

# Automatic Pneumatic Bumper-Braking System

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**Abstract**— In today’s world vehicle accident is the major problem. To avoid this we developed automatic braking system in our innovative project. The system is based on intelligent electronically control system known as “Automatic pneumatic-bumper braking system”. This system is used in four wheeler vehicle & heavy vehicles. This system consists of two mechanisms ie automatic braking system and pneumatic bumper system. Automatic braking system use the infrared sensor (IR), which is used to sense the vehicle coming from front of our vehicle and which is responsible for accident. Then sensor sends feedback signal to engine through the relay control to stop the working of engine. During the working of Automatic braking system simultaneously the driver also try to stop the vehicle by applying brake pedal. Limit switch is placed below the brake pedal which activates the pneumatic bumper system and brake to reduce the damage to vehicle which occurs in accidents. This system provide pre-crash safety to the vehicle. As well as it improves the response time of vehicle braking to keep safe distance between the vehicles. By using this system we can obtain control over the speed of vehicle in short distance.

**Key words:** Automatically operated braking System, Pneumatic bumper system, IR Transmitter, IR Receiver, Electromechanical system

## I. INTRODUCTION

India is the developing country in the world. India is the largest country in the use of various type of vehicles sector. While the available resources to run the vehicles like roads quality & new technologies in vehicles are being developed to avoid accidents. The number of peoples are dead during the vehicle accidents. It is very large as compared to the other causes of death. Though there are different causes for accidents but proper technology of braking system and technology to reduce the damage during accident wants to be developed. Hence there is need of proper braking system to prevent the accidents and to reduce the damage to vehicle is necessary. To achieve this goal, we design this Automatic Pneumatic Bumper braking system.

Our main aim is to design & develop automatic control system based on intelligent electronic control automotive bumper activation system called “AUTOMATIC PNEUMATIC BUMPER SYSTEM”.

It consist of IR sensor which has IR transmitter & IR receiver circuit, Control unit, Pneumatic-Bumper System. IR sensor is used to detect the obstacle coming in front of vehicle.

If there is any obstacle close to the vehicle (within 2-3 feet), the control single is given to the electronic bumper activation system & then Pneumatic-Bumper Braking System is used to protect the driver & vehicle.

## II. BASIC PNEUMATIC SYSTEM

The basic pneumatic system shown below consists of air compressor, air receiver, on-off control valve, FLR unit ie, filter lubricator & regulator unit.

The air after this is given to the system for future expansion & it uses compressed air as the working fluid which is compressed by air-compressor.

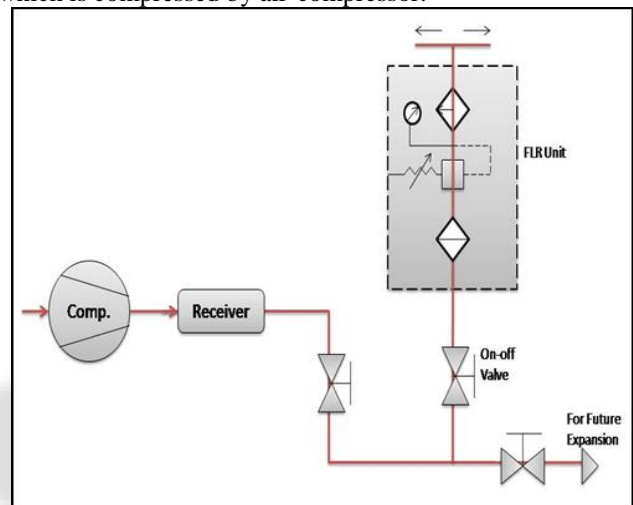


Fig. 1: Basic Pneumatic System

## III. CONSTRUCTIONAL BLOCK DIAGRAM

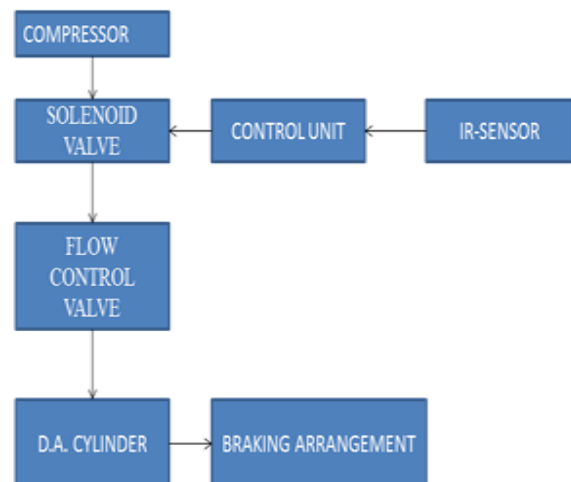


Fig. 2: Constructional Block Diagram

## IV. PARTS TO BE USED

- 4 - DC motors of 6-12 volts & 30 rpm.
- 4 - Wheels.
- Sensor – Infrared Sensor.
- Double acting pneumatic cylinder.
- Limit Switch.
- Solenoid Valve.

- Bumper.
- Stand (frame).

#### A. Sensors

- A sensor is a transducer which is used to make measurement of a physical variable.
- Any sensor requires calibration in order to be useful as a measuring device.
- Calibration is the relationship between measured variable & output signal.

##### 1) IR Transmitter

- The IR transmitter transmits the signal from sensor. The IR transmitter sends 40 kHz carrier frequencies.

##### 2) IR Receiver

- It receives reflected signals from the obstacles & IR receiver gives control signal to controlling unit.

#### B. IR – Sensor

- It is a device used to detect the presence or absence of an object by using a infrared light rays transmitter, & a IR receiver.
- It is widely used in industrial manufacturing & automatic control systems.



Fig. 3: IR-Sensor

#### C. Limit Switch

- It is A mechanical device which senses the physical movements ie, linear. It limits the mechanical motion or position with an electrical circuit.
- The most common limit switch used is the single-pole contact block with one NO (Normally open) and one NC (Normally closed) set of contacts; however limit switches are available with up to four pole.



Fig. 4: Limit Switch

#### D. Solenoid Valve



Fig. 5: Solenoid Valve

- It is a flow control device used in pneumatic system to change the direction of air flow.
- Solenoid valve is used in automatic brake system to control the compressed air towards the brake chamber during the brake needed and release the compressed air when driver release the parking brake.
- Different types of solenoid valves are available in market. But most common is  $\frac{1}{2}$  solenoid valve and  $\frac{2}{5}$  solenoid valve.  $\frac{1}{2}$  means one way operation and two ports and  $\frac{2}{5}$  means two way operation and five ports.

#### E. Electronic Relay Circuit



Fig. 6: Electronic Relay Circuit

It is a electro-mechanical device which is used to control the movement of solenoid valve & electric motor.

#### F. Hose Collar And Reducer



Fig. 7: Hose Collar & Reducer

- The function of the piping in either a hydraulic or a pneumatic system is to act as a leak proof carrier of the fluid. Steel pipes are normally used for air mains.
- For smaller lines up to about 25 mm bore copper piping nylon tubing is commonly employed with flexible lines at the takeoff points.
- Rubber hose is used for flexible lines where a wide working temperature is required or larger size is required.

#### G. Double Acting Cylinder



Fig. 8: Double Acting Cylinder

Fig shows double acting pneumatic cylinder ie, (DA Cylinder). The working fluid act alternately on both side of piston. For connecting a rod to a piston with external mechanism holes are provided both side of the cylinder. DA cylinder is used where it is needed to produce a force in both direction.

#### V. AUTOMATIC PNEUMATIC-BUMPER BRAKING SYSTEM

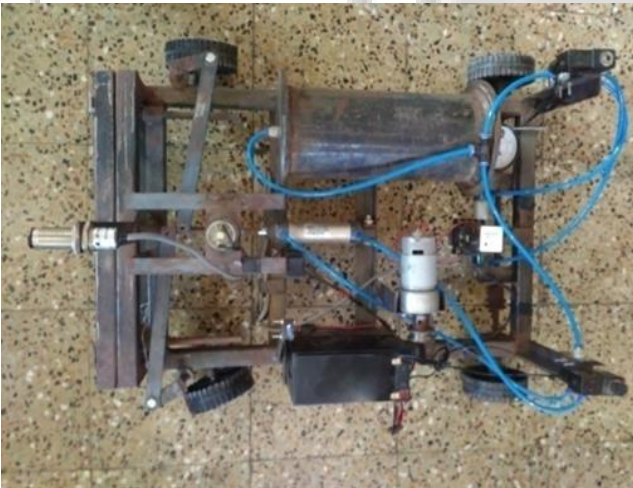


Fig. 8: Automatic Pneumatic-Bumper Braking System

The above shown figure is of the model that we have produced for our system it works on the pneumatic system. It is similar to the hydraulic system. In hydraulic system the input mechanical energy is given to the oil by pump. Whereas in pneumatic systems the working fluid is air & the air is compressed by a compressor.

Hydraulic system usually operates at very high pressures to transmit the large force and power. While pneumatic system operates at lower pressures of about 5 to 7 bar. Compressed air is used as force medium for this operation. This air is taken from the air receiver of the

vehicle & used in air brake system. The control unit consists of a relay circuit. It is a photo-sensor switch. It has two outputs.

The solenoid valve are of  $\frac{1}{2}$  solenoid valves.  $\frac{1}{2}$  indicates two ports and one way operation. Compressed air enters through first solenoid valve and expelled to atmosphere through second solenoid valve.

When driver is driving the vehicle at that time, the photovoltaic sensor is in open mode. So current cannot pass to relay circuit through the switch. When driver press the brake pedal, photovoltaic sensor senses and sends electric current to relay circuit. One of the relay output sends a voltage to first solenoid valve and now it is in opened position so the compressed air enters to break chamber and these time relay stop the current engine coil or motor current. Additional emergency switch is provided in emergency. If the driver needs bumper, then the emergency switch can also be used. It to gives the bottom of break paddle and provide voltage to the solenoid valve. So the urgent brake is applied. Moment gives extra of paddle these time limit switch is on and pneumatic bumper is operated in forward direction This can be used in the case of extreme condition.

#### VI. SELECTION OF MATERIALS

The materials used in this project are detailed as follows

##### A. Ferrous Materials

###### 1) Mild Steel

(EN – 4 to EN – 6)

Carbon – 0.15% to 0.35%

Tensile strength – 1200/1420 MPa

Yield strength – 750/1170 MPa

###### 2) C30

Carbon – 0.25% to 0.35%

Tensile strength – 620 MPa

Yield strength – 400 MPa

Izod Impact Value – 55 Nm

% Minimum Elongation – 21

Typical composition — Carbon – 0.25% to 0.3

Manganese – 0.60% to 0.90

BHN – 207

C30 material is generally used for cold formed levers, hardened and tempered tie rods, Cables, Sprockets, Hubs and Bushes – Steel Tubes.

###### 3) 40c8

Carbon – 0.25% to 0.35%

Tensile strength – 620 MPa

Yield strength – 400 MPa

Izod Impact Value – 55 Nm

#### VII. ADVANTAGES AND LIMITATIONS

##### A. Advantages

- Simple in operation
- Free from wear adjustment.
- Less power consumption.
- Lesser noisy in operation due to pneumatic system.
- System prevents accidents & provides safety to the passengers.
- System has fast response.
- System able to increase the pre-crash safety.

### B. Limitations

- Additional cost is required to use the system.
- Vehicle speed above 40-50 km/hr.
- System have few limitations in densely traffic road.
- System has no provision to prevent accidents from rear side of vehicle.

### VIII. APPLICATIONS

- For Automobile applications.
- For Industrial applications.
- Passenger car vehicles.
- This system also successfully installed in cars, Rickshaws, Tempos & heavy vehicles like buses, trucks, trailers, etc.

### IX. CONCLUSION

Our main aim behind the designing of this system is to improve the prevention technique of accidents and also reducing the hazard from accidents like damage of vehicle, injury of human etc.

We observed that our system is able to achieve all the objectives which we have determined.

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