

# Review on Braking System

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**Abstract-** In recent years, the automobile industry has seen huge developments and most of them are particularly focused towards improving the safety of not only the individuals sitting inside the vehicle but also the ones who are within a certain range of the vehicle. There are safety systems which are being continuously developed and tested such as the AEBS (Automatic Emergency Braking System) which, as the name suggests, applies the brakes automatically thereby reducing the casualties. The systems which are currently being used are the Traction control (TC), Brake Assist (BA), Anti-Lock Braking System (ABS) and the Electronic Stability Control (ESC). These systems help the driver to have better control over their car. With the help of this paper, we aim to review the current braking systems and explore their advantages and disadvantages.

**Keywords-** AEBS (Automatic Emergency Braking System), TC (Traction Control), BA (Brake Assist), ABS (Anti-Lock Braking System), ESC (Electronic Stability Control), Sensors.

## I. INTRODUCTION

The automatic braking system is a combination of various components such as the sensors and brake control which prevent or assist the driver to avert a collision. The warnings can be in the form of an audio or a visual (on a display system attached to the vehicle) when the obstacle comes within a certain predefined proximity.

**Need for automatic braking system:** Whenever the vehicle comes too close to another vehicle, an alarm is triggered and the driver is warned. The reaction time of a human in this situation is a little longer as compared to an autonomous system and hence the automatic brakes are used so that the time taken to apply the brakes after the alarm is triggered, is minimised.

This project will be developed with the main aim to reduce the reaction time and hence improve the safety. Using an ultrasonic sensor, a signal will be sent to the relays and solenoid valve. These signals will actuate the pneumatic cylinder which pushes the brake lever and applies the brake.

### A. Key Objectives:

- 1) *Improving on road safety:* According to the National Safety Council, one of every four accidents occurs while the vehicle is operating in reverse. Approximately 500 deaths and 15000 injuries are caused due to 'Backing' and 'Back-Over'. This is a huge concern keeping in mind that reverse speeds of automobiles are usually very less. Reducing the number such accidents and accidental deaths serves as the main objective of our project. Backing accidents cost business owners and insurance companies millions of rupees in vehicle property damage, this too can be reduced and controlled using intelligent reverse braking mechanism.
- 2) *Decreases scope of human error:* The second objective of this project is to decrease human involvement and switch reverse braking from manual to complete automatic. Backing accidents are 100 percent preventable because they are always caused by human error. Human error comes in many forms some of which are as follows:
  - Blind Spots while driving in reverse
  - Inappropriate use of technology (backup alarms and closed-circuit TV cameras)
  - Poor response time of the driver

- Fatigue and lack of rest
  - Lack of concentration during driving
- 3) *Easy maintenance:* Since this prototype is detachable, it becomes easy to maintain in case of malfunction. Any issue with the working of the system can be addressed separately without interfering with the dynamics of the automobile. This makes the system independent and less complex.

II. LITERATURE

After doing research on various breaking mechanisms which are used in the automobile industry currently, we found that these systems are most widely used:

A. *Mechanical Brakes:* This type of braking system can further be classified into the following:

- Disc brakes- Brakes are applied due to the friction that is generated between the disc and the wheel. The braking pads are applied to the brake calliper. When the brake lever is pushed, the force acts on both sides of the disc evenly and the speed is regulated.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• Generates less heat</li> </ul>	<ul style="list-style-type: none"> <li>• It is expensive when compared to drum brakes</li> </ul>
<ul style="list-style-type: none"> <li>• Requires less brake torque to stop the vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• more moving parts hence complexity increases</li> </ul>
<ul style="list-style-type: none"> <li>• Much safer in hard braking conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Requires periodic changing of brake pads</li> </ul>

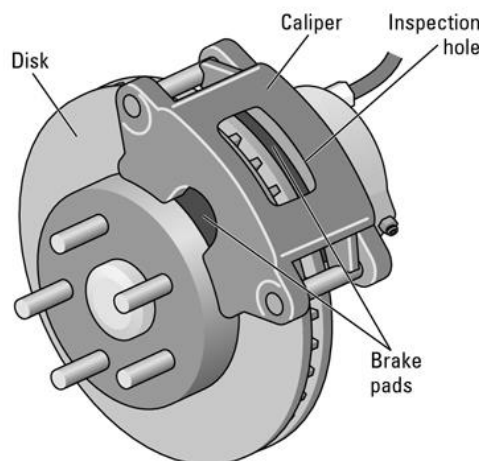


Fig. 1 Example of disc brake.

Source: www.dummies.com

- Drum brakes- The friction is generated between the pads and the inner surface of the rotating drum. This drum is attached to the rotating wheel. These brakes are cheaper in production, easy to maintain and inspect.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>Easier to maintain due to better corrosion resistance</li> </ul>	<ul style="list-style-type: none"> <li>Can collect water which will reduce frictional properties</li> </ul>
<ul style="list-style-type: none"> <li>Cheaper production and purchase cost</li> </ul>	<ul style="list-style-type: none"> <li>Experiences brake fade faster</li> </ul>
<ul style="list-style-type: none"> <li>Can produce more braking force</li> </ul>	<ul style="list-style-type: none"> <li>Heats up more quickly</li> </ul>

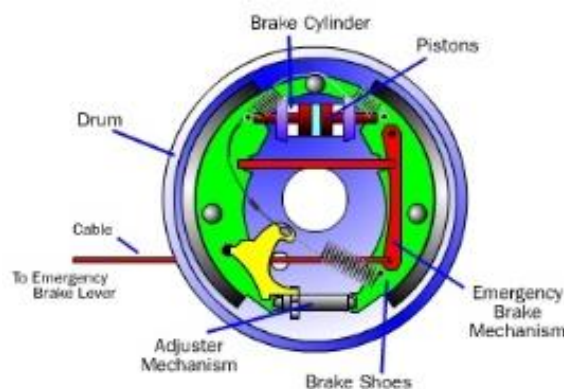


Fig. 2 Example of drum brakes.  
<https://auto.howstuffworks.com>

B. *Hydraulic Brakes:* Glycol ethers and other braking fluids are used to transfer the pressure from the controlling mechanism to the braking mechanism. These type of brakes are commonly used in multiple piston systems and the fluid is equally distributed which increases the braking capacity

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>Wear rate of brake lining is low</li> </ul>	<ul style="list-style-type: none"> <li>Braking system fails if there is a leak in the brake lining</li> </ul>
<ul style="list-style-type: none"> <li>Increase in braking action on all wheels</li> </ul>	<ul style="list-style-type: none"> <li>Presence of air in the tubing decreases the efficiency of the brake</li> </ul>
<ul style="list-style-type: none"> <li>Improved mechanical advantage</li> </ul>	<ul style="list-style-type: none"> <li>Cost of maintenance is high as the filters need to be changed regularly</li> </ul>

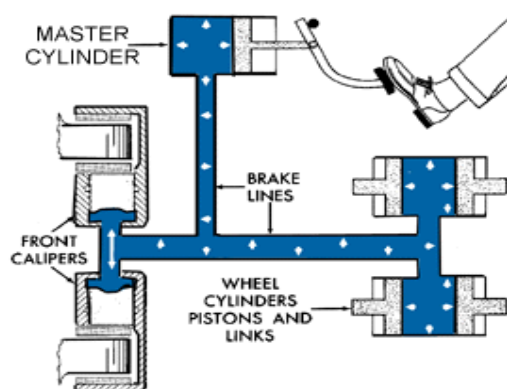


Fig. 3 Example of hydraulic brakes.  
 Source: [www.mechanicalmania.blogspot.in](http://www.mechanicalmania.blogspot.in)

C. *Electromagnetic Brakes:* The hybrid vehicles use this type of braking system in which an electric motor is used. The friction needed for stopping the vehicle is generated by the eddy currents which are flowing in the direction opposite to the rotation of the wheel. This eddy current is due to the magnetic flux which passes in the direction perpendicular to the rotation of the wheel.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• Friction is eliminated hence tire deterioration is less</li> </ul>	<ul style="list-style-type: none"> <li>• Battery is required to energize the braking system</li> </ul>
<ul style="list-style-type: none"> <li>• No oil leakage</li> </ul>	<ul style="list-style-type: none"> <li>• Installation is difficult due to lack of space between gearbox and rear axle</li> </ul>
<ul style="list-style-type: none"> <li>• Brakes remain cool due to higher heat dissipation efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Needs a separate compressor for proper working which increases complexity and cost</li> </ul>

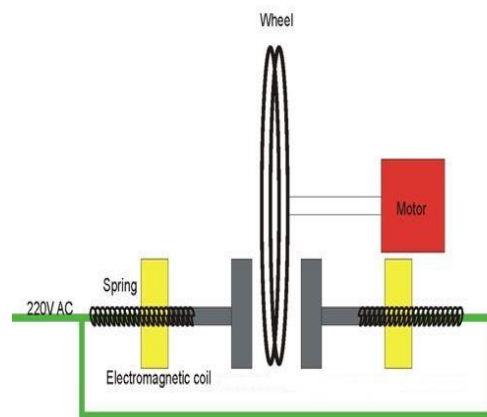


Fig. 4 Example of electromagnetic brakes.  
Source: www.mechanicalbuzz.com

D. *Pneumatic Brakes:* When air is used as the braking fluid, the system is called as the pneumatic braking system. It is also called as air brakes or compressed air brakes. The compressor compresses the air and stores it in the reservoir. It works on the principal of application of brakes due to friction. When put to use, the pneumatic cylinder is actuated and the piston moves forward and pushes against the brake pedal and that engages the brakes.

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> <li>• Medium used for braking is easily available (air)</li> </ul>	<ul style="list-style-type: none"> <li>• Increased noise level due to compressed air</li> </ul>
<ul style="list-style-type: none"> <li>• Has better reliability as compared to hydraulic brakes</li> </ul>	<ul style="list-style-type: none"> <li>• Pressurised air is easily condensed which increases moisture</li> </ul>
<ul style="list-style-type: none"> <li>• Increased safety since no risk of fire or explosion (absence of braking oil)</li> </ul>	<ul style="list-style-type: none"> <li>• Pressure can be easily lost due to leakage</li> </ul>

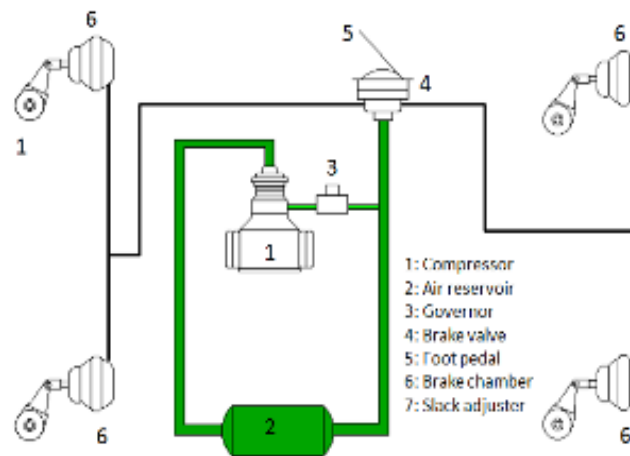


Fig. 5 Example of pneumatic brakes.  
Source: www.mechanicalbooster.com

### III. CONCLUSION

Upon further research, we found that on an average 3200 deaths occur in a day due to accidents. Apart from this more than 20 million people who are disabled due to road accidents. This not only has an effect on human lives but also has a devastating effect on the global economy which costs around 65 billion dollars annually.

With the industrial revolution, the number of vehicles being driven have increased ten folds. This in-turn has led to increase in human error and according to the survey conducted in Georgia Personal Injury Block (2016), 94% of these accidents were caused due to human error or bad decisions.

Since human error being a major cause of these accidents, we plan to fabricate an automatic braking system which will reduce the human interference and hence improving the efficiency and increasing the safety.

- A. *Future scope:* There is a huge scope of research and development in the field of braking system which needs to be explored.
- According to the current and growing importance of safety features included in a vehicle, these automatic / self-reliable systems will hold a key position in the industry.
  - The detection and warning systems are already being implemented on a large scale but are unable to provide the required safety. The manual cars are likely to become obsolete in another 20 years.
  - By the end of the year 2020, 15% of the Indian car market is predicted to shift to automatic braking.
  - Fully automated vehicles is another concept which has caught the attention of a lot of companies, Apple, Google and Uber are one of the top competitors in the race to develop safer and more efficient vehicles.
  - Even though countries such as USA, UK and Canada are already seeing driverless cars, the penetration of this mechanism on the roads of India will be an uphill task.

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