

SLIDER CRANK AND RACK AND PINION MECHANISM BASED ON THE POWER GENERATION BY USING FOOT STEPS

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ABSTRACT

Electricity is a big problem in India, which is faced by people who reside in the country. Electricity is the form of energy sources, 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. As the demand of energy is increasing day by day, so the ultimate solution to deal with these sorts of problems is just to implement the renewable sources of energy. The basic working principle of “footstep power generation system” is based on the slider crank and Rack and pinion mechanism and fly wheel. So in order to implement this foot step power generation system we adjust the plates above and below the sensors and moveable springs, when we walk on the steps than automatically force is applied for plates. As a result of completing the above mechanism or technique. We made ourselves able to design such compatible system through which we could run our home appliances through AC output.

INTRODUCTION

In this paper the generation of electrical energy is described by using the weight energy. Person can amaze simply knowing that how much energy a person has by simply walking on the floor with normal speed. So the people usually have thousands steps in a day. While people walks they lose huge amount of energy that their weight energy of foot may be used and converted into electrical energy. The actual electro-kinetic floor is really an approach to make electrical energy by using kinetic energy

of person who walks on the floor. The energy that is usually produced by the floor which can make the environment sound without any pollution such kind of energy will cost effective indeed the power floor does not need any fuel or any type of energy source only by using the kinetic energy which based on the person weight who moves on the floor. Regarding this modern world now a days energy and power are the basic key factors as the energy demand is increasing day by day, so the ultimate solutions of renewable energy are implemented. In case of our project we have used a technique of Generating power through foot step which is the source of renewable energy that is obtained by walking on footpaths, stairs, platforms and such a system is installed mainly in populated areas. The basic principle of “Foot step power generation” is based on piezoelectric sensor in order to employ this system we will adjust wooden plates above and below the piezoelectric sensor and moving springs when person will walk on that steps the force will be applied in the result magnet will be fixed under the top wooden sheet and moves into the cavity. While this cavity is fixed at the bottom wooden sheet of step. As completing the above procedure, we made ourselves to be able to design a compatible system by the help of which we could run the load, Home appliances by AC output voltage. And our task is to charge battery with the help of DC output and then using inverter to convert DC into AC for normal usage. It is achieved in three possible ways. The ways are,

1. Use of rack and pinion mechanism.
2. Use of slider crank mechanism
3. Use of roller mechanism

The rack and pinion mechanism has advantages over the other two mechanism. When compared with roller mechanism, the slip of the tyres over the speed breaker is avoided as is possible in roller mechanism. The slip of the tyres would pose more trouble to the vehicle user than the power generated. Now our project is to completely utilize the technique of using rack and pinion mechanism for power generation.

LITERATURE REVIEW

“The energy crisis is a bottleneck in the supply of energy resources to an economy. The studies to sort out the energy crisis led to the idea of generating power using speed breaker²⁰⁰³”. “First to make use were South African people, their electrical crisis has made them to implement this method to light up small villages of the highway. The idea of basic physics to convert the kinetic energy into electrical energy that goes waste when the vehicle runs over the speed-break was used. Since then a lot has been done in this field. The idea caught our working team and we have decided to develop such a project that will produce more power and store it for use at night time as it proves to be a boon to the economy of the country²⁰⁰⁶”.

“There are few methods to generate electrical energy from footsteps. Power would generated by footsteps of crowd on the floor. Piezo plate scheme is located beneath the floor then there will be sheet covering the piezo plate and also spring will be there for vibration force on piezo. The piezo plate will be in chunks in the floor. This plate will generate power in the type of electric current. The power produced by pedestrians can also be used as additional features such as to lightning up street light like railway stations, airports, footpaths²⁰¹³”.

LIST OF COMPONENTS

1. Rack and pinion
2. Dynamo
3. V belt
4. Pulley
5. Spur gear
6. Open coil helical springs

7. Rectifier
8. Filter
9. Battery

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 and linear to rotary.

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.

RECTIFIER

Rectifier is an electrical device. It is converting to the alternating current to direct current this process known as a rectification.

FILTER

Electronic filters are electronic circuits which perform signal processing functions, specifically intended to remove unwanted signal components and/or enhance wanted ones.

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 are used by 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.

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 0.75% carbon 0.6 to 1% Manganese.

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 pulley. When the two pulleys are very near to each other.

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 precision 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.

TECHNICAL DATA

RACK AND PINION

RACK

Material: mild steel

Number of teeth = 38

Length of rack = 180mm

PINION

Dia meter of pinion = 90mm

No of teeth = 64 no's

SPRING

Dia of wire (d) = 2mm

Mean dia of spring (D) = 30mm

Number of turns (n) = 14 no's

Free length = 115mm

DYNAMO

Material of yoke = mild steel

Quantity = 1

BATTERY

Voltage = 12v dc

Material = plastic

Type = lead acid battery

SPUR GEAR

No of teeth = 96 no's

Outer dia of the gear = 105mm

Thickness of the gear = 10mm

SHAFT

Length of the shaft = 160mm

Dia of the shaft = 16mm

PULLEY

Driven pulley dia (D) = 250mm

Arm length = 105mm

Driving pulley dia (d) = 50mm

Rim thickness = 5mm

BELT

Cross section thickness of belt = 7mm

Width (b) = 11mm

Angle of 'v' belt = 50°

DESIGN CALCULATION

We know;

$$n = 100 \text{ rpm (assume)}$$

$$\text{Weight} = 70\text{kg} \quad 70 \times 10 = 700\text{N}$$

Power = force X velocity

$$P = 700 \times 3.14 \times 16 \times 10^{-3} / 60 \times 100$$

$$P = 58.6\text{W}$$

P = 60 watts power is to be transmitted

LENGTH OF THE BELT

$$L = 2c + 3.14/2 (D + d) + (D + d)^2 / 4c$$

$$\text{Center of distance (C)} = 225 \text{ mm}$$

$$\text{Speed ratio } I = D / d$$

$$I = 250 / 50$$

$$I = 5$$

The recommended C / D ratio is 0.9

Therefore,

$$C / D = 0.9$$

$$C / 250 = 0.9$$

$$C = 250 \times 0.9$$

$$C = 225\text{mm}$$

$$L = 2c + 3.14/2 (D + d) + (D + d)^2 / 4c$$

$$= 2 \times 225 + 3.14/2 (250 + 50) +$$

$$(250 - 50)^2 / 4 \times 225$$

$$= 965.67\text{mm}$$

$$L = 96 \text{ cm (length of the belt)}$$

ANGLE OF CONTACT

$$\theta = 180 - (D - d) / c \times 60^\circ$$

$$\theta = 180 - (250 - 50) / 225 \times 60^\circ$$

$$\theta = 126.6^\circ$$

Initial belt tension to be provided for firm grip of the v- belt on pulleys, is 0.5% of L.

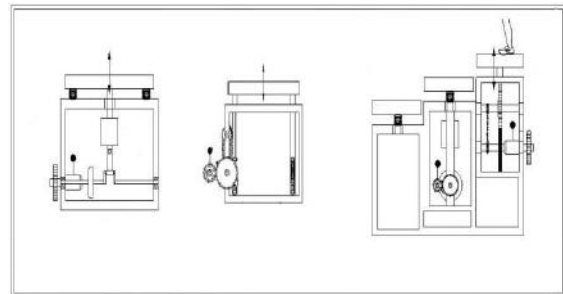
$$\text{New length} = L + 0.5 \% \times L$$

$$= 965 + 0.5 \times 1/100 \times 965$$

$$= 970\text{mm}$$

WORKING PRINCIPLE

This project is designed with electrical power generation for walking on the step using with the help of dynamo arrangement. Here we are using the foot step arrangement, below the arrangement we are placing the rack and pinion then crank mechanism. Whenever people steps on the foot step arrangement the setup goes down to push the rack in downward motion. This downward motion is converted to rotary motion through pinion and crank movement. Chain drive is connected on the same pinion shaft which transmits the rotary motion to another shaft. The rotary motion is given to the spur gear arrangement which the dynamo is coupled on it, so the dynamo is rotated and generates the electrical power. When the dynamo rotates the output DC voltage is stored in the battery. An inverter is connected to the battery to convert DC to AC. From the inverter a CFL is made to glow.





ADVANTAGES :

1. Power generation with low cost and using non-conventional energy sources which will help us to conserve the conventional energy sources to meet the future demand.
2. By using this method, electricity will be generated throughout the year without depending on other factors.
3. Easy for maintenance and no fuel transportation problem.

DISADVANTAGE:

1. Mechanical moving parts are high need regular maintenance.
2. Digging of ground is required for installation.

CONCLUSION

Since the power generation using foot step get its energy needs from no conventional source of energy there is no need of power from the mains and there is less pollution in this source of energy it is very essential to the places, all roads and as well as all kind of foot step which is used to generate non-conventional energy such as electricity. As a common fact 11% Non-conventional energy which contributes our primary energy. Weather this project is employed then we can not only overcome the energy shortfalls issues but this will also contribute to create sound global environmental change

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