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Fabrication of Pedal Operated Hydraulic Forklift

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ABSTRACT: The Fabrication of a pedal-operated hydraulic forklift offer a sustainable and cost-effective solution for material handling in small-scale industries and resource-constrained environments. This project aims to develop a manually operated forklift that utilizes human power for propulsion and hydraulic mechanisms for lifting and lowering loads. The design process involves conceptualizing a robust frame structure capable of supporting varying loads while ensuring ergonomic pedal operation. Hydraulic systems are integrated to provide the necessary force amplification for lifting heavy loads efficiently. Emphasis is placed on simplicity, reliability, and ease of maintenance to suit the needs of users in diverse settings.

Fabrication involves selecting appropriate materials and components, machining, welding, and assembly. Attention is given to optimizing the design for durability, safety, and ease of operation. Performance testing is conducted to evaluate the lifting capacity, maneuverability, and overall efficiency of the forklift prototype. The outcome of this project is expected to provide a practical solution for material handling tasks in environments where conventional forklifts are inaccessible or economically unfeasible. The pedal-operated hydraulic forklift offers advantages such as low cost, sustainability, and versatility, making it a valuable asset for small-scale industries, agricultural operations, and humanitarian aid efforts.

KEYWORDS: Monitoring display, solar panels, rack and pinion, torque motor, battery.

I. INTRODUCTION

This project deals with a Study on the A forklift truck is a powered industrial truck used to lift and move materials short distances. The forklift was developed in the early 20th century by various companies including the transmission manufacturing company Clark and the hoist company Yale & Towne Manufacturing. Following World War II the use and development of the forklift truck has greatly expanded worldwide. Forklifts have become an indispensable piece of equipment in manufacturing and warehousing operations. Forklifts are primarily used for lifting and transferring heavy loads to stations or locations in warehouses, shops or construction sites. Usually there are two forks in the front of a forklift (some type of forklifts have the forks on the side) that are used to lift loads that may weigh up to thousands of pounds. These forks can be moved forward and backward, and also up and down for lifting and moving cargo. Forks are classified into 4 different groups depending on the spacing between the fork hooks, i.e. Class I (Rated for loads up to 2000 lbs. with the spacing at 13 inches), Class II (Rated for loads up to 5,550 lbs. with the spacing at 16 inches), Class III (Rated for loads up to 10,000 lbs. with the carriage bar spacing at 20 inches), and Class IV (Rated for loads up to 15,500 lbs. with the spacing at 25 inches). Forks are responsible for picking up the load and carry it during the transportation. In this process, there are two kinds of failure: sudden fracture due to the heavy load and fatigue fracture due to the vibration caused by uneven ground during the transportation. These can be effectively analyzed using FEA. In this project we deals with the analysis of forklift forks and cylinders etc., where the load will be effective by using the ansys software. To make a note of analysis we created a model by solidworks software.

A Population of India is very large so that the main of any industrial company to fulfill a customer This machine transfer a work from one station to other hence work is done in time, So that we get more production as well as accuracy. This may gives better production efficiency. Due to material handling machines we reduce cycle time of particular job by reducing handling, fixing and carrying time. Forklifts are rated for loads at a specified maximum weight and a specified forward center of gravity. This information is located on a nameplate provided by the manufacturer, and loads must not exceed these specifications. In many jurisdictions, it is illegal to alter or remove the nameplate without the permission of the forklift manufacturer. An important aspect of forklift operation is that it must

have rear-steering While this increases maneuverability in tight cornering situations, it differs from a driver's traditional experience with other wheeled vehicles.

II. LITERATURE REVIEW

- Ravi G. Kaithwas stated that, Forklifts are designed to handle and transport both raw materials and goods carefully and efficiently. From time to time these machines must be transported from one work site to another. A normalsitdown forklift with the ability to lift 5,000 pounds will itself weigh as much as 9,000 pounds.
- Anil A. Sequeira stated that Forklift is defined as an industrial truck which is capable of lifting hundreds of kilograms. Forklift is commonly used in warehousing and manufacturing and it consists of two metal forks at the front of the vehicle in order to lift and transfer the load.
- Jian-Yi Wang stated that Forklift truck is one of the most important tool sin logistics. However, the general mast system of a forklift truck not only restrains the driver's vision, but also increases the whole weight of a truck and decreases the fuel economy. Therefore, this paper focuses on the innovative design of a new lifting mechanism for forklift

III. OBJECTIVES

- └ Safety: Safety should always be the top priority. Objectives related to safety might include reducing the risk of accidents and injuries by implementing proper training programs for forklift operators.
- └ Efficiency: Improving efficiency helps maximize productivity and minimize downtime. Objectives in this area could include reducing the time required to complete material handling tasks.
- └ Productivity: Increasing productivity involves achieving higher output with the same or fewer resources. Objectives may include improving the speed and accuracy of forklift operations, increasing the number of loads handled per shift, reducing idle time, and minimizing delays in material flow.
- └ Cost Reduction: Controlling costs is essential for maintaining profitability. Objectives related to cost reduction might include reducing fuel consumption by optimizing forklift routes and operations, minimizing equipment downtime through proactive maintenance.
- └ Accuracy: Ensuring accuracy in material handling helps prevent errors and minimize waste. Objectives may include improving the precision of forklift movements during loading, unloading, and stacking operations, minimizing product damage through careful handling practices, and implementing inventory tracking systems to maintain accurate records of stock levels.
- └ Training and Development: Investing in training and development programs for forklift operators is essential for ensuring competence and proficiency. Objectives might include providing comprehensive training on forklift operation, safety procedures, and equipment maintenance.
- └ Environmental Sustainability: Promoting environmental sustainability involves minimizing the environmental impact of forklift operations. Objectives could include reducing fuel consumption and emissions by transitioning to electric or alternative fuel-powered forklifts, implementing energy-efficient practices such as optimizing equipment usage and minimizing idling, and exploring opportunities for recycling and waste reduction in material handling processes.

IV. REQUIREMENT OF COMPONETS

1. HYDRAULIC JACK:-

A hydraulic jack is a mechanical arrangement that uses the power of fluids for operation. With a hydraulic jack, one can easily lift heavy loads using a small applied force. Normally, this lifting device uses a hydraulic cylinder for applying initial power. Hydraulic jacks have a wide range of applications in railways, defense, earthmoving equipments, aeronautical, material handling equipment, hydropower plants, mining and lifting platforms. The even and stable transmission movement under varying or maximum load made hydraulic jacks suitable for all the above applications. Also, jacks using hydraulics can provide increased lifting capacity over a greater distance. Hydraulic Jack Working is

based on Pascal's principle.



FIG :- HYDRAULIC JACK

2. 360DEG ROTATING WHEEL :

This project is about 360-degree rotating wheel. This wheel moves in all directions and this design provides better comfort and also saves the time, most of the people uses this vehicle to carry goods, emergency patients etc. The normal wheel face lot of problems like parking, U turn and much more which consumes more time. So, we have designed a 360-degree wheel rotating vehicle to reduce and eliminate problems in the industry as well as common life of people. The vehicle can take a turn without moving the wheel. No extra space is required to turn the wheel. In this system, each of the 4 wheels has given drive with DC motors, so it can rotate 360 degree. 360-degree rotating wheel is controlled by RF remote. Consequently, we can utilize this 360-degree rotating vehicle from various perspectives like to transport things overwhelming bags and furthermore in vehicles, which will help in decreasing rush hour gridlock and spare time.



FIG:- ROTATING WHEEL

3. BEARING :-

A **bearing** is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction. In the ball bearing and roller bearing, to reduce sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.



FIG :- BEARING

4. SPRING:-

A **spring** is an elastic object that stores mechanical energy. Springs are typically made of spring steel. There are many spring designs. In everyday use, the term often refers to coil spring. When a conventional spring, without stiffness variability features, is compressed or stretched from its resting position, it exerts an opposing force approximately proportional to its change in length. The rate or spring constant of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring's rate is expressed in units of force divided by distance, for example or N/m or lbf/in.

A torsion spring is a spring that works by twisting; when it is twisted about its axis by an angle, it produces a torque proportional to the angle. A torsion spring's rate is in units of torque divided by angle, such as N-m/Rad or ft-lbf/degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.



Fig : Spring

5. BOLT & NUT:-

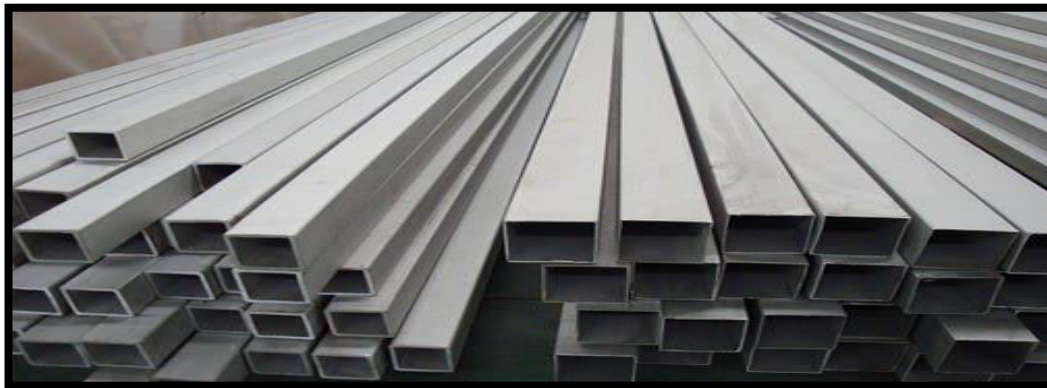
Bolts are often used to make a bolted joint. This is a combination of the nut applying an axial clamping force and also the shank of the bolt acting as a dowel, pinning the joint against sideways shear forces. For this reason, many bolts have a plain unthreaded shank (called the grip length) as this makes for a better, stronger dowel. The presence of the unthreaded shank has often been given as characteristic of bolts vs. Screws, but this is incidental to its use, rather than defining. A **nut** is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together. In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive thread-locking fluid such as Loctite, safety pins (split pins) or lockwire in conjunction with castellated nuts, nylon inserts (nyloc nut), or slightly oval-shaped threads.



Fig:- Bolt and nut

6. Mild Steel Square Pipes:-

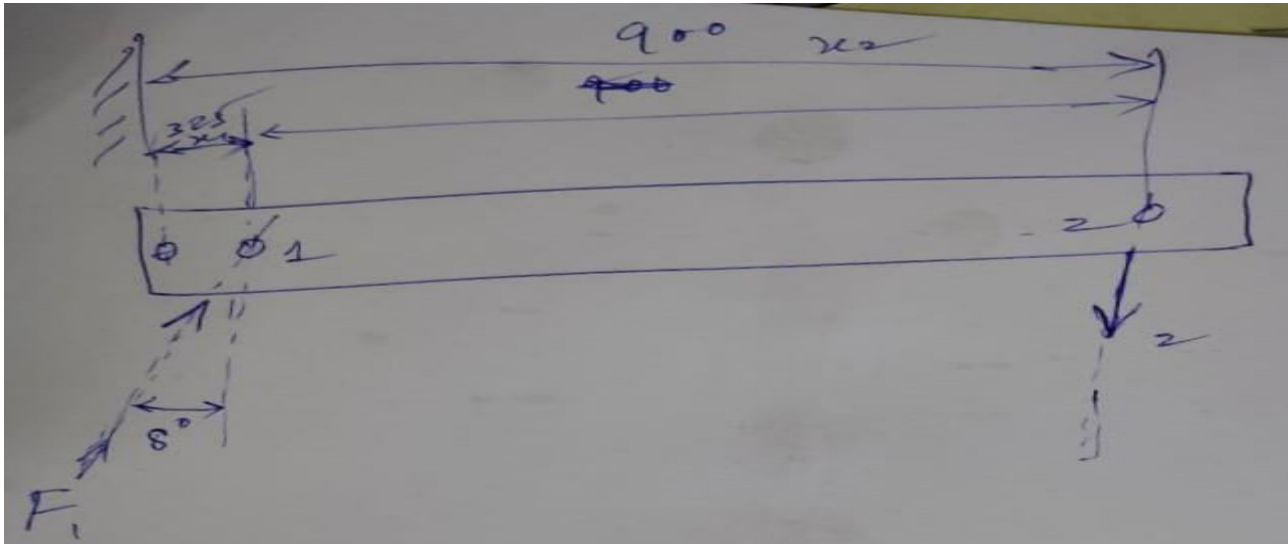
Mild steel square pipes are widely utilised in building projects because of their exceptional blend of durability and cost-efficiency. These pipes are commonly utilised in the construction of building frameworks, support structures, and various fabrication operations. Due to their exceptional weldability and high tensile strength, these materials are well-suited for various applications, including but not limited to fencing, railings, and pedestrian walkways. As a reputable Square pipe dealer in Vadodara, we provide an extensive selection of mild steel square pipes to accommodate various project needs.



ASSEMBLE MODEL



Calculation: -



$$F1 = 3000 \text{ N} \quad X1 = 325\text{mm}$$

$$F2 = ? \quad X2 = 900\text{mm}$$

$$F1 X1 = F2 X2$$

$$F2 = \frac{F1 X1}{X2}$$

$$F2 = \frac{3000 \times 325}{900}$$

$$F2 = 1083.33\text{kgf}$$

Bending moment

$$\begin{aligned} \text{At point 1} &= F1 * X1 \\ &= 3000 * 325 \\ &= 975000 \text{ N-mm} \\ &= 975 \text{ N-m} \end{aligned}$$

$$\begin{aligned} \text{At point 2} &= F2 * X2 \\ &= 1084 * 900 \\ &= 975600 \text{ N-mm} \\ &= 975.6 \text{ N-mm} \end{aligned}$$

V. CONCLUSION

A hydraulic lift moves objects using the force created by pressure on a liquid inside a cylinder that moves a piston upward. The principle for hydraulic lifts is based on Pascal's law for generating force or motion, which states that pressure change on an incompressible liquid in a confined space is passed equally throughout the liquid in all directions. Hydraulic lifts provide controlled and precision force. The sturdy and durable design of hydraulic lifts has made them popular in a wide variety of industries. The Occupational Safety and Health Administration (OSHA) and the American National Standards Institute (ANSI) have specific requirements regarding the operation of hydraulic lifts and training for operators. The conclusion and scope of the project on the fabrication of a hydraulic fork lift succinctly summarize the key findings, achievements, and future prospects. It outlines the project's success in meeting objectives, contributions to knowledge, recommendations for implementation, future research directions, limitations, and final remarks on its significance.

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