



# Inbuilt Lifting Arrangements for Heavy Vehicles

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**ABSTRACT:** An inbuilt lifting and safety arrangements for a Four Wheeler with a hydraulic bottle jack system is attached to automobile vehicle on front and rear part of the chassis. During puncture or some repairs without lifting externally drop the hydraulic bottle jack with a single button. For heavy vehicles like truck, lorry etc., it will be easy to remove and fix the tyre in case of inflated. In this paper, we are fixed a mechanism to lift the vehicles for the four sides and by operating the motor in single switch. The hydraulic jack is operated by a cam which works under the mechanism of single slider crank chain. It consists of one sliding pair and three turning pair, the lever is connected with a return spring rod. Force applied to the piston is 10 times lesser than the weight lifted.

## I. INTRODUCTION

A hydraulic jack is a device used to elevate heavy weight without manpower. The device is accomplished of exerting great force. It thrust the liquid against a piston, pressure is reinforced in the jack's container. Based on Pascal's law that the pressure of a liquid in a container is the same at all points. It control the equipment consists of hydraulic jacks with cam operated using the electrical power of motor. The pumping rod is present at the center. Motor shaft is coupled with cam. Battery is operated by a motor, the motor is connected with cam. It is rotated with the specified rpm, the cam is connected to a hydraulic bottle jack when the continuous rotation of the cam the circular motion is converted to a reciprocating motions that reciprocating motion used to step up the bottle jack. The link is connected with the bottle jack is used to rise the arm. This arm connected to spring shaft is lower down and lift the vehicles.

## II. WORKING PRINCIPLE

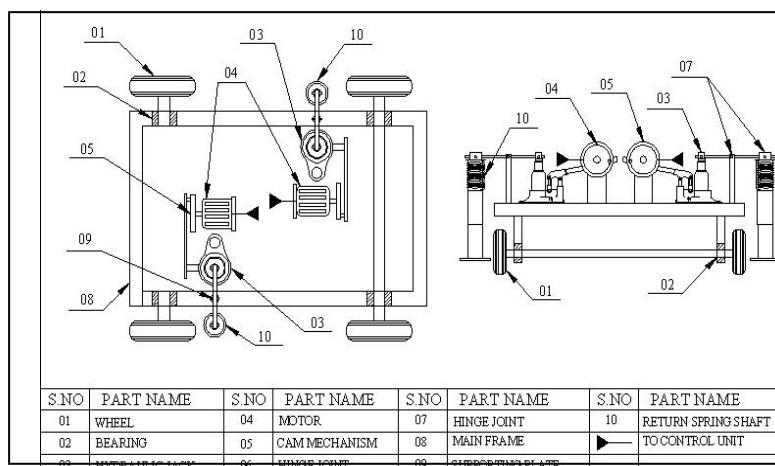


Fig.:1 Hydraulic Jack



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Here we are converting the rotary motion into linear motion for lifting the vehicle using the jack which is fixed in the bottom of the axles by means of a frame. The motor is operated by the control unit. It gets power from the battery. The four numbers of hydraulic jack is arranged under the vehicle body. One shaft is connected to the cam and moving shaft. The link is used to provide the smooth operation during the up and down movement .When we press the button in the control unit the motor starts rotates. Then the cam rotates the supporting shaft moves up which makes the return spring shaft to move down by touches the ground and lifts the front wheels of the vehicle. The wheels are grounded safely even after the wheel puncture or any other fault in the vehicle. The mechanism will be operated by automatically when the pressure sensor is fitted in the tyre.

## III. DESIGN AND FABRICATION

### 3.1 DESIGN CALCULATION FOR HYDRAULIC JACK:

The weight to be lifted is 100 kg or 1000N.

Let us find out the effort required by the human.

Formula:

$$F = P * A$$
$$1000 = P * \frac{\pi}{4} * (50 * 10^{-3})^2$$
$$P = 1000 * \frac{4}{\pi} * (50 * 10^{-3})^2$$
$$P = 509.29 * 10^3 \text{ N/M}^2$$

Force required at the working piston:

$$F = P * A$$
$$= 509.29 * 10^3 * \frac{\pi}{4} * (15 * 10^{-3})^2$$
$$F = 90\text{N} = 9\text{kg}$$

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

### 3.2 FABRICATION:

- Hydraulic bottle jack
- Motor
- Cam arrangement
- Arm

#### 3.2.1 HYDRAULIC BOTTLE JACK

The hydraulic bottle jack has saddle, extension screw, ram, Cylinder, handle sleeve, handle assembly, carry handle and release valve. Pressure is applied to the handle assembly. It is possible to get a lift of ram per stroke of the handle assembly. The release valve is used to release the pressure inside the cylinder. Bottle jacks are placed in a horizontal position.

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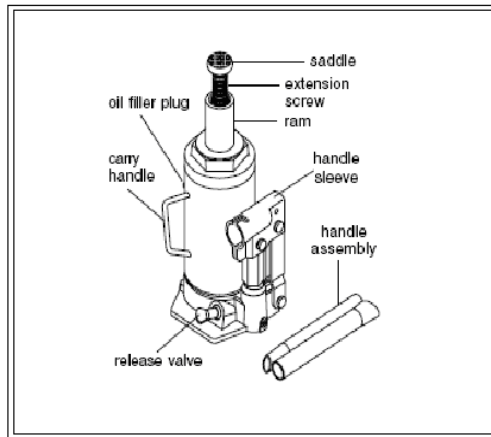


Fig.:2a Hydraulic bottle jack



Fig.:2b Hydraulic bottle jack parts

Bottle jacks are versatile because their horizontal position makes it possible to place them in tight spots and provides good leverage (fig.1a). Bottle jacks have proven useful in search and rescue missions following earthquake damage. As a result, bottle jacks are standard equipment in firehouses and for search and rescue teams. They are also used for elevating, thrusting, weighing, or forcing requirements. The base of bottle jacks is welded for strength. All models of bottle jacks are capable of working in erect, angled, or horizontal positions.

### 3.2.1.1 STEPS TO USE AND OPERATE:

1. Before operating the jack you must purge its hydraulic circuit in order to eliminate any possible air in the system.
2. To purge the system open the release valve, turning it anti-clockwise. Then with the aid of the lever operate the pump several times.
3. Close the release valve with the lever in a clockwise direction until it is fully closed.
4. The jack is setup for use.
5. To lower the jack, turn the release valve very tardily in an counter clockwise direction.
6. Always keep the jack in erect position, with the ram, extension screw and pump retracted after use.
7. If you require operating the jack in a horizontal manner the pump should be located on the lower side of the jack.

### 3.2.2 RETURN SPRING

Springs are placed between the supporting shafts and return spring shaft. it is used to reduce the return time of return spring shaft. When the total extension of the hydraulic cylinder the spring fully compressed. When the wheel comes across a relegate on the road, it ascend and distracts the spring, thereby storing energy therein. On discharging, due to the elasticity of the spring, material, it bounces thereby expending the stored energy. In this way the spring starts oscillate, with amplitude decreasing gradually on internal friction of the spring material and friction of the suspension joints till oscillates die down.

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Fig.: 2 Return Spring

### 3.2.3 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 cam or crank is used to deliver impulse of power to an eccentric disc that produces a smooth reciprocating (back and forth) motion in the follower which is a lever making contact with the hydraulic jack. This cam or crank is connected with a slider mechanism that converts reciprocating motion to rotary motion.



Fig.:3 Cam

### 3.2.4 MOTOR

A machine that converts 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.



Fig.:4 Motor



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## IV. CHOICE OF MATERIALS

### 4.1 PROPERTIES:

The material selected must have the essential properties for the proposed application. The various requirements to be quenched can be weight, surface finish, inflexibility, ability to withstand environmental aggress from chemicals, service life, reliableness etc. The following four types of principle properties of materials resolutely affect their selection

- Physical
- Mechanical
- From manufacturing point of view
- Chemical

The various physical properties referred are melting point, thermal Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc. The various Mechanical properties referred are strength in tensile, Compressive shear, bending, torsion and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

The various properties referred from the manufacturing point of view are,

- Cast ability
- Weld ability
- Surface properties
- Shrinkage
- Deep drawing etc.

### 4.2. MANUFACTURING CASE:

Requirement for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

### 4.3 QUALITY REQUIRED:

This generally affects the manufacturing process in the end of material. For example, it would never be desirable to go casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

### 4.4 AVAILABILITY OF MATERIAL:

Some materials may be scarce supply. It then becomes obligatory for the designer to use some other material which though may not be a perfect replacement for the material designed.

### 4.5 SPACE CONSIDERATION:

High strength materials have to be selected because the forces involved are high and space are restricted.

### 4.6 COST:

In selection of material the cost of material plays an important part and should be considered. Factors like scrap utilization, appearance, and non-maintenance of the designed part are involved in the selection of proper materials.

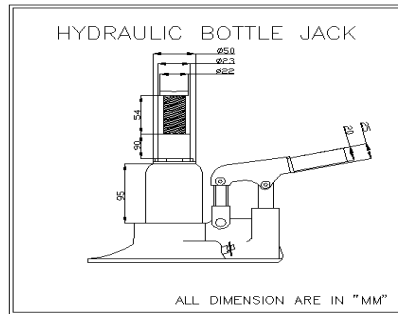
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## IV. RESULTS AND CONCLUSION

### 4.1 RESULTS:



### PARAMETER MEASURED:

Lift Capacity (tons)	2
Min. Lift Height (in.)	7
Max. Lift Height (in.)	11 ½
Ram Travel (in.)	4 ½
Screw Top Adjustment (in.)	1 7/8
Operation	Manual
Handle Included	Yes
Dimensions L x W x H (in.)	3 1/2 x 3 5/8 x 7

Battery: Voltage-12V



Fig.:5 Model



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## 4.2 CONCLUSION

An inbuilt hydraulic jack system can be easily attached to all currently manufacture automobile chassis. There is a front suspension hydraulic jack that is mounted externally to the front suspension of an automobile between its front wheels. There is also a rear delay hydraulic jack that is mounted externally to the rear suspension of the automobile between its wheels. The system operates on the hydraulic power. This arrangement has many advantages such as maintenance and servicing of vehicle. It reduce the security tension and easy to implement. Quick lifting is possible and Suitable for heavy load for about 100 kg or 1000N. The force to be applied at the working piston is 10 times lesser than the weight to be lifted. With the help of this system the driving of vehicles will be easy. Arrangement is also very useful for heavy loading vehicles and a single person can go on a long drive.

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