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AUTOMATIC TYRE PRESSURE CONTROL IN A VEHICLE

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Abstract — This paper suggests a new technique towards one more improvement in our automobile industry. We always try to make everything perfect around us and there is major problem still remaining in our automobiles, a puncture. We have developed tubeless tires but that's not a perfect solution, so there is a serious need of improvement in this section. In this paper the compressor is used to create the pressure equal to the tire pressure and air is transferred using pneumatic pipes. This is a very basic concept which uses compressor power to maintain the pressure of a tire, while running using pressure gauges and leak proof connection. This technique allows us to drive a punctured vehicle which increases safety, comfort & saves time. A very simple and efficient technique is explained below.

Keywords = Tubeless tires, Pneumatic pipes, Leak proof connection.

I. INTRODUCTION

When we travel in car & if there is prickle or puncture in a tire then we need to wait and we can't reach the destination in time. If we use this system then we can drive that punctured vehicle without any trouble, so efficiency increases. We do not need more cost to invest in this system. With this system we can fill air in moving vehicle easily just attaching few components to the engine or battery.

II. COMPONENTS TO BE ATTACHED

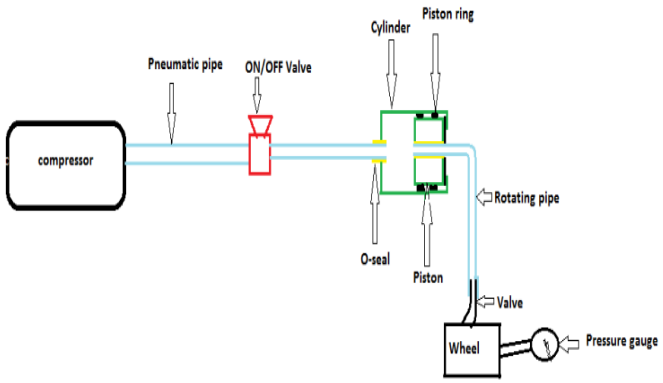
1. Compressor
2. Pneumatic pipes
3. Non return valve
4. Pressure gauges
5. Leak proof connection etc...

III. CONSTRUCTION

Initially we connect the compressor to the engine sub-assembly through the belt drive mechanism. Then through the non-return valve, we connect the compressor by pneumatic pipe or hoses to the wheel assembly. Here with the help of leak proof connection we connect this pipe to the tire valve. A gauge is connected to the pneumatic pipe such that it will sense the change in pressure in the tire.

The piping arrangement near the tire is done according to the available space. If possible it will be connected from inner side of the wheel else from outer side, if connected from outside its connection will be as shown in the diagram (rough).

Automatic air pressure control in a vehicle while running



Block diagram

IV. COMPRESSOR

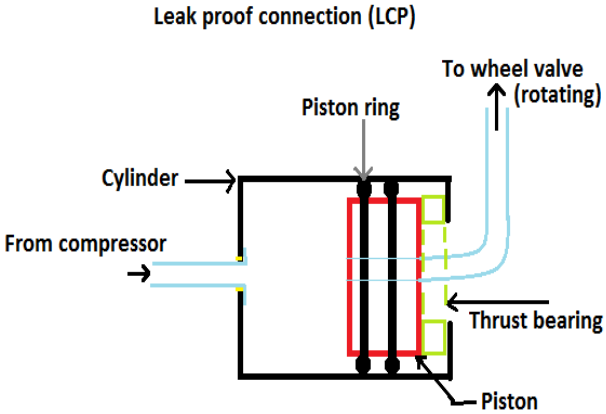
Normal sized compressor with capacity of around 150 psi is required for the proper functioning. The cost of this compressor is around Rs.3000-3500. It can be easily mounted on the engine assembly since its size is small. Normally if operated on battery it will operate on 12V DC supply. That is again an advantage of this system.

V. HOSES

Standard hoses with diameter of 1-1.5 cm are required which must sustain pressure equal to that of compressor.

VI. LEAK PROOF CONNECTION (LPC)

Our main motto in making this connection is to transfer the pressurized air from the stationary pipe to the rotating pipe and the air should not leak. The concept of piston cylinder is used with some modification (piston is without piston rod).The size of cylinder should be optimum and one end of the cylinder liner is welded and stationary pipe is fixed to it as shown in figure. Piston instead of making its motion to-fro, it is made to rotate at one position. It is supported by a protrusion inwards to the cylinder and in between this there is a thrust bearing. The hole is drilled to that piston and pipe is connected from that hole to the tire valve. The work done by friction and heat generation in piston ring and cylinder is given in later section.



VII. WORKING

If any prickle occurs in the tire of our vehicle, we get a gradual decrease in the tire pressure which obstructs our drive which may lead to an accident. Also at times, if we are stuck in some situation where we cannot get an immediate aid for the problem, this system is very useful and helpful for the purpose.

In this system with decrease in pressure, sensor senses the pressure change and actuates the non-return valve which allows the compressed air from the compressor to pass to the tire from the LPC to make the pressure equal to the required pressure.

Once the pressure gets equalized, the sensor cuts off the supply of compressed air by closing the non-return valve.

If this process takes place more than 3 to 4 times in a specific period, the display warns the driver that the tire is punctured and needs replacement or repair.

The losses which are to be considered are mainly from piston ring and cylinder which are due to the continuous rotational motion of piston. The analysis for the work done and heat losses are as follows:

Dimension-

Cylinder bore dia. - 0.052 m

Piston ring width – 0.00115 m

RPM of wheel (assume average speed 80 kmph)

Dia. of wheel = rim dia. + (2*tire section length)

= 15” + (6” * 2)

= 27”

Circumference = π D

= 84.8”

Car will travel 80 km in hour so in one minute it will travel 1.34 km, if we convert 1.34 km in to inches it will come 52493.7”.

Therefore, RPM = distance travelled / circumference of wheel

= 52493.7 / 84.8

= 619.03

Now revolution of the piston ring will be exactly equal to that of wheel.

So, rev per second of a piston ring will be 619.03 / 60

= 10. 317

The pressure between the ring and cylinder is normally 0.9Mpa.

Force between each piston ring and cylinder

= 0.00115 * π * 0.052 * 900000

= 169.08 N

Coefficient of friction between piston ring and cylinder is approximately 0.2

Friction force = 169.08 * μ

= 169.08 * 0.2

= 33.82 N

Work done = displacement in 1 sec * frictional force

= 10.317 * π * 0.052 * 33.82

= 57.00 N-m

Total work done = work done by each ring * no. of rings

= 57 * 2

= 114 N-m

The heat generated is thus calculated.

VIII. ADVANTAGES

There are vast and many important positive points of this system as explained below:

1- The first main advantage is you don't have to check tire pressure regularly and so never want to go for the air filling.
2- The next major advantage is you don't have to stop in any unsafe area if tire get punctured, where safety is the matter of concern.
3- The most important is you don't have to change your tire with another tire which saves a lot of time and you can utilize that time in reaching to your destination.
4- The cost of system is optimum, but increases safety, comfort and efficiency.
5- The weight of this system is also very less so one can use it in cars, buses, etc.

IX. CONCLUSION

This system if applied in a car then surely without losing much energy we will get luxurious comfort. If further developed and automated then we can use it in bikes and heavy vehicle too.

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