Eco-FRIENDLY ELECTRICITY GENERATOR FROM BUSY ROAD

Kaushal Pratap Singh*, Priyanka singh**
*Jaypee University of Information Technology, Samirpur, Hamirpur-HP (India)
** Sambhram Institute of Technology, M.S.Palya, Jalahalli East, Bangalore, Karnatka-560097

Abstract

The concept is to capture the normally lost energy surrounding a system and converting it into electrical energy that can be used to extend the life time of that system's power supply**.** So this is my step to improve the situation of electricity with an innovative and useful concept i.e Generating Electricity from a Speed breaker. Producing electricity from a speed breaker is a new concept that is undergoing research. The number of vehicles on road is increasing rapidly and if we convert some of the kinetic energy of these vehicle into the rotational motion of roller then we can produce considerable amount of electricity, this is the main concept of this project. In this project, a roller is fitted in between a speed breaker and some kind of a grip is provided on the speed breaker so that when a vehicle passes over speed breaker it rotates the roller. This movement of roller is used to rotate the shaft of D.C. generator by the help of chain drive which is there to provide 1:5 speed ratios. As the shaft of D.C. generator rotates, it produces electricity. This electricity is stored in a battery. Then the output of the battery is used to lighten the street lamps on the road. Now during daytime we don't need electricity for lightening the street lamps so we are using a control switch which is manually operated .The control switch is connected by wire to the output of the battery. The control switch has ON/OFF mechanism which allows the current to flow when needed.

Keywords – D.C: Direct current, A.C: Alternating current, Generation, Mechanism.

1. INTRODUCTION

Before starting I have one question to you all who is really very happy with the current situation of the electricity in India? I suppose no one. So this is my step to improve the situation of electricity with an innovative and useful concept ie Generating Electricity from a Speed breaker. First of all what is electricity means to us? Electricity is the form of energy. It is the flow of electrical Power. Electricity is a basic part of nature and it is one of our most widely used forms of energy. We get electricity, which is a secondary energy source, from the conversion of other sources of energy, like coal, natural gas, oil, nuclear power and other natural sources, which are called primary sources. Many cities and towns were built alongside waterfalls that turned water wheels to perform work. Before electricity generation began slightly over 100 years ago, houses were light with kerosene lamps, food was cooled in iceboxes, and rooms were warmed by wood-burning or coal-burning stoves. Direct current (DC) electricity had been used in arc lights for outdoor lighting. In the late-1800s, Nikola Tesla pioneered the generation, transmission, and use

of alternating current (AC) electricity, which can be transmitted over much greater distances than direct current. Tesla's inventions used electricity to bring indoor lighting to our homes and to power industrial machines. How is electricity generated? Electricity generation was first developed in the 1800's using Faradays dynamo generator. Almost 200 years later we are still using the same basic principles to generate electricity, only on a much larger scale. The rotor (rotating shaft) is directly connected to the prime mover and rotates as the prime mover turns. The rotor contains a magnet that, when turned, produces a moving or rotating magnetic field. The rotor is surrounded by a stationary casing called the stator, which contains the wound copper coils or windings. When the moving magnetic field passes by these windings, electricity is produced in them. By controlling the speed at which the rotor is turned, a steady flow of electricity is produced in the windings. These windings are connected to the electricity network via transmission lines. Now i m throwing some light on the very new and innovative concept i.e generation of electricity from a Speed Breaker. Producing electricity from a speed breaker is a new concept that is undergoing research. The number of vehicles on road is increasing rapidly and if we convert some of the kinetic energy of these vehicle into the rotational motion of roller then we can produce considerable amount of electricity, this is the main concept of this project. In this project, a roller is fitted in between a speed breaker and some kind of a grip is provided on the speed breaker so that when a vehicle passes over speed breaker it rotates the roller.
The function will be as follows:

1 The speed beaker on a busy road will be lifted to some height from one side and fixed to the road from other side.

2. Then there will be a shock absorber kind of mechanism beneath the speed breaker. The arrangement will be as in a cam and shaft arrangement.

3. The shaft of the generator placed below will be attached to the cam and the rod connected to the speed breaker vertically will be on cam. This arrangement will make one rotation of the generator shaft as soon as a vehicle moves over speed breaker.

4. The rotations can also be increased using certain mechanism, like gears and all.

Then there will be a circuit storing the electricity generated during day time and the power generated will be used during night.
One question that u all are thinking is why I have apply this on the speed breaker and not on the rough road or plane road where the kinetic energy of the vehicle is more then what I m getting on the speed breaker I m giving u one example, just think over it. A car or any heavy vehicle is coming with a speed of 100 mph on the road and passing over this roller which is fitted at the level of the road then this roller is gaining the speed nearly somewhere 90 mph (due to losses). So now suppose a cycle is coming with a speed of 20 mph and is going to pass this roller (which is moving at a speed of 90 mph) due to this difference in the speed there will be a collision that is the main reason for using this concept on the speed breaker

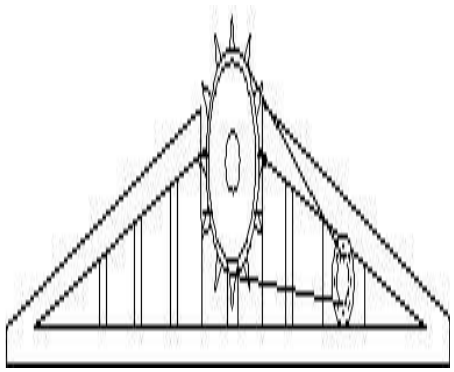


Fig.2 Side View **Fig.1** Working Model

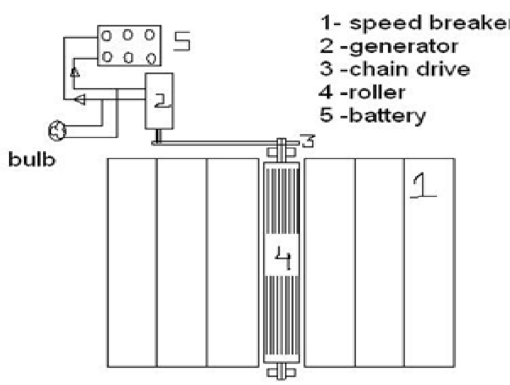


Fig.3 Top View

2. EQUIPMENT USED

1. Dynamos

In simplest terms, a dynamo is essentially an electric motor run in reverse. The electric motor uses magnets spinning in a metal coil to spin an axle. Conversely, spinning the axle causes the magnets to rotate in the coil and generates an electric current moving away from the motor. A cool experiment to try is to buy a small motor from radio shack and put it to your tongue. Spin it and you will feel a slight tingle coming from the connectors. This is known as the Faraday Effect. Look up this effect to gain a fuller understanding of motors and dynamos.

In physics, a simple generator or machine for transforming mechanical energy into electrical energy. A dynamo in basic form consists of a powerful field magnet between the poles of which a suitable conductor, usually in the form of a coil (armature), is rotated. The magnetic lines of force are cut by the rotating wire coil, which induces a current to flow through the wire. The mechanical energy of rotation is thus converted into an electric current in the armature.

Present-day dynamos work on the principles described by English physicist Michael Faraday in 1830, that an electromotive force is developed in a conductor when it is moved in a magnetic field. The dynamo that powers the lights on a bicycle is an example of an alternator, that is, it produces alternating current (AC).

1.1 Working

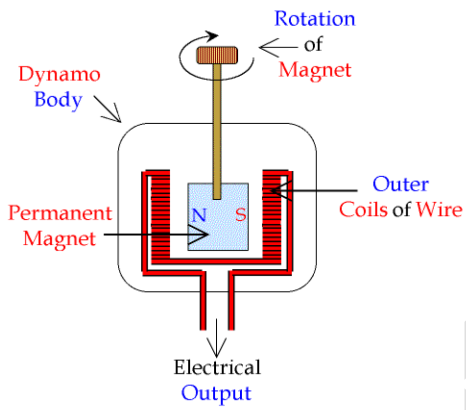


Fig.4 Working of Dynamo

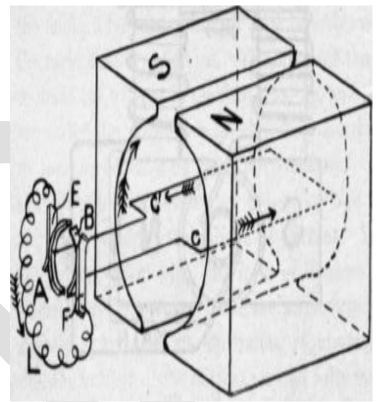
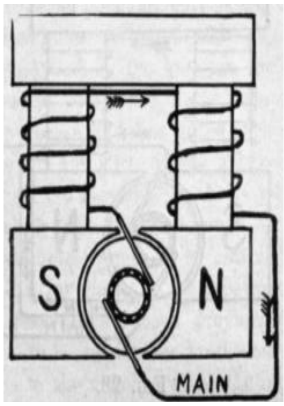
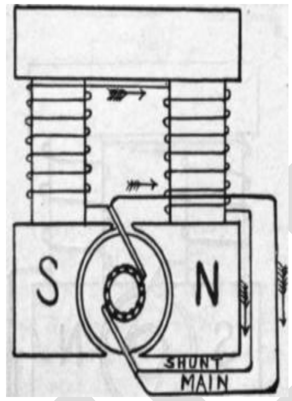


Fig.5 Dynamo- Electric Machine

If you move a conductor such as wire across a magnetic field, it generates a current in the wire. All dynamos are just different way of packaging up a lot of wires and moving them fast in a magnetic field. There are lots of subtleties, but the underlying physics is the same uses a permanent magnet which is rotated by a crank. The spinning magnet is positioned so that its north and south poles passed by a piece of iron wrapped with wire. It was discovered that the spinning magnet produced a pulse of current in the wire each time a pole passed the coil. Furthermore, the north and south poles of the magnet induce currents in opposite directions. By adding a commutator, it is possible to convert the alternating current to direct current.
The generating of a current by means of a dynamo-electric machine was briefly considered. The reversal of the direction of the current induced by the motion of the coil of wire, as illustrated in Fig.5, is true of all the coils of wire comprising in part the armature of a dynamo. This is further illustrated in Fig.5(a), which shows the ends of the wire coil C - C connected with two semicircular pieces of brass, A and B, representing the commutator, which are in contact with flat pieces of copper, E and F, representing the brushes of a dynamo. Assuming that the coil of wire is revolving clockwise, and cutting the lines of force from the N to the S poles of the magnet, a current induced in the part of the coil C is in the reverse direction from that in the part C, and only requires a closed circuit to flow around the coil in the direction shown by the arrows. As the coil continues to revolve until the position of the parts C and C are reversed, the current still flows around the circuit L in the same direction. The direction of the current in the coil has been reversed, but the pieces E and F are now in contact with different brushes, so the current still flows in the same direction around the main circuit. By having a large number of coils of wire in the armature and a corresponding number of sections in the commutator, the current in the main circuit is made practically uniform, the current from one coil rapidly succeeding that from the preceding coil In addition to the coils of wire in the armature of a dynamo is an iron core, the purpose of which is to make a good magnetic path for the lines of force passing through it from the N to the S pole of the field magnets, as the core concentrates these lines of force, so increasing the number cut by the coils of wire, and consequently increasing the efficiency of the

dynamo. The magnets between which the armature revolves are called the field magnets. The function of the field magnets is to provide the magnetic lines of force, through which the armature coils revolve. They may be permanent magnets or electro-magnets, the latter being universally used when other than very light work is required. The reason for this is that electro-magnets are capable of giving a much more powerful current than permanent magnets.





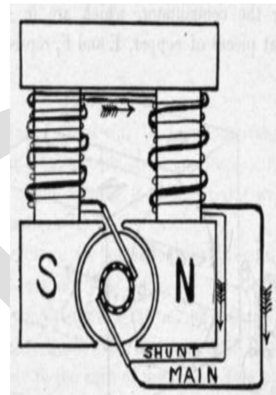


Fig.5(a) Self-Exciting Dynamo **Fig.5 (b)** Shunt Wound Dynamo **Fig.5 (c)** Compound Dynamo

In the earliest forms of dynamos the field magnets were excited by a current from an outside source; but this form was soon superseded by the self-exciting dynamo. One form, known as the series dynamo, is shown in Fig. 5(a). The iron cores of the field magnets, after being once excited, retain a certain amount of magnetism, termed residual magnetism. While small in amount, it is yet sufficient to produce some electro-motive force, so that when the armature revolves, a feeble current is produced, which, passing through the field coils, increases the magnetism, which, in turn, increases the magnetic lines of force and the resulting current from the armature coils. This continues until the armature core and field cores are thoroughly saturated with magnetism, and the dynamo reaches its maximum efficiency. By experiment and calculation the size and wiring of the several parts of a dynamo are carefully determined, the the greatest output may be obtained from a given expenditure of power, and yet not reach a point where excessive or injurious E. M. F. is generated. The series dynamo is a form not much used, as it is not self-regulating under a varying load. If under loaded, the E. M. F. increases excessively; if overloaded, it decreases rapidly, - the reverse of which is desirable under those conditions.

The wiring of the field coils is in series with the outside circuit, and the armature and the whole current passes through them. This necessitates a few turns of large wire for the fields. The load of a series dynamo is usually connected in series.

Another form of wiring which overcomes certain of the objections of the series dynamo is that known as the shunt-wound dynamo, shown in Fig. 5(b). In this type the field coils form a shunt to the main circuit, only a portion of the current from the armature passing through them. The current, therefore, is divided or shunted, the larger part going directly to the outside circuit, and the balance around the field coils. As this latter current is small in amount, the wire for the field coils of a shunt-wound dynamo is small in size, but consists of many turns. The magnetism produced by the field coils is proportional to the current and the turns of wire, ampere turns, as

they are called. Thus 10 turns of a large wire carrying 10 amperes is the equal of 100 turns of smaller wire carrying 1 ampere, and each will exert the same magnetizing force. By reducing the size of the wire, the ampere turns of a shunt-wound dynamo is made equal to the ampere turns of a series dynamo of the same size. The amount of energy required to magnetize the fields, and the efficiency of the two types of dynamos under a normal load, should be the same.
The shunt dynamo is more nearly self-regulating under a varying load than a series dynamo, the load being usually in parallel. Therefore, as additional branches in parallel in the main circuit are closed, the resistance falls, and more current is supplied by the armature. This decreases the amount received in the shunt or field coils, thus reducing the magnetism, which in turn slightly reduces the current of the armature, and so regulates the output of the dynamo. A low resistance in the armature is desirable in this type, and also an even strength of magnetism in the fields. To regulate the voltage of a shunt dynamo, a rheostat is generally inserted in the shunt circuit. A rheostat is an instrument containing circuits of varying resistance, with a switch for disconnecting any or all of them.
Another type of dynamo which is self-regulating under wide variations of load is that known as the compound dynamo, shown in Fig. 5(c). This is a combination of the two previous forms of winding. In addition to the shunt winding of the fields, a few coils of thick wire in series with the main circuit are added. The effect of this is to make the current in the field winding, and consequently the magnetism produced proportional to the current flowing from the armature. The shunt winding maintains the proper voltage and the series winding the volume of current. It is customary, when using this form of dynamo for electric lighting work, to have the series winding slightly in excess of the theoretical requirements, that the voltage of the current may be fully maintained at all parts of the main circuit. This is called over compounding. The various parts of the above types of dynamos will be more fully considered in subsequent chapters

2. Light Emitting Diode (L.E.D)

Light emitting diode (LED) is basically a P-N junction semiconductor diode particularly designed to emit visible light. There are infra-red emitting LEDs which emit invisible light. The LEDs are now available in many colors red, green and yellow, a normal LED emits at 2.4V and consumes MA of current. The LEDs are made in the form of flat tiny P-N junction enclosed in a semi-spherical dome made up of clear colored epoxy resin. The dome of a LED acts as a lens and diffuser of light. The diameter of the base is less than a quarter of an inch. The actual diameter varies somewhat with different makes. The common circuit symbols for the LED are shown in fig. 1. It is similar to the conventional rectifier diode symbol with two arrows pointing out. There are two leads- one for anode and the other for cathode.
LEDs often have leads of dissimilar length and the shorter one is the cathode. This is not strictly adhered to by all manufacturers. Sometimes the cathode side has a flat base. If there is doubt, the polarity of the diode should be identified. A simple bench method is to use the ohmmeter incorporating 3-volt cells for ohmmeter function. When connected with the ohmmeter: one way there will be no deflection and when connected the other way round there will be a large deflection of a pointer. When this occur the anode lead is connected to the negative of test lead and cathode to the positive test lead of the ohmmeter.

Issue 4, Vol.3 (May 2014)
ISSN 2249-6149

Fig.6 Circuit Symbol of L.E.D

3. Relay

Relay is a common, application of application of electromagnetism. It uses an electromagnet made from an iron rod wound with hundreds of fine copper wire. When electricity is applied to the wire, the rod becomes magnetic. A movable contact arm above the rod is then pulled toward; a small spring pulls the contract arm away from the rod until it close, a second switch contact. By means of relay, a current circuit can be broken or closed in one circuit as a result of a current in another circuit. Relays can have several poles and contacts. The types of contacts could be normally open and normally closed. One closure of the relay can turn on the same normally open contacts; can turn off the other normally closed contacts.

A relay is a switch worked by an electromagnet. It is useful if we want a small current in one circuit to control another circuit containing a device such as a lamp or electric motor which requires a large current, or if we wish several different switch contacts to be operated simultaneously.

The structure of relay and its symbol are shown in fig.7. When the controlling current flows through the coil, the soft iron core is magnetized and attracts the L-shaped soft iron armature. This rocks on its pivot and opens, closes or changes over, the electrical contacts in the circuit being controlled.

The current needed to operate a relay is called the pull-in current and the drop-out current is the current in the coil when the relay just stops working. If the coil resistance R of a relay is 100Ω and its operating voltage V is 6V, the pull-in current *I* is given by:

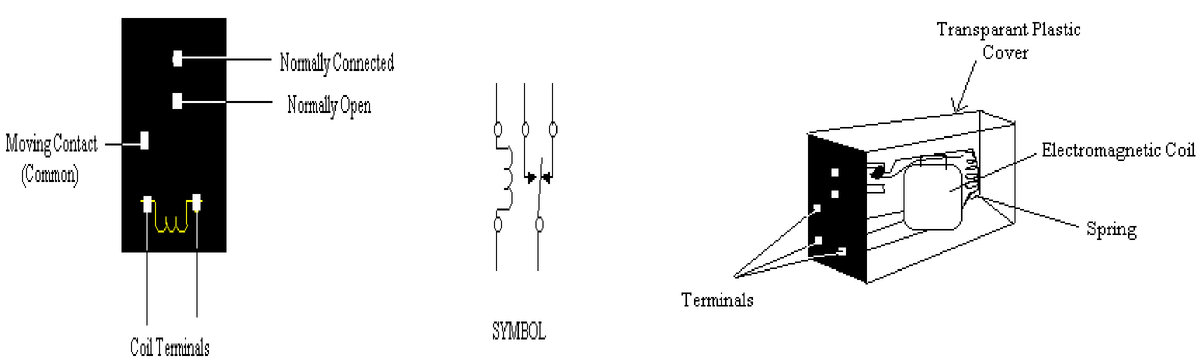


Fig.7 Structure of Relay and Its Symbol

4. Speed breakers

Speed breakers are used to slow down the speed of vehicle by offering a resistance on wheels. It is in strips in two to five numbers lying parallel to each other on the road. It can be easily seen on railway crossings

3. CONCLUSION

In this world where there is shortage of electrical power supply, this project will be helpful to solve some of the problems. This project has some advantages which are:-

- The project is economical and easy to install.
- This project is none polluting.
- Maintenance cost is low.
- Installation cost is low.
- Will solve some of the electricity problems of the world.
- The electricity produced by this system can be used to drive an electric motor or for any other purpose. This project can be implemented on road and can be used to lighten the street lamps

4. FUTURE SCOPE

A control system for an AC excited synchronous machine for use in an electricity generator/motor system. The AC excited synchronous machine can be driven not only in a variable-speed operation based on 2-axis current control but also in a constant exciting frequency operation based on only direct-axis current component control. A phase signal is switched to drive stably the AC excited synchronous machine in a self-excited operation or in a rotary phase modifying operation. Further, when it is desired to start pumping-up water, a synchronizing power is provided to keep constant the rotational speed of the machine at the time of establishing a desired water pressure.

Because of the switching arrangement of the phase signal, the AC excited synchronous machine can be operated as an ordinary synchronous machine exhibiting ordinary synchronous characteristics, that is, self-excited operation characteristics, rotary phase modifying operation characteristics and pumping-up start characteristics. Even when the synchronous machine is cutoff from an AC power system and the voltage of the synchronous machine is abruptly changed, the stable self-excited operation of the machine can be realized.

REFRENCES

[1]. Gannon, Thomas. Newport Mansions: The gilded age. Fort church publishers, Inc., 1982:p.8

[2] Miller, G. Wayne (2000-07-07),"fortune's children". A nearly perfect summer (providence Journal)

[3]. Shirley (November 11, 2005).”Smart road humps will smooth the way for safe drivers”. London:

[4]. Dr. Anders Brandt & MSc Johan Granlund, Swedish Road Administration (2008).” Bus Drivers’ Exposure To Mechanical Shocks Due To Speed Bumps”.Society for Experimental Mechanics, IMAC XXVI Conference and Exposition on Structural Dynamics.