

Design and Development of Automatic Pneumatic Bumper System

Prof. Rajendra Belkar¹, Tejas Avinash Navale², Rupesh Avinash Nakave³,
Shubham Balu Ighe⁴, Gokul Subhash Ghodsare⁵

Assistant Professor, Department of Mechanical Engineering¹

BE Student, Department of Mechanical Engineering^{2,3,4,5}

Visvesvaraya Institute of Technology Nashik, Maharashtra, India

Abstract: *The Car accidents are happening every day. Most drivers are convinced that they can avoid such troublesome situations. However, the statistics shows that ten thousand dead and hundreds of thousands of million wounded each year. Hence, improvement in the safety of automobiles is prerequisite to decrease the numbers of accidents. Automobile bumper is a structural component of an automobile vehicle which contributes to vehicle crashworthiness or occupant protection during front or rear collisions. The bumper system also protects the hood, trunk, fuel, exhaust and cooling system as well as safety related equipment. Bumper beams are usually made of steel, aluminium, plastic, or composite material. Bumper beams are also the backbone of the energy absorbing systems located at both front and rear on automobiles. This energy absorber which looks like a shock absorber, functions as a connecting member between a bumper and front cross member for the purpose of damping load and the shock load during a low speed collision between the motor vehicle and an obstacle. Under the bumper impact situation these energy absorbers are loaded in compression or tension as well as the bumper moves from a designed outer position toward the vehicle body and are operative to absorb the energy of the impact. After impact, these energy absorbers recover at various rates to return associated with bumper assembly toward its original pre-impact position.*

Keywords: Pneumatic hoses and fittings .IR transmitter and IR receiver, Pedestal bearings.

I. INTRODUCTION

In case of accident occurs, there is no any provision to minimize the damages of vehicles. In currently used vehicles generally bumpers used are of rigid types. These bumpers have specific capacity and when the range of the accidental force is very high then the bumpers are fails and these forces transferred towards the passengers. So this system never reduces the damage of both vehicle and passengers that much amount. We have introducing our project “Automatic Pneumatic bumper for four-wheeler”, which is fully equipped by IR sensors circuit and Pneumatic bumper activation circuit. it is a genuine project which is fully equipped and designed for automobile vehicles. this forms an integral part of best quality safety. Pneumatics form an attractive medium for low cost automobile automation. The main advantages of all pneumatic systems are economy and simplicity.

We have introducing our project “automatic Pneumatic bumper”, which is fully equipped by IR sensors circuit and Pneumatic bumper activation circuit. it is a genuine project which is fully equipped and designed for automobile vehicles. this forms an integral part of best quality. This product underwent strenuous test in our automobile vehicles and it is good. Need for automation: automation can be achieved through computers, hydraulics, Pneumatics, robotics, etc., of these sources, Pneumatics form an attractive medium for low cost automation. the main advantages of all Pneumatic systems are economy and simplicity. Automation plays an important role in mass production of the product; the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. The components must be moved automatically from the bins to various machines sequentially and the final component can be placed separately for packaging. materials can also be repeatedly transferred from the moving conveyors to the work place and vice versa. Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. the manufacturing operation is being atomized for the following reasons

II. LITERATURE REVIEW

Ahmad Syuhri, done the work on ,Design and Modeling of Hydraulic Crash Damper in a Racing Electric Vehicle, according to his work,racing vehicle has greater risk of injury and vehicle damage than any others urban vehicle, this paper presents the design, modeling and performance study of crash damper in a racing electric vehicle. Using lumped parameter model (LPM) as analytical approach, the development model of hydraulic crash damper is used to absorb or to dissipate the kinetic energy on frontal crash. The mathematical model between initial model and development model is derived to obtain responses of both vehicle and occupant. Plot 3D surface from numerical simulation is used to obtain optimum value of development model. The results in time response are also plotted to compare both initial model and development model. Development model also claimed that can reduce in vehicle deceleration, occupant deceleration and vehicle deformation in the range of 25% to 28.1% than initial model.[1]

R. Balamurugan & Dr. M. Sekar, done the work on , Design of Shock Absorber for Car Front Bumper, according to his work, Automotive designs with economy, safety and aesthetics have been a great challenge to design engineers. Automobile bumper subsystem is the front and rear structure of the vehicle that has the purpose of energy absorption during low velocity impact. Bumpers are structural components installed to reduce physical damage to the front and rear ends of a light/ heavy motor vehicle from low-speed collisions. The bumper should support the mechanical components and the body. It must also withstand dynamic loads without undue deflection. This Project deals with the idea of Hydraulic shock absorber using bumper in the front overhang of the four-wheeler, which reduces the loss and deformation of the vehicle during the accident. It includes Hydraulic fluids and shock absorber spring as an active component in the Impact reducing system. This Project model built using the CATIA V5 R20 Software[2].

Prof. M. B. Bankar, Prof. S. K. Pawar, Prof. R. V. Lalge, done the work on , Design And Development Of Automatic Pneumatic Bumper System, according to his work, India is the largest country in the use of various types of vehicles. As the available resources to run these vehicles like quality of roads, and unavailability of new technologies in vehicles are causes for accidents. Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage during accident are mainly affects on the accident rates. So today implementation of proper braking system.

III. PROBLEM STATEMENT

In currently used vehicles generally bumpers used are of rigid types. These bumpers have specific capacity and when the range of the accidental force is very high then the bumpers are fails and these forces transferred towards the passengers. So, this system never reduces the damage of both vehicle and passengers. To overcome these unwanted effects, design the Automatic Pneumatic Bumpers is important. The statement of project is “design & fabrication of automatic pneumatic bumper system for four-wheeler.” for the safety application in automobile as per requirements for vehicle performance.

IV. AIM & OBJECTIVES

- To overcome these unwanted accidental effects during automobile crash, we have to design the Automatic Pneumatic Bumpers system which have following objectives,
- To improve the pre-crash safety.
- To avoid the percentage of passenger injury by using external vehicle safety.
- To reduce the requirement of internal safety devices like air bags.
- To increase the sureness of impact absorption application while vehicle accident.
- To reduce the response time of safety with bumper system.

V. PROPOSED SYSTEM

Pneumatic systems introduction:

Pneumatic systems form the most primitive and distinct class of mechanical control engineering. They are classified under the term 'Fluid Power Control', which describes any process or device that converts, transmits, distributes or controls power through the use of pressurized gas or liquid. In a pneumatic system, the working fluid is a gas (mostly

air) which is compressed above atmospheric pressure to impart pressure energy to the molecules. This stored pressure potential is converted to a suitable mechanical work in an appropriate controlled sequence using control valves and actuators. Pneumatic systems are well suited for the automation of a simple repetitive task. The working fluid is abundant in nature and hence the running and maintenance cost of these systems are exceptionally low. All fluids have the ability to translate and transfigure and hence pneumatic systems permit variety of power conversion with minimal mechanical hardware.

Conversion of various combinations of motions like rotary-rotary, linear-rotary and linear-linear is possible. The simplicity in design, durability and compact size of pneumatic systems make them well suited for mobile applications. These features make them versatile and find universal applications including machines, aerospace technology, production and assembly of automotive components (power steering, chassis and engine assembly), CNC machines, food products and packaging industry, bomb deployment units and fabrication process of plastic products. The basic layout of a pneumatic system is shown in fig. it could be observed that the basic components involved are similar to a hydraulic system. The basic differences between hydraulic and pneumatic systems are that in hydraulic system the input mechanical energy is imparted to the oil is by pump, whereas, in pneumatic systems the working fluid being air, the mechanical energy is imparted to air by a compressor. Further, a hydraulic system usually operates at very high pressures to transmit the large force and power while a pneumatic system operates at low pressures of about 5 – 7 bar for industrial applications.

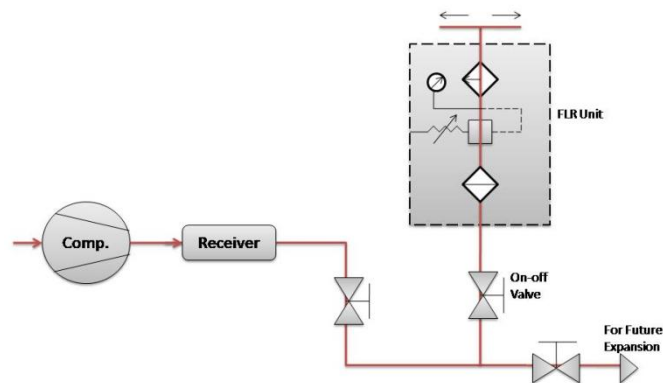


Fig..Basic pneumatic system

The major components of the pneumatic systems are:

- A compressor of appropriate capacity to meet the compressed air requirements.
- A receiver to store the compressed air.
- Air distribution lines to distribute the air to various components of the system.
- Filter lubricator regulator (FLR) unit for conditioning of air and regulation of pressure.
- Pneumatic control valves to regulate, control & monitor the air energy.
- Pneumatic actuators & Air driers.

VI. WORKING

As this system is used at the time of emergency during work. In normal travelling of vehicle this system is off and it never impact on the normal working. When any obstacle, humans, animals or vehicle is coming in front of the vehicle then the installed infrared sensor senses that obstacle. The range of distance between the vehicle and obstacle is variable. This range is varied according to the density of vehicles or humans on road.

The received signal by IR sensor is provided to the control unit. This control unit operates the relay according to the input signal. The relay operated by solenoid valve control unit the pneumatic power supply given to the cylinder so the working of bumper is protecting the vehicle from impact. There is some incidence when the working of automatic bumper works and vehicle run to forward motion safely. During impact IR Sensor on the Solenoid control valve opens port going towards the bumper system. This pneumatic force used to forward motion of the bumper. By receiving the impact of accidental force bumper try to deflects. The flexible nature of the bumper able to sustain the force and so

the impact of this force on vehicle is reduced. When the bumper external body is kept safe then there is no chance of inner damage.

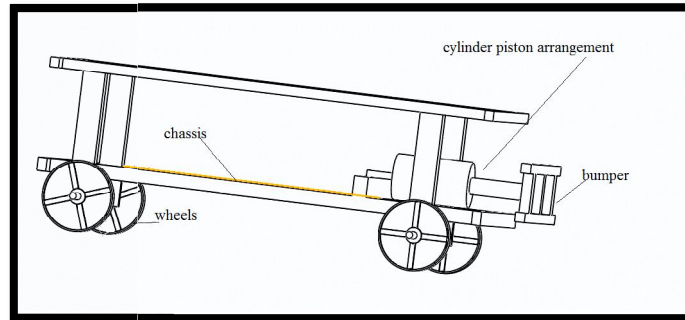


Fig..Concept of Automatic Bumper





VII. ADVANTAGES & APPLICATIONS

7.1. Advantages

- 1) Simple construction of the prototype vehicle.
- 2) It provides safety to passengers in the vehicle as well as to the vehicle body.
- 3) It reduces accident intensity and impact.
- 4) This system increases the response time of vehicle by keeping safe distance between two vehicles.
- 5) The design also increases the crashing distance by providing extra space due to extension of the bumper, decreasing the chances of injuries to commuters.

7.2.Applications

- 1) This system may be applicable in all types of light vehicles like cars.
- 2) This system also successfully installed in the heavy vehicles like buses, trucks, trailers, etc.

VIII. CONCLUSION

The standard formulae are contributed towards the attainment of conceptual design of bumper. Literature survey about bumpers have provided the details of mechanical properties of short-listed materials and then details are supported for successful completion of numerical calculations. From the previous works, it can be concluded that the bumper is an important member of an automobile from the safety point of view. Thus, modification of bumper will help to increase the safety considered. This work will be milestone in Automotive industry as per as vital issue of passenger safety is concerned. This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We are feeling that we have completed the work within time successfully. The Pneumatic Bumper for Four-Wheeler is working with satisfactory conditions. Thus, we have prepared an “Pneumatic Bumper for Four-Wheeler” which helps to know the how to achieve low-cost product. Working on this project has provided us an excellent opportunity and experience, to use our limited knowledge to develop altogether a new technology to ensure public safety. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while working on this project. We feel that the project work is a good solution to bridge the gates between institution and industries. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. While concluding this report, we feel quite fulfill in having completed the project assignment well on time, we had enormous practical experience on fulfillment of the manufacturing schedules of the working project model. We are therefore, happy to state that the in calculation of mechanical aptitude proved to be a very useful purpose. Although the design criteria imposed challenging problems which, however were overcome by us due to availability of good reference books. Needless to emphasize here that we had lift no stone unturned in our potential efforts during machining, fabrication and assembly work of the project model to our entire satisfaction

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