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ANALYSIS OF BRAKE SYSTEMS USED TO ENSURE VEHICLE TRAFFIC SAFETY

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Abstract. In this article, the structure and operating principle of two main types of automotive braking systems - disc and drum braking systems - are studied. The advantages and disadvantages of disc and drum braking systems were analyzed, and it was explained in which cases their application is more effective.
Keywords: braking system, disc brake, drum brake, lead brake, trailing brake, twin lead brake, du-servo, vehicle safety.

1. Introduction. The brake control serves to slow down the vehicle's movement, stop it, and prevent it from self-shifting on road slopes for an extended period. The creation of a braking force between the wheels and the road surface and its control is carried out precisely by means of brake control [1].

The operation of friction braking mechanisms in automobiles is based on the friction created between rotating and stationary parts. Depending on the shape of the rotating parts, brake mechanisms are divided into disk and drum types.

In modern passenger cars, only disc braking mechanisms are used on the front wheels, while disc or drum braking mechanisms are used on the rear wheels. Disc braking mechanisms began to be used on the front wheels of trucks and buses.

The friction coatings of disc brake mechanisms operate under high specific pressure, therefore they wear out faster than the coatings of drum brake mechanisms [2].

2. Research Methodology.

Disc braking mechanism. The brake rotors of the disc brakes rotate with the wheels, and the brake pads installed on the brake calipers are pressed against these rotors to stop or slow the wheels. Brake pads resisting the rotors create friction, which converts kinetic energy into thermal energy.

There are two types of disc brakes. The first is called a "opposite-cylinder disc brake" with cylinders on both sides of the disk rotor, and the second is called a "floating-type disc brake" with cylinders only on one side.

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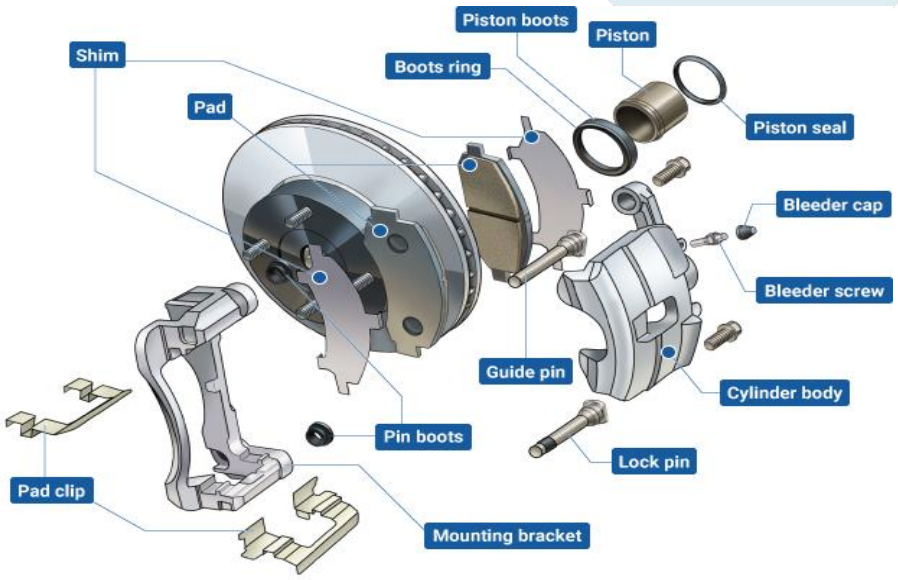

Figure 1. Main parts of floating disc brakes

Disc brakes are commonly used in passenger cars, but due to their stable operation at high speeds band resistance to brake drop, they are gradually becoming widespread for other types of cars (drum brakes for other types of cars traditionally selected for longer service life).

Drum braking mechanism. Brawler brakes - a braking system with brake drums (rotors) rotating with the wheels. Inside each drum, brake pads are installed, equipped from the inside with brake pads (friction material) pressing on the drums to create braking force, which allows the car to slow down and stop.

When the driver presses the brake pedal, the power is increased by the brake booster and converted to hydraulic pressure by the main cylinder. The applied pressure pushes the pistons in the brakes of four wheels. The pistons compress the brake plates, which are friction materials, onto the inner surfaces of the brake drums rotating with the wheels. The coatings are pressed against the rotating drums, thereby slowing down and stopping the vehicle.

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Figure 2. Drum brake mechanism

In this system, friction is created by pressing the brake coatings against the inner surfaces of the drums. The rotation of the drum contributes to the pressure of the shoes and lining on the drum with greater force, providing a higher braking force than disc brakes.

Depending on how the brake shoes are pressed on the drums, there are three types of drum brakes: drive/track brake type, twin drive brake type, and du-servo type.

Small-drum brakes can use brake pads made of soft steel, while commercial vehicle brakes can use cast iron pads. Brake shoes are installed on a screwdriver plate fixed to the axle or suspension of the vehicle. The brake drum is fixed to the wheel hub and rotates with it, so that when the shoes are pushed out onto the inner surface of the drum, the brake drum, the wheel, and thus the vehicle, slow down.

Driver brake with drive/rear brake pad. The term "leading (or main) block" refers to a block that moves in the direction of rotation when the drum is pressed. The other block is called the "rear (secondary) block." The driving block is pressed in the same direction as the rotation of the drums, and this rotation helps to press the blocks on the drum with greater pressure for stronger braking. This is called the servo effect (self-amplifying effect), which provides the drum brakes with strong braking ability.

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Structurally, it consists of a wheel cylinder, in which a piston is located. With the help of this piston, hydraulic pressure is created, which pushes both shoes onto the inner surface of the drum.

Both shoes work in such a way that, depending on the forward or reverse movement of the vehicle, they turn into either the rear or the leading shoes. Drum brakes generate the same braking force regardless of whether the car is moving forward or backward. This is because drum brakes provide the same braking in both directions.

Figure 3. Drive/Rear Shoe Drum Brake

Double-leader drum brake. This type of drum brake has two wheel cylinders and two driving shoes. Each wheel cylinder presses on one brake pad, as a result of which both brake pads act as the driving force when the vehicle moves forward, providing a high level of braking force.

Each of the pistons mounted on the wheel cylinders moves in only one direction, therefore, when the vehicle moves backward, both shoes act as a follower. This type of brake is mainly installed on the front wheels of small and medium-sized trucks.

Figure 4. Double-leader drum brake

Duo-servo type drum brake. The Duo servo type has a structure where two brake shoes, called the primary and secondary brake shoes, are connected through a brake shoe regulator. As

a result of the servo effect (self-amplification effect) of the primary shoe, strong pressure is transmitted to the bound secondary shoe, resulting in a very large braking force.
This type of brake is mainly used as parking brakes for passenger cars, central brakes for trucks, and brakes for forklifts[3].

Figure 6. Duo-servo type drum brake

3. Research Results.

Advantages of disk brakes:

Disk brakes offer better braking force than drum brakes.
When braking the disc, the force can be applied much faster to bring the car to the parking lot.
Disc brakes are also capable of better controlling lateral forces during braking and turning.
Disk brakes are easy to install and store.
For good braking performance, disc brakes can be used on both front and rear wheels.

Disadvantages of disk brakes:

Disk brakes are not as easy to repair as drum brakes.
Disc brakes, compared to drum brakes, can cause slippage, especially in humid conditions.
The price of discs is significantly higher than that of conventional caliper brakes.
Vehicles with disc brakes also tend to overheat the caliper [4].
Advantages and disadvantages of drum brakes:

Benefits:

The drum brake has a good self-locking effect.
In addition to the lower cost, the difference between the drum brakes of large vehicles and small vehicles can only be a large volume of pneumatic support.
Small cars use vacuum to support brakes.
Kichik avtomobillar tormozlarga yordam berish uchun vakuum yordamidan foydalanadi.
The production cost is lower than that of disc brakes.
The manual brake mechanism is easy to install.

Disadvantages:

The brake pedal pressure can be less than the expected brake reaction.
The brake pedal force is not easy to control, which is incompatible with high-frequency braking movements.
There are many parts with complex structures, which makes maintenance difficult[5].

4. Conclusions.

Disc brake mechanisms, compared to drum brake mechanisms, have minimal clearance between friction surfaces, create a stable braking torque, cool well, and are automatically regulated.

If the drum brake mechanisms are mounted on the front wheels, it is likely that the braking force on the left and right wheels will be different. This causes self-rotation of the front wheels during braking and a change in the vehicle's direction.

The friction surface of the brake plates is about 70% of the drum friction surface, while that of the disc brakes is 15%.

On the other hand, it is very important to design parts so that the heat of thermal energy effectively dissipates into the atmosphere.

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