DESIGN AND FABRICATION OF PNEUMATIC CAR LIFTER

Shubham Gumphalwar[1], Darshan Dhabarde[2], Shubham Gade[3], Amit Kalhane[4],Vishnu Nair[5], Prof. Praful Randive[6]

[1] *Student, Mechanical Engineering, AGPCE, Maharashtra, India*
[2] *Student, Mechanical Engineering, AGPCE, Maharashtra, India*
[3] *Student, Mechanical Engineering, AGPCE, Maharashtra, India*
[4] *Student, Mechanical Engineering, AGPCE, Maharashtra, India*
[5] *Student, Mechanical Engineering, AGPCE, Maharashtra, India*
[6] *Assistant Professor, Mechanical Engineering, AGPCE, Maharashtra, India*

ABSTRACT

This fabrication is based on pneumatics which deals with the study and application of pressurized air to produce mechanical motion. Pneumatic jack is a fabricated model which when installed in four wheeler, will ease in the problems arising in the conventional operated jack. This fabricated model consists of a small size reciprocating air compressor which is driven by the battery used in four wheeler, an air tank to store the compressed air, and a pneumatic control valve which regulates the air flow and double acting cylinder used as a jack which performs lifting. Thus the car is lifted using jack and the problem related to tyres such as puncture tyres, tyre replacement and wheel balancing can be resolved with less effort and time.

Keyword : - *Jack1 , Pneumatic2, Car lifter3, and Compressor4*

1. INTRODUCTION

Due to the difficulty of operating automobile jacks, various forms of electric jacks have been proffered. With the development of such electric jacks has gradually come an understanding of some of the problems associated therewith. Due to the torque needed to lift something as heavy as most automobiles, as a severe mechanical advantage must be utilized. Jacks that are built into an automobile have not been accepted due to expense and the need to at least lift each side of an auto, if not all corners individually. To reduce the human effort for operating any kind of jack separately. This will most appropriately benefit senior citizens to provide a safe and simple automatic pneumatic jacking system without manual effort. To provide a novel jacking system that can be operated from within the vehicle by means of a valve control. There are certain mechanisms already available for the same purpose which has a definite capacity to lift the car wheels viz.

This fabrication is based on pneumatics which deals with the study and application of pressurized air to produce mechanical motion. Pneumatic jack is a fabricated model which when installed in four wheeler, will ease in the problems arising in the conventional operated jack. This fabricated model consists of a small size reciprocating air compressor which is driven by the battery used in four wheeler, an air tank to store the compressed air, and a pneumatic control valve which regulates the air flow and double acting cylinder used as a jack which performs lifting. Thus the car is lifted using jack and the problem related to tyres such as puncture tyres, tyre replacement and wheel balancing can be resolved with less effort and time. While driving a four wheelers in the way when we faced a problem related to tyres there is a hectic manual procedure is used to lift a vehicle i.e., use of manual or hydraulic operated jack which requires extra human effort and time i.e., to place a jack in a supportable position then applying muscular force to screw in the jack for spherical and transitional motion to lift vehicle. To save this effort and time we propose a fabricated model based on Pneumatics.

1.1 Overview of Project

This fabrication is based on pneumatics which deals with the study and application of pressurized air to produce mechanical motion. Pneumatic jack is a fabricated model which when installed in four wheeler, will ease in the problems arising in the conventional operated jack. This fabricated model consists of a small size reciprocating air compressor which is driven by the battery used in four wheeler, an air tank to store the compressed air, and a pneumatic control valve which regulates the air flow and double acting cylinder used as a jack which performs lifting.

1.2 Description of Project

Design concept generation refers to the actual conceptual design where the design concept is an approximate description of the technology, working principles and form of the product. It has a detailed description on how the product will satisfy and meet customer requirements. Existing design constraints may even be solved by having a good development in the design concept.

For this project, many alternative concepts have been generated. The various generated concepts were then individually evaluated to find the most appropriate concept for the product. The concepts that gave the most advantages were considered as the best concept and a waits further evaluation. The product sketch for the chosen concept was further drafted.

2 Literature review

2.1 JackK.Sainath, MohdSalahuddin “Design of Mechanical Hydraulic”

A jack is a device that uses force to lift heavy loads. The primary mechanism with which force is applied varies, depending on the specific type of jack, but is typically a screw thread or a hydraulic cylinder. Jacks can be categorized based on the type of force they employ: mechanical or hydraulic. Mechanical jacks, such as car jacks and house jacks, lift heavy equipment and are rated based on lifting capacity (for example, the number of tons they can lift). Hydraulic jack end to be stronger and can lift heavier loads higher, and include bottle jacks and floor jacks. HYDRAULIC JACKS depend on force generated by pressure. Essentially, if two cylinders (a large and a small one) are connected and force is applied to one cylinder, equal pressure is generated in both cylinders **[1]**

2.2 Sourabh Savadatti, Amit Doddamani: "Android Controlled Automatic Jack System for Vehicle"

The concept of this work is to design and develop the automatic jack system using an android app. An automotive jack is a device used to raise all or part of a vehicle into the air in order to facilitate repairs. With the manually operated car jack most people are familiar with, that is still included as standard equipment with most new cars. Changing flat tire is not a very pleasant experience. Operating the manual car jack is quite difficult job. This purpose is to mainly encounter this problem. This paper presents the development of the car jack which is controlled by android app. A vehicle frame, also known as its chassis, is the supporting structure of a motor vehicle to which all the components are attached, comparable to the skeleton of an organism. Where the jack is placed in the middle of the chassis, to which the movement of the jack is control through the app. A car jack works on the 12V power supply which is obtained from the car battery itself. Operator only needs to press a button from the app without working in a bent or squatting position for a long period of time to change a tire. In order to fulfill the present car jack problem, some improvement in the present technology has to be made.**[2]**

2.3 S.Vigneswari: "Compressed Air Production Using Vehicle Suspension"

In this project we are collecting air cylinder and store this energy to the compressor tank as non-conventional method by simply driving the vehicle. Non-conventional energy system is very essential at this time to our nation. Compressed air production using vehicle suspensor needs no fuel input power to produce the output of the air. For this project the conversion of the force energy in to air. The control mechanism carries the air cylinder (vehicle suspensor), quick exhaust valve, Non-return valve and spring arrangement.

We have discussed the various applications and further extension also. The initial cost of this arrangement is high.

Man has needed and used energy at an increasing rate for his sustenance and well being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted. Subsequently he discovered fire and his energy needs increased as he started. To make use of wood and other bio mass to supply the energy needs for cooking as well as for keeping himself warm. With the passage of time, man started to cultivate land for agriculture. With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of falling water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy.**[3]**

2.4 Rajmohan G ,Jazim Haris: "Inbuilt Lifting Arrangements for Heavy Vehicles"

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. 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.

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.**[4]**

3. PROJECT WORKING

The main target of our project is to fabricate compact version of pneumatic power car lifter. This will be more efficient for the local car service provider as well as car users. This machine is pneumatic powered which has low coefficient of friction. A pneumatic cylinder erected provides power to lift of the jack. This is a pneumatic powered machine and requires energy to run the pneumatic pump. The required components are compressor, pneumatic cylinder, control circuit and jack. Pneumatic systems used pressurized fluid to transmit and control power. Pneumatic systems typically use air as the fluid medium which is free in nature.

3.1 Working Principle

The working medium adopted is compressed air. The compressed air is transmitted through tubes to pneumatic cylinder where power is converted into reciprocating motion. The reciprocating motion is obtained by using an electrically controlled solenoid valve. The input to the solenoid valve is given through the control unit. The reciprocating motion transmitted to the jack through the piston which moves on the cylinder. The jack is placed under the vehicle chassis, where the vehicle to be lifted. The vehicle can be lifted when the solenoid valve is switched. The vehicle over the jack gets the reciprocating motion through the piston which is connected to the jack. Thus using a pneumatic jack the vehicle can be lifted with ease in operation.

- Power can be easily transmission.
- Less loss in transmission.
- A single compressor can supply power to many pneumatic Jacky.
- Low cost.
- Easy to work and reduces the manual stress.

3.2 Fabrication Process

In order to mount a pneumatic jack an additional frame mounting is imperative as frame is the support structure for the jack. Frame mounting is the first step in manufacturing of the pneumatic jack . Steel tubes are used as the frame structure, they are joined by welding one end of the frame is to the front end of the vehicle and other end is rear. The frame is connected to wheel by spot welding. However certain considerations are made so the geometry of the frame does not hinder the riding comfort of the driver.

3.3 Manufacturing Processes

Manufacturing processes are shaft, Frame, Rotavator, hopper and plough. Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made.

These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

4. CONCLUSIONS

After completing the project we have come to the conclusion that pneumatic power car lifter can act in the place of hydraulic jacks efficiently. The air required for the operating of the car lifter is easily available in the nature. Cost of the project is not high compared with other jacks. As our car lifter is inbuilt the fatigue is less. If made in the lot the cost could be less. It serves better than pneumatic jacks which is used for lifting.

5. ACKNOWLEDGEMENT

We express our sincere gratitude towards the faculty members who made this project work successful.
We would like to express our thanks to our guide Prof. Praful Randive for whole hearted co-operation and valuable suggestions, technical guidance throughout the Project work.
Special thanks to Class In-charge Prof. Gaurav Nagdeve and H.O.D. Prof Ritesh Banpurkar for their kind official support and encouragement.
We would also like to express our deep gratitude towards Principal Dr.Prashant Kadu and Vice Principal Prof. Pragati Patil for providing all the facilities and environment for research.
Finally, We would like to thank to all our faculty members of Mechanical Engineering Department who helped us directly or indirectly to complete this work successfully.

6. REFERENCES

[1] Sreevalsan S Menon, Sooraj M S, Sanjay Mohan, Rino Disney, Suneeth Sukumaran "Design and Analysis of KERS in Bicycles", International Journal of Innovative Research in Science, Engineering & Technology, Vol. 2, Issue 8, 2013.

[2] Ricardo Chicurel, "A Compromise Solution for Energy Recovery in Vehicle Braking," Energy, vol.24, 2009.

[3] Medlicott P.A.C., "Development of A Light Weight Low Cost Flywheel Energy Storage System for A Regenerative Braking Application," The British Petroleum Company Plc. 20th Inter Society Energy Conversion Engineering Conference (IECEC), Miami Beach, Florida, 1985.

[4] Radhika Kapoor, C. Malik Parveen, "Comparative Study on Various KERS", Proceedings on the World Congress on Engineering, Vol. 3, 2013.

[5] Hydraulics, Andrew Parr (A Technician's And Engineer's Guide) Fundamentals Of Pneumatic Control Engineering -Festo Manual. Fluid Mechanics And Hydraulic Machines,R. K. Bansal, Laxmi Publications Pvt.,Ltd,22,Golden House, Daryaganj, New Delhi – 110 002

[6] Jagadishlal, Hydraulic Machines, 1990, Published By Metropolitan Book Co. Pvt. Ltd., 1 Faiz Bazaar, New Delhi – 6.

[7] R.K.Bansal, Fluid Mechanics And Hydraulic Machines ,Edn. 8, Laxmi Publications P. Ltd., 22 Golden House, Daryaganj, New Delhi 110 002 – 2003.

[8] A Text Book Of Fluid Mechanics And Hydraulic Machines – By, R. K Rajput And S. Chand &Co,Ram Nagar, New Delhi – 110 055.

[9] A Text Book Of Hydraulics, Fluid Mechanics And Hydraulic Machines, R.S. Khurmi, - Edn.18, S. Chand & Co., Ram Nagar, New Delhi – 110 055, Ram Nagar, New Delhi – 2002

BIOGRAPHIES

Author Photo-1	Shubham Gumphalwar Student, BE 8th Semester Mechanical Engineering AGPCE, Nagpur
Author Photo-2	Vishnu Nair Student, BE 8th Semester Mechanical Engineering AGPCE, Nagpur
Author Photo-3	Darshan Dhabarde Student, BE 8th Semester Mechanical Engineering AGPCE, Nagpur
Author Photo-4	Amit Kalhane Student, BE 8th Semester Mechanical Engineering AGPCE, Nagpur
Author Photo-5	Shubham Gade Student, BE 8th Semester Mechanical Engineering AGPCE, Nagpur