

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 4, April 2016

To Study on Implementation of Tyre Inflation System for Automotive Vehicles

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ABSTRACT: The Tire Inflation System is based on the idea to maintain uniform tire pressure of an automobile and to reduce tire wear, increase fuel efficiency and increased overall vehicle safety. The main working principle of the Tire Inflation System is that the compressed air is passed through the rotary joint into the nozzle fitted in Rim of the Wheel. The rotary joint thus allows the air to flow through itself along with providing the rotary motion of the wheel assembly. Thus the rotary joint makes it possible work out the idea. A compressor is used which gets its power supply from the battery. When the pressure falls below desired level the compressor pumps air through the rotary union to the Tyre and inflates it.

KEYWORDS: Tire Inflation System, rotary union, uniform tire pressure, reduced tire wear.

I. INTRODUCTION

Tyre Inflation System is device to inflate the tires when air pressure drops below normal level and to maintain it at required level. The working principle of Tyre Inflation System is that compressed air from a compressor is passed through rotary joint into the nozzle fitted in the rim of the wheel. The rotary joint thus allows the air to flow through itself providing the rotary motion to the wheel assembly.

Most of the vehicles on road are driving with one or more tires underinflated due to several reasons. Tires can lose air through normal driving or after hitting pot holes or curbs). Bad quality roads in rainy season and temperature changes can further deteriorate the situation. Tires lose 1 or 2 Psi each month in the winter and even more in summer and rainy season. It is difficult to predict the condition of tires just by looking at them and we have to use a tire pressure gauge. Under inflation is bad for the tires as well as for the fuel economy and road safety. It can affect the handling and control of the vehicle and is generally unsafe to drive when tires are underinflated. The tires wear more quickly when underinflated which reduces the life of tires. The underinflated tires may also get over heated more quickly than tires which are properly inflated tires. This can result in greater tire damage. Underinflated tires can also cause severe road accidents.

The objective of Tyre Inflation System is to detect when the air pressure in a particular tyre has dropped and to monitor the air pressure of the tyre and to notify the driver if there is a problem with the pressure of a particular tyre. To reduce tyre wear and maintenance cost of the vehicle and to improve the overall safety of the vehicle. To improve fuel economy by maintaining tyre pressure at required level.

II. COMPONENTS AND WORKING PRINCIPLE

The working principle of Tyre Inflation System is that compressed air is passed through rotary joint into the nozzle fitted in the rim of the wheel. The rotary joint thus allows the air to flow through itself providing the rotary motion to the wheel assembly.

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Rotary Union: A rotary joint is a joint that allows passage of fluid along with the rotation of shaft. While rotary union comes in many shapes, sizes and configurations, they always have same basic four components: a housing unit, a shaft a bearing (mechanical) (or bearings), and a seal. The rotary union used has following components:

1. **Housing:** Housing is the component that holds all the other components of the rotary union together. The housing has an inlet port, which is a threaded port to which the house supplying the medium is attached. The housing used here is stationary. It is made up of a hollow cylindrical pipe with shaft, bearings and mechanical seal inside.
2. **Shaft:** A hollow shaft is used to carry the compressed air through the rotary union into the drum or roll. The shaft rotates when the wheel is in motion. The bearings and seal are typically assembled around the shaft. The shaft is 12 cm in length and 10mm internal diameter. It is made up of mild steel.
3. **Bearing:** The second most important part of rotary union is the bearing. Two bearings of 6200 no of steel are used in this rotary union. The bearings are used to allow the shaft to rotate while the housing is stationary.
4. **Mechanical seal:** A very important component of rotary union is the mechanical seal. The seal prevents the air from leaking outside the rotary union while the wheel and shaft are in motion. Two mechanical seals has been used in the rotary union.

Compressor: An air compressor is a device that converts power (from an electric motor, a diesel engine or a gasoline engine etc.) into potential energy by forcing the air to pass through smaller volume and which increasing its pressure. The compressor used here gets its power supply from the 12 volts dc supply from a battery. A 300 psi compressor is used for this purpose.

Wheel Hub: A Wheel Hub Assembly (WHA), also referred to as hub assembly, where hub unit, wheel hub bearing, etc. is an automotive part used in cars, passenger vehicles and light and other heavy trucks. It is located between the brake drum or discs and the driver axle on the axle side, it is mounted to the holding bracket from the chassis; on the disc side, and the wheel is mounted to the bolts of WHA. When replacing a wheel hub assembly should be torqued to the vehicle specification to prevent failure.

Other components: Wooden plank of (58 cm x 38cm), two mild steel plates of 37cm and 55cm has been used as horizontal component (or base) and vertical component (or column) respectively, nuts, bolts, clamps, nozzles for air supply etc. has been used as per the need.

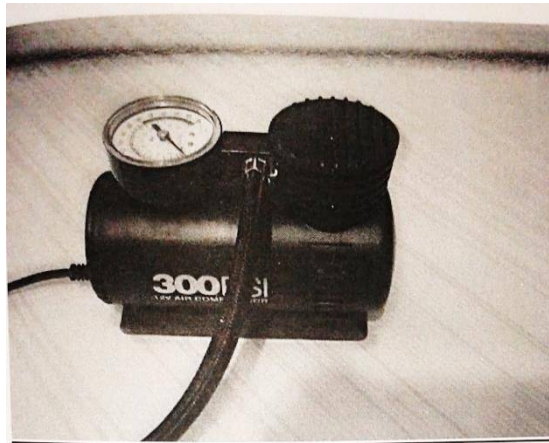
III. ASSEMBLING

1. The horizontal and vertical component are fixed on a wooden plank through nut and bolts.
2. Now the wheel hub or wheel assembly is attached to the vertical component which allows the free rotation of the wheel.
3. The wheel nozzle is permanently fixed by a hollow tube going through it and which is then further attached to the rotary joint end.
4. Now the rotary joint is attached to tube which goes to the nozzle of the wheel.
5. The rear nozzle coming out of the nozzle is attached to compressor mouth from where the compressed air is to be supplied.
6. The compressor is fixed on the wooden board and is attached to the available power source.
7. Now the final assembling is complete.

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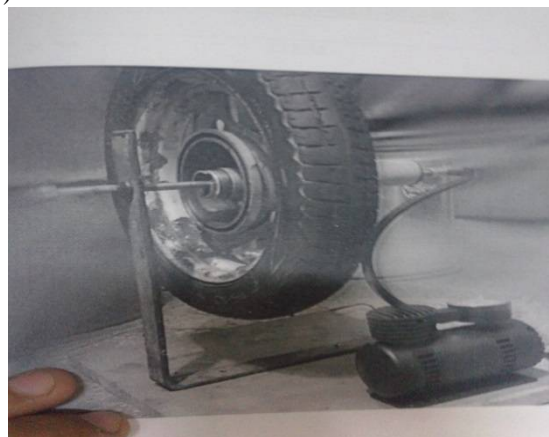
(a)



(b)



(c)



(d)

Figure(a) Compressor used in Tyre Inflation System for supplying air, (b) & (c) Interactive images of authors with Tyre Inflation System during assembly, (d) assembled view of Tyre Inflation System

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IV. ADVANTAGES

The Tyre Inflation System can be introduced as a new product in the automobile industry. It addresses the needs of the consumers and maintains appropriate tire pressure conditions.

1. There will be reduction in the tire wears due uniform pressure in the tires.
2. Increase in fuel economy.
3. Increased overall vehicle safety of the vehicle and passengers.
4. As this device is not used in majority of vehicles, the market condition would be favourable for the introduction of a tire inflation system.
5. It will provide sufficient airflow to the tire with minimum leakage
6. The main beneficiaries from this device will be the vehicles owners.
7. Despite an initial investment, there will be reduction in cost due to reduced tire wear and an increase in the fuel economy.
8. With an increase in fuel economy for passenger vehicles and the demand for petroleum fuel will reduce.

V. LIMITATIONS

Life of rotary joint is limited due to continuous in motion and hence need maintenance. Seals used in rotary joint needs to be replaced from time to time.

VI. CONCLUSION

Tyre 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 Tyre pressure is used, reduction in road maintenance, increased fuel efficiency and a considerable increase in the Tyre life of vehicles. Thus Tyre Inflation System should be used in vehicles for the betterment of automobile industry, vehicle owners, passengers and society as a whole.

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