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DESIGN AND ANALYSIS OF LOADING MECHANISM FOR A BOGIE RETURN SYSTEM

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Abstract— this paper describes the design as well as analysis of a mechanical lifts which works on the principle of screw jack and concepts on of lean management. It gives the basic idea on implementation of height adjustment mechanism, mechanism analysis and conceptualization on the platform along with the help of various mechatronic devices, pneumatic cylinder, and sensor. The entire paper is divided into two methods of solution.

The lifts, a staple of mechanical design, especially in competitive robotics, industries, factories and various applications, are a type of linkage that can be used to raise a load to some height, when acted upon by some force, usually exerted by a pneumatic. Hence, there needs to be a concrete way to analytically compare different cylinder positions. However, all current research into the analysis of scissor lifts either focuses only on the screw jack configuration, or derives separate force expressions for different cylinder positions. This, once again, leaves the decision between different cylinders positions to trial and error, since the expression to test the potency of the position can only be derived once the position is chosen. This paper deals with analysis and design of pneumatic scissor lift. Catia is used for modeling purpose, meshing for analysis work i.e. to check stress, strain, displacement and deformation induced in the system.

Keywords— Mechanical advantage, Pneumatic cylinder, Scissor lifts and Cylinder positioning.

INTRODUCTION

Manufacturing and industrial environments today are becoming increasingly dynamic and competitive. Companies are competing on a global scale in a fast moving world with customers demanding reliable delivery dates and high quality products and services as well as quick response to market changes. Supplies are expected on deliver on time in increasingly small batches. To respond to these demands, businesses need to increase productivity and efficiency. This can be achieved through lead time and set-up time's reduction, through the implementation of rapid changeovers and through effective scheduling.

In the environment, time reduction provides a key competitive advantage. Reduced time can translate into increased customer satisfaction. Quick response companies can launch new products earlier, penetrate new markets faster, meet changing demand, and can deliver rapidly and on time. They can also offer their customers lower costs because quick response companies have efficient processes with low inventory and less obsolete stock. According to practical studies, halving the time and doubling the work-in-process inventory turns can increase productivity.

On the other hand, Aerial scissor lifts are generally used for temporary, flexible access purposes such as maintenance and construction work or by fire-fighters for emergency access, etc. This distinguishes them from permanent access equipment such as elevators. They are designed to lift limited weights — usually less than a ton, although some have a higher safe working load (SWL). This is especially true when the work being accessed is raised off the floor and outside an operator's normal ergonomic power zone. In either case, it is much more economical to bring the worker to the work rather than bringing the work to the worker. The need for the use of lift is very paramount and it runs across labs, workshops, factories, residential/commercial buildings to repair street lights, fixing of bill boards, electric bulbs etc. expanded and less-efficient, the engineers may run into one or more problems when in use. Considering the need for this kind of mechanism, estimating as well the cost of expanding energy more that result gotten as well the maintenance etc. it is better to adopt this design concept to the production of the machine. The initial idea of design considered was

the design of a single pneumatic ram for heavy duty vehicles and putting it underneath, but this has limitations as to the height and stability, and someone will be beneath controlling it. This is designed in CATIA and analyzed in ANSYS

LITERATURE REVIEW

A lifting device is a system that allows small force (effort) to overcome a large force or Load. There are practically hundreds of uses for lift tables in manufacturing, warehousing and distribution facilities. The Addition of this device (lift table) makes job faster, safer and easier.

Georgy Olenin (2016) Design of hydraulic scissors lifting platform, made a study and the goal of this study was to apply the knowledge obtained from studying in the university and solve the substantial task of creating a design of the hydraulic scissors lifting platform. The results of this research are presented in the first theoretical part of the thesis. Then to verify the validity of the theory the practice work was accomplished. The type of the platform and the design of the structure were selected. The se-lection of the material and calculations of the loads and stresses were per-formed and explained. As the result of the work the 3D model of the lift using Solid Works software was created. [1]

Problem statement

Previous method of loading a trolley on to the underground service line were developing a risk of safety for labors as well as it requires a skilled labor and also time consumption was much which directly affects productivity. Therefore we analyzed the procedure using above parameters and came to conclusion to finalize two mechanisms which we can implement within our confined space .By this method we can save lot of time which we were spending on loading of trolley .We also made a permissible changes to the design wherever necessary to bring up the rapid loading of trolley and to maintain steady motion while loading.

Aim

The goal of the study is to design and analysis the productivity and developing a safety for the labors by loading mechanism for bogie system by using pneumatic scissors and Linear Actuating Mechanism.

Objectives

a) To study and analyze the Excavator assembly line.

b) To analyze the current methods and parameters and identify gaps and scope of improvements by using lean concepts, standardize work etc.

c) To design the pneumatic scissors lift to lift up to a height of approximately one meter and with the carrying capacity of 300 kilograms.

Scope of Present Work

a) Assured safety for employees.

b) There is no need of skilled labor.

c) By using Pneumatic lifters there is no need of overhead lifters .So the time interval can be reduced.

d) Reduces Power consumption and Increases Productivity.

Methodology

The basic procedure followed are shown in form of flowchart,

LOADING MECHANISM FOR A BOGIE RETURN SYSTEM

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PROBLEM DEFINITION

⇩

MATERIAL SELECTION

⇩

PRELIMINARY DESIGN IN 2D

⇩

FIXTURE DESIGN USING CATIA MODELLING

⇩

ANALYSIS AND TESTING

⇩

PRODUCTION (FABICATION)

The above flowchart shows the process flow involved in our project.

Design criteria

As we analyzed the procedure using above parameters and came to conclusion to finalize two mechanisms which we can implement within our confined space .By this method we can save lot of time which we were spending on loading of trolley .We also made a permissible changes to the design wherever necessary to bring up the rapid loading of trolley and to maintain steady motion while loading.

Concept 1- PNEUMATIC SCISSOR LIFTS

A pneumatics pallet lift is a mechanical device used for various applications for lifting of the loads to a height or level. A lift table is defined as a scissor lift used to stack, raise or lower, convey and/or transfer material between two or more elevations. The main objective of the devices used for lifting purposes is to make the table adjustable to a desired height. A scissor lift provides most economic dependable & versatile methods of lifting loads; it has few moving parts which may only require lubrication. This lift table raises load smoothly to any desired height. The scissor lift can be used in combination with any of applications such as pneumatic, pneumatics, mechanical, etc. Lift tables may incorporate rotating platforms (manual or powered); tilt platforms, etc. as a part of the design.

Industrial scissor lifts & tilters are used for a wide variety of applications in many industries which include manufacturing, warehousing, schools, grocery distribution, military, hospitals and printing.

The scissor lift contains multiple stages of cross bars which can convert a linear displacement between any two points on the series of cross bars into a vertical displacement multiplied by a mechanical advantage factor. This factor depends on the position of the points chosen to connect an actuator and the number of cross bar stages. The amount of force required from the actuator is also amplified, and can result in very large forces required to begin lifting even a moderate amount of weight if the actuator is not in an optimal position. Actuator force is not constant, since the load factor decreases as a function of lift height. Types of lifts can be classified as follows:-

Classification based on the type of energy used

a) Hydraulic lifts
b) Pneumatic lifts
c) Mechanical lifts

Many of the organizations around the world have been using all kinds of scissor lifts. But, many of these lifts are failed with portability constraint. For heavy duty applications hydraulic and pneumatic is preferred. Also, there are some mechanical alternatives are also available which can improve portability, simplicity and by providing proper gearing, input energy is reduced along with the cost. Therefore, advantages of mechanical system over other mechanism are explained below:-

Simple in construction.

a) Portable over other mechanism.

b) Cost of manufacturing is low.

c) Lift heavy loads with help of proper gearings.

d) Easy to find faults. (Diagnose)

e) No external storage required. (Hydraulic and pneumatic requires tank for fluid and air)

Mechanical lift is another type of scissor lift which works on the principle of screw jack. Because of simple design aspects and simplicity in construction, mechanical lift has wider range of applications over other types of lift mechanisms

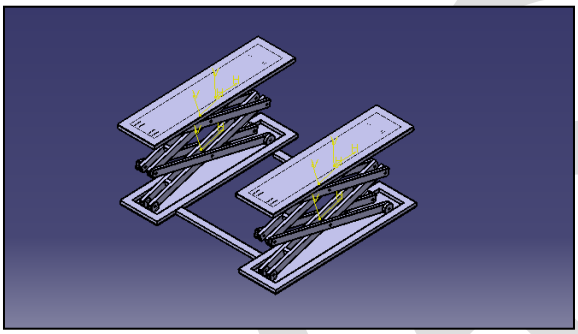

Figure1 Scissor lifts

Concept 2- LINEAR ACTUATING MECHANISM

A linear actuator is an actuator that creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. Linear actuators are used in machine tools and industrial machinery, in computer peripherals such as disk drives and printers, in valves and dampers, and in many other places where linear motion is required. Hydraulic or pneumatic cylinders inherently produce linear motion. Many other mechanisms are used to generate linear motion from a rotating motor.

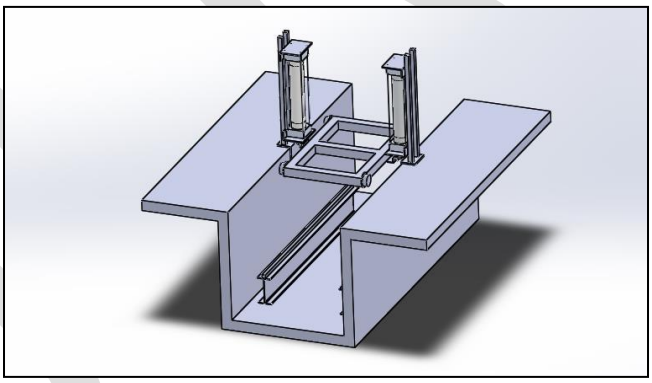

Figure2. Linear Actuating Mechanism

Analysis

STAAD.Pro is one of the most widely used structural analysis and design software products worldwide. It supports over 90 international steel, concrete, timber & aluminium design codes.

It can make use of various forms of analysis from the traditional static analysis to more recent analysis methods like p-delta analysis, geometric non-linear analysis, Pushover analysis (Static-Non Linear Analysis) or a buckling analysis. It can also make use of various forms of dynamic analysis methods from time history analysis to response spectrum analysis. The response spectrum analysis feature is supported for both users defined spectra as well as a number of international code specified spectra.

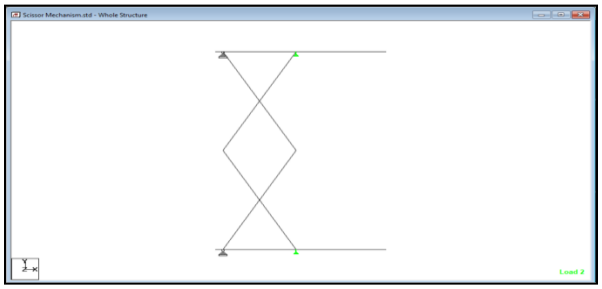

Figure 1 Analysis Model

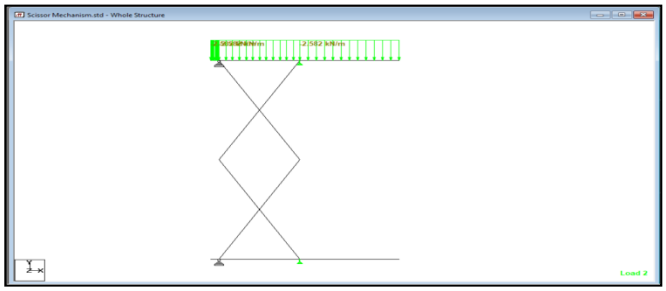

Figure 2 Load applied

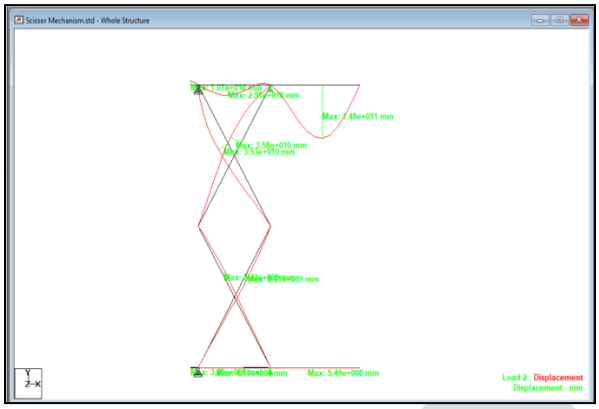

Figure 3 Displacement Diagram

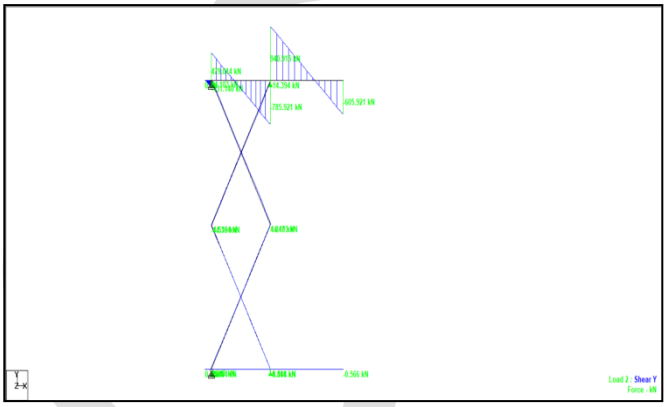

Figure 4 Shear Force Diagram

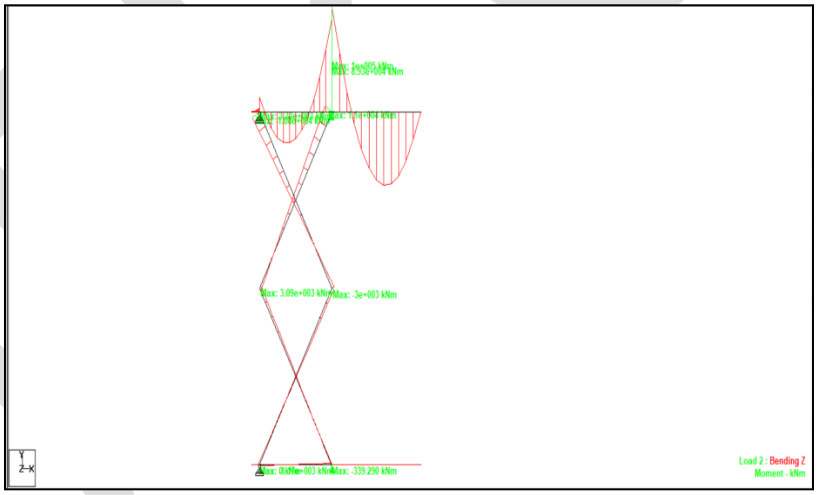

Figure 5 Bending Moment Diagram

Future Scope

Since this type of automated system is currently not present and our design reduces the operational time successfully it has good chance of getting commercialize worldwide for different application purpose.

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Conclusion

This paper leads to many conclusions among them the most suitable and as per requirement or design criteria's are following such as Less Operational Time as compare to manual operated, less labor work, more efficient and gives better dynamic control over the system. However, the only limitation of the system is that it is a costly as compare to existing one.

REFERENCES:

[1] Balkeshwar Singh, Anil Kumar Mishra, "Analysis and Fabrication of Remote Control Lifting Jack". International Journal of Scientific Engineering and Applied Science (IJSEAS) - Volume-1, Issue-3, June 2015 ISSN: 2395-3470.

[2] Dr. Ramachandra C G, Krishna Pavana, Shivraj Shet and Venugopal Reddy, "Design and fabrication of automotive hydraulic jack system for vehicles".International Journal of Advances in Engineering Research (IJAER) 2013, Vol. No. 6, Issue No. VI, Dec.

[3] M.M.Noor, K. Kadirgama, M.M. Rahman, M.S.M. Sani, M.R.M. Rejab, "Development of Auto Car Jack Using Internal Car Power". Malaysian Science and Technology Congress,MSTC08, 16~17 Dec, KLCC, Malaysia, 2008.

[4] Helmi Rashid and et.al, "Design Review of Scissors Lifts Structure for Commercial Aircraft Ground Support Equipment using Finite Element Analysis". International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012).

[5] Bharath Kumar K, Gowtham S., Paul James Thadhani,Deepak Kumar.Bibin George Thomas, Kiron Antony Rebeiro "Fabrication of zig zag pneumatic lift" published by international journal of scientific engineering and applied science (IJSEAS) - Volume-1, Issue-3, June 2015 ISSN: 2395-3470

[6] Jaydeep M. Bhatt, Milan J. Pandya, "Design And analysis of an aerial scissor lift" Journal of information knowledge and research in Mechanical Engineering, Volume – 02, Issue – 02, P.N.452-455, Nov 12 To Oct 13.

[7] Ivan Sunit Rout, Dipti Ranjan Patra, Sidhartha Sankar Padhi, Jitendra Narayan Biswal, Tushar Kanti Panda" Design and fabrication of motorized automated object lifting jack" IOSR journal of engineering (IOSRJEN) ISSN (e): 2250-3021, ISSN (p): 2278-8719 Vol. 04, Issue 05 (may. 2014), ||V5|| pp 06-12.

[8] Rahul J.Kolekar, S.S. Gawade "Design and development of lift for an automatic car parking system" published by India.

[9] Gaffar G. Momin, Rohan Hatti, Karan Dalvi, Faisal Bargi, Rohit Devare "Design, manufacturing & analysis of hydraulic scissor lift"International Journal of Engineering Research And General Science Volume 3, Issue 2, Part 2, MarchApril, 2015 ISSN 2091-2730733.

[10] P.S. Rana, P.H. Belge1, N.A. Nagrare, C.A. Padwad1, P.R. Daga1, K.B. Deshbhratar N.K. Mandavgade "Integrated automated jacks for 4- wheelers" [11]Scholars Research Library European Journal of Applied Engineering And Scientific Research, 2012, 1 (4):167-172.