Evolution of the Technology of Brake Systems and Design

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ABSTRACT: ***Braking is a critical feature of any vehicle, enabling the speed to be regulated by the driver under any Situations. In vehicles, motorcycles, rail trains, and aircraft, braking systems have been used extensively. Friction is both a key efficiency factor in brake systems and a possible source of unwanted noise and vibration. One of the most difficult problems in the brake industry has been friction dynamics. Modern brake systems are the result of successive upgrades to previous brake systems, which are most frequently done by the use of new technologies or materials. It is useful to briefly examine the key technical advancements that have been used in the past to enhance performance in order to fully understand existing brake systems and how they can better be improved. From braking systems to what we are taking for granted today. Disc brakes are much more costly, however, and this is why drum brakes are still used, even though today, while primarily for vehicles' rear wheels. Lastly, the latest big brake improvements is the discovery of ABS.***

KEYWORDS: ***Vehicle security, ABS, Automobiles, Braking system, Disc brake, Drum brake, Guidelines.***

INTRODUCTION

1.1 Brake System

Braking is a critical feature of any vehicle, enabling the speed to be regulated by the driver under any Situations. This is especially important in the Industrial driving conditions and elevated driving conditions driving speeds and dynamic conditions in traffic [1]. Nevertheless, the degree of control over velocity that the Driver obtains depends on the use of breaking highly reliant on the brake system output. In vehicles, motorcycles, rail trains, and aircraft, braking systems have been used extensively. Friction is both a key efficiency factor in brake systems and a possible source of unwanted noise and vibration [2]. The mechanisms and concepts of various types of vehicles' braking systems are comparable and identical. One of the most difficult problems in the brake industry has been friction dynamics. Friction dynamics related issues in many ways affect the efficiency and quality of brake systems.

For example, brake squeal, an acoustic phenomenon caused by dynamic instability which occurs at one or more of the brake system's natural frequencies. In automotive brake systems, it has been the most difficult issue, as it has been considered to be equal to the quality of products by customers. Friction-induced torque oscillations in aircraft braking systems may lead to extremely high loads in the landing gear and brake structure, resulting in passenger pain, part failure, or both, and thus contributing to warranty claims.

1.1.1 Types of brakes

There are two main types of brakes: disc and drum. Disc brakes, despite the fact that drum brakes are primarily used in trucks and buses, have been commonly used in both heavy vehicles and passenger cars. A disc brake system is made up of a rotor that can rotate around the axis of the wheel. In the brake system, the caliper assembly is mounted on the frame, and the caliper housing can slide on the bracket. On the anchor bracket, the pads can also slide, and the piston can slide within the casing of the caliper. The piston pushes the pad against the rotor when hydraulic pressure is applied, thereby creating braking torque by friction. A friction material that is fixed to a rigid-pad backing plate consists of the brake pad assemblies. Using rivets or adhesives, or integrally moulding the friction material to the backing plate, the mounting may be accomplished. In a single disc brake, the two brake pad assemblies are usually known as inboard and outboard. In different forms, these assemblies are mounted to the caliper or the caliper-mounting bracket [3].

Vibration control measures such as dampers (or shims) or damping substances are widely used between each of the pad backing plates and the caliper, and the mounting bracket and piston of the caliper. Generally made of grey cast iron, the rotors dominated the market [4].

Other materials have begun to appear, such as silicon carbide (SiC)-reinforced aluminium, carbon-SiC composites and sintered carbon[5]. Organic materials based on a metal fiber-reinforced organic matrix are most pad friction materials. Metallic, semimetallic, and carbon-based materials provide several types of friction materials. Organic pads are a compound of a variety of different materials (up to two dozen), with adhesion binder feature groups, strength-enhancing structural materials, cost and volume control fillers, and friction additives for friction control. Any kind of phenolic resin is usually the binder or matrix. The fibres contain organic or resin-bonded metallic non-asbestos. Steel, carbon, glass and kevlar fibres [6] are used in the structural materials that are applied to the linings to provide mechanical stability. In order to make the material less costly and strengthen the main material, fillers are primarily used. To regulate the friction coefficient or to alter the form of wear, frictional additives are added. To reduce the coefficient of friction, lubricants such as graphite are used. In order to remove iron oxides from the rotor surface, abrasive particles are used to increase the coefficient of friction or to increase brake disc wear.

1.2 Modern brake systems

Modern brake systems are the result of successive upgrades to previous brake systems, which are most frequently done by the use of new technologies or materials. It is useful to briefly examine the key technical advancements that have been used in the past to enhance performance in order to fully understand existing brake systems and how they can better be improved. From braking systems to what we are taking for granted today. Over the years, the core concept of the brake system remained remarkably unchanged: friction is used as a means of slowing wheel movement as needed [7]. However, there has been a major shift in the manner in which additional friction is produced and controlled.

Initial brake systems used before the 1920s were operated mechanically: rods or cables were used to turn the pressing of the brake pedal directly into a push against the wheel drum of some type of "brake shoes" or its equivalent In addition, most cars had brakes only on the rear wheels at that time, as four wheel mechanical braking involved a complicated system of rods and cables to maintain the vehicle's stability. The first technical advancement to radically change brake systems was the 1918 invention of hydraulic brakes. Hydraulic brakes [8] replaced the mechanical brake rods and wires with pistons which applied the brake force to fluids which, in turn, transmitted the force to the pistons of each wheel brake. Hydraulic brakes brought two highly significant advantages: first, the brake force was distributed uniformly to the wheels without the need for complicated, additional balancing systems; second, the force applied to the pedal was magnified as it was transferred to the wheels, making it much simpler to operate. Stop or even slow down a car. These two benefits have significantly improved protection as a result of when four-wheel braking vehicles became the standard. Instead of being the exception, braking was simply becoming simpler and more powerful.

LITERATURE REVIEW

B.Keshavaram wrote a paper for SAE international titled “Aluminum Alloys for Automotive Disc Brake Calipers 1999-01-0346” in which he explains about Disc brake calipers have historically been made from ductile iron for the automotive industry, but more of the calipers are now being converted to aluminium, with about 40 percent weight savings. Since 1984, Amcast Automotive has been involved in the manufacturing and manufacture of aluminium caliper castings, when it first supplied aluminium caliper castings for the Pontiac Fiero four-wheel disc brake service production. Currently, Amcast is using heat-treated aluminium 354 and 357 alloys to launch some new high volume automotive calipers [5].

CONCLUSION

Ten years after hydraulic brakes were invented. Another technical advance has dramatically enhanced Brake systems: adding vacuum boosters to Brakes, converting them into strength in the so-called the brakes. There have been many updates and enhancements over the next few years. Brake control, but the modern version of the original version Power brakes continues to be used on most light trucks and other automobiles. The primary benefit of discs over drums was that they it was easier to cool down, lighter, more self-adjustable, more durable and more lightweight. Disc brakes are much more costly, however, and this is why drum brakes are still used, even though today, while primarily for vehicles' rear wheels. Lastly, the latest big brake improvements is the discovery of ABS.

The novelty of the electronic ABS was that unlike prior advancements. The fundamental operation of a brake device changes a great deal. As it has added new features to make it more secure, more stable and easy to use. The primary objective of ABS is to keep the wheels from skidding and locking during braking. This, in fact, boosts the stability of vehicles during braking and helps the driver to retain. Also during emergency braking, power over steering and other potentially unsafe examples. Presently, in most cases, electronic ABS is a regular alternative the vehicles that are produced.

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