



Electric Based Braking System

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ABSTRACT

The technology of Electric has gained tremendous importance in the field of workplace rationalization and automation from old-fashioned timber works and coal mines to modern machine shops and space robots. It is therefore important that technicians and engineers should have a good knowledge of pneumatic system, air operated valves and accessories. The air is compressed in an air compressor and from the compressor plant the flow medium is transmitted to the pneumatic cylinder through a well laid pipe line system. To maintain optimum efficiency of pneumatic system, it is of vital importance that pressure drop between generation and consumption of compressed air is kept very low.

The aim is to design and develop a control system based on an intelligent electronically controlled automotive braking system called “ Electric Based Braking system ” it consists of Tachometer, Control Unit, Pneumatic breaking system. The tachometer is used to detect the speed of the wheel. When the driver sets a desired speed limit the tachometer detects any increase above the set speed limit and uses the Electric Cylinder braking system to apply sufficient braking to bring down the speed to the set limit.

INTRODUCTION

It is a brake system that has a mechanism which presses the disc brake pad against the brake rotor by a direct motor driven instead of hydraulic pressure. The ECU (electronic computer unit) judges the electronic signals from the brake pedal and vehicle dynamic information from vehicle sensors, and operates the electric actuator to control the braking force.

Nomenclature:

BLOCK DIAGRAM AND EXPLANATION

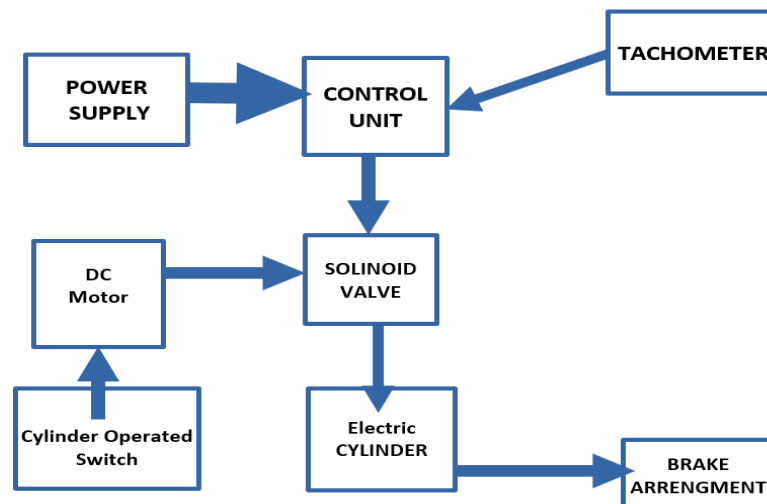


Figure 3.1 WORKING SYSTEM BLOCK DIAGRAM

The block diagram depicts the working of the system. The tachometer continuously sends the speed of the wheel to the control unit. When the driver sets his required speed limit the control unit monitors for any increase in the speed of the wheel. When the speed increases the control unit sends a signal to the actuator which controls the flow of air into the Electric braking system. This actuator allows enough pressure to reduce the speed of the vehicle but not stop the vehicle.

EXPERIMENTAL EQUIPMENT AND INSTRUMENTATION:-

- SAEFTY SYSTEM
- Electric
- BRAKE ARRANGEMENT
- SOLENOID VALVE
- FLOW CONTROL VALVE
- PU CONNECTOR, REDUCER, HOSE COLLAR
- FRAME
- SINGLE PHASE INDUCTION MOTOR

4.1 SAFETY SYSTEM:

The aim is to design and develop a control system for pneumatic breaking system and intelligent electronically controlled automated speed control system. Based on this a control unit was used to help automate this system. The control unit used was a Arduino Uno controller.

MICROCONTROLLERS

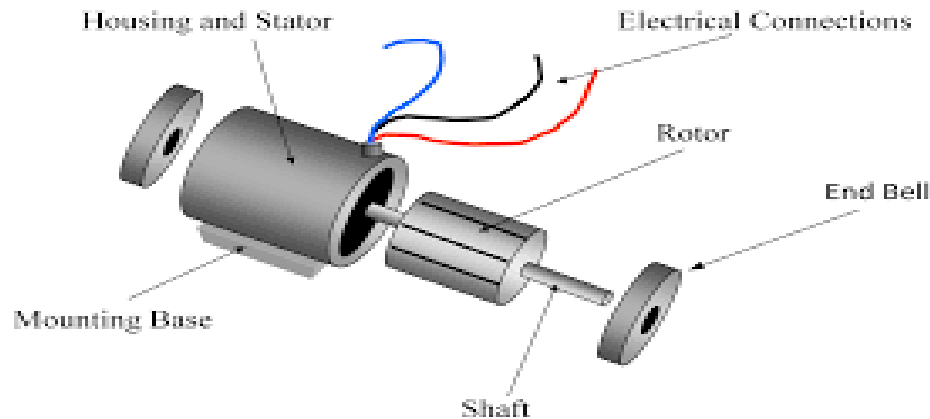
A microcontroller is a computer present in a single integrated circuit which is dedicated to perform one task and execute one specific application. It contains memory, programmable input/output peripherals as well a processor. Microcontrollers are mostly designed for embedded applications and are heavily used in automatically controlled electronic devices such as cellphones, cameras, microwave ovens, washing machines, etc.

SOME OF ITS ADVANTAGES INCLUDE :-

- It is far more economical to control electronic devices and processes as the size and cost involved is comparatively less than other methods.
- Operating at a low clock rate frequency, usually use four bit words and are designed for low power consumption. □
- Architecture varies greatly with respect to purpose from general to specific, and with respect to microprocessor, ROM, RAM or I/O functions.
- Has a dedicated input device and often has a display for output.
- Usually embedded in other equipment and are used to control features or actions of the equipment.
- Program used by microcontroller is stored in ROM.
- Used in situations where limited computing functions are needed

SINGLE-PHASE MOTOR:-

Because it has but a single alternating current source, a single-phase motor can only produce an alternating field: one that pulls first in one direction, then in the opposite as the polarity of the field switches. A squirrelcage rotor placed in this field would merely twitch, since there would be no moment upon it. If pushed in one direction, however, it would spin. The major distinction between the different types of single-phase AC motors is how they go about starting the rotor in a particular direction such that the alternating field will produce rotary motion in the desired direction. This is usually done by some device that introduces a phaseshifted magnetic field on one side of the rotor. The figure the performance curves of the four major types of single-phase AC motors.



RESULT AND CONCLUSION

RESULT:-

The project was designed and fabricated according to the mentioned specifications. The initial tests performed on the fabricated project worked wonderfully. The functionality of the project was achieved which was to reduce the speed of the vehicle and not stop it completely, which was achieved with slight tweaking to the software and the position of the Electric. There were 5 tests done on the fabricated machine which proved to us that the model worked according to design and functional specifications. Due to the recent pandemic no further tests could have been performed on the model and thus some aspects of the model are still to be tested out and unidentified issues are still to be rectified. There were no calculation done on the model, therefore identifying working of few key components are yet to be determined.

SCOPE OF WORK:-

This project hold a strong ground for future work. Some key parts of the projects can be worked on in the future to check for usability in the market.

Some of the tests could not be performed due to the pandemic and thus are included in the scope of future works.

Some of the key areas where future work can be done is listed as below :-

- The effects of this system on the brake pads of the vehicle. From a general perspective this system would have a large impact on the longevity of the brake pads, as brake pads are the active component in this project keeping the vehicle's speed on the set limit.
- Tests on higher RPMs and high speed can be done. Due to the costs involved in using powerful motors to achieve high RPM and high speed they couldn't be performed.
- Use of better Electric equipment for more sensitive and accurate reduction of speed. The use of better two way Electric pistons for faster engage and disengage of braking. Use of a better control valve.
- The software of the system can be updated to get better results. The control unit which is the Arduino Uno can be programed better to help with lowering of wear of brake pads, it can also help with more accurate and precise braking and integrating some sort of ABS module into the system will surely help with smooth application of braking.

METHODOLOGY

1. Fabrication of chassis of the setup is made using MS.
2. A wheel is used to resemble the tire of a HTV.
3. The wheel is assembled to the chassis.
4. Speed sensors are fixed to the chassis.
5. The Electric brakes are then integrated into the setup.
6. A programed Arduino microprocessor is used to tie the whole setup.
7. The movement of wheel is simulated by using an electric motor which is connected to the wheel through a belt.

WORKING

This project is designed to reduce stress of drivers of heavy duty vehicles. Keeping this in mind the project makes the use of already available systems in the vehicle to help integrate this equipment easily. The use of pneumatic brakes in the vehicle is important as Electric use atmospheric air to control the braking system, which reduces the force required to apply the brakes.

When the driver of the vehicle decides he needs to maintain a certain speed limit, be it for docking , toll plaza or even to maintain the speed limit of the road all he needs to do is set the speed limit to his liking. The wheel speed sensors (Tachometer) which will always be monitoring the speed of the wheel, sends its information to the programmed control unit (Arduino Uno) which monitors the speed of the vehicle and checks if any limit has been set by the driver. When a limit is set and the vehicle is moving above the set limit the control unit also connected to the actuator, sends the signal to the actuator which is intern connected to the control valve.

This control valve is the main part of the Electric braking system which regulates the flow of air into the pistons. This control valve has an input connection from the air tank/reservoir ,which holds compressed air from the air compressor. When the speed limit is crossed the actuators are activated opening the control valve and slowly reducing the speed of the vehicle back to the set limit. The system then resets and the whole cycle is repeated if the limit is crossed.

CONCLUSION

This project has helped us to showcases our capabilities by providing a great opportunity and showcase our experience and knowledge that we gained form our academies. We gained a lot of practical and theoretical knowledge by reading the many articles and journals papers related to our topic. Which made to understand the concepts related to Electric brakes.

We gained knowledge on planning, purchasing , assembling , machining and manufacturing while doing this project. We tried to eliminate the problems faced by truck drivers on their day to day routine on the road. By doing so we hope to ease their mental and physical pain of the truck drivers.

We are proud to complete this project with the limited time and limited sources that was available to us. The project “Electric Cylinder Based Braking system ” is going on with satisfactory condition, also justifies its functionality. Few trials were done inically to check the functionality of the model. But due to the pandemic, calculations was not complete. We realize the need for tolerance and quality which play an important role in manufacturing a product. With few changes and adjustments this project could see the market in the coming future.

REFERENCES

- [1] A Microprocessor System of Automatic Control by Electric Braking of Freight Long Trains.O. E. Pudovikov and S. A. Murov
- [2] Electric Brake Control for Precision Stopping of Heavy-Duty Vehicles.
- [3] Fabrication Of High Speed Indication And Automatic Electric Braking System P.Balashanmugam1 , K.Balasubramaniyan G.Balasubramaniyan3 ,S.Vinoth4 1Assistant Professor, Mechanical Engineering,
- [4] MICROCONTROLLER BASED AUTOMATIC VEHICLE OVER SPEED INDICATION AND CONTROLLING SYSTEM
- [5] OVER SPEED INDICATION AND ACCIDENT PREVENTION SYSTEM Prof. V.V.khadakkar 1 , Prof. S.M.Awhale 2 , Prof. V.V. Brokar 3 1,2,3Lecturer in Mechanical Engineering Department CSMSS college of Polytechnic, Aurangabad.
- [6] Automatic Brake Failure Indicator and Over Heating Alarm Dr.N.Venkatachalapathi1 , V. Mallikarjuna2 Professor and Head1 , Assistant Professor2 Department of Mechanical Engineering, Annamacharya Institute of Technology & Science, Rajampet, A.P – India
- [7] Electric Brake Control for Precision Stopping of Heavy-Duty Vehicles
- [8] Design and Analysis of Intelligent Braking System Mr. Tushar Kavatkar1 Mr. Harshal Salvi2