

FABRICATION & ANALYSIS OF ELECTRO MAGNETIC BRAKING SYSTEM

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ABSTRACT: An electromagnetic brake is a new and revolutionary concept. These are totally frictionless. Electromagnetic brakes are the brakes working on the electric power & magnetic power. Electromagnetic braking system is a modern technology braking system used in light motor & heavy motor vehicles. This system is a combination of electro-mechanical concepts. The frequency of accidents is now-a-days increasing due to inefficient braking system. It aims to minimize the brake failure to avoid the road accidents. An Electromagnetic Braking system uses Magnetic force to engage the brake, but the power required for braking is transmitted manually. The disc is connected to a shaft and the electromagnet is mounted on the frame. When electricity is applied to the coil a

magnetic field is developed across the armature because of the current flowing across the coil and causes armature to get attracted towards the coil. In this research work, with a view to enhance the braking system in automobile, a prototype model is created and analyzed. Different material of higher electrical conductivity will be studied as the brake disc material for this electromagnetic braking system using eddy current in ansys software to know the greater performance of the brake.

INTRODUCTION

A vehicle brake is used to slow down a vehicle by converting its kinetic energy into heat. 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.

Types of Brake

- 1) Friction Brake
- 2) Electromagnetic Brake

Friction Brake B.

A friction brake is a type of automotive brake that slows or stops a vehicle by converting kinetic energy into heat energy, via friction. The heat energy is then dissipated into the atmosphere. In most systems, the brake acts on the vehicle's wheel hubs, but some vehicles use brakes which act on the axles or transmission.

Friction brakes may be -

- 1) Drum Type.
- 2) Disc Type.

LITERATURE REVIEW

Ashutosh Kumar et. al, [1] In this paper author noted that electromagnetic brakes make up approximately 80% of all of the power applied brake applications. The electromagnetic brakes prevent the danger that can arise from the prolonged use of brake beyond their capability to dissipate heat. These brakes help in avoiding and minimizing traffic accidents.

Abhijeet N. Naikwadi et. al. [2] In this paper author said that electromagnetic brakes can be used as an auxiliary braking system along with the friction braking system to avoid overheating and brake failure. Electromagnetic or frictionless braking is a non-contact braking system and hence there is no friction and minimum wear and tear. The maintenance cost of this braking system is low.

Mohamed Faizal et. al. [3] In this paper author presented EM braking system superior controllability. These brakes consume small space and hence installation is pretty easy. EM brakes are reliable and eco-friendly.

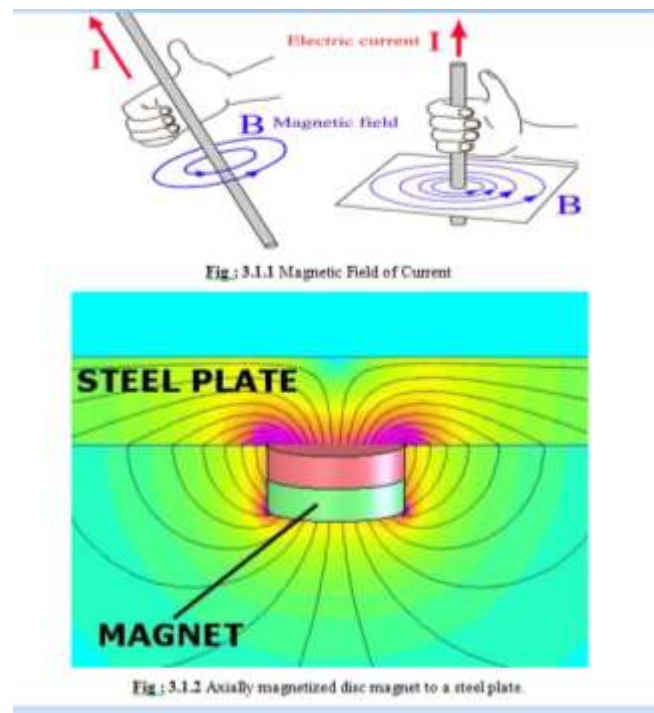
M Z Baharom et. al. [4] In this paper author studied various condition of disc to increase the breaking. According to him thicker disc will generate high torque which

will approach the motor torque in order to stop the disc rotation which in this study disc of 5 mm is better than 4 mm of thickness. Smaller air-gap will produce high braking torque and give better performance to the electromagnetic braking which air-gap of 1 mm shows the best result compared to 3 mm and 5 mm gap. Al6061 which has higher electrical conductivity than Al7075 shows great performance of braking torque produced.

Sudarshan et. al. [4] In this paper author concluded that electromagnetic braking system, the abrasion, noise, harmful friction dust, and the risk of thermal failure in braking system were reduced obviously. Cost of these brake are cheaper than the other types. Wheel skidding is eliminated.

WORKING PRINCIPLE

If a piece of copper wire was wound, around the nail and then connected to a battery, it would create an electro magnet. The magnetic field that is generated in the wire, from the current, is known as the “right hand thumb rule”.



TYPES OF MAGNETIC MATERIALS

To study magnetic properties of magnetic materials, the material is usually placed in a uniform magnetic field and then the magnetic field is varied. There are three major kinds of

PARAMAGNETIC MATERIALS

In these materials the magnetic dipoles in the Magnetic Materials tend to align along the applied magnetic field and thus reinforcing the applied magnetic field. Such substances are attracted by a magnet if it applies a sufficiently strong field. It must be noted that such materials are still feeble magnetized and the magnetization disappears as soon as the external field is removed. The magnetization (M) of such materials was discovered by Madam Curie and is dependent

on the external magnetic field (**B**) and temperature T as:

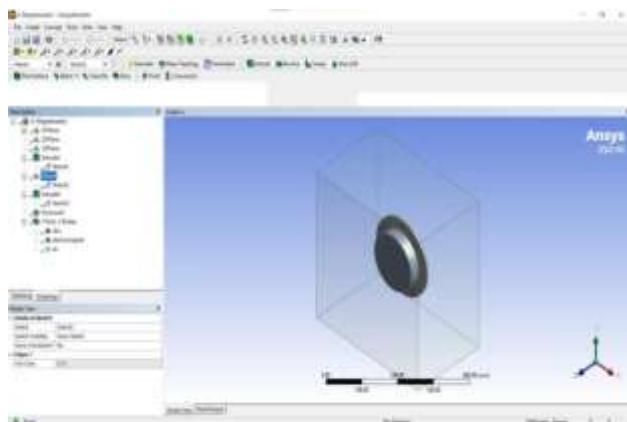
$$\vec{\mu} = \frac{C}{T} \vec{B}$$

Where C= Curie Constant

Ex: Liquid oxygen, sodium, platinum, salts of iron and nickel.

FERROMAGNETIC MATERIALS

We are most familiar with these materials as they exhibit the strongest magnetic behaviour. Magnetic dipoles in these materials are arranged into domains where the



arrangements of individual magnetic dipoles are essentially perfect that can produce strong magnetic fields.

RESULTS AND DISCUSSIONS

MODELLING & DESIGNING OF THE ELECTRO MAGNETIC BRAKE

By using the creo parametric software

designed the electromagnetic brake. Firstly each part is designed, and then assembled each part.

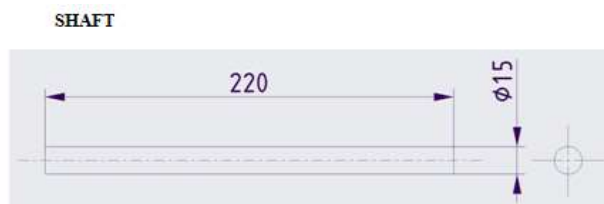


Fig. 7.1.1 Front view and side view of the shaft

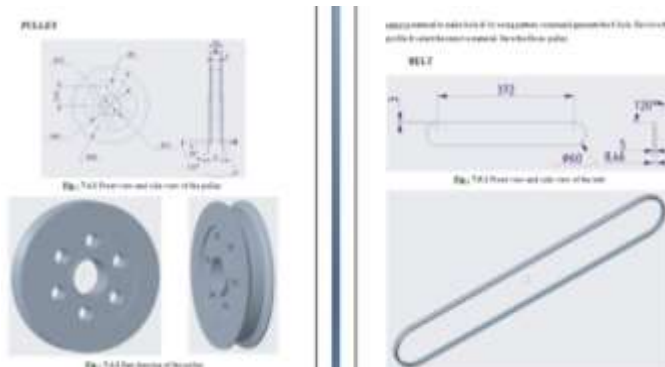
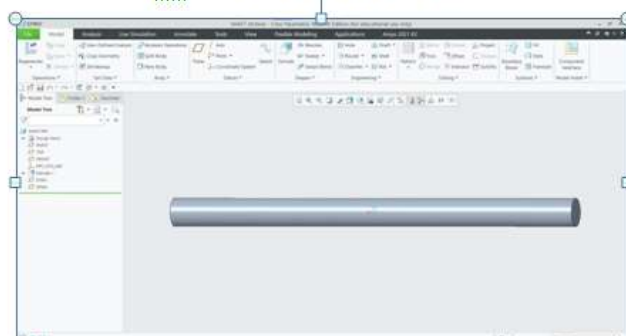


Fig. 7.1.2 Front view and side view of the pulley

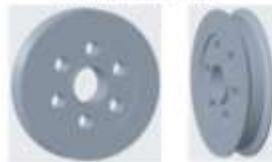
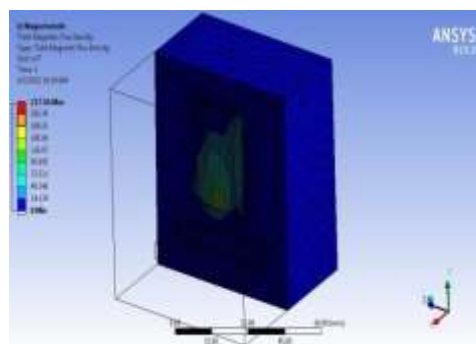
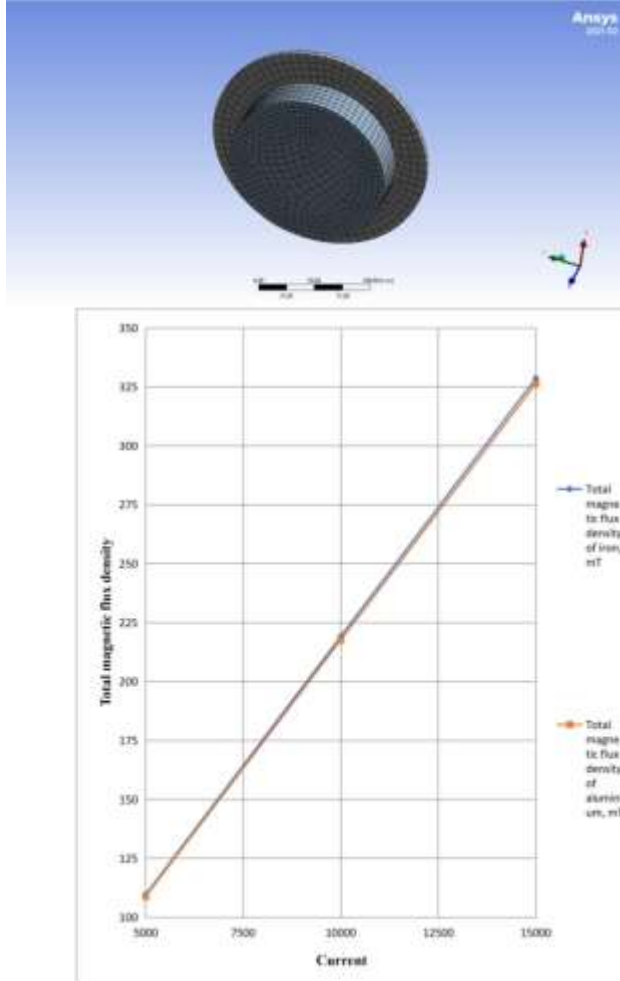


Fig. 7.1.3 3D view of the pulley





CONCLUSION

Electromagnetic braking system is found to be more reliable as compared to other braking systems. In oil braking system or air braking system even a small leakage may lead to complete failure of brakes. While in electromagnetic braking system as four disc plates, coils and firing circuits are attached individually on each wheel, even any coil fails the brake does not completely fails remaining three coil works properly. And this system needs very little of maintenance. Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction brakes on heavy vehicles. The frictions brakes can be used less frequently and therefore practically



never reach high temperatures. From the ansys results the iron is better than the aluminium. Cost of iron is cheaper than the aluminium. So iron is the best material compared with the aluminium.

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