



Battery Operated Forklift Vehicle

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Abstract:

Material Handling is the movement, storage, control and protection of materials and products. Material handling equipment are used to increase throughput, control costs and maximize productivity. Everything we use at some stage, has been stored and handled by materials handling equipment. A FORKLIFT TRUCK is a powered industrial truck used to lift and transport materials. It is an indispensable piece of equipment in manufacturing and warehousing operations. The battery operated 3 wheel Forklift vehicle should be designed to make the process of stocking warehouses safer and more efficient. This vehicle is self drive by the used of battery power and the lifting mechanism is also runs on battery power with the help of lead screw mechanism. There are already many types of forklift conveyer available since ancient time. But our aim is to design forklift conveyer pollution free by using battery and more efficient lifting by using lead screw.

Keywords: Ball bearing, battery, forklift, lead screw.

I. INTRODUCTION

A forklift (also called lift truck, fork truck, fork hoist, and forklift truck) is a powered industrial truck used to lift and move materials over short distances. The forklift was developed in the early 20th century by various companies, including Clark, which made transmissions, and Yale & Towne Manufacturing, which made hoists. Since World War II, the use and development of the forklift truck have greatly expanded worldwide. Forklifts have become an indispensable piece of equipment in manufacturing and warehousing. In 2013, the top 20 manufacturers worldwide posted sales of \$30.4 billion, with 944,405 machines sold. The Forklift System is designed to make the process of stocking efficient while decreasing unnecessary work related spending. A one-sixth scale model forklift is being used to demonstrate the feasibility of the project. An operator will control the system at a safe distance away from the forklift, such as in a separate control room, decreasing the risk of work related injuries with a handheld user interface. The Automatic Forklift System is capable of the following operations: receiving commands from the operator, navigating through the modeled warehouse, retrieving and placing pallets at desired locations. Our proposed device will use lead screw for lifting fork lift, it has been developed for the needs of small and medium scale industries, who are normally man powered with very minimum of skilled labours. In most of the industries the materials are lifted by using high impact man power and more amount of skilled labours.

II. LITERATURE REVIEW

Forklift is a part of AGV's. It has played a role in moving material and product for more than 50 years. First AGV system was introduced in 1950 by the late 50's and early 60's forklift AGV were involved in various factories and warehouses the development in the automatic guided vehicle came in 1970 with improvement in its several functions, work platform and transportation devices. The middle 19th Century through the early 20th century saw the development that lead to today's modern lifts. In 1906, Pennsylvania rail road

introduced battery powered platform trucks for moving luggage at their Altoona. In 1917, Clark in the United States began developing and using powered tractors and power lift tractors in their factories. Towne manufacturing in 1920 entered the lift truck market in the United States. During the 1990 exhaust emissions from forklift operation begin to be operating which lead to emission standards being implemented for forklift manufactures in various countries. The introductions of AC power lifts along with fuel cell technology are also refinements in continuing forklift development.

1. Clark proposed the Engine operated forklift

An engine is a device that uses chemical energy, a fuel, to produce mechanical energy. Engines operating on this principle are called internal combustion engines and are used in what we call IC forklifts. Because automobiles use the same type of engine, many people are familiar with an internal combustion (IC) engine. While it operates similar to your vehicle, four unique engine types are used in forklifts.

- **Gasoline engines** use the same fuel as an automobile.
- **Liquefied Petroleum Gas (LPG)** engines run on a gas that occurs naturally. LPG is commonly used for gas grills.
- **Compressed Natural Gas (CNG)** engines use the same fuel supplied to homes and businesses to power stoves, furnaces and other appliances.
- **Diesel engines** use diesel fuel, a lower grade fuel not as refined as gasoline and therefore, not as combustible.

2. Operation of fuel operated forklift

An ignition battery and gear-driven starter forces the engine to "crank over," starting the internal combustion process. The carburetor mixes a combustible, liquid fuel with air and injects it into the cylinders through a valve. Within the cylinder, the piston is attached to a rod, which in turn is attached to the crankshaft. Mechanical energy is produced when the spark plug introduces a spark to the compressed fuel/air mixture, igniting the explosion. The explosion drives the piston and rod

down in the cylinder. Because of the way the crankshaft is designed, it will convert the downward energy of the piston and rod to the mechanical energy



Figure.1. Fuel Operated Forklift

3. Advantages of forklifts powered by diesel include

- Great for outdoor use. Diesel forklifts are not adversely affected by wet or damp weather.
- Convenience; A diesel forklift can be parked anywhere.
- Better performance. Acceleration, forklift speed, driveline torque at low RPM, and other performance capabilities are superior and it can easily handle any hydraulic additions.
- More power: Diesel lifts are more powerful and cost less to operate.
- More loading capacity. Diesel forklifts are considered better in industrial applications or carrying heavier loads
- Less maintenance issues: A diesel forklift requires less scheduled and repair maintenance.

4. Disadvantages

As you would expect, the disadvantages of diesel forklifts concern their use of a fossil fuel. Here are some disadvantages to consider.

- Noise and fume emissions. This could be an issue with some workers and can cause problems if the lifts are used primarily indoors. Emission limiting accessories can be added, but they can be quite costly.
- It's large and cumbersome. The diesel models size and bulk may cause a problem in a cramped warehouse and requires more space if it is stored inside a warehouse.
- A bulky fuel tank. You may be required to pay extra for the tank that stores the diesel fuel.
- Higher fuel costs in the future. If you're in the market for a fleet of forklifts, then you don't want to get stuck with vehicles with ever-rising costs of ownership.
- More brake wear. Unlike electric forklifts, the driver of a diesel forklift is required to apply the brakes more often. Waste fluids to recycle. Unlike electric lifts, diesel lifts require engine, transmission, and coolant fluid changes.
- On-site fuel storage. This could result in liability and safety issues.
- Higher purchase price. The initial cost of buying and the capital costs of a diesel forklift are higher.

III. PROPOSED THEORY AND SCOPE OF RESEARCH OBJECTIVE

In this research, we investigate a forklift design that is new and different from existing designs. The new design offers two features: one is that the battery operated forklift is made by eliminating engine so that less emission of carbon dioxide will take place, and the other feature is that the new lifting mechanism uses here will be lead screw mechanism instead of rope and pulley to avoid slipping of rope during lifting . The

remainder of the thesis elaborates these new features in more details.

1. SYSTEM DESIGN

In system design we will mainly concentrate on the following parameter

1.1) System selection based on physical constraints:-While selecting any m/c it must be checked whether it is going to be used in large scale or small scale industry In our case it is to be used in small scale industry So space is a major constrain .The system is to be very compact it can be adjusted to corner of a room. The mechanical design has direct norms with the system design hence the foremost job is to control the physical parameters so that the distinction obtained after mechanical design can be well fitted into that.

1.2) Arrangement of various component Keeping into view the space restriction the components should be laid such that their easy removal or servicing is possible moreover every component should be easily seen & none should be hidden every possible space is utilized in component arrangement.

1.3) Components of system:-As already stated system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact A compact system gives a better look & structure.

1.4) Man –m/c Interaction:- The friendliness of m/c with the operation is an important criterion of design. It is application of anatomical.

1.5) Cances of failure:- The losses incurred by owner in case of failure of a component are important criteria of design. Factor of safety while doing the mechanical design is kept high so that there are less chances of failure there over periodic maintenance is required to keep the m/c trouble free.

1.6) Sevicng facility:- The layout of components should be such that easy servicing is possible especially those components which required frequent servicing can be easily disassembled.

1.7) Scpe of future improvement:-Arrangement should be provided to expand the scope of work in future such as to convert the m/c motor operated this system can be easy conFigd to required one.

1.8) Height of m/c from ground:-Fore ease and comfort of operator the height of m/c should be properly decided so that he may not get tired during operation .The m/c should be slightly higher than that the level also enough clearance be provided from ground for cleaning purpose.

1.9) Weight of machine:-The total wt of m/c depends upon the selection of material components as well as dimension of components. A higher weighted m/c is difficult for transportation & in case of major break down it becomes difficult to repair.

IV. CONSTRUCTION

The following can be the main component for the proposed battery operated forklift

1) LIFTING TROLLEY:

This trolley is made by the M.S. Material for loading and unloading and for lifting and transporting the material from one place to the another place in the industry.

2) D.C. BATTERY:

Batteries are further classified into two types

• **DRY RECHARGEABLE BATTERY**

These batteries are very small in size; they are also called as pencil cells. This battery consists of Nickel cadmium material for electricity generation. It has an output voltage of 12v and

an output current of 500 ma. It is used mobile phone, pagers, electronic pocket diaries etc.

• WET RECHARGABLE BATTERIES

These batteries consist of lead electrodes and Sulphuric acid for power generation. The lead electrodes are immersed in conc. Sulphuric acid in porous partition. These batteries are mostly used in automobiles. Lead acid battery is also an example of wet batteries. This consists of lead acid medium for current generation. These materials are placed in a sealer casing. These are comparatively compact and are mostly use in emergency light solar lanterns etc.



Figure.2. Lead Acid Cell

3) D.C. MOTOR:

DC Geared Motor, 12V, 150 RPM, Torque up to 1.5 Kg-cm. This DC Motor with Metal Gear Head is generally used in various robotics applications,



Figure.3. Dc Geared Motor

4) DP/DT SWITCH: In electrical engineering, a switch is an electrical component that can break an electrical circuit, interrupting the current or diverting it from one conductor to another. The mechanism of a switch may be operated directly by a human operator to control a circuit (for example, a light switch or a keyboard button), may be operated by a moving object such as a door-operated switch, or may be operated by some sensing element for pressure, temperature or flow. A relay is a switch that is operated by electricity. Switches are made to handle a wide range of voltages and currents; very large switches may be used to isolate high-voltage circuits in electrical substations.

5) LEAD SCREW:

A lead screw also known as a power screw or translation screw is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the

large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. Common applications are linear actuators, machine slides (such as in machine tools), vises, presses, and jacks. Lead screws are manufactured in the same way as other thread forms (they may be rolled, cut, or ground).



Figure.4. Lead Screw

6) BALL BEARING:

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least two races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly. As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

2. WORKING

The forklift can be assembled as per our concept and design. For this forklift we proposed to use two D.C. Motors. First motor is used for moving the forklift from one place to another place i.e. to transport the material from one place to another place. For moving the forklift we operate the DP/DT Switch this switch rotate the D.C. Motor in clockwise and anticlockwise due to this the machine is move in reverse and forward direction and move the material from one place to another place. The second D.C. Motor is used for lifting and lowering the material from one place to another place through the lead screw. For lifting and lowering the material initially we put the material on the tray. According to the requirement we rotate the D.C. Motor through the DP/DT Switch in clockwise or anticlockwise through the lead screw rotation. This lead screw is connected to the D.C. Motor through the pinion arrangement. Hence in this way forklift runs.

V. ADVANTAGES

1. Loading and unloading process is easily done by this 3 wheel forklift.
2. This forklift is faster as compared to existing forklift.
3. This forklift is safe for worker during the material handling.
4. Easy formaintenance.
5. Cost effective.

VI. APPLICATION

1. This forklift can be used for transporting every material

2. This forklift is used in warehouses
3. This forklift is used in manufacturing, automobile industry for transporting raw material, semi finished material and also for finish product.

VII. RESULT

In order to enhance the transportation system with in the industries a manually operated vehicle is designed to move the finished product or industrial components. The advanced vehicle is forklift conveyer. This vehicle is completely ecofriendly as it is battery operated. In order to have smooth movement of the fork of the vehicle to move from top to bottom and vice versa, it is mounted with lead screw mechanism. This consumption of forklift conveyer is less as compare to other transport vehicle within industries. As it is compact it requires less area. The components can be loaded and unloaded easily in a forklift conveyer. The working efficiency of the forklift is more as compare to other transport vehicle. On mass production it can be manufactured at low cost. The leading companies such as HAL, Tata Motors, Maruti Suzuki etc. uses this vehicle in their assembly line for transport.

VIII. CONCLUSION

The project work “Battery operated forklift” is aimed to control through lead screw. The main advantage of using this technology is to increase the safety of operator by operating the forklift from certain distance. This increases the efficiency of the productivity, because human errors due to the poor visibility can be minimized. The system is designed and developed successfully, for the demonstration purpose prototype model (mini model) is constructed. After going through these collected data and statistics from various journals as well as research papers; we came to conclusion that remote controlled fork lift is the only way to stop such industrial issues like labour cost, hazardous material handling. Our project has a simple electrical heart and a simple mechanical body. It can be modified into any high class application. Considering the project time and all the necessary steps, we concluded this project is the right one.

IX. REFERENCE

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