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A Review Fabrication of Self-Inflating Tires and Pressure Monitoring Systems

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Abstract

This paper presents the methods for self inflating tires. Nowadays every part of an automobile sector is getting automated. Automation relaxes a person to do manual work. Driven by studies that show that a drop in tire pressure by just a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance, we have developed an automatic, self-inflating tire system that ensures that tires are properly inflated at all times. Our design proposes and successfully implements the use of a portable compressor that will supply air to all four tires via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The rotary joints effectively allow air to be channeled to the tires without the tangling of hoses. With the recent oil price hikes and growing concern of environmental issues, this system addresses a potential improvement in gas mileage; tire wear reduction; and an increase in handling and tire performance in diverse conditions.

INTRODUCTION

The "Automatic tire inflation and deflation system" is a Mechanical device which is widely used in automobile works. The manual work increases the effort of the man power (operator) during the air checking in vehicles. The air maintenance technology system developed through this project replenishes lost air and maintains optimum tyre cavity pressure whenever the tyre is rolling in commission, so up overall fuel economy by reducing the tyre's rolling resistance. . Self inflating systems are designed to constantly maintain tire pressure at the proper level. Around 250 to 300 people die every day in road accident across India. A recent survey conducted by Apollo Tyre begs the question: How many are because 75% of India rides on incorrect tyre pressure? In this survey, Almost 44% of the car tyre were over inflated and 34% were under inflated. Over-inflated tyre decrease the efficiency and are prone to burst at high speed resulting in collision. Under-inflated or deflated tyre has vehicle handling, leading to accident due to lack of control. The mode of transport is one of the best criterions in these days. The vehicle safety is essential. Accident is also increasing at a quick pace. These are several factors which cause the accident. The improper inflation of tyres is one of among them. Tyres loss the air through normal driving (after heating pot holes or curbs), permeation & seasonal change in temperature. When tyre is under-inflated the treads wear more quickly. Under inflated tyre gets

damaged quickly due to overheating as compared to properly inflated tyres. The under inflation also cause a small depreciation in the mileage as well. Above all the vehicle running with under inflated tyre can cause accident. Different tyre pressure conditions are shown in the figure 1.

Fig. 1: Tyre Pressure Conditions

LITERATURE REVIEW

Vishnuram K [1] has concluded that the SIT are designed to constantly maintain tyre pressure at the proper level. SIT systems are designed more for the slow leaks and for optimizing performance and safety than for keeping a vehicle moving on a tyre that will no longer hold air. SIT allows a vehicle to adjust to the current terrain for ideal performance & safety in that condition.

Inderjeet Singh [2] has concluded that the tyre implementation system is based on the idea to maintain uniform tyre pressure of an automobile reduce tyre wear, increase fuel efficiency & increase overall safety. So, this system maintains the proper air pressure in tyre.

Ashwadip Meshram [3] has concluded that the Filling air in automobile wheel's tyre is a primary need of vehicle operation & it is widely done by compressor. But sometimes maintain pressure in both the wheel's become very difficult due to puncture in tyre or reduction of air pressure level. Puncture in tyre in that case, more chance to accident. Overcome this problem, we works on project which is automatic air feeling in tyres. The name indicates that all the system which will fill the air in all the wheels & also maintain the proper air pressure in each tyre.

Harshal junankar [4] has concluded that Tyres are the second highest cost for the trucking industry. The on board air inflation system is used to maintain the pressure of tyre in running condition. The environmental condition varies according to region, season because of this, it require maintaining the tyre pressure for better performance according to condition. At some crucial times like war condition or any flood condition there is no time to filling the air thus there arises a need for automatic tyre inflation system...

PROBLEM STATEMENT AND OBJECTIVE

To develop an automatic air filling system, this recognizes and fills air in respective tyre when its pressure goes below the desired/required pressure (under inflated condition). Underinflated tyres overheat more quickly than properly inflated tyres, which cause damage to tyres. To reduce this problem we are designing this system. As soon as a tyre Pressure goes under inflated, then a pressure sensor senses it and send it to the Controller which activates the solenoid valve and air is filled up to proper inflation. systems.

Objective

1. Maintains the required tyre pressure: The function of the system is to maintain and adjust the pressure in all the tyres of the system according to varying loading and driving conditions.
2. An Automatic System: An automatic system further saves human energy & time in filling the air in tyres when they are in under inflated conditions.
3. Builds a Low cost system: The installation of such a system in vehicles is a low cost affair.
4. Improves fuel efficiency & tyre life: This system helps in less consumption of fuel and also improves tyre life by reducing chances of wear in tyre.

METHODOLOGY

After referring several papers we got many ideas. This system consists of centralized compressor, rotary joint, pressure sensor, electronic control circuit, battery, wheel and a motor to run that wheel. After getting ideas of different components needed, we will start making rough design and after that we will draw a 3-D model in solid work. By referring this 3D model we will buy the

standard component required for the projects. After this we will start manufacturing work in workshop. Along with this electronics part will also be done. In electronics we will have to build controller circuit to get signal from pressure. After this, assembly of different components will be done. Later testing will be started for getting various results.

The project work has been started with literature review as below. After referring several papers we got many ideas. From these ideas we started developing a typical air inflation system as follows figure 2

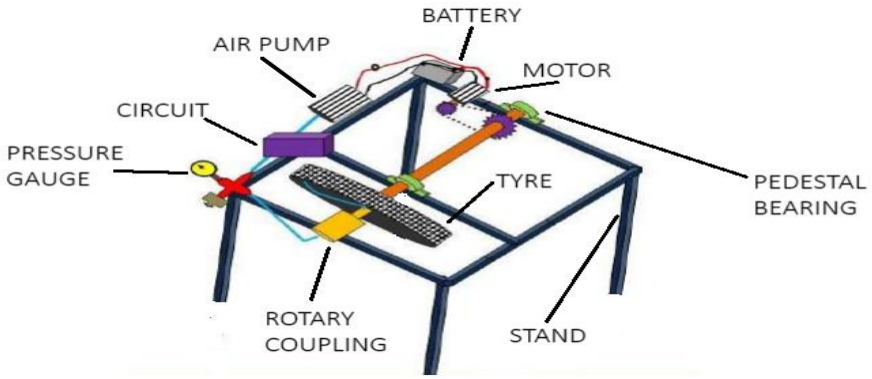


Fig. 2 CAD Design

DESCRIPTION OF COMPONENTS

Rotary Joint: Rotary joint or a Rotary Union is a device that provides a seal between a stationary passage and a rotating part. Stationary passage may be a pipe or tubing; whereas rotating part can be a drum, spindle or a cylinder. Thus it permits the flow of the fluid into and/or out of the rotating part. Generally, the fluids that are used with the rotary joints and rotating unions are steam, water, thermal oil, hydraulic fluids etc. A rotary union will lock onto an input valve while rotating to meet an outlet. During this time the liquid and/or gas will flow into the rotary union from its source and will be held within the device during its movement. This liquid and/or gas will leave the union when the valve openings meet during rotation and more liquid and/or gas will flow into the union again for the next rotation.

Pressure Sensor: A pressure sensor measures pressure of gases or liquids. It generates a signal as a function of the pressure imposed; in our system such signal is electrical. Pressure sensors can also be uses to measure other variables such as fluid/gas flow, speed and water level. Pressure sensors can alternatively be called pressure transducer, pressure transmitters, pressure senders, pressure indicators, piezometers and manometers among other names.

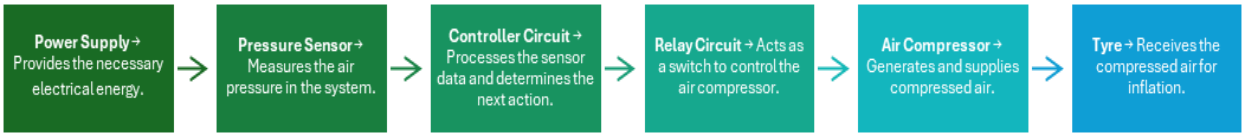
Compressor: The system uses compressor to get the air from atmosphere & to compress it to a required pressure. A 12V DC compressor has being used in our system. It is perfect for cars, bikes and inflators. It operates from the cigarette lighter socket of a DC-12V. Proper design has been set up for installing hose and cord. It is ideal for inflating all vehicle tires and other high-pressure inflatables. The following table shows the specification of our portable compressor.

Arduino UNO: Arduino UNO is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control relays, LEDs, servos, and motors as an output.

WORKING

In this system, compressor is connected to wheel with the help of hoses through a rotary joint. Pressure sensor and control circuit are connected between wheel and compressor. Two limits (upper limit and lower limit i.e. 20psi and 30 psi respectively) are set in the control circuit for automatic start and stop of compressor. Compressor works on 12V DC supply that is either a car battery or bike or an adapter. A non-return valve is connected between pressure sensor and compressor, so that the air flow must be unidirectional from compressor to tyre. When the pressure reduces below the lower limit (20psi) in the tyre during its rotation, pressure sensor senses this drop and starts the compressor automatically for the filling air into tyre 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 tyre pressure is maintained.



CONCLUSIONS

This system will improve safety, automation of filling air in tires, reduced human labor for filling the air at fuel stations, control of driver over vehicle, comfort, control over vehicle. This system will help avoid accidents due to tire bursting. This system helps us to improve tire life, reduces tire wear, increase fuel efficiency and also increases the overall safety of the vehicle, this system also helps us to ensure the tire pressure constantly. And it also gives proper inflation and deflation system to the vehicle. It can be used in very costly vehicles where maintenance of standard is important, sports cars as there is need of regular checking of air pressure in tires.

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