

Design and development of automatic pneumatic bumper for four wheelers

A. S. Pranav[†], Pravin Surwase, Sanket Pimplikar, Chetan K. Patil[‡]

^[1,2,3]B.E. Student, Department of Mechanical Engineering, Savitribai Phule Pune University, Pune, India. ^[4]Professor, Department of Mechanical Engineering, Savitribai Phule Pune University, Pune, India, India.

Abstract - In almost all of the cases of vehicle accidents, the basic reason cited is failure to apply the brakes at the right time. If brakes are applied at the right time, accidents can be prevented. Automation can assure higher reliability of braking as compared to fully manual braking. The use of pneumatic system can prove to be useful in automation due to its simplicity and ease of operation. So, the aim is to design and develop a system based on automatic control of vehicle in order to reduce accidents on roads and offer a safer driving experience.

Keywords: Pneumatic, Bumper, Braking, Ultrasonic, Solenoid

1. Introduction

Automobile vehicles have become integral part of our lives. With growing number of vehicles on road, the numbers of traffic accidents are also increasing. It is important to prevent the chances of accidents and to protect the passengers when accidents occur. Air bags provide safety, but they are costly. Safety, being a matter of prime importance, cannot be compromised for cost. Hence our attempt is to provide a reliable and safe system at low cost. Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage (such as pneumatic bumper system) during accident can be effective on the accident rates. So, in today's world, implementation of proper (automatic) braking system to prevent the accidents is a must for vehicles. Therefore, pre-crashing system is demanded. Such a system will prevent accidents on roads with poor visibility by using ultrasonic sensors.

2. Pneumatic systems

The word 'pneuma' comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it will indeed be necessary to deal with the question of compressed air supply.

The compressibility of the air was first investigated by Robert Boyle in 1662 and that found that the product of

pressure and volume of a particular quantity of gas is constant at a given temperature

The law is written as

$$PV = C \quad (\text{or}) \quad P_1V_1 = P_2V_2$$

3. Pneumatic components

3.1 Air compressor

Compressor is a device which gets air from the atmosphere and compresses it for increasing the pressure of air. Thus, compressed air is used for many applications. The compression process requires work in put. Hence a compressor is driven by a prime mover. Generally, an electric motor is used as prime mover

3.2 Pressure regulator:

Constant pressure level is required for the trouble-free operation of a pneumatic control. A pressure regulator is fitted downstream of the compressed air filter. It provides a constant set pressure at the outlet of the outlet of the regulator. The pressure regulator is also called as pressure reducing valve or pressure regulating valve.

3.3 FLR Package (or) FRL Package:

The air service unit is a combination of following units.

1. Compressed air filter
2. Compressed air regulator
3. Compressed air lubricator

Air Filter, regulator and lubricator are connected together with close nipples as one package. This unit is known as FLR (Filter, regulator, lubricator.).

3.4 Pressure control valve:

Each hydraulic system is used to operate in a certain pressure range. Higher pressure causes damage of

components. To avoid this pressure control valves are fitted in the circuits.

3.5 Direction control valve:

Directional control valves are used to control the direction of flow. The design principle is a major factor with regard to service life actuating force switching times etc.

3.6 Piston and Cylinder:

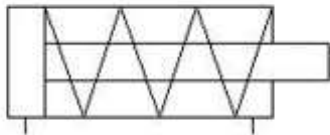
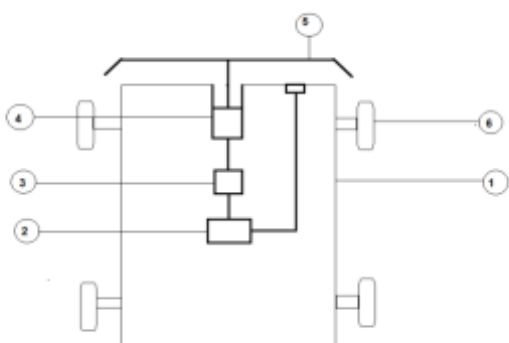


Figure 1: Double acting cylinder

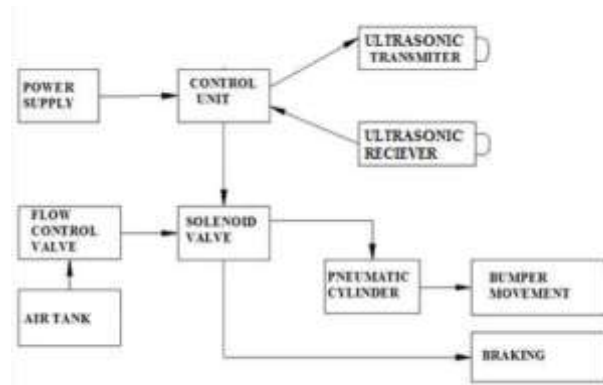
Pneumatic cylinders are mechanical devices which produce force, often in combination with movement, and are powered by compressed gas (typically air). To perform their function, pneumatic cylinders impart a force by converting the potential energy of compressed gas into kinetic energy. This is achieved by the compressed gas being able to expand, without external energy input, which itself occurs due to the pressure gradient established by the compressed gas being at a greater pressure than the atmospheric pressure. This air expansion forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. However, the repeatability of the results is a major challenge.

4. Project System Components

- 1.Box
- 2.Control unit
- 3.Solenoid valve
- 4.Pneumatic actuator
- 5.Bumper



Block diagram



5. Working

The system of the pneumatic bumper works on the pneumatic system. Ultrasonic sensor is used to detect the obstacle. The signal send to the microcontroller which operate the solenoid valve. Compressed air supplied to the pneumatic actuator through compressor. For condition of the solenoid valve compressed air is passed through the solenoid valve which actuates the pneumatic actuator. The piston of the pneumatic actuator will move on forward direction. On removing the obstacle the actuator will set to its original position.

6. CONCLUSION

Behind the designing of this system, our main aim is to improve the prevention technique of accidents and also reducing the hazard from accidents like damage of vehicle, injury of humans, etc. We observed that our work is able to achieve all the objectives which are necessary. Initial cost of cars with air bags is always high. Usually air bags are given to high end cars. By implementing this project we can reduce cost of high end cars by giving similar kind of safety. Air bags are helpful to provide internal safety to people sitting in vehicle, whereas in our project we will be giving internal plus external safety to car from damage. Thus we will reduce initial cost of cars and also provide better safety.

7. REFERENCES

- [1] Srinivasa Chari.V, Dr.Venkatesh P.R, Dr.Prasanna Rao N.S, Adil Ahmed S “Automatic Pneumatic Bumper And Break Actuation Before Collision”, 2015, International Research Journal Of Engineering And Technology (Irjet) Volume: 02 Issue: 04, Pp1015-1023.
- [2] Dr. P. Poongodi. Mr. P. Dineshkumar, “Automatic Safety System For Automobiles”.
- [3] Dr.Eung Soo Kim, “Fabrication Of Auto Braking System Using Sensor”, International Journal Of Control And Automation, Vol-2, And No1.
- [4]Takahiro Wada, “A Deceleration Control Method Of Automobile For Collision Avoidance Based On Driver Perceptual Risk” IEEE International Conference On Intelligent Robots And Systems, Oct 4881-4886.
- [5] Lee, “A Theory Of Visual Control Of Braking Based On Information About Time To Collision”, Perception, Vol 5, Pp 437-459.