

DESIGN AND FABRICATION OF TWO WHEEL DRIVE FORKLIFT

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ABSTRACT:

Factories, industries and storage godowns need forklifts and cranes for lifting and moving goods. The goods that are weighing around 30-40 kgs uses human effort for lifting and moving. To fill that need this two wheel drive forklift plays a vital role. This wheel drive is fast, efficient and low power consumption which needs less human effort for operating purpose only. In the previous forklift, the lifting mechanism is done by chains or ropes which is connected to a motor. We replaced this lifting mechanism with automatic lead screw mechanism which is connected to motor and powered by a battery. Our forklift can lift weight up to 15-20 kgs.

KEY WORDS: Two wheel drive forklift, Lead Screw mechanism, Wiper Motor.

1. INTRODUCTION

The population of India is very large so that the main aim of any industry is to fulfill the customer requirements due to that there is an extra work in mechanical industry line. This work load will increase the stress on workers and then workers are prone to unhealthy condition. To minimize the stress factor on the worker, some material handling machines are developed. This machine transfers the work from one station to another. Hence, work is done in time, so that we get more production as well as accuracy. This gives better production efficiency. Due to material handling machines we reduce cycle time of particular job by reducing handling, fixing and carrying time.

1.1 Material handling systems:

Material handling is defined as “the movement of raw materials, semi goods through various stages of production and ware housing”. It

is concerned with the movement, storage and control of materials in a production process.

Various material handling devices are

- Conveyors,
- Cranes and Hoists,
- Pipelines,
- Forklifts, etc.

This project is about helping small scale industries which are dominant in India with custom designed forklifts of variable capacity where the operating cost and maintenance is negligible and hence economical and efficient. This forklift is operated by accelerator for moving and linear screw mechanism for lifting.

1.2 Forklifts:

- Forklifts are the material handling devices which are used to transport the load from one station to another.
- Forklifts are either powered by gasoline, propane or electricity. Electric forklifts

- rely on batteries to operate. Gasoline or propane forklifts are sometimes faster and stronger than electric forklifts, but they are more difficult to maintain and fuel can be costly.

Rough terrain forklifts have the highest lifting capacity of all forklifts and heavy duty tires like those found on trucks, making it possible to drive them on uneven surface several types of forklifts are

1. Pallet jacks
2. Rider motorized pallet trucks
3. High lift pallet trucks
4. Center rider pallet trucks
5. Automated guided vehicle

1.3 Forklift classifications:

Forklifts are also organized based on their classification. There are seven forklift classes outlined by the **OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)** that describe their **Fuel Type** and **Use**. Forklift operators must be aware of the necessary forklift safety practices for each classification and certified on each class of the forklift to operate it.

The different forklift classifications are:

CLASS I - ELECTRIC MOTOR RIDE TRUCK

- **Fuel Type:** Electric
- **Use:** Indoor settings where air quality is a concern

CLASS II - ELECTRIC MOTOR NARROW AISLE TRUCK

- **Fuel Type:** Battery
- **Use:** Moving inventory in narrow or right spaces

CLASS III - ELECTRIC MOTOR HAND TRUCK

- **Fuel Type:** Battery
- **Use:** Quickly uploading delivery trucks across short distances

CLASS IV - INTERNAL COMBUSTION ENGINE WITH CUSHION TYRES

- **Fuel Type:** Gas or Diesel
- **Use:** Low clearance situations

CLASS V - INTERNAL COMBUSTION ENGINE TRUCKS WITH PNEUMATIC TYRES

- **Fuel Type:** Gas or Diesel
- **Use:** Indoor and Outdoor with rough surfaces

CLASS VI - ELECTRIC AND INTERNAL COMBUSTION ENGINE TRACTORS

- **Fuel Type:** Battery, Gas or Diesel
- **Use:** Hauling or Towing loads

CLASS VII - ROUGH TERRAIN FORKLIFT TRUCK

- **Fuel Type:** Gas or Diesel
- **Use:** Construction sites, Uneven grounds, High elevation lifting

2. LITERATURE REVIEW

Design development and modeling forklift by Ugale Sachin, Salvi Tushar, Lanjekar Sachin and Kshirsagar Prashant fabricated a forklift by using radio frequency technology. This makes it wireless and increase visibility as well as safety. A transmitter which are present in forklift able to control a forklift from 15 feet, above 15 feet we can't use it. Chunshan states when forklift is loading and unloading it is directly under all cargo weight and finished the goods fork, handling and lifting. It is mainly composed of door frame outrigger and cargo, guide wheel chain and lifting oil cylinder. Aashish Kumar L Sharnagat, M.S.Tufail were developed a robotic forklift to handle palletized material using local sensing so that it needs electricity. Design and development of human powered forklift by Sandip Patil, Ayubkhan Panthan, Manohar Chavan, Sajid Shikalgar, Prof.B.Nangare Patil. This will lead a small scale industry going towards high quality of product with minimum cost and also minimized material handling cost.

Design and Structural Analysis of Mechanical Forklift using ANSYS software by Prof.Kshirsagar Prashant is used for the structural

analysis of the forklift using ANSYS software. Theoretical calculation is compare with software analysis to verify. Due to this we select the forklift material as mild steel due to high specific stiffness and strength. Lift by the fork is tried to deform and bend in a particular direction so in order to prepare design of forklift.

Material handling equipment selection using Weighted Utility Additive Theory by Prasad Karande, Shankar Chakraborty is used to solve material handling equipment solution. This method is to compare with drive by the past research with its potentiality, applicability and accuracy to solve machining problem.

3. DESIGN OF THE TWO WHEEL DRIVE FORKLIFT:

The design of two wheel drive forklift is completed by using CATIA V5 R19 and SOLIDWORKS software. By using these software's we design several parts of this machine and finally assembled these parts.

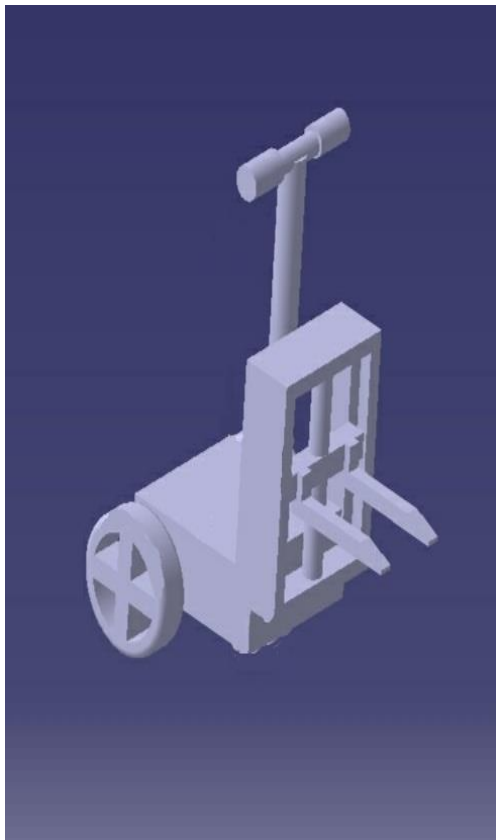


Fig: 1 DESIGN OF TWO WHEEL DRIVE FORKLIFT BY CATIA

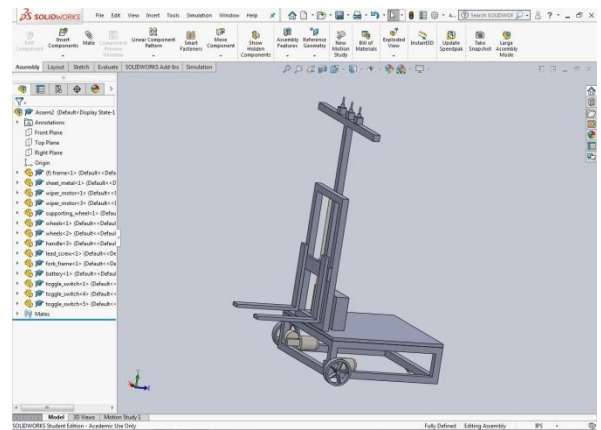


Fig: 2 DESIGN OF TWO WHEEL DRIVE FORKLIFT BY SOLIDWORKS

4. FABRICATION OF TWO WHEEL DRIVE FORKLIFT:

The fabrication of two wheel drive forklift is fabricated by different fabrication techniques i.e. cutting, welding, drilling and grinding process etc. This TWO WHEEL DRIVE FORKLIFT consists of several parts such as follows

- FRAME
- WIPER MOTOR
- WHEELS
- SUPPORTING WHEEL
- HANDLE
- SHEET METAL
- LEAD SCREW
- FORK FRAME
- TOGGLE SWITCH
- WIRES
- BATTERY

4.1 FRAME:

A vehicle frame, also known as its *chassis*, is the main supporting structure of a motor vehicle, to which all other components are attached, comparable to the skeleton of an organism.

The main functions of a frame in motor vehicles are:

1. To support the vehicle's mechanical components and body

2. To deal with static and dynamic loads, without undue deflection or distortion.



Fig: 3.FRAME

4.2 WIPER MOTOR:

The wiper motor consists of the motor itself and the gears, which reduce the speed output by the motor. Wiper motors are devices in the wiper system that functions on a power supply in order to move the wiper blades in a smooth motion. Its composition entails a lot of mechanical linkages each playing a role in initiating the movement. The gear head motor is the type of wiper motor known for its abundance in torque. These smooth motions are only made possible from the key mover in windshield wiper and these are the wiper motors.



Fig: 4.WIPER MOTOR

4.3 WHEELS:

The main functions of these wheels are to contact only with ground, provides frictional contact with the road surface. This allows the driving wheels to move the vehicle. These wheels act as a primary suspension, cushioning the vehicle from effects of rough surface. It allows braking to slow or to stop the vehicle. The main properties of these wheels are non-skidding, uniform wear, load carrying capacity and it has to be in balance.



Fig: 5.WHEELS

4.4 SUPPORTING WHEEL:

This wheel is for supporting the backside body of the forklift which includes operator weight also. This supporting wheel can rotate in 360° which plays a major role in turning cases. The supporting wheel is made of good quality steel and soft rubber to resist the shock damping and to minimize the noise while moving.



Fig: 6.SUPPORTING WHEEL

4.5 HANDLE:

This handle is an attachment to the frame such that it carries the switches on it and it can be used as a support for the operator who stands on the frame. This handle is made of two iron bars which are welded as T-Shaped structure.



Fig: 7.HANDLE

4.6 SHEET METAL:

Sheet metal is metal formed by an industrial process into thin, flat pieces. Sheet

metal is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly; extremely thin sheets are considered foil or leaf. There are many different metals that can be made into the sheet metal, such as aluminium, brass, copper, steel, tin, nickel, and titanium. For decorative uses, some important sheet metals which include the silver, gold, and platinum (platinum sheet metal is also utilized as a catalyst). Sheet metal is used in automobile and truck (lorry) bodies, airplane fuselages and wings, medical tables, roofs for buildings (architecture) and many other applications. Sheet metal of iron and other materials with high magnetic permeability, also known as laminated steel cores, has applications in the transformers and electric machines.



Fig: 8.SHEET METAL

4.7 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. Lead screws are commonly used in linear actuators, machine slides (such as in machine tools), vices, presses, and jacks.



Fig: 9. LEAD SCREW

4.8 FORK FRAME:

The fork frame consists of fork mast and the forks. Fork mast is a frame section which is used to support the fork guidance. It depends on the vehicle frame and it is fixed rigidly. Forks are in rectangular hollow section which is fixed to the guidance of the fork mast. It is used to lift the load and carry the load from one place to another by means of a vehicle.



Fig: 10. FORK FRAME

4.9 TOGGLE SWITCH:

A toggle switch is a class of electrical switches that are manually actuated by a mechanical lever, handle, or rocking mechanism. Toggle switches are available in many different styles and sizes, and are used in numerous applications. Many are designed to provide the simultaneous actuation of multiple sets of electrical contacts, or the control of large amounts of electric current or mains voltages.



Fig: 11. TOGGLE SWITCH

4.10 WIRES:

A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term 'wire' is also used more loosely to refer to a bundle of such strands, as in multi stranded wire, which is more correctly termed a wire rope in mechanics, or a cable in electricity.



Fig: 12. WIRES

4.11 BATTERY:

A battery is a device consisting of one or more electrochemical cells with the external connection for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products,

and the free energy difference is delivered to the external circuit as electrical energy.



Fig: 13. BATTERY

5. WORKING OF TWO WHEEL DRIVE FORKLIFT

5.1 LIFTING MECHANISM:

The load will be lifted with forks by using LEAD SCREW MECHANISM. A lead screw is a screw which translates rotary motion into linear motion. Normally used as the driving mechanism in horizontal or vertically driven applications aided by linear guides for supports. They are described by diameter and pitch or lead. The pitch or lead is the amount of travel you get or distance the nut travels along the screw for every complete revolution. They can be operated manually or motorised.

5.2 MOVING MECHANISM:

The moving of the forklift can be obtained by operating the toggle switches. The WIPEER MOTOR which is powered by a battery plays a major role on moving mechanism.



Fig: 14. TWO WHEEL DRIVE FORKLIFT

5.4 ADVANTAGES OF FORKLIFT:

- Maintaining cost of the forklift is less.
- This forklift is easy to operate.
- Forklift can be easily movable.
- It requires less space for riding and parking.
- This forklift is clean, green and eco-friendly machine.
- There is a clear view for the operator even though the weight is lifted.
- Human effort will be minimized.

5.5 DISADVANTAGES OF FORKLIFT:

- The forklift is limited to lifting 20 kgs of weight.
- Speed of lifting is low due to lead screw mechanism.
- Motor cost is slightly high.

5.6 APPLICATIONS OF THE FORKLIFT:

- This machine can be used for transporting material containing liquid.
- This machine is used in warehouses as well as in plant operation and storages.
- This machine is used in manufacturing plant, automobile industry for transporting raw material, semi finished material and also for finish product.
- This forklift is used in recycling operation for loading and unloading purpose of wastage.
- Forklift can also serve the need of snow plows. It can easily clear off the way covered by snow in parking lot and outdoor walkways.

6. CONCLUSION:

It is conclude that this machine is for small scale industries. This machine operates within short period of time. Its operating cost as well as labour cost is reduced. Comparing to previous forklift (i.e., movement with chain drive), the human effort for operating forklift is minimized due to external source (i.e., battery).

This two wheel drive forklift which we have designed is limited to load capacity of further improvements can be made in designing of lead screw to increase the lifting capacity. The speciality of the frame design is that it does not bend easily and a human can be stand on it for the movement in the forklift.

Also a further improvement in the lifting of the weight can be obtained by replacing the lead screw mechanism with hydraulic system.

7. FUTURE SCOPE:

- The main aim of our work is to help small scale industries.
- Hydraulics can be applied for lifting mechanism.
- The load capacity of the system can be increased by increasing the battery and the motor capacity.
- Solar panels can also be used as power source.
- An accelerator can be provided for speed movement.

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