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Design of Screw Feeding System with Shaft less Fights Bending Analysis in Earthen Pot Making Equipment

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ABSTRACT

New Product design for material transfer with customized and optimized parameter is carried out in this work. Conventional screw feeder or screw conveyor idea is taken with its functionality instead it's a shiftless functioning here.While designing care has been taken that no bending will form while working actual in process. For that new anti-bend mechanical support is added that is to help as a central support for shaft less flights also to make feasible coupling with drive geared motor. All these work carried out with CAD and taken validation on CAE tool.

Keywords— **Cad, CAE analysis, Flights design, Screw feeder**

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I. INTRODUCTION

Proposed project is designed for the customized earthen pot making system automation. A typical screw conveyor is considered for this with changing the flow medium in the process accordingly flights and its parameters need to be designed. Clay feeding needed when the clay of multiple densities is processed through crusher and magnetic screening machine. Instead of typical feeder we are going to design the screw structure without shaft. Shaft less screw idea is governed from spiral material flow system. This screw exist after this crusher to make feeding of the material in further processing machineries in the plant. The screw conveyor is one of the oldest methods of conveying materials known to mankind with the original design dating back to more than two thousand years. Since the screw conveyor came into general use a little over a century ago for moving grains, fine coal and other bulk material of the times, it has come to occupy a unique place in a growing area of material

handling processing. Today, modern technology has made the screw conveyor one of the most efficient and economical methods of moving bulk material. Instead of typical feeder here going to design the screw structure without shaft. Shaft less screw will deliver more volume of material to outlet and more efficient in productivity. Project comes with the lightweight screw solution and innovation in material handling and feeding machineries in the plant. Screw conveyors are the compact and easily adapted to the congested locations. They can be used to control the flow of material in processing. The Screw conveyors are used to convey any type of bulk material and are found in thousands of applications. The major industries that utilize screw conveyors are Food processing, Mining and Minerals processing, Oil and Gas extraction and Agriculture production chemicals.

II. PROPOSED METHODOLOGY

a Instead of typical feeder here going to design the screw structure without shaft. Project comes with the lightweight screw solution and innovation in material handling and feeding machineries. The shaft less analysis of screw will be done here.

Here done the design of screw flights. The flights are designed by considering sheet metal design consideration and engineering parameters in sheet metal. The size and thickness of the sheet metal structure can be considered with ISO standard availability.

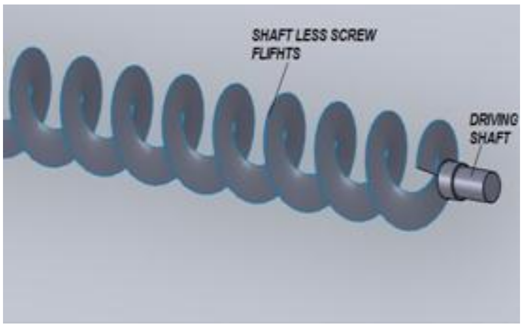


Fig. 1 Shaft less screw structure

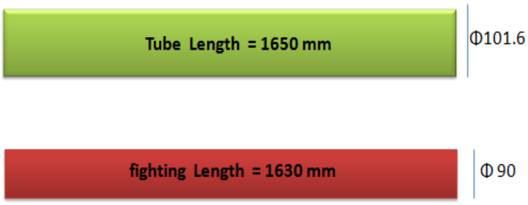


Fig.2 Flights diameter structure

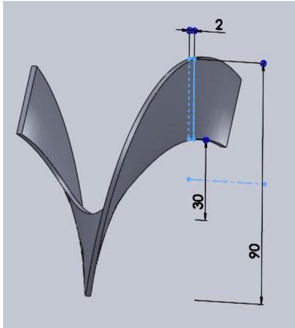
From Fig.1 Flights bending behaviour and stress values are to be validated. Also volume between two flights is to be calculated so that flow rate and diametric values can be decided accordingly. The fights need to be steady with the long length application. Hence the thickness may be varying accordingly length of the screw conveyor size.The figure shows the shaft less screw structure. Only small external driven and driving shafts present at the both sides of the flights to fit the bearing.

III. DESIGN & DEVELOPMENT

Flight diameter 90 means which is shown in fig.2 at least 60 % pitch must be taken to give easy spiral bend tothe sheet metal flight bending. Hence the maximum pitch is considering i.e. 80 mm.

A. Flight Implementation

The flights implementation is done in the CAD. The stages forming for the implementation of flights in CAD by using sweep command which is shown fig.3 and fig.4.



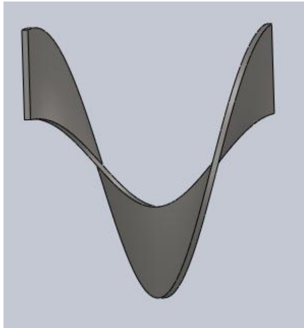


Fig.3. Sheet metal swept flight Fig.4. S haft less Flights

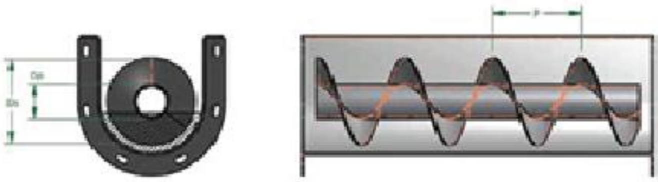


Fig.5. Screw structure

The design steps is carried out is as following. The mathematical steps are as following.

From the fig. 6

Ds- Diameter of Screw

Dp-Diameter of pipe

K - Trough loading

P- Pitch of Screw

$$\frac{c}{rpm} = [0.7854(Ds^2 - Dp^2)PK * 60]/30$$

Where c- cubic (feet per hour)

rpm- speed (revolution per minute)

No. of flights required to decide the length 1630/80= 20 units Volume of total inner tubular vessel $= r$

Density of flowing material (d) in kg/m3 ,

V= m/d,

Coefficient of friction =0. (Neglecting)

Total load = 29

F= 290 N

B. Design structure

The design structure of traditional screw is shown in fig. 6Iin the figure shows that sometimes shaft breaking problems occurs in the traditional screw conveyor.Hence the new conceptual model of screw conveyor is formed to solve the shaft breaking problem. The structure of new conceptual model is shown in fig. 7 at the below. This new model has many advantagescompared to traditional model such as low weight, lesstorque requirement. The model of screw is shown in fig.8 after installation of screw in machine.

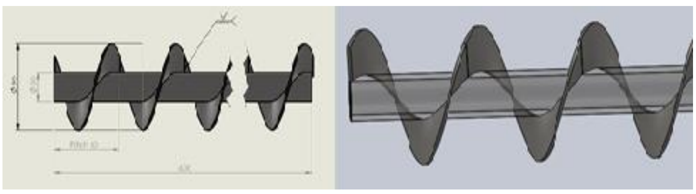


Fig.6. Traditional screw structure design.

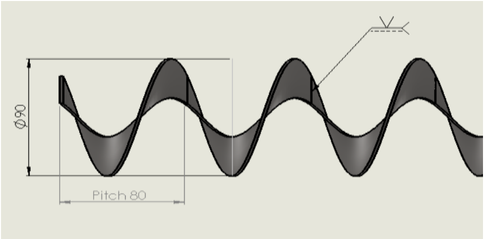


Fig.7. New conceptual design

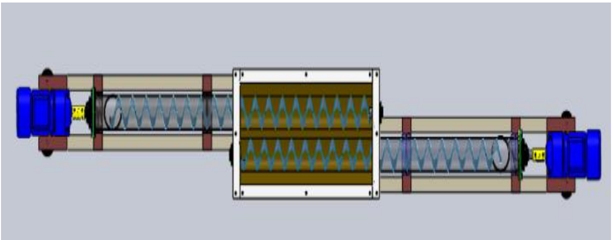
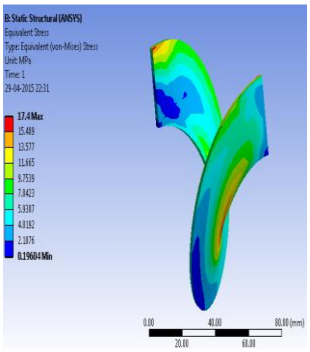


Fig.8. Machine structure after screw installation



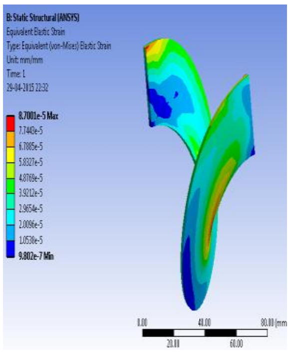


Fig.9. Stress result Fig.10. Deformation result

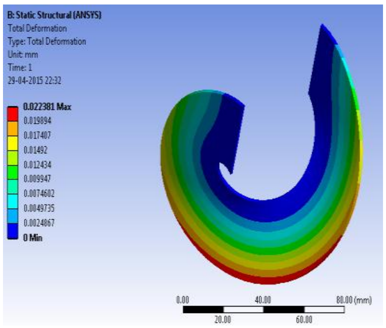


Fig.11. Total Deformation result

C. Flight Structural behaviour:

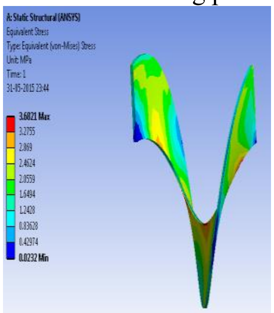
[a]For shaft structure:

The stress distribution shown in figure 9.Maximum stress 17.4 Mpa found after rotating condition with load on each flight individual. Maximum strain0 mm found after rotating condition with load on each flight individual which is shown in following figure 10.

The total deformation found in flight after welding is shown in figure 11. Two ends and edges are fixed with welding joint on another edge of same flight.

[b]For shaft less structure:

The below figure shows the stress distribution results for shaft less structure shown in figure 12. The shaft less structure deformation result shows in figure 13.The deformation result is too much hence it cannot be accepted. Because of the design will be failed due to too much deformation. Hence we need to provide central support for whole flight weldment. Instead of shaft it will work to occupy in smaller volume this central support we will call as “Central anti bending plate”.



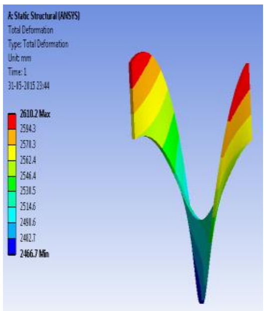


Fig.12. Stress result Fig.13. Deformation result

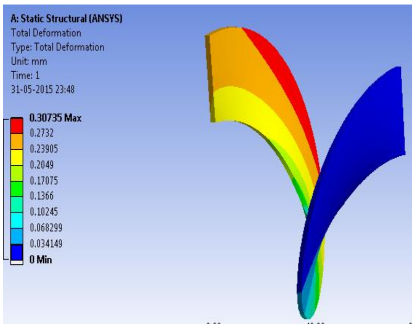


Fig.14.Deformation result

The figure.14 shows deformation result for shaft less structure by using central support instead of shaft.

IV.RESULT DISCUSSION

The deformation for shaft less flights is too much more hence we give central support shaft. The results for central support shaft or central anti bending shaft are maximum stress 3.6821 Mpa and the deformation is o.30735 mm. Hence design is safe. By using this type of screw conveyor feeder system the weight will be reduced and the required torque to push the feeding material is less. The output of volume will be more. This screw conveyor feeder system is simple Compared to conventional screw conveyor feeder.

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