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Modification of Hydraulic Jack Loaded Lift Table for Industrial Application Using Lifted IoT

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Abstract

In many industries, irrespective of the working height of the loading or unloading of the goods may cause of the product losses and also increases the worker's injury. In this paper, it is shown how a Computer Aided Engineering (CAE) analysis of a lift table is being done and deformation of parts of lift table is determined when loading and unloading take place. 'this includes analytical design, and further development of computational models of components, their analysis. assembly of components and analysis of the complete assembly. The solid models are created in Creo5.0 and the stress analysis has been carried out in ANSYS 14.5. The lift table is a leveller and the load is directly supported on the springs. The scissors legs are not lifting the load, but merely functioning as an equalizer to keep the platform square and level to the base.

Xe]words• Coinfi›uler Aided W$inerring fCA£,l. Eft TahJe. Computrilional model. CreoS.ä, ANSYS14.S

1. *Introduction*

Machine design is creatîon of plans for machine to perform the desired funcôons. The machine œay be entirely new in concept performing new types of work or it may perform more economically the work that can be done by exîsting machine. Design can be taken to mean ail the processes of conception, invention, vîsualîzatîon, calculatîon, refinement and S RCification of details that determine the form of a product. Design generally begîris with either a need or requirement or altematively, an idea. lt ends with a set of drawings or computer representations and other information that enables a product to be manufactured and utilized.

The work in this thesis is being done with the visit of the Crompton greaves. During the visit of the Crompton greaves, the management of the assembly department need something which automatically keep work piece or still age load at an optimum working height when loading or unloading of goods. Crompton greaves assemble the fans which are used in a train. So, they need something which maintains 500mm height with a load of 668N (totai weight of the 50 nos. of fan cover)

R Computer aided engineering (CAT) analysis of a lift table is being done and deformation of parts of lift table is determined when loading and unloading take place.

4 This includes analytical design, and further development of computational models of components, their analysis, assembly of components and analysis ot the complete assembly.

H The solid models are created in Creo5.0 and the stress analysis has been carried out in ANSYS 14.5.

2. Problems in Industries

In many industries the employees of the assembly depamnent complain about the back pains and muscular pains, for manual handling of the goods.

The effect of manual material handling represent the biggest single contribution to worker injury in India and the application of good ergonomic program can reduce those incidences and the worker will be more productive and that productivity contributes to profit.

- In many industries irrespective of the working height of the loading or unloading of the goods may cause of the product losses and also increases the workers injury.
- Lifting of goods, Stretching, Reaching, Buckling, Stooping and Walking with goods, nre soirie unnecessary worker activities can result ergonomics problems.
- Further the main problems arises when assembling the parts because in lift table. the parts are having motion between them, to increase the problems constraints are present which if gets wrong can change the direction of analysis. So, proper constraints have to be applied in the system.
- Experimental parameters is to be matched with simulation results but the problem is up to which level environmental conditions present actually matches with conditions avnilable in the software

Fig. ITypical problem in industries

3. Design Calculation Of the Lift table

The lifting table is being designed for lifting number of fan cover each weighing 1.19 kg. Hence it is breing designed for a total load of 584N. Fig.2 Shows three dimensional view of the lifting table listing various components of the lifting table.

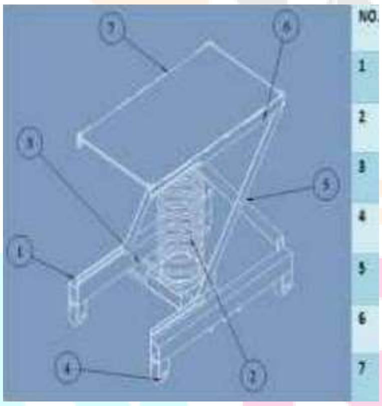


Fig. 2 Various component uf' the lifting iable

2. 1 Top deck frame

The iriain function of the Top deck frame is to bear the toad of the fan covers and to hold the compressive spring. It appears in a rectangular shape and the top surface is flat and fabricated with different frames. And all the four comers of the top frame are clamped with the scissor legs. Initially, rectangular plate is use but the weight of the plate is too bulky and the material waste is taking place so in place of rectangular plate use top deck frairie.

2"he material "ASTM A36" has been considered for it. A36 is the most commonly used mild and hot- rolled steel. lt has excellent welding properties and is suitable for grinding, punching, tapping, drilling and machining processes. The mechanical and chemical properties of ASTM A36 material are as follows:

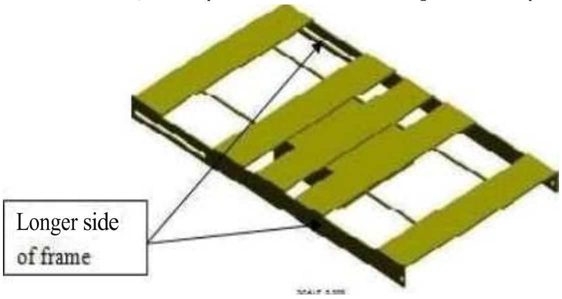


Fig. 3 Lunger side of frame

Wi — 584/2 N — 292 N

For convenience, a concentrated load is considered on the centre of the beam and design and the bending stress are found out as shown in Fig. 4.

" Fig. 4 Load on linger side of frame "

Let, L — 750 mm, d — 40 t b — 4 t App - 5 N/inm², FOS — 4 (Mahadevan, 2012)

s FOS = 63 N/mm²

Now using bending equation,

σ = M/Z , M = WL/4 Z - I/y , I = bd³/12 , y = d/2

s — 51.33 N/m$jj2

For shorter side of the frame as shown in I-ig 5, the three rectangular beams are loaded at a single interval of time with a load i.e.

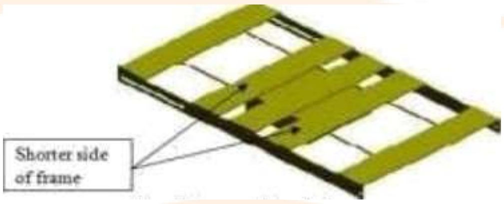


Fig 5 Shtnter side o1' frame

W, 4/3= 195N
Let, L-420mm, d- 5min, b- 80mm
S,, z= 61.46n/min
Then, the total weigt mass of the deck frame are given below ,= 55.13 N/mm

3.2 Base flame

The function of the base frame is to hold the compressive spring and clamped with all the four scissors legs. And its four edges are attached with the ground with tbe help of roller wheel as shown in Fig 6.The material of the base frame is same as used in the top deck frame.

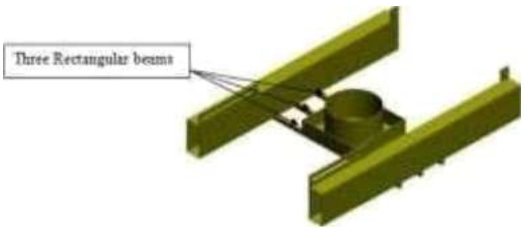


Fig 6 Three reciungiil r beams of base frame

The three rectangular beams as shown in Fig 7are loaded with a load of 670N. For convenient we take a concentrated load applied on the centre of the beam. Now finding the bending stress of a beam is as follows:

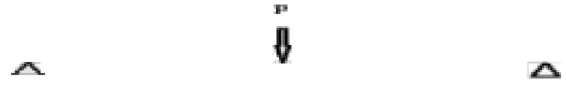


Fig 7 Load un three rectangular beams

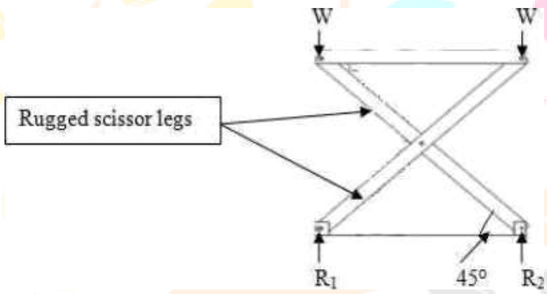
670 224 N, L - 420mm, s 63 N mm—, b

σ = 1224 * J 20 * i 6 * 12) / \4 * * * 0 * 6) 55.13 N/mm'

3.2 Rugged scissor legs

The main function of the scissor legs are to clamped both the top frame and the base frame and position the material at the proper work height. The scissor legs are not lifting the load, but merely functioning as an equalizer to keep the platform square and level to the base.

The rugged scissor legs are designed with a load of 584N and a weight of top deck frame as shown in Pig 8. Then the total load is divided into four parts and each parts is loaded as follows

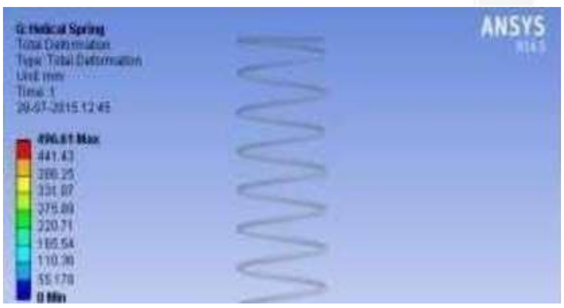


4 Results and Diskussion

The finite element analysis of various components of the lift table has been done. It may be noted that the analytical appmach of designing components has the limitation thai the intricate and complex details cannot be included in the design process. This limitation is overcome in finite element modelling and analysis.

Stress of each component is found out in static structural analysis of ANSYS Workbench and an attempt is made to correlate the results with closed form solution. The details of components e.g. geometry, material, load applied etc has not been reproduced. All these details and dimensions of each component with boundary conditions and load applied can be seen above.

SiIRulation viRw of helical compression spring is shown in Fig 14, the total deformation comes out under the required limit.



5 Conclusions of the study

This project work considered the work done in past to understand the need of ergonomic design, to know design criteria and requirements and also learn about computer aided methods and modelling tools. Computer aided design of various components of lifting table is presented and static structural analysis has been carried out.

This research describes the approach to design an optimized component of the lift table with bending stress, strain and deformation. The main objective of this research is modeling and stress analysis of the different components of the lift table. Modeling of various components and their assembly has been done in Creo5.0 sofiware. The solid model is then imported in ANSYS workbench for carrying out the stress analysis. Modeling of lifi table can be achieved by using Creo5.0 sofiware. Each component is modelled in part module and assembly has been created in assembly module. FEA analysis has been performed using ANSYS 14.5

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