Power Generation from Foot Steps

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Abstract- ***Recently, use of electrical energy is increasing. But the amount of coal and some other resources are decreasing. Due to the decrease in amount of raw materials, so many researchers are doing their research in developing alternate ways. By lots of research the scientists came with the idea of electricity generation from footsteps. This method is already in implementation in developed countries like California in USA. This type of electricity will be useful for low power ranges and helps in reducing little amount of load on the line.***

Indexed Terms- Piezoelectricity, Ferroelectric

I. INTRODUCTION

Piezoelectric is the electric charge that accumulate in determined solid materials in response to applied mechanical stress. Piezoelectricity was found by the Curie brothers in 1880. It is spotted in crystalline lucid materials with no symmetry. The materials that display direct piezoelectric also shows reverse effect. By using this piezoelectricity, we can generate some voltage for use in small range applications like microphones, sensors.

II. MATERIALS

There are many types of materials used in the generation of footstep power. They are

i. Natural materials.
ii. Plastic materials.

Natural materials: silica (quartz), sodium potassium tartrate (Rochelle salt), topaz, sucrose, tendon, silk, enamel.

Plastic materials: PZT, Zinc oxide, $BaTiO_3$, $GaPO_4$, $KNbO_3$, Na_2wO_3.

- Working: In the piezoelectricity concept, both +ve and-ve charges are equally distributed in the crystal. The piezoelectric materials are not piezoelectric until the irregular ferroelectric domains are lined up by polling.

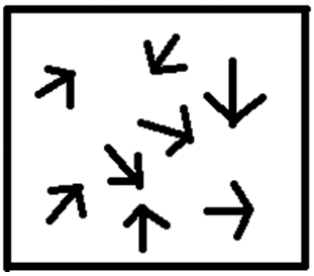


Fig. (a)

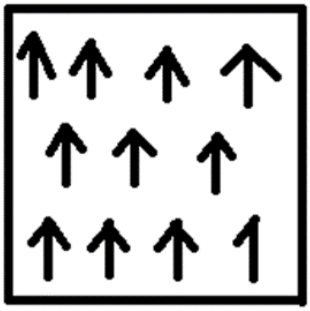


Fig. (b)

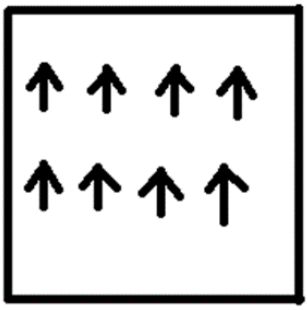
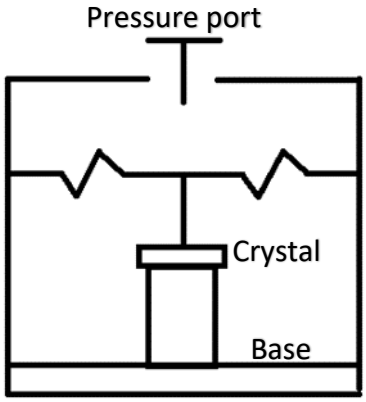


Fig. (c)

a. Irregular orientation of domains according to poling.

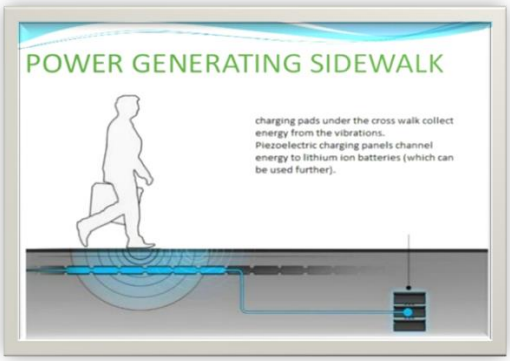
b. Polling in dc field.
c. Remnant polarization after the field is removed.

When the pressure is applied on the body, a negative energy is generated in enlarged side and positive energy on flattened side. Once the pressure is lightened, current flows through the material. Charging dock below the crossway pile up the power from the vibrations. This power will be stored in the lithium-ion batteries that can be used further.

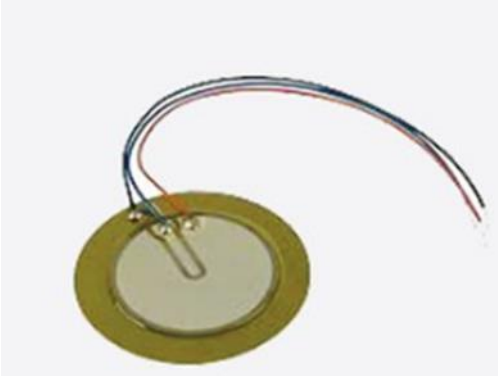


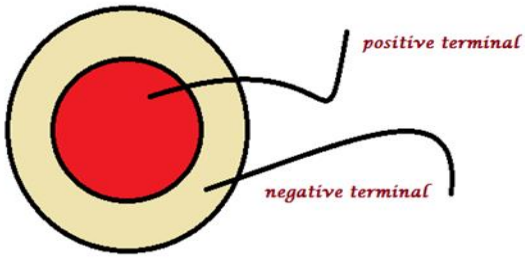
Between two metal plates, the piezoelectric crystal is deposited. On the metal plates the mechanical pressure will be applied that efforts the electric charge with in the crystal off-balance.

- OUTPUT: The o/p voltage is different for different types of materials. The generated voltage from a single piezoelectric crystal is in mV range. The wattage is in range of microwatt. For increasing voltage ranges the crystals will be connected in series.



The maximum of 2mW energy is generated and charges 40mAH button cell battery in 1 hour. As the mob farmstead won't work in the home, the power that will be required to light 15 LED lights for 1 second will be produced from a single human step.





It is determined that approximately 600 steps is required for charging 6V, 1.2AH battery.

Features and its specifications:

Impedance: ≤500Ω;

Voltage: ≤30V P-P;

Operating temperature: -20 degrees Celsius to 60degrees Celsius;

Storage temperature: 30 degrees Celsius to 70 degrees Celsius;

Low soldering temperature;

Strain sensitivity: 5V/μE.

III. ADVANTAGES

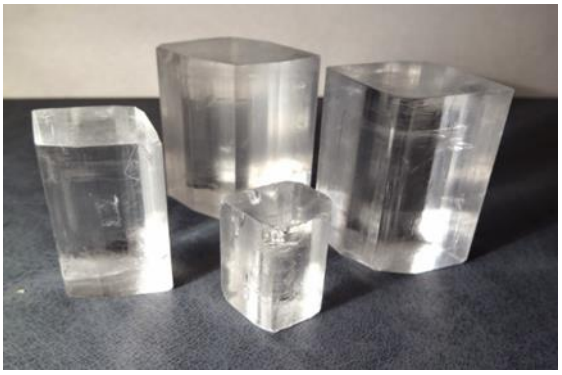
1. Uninfluenced by external electromagnetic fields.
2. Free of pollution.
3. Its maintenance is low.

4. Equipment can be replaced easily.

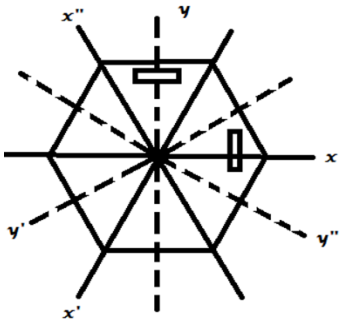
IV. DISADVANTAGES

1. This cannot be utilized for truly static measurements.
2. If crystal is over stressed it has chance to crack.
3. It may affects when used at high temperatures for long time.

The quartz is largely used for production of power from footsteps I.e., piezoelectricity. But there are also another materials that are used for production of piezoelectricity. The other material i.e., mostly used for generation of piezoelectric power is Rochelle salt ((sodium potassium tartrate).



When this crystal is placed in electric field exposed first to a shearing stress. So, in the event of plates cut with all edges that are parallel to the axes, the expected type in an alternating field is shear vibration. Although the possibility of longitudinal vibration is not eliminated through elastic reactions. Rochelle salt crystal can also be cut into plates in such a way to show shrinkage and restaurant extensions in directions perpendicular to field of electricity.



This Rochelle salt was the first material that was discovered by Valasek. He found the ferroelectric phenomenon in Rochelle salt in 1921. From this he also introduced curie temperature and curie point of ferroelectric. There are some differences between Rochelle salt and quartz.

Rochelle salt	Quartz crystal
Rochelle salt has the best piezoelectric effect. It weak in strength so that it breaks easily. It is used in microphones, headsets, loud-speakers.	It has a moderate characteristic. It is cheap in cost and readily available. Its main applications are RF oscillator and Filters

Rochelle salt contains unique piezoelectric and dielectric properties. These are also known as ferroelectrics. This is due to likeness of these properties to the magnetic properties of Ferro-magnetic substances. These crystals will never worn out unless they are broken, no longer converting energy. This piezoelectricity has some applications.

V. APPLICATIONS

1. PIEZO-ELECTRIC RESONATOR: Device which maybe excited piezoelectrical to resonant vibrations at one or more frequencies.

   Exclusively, all piezo-electric preparations that are utilized in radio are resonators.
2. High voltage and power sources.
3. Sensors.
4. Actuators.

5. Frequency standards.
6. Piezoelectric motors.
7. Reduction of vibrations and noises.
8. Infertility treatment.
9. Surgery.

Output voltage of piezoelectric crystal can be calculated by using formula:
V= P*q*t

Where, P is the applied pressure.
q is the sensitivity.
t is the thickness.
V is the output voltage.

CONCLUSION

Piezoelectricity is a radical source for GREEN ENERGY. Pliable piezoelectric materials are fascinating for power harvesting implementation.as they withstand large amount of strain. Then, the ambient vibration energy surrounding them will be converted into electrical energy. This generated energy can be stored for later use. This piezoelectricity can be used for mobile charging applications too. Piezoelectric transducers will be used in generation of electrical energy which converts vibrations due to applied pressure to electrical energy.

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