

# Development and Testing of Pneumatic Jack System for Vehicles

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**Abstract**— A jack is a mechanical device used as a lifting devices to lift heavy loads or apply great forces. Various innovations have been done in the jacks with different electronic and mechanical devices. This project is based on pneumatic jack which is one of the efficient jack from all its types. The available jacks in the market are time consuming and also require much efforts which makes use of jack very difficult. As the jack is also required to set at "jack point" which further increases the complications in its application. So need of automatic inbuilt jack in automobiles is inescapable. It can be vastly used in light weight to medium weight cars. It can also be used in maintenance purpose. The project can be made highly feasible if considered while designing the vehicle, as the model is an inbuilt device assembly so a greater perfection, higher stability and accuracy can be seen if installed during the designing rather than installing it later after the design.

**Keywords:** Pneumatic Jacks, Compressor, Hand Lever Valves, Chassis, Lifting of an Automobile Vehicle rating

## I. INTRODUCTION

A mechanical jack employs a screw thread for lifting heavy equipment. A hydraulic jack uses hydraulic power. The most common form is a car jack, floor jack or garage jack, which lifts vehicles so that maintenance can be performed. Jacks are usually rated for a maximum lifting capacity (for example, 1.5 tons or 3 tons). Industrial jacks can be rated for many tons of load. Various innovations have been done in the jacks with different electronic and mechanical devices. With the help of technology, the priorities are given to safety, luxury and comfort. Pneumatic jack which is one of the efficient jack from all its types. The available jacks in the market are time consuming and also require much efforts which makes use of jack very difficult. It can be vastly used in light weight to medium weight cars. It can also be used in maintenance purpose.

## II. HISTORICAL PERSPECTIVE

The personal name Jack, which came into English usage around the thirteenth century as a nickname form of John, came in the sixteenth century to be used as a colloquial word for 'a man (of low status)' (much as in the modern usage 'jack of all trades, master of none'). From here, the word was 'applied to things which in some way take the place of a lad or man, or save human labor'. The first attestation in the Oxford English Dictionary of jack in the sense 'a machine, usually portable, for lifting heavy weights by force acting from below' is from 1679, referring to 'an Engine used for the removing and commodious placing of great Timber.

## III. PROBLEM DEFINITION

All the available numerous types of jacks are the separate jacks.

- Also if they are inbuilt even then they all are integrated ones.
- Even if the jacks invented later on were inbuilt but again the input power is not inbuilt.
- Setting of improper "jack-point" which any of the unskilled person will probably do.
- All the jacks available in the market for economic cars are Manually operated.
- The installing of the jack and lifting of the vehicle with it, is highly time consuming.
- Also Every non inbuilt jack is highly Labor consuming which can be unfavorable for the ladies or even the senior citizen.
- Skilled operators required as the improper setting of jack may cause damage to the vehicle body as well as may cause accident.

## IV. RESEARCH OBJECTIVE

- To use the most efficient and affordable assembly at a same time.
- Operate and lift only the targeted area where any of the operation is to be performed keeping the rest at a neutral position.
- To minimize the size of the assembly as much as possible with same load lifting capacity.
- Low maintenance cost with ease of operation in every conditions.
- Provide few sub-facilities with assembly components which may serve as an extra benefit of installing this system.
- Eliminates the need of finding the proper "Jack Point".
- Cleaning and repairing as well as puncture repair and washing etc. becomes convenient any time without mechanical input.
- At emergency times its compressor can be used for air filling in the tires in the middle of the way also.
- If the air wrench provided by the manufacturer the compressed air can be used for the fitting and removing of the wheel.
- This project can become a real easy operation and time saver assembly.
- Independent operation of the jack is possible so no further unnecessary forces would be wasted raising whole part of a vehicle.
- To minimize the manual operation.
- To reduce the labor of the operation while lifting.
- Convenient operation of the jacks by all the kinds of user.

- To use the most efficient and affordable assembly at a same time.

Operate and lift only the targeted area where ever any operation is to be performed keeping the rest at a neutral position.

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## V. MODIFIED DESIGN OF INBUILT PNEUMATIC JACK SYSTEM

### A. Working

The working medium used here in this mechanism is compressed air. The compressed air is transmitted to the pneumatic cylinder via the help of pressure pipes (tubes) and the power is converted in to the reciprocating motion by the help of the solenoid valves and this valves can be controlled as per our requirement. This reciprocating motion gets transmitted to the jack with the help of piston movement inside the pneumatic cylinder which is the result of the compressed air. The jacks are placed below the vehicle body on the chassis, from where the vehicle is to be lifted. The vehicle can be lifted as per choice by witching the solenoid valve, thus using such an assembly lifting of a pneumatic jack is an ease to the vehicle lifting operation.

### B. Fabrication Process

For the purpose of mounting this jack assembly a separate modified frame is needed which is its basic step the fabrication process, it is made up of mild steel square rods, whereas the axles are made up of cylindrical mild steel and the wheels are mounted with the axle with the help of bearings. However certain considerations are made so that the geometry of the frame do not interrupt or hinder the drivers riding comfort.

Components Required the inbuilt pneumatic jack systems

- Frame
- Wheel
- Pneumatic Cylinder (Jack)
- Connecting pipes
- Connectors
- Solenoid Valve
- Compressor.

#### 1) Frame

It is used for support for the setup. Mild steel (MS) metal is used for the chassis.

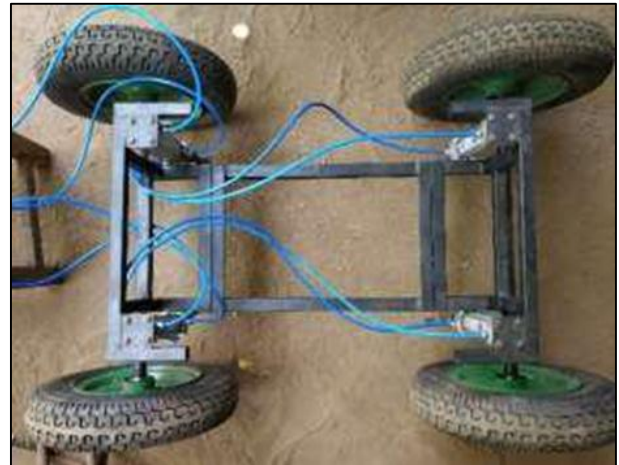


Fig. 2.1: Frame

#### 2) Wheel

Wheels are used to move the prototype. The type of wheels used are made up of rubber material.



Fig. 2.2: Rubber Wheel

#### 3) Pneumatic Cylinder

It is a pneumatic type of device which works with the help of compressed air resulting in the reciprocating motion of the piston inside the cylinder up to a certain length, which will lift the automobile vehicle.



Fig. 2.3: Pneumatic Cylinder

### C. Connecting Pipes

Connectors pipes commonly known as air pressure pipes are used for the transmission of compressed air from the compressor to the pneumatic cylinders.



Fig. 2.4: Connecting Pipes



Fig. 3: Fabricated Model

#### D. Connectors

These are small attachments used for the connecting of the air pipes along with the pneumatic cylinders having threads on one side and pipe holding mechanism on another side. These are available with different sizes (currently used is of 6mm diameter).

#### E. Hand Lever Valves

These are operating switch mechanism which controls the compressed air passage from the compressor to the pneumatic cylinders as per requirement of operation. They are available in two of the types:

- Single acting (Forward type)
- Double acting (Forward-reverse both)

(Here we have used double acting which works on both directions).



Fig. 2.6: Hand Lever Valve

#### F. Compressor

It is a device which converts the naturally sucked atmospheric air in to compressed form with the means of external electrical supply.

### VI. IMPLICATION FOR FINAL DESIGN

Following figure shows the final model of the prototype of our project.

### VII. SPECIFICATIONS OF THE EQUIPMENT'S USED

Sr. No.	Equipment	Property	Quantity
1.	Jacks (Pneumatic cylinder)	Bore=32 Stroke length =100 Temp=0°C to 80°C Pressure=0.5bar to 10bar	4
2.	Connectors	Diameter=6mm	20
3.	Hand lever valves	Two way(double acting),(Forward and reverse)	4
4.	Pipes	Diameter=6mm	10m
5.	Rubber wheels	Diameter=15Inch (38.1cm)	4
6.	Compressor	Capacity=300psi	1

Table 1:

### VIII. CONCLUDING REMARKS

In this dissertation work, the prototype made for the attempt to reduce the human effort for the lifting the automobile vehicle by using manual jack's system is replaced by our project assembly and the effort is reduced considerably and the results are satisfactory. The results are concluded as follows:

- 1) The pneumatics jacks can act efficiently in the place of hydraulic jacks.
- 2) The air required for the operating of the jack is easily available in the nature, so resulting in to the reduction in the cost of the system compared to other jacks.
- 3) It serves better than other jacks and can be more accurately assembled at the time of manufacturing of the vehicle, also if made in the lot the cost could be less.
- 4) As our system assembly is built-in the fatigue is also less.
- 5) This innovation would help the elders, women, handicaps and other fellow folks which are unaware of mounting jacks for easily changing the tires or lifting of vehicle for any reason when stuck in the middle of anywhere.
- 6) Unloading would be minimized. This project would save time of installing a manual jack and unloading and lifting the vehicle as the problem.

- 7) Since a jack has always been an integral part of any operation It would help the mechanic to repair the vehicle on road as the project's system assembly would increase the road clearance of the car and would be easily repaired, also it would resolve the issues related to servicing of the vehicle far more easy.

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