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DESIGN AND ANALYSIS OF BELT CONVEYOR SYSTEM

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Abstract: In an assembling processing plant, crude materials and items should be transported starting with one machine then onto the next where material taking care of gear are utilized for simple, modest, quick and safe stacking and emptying with least human impedance. For example, belt transport framework can be utilized broadly to deal with of materials which may be past human limits as far as weight and tallness. This paper for the most part talks about the structure figurings and contemplations of belt transport framework for valve body, as far as size, length, limit and speed, roller measurement, power and pressure, idler separating, sort of drive unit, distance across, area and plan of pulley, control mode, planned application, item to be taken care of just as its greatest stacking limit all together guarantee quick, ceaseless and proficient development of valve body while keeping away from time for stacking and emptying of it physically. The structure of this belt transport has created plan information for modern uses in the advancement of a robotized belt transport framework which is quick, sheltered and productive.

Keywords: Belt Conveyor framework, Idler, Loading, Material dealing with gear, Unloading.

I. INTRODUCTION

The target of this examination work is to give plan information base to the improvement of a solid and effective belt transport framework that will diminish cost and upgrade profitability while decreasing stock issues. Transport framework is a mechanical framework utilized in moving materials starting with one spot then onto the next. It is less demanding, more secure, quicker, progressively proficient and less expensive to transport materials starting with one preparing stage then onto the next with the guide of material dealing with hardware then manual treatment of the items. Treatment of materials which is a critical factor in assembling as proficiency of material taking care of gear add to the execution dimension of a firm. In view of various standards of activity, there are distinctive transport frameworks in particular: gravity, belt, screw, basin, vibrating, pneumatic/water powered , chain, winding, grain transport frameworks and so forth. The decision relies upon the volume to be transported, speed of transportation, size and weight of materials to be transported, stature or separation of transportation, nature of material, technique for generation utilized.

II. LITERATURE REVIEW

[1] I. A. Daniyan discusseed the plan counts and contemplations of belt transport framework for limestone utilizing 3 moves idlers, as far as size, length, limit and speed, roller width, power and strain, idler dispersing, sort of drive unit, breadth, area and game plan of pulley, point and pivot of revolution, control mode, expected application, item to be taken care of aswell as its most extreme stacking limit all together guarantee quick, constant and productive development of pounded limestone while maintaining a strategic distance from end or fatalities amid stacking and emptying. The effective fulfillment of this exploration work has created structure information forindustrial utilizes in the improvement of a robotized belt transport framework which is quick, sheltered and productive.

[2] Devendra Kumar ,R.K. Mandloi present the paper on the Analysis and Prospects of Modification in Belt Conveyor - A Review. The survey of belt transport plan alteration and most recent advances or systems. The examination indicates diverse plan parameter required for various applications. A portion of the regular structure parameters required in every application and the significance of every parameter which impacts on various application. The attention is on strategies as Design change, Drum and pulley disappointments, Belt structure and its disappointment, vitality and proficiency, rubbing, review, activity and upkeep and flame and security

In this exploration paper I will figure structure parameters like Belt Dimension, Capacity and Speed, Roller Diameter, Belt Power and Tensions, Idler Spacing, Control by thinking of some as information like number of machines, length, width, stature of the belt transport with expecting a few information like speed of the belt transport dependent on inactive and machining time of the valve body machining tasks to give plan counts to the association for building up a belt transport framework out of it for the valve body.

III. DESIGN CONSIDERATIONS

The structure of a powerful and proficient material taking care of framework which will expand efficiency and limit cost, the rules typically pursued are:

1. Designing the framework for ceaseless stream of material (inactive time ought to be zero);
   - Total Number of machines = 9
   - Total task time = 43 min
   - Length of transport = 12 m
   - Height of transport = 0.5 m
   - Width of Belt = 160 mm
2. Going in for standard hardware which guarantees low speculation and adaptability;
3. Joining gravity stream in material stream framework; and
4. Guaranteeing that the proportion of the dead weight to the payload of material dealing with hardware is least.

The structure of belt transport framework includes assurance of the right element of the belt transport parts and other basic parameter esteems in order to guarantee ideal proficiency amid stacking and emptying conditions. A portion of the segments are: Conveyor belt, engine, pulley and idlers, rollers, pneumatic chamber and so forth.

The plan of a belt transport framework considers the followings:

I. Measurement, limit and speed
ii. Roller measurement
iii. Belt power and pressure
iv. Idler dispersing
v. Pulley width
vi. Engine
vii. Kind of drive unit
viii. Control mode

Structure Parameters
- Velocity = 0.1 – 1.25 m/s
- Weight of item = 4 kg
- Force required = 39 N(F = mg)
- Power = 39*0.1 = 3.9 W
- Consider 25 inventories are on the transport line = 25* 4 = 100 kg
- F = 100*9.81 = 981 N
- Motor Power = 981*1.25/1000 = 1.22 KW = 1.63 HP

Structure Calculations
1) Diameter of rollers
v = d * pi (v = 0.1 m/s)
d = 0.0318 m
d = 31.8 mm

2) No of Revolutions(rpm)
n = v*1000*600/d*pi
n = 600 rpm

3) Load Torque required for driving a belt transport
T = 0.5d(F + Mu *W)
= 0.5*0.0318*(981+0.5*100)
= 23.38 Nm
Where Mu = coefficient of grating = 0.5-0.6
F = 9.81*100 = 981 N
d = roller breadth

3) Area of belt = L*T
Length = 12000 + 15.9 +15.9 + 12000
= 24032 mm
= 24.032 m
Territory = 24032 mm * 2 mm
= 48064 mm2
= 48.06 m2
Where T = thickness
4) Idler Spacing
- Total length = 12 m
- Idlers are set at 1m each
- Total number of idlers = 12

(Reason – Idlers are set at continuous dividing)
5) Control
Conservative Programmable Controllers also called application controllers can be utilized for the control of the framework.

Results:-
The followings are structured qualities were gotten for belt transport framework for valve body:-

Table 1: Design Values for Belt Conveyor System

S/N	Parameter	Values
1	Length of Conveyor(L)	12 m
2	Height of Conveyor(H)	0.5 m
3	Width of Conveyor(w)	160 mm
4	Power required to pull the wieght	3.9 Watt
5	Force	981 N
6	Motor Power	1.63 HP
7	Diameters of rollers	31.8 mm
8	No of revolutions(rpm)	600 rpm
9	Torque required	23.38 Nm
10	Area	48.06 m2
11	Belt Capacity	21081.6 kg/sec
12	Idler spacing	1 m

CAD Design

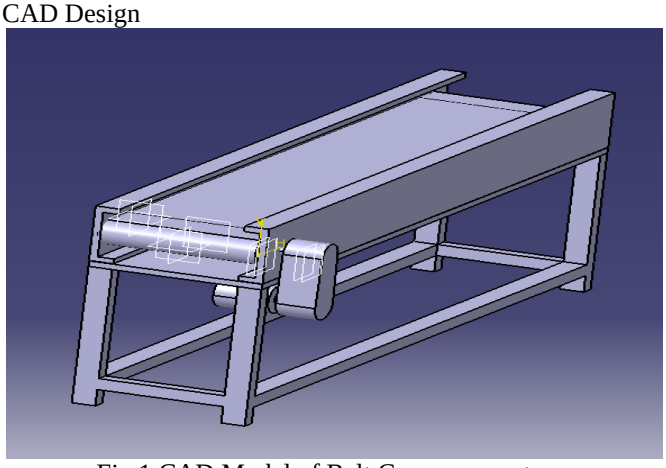


Fig.1 CAD Model of Belt Conveyor system

IV. MATERIAL SELECTION

Material Properties Nylon 66 for Conveyor Belt
This material has higher strength then other nylon grades, , good resistance to abrasion, fatigue and it is resistant to impact. The moisture absorption is much higher then the cotton ,and it will absorb up to 10% of its own weight in moisture. Consequently, poor dimensional stability. High resistance to mildew. Thatswhy Nylon 66 material is selected for the conveyor beltto increase the life of the Belt Conveyor system

TABLE 1

Material Properties	Value	Unit
Density	1180	Kg/m^3
Young's Modulus	1999.5	Mpa
Poisson's ratio	0.39	
Bulk Modulus	3.0295×10^9	Pa
Shear Modulus	7.0924×10^8	Pa
Tensile Yield Strength	527	Mpa
Compressive Yield Strength	527	Mpa
Tensile Ultimate Strength	604	Mpa
Compressive Ultimate Strength	0	Mpa

Material Properties Astm A36 Hot Rolled Steel For Structures

For conveyor belt system it is very important to have a high strength material so that it can withstand the load of 1000 kg at a time,as it is designed for 25 valve bodies.So after doing the research in materials I came to know about this material and that is A-36. A-36 steel bar is one of the most widely used carbon steel bars.A36 bar is a hot rolled steel bar which has high machinability and weldability which is desirable for the conveyor belt.

TABLE 2

Material Properties	Value	Unit
Density	7800	Kg/m^3
Young's Modulus	2×10^5	Mpa
Poisson's ratio	0.26	
Bulk Modulus	1.3889×10^{11}	Pa
Shear Modulus	7.9365×10^{10}	Pa
Tensile Yield Strength	250	Mpa
Compressive Yield Strength	250	Mpa
Tensile Ultimate Strength	400	Mpa
Compressive Ultimate Strength	0	Mpa

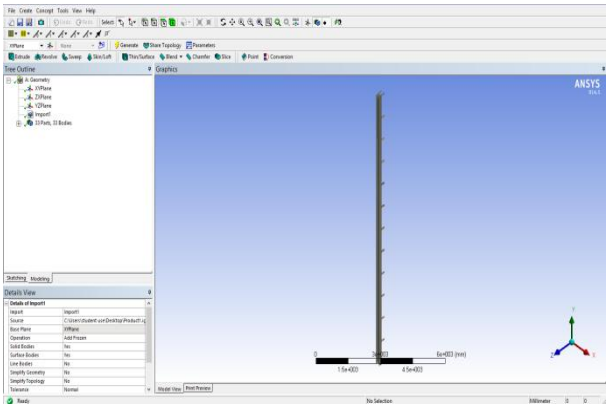
Analysis.

Introduction to ANSYS software

ANSYS is general-purpose Finite Element Analysis (FEA) .The ANSYS computer program is a large-scale multipurpose finite element program and it is used for solving several engineering analyses like CFD aqnd structural analysis. The analysis capabilities of ANSYS include the ability to solve static and dynamic structural analyses, steady-state and transient heat transfer problems, mode frequency and buckling Eigen value problems, static or time varying magnetic analyses and various types of field and couple field application. Finite Element Analysis is a numerical method of deconstructing a complex system into very small pieces (of user designed size) called elements. The software implements equations that govern the behavior of these elements and solves them all; creating a comprehensive explanation of how the system acts as a whole. The ANSYS Workbench environment is an intuitive up-front finite element analysis tool that is used in conjunction with CAD systems and/or Design Model. ANSYS Workbench is a software environment for performing structural, thermal, and electromagnetic analyses. The Workbench focuses on attaching existing geometry, setting up the finite element model, solving, and reviewing results. After geometric modeling of the conveyor belt system with given specifications it is subjected to analysis. The Analysis involves the following discretization called meshing, boundary conditions and loading.

V. PROCESS OF ANALYSIS

- Transferring the CATIA model to the ANSYS workbench through import command in Static Structural
- Meshing it into appropriate nodes and elements
- Gravity were applied to all the bodies
- Rotational velocities of 120 RPM is applied on drive pulley shaft
- Force of approx. 1000 N is applied on belt
- Fixed supports are applied to all supports



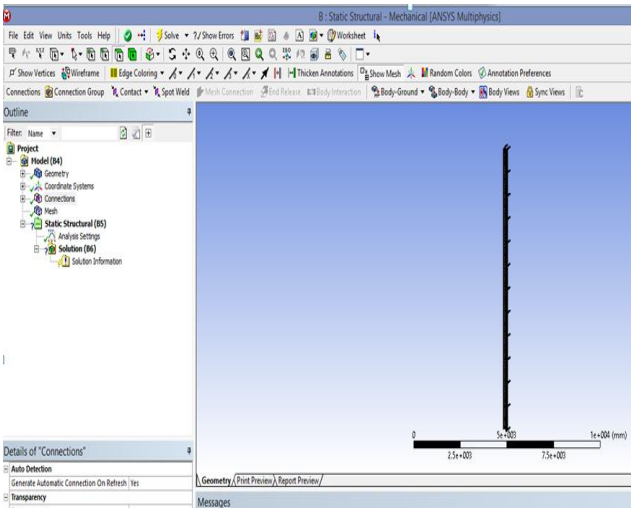
2. Meshing it into appropriate nodes and elements

Mesh Statics:

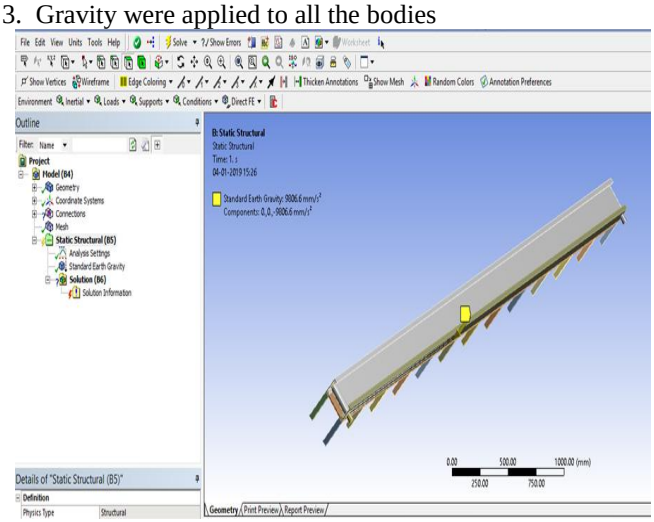
Type of Element: Tetrahedrons

Number of nodes: 2866

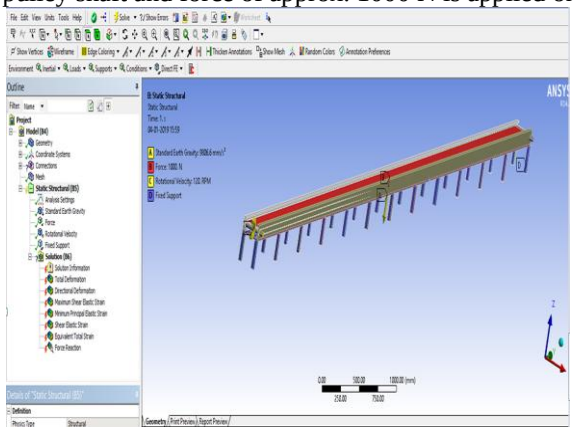
Number of Elements: 14719



3. Gravity were applied to all the bodies



4. Rotational velocities of 120 RPM is applied on drive pulley shaft and force of approx. 1000 N is applied on belt



VI. CONCLUSION

The belt transport framework is structured with high level of robotization, stacking, development and emptying productivity. It is additionally truly adaptable, safe, with low starting, operational and support cost while disposing of monotonous short separation development in the assembling business.

The maximum equivalent stress induced is 12.817mpa and minimum equivalent stress induced is 1.9949 x 10 -7 mpa

The maximum shear stress induced is 7.1721mpa and minimum shear stress induced is 1.151 x 10 -7 mpa

