Design of Pneumatic Bumper and Braking System

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Abstract - The technology of pneumatic has gained tremendous importance in the field of workplace rationalization and automation. A pneumatic system is a system that uses compressed air to transmit and control energy. The "Pneumatic bumper and braking system" is used to protect the vehicle from accident. It consists of ultrasonic sensor, Control Unit, Pneumatic bumper system. The ultrasonic sensor is used to detect the obstacle. If there is any obstacle closer to the vehicle, the control signal is given to the bumper activation system. Vehicle speed is sensed by the proximity sensor and signal is given to the control unit and pneumatic bumper activation system.

*Key Words***:** pneumatic , automation , proximity sensor, ultrasonic sensor , bumper activation system

1.INTRODUCTION

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. The number of peoples which are dead during the vehicle accidents is also very large as compared to the other causes of death. Though there are different causes for these accidents but proper technology of braking system and technology to reduce the damage during accident are mainly effects on the accident rates. So today implementation of proper braking system to prevent the accidents and pneumatic bumper system to reduce the damage is must for vehicles. To achieve the system modification goal there is designing of "fabrication of pneumatic bumper and braking system". This system consists of ultrasonic transmitter and Receiver circuit, Control valve, Pneumatic bumper system. The working of model is much simpler that when driver applies break more than its maximum braking limit it closes the limit switch contact points and generates output signal then it sends signal to direction control valve and it gets actuated. The solenoid direction control valve is used in this system. When it gets signal and opens the pneumatic valve as a result it pushes the piston forward along with flexible bumper. There by due to compressible properties it absorbs the sudden shocks on vehicle chassis and releases when obstacle rare.

1.1 Pneumatic Braking

It is a type of friction brake for vehicles in which compressed air pressing on a piston is used to apply the pressure to the brake pad needed to stop the vehicle. Air brakes are used in large heavy vehicles, particularly those having multiple trailers which must be linked into the brake system. The air compressor operated by the engine forces air through the water and oil separator to the air reservoir. The air pressure in the reservoir is indicated by a pressure gauge. The reservoir contains enough compressed air for several braking operations. From the reservoir the air is supplied to the brake valve. If brake pedal is not depressed, brake valves stop the passage of air to brake chambers and there is no braking effect.

1.2 Double acting pneumatic cylinder

A double acting pneumatic cylinder is one where the thrust, or output force, is developed in both extending and retracting directions. Double acting cylinders have a port at each end and move the piston forward and back by alternating the port that receives the high-pressure air, necessary when a load must be moved in both directions such as opening and closing a gate. Air pressure is applied alternatively to the opposite ends of the piston. Application of air pressure produces a thrust in the positive (push) stroke, and a thrust in the negative (pull) stroke

2. WORKING PRINCIPLE

In this concept of development of pneumatic bumper and breaking system, there are problems like range of sensors, speed regulation and many more.The ultrasonic circuit is to transmit the ultrasonic rays. If any obstacle is there in a path, the ultra-sonic rays are reflected. These reflected ultrasonic rays are received by the receiver. The receiver circuit receives the reflected rays and giving the control

signal to the control circuit. The control circuit is used to activate the solenoid valve. If the solenoid valve is activated, the compressed air passes to the Single Acting Pneumatic Cylinder. The compressed air activates the pneumatic cylinder and moves the piston rod forward. Thus, the bumper is actuated. When the solenoid valve gets actuated the compressed air also goes to the small single acting pneumatic cylinder and actuates it. If the piston moves forward, then piston rod which is connected to the lever of the hydraulic disc brake pushes and hence the brake is applied.

fig -1: pneumatic connection

3. CALCULATIONS

3.1 FORCE CALCULATION
Applying of newton 2nd law of motion
Firstly we estimate the mass of car and observe the pickup i.e acceleration of car,
Secondly, we apply the law by multiply the mass and acceleration we will get force .
Force = mass *acceleration (2nd law of motion)

3.2 STOPPING DISTANCE (D)

For calculating stopping distance we need to conserve energy i.e conserving the kinetic energy at specified speed and equating to work done by friction force
Kinetic energy= $0.5mv^2$
Friction force =$u*m*g$
Where
u=dry friction coefficient
m= mass of vehicle,

g=acceleration due to gravity
v= instantaneous velocity of vehicle

Applying conservation of energy
$0.5mv^2 = (umg)*D$

3.3 IMPACT FORCE OR DYNAMIC ENERGY
it can be expressed as kinetic energy which is equal to
$K.E=0.5 \ mv^2$

4 EXISTING SYSTEM

As till now date many discoveries have been made regarding bumper activation and its stroke but the actuating forces was due to electricity, electromagnet and even pneumatically controlled.
Pneumatic system is preferred due to silent nature , low maintenance and less heaviness.

5 MODIFICATION

As by this concept many question like "it will apply brake and apply bumper stroke when ever any obstacle comes near its sensing range? ".
But doing a little bit modification like setting up microprocessor and loaded with some programming that deals with the numerical calculation and calculate the stopping distance which is required for the given speed at which vehicle is driven.
The above mentioned point shows that the system will be fully automatic as it includes severe coding and all.
Although it can be made semiautomatic by much simpler way that when driver applies break more than its maximum braking limit it closes the limit switch contact points and generates output signal then it sends signal to direction control valve and it gets actuated. The solenoid direction control valve is used in this system. When it gets signal and opens the pneumatic valve as a result it pushes the piston forward along with flexible bumper. There by due to compressible properties it absorbs the sudden shocks on vehicle chassis and releases when obstacle rare.

6 CONCLUSION
In this paper I have designed the pneumatic bumper and braking system which is supported by different laws like conservation of energy and newton 2nd law of motion which helps me to calculate different
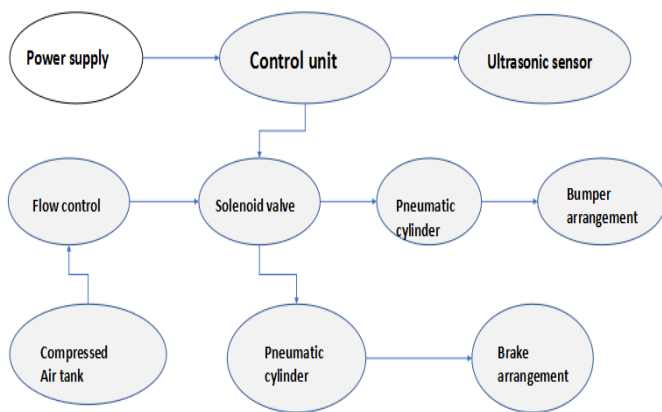
parameter like stopping distance , impact force and calculation of force.

As this simple easy to install in vehicle can bring a lot change in result of accident . As we cannot reduce the accidents (apart from following traffic rules) but what we can do is to reduce its effect by minimizing the number of death and injuries.

7 REFERENCES

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