

# Foot Step Power Generation

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**Abstract:** Now-a-days power has become a major and basic need for human life. As the population is drastically increasing day-by-day an also conventional resources are decreasing, there comes the necessity of depending on the non-conventional sources for generation of power. Hence the main focus is given n renewable resources like wind energy, solar energy and tidal energy. So our project is based on generation of power by human footsteps. Basically, while walking or dancing, humans possess some kinetic energy which is being wasted. So by utilizing this kinetic energy we can produce power by using the arrangement of “Tiles”.

As per our idea of this power generation project, when a person walks particularly on the tiles fixed releasing kinetic energy. Hence the piston fixed to the tile will compress the air allowing the air to flow to the tank. This tank will store the pressurized air. As the tank outlet is connected to the motor, this pressurized air will be passed to through the outlet, which enables the air motor to run. This motor is coupled to the generator which produces electricity. The electricity produced in this project will be stored using battery.

The energy saved in this project during daytime can be used for traffic signals, street lights, apartment, public mobile charging spots, electric vehicles charging spots and many more. The energy produced can also fulfil the future demands. The working principle of our project is based on Compressed Air Energy Storage (CAES).

**Keywords:** Foot, Generator, Power, Pressure tank, Tiles.

## 1. Introduction

### A. Overview

As there is increase in power demand for power, the necessity for non-conventional resource is being desired. There are many alternate ways of producing electricity. One of it could be footstep power generation which is effective method of producing electricity.

The most basic activity human being possess in daily life is walking. When a person walks, he will lose energy in various forms unknowingly. This happens due to the transfer of his weight on earth when he walks every single step. Hence this wastage of energy can be utilized and converted into electrical energy [1]. Our project describes how the electricity can be generated when people walk on floor.

The working principle of our project is based on CAES i.e.

Compressed Air Energy Storage; which means to drive the compressor to compress air at high pressure and then to store the energy produced using this process.

### B. Problem Statement

One of the daily requirements of human beings is electricity. Even for today, some of the countries are still a developing country. Several places in these developing countries suffer through the crisis of power-cuts of several hours which is not acceptable when we are living in such advanced technology generation. Another reason would the increase in population, because of which the power demand increases. Hence desire for using the renewable resource increases. As another alternate solution, we can utilize footsteps energy to produce power which will be stored and can be used when there is any cut-off of electricity.

### C. Project Objective

The main objective of this project is to generate electricity by utilizing the energy of human footsteps from footpaths, staircase, platforms, etc. at cheapest cost and to fulfil the future demands, and also providing electricity in the area of requirement, when power is cut-off, to promote the saving of conventional resources and increase the usage of non-conventional energy resources. It is also simple in construction and installation with low maintenance cost. It is eco-friendly with no pollution occurrence.

### D. Scope of Project

Using the principle of Compressed Air Energy Storage, we can use this system in the crowded area, where there is lot of human activities going on. We can use this system in staircases, in dance floor, railways and etc. So by installing these systems in crowded areas we can generate continuous power without interrupting people. As there is no mode of pollution, eco-friendly this system is adaptable. It is economical and also easy to install with less maintenance.

## 2. Literature Survey

T. R. Deshmukh has explained about footstep power generation system using 3D modelling software along with the

design and modelling parts. The model consists of number of simple parts which is installed under the walking platform [2]. The principle of this project is based on conversion of linear motion into rotating motion pinion and by rack arrangement. If the loads varies it leads in unbalance, and power will not be generated when the rack movement returns henceforth this fails the entire mechanism.

In another research paper, authors experimented using the following specified equipment that is motor of 10V with dc generator having 1k rpm, gear 1 which is mild steel having 59 teeth big gear, and 36 teeth small gear, gear type is spur gear, 2 spring gear is used, one load bearing capacity is of 60kg to 90kg, 5 inch of total displacement, bearing 1 is ball bearing, shaft diameter of 15mm. So by this the authors concluded that energy conversion is efficient and simple which is eco-friendly.

Authors named Farrukh Hafeez and Shiraz Afsal described about producing electricity, that is when people walk if we can install power producing platform which can produce 100W with 12 steps, we can produce 1000W. Then if we can install 100 floors, the power produced will be 1MW. So if this system is installed, we can get the better of energy crisis issue which can also create a change in global environment in a healthy way. So in this project flywheel is being attached with the gear system. This helps dynamo to rotate when the tile is pushed. The power generated will be saved using the battery. When a person steps on the tile, the shaft which is placed beneath the tile turns with approximate turns of two [1].

Another author named Sasankshekhhar Panda ha explained based on principle of crankshaft, flywheel and gear arrangement. This project can be installed in crowded locations. So this project can be considered to provide effective power producing solution to such places where transmission becomes difficult. But time to time lubrication and maintenance is needed.

A simple driving mechanism is explained by Jose Ananth Vino which involves rack and pinion assembly with chain drive mechanism. Here the pressure is converted into electrical energy. In this project there is no doubt that the power generation will be very high but the difficulty is only that it requires high initial cost. This system is pollution free and requirement of power from mains is not necessary. This system can be installed in places filled with crowd and can be used in roads as well. Maintenance and lubrication is necessary time to time. If problem occurs for the rack movement to return back, then the power cannot be generated.

### 3. Block Diagram

In India per square kilo meter there are 382 people living in so there might be a high chance that everyone will step into every square foot of area frequently, when foot step is kept in sq. foot of area is of no use so this can be utilized to generate electric power. These days there is increment in power demand. People are using more electricity than its to be every year power demand is increasing so the developing country like India there

is a huge market for electricity. Every day the load increment is in the MW scale also there are many private and public power plants constructing hence there is a lot of engineers researching for developing in new methods to generate the electricity, in this method we are generating electricity from the foot step kept by people so these foot step is converted into electrical energy by the following methodology.

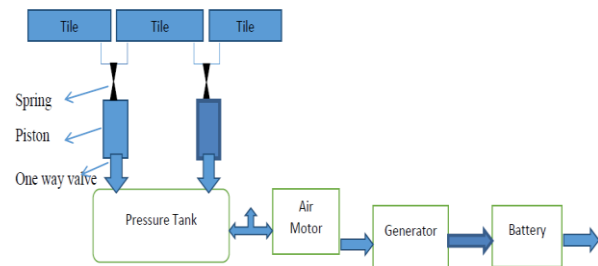


Fig. 1. Block diagram

The basic working principle of this project is based on the Transmission of pressure. So this pressure from foot step is utilized using piston and cylinder set up. When the pressure is applied. Using as storage tank for pressurized air this tank only unidirectional air valve hence every time person foot keeps it on the tile which is connected piston arrangement, the more air enters to the cylinder hence building up more pressure. This pressurized air inside the tank is utilized to rotate air turbine or air motor which is coupled with DC generator, this energy is stored inside battery arrangement. This cycle of a person keeping foot step on the generator tile and generation of electricity is continued for several times for this stored energy in the battery. This can be utilized by connecting DC load. This DC power can be used in the AC circuit by using an inverter.

In this mechanism the first stage is the person stepping on foot step tile arrangement hence the pressure which is applied on the tile will result the piston in linear motion towards down side, this piston arrangement will have compressed air, and this compressed air is stored in an air tank tight, here the air flow is unidirectional in motion this can be achieved using sophisticated air valve which allows the air to flow in one direction only. This pressurised air is utilizes to generate so this generated electrical energy is utilized and stored by using DC storage methods like battery, here we are using permanent magnet DC generator to obtained better efficiency because there is no field windings.

The upper plate is mounted on two springs; the weight impact is converted into electrical power with proper control unit. The spring and piston 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. This small momentary load creates pressure inside cylinder which occupies piston arrangement so this small quantity of pressurized air is in reverse air tank. The purpose of the tank is to obtained higher pressure using small piston arrangement. This air actuated turbine is coupled with DC permanent magnet

generator hence output of the generator is stored in a battery or utilizes, here the bulb indicates the load. The entire operation is actuated from stepping up on a tile and the end result is electrical energy. Here this kind of process is continuous every time the person on this tile. As shown in the block diagram the working procedure is explained in step by step manner:

Step 1: When force is applied on the tiles by virtue of stamping on the tiles the force spring gets compressed.

Step 2: Due to this the piston moves downwards. Here we have used Pneumatic Piston.

Step 3: The piston is compresses the air.

Step 4: This high pressurised air enters to the pressure tank by one-way valve fixed to the tank.

Step 5: In the pressure tank we have fix the Pressure gauge to measures the force of the pressure in the air so that we can determine whether any error in the pressure tank.

Step 6: pressurised air enters the air motor or air turbine by using valve, at the time motor will start to rotate.

Step 7: The generator is attached to the Air Motor which is convert mechanical energy into electrical energy.

Step 8: From here the power is stored directly in to battery.

Step 9: Here the Bulbs are connected to battery for showing the result.

#### 4. Equipment's

##### A. Permanent magnet DC Generator



Fig. 2. Permanent magnet DC Generator

Specifications:

- Voltage: 12V
- Rated Power: 120W
- No Load current: less than 0.55A
- Rate torque: 4.58KgCm
- Rate current: less than 7.0A
- Efficiency: greater than 70%
- Shaft diameter: 8 mm
- 100% Ball Bearing construction
- Speed: 3350RPM
- Weight: 1.06Kg

##### B. Pneumatic motor

Description:

- It is the air motor which works at a maximum speed 10000 RPM and at a pressure of 90Rs.
- A pneumatic motor (air motor) or compressed air engine is a type of motor which does mechanical work

by expanding compressed air to the respective systems.

- Pneumatic motors generally convert the compressed air energy to mechanical work through either linear or rotary motion.



Fig. 3. Pneumatic motor

##### C. Battery



Fig. 4. Battery

Specifications:

- Type: Sealed Lead Acid battery
- Voltage: 12 V
- Current Rating: 7.2 A

##### D. Non return valve



Fig. 5. Non return valve

Specifications:

1. Diameter: 10mm
2. Length: 50mm
3. Lift-off pressure: 0.5 bar

##### E. Pneumatic Cylinder

- Pneumatic cylinder is also known as pneumatic piston it is a mechanical device which use the power of compressed gas to produce a force in a reciprocating linear motion.

- This type of pneumatic piston which move in a single direction.
- These pneumatic pistons have a linear working operation and hence which helps the tank to get a complete range of storage capacity.

F. Pressure Tank



Fig. 6. Pressure tank

Specifications:

1. Tank orientation: Horizontal
2. Storage capacity: 30 L
3. Pressure rating: 0-100 psi
4. Material: SS, MS
5. Maximum work pressure: 5 Kg/cm<sup>2</sup> to 100 Kg/cm<sup>2</sup>

G. Spring

Specifications:

1. Height (H): 100 mm
2. Outer Diameter: 30 mm
3. Inner Diameter: 24 mm
4. Wire Diameter: 3 mm
5. Total no. Of turns: 12
6. Active no of turns 10
7. Spring index (C): 18
8. Wahl's Correction factor(K): 1.10
9. Free length(L): 93.96 mm
10. Pitch of coil(P): 11.32 mm

H. Flywheels



Fig. 7. Flywheels

Descriptions:

A flywheel is a mechanical device in detail designed to efficiently store rotational energy or kinetic energy.

Flywheels withstand changes in rotational speed by their moment of inertia.

The average amount of energy stored in a flywheel is proportional to the square of its rotational speed and mass.

By increasing or decreasing its rotational speed we can change a flywheels stored energy without changing its mass.

Hence, flywheels act as mechanical energy storage devices.

5. Result

Our project is land based Electricity generation. In our nation there is 3.287million kilo meter square area is present our project is a proto-type designed and implemented on a square foot of area. In a square foot of area considering 100 to 500 footsteps per day is capable of generating in an average of 5,000 PSI. This pressure can be utilized to generate electricity using a turbine air as prime mover. Which can generate approximately 1.5KW of power. This setup along the country can generate even more power assuming there is a setup every square kilo meter of this country. Which results in 3.287 million setup of size one square foot. Considering this setup is stepped average of say 250 times then in average it can generate 4.9MW of power.

Our project is a small step towards a big moment which is to walk and generate power as well as good health.

6. Conclusion

Electricity has now become one of the basic needs for everyday life. Due to increase in population, the generation of electricity is not sufficient to fulfil the power demand. So in this project we are utilizing the footstep energy to generate electricity and this technique will also help to conserve our natural resources. The power gained from conventional source must be saved for efficient use, as here is to not only to provide alternative but the economy of the country will also be counted.

It can be implemented at metropolitan cities, so that more electric power is generated. Installation of this project is easier. This system is affordable as well as economical. They are eco-friendly, reliable, less noise and self-generating. The stored electricity could satisfy the power demand requirement of electric power.

7. Future Scope

1. If there is any emergency power failure situation, then footstep power generation can be an alternative solution.
2. It also can be used for agricultural applications, street lighting, electric car charging spot, mobile charging spot and etc.
3. If we develop further with more power outcomes then we can use the energy saved for metro and rural applications also.

References

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