



Power Generation in Automobiles by using Regenerative Clutch with Dynamo

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Abstract –

The objective of this paper is to store the kinetic energy dissipated in the brakes to accelerate the vehicle. This project is based on prototype model of Regenerative braking system using electromagnetic clutch. The energy output is to be increased that was found in the result of the regenerative braking. While moving the vehicle the work done of the engine efficiency getting reduced, so some amount of propulsion is needed to pull the vehicle. The energy storage unit must be compact, durable and capable of handling high power levels efficiently. The drive can be nonstop on condition that to dynamo itself to produce current and will be presented on the Ammeter installed in the set up. This set up also consists of an Infrared Sensor which helps to prevent the frequency of accidents increasing due to inefficient braking system and therefore can be considerably avoided using IR sensors. The vehicle instantly stops as any object appears in front of it where IR Sensors are installed.

Index words: Dynamo, Efficiency, Electromagnetic Clutch, Infrared Sensor, Regenerative Braking

I. INTRODUCTION

Electromagnetic authorities are made to operate electrically and transmit torque mechanically. This is why they used to be referred to as electro-mechanical authority. Over the years, EM become known as electromagnetic against electro mechanical, referring more on their actuation system versus mental operation. Since the clutches happening becoming all the rage over 60 years ago, the selection of applications and grab designs has increased spectacularly, but the basic business remains the same. Single visage clutches make up around 90% of all electromagnetic clutch sales.

The electromagnetic grasp is most suitable for inaccessible procedure, since it does not require linkage to control its date. It has very fast and

smooth function. However, for the reason that energy dissipates as heat in the electromagnetic actuator every time the clutch is unavailable, there is a chance of grip being impassioned. Consequently the maximum operating warmth of the clutch is restricted by the temperature mark of the insulation of the electromagnet.

Electromagnetic authority operate electrically, save for transmit torque involuntarily. This is why they worn to be referred to as electro-mechanical command. Over the years, EM became branded as electromagnetic against electro mechanical, referring more about their actuation method versus physical operation. Since the clutches started unattractive popular over 60 time ago, the variety of applications and clutch designs has increased severely, but the basic operation ruins the same.

Single-face clutches craft up approximately 90% of every electromagnetic clutch sales. The electromagnetic hang on to is most proper for remote operation while no linkages are required to be in command of its engagement. It have fast, smooth operation. However, as energy dissipates as heat in the electromagnetic actuator every time the clutch is betrothed, there is a hazard of overheating. Consequently the minimum operating temperature of the clutch is restricted by the warmth rating of the wadding of the electromagnet. This is a most important limitation. Another shortcoming is higher initial cost.

REGENERATION

In science, renaissance is the process of renewal, reinstallation, and growth with the aim of makes genomes, cells, organisms, and ecosystems supple to natural fluctuations or actions that cause disturbance or damage. all species is capable of restoration, from bacteria to human.

ELECTROMAGNETIC CLUTCH

Electromagnetic clutches operate electrically but transmit torque unconsciously. This is why they new to be referred to as electro-mechanical clutches. Over the years, EM became notorious as electromagnetic versus electro-mechanical, referring more in relation to their actuation method versus physical operation. Since the authority started becoming trendy over 60 years ago, the variety of application and clutch design has increased dramatically, but the indispensable operation ruins the same today. Single-face authority make up approximately 90% of all electromagnetic hold sales.

Electromagnetic authority are most suitable for in the sticks operation since no unthinking linkages are essential to control their rendezvous, providing fast, smooth procedure. However, because the establishment energy dissipates as heat in the electromagnetic actuator when the clutch is affianced, there is a risk of overheating. therefore, the maximum operating temperature of the clutch is limited by the temperature rating of the wadding of the electromagnet. This is a major limitation. Another inconvenience is higher preliminary cost.

In the effort to produce greener cars numerous process have been examine that effect fuel burning up. One process is braking - established braking waste energy because it kills the momentum that the engine has built up. nonetheless, with the process of regenerative braking, this vigor effectively finds a new home. Instead of being lost as heat in the brake the energy is used to drive an alternator which allow the energy to be partially well again and stored in a batter. In activist vehicles this store energy is then used to command electrical components including headlights, stereo and air conditioning. In hybrid cars, regenerative braking is used to lay the blame on the succession that propels the exciting motor. This is particularly useful in town driving situations when cars traditionally travel at little speeds. With regenerative braking a hybrid can rely solely on the stimulating motor in these situations, therefore producing nought emissions.

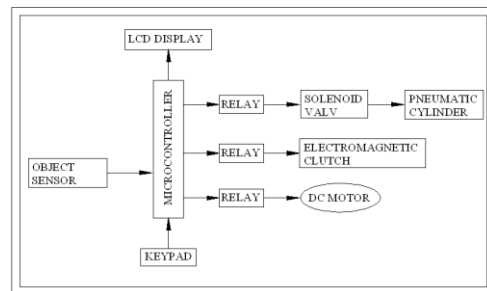
II.CONVERSION TO ELECTRIC ENERGY

Electric motors, when used in annul function as generator, convert mechanical energy into electrical energy. Vehicles propel by electric motors use them as generators as using regenerative brake, braking by transferring emotionless energy from the wheel to an electrical load.

Early examples of this system were the front-wheel drive conversion of horse-drawn cabs by Louis Antoine Krieger in Paris The Krieger thrilling landaulet had a impel motor in each front wheel in the midst of a second set of parallel windings (bifilar coil) used for regenerative braking. into England, the Raworth structure of "regenerative control" was introduced by tramway operator in the early since it offered them economic and operational benefits as explain by A. Raworth of Leeds in several detail. These integrated tramway systems at Devonport Rawtenstall, Birmingham, precious stone Palace-Croydon and many others. slow the speed of the cars or keeping it in control on sliding gradients, the motors worked as generator and braked the vehicles. The tram cars also had veer brakes and track slipper brakes which could stop the tram ought to the electric braking systems fail. In quite a lot of cases the tram car motors were shunt wound as a substitute of series wound, and the systems on the precious stone Palace line utilize series-parallel controllers. Following a serious accident at Rawtenstall, an embargo was positioned on this figure of traction in the regenerative braking system be reintroduced 20 years later

Fig.1 Block Diagram For Sensor Operated Electromagnetic Clutch

CONTROL UNIT



The control unit (CU) is a module of a computer's central processing unit (CPU) that directs the act of the processor. It tells the computer memory, arithmetic/logic piece and input and amount produced devices how to counter to a program's directives. It directs the operation of the further units by providing time and control signals. Most mainframe resources are managed by the CU. It directs the flow of data connecting the CPU and the other plans. John von Neumann built-in the control part as part of the von Neumann architecture. In up to date mainframe design, the control unit is classically an inner part of the CPU with its in general role and action unchanged since its preface.

Microcontrollers are ordained to play an yet more vital role in revolutionize various industry and influence our day to day life more powerfully than one can picture. Since its appearance in the early 1980's the microcontroller has been predictable as a universal purpose structure block for gifted digital systems.

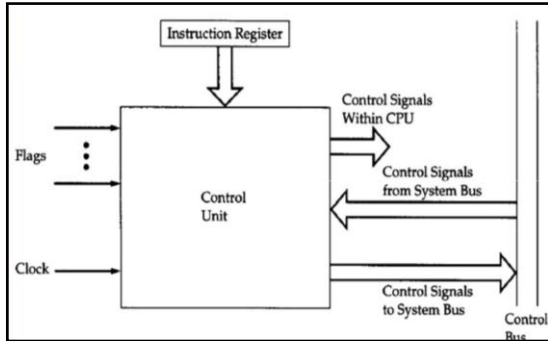


Fig.2 Block Diagram for Control Unit

B. BEARINGS

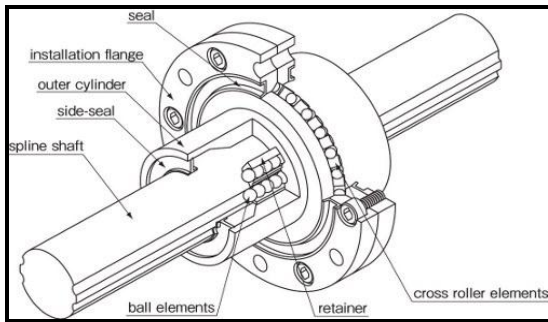


Fig.3 Block Diagram for Bearing

Most bearing facilitate the preferred motion by minimizing friction. Bearings are secret broadly according to the type of process, the motions allowable, or to the instructions of the loads (forces) practical to the parts.

C. CLUTCH

A hold is a mechanical machine which engage and disengage power program in particular from lashing shaft to drive shaft. rule are used when on earth the spread of power or proposal must be forbidden either in amount or over time e.g., electric screwdrivers limit how much torque is transmit through use of a grasp; clutches control whether automobile put on the air engine authority to the wheels. In the simplest application, control connect and detach two rotating shafts drive shafts or line shaft.

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operation. Since the rule started suitable popular over sixty years ago, the variety of applications and clutch design has increased significantly, but the basic scheme remains the same. Single-face authority make up in the classify of 90% of all electromagnetic clutch sales.

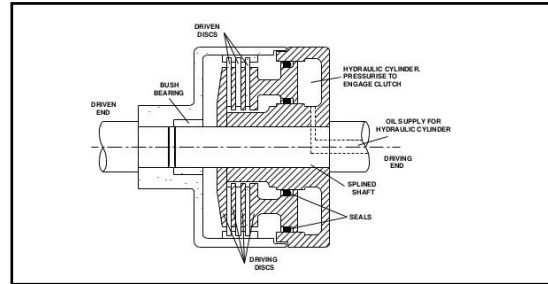


Fig.4 Block Diagram for Multiple Disc Clutch

III. LITERATURE SURVEY

The times past of the auto begins as early as 1769, with the creation of steam- powered automobile capable of human move In 1806, the first cars mechanical by internal combustion engines running on fuel gas appear, which led to the opening in 1885 of the ever-present modern gasoline or petrol fueled internal ignition engine. Cars mechanical by electricity briefly appeared at the turn of the 20th century but largely disappeared from commonality until the turn of the 21st century, when interest in low and zero emissions transportation was reignited. In electronics, a battery or voltaic cell is a combination of many electrochemical Galvanic cells of identical type to store chemical energy and to deliver higher voltage or higher current than with single cells

Most commonly brakes use friction to convert kinetic energy into heat, though other methods of energy conversion may be used. This work is based on regenerative braking which converts much of the energy to electrical energy, which may be stored for later use [1]. The driving range limitation is the key restriction for the large scale development of EV(electric vehicle), and regenerative braking is one of the effective approach to extend the driving range of EV. To protect the battery from broken due to large charging current during regenerative braking, the control strategy that makes the charging current as control objects [2].

Regenerative braking is a small, but still a very important step towards our gradual independence from fossil fuels. These techniques allow batteries to be used for longer periods of time without plugging into an external charger. Kinetic energy recovery system used in the vehicles saves a part of energy

recovery system used in the vehicles saves a part of the energy lost during braking. It can also be operated at high temperature range and are very efficient as compared to conventional braking system. The results from some of the test conducted show that around 30% of the energy delivered can be recovered by the system.

IV. DESCRIPTION OF EQUIPMENTS

A.DYNAMO

A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter.

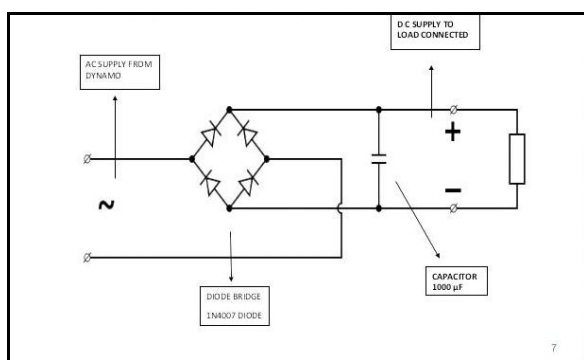


Fig.5 Block Diagram for Dynamo

Today, the simpler alternator dominates large scale power generation, for efficiency, reliability and cost reasons. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economical.

The electric dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. Due to Faraday's law of induction the motion of the wire within the magnetic field creates an electromotive force which pushes on the electrons in the metal, creating an electric current in the wire. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils.

A. MOTOR

An electric motor uses electrical energy to produce mechanical energy. The reverse process which of using mechanical energy to produce electrical energy is accomplished by a generator or dynamo. Traction motors used on locomotives and some electric and hybrid automobiles often performs both tasks if the vehicle is equipped with dynamic brakes. Electric motors are found in household appliances such as fans, refrigerators, washing machines, pool pumps, floor vacuums, and fan-forced ovens. They are also found in many other devices such as computer equipment, in its disk drives, printers, and fans; and in some sound and video playing and recording equipment as players and recorders, tape players and recorders, and record players. Electric motors are also found in several kinds of toys such as some kinds of vehicles and robotic toys.

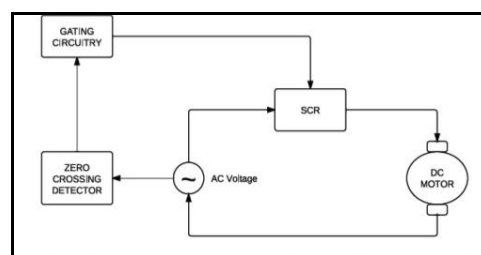


Fig.6 Block Diagram for Motor

The principle of conversion of electrical energy into mechanical energy by electromagnetic means was demonstrated by the British scientist Michael Faraday and consisted of a free hanging wire dipping into a pool of mercury. A permanent magnet was placed in the middle of the pool of mercury. When a current was passed through the wire, the wire rotated around the magnet, showing that the current gave rise to a circular magnetic field around the wire.

V. MACHINE COMPONENTS

The regenerating braking system is consists of the following components to full fill the requirements of complete operation of the machine.

- AC Motor
- Dynamo
- Spur Gear
- Belt and Pulley
- Electromagnetic Clutch
- Bearing
- Tyre
- Clutch Pedal

A. AC MOTOR

An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

AC motors operate with two rotating (or moving) magnetic fields on the rotor and stator respectively. Pulling or pushing the poles of the two magnetic fields along, the speed of the stator rotating magnetic field (W_s) and the speed of the rotor rotating magnetic field (W_r), which is relative to the speed of the mechanical shaft (W_m), must maintain synchronism for average torque production by satisfying the synchronous speed relation (i.e., $\pm W_s \pm W_r = W_m$). Otherwise, asynchronously rotating magnetic fields would produce pulsating or non-average torque

DYNAMO

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SPUR GEAR

Spur gear teeth are manufactured by either involute profile or cycloidal profile. Most of the gears are manufactured by involute profile with 20° pressure angle. When two gears are in mesh at one instant there is a chance to mate involute portion with non-involute portion of mating gear.

This phenomenon is known as interference and occurs when the number of teeth on the smaller of the two meshing gears is less than a required minimum. To avoid interference we can have undercutting, but this is not a suitable solution as undercutting leads to weakening of tooth at its base. In this situation Corrected gears are used. In corrected gears Cutter rack is shifted upwards or downwards.

When two gears mesh, if one gear is bigger than the other, a mechanical advantage is produced, with the rotational speeds, and the torques, of the two gears differing in proportion to their diameters.

In transmissions with multiple gear ratios-such as bicycles, motorcycles, and cars-the term "gear" as in "first gear" refers to a gear ratio rather than an actual physical gear. The term describes similar devices, even when the gear ratio is continuous rather than discrete, or when the device does not actually contain gears, as in a continuously variable transmission.

BELT AND PULLEY

Where the belt is adapted to carry a load continuously between two points. A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction the same if on parallel shafts or the belt may be crossed, so that the direction of the driven shaft is reversed the opposite direction to the driver if on parallel shafts. As a source of motion, a conveyor belt is one application.

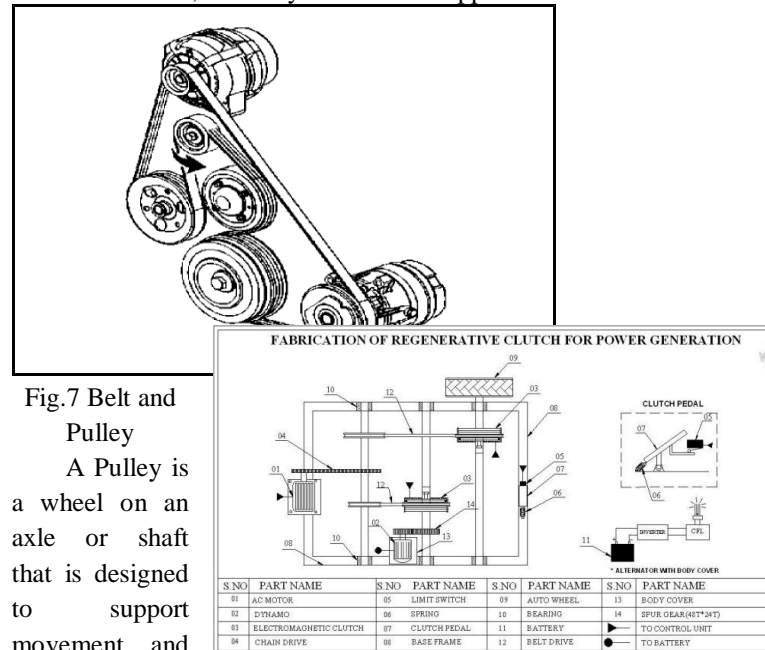


Fig.7 Belt and Pulley

A Pulley is a wheel on an axle or shaft that is designed to support movement and

change of direction of a taut cable, rope or belt along its circumference. Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power. In nautical contexts, the assembly of wheel, axle, and supporting shell is referred to as a "block."

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used to be referred to as electro-mechanical clutches. Over the years, EM became known as electromagnetic versus electro-mechanical, referring more about their actuation method versus physical operation. Since the clutches started becoming popular over 60 years ago, the variety of applications and clutch designs has increased dramatically, but the basic operation remains the same today. Single-face clutches make up approximately 90% of all electromagnetic clutch sales.

B. 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.

TYRE

A tire American English or tyre British English 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.

VI. ARCHITECTURE OF REGENERATIVE CLUTCH FOR POWER GENERATION

Fig.8 Regenerative Clutch for Power Generation

VI. WORKING PRINCIPLE

The main components involved in this project consist of motor, spur drives, dynamo, electromagnetic clutch, and bearing, and limit switch, clutch pedal and battery. The basic concept behind this project is to generate electricity while the clutch is in engaged position. Here we are using a belt drive to couple the wheel with the electromagnetic clutch and similarly couple the dynamo setup with the electromagnetic clutch from motor.

When the motor rotates coupled with the dynamo setup and wheel also rotates with the help of two electromagnet clutches using belt drives. Limit switch is placed below the clutch pedal. If we press the clutch pedal limit switch activates it gives signal for disengage the electromagnetic clutch near wheel

and engage the electromagnetic clutch near dynamo setup. So dynamo will produce power according its rotation. With the help of inverter circuit, the generated power is converted and stored in Battery. So whenever the clutch is applied, some amount of power can be produced which can be stored in the battery.

If the clutch pedal in rest position, wheel near the electromagnetic clutch is engaged. Dynamo setup near the electromagnetic clutch is disengaged.

Engagement

When the clutch is actuated, current flows through the electromagnet producing a magnetic field. The rotor portion of the clutch becomes magnetized and sets up a magnetic loop that attracts the armature. The armature is pulled against the rotor and a frictional force is generated at contact. Within a relatively short time, the load is accelerated to match the speed of the rotor, thereby engaging the armature and the output hub of the clutch. In most instances, the rotor is constantly rotating with the input all the time.

Disengagement

When current is removed from the clutch, the armature is free to turn with the shaft. In most designs, springs hold the armature away from the rotor surface when power is released, creating a small air gap.

Motor specification

SPEED = 1440 Rpm
 Volt = 220 v
 Watt = 180 w
 Amps = 2.5

Hp = ¼

Ph = 1

Motor calculation

Electrical (electric) power equation:

$$\text{Power } P = I \times V$$

Where,

$$I = 2.5 \text{ amps}$$

$$V = 220$$

$$P = I \times V \\ = 2.5 \times 220 = 550$$

To find the torque of the motor

$$P = 2 \times 3.14 \times n \times r / 60$$

$$T = p \times 60 / 2 \times 3.14 \times n \times r$$

$$T = 550 \times 60 / 2 \times 3.14 \times 1440$$

$$T = 3.65 \text{ N-m}$$

Dynamo

$$\text{Speed} = 1500 \text{ rpm}$$

$$\text{Volts} = 12 \text{ v}$$

$$\text{Watts} = 18 \text{ w}$$

If the dynamo rotates at 1500 rpm it will produce 6-8 v

Battery Calculation

$$B_{AH}/C_I = 8 \text{ ah}/420\text{ma} \\ = 19 \text{ hrs}$$

To find the Current

$$\text{Watt} = 18 \text{ w}$$

$$\text{Volt} = 12\text{v}$$

$$\text{Current} = ?$$

$$P = V \times I$$

$$18 = 12 \times I$$

$$I = 18/12$$

$$= 1.5 \text{ AMPS}$$

BATTERY USAGE WITH 1.5 AMPS

$$B_{AH}/I$$

$$8/1.5 = 5.3 \text{ hrs}$$

A gear is component within a transmission device. Transmit rotational force to another gear or device.

Advantages

- Automatically operate
- Implementation is easy
- Maintenance is easy

Disadvantages

- Cost is high
- Production of power is less
- Cost of installation is high

VII. CONCLUSION

The project carried out by us will make an impressing mark in the field of automobile. Regenerative clutch is an effective method of improving vehicle efficiency and longevity. The regenerative clutch system used in the vehicles satisfies the purpose of saving a part of the energy lost during clutch applied. Regenerative clutch system has a wide scope for further development and the energy savings. The use of more efficient systems could lead to huge savings in the economy of any country. It is very usefully for recover the energy waste from clutch system.

The miraculous thing about regenerative clutch is that it may be able to capture as much as half of that wasted energy and put it back to work. This project has also reduced the cost involved in the concern. The project has been designed to perform the required task taking minimum time. The lower operating and environment costs a vehicle with regenerative clutch system should make it more attractive than conventional one. The traditional cost of the system could be recovered in few years only.

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