

“Automatic braking system with pneumatic bumper”.

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Abstract

Now, a car accident day is the main problem. This braking system used an innovative design to prevent accidents on restricted traffic roads. The purpose of this system is based on an intelligent electronic control with automatic bumper activation system, known as the "Pneumatic Bumper Automatic Braking System". This system is mounted on four-wheeled vehicles. Generally, this system consists of two mechanisms and these are the automatic braking system and the pneumatic bumper system.

The automatic braking system uses the sensor that detects the vehicle that is approaching our system and which could be the cause of an accident. Then the sensor sends information to the engine through the relay to stop the engine from running. During simultaneous operation of the automatic braking system, the driver of the vehicle also attempts to stop the vehicle by pressing the brake pedal. The limit switch is provided under the brake pedal which simultaneously activated the pneumatic bumper and the disc brake to reduce the damage that occurs to our vehicle if both vehicles collide with each other. This ensures pre-accident safety for the vehicle. In addition, this system improves the vehicle's brake response time to maintain a safe distance between two vehicles.

Using this system, we check the speed of the vehicle over small distances. Therefore, we are trying to carry out the project on the "emergency brakes with automatic bumper system".

Using this system, we check the speed of the vehicle

Keywords: Parking, emergency brake, bumper, accident prevention

Introduction

A brake is a device that inhibits movement. Its opposite component it's a clutch. Most commonly, brakes use friction to convert kinetic energy into heat, although other methods of converting energy can be employed. Effective braking depends primarily on response timing of the whole system and the feeling of the driver. response time is determined as the time between the start of the actuation of the control pedal and the moment when the pressure in the actuator reaches 75 percent of its asymptotic value.

The brake the system project configuration should be designed in such a way that response time must meet vehicle safety standards regulations the brake system design of heavy commercial vehicles is designed while maintaining various vehicle parameters such as gross vehicle Weight, wheelbase, center of gravity of the vehicle, no boards etc. System layout design is extremely complex implies the number of valves that must operate in a logic sequence during the different braking phases (Normal, Emergency, and Fault condition of a circuit). Conventionally, the system design the design came after many iterations based on field tests and Experience.

I Objective

To overcome these unwanted effects, we have to design the Automatic Braking System with Pneumatic Bumpers which have following objectives

- To increase the sureness of braking application while car parking.
- To reduce the response time of braking system & to maintain the accuracy in reverse braking system.
- To performed the most rigid operation with high speed braking.
- To improve the pre-crash safety.
- To avoid the percentage of passenger injury & vehicle damage by using external vehicle safety.

II Problem Statement

In conventional vehicles there are different mechanism operated for braking system like hydraulic, pneumatic, air, mechanical, etc. But all these braking mechanisms receive the signal or input power directly from the driver so it totally manual operated. When the driver saw the obstacle or any vehicle in front of his driving vehicle, he was irritated or becomes mazy. Due to this the driver fails to give the proper input to braking system and proper working is not occurs. Also, the driver may not able to pay the full attention during night travelling so there are many chances to accidents. After the 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. The braking is the major operation performed in automobile used to control & reduced the speed of a vehicle and to perform most rigid operation in automobile safety. the accuracy of braking is increases by using automation in system, so we are trying to do a work on new system in **“emergency brakes with automatic bumper system.”**

III System Element

3.1. Frame:

The frame is of MS material. The frame of our machine is basically used to support the pneumatic components mounted

on it. That is Piston cylinder, d.c.v, flow control valve, switches are mounted on frame.

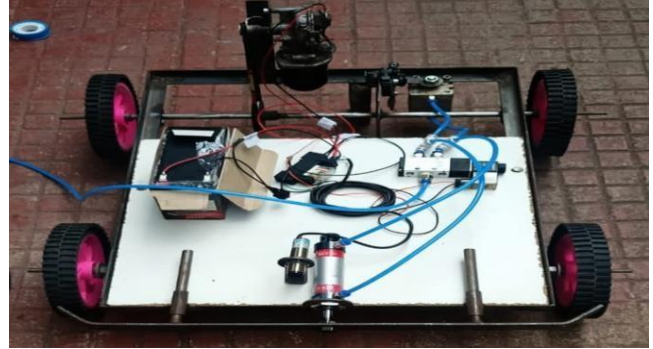


Fig.3.1. Frame

3.2. Double acting cylinders:

Actuators are output devices which convert energy from pressurized hydraulic oil or compressed air into the required type of action or motion. In general, hydraulic or pneumatic systems are used for gripping and/or moving operations in industry. These operations are carried out by using actuators. The construction of hydraulic and pneumatic linear actuators is similar. However, they differ at their operating pressure ranges. Typical pressure of hydraulic cylinders is about 100 bar and of pneumatic system is around 10 bar.

Actuators can be classified into three types.

- **Linear actuators:** These devices convert hydraulic/pneumatic energy into linear motion.
- **Rotary actuators:** These devices convert hydraulic/pneumatic energy into rotary motion.
- **Actuators to operate flow control valves:** these are used to control the flow and pressure of fluids such as gases, steam or liquid.

The main parts of a hydraulic double acting cylinder are: piston, piston rod, cylinder tube, and end caps. These are shown in Fig. The piston rod is connected to piston head and the other end extends out of the cylinder. The piston divides the cylinder into two chambers namely the rod end side and piston end side. The seals prevent the leakage of oil between these two chambers. The cylindrical tube is fitted with end caps. The pressurized oil, air enters the cylinder chamber through the ports provided. In the rod end cover plate, a wiper seal is provided to prevent the leakage of oil and entry of the contaminants into the cylinder. The combination of wiper seal, bearing and sealing ring is called as cartridge assembly. The end caps may be attached to the tube by threaded connection, welded connection or tie rod connection. The piston seal prevents metal to metal contact and wear of piston head and the tube. These seals are replaceable. End cushioning is also provided to prevent the impact with end caps.

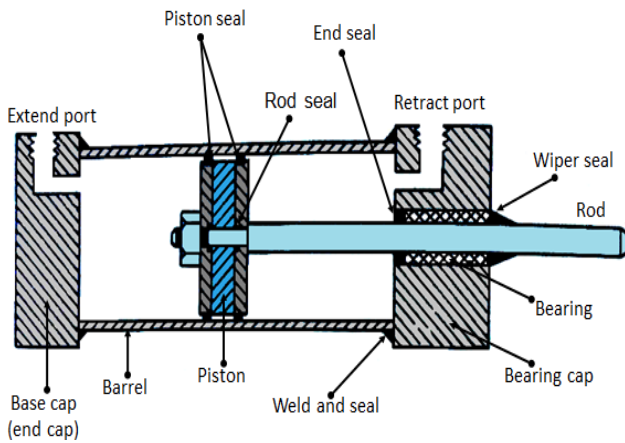


Fig.3.2. Double acting cylinder.

3.3. Pneumatic pipe fittings:

Pneumatic tubes are also available in other materials with and without reinforcement for use in standard applications SMC fittings incorporate a positive tube seal

while the the connection is under pressure, which allows the polyurethane tube to do this Used. The tubes are available in sizes 3.2, 4, 6, 8, 10, 12 and

16 mm are available.

Tubing Series:

Polyurethane Tubing: TAU, TCU, TFU, TIUB, TU

Nylon Tubing: T, TAS, TIA, TISA, TRS, TS

Spark Resistant Tubing: TRB, TRTU

Coaxial Tubing: TW

Polyolefin Tubing: TP

Moisture Control Tubing: IDK This can be used for connection of pneumatic system with total drill assemble.



Fig.3.3. Pneumatic hoses and fittings.

3.4. 5/2 Solinoid valve:

A valve is a device that regulates the flow of fluid (gases, liquids, fluidized solids or slurries) by opening and closing or partially obstructing passage ways. A 5/2-way directional valve from the name itself has 5 ports equally spaced and 2 flow positions. It can be used to isolate and simultaneously bypass a passage way for the fluid which for example should retract or extend a double acting cylinder. There is variety of ways to have this valve actuated.

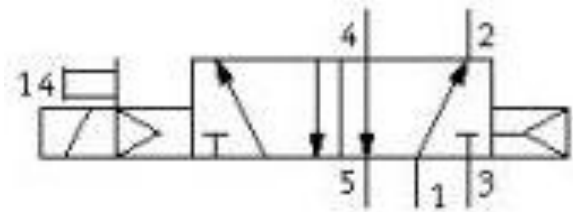


Fig.3.4. 5/2 solenoid valve.

3.5. Pneumatic connectors, reducer and hose collector:

Two types of connectors are used in our pneumatic system; one is the hose connector and the other is the reducer.



Fig.3.5. Manifold and pipe fitting

3.6. IR transmitter and IR receiver sensor:

The IR transmitting circuit is used in many projects. The IR transmitter sends 40 kHz (frequency can be adjusted) carrier under 555 timer control. IR carriers at around 40 kHz carrier frequencies are widely used in TV remote controlling and ICs for receiving these signals are quite easily available. The transmitted signal reflected by the obstacle and the IR receiver circuit receives the signal and giving control signal to the control unit. The control unit activates the pneumatic braking system, so that break was applied.



Fig.3.6. IR sensor.

3.7. Disc brake:

A disc brake is a type of brake that uses calipers to squeeze pairs of pads against a disc in order to create friction that retards the

rotation of a shaft, such as a [vehicle axle](#), either to reduce its rotational speed or to hold it stationary.



Fig.3.7. Disc brake:

3.8. Pedestal bearings

This type of bearing consists of I) a cast iron pedestal, ii) gun metal, or brass bush split into two halves called “brasses”, and iii) a cast iron cap and two mild steel bolts. The detailed drawing of a pedestal bearing is shown in image below. The rotation of the bush inside the bearing housing is arrested by a snug at the bottom of the lower brass. The cap is tightened on the pedestal block by means of bolts and nuts. The detailed part drawings of another Plummer block with slightly different dimensions are also shown in image below.



Fig.3.8. Pedestal bearing.

1.9. Shaft:

The shaft is a common and important element of the machine. It is a pressure member, in general, has a circular cross section and is used to transmit power. The shaft can be hollow or solid. The axis is supported on bearings and rotates a set of gears or pulleys for the purpose of power transmission.

Shaft material:

Ferrous, non-ferrous and non-metallic materials are used as the axis material depending on the application.



Fig.3.9. Shaft.

3.10. Washer

A washer is a thin plate (typically disk-shaped) with a hole (typically in the middle) that is normally used to distribute the load of a threaded fastener such as a screw or nut. Other uses are as a spacer, spring (wave washer), wear pad, preload indicating device, locking device, and to reduce vibration (rubber washer). Washers usually have an outer diameter (OD) about twice the width of their inner diameter (ID). Washers are usually metal or plastic. High quality bolted joints require hardened steel washers to prevent the loss of pre-load due to Brinelling after the torque is applied. Rubber or fiber gaskets used in taps (or faucets, or valves) to stop the flow of water are sometimes referred to colloquially as *washers*; but, while they may look similar, washers and gaskets are usually designed for different functions and made differently. Washers are also important for preventing galvanic corrosion, particularly by insulating steel screws from aluminum surfaces.



Fig.3.10. Washer

3.11. Nut and Bolt

Since the nuts and bolts are not perfectly stiff, they stretch slightly underneath load, the load distribution in the threads is uneven. In fact, in a theoretically infinitely long bolt, the first thread requires a third of load, the first three threads take three quarters of the load and the first six threads essentially take all the load. Beyond the first six threads, the remaining threads are essentially dumped in all. Therefore, a nut or bolt with six threads behaves very similarly to an infinitely long nut or bolt.



Fig. 3.11. Nut and Bolt.

3.12.12 Volt Battery:

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work.



Fig.3.12. 12 Volt Battery.

IV. Methodology

The below Methodology shows the sequential operation/steps that will be performed during the project process

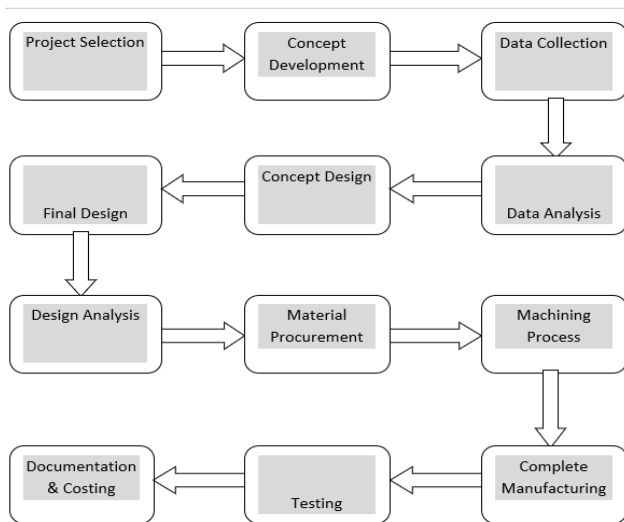


FIGURE :BLOCK DIAGRAM OF THE SYSTEM

Since this system is used at the time of the emergency during jobs. During normal vehicle driving, this system is disabled and never will impact on normal operation. When any obstacle, humans, animals or the vehicle approaches the vehicle, then the infrared installed the sensor detects that obstacle. The distance interval between vehicle and obstacle is variable. This range varies depending on the density of vehicles or people on the road. The signal received from the IR sensor is supplied to the control unit.

This control unit works the relay according to the input signal. The relay operates the solenoid valve to operate the brake and the bumper. At the same time

working The IR sensor also operated the brake, hence the brake system the flexible.

V. Result

- Motor selection:
Thus, selecting a motor of the following specifications
Single phase AC motor
Power = 1/15hp=50 watt
Speed= 60 rpm
- Power is transmitted from the motor shaft to the input shaft by means of an open V- belt drive, Motor pulley diameter $d = 20$ mm IP _ shaft pulley diameter $D = 60$ mm, $d =$ diameter of rope = 5 mm
- Shaft design: To find diameter of shaft by ASME code for commercial steel shaft. select $d=20$ mm
- Bearing selection: As shaft dia. – is 20mm so we have selection a pedestal bearing having shaft outer dia. – 20mm.
- Design of Pneumatic Cylinder: Clavarino’s equation for closed end cylinder at both ends. For ductile material use to determine the thickness of cylinder. Double acting cylinder $\varnothing 25 \times 50$ (Diameter X Stroke)

VI. Advantage

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

VII. Disadvantage

- Additional cost required for doing modification.
- System have few limitations in densely traffic road.

- System has no provision to prevent accidents from rear side of vehicle

VIII. Cost Estimation

The approximate cost required of the completion of this project is noted in the table below:

Part Name	Quantity	Total Cost (Rs)
Wheel	1	1750
Solenoid Cylinder	2	2400
Solenoid Valve	2	1600
Small Wheel	4	800
Bearing	6	330
Shaft(m)	3	285
Clamp	6	360
Battery(12V)	1	850
Electronic Circuit	1	1200
Pneumatic Pipe(m)	2.5	300
Square Pipe(ft)	2	1100
Total		15000

Table: Cost Estimation of the Project.

Conclusion

Our main focus behind the design and manufacture of this project was to reduce the number of road accidents, thus ensuring the passenger safety. Our design also reduces damage caused to the vehicle during a collision with the help of the pneumatic bumper. Make up for the shortcomings of others systems already available, our work is not just about good feasibility and high reliability, but also affordable.

OUR WORK ON THIS PROJECT HAS PROVIDED US WITH GREAT EXPERIENCE, PLANNING AND MAKING USE OF OUR PRACTICAL AND THEORETICAL KNOWLEDGE. WE ARE PROUD THAT WE HAVE COMPLETED THE WORK WITH THE LIMITED TIME SUCCESSFULLY.

The prototype we designed and manufactured is working with satisfactory conditions and is able to achieve all the objectives which we hoped to achieve.

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success is the epitome of hard work, perseverance and most of all those guidance and encouragement crowned our efforts and success.

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REFERENCES

- <https://www.irjet.net/archives/V2/i4/Irjet-v2i4171.pdf>
<http://israse.com/digital/assets/papers/FIESTA126.pdf>
<http://v3i2.ardigitech.in/AUTOMATIC%20BRAKING%20WITH%20PNEUMATIC%20BUMPER%20SYSTEM%20.pdf>
<http://www.ijserd.com/articles/IJSRDV4I10782.pdf>
http://www.jrtr.net/jrtr20/pdf/F52_Tech.pdf
<http://www.eng.uwaterloo.ca/~samir/ka/files/brakesafe.pdf>
<http://inform.wabco-auto.com/intl/pdf/815/00/57/8150100573-04.pdf>
<http://www.adam-europe.eu/prj/2047/prd/5/1/p2182e1800f1.pdf>
<http://iosrjournals.org/iosr-jmce/papers/vol11-issue1/Version-2/A011120109.pdf>
<http://www.ijserd.com/articles/IJSRDV4I40131.pdf>
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