Automatic Tyre Inflation System

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Abstract— Driven by studies, if there is a drop in tire pressure by a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance. We have developed an automatic tire inflation system that ensures the tires are properly inflated constantly. Our design proposes and successfully implements the use of a compressor which is centralized and will supply air to all four tires through hoses and a rotary joint which is fixed between the wheel spindle and wheel hub at each wheel. The rotary joints effectively allow air to the tires without the tangling the 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 inverse.
Key words: Tyre Inflation System

I. 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, and a clarification needs to be found to correct this issue. From the perspective of the designers, however, the root cause of improperly- inflated tires is due to vehicle owners not knowing appropriate tire pressures for certain conditions, trouble finding an air pump, lack of pressure calculating device, and a general lack of concern. Thus, the combination of the user and expert perspectives will be used to make decisions in the design process of this product.

II. DESIGN OBJECTIVES

The overall goal of our design project is to develop a system that will decrease tire wear while improving fuel economy, performance and safety of a passenger vehicle through dynamically- adjustable tire pressures. However, there are several key objectives that the team has targeted our design to meet, and these objectives include both design characteristics and business objectives.

III. ABILITY TO PROVIDE PROPER TYRE PRESSURE

The ideal functional objective of the design is its capability to adjust the pressures in all four tires of a passenger vehicle to obtain conditions. Specifically, it is desired that:

- As vehicle speed increases, the tire pressures increases. the tire pressures decreases.
- As vehicle load increases, the tire pressures increases.
- As vehicle load decreases, the tire pressures decreases.

Based on more detailed research on the components necessary for the system, it was discovered that a specialized rotary joint must be designed to support this process. This design consideration requisite additional product development time that was not originally anticipated. Therefore, the ideal functional objectives have been modified to account for this design requirement. Specifically, the new objectives require that: Cold tire pressure is maintained by ensuring that the rotary joint- shaft system does not fail.

- Cold tire pressure is retained by ensuring that the rotary-joint shaft system does not leak extremely.
- Cold tire pressure is retained by ensuring that the entire system (compressor, air tubes, rotary joint, etc.) can provided sufficient flow rate. Because of the detailed level of explanation required for these items, these objectives are discussed numerically in the Engineering Analysis and Optimization section of this document.

IV. METHODOLOGY

After referring numerous 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 the wheel. After gathering ideas of different components needed, we will start making rough design and after that we will draw a 3-D model in Auto CAD.

By referring this 3D model we would buy the standard component required for the projects. After this we would start manufacturing work in workshop. Along with this electronics part would also be done. In electronics we would have to build controller circuit to get signal from pressure. After this, the assembly of various components would be done. Later testing will be started for getting various results.

V. IMPORTANT PARTS OF THE SYSTEM

A. 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 parts are a drum, spindle or a cylinder. Thus it permits the flow of the fluid in or out of the rotating part. Generally the fluids that are used with the rotary joints and rotating unions are steam, water, oil, hydraulic fluids etc. A rotary union will lock onto an input valve while rotating to meet an outlet. During this time the liquid or gas will flow into the rotary union from its source and will be seized within the device during its movement. This liquid or gas will leave the union when the valve openings meet during rotation and more liquid or gas will flow into the union again for the next rotation.

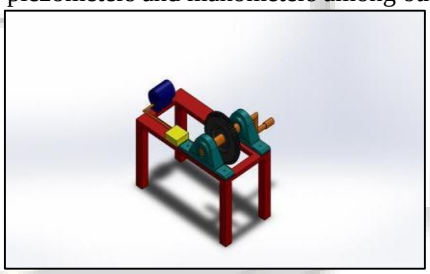
B. Steps for Methodology

1) Selection of component
2) Designing of model
3) Manufacturing and Assembly
4) Testing
5) Review
6) Testing

C. System Design & Cad Model:

The project work has been started with literature review as below. After referring quite a few papers we got many ideas. From those ideas we started developing a typical air inflation system as follows figure 2 & figure 3.

Measure other parameters such as fluid/gas flow, speed and water level. Pressure sensors can otherwise be called as pressure transducer, pressure transmitters, pressure indicators, piezometers and manometers among other names.



D. Pressure Sensor:

A pressure sensor measures the pressure of gases or liquids. It produces a electrical signal as a function of the pressure imposed; in the system Pressure sensors can also be used to pressure sensors and switches enable accurate and reliable pressure measurement and monitoring of both relative and absolute pressures. The line differentiates between sensors for pressure measurement and switching in general applications, and models specifically designed to meet the stringent hygiene requirements of the food and beverages industries. Though simple, these sensors and switches come with finely graduated measuring ranges and the process connections that will fit your measuring points, whether you are active in e.g. the pumps business, the food industry, heating and ventilation systems, and many more.

E. Compressor:

The system uses compressor to get the air from atmosphere and to compress it to a required pressure. A 12V DC compressor has been 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 fixing hose and cord. It is ideal for inflating all vehicle tires and other high-pressure inflators. The following table shows the specification of our portable compressor.

F. System Working:

In this system, compressor is connected to the wheel with the help of hoses through a rotary joint. Pressure sensor and control circuit are attached between wheel and compressor. Two limits (upper limit and lower limit i.e. 20psi and 30 psi individually) 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 a bike or a adapter. A non-return valve is placed between pressure sensor and compressor, so that the air flow must be unidirectional from compressor to tire.

Tyre inflation system: When the pressure reduces below the lower limit in the tyre during its rotation, pressure sensor senses the air drop and starts the compressor and solenoid valve automatically for of into the 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 tire pressure is maintained.

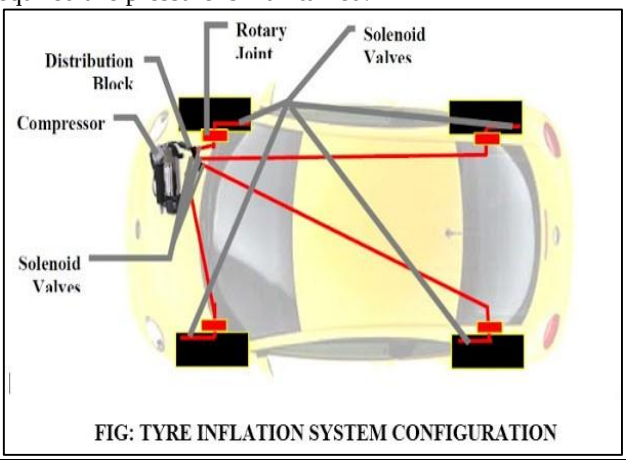


FIG: TYRE INFLATION SYSTEM CONFIGURATION

Sr.No.	Description	Specification
1.	Compressor	80 psi (5.516 bar) 12V D.C.
2.	Rotary Joint	Size=1\2'' , Pressure=10 Kg/Cm Sq.

3.	Pressure Sensor	Pressure Range =1-100 psi
4.	Bearing	Roller Bearing, carbon steel
5.	Chain sproket	NO. Teeth =18 , Carbom Steel
6.	Shaft	Carbon Steel
7.	Frame	30"*20"*13", Mild Steel
8.	Wheel	Moped Vehicle (Honda Activa)
9.	Hoses	Polyvinyl chloride (PVC)
10.	DC Motor	12 V DC,100 RPM

VI. CONCLUSION

The automatic-self-inflating tire system would be capable of succeeding as a new product in the automotive supplier industry. It explicitly address

VII. COMPONENTS SPECIFICATIONS

The needs of the consumers by maintaining appropriate tire pressure conditions for:

- Reduced tire wear
- Increased fuel economy
- Increased overall vehicle safety

Because such a product does not currently exist for the widely held passenger vehicles, the market conditions would be advantageous for the introduction of a self-inflating tire system.

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