IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, May 2022
Impact Factor: 6.252

Four Wheel Automatic Tyre Inflection System

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Abstract: *Driven by studies that show that a drop in tyre pressure by just a few PSI can result in there reduction of gas mileage, tyre life, safety, and vehicle performance, we have developed an automatic, self-inflating tyre system that ensures that tyres 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 tyres 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 channelled to the tyres 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; tyre wear reduction; and an increase in handling and tyre performance in diverse conditions. The most important factors in tyre care are: Proper Inflation Pressure Proper Vehicle Loading Proper Tyre Wear Regular Inspection Good Driving Habits Vehicle Condition.*

Keywords: Four Wheel, inflation system, Automatic filling air, Static Structural analysis

I. INTRODUCTION

The "Automatic tyre 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 optimal tire cavity pressure whenever the tire is rolling in service, thus improving overall fuel economy by reducing the tire's rolling resistance. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. 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 tyre regularly. As its well-known, one of the most serious problems 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 tyres. This means making sure that tyre are inflated and stay inflated for the right amount of pressure for the load being carried and for road condition this way one can ensure not only the preservation of outer covering of the tyres, but also the correct operation of vehicle without any risks. Tires are designed and built with great care to provide

II. PROBLEM STATEMENT

Improperly inflated tires are fairly common problems on passenger vehicles. In fact,80% of passenger vehicles on the road have at least one under-inflated tyre and 36% of passenger cars have at least one tyre that is 20% or more under-inflated. Often pressure loss in tyres is a result of natural permeation of the gas through the elastic rubber, road conditions (such as potholes), and seasonal changes in temperature. (According to Weissler of Popular Mechanics, for every drop of 10 ºF, tyre pressure drops by1 psi). Most vehicle owners are unaware of the fact that their tyres are not the correct pressures because it is difficult to determine the tyre pressure visually; a tyre that is properly inflated to the correct pressure looks very similar to one that is either over-inflated or under-inflated.

2.1 Objective

The paper contains the given objectives.

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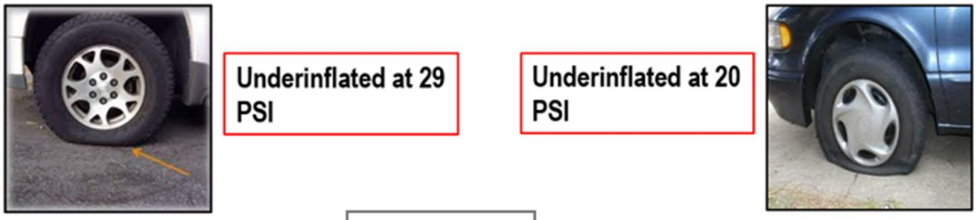

Figure No:1

The ideal functional objective of the design is its capability to adjust the pressures in all four tires of a passenger vehicle to obtain the proper pressure for varying road/driving conditions. Specifically, it is desired that: As vehicle speed increases, the tire pressures increase. As vehicle speed decreases, the tire pressures decrease. As vehicle load increases, the tire pressures increase. As vehicle load decreases,

2.2 Future Scope

As antecedent mentioned, the most beneficiaries of this advancement in technology that may leave tyre pressure to be adjusted for driving conditions are going to be the vehicle homeowners. •Despite AN initial investment within the technology, they're going to expertise a discount in tire wear and a rise in fuel economy; each of which can lead to saving cash within the end of the day. •It is plausible to mention that society as an entire can like the ensuing style. •The reduction in tyre disposal in landfills and reduce the speed of consumption of natural resources can actually profit society. Also, the development in vehicle safety can profit all those that drive a vehicle on the roadways. •However, not everybody can like this technology. •Both tire makers and also the crude oil trade are going to be negatively plagued by this ensuing style.

III. METHODOLOGY

The Automatic tire inflation system contains a compressor which is used to pass air through the rotary joint (which is fixed between wheel spindle and wheel hub at each wheel) via hoses, providing the rotary motion of wheel assembly. Air is channeled through rotary joint without entangling the hoses.

The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors: • Availability of the materials. • Suitability of materials for the working condition in service. • The cost of materials. • Physical and chemical properties of material.

Mechanical properties of material. The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows: • Strength: It is the ability of a material to resist the externally applied forces • Stress: Without breaking or yielding. The internal resistance offered by a part to an externally applied force is called stress. • Stiffness: It is the ability of material to resist deformation under stresses. The modules of elasticity of the measure of stiffness.

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

3.1 Flow Chart

Methodology of Working Process:

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2. Timeline for Research Work –

A] Topic Selection
B] Literature Review
C] Model Analysis using cad software
D] Structural Design
E] Components Collection
F] Assembly of machine inflation tyre system
G] Experimental Set-up
H] Interpretation of Result

	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
A											
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IV. SYSTEM DESIGN AND COMPONENT

In our attempt to design we have adopted a careful approach, the total design work.

4.1 Mechanical Design

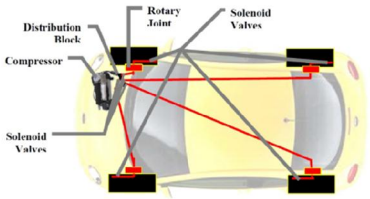

Fig. (6)

Portable Compressor

2V Car Electric Air Compressor Tyre Pump - Tyre Inflator also for Bikes, Cycles, Boats, Inflatable Toys100% Brand New 12V Air Compressor/Tyre Infiltrators imply use this for fast & easy inflation of car tyres" No strength required for pumping air as it is all electronic & is powered directly from your car battery Perfect foranyone who wants a ease while inflating a tyre Time saving as compared to mechanical pump. Quick operation,

A compressor is a device which is used to compress the air at high pressure by using power from the electric motor or the IC engine. It stores air into the smaller volume place so that the pressure of the air increases above atmospheric

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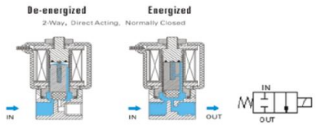
pressure. There are different types of compressors available in the market such as rotary, reciprocating however for our project we have selected reciprocating type of compressor of 12V dc 100psi capacity.

4.2 Solenoid Valves (In Future)

2/2 air solenoid valves are direct acting solenoid valves and do not require a minimum operating differential pressure. As shown below when the coil is energized (right diagram), it lifts the solenoid plunger, which normally rests on the valve seat and lifts it to open the main valve orifice. When the coil is de-energized (right diagram) A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves.

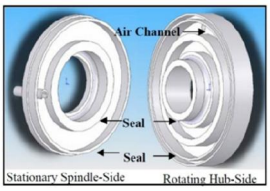


4.3. Pressure Sensor (In Future)

A pressure sensor measures pressure, typically of gases or liquids. Pressure is an expression of the force required to stop a fluid from expanding, and is usually stated in terms of force per unit area. A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed. For the purposes of this article, such a signal is electrical. Pressure sensors are used for control and monitoring DYPIT, B.E.(MECHANICAL) 12 in thousands of everyday applications. Pressure sensors can also be used to indirectly measure other variables such as fluid/gas flow, speed, water level, and altitude. Pressure is defined as the amount of force (exerted by a liquid or gas) applied to a unit of “area” (P=F/A), and the common units of pressure are Pascal (Pa), Bar (bar), N/mm2 or psi (pounds per square inch). Pressure sensors often utilize piezo resistive technology, as the piezo resistive element changes its electrical resistance proportional to the strain (pressure) experienced

4.4 Rotary Joint

We are designing this device for common passenger vehicles, and the main challenge is the presence of the axle shaft that runs straight into the centre of the wheel forcing us to find an alternative method of routing the air. Our proposed solution to this challenge is to place rotary joint that has one half spinning with the drive axle hub and the other half stationary with the spindle. Within this rotary joint will be an air chamber that will allow air to pass from the stationary half of the joint into that is the rotating. A rotary joint is a joint that permit to transfer of fluid along with the rotation of shaft. Rotary joint may be come in different sizes and shapes as per different type of applications. Rotary joint consists of different components such as housing unit, shaft, ball bearing and mechanical seal.



4.5 Pressure Switch

A pressure switch is a form of switch that makes electrical contact when a certain set pressure has been reached on its input. This is used to provide on/off switching from a pneumatic or hydraulic source. The switch may be designed to make contact either on pressure. Pressure switches are used to monitor pressure in pneumatic systems by providing an output when a set pressure is reached, as well as improving operation and safety. A pressure switch is a device that operates an electrical contact when a preset fluid pressure is reached. The switch makes an electrical contact on either

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pressure rise or pressure fall from a certain present pressure level. Pressure switches are in a wide range of industrial and residential applications like HVAC systems, well pumps, furnaces, etc. Read our pressure switch symbol article for diagram information.

4.6 Car Battary 12v

An automotive battery is a type of rechargeable battery that supplies electric energy to an automobile. Usually this refers to an SLI battery (starting, lighting, ignition) to power the starter motor, the lights, and the ignition system of a vehicle's engine.

The ideal car battery voltage with the engine running is between 13.7 and 14.7V. With the engine off, you should get a reading of 12.6 volts. If the battery isn't fully charged, it will diminish to 12.4V at 75%, 12V when it's only operating at 25%, and down to 11.9V when it's completely discharged.

V. CONCLUSION

We can conclude that this automatic centralized compressor self-inflating tyre system ensures that all tyres are always properly inflated and thus improves the tyre life, safety, reduction of gas mileage and vehicle performance by supplying air to all tyres via hoses and a rotary joint fixed between wheel spindle and wheel hub at each wheel whenever there is a pressure drop inside the tyre.The dynamically-self-inflating tyre system would be capable of succeeding as a new product in the automotive supplier industry. It specifically addresses the needs of the consumers by maintaining appropriate tyre pressure conditions for: Reduced tyre wear Increased fuel economy Increased overall vehicle safety Because such a product does not currently exist for the majority of passenger vehicles, the market conditions would be favourable for the introduction of a self-inflating tyre system. In this proper design of the chassis was designed to obtain all deformation conditions and to check rigidity. As well as analysis of frame was done with 2 different materials which are aluminium alloy and structural steel respectively. From the ANSYS result it was clear tensile yield strength of aluminium is greater than steel.

ACKNOWLEDGEMENT

We would like to thank our project guide Prof.Tushar V. Edake for her valuable guidance, and also for all the necessary faculties which were needed for our completion of project and also, we would like to thank Prof.Vaibhav V.Edake (HOD Mechanical Engineering Department). Our college has also provided all the faculties that we needed for completion of our project

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