



ORIGINAL RESEARCH PAPER

Mechanical Engineering

AUTOMATIC TIRE INFLATION AND DEFLATION SYSTEM

KEY WORDS: Automatic Tire Inflation And Deflation, Tire Pressure, Tire Life, Compressor With Air Tank, Laser Triangulation.

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ABSTRACT

As the existing of tire, from that time it required enhancement continuously done for better performance. As we know a small change in pressure is directly noticeable on the effectiveness, performance, life of tire and performance of vehicle. On a long run of vehicle, due to friction of tire and road, temperature of tire increases so for that pressure of tire also increases. Therefore its cause a tire blowout. So for augmentation, we assemble a machine named "automatic tire inflation and deflation system". The major focus of our project to inflate a tire during low pressure and deflate during high pressure. Other focus of that project is to be provided the limited pressure according to the load and tire wear. In this machine we introduced a laser technology that can be able to check the thickness of tire and according to condition of tire wear it can be able to maintain limited pressure in tire. Under inflated tires also overheat more rapidly than perfectly inflated tires, which cause major tire damage. Among the present environmental issues and fast devolution of natural resources our project will successfully improve the fuel economy of the vehicle along with the maximization tire life and improved Vehicle handling and vehicle performance.

1. INTRODUCTION

Improperly inflated tires are quite common problems on passenger vehicles. In fact, 80% of passenger vehicles on the road have at least one under-inflated tire and 37% of passenger cars have at least one tire that is 20 percent or more under-inflated. Often pressure loss in tires is a result of natural permeation of the gas through the unpredictable rubber, road conditions (such as potholes), and seasonal changes in. Most vehicle owners are unaware of the fact that their tires are not at the exact pressures because it is difficult to determine the tire pressure visually; a tire that is properly inflated to the accurate pressure looks very similar to one that is either over-inflated or under- inflated. Thus, from the lookout of passenger vehicle owners, they are losing money due to increased tire wear and decreased fuel efficiency.

Today automobile sector plays a big role in the economics of all the countries in the world and lots of researches have been carried out to improve the efficiency of the vehicle one the techniques to improve the efficiency of an automobile is inflate the tire regularly. As its well-known, one of the most serious problem that the large motor vehicle have whether they are for the transportation of passenger or cargo and especially those used for middle or longer distance travel, resides the ensuring the correct performance of the tires .This means making sure that tire are inflated and stay inflated for the right amount of pressure for the load being carried.

The Air Maintenance Technology system developed through this project replenishes lost air and maintains optimal tire cavity pressure whenever the tire is rolling in service, thus improving overall fuel economy by reducing the tire's rolling resistance. The deflation is a process of letting air or gas out of the tires. Deflation is the problem of an automobile vehicle. Because a certain period of time in air reduced to the vehicle for running time. So a long distance travelled vehicle scar able things for deflation. The air is also decreasing the tire. The vehicle and its passenger's safety, fuel economy,

improving tire life, reducing tire blowouts chances are the most essential aspects in a vehicle, fortunately Automatic tire inflation system substantially helps in taking care of these aspects. As it regularly compensates the lost air in the tire thus reducing human effort by not regularly checking the tire pressure manually. Another aim of introducing this system is to improve handling and control over vehicle thus reducing the chances of accidents

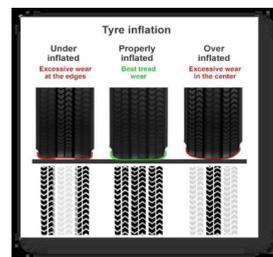


Fig.1.1

With the tire inflation and deflation system, we proposed a new system in our project for the betterment and safety of the passenger. In this machine can be able to check the tire wear. For the tire wear we are set up a Laser proximity sensor for thickness measurement that is based on optical triangulation that serves as a basic concept for displacement measurement of diffuse target surface.



Fig.1.2

2. LITERATURE REVIEW

A number of authors have reported on automatic tire inflation system they propose some ideas and successfully complete their research.

Ram bansal et al [1] analyzed a wireless pressure sensor fitted inside the wheel rim of each tire for sensing the air pressure inside the tire continuously. Tire pressure monitoring system (TPMS) which will continuously receive pressure value from the pressure sensor. This TPMS will be set at a certain value of high pressure as well as low pressure. As soon as either of the pressure value will be altered due to any reasons the TPMS will generate a signal in the form of buzzer sound which will in turn be an input to the ECU. An automation system programmed in such a manner that as soon as it will receive signal from the TPMS of either high or low pressure it will generate a current to actuate the compressor and solenoid valve. This will be done with the help of ECU programmed according to the logic mentioned. An air compressor along with an air tank which will store the air at a predestined value of pressure in it. As soon as the signal will be passed by the ECU the solenoid valve will allow the air to pass through the air tank via the hoses or pressurized fluid linings.

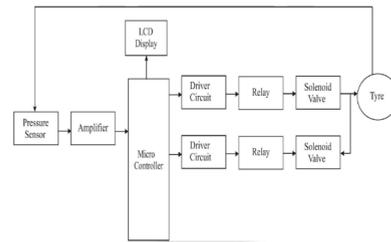
The motoring industry has seen automation of many parts of the automobile for enhanced service quality and performance (Omprakash & Kumar [2]. The system comprises of a small wind turbine with 8 rotor blades of radial length R83mm (due to the limited space on the wheel) which is driven by the drag (wind) near the body of a speeding car. A speeding car will be cutting through a mass of wind which is in the opposite direction its motion. The kinetic energy in this mass of air is utilized in this design as it will function to turn the turbine thereby turning with it a small crank disk R40mm which is rigidly fixed to the turbine axis' rear. The crank - turn will push up and down in one revolution the piston rod thus achieving compression strokes directly. Tire area on an automobile which is reasonably responsible for vibration absorption and vehicle safety considering that it is the lone means of contact of the ground and the machine in question. The tires and the automobile's suspension system have been designed with the capability to absorb vibrations from both the ground and the vehicle hence forth maintaining a balance of masses (Kottayam, 2002-2003) [3] and thus keeping low response levels.

UG scholar Mayur Chaure et al [4] of Mechanical Dept in Smt. Kashibai Navale College of Engineering, have carried out with the rotary union that allows for rotation of the united parts. It is thus a device that provides a seal between a stationary supply passage (such as pipe or tubing) and a rotating part (such as drum, cylinder, or spindle) to permit the flow of a fluid into and/or out of the rotating part. A rotary union will lock onto an input valve while rotating to meet an outlet. Shaft has hole in two different planes by which air can be passed through it to the rotary coupling. One part of the rotary coupling is stationary and it is mounted outside the rim. Then the air from the inflator enters the rotary coupling from where it enters the tire

Aneesh rs et al [5] have developed a system with a rotary union and a pressure sensor. A pressure sensor measures the pressure of gases or liquids. It produces a signal as a function of the pressure imposed; in the system such signal is electrical. Pressure sensors can also be used to measure other parameters such as fluid/gas flow, speed and water level. When the pressure reduces below the lower Limit in the tire during its rotation, pressure sensor senses the air drop and starts the compressor and solenoid valve automatically for filling of air into the tire with the help of control circuit. As soon as the pressure crosses the set upper limit (30psi), compressor stops working with the help of pressure sensor and control circuit. In this way, a proper required tire pressure is maintained.

Most tires, such as those for automobiles and bicycles, provide traction between the vehicle and the road while providing a flexible cushion that absorbs shock. D.Johny et al [6] have attempted inflation and deflation by the solenoid valve. The level of pressure is already programmed in the control unit. When the pressure level is decreased, the sensor gives signal to the control unit. After that the controller unit will open the solenoid valve for filling the air when the required pressure is obtained the control unit will turn OFF the solenoid valve. In case the pressure level will be more than the required level means control unit will switch ON another solenoid valve for air to the atmosphere. When the required pressure is reached the operation will be stopped by the control unit.

Osmosis of air through the tire casing can lead to a loss 1 to 3 PSI per month, depending on the specific tire make and model. The type of compounds used in the manufacture of the tire can have a big impact on osmosis. The composition and gauge of the tire inner liner compound also plays significance in osmosis.



Optimess laser sensors are becoming an increasingly universal measuring instrument in research & development, production, quality assurance and testing department of the rubber and tire industry due to their small size, high measuring frequency and accuracy and their ability to measure under almost all ambient conditions. Dr. D. Wehrhahn [7] two sensors are available basically for the thickness measurement. One sensor is used for the references measurement on a roller. The product runs over a roller which is used as a basis for the zero point .the subsequent measurement on the product is set off against the zero point and output as thickness. In the thickness measurement with two sensors the product runs between two sensors, one above and one below the material. The difference between two sensors values gives the thickness.

R. P. Bachute et al [8] attempt to provide a Pneumatic Actuator mainly consists of a piston or a diaphragm which develops the motive power. It keeps the air in the upper portion of the cylinder, allowing air pressure to force the diaphragm or piston to move the valve stem or rotate the valve control element. A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

Kamlesh R. Patil et al [9] has concluded that Tire Inflation Systems have several benefits for the transportation industry and for the for the vehicle owners. These benefits include, improved vehicle mobility due to improved traction, improved ride quality and cargo safety due to the reduction in vehicle vibrations when the correct tire pressure is used, reduction in road maintenance, increased fuel efficiency

Indrjeet Burase et al [10] (2016) have studied that the tire implementation system is based on the idea to maintain uniform tire pressure of an automobile reduce tire wear, increase fuel efficiency & increase overall safety. So, this system maintains the proper air pressure in tire

V. Jeeva Bharathi [11] have investigated that Automatic

pressure controlling and self-inflating system would be exploding as new product in the automobile supplier industry as such a product does not currently installed for majority of passenger automobiles, hence the market conditions would be favorable to release such a system. It satisfies the user requirement by maintaining ideal Tire pressure for under inflated Tire, also improves fuel efficiency and overall safety of automobile is concerned.

Petar B. Petrovic [12] have developed Analytical model of laser triangulation and the most critical problems in distance measurements of the objects having highly textured surfaces are considered in details. This method is based on three-layer structured surface textured and statistical characterization of these layers. It is proved analytically and by experiments that the RCS texture is Gaussian type of texture, which further enables accurate and robust thickness estimation only using identified parameters normal distribution of scanned RCS surface texture. Based on this analysis the new method for noncontact thickness estimation of RCS is proposed.

Yi Xiong and Ari Juhani Tuononen [13] have successfully done a laser system that can able to check the tread deformation. This work, based on the optical sensing method, provides quantitative measurements for tire designers to verify finite-element simulation results and optimize tire construction and materials. The rolling direction, wheel loads and inflation pressures affected the tread deformation considerably, whereas the tire-rolling velocity, in a certain operating range, had only a slight effect on the tread deformation. The observations reveal the direct link and qualitative relationship between tread deformations and rolling resistance. To further develop a quantitative relationship between them, experiments that measure both tread deformations and rolling resistance are needed. In addition, for a spot laser sensor, only one tread element in the tire cross-section was measured.

3. WORKING PRINCIPLE

Motor rotates the chain & sprocket mechanism which inthen rotates the shaft, tire. The Automatic tire inflation system contains a compressor which is used to passair through the axle of wheel via hoses pipe, Air is channeled through without entangling the hoses [13]. When pressure goes below the desired level it pumps air from compressed storage air tank and tire inflates. The compressor gets power from the battery. This operation takes place when the vehicle is moving and there is a requirement of inflation of tire due to reduced tire pressure level. For the tire wear are set up a Laser proximity sensor for thickness measurement that is based on optical triangulation that serves as a basic concept for displacement measurement of diffuse target surface. Tire temperature sensor is specifically designed to measure the highly transient surface temperature of a tire with spatial fidelity, providing invaluable information for chassis tuning, tire exploitation, compound selection, and driver development [8]. The sensor is also available as a PCB assembly, without an enclosure, amounting to a significant reduction in cost and allowing the user to package the sensor to their specific needs.

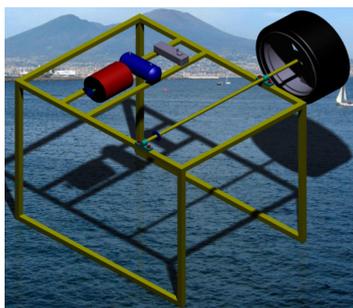


Fig.3.1

4. CONCLUSION

In order to serve efficiently and increase the vehicle performance, tire life and overall safety of the vehicle or society as a whole, it becomes essential to implement this technique. This system doesn't exist in majority of passenger vehicles till date so it will be a boom to the automobile industry. As discussed earlier it will lead to thrifty fuel consumption, better vehicle mobility due to better traction and the vehicle vibrations lessens. The project is designed to the ideal condition vehicles. Then our project developed to the next level of running condition vehicle. Because of their vehicles will be a running condition some times to puncturing the tire. So the alternative sensors are used to their process. Then the air will be filled in the tire pressure per the seconds. They calculate and the air filling efficiency and to find out the punctured tires. So easily identified the punctured and to solve the problems. In this process is an advanced technique of our project. This system will help avoid accidents due to tire bursting.

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