

Inbuilt Pneumatic Jack Using Lead Screw Mechanism

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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.

Keywords: Pneumatic Jack, Lead Screw Mechanism

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. LITERATURE SURVEY

This work is inspired by journal papers published in three international journals. These journal papers emphasized on the use of dc motor, joined with lead screw and hydraulic cylinders for lifting the vehicle to reduce the human effort. Hence, hydraulic lift results in easy and safe operation. Experimental investigation of Fabrication of Inbuilt Hydraulic Jack for Four Wheelers, International Journal of Research in Engineering and Technology. This paper explains that this project not only saves human effort but also reduces the replacement time during the time of puncture. Lifting capacity is more in hydraulic jack in comparison with pneumatic.

III. COMPONENTS DESCRIPTION

A. Pneumatics

Pneumatics is that branch of technology, which deals with the study and application of use of pressurized air to affect mechanical motion. "Pneumos" means "Air" and "Tics" means "Technology". The compressed air is used as the working medium, normally at a pressure of 6-8bars (also can be extended up to 15bar) and a maximum force up to

50KN can be obtained. Pneumatics is used extensively in industry as well as in many everyday applications. It has many distinct advantages in terms of energy consumption, cost and safety. Pneumatic power is used in industry, where factory machines are commonly plumbed for compressed air (other compressed inert gases can also be used). Pneumatics also has applications in dentistry, construction, mining, and other areas.

B. Solenoid valve

A solenoid valve is an electro-mechanically operated valve. The valve is controlled by an electric current through a solenoid. in the case of a two-port valve the flow is switched on or off. in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

C. Wheels

In its primitive form, a wheel is a circular block of a hard and durable material at whose center has been bored a circular hole through which is placed an axle bearing about which the wheel rotates when a moment is applied by gravity or torque to the wheel about its axis, thereby making together one of the six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials (e.g. a potter's wheel); when mounted on a column connected to a rudder or a chassis mounted on other wheels, one can control the direction of a vessel or vehicle (e.g. a ship's wheel or steering wheel); when connected to a crank or engine, a wheel can store, release, or transmit energy (e.g. the flywheel).

D. Lead Screw

A lead screw (or lead screw), also known as a power screw or translation screw, is a screw used as a linkage in a machine, to translate turning motion into linear motion. Because of the large area of sliding contact between their male and female members, screw threads have larger frictional energy losses compared to other linkages. They are not typically used to carry high power, but more for intermittent use in low power actuator and positioner mechanisms. Common applications are linear actuators, machine slides (such as in machine tools), visas, presses, and jacks.

E. Transformer

A transformer is a device which transforms high voltage AC into low voltage AC or vice versa. Our goal is to convert high voltage AC into low voltage DC. So there is absolutely no reason to use step-up transformer. The transformer that is used in power supply is step-down transformer, which steps down the input AC voltage. The magnitude by which transformer steps down the voltage depends on the turns ratio

of primary and secondary winding. Observe the magnitude of sinusoidal signal before the transformer block. Its magnitude is quite high as compared to that of the signal after the transformer block diagram. This indicates that the signal was stepped down by the transformer. There arises an obvious question as to why transformer is used in this system. The main reason why we use transformer in the system are as follows.

F. Bridge Rectifier

Bridge rectifier is used to maintain the proper DC polarity at the input to the circuit, irrespective of telephone line polarity. It comprises of four diodes connected to form a bridge. It uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in fig below. There are various factors that determine the quality of the power supply like the load voltage, load current, voltage regulation, source regulation, output impedance, ripple rejection, and so on.

A regulated power supply is a very stiff dc voltage source. This means that the output resistance is very small. Even though the external load resistance is varied, almost no change is seen in the load voltage. An ideal voltage source has an output impedance of zero. Voltage regulators stabilize the output voltage against variations in input voltage. Ripple is equivalent to a periodic variation in the input voltage. Thus, a voltage regulator attenuates the ripple that comes in with the unregulated input voltage. Since a voltage regulator uses negative feedback, the distortion is reduced by the same factor as the gain.

G. Relay

Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on.

H. Diode

Diode Function Diodes allow electricity to flow in only one direction. The arrow of the circuit symbol shows the direction in which the current can flow. Diodes are the electrical version of a valve and early diodes were actually called valves. We can apply external voltage to the semiconductor diode. So we can connect a semiconductor diode terminals (Anode and cathode) to the external source terminals in two ways.

IV. WORKING PROCESS

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 into the reciprocating motion by the help of the solenoid valves and this valve 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 switching the solenoid valve, thus using such an assembly lifting of a pneumatic jack is an ease to the vehicle lifting operation.

A. 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.

V. PHOTOGRAPH





VI. ADVANTAGES

- 1) The maintenance of the vehicle will be easy
- 2) The servicing of the vehicle will be easy and cheap
- 3) Reduces human efforts at large extent
- 4) Time saving
- 5) Can be operated even when the vehicle is not in starting condition.

As it is electrically powered, does not harm vehicle efficiency.

VII. CONCLUSION

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.

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