Electrical Power Generation from Footsteps

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ABSTRACT: With the increasing crisis of energy, there has been always a requirement in the advancement of methods of generating electrical energy from different non-conventional methods. Non-conventional energy system is very essential at this time to our nation. Hence this work is one such solution of generating electrical power from a non-conventional method by simply walking or running on the footsteps. Nonconventional 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 are used for generating power by utilization of force which is obtained during the walking on steps that 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.

Key Words: Electrical Power Generation, Footsteps, Battery

I. INTRODUCTION

This manuscript describes about generating the power by using the weight energy, one gets simply shocked by knowing how much energy a person can generate by simply walking on the floor with a normal speed. As people steps (thousands of steps a day) can be utilized and channel the kinetic energy to a useful work. Whenever a person walks, manages to lose energy towards the floor by means of direct weight, vibration, and audio and so on, a result of the move of excess weight to the floor. That energy may be used and converted into power. The actual electro-kinetic floor is really an approach in making energy by using the kinetic energy of the person who walks on the floor. The power floor is not like traditional floor. The energy produced by this floor will be environment friendly without having smog. Producing this type of energy will also be cost effective. The power floor does not need any fuel or perhaps any sort of energy resource, simply making use of kinetic energy. Based upon your excess weight from a person moving on the floor. In this work we Are Generating Power by Non- Conventional Method by Simply Walking or Running on the Foot Step. Non-conventional energy system is very essential at this time to our nation. Non-conventional energy using foot step is converting mechanical energy into the electrical power by using simple drive mechanism such as rack and pinion assembly and chain drive mechanism.

2. METHODOLOGY

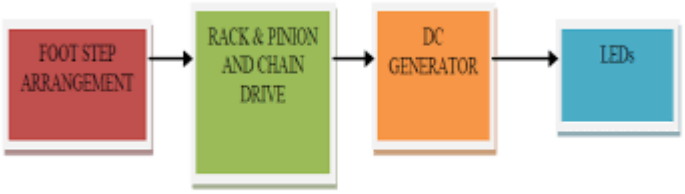

Fig.1 Block diagram of foot step power generation system

Whenever a man is passing over the system, it gets pressed downwards. As the springs are attached to the plate, they get compressed and the rack, which is attached to the bottom of the plate moves down in reciprocating motion. Since rack has teeth connected to gear there is conversion of reciprocating motion of rack in to rotary motion of gears, but the two gears rotate in opposite direction. So that shafts will rotate with certain RPM these shafts are connected through a chain drive to the dynamos, which converts the mechanical energy into electrical energy.

Now made to rotate a wheel in one direction by supplying power to shaft, while other made to rotate freely on the shaft, as the free wheel is inserted in the gears. We can insert a flywheel which is mounted on the shaft when the main function is to avoid energy fluctuation.

3. MATERIALS USED

1) Rack and pinion
2) Spur gear
3) Ball bearings
4) Chain drive
5) Springs
6) Shaft
7) Electric dynamo
8) Lead acid battery
9) Mild steel frame

3.1. RACK AND PINION

Rack and pinion in mesh Line diagram: The rack and pinion of the following specifications have been used. Fig 2 shows the assembly of the Rack and pinion which is being used in order to convert the reciprocating motion in to rotary motion.

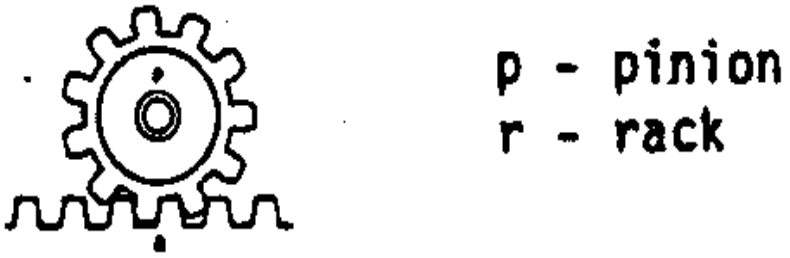

Fig. 2 Rack and pinion line diagram

- **DESIGN OF RACK:**

No. of teeth	=	14
Size of rack	=	80 x 80 x 650mm
Module	=	8
Addendum	=	12.56
Dedendum	=	12.56
Tooth load (W_t)	=	7134.94N

3.2. SPUR GEAR

Fig.3 Spur gear

STANDARD PROPORTIONS OF GEAR SYSTEM: Fig 3 shows the spur gear of 50mm diameter for transmitting the motion. The specifications related to the spur gear used are given below.

S.NO.	PARTICULARS	20° STUB INVOLUTE SYSTEM
1.	ADDENDUM	0.8 mm
2.	DEDENDUM	1 mm
3.	WORKING DEPTH	1.60mm
4.	MINIMUM TOT AI DEPTH	1.80mm
5.	TOOTH THICKNESS	1.5708mm
6.	MINIMUM CLEARENCE	0.2mm
7.	FILLET RADIUS	0.4mm

3.3 CHAIN DRIVE

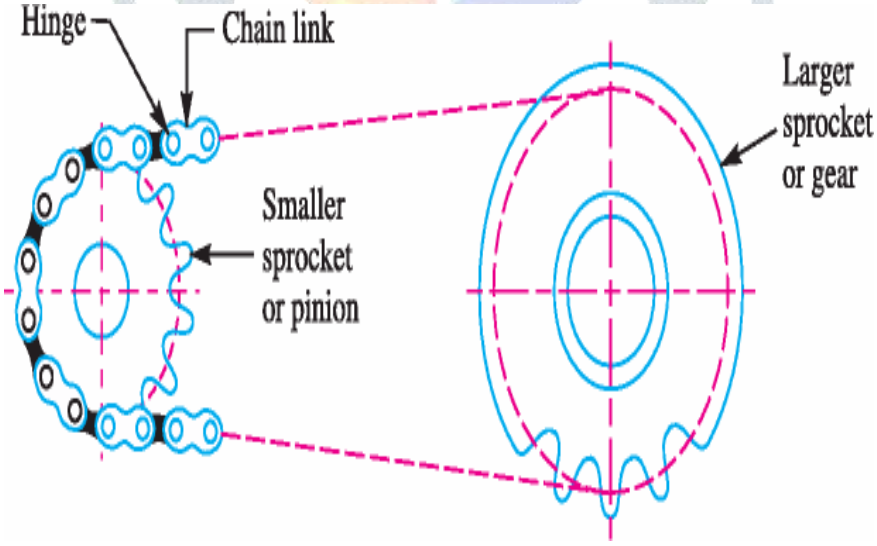

Fig. 4 chain drive

For the transmission of the motion the chain drives have been used. The figure 4 shows an open type chain drive which is used to transmit the motion between the smaller and larger sprocket which will rotate the sprockets in the same direction. The length of the chain drive is calculated as shown in the calculations below. The overall length of the chain used is 381mm.

- Length of chain drive

L=∏ (r1 + r2) +2x+ (r1 - r2)2 /x

where x =30 to 50 times pitch

at ISO chain number 06B pitch=9.525mm

x= 40*9.525=381mm

3.4. SPRINGS

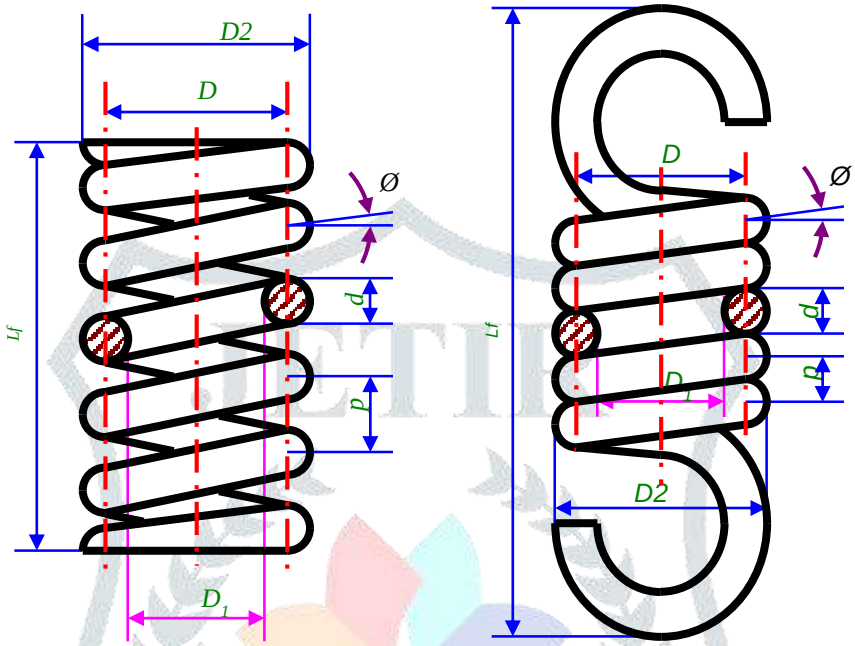

Fig.5. Dimensions of the Springs

- (wire dia.), d
- (outside dia.), D2
- (inside dia.), D1
- (mean dia.), D
- (pitch), p
- (pitch angle), Ø
- (free length), Lf

- **MATERIALS FOR SPRINGS:** The material for spring should have high fatigue strength, high ductility, high resilience and it should be creep resistant.
- 0.9% - 1.0% carbon is common material for springs.
- Steel with 0.85% - 0.95% carbon and 0.3% - 0.4%
- 3. Manganese is used for longer sized springs.
- Alloy steels such as chrome - vanadium and silicon manganese steels are used for better grade springs.
- Chrome steel, phosphorus bronze and Monel metal (nickel alloy) can also be used in special cases, to increase corrosion resistance and temperature resistance.

3.5. 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 specifications of the shafts are specified below.

- **SPECIFICATION OF THE SHAFT:**

- Length of the shaft = 800mm
- The material used = mild steel
- Diameter of the shaft = 50mm
- No. of shafts = 4

3.6. BEARINGS

A bearing is a machine element, which supports another machine element. It permits a relative motion between the contact surface, while carrying the load. In this automobile gearbox roller bearings are adopted. The ball or roller bearings consists of an inner race, which is mounted on the shaft or journal, and the outer race, which is carried by the housing or casing. In between the inner and outer race there are balls or rollers. A No. of balls or rollers are used and these are helped at proper distance by retainers so that they do not touch each other. The retainers are this strip and usually in two parts, which are assembled after the ball bearings are used for light loads and roller bearings are used for heavier loads.

3.7.ELECTRIC DYNAMO

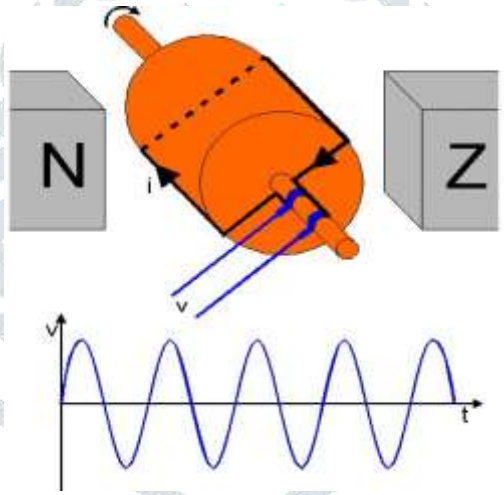

Fig-6 Electrical dynamo

It is well known that whenever electric current flows through a conductor a magnetic flux is immediately brought 10 existences in the space surrounding the conductor. We say that when the electrons are under motion, they produce magnetic field. The converse is also true, i.e., when a magnetic field embracing a conductor moves relative to the conductor, it produces a flow of electrons.

4. FABRICATION

The complete fabricated model picture of Foot Step power generation system is shown in fig 7. The upper plate is mounted on four springs, the weight impact is converted into electrical power with proper control unit. The spring and rack & pinion arrangement are 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. A gear is provided there also. A gear is coupled to the shaft. The gear wheel which is provided in shaft is coupled to the Dynamo.

Fig.7 Final product in different views.

ADVANTAGES

- This is a non-conventional system.
- No need fuel input.
- Battery is used to store the generated power.
- No pollution.
- Easy construction.
- Highly efficient in more crowded places.
- Conversion of mechanical energy into electrical energy is easy.

APPLICATIONS

- At all entry and exit point. Like in railway stations, bus stand etc.

5. RESULT

Power can be calculated in terms of obtained voltage and current when the load is applied on the footsteps. The readings are noted by using the Multimeter. [1]

- Power = Voltage x Current
- Here, when the foot is depressed due to the applied load on the footstep the calculated power is as follows.
- For one step of 20kg of load applied on the footsteps, the generated voltage is 2.6V and the average current produced is 12milliamps.
- Power = 2.6 x 0.012 = 0.0312
- Power generated per hour is0.0312 x 3600 = 112.3Watts.
- Thus, the obtained power for continuous load applied on the footsteps for one hour is 112.3Watts.

6. CONCLUSION

Energy is an important input to sustain industrial growth and standard of living of a country and can be directly related to energy consumption. The conventional sources energy like coal, oil, uranium etc.is depleting very fast and by the turn of the century, Man will have to depend upon nonconventional sources of energy for power generation**.** The concluding words of our project are, since the power generation using footstep get its energy requirements from the Non-renewable 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 useful to the places all roads as well as all kind of public places which is used to generate the nonconventional energy like electricity. It is able to extend this project by using some different dimensional arrangements and construction of the footsteps or the speed breaker so that it will increase the power production rate by fixing in school and colleges, highways etc.

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