International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 11, 2019 (Special Issue)

AUTOMATIC PNEUMATIC CONTROL BRAKING SYSTEM

J.Dilipsingh[1]
Department of mechanical engineering
Jeppiaar engineering college
Chennai,India

K.Arul[2]
Department of mechanical engineering
Jeppiaar engineering college
Chennai,India

M.Ayyandurai[3]
Department of mechanical engineering
Jeppiaar engineering college
Chennai,India

T.Arunkumar[4]
Department of mechanical engineering
Jeppiaar engineering college
Chennai,India

Abstract
In our project automatic braking technology for automobile is used to sense and intimate collision with the vehicle or person or obstacles.We are fixing the ultrasonic sensor in the bumper and the ultrasonic sensor sense the obstacles, then halls effect sensor which detect the speed of vehicle both the sensors send the signal to the micro-controller which actuates the brake and clutch by using pneumatic system.Therefore by using this automatic pneumatic control braking system, we can ensure the safety of the vehicle and also avoid accidents due to human error.

Keywords: Brake, pneumatic, micro-controller

Introduction

A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle, wheel, axle, or to prevent its motion, most often accomplished by means of friction. Most brakes commonly use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed. Brakes are generally applied to rotating axles or wheels, but may also take other forms such as the surface of a moving fluid (flaps deployed into water or air). Some vehicles use a combination of braking mechanisms, such as drag racing cars with both wheel brakes and a parachute, or airplanes with both wheel brakes and drag flaps raised into the air during landing.

I. LIST OF COMPONENTS

A. BRAKES

Most brakes commonly use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed. For example, regenerative braking converts much of the energy to electrical energy, which may be stored for later use. Other methods convert kinetic into potential energy in such stored forms as pressurized air or pressurized oil. Eddy current brakes use magnetic fields to convert kinetic energy into electric current in the brake disc, fin, or rail, which is converted into heat. Still other braking methods even transform kinetic energy into different forms, for example by transferring the energy to a rotating flywheel. Maintaining the Integrity of the Specifications

B. DRUM BRAKE

A drum brake is a vehicle brake in which the friction is caused by a set of brake shoes that press against the inner surface of a rotating drum. The drum is connected to the rotating road wheel hub.

C. ELECTROMAGNETIC BRAKE

Electromagnetic brakes are likewise often used where an electric motor is already part of the machinery. For example, many hybrid gasoline/electric vehicles use the electric motor as a generator to charge electric batteries and also as a regenerative brake. Some diesel/electric railroad locomotives use the electric motors to generate electricity which is then sent to a resistor bank and dumped as heat. Some vehicles, such as some transit buses, do not already have an electric motor but use a secondary "retarder" brake that is effectively a generator with an internal short-circuit. Related types of such a brake are eddy current brakes, and electro-mechanical brakes.

D. SINGLE ACTING CYLINDER

Single acting cylinder applies pneumatic air pressure to one end of the piston to extend or retract. Thus, they perform work in only one direction of movement. Single acting cylinders have only one compressed air connection. The incoming compressed air moves the piston in one direction, and the cylinder force is built up in this direction. If the piston needs to return to its initial position, the air is simply expelled from the cylinder. The mechanical spring pushes the piston back to its initial position. This part has exhaust hole so that no excess or low pressure is generated through the piston movement in the second cylinder chamber. For example, cylinders used in car jacks use the weight of the jacked vehicle to return the cylinder to its rest position. Cylinder that are used to open ventilation damper may have an integral spring to return the cylinder, and the damper, to its rest position.

E. SOLENOID VALVE

A solenoid valve is an electromechanical valve that is controlled by an electric current. The electric current runs through a solenoid, which is a wire coil wrapped around a

metallic core. A solenoid creates a controlled magnetic field when an electrical current is passed through it. This magnetic field affects the state of the solenoid valve, causing the valve to open or close. Solenoid valves are used to transport gases or liquids and have a wide variety of applications, including irrigation, sprinkler systems and industrial uses.

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV; this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts. This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve. A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoid is one in which the plunger is pulled when the solenoid is energized.

II. WORKING

In our project, the ultrasonic sensor is connected to solenoid valve. The compressor is connected to the pneumatic cylinder through flow control valve and solenoid valve. The piston of the pneumatic cylinder is connected to the brake lever. The connections between the valves, cylinder and compressor are connected by polyurethane hoses. This whole setup is welded in a cast iron frame.

A. Step 1

The brake and clutch are controlled by using the source of pneumatic supply (air). This can be handled by using the directional control valve or DC valve. The air is supplied from the compressor. In this piston rod is connected to the brake and cylinder is connected to the frame of the body. The sensors and microcontroller are fixed to the frame which controls the solenoid valve movement in the dc valve. The 5/2double side directional control valve can be used for the operation of forward and return stroke of the pneumatic cylinder.Equations

Halls effect sensor which help to detect the speed give the input when it reach certain speed so it on the ultrasonic sensor through the microcontroller. To avoid the detection of object using ultrasonic sensor during slow moving traffic and traffic jam. Ultrasonic sensor detect the object when it come near to ultrasonic sensor. With the help of with the help of sensors such as ultrasonic and halls effect sensor through microcontroller break is applied. When ultrasonic sensor detects an object it produce the signal and give input to microcontroller. the microcontroller produce output signal which actuates the solenoid valves where the compressed air moves to pistons in pneumatic cylinders movement where it release the clutch then the break gets engage. halls effect sensor detects speed when the sped comes to zero rpm it produce the signal and give input to microcontroller.

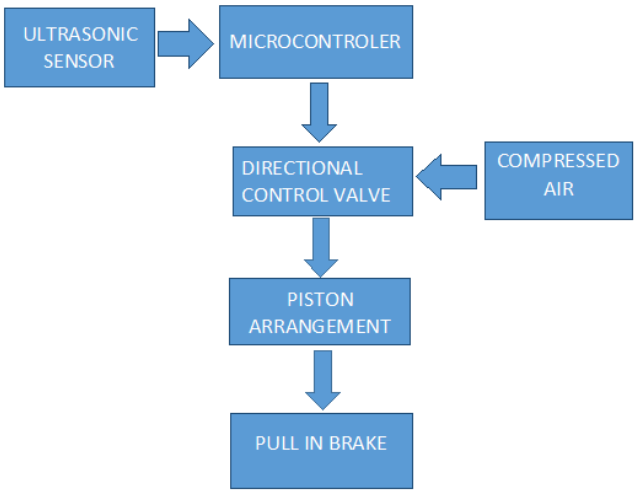
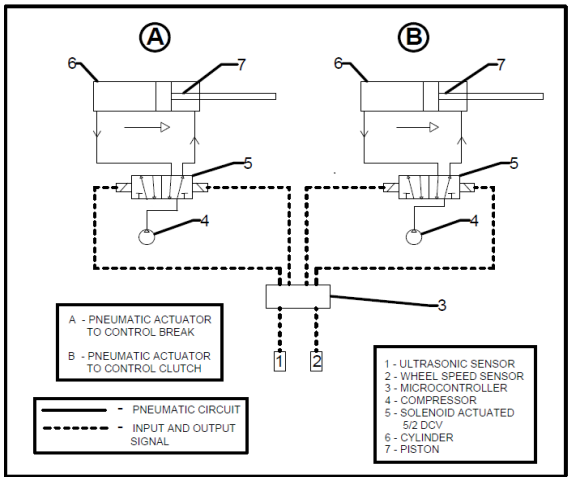


Fig 1 automatic of pneumatic controlled breaking system

Halls effect sensor which help to detect the speed give the input when it reach certain speed so it on the ultrasonic sensor through the microcontroller. To avoid the detection of object using ultrasonic sensor during slow moving traffic and traffic jam. Ultrasonic sensor detect the object when it come near to ultrasonic sensor. With the help of with the help of sensors such as ultrasonic and halls effect sensor through microcontroller break is applied. When ultrasonic sensor detects an object it produce the signal and give input to microcontroller. the microcontroller produce output signal which actuates the solenoid valves where the compressed air moves to pistons in pneumatic cylinders movement where it release the clutch then the break gets engage. halls effect sensor detects speed when the sped comes to zero rpm it produce the signal and give input to microcontroller. the microcontroller produce output signal which actuates the solenoid valves where the compressed air moves to pistons in pneumatic cylinders movement where it engage the clutch then the break gets disengage simultaneously.

III. Cad Diagram



IV. FABRICATION PROCESS

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.

These processes use a welding power supply to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is sometimes protected by some type of inert or semi-inert gas, known as a shielding gas, and filler material is sometimes used as well.

A. Power supplies

To supply the electrical power necessary for arc welding processes, a variety of different power supplies can be used. The most common welding power supplies are constant current power supplies and constant voltage power supplies. In arc welding, the length of the arc is directly related to the voltage, and the amount of heat input is related to the current. Constant current power supplies are most often used for manual welding processes such as gas tungsten arc welding and shielded metal arc welding, because they maintain a relatively constant current even as the voltage varies.

B. Processes

One of the most common types of arc welding is shielded metal arc welding (SMAW); it is also known as manual metal arc welding (MMA) or stick welding. Electric current is used to strike an arc between the base material and consumable electrode rod, which is made of filler material (typically steel) and is covered with a flux that protects the weld area from oxidation and contamination by producing carbon dioxide (CO2) gas during the welding process. The electrode core itself acts as filler material, making a separate filler unnecessary.

V. CALCULATION

Diameter of the piston (D) = 25x10-3 m
Diameter of the piston rod (d) = 12x10-3 m

Aream of piston (Ap) = π /4*(D2)
= π/4 (25x10-3)2
= 4.908×10-4 m2

Aream of piston rod (Ar) = π /4*(d2)

For maximum pressure (Pr) = 5 bar
Force on the expansion stroke = Pr×Ap
= 1×105×(4.908×10-4)
= 245.43N

Force on the retardation stroke = Pr× [Ap- Ar]
= 1×105×[4.908×10-4 -1.1309×10-4]
= 188.88N

Force acting on the moving vehicle = m×a
Assume ,
Mass of the vehicle, m = 100kg
Acceleration, a = 1m/sec

Force = 100×1
= 100 N

Force acting on the vehicle is in slop = m×g×sin θ
Assume ,
Mass of the vehicle, m = 100kg
Gravity = 9.81m2/sec
Angle of inclination, θ = 45°
Force = 100×9.81× sin 45°
= 693.67N

Pressure acting on the cylinder when the force acting is 693.67N
Force on the expansion stroke = Pr×Ap
693.67N = Pr×4.908×10-4
Pressure, Pr =14.133 bar

Force on the retardation stroke = Pr× [Ap- Ar]
693.67 = Pr× [4.908×10-4 -1.1309×10-4]
Pressure, Pr = 18.365bar

VI. CONCLUSION

In our project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gap between institution and industries. We are proud that we have completed the work with the limited time successfully. The automatic pneumatic controlled brake is working with satisfactory conditions. 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.

In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed an automatic pneumatic controlled brake which helps to know how to achieve low cost automation. The application of pneumatics produces smooth operation. By enhancing this technique, the system can be modified and developed according to the applications.

References

[1] Refer from "International Journal of Engineering Trends and Technology (IJETT) Volume 5 number I Nov 2013 Fabrication Of High Speed Indication And Automatic Pneumatic Braking System" by P.Balashanmugam, K.Balasubramaniyan , G.Balasubramaniyan ,S.Vinoth

[2] Refer from "International Journal of Engineering Trends and Technology (IJETT) Volume 3 number 2 Feb 2014 Review of Speed Control and Automatic Braking System" Gopal P. Gawande, Shruti V. Gavhale, Irshad A. Zariye, Sagar P. Ritpurkar

[3] Refer "IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) volume9 issue 3 may 2014 High Way Vehicle Speed Control & Automatic Braking System" by Avvaru Subramanyam, K.Satya Rajesh, L.Bharhav Kumar

[4] Refer " united states patent patent no US 7670259B2 on mar 2010" by Andrew l.mitchell, Brett R.Caldwell