

## POWER GENERATION FROM TRAIN TRACK

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### **Abstract**

*An idea to produce electricity from train track, the project is proceeded with the help of Rack and Pinion mechanism. The rotational force from Rack and Pinion mechanism is propagated into the chain drive and through the generator. Whenever the train is allowed to pass over the train track with beam setup, it gets pressed downwards. As the helical springs are attached to the setup, they get compressed and the rack, which is attached to the bottom of the setup, moves down in reciprocating motion. Since rack has teeth connected to pinion there is conversion of reciprocating motion of rack in to rotary motion of pinion, but the two gears rotate in opposite direction. So that shafts will rotate with certain RPM these shafts are connected to a sprocket and chain arrangement, which converts the mechanical energy into electrical energy. The chain arrangement with small sprocket at the end is coupled with the 12v dc dynamo. Finally the power produced from the dynamo is sent to the LED light.*

**Keywords -**

### **I.INTRODUCTION:**

The main objective is to produce electricity without any pollution. The extensive usage of energy has resulted in an energy crisis over the few years. Therefore to overcome this problem we need to implement the techniques of optimal utilization of conventional sources for conservation of energy and also to identify the new source for producing renewable energy.

The conventional sources of energy are generally non-renewable sources of energy, which are being used since a long time. To improve the power generation technologies and to make them more sustainable, non – conventional technologies have been discovered. Energy generated by using wind, tides, solar, geothermal heat, and biomass including farm and animal waste is known as nonconventional energy. All these sources are natural, renewable or inexhaustible and do not cause environmental pollution and are eco-friendly. Moreover they do not require heavy

expenditure. The non-conventional sources of energy are abundant in nature.

Our idea is to produce electricity from train track and we just did model and it is achieved by the rack and pinion mechanism.

### **II.LITERATURE REVIEW:**

#### **RACK AND PINION MECHANISM**

There are some projects which works with the help of rack and pinion mechanism and that are used for various proposes in various domains. For example automatic painting machine uses rack and pinion mechanism and also chain drive arrangement, we refer that project for doing our work but it is completely different one.

And also “**Rack and Pinion based Steering System**”, demonstrates the most common type of steering on cars, small trucks and SUVs. It is actually a pretty simple mechanism. A rack-and-pinion gear set is enclosed in a metal tube, with each end of the rack protruding from the tube. A rod, called a tie rod, connects to each end of the rack.

The pinion gear is attached to the steering shaft. When you turn the steering wheel, the gear spins, moving the rack. The tie rod at each end of the rack connects to the steering arm on the spindle. It converts the rotational motion of the steering wheel into the linear motion needed to turn the wheels. It provides a gear reduction, making it easier to turn the wheels.

Our design uses extremely simple ideas and mechanisms to achieve a complex set of actions and is intended to imitate the actions of the operators. Here, we have used small prototype of steering system with material like Steel rod, Aluminium strips, Rack Pinion Gear.

### POWER GENERATION USING SPEED BREAKERS

This project explains the mechanism of electricity generation from speed breakers. The vehicle load acted upon the speed breaker system is transmitted to rack and pinion arrangements. Then, reciprocating motion of the speed-breaker is converted into rotary motion using the rack and pinion arrangement where the axis of the pinion is coupled with the sprocket arrangement. The sprocket arrangement is made of two sprockets.

One of the sprockets is larger in dimension than the other sprocket. Both the sprockets are connected with chain which transmits the power from the larger sprocket to the smaller sprocket. As the power is transmitted from the larger sprocket to the smaller sprocket, the speed that is available at the larger sprocket is relatively multiplied at the rotation of the smaller sprocket. The axis

of the smaller sprocket is coupled to a gear arrangement. Here we have two gears with different dimensions.

The gear wheel with the larger diameter is coupled to the axis of the smaller sprocket. Hence, the speed that has been increased at the smaller sprocket wheel is passed on to this gear wheel of larger diameter. The smaller gear is coupled to the larger gear.

Therefore, as the larger gear rotates it increases the speed of the smaller gear which is following the larger gear and multiplies the speed to more intensity. Though the speed due to the rotary motion achieved at the larger sprocket wheel is less, as the power is transmitted to gears, the final speed achieved is high. This speed is sufficient to rotate the rotor of a generator and is fed into the rotor of a generator.

### III COMPONENTS AND DESCRIPTION

#### STEEL TUBE OF SQUARE CROSS SECTION



Fig 1 Steel Tube

In our project we use steel tube of square cross section of dimension 2x2 cm for the construction of entire frame.

#### BEAM TRACK ARRANGEMENT

Beam track arrangement gives upward and downward motion for the power generation. Downward motion is produced by wheels of the train and upward motion produced by helical spring.

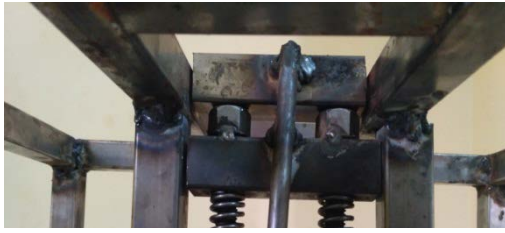


Fig 2 BEAM Track

### HELICAL SPRING



Fig 3 Helical Spring

A coil spring, also known as a helical 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.

### RACK GEAR

Rack gear in our project gives reciprocating motion from the beam track arrangement already explained above. This rack gear is connected with the helical pinion gear.



Fig 4 Rack Gear

### HELICAL PINION GEAR



Fig 5 Helical Pinion Gear

Helical pinion gear converts reciprocating motion from the rack gear into rotary motion. This pinion gear is connected with the sprocket.

### SHAFT

A shaft is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power. The various members such as pulleys and gears are mounted on it. In our project we use two shafts one is connected with dynamo and small sprocket and another one is connected with helical pinion gear and large sprocket.

### CHAIN DRIVE WITH SPROCKETS



Fig 6 Chain Drive

The sprocket arrangement is made of two sprockets. One of the sprockets is larger in dimension than the other sprocket. Both the sprockets are connected with chain which transmits the power from the larger sprocket to the smaller sprocket. As the power is transmitted from the larger sprocket to the smaller sprocket, the speed that is available at the larger sprocket is relatively multiplied at the rotation of the smaller sprocket.

### 12V DC DYNAMO

Specification:

Type – 12v dynamo

Shaft thickness – 6mm  
Power generation – anticlockwise  
direction



Fig 7 working model

#### LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated. This is used to show our generated output power.

### IV METHODOLOGY

#### DESIGN PROCESS

We first draw the diagram of our project and then we select the mechanism suitable for our project. Then we go for our work plan, after that we select materials required for our project and then we analyze the process required to complete our project. After that we start our project work.

#### SELECTION OF MATERIALS

Materials one of the foremost functions of effective engineering design as it determines the reliability of the design in terms of industrial and economical aspects. A great design may fail to be a profitable product if unable to find the most appropriate material combinations. We consider following properties to select material such as Mechanical properties, wear and cost.

#### RACK GEAR

We analyze the type of gear suitable for our project and finally we go with rack gear. These rack gear are used in the steering system.

#### PINION GEAR

Our project mainly based on rack and pinion mechanism. So, we go with helical pinion gear. We planned to mesh rack gear with the pinion gear; hence we select the helical pinion gear.

#### HELICAL SPRING

In our project, we need free upward and downward motion. We find that helical spring is suitable for that, so we select helical spring. First we install single helical spring but it creates some problem so we install two helical springs.

#### STEEL TUBE OF SQUARE CROSS SECTION

In our project, we need model railway track to explain our project and we need to construct a frame to show it, in order to make our project in low cost we select steel tube of square cross section.

#### V MANUFACTURING

While starting our project manufacturing process we have faced lot of problems like in metal cutting take long time and also during welding we have faced so many problems. For example, so many times we welded wrongly.

#### MACHINING PROCESS

##### METAL CUTTING

In our project metal cutting, we use hacksaw to cut metal pieces. During metal cutting process also our team takes very long time. We wasted some material during metal cutting process and that will increase our overall project cost.

#### WELDING



Fig 8 Arc welding

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing fusion, which is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal. In our project welding, we use electrode welding machine to weld the metals. Welding is applied in the steel tube of square cross section and also to connect sprocket with the shaft.

#### RACK AND PINION MECHANISM

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called “the pinion” engages teeth on a linear “gear” bar called the rack; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion. But here in our project we convert reciprocating motion from the beam track arrangement into rotary motion with the help of pinion gear. As shown in the figure the arrangement is connected to the chain and sprocket arrangement.



Fig 9 Rack and pinion

#### CHAIN DRIVE ARRANGEMENTS

The sprocket arrangement is made of two sprockets. One of the sprockets is larger in dimension than the other sprocket. Both the sprockets are connected with chain which transmits the power from the larger sprocket to the smaller sprocket. As the power is transmitted from the larger sprocket to the smaller sprocket, the speed that is available at the larger sprocket is relatively multiplied at the rotation of the smaller sprocket. The smaller sprocket is coupled with the dynamo through a shaft.

#### 12V DYNAMO WITH LED

Since our project is a model input the dynamo is given from manual operation of the beam track arrangement. The output from the dynamo is sent to the LED.

#### BLOCK DIAGRAM

In our project, we create a model of train track, in that we fit a beam track arrangement and followed to that rack and pinion arrangement and chain drive. Finally it is connected to the dynamo to LED.

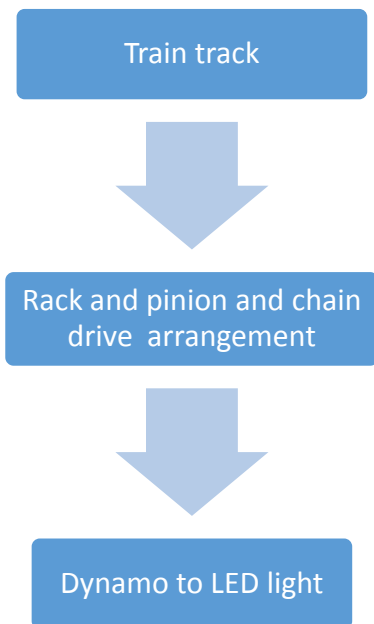


Fig 10 Working model

### WORKING

This project explains the mechanism of electricity generation from train track. The load acted upon the beam in train track by train wheel is transmitted to rack and pinion arrangement.

Then, reciprocating motion of the beam track arrangement is converted into rotary motion using the rack and pinion arrangement where the axis of the pinion is coupled with the sprocket arrangement.

This project explains the mechanism of electricity generation from train track. The load acted upon the beam in train track by train wheel is transmitted to rack and pinion arrangement.

Then, reciprocating motion of the beam track arrangement is converted into rotary motion using the rack and pinion arrangement where the axis of the pinion is coupled with the sprocket arrangement.

### POWER CALCULATION

While implementing,

Load applied by one wheel of the train is 8.125 tons on a load train.

Finally the load on the beam is 16.25 tons.

Height of the beam track fitted 15cm.

Weight of the body =  $16250 \times 9.81 = 159412.5 \text{ N}$

Distance = 15cm.

Power = work done/second =  $(159412.5 \times 0.15)/60 = 398.53$

While implementing our project approximately we get 398.53 v of power. Since our project is just a model, we get very less power.

Our project,

Load is applied manually 5-10 kg.

Height of the beam fitted 2cm.

Since manual load weight is same as applied load 1 kg (approx.)

Weight of the body =  $10 \times 9.81 = 98.1 \text{ N}$

Distance = 2cm.

Power =  $(98.1 \times 0.02)/60 = 0.327 \text{ W}$ .

However power generation from the project is very less but it will not create any pollution and environmental hazards. Our project is a purely eco-friendly one and with the help of our project it is possible to green energy.

### VI RESULT AND DISCUSSION

### DEVELOPMENT OF PLAN

The overall project carried out with the help of rack and pinion mechanism and the chain drive arrangement. With the help of the mechanism the reciprocating motion from the beam track arrangement is converted into rotary motion.

### RESULTS

In the first test of our project there is some lag due to irregular arrangement of rack and pinion gear. After rectifying that, chain drive make some problems and our team remove the chain fix that issue. After that our project run well and gives certain desired outputs.

Finally, we make several tests and calculate the power produced and we connect with LED to check that the output is enough or not. After a long time we complete our entire work and also project works well.

### DISCUSSION

After completing our work, our entire team discusses about our project and also we discuss about the difficulties we face during our project work.

We identify where we lag during our work and how we work in the group and also discuss about where we take long time and also how to ignore those things.

### SAFETY ISSUE

Safety is essential one while doing projects; in our project we generate power from railway track. While doing these kinds of projects safety is an important one. Many of them bother that it will create some kind accident and some other issue. It will not create any damage to the train and also to the passengers. Because we use just a helical spring it is easy to compress so the train need not to pull a heavy load and also 16 ton train compartment is not affected by pulling down the small load.

### COST ESTIMATION

NO	NAME OF THE COMPONENTS	NUMBER OF COMPONENTS	PRICE
1	Steel tube of square cross	4 nos (2 meter)	1000

	section		
2	Rod and shaft for connection	3 nos	500
3	Rack and pinion arrangement	1 nos	1000
4	Chain sprocket arrangement	1 nos	500
5	Dc dynamo	1 nos	200
6	LED	1 nos	100
	Total	-	3300

### VII CONCLUSION

"Electricity plays a very important role in our life". Due to population explosion, the current power generation has become insufficient to fulfil our requirements. In this project we discover technology to generate electricity from speed breakers in which the system used is reliable and this technique will help conserve our natural resources.

In coming days, this will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the street lights. As the conventional sources are depleting very fast, it's high time to think of alternative resources. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country.

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