



Application of Forklift for Sensitive Material Handling

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Abstract:

The forklift are the lifeline of warehouses, storages and transporting units. Various units and plant uses different types of forklift according to their usage and application. Now a day's the forklifts are designed according to their areas of application like special operation forklifts which are designed for special tasks. Another factor is safety of operator and avoiding accidents in industries while operating the forklift, the conventional forklift are comes with safety attachment of operator but whereas material or logistic concerned the sensitive material needed to handle with extra care and safety factor is high while handling them and the conventional forklifts cannot be utilized for it as it's having high raising speed of fork/lifting trolley for such application we designed a forklift to handle sensitive material like flammable or inflammable liquid, glass objects and other material.

Keywords: Forklift, battery, lead screw, ball bearings, pinion, Energy consumption, Human power, actuator, sensitive material handling, Safety factor.

I. INTRODUCTION

From the beginning if industrialization the problem of in plant material handling and transporting is much time taking and consumed a lot human power solution over this in 19th century the Clark company which used to manufacture axels started using tractor an in plant material transporting vehicle, In year 1917. The other industrialist also showed interest in this in plant transporting vehicle and the ordered Clark Company to manufacture tractor for their industries also. This is the beginning of forklift to lift object and transport them one unit of plant to another, also they used to loading and unloading of transporting vehicles like trucks. Various innovations are added and various new features are introduced to the forklift from 1917. Now a day's forklift are of many types and can be categorized into two main types according to their use.

- i. Indoor forklift
- ii. Outdoor forklift

The indoor are battery operated and are used in favorable conditions like plane surface, and under favorable temperature and are light duty forklift. Whereas, the outdoor forklifts are heavy duty and operated on gasoline or diesel and they can be used in all terrains and utilized outdoor as name suggest. The conventional industrial forklifts designed to handle and transport solid material like cars, containers maximum but, there is no such conventional forklift available to handle and transport liquid material and sensitive material and objects so we proposed design of liquid and sensitive material handling forklift which add extra safety factor in handling f material while lifting them.

II. FORKLIFT DESIGN AND CLASSIFICATIONS

There are actually seven classifications of forklifts (aka industrial trucks). The classifications are set up by the Professional Safety and Health Administration, or OSHA, and include the following typed of forklifts:

- Class I: Electric Motor Rider Trucks
Class II: Electric Motor Narrow Aisle Trucks

- Class III: Electric Motor Hand Trucks or Hand/Rider Trucks
Class IV: Internal Combustion Engine Trucks (Solid/Cushion Tires)
Class V: Internal Combustion Engine Trucks (Pneumatic Tires)
Class VI: Electric and Internal Combustion Engine Tractors
Class VII: Rough Terrain Forklift Trucks

The classifications above give us some general differences between forklifts, such as different type of tires, power sources and even terrain. Forklifts can be built-in with pneumatic tires, which consist of a long-lasting rubber that can go outdoors. Or solid tires (aka cushion tires), which are made of solid rubber tire that are normally used on forklifts that will be used indoors on hard and flat surfaces

III. OBJECTIVES

This project is developed to forklift mainly preferable for small industries. The main purpose of this project are listed below:

- Taking safety as prime consideration: This device is safer in all respects
- To build a device which is helpful for carrying material in plant
- To develop a device which is helpful for the industrial works like lifting and transportation
- To save the cycle & other time of the job production.
- To make a device which is suitable economically for small Scale industries

IV. MECHANISM USE:

i. Mechanism of Electric Actuator

An actuator is a module of a machine that is responsible for movement and controlling of a mechanism or system, example: opening a valve. In simple terms, it is a "mover". An actuator needed a control signal and a source of energy. The control signal is reasonably low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power. Its core energy source may be an electric

current, hydraulic fluid pressure, or pneumatic pressure. When it gets a control signal, an actuator responds by transforming the signal's energy into mechanical motion. An actuator is the instrument by which a control system acts upon an environment. The control system can be simple (a fixed mechanical or electronic system), software-based (e.g. a printer driver, robot control system), a human, or any other input. An electric actuator is motorized by a motor that transforms electrical energy into mechanical torque. The electrical energy is used to actuate tools such as multi-turn valves. Additionally, a brake is typically installed above the motor to prevent the media from opening valve. If no brake is installed, the actuator will uncover the opened valve and rotate it back to its locked position. If this continues to happen, the motor and actuator will ultimately become damaged. It is one of the uncontaminated and most readily available forms of actuator because it does not directly involve oil or other fossil fuels. 'Free Lift' denotes to a forklift truck's ability to lift its forks without raising the masts. This is mostly useful when operating within tight height restrictions. In this project we created an actuator type module in which the trolley get lifted, by the rotation of lead screw which act like an actuator but having fixed length and the movement of trolley occur in between fixed length of lead screw. The motion is provided by the DC geared motor (12V, 150RPM, 1.5kg-cm) which is mounted on the top of the mast.

ii. Driving Mechanism

The driving mechanism is inspired from the turning mechanism used in tractor but we have done some special arrangements keeping the mechanism same and simple we attached a strip directly to the steering and attached it to the both front wheels which can be adjust according to working condition or the turning depending according to the path of forklift. This will have benefit in maintenance as it's having simple mechanism as well as better control over forklift even to the new operator.

V.CONSTRUCTION

The lifting trolley is made from sheet of mild steel and square mild steel rod which itself insure strength of the trolley which can be used to sustain up to 35 kilograms easily. The electric DC motor with attached gear box , having working voltage 12 volt and can provide speed of 150 Rpm and torque up to 1.5 kg-cm. The battery used for project is Dry nickel cadmium battery having 12 volt output and current 2 ampere. The mass is prepared using square mild steel rods and guide bar and lead screw is fixed with the help of ball bearing at the middle vertically. The motor is fixed at the top of mast, which provide rotational motion to lead screw with the help of pinion which convert vertical motion to horizontal motion and its linked to leads screw the trolley is mounted on mast with the help of guide bar and the lead screw is connected with the help of threaded bolt so the rotation of lead screw guide the motion of lifting trolley. The chassis are made of mild steel sheet and bars having three alignment to join wheels. The wheels having diameter 14 inch are used in this model the rare wheels provide motion to the forklift in front or rare direction, as DC geared motor is joined. The chassis can sustain up to 80 kilograms weight of operator.

VI.WORKING

They are many kinds of forklift available industry but they are not convenient to handle liquid and sensitive material. We designed sensitive material handling forklift using simple

mechanism like electric actuator and turning mechanism of tractor using steering. The forklift is driven by a DC geared motor (12V, 150RPM, 1.5Kg-cm) which is aligned to there are wheel of forklift. The moment is operated with the help of DP/DT switch which allow better control over motion in front and back direction. The switch is provide control over deciding the direction forklift so the possible outcomes from DP/DT switch is motion in forward direction, motion in backward direction and steady or rest position. The mechanism inspired from tractor turning mechanism is utilized in turning mechanism of forklift .the metal strip is attached to the steering rod at its base. And with the help of nut-bolt the connecting rod attached to the wheel. The wheels are allowed to move in certain angle required to take turn. When there steering turns to left the forklift take left turn and when steering turns to right direction the forklift take right turn. And when steering is steady or at rest position the forklift can move forward or backward direction. The lifting trolley is based on concept of electric actuator the adjustment are done for lifting trolley within certain height. The lead screw having threads over it is the rotating part with the help of DC geared motor (12V, 150RPM, 1.5Kg-cm). The lifting trolley is mounted on lead screw and guide bars (for support) when the lead screw rotating anticlockwise direction the lifting trolley goes up. And when lead screw rotate clockwise i.e. opposite direction the lifting trolley goes down.

VII. ADVANTAGES

1. Easy loading and Unloading process.
2. This machine can be utilize to lift liquid packages where fast lifting can cause an accident.
3. Safe for operator.
4. Easy maintenance.
5. Cost efficient.

VIII. DISADVANTAGES

1. This machine can't be operated in medical waste management plant, as its human operator.
2. This machine cannot be used in Nuclear Waste management as it's not remotely or distance operated.

IX. APPLICATION

1. This machine can be used for transporting material containing liquid.
2. This machine is used in warehouses as well as in plant operation and storages.
3. This machine is used in manufacturing plant, automobile industry for transporting raw material, semi-finished material and also for finish product.

X. FUTURE SCOPE

As this project is man operated forklift, the possible research and modification can be possible by making this model unmanned or remotely operated from distance wired or unwired. The wired control can be possible where material is non-hazardous, and safe for human whereas the mandatory wireless and distance operation of forklift in case of lifting and working of hazardous material like Flammable, nuclear waste, Bio-hazardous material in Decomposition plant.

XI. RESULT

For the better transporting and material handling in storage, supply and transporting unit the conventional forklift are

designed to lift solid objects like metallic containers, cars etc. but as when it comes to handle liquid material and sensitive material like glass objects there is no such forklift which would handle liquid material, glass products, medical & surgical appliances and equipment. This model is prepared to handle such material which cannot be handle with normal forklift speed they required extra safety factor to protect them from damaging. And we prepared a forklift with could handle this kind of sensitive material with slow speed while lifting the material and hence the chances of any accident is minimized for handling sensitive material by this forklift.

XII. CONCLUSION

The model of “forklift of sensitive material handling” is designed to carry sensitive material with extra protection and comparatively low speed than conventional forklift which insure the safety of sensitive material like liquid (flammable or non-flammable), glass objects, and medical & surgical equipment’s. This forklift is useful when the material required operator’s attention while transporting so it’s man-operated forklift. And this forklift definitely minimize the accident rate while in industry warehouses and in plant operation it’s also be utilized to reduce damage to lab material while transporting from one place to another.

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XIV. REFERENCE

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