



## Design and fabrication of electrical power generation from railway track

K.Adithya<sup>1</sup>, B.Dhivagar<sup>2</sup>, Abhijeet Kumar Singh<sup>2</sup>, Abhishek Kumar Singh<sup>2</sup>, Ashwini Sharma<sup>2</sup>

Assistant Professor<sup>1</sup>, UG Students<sup>2</sup>

Department of Mechanical Engineering, Nandha College of Technology,

Erode-52, Tamil Nadu, India

*Aksc01550@gmail.com<sup>1</sup>, thakurashwini596@gmail.com<sup>2</sup>*

**Abstract :** Energy is the ability to do work. While energy surrounds us in all aspects of life, the ability to harness it and use it for constructive ends as economically as possible is the challenge before mankind. Alternative energy refers to energy sources which are not based on the burning of fossil fuels or the splitting of atoms. The renewed interest in this field of study comes from the undesirable effects of pollution (as witnessed today) both from burning fossil fuels and from nuclear waste byproducts. Fortunately there are many means of harnessing energy which have less damaging impacts on our environment.

The alternatives are,

- Solar
- Wind Power
- Geothermal
- Tides
- Hydroelectric

In addition to these we have developed a new methodology of generating power using human energy and the name of this alternative is a railway track power generation.

### I. INTRODUCTION

The power generating plant maintains the equipment with periodic inspections and logs temperatures, pressures and other important information on regular intervals. The plants are responsible for starting and stopping the generators depending on need. They are able to synchronize and adjust the voltage output of the added generation with the running electrical system without upsetting the system. They must know the electrical and mechanical systems in order to troubleshoot problems in the facility and add to the

reliability of the facility. The power plant must be able to respond to an emergency and know the procedures in place to deal with it. Power plant is a net consumer of energy but decreases the price of electricity. Water is pumped to a high reservoir during the night when the demand, and price, for electricity is low. During hours of peak demand, when the price of electricity is high, the stored water is released to produce electric power.

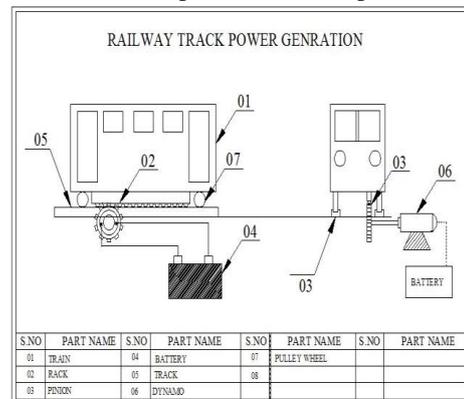


Fig.1 Railway Track Power Generation

The usage of traditional power generation method such as burning of coal, wood, diesel (generators) etc is continuously depleting our natural resources such as fossil fuels, which is the demand for power has exceed the supply due to the rising population. In addition to this the traditional methods cause pollution, encourage deforestation (cutting of trees) the consequences are global warming, power shortage like we are facing in tamilnadu.

### II.LITERATURE SURVEY

### RAILWAY TRACK POWER GENERATION:

The usage of traditional power generation method such as burning of coal, wood, diesel (generators) etc is continuously depleting our natural resources such as fossil fuels, which is the demand for power has exceed the supply due to the rising population. In addition to this the traditional methods cause pollution, encourage deforestation (cutting of trees) the consequences are global warming, power shortage like we are facing in tamilnadu. Global warming is the increase in the average measured temperature of the Earth's near-surface air and oceans since the mid-20th century, and its projected continuation. Global surface temperature increased  $0.74 \pm 0.18 \text{ }^\circ\text{C}$  ( $1.33 \pm 0.32 \text{ }^\circ\text{F}$ ) during the 100 years ending in 2005. The Intergovernmental Panel on Climate Change (IPCC) concludes that most of the increase since the mid-twentieth century is "very likely" due to the increase in anthropogenic greenhouse gas concentrations. Natural phenomena such as solar variation combined with volcanoes probably had a small warming effect from pre-industrial times to 1950 and a small cooling effect from 1950 onward. Climate model projections summarized by the IPCC indicate that average global surface temperature will likely rise a further 1.1 to 6.4  $^\circ\text{C}$  (2.0 to 11.5  $^\circ\text{F}$ ) during the twenty-first century. This range of values results from the use of differing scenarios of future greenhouse gas emissions as well as models with differing climate sensitivity. Although most studies focus on the period up to 2100, warming and sea level rise are expected to continue for more than a thousand years even if greenhouse gas levels are stabilized. The delay in reaching equilibrium is a result of the large heat capacity of the oceans.

### III. METALS AND FLOATING MATERIAL USED IN FABRICATION

#### 1.RACK AND PINION:

The rack and pinion is used to convert between rotary and linear motion. The rack is the flat, toothed part, the pinion is the gear. Rack and pinion can convert from rotary to linear or from linear to rotary. The diameter of the gear determines the speed that the rack moves as the pinion turns. Rack and pinions are commonly used in the steering system of cars to convert the rotary motion of the steering wheel to the side to side motion in the wheels. Rack and pinion gears give a positive

motion especially compared to the friction drive of a wheel in tarmac. In the rack and pinion railway a central rack between the two rails engages with a pinion on the engine allowing the train to be pulled up very steep slopes. A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a rack with a pinion: the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steeringwheel into the left-to-right motion of the tie rod(s). Racks also feature in the theory of gear geometry, where, for instance, the tooth shape of an interchangeable set of gears may be specified for the rack (infinite radius), and the tooth shapes for gears of particular actual radii then derived from that. The rack and pinion gear type is employed in a rack railway.

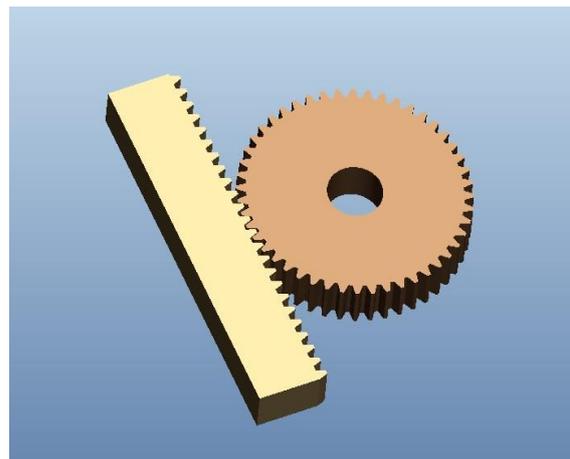


Fig.2 Rack and Pinion

#### 2.DYNAMO:

Dynamo is an electrical generator. This dynamo produces direct current with the use of a commutator dynamo were the first generator capable of the power industries. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current. 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. 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.

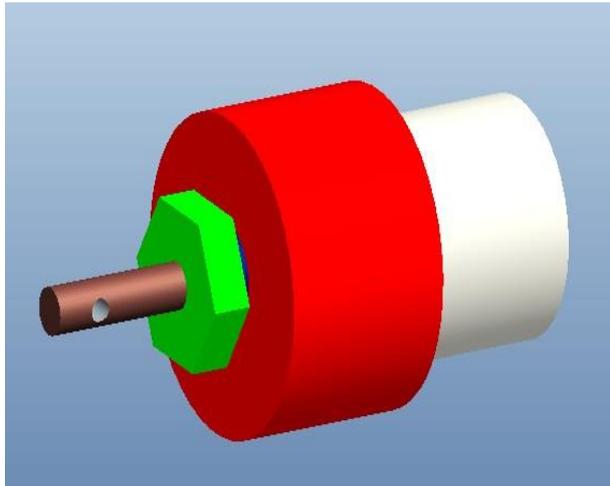


Fig 3.Dynamo:

The commutator was needed to produce direct current. When a loop of wire rotates in a magnetic field, the potential induced in it reverses with each half turn, generating an alternating current. However, in the early days of electric experimentation, alternating current generally had no known use. The few uses for electricity, such as electroplating, used direct current provided by messy liquid batteries. Dynamos were invented as a replacement for batteries. The commutator is a set of contacts mounted on the machine's shaft, which reverses the connection of the windings to the external circuit when the potential reverses, so instead of alternating current, a pulsing direct current is produced.

### 3.RECTIFIER:

Rectifier is an electrical device .it is converting to the alternating current to direct current this process known as a rectification.rectifier has many uses it can be found in many power supply components and also as a detector. The term rectifier describes a diode that is being used to convert AC to DC. Almost all rectifiers comprise a number of diodes in a specific arrangement for more efficiently converting AC to DC than is possible with only one diode.

### 4.FILTER:

Electronic filters are electronic circuits which perform signal processing functions,

specifically intended to remove unwanted signal components and/or enhance wanted ones.

### 5. BATTERY:

In our project we are using secondary type battery. It is rechargeable Type.A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.

Batteries have gained popularity as they became portable and useful for many purposes. The use of batteries has created many environmental concerns, such as toxic metal pollution. A battery is a device that converts chemical energy directly to electrical energy it consists of one or more voltaic cells. Each voltaic cell consists of two half cells connected in series by a conductive electrolyte.

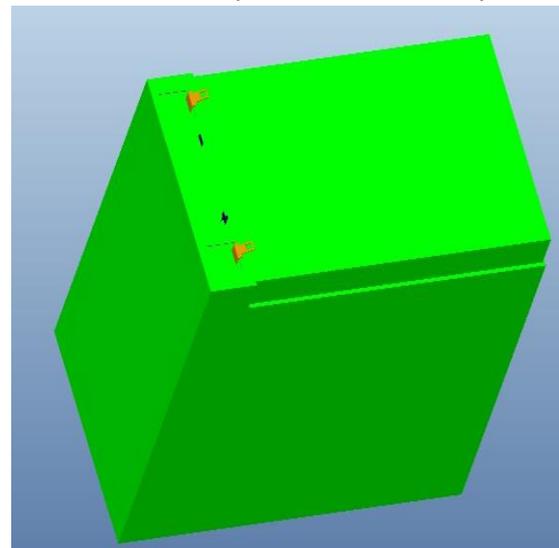


Fig.4. Battery

One half-cell is the positive electrode, and the other is the negative electrode. The electrodes do not touch each other but are electrically connected by

the electrolyte, which can be either solid or liquid. A battery can be simply modeled as a perfect voltage source which has its own resistance, the resulting voltage across the load depends on the ratio of the battery's internal resistance to the resistance of the load.

When the battery is fresh, its internal resistance is low, so the voltage across the load is almost equal to that of the battery's internal voltage source. As the battery runs down and its internal resistance increases, the voltage drop across its internal resistance increases, so the voltage at its terminals decreases, and the battery's ability to deliver power to the load decreases.

Battery is use for storing the energy produced from the solar power. The battery used is a lead-acid type and has a capacity of 12v; 2.5A.the most inexpensive secondary cell is the lead acid cell and is widely used for commercial purposes. A lead acid cell when ready for use contains two plates immersed in a dilute sulphuric acid ( $H_2SO_4$ ) of specific gravity about 1.28.the positive plate (anode) is of

Lead -peroxide ( $PbO_2$ ) which has chocolate brown colour and the negative plate (cathode) is lead (Pb) which is of grey colour.

When the cell supplies current to a load (discharging), the chemical action that takes place forms lead sulphate ( $PbSO_4$ ) on both the plates with water being formed in the electrolyte. After a certain amount of energy has been withdrawn from the cell, both plates are transformed into the same material and the specific gravity of the electrolyte ( $H_2SO_4$ ) is lowered the cell is then said to be discharged. There are several methods to ascertain whether the cell is discharged or not.

To charge the cell, direct current is passed through the cell in the reverse direction to that in which the cell provided current. This reverses the chemical process and again forms a lead peroxide ( $PbO_2$ ) positive plate and a pure lead (Pb) negative plate. At the same time, ( $H_2SO_4$ ) is formed at the expense of water,restoring the electrolyte ( $H_2SO_4$ ) to its original condition. The chemical changes that Occur during discharging and recharging of a lead-acid cell.

## 6.SPRING:

A SPRING is defined as an elastic body, whose function is to Distort when loaded and to recover its original shape when the Load is removed. The

springs used here are open coil helical springs which are used where there is compression load. These springs are made from oil tempered carbon steel wires containing 0.60 to 0.7 5% carbon 0.6 to 1% Manganese.The automobile chassis is mounted on the axles not direct but through some form of springs. This is done to isolate the vehicle body from the road shocks which may be in the form of bounce, pitch, roll or sway.these tendencies give rise to an uncomfortable ride and also cause additional stress in the automobile frame and body. All the parts which perform the function of isolating the automobile from the road shocks are collectively.



Fig.5. Spring

A Springing device must be a compromise between flexibility and stiffness. If it is more rigid, it will not absorb road shocks efficiently and if it is more flexible it will continue to vibrate even after the bump has passed so we must have sufficient damping of the spring to prevent excessive flexing.A spring is a flexible elastic object used to store mechanical energy. Springs are usually made out of hardened steel. Small springs can be wound from pre-hardened stock, while larger ones. A spring is a mechanical device, which is typically used to store energy and subsequently release it, to absorb shock, or to maintain a force between contacting surfaces. They are made of an elastic material formed into the shape of a helix which returns to its natural length when unloaded this is called return spring. Springs are placed between the road wheels and the vehicle body. When the wheel comes across a bump on the road, it rises and

deflects the spring, thereby storing energy therein. On releasing, due to the elasticity of the spring material, it rebounds thereby expending the stored energy in this way the spring starts vibrating, with amplitude decreasing gradually on internal friction of the spring material and friction of the suspension joints till vibrations die down.

#### 7.V BELT DRIVES:

A v- belt is mostly used in factories and workshops where a great amount of power is to be transmitted from one pulley to another when the two pulleys are very near to each other. The v-belts are made of fabric and cords molded in rubber and covered with fabric and rubber. These belts are molded to a trapezoidal shape and are made endless. These are particularly suitable for short drives. The included angle for the v-belt is usually forming  $30^\circ$  to  $40^\circ$ . The power transmitted by the wedging.

#### 8.SPUR GEAR:

The slipping belt of a belt is a common phenomenon, in the transmission of motion or power between two shafts. The effect of slipping is to reduce the velocity ratio of the system machines, in which a definite velocity ratio is of importance, the only positive drive is by gears or toothed wheels. A gear drive is also provided, when the distance between the driver and the follower is very small.



Fig.6. Spur gear

### VIII. DESIGN PROCESS

#### Block diagram

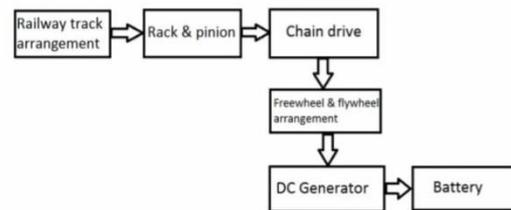


Fig .7. Block Diagram

The electrical power generation from railway track consists of the following components to full fill the requirements of complete operations of a machine.

- Rack and pinion
- Pulley and belt
- Spring
- Spur gear
- Dynamo

#### 1. RACK AND PINION

##### RACK:

Material: cast iron

Number of teeth =38

Length of rack =180mm

Width of gear =20mm

Thickness of gear =15mm

##### 2. PINION:

Diameter of pinion =  $\varnothing 90$ mm

No of teeth =64 no

Thickness of the gear =10mm

Material =cast iron

##### 3. DYNAMO

Material of yoke =mild steel

Quantity =1

##### 4. BATTERY

Voltage =12v dc

Material =plastic

Type =lead acid battery

Quantity 1

**5. SPUR GEAR**

Gear 1:

No of teeth =96 no

O.D of the gear =105mm

Thickness of the gear =10mm

Gear 2:

Dia of gear = Ø30mm

No of teeth =24 no

Thickness of the gear =10mm

**6. SHAFT**

Length of the shaft =160mm

Dia of the shaft =16mm

**7. Pulley:**

Driven pulley Dia (D) =250mm

Arm length =105mm

Driving pulley dia (d) =50mm

Rim thickness =5mm

**8. Belt:**

Cross section thickness of belt =7mm

Width (b) =11mm

Angle of 'v' belt =50°

**9. BASE FRAME:**

Length of frame =600mm

Height of frame =490mm

**10. TRACK:**

Length of tack =1200mm

Width of track =230mm

**IX. WORKING OF ELECTRICAL POWER GENERATION FROM RAILWAY TRACK**

The equipment consists of gear attachment, dynamo, light, sensor, battery and control unit. The power is generated by the railway track through the moving train. The moving train is

fixed with rack in the bottom and pinion wheel is placed in the middle of the track. Then the pinion wheel is connected with output shaft then it connected to the dynamo by mean of spur gears. and is coupled directly to the dynamo for producing electricity. The power is also stored in a battery. Then the stored battery power is used for various purposes .

**X. COST ESTIMATION****1. MATERIAL COST.****2. LABOUR COST:**

Lathe, drilling, welding, grinding, power hacksaw, gas cutting cost

**3. OVERHEAD CHARGES:**

The overhead charges are arrived by "manufacturing cost"

Manufacturing Cost =Material Cost +Labour Cost

=Rs.7000 + Rs.1500

=Rs. 8500

Overhead Charges =20%of the manufacturing cost

=Rs. 1700

**4. TOTAL COST:**

Total cost = Material Cost +Labour Cost +Overhead Charges

=Rs. 7000 + Rs.1500 + Rs.1700

=Rs.10,200

Total cost for this project =Rs.10,200

**XI. CONCLUSION**

This project is made with pre planning, that it provides flexibility in operation. Thus providing Smoother and noiseless operation by the medium of "ELECTRICAL POWER GENERATION FROM RAILWAY TRACK".The comparative gain that can be accomplished is the utilization of roller bar. This innovation has made the more desirableThis project "ELECTRICAL POWER GENERATION FROM RAILWAY TRACK" is designed with the hope that it is very much economical and help full to many industries and workshops.This project helped us to know the periodic steps in completing a project work. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been

provided. Thus we have completed the project successfully.

### REFERENCES

[1] E.Aboelela, W. Edberg, C. Papakonstantinou, and V. Vokkarane, "Wireless Sensor Network Based Model for Secure Railway Operations", Proc. of the IEEE IPCCC, 2006, pp. 623–626.

[2] Gatin and B. Lhenoret, "WSN and Energy Harvesting for Railway Applications", Presentation at Energy Harvesting & Storage USA, Denver, CO., 2009.

[3] H. Abramarich, E. Harash, Milogram, Amit, Azilay, "Power Harvesting from railways; apparatus, system and method", US patent 7812508, 2008.

[4] John J wang, G.P Penamalli and Lei Zuo, "Electromagnetic Energy Harvesting from Train Induced Railway Track Vibrations", IEEE, 2012, pp.29-34.

[5] P. Zhang, Masterthesis, "Study of Road Energy and Regenerative Electromagnetic Shock Absorber", SUNY Stony Brook, 2010.