Design and Fabrication of Electric Jack with Wheel System

Nitin Pardhi[1], Digvijay Madne[2], Prajwal Dahake[3], Akash Mohod[4], Atul Bhoyar[5], Akshay Sasankar[6], N.U.Kakde[7]

[123456] *Dr. Babasaheb Ambedkar College of Engineering and Research, Nagpur*

[7]*Assistant Professor, Dr.Babasaheb Ambedkar College of Engineering and Research, Nagpur*

***Abstract*- The four-wheel vehicle often finds itself stuck in a ditch. It is then lifted using a jack to put it back on the road. This project deals with design and fabrication of electric jack system with wheel to lift the four-wheeler while changing the wheel, repairing a punctured tyre or lifting the four-wheeler when it is stuck in a ditch or manhole. Traditional method of using a jack to lift the four-wheeler takes time and a lot of effort .This is operated by a push-button and consists of battery, electric jack, and sliding mechanism to list the four-wheeler from one side in case breakdown occurs.**

Index Terms- Electric jack, lifting automobile, sliding mechanism.

I. INTRODUCTION

The electric jack is operated by the help of power source which is a battery with a push-button and the sliding mechanism takes the jack to the desired position to perform its work. When the push-button is operated, the jack slides to the desired location and the wheel attached to it comes down. Now the plunger of the jack lifts the vehicle and it is moved forward or backward with the help of the wheel attached to it. The main objective of this project is to reduce human effort and to provide a simple and effective method of using a jack.

II. LITERATURE REVIEW

The research survey revealed that few methods were adopted to lift the vehicle for repair or maintenance. The most common way used to lift the vehicle is with the help of a hydraulic jack or a screw jack. These methods are generally also used in vehicle service centres which require a lot of effort. This jack mechanism is simple enough to be used by a layman with the push of a button. This can be used with minimum effort by anyone to perform repair or replacement work on their vehicle.

Also considering this project, it will be very useful for people with disabilities as it is operated by the push of a button. Most listing mechanisms are not user friendly for disabled people and hence the need of a lifting mechanism arises for this very purpose. The ability to lift and move the vehicle is absent in most available mechanisms and hence only lifting occurs. However, this project allows both these purposes to be fulfilled.

III METHODOLOGY

Presently the methods of lifting a vehicle are by hydraulic or screw jack. The types of methods were identified and studied and it was found that these methods required a lot of effort and were not compatible for use by disabled people. The experiments were carried out to test the different methods of lifting a vehicle and it was deduced that a better method was needed to reduce the effort. Here jack will be selected according to compatibility and ease of use and the same will be done for the design of mechanism as well to obtain the best mechanism to lift the vehicle

IV. DESIGN

The design of jack mechanism was done keeping in mind the required space for the different parts to be used in this project. Since this project deals with a different lifting mechanism to minimize effort, the frame was designed to accommodate the mechanical as well as the electrical components. The height of the frame maintained keeping in mind that the jack has a maximum extension of 150mm. The sliding

mechanism is designed with a fixture to hold the jack so that it can reciprocate while holding the jack.

V. MATERIAL SELECTION

The material selection consisted of considering parameters such as approximate weight of the project, the capacity of the jack and the stress capacity of the material. After considering these factors M.S. was selected as the material for the frame.

VI. WORKING PRINCIPLE

It consists of a jack, battery, sliding mechanism, gear motor, and remote. When the button on the remote is pushed the current flows through the battery to the sliding mechanism and the mechanism moves to the desired location moving the jack as well. Then the wheel comes down to touch the ground and then the jack is operated which lifts the vehicle for maintenance work. After the work is completed the operator can push another button to bring down the vehicle and the wheel is also returned to its initial position. The sliding mechanism is also brought to neutral position.

VII. CALCULATIONS

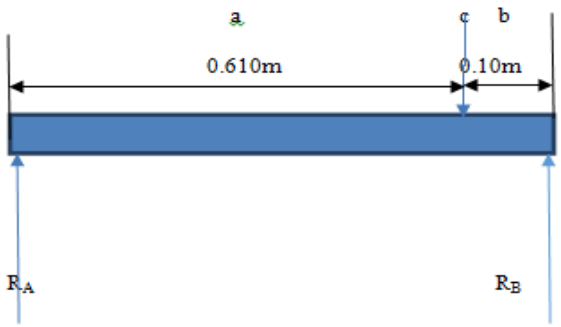

Fig.1.1

Calculations:-

Length of beam (l) =710mm=0.71 m
Width of beam (b) =50.8mm=0.0508 m
Depth of beam (d) =25.4mm=0.0254 m
Load or Force (W) =127.53N=0.1275 KN

For Banding Moment (B.M) at "C"

$R_B \times l = W \times a$

$R_B \times 0.710 = 0.1275 \times 0.610$

$R_B = 0.1095$ KN

Now,

$R_A + R_B = W$

$R_A = W - \frac{Wa}{l} = \frac{W(l-a)}{l} = \frac{Wb}{l}$

$R_A = \frac{0.1275 \times 0.100}{0.710}$

$R_A = 0.0179$ KN

Bending Moment (B.M) at the support A & B =0

Bending Moment (B.M) at 'C'

$C = \frac{Wab}{l} = \frac{0.1275 \times 0.610 \times 0.100}{0.710} = \underline{0.01095 \text{ KN-m}}$

For Maximum tensile and compressive stresses (σt & σc),

Using the relation:

$\frac{M}{I} = \frac{\sigma}{\gamma}$

Where,

$M = \frac{Wl}{4} = \frac{0.1275 \times 0.710}{4}$

=0.0226KN-m

$I = \frac{bd^3}{12} = \frac{0.0508 \times (0.0254)^3}{12}$

$=6.93 \times 10^{-8}\ m^4$

Now,

$y_t = y_c = \frac{0.0254}{2} = 0.0127$m

Substituting the values, We get

$\sigma t = \sigma c = \frac{0.0226 \times 0.0127}{6.93 \times 10^{-8}} \times 10^{-8}$

$=4.14\ N/mm^2$

VIII. MERITS

- Less effort required as compared to other methods.
- Heavy loads can be lifted.
- Simple operation.
- User friendly.
- Easy power transmission.

IX. APPLICATIONS

- It can be used to replace punctured tyres.

- It can be used to carry out repair and maintenance work.
- It is useful in bringing the vehicle on the road that is stuck in a ditch.

X. CONCLUSION

It is very useful in carrying out repair and maintenance work on the vehicle by lifting the vehicle using an electric jack and motor. It also requires far less effort to lift the vehicle. This project will reduce the effort required to lift the vehicle by using simple push-button for operation of the mechanism.

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