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Design and Development of Pneumatic Jack

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Abstract - For car lifting there are numbers of jacks are available into the market such as hydraulic jack, screw jack, floor jack and garage jack etc., which lifts the car for various purpose such as repair, maintenance and puncture. But this are jack quite uncomfortable to use sometime. We make equipment which will lift the vehicle without any great effort it is pneumatic jack which is simply operated by car owner whenever it is required.

Keywords: Pneumatic Jack, Solenoid valve, Jack, Piston, Cylinder,

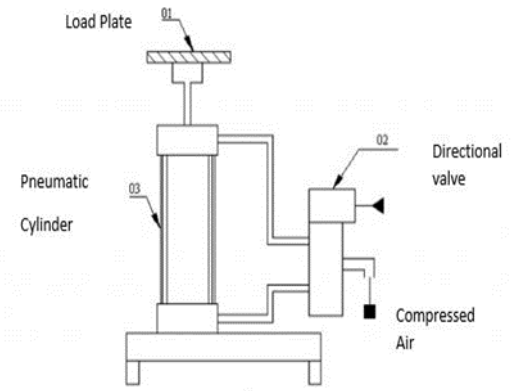
1.INTRODUCTION

This project is made in order to make a pneumatic jack that could lift up a weight. Pneumatics is a branch of technology, which deals with the study and application of use of pressurized air or gas to affect mechanical motion. Pneumatic systems are extensively used in industry, where factories are commonly plumbed with compressed air or other compressed inert gases. This is because a centrally-located and electrically-powered compressor that powers cylinders and other pneumatic devices through solenoid valves is often able to provide motive power in a cheaper, safer, more flexible, and more reliable way than a large number of electric motors and actuators. Pneumatics also has applications in dentistry, construction, mining, and other areas. Here, we are using pneumatic system to move the jack up with the air pressure input. This pneumatic jack may also be used in order to lift a car by putting force at the bottom of the car. Here, we are using pneumatic system to move the jack up with the air pressure input.

2. METHODOLOGY

A pneumatic jack is similar as hydraulic jack that is actuated by compressed air – for example, air from a compressor – instead of human work. This eliminates the need for the user to actuate the hydraulic mechanism, saving effort and potentially increasing speed. Sometimes, such jacks are also able to be operated by the normal hydraulic actuation method, thereby retaining functionality, even if a source of compressed air is not available. A pneumatic jack energized from a container having a pressurized gas therein for rapidly and effortlessly lifting an object such as a motor vehicle including an automobile, a van, and a truck for one purpose of changing a tire that has gone flat is disclosed. The pneumatic jack has a housing with a piston slidably disposed in a chamber therein cooperating with a lifting element, a hose connected between the housing and the container, a gas fill valve and a throttle valve for controlling the pressure to the piston for raising and for maintaining the lifted object in an elevated position and a handle pivotally connected to the housing for manipulating the pneumatic jack for placement under the motor vehicle.

Diagram -1: Design of Pneumatic Jack



3. SYSTEM REQUIREMENTS

3.1 Double Acting Pneumatic Cylinder

When looking for a device to move load in both directions, double acting cylinders are a useful application as our machine requires more than one movement.
Specification:
Festo DNCB-32-100
PmAX-12 Bar
Double Acting

3.2 Manual Air Pump

An air pump is a pump for pushing air. Examples include a bicycle pump, pumps that are used to aerate an aquarium or a pond via an air stone; a gas compressor used to power a pneumatic tool, air horn or pipe organ; a bellows used to encourage a fire; a vacuum cleaner and a vacuum pump. All air pumps contain a part that moves (vane, piston, impeller, diaphragm etc.) which drives the flow of air. When the air gets moved, an area of low pressure gets created which fills up with more air.
Specification:
10 bar / 160 Psi
Dual Cylinder

Aluminium alloy outer tube

3.3 Air Hose

An air hose or sometimes airline is a flexible tube for conveying the flow or pressure of air.
Specification:
Diameter: 8 mm
Operating Temperature: 80 Degree Celsius

3.4 Solenoid Valve

Hand lever operated solenoid valve it is necessary to start or stops the flow in the cylinder to control upward and downward movement.
Specification:
5 Port 2 Position 1/4 Inch
10.2 x 8.2 x 3.8 cm

3.5 Load Plate

It is the platform where our weight will rest or it is use to give support for lifting weight**.**

4. CALCULATION

Pneumatic System Design Notes Constants
1 mm = 0.0394 inches
1 square mm = 0.0016 square inches
1 litre = 0.0353 cubic feet
1 bar = 14.50 psi
As we design a pneumatic system of the type used in the FIRST competitions, we want to know three things:

- How much force can an actuator apply?
- is that force sufficient to move the desired load?

In Simple terms pressure is nothing but the force per unit area.

Given: Piston rod diameter: 10mm
Inner diameter= 32 mm
Outer diameter = 34 mm
Load to be lift is around 300 Kg
F = M * G
= 300 * 9.81
F = 2973 N……... (1)
Area = π/4 d2
Here d = 32 mm
Therefore,
Area = π/4 * 0.0322
= 8.04247*10-4 m2 …… (2)
Now, required pressure to lift 300 kg weight is
P = F/A
P = 2973 / 8.04247 * 10-4
P = 3.696 * 106 / m2
P = 36.96 * 105 / m2 …… …… (3)
P = 36.96 Bar pressure is required for lifting 300 kg weight.
Design Capacity of Proto-type weight lifting.
Weight to be lift is 175 KG
F = M * G
F = 175 * 9.81 N
F = 1716.75 N …… ……... (4)
Area = 8.04247*10-4 m2 …… ... (5)
P = F/A
P = 1716.75 / 8.04247*10-4
P = 2.134 * 106 N/m2
P = 21.34 * 105N/m2…… …… (6)
P = 21.34 Bar is required to lift 175 KG weight

5. FABRICATION

5.1 Cutting

Metal cutting is the process of producing a job by removing a layer of unwanted material from a given workpiece. Fig. shows the schematics of a typical metal cutting process in which a wedge-shaped, sharp-edged tool is set to a certain depth of cut and moves relative to the workpiece.

Figure 5.1 Cutting

5.2 Welding

Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool. Welding is usually used on metals and thermoplastics but can also be used on wood. The completed welded joint may be referred to as a weldment.

Figure 5.2 Welding

Figure 5.3 Actual Jack

6.CONCLUSION

we have come to the conclusion that our pneumatic jack 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 jack 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.

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