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Fabrication of Inbuilt Hydraulic Jack in Automobiles

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Abstract: *An inbuilt lifting arrangement is joined to fourwheeler using hydraulic bottle jack which helps the vehicle to lift during tyre punctures or incase if tyre gets inflated Hydraulic jack is arranged to chassis of the vehicle with the help of cam and motor arrangement. Two hydraulic jacks are used to lift the car which are arranged on left and right side of chassis.*

Keywords: *Four-Wheeler, hydraulic bottle jack system, automobile vehicle, single slider crank chain.*

I. Introduction

Hydraulic jacks work on Pascal's Principle. According to principle the pressure in closed container is the same at all points. Pressure is given by a Force divided by Area. Therefore, if you have two cylinders connected together, a small one and a large one, and apply a small Force to the small cylinder, this would result in a given pressure. By Pascal's Principle, this pressure would be the same in the larger cylinder, but since the larger cylinder has more area, the force emitted by the second cylinder would be greater. This is represented by rearranging the pressure formula P = F/A, to F = PA.

According to pascals theory the pressure in the second cylinder remain same and area increased and hence give rice to increase of force. According to pascal the greater the difference between areas of cylinder more force will be generated means more output will be gained. The hydraulic jacks is mounted with release pedal for rapid lowering and lugs that make it easy to mount. The heavy-duty chassis avoids jack from bending and foot pump helps to lift the load fast. Hydraulic jack is also provided with a safety overload valve that prevents overloading of the jack beyond prescribed capacity. The hydraulic jack uses oil which is under pressure to lift vehicle by mere moving a lever up and down. This turns out to operate the vehicle with ease so that even a child or old people can lift the vehicle with ease. Principle of hydraulic jack is to lift the heavy loads by using less force. The device is accomplished of exerting great force. It forces the liquid against a piston; pressure is occupied in the container of the jack. According to Pascal's law the pressure of a liquid in a container is the same at all points While designing any hydraulic concepts use of pasacal's law is more essential as hydraulic operations works on pascals law only

II. Literature Review

A variety of work is done in inbuilt hydraulic jack and lots of experiments are done. Especially hydraulic jack has many researches done on it.

R. Sabarish, Asst. Professor [1] studied Design of inbuilt hydraulic jack**.** This invention relates to Lifting an automobile vehicle by using built-in hydraulic jack. It is operated by a single push button provided on the dashboard of the vehicle. Hydraulic drive consists of: hydraulic cylinder, lead screw and solenoid valve. The hydraulic jack can operate any one side of the four-wheeler, when it will at the breakdown condition. The four-wheeler will lift and load distribute on three ways: plunger of hydraulic cylinder and two tires are lifted which will in opposite side**.** The research survey revealed that few methods were adopted to lift the vehicle for reconditioning, repairing and others. This hydraulic jack has mainly focused on this difficulty. Therefore, a suitable device has been designed for lifting the vehicle without apply any impact force. The device has been considered for simple and economy therefore it is one of the important and essential equipment in automobile service center's which are required minimum skilled technician. In many auto service center's vehicles are lifted by using screw jack, to avoid this automatic hydraulic jack may be utilized in lifting the vehicles easily without impact force**.**

R. Sharavanan [2] studied design of built in hydraulic jack. The invention relates to Self-lubricating and hydraulic jack with a fixed asset with a pump, which uses a fluid forced into a cylinder. Inside plunger pump draws oil from the reservoir via a suction valve. It pushes the plunger cylinder moving oil through a discharge valve. Ball room and the suction valve plunger opens with each draw. The exhaust valve, and oil out of the room at the time the ball is pushed open cylinder. The main objective of this project is to reduce the human effort and when operating the hydraulic lift hydraulic jack is to provide a safe and simple. The research survey revealed that few methods were adopted to lift the vehicle for reconditioning, repairing and others. This hydraulic jack has mainly focused on this difficulty. Therefore a suitable device has been designed for lifting the

vehicle without apply any impact force The device has been considered for simple and economy therefore it is one of the important and essential equipment in automobile service center's which are required minimum skilled technician. In many auto service center's vehicle are lifted by using screw jack, to avoid this automatic hydraulic jack may be utilized in lifting the vehicles easily without impact force.

Tian Hongyu, Zhang Ziyi [3] studied Design and Simulation Based on Pro/E for a Hydraulic Lift Platform in Scissors Type. The invention relates to Scissors lift platform with a wide range, the main platform, lift mechanism and the bottom are composed of three parts. Lifting from low to high lifting, the scissors posts, and the hydraulic cylinder layout multiple, mobile way has traction, self-propelled, booster, etc. Scissors lift mechanism of scissors post number and cylinder layout by lifting height. This paper is about a design-based 3D software Pro/E with 8m high scissors lift platform, which gives a entire platform dimension with 1800 × 900mm2. A rated load of features so that the whole platform can be set up by two pairs of scissors refers to like products. The platform is designed to be folded away doors, to save more space for convenient storage. Lift platform uses a hydraulic driver, which runs smoothly, stably, and accuracy factors relative to high. Scissors lift platform is the one of the vertical lifting equipment, which can be used indoor or outdoor with a considerable extensive space. It can be used in the mechanical industries, automatic production lines, the basements and physical distribution lines and so on. In order to fulfill the more and more using areas, scissors lift platform must be given higher and higher loading capability, faster and faster moving velocity and more and more steady starting and stopping of the platform.

III. Problem Statement

Presently the procedure of tyre changing in automobiles in case of tyre failure is very much time consuming and requires a lot of human efforts. So, there is need to come up with different techniques which can reduce human efforts as well as time in case of tyre failure of automobile.

III-a) Objectives

- To reduce the point load acting on a tyre of a heavy loaded truck
- To increase life of tyres
- To reduce damage caused to tyre
- It allows driver to lift the vehicle with the help of one button.
- It becomes easy to remove and fix the tyre in case of an inflated.

III-b) Scope-

The arrangement of inbuilt hydraulic jack is used for lifting of heavy vehicles like trucks by making more modification this arrangement can be used in real life for lifting of heavy loaded vehicles.

III-c) Methodology

In our present project we are going to design a inbuilt hydraulic jack system which is essential for lifting of heavy vehicle with ease so that it can save efforts and time to change the tyre in case if tyre gets inflated . The arrangement is done by making use of hydraulic bottle jack , cam , and motor so that the rotary motion of motor will be converted into reciprocating motion of hydraulic jack which will help us to lift vehicle whenever necessary.

IV. Experimental Setup

VI- a) MATERIAL REQUIRED

- **Hydraulic bottle jack**

The hydraulic bottle jack consist of saddle, extension screw, ram, Cylinder, handle sleeve, handle assembly, carry handle and release valve. Pressure is applied to the handle assembly. When pressure is applied on handle of hydraulic jack it helps to lift the ram of jack. The pressure release valve which is present at bottom of hydraulic jack helps to release pressure caused inside the hydraulic jack when it is in working condition.

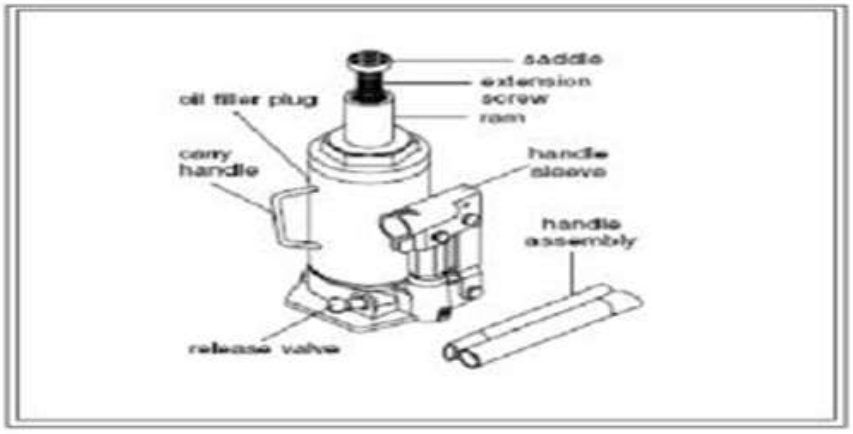

Fig. a) Hydraulic Bottle Jack

- **Cam**

A cam is a projecting part of a rotating wheel or shaft that strikes a lever at one or more points on its circular path. The use of cam in our project is to convert the rotary motion into linear or reciprocating motion with the help of connecting rod which connects the cam and hydraulic jack so that the jack would get lift with ease by simply pressing button.

Fig. b) Cam

- **Motor**

A machine which is used to convert direct current power into mechanical power is known as D.C Motor. Its generation is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor receives a mechanical force. In our project is 12 volt 60 rpm gear motor is used to give the rotary motion to cam which will convert into reciprocating motion of hydraulic jack.

Fig. c) Hydraulic Motor

VI- B) Experimental Design-

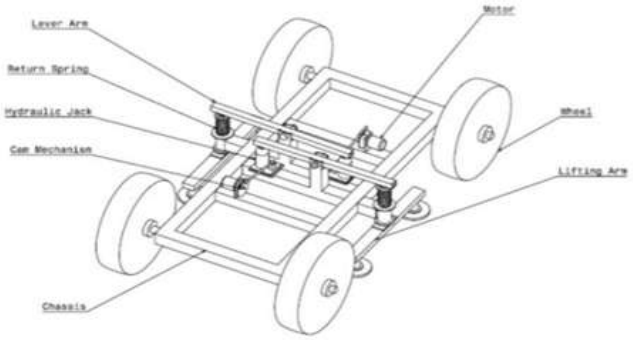

Fig. d) Experimental Design

V. Working

It controls the equipment of hydraulic jacks with cam operated using the electrical power of motor. The motor used in it is 12 volt 60 r.p.m.the motor is connected to battery having capacity of 12 volts which is used to run motor, cam is connected to motor as the motor revolve cam also revolves, hydraulic bottle jack is connected to cam with the help of connecting rod the use of connecting rod is that it converts the rotary motion or circular motion into reciprocating motion of jack.

The jack is fixed to the bottom of the frame with the help of fabrication to lift the vehicle. The motor is operated by the battery. It gets power from the battery. The two numbers of hydraulic jack is arranged on opposite side of vehicle body.The connecting rod is used to convert the rotary motion into linear motion.

Present procedure of tyre changing in automobile is very much effort full process and also time consuming process So to save time of people and to make it effort less process this modification of inbuilt hydraulic jack is essential in today's world.

VI. Calculations

- **Hydraulic Bottle Jack Calculation**

Lift Capacity (tons)	2
Min. Lift Height (in.)	7
Max. Lift Height (in.)	11.5
Ram Travel (in.)	4.5
Screw Top Adjustment (in.)	1.875
Operation	automatic
Handle Included	Yes
Dimensions L x W x H (in.)	3.5 x 3.62 x 7

- **Hydraulic jack**

The weight to be lifted is 100 kg or 1000N. Let us find out the effort required by the human.

Formula:

$F = P \times A$

$1000 = P \times \pi/4 \times (50 \times 10^{\wedge -3})^2$

$P = 1000x4/ \pi \times (50 \times 10^{\wedge -3)2}$

$P = 509.29 \times 10^3$ N/M^2

Force required at the working piston:

$F = P \times A$

$= 509.2910^3 \pi/4 \times (15 \times 10^{\wedge -3)2}$

$F = 90N = 9$ kg.

Therefore the force to be applied at the working piston is 90N, which is 10 times lesser than the weight to be lifted.

IX. Conclusion

An in built hydraulic system can be easily attached to automobile generally heavy vehicle automobile so that in case of puncture they can lift the vehicle with ease without consuming lot of efforts. This can be done by knowing the concept of pascals law. The use of motor , cam and hydraulic bottle jack this arrangement can be completed and with some fabrications it gives ease to the operations of lifting vehicle by simple hydraulic operations by consuming less force to do work.

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