

Design and Fabrication of Hand Operated Forklift

MANIK SHARMA¹, PRANAY GANGURDE², PRAJWAL CHARDE³, KISHOR BHOSALE⁴, Dr. SACHIN JAMBHALE⁵

^{1,2,3,4,5}Dr. D. Y. Patil College of Engineering (DYPCOE), Department of Mechanical Engineering, Akurdi, Pune

Abstract--The present work is concerned with design and manufacturing of a portable 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 products transporter system is simple to utilise as designed. The tool is more frequently utilised in industrial lines for the internal transportation of commodities in the fabrication plant and for the movement of machined jobs. An industrial power truck called a forklift is used to lift and move items. Lifting and transporting of the cargo have been completed using the steel fork underneath. 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).

I. INTRODUCTION

Today's mechanical sector workers are depressed for bearing a large weight, which puts them at risk for hazardous circumstances. This is due to the industry's excessive work load environment. These factors led to the development of some load-carrying equipment in recent years. A powered industrial truck that is used to lift and transport things over short distances can be compared to a forklift. Forklifts are available at the market which needs more energy to operate, and cannot be used on the uneven surface. while loads (bars, plates, machined jobs, etc.) need to be carried from one unit of the factory to the other unit, such as while working in mechanical workshops or any other large fabrication unit, this device is useful. There are 96,785 injuries in total each year, including minor, major, and fatal ones.

The goal of this project is to change the forklift's design in order to improve functionality and take into account human issues. In this project, we are designing forklifts with a lifting capacity of up to 50 kg. The customer's requirements will be translated into engineering characteristics as part of the process of creating a suitable design to produce the concepts that need to be changed and manufactured. The most recent automated forklifts still come with the basic forklift (manually operated), which is known to most people. 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 products transporter system is simple to utilise as designed.

The device is more frequently used in industrial lines for the internal transportation of commodities within the fabrication facility and for the transportation of machined tasks. An industrial power truck called a forklift is used to lift and move items. Through the steel fork under the load, the lifting and transportation are done. at the present, different sorts of forklift is 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).

II. HISTORICAL BACKGROUND

Forklifts were initially thought about in the 19th century. These trucks had a minimal lift capacity and could only raise platforms a few inches. Those were usually employed to move products inside a store. The idea for a high forklift first emerged in late 1910. Tier trucks were approved for stacking cargo in 1930[1]. In 1930, forklift usage slowed down. Labour was inexpensively accessible during the Great Depression, but finding finance for investments was considerably more difficult. Then, from 1939 to 1945, the use of forklifts to transport weapons or supply the war effort became strategically important [1]. Because of the shortage of labour caused by enlistment in the military during the war, the forklift and its operator were more productive than manual labour. The current fork truck now combines handling benefits that were formerly dispersed among various distinct types of equipment after years of development and research. Local manufacturers created the initial versions without the aid of machinery, wrought iron axles, or cast-iron wheels. They possibly were the first materials handling devices to implement the cantilever principles, allowing weights to be picked up and moved without being raised. The unit load theory with skids was probably first applied when a crude vehicle that could raise its platform a few inches was built [2]. With the invention of the truck in 1913, the benefits of combining vertical and horizontal handling ability were increased. It was shaped like a little crane mounted atop.

III. LITERATURE REVIEW

Aashishkumar L Sharnangat et al. [1] demonstrated that Robotic forklifts are designed to work alongside human labourers in busy, semi-structured outdoor storage facilities, moving palletized accessories. The robot operates in sparsely prepared, semi-structured environments, where the forklift transfers the fluctuating palletized weight while interacting with other forklifts in motion. LiaiPan et al. [2] Qiulei Dub Forklifts, a type of industrial handling forklift, are crucial to people's daily lives. There are a growing number of different types of forklifts available today to fulfil consumer demand. The working forklift equipment has been introduced during this project, which already supported the fundamental forklift market parameters. Praveen raj et al. [3] Thus, it can be said

that engineering has undergone several advancements in the current world. Although the development of lifts made it easier to transport large objects upstairs, not all locations, such as schools and college construction zones, allow the use of lifts. This study intends to provide a system for simple transportation of big goods up and down staircases. Finding a practical and user-friendly way to carry various goods up and down stairs while requiring the user to exert the least amount of effort possible is the major goal. Stair climbers are built with tri lobed wheel frames, which have three wheels apiece on each side of the climber. the wheel assembly in question. Mr. Ravi R. Mishra et al. [4] demonstrated Due to the height factor of stairs creating a significant obstacle during the forklift in the first design, the installation gearbox to the single- or double-wheel trolley is useless to ascend the stairs. Additionally, the design of the straight wheel frame became more challenging and needed to be updated to consider its wind-globular shape to provide the correct drive, which increased frictional force. These factors led to the introduction of three-wheel assaults on each side of the forklift's frame, which provide smooth power transmission and enable obstacle-free stair climbing. It is possible to broadcast precise haste rates using frame arrangements. It delivered cutting-edge efficiency, a small design, and trustworthy service. Kulkarni et al. [5] It was determined that more accidents occur because there are more trolleys attached to a single tractor and more goods, making it difficult for the driver to handle the tractor and its connection trolleys. They have created a folding trolley that may be adjusted in size in this study. They therefore created a straightforward trolley that can perform the tasks of two trolleys in order to eliminate any trolley-related issues and cut costs. This type of architecture makes it simple for drivers to safely operate the tractor and trolley over extended distances. Md. A. Hossain. Nafis et al. [6] concluded for the purpose of moving the loads over the stair, it was decided on a replacement horizon. Lifting huge loads is tough and laborious because the majority of the country's buildings lack lifts and are structurally crowded. In places like libraries, hospitals and construction sites where items need to be lifted over short distances, the stair climbing trolley can be extremely useful. The trolley is known as a stair climbing trolley because it can run on extremely uneven and rocky surfaces or move up and down stairs under pressure. VegimImeri et al. [7] employing physical trial and current dimension bias, it was shown that the forklift's dynamic conditions when lifting loads prove to be delicate. To study these conditions, it is essential to develop a multibody model of the forklift and use computer simulations. This helps to interpret the causes of forklift failures and accidents and offers insights that can be helpful for design and safety considerations. The goal is to determine how dynamic forces, moments, speed, and oscillations influence the forklift's design and stability while lifting goods. We created a whole "virtual forklift" utilising model design and simulation operation to try to make this work.3) and carried out simulations to obtain results. We are going to analyse the key factors that have an impact on the forklift's dynamic gesture and look for insights that will help us better comprehend its dynamics. This study finds a set of variables that affect the primary forklift corridor and presents findings in the form of graphs and tables with dynamic values, high confines, and a high frequency of products that contribute

directly to fabric wear or failure. Muthukumar K et al. [8] We came to the conclusion that while forklifts have many advantages, such as reducing manual material handling and increasing productivity, there are also factors that can lead to musculoskeletal disorders (MSDs) in forklift operators, such as awkward postures, prolonged sitting, and vibration exposure, etc., which in turn can lead to low productivity. The subjects were forty-four operators operating forklifts from five different manufacturers, ranging in age from 20 to 58. Operators operating with Godrej diesel expressed greater discomfort, whilst those using Voltas electricity expressed less difficulty. Operators using diesel-powered forklifts reported more discomfort than those using electric forklifts, however the difference was not great. Independent of the engine type, a part-by-part examination showed that the operators' lower backs had the most discomfort. Ben T Rails back et al. [9] demonstrated the risk of a lower branch crush injury or bottom crush because of the opening across the reverse of the driver cube is a serious risk associated with the operation of stage-up lift swaps or stand-up forklifts. In the past 30 times, approximately 500 mishaps involving stage-up lift exchanges resulted in an injury to the lower branch of the driver, according to figures provided by one lift truck manufacturer. Similar mishaps have happened with other manufacturers. Due to the proximity of the driver's lower branches to the lift truck's surface and the restricted spaces that stand-up lift exchanges operate in, the injuries have spread to the driver's lower branch. The lower branch of the driver could be crushed if it were to project between the driving lift and something stationary, like a rack system, a column, or another lift truck. Chopstick-like objects can also slam into the driver cube and graze the lower extremities of the driver. Swagat Kelkar et al. [10] demonstrated that forklifts are used for material movement from one place to a different. the end of the study was to find out the effective system for stability testing of the artificial forklift truck with the help of CAD model of the forklift. The forklift should be stable alongside and longitudinal axis while moving with and without cargo on plain ground also as on pitches specified. These styles of stability testing and their values in several conditions are specified in IS4357. This study focuses on the process for forklift stability testing in CAD before actual vehicle construction.

IV. PROBLEM DEFINITION

Humans have always needed to lift things, but they haven't always had the skills to do it safely. Hoist were developed and used but we cannot use hoist to lift loads in few places. A hoist is just a system of chain and winches on platform that could somewhat be moved. Hoist were great for lifting but not for much for moving from one place to another in few places. The platforms could get under lifted goods and then moved with a handle for transportation of machines in few places was our idea to minimize the labor work. Forklift help moves stuff that humans could not move easily. To overcome this problem, we are using Forklift to find the solution on how to design a forklift using the simplest and cheapest way while it is energy saving. Although there were many ways to solve this problem, we recommend that the design of forklift system is the practical way when we considered all the factors

and consequences especially about the analysis to develop this product. Hence, this report had been prepared to recommend the design of the forklift that is user friendly and easier to operate as do not required too much money to develop this product.

V. WORKING METHODOLOGY

The project that we are planning to build will made by using the raw material mentioned above,the main raw material of project is mild steel, linear actuator, battery, shaft, wheel and hook. The project works, when the manual operator switches on the linear actuator as soon as the linear actuator motor switch is on it rotates the gear inside it and forces the lead screw to push the linear actuator, the linear actuator pushes the upper arm of the forklift. The upper arm of Forklift is connected to chain and hook. The operator operating the linear actuator holds the shaft on his hand. One end of linear actuator is connected to hook another end is to lower body, where the total weight of a machine is transmitted to the floor. It is operated on 24-volt lead acid dry battery. The electrical energy of battery is converted into mechanical energy by using linear actuator, the linear actuator gives power to the upper arm and weight lifting capacity of the machine is around 50 kg.

VI. DESIGN

The entire model has been designed with the help of designing software solid works. With the help of colour feature the colours are given to the entire model.

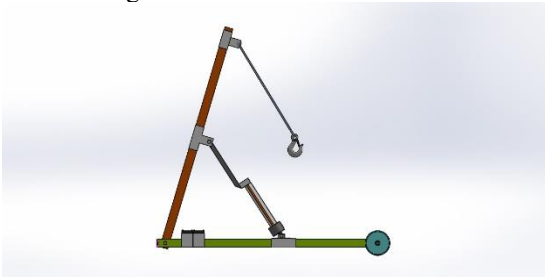


Fig 1. Side view of forklift

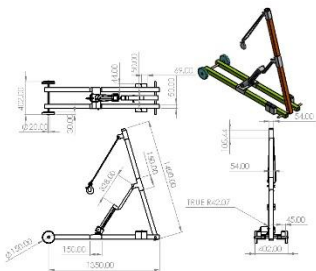


Fig 2. Drafting of forklift



Fig. 3 Isometric view of forklift



Fig. 4 Working Model

Sr no.	Weight to be applied (kg)	Weight Lifted (Yes/No)
1.	8	Yes
2.	20	Yes
3.	25	Yes
4.	53	Yes

Fig. 4 Result and Validation

VII. CONCLUSION

This machine will pay for itself quickly thanks to the savings it produces from use, and it can be a tremendous helper in any field dealing with rusted and unused essence.

The use of a mechanical forklift guarantees the driver's or employee's ergonomic comfort and cuts down on the time needed for manual lifting and jogging.

It is capable of lifting 68kg weight which ensures to reduce human efforts.

Different weights are applied to see the maximum ability of the forklift and it is qualified in every test of testing.

We get to the conclusion that our design will be beneficial for small-scale enterprises since it is simple to use, inexpensive, and will laterally save manpower costs.

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