

# Design & Development of Toggle Jack using Minimum Human Effort

Prof. Mahesh Pisal<sup>1</sup> Vrushali B. Gaikwad<sup>2</sup> Akshata N. Gole<sup>3</sup> Prashis P. Ingole<sup>4</sup>

<sup>1</sup>Assistant Professor <sup>2,3,4</sup>B.Tech Student

<sup>1,2,3,4</sup>MGM Collage of Engineering Kamothe, Maharashtra, India

**Abstract**— Now-a-days numbers of vehicles are increasing and problems like maintenance, puncture also arises along with it. To fix this problem no source are available nearby. Thus simple devices are needed to overcome this problem. The toggle jack is a mechanical device designed to lift heavy equipment's or loads. Screw threads are the main component in toggle jack. The significance to modify existing toggle jack are ergonomic snags experienced by the operator due to prolonged bending, squatting position which leads to backache, waist pain, and also for the pregnant women's and old persons. In electric toggle jack, energy or power required lifting the vehicle is insufficient also same issue arises in remote areas where electric supply is not available. To avoid the problem of electric jack and health issue, we modified toggle jack by using gear arrangement.

**Key words:** Design, Gear Arrangement, Human Effort

## I. INTRODUCTION

From many years, engineers, scientist and ergonomist have praised the conventional toggle jack as being an efficient. Yet to achieve new design to increase reliability, reduce weight, maintenance and make it handy and convenient to use in any condition.

Jack is the instrument or main part use to lift the car from ground level in order to repair or to change the tires It's a machine where a small force is applied in horizontal plane to raise or lower a large load.

As toggle jack available now a days in market are heavy and gives trouble during application, which gives unpleasant experience in changing tires. Thus achieving the goal by making it lighter and easy for the operator by using proper consideration in design making it safe and reliable.

## II. LITERATURE REVIEW

### A. Electrically Operated

In Design, Development and Analysis of electrically operated toggle jack using power of car battery by Gaurav S. Udgirkar on July 2014, The analysis of toggle jack done by incorporating electric DC motor using 12 V car battery connected to the brush motor running at 50 rpm having current of 2 A to lift the load of 1200 kg easily. The jack is made up of a steel having 1/3 density of aluminum as it is light in weight and has low melting point which makes it easier and efficient thus extends its durability.

In Design and Construction of Powered toggle jack system by Chinwuko E. Chuka on October 2014, to design and construct the electric powered toggle jack by choosing the suitable servomotor to provide the high torque corresponding to gear to turn the thread for lifting the car load of 1250 kg.

In Design Construction and Testing of Electric powered toggle jack mechanism by Ippilakyaa T D. on Feb 2017, the toggle jack is modified by using appropriate DC motor in combination with gears that can produce required

turning effect on the screw, eliminating the use of manually operated lever and a 12 V car battery as a source for lifting 1550 kg.

In Automatic Scissor jack using car battery by D. Hari Purvidhi on May 2017, the design was modified to drive the DC motor with a torque of 26.33 KN/mm connected to the screw by coupling which converts rotary motion to translatory motion and plugged to 12 V battery in order to lift the load and having efficiency of 28%.

In Design and Development of Electric jack by Jayesh Vaghmashi on April 2017, the mechanical toggle jack is modified to electric jack using a DC motor using the power of 60 Watt and torque of 13N/m and the material used is C45, to lift the load of 2000kg. The electric motor is connected with a remote which can be used for lifting and lowering the jack using the car battery.

In Automated Car Jack by Manoj Patil on Aug 2014, the existing design was modified by introducing the electric motor in a jack and connecting with gear with pinion. The electric switch connected to motor and plugged to 12 V battery to generate power for prime mover in order to lift 1200 kg of load easily.

In Fabrication of an Innovative Scissor jack by KL University on May 2015, the power scissor jack which can be operated by power gun has been designed and fabricated. The jack has been designed to pay a load of 4.5 KW by using 12 V battery and provision of light source to facilitate convenient operation during right time.

In Design and Calculation of stress induced in Scissor jack by Jaideep Chitransh on July 2016, the designing of a jack is made in such a way to reduce the cost of jack. By selecting the two components and analyzed the stress by changing the three selected material i.e, Mild Steel, Steel and Cast Steel and the thread used was double started square thread.

### B. Manually Operated

In Design of toggle jack and considering material selection of screw nut by Vijay Thakor on May 2013, for low load condition at 1 KN the difference between allowable tensile stress and maximum stress is higher i.e. 184.11MPa while for higher load at 5 KN it is higher i.e.120.52 MPa. The same way for load condition at 1 KN the difference between allowable torque and maximum torque is higher i.e.74.49 MPa at 5 KN.

In Modified screw jack for lifting operation in industrial setting by Benjamin Ezuike on December 2017, the designing and modification of toggle jack introduce the crank and gear mechanism which helps to reduce the difficulty in operation and increase efficiency. The bevel gear is used in operation with the handle during designing.

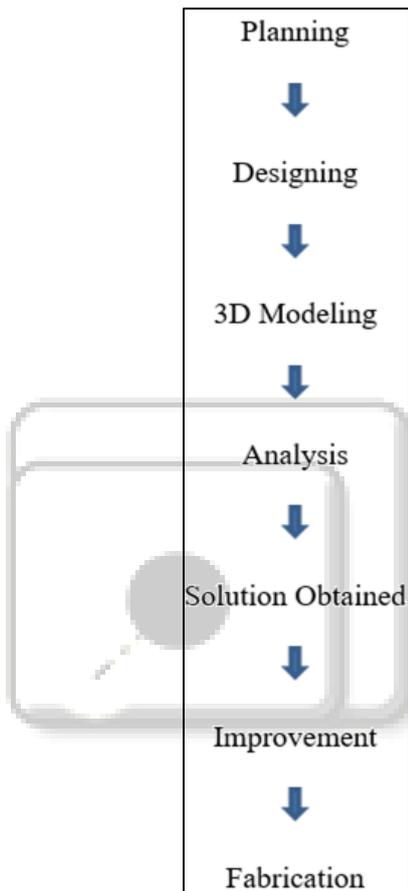
## III. PROBLEM STATEMENT

Toggle Jack available is mainly of electrically operated which uses the source of car battery.

But due to circumstances like low battery or long distance garages or less frequency and also in remote areas this electrically operated toggle jack is not worth sometimes. Also in mechanically operated toggle jack. The effort required to lift the car is more and also it is difficult to use for a women and old person.

The physical problem arises after course of time. To overcome this problem, we designed toggle jack, using gear arrange meet such a way that it can lift the jack with minimum manual efforts.

#### IV. METHODOLOGY



For improving the current model to satisfy the needs and make it more easy and efficient for operator to use or as per the study, it is discovered that the gear management can produce the required turning effect on screw with the less amount of time and less human effort for improving the current model some measures are taken for easy handling and to satisfy operation need.

As per the planning the part is designed by taking the appropriate measures and dimensions so as to withstand at maximum load and pressure.

By using software the 3 dimensional designing of the jack is done then it is analyzed by applying load, pressure, stress on different part to check the strength and can withstand and the maximum load

The solution of this analysis is obtained and further changes are made to overcome the failure, wear and tear in the object.

#### REFERENCES

- [1] Design, Development and Analysis of electrically operated toggle jack using power of car battery, (IJCER) ISSN (e): 2250-3005, Vol 04, Issue 7, July 2014.
- [2] In Design and Construction of Powered toggle jack system ,Vol 1, pp. 66-71, October 2014.
- [3] Design Construction and Testing of Electric powered toggle jack mechanism, IRJET, e-ISSN: 2395-0056, p-ISSN: 2395-0072, Vol 04, Issue 02, Feb 17.
- [4] Automatic Scissor jack using car battery, IJETMAS, ISSN 2349-4476, Vol 5, Issue 3, March20017.
- [5] In Design and Development of Electric jack, IJRSET, ISSN: 2319-8753, ISSN (p):2347-6710, Vol 6, Issue 4, And April 2017.
- [6] Automated Car Jack, IJCET, E-ISSN: 2277-4106, P-ISSN: 2347-5161, Vol 4, Aug 2014.
- [7] In Fabrication of an Innovative Scissor jack, ISRJ, ISSN: 2230-7850, Vol 5, Issue 4, May 2015.
- [8] Design and Calculation of stress induced in Scissor jack, IJSTR, ISSN: 2277-8616, Vol 5 Issue 07, July 2016.
- [9] Design of toggle jack and considering material selection of screw nut, IJRSET, ISSN: 2319-8753, Vol 2, Issue5, May 2013.
- [10] Modified screw jack for lifting operation in industrial setting, IJET, ISSN: 2297-623X, Vol13, pp 39-50, December 2017.
- [11] Wikipedia.com
- [12] scholar.google.com
- [13] Scribd.com