

Design and Development of Pneumatic Jack in Automobile

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Abstract: *There are many types of jacks available in the market to lift an automobile to access the underbelly of the vehicle. However, these jacks are too huge to carry around or require the vehicle to be taken to some garage. The dependency of an individual on garage or other services increases. During emergencies or in places where the probability of finding a service station is very low such as hilly regions, rural areas, forest areas and etc. It becomes extremely hard to replace a punctured tire or temporarily fix a broken axle on one's own. The time taken for a support system to reach is tiresome. The service provided in high demand areas such as hilly regions or forests is also expensive. This project focuses on helping individuals and physically challenged persons to change a punctured tire. As most of the civilians out there are not trained to place a mechanical jack properly and lift a car. The main target of project is to improve version of mini pneumatic jack this will be more efficient for the user this machine is pneumatic powered which has low co-efficient of friction. A Pneumatic cylinder erected provides power to lift the Wheel. This is a pneumatic powered machine and requires no other means of power to operate. The required components are Compressor (portable), Receiver tank, Pneumatic cylinder, 4/3 DCV, Check valve, Flow control valve, FRL unit, etc.*

Keywords: Pneumatic Jack, Pneumatic Circuit., etc.

I. INTRODUCTION

The term Pneumatic stands for operations performed using air. The pneumatic jack is the device which is used to lift the vehicle or a wheel of a vehicle by using pressurized fluid that is Air. Most of the vehicles are lifted by using screw jack. This needs much human efforts and consume a lot of time. Various types of jacks or lifting devices are available like Screw jack, Floor jack, Hydraulic bottle jack, etc. Conventionally we have always used a single portable jack for the vehicle. Here we have designed separate Pneumatic jack for each wheel which is permanently installed on vehicle chassis. The virtues of using a screw as a machine, essentially an inclined plane wound round a cylinder, was first demonstrated Archimedes in 200BC with his screw used for pumping water.

There is evidence of the use of screws in the Ancient Roman world but it was the great Leonardo da Vinci in the late 1400's who first demonstrated the use of a screw jack for lifting loads. With the industrial revolution of the late 18th and 19th centuries came the first use of screws in machine tools from English inventors such as John Wilkinson and Henry Maudsley The most notable inventor in mechanical engineering from the early 1800's was undoubtedly the mechanical genius Joseph Whitworth. Over the past 60+ years, the product has evolved to push, pull, lift, lower and position loads of anything from a few kilos to hundreds of tones. Most features now offered our competitors were actually designed and patented Screw Jack & Duff-Norton over the years.

II. PURPOSE OF INBUILT PNEUMATIC JACK

The pneumatic jack is a device used for lifting heavy loads by the application of much smaller force. It is based on pascal's law, which states that intensity of pressure is transmitted equally in all direction through a mass of air at rest.

III. SCOPE

Hydraulic jack or other jack causes more efforts during lifting the vehicle. To make an inbuilt pneumatic jack for the easy to lifting the vehicle & provide seamless operation.

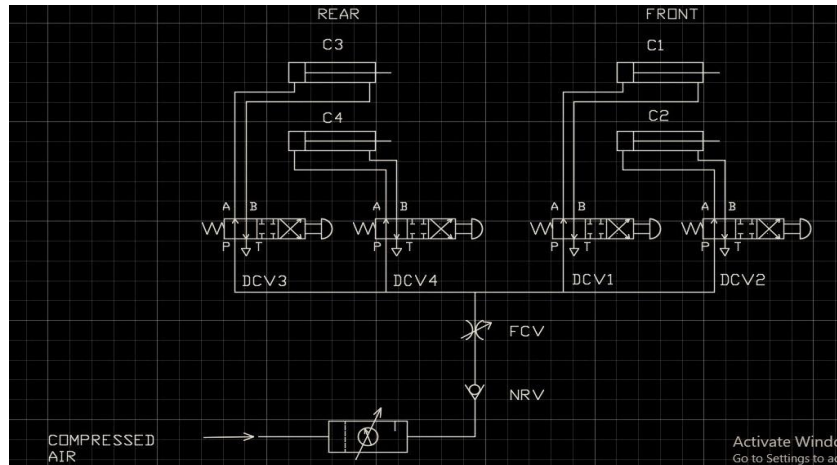
IV. BASIC PRINCIPLE OF PNEUMATICS

In pneumatic system electric energy converted in mechanical motion and using this air compressed to higher pressure. The compressed air is used to developed the force. The force is used to do some mechanical work.

V. CONSTRUCTION

PNEUMATIC CIRCUIT

A pneumatic circuit is an interconnected set of components that convert compressed gas (usually air) into mechanical work. In the normal sense of the term, the circuit must include a compressor or compressor-fed tank.



Components: Following components are used in circuit

Sr. No.	Name of Component	Quantity
1.	Double acting cylinder	4
2.	4/3 Direction control valve	4
3.	Flow control valve	1
4.	Check valve	1
5.	FRL unit	1

VI. PROBLEM STATEMENT

Mechanical jack requires more effort moreover not suitable for uneven surfaces. It requires more power consumption also Maintenance is quite high as well as Suitable for small capacity and requires skilled labor. The purpose of this project is to modify the design of existing car jack in terms of its functionality and also human factors considerations. General idea of the project is to minimize the human effort while operating the jack.

Platform Details

In this project we used Double acting cylinder with piston rod on one side.

Specifications of double acting cylinder

Bore diameter = 25 mm

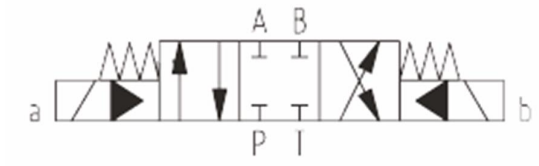
Stroke length = 50mm

Pressure range = 0.1 – 10 bar

No. of cylinders = 4 nos.



In this project we have used 4/3 direction control valve with closed center type.



Symbol of 4/3 DCV



Specifications of 4/3 DCV

Manually operated

Lever operated

Rotary spool type

Closed center type

Advantages

The advantages are as follows:

1. It occupies less space
2. They are also less likely to jam due to rust in the screw thread
3. It is highly effective with heavy loads
4. It lifts loads with the minimum of effort
5. It is easier to use
6. The maintenance of the vehicle will be very easy.
7. Reduces human efforts at large extent.
8. Time saving process.
9. Can be operated even when the vehicle is not in starting condition.
10. As it is electrically powered, does not harm the vehicle efficiency

VII. LIMITATIONS

1. Cost will increase slightly.
2. Weight of vehicle will increase slightly.
3. System cannot work without 12-volt DC current.
4. System required maintenance also

VIII. CONCLUSION

With some design consideration an inbuilt car lifting mechanism can easily be fitted in all light weight automobiles. The project works on hydraulic power provided by battery. Maintenance and service of the vehicle can be easily done by this project. With this project the usage of automobile can be made easy for women and old people. Some extra automation like solenoid control valve can add great value to the project. The inbuilt jack is operated by battery so it can also be used when the vehicle engine is not started.

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