

# Construction of Battery Operated Forklift

**Kaushik S. Panara**

*Lecturer*

*Department of Mechanical Engineering  
L.I.T. Sarigam , Valsad, India*

**Amrat M. Patel**

*Assistant Professor*

*Department of Mechanical Engineering  
L.I.T. Sarigam , Valsad, India*

**Vivek R. Mishra**

*Lecturer*

*Department of Mechanical Engineering  
L.I.T. Sarigam , Valsad, India*

**Tushar B. Patel**

*Lecturer*

*Department of Mechanical Engineering  
L.I.T. Sarigam , Valsad, India*

**Krunal R. Dhivar**

*Lecturer*

*Department of Mechanical Engineering  
L.I.T. Sarigam , Valsad, India*

## Abstract

Mechanical fork lift is an improved and advance technology that helps brought about revolution in the mechanical industries today all heavy engineering company uses it. Widespread use of the forklift truck had revolutionized warehousing practices before the middle of the 20th century. A mixture of material handling systems is in the use, exact from that entirely physical to the ones that are semi-automatic but manually controlled. Forklifts have revolutionized warehouse work. They made it possible for one person to move thousands of pounds at once. Well-maintained and safely operated forklifts make lifting and transporting cargo infinitely easier. This is the general description of a normal forklift truck. To enhances the technology further, this prototype module is constructed with remote technology, there by the operator can walk along with the forklift for better visibility & the container can be placed accurately (precision position). This increases the safety of the operator.

**Keywords: Base (Chassis), Remote Controlled System, Rope Pulleys, DC motor**

## I. INTRODUCTION

In general the forklift can be defined as a tool capable of lifting hundreds of kilograms of weight. A forklift is a vehicle similar to a small truck that has two metal forks on the front used to lift cargo. The forklift operator drives the forklift forward until the forks push under the cargo, and can then lift the cargo several feet in the air by operating the forks. The forks, also known as blades or tines, are usually made out of steel and can lift up to a few tons.

Forklifts are machines that use levers and/or pulleys to lift significant weights. A fork lift one passes on the road may look like a fairly modern invention, but these machines have actually been used for at least the past 2000 years, if not longer. The Romans used forklifts to build huge monuments. Medieval churches were constructed with them. Also, the Egyptians may have used them to create pyramids. The modern version can be either simple or complex, and forklifts vary based on their application.

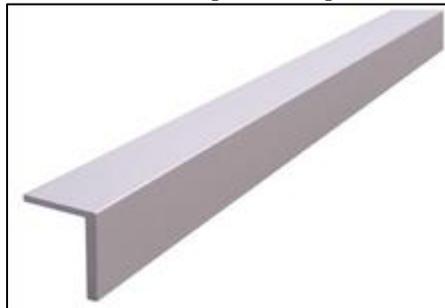


Fig. 1

To make the project work more realistic, much importance is given for practical orientation, therefore a prototype module is constructed for the demonstration purpose. This module simulates the real working system & based on this technology with slight changes in the structure & motor ratings, the system can be converted for real applications. The method of converting rotary to linear motion is implemented in the mechanism. The forklift is designed to move in all directions including reverse direction also.

## II. SYMBOLS AND ASSUMPTIONS

“Construction of Battery Operated Forklift” aims at eco-friendly and fuel efficient and robust working with easy material handling and reducing the number of accidents as it is remote operated. We also focused on reducing the number of man power required during the loading and unloading operation of forklift. Though it is remote operated not only the skilled labour but unskilled labour can also operate as it does not require any special training. This forklift will provide better visibility and thus reduces the number of accident and helps in safe transportation to the destination.

## III. COMPONENTS DESCRIPTION

Different components used in this project are as given below:-

- 1) Base (Chassis)
- 2) Remote Controlled System
- 3) Slider
- 4) Shaft
- 5) Rope
- 6) Pulleys
- 7) DC Motor
- 8) Battery

### A. Base (CHASIS):

The chassis is fabricated from Plywood sheet. This is done for ease of fabrication, and to reduce the overall weight. The chassis was designed to take a static load of 3kg. The flange which holds the motor was designed using Aluminium and is bolted to the chassis. So that the driving motors can easily accommodate below the chassis. The chassis incorporates hole for attaching front globe wheel, and also for attaching the lift structure.

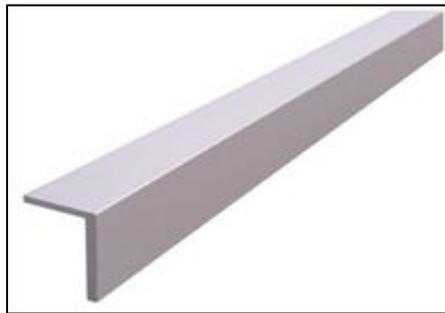


Fig. 2

### B. Remote Controlled System:

The forklift is equipped with 6 manual keys. By activating these keys manually, all the movements can be created in the forklift. All these 6 keys are directly interfaced with electrical bridge circuit at input side, one end of all the keys are shorted together and connected to the ground. When any key is pressed, biased current is transmitted to the next node and follows, based on this bias the circuit drives the motor.

### C. SLIDER:

Its a rectangular plate which is held between two vertical channels of Aluminium which are free to slide up and down to lift and lower the weight/load up to a desired limit with the help of rope which is connected to the DC Motor by means of Shaft and Bevel gears.



Fig. 3

#### **D. SHAFT:**

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque set up with the shaft permits the power to be transmitted to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.



Fig. 4

#### **E. Nylon Rope:**

The rope is used to transmit power from one point to another by means of pulleys which rotate at the same speed or at different speeds. The amount of power transmitted depends upon the following factors:

- 1) The velocity of the rope.
- 2) The tension under which the rope is placed on the pulleys.
- 3) The condition under which the rope is used.

#### **F. PULLEYS:**

The pulleys are used to transmit power from one point to another by means of belts or ropes. Since the velocity ratio is the inverse ratio of the diameter of the driving and driven pulleys, therefore the pulley diameter should be carefully selected in order to have a desired velocity ratio. The pulley must be in perfect alignment in order to allow the belt or rope to travel in a line normal to the pulley faces. In our model we use plastic pulleys.

#### **G. DC MOTOR:**

An electric motor is a machine which converts electric energy into mechanical energy. Its action is based on the principle that when a current carrying conductor is placed in magnetic field, it experiences a mechanical force whose direction is given Fleming's Left Hand Rule.

#### **H. BATTERY:**

It supplies power to motor and gear box which runs the wheel and barrel. 12volt battery is used to supply power.

### **IV. WORKING**

- 1) Counterweight - is a mass attached to the rear of the forklift truck frame. The purpose of the counterweight is to counterbalance the load being lifted. In an electric forklift the large lead-acid battery itself may serve as part of the counterweight.
- 2) Power Source: Electric forklifts are powered by either a battery or fuel cells that provides power to the electric motors. The electric motors used on a forklift may be either DC or AC types.
- 3) Slider - is the vertical assembly that does the work of raising and lowering the load. It is made up of interlocking rails that also provide lateral stability. The interlocking rails may either have rollers or bushings as guides. It may be mounted to the front axle or the frame of the forklift.
- 4) Switch: - 2 way switch  
This switch is used in our project for selecting direction of fork lift.
- 5) Dc Motor:  
D.C. Motor is used in our project for moving fork lift from one location to another.  
Our project has used three number of motors in which two motors are used to run the rear wheels while one motor is used to run the barrel.

## V. WORK ACTIVITIES OF FORKLIFT TRUCK

Forklift trucks are vehicles designed to move and stack heavy or bulky goods. They are mainly used in warehouses, stockyards and other storage areas. Forklift trucks are highly mobile with a very small turning circle which allows them to move easily in confined spaces. On the front of the truck are two forks operated by hydraulics. The driver must fit these forks into the pallets on which goods are stored. The operator then uses the hydraulic forks to lift the pallet, takes it to where it is needed and sets it down.

Some goods, such as bricks, can be moved by fork-lift trucks without the need for pallets. They are stacked in bales with spaces for the forks. The operator must work carefully as these goods are not protected by pallets. Some trucks are fitted with small computer display panels that direct the operator where to place goods in the warehouse.

Operators may also have to keep records and follow instructions written on a worksheet. They are also responsible for the basic maintenance of the truck. This includes greasing or oiling parts and changing or recharging the battery. Forklift truck operators may have to work in a noisy and dusty environment. Working outdoors in all weather conditions may also be necessary.

Industrial lift trucks are used for handling materials, parts, products, tools, equipment, supplies and maintenance items. Forklifts are efficient for material handling because they are self-propelled, maneuverable and require only one operator to lift, transport, and stack or un-stack the material. Forklifts may be used for indoor or outdoor use depending on their size, tyres and load capacities. The major factors that lead to injuries involving the use of forklifts include unsafe driving and material handling practices.

Although the term 'forklift', 'fork lift', or 'fork truck' is instantly recognizable, their full, official title is a Fork Lift Truck, due to the fork shaped tool at the front that traditionally was used to lift pallets. But now, like any other piece of equipment, the forklift has evolved and is available in a wide variety of styles, with varying functions and capacities, depending on where and how they are to be used.

All lift truck operators must be trained prior to operating a lift truck. Training is provided by the concern manufacturer and consists of both formal instruction and practical training. Training is both vehicle- and workplace-specific. The training is a one-time requirement unless the operator is involved in a lift truck accident or is observed operating the truck in an unsafe manner.

Industrial lift trucks must be inspected prior to each day of service. A daily inspection checklist must be completed and any defects should be reported and corrected immediately. A truck may not be placed into service if any defects are found during the inspection.

## VI. CONCLUSION AND FUTURE SCOPE

### A. Conclusion:

The project work "Battery operated forklift" is aimed to control through wired communication. 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. Most of all human safety is a major concern's by using a remote controlled forklift.

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 module (mini module) is constructed & results are found to be satisfactorily. 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. Most of all human safety is a major concern's by using a remote controlled forklift. We can use our human brain but the hands and legs of a robot, and thereby nullifying the chances of accident.

Our project has a simple electrical heart and a simple mechanical body. As this is the simplest one, we have got wired remote for manual operating. 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. Since just a simple modification in its mechanical arm and movement way, we can convert into any robot that can perform a special type of work.

We can use our human brain but the hands and legs of a robot, and thereby nullifying the chances of accident. As this is the simplest one, we have got wired remote for manual operating. It can be modified into any high class application. We came to conclusion that remote controlled fork lift is the only way to stop such industrial issues like labour cost, hazardous material handling.

## REFERENCES

### 1) Books & Journals

- [1] Dr.R.N. Mall (2013), Automated Guided Vehicle, ISBN 2091 Journal, MMMEC, Gorakhpur.
- [2] Kenneth B. Ackerman (1990), Forklifts and Other Mobile Equipment, Practical Handbook of Warehousing
- [3] R S Khurmi, J.K Gupta (2005), A text book of Machine Design.
- [4] S S Rattan (2009), Theory Of Machines, Professor Of Mechanical Engineering, National Institute Of Technology, Kurukshetra.
- [5] V B Bhandari (2010), Design Of Machine Elements, Retired Professor And Head Department Of Mechanical Engineering, Vishwakarma Institute Of Technology, Pune.
- [6] J B Gupta (2011), Basic Electrical & Electronics Engineering.
- [7] B L Thareja, A K Thareja Revised By S G Tarnekar (2005), Electrical Technology, Former Professor & Head, Electrical Engineering Department, Visvesaraya National Institute Of Technology, Nagpur.
- [8] From Vol. IV Number 1 of Warehousing Forum ©1988, The Ackerman Co.
- [9] Significant contributions to the AGVS material came from Tom Ewers of Kalmar AC Handling Systems, Bob MacEwan of Clark Lift of Columbus, and Russ Gilmore of Autocon in Dayton, Ohio. Portions appeared in Vol. 20, No. 6, Warehousing and Distribution Productivity Report, Marketing Publications, Inc., Silver Spring, MD.
- [10] Conte M, Pasquali M (2009) Impact of innovative ILHYPOS super capacitors on a fuel cell vehicle, international electric vehicle symposium EVS-24. Stavanger, Norway
- [11] Conte M (2010) Super capacitors technical requirements for new applications. Fuel Cells 10:806–818.