A review for design of compact weight lifting machine using linear actuator

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***Abstract*— The present work is concerned with design and manufacturing of a compact weight lifting machine i.e. forklift which can be used for various purpose in domestic as well as industrial places. Improvement in forklift is really needed to make it more efficient, user friendly, and practical to use, & most importantly high safety features.**

The in-plant goods carrier system is user friendly as designed. The device finds greater use in the industrial lines for transport of the machined jobs, carrying goods internally in the fabrication plant. Forklift is an industrial power truck used for lifting and transport materials. Through the steel fork under the load, the lifting and transportation have been done. At present, different kinds of forklift is available, according to the lifting weight of forklift is divided into small tonnage (0.5t) and (1t), middle tonnage (2t and 3t) and large tonnage (5t and above).

The sort of compact weight lifting machine that we used in this project is linear actuator operated forklift as it is more reliable to operate. To develop new concept of the forklift design, we have done some survey by discussing with the forklift user. The scopes of project were on the designing 50kg maximum lifting capacity of forklift. To realize our new design goals, we would like to do some work on the existing forklift design and what kind of product transportation is using. supported that work, we would like to find what the shortcomings of existing designs are. The new design offers both new and improvised features, over what is currently available.

***Index Terms*— About four(minimum) key words or phrases in alphabetical order, separated by commas.**

INTRODUCTION

Now days thanks to heavy work load environment in the mechanical industry workers are been depressed for carrying a heavy load, where the workers are susceptible to unhealthy conditions. thanks to these factors some load carrying machines were developed in the recent past years. Like forklift may be a powered industrial truck used to lift and move materials over short distances. Forklifts are available at the market which needs more energy to operate, and cannot be used on the uneven surface. Working within the mechanical workshops or any other large fabrication unit, where load is to hold (bars, plates, machined jobs etc.) from one unit of the factory to the opposite unit this device is useful. the entire number of injuries per year (non-serious, serious, and fatal) is 96,785.

The aim of this project is to modify the design of the forklift in terms of its functionality and taking human factors considerations. during this project we are designing forklift up to 50kg of lifting capacity. within the process of obtaining a suitable design, the customer needs are going to be translating to the engineering characteristic to obtain the concepts that need to be modified and fabricated. most of the people are familiar with the basic forklift (manually operated) that is still included as standard equipment with newest automated forklifts.

Improvement in forklift is basically needed to make it more efficient, user friendly, and practical to use, & most significantly high safety features.

The In-plant goods carrier system is user friendly as designed. The device finds greater use within the industrial lines for transport of the machined jobs, carrying goods internally within the fabrication plant. Forklift is an industrial power truck used for lifting and transport materials. Through the steel fork under the load, the lifting and transportation are done. at the present, different sorts of forklift are available, consistent with the lifting weight of forklift is divided into small tonnage (0.5t) and (1t), middle tonnage (2t and 3t) and enormous tonnage (5t and above).

The aim of this project is to encounter these problems. during this project we are using two types of lifting mechanism to lift the load. Assumptions made in designing a forklift, the entire load is distributed among the forks for forklift (up to 100kg).

NEED OF STUDY

The main objective of this work is to minimize the human effort by improving the design of lift. To fulfill the requirement of industry, to reduce the cycle time and improving the productivity of plant.

Following are the objectives -

- To minimize the human effort.
- To make it compact in size as compared to the forklift that we used in the industries.
- To cut down the time and effort needed to lift, carry, and transport.

LITERATURE REVIEW

Aashishkumar L Sharnangat et al. [3] demonstrated that the robotic forklift intended to operate alongside human personnel, handling palletized materials within existing, busy, semi structured outdoor storage facilities. The robot operates in minimally-prepared, semi structured environments, in which the forklift handles variable palletized cargo using only local sensing, and transports it while interacting with other moving forklifts.

LiaiPan et al. [4] Qiulei Dub As a sort of industrial handling forklifts, forklift plays an important role in people's life. Nowadays, to meet the needs of the people, the kinds of forklift are more and more. during this project, supported already the basic parameters of the push forward forklift tin the market, the working device of the forklift has been introduced.

Praveen raj et al. [8] concluded that in the modern world though there are many developments in the field of engineering. Development of lift simplifies the effort of carrying heavy loads over stairs, it is not possible to use lift in all places like schools, college's constructional areas. This paper aims at developing a mechanism for easy transportation of heavy loads over stairs. The main objective is to find an efficient and user-friendly method of carrying various objects through stairs using minimum effort from the user and to also provide a smooth movement while climbing the stair. A stair climber is manufactured with tri lobed wheel frames at both sides of the climber and three wheels on each side are used in the tri lobed frame. The wheel assembly is rotated by a gear- motor mechanism where a direct current (DC) gear motor is used to provide the necessary power for rotation and a pinion- gear mesh is used for reducing the rotating speed of the wheel.

Mr. Ravi R. Mishra et al. [9] demonstrated within the first design, the facility transmission to the single- or double-wheel trolley is useless to climb the stairs due to height factor of stairs creates huge obstacle on the way of forklift. Also, the planning of the straight wheel frame became more complicated and was needed modified with its curve- spherical shape to give proper drive, which create more frictional force. For these reasons, three-wheel assail each side of forklift attached with frame was introduced to provide smooth power transmission to climb stairs without obstacles. Frame arrangement is suitable to transmit exact velocity ratio also. It provided higher efficiency and compact layout with reliable service.

Kulkarni et al. [9] concluded that, as per the survey a greater number of accidents happen due to a greater number of trolleys connected to a single tractor along with more load and it becomes difficult for the driver to control the tractor and its attachment trolleys. In this paper, they have designed a collapsible trolley that can be adjusted in size. So, to eliminate all the trolley related problems and reduce the cost, they have designed a simple trolley so that the work of two trolleys can be done in a single trolley. With this kind of design, it becomes easy for the drivers to drive the tractor and the trolley to the long distance safely.

Md. A. Hossain. Nafis et al. [12] concluded a replacement horizon for the transportation of the loads over the stair. Most of the buildings of the country are structurally congested and unavailing of elevator facility so it is difficult and laborious to lift heavy loads. The stair climbing Trolley can play a crucial role in those areas to lift loads over a short height, like libraries, hospital, and in construction area. The Trolley, which may move upper level through strain, or run in very rough and rocky surfaces, is named stair climbing Trolley.

VegimImeri et al. [13] demonstrated the dynamic occurrences on forklift during lifting of loads proves to be difficult using physical experimentation and current measurement devices. Creating the forklift's multibody model and applying computer simulations is extremely use full method to study these occurrences, which helps to elucidate the reasons of heavy oscillations, failures, and accidents of forklifts, and provides conclusions that can be useful for design considerations and safety. The aim is to work out how dynamic forces, moments, speed, and oscillations effect the forklift's construction and

its stability during load lifting. To try this work we designed entire "virtual forklift" using model design and simulation application and performed simulations in order to gain results. Main parameters that are influential on the dynamic behavior of forklift are going to be analyzed and will be searched for conclusions that can be useful for better understanding dynamics of forklift. This paper identifies a group of parameters that have influence in main forklift parts, and provides results with graphs and tables with values that are dynamic in nature, with high amplitudes and frequencies that effects directly in causes of fabric fatigue or failure.

Muthukumar K et al. [16] concluded that, forklifts offer many benefits like reducing manual material handling and enhancing productivity, there are factors that cause Musculoskeletal disorders (MSDs) to the forklift operators, like severely twisted postures, prolonged sitting, and exposure to vibration etc., ultimately resulting in low productivity. the most objective of this study is to evaluate different make forklifts in a heavy equipment manufacturing industry (Voltas-diesel, Godrej-diesel, Doosan-diesel, Voltas-electrical and Macniell-electrical) and forklifts with differing types of engines (diesel and electrically operated) based on subjective discomfort reported by the forklift operators using Corlett and Bishop's method of body mapping and Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). Forty-four operators aged between 20-58 years driving five different make forklifts were the themes. Operators performing on Godrej diesel reported more discomfort while operators working on Voltas-electrical reported less discomfort. Operators performing on diesel operated forklifts reported higher discomfort compared to electrically operated forklifts but the difference is small. part wise analysis revealed that the operators reported the highest level of discomfort at the lower back irrespective of the engine type.

Ben T Rails back et al. [15] demonstrated significant hazard related to the use of stand-up lift trucks, or stand-up forklifts, is the hazard of a lower limb crush injury or foot crush due to the opening across the rear of the operator compartment. According to one lift truck manufacturer's statistics, there have been over 500 accidents that resulted in an injury to the lower limb of the operator in the last 30 years that involved their stand-up lift trucks. Other manufacturers have had similar accidents. The injuries have occurred to the lower limb of the operator due to the proximity of the operator's lower limbs to the exterior of the lift truck, and the confined areas that stand-up lift trucks operate in. The operator's lower limb can become pinned and crushed between the moving lift and another fixed object such as a rack system, a column, or another lift truck. Objects, such as a fork tine, can also intrude into the operator compartment, injuring the operator's lower extremities.

Swagat Kelkar et al. [14] demonstrated that forklifts are used for material movement from one place to a different. the aim of the study was to find out the effective method for stability testing of the industrial forklift truck with the help of CAD model of the forklift. The forklift should be stable along lateral and longitudinal axis while moving with and without load on plain ground also as on slopes specified. These methods of stability testing and their values in several conditions are specified in IS4357. This paper focuses on procedure for stability testing of forklift in CAD before actual manufacturing of the truck.

CONCLUSION

We conclude that, compact weight lifting machine will helpful for little scale industries as it is easy to operate with less cost and indirectly it will save the labor cost. Savings resulting from the utilization of this machine will make it pay for itself with in short period of time and it can be a great companion in any field dealing with rusted and unused metals. It is mechanical device, does not required electricity as well as any external source of battery. The event of mechanical forklift assures the ergonomically comfort to the operator or worker and to reduces time required for manual lifting and handling. This increases efficiency of productivity and it provide safety of operator while handling of the fabric.

FUTURE SCOPE

The standard market for forklift is mainly focused on heavy loads and many big corporate companies are selling products for that, but their product has main disadvantage of big size, weight, and high cost. Whereas portable forklift is lighter small size and low cost. Also, it can be operated by unskilled user. Normal forklift cannot be made portable and cannot be used in rooms and office for lifting load hence there is a big market gap for our product. Based on end users, forklift market size is categorized into food, electrical, retail & wholesale, chemical,

logistics and automotive. Wholesale & retail distribution segment is projected to witness high demands owing to increased transportation activities across different regions and surplus goods stocking generating the requirement for distributors to increasingly deploy forklifts. Battery operated for are highly used in retail segment due to its high efficiency.

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