App Controlled Pneumatic Jack

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Abstract- *In this project the manual jack has been replaced with inbuilt Pneumatic jack permanently attached to the bottom of the vehicle and whenever its necessary, lift the vehicle either from front end or back end based on requirement. Its controlled by Bluetooth signal and compressed Air. The operation is made to be so simple that even an unskilled person can operate the Pneumatic Jack in time of need. This fabricated model consists of a small size reciprocating air compressor which is driven by the battery used in four wheelers, 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 tires such as puncture tires, tire replacement and wheel balancing can be resolved with less effort and time. The whole operation will be controlled remotely using an app.*

Keywords- Pneumatic, Bluetooth, Chassis mounted

I. INTRODUCTION

While driving a four wheelers in the way when we faced a problem related to tires 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 and that will be controlled by the application of using the mobile blue tooth.

II. INTRODUCTION TO THE PLAN

Although there are available sources of lifting the vehicle but those mechanisms do not provide the safe, simple and cost effective method. This project contains unique safety features which were not provided before. We have made the project on the pneumatic jack for lifting the four wheelers i.e. light weight four wheelers especially cars. Now a day we can see hydraulic jacks are used for the lifting up the vehicles. And it is very hectic and a long tedious procedure is used. So we planned an in built pneumatic jack for four wheelers which is mounted at the center of the of wheel shaft at the middle of the vehicle.

III. MODELLING

Components Used and Their Specification

A. Battery

Battery used in our model is of 12V X 2. The battery used is the dry cell battery which is connected to the tripping switch.

B. Air compressor

Air compressor used for compressing the air upto the 6 bar pressure. It takes the air from the atmosphere and compresses it. Then the air goes to the storage tank.

C. Pneumatic cylinder

This cylinder is used in our model which acts as the jack. The air from the directional control valve comes to the cylinder where flow control valves are present. This type of jack is used in our model considering the weight of our model as 25kgs.

Its specifications are

Connecting rod = 8.5mm
Cylinder length = 18cm
Cylinder diameter = 40mm
Cylinder stroke length = 16cm

D. Chassis frame

For chassis frame mild steel of cold rolled type iron has been used. The welding or fabrication is done and model of the chassis is made.

Its specifications are

Metal used- mild Steel
Width = 50.5cm
Length = 76 cm

Ground clearance =2cm in normal position

E. Bluetooth controller

For the control of the DC motor, DC solenoid valve & the pneumatic jack ardino board the program inbuilt of movement of jack with DC motor forward & backward . And the pneumatic jack lifting the vehicle & lowering.

IV. COMPONENT DETAL

1) Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion.

Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tike Room, pneumatics is used to prevent fluid from dripping onto people below the puppets.

Cylinders are linear actuators which convert fluid power into mechanical power. They are also known as JACKS or RAMS. Hydraulic cylinders are used at high pressures and produce large forces and precise movement. For this reason, they are constructed of strong materials such as steel and designed to withstand large forces.

Because gas is an expansive substance, it is dangerous to use pneumatic cylinders at high pressures so they are limited to about 10 bar pressure. Consequently, they are constructed from lighter materials such as aluminum and brass. Because gas is a compressible substance, the motion of a pneumatic cylinder is hard to control precisely. The basic theory for hydraulic and pneumatic cylinders is otherwise the same

That cylinder has been connected rigidly to the DC motor and that will carry the jack from rear position of the wheel to the front side & that will be controlled by the signal which is commanded by the mobile .

2) Control Valves, Control valves are valves used to control conditions such as flow, pressure, temperature, and liquid level by fully or partially opening or closing in response to signals received from controllers that compare a "set point" to a "process variable" whose value is provided by sensors that monitor changes in such conditions. Control Valve is also termed as the Final Control

Element.

The opening or closing of control valves is usually done automatically by electrical, hydraulic or pneumatic actuators. Positioners are used to control the opening or closing of the actuator based on electric or pneumatic signals. These control signals, traditionally based on 3-15psi (0.2-1.0bar), more common now are 4-20mA signals for industry, 0-10V for HVAC systems, and the introduction of "Smart" systems, HART, Fieldbus Foundation, and Provirus being the more common protocols. Some of the control valves available are Reverse Double-Ported Globe-Style Valve Body, Three-Way Valve with Balanced Valve Plug, Flanged Angle-Style Control Body, and Valve Body with Cage-Style Trim, Balanced Valve Plug, and Soft Seat.

A control valve consists of three main parts in which each part exist in several types and designs:

Valve's actuator
Valve's positioner
Valve's body

VI. CALCULATIONS

B. Pressure Required Lifting Up the Chassis

Weight of the chassis = 25 kg 25 kg = 245 N
$F=P\pi (d12-d22)/4$ Where,
F= Load to be lifted d1= cylinder diameter
d2= cylinder rod diameter P= pressure required
$P =4 F/\pi (0.0322-0.00852)$ P = 327758.0126 Pa

Or P = 327 kPa

Above is the result for the pressure required to lift up the model by the cylinder.

VII. COMPARISON OF PNEUMATICS WITH HYDRAULICS

Pneumatic jacks work by way of pressurized gas used to create mechanical motion. Hydraulic jacks, on the other hand, use liquid to affect motion. Both types of jacks are available to consumers; however, hydraulic jacks are more popular for a number of reasons, and pneumatic jacks are less readily available due to the drawbacks of pneumatic mechanics. This doesn’t mean that a pneumatic jack is a bad choice, but rather that a comparison between the two products is time well spent.

A. Lifespan and Cost

Pneumatic jacks have a lifespan of five to 10 years if the jack is properly maintained and serviced as necessary. Hydraulic jacks often last upward of 15 years. The cost of pneumatic jacks, though, is often lower than the cost of hydraulic jacks.

B. Efficiency

Pneumatic jacks are more efficient than hydraulics, as air does not cause the wear and tear of the parts of pneumatics and hence works for the longer time.

C. Safety issues

Despite the immense capabilities of hydraulics presented in terms of moving higher loads and in other industrial utilization, pneumatics is still in wide use today.

Pneumatics is study of mechanical motion caused by pressurized gases and how this motion can be used to perform engineering tasks. Pneumatics is used mainly in mining and general construction works. Pneumatic devices are used frequently in the dentistry industry across the world. On the other hand, hydraulics means use of pressurized fluids to execute a mechanical task. Hydraulics is frequently used in the concepts of turbines, dams, and rivers. Air brakes in buses, air compressors, compressed air engines, jackhammers, and vacuum pumps are some of the most commonly used types of mechanical equipment that are based on pneumatics technology.

VIII. OPERATION OF A PNEUMATIC SYSTEM

In order to affect mechanical motion, pneumatics employs compression of gases, based on the working principles of fluid dynamics in the concept of pressure. Any equipment employing pneumatics uses an interconnecting set of components: a pneumatic circuit consisting of active components such as gas compressor, transition lines, air tanks, hoses, open atmosphere, and passive components. Compressed air is supplied by the compressor and is transmitted through a series of hoses. Air flows are regulated by valves and the pneumatic cylinder transfers the energy provided by the compressed gas to mechanical energy. Aside from compressed air, inert gases are also applied particularly for self-contained systems. Pneumatics is applied in a wide range in industries, even in mining and dentistry. The majority of industries use gas pressures of about 80 to 100 pounds per square inch.

Thus leaks will be of less concern since the working fluid of pneumatics is air, unlike oil in hydraulics. Its working fluid is also widely available and most factories are pre-plumbed for compressed air distribution, hence pneumatic equipment is easier to set-up. To control the system, only ON and OFF are used and the system consists only of standard cylinders and other components, making it simpler than hydraulics. Pneumatic systems require low maintenance and have long operating lives. Lastly the working fluid of the pneumatic system absorbs excessive force, leading to less frequent damage to equipment. Compressible gases are also easy to store and safer; no fire hazard is presented and machines could be made to be overload safe.

Fig. 3: Pneumatic Drill

Fig. 4: Actual Model

IX. OTHER ADVANTAGES

- Initial cost is less; hydraulics equipment cost as much as twice the price of pneumatic equipment.
- A pneumatic water treatment automation system reduces the costs of installation and operation compared with conventional electrical installations. For opening and closing of underwater valves, pneumatic systems work

well because they can sustain overload pressure conditions.

- Pneumatic actuators also have long life and perform well with negligible maintenance requirement throughout their life cycle.
- Very suitable for power transmission when distance of transmission is more.

X. RESULT

- From our project the following results came
- We can lift the weight of 25 kg at 327 kPa.
- Volume of the air can be stored in the storage tank is 66.05m3.
- Pneumatics working fluid is also widely available and most factories are pre-plumbed for compressed air distribution, hence pneumatic equipment is easier to set-up then hydraulics.
- To control the system, only ON and OFF are used and the system consists only of standard cylinders and other components, making it simpler than hydraulics.
- The working fluid of the pneumatic system absorbs excessive force, leading to less frequent damage to equipment.

XI. CONCLUSION

Following are the conclusion made from the project:

- After completing the project we have come to the conclusion that pneumatics jacks can act in the place of hydraulic jacks efficiently. The inbuilt jack serves as the boon for the cars.
- The air required for the operating of the jack 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 hydraulic jacks which is used for lifting up.

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