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Lifting Trolley for Easy Mounting

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Abstract : Hydraulic Trolley is the device used or carrying load or to transport the material from one point to another. For different types of application various types of trollies are available in the market. Depending upon the specific use the one will select the trolley, but it is limited to do a specific work. To overcome this problem, a new trolley was designed which could be used for multi-purpose. There are many types of trolley available in the market for various fields like airport, shopping malls, industries, hospitals etc. to carry the heavy or light loads. This paper contains the development of trolley, which includes design on the basis of creativity skills and fabrication, which can be used for more than one type of task. The trolley designed is the integration of airport trolley and shopping mall trolley. One more advantageous feature added to the design was a motorized wheel which reduces the human effort for carrying of load and also it can be operated manually if required.

Index Terms **– Hydraulic, Trolley, Lift.**

I. INTRODUCTION

The structure of this thesis is planned as follows: in the first part, the theory is presented. It consists of several topics concerning overall of lifting tables of scissors type, things that are needed for the design, principles of working, technical characterization and others.

The first part is needed to give a general concept of the subject and after that comes the practical part which presents and explains how to perform the knowledge. It contains the 3D model of the lift, calculations of the load, several diagrams, charts, and stress calculations, which confirm the viability and validity of the theory part.

Such a thesis structure was chosen as the most appropriate and suitable for the chosen topic. It allows increasing knowledge by appealing to the literature and adding an individuality of the author by making him solve an actual practical problem using own approach.

The scissors elevator is an elevator with a system of levers and hydraulic cylinders on which the metal platform is capable of moving in the vertical plane. This is achieved by using of linked, folding supports in a crisscross pattern, called scissor mechanism.

The hydraulic lift was chosen as a subject of the thesis because it is a perfect example of mechanical engineering field. This mechanism combines a result of several main fields of engineering and at the same time, it is simple and accessible for understanding. The construction and load distribution represent statics and strength of material subjects, the hydraulic cylinder and the control unit involve knowledge of hydraulic systems and automation. Material science is important for selection of a suitable material as well as knowledge of 3D modeling.Also, scissors lift is an integral part of most of the workshops and building objects. The key advantage of lifts is that they even offer the best way to organise a technological and industrial process. Besides, almost all lifts give the possibility to change the place of their installation without much effort, which is important in the frequently changing conditions in the production process these days..

II. STATEMENT OF THE PROBLEM

A problem remains a problem until a solution is offered. With the limitations encountered in the use of Cranes, ropes, ladders, scaffold and mechanical scissors lifts in getting to elevated height such as the amount of load to be carried, conformability, time consumption, much energy expended etc. the idea of a hydraulically powered scissors lift which will overcome the above stated limitations is used.

III. LITERATURE REVIEW

Hydraulic lifting trolly is a device to raise something, such as worker, materials or objects to a certain height as desired. However, if the scissor lift is designed, manufactured and maintained in accordance properly, it will improve job performance, productivity and safety factor. Unfortunately, there are still many accidents that occur due to the lack of safety factors in the design. Some of these factors are scissor-speed, heavy load which not appropriate and the material strength. It is necessary to design highly appropriate to determine the sizes and strength on this device. (Ren G.Dong, 2012)

Every part of the machine cannot move to a position corresponding to the desired to move a component. Some of them are aerial lifts, boom lifts, scissorlift, towable elevator used to move a material or device to different directions as desired. A scissor lift is a portable, easily extended and compressed, used for safe operating machine. (M.Kiran Kumar, 2016)

Mans quest for improvement has never been satisfied. The drive towards better and greater scientific and technological outcome has made the world dynamic. Before now, several scientist and engineers have done a lot of work as regards the scissors lift in general. A review of some of that work gives the design and construction of a hydraulic scissors lift a platform.

IV. DEFLECTIONS IN SCISSORS LIFT

Deflection Defined

Deflection in scissors lifts can be defined as the resulting change in elevation of all or part of a scissors lift assembly, typically measured from the floor to the top of platform deck, whenever loads are applied to or removed from the lift.

ANSI MH29.1 - Safety Requirements for Industrial Scissors Lifts states that all industrial scissors lifts will deflect under load". The industry standard goes on to outline the maximum allowable deflection based on platform size and number of scissors mechanisms within the lift design.

What Causes Deflection?

Before attempting to discuss how to limit scissors lift deflection, it is important to understand the contributing factors to a lift's total deflection. An open, or raised, scissors lift acts very much like a spring would – apply a

load and it compresses, remove a load and it expands. Each component within the scissors lift has the potential to store or release energy when loaded and unloaded (and therefore deflect). There are also application-specific characteristics that may promote deflection. Understanding these Top 10 root causes helps to pinpoint and apply effective measures to limit deflection.

Scissors Legs

Leg deflection due to bending is a result of stress, which is driven by total weight supported by the legs, scissors leg length, and available leg cross section. The longer the scissors legs are, the more difficult it is to control bending under load. Increased leg strength via increased leg material height does improve resistance to deflection, but can create a potentially undesirable increased collapsed height of the lift.

Platform Structure

Platform bending will increase as the load's center of gravity moves from the center (evenly distributed) to any edge (eccentrically loaded) of the platform. Also, as the scissors open during raising of the lift, the rollers roll back towards the platform hinges and create an increasingly unsupported, overhung portion of the platform assembly. Eccentric loads applied to this unsupported end of the platform can greatly impact bending of the platform. Increased platform strength via increased support structure material height does improve resistance to deflection, but also contributes to an increased collapsed height of the lift.

Base Frame

Normally, the lift's base frame is mounted to the floor and should not experience deflection. For those cases where the scissors lift is mounted to an elevated or portable frame, the potential for deflection increases. To effectively resist deflection, the base frame must be rigidly supported from beneath to support the point loading created by the two scissors leg rollers and the two scissors leg hinges.

Pinned Joints

Scissors lifts are pinned at all hinge points, and each pin has a running clearance between the O.D. of the pin and the I.D. of its clearance hole or bushing. The more scissors pairs, or pantographs, that are stacked on top of each other, the more pinned connections there are to accumulate movement, or deflection, when compressing these running clearances under load.

Hydraulic Circuit – Air Entrapment

All entrapped air must be removed from the hydraulic circuit through approved "bleeding" procedures – air is very compressible and is often the culprit when a scissors lift over-compresses under load, or otherwise bounces (like a spring) during operation.

Hydraulic Circuit – Fluid Compressibility

Oil or hydraulic fluid will compress slightly under pressure. And because there is an approximate 5:1 ratio of lift travel to cylinder stroke for most scissors lift designs (with the cylinders mounted horizontally in the legs), there is a resulting 5:1 ratio of scissors lift compression to cylinder compression. For example: 1/16" of fluid compressibility in the cylinder(s) translates into 5/16" of vertical lift movement.

Hydraulic Circuit – Hose Swell

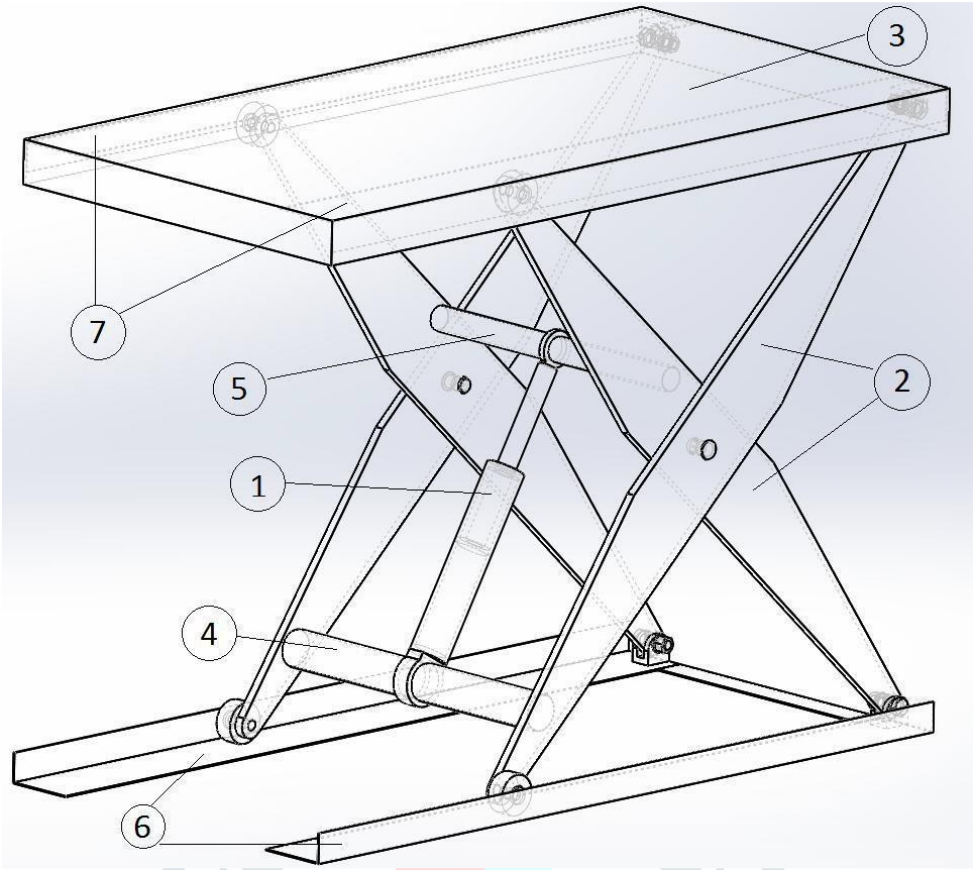
All high pressure, flexible hosing is susceptible to a degree of hose swell when the system pressure is increased. System pressure drops slightly because of this increased hose volume, and the scissors table compresses under load until the maximum system pressure is re-established. And, as with compressibility, the resulting lift movement (deflection) is 5 times the change in oil column height in the hosing.

Cylinder Thrust Resistance

Cylinders lay nearly flat inside the scissors legs when the lift is fully lowered and must generate initial horizontal forces up to 10 times the amount of the load on the scissors lift due to the mechanical disadvantage of their lifting geometry. As a result, there are tremendous stresses (and resulting deflection) placed on the scissors inner leg member(s) that are designed to resist these cylinder forces. And, as already mentioned above with any

changes in column length along the line of the lifting actuator(s)/cylinder(s), the resulting vertical lift movement is 5 times the amount of deflection or movement of cylinder hinge points mounted to leg cross members.

V. COMPONENTS OF LIFT



1. Hydraulic Cylinder
2. Leg
3. Table-top
4. Supporting tube 1
5. Supporting tube 2
6. Base plates
7. Top plates

VI. Material selection

Material selection plays a very important role in machine design.
For example, the cost of materials in any machine is a good determinant of the cost of the machi8ne. more than the cost is the fact that materials are always a very decisive factor for a good design. The choice of the particular material for the machine depends on the particular purpose and the material for the machine depends on the particular purpose and the mode of operation of the machine components. Also, it depends on the expected mode of failure of the component.

Engineering materials are mainly classified as:
1. Metal and their alloys, such as iron, steel, copper, aluminum etc.
2. Non-metals such as glass, rubber, plastic etc. metals are further classified as ferrous metals and non-ferrous metal
3.Ferrous metals are those metals which have iron as their main constituent, such as cast iron, wrought iron and steels.
4.Non-ferrous metals are those which have a metal other than iron as their main constituent, such as copper, aluminum, brass, tin, zinc etc.

4.1 ANALYSIS OF MECHANICAL PROPERTY REQUIREMENT OF ESSENTIAL MACHINE COMPONENTS

It is necessary to evaluate the particular type of forces imposed on components with a view to determining the exact mechanical properties and necessary material for each equipment. A very brief analysis of each component follows thus:

Scissors Arms: this component is subjected to buckling load and bending load tending to break or cause bending of the components. Hence based on strength, stiffness, plasticity a hardness. A recommended material is stainless steel.

Hydraulic Cylinder: this component is considered as a strut with both ends pinned. It is subjected to direct compressive force which imposes a bending stress which may cause buckling of the component. It is also subjected to internal compressive pressure which generates circumferential and longitudinal stresses all around the wall thickness. Hence necessary material property must include strength, ductility, toughness and hardness. The recommended material is mild steel.

Top Platform: this component is subjected to the weight of the workman and his equipment hence strength is required, the frame of the plat form is mild steel and the base is wood.

Base Platform: this component is subjected to the weight of the top plat form and the scissors arms. It is also responsible for the stability of the whole assembly, therefore strength. Hardness and stiffness are needed mechanical properties. Mild steel is used.

Wheels: the wheels are position at the base part of the scissors lift and enable the lift to move from one place to the other without necessary employment of external equipment like car.

VI. DESIGN OF PARTS

In this section all design concepts developed are discussed and based on evaluation criteria and process developed, and a final here modified to further enhance the functionality of the design.

Considerations made during the design and fabrication of an acting cylinder is as follows:

1. Functionality of the design
2. Manufacturability
3. Economic availability. i.e. General cost of materials and fabrication techniques employed.

PRESSURE SUPPLIED TO THE HYDRAULIC CYLINDER

Pressure (P) = Force (P)/ Area (A) $P = F/A$

Construction Procedure

Assembling of various components of the hydraulic scissors lift.

The scissors assemblage was mounted on the base frame with one end hinged and the other fitted with roller (bearing) to produce the needed motion of rolling along the rail to cause lifting and lowering of the scissors lift. The scissors arm connected to the platform is also connected with one end hinged and the other fitted with roller to effect extension and contraction of the lit. The hydraulic cylinder is connected to the first arm of the scissors lift with both ends hinged. This cylinder provides the force needed to lift the load on the platform.

VII. CONCLUSION

The design and fabrication of a portable work platform elevated by a hydraulic cylinder was carried out meeting the required design standards. The portable work platform is operated by hydraulic cylinder which is operated by a motor. The scissor lift can be design for high load also if a suitable high capacity hydraulic cylinder is used. The hydraulic scissor lift is simple in use and does not required routine maintenance. It can also lift heavier loads. The main constraint of this device is its high initial cost, but has a low operating cost. The shearing tool should be heat treated to have high strength. Savings resulting from the use of this device will make it pay for itself with in short period of time and it can be a great companion in any engineering industry dealing with rusted and unused metals.

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