DESIGN AND FABRICATION OF COATING POWDER FILTRATION MACHINE

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ABSTRACT : The paper is about fabrication of coating powder filtration machine. Coating powder is mainly used to coat the job in various manufacturing industries. After coating the job some amount of powder has been wasted, while it is necessary to prevent this powder for further reused. So the powder coating filtration machine is mainly focused on the reused of coating powder and save some amount of powder which leads to cost effective. After that the amount of powder which is save filter by using sieving process This mechanism is based on cyclone and sieving process which plays an important role in mechanism. Cyclone is one of the simplest and cheapest type of separator. Cyclone has high efficiency and relatively economic in power. Cyclone have been widely used in industrial process. The literature review that the cyclone efficiency is depends upon the size of the particle of powder. The input velocity of air directly impact on the fan energy and powder collection. This paper have discussed the process of powder extracting from manual powder spray booth in the first chamber with a cyclone recovery system. The cyclone cleaned air drawn from pre filter section by fan. The pre filter section further separate powder from cyclone air. Collection of powder without loss of coating powder and filter the coating powder by using sieving process with less time consumption.

I. Introduction

Onkar furniture is one of the industry which is situated in hingana location works for coating the equipment's required in hospital like bed, cabinet etc. They used coating powder cyclone to save powder but they have faces some problem regarding the powder filtration process which is done by manually. So they require some automatic process for the filtration of waste coating powder to save capital, labour cost and time. So observed the problem and decided to do this process of sieving by automatically.

The powder coating is a coating which is applied on the job in the powder form it does not require any liquid carrier while the paint. It is dry paint which gives almost good finished product or material. The powder may be a thermoplastic or a thermo set polymer. It is usually used to create a hard finish that is tougher than conventional paint powder coating mainly used for coating of metals, such as household appliances, aluminium extrusions, drum hardware and automobile and bicycle parts. There are so many industries where coating powder get waste during operation of spraying powder and after operation this powder get mixes with the foreign particles, dust, dirt, and various impurities. For this workers are needed for the filtration of powder which leads the labour cost and time consumption. To overcome this problem it is needed to design and fabricate such a mechanism which will do the above operation automatically.

Figure 1.1 :- Manually sieving process

II. SCHEMATIC DIAGRAM OF PROPOSED MECHANISM

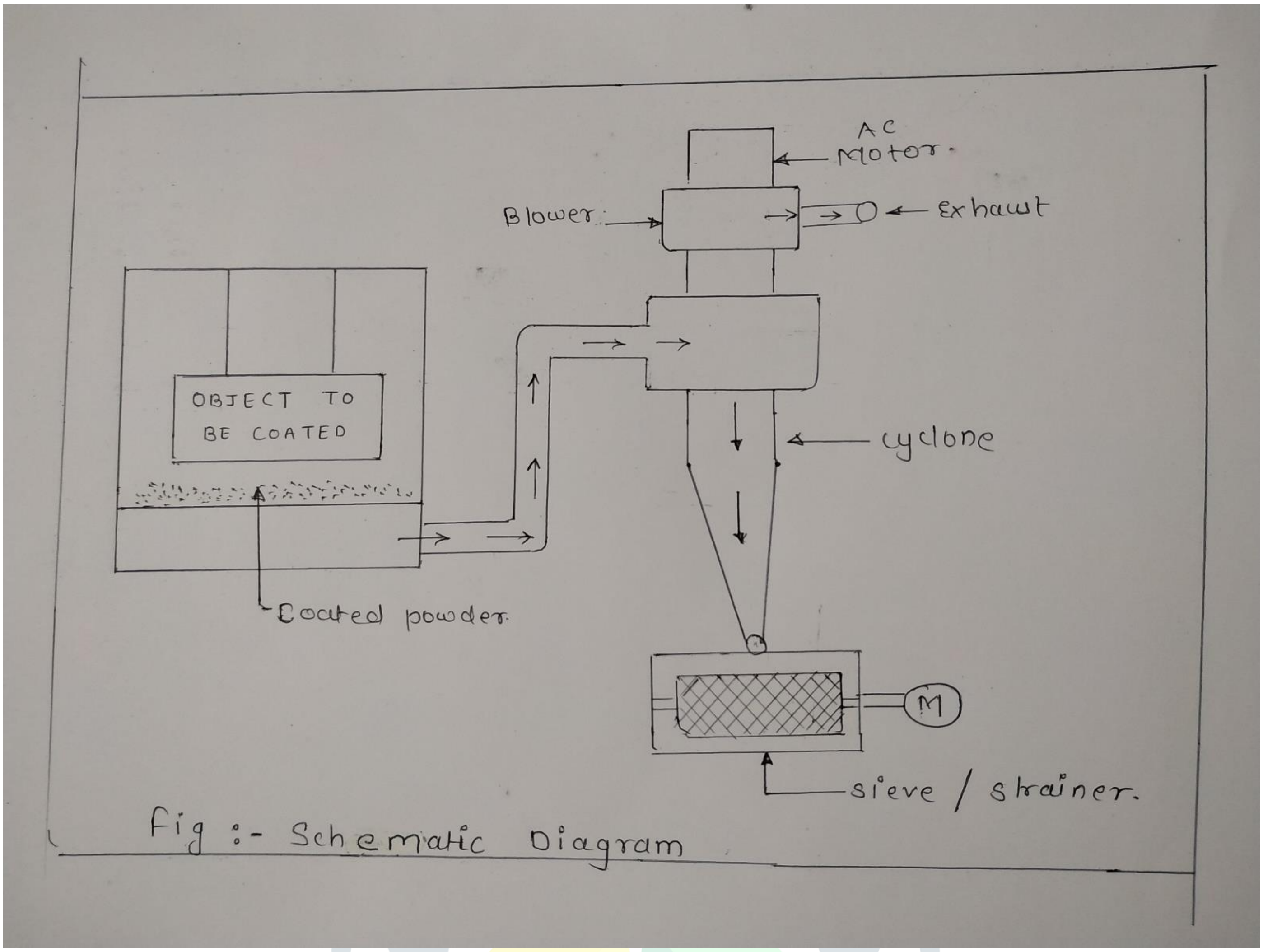


Figure 2.1 :- Schematic diagram of coating powder filtration machine

III. WORKING PRINCIPLE

The input to the cyclone is connected to the booth while the output is connected to a suitable exhaust fan. The overspray powder arrives at the cyclone inlet.

On entering the cyclone chamber tangentially the air/powder mixture is given a rotary motion which creates a centrifugal force on the particles. The larger and heavier particles tend to be ejected to the outside walls of the chamber and fall to the bottom where they are collected. The lighter fractions will stay suspended in the air stream which on reaching the bottom is deflected by a conical tail air/powder mix into a rising spiral which is then carried through the central stack to a filter collector. The recovered powder is then pass through the sieve mechanism to remove any foreign particle or dust. This process of sieve mechanism is done after the collection of coating powder and then filter. After researching one conclusion is made in which other model has no filtration system only they separate the powder or dust so the filtration system in cyclone unique and should be implement.

IV. DESIGN CALCULATION

Overall dimensions are taken from the proposed planed mechanism
Given:-
Outer diameter of cyclone body barrel (D) :- 0.127m
Length of the Body (Lb) = 2D = 0.254
Length of the Cone (Lc) = 2D = 0.254
Height of the Inlet (H) = D/2 = 0.0635
Width of the Inlet (W) = D/4 = 0.0317
Diameter of inlet Pipe (d) = $A = \pi r2$ = 3.14*(0.0635) = 0.1993
Diameter of Gas Exit (De) = D/2 = 0.0635
Diameter of Dust outlet (Dd) = D/4 = 0.0317
Length of vortex Finder (S) = 0.625
Total length of cyclone (Lb+Lc) = 4D = 0.508

[4.1] Blower Calculations

Blower calculation given by the velocity of air at inlet is equal to the volumetric flow rate of blower to the width of inlet and height of inlet

Volumetric flow rate of Blower=0.058 m3/s
Velocity of Air inlet Duct = V i= Q/WH
= 0.058/0.0317 x 0.0635
= 28.81 m/s

Where
Q = volumetric flow rate of blower
W = width of inlet duct
H = height of inlet duct

[4.2] Number of Effective turn

The number of effective turns in a cyclone is the number of revolutions the powder spins while passing through the cyclone outer vortex. A higher number of turns of the air stream result in a higher collection efficiency.

$$N_e = \frac{1}{H}\left[L_b + \frac{Lc}{2}\right]$$

Ne = 1/0.0635[0.254+0.254/2]
Ne = 6

Where
N = number of turns inside the device
H = height of inlet duct (m)
Lb = length of cyclone body (m)
Lc = length (vertical) of cyclone cone (m)

[4.3] Gas Residence time

To be collected, particles must strike the wall within the amount of time that the gas travels in the outer vortex. The *gas residence time* in the outer vortex is

Δt = πDN/Vi
= 3.14x0.127x6/28.81
= 0.08 Sec

Δt = time spent by gas during spiraling descent (sec)
D = cyclone body diameter (m or ft)
V_i = gas inlet velocity (m/s or ft/s) = Q/WH
Q = volumetric inflow (m^3/s or ft^3/s)
H = height of inlet (m or ft)
W = width of inlet (m or ft).

[4.4] Pressure Drop

The first step in this approach is to calculate the pressure drop in the number of inlet velocity heads (H) by equation The second step in this approach is to convert the number v of inlet velocity heads to a static pressure drop (ΔP) by equation

$\Delta P = \alpha \rho Vi^2/2$
α =16 HW/De^2 =16x0.0.635x0.317/(0.635)2 = 7.987
ΔP = 7.987x1.22x28.81/2 = 140.36 Pa

Where

Hv = pressure drop, expressed in number of inlet velocity Heads

K = constant that depends on cyclone configurations and
Operating conditions (K = 12 to 18 for a standard tangential-entry cyclone)

[4.5] Power Requirement

$$W_f = Q\Delta P$$

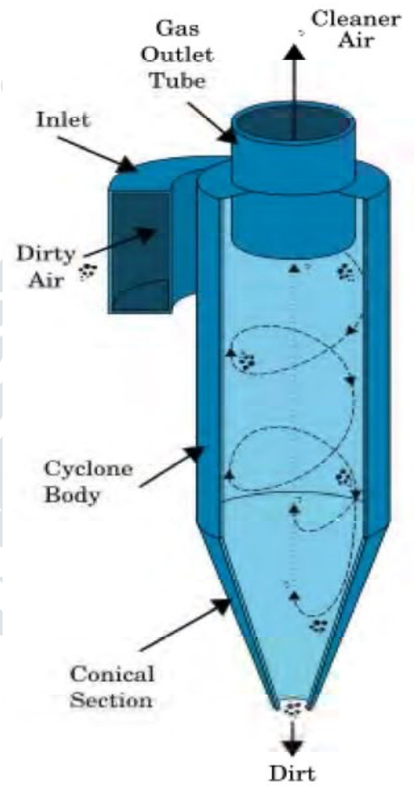
= 0.058x140.36

W = 8.14 J/sec

V. FABRICATION

The cyclone design made up in cooper and alloy. The shape of cyclone is design by Scientist Lapple known as Lapped model this model has several problem but some engineers considerable to be acceptable. First of all develop the dimensions which mainly used while fabrication process. Considering cyclone inlet velocity for optimum cyclone performance also calculate number of turns, flow direction, overall efficiency. The function of cyclone barrel diameter is equivalent to principle dimensions which is provide by cyclone. With this all given standard data we have to fabricate the model in step by step manner. While fabricating the model of cyclone always consider accurate dimensions, efficiency and size of particle (i.e. powder size).

VI. PROPOSED CAD MODEL OF CYCLONE :-



VII. ADVANTAGES OVER EXACTING MANUALLY SIEVING PROCESS :-

[1] Manually operated sieving process of coating powder can be done by automatically.

[2] Powder can be easily filter with the maximum efficiency without any human interference.

[3] As the process will automatically work with the help of motor power, leads to be reduce labour wages and enhance the productivity.

[4] Filter powder can be reused again with help of sieving mechanism.

[5] Wastage of coating powder may prevent

[6] The complete automatic operation will leads to save more time consumption.

VIII. CONCLUSION

Manually operated sieving process of coating powder is now done automatically by using D.C motor and sieve. Coating powder easily filtered by sieve mechanism it resulting into the less time consumption. So the labour cost also reduced and enhance the productivity by the use of powder again and again. Wastage of coating powder also prevent by using this mechanism and this complete automatic machine save more time and cost.

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