



A Review of Systems for Automatic Bumper and Braking System for the Reduction in Impacts during Collision

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ABSTRACT: *It is very well known that the number of vehicles increases drastically all over the world. Increment in demand comes with the improvement in technologies as the people are more inclined towards the reliable, comfy and performance vehicles. There are plethora reasons causes the accidents and one of which is the unexpected encounter of the vehicles at the sharp corners and at the cross roads. So, implementation of proper passive safety system is needed to reduce the damage during the accident. And this can be archived by the design and development of the "Automatic Bumper and braking System", which is very effective concept and allows industries and institutions to understand the difficulties in maintaining the standard and forbearance of vehicles.*

KEYWORDS: *AutomaticBumper system, IR transmitter and receiver, Solenoid valve, Proximity sensor, Electropneumatic system, Electrohydraulic system, Brakes, Ultrasonic sensor*

I. INTRODUCTION

Countries like India, China and USA are the most important countries in technical and economic advancement and these leads to the use of large number of vehicles. Factors like huge traffic, road condition, inattentiveness of driver and insufficiency in technological advancement causes the accident problem and increases number of death due to accident. So, the proper technique is needed to ameliorate this situation and this can be efficiently archived by "automatic vehicle bumper and braking system".

This is the study of researches carried out in the reduction of impact during the accident by the different techniques behind the Automatic bumper and brakes . Different parameters in different techniques is discussed in this article. However the main contribution of this article is comparative study of the different principles used for the actuation of bumper and their rate of reduction in impact during accident. This study will be useful while developing a new technique or improvement in current shock absorbing technique of the "Automatic Bumper". The scope of the discussion of reduction in impact during accident by bumper systems is however limited to four wheelers only and a particular range of vehicle speed.

II. Principle for Actuation

Automatic bumper developed for automobile comprise of mainly components like single/double acting cylinder, Sensors, Receiver, Proximity sensor, Solenoid valve. But the actuation of bumper is however carried out chiefly by Pneumatically and Hydraulically. Electropneumatic system contains the compressor, after receiving the

signal that causes the high pressure to press the cylinder hence it pushes the bumper forward. On the other hand in electrohydraulic system motor is used to flow the high pressure fluid for the purpose to push bumper. Due to the compressive property and appropriate technique it provides cautioning effect during collision. For the braking purpose corresponding systems which are used for bumpers are used.

III. Components

NO.	Component	Electropneumatic	Electrohydraulic
1.	Cylinder	Single acting pneumatic cylinder  Material: Cast iron Length of stroke: 160mm Working pressure: 0-8 bar Working Temperature: 0-80 °c	Double acting hydraulic cylinder  Material: Mild steel Length of stroke: 100mm (Bumper) 50mm (brake) Working pressure: 0-10 bar Working Temperature: 0-80 °c
2.	Solenoid Valve	 Type: 5/2 Voltage: 230V Power: 6VA Working pressure: 1.5-10 bar Current: 23A AC	 Type: 3/2 Voltage: 220V Power: 6VA Working pressure: 2-10 bar Current: 23A AC
3.	Motor	DC Motor  Rated power: 0.25 HP Type: Single Phase AC Voltage: 240V Speed: 1440 RPM Pole: 4 Mounting: Foot	AC Motor  Rated power: 0.25 HP Type: Single Phase AC Voltage: 220-240V Speed: 1440 RPM Pole: 4 Mounting: Foot
4.	Sensor	IR sensor	Ultrasonic sensor
5.	Storage system	Airtight Tank	Oil tank
6.	Brake system	Air Braking system	Disc Brake system
7.	Controller	IC SE / NE 555	P89V51RD2 controller

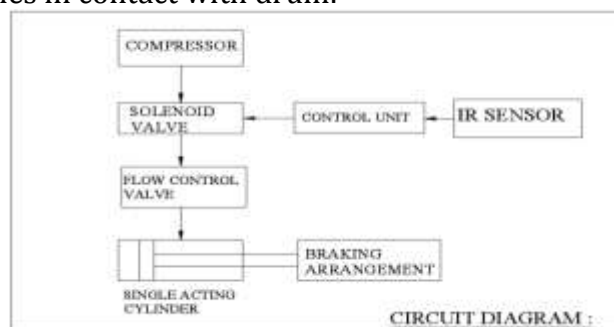
Other components like Limit switch, Receiver, Proximity sensor, Electric Relay circuit, Hoes caller and reducer, basic chassis structure, Wheels and Bumper are used in both AUTOMATIC BUMPER SYSTEMs and the specification of this parts is also approximately similar.

⇒ Functions of the stated component :

- Cylinder : Cylinders are the devices which converts air/fluid pressure in to linear mechanical force and pushes the Bumper forward.
- Solenoid valve: It is an electromechanically operated valve controlled by an electric current through the solenoid. It is used in braking system to control compressed air/fluid towards the brake chamber.
- Motor: It is the device that converts Electrical energy into Mechanical energy. Here motor is used to create high pressure for air/fluid.
- Sensor: Device which is used to sense the object if it is in the particular range of distance.
- Receiver: It receives the signal generated by the sensor.
- Storage tank: it is the reservoir for the working fluid.
- Controller: It calculates the input given by receiver and generates the algorithm for particular output.
- Electric Relay switch: It is a electro-mechanical device that is used for controlling the movement of solenoid valve & electric motor.
- Limit switch: A mechanical device which senses the physical movements.
- Hoes caller and reducer: The function of the Hoes/Pipes in either a hydraulic or a pneumatic system is to act as a leak proof carrier of the fluid and reducer controls the velocity of air/fluid.
- Bumper: It is the steel or fibre structure used to protect the frontal area of the car.

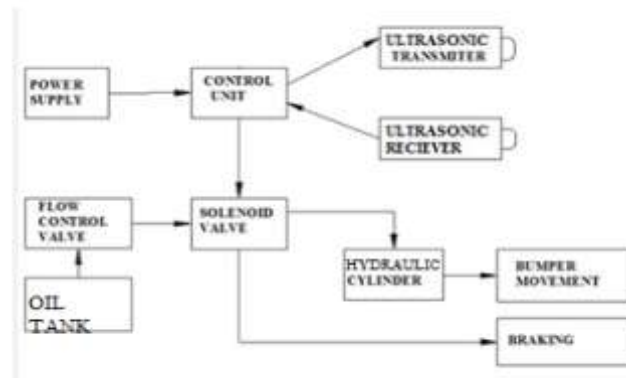
IV. Working Principle:

- Automatic Pneumatic Bumper and Braking system: The Infrared sensor emits the signal of particular wave length continuously if any object is detected in the path the signals are reflected which are received by the receiver and it transfers the data to Controller. The control circuit activates the solenoid valve which allows compressed air to come inside the piston. The air is compressed by the compressor(DC motor driven rotor) at the pressure of 5-8 bar. The air is travelled from compressor to piston with the help of leak proof hoses. This creates pressure disturbance and due to this piston moves forward and push the bumper. At the same time flow valve is opened due to piston movement which applies the brakes on the wheels due to the passing of air causing the brake paddle to comes in contact with drum.



- Automatic Pneumatic Bumper and Braking system: The Ultrasonic sensor emits the signal of particular wave length continuously if any object is detected in the

path the signals are reflected which are received by the receiver and it transfers the signal data to Controller. The controller activates the solenoid valve which allows compressed oil to come inside the piston. The oil is compressed by the compressor (AC motor driven rotor) at the pressure of 5-10 bar. The oil travels from compressor to piston by the leak proof hoses. This creates pressure disturbance in double acting cylinder as the pressure of rear portion is increases and due to this piston moves forward and push the bumper. At the same time flow valve is opened due to piston movement which causes the high pressure oil to push brake paddle and hence the brakes applies on the wheels.



V. Advantages and Disadvantages of Pneumatic Bumper system over Hydraulic Bumper system

⇒ Advantages:

- Maintenance is less in pneumatic system compared Hydraulic.
- Overall weight of the pneumatic system is less compared to Hydraulic.
- Fast response than the hydraulic system.
- Installation is simple when it is compared to hydraulic bumper system.
- Less costlier as its working fluid is air.

⇒ Disadvantages:

- Slightly noisy compared to hydraulic system.
- Wear is more as the working fluid is air whereas in hydraulic the oil it self lubricates the system.
- Location of leaking is hard to find because air is invisible.
- The pneumatic bumper system can be used in light weight vehicle only where hydraulic system can be used for medium and heavy duty vehicle as well.

VI. Advantages and disadvantages of Automatic Bumper and Braking system

⇒ Advantages:

- System provides safety to the passenger and driver as well.
- It reduces the damage of frontal area of the car during the accident.
- Response of the system is very fast
- Less power consumption
- Breaking system works effectively because at the time of accident it doesn't depend only on the reflexes of the driver.

- ⇒ Disadvantages:
- There no system used to prevent the damage at the rear of car.
- Limitation in dense traffic.
- No provision when the vehicle speed is high.

VII. Application

- ⇒ In Light vehicle like car and pickup trucks.
- ⇒ In Heavy duty vehicle and industrial vehicle.

VIII. Conclusion

It is very well known that the compressibility of the air is high than the liquid so when it comes to cautioning effect during the accident than Automatic Pneumatic bumper is more efficient, However it is only true for the Light weight vehicle.

For the Heavy and Medium Duty vehicle the use of mineral oil is desirable because, the impact or force exerted on the heavy and medium vehicle is more due to their inertia which requires system to be rigid enough to sustain that amount of force, So Hydraulic Bumper system works effectively in this condition. And in addition to that mineral oil is compressible so it gives cautioning effect During the collision.

So, it can be concluded that both system are very effective and useful not only in terms of saving the life of passenger and driver but also to reduce the damage. The selection of the system used for the actuation of Bumper lies on the type of vehicle.

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