NEW HORIZON COLLEGE OF ENGINEERING

Department of Mechanical Engineering

Dated-06/05/2020

CERTIFICATE

This is to certify that **Shiva Prasad P M, M N Sanath, Prabhuling, Nihal C L** has submitted the Self Study Assignment(SSA) report entitled "**FOOT STEP POWER GENERATOR**". The report has been prepared as per the prescribed format and is approved for submission and presentation.

Signature of the faculty

Signature of the HoD

ACKNOWLEDGEMENT

This is to acknowledge my gratitude towards our guide **Mr.Rajesh ,** Asst. Professor Dept. of ME. for his guidance and suggestions in preparing this SSA report. His suggestion and way of summarizing the things made us to go for independent studying and trying our best to get the maximum in our topic this made our circle of knowledge very vast. We are highly thankful by getting guidance from you on this seminar.

We also place on record, our sense of gratitude to one and all who, directly or indirectly, have lent their helping hand in the SSA report.

Date- 06/05/2020

Shiva Prasad P M
M N Sanath
Prabhuling
Nihal C L

Contents

Abstract

Nowadays energy and power are the one of the basic needs in this modern world. Energy demand is increasing day by day. On the other hand, the many energy resources are getting exhausted and wasted. Proposal for utilization of waste energy of foot power with human locomotion is very relevant in populated countries like India where roads, railway stations, bus stands, temples, etc. are overcrowded and millions of people move around. This whole energy is wasted. If this energy made possible for utilization it will be a great invention. In this project we are converting non-conventional from just walking foot step into electrical energy. This project uses simple drive mechanism such as rack and pinion assembly. The control mechanism carries the rack & pinion, and D.C generator to output.

In this project we are generating electrical power as nonconventional method by simply walking or running on the footsteps. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step needs no fuel input power to generate the electrical power. In this project the simple drive mechanism such as rack and pinion assembly and chain drive mechanism is used for generating power by utilization of force which is obtained during the walking on steps is converted in to electrical energy with the help of mechanical systems. The generated power is stored by means of battery and this is used for activating the connected loads. This is one of the compact and efficient systems for generating electricity which can be easily installed in many regions.

Introduction

The deployment of different clean energy systems is a crucial strategy to achieve environment sustainability. Most people are spending most of their lifetime in walking. It is a fundamental and common locomotion for human in daily life. The contacts between human feet and ground surface is created during the walking. The forces experienced by human feet upon landing on the ground can generate a renewable energy known as kinetic energy. This energy can be converted into electricity through a footstep power generator. Different types of footstep power generators are available in the market and majority of these devices use piezoelectric transducer to generate power. One of the greatest challenges in designing the footstep power generators with piezoelectric transducer is the selection of suitable ferroelectric material because it governs the efficiency of converting kinetic energy to electricity [5]. Conventionally, the piezoelectric footstep power generator uses ferroelectric materials made up of crystal such as Lead (II) titanate (PbTiO3), Lead (II) Zirconate (PbZrO3), Polyvinylidene Difluorideor Polyvinylidene Fluoride (PVDF) and Lead Zirconate titivate (PZT). While both of the PZT and Polyvinylidene Difluorideor (PVF) are commonly used as piezoelectric.

Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important for highly populated countries like India and China where mobility of its masses will turn into boon in generating electricity from its footsteps. In India, places like roads, railway stations, bus stands, are all over crowded and millions of people move round the clock. As a result large amount of power can be obtained with the use of this promising technology. This process involves number of simple setup that are installed under the walking platform. When people walk on this platform their body weight compresses the setup which rotates a dynamo or Sanyo coil and current produced is stored in dry battery. To reduce the external compression, a responsive subflooring system is installed. And while the power producing platform is over crowded with moving population, energy is produced at larger levels. Greater movement of people will generate more energy.

In this project the weight which acts on the foot step is used to generate electrical energy. When a person walks Over the foot step, a force acts on the step. One can simply be amazed by knowing how much energy a person can have just by walking on the floor with normal speed. Whenever a person walks, manages to lose energy towards the floor by means Excess weight to the floor. That energy

may be used and converted into electrical energy. The Mechanical energy (weight) is converted into electrical energy using drive mechanism, in this case rack and pinion. Generated energy can be stored in Batteries. Then the output of the battery is used to lighten the lamps in the room. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important.

This process involves number of simple setup that is installed under the walking platform. When People walk on this platform their body weight compresses the setup which rotates a dynamo and current is produced. The power producing platform is overcrowded area with moving population, energy is produced at larger levels. Greater movement of people will generate more energy. This whole human energy being wasted if can be made Possible for utilization it will be great invention and power producing platform will be very useful energy sources in crowded countries. Proposal for the utilization of waste energy of foot power with human locomotion is very much relevant and important. There are many types of combination for mechanical footstep power generator in the market. For example, rack and pinions with pulley, crank shaft with chain drive system , fly wheel with gear and etc. However, most of these designs are combined with two mechanism components such as rack and pinion with fly wheel, rack pinion with pulley systems, and rack and pinion with chain drive system.

BLOCK DIAGRAM

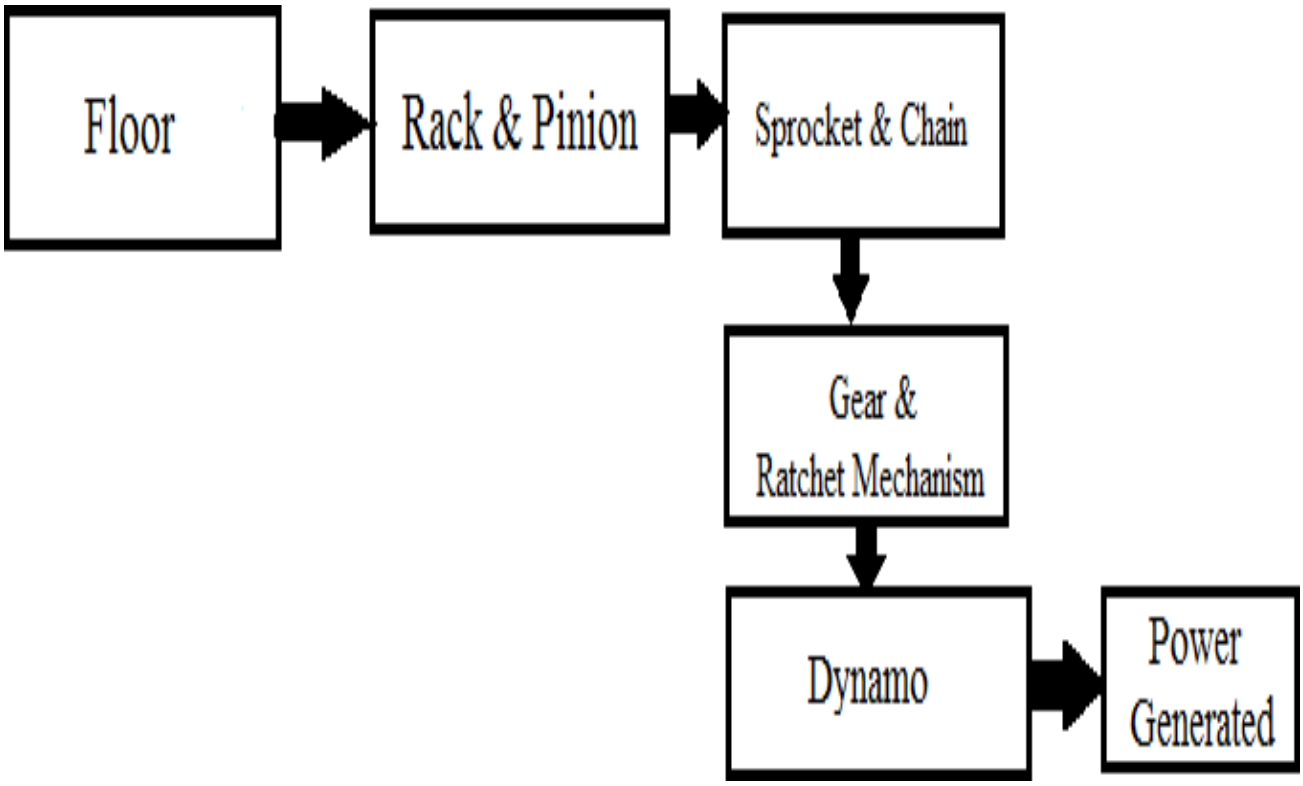

Fig 3.1: Block Diagram

COMPONENTS

1. Springs

There are several types of springs. One of the most common consists of wire wound into a cylindrical or conical shape. Here a compression spring is used. A compression spring is a coiled spring with space between successive coils; when a force is applied to shorten the spring, the coils are pushed closer together. Steel alloys are the most commonly used spring materials. The most popular alloys include high-carbon (such as the music wire used for guitar strings), oil-tempered low-carbon, chrome silicon, chrome vanadium, and stainless steel.

Fig,4.1.Spring

2. Rack and Pinion

Rack and pinion**,** mechanical device consisting of a bar of rectangular cross_section (the rack), having teeth on one side that mesh with teeth on a small gear (the pinion). The pinion may have straight teeth, as in the figure, or helical (twisted) teeth that mesh with teeth on the rack that are inclined to the pinion-shaft axis. Gear racks are utilized to convert rotating movement into linear motion. A gear rack has straight teeth cut into one surface of a square or round section of rod and operates with a pinion, which is a small cylindrical gear meshing with the gear rack. If the pinion rotates about a fixed axis, the rack will translate; *i.e.*, move on a straight path.

Fig.4.2. Rack and Pinion

3. DC Motor

It is an electrical device used to convert mechanical energy into electrical energy. The generator is used here is permanent magnet DC generator. The generated voltage is 12V. This DC voltage is stored to the lead acid 12V battery. The battery is connected to the invertor. This invertor is used to convert 12V DC to 230V AC. This 230V is used to activate lights, fans, etc. By increasing the battery capacity and invertor circuit the power rating is increased.

Fig.4.3.DC Motor

4. Spur Gears

Spur gears are the most easily visualized common gears that transmit motion between two parallel shafts. Because of their shape, they are classified as a type of cylindrical gears. Since the tooth surfaces of the gears are parallel to the axes of the mounted shafts, there is no thrust force generated in the axial direction. Spur gears can be made from metals such as steel or brass, or from plastics such as nylon or polycarbonate. Gears made of plastic produce less noise, but at the expense of strength and loading capability. Spur gears are generally seen as best for applications that require speed reduction and torque multiplication.

Fig.4.4.SpurGear

5.Shaft

A mechanical shaft is a rotating member usually of circular cross-section either solid or hollow, which transmits power and rotational motion. Machine elements such as gears, pulleys, flywheels, clutches and sprockets are mounted on various types of shafts and are used to transmit power. Generally, for most applications, steel is the most popular choice of material for shafts. However, aluminium could be used, as well as exotic materials such as titanium.

Fig.4.5.Shaft

6.Base and Upper Plates

Here Mild Steel plates are used at top and bottom. It is known as mild steel because of its relatively low carbon content. Mild steel is very strong due to the low amount of carbon it contains. In materials science, strength is a complicated term. Mild steel has a high resistance to breakage. Mild steel, as opposed to higher carbon steels, is quite malleable, even when cold. This means it has high tensile and impact strength. Higher carbon steels usually shatter or crack under stress, while mild steel bends or deforms. Because of its high strength and malleability, it is quite soft. This means that it can be easily machined compared to harder steels. It is also easy to weld, both to itself and to other types of steel. It takes on a nice finish and is polishable. However, it cannot be hardened through heat treatment processes, as higher carbon steels can.

Fig.4.6.Mild Steel Sheets

7. Battery

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work.Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable electronics. Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centers.

Fig.4.7.Battery

ASSEMBLY

The General design of the foot step power generation is given in the figure below. In this arrangement we are using two steps. The rack & pinion, spring arrangement is fixed below the steps. We are using four springs foe each step. The spring is used to return the step-in same position by releasing the load. The rack is coupled to the foot step. In the second step, the Rack is connected to the footsteps. From Rack a shaft is provided in which the larger sprocket lies. The larger sprocket is coupled with Rack, so that it is running at the same speed of Rack. The larger sprocket is coupled to the smaller sprocket below in the other shaft with the help of chain (cycle). This larger sprocket is used to transfer the rotation force to the smaller sprocket. A gear is provided there also. The smaller sprocket is running same direction for the forward and reverse direction of rotational movement of the larger sprocket.

The upper plate is mounted on two springs; the weight impact is converted into electrical power with proper control unit. The spring and rack & pinion arrangement is fixed below the foot step which is mounted on base. Spring system is used for return mechanism of upper plate after release of load. The shaft along with pinion is supported by end bearings the complete diagram of the footstep power generation is given below. Only one step is inclined in certain small angle which is used to generate the power. The pushing power is converted into electrical energy by proper driving arrangement. The main phenomenon on which the working of this project is based is that rack and pinion assemble converts the linear motion into rotary motion and vice versa also. The pinion is of finite diameter and gives circular motion when the rack of infinite diameter comes in contact with pinion and gives linear or translator motion for proper contact between both rack and pinion the should have equal module. The shaft of rack and pinion remains parallel during their motion.

WORKING PRINCIPLE

With the help of block diagram as show in the block diagram the working procedure is explained in step by step manner. When force is applied on the plate by virtue on stamping on the plate the force spring gets compressed. Due to this the rack moves vertically down. The pinion meshed with the rack gear results in circular motion of the pinion gear. For one full compression the pinion Moves one semicircle, when the force applied on the plate released the pinion reverses and moves another semicircle. The intermediate gear with more number of teeth will rotate as a result of motion of pinion. The generator attached to the intermediate will obtain the rotating motion, hence results in the sinusoidal waveform (for single Generator). The obtained voltage is passed through Ac neutralizer in order to reduce the ripples that are produced due to uneven motion of generator. From here the power is stored directly in 12v lead acid battery. So the 12v DC is connected to the inverter to convert it into 230AC. Now the voltage obtained is used for small applications. The display unit takes signal from battery and converts it into digital signal by ADC and transfers its data to microcontroller. The voltage signal thus obtained will be displayed in LCD display about how much voltage of current is available.

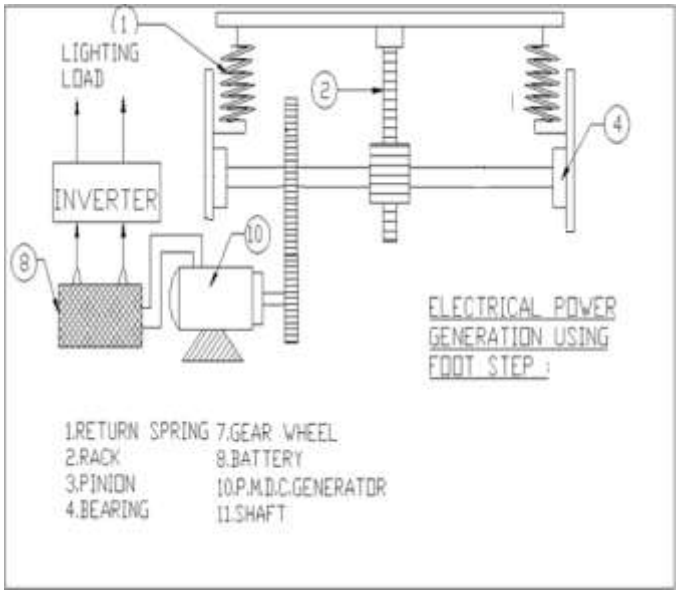

Fig.6.Line Diagram for Foot Step Power Generation

APPLICATIONS

- Railway, subway stations
- Roads
- Temples
- Bus stands, air ports
- Music halls, auditoriums
- Markets
- In bus station.
- In car parking system.
- In Airports.
- In Lift system.
- In car lifting system.
- In street lights and Electric escalator.

This can be implemented on railway station to generate electric power and in all places where movement of people is abundant.

ADVANTAGES

- Produces electricity efficiently.
- It is an inexpensive source of all known forms of energy.
- It does not pollute the environment.
- Automatically operates the street light when the sun falls.
- It can be easily maintained.
- Simple construction, mature technology.
- No manual work necessary during generation.
- Energy available all year round.
- No fuel transportation problem.
- No consumption of any fossil fuel which is nonrenewable source of energy.
- Reliable, Economical, Eco-Friendly.
- No need of fuel input.
- This is a non-conventional system.
- Battery is used to store the generated power.

CONCLUSION

The project work “Power generation by foot step” is designed and developed successfully, for the demonstration purpose a proto type module is constructed with lower ratings of devices, & results are found to be satisfactory. As it is a demo module it cannot be used for real applications, but the concept is near to the real working system, to make it more realistic, higher rating power generator with suitable gear mechanism is essential to produce more energy. This concept falls under the subject of non-conventional energy resources, out of the many alternative energy resources one dependable source is solar energy, but it is quite costliest affair. Therefore alternative cheapest source is to generate electricity from foot step. This technology proven here is the ultimate inexpensive source of all known forms of energy. When it is implemented practically, depending up on the size & traffic flow, each foot step may produce tens of kilowatts power every day, this power can be utilized for many applications. If we are used this project at very busy stairs palace then we produce efficient useful electrical for large purposes. One important advantage of producing energy through this technology is that it does not pollute the environment. Hence these foot step can be altered with this technology, there by all the street lights belongs to a particular city can be energized.

REFERENCE

- **https://nevonprojects.com/design-fabrication-of-mechanical-footstep-power-generator/**
- **https://ijritcc.org/download/conferences/ICIIIME_2017/ICIIIME_2017_Track/1498284496_24-06-2017.pdf**
- **Rajesh Kumar Dutta , Sazid Rahman "Power generating Slabs: Lost energy conversion of human locomotive force into electrical energy", 8th International conference on Electrical and Computer Engineering, 20 – 22 December 2014, Dhaka, Bangladesh.**