

## HYDRAULIC JACK

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**Abstract** - This project work titled "Hydraulic Jack" has been conceived having studied the difficulty in lifting the any type of light vehicles. Our survey in the regard automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning.

Now the project has mainly concentrated on this difficulty, and hence a suitable device has been designed. Such that the vehicles can be lifted from the floor land without applications of any impact force. The fabrications part of it has been considered with almost ease for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile garage

### 1. INTRODUCTION

hydraulic jack is a jack that uses a liquid to push against a piston. This is based on Pascal's Principle The principle states that pressure in a closed container is the same at all points. If there are two cylinders connected, applying force to the smaller cylinder will result in the same amount of pressure in the larger cylinder. However, since the larger cylinder has more area, the resulting force will be greater. In other words, an increase in area leads to an increase in force. The greater the difference in size between the two cylinders, the greater the increase in the force will be. A hydraulic jack operates based on this two cylinder system

### 2. LITERATURE SURVEY

Hydraulic systems play a vital role in modern mechanical engineering applications, particularly in load lifting, force transmission, and automation. The working principle of a hydraulic jack is based on Pascal's Law, which states that pressure applied to a confined fluid is transmitted equally in all directions without loss. This principle enables force multiplication, allowing heavy loads to be lifted with relatively small input effort.

According to Theory of Machines by R. S. Khurmi and J. K. Gupta, hydraulic machines utilize incompressible fluids to transmit power efficiently. These systems typically consist of cylinders, pistons, hydraulic fluid, and valves. When force is applied to a smaller piston, it generates pressure in the fluid, which is transmitted to a larger piston, resulting in an increased output force. This

relationship is governed by the equation , where pressure remains constant and force increases with area [1].

Similarly, Theory of Machines by S. S. Rattan explains the concept of mechanical advantage and emphasizes that hydraulic systems provide smooth and controlled motion with high load-carrying capacity. These systems are preferred over conventional mechanical devices due to their efficiency, reliability, and reduced manual effort. Applications include lifting devices, presses, braking systems, and industrial machinery [3].

The study by Gearless Transmission Mechanism and its Applications discusses the importance of minimizing mechanical complexity and improving system efficiency [2]. Although focused on transmission mechanisms, the study highlights design principles such as reducing friction, simplifying mechanisms, and enhancing performance, which are equally applicable to hydraulic systems. Hydraulic systems inherently have fewer moving parts compared to mechanical systems, resulting in lower wear and maintenance.

Furthermore, the performance of hydraulic systems depends on critical design parameters such as cylinder dimensions, fluid properties, sealing mechanisms, and material selection. Mild steel is commonly used for structural components due to its strength, durability, and ease of fabrication. Proper selection of hydraulic fluid is essential to ensure adequate lubrication, thermal stability, and efficient power transmission.

Hydraulic jacks are widely used in automotive and industrial applications for lifting vehicles and heavy loads. However, conventional jacks often require significant manual effort and time. This has led to the development of improved systems, such as motorized hydraulic jacks, which enhance convenience, reduce human effort, and improve operational safety.

From the reviewed literature, it is evident that hydraulic systems offer advantages such as high load capacity, compact design, precise control, and reliability. These features support the development of an efficient hydraulic jack system that overcomes the limitations of traditional lifting methods while maintaining cost-effectiveness and ease of operation

### 3. METHODOLOGY

Forming a group:- First we form the group of capstone project.

Selection of project:- We searched for the topic of project on Google, you tube and in books. Also we took project by considering some criteria's such as time and cost required to make project. We also approved our project from our guide.

Design of components:- Then we figure out dimensions required for all components. Stress going to applied on each component, factor of safety of component and important designs. Drawing of the project:- The main need of making any project is to make the production drawing with all dimensions, tolerance and other required values of the project.

Decided specification and quantity of components:- We then decided specification of components such as its capacity, dimensions. Also we decided how many components are required.

Buy or make components:- Then we figure out which components are required to buy and which we can make so that we could able to decide approximate costing required for our project.

### 4. SYSTEM DESIGN AND COMPONENT DESCRIPTION

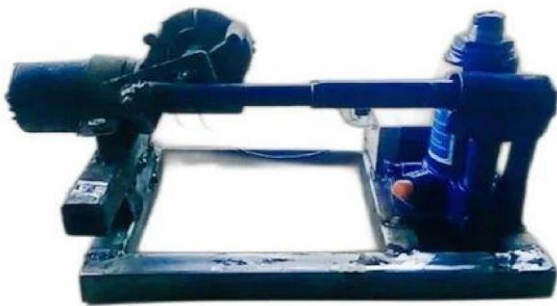


Fig no 1 Final Model Of Hydraulic Jack

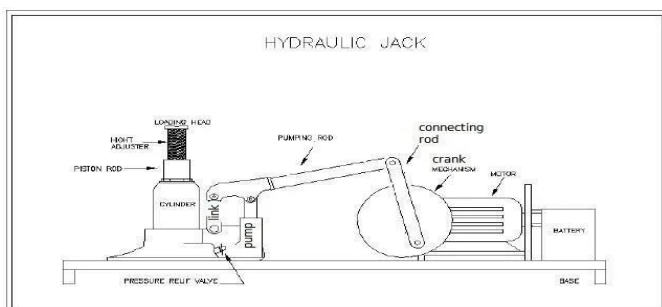


Fig no 2 working Model

Hydraulic jacks and many other technological advancements such as automobile brakes and dental chairs work on the basis of Pascal's Principle, named for Blaise Pascal, who lived in the seventeenth century. Basically, the principle states that the pressure in a closed container is the same at all points. Pressure is described mathematically 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  $F = PA$ . The pressure stayed the same in the second cylinder, but Area was increased, resulting in a larger Force. The greater the differences in the areas of the cylinders, the greater the potential force output of the big cylinder. A hydraulic jack is simply two cylinders connected as described above.

Good material selection was undertaken to reduce noise and wear, ease of maintenance, improve service life and reduce corrosion. Machine frame, shaft and dome-shaped top – (Mild Steel).

### 5. SCOPE OF THE PROJECT

The scope of the hydraulic jack project lies in the design and development of an efficient and userfriendly lifting system for light to moderate load applications, particularly in the automotive sector. The system is intended to reduce manual effort and improve operational safety while lifting vehicles for maintenance and repair work.

This project focuses on utilizing hydraulic principles to achieve force multiplication, enabling heavy loads to be lifted with minimal input force. The developed hydraulic jack can be effectively used in automobile garages, workshops, and service stations where frequent lifting operations are required. Its compact design allows easy portability and convenient usage in confined spaces.

Furthermore, the project can be extended by integrating automation features such as motorized operation, remote control systems, or sensor-based safety mechanisms. This would enhance ease of use and reduce human intervention. The system can also be modified for higher load capacities by selecting appropriate materials, increasing cylinder dimensions, and optimizing hydraulic pressure. In industrial applications, the same concept can be adapted for operations such as metal forming, pressing, bending, and assembly work. With further improvements in design and material selection, the hydraulic jack can be developed into a more robust and versatile lifting device suitable for heavy-duty applications.

Thus, the project has significant potential for future development in terms of automation, increased efficiency, enhanced safety, and broader industrial applications.

## 6. ADVANTAGES AND APPLICATIONS

### Advantages

- I. Zero Manual Effort
- II. High Load Capacity & Safety
- III. Efficiency & Convenience
- IV. Compact Design
- V. Precise Control

### Applications

- I. Metal Press Work
- II. Drawing and pushing rods
- III. Bending and straightening any metal      Packing Press
- IV. Dismantling of old tanks

## 7. CONCLUSIONS

Hydraulic Jack can be used in many industries for the power transmission and load lifting purpose. For lifting up the vehicle the motorized hydraulic jack is positioned in centre. The system operates on the hydraulic power. For lifting a car 300kg or a load of 3000N we have to apply a force of 49.5928N is applied which is quite less than the weight to be lifted.

An inbuilt Motorized Hydraulic Jack system can be easily attached to all currently manufacture automobile chassis. There is a front suspension jack that is mounted externally to the front suspension of an automobile its front wheels. Quick lifting is possible and suitable for heavy load for about 100kg or 1000N. With the help of this system the driving of vehicles will be easy.

## 8. REFERENCES

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