

# Self-Inflating Tires to Maintain Pressure during Working Condition

Prashant D. Chaudhari<sup>1</sup> Gaurav S. Gajare<sup>2</sup>

<sup>1,2</sup>Department of Mechanical Engineering

<sup>1,2</sup>Dr. Vithhalrao Vikhe Patil College of Engineering, Ahmednagar, Maharashtra, India

**Abstract**— Self-Inflating Tire (SIT) system is designed with the help of Electronic and Telecommunication (ENTC) and Mechanical Department. SIT is implemented to maintain the tire pressure at proper level during Geotechnical condition for self-lubrication and issuing tire free from puncture as well as leakage. The proper inflation of tires all the times is ensured by this system. This system is designed to increase the performance of vehicle, reduce the wear-tear of tire, increase safety of vehicle and used for military purpose. Proper tire pressure allows vehicle to acquire to the terrain conditions for ideal performance and increase the stiffness of the vehicle movement. SIT has automatic air controlling system to ensure safety, reduce cost as well as time of driver. This enhances fuel efficiency during operation in the field works and increase wheel balancing. The major parts of SIT application is human safety.

**Keywords:** SIT, Stability, Pressure, Geotechnical, Safety

## I. INTRODUCTION

There has been drastic increase in the development and use of automobiles which is the sign of rise in civilization. For transport humans are completely reliable on automobile. It is very essential that the vehicle is safe. The improper inflation of tires is one of the factors which is responsible for accidents. When the tires are under inflated the tread wears more quickly, tires get damaged due to overheating, there is small depreciation in mileage. AAA statistical survey indicates that if the tire is under inflated even by 2psi the fuel efficiency is reduced by 10 percent. The best application of such automatic air inflation system is in military vehicles. Military vehicles are supposed to run on various environmental conditions; where land conditions are continuously changing. Such vehicles are supposed to be operated in worst conditions such as heavy rainfall, snowfall & deserts. At such remote places tire maintenance stations are not available. In such crucial conditions such systems serves as a boon for the users. Thus such a system will maintain correct inflation pressure in tire automatically, whenever the pressure in tires (psi) is low.

The use of automobiles has been increasing day-by-day. Humans are completely reliable on automobiles for transport purpose. In today’s competitive automobile sector; various automobile industries are competing with each other in order to win hearts of human. In order to do so the companies are making the system more effective by improving the safety systems in cars. The more reliable the system is, more successful the car becomes. After the discovery of wheels by man, it has been used extensively for variety of purposes. Wheels have become the vital part of human lives since ages. The effective use of wheels with more innovative ideas further developed with developing technologies. One such upcoming technology is automatic air inflation system used in automobiles. This system is used to maintain the pressure of tires in running condition.

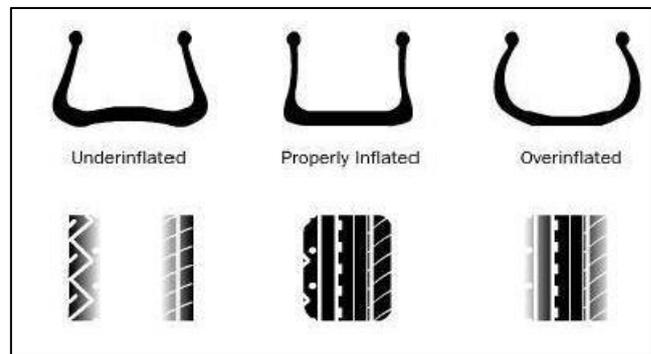


Fig. 1: Various inflated conditions of tires

## II. LITERATURE REVIEW

| Author  |  | Result/Conclusion   |
|---|--|---|
| Harshal Junankar, Vishnusagar Bihare (2015)         | Automatic Tire Inflation System.   | The paper discussed about the automatic inflation of tires of vehicle.                        |
| Inderjeet Singh, Bhupendra Pratap Singh (2016)      | To Study on Implementation of Tire Inflation System for Automotive Vehicles.   | This paper studied the implementation of actual inflation system in vehicles.                 |
| Simion Popescu, Sorin Boruz, Mihnea Glodeanu (2015) | Testing of Centralized Control System of Inflation Pressure.                   | The paper emphasized on the test results of centralized control system of inflation pressure. |
| John Woodrooffe (2017)                              | Effects of Tire Inflation Pressure on Wheel’s Road Life and Vehicle Stability. | Discussed about the pros and cons of proper inflation of tires.                               |
| Swapnil Kadam, Amol Patil (2017)                    | Review on different available inflation system.                                | Different systems available were studied in then paper.                                       |

## III. METHODOLOGY

The steps followed during the process are as follow

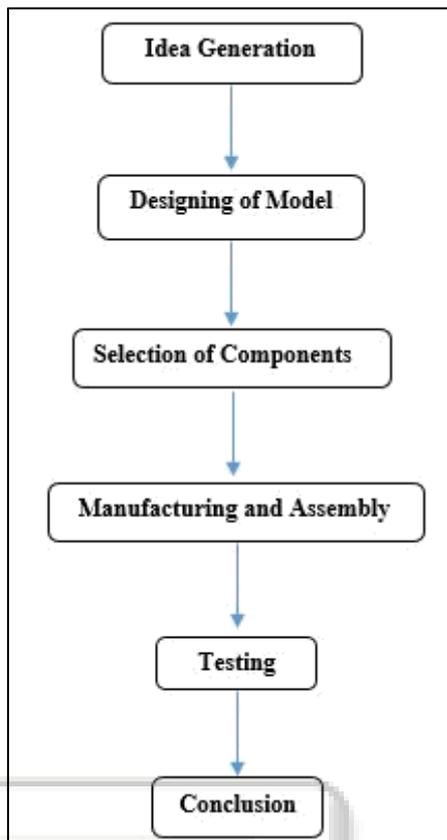


Fig. 2: Methodology

#### IV. SELF-INFLATING SYSTEM

This system is mainly divided as follows:

- The pressure monitoring system is used to constantly keep check on the air pressure in the tire.
- If the air pressure is dropped down, then the driver is notified on ECU present on dashboard.
- The compressor is activated and the compressed air from the tank starts filling the tire through ducting.

#### V. COMPONENTS OF SIT SYSTEM

##### A. Compressor and PCU

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. The atmospheric air is taken and compressed to required pressure with the help of reciprocating compressor. And this compressed air is received by air tank. The feedbacks coming from ECU are detected by PCU.



Fig. 3: Portable Compressor

##### 1) Calculation:

Compressor Selection:

For tire pressure of 30 psi

Where, 1 psi = 0.06895 bar

Therefore, 30 psi =  $30 \times 0.06895$  bar = 2.0685 bar = 2.1 bar (approx.)

Therefore, we are selecting 12V D.C., 5.5 bar compressor for tire pressure of 30psi.

##### B. Air Tank

Air tank is the store tank, where the compressed air from the compressor is stored and this air is supplied to the tires through duct lining when required. Pressure gauge is attached to air tank to monitor air pressure in the air tank.

##### C. Ducting

These are the lines which are used to carry the compressed air from air tank to the tires.

##### D. 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. These are the connecting members between wheel valve and ducting.



Fig. 4: Rotary Joint

### E. Sensors and ECU

Sensors are used to detect the tire pressure, when the level of the pressure drops down the proper pressure level. After detecting the pressure drop it sends signal to the ECU. And ECU actuates PC. 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 used 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.



Fig. 5: Pressure Sensor

### VI. WORKING PRINCIPLE

SIT system works electronically as well as mechanically. For compressing the atmospheric air, compressor is used. As it is easy to obtain the required air pressure level, reciprocating compressor is used. For measuring the air pressure of air tank, pressure gauge is used. For detecting the tire pressure, electronic sensor is used. When there is pressure drop in tire it is sensed by the electronic sensor and it these sensors sends the signal to the electronic control unit and from here the signal is further received by PCU. Now the compressed air from the air tank is supplied to the tires through duct lines.

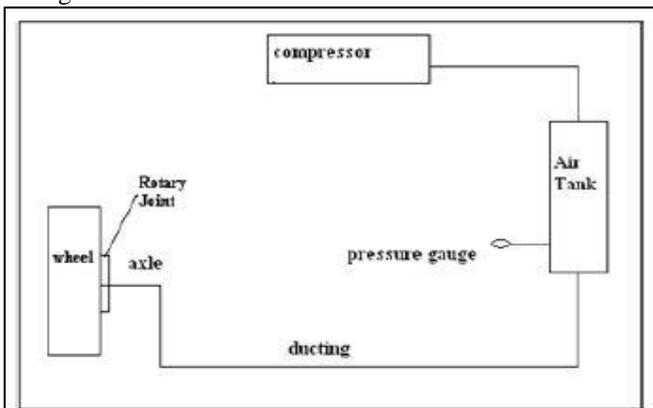


Fig. 6: System Layout

### A. Specifications:

The specifications and material used for manufacturing of different components are as follows

| Sr. No. | Component        | Specifications                           |
|---------|------------------|--|
| 1       | Compressor       | 80 psi (5.516bar), 12V DC                |
| 2       | Rotary Joint     | Size=1/2", Pressure=10kg/cm <sup>2</sup> |
| 3       | Pressure Sensor  | Pressure Range 0-100 psi                 |
| 4       | Bearing          | Roller Bearing, Carbon Steel             |
| 5       | Chain & Sprocket | Sprocket teeth – 18, Carbon Steel        |
| 6       | Shaft            | Carbon Steel, Diameter – 32 mm           |
| 7       | Wheel            | Standard (Honda Activa)                  |
| 8       | Hoses            | Polyvinyl Chloride (PVC)                 |
| 9       | DC Motor         | 12 V DC, 100 rpm                         |

### VII. ADVANTAGES

- SIT system increases the fuel efficiency of vehicle.
- It increases the safety of vehicle.
- Reduces the wear of tire.
- Improves the braking distance.
- Reduces the steering efforts.
- SIT system has its wide applications in the field of defence.
- This system can also be used in commercial vehicles

### VIII. CONCLUSION

We can conclude that this automatic centralized compressor self-inflating tire system ensures that all tires are always properly inflated and thus improves the tire life, safety, reduction of gas mileage and vehicle performance by supplying air to all tires via hoses and a rotary joint fixed between wheel spindle and wheel hub at each wheel whenever there is a pressure drop inside the tire.

The dynamically-self-inflating tire 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 tire pressure conditions for:

- Reduced tire 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 tire system. Through extensive engineering analysis, it has also been
- Determined that the self-inflating tire system would actually function as desired. In particular, the product would be capable of:
- Providing sufficient airflow to the tire with minimal leakage
- Withstanding the static and dynamic loading exerted on the rotary joints.

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