FABRICATION OF HYDRAULIC TROLLEY FOR MATERIAL HANDLING

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Abstract: -The foremost aim of our project is to design and fabricate a hydraulic operated Hydraulic trolley for the purpose of material handling at a faster rate. At present forklifts, pallet trucks are used for the purpose of material handling. For forklift it requires a well-experienced technical person for handling operation. For pallet trucks, it does not have large cross-section, as the material to be handles is in small unit. For both the equipment the initial cost is high. This project work titled "Fabrication of Hydraulic Trolley for Material Handling " has been conceived having studied the difficulty in lifting and loading the any type of materials. Our survey in the regard in several small scale industries, revealed the facts that mostly some difficult methods were adopted in lifting the material. Now the project has mainly concentrated on this difficulty, and hence a suitable device has been designed. Such that the material can be lifted from the floor land without application of any impact force. The fabrication part of it has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on all industries.

Keywords: Hydraulic Trolley , Fabrication, Material Handling Equipment

I. Introduction:

A scissor lift or mechanism is a device used to extend or position a platform by mechanical means. The term "scissor" comes from the mechanic which has folding supports in criss cross "X" pattern. The extension or displacement motion is achieved by the application of force to one or more supports, resulting in an elongation of the cross pattern. The force applied to extend the scissors mechanism may by hydraulic, pneumatic or mechanical (via a lead screw or rack and pinion system).

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. [1]

The name scissors lift originated from the ability of the device to open (expand) and close (contract) just like a scissors. 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 hydraulic 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. It was rather found out that; there is a possibility of the individual ascending/descending, to be controlling the device himself. Therefore further research was made to see how to achieve this aim.[6]

Before this time scissors lift existing use mechanical or hydraulic system powered by batteries for its operations. Several challenges were encountered in this very design. Some amongst many include; low efficiency, risk of having the batteries discharged during an emergency, extended time of operation, dependent operation, as well as maintenance cost. It is the consideration of these factors that initiated the idea of producing this hydraulically powered scissors lift with independent operator. The idea is geared towards producing a scissors lift using one hydraulic ram placed across flat, in between two cross frames and powered by a pump connected to a motor wheel may be powered by a pump generator. Also, the individual ascending / descending is still the same person controlling it. I.e. the control station will be located on the top frame.[3]

A scissors lift is attached to a piece of equipment having a work station known as scissors lift table that houses the pump, the reservoir, the generator, control valves and connections and the motor. A scissors lift does not go as high as a boom lift; it sacrifices heights for a large work station. Where more height is needed, a boom lift can be used

II. Principle of operation of a Hydraulic lift (Extension and Contraction)

A scissors lift is a type of platform that can usually only move vertically. The mechanism to achieve this is the use of linked, folding supports in a criss-cross "X" pattern, known as a scissors mechanism. The upward motion is achieved by the application of pressure to the outer side of the lowest set of supports, elongating the crossing pattern and prepelling the work platform vertically. The platform may also have extending "bridge" to allow closer access to the work area, because of the inherent limits of vertical – only movement. The contraction of the scissor action can be hydrdaulic, pneumatic or mechanical (via a leadscrew or rack and pinion system), but in this case, it is hydraulic. Depending on the power system employed on the lift; it may require no power to enter "desert" mode, but rather a simple release of hydraulic or pneumatic pressure. This is the main reason that these methods of powering the lift (hydraulic) is preferred, as it allows a fail – safe option of returning the platform to the ground by release of a manual valve

III. Design process of Hydraulic Trolley

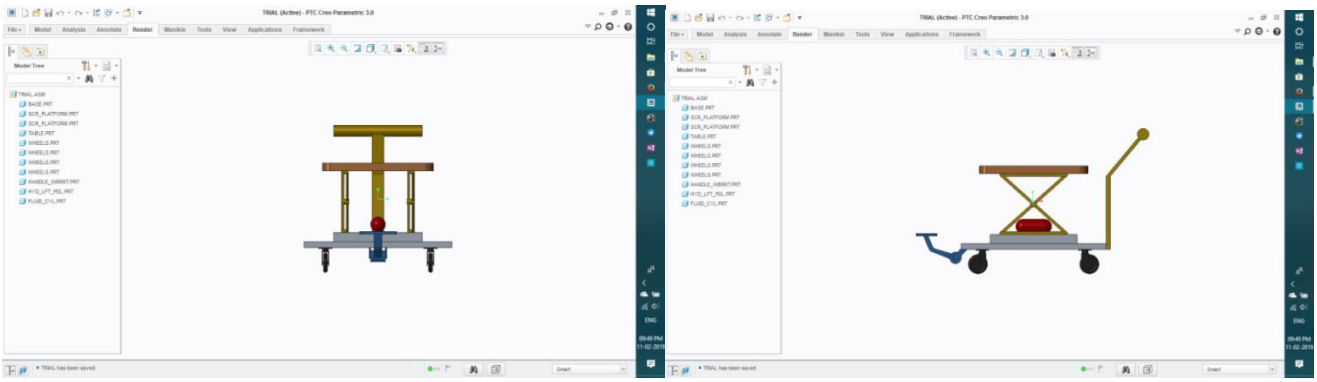

Figure 1Figure 2

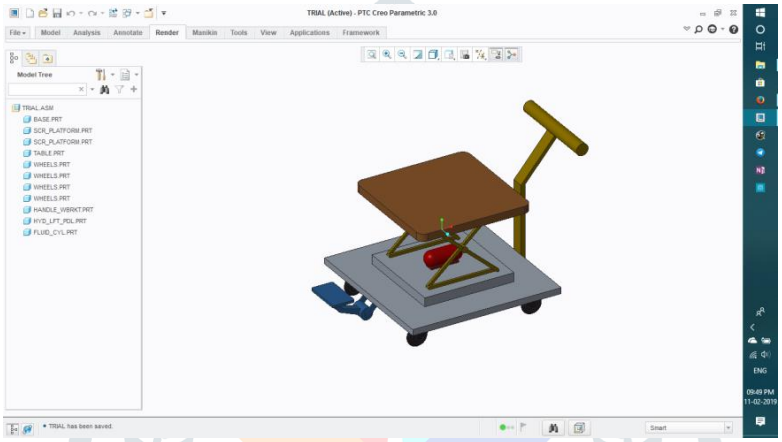

Figure 3

Fihure 1,2,3 : Front View, Side View, 3D View

3.1 Fabrication of Hydraulic Trolley

The base frame at the below, which is the main frame holding all weight of the Trolley , futher the scissor chain of 2 are mounted on the both side of the frame.finally the upper plate which held to carry the load is fitted onto the scissor lift chain mechanism. The single acting cylinder which used to lift the scissor link upwards are mounted at the centre of the base frame connecting it to the scissor chain on the both side using a steel rod.

Figure 1Figure 2

Figure 3Figure 4

Fig 1&3 = Ideal positon

Fig 2&4= Lifted position

3.2 Basic Dimensions of component member.

Lift Extension

- At maximum extension, an "X" arrangement of the lift moves 11inch = 279.4 mm.
- Total number of tiers of scissors (combined) = 2
- Thus, total height of extension = 3 × 279.4 = .
- Length of base = 609.6 mm
- Width of base = 469.9 mm
- Height of base from ground = 200 mm
- At maximum extension, Angle of inclination = 50

Platform

- Total height of platform = 279.4 mm.
- Total width of plat form = 469 mm
- Total height of platform = 508 mm

Jointed Members

- Thickness of rectangular pipe = 3mm
- Thickness of angle bar = 3mm.
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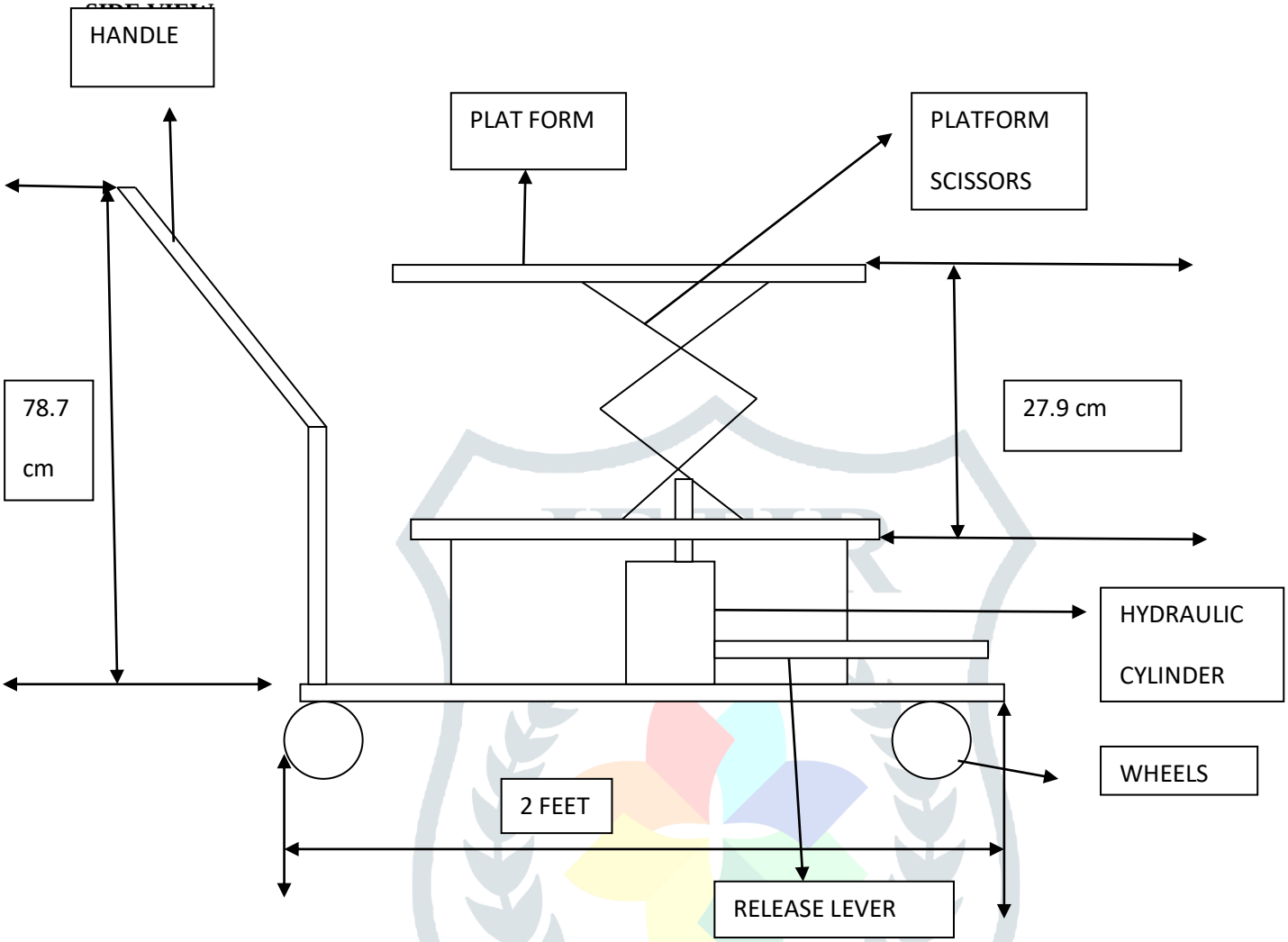
3.3 2D View of Hydraulic Scissor lift – Side View



IVDesign Calculations

TABLE 1 :DESIGN OF CYLINDER FOR STRESSES

P = 38.2 bar D = 50mm t = 5mm	Hoop stress $\delta_c = \frac{Pd}{2t}$ $= 3.83 \times 10^6 \times 50 \times 10^{-3} / 2 \times 5 \times 10^{-3}$	δ_c=19.1MN/M^2
P = 38.2 bar D = 50mm t = 5mm L = 450mm D = 50mm P = 38.2 bar	Longitudinal stress $\delta_L = \frac{Pd}{4t}$ $= 3.82 \times 10^6 \times 50 \times \frac{10^{-3}}{4} \times 5 \times 10^{-3}$ Bursting force (pressure) = PdL $3.82 \times 10^6 \times 50 \times 10^{-3}$ 0.45 Therefore Bursting force = Resisting force. Since the Hoop stress is less than the tensile stress of the material of the cylinder, the cylinder will not burst. δ_c = 19.1MN/M^2< 410MN/M^2 = δt	δ_L = 9.55mn/m^2

TABLE 2: HYDRAULIC CYLINDER CALCULATION

D=36 D=50 F=7.5KN A=1.9635×10^{-3}m2	Selected cylinder diameter from standard cylinder sizes $A_{1=\pi D}{}^{2}/_{4}$ $=\pi\ 50^2/4$ $A_2=\pi/4[D^2-d^2]$ $=\pi/4[50^2-36^2]$ Supplied pressure P=F/A $=7.5\times10^3/1.9635\times10^{-3}$	A_1 =1963.5mm^2 A_2=945.6mm^2 P=38.20bar

V. Material Selection, Construction Procedures, Cost analysis and maintenance

5.1 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 components.

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 metals.

Ferrous metals are those metals which have iron as their main constituent, such as cast iron, wrought iron and steels.

Non-ferrous metals are those which have a metal other than iron as there main constituent, such as copper, aluminum, brass, tin, zinc etc.

For the purpose of this project, based on the particular working conditions machine component were designed for only the ferrous metals have been considered.

5.2 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:

I. Scissors arms
II. Hydraulic cylinder
III. Top plat form
IV. Base plat form
V. Wheels

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 an 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. Result

By completion of Hydraulic Trolley it was found that it is capable of lifting 50kgs without any struggle from one place to another

VII. Conculsion

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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