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Design and Fabrication of Hydraulic Lift

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***Abstract*: Hydraulic lift is become very essential part of human life and also for companies that needs specific lifting elevators, that huge requirement is very customizable and also company oriented. Product design become complex because every products function is different from every aspect. In this project lift should be rigid enough to take load of 3 tones and also its speed is low. Hydraulic lifts bridge the gap between its requirements. So it require hydraulic power pack, actuators, ropes for more stability purpose.**

***Keywords*: hydraulic lift, customizable, hydraulic power pack, actuator.**

1. Introduction

Hydraulic lifting machines are widely used for the lifting, moving and pushing function in mining, construction and steel industries and in material handling equipment. Since 1950s the applications of hydraulic systems have been started in the industries and this form of power has become standard for the operations of industrial equipment's. Today, modern automation technology has a very important place for hydraulic systems. The reason for this is that hydraulic systems are simple, versatile and efficient for the transmission of power. The main job of a hydraulic system is the transmission the power as the power is changed from one form to another. Hydraulic systems with lift valves have been widely applied in various machines and devices, especially in those which operate on high flow rates of working medium. The dynamics in systems provided with such valves is highly influenced by correct selection of control nozzles. This article presents dynamic analysis of a selected hydraulic system provided with a lift valve, whose schematic diagram corresponds to the control of positive-displacement pumps in the feeding system of the pressure casting machine. A mathematical model of the lift valve as presented in this article illustrates the effect upon the working dynamics of the hydraulic system exerted by control nozzle diameter values.

2. Problem definition

The company actual works on conventional and experience basis only, but company want to enhance their design and production by using engineering, technologies. Company manufactures lifts on trial and error basis, so at starting level their lifts failed at 3 times, so company faced more economical and problem hence if proper design procedure if they will have, then design will not fail anymore.

It means they require appropriate design procedure for their lift. Before starting any project we should know the goal of project, this enables us to clear our design and manufacturing path.

- For material handling more time required.
- For material handling more efforts and man power required.

While handling material from one floor to another more chances of accidents.

3. Objectives

The major objectives of project are:

- To reduce the human efforts up to 70 - 80%.
- To develop an appropriate Design procedure for the design and fabrication of hydraulic lift.
- To minimize manufacturing cost up to 15 - 20% by using cost reduction in material, but having required strength.
- To develop a lift which reduce time of material handling with best utilization of available space.
- As compare to conventional it has less maintenance.

4. Literature review

Sampath S S, Dr. M. Chithirai Pon Selvan, in the present day, with the revolution in the materials and mechanical elements, applied technologies perceive folded growth.

Ye HUANG, Changsheng LIU, A butterfly valve has a simple structure, is convenient to operate, allows good flow regulation, and provides a good seal, and is widely used in petroleum, chemical, shipbuilding, metallurgy.

M. Antony Maria Thomas Benny, A hydraulic cylinder is a complicated mechanical system that are used to provide linear force action and motion. Hydraulic cylinders are powered from externally pressurized hydraulic fluid.

Ramesh.S, S. Denis Ashok, A Regenerative circuit is used to speed up the extension stroke of a double-acting single rod cylinder. Allowing fluid to flow into both the ports of a single rod cylinder to make it expand or at least try to expand as areas of contradictory sides of the piston are inadequate, the piston end of the cylinder has more force than the rod side.

5. Design

- *Lifting load constrain:* As per company's goods loading, Lift should be lift the maximum 3 tones. This enables us to design the lift, selecting materials and so on.

- *Lifting length constrain:* We have to design a lift such as minimum lifting length should be 7foot.Lifting length is one of the important aspect to design a lift one who design a lift has to consider minimum and maximum length of travel of lift.
- *Lift floor space area constrain:* As per company norms, we have to design a lift that has to be following floor space area requirement, Net Floor Space is to be covered

Total Area signed for lift = 98 square feet
Shape = Pure Rectangular shaped
Length x width = 7foot x 14foot

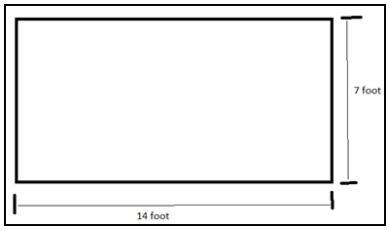

Fig. 1. Sketch in 2 D

6. Selection of system for lift mechanism

Selection of system for lift is one of the most influencing factor to meet required design constrains. We have sort out some of the main comparison points as follows. From discussing below points comparing with one another, we are at the result that Hydraulic System will be the best suitable for design constrains.

Table 1
Selecting the system and its comparison

Characteristics	Pneumatic	Hydraulic	Electric
Complexity	Simple	Medium	Medium/High
Peak power	High	Very high	High
Size	Low size/force	Very low size/force	Medium size/force
Control	Simple valves	Simple valves	Electronic controller
Position accuracy	Good	Good	Better
Speed	Fast	Slow	Fast
Purchase cost	Low	High	High
Operating cost	Medium	High	Low
Maintenance cost	Low	High	Low
Utilities	Compressor/power/ pipes	Pump/power/ pipes	Power only
Efficiency	Low	Low	High
Reliability	Excellent	Good	Good
Maintenance	Low	Medium	Medium

7. CAD model

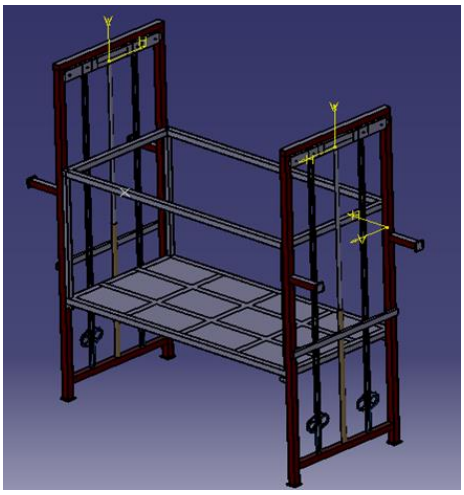
Fig. 2. CAD model

8. Material used and its properties

Material used for project is AISI1018 properties of this material is below,

Table 2
Mechanical properties

Mechanical Properties	Metric	Imperial
Hardness, Brinell	126	126
Hardness, Knoop (Converted from Brinell hardness)	145	145
Hardness, Rockwell B (Converted from Brinell hardness)	71	71
Hardness, Vickers (Converted from Brinell hardness)	131	131
Tensile Strength, Ultimate	440 MPa	63800 psi
Tensile Strength, Yield	370 MPa	53700 psi
Elongation at Break (In 50 mm)	15.0 %	15.0 %
Reduction of Area	40.0 %	40.0 %
Modulus of Elasticity (Typical for steel)	205 GPa	29700 ksi
Bulk Modulus (Typical for steel)	140 GPa	20300 ksi
Poissons Ratio (Typical For Steel)	0.290	0.290
Machinability (Based on AISI 1212 steel. as 100% machinability)	70 %	70 %
Shear Modulus (Typical for steel)	80.0 GPa	11600 ksi

9. Table

σ_{ty} = 370MPa
We know from V.B.Bhandari,
$\sigma_B = \sigma_{ty}$
$Z = \frac{1}{2} * \sigma_{ty}$
Line /loading diagram for slider
Loads $\Longrightarrow$

A = Total load/4
= 3000*9.81/4
A = 7357.5NA=B=7357.5 N
So,
Total vertical loads = Total downward loads
A+B = C
C= 7357.5 + 7357.5
C = 14715 N.

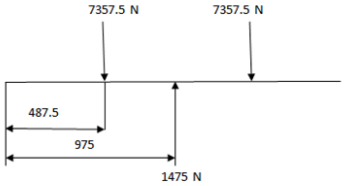

Fig. 3. Design of slider

Maximum bending moment = 975 *14715
= 14347125 N-mm

We know bending equation,

$M/I = \sigma_t /FOS * y$

Factor of safety should be minimum 2.

$14347125 *12 / Bd^3 = 185 *2/d$

Note: B= L= 1950

$14347125 /1950*d^3 = 30.83/d$

$d^2 = 14347125 /60125d= 6m$

Minimum height of slider should be 6mm.

10. Conclusion

This paper presented the design and fabrication of hydraulic lift.

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