FABRICATION OF AN ELECTROMAGNETIC BRAKING SYSTEM

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In partial fulfillment of the requirement for the award of the degree Of Bachelor of Science in Mechanical Engineering

September, 2023

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project. In my opinion, this project is satisfactory in terms of scope and quality for the award of the degree of Bachelor of Science in Mechanical Engineering.

Supervisor

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STUDENT'S DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for the award of any degree or certificate.

We hereby ensure that the works that have been prevented here do not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from a breach of the foregoing obligation.

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Dedicated

To

Our Beloved Parents

ACKNOWLEDGEMENT

First, we started in the name of Almighty Allah. This thesis is accomplished under the supervision of Md. Mostofa Hossain, Professor & Head, Department of Mechanical Engineering, Sonargaon University. It is a great pleasure to acknowledge our profound gratitude and respect to our supervisor for this consistent guidance, encouragement, helpful suggestion, constructive criticism, and endless patience through the progress of this work. The successful completion of this thesis would not have been possible without his persistent motivation and continuous guidance.

The authors are also grateful to Professor Md. Mostofa Hossain, Head of the Department of Mechanical Engineering, and all respectful teachers of the Mechanical Engineering Department for their cooperation and significant help in completing this project work successfully.

ABSTRACT

This project aims to create an electromagnetic braking system model capable of applying brakes without any friction loss and without losing the energy supplied. It uses two electromagnets which are run by the supply of power from the battery. Also, there is a wheel which is attached to the motor so when the power is supplied, by the help of the motor the wheel rotates the generator motor for regenerate power from spin the wheel motor and store the power in battery. A metal bar is in the vicinity of the electromagnets and wheel so when the electromagnets produce eddy currents which stop the rotating wheel or rotor. This model helps in a way to be used as retardation equipment in vehicles.

The main objective of our project is to control the speed of the vehicle as well as to stop it when and where quickly and efficiently. To make human life easier by using technology. To understand project planning and execution. After making our project we observe it very carefully. Firstly, when we press switch on then the project will be run. After that pressing a switch will turn the relay with power from the battery on and the motor will start and the wheel will continue to spin. Then when the brake pedal or push switch is pressed, the relay turns off the connection to the motor and the electromagnet brakes stop the wheel. Our project gives output perfectly and all equipment works perfectly. We check how much it works and we get perfect output from this project.

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CHAPTER 1
INTRODUCTION

Electromagnetic brakes (also called electro-mechanical brakes or EM brakes) slow or stop motion using electromagnetic force to apply mechanical resistance (friction). The original name was "Electro-mechanical Brakes" but over the years the name changed to "Electromagnetic Brakes", referring to their actuation method. Since becoming popular in the mid-20th century especially in trains and trams, the variety of applications and brake designs has increased dramatically, but the basic operation remains the same. Electromagnetic brakes are the brakes working on the electric power & magnetic power. They work on the principle of electromagnetism.

These brakes are an excellent replacement on the conventional brakes due to their many advantages. The reason for implementing this brake in automobiles is to reduce wear in brakes as its friction less. Electromagnetic brakes are of today's automobiles. The working principle of this system is that when the magnetic flux passes through and perpendicular to the rotating wheel the eddy current flows opposite to the rotating wheel/rotor direction. This eddy current is trying to stop the rotating wheel or rotor. This results in the rotating wheel or rotor coming to rest/ neutral.

1.1 Objectives

The objectives of this project are:

- The main objective of our project is to control the speed of the vehicle as well as to stop it when and where quickly and efficiently.
- To Fabrication of an Electromagnetic Braking System.
- To Determine the performance of an Electromagnetic Braking System.
- To understand project planning and execution.

1.2 Methodology

Our used Methodology for the project:

- Creating an idea for the design and construction of **Fabrication of an Electromagnetic Braking System** And designing a block diagram & circuit diagram to know which components we need to construct it.
- Electromagnetic (EM) methods detect the electrical properties of the subsurface by inducing EM energy within the subsurface and measuring the response of earth materials. Generally, EM geophysical instruments output a time-varying electric current into its transmitter coil, or loop.

1.3 Types of Braking Systems

1.3.1 Electromagnetic Brake System

A rising style of brake system, electromagnetic brakes use an electric motor that is included in the automobile which help the vehicle come to a stop. These types of brakes are in most hybrid vehicles and use an electric motor to charge the batteries and regenerative brakes. On occasion, some buses will use it as a secondary retarder brake. In locomotives, a mechanical linkage transmits torque to an electromagnetic braking component. Trams and trains use electromagnetic track brakes where the braking element is pressed by magnetic force to the rail. They are distinguished from mechanical track brakes, where the braking element is mechanically pressed on the rail. Electric motors in industrial and robotic applications also employ electromagnetic brakes. Recent design innovations have led to the application of electromagnetic brakes to aircraft applications. In this application, a combination motor/generator is used first as a motor to spin the tires up to speed prior to touchdown, thus reducing wear on the tires, and then as a generator to provide regenerative braking.

A friction-plate brake uses a single plate friction surface to engage the input and output members of the clutch. Single face electromagnetic brakes make up approximately 80% of all of the power applied brake applications. Power off brakes stop or hold a load when electrical power is either accidentally lost or intentionally disconnected. In the past, some companies have referred to these as "Fail Safe" brakes. These brakes are typically used on or near an electric motor. Typical applications include robotics, holding brakes for Z axis ball screws and servo motor brakes. Brakes are available in multiple voltages and can have either standard backlash or zero backlash hubs. Multiple disks can also be used to increase brake torque, without increasing brake diameter. There are 2 main types of holding brakes. The first is spring applied brakes. The second is permanent magnet brakes.

Spring type - When no electricity is applied to the brake, a spring pushes against a pressure plate, squeezing the friction disk between the inner pressure plate and the outer cover plate. This frictional clamping force is transferred to the hub, which is mounted to a shaft.

Permanent magnet type - A permanent magnet holding brake looks very similar to a standard power applied electromagnetic brake. Instead of squeezing a friction disk, via springs, it uses permanent magnets to attract a single face armature. When the brake is engaged, the permanent magnets create magnetic lines of flux, which can in turn attract the armature to the brake housing. To disengage the brake, power is applied to the coil which sets up an alternate magnetic field that cancels out the magnetic flux of the permanent magnets. Both power off brakes is considered to be engaged when no power is applied to them. They are typically required to hold or to stop alone in the event of a loss of power or when power is not available in a machine circuit. Permanent magnet brakes have a very high torque for their size, but also require a constant current control to offset the permanent magnetic field. Spring applied brakes do not require a constant current control, they can use a simple rectifier, but are larger in diameter or would need stacked friction disks to increase the torque.

Think of the coil shell as a horseshoe magnet having a north and south pole. If a piece of iron contacted both poles a magnetic circuit is created. When power is applied a magnetic field is created this field (flux) overcomes the air gap between field and the armature. This magnetic attraction pulls the armature in contact with the brake field face. The friction and the strength of the magnetic field is what causes the rotational motion to stop. Almost all the torque comes from the magnetic attraction and coefficient of friction between the steel of the armature and the steel of the rotor or brake field. But for many industrial clutches or brakes, friction material is used between the poles. The material is mainly used to help decrease the wear rate. But different types of material can also be used to change the coefficient of friction for special applications. For example, if the brake was required to have an extended time to stop or slip time, a low coefficient material can be used. Conversely, if the brake was required to have a slightly higher torque, a high coefficient friction material could be used. Copper (sometimes aluminum) magnet wire used to create the coil which is held in the shell either by a bobbin or by an epoxy / adhesive. For most industrial brakes, friction material is then placed over the coil and is set between the inner and outer pole. The friction material is flush with the surface of the brake because you want to have metal to metal contact between the coil shell and the armature. (Some people mistakenly look at electromagnetic brakes and assume that it is already worn down since the friction material is flush but that is not the case.)

1.3.2 Frictional Brake System

A frictional brake system is found in many automobiles. They are service brakes, and typically found in two forms: pads and shoes. As the name implies, these brakes use friction to stop the automobile from moving. They typically include a rotating device with a stationary pad and a rotating weather surface. On most band brakes the shoe will constrict and rub against the outside of the rotating drum, alternatively on a drum brake, a rotating drum with shoes will expand and rub against the inside of the drum.

1.3.3 Hydraulic Brake System

A hydraulic brake system is composed of a master cylinder that is fed by a reservoir of hydraulic braking fluid. This is connected by an assortment of metal pipes and rubber fittings which are attached to the cylinders of the wheels. The wheels contain two opposite pistons which are located on the band or drum brakes which pressure to push the pistons apart forcing the brake pads into the cylinders, thus causing the wheel to stop moving.

1.4 Thesis Overview

This Project is organized as follows:

Chapter 1 Introduction**:** The first chapter contains the statement of the introduction, our background study for the project, the problem statement, the objectives of the study, and the project outline.

Chapter 2 Literature Review**:** Chapter two contains our introduction and literature review part.

Chapter 3 Hardware and Software Analysis**:** Chapter three describes the theoretical model. Here we mainly discuss the proposed system Hardware and software development of our project etc.

Chapter 4 Methodology**:** Chapter three describes the theoretical model. Here we mainly discuss the proposed system architecture in detail with having a block diagram, circuit diagram, structural diagram, project working principle, complete project image, etc.

Chapter 5 Result and Discussion**:** Chapter four deals with the result and discussion and discuss our project's advantages and application.

Chapter 6 Conclusion**:** Chapter five is all about our project conclusion and future scope.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

In this section topics related to **Fabrication of an Electromagnetic Braking System.** are included. These provide a sampling of problems appropriate for the application of Electromagnetic Braking System. The references are summarized below.

2.2 Literature Review

[1] Stephen Z, Oldakowski, Bedford, Ohio A magnetic brake provides braking or locking capability and is remotely controlled by electric power. The magnetic brake comprises a rotatable shaft and a brake disc mounted on the shaft. A nonrotating core housing assembly located around the shaft includes a permanent magnet and a bipolar solenoid. A magnetic armature adjacent to the core housing assembly is capable of movement toward the core housing assembly and toward and into engagement with a brake disc to prevent rotation of the shaft. A spring urges the armature away from the core housing assembly and into engagement with the brake disc. The brake does not use any electric power to maintain the brake in the set mode with the rotating shaft fully locked or in the released mode with the rotating shaft fully released. The permanent magnet is of sufficient strength to hold the armature against urging of the spring until an opposite polarity is supplied by the solenoid.

[2] Hung-Chi Wu, 958-2, Ghung Shan Rd., Tao Yuan, Taiwan This invention relates to an adjustable magnetic brake and in particular to one including an aluminum fan, a magnetic conducting ring enclosing the aluminum fan, a permanent magnet disposed within the aluminum fan, a fixing seat for keeping the permanent magnet in position, a sliding seat mounted in the fixing seat and provided with a bearing, a housing, bolts provided on one side of the fixing seat and extending out of the housing, a mounting plate connected with the bolts and a wire connected with the mounting plate such that when the wire is pulled outwards, the permanent magnet will be moved outwards.

[3] P. Hanyecz, (1982), "Calculation of Braking force in Eddy current brakes", Department of Theoretical Electricity. Technical University Budapest Pushkin Kuchroo, (1997), "Modelling and control of Electromagnetic brakes", Faculty Publications, University of Nevada, Las Vegas When electrical power is unintentionally or purposefully withdrawn, power-off brakes halt or hold a load. They often operate near or on an electric motor. To increase torque without expanding the brake, multiple discs can be utilized. Two distinct categories of power-off brakes exist. There is first spring-applied braking. A spring needs to pull against the pressure plate without the use of electricity,

trying to retain the friction disc here between internal baseplate and the external cover plate. Attached to a shaft, the wheel receives the friction transfer. Since this sort of brake frequently exhibits considerable backlash, it is better suited for less precise applications in which precise response time is indeed not essential. The permanent magnet brake is the second variety of power off brake. In this design, the armature is drawn to the permanent magnets by means of springs.

[4] Design of a magnetic braking system, Min Jou, Jaw-Kuen Shiau, ChiChian Sun. The concept designed by us is just a prototype and needs to be developed more because of the above-mentioned disadvantages. These electromagnetic brakes can be used as an auxiliary braking system along with the friction braking system to avoid overheating and brake failure. ABS usage can be neglected by simply using a micro controlled electromagnetic disk brake system. These find vast applications in heavy vehicles where high heat dissipation is required. In rail coaches it can used in combination of disc brake to bring the trains moving in high speed. When these brakes are combined it increases the life of brake and act like fully.

[5] Prajapati, K., Vibhandik, R., Baria, D., Patel, Y. and Detail, I.G., 2017 electromagnetic braking system. International Journal of Scientific Research in Engineering, 1(3). In this thesis, a new mathematical model for electromagnetic brakes is proposed to describe their static characteristics (angular speed versus brake torque). The performance of the new mathematical model is better than the other three models available in the literature in a least-square sense. Compared with old models that treat reluctance as a constant, our model treats reluctance as a function of speed.

[6] Patel, S., Patel, M., Patel, A., Sanghani, C., Patel, D., Patel, S.K., Patel, M.K., Patel, A.R., Sanghani, C.D. and Patel, D., 2015. Development of the Electro Magnetic Brake. International Journal, 1, pp.485- 492. In this way, the model represents more precisely the aggregate effect of all side effects such as degree of saturation of the iron in the magnet, demagnetizing effects, and air gap. The software program written in Mat lab can be used to code different brake characteristics (both static and dynamic) and evaluate their performance in different road scenarios.

[7] Flemming, Frank; Shapiro, Jessica (July 7, 2009). "Basics of Electromagnetic Brakes". machine design: pp. 57-58 an appropriate rate of heat dissipation if a reasonable temperature and performance stability are to be maintained. While the design, construction, and location feature severely limit the heat dissipation function of the friction brake, electromagnetic brakes work in a relatively cool condition and avoid problems that friction brakes face by using a totally different working principle and installation location. By using the electromagnetic brake as supplementary retardation equipment, the friction brakes can be used less frequently and therefore practically never reach high temperatures.

[8] Auguston, Karen; Flemming, Frank (September 1999). "Floating Armature Speeds Response". Global Design News: pp. 46–47 The brake linings thus have a longer life span, and the potential brake fade problem can be avoided. It is apparent that the electromagnetic brake is an essential complement to the safe braking of heavy vehicles. In this paper, a new mathematical model for electromagnetic brakes is proposed to describe their static characteristics (angular speed versus brake torque). The performance of the new mathematical model is better than the other three models available in the literature in a least-square sense.

[9] Akshyakumar S. Puttewar1, Nagnath U. Kakde2, Huzaifa A. Fidvi3, Bhyshan Nandeshwar4, "Enhancement of Braking System in Automobile using Electro-magnetic braking" Electromechanical brakes, also known as EM brakes, are another term for electromagnetic brakes. They construct mechanical properties, or friction, by using electromagnetic force to slow or stop motion. A braking coil's current produces a magnetic field powerful enough just to push an armature toward and away from one magnetic face. They are not to be confused with eddy current braking, which produces resistance by applying magnetic force. Numerous brake applications and designs have evolved a lot since they were initially widely used.

[10] Sevvel P1, Nirmal Kanann V2, Mars Mukesh S3, "Innovative Electromagnetic Braking System. A brake is a device that stops movement. It is well understood that friction is employed by brakes to convert kinetic energy into heat. Electromagnetic brakes, in place of conventional friction brakes, have been used on large vehicles as a basis for formulating of retardation apparatus. They work on the basis of electromagnetic theory. When a magnetic force is applied perpendicular to a revolving wheel or rotor, eddy current to flow in the opposite way [5],[6].

[11] Journal- Eddy Current in Magnetic Brakes- Henry A. Sudano and Jae SungBae.s. It minimizes brake failure in order to avoid road accidents [7],[8]. It also reduces the need for brake system maintenance. This system has the advantage of being able to adapt to any vehicle with only minor transmitting and electrical system modifications. Magnetic brakes are electrically powered yet mechanically transmit torque. For this reason, they were once known as electromechanical braking. Due to its actuation technique, EM brakes have come to be characterized as electromagnetic over time. Although there is now a vast array of uses and brake types since brakes first gained popularity more than 60 years ago, the fundamental function has not changed.

2.3 Summary

The above discussion gives an idea about the Braking System. The **Fabrication of an Electromagnetic Braking System.** In the situation are described in detail. From this we also got the direction of work of the project.

CHAPTER 3
HARDWARE AND SOFTWARE ANALYSIS

3.1 Introduction

This Project has worked on two things, Hardware and Software. Here we will discuss about our project hardware and software details.

Required instrument:

Hardware's:

- DC Gear Motor
- Electromagnetic Brake
- Battery
- Relay
- Chain Sprocket
- Bearing
- Shaft
- Rotary Wheel

3.2 DC Gear Motor

A DC motor is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications.

Specifications:

- Voltage: 12V DC
- Gear ratio: 1/31
- No-load speed: 200 RPM
- Rated Speed: 140 RPM
- Rated torque: 10 kg-cm
- Rated current: 2.5 Amp
- Length of Motor (Including spindle): 106 mm/4.17″

- Diameter: 37 mm/1.45″
- Shaft length: 21 mm/0.82″
- Shaft diameter: 6 mm/0.24″

Fig 3.2: DC Gear Motor

3.3 12V Battery

A twelve-volt battery has six single cells in series producing a fully charged output voltage of 12.6 volts. A battery cell consists of two lead plates a positive plate covered with a paste of lead dioxide and a negative made of sponge lead, with an insulating material (separator) in between.

Quick Details

- Nominal Capacity: 200AH
- Rechargeable 12V DC battery pack: 1PCS/CTN (According to the actual situation)
- Production Capacity: Rechargeable 12V dc battery pack: 50000 PCS/Month
- Factory Space: 6000m2
- Maintenance Type: Free
- Voltage: 12V

Fig 3.3: 12V Battery

3.4 5V Regulator IC

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.

7805 IC Rating

- Input voltage range: 7V- 35V
- Current rating IC = 1A
- Output voltage range: Voltage Max = 5.2V, Voltage Min=4.8V

Fig 3.4: 5V Regulator IC

3.5 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Fig 3.5: Relay

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "Protective Relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands.

Description: MK2P-I 10A 220V AC Electromagnetic relay with 8 pin round base coil voltage AC 220V 2 poles use for household & industrial.

8 Pins, DPDT type, plastic housing. Can adjust automatically, protect and transform the electric circuit. Used widely in the remote control, communication, automatic control system, electronic equipment’s etc.

MK2P-I 10A 220V AC Electromagnetic Relay With 8 Pin Round Base General Purpose Relay Coil Voltage AC 220V 2 pole Use for Household & Industrial Replace Finder Relay

FEATURES:

- Electromagnetic Relay power relay;
- Coil Voltage: AC 110V;
- Model: MK2P-I;
- Contact: DPDT 2NO 2NC; 8 Pins
- Contact Capacity: 250V AC/28V DC 10A RES; 250V AC 7A GEN
- Relay Contacts: Terminals 1 and 8 public points ; Terminals 2 and 7 Relay Coil Voltage; Terminals 3 and 6 N/O Normally Open; Terminals 4 and 5 N/C Normally Closed.
- It is perfect used in the remote control, communication, automatic control system, electronic equipment’s.

SPECIFICATIONS:

- Product Name: Electromagnetic Relay;
- Coil Voltage: AC 220V
- Contact: DPDT;
- Number of Pins: 8
- Contact Capacity: 250V AC/28V DC 10A RES; 250V AC 7A GEN

3.6 Wheel

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel, and flywheel.

Fig 3.6: Wheel

3.7 Push Button

A push-button (also spelled push-button) or simply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state.

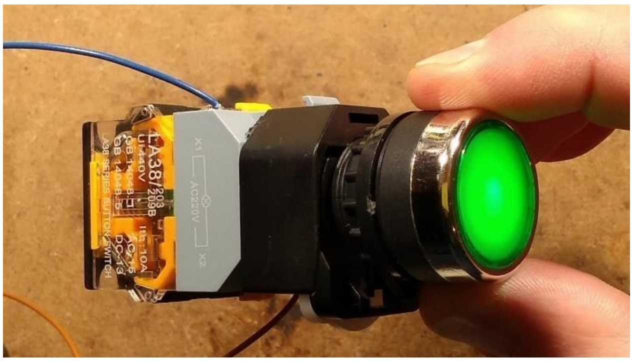


Fig 3.7: Push Switch

3.8 Electromagnetic Brake

Electromagnetic Brakes (also called electro-mechanical brakes or EM brakes) slow or stop motion using electromagnetic force to apply mechanical resistance (Friction). They were originally called "Electro-mechanical Brakes," but over the years the name changed to "Electromagnetic Brakes", referring to their actuation method. Since becoming popular in the mid-20th century, especially in trains and trams, the variety of applications and brake designs has increased dramatically, but the basic operation remains the same.

Application

In locomotives, a mechanical linkage transmits torque to an electromagnetic braking component. Trams and trains use electromagnetic track brakes where the braking element is pressed by magnetic force to the rail. They are distinguished from mechanical track brakes, where the braking element is mechanically pressed on the rail.

Electric motors in industrial and robotic applications also employ electromagnetic brakes. Recent design innovations have led to the application of electromagnetic brakes to aircraft applications. In this application, a combination motor/generator is used first as a motor to spin the tires up to speed prior to touchdown, thus reducing wear on the tires, and then as a generator to provide regenerative braking.

Fig 3.8: Electromagnetic Brake

3.9 Chain Sprocket

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system. Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth. Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear.

Fig 3.9: Chain Sprocket

Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotates once, it causes the gear that drives the wheels to rotate more than one revolution. Duplex chains are another type of chain which are essentially two chains joined side by side which allow for more power and torque to be transmitted.

3.9.1 Belt drive

Most chain drive systems use teeth to transfer motion between the chain and the rollers. This results in lower frictional losses than belt drive systems, which often rely on friction to transfer motion. Although chains can be made stronger than belts, their greater mass increases drive train inertia. Drive chains are most often made of metal, while belts are often rubber, plastic, urethane, or other substances. If the drive chain is heavier than an equivalent drive belt, the system will have a higher inertia. Theoretically, this can lead to a greater flywheel effect, however in practice the belt or chain inertia often makes up a small proportion of the overall drive train inertia. One problem with roller chains is the variation in speed, or surging, caused by the acceleration and deceleration of the chain as it goes around the sprocket link by link. It starts as soon as the pitch line of the chain contacts the first tooth of the sprocket. This contact occurs at a point below the pitch circle of the sprocket. As the sprocket rotates, the chain is raised up to the pitch circle and is then dropped down again as sprocket rotation continues. Because of the fixed pitch length, the pitch line of the link cuts across the chord between two pitch points on the sprocket, remaining in this position relative to the sprocket until the link exits the sprocket. This rising and falling of the pitch line is what causes chordal effect or speed variation. In other words, conventional roller chain drives suffer the potential for vibration, as the effective radius of action in a chain and sprocket combination constantly changes during revolution ("Chordal action"[10]). If the chain moves at constant speed, then the shafts must accelerate and decelerate constantly. If one sprocket rotates at a constant speed, then the chain (and probably all other sprockets that it drives) must accelerate and decelerate constantly. This is usually not an issue with many drive systems; however, most motorcycles are fitted with a rubber bushed rear wheel hub to virtually eliminate this vibration issue.

Toothed belt drives are designed to limit this issue by operating at a constant pitch radius Chains are often narrower than belts, and this can make it easier to shift them to larger or smaller gears in order to vary the gear ratio. Multi-speed bicycles with derailleurs make use of this. Also, the more positive meshing of a chain can make it easier to build gears that can increase or shrink in diameter, again altering the gear ratio. However, some newer synchronous belts claim to have "equivalent capacity to roller chain drives in the same width". Both can be used to move objects by attaching pockets, buckets, or frames to them; chains are often used to move things vertically by holding them in frames, as in industrial toasters, while belts are good at moving things horizontally in the form of conveyor belts. It is not unusual for the systems to be used in combination; for example, the rollers that drive conveyor belts are themselves often driven by drive chains.

3.9.2 Drive Shafts

Drive shafts are another common method used to move mechanical power around that is sometimes evaluated in comparison to chain drive; in particular belt drive vs chain drive vs shaft drive is a key design decision for most motorcycles. Drive shafts tend to be tougher and more reliable than chain drive, but the bevel gears have far more friction than a chain. For this reason, virtually all high-performance motorcycles use chain drive, with shaft-driven arrangements generally used for non-sporting machines. Toothed-belt drives are used for some (non-sporting) models. A sprocket, sprocket-wheel or chain wheel is a profiled wheel with teeth that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth except for timing pulleys used with toothed belts. Sprockets are used in bicycles, motorcycles, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc.

Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles. Sprockets are of various designs; a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centered. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys. They can be run at high speed and some forms of chain are so constructed as to be noiseless even at high speed.

3.10 Ball Bearing

A bearing is a machine element that constrains relative motion to only the desired motion and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is often used to reduce friction. In the ball bearing and roller bearing, to prevent sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.

The purpose of Bearing is to reduce rotational friction and support radial and axial loads Types of bearings There are at least 6 common types of bearing, each of which operates on different principles: - Plain bearing, consisting of a shaft rotating in a hole. There are several specific styles: bushing, journal bearing, sleeve bearing, rifle bearing, and composite bearing. Rolling-element bearing, in which rolling elements placed between the turning and stationary races prevent sliding friction. There are two main types Ball bearing, in which the rolling elements are spherical balls Roller bearing, in which the rolling elements are cylindrical, taper and spherical rollers Jewel bearing, a plain bearing in which one of the bearing surfaces is made of an ultra-hard glassy jewel material such as sapphire to reduce friction and wear Fluid bearing, a noncontact bearing in which the load is supported by a gas or liquid, Magnetic bearing, in which the load is supported by a magnetic field Flexure bearing, in which the motion is supported by a load element which bends.

Fig 3.10: Ball Bearing

CHAPTER 4
METHODOLOGY

4.1 Block Diagram

The block diagram here is representing the whole circuit and the components of the project. Here we have used standardized symbols and lines.

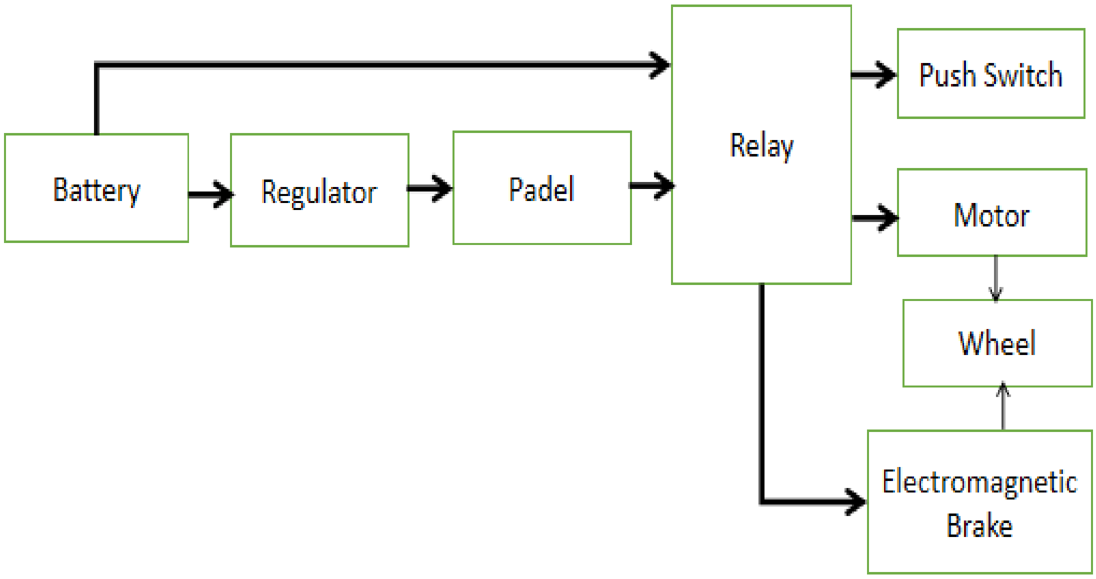


Fig 4.1: Block Diagram of Our Project

4.2 Schematic Diagram

The schematic diagram here is representing the electrical circuit and the components of the project. Here we have used standardized symbols and lines.

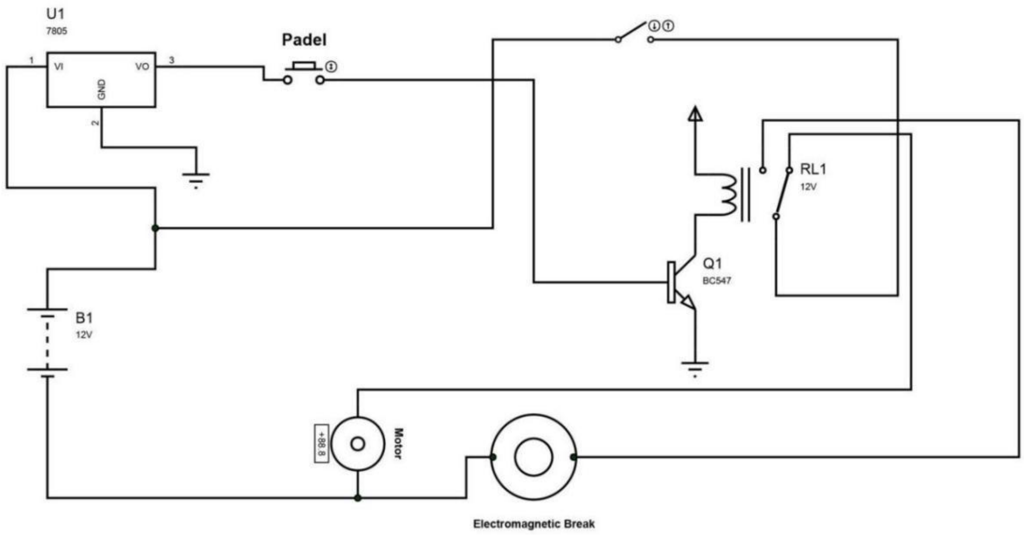


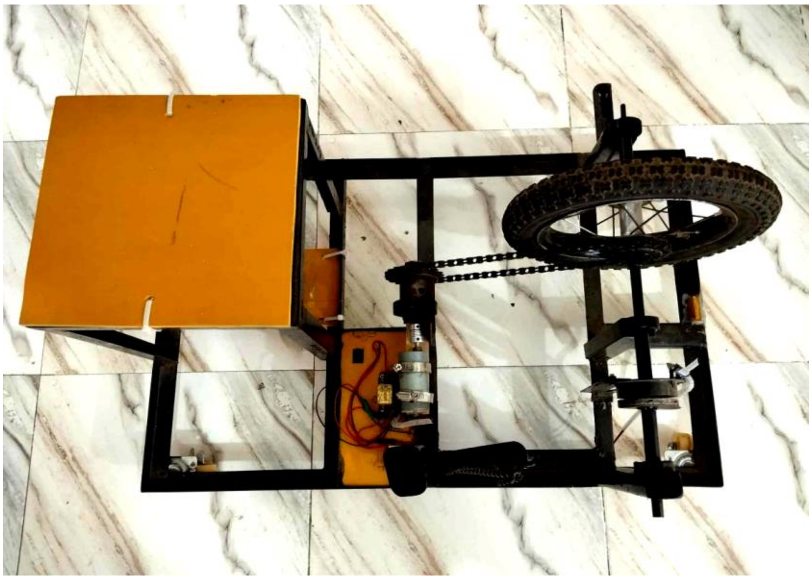
Fig 4.2: Schematic Diagram of Project

4.3 Working Principle

The main power source of our system is a powerful 12-volt battery. Once the system is switched on and connected to the battery, the system is ready to work. The working principle of an electromagnetic braking system involves the use of electromagnetic force to create a resistance force against the motion of a moving object, which slows it down or brings it to a stop. The braking system includes a set of electromagnets, which are energized by an electrical power source. When the electromagnets are energized, they produce a strong magnetic field that opposes the motion of the object to be stopped. As the object moves closer to the electromagnets, the magnetic field induces eddy currents in the conductive material of the object, such as a metal disk or wheel. The eddy currents produce their own magnetic field, which opposes the magnetic field produced by the electromagnets. This creates a resistance force that slows down or stops the object. The strength of the braking force can be controlled by adjusting the electrical current supplied to the electromagnets. Once the object is slowed down or stopped, the electrical power to the electromagnets is switched off, allowing the object to move freely. After that pressing a switch will turn the relay on and the motor will start and the wheel will continue to spin. Then when the brake pedal or push switch is pressed, the relay turns off the connection to the motor and the electromagnet brakes stops the wheel. Here we attached a generator motor for regenerate power from spin the wheel motor and store the power in battery. This is the main function of our system.

4.4 Final Project View

Here we have shown the final project overview with appropriate marking. Like train, rail line, board etc.



(Top View)

(Front View)

Fig 4.4: Final Project

CHAPTER 5
RESULT AND DISCUSSION

5.1 Result

After making our project we observe it very carefully. It works as we desire. Our project give output perfectly and all equipment are work perfectly. We check how much it works and we get perfect output from this project.

- Firstly, when we press switch on then the project will be run,
- After that pressing a switch will turn the relay with power from the battery on and the motor will start and the wheel will continue to spin
- Then when the brake pedal or push switch is pressed, the relay turns off the connection to the motor and the electromagnet brakes stops the wheel.

5.2 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involve improvement in system design and wiring, adding features for more efficiency.

5.3 Advantages

There are Some advantages of our Project because of its accuracy. The advantages are pointed out below:

- Alternative Braking system with foot brake pool.
- Better Performance From foot braking system.
- Maintenance cost is very less.
- Simple construction.
- Limited Heat Dissipation.

5.4 Disadvantages

There are Some Disadvantages of our Project because of its accuracy. The Disadvantages are pointed out below:

- High Initial Cost.
- Limited range of operation.
- Maintenance Requirements.

5.5 Applications

The application areas for Our Project in this modern and practical world are huge and some of these are given below:

- Motor Bike
- Motor Van
- Easy Bike
- Motor Electric Scooter Bike.
- Auto Electric Car.

CHAPTER 6
CONCLUSION

6.1 Future Scope

As we have already discussed about the limitations of this system so definitely there's room for improvement and thus, we have Some future scope of work available to us for this system. Some of these are listed below:

- Braking system can be done depending on the speed and add some sensors. So that the accident will be reduced.

- Depending on the sensor, the automatic brake system can be done without pressing the pedal.

6.2 Conclusion

The Electromagnetic braking system is found to be more reliable as compared to other braking systems. In addition, it is found that electromagnetic brakes make up approximately 80% of all of the power applied brake applications. Electromagnetic brakes have been used as supplementary retardation equipment in addition to the regular friction of the brakes. This enhanced braking system not only helps in effective braking but also helps in avoiding the accidents and reducing the frequency of accidents to a minimum. Furthermore, the electromagnetic brakes prevent the danger that can arise from the prolonged use of brake beyond their capability to dissipate heat.

ABS usage can be neglected by simply using a micro controlled electromagnetic disk brake system. For the brake distribution of the electromagnetic braking system, the abrasion, noise, harmful friction dust, and the risk of thermal failure in braking system were reduced obviously. These electromagnetic brakes can be used in wet conditions which eliminate the anti-skidding equipment, and cost of these brake are cheaper than the other types. The concept designed by us is just a prototype and needs to be developed more. It can not only be used in the field of automotive but also in the field of aeronautics. Hence the electromagnetic braking system can be a better technological revolution in the future application.

CHAPTER 7
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