Footstep Power Generation

Nikhil R. Matey
UG Student
Department of Mechanical Engineering
JDCOEM, Nagpur

Dinesh G. Koche
UG Student
Department of Mechanical Engineering
JDCOEM, Nagpur

Nikhil S. Kolte
UG Student
Department of Mechanical Engineering
JDCOEM, Nagpur

Shubham W. Nagrale
UG Student
Department of Mechanical Engineering
JDCOEM, Nagpur

Swapnil P. Bhoyar
UG Student
Department of Mechanical Engineering
JDCOEM, Nagpur

Abstract

Global environmental issues and shortage of fossil fuel available are major concerned in today's world. Due to this focus has been turned to renewable energy sources like wind energy solar energy & tidal energy. They are becoming more and more popular all over the world due to many advantages associated with them. Our model concern to generate electricity by human footstep through the foot pump at 0.7 bar pressure. The volume of air generates in a cylinder210702.69 mm3.The model consists a setup of mechanism to compress an air in foot pumps through human footsteps energy this convert it into compressed air. This compressed air is then stored in the air tank of sufficient pressure, then this compressed air gets impacted on fan coupled with D.C. generator through a high pressure nozzle. The D.C. generator generates D.C. voltage which gets stored in battery.

Keywords- Battery, Compressed air, D.C. generator, Pressure, Foot pumps

I. INTRODUCTION

The objective of this work is power generation through footsteps as a source of renewable energy that we can obtained while walking on to the certain arrangements like footpaths, stairs, plate forms and these systems can be install elsewhere specially in the dense populated areas. The basic working principle of 'footstep power generation system' is based on piston pump and compression spring [1]. A large amount of energy is wasted when we are 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 lighting the building [2]. In this project we are using a plate beneath the footsteps which is connected with the piston-cylinder arrangement through a compressive spring. We will accumulate the compressed air in the tank. And this compressed air will have used to rotate the blades of fan by using high velocity nozzle as result electricity will generate. This electricity is stored in a battery. Then the output of the battery is used to lighten the lamps in the room. Now during daytime, we don't need electricity for lightening the lamps so we are using a control switch which is manually operated. The control switch is connected by wire to the output of the battery. The control switch has ON/OFF mechanism which allows the current to flow when needed.

II. WORKING PRINCIPLE

A. Components

This method consists of different equipment's of instrumentation that are used to work as per system diagram to generate power. The block diagram comprises of spring, Piston, Cylinder, Non return valve, Common tube, Air tank, Solenoid valve, Pressure gauge, Air turbine, D.C. generator, Battery.

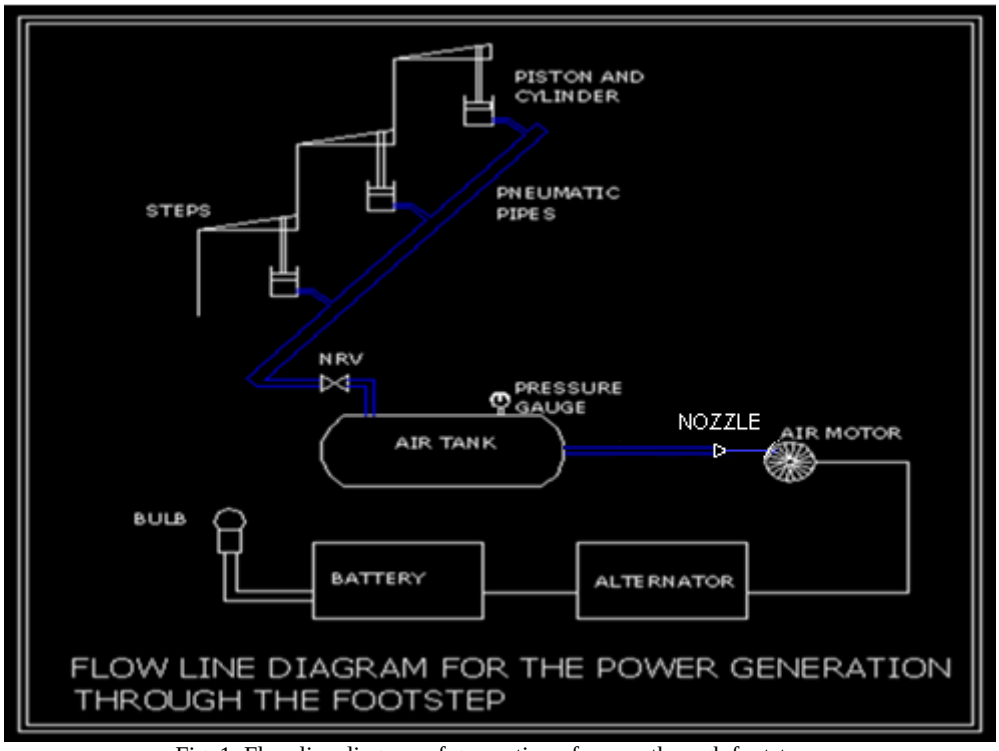

Fig. 1: Flow line diagram of generation of power through footsteps.

1) Spring

a) Types of Spring

1) Compression Spring.
2) Tensile spring.
3) Torsional spring.

The helical compression spring used in the model has specifications in order as below.

1) Height (H) = 100 mm.
2) Outer Diameter (D_o) = 30 mm.
3) Inner Diameter (D_i) = 24 mm.
4) Wire Diameter (D_w) = 3 mm.
5) Total no. of turns (n_1) = 12.
6) Active no. of turns (n) = 10.
7) Spring Index (C) = 19.
8) Wahl's Correction factor (K) = 1.10
9) Free Length (L) = 92.96 mm.
10) Pitch of Coil (P) = 10.32 mm.

2) Non Return Valve (NRV)

A non-return valve or one-way valve is a mechanical device, which normally allows fluid (liquid or gas) to flow through it in only one direction. Non return valves are two-port valves, meaning they have two openings in the body, one for air to enter and the other for air to leave.


Fig. 2: Non-return Valve

The Non-Return Valve used in the model has 10 mm inner diameter. The reducers are connected to NRV for connecting the pipes to NRV. It has the following specifications.
Diameter = 10 mm
Length = 50 mm
Lift-off Pressure =0.5 bar.

3) Battery

A battery is a device that converts chemical energy directly to electrical energy it consists of one or more voltaic cells. Each voltaic cell consists of two half cells connected in series by a conductive electrolyte. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. In this model used rechargeable battery. Rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.
The battery used in the model has following specifications.
Type = Sealed Lead Acid battery
Voltage = 12 V
Current rating = 7.2 Ah

B. Generation of Compressed Air

It consists of staircase which is supplied with inclined stairs which are inclined at an angle of 9º. The foot pumps are attached below the stairs by spring arrangement so that when a person climbs on the stairs the stair gets pressed and thus the foot pump gets pressed which creates compressed air. This compressed air gets stored in air tank through a series of non-return valves attached to bottom of foot pumps and before the air tank.

C. Impact of Compressed Air on Fan

The piston-cylinder is placed under the footsteps to create the appropriate pressure at regular intervals. The high pressure air in air tank then impacted on a fan which is connected to D.C. generator by a high velocity nozzle.

D. Generation of Electricity

Due to impact of compressed air on fan causes the fan to rotate at high speeds. As the fan rotates the D.C. generator coupled to fan also starts rotating. This rotation of generator produces D.C. voltage which gets stored in the battery for further uses. This D.C. voltage can be converted into A.C. voltage by connecting an inverter circuit to battery before connecting battery to output. Then the output of the battery is used to lighten the lamps. Now during daytime, we don't need electricity for lightening the building lamps so we are using a control switch which is manually operated. The control switch is connected by wire to the output of the battery. The control switch has ON/OFF mechanism which allows the current to flow when needed.

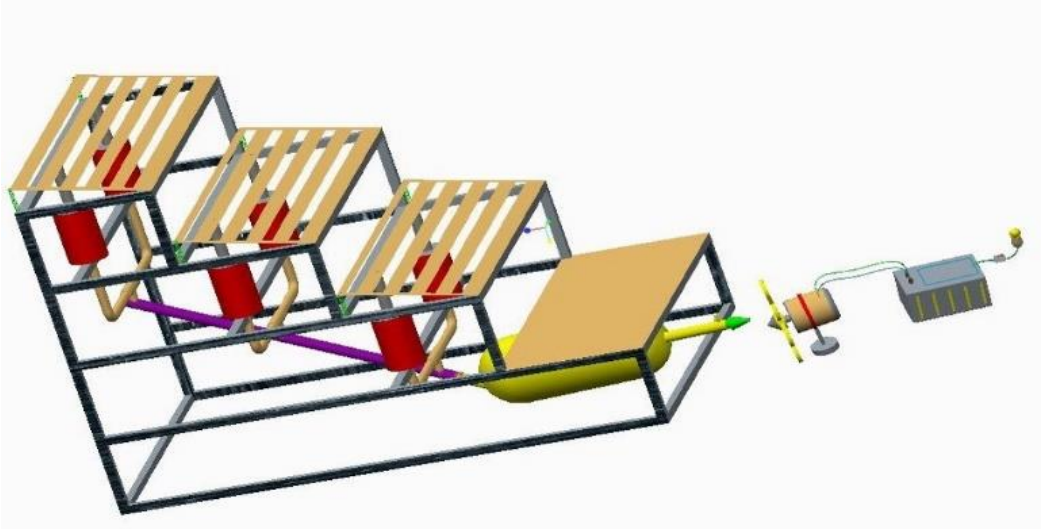

Fig. 3: Proposed Project Model

III. ADVANTAGES

- Economics in application: - The project model is manufactured in minimum cost and it does not require expensive parts for construction.
- The required input is free of cost: - The input required for working of project i.e. air is available to us in no cost.

- Reduces the demand of conventional energy: - As electricity is being produced by the project, we do not have to be dependent upon the conventional sources of electricity.
- Simple in construction: - As the project consists of cheap and light parts, it is simple in construction.
- Simple in installation: - The project model is simple to install as it is light weight and portable.
- Low maintenance cost: - As the project consists of less moving parts as compared to other models having mechanical linkages and models having piezoelectric transducers.

IV. LIMITATIONS

- Large maintenance of the battery is needed.
- Used for linear stairs only.
- Space Constraint: The proposed model is not useful in places in which small floor space is available, because the smaller the model gets the output produced from the model is less.

V. CONCLUSION

In this we conclude by giving the detailed idea of our paper there by collecting data and detail of various components required in the model. In this model we used the weight of people as energy (for actuating the piston and cylinder mechanism) and this energy is converted into electrical energy for fulfilling our preliminary needs of electricity.

REFERENCES

[1] Siba Brata Mohanty, Sasank Shekhar Panda, "An Investigation of Generation of Electricity Using Foot Step", IJESRT-2013.
[2] Ramesh Raja R, Sherin Mathew, "Power Generation from Staircase (Steps)", ICETS-2014.