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Compact Button based Hydraulic Jack

Vaibhav Thakkar

Mechanical Eng. Dept., University of Petroleum & Energy Studies, Dehradun

Abstract: *The purpose behind this project is to alter the structure of the existing car jack as far as its usefulness and furthermore human factors considerations. Creative changes have taken place in Fluid power technology and this is because electronic parts are utilized to control hydraulic components. Utilizing the guide of innovation & luxury, safety and comfort are foremost preference being given nowadays. Anyway vehicle jacks are accessible at the market has a few disadvantages, for example, requiring more vitality to work, are not appropriate for all individual and can't be utilized on the uneven surface. Likewise, it turns out to be incredibly difficult to replace a punctured tire or incidentally fix a broken pivot without anyone else. To optimize the current design, the hand lifter has been supplanted by the use of lever associated with motor as it can lessen energy usage and helps them to lift the vehicle in a push of a button. This fused hydraulic powered jack helps the client to act self-dependent.*

Keywords: *Hydraulic jack, automobile, Car, lifting mechanism, Pascal's law, Compact, Automation, Button*

I. INTRODUCTION

A jack is a mechanical machine which utilizes a screw thread framework or a hydraulic cylinder apply incredible powers utilizing pressure driven liquid as the main source of energy. In the vast majority of the jacks, hydraulic power is utilized to give more lift over greater separations. Mechanical jacks usually have lifting capacity varies from 1.5 tons to 3 tons.

Jacks are widely used in vehicle, industrial, construction and mining industries. These are compact in size, portable and can apply large forces. It contains two cylinders of different sizes which are connected together and contains a hydraulic fluid or oil.

These can be segmented into two types:

- A. Bottle Hydraulic Jack
- B. Floor Hydraulic Jack.

Bottle hydraulic jacks are generally proper for lifting vehicles (LMVs, SUVs, and Trucks) and other heavy things. In this type of jack a cylinder is in vertical direction.

In a Floor Jacks, the piston is in a flat cylinder and there is a long arm which gives the vertical movement to a lifting pad.

There are wheels and castors in floor jacks. The jack pushes fluid against a cylinder and pressure is generated in the jack's chamber.

The jack follows the rule of Pascal's law.

II. LITURATURE REVIEW

Screw jacks are being used for a long time now for lifting a vehicle in case of tire puncture or other malfunctions. The physical operated hydraulic jacks which follows the lever principle are used only in automobile workshops. Introduction of an compact button based hydraulic jack can be of great help especially for car owners as the lifting of the vehicle would be finished by the jack with the press of a button.

For the most part hydraulic jacks are utilized for shop work instead of as an emergency jack to be carried in a vehicle. Utilization of these jacks are not expected for lifting vehicles as it requires more than the standard consideration in choosing ground conditions, the jacking point on a vehicle, and to ensure stability when the jack is expanded. In this project we will try to minimize these anomalies.

The Pascal's law expresses that "The strength of the force is isolated similarly every which way through a mass of liquid very still". The jack utilizes a fluid which is compressible. The jack forces into a cylinder by a pump plunger. Oil is utilized since it is self-lubricating and stable.

When the plunger hauls back it coaxes oil out of the chamber through a suction valve with the pump. At the point when the plunger pushes ahead, it drives the oil through a release valve into the chamber. The suction valve ball is inside the chamber and opens with each draw of the plunger. The release valve ball is outside the chamber and opens when the oil is pushed into the chamber. Presently, the suction valve inside the chamber is obliged and oil pressure produced in the chamber.

III. WORKING PRINCIPLE

Pascal's Law is working principle for the hydraulic jack. Pascal's law states that pressure remains constant with given fluid if there is no resistance when mass of fluid is at rest. The ram and plunger, working in two cylinders of various breadths, which are joined at the base, through a chamber, which is loaded up with some kind of liquid

IV. CONSTRUCTION AND WORKING

A. Hydraulic Cylinder

The cylinders as shown in the Fig.1 manufactured for the jack contains a sleeve where the piston responds while working material for the cylinder is solid cast iron metal and welded with an iron base plate. The hollow cast iron cylinder is connected with base plate. Entrance for oil is in the base of the cylinder.

Cylinder Specification:

Internal diameter = 76mm Stroke = 116.5mm
 Outer diameter = 94mm Volume of cylinder = 528.22ml
 Volume of cylinder = 528.22ml Piston length = 15mm

Cylinder Diameter calculation:

Lifting capacity = 1000kg

Pump maximum pressure = 22bar at 1000rpm
 $= 224337.56 \text{kgf/m}^2$ (1 bar = 10197.162kgf/m²)

$W = P \times A$ $1000 = 224337.56 \times 3.14 \times r^2$
 $r = .0376\text{m} = 37.67\text{mm}$

Therefore Diameter, $d = r \times 2 = 75.35\text{mm}$ (Approximate 76mm)

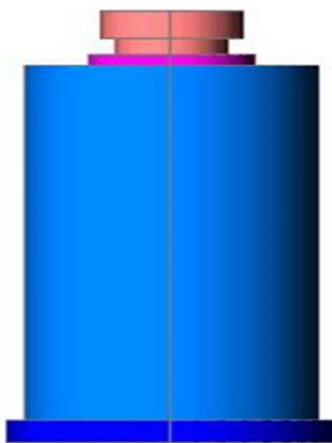


Fig. 1 Hydraulic Jack cylinder

B. Control Unit

Control unit controls the course of stream and pressure of the liquid in the system. Control unit transfers oil from pump to cylinder & cylinder to tank. It is a significant piece of the system, the control unit reliefs the excess pressure and stops the load of oil filled the chamber to return back. Control unit can operate on both automatic and physical control on both oil flow and pressure control in the system.

1) *Working Of Control Unit:* There are three valves in a control unit i.e., Relief, delivery and release valves. Pressurized oil only flow in one direction when it enters control unit that means flow from pump to chamber. Control unit resist backward flow of cylinder to pump oil flow. If pressure exceed given limit then oil is drained in the reservoir using relief valve. The return valve (On-Off valve) is not automatic operated used to drain the stock of the cylinder.

C. Hydraulic Pump

Hydraulic pumps convert mechanical power from an electric motor into hydraulic (pressure) vitality. Pumps push on a hydraulic fluid and make stream. A pump is utilized in the jack to make pressure difference in a liquid medium.

Positive pressure pump which contains vanes mounted to a rotor. Like rotary vane pump's rotor rotates inside the cavity.

Note that modern pumps have an area contact among rotor and stator (and not a line contact).

- 1) Pump Housing
- 2) Rotor
- 3) Vanes
- 4) Spring

D. DC Motor

Motor is a device used to transform electrical energy like electricity into mechanical energy. A Direct Current motor is used in the jack to turn the pump. DC motor is used because the electric current available at car battery is DC current. Motor involves two terminals- positive and negative. Negative terminal of the motor is itself the body of the motor.

Motor Specification:

Type = Permanent magnet DC motor

Power input = 12 volt DC

Power output = 0.4KW = 0.5HP

Rotation = clockwise

E. Electrical Connection

Electric connections are mad using two terminal wires as positive and negative. Positive terminal wire has a battery clip on one end which is to be joined with the positive terminal of the battery of the vehicle. A switch is used for ON/OFF operation of the jack. Negative terminal wire is connected with jack body as earth and while operation it is connected to the vehicle body acting as negative terminal.

F. Working of Hydraulic Jack

The cylinder of the jack is placed according to the lifting position of the vehicle. After that terminal wires are connected according to polarity. Positive terminal wire is associated with the positive terminal of the battery, while negative terminal is associated with the vehicle body any point close to the jack. At the point when the starter switch is pushed, the motor turns over pivoting the pump. The pump drives the high pressure liquid into the control unit. By using hydraulic hose given oil is transferred to cylinder through valve.

As soon as oil goes into the cylinder the piston in the cylinder starts moving up. Pump sucks the oil from tank and conveys it to the cylinder. The jack begins lifting the weight and stops after completion of stroke of the cylinder. Now after releasing the switch the vehicle remains at raised, as the return flow of the oil is stopped by the delivery valve fitted in the control unit. The relief valve reliefs the pressure if the load is exceeding the maximum lifting capacity and also if switch is not released after completion of stroke.



Fig. 2 Designed Hydraulic Jack

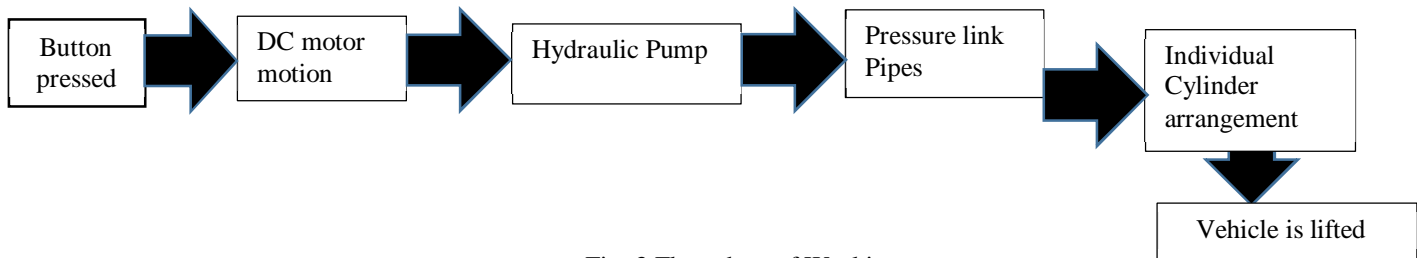


Fig. 3 Flow chart of Working

Now to let down the load on the jack, the oil-filled in the chamber which will, in general, keep the vehicle lifted is discharged with the assistance of discharge valve. The oil-filled in the chamber is depleted in the tank and the load descends gradually. In this way the oil circulates from cylinder to tank and tank to cylinder during operation.

V. CONCLUSIONS

The primary aim of this project is to the execution of hydraulic jack to a heavy vehicle, because of these substantial loads on a vehicle, the life of tire will be decreased.

With some design variation, an inbuilt vehicle lifting component can without much of a stretch be fitted in all light weight vehicles. The project works on hydraulic power gave by the battery. With this task the utilization of car can be made simple for ladies and elderly individuals. Some additional mechanization like solenoid control valve can increase the value of the project.

VI. SCOPE for FUTURE WORK

The course of action of button-based hydraulic jack system is intended for most extreme 1000kg weight vehicles in this project work, yet this plan can be broadly used in the future for heavy loaded trucks by making some little changes in the current tasks.

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