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# Frictionless Electromagnetic Braking and Plugging Method of Braking System of Any Rotating Machine or Vehicle

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**ABSTRACT:** In this paper we had develop the electromagnetic braking system. Braking System should ensure the safety and comfort of the passenger, driver and other road user. The brake must be strong enough to stop the vehicle during emergency within shortest distance. The conventional braking system are bulky and power to weight ratio is low. Electromagnetic braking system is high-tech braking system find its use in small & heavy vehicle like car, jeep, truck, busses etc. This paper represents about minimizing the brake failure in order to avoid the accident. It also reduces the maintenance of braking system. The effectiveness of brake should remain constant. The proper cooling of brake gives anti fade character and efficient operation of brake. Proper lubrication and maintenance must be done to operate brake safe, effective and progressive with minimum fatigue to driver. This system provides better response time for emergency situations and in general keeps the friction brake working longer and safer.

**KEYWORDS:** Brake, Electromagnetism Brake power, Torque

## I. INTRODUCTION

Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction brakes on heavy vehicles, lifts and elevators. We outline the general principles of regular brakes and several alternative retardation techniques in this section. The working principle and characteristics of electromagnetic brakes are then highlighted. The principle of braking in road vehicles involves the conversion of kinetic energy into thermal energy (heat). When stepping on the brakes, the driver commands a stopping force several times as powerful as the force that puts the car in motion and dissipates the associated kinetic energy as heat. Brakes must be able to arrest the speed of a vehicle in a short period of time regardless how fast the speed is. As a result, the brakes are required to have the ability to generating high torque and absorbing energy at extremely high rates for short periods of time. Brakes may be applied for a prolonged period of time in some applications such as a heavy vehicle descending a long gradient at high speed. Brakes have to have the mechanism to keep the heat absorption capability for prolonged periods of time. In the electromagnetic brake, the coil or solenoid attracts a steel disc. The steel disc presses a brake disc made of sintered or asbestos material between itself and a stationary steel disc. The torque is thus 'grounded' and braking action takes place. This type of brake is used in machines like lathes, presses etc. In electro-magnetic braking system electromagnetic property is used due to this action of braking will be done. In this system, electro magnet iron plate, liners, tension spring, stud, disc brake plate are used. The brake liners are attached with electro-magnet and iron plate individually and both plates insert the disc plate and this plate rigidly attached with wheels. The battery of minimum 12 volt is used for external power supply. Electromagnet consists of wire wound over a soft iron core. When current is passed through the coil, it produces a magnetic field which magnetizes the core into the bar magnet with the polarities. Strong magnetic field is obtained by high currents of large self-induction. High currents are not always feasible, which is why a high self-induction is obtained by making a loop of wire in the shape of a coil, a so-called solenoid. More current and more turns produce a stronger magnetic field which results in stronger electromagnet. When current is switched OFF field disappears and the iron core no longer a magnet. This ability of an electromagnet provides a strong magnetic force of attraction. Shape geometry and material used in construction of electromagnet decide the shape and strength of magnetic field produced by it.

## II. CONVENTIONAL METHOD OF BRAKING

There are 2 main types of brake system used in vehicles. Drum brake and disc brake. In drum brake system, arrangement is look like drum. One brake pad is built inside the drum and drum rotates with wheel of vehicle. When we apply brake, brake pad gets expand and rotating drum get force from brake pad to stop. In disc brake type braking system metallic disc is connected with wheel. When we apply brake, disc will get stopped immediately. This system is dangerous because it depends on how we apply brakes. Due to this braking system accidents happen regularly and due to friction of disc with brakes, we need to change that disc frequently.

The third braking system of rotating machine which is electromagnetic braking is also discussed. This braking system is commonly used in lifts, elevators and escalator. In this braking system one electromagnetic plate is placed for braking. Whenever we need to stop, we need to give supply to electromagnetic plate. When we give supply to that plate, that plate will attract towards the rotating shaft and that plate will hold that shaft to stop. In this braking system immediate braking will occur and there is also a friction between shaft and plate.[2]

Regenerative braking and plugging method of braking are discussed. Regenerative braking will be used in electric vehicles which are the future of automobile engineering. Plugging method is being used by many industries for immediate stop of any machine. But for Electric vehicle we can use as emergency braking.

## III. PROPOSED WORK

### Construction and Working

The magnetic disc is attached to the rotating wheel as a replacement of disc brakes. On both the side of magnetic disc we will place a construction of electromagnet. This will look like a complete magnetic disc is enclosed by the electromagnets. As we want to apply brake, we will give 12 V dc supply to those two electromagnets. As electromagnets energized they will act like a strong magnet. Due to strong magnetism and use of magnetic disc, electromagnet will pull that magnetic disc and brake will occur. For safe braking we need to apply brakes gently. This system will not lock the brake disc and we can prevent accidents of vehicles and elevators. If we are using such system in electric vehicle we will get regenerative braking. This will give us long duration of electric vehicle. Plugging method is done by a simple toggle switch which can shift motor from steady mode to forward mode, steady mode to reverse mode and forward mode to reverse mode. For plugging method we will switch motor from forward mode to reverse mode. This will give us immediate braking which help us for emergency braking. For that if motor is running in forward mode, we will shift that motor into reverse mode. During this switching action, motor needs 1.5 seconds to come in reverse mode from forward mode. So that we can achieve this immediate braking by switching motor from forward to reverse and then reverse to off mode.

### Specifications

1. 12v Dc power supply for Electromagnets
2. 1543 Lbs. electromagnet required. So we take 2 electromagnets of 750 Lbs. ( for 700 kg weight )

### Applications

1. Lifts and elevators.
2. Electric vehicles
3. Normal vehicles
4. Escalator
5. Trains and cranes



## Model Images

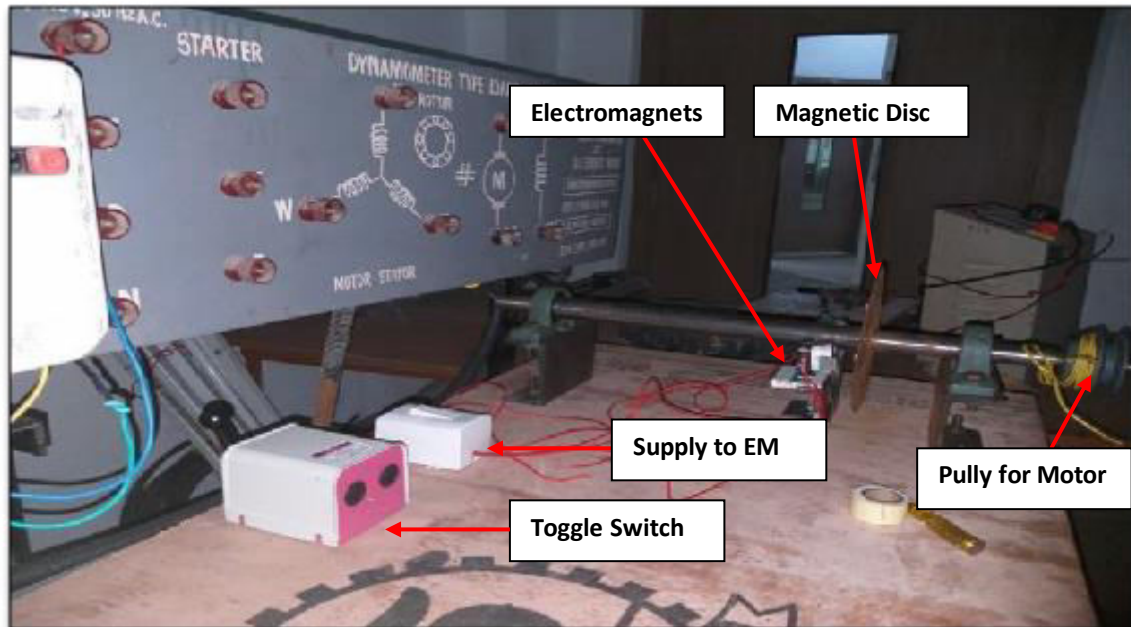


Fig (a) Prototype

## IV. RESULTS AND DISCUSSIONS

In the above paper, we performed contactless electromagnetic braking. That means there is no contact between electromagnets and disc of brakes. The time required to stop disc by contactless braking is around 1.5 sec to 1.7 sec for 700kg weight on the machine/motor/vehicle. This time can be reduced by reducing the weight on the rotating machine. We need to select electromagnets as per the weight to be traveled with machine. We performed plugging method of braking. This is an immediate brake for any rotating machine. This is very useful in emergency condition. Plugging takes 0.05 seconds to perform the action. We performed regenerative braking. This is useful to Electric vehicle to produce some extra power.

## V. CONCLUSION

From the above paper, we come to know that accidents happen due to improper braking systems. The above paper says we can reduce the rate of such accidents by implementing contactless braking systems in the vehicles or in the rotating machines like, elevators, escalator, lifts, trains and cranes. This system reduces the heat dissipation in the brakes. Also useful for future of electric vehicles to get reliable braking and long range of battery backup.

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