some other parameters like vibration motion, different types of circular vibrators, use of that vibrator for different purpose, different types of conveyor systems and their uses, calculation of vibrating frequency for vibrators, different types of powder coating process, different types of powder coating powders, etc. From this project we also learn the different types of difficulties occur in powder coating process of small parts.

VIII. ACKNOWLEDGEMENT

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