Self Inflation of Tyre

Prathamesh Salvi [1], Sagar Raghvani [2], Sachin Vishwakarma [3], Shubham Pawar [4], Dr. S.N. Teli [5]

[1]B.E Student, Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, prathameshsalvi637@gmail.com
[2]B.E Student, Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, sagar.raghvani.3@gmail.com
[3]B.E Student, Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, babitanigam339@gmail.com
[4]B.E Student, Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, shubhampawar105@gmail.com
[5]Professor, Department of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai, shivanandteli@yahoo.com

Abstract: Studies have shown that due to drop in Tyre pressure by just a few PSI can result in reduction of tire life, gas mileage, and performance of vehicle. Also it can be the for road accidents. Though tubeless Tyres has been invented but it could not withstand as a perfect solution in all the conditions. So, we have developed automatic and self-inflated Tyresystem for stabilization of air in Tyres that ensures that Tyres are properly inflated all the times. This concept is based on the use of nozzle which helps to increase air thrust to overcome internal pressure of Tyre to regulate and maintain the Tyre pressure in running condition.The most important factors that should be taken in account for maintenance of Tyre like proper inflation pressure, proper vehicle loading, regular inspection, good driving habits, vehicle condition, etc.This concept arises with innovative idea for improvement in our Automobile industry.

With the increasing prices of oil and growing concern of environmental issues, this system addresses a potential improvement in gas mileage. Thus in this concept, we reviewed the all available self-inflating Tyre systems that are used nowadays. There are lots of self-inflating-tire systems on the market, but most of them are only available for commercial and military application.

1. Introduction

About 80 percent of the cars on the road are driving with one or more tyres under inflated[2].

Tires lose air through normal driving (especially after hitting pot holes or curbs), permeation and seasonal changes in temperature.

Tyres lose one or two psi (pounds per square inch) each month in the winter and even more in the summer. It cannot be told that Tyres are properly inflatedor not by looking at them. Tyre pressure gauge is used for this. Not only is under inflation bad for Tyres, but it's also bad for gas mileage, also affects the way car handles and is generally unsafe. When Tyres are under inflated, the tread wears more quickly. This equates to 15 percent fewer miles which can be drive on them for every 20 percent that they're under inflated[4].Under inflated tires also overheat more quickly than properly inflated tires, which cause more tire damage.

As Tyres areflexible, they flatten at the bottom when they roll. This contact patch rebounds to its original shape once it is no longer in contact with the ground. This rebound creates a wave of motion along with some friction. When there is less air in the tire, that wave is larger and the friction created is greater -- and friction creates heat. If enough heat is generated, the rubber that holds the tire's cords together begin to melt and the Tyre fails. Extra resistance of an under inflated tire while rolling makes car’s engine to work harder. AAA statistics show that tires that are under inflated by as little as 2 psi reduce fuel efficiency by 10 percent. The figure 1, illustrates, Various pressure level inside the Tyre.

IJSER © 2018
http://www.ijser.org

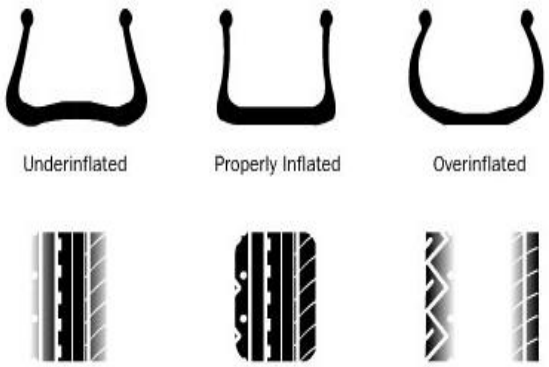

Fig.1: Various pressure level inside the Tyre

We are also using non-return valve in addition with nozzle to ensures pressure inside Tyre should not reach dangerous level. Most of the road accidents in India happen because of bursting of Tyre (overheating of air inside Tyre) due to increased pressure inside the Tyre. By using the Non-returnvalve, the pressure inside the Tyre which was increased due to high speed of vehicle can be brought down to the recommended value. The Figure 2, illustrates the Non-Return Valve.

Fig.2: Non-Return valve

(A) Problem Statement:

To design, develop and install a nozzle which can fix on the Tyre along with NRV to enable the automatic inflation of vehicle Tyre.

(B) Problem Description:

Our aim is to design a convergent nozzle which can compress the air to a particular extent at optimum speed. It includes design of nozzle which is dynamically stable and use of NRV along with nozzle in such a way that auto inflation occurs. The table I , illustrates, Problem arises due to under-inflation and over- inflation.

Table I: Problem arises due to under-inflation and over-inflation

Sr. No.	Problem	Cause
1	Shoulder Wear: Both Shoulders wearing faster than the center of the tread	Under-inflation
2	Spot Wear: A part (or a few parts) of the circumference of the tread are wearing faster than other parts.	Under-inflation
3	Diagonal wear: A part (or a few parts) of the tread are wearing diagonally faster than other parts.	Under-inflation
4	Centre Wear: The center of the tread is wearing faster than the shoulder.	Over-inflation

2.Literature Review

The current processes for auto inflation of Tyre which are applied to luxury cars are mostly using some pneumatic valves or electronic valves to direct the pressurized air from the reservoir which is fitted externally on chassis, and the means of electronic sensors the message is prompted on driver's screen to notify the pressure drop inside the tire and driver actuates the sensors which allows the determined quantity of air to draw inside Tyre.

This technology of self-inflating Tyre is not purely automatic since the driver has command over whether theTyre needs to be re-inflated or not? The various devices used are very costly and their maintenance costs a lot.

(A) Air Filling in A Moving Tyres(ISSN 2395-1621):

In this a central air compressor is used which compresses the air to the required optimum pressure level and it is then connected to the air dryer where the air is filtered and any impurity if present is then removed. The air compressor is connected to air tank where this pressurized air is kept and it is constant under watch of pressure switch and Electronic Control Unit(ECU) and speed sensor and further is connected to Pneumatic control unit to all Tyre to inflate according to the need.

IJSER

IJSER © 2018
http://www.ijser.org

(B) Self-Inflation Tyres when vehicle is at rest

This system requires the car to me still at rest to inflate the Tyre and hence it does not account as much sensors as required in moving vehicle Tyre inflation system.There is a central receiver of air which has a center in line for air and is connected to the Pneumatic control unit which allows the required amount of air to be filled in the central receiver the central receiver is connected to all the 4 Tyre of a vehicle and inflates them. The Figure 4, illustrates, self-inflation using compressor, when vehicle is moving.

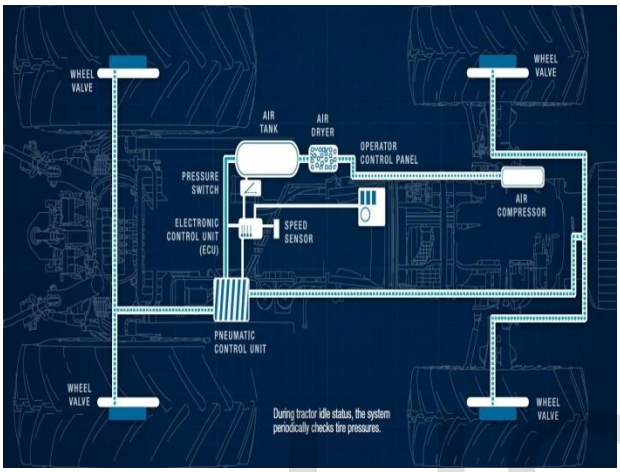

Fig.4: Self Inflation using compressor

The collection of the solar panel was enhanced by 68.5% from that of the single panel with the help of reflectors and tracking. Further energy obtained using the windmill with addition of dedicated wind sensor and altered design together adds to an increase in the efficiency by an overall margin of above 50%(Mishra et al., 2012).

A portion of the energy requirement for a private house, farm house, a small company, an educational institution or an apartment house depending on the need at the site where used has been supplied with the electricity generated from the wind and solar power. It reduces the dependence on one single source and has increased the reliability (Godson et al., 2013).

The hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the nonconventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation (Ingole et al., 2015).Deshmukh and Deshmukh (2008) discussed methods of modeling and designing hybrid renewable energy systems, and also issues involved in increasing the penetration of such systems.

3. Expected Outcomes

- ✓ As inflation of Tyre is done automatically when pressure reduces the life of Tyre is increased.
- ✓ Reduction of pressure inside Tyresometimes become the cause of road accidents, with this system chances of road accidents are significantly reduced.
- ✓ It improves Braking distance and Improves the efficiency of fuel
- ✓ Increase safety of passenger as well as driver.
- ✓ It can have used in military vehicles.
- ✓ It can be used in commercial vehicle.
- ✓ It can be used in Emergency vehicles like Ambulance, Police vehicles, fire vehicles.
- ✓ It can be used in sports car as there is no need of regular checking of air pressure in Tyres.

4. References

[1] Latha O. H.,Sadaq O. H., Junaidi M. A. R. (2014)," Solar Based Air Compressor for Inflating Tyres". *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, Vol. 11(5), pp. 29-33.

[2] Ramesh G., Mallesha M. and Gangadhar V." Effect of Tyre Overload and Inflation Pressure on Rolling Loss in Cars",*Int. Journal of Engineering Research and Applications*, Vol. 5(8), pp.01-08.

[3] Collins J.A.(2007), "Mechanical Design of Machine Elements and Machines, a failure prevention perspective", *John Wiley & Sons*, pp 515- 533.

[4] Vishnuram K., Dinesh R., Krishna S., Kumar D.,Chazhiyan. T. (2015),"Self-InflatingTyres" *International Journal on Applications in Mechanical and Production Engineering*, Vol.1(5), pp 5-6.

[5] Chandreshkumar L., Pranav J.,Hemra C., Bokade .(2013)," Tire Pressure Monitoring System And Fuel Leak Detection", *International Journal of Engineering Research and Applications (IJERA)*,Vol. 3(3), pp.345-34.

[6] Sahim M.(2006), "An experimental study on joining of several plastic deformed aluminum materials with friction welding method", *Journal of Material and design*, vol. 29, pp. 265-274.

[7] Omprakash P., Kumar T.(2014), "M.A.R.S - Mechanized Air Refilling System", *International Journal of Information Sciences and Techniques*, Vol.4(3).

[8] Singh I., Singh B.P. Sahu H.S., Chauhan R., Sahu N.K. (2016), "To Study on Implementation of Tyre Inflation System for Automotive Vehicles",*IJIRSET*,Vol. 5.

IJSER © 2018
http://www.ijser.org