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Fabrication of Foot Step Electricity Generation

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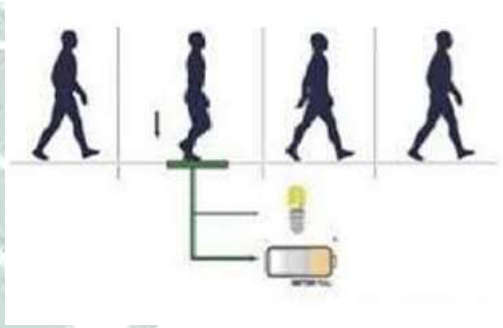
Abstract— Man has needed and used energy at an increasing rate for the sustenance and well-being since time immemorial. Due to this lot of energy resources have been exhausted and wasted. Proposal for the utilization of waste energy of foot power with in human locomotion is very much relevant and important for highly populated countries like Indiawhere the railway stations, temples etc., are overcrowded all round the clock. 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. Keywords : foot step power generation, non conventional power, rack & pinion power generation, electricity generator.

INTRODUCTION

For an alternate method to generate electricity there are number of methods by which electricity can be produced, out if such methods foot step energy generation can be an effective method to generation can be an effective method to generate electricity. Walking is the most common activity in human life. When person walks he losses energy to the road surface in form of impact, vibrations, sound etc., due to transfer of his weight to the road surface through foot falls on the ground doing every step. This energy can be tapped and converted in the usable form such as in electrical form. This device, if embedded in the footpath, can convert foot impact energy into Electrical form.



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.

II. LITERATURE REVIEW

"Power Generation in Automobile Suspension System" by C. Nithiyesh Kumar, K.Gowtham, M.Manikandan, P.Bharathkanna, T. Manoj Kumar In this research paper author studied three methods of foot step power generation namely piezoelectric method, rack and pinion method and fuel piston method comparatively and found that the rack and pinion mechanism is more efficient with moderate cost of operation and maintenance. [1] "Power generation through step" by Vipin Kumar Yadav1, Vivek Kumar Yadav1, Rajat Kumar1, Ajay Yadav In these research paper authors used equipment with following specification: Motor Voltage:10 volt Type: D.C. Generator, RPM:1000 rpm, Gear 1-Mild Steel, No. of teeth:59(big gear),No. of teeth:36(small gear),Type: Spur Gear, No. of gear used:2 Spring 1-Load bearing capacity:60-90 kg, Mild Steel, Total displacement:5 inch, Bearing 1- Type: Ball bearing, Bearing no.N35,Shaft 1 Diameter: 15 mm- Material: Mild steel author concluded that with these method energy conversion is simple efficient and pollution free. [2] "POWER GENERATION FROM STEPS" by This research paper attempts to show how energy can be tapped and used at a commonly used floor step. The usage of steps in every building is increasing day by day, since even every small building has some floors. A large amount of energy is wasted when we are 216 stepping on the floors by the dissipation of heat and friction, every time a man steps up using stairs. There is great possibility of tapping this energy and generating power by making every staircase as a power generation unit. The generated power can be stored by batteries, and it will be used for slighting the building. [3]

III. COMPONENT AND ASSEMBLY

The footstep arrangement is used to generate the electric power. Now a day's power demand is increased, so the footstep arrangement is used to generate the electrical power in order to compensate the electric power demand. In this arrangement the mechanical energy is converted into electrical energy. This section is constructed by of rubber or other material which is placed within the surface areas. This section is mainly placed in the crowed areas. This footstep arrangement is attached with spring section. Footstep section consists of

1. Frame

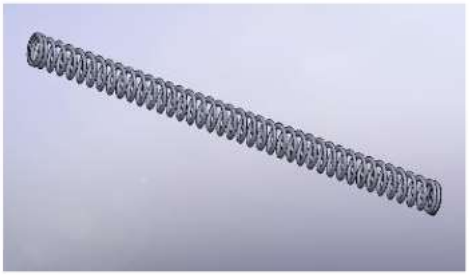
Frame is the foremost supportive element in the system. The frame needs to endure all the heaviness of the exploratory setup. The power applied on the framework is conveyed to the four legs.

Base Assembly

Upper Assembly

2.Spring

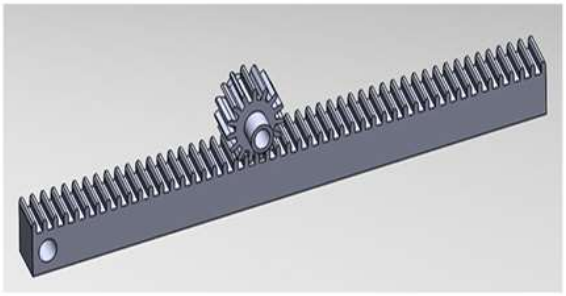
A spring is characterized as a versatile body, whose capacity is to twist when stacked and to recuperate its unique shape when burden is expelled. There are many types of springs but here we used a helical compression spring and there are four springs used as our requirement.



Spring

3.Rack and pinion

The gear of a shaft meshes externally and internally with gear in a straight line. Such type of gear is called rack and pinion gear. The straight line gear is called a rack and the circular wheel is called pinion



Rack &pinion

Specification of rack

material	Cast iron
Module	1.5mm
Cross section	75×25mm

Specification of pinion

material	Cast iron
Outside diameter	75mm
Circular pitch	4.7mm
Tooth depth	3.375mm
Module	1.5mm
Pressure angle	21
Pitch circle diameter	72mm
Circular tooth thickness	2.355mm
Fillet radius	0.45mm
Clearance	0.375mm

4. Flywheel

A flywheel utilized in machines fills in as a repository which stores vitality amid the period when the supply of vitality is more than the necessity and discharges it amid the period when the prerequisite of vitality is more than supply.

5. Bearing

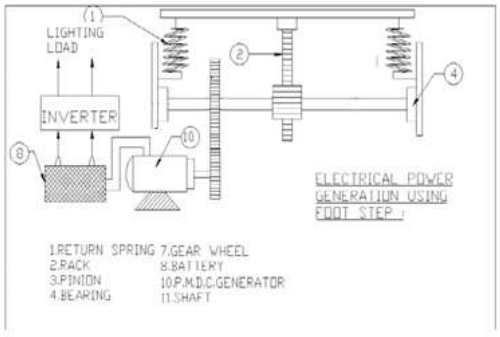
A bearing is a machine component which bolster another moving machine component (known as diary). It allows a relative movement between the contact surfaces of the individuals, while conveying the heap. A little thought will demonstrate that because of the relative movement between the contact surfaces, a specific measure of intensity is squandered in conquering frictional obstruction and if the scouring surfaces are in direct contact, there will be quick wear. So as to lessen frictional obstruction and wear and now and again to divert the warmth produced, a layer of liquid (known as ointment) might be given. The oil used to isolate the diary and bearing is generally a mineral oil refined from oil, however vegetable oils, silicon oils, oils and so forth., might be utilized. layer of liquid (known as ointment) might be given. The oil used to isolate the diary and bearing is generally a mineral oil refined from oil, however vegetable oils, silicon oils, oils and so forth., might be utilized.

6. Inverter

It‟s an electric device that convert the direct current (DC) into alternating current (AC). The design of specific circuity depends by the input voltage, output voltage, frequency and overall power handling capacity. The inverter does not provide power but the power is provided with the help of DC source.

7. Battery

An electric battery is a device consisting of one or more electromechanical cells that convert stored chemical energy into electrical energy. Every cell contains a positive terminal or cathode and a negative terminal or anode. Electrolytes allow ions to move between the electrode and terminal, which allows current to flow out of the battery to perform work.



IV. WORKING PROCESS

I.When a person moves from a foot step power generation system the plates move downward direction due to force is applied on the plate by virtue of impressing on the plate the force spring gets compressed.

II. The rack here moves vertically downward.

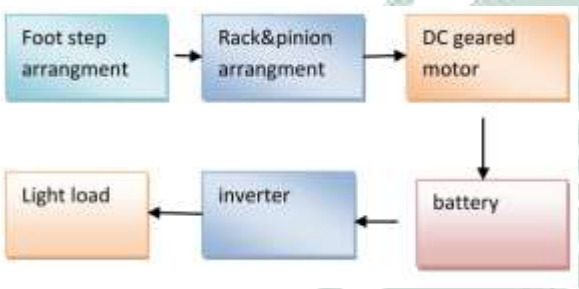
III. When the rack moves pinion will have engaged with the rack gear results in circular motion of the pinion gear.

IV. For one full compression the pinion moves 1 half circle.

V. When the force will have removed on the plate the pinion reverses and moves another half circle.

VI. The dynamo attached to the pinion hence result in the sinusoidal wave form (for single dynamo).

VII. Then, in this result energy produced will stored on battery for used.



V. CALCULATIONS

Let us consider, The mass of a body = 60 Kg (Approximately) Height of spring = 6 cm ∴Work done = Force x Distance Here, Force = Weight of the Body = 60 Kg x 9.81 = 588.6 N Distance traveled by the body = Height of the spring = 6 cm = 0.06 m ∴Output power = Work done/Sec = (588.6 x 0.06)/60 = 0.5886 Watts (For One pushing force)

VI. WORKING PRINCIPLE

The working principle of the foot step electricity generation system is based on the conversion of mechanical energy produced by human footsteps into electrical energy through suitable energy transducers such as piezoelectric sensors or electromechanical mechanisms like rack and pinion with a generator. When a person steps on the platform, a downward force is applied on the surface, which creates mechanical deformation or motion within the system. In the case of piezoelectric sensors, this mechanical stress generates an electric charge due to the piezoelectric effect, where certain materials produce voltage when subjected to pressure. Multiple piezoelectric sensors are arranged beneath the platform so that each footstep produces a small electrical output, and when these outputs are combined, a usable amount of electrical energy is generated. The generated voltage is typically alternating and low in magnitude, so it is passed through a rectifier circuit to convert it into direct current (DC) and then regulated using voltage regulators before being stored in rechargeable batteries or capacitors.

In another commonly used mechanism, the system employs a rack and pinion arrangement connected to a shaft and generator. When the footstep presses the platform downward, the linear motion of the rack is converted into rotational motion of the pinion. This rotational motion is transferred to a dynamo or DC generator, which converts mechanical energy into electrical energy based on electromagnetic induction. As the shaft rotates, it cuts the magnetic field inside the generator, inducing an electromotive force (EMF) according to Faraday's law of electromagnetic induction. A spring mechanism is often used to bring the platform back to its original position after the footstep is removed, allowing continuous operation for successive users. The generated electrical energy is then passed through a rectifier and stored in a battery for later use.

The efficiency of the system depends on several factors such as the force applied by the user, frequency of footsteps, number of sensors or mechanical linkages, and the design of the transmission system. Proper alignment, minimal friction, and effective energy transfer mechanisms are essential to maximize output. The system also includes components like charge controllers to prevent overcharging and ensure stable energy storage. Overall, the working principle revolves around harvesting otherwise wasted human kinetic energy and converting it into electrical energy through mechanical-to-electrical energy conversion techniques, making it a sustainable and eco-friendly method for small-scale power generation.

VII.RESULTS AND DISCUSSION

The results obtained from the foot step electricity generation project demonstrate that the system is capable of converting mechanical energy produced by human footsteps into usable electrical energy with reasonable efficiency for low-power applications. During experimental testing, it was observed that each footstep applied on the mechanism (generally using piezoelectric sensors or a rack and pinion–dynamo setup) generated a

small amount of voltage, typically in the range of 1–10 volts depending on the force applied, the number of sensors used, and the design of the transmission system. When multiple sensors or mechanical linkages were connected in series or parallel, the output voltage and current increased significantly, making it possible to store the generated energy in batteries. The system performed best in areas with continuous foot traffic, such as corridors, staircases, railway stations, and public walkways, where repeated application of force ensured continuous energy generation. The integration of energy storage components like rechargeable batteries and capacitors helped in stabilizing and utilizing the generated power effectively for applications such as LED lighting, mobile charging, or small electronic devices.

From the discussion perspective, it is evident that the efficiency of the system largely depends on the design of the energy conversion mechanism and the magnitude of force applied by users. Piezoelectric-based systems offer compact size and simplicity but produce relatively low power output, whereas mechanical systems using gears, springs, and dynamos can generate higher energy but require more robust construction and maintenance. One key observation is that energy generation is not constant and depends heavily on human activity, making it an intermittent source of power. However, when installed in high-footfall areas, the cumulative energy generated can be substantial over time. Another important aspect discussed is energy loss due to friction, improper alignment, and mechanical wear, which reduces overall efficiency; hence, proper material selection and design optimization are crucial. Additionally, the system proves to be environmentally friendly as it utilizes renewable human energy and reduces dependency on conventional power sources.

The project also highlights certain limitations, such as initial installation cost, lower efficiency compared to conventional energy systems, and the need for proper maintenance. Despite these challenges, the concept is highly innovative and sustainable, especially for smart city applications. The results indicate that while the system may not replace large-scale power generation methods, it serves as an effective supplementary energy source for low-power requirements. Overall, the project successfully demonstrates the feasibility of harvesting energy from human footsteps and emphasizes its potential application in energy conservation and green technology initiatives.

CONCLUSION

1.The poject “POWER GENERATION USING FOOT STEP” is successfully tested and implemented which is the best economical, affordable solution to common people. 2. Footstep power generation system produces electricity by utilizing energy which is wasted through walking. Mechanism like rack and pinion and piezo-electric material are integrated to produce desired output. Cost of electricity generation solely depends upon the initial cost, maintenance cost and life of system Maximum advantage of this system can be taken if installed in highly dense area. 3. Implementing this system, we can easily reduce our dependency on the conventional sources of energy, thus can be considered beneficial from that point of view. 4. In energy crises facing countries where the load shading of electricity are due to the shortage of energy, this foot step power generation system is best method to produce energy and the output of electricity production is increased by increasing the size of foot step power generation system. As compare to other energy producing system the cost of this system is less.

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