

Disc Brake Interfaced With Hydraulic System

Elimination of differential transmission

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Abstract— Brakes are generally of drum type in four wheelers. In this kind of brakes we have two individual brakes for both the rear wheels of a car. In this type of brake we have a disc type of brake-shoe wherein they are separated from the wheels a distance apart and so when the brakes are applied the brake-shoes are forced into the drum by the hydraulic system and the wheel is stopped by the disc type brake-shoe whose outer surface is rough and abrasive.

Index Terms— brakes, four wheelers, hydraulic system.

I. INTRODUCTION

Initially it was drum-type brakes. As the technicians and technical experts started to ponder over the concept, they came up with better braking mechanisms like disc brakes, etc. The world is now looking for better options and we must try to give our best for the fast-advancing world for the betterment and progress in the field of automation. Now we are going to see a new and innovative model of brake that can be implemented in four-wheelers as of now.

II. BRAKES

A brake is a mechanical device which inhibits motion, slowing or stopping a moving object or preventing its motion. The rest of this article is dedicated to various types of vehicular brakes. Most commonly brakes 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 energy 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.^[1]

- **Frictional brakes** are most common and can be divided broadly into "shoe" or "pad" brakes, using an explicit wear surface, and hydrodynamic brakes, such as parachutes, which use friction in a working fluid and do not explicitly wear. Typically the term "friction brake" is used to mean pad/shoe brakes and excludes hydrodynamic brakes, even though hydrodynamic brakes use friction. Friction (pad/shoe) brakes are often rotating devices with a stationary pad and a rotating wear surface. Common configurations include shoes that contract to rub on the outside of a rotating drum, such as a band brake; a rotating drum with shoes that expand to rub the inside of a drum, commonly called a "drum brake", although other drum configurations are possible; and pads that pinch a rotating disc, commonly called a "disc brake". Other brake configurations are used, but less often. For example, PCC trolley brakes include a flat shoe which is clamped to the rail with an electromagnet; the Murphy brake pinches a rotating drum, and the Ausco Lambert disc brake uses a hollow disc (two parallel discs with a structural bridge) with shoes that sit between the disc surfaces and expand laterally.^[2]
- **Pumping brakes** are often used where a pump is already part of the machinery. For example, an internal-combustion piston motor can have the fuel supply stopped, and then internal pumping losses of the engine create some braking. Some engines use a valve override called a Jake brake to greatly increase pumping losses. Pumping brakes can dump energy as heat, or can be regenerative brakes that recharge a pressure reservoir called a hydraulic accumulator.^[2]
- **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 (which actually are magnetically driven friction brakes, but nowadays are often just called "electromagnetic brakes" as well).^[2]

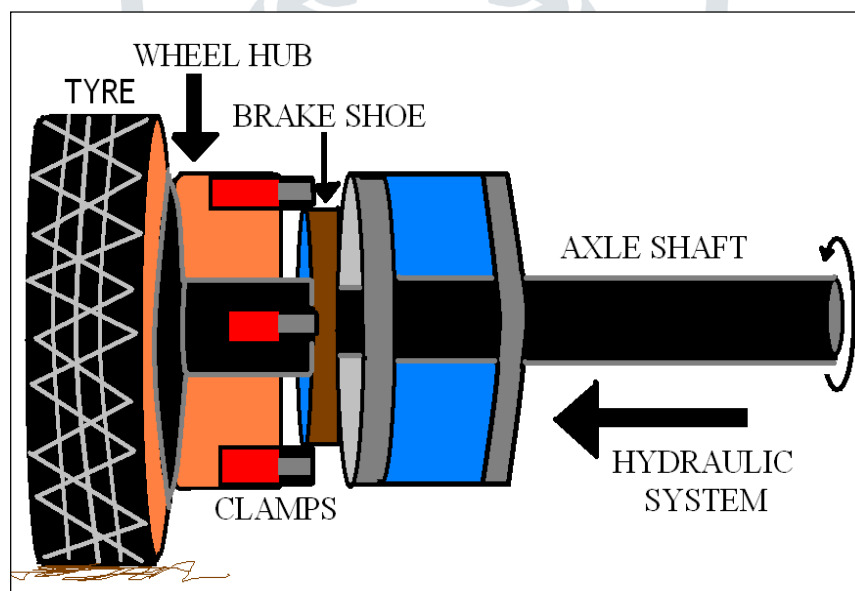
III. TRANSMISSION SYSTEM

In a front-engine rear-wheel-drive car, power is transmitted from the engine through the clutch and the gearbox to the rear axle by means of a tubular propeller shaft. The rear axle must be able to move up and down on the suspension according to variations of the road surface. The movement causes the angle of the propeller shaft, and the distance between the gearbox and the rear axle, to change constantly. To allow for the constant movement, splines on the front end of the propeller shaft slide in and out of the gearbox as the distance changes; the shaft also has universal joints at each end, and sometimes in the middle. The universal joints allow the propeller shaft to be flexible, while constantly transmitting power. The last part of the transmission is the final drive, which incorporates the differential and is sometimes called the differential. The differential has three functions: to turn the direction of drive through 90 degrees to the rear wheels; to allow either rear wheel to turn faster than the other when cornering; and to effect a final gear reduction. A pinion gear inside the differential is driven by the propeller shaft and has its gears beveled - cut at an angle. It meshes with a beveled crown wheel so that the two gears form a 90 degree angle. The engine and the gearbox are bolted together, with the clutch between them. The engine is rigidly mounted, but the propeller shaft must be flexible to allow for movement of the back axle. The crown wheel usually has about four times as many teeth as the pinion gear, causing the wheels to turn at a quarter the propeller-shaft speed. The drive is transmitted from the differential to the rear wheels by means of half shafts, or drive shafts. At the differential end of each half shaft, a beveled pinion gear is connected to the crown wheel by means of an intermediate set of bevel pinions.^[3]

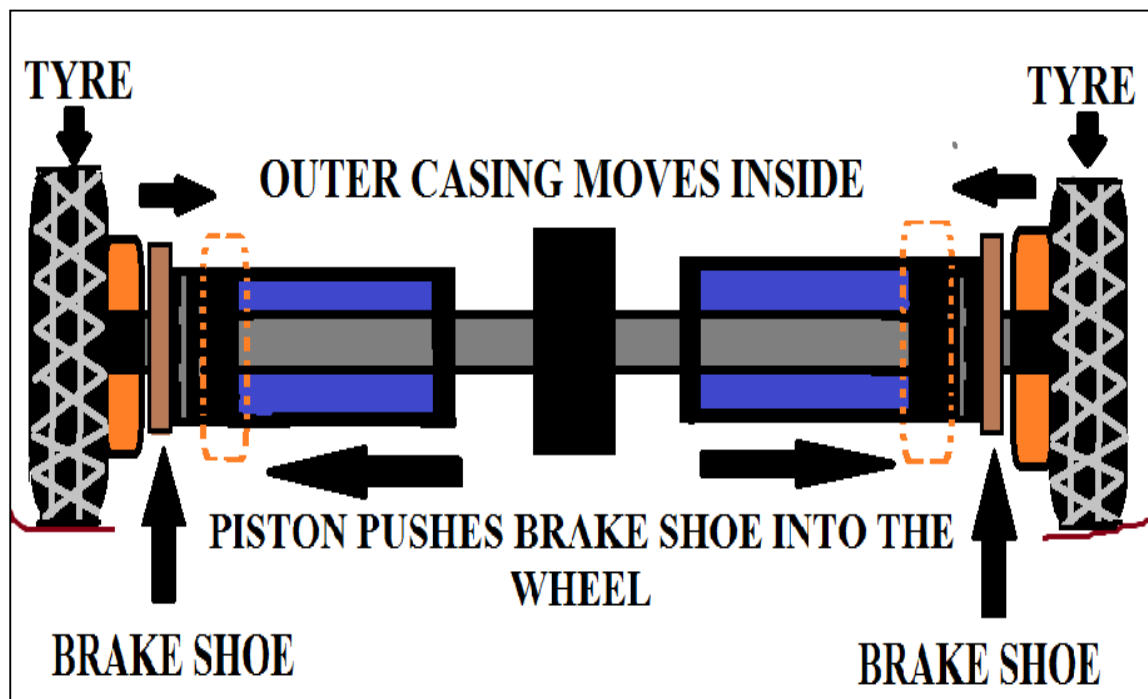
IV. THE CONCEPT

Initially, when the brake is applied the hydraulic system gets activated and the piston pushes the brake shoe into the drum while the wheel hub casing ejects to the inside. Later when the brake is released the clamp releases and the brake shoe is again pulled in and the hub casing pushes out to the original position.

V. DIAGRAMS



INNER VIEW OF THE BRAKE SET ON A SINGLE WHEEL



OUTER VIEW OF THE BRAKE SET ON THE REAR WHEELS

VI. DEFINITIONS

- **Axle shaft:** An axle is a central shaft for a rotating wheel or gear. On wheeled vehicles, the axle may be fixed to the wheels, rotating with them, or fixed to the vehicle, with the wheels rotating around the axle. In the former case, bearings or bushings are provided at the mounting points where the axle is supported. In the latter case, a bearing or bushing sits inside a central hole in the wheel to allow the wheel or gear to rotate around the axle. Sometimes, especially on bicycles, the latter type axle is referred to as a spindle.^[4]
- **Brake drum:** A drum brake is a brake that uses friction caused by shoes or pads that press against a rotating drum-shaped part called a brake drum. The term drum brake usually means a brake in which shoes press on the inner surface of the drum. When shoes press on the outside of the drum, it is usually called a clasp brake. Where the drum is pinched between two shoes, similar to a conventional disc brake, it is sometimes called a pinch drum brake, though such brakes are relatively rare. A related type called a band brake uses a flexible belt or "band" wrapping around the outside of a drum.^[5]
- **Brake pads:** Brake pads are a component of disc brakes used in automotive and other applications. Brake pads are steel backing plates with friction material bound to the surface that faces the disk brake rotor.^[6]
- **Brake shoe:** A brake shoe is the part of a braking system which carries the brake lining in the drum brakes used on automobiles, or the brake block in train brakes and bicycle brakes.^[7]
- **Clutch:** A clutch is a mechanical device that engages and disengages the power transmission, especially from driving shaft to driven shaft. Clutches are used whenever the transmission of power or motion must be controlled either in amount or over time (e.g., electric screwdrivers limit how much torque is transmitted through use of a clutch; clutches control whether automobiles transmit engine power to the wheels).^[8]
- **Differential gear system:** The differential gear is a part of the power transmission device. The driving force generated by an engine is transmitted to the tires through various types of bevel gears. Differential gear is representative of the automotive components that incorporate such bevel gears. The differential gear assembly absorbs rotational differences due to the direction change of the rotational axis drive and/or the rotational differences between the right and left wheels that lead to smooth cornering.^[9]
- **Hydraulics:** Hydraulics is a topic in applied science and engineering dealing with the mechanical properties of liquids. At a very basic level, hydraulics is the liquid version of pneumatics. Fluid mechanics provides the theoretical foundation for hydraulics, which focuses on the engineering uses of fluid properties.^[10]
- **Piston:** A piston is a component of reciprocating engines, reciprocating pumps, gas compressors and pneumatic cylinders, among other similar mechanisms.^[11]

- **Propeller:** A propeller is a type of fan that transmits power by converting rotational motion into thrust. A pressure difference is produced between the forward and rear surfaces of the airfoil-shaped blade, and a fluid (such as air or water) is accelerated behind the blade. Propeller dynamics can be modelled by both Bernoulli's principle and Newton's third law. A marine propeller is sometimes colloquially known as a screw propeller or screw.^[12]
- **Steering ratio:** **Steering ratio** refers to the ratio between the turn of the steering wheel (in degrees) or handlebars and the turn of the wheels (in degrees).^[13]
- **Tyre:** A tyre is a ring-shaped vehicle component that covers the wheel's rim to protect it and enable better vehicle performance. Most tires, such as those for automobiles and bicycles, provide traction between the vehicle and the road while providing a flexible cushion that absorbs shock.^[14]
- **Wheel hub:** It is located between the brake drums or discs and the drive axle. On the axle side, it is mounted to the holding bracket from the chassis; on the disc side, the wheel is mounted to the bolts of the WHA. When replacing, a wheel hub assembly should be torqued to the vehicle's specifications to prevent failure.^[15]

VII. CONCLUSION

Thus we have come across a new type of brake system. Through the introduction of this system a differential gear system of transmission can be eliminated as, when the vehicle has to turn the brake switches on one side and the other side it remains released due to which the steering ratio is increased and enables the vehicle to take a more sharp turn.

VIII. REFERENCE

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