Design and Fabrication of Hydraulic Jack (Self Jacking)

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Abstract - This paper is regarding the design of fabrication of self-jacking mechanism in four wheeler cars. Driving a car in quite common now a days, whereas tyre failure during the journey is also quite common and unexpected. In this situation lifting a car from the road surface using a mechanical jack is a Hercules task. This process requires excess manual effort and is a time consuming process also. In this regard this mechanism helps to overcome these disadvantages. The motive of this paper is to develop a automatic jacking mechanism that can be operated by the driver from inside the car. The buttons are provided separately in order to convert the right and left side jacks. By pressing the provided button in the dashboard, the inbuilt self jacking mechanism gets activated. This paper deals with the design of fabrication of this mechanism. The reason for using this technique is because of the less power loss and its simple design.

Keywords: Hydraulic Jack

I. INTRODUCTION

A jack is a mechanical device used as a lifting device in order to lift heavy loads or to exert great forces. In order to perform maintenance process in automobiles, jacks are commonly used. The most common tyre is car jack, floor jack or gauge jack .Basically it is very difficult to operate a mechanical jack. Only skilled labours are able to operate it. Expecting skilled labour all the time is not possible .The main objective of this project is to minimize the manual effort during the jack operation. A mechanical jack is a mobile device which provides mechanical advantage to allow a human to lift heavy equipment. Hydraulic jack works on the principle of Pascal's law. Blaise pascal[1] derived the basic law of hydraulics. Pascal's law also known as principles of transmission of fluid –pressure is the statement that in a fluid at rest in a closed container , a pressure change in one part is transmitted without loss to every portion of the fluid and to the walls of the container.

$$\Delta P = \rho g(\Delta h)$$

Where,

ΔP is hydrostatic pressure
ρ is fluid density
g is acceleration due to gravity
Δh is height of fluid above the point of measurement.

P.S.Rana et al[2] Concludes that implementing the idea of integrated automated jacks for 4 wheelers in which the system can be operated by the button in the dashboard. Mohammed abuzard et al [3] concludes that an inbuilt hydraulic jack system that an inbuilt hydraulic jack system that is fitted to the automobile front and rear chassis. Parth M Patel et al [4] concludes that the implementation of automatic hydraulic jack mechanism in a four wheeler is powered by the battery. Mayanak Agarwal et al [5] concludes that there an inbuilt hydraulic jack system has many benefits and can be easily operated from inside the car by the driver. Aditya Masiwal et al [6] concludes that using the inbuilt hydraulic jack system will be very useful for ladies and old people. P.S Borkar , S.V Sontakke , R.R Dorwe, A.B Ganorkar and S.P Lokhande et al [7] deals with the study and application of pressurical air to produce motion mechanically.

1.1 PROBLEM STATEMENT

Now a day's one of the most common and easy thing is driving a car especially among young peoples, ladies to old peoples. But the problem is in the maintenance and the replacement of the car. Although technology has grown to a greater extend, still people face problem in replacing the tyre when it gets punctured at an unexpected place and at an unexpected time. In this regard the one and only situation is to get out of the car, search for the equipment and does the replacement process manually. This process is time taking and a difficult task respectively. Introduction of tubeless tyre have overcome this problem to a particular extend but not completely. in case of a puncture , tubeless tyre also need replacement after a few kilometers of journey . but this project helps to replace the tyre easily and time consumption is also less . this system requires initial implementation cost but provides various benefits during the time of puncture.

2. SPECIFICATIONS OF HYDRAULIC JACK

The following specifications were used in fabrication of hydraulic jack.

Sl.No.	Description	Specifications
1	Working Load Limit	2000Kg

2	Closed Height	180mm
3	Lift	115mm
4	Extension screw Height	50mm
5	Maximum Height	345mm
6	Base Area	142mmx92mm
7	Weight	2.4Kg

Table 1. Specification of hydraulic jack

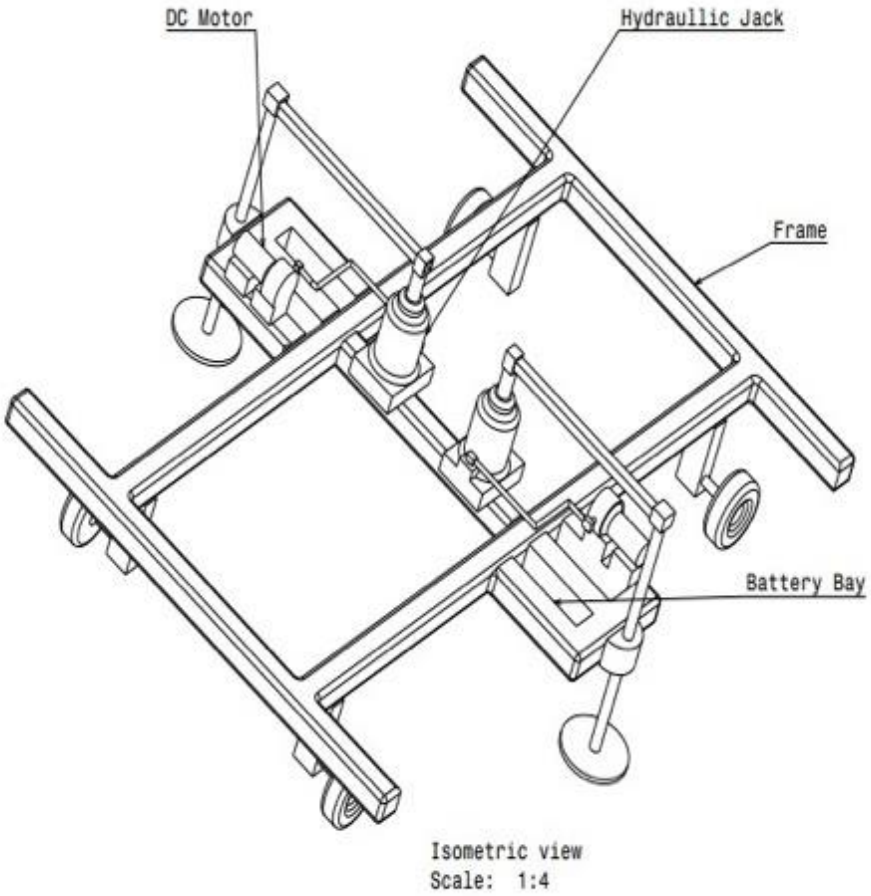

Fig 1.1 Schematic representation of Self-Jacking mechanism in four wheelers.

3. FABRICATION:

Two hydraulic jacks were mounted on the top of the frame in accordance with the time of center of gravity. Two motors are used to control the jacks separately. The motors are connected with the crank shaft which is connected to the hydraulic jacks .And also suspension spring is attached at both the sides and the red is attached with the floor bed respectively. The batteries of 12V on each side are soldered and the separate buttons are provided in order to control both side separately. These buttons will be placed on the dashboard when fitted in the vehicle. Four buttons are provided left up, left down, right up and right down respectively. When the left down button is pressed, the left jack is operated making the left floor bed touch the ground resulting in the lifting of left side of the vehicle. This same process is done at the right side by pressing the right down button. Both the buttons can also be pressed simultaneously in order to lift the whole vehicle.

Fig 1.2 Image of two hydraulic jacks fitted on the frame.

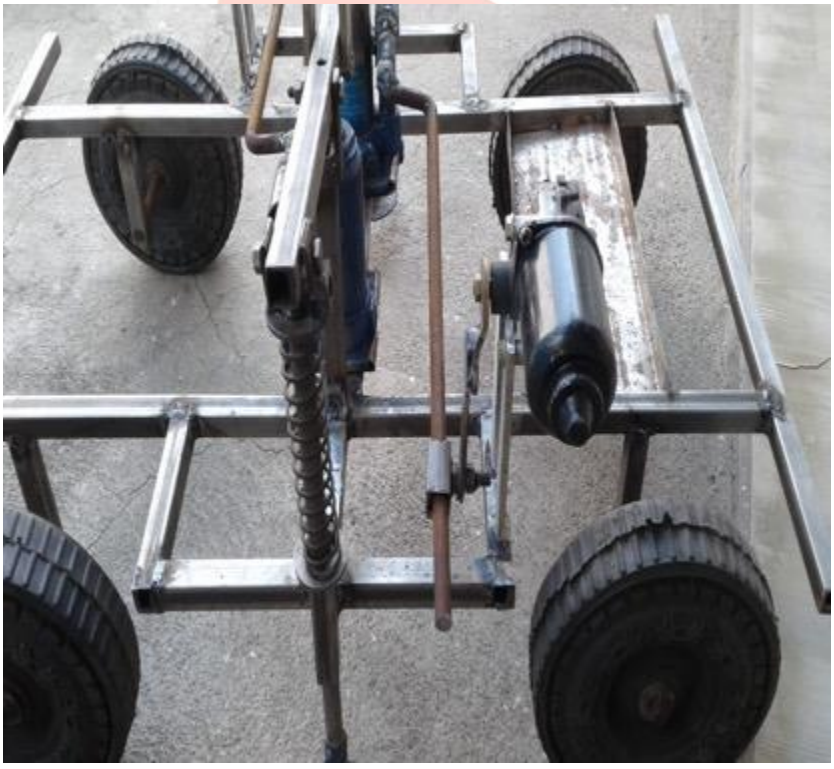

Fig 1.3 Image of arrangement of components on the chassis frame.

Fig 1.4 Image of the chassis frame fitted with hydraulic jacks.

Fig 1.5 Image of the fabricated self-jacking mechanism prototype model.

4. CONCLUSION

This self jacking mechanism system can be easily installed to the automobile chassis and frames .This systems's arrangement has many advantages such as maintenance and servicing of the vehicle. At times of puncture this system will be very helpful in saving time as well as reduces manual effort. With the help of this system driving of vehicles will be easy especially for old persons and ladies. People can go on for a long drive without any hesitations. This system eliminates the need to carry a mechanical jack during the time of travel. This system will be easy to use and transmission loss during the operation of this mechanism is also very less. This mechanism performs very well and capable of lifting 125 kgs.

- At first trial the prototype was loaded with 65 kgs and the lifting was successful.
- At second trial the prototype was loaded with 75 kgs and the lifting was successful.
- At third trial the prototype was loaded with 100 kgs and the lifting was successful.
- At fourth trial the prototype was loaded with 120 kgs and the lifting was successful.
- At fifth trial the prototype was loaded with 125 kgs and the lifting was successful.

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