

Design and manufacturing of rotary joint for self-inflation of tyre in two-wheeler



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ABSTRACT

There is unawareness in people about maintaining a proper tyre pressure. Tyre loses air periodically through normal driving and seasonal changes in temperature. To inflate tyres a driver has to take his vehicle to the gas station or need to use foot operated pump. People feel lazy and time consuming to check tyre pressure from time to time. When there is less air pressure in the tyre friction generated is greater and it creates heat. Extra resistance of an under inflated tyre makes engine to work harder. In addition to this a tyre is subjected to shoulder wear, diagonal wear, spot wear, centre wear etc. If the tyre is under inflated or over inflated then it reduces tyre life and safety. We have designed and manufactured a rotary joint which is the heart of whole system. We have used a 12 V portable air compressor of 100 PSI capacity, Battery, Pressure gauge and pressure safety valve. When tyre pressure decreases, air will be filled in respective tyre through rotary joint by interchanging positions of 5/3 solenoid directional control valve.

Keywords - Tyre pressure, Inflate, Tyre wear, Portable air compressor, Rotary joint

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I. INTRODUCTION

The loss of tyre pressure is serious problem in vehicles. Tyres lose air through normal driving, road conditions and seasonal changes in temperature. Even more, one cannot judge if tyres are properly inflated just by looking at them. It is important to inflate the tyre on regular basis. The under-inflation of tyres contribute to high maintenance cost of the tyres, increased fuel consumption, tyre blast and inconveniences or holdups to the user which has negative effects on finances and it causes delays to work and other appointments.

Our system is able to maintain a proper tyre pressure in vehicle. It consists of a component called 'rotary joint'. Basically, rotary joint is an assembly of bearing, oil seal, shaft, internal, external circlips and pneumatic connectors. A portable 12 V D.C operated compressor is used. A pressure gauge for both the front and rear tyres is mounted in front compartment of vehicle for display of tyre pressure.

When the pressure in tyre reduces from the recommended value the same is visualized on the pressure gauge and hence driver has to operate toggle switch. This gives signal to 12 V, 5/3 solenoid operated direction control valve. As such air will get filled in respective tyre by interchanging the positions of toggle switch. A pressure relief valve is used to release excess amount of tyre pressure in order to avoid over inflation of tyre. A 12 V 5Ah rechargeable battery is used to run compressor.

II. PROBLEM STATEMENT

The loss of tyre pressure causes tyre wear which reduces tyre life, safety and fuel economy. It increases greenhouse gas emissions and over inflation leads to blast of tyre which causes accidents. Therefore, we have designed a system which will fill air in tyres and maintain recommended tyre pressure.

OBJECTIVES:

1. To fill and maintain the required tyre pressure according to various driving conditions.
2. To manufacture a rotary joint which supplies air during rotating condition of tyre.
3. To improve tyre life and develop a low cost system.

III. CONSTRUCTION

The self-inflating system consists of following components:

Rotary Joint:

We have design and manufactured rotary joint which mainly consists of housing called as rotor and shaft called as stator.

Portable Air Compressor:

It draws air from atmosphere and compresses it to a required pressure. It is 12 V D.C operated, capacity of 100 PSI and flow rate of 35 litres/ min.

Battery:

It is a 12 V 5 Ah and rechargeable battery.

Pressure Gauge:

It has an operating range between 0 to 150 PSI.

5/3 Solenoid Operated Direction Control Valve:

It is used to supply air for both front and rear tyre.

IV. WORKING METHODOLOGY

Our system works on the principle that a portable compressor receives power from 12V battery and supplies air to the tyre. The air is taken from the atmosphere and is compressed at required pressure. So, driver operates a toggle switch of 5/3 directional control valve and air is supplied to desired tyre finally without tangling the hoses. 4

There are independent rotary joints for each wheel. The pressure is indicated on pressure gauges. The rotary joint fits on a plate which is bolted on wheel rim. The rotary joint is sustainable and able to rotate along with wheels so that there is no need for a driver to unplug and plug each tyre connection of air filling nozzles manually which is done in conventional system. As the maximum pressure by considering both the tyres is near about 30 to 40 PSI the safety valve is set to release excess amount of air pressure when line pressure exceeds 30 PSI.

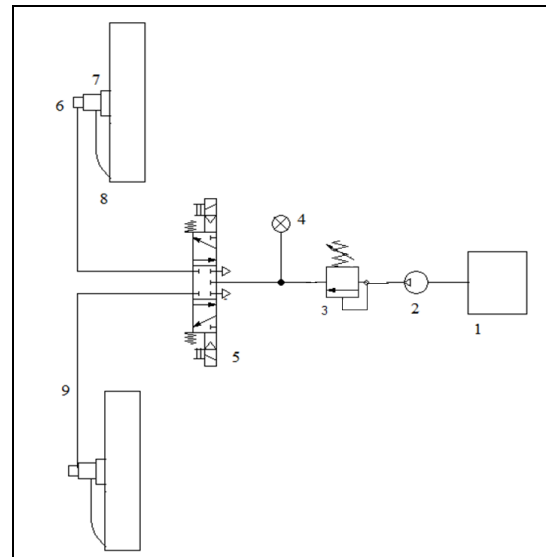


Fig (a): Working Principle

1. 12 Volt Battery
2. 12 Volt Compressor
3. Pressure Relief Valve
4. Pressure Gauge
5. 5 x 3 Direction Control Valve Solenoid Operated
6. Rotary Joint
7. Plate
8. Wheel
9. Hose Pipe

V. ANALYSIS

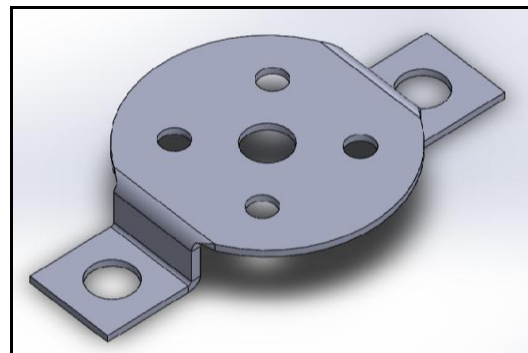


Fig (b): Mounting Plate

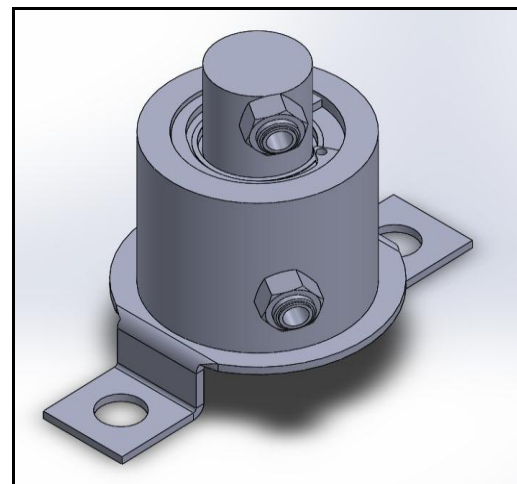


Fig (c): Rotary joint mounted on plate

A rotary joint is designed in Solid works and manufactured into two separate parts as housing and shaft. A boring operation is performed on housing. A bearing is mounted on shaft with external circlip and shaft is guided inside housing with internal circlip. Pneumatic connectors are fitted on housing and shaft.

VI. CONCLUSION

- 1) The system maintains the tyre pressure as per the different load as well as environmental conditions.
- 2) A correct control over tyre pressure improves fuel efficiency and tyre life. The chances of tyre blast are reduced considerably and hence improving nation's security.
- 3) As the cost of overall system is low, market conditions will be favourable for such systems. This will lead to introduction of a new product in automobile industry.
- 4) By installing this system user inflates tyres more frequently at home and found to be an easier application towards sustaining correct tyre pressure at all times.

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