

Converting Sound Energy to Electric Energy

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ABSTRACT

Nowadays the main problem is noise pollution. However we cannot either control it or reduce it but we can use it as a source of energy. There is a huge shortage of electricity even though there are many sources because we need electricity to run most of our devices and do our daily work. Sound is a mechanical form of energy which travel in the form of wave, wave that is an oscillation of pressure this pressure created by the sound could be used to convert it into electric energy transducer.

Keywords: Diaphragm, Piezoelectric materials, Transducer, Sound energy, Thermodynamics.

INTRODUCTION:

According to the law of conservation, "energy is neither created nor destroyed, but can be changed from one form to another." With the help of this concept, various so-called ecological energy sources were discovered. Some of them are mainly used to address short-term energy. Some of the renewable energy sources are sun, wind, water, and biomass. However, the renewable energy sources discussed above have major problems in terms of efficiency and cost. Therefore, for our conventional application, we need a different type of source. A scenario arises that will lead us to a new, renewable energy source that has long been known and healthy for us. In other words, noise or noise is present all around us. So why not cover your energy needs with it? In our main application, we saw that sound is converted into electrical signals to travel through the medium for communication purposes. For example, the diaphragm in a microphone converts sound energy into an electrical signal that enters the speaker and is then converted back into sound. However, the electric current generated by the microphone is very small and is usually measured in millivolts. Before it can be seriously used, the signal needs to be amplified, usually to line level (usually 0.5 - 2V) the application of sound energy as a source of electricity can be very beneficial for human existence compared to other sources. Because sound is present in the environment as noise, which is an important part of environmental pollution. Sonic energy is a boon to non-renewable sources like coal, petroleum, etc. which is in danger of extinction.

INTRODUCTION TO SOUND ENERGY:

Sound is what the human ear can hear and feel, while noise is unwanted sound. Sound is basically a mechanical wave, which is a pressure vibration that is transmitted through the environment (such as air or water) and consists of frequencies that are within the audible range. So if we think of sound as a wave, we can think of it as a flow of energy from one point to another using a medium like air. Sound waves can be elongated and transverse depending on the direction of vibration of sound particles called phonons. Sound perceived by humans has a frequency from about 20 Hz to 20,000 Hz. In air at standard temperature and pressure, the wavelength of the corresponding sound wave varies from 17 m to 17 mm. Because sound is a mechanical wave that can be easily converted into electrical energy.

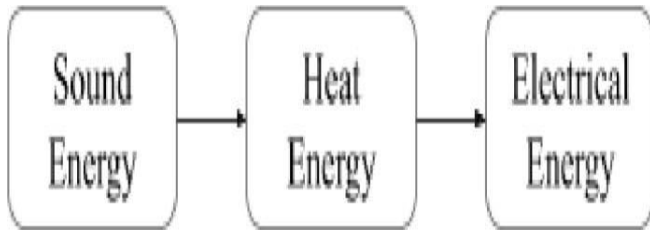
PRACTICAL METHODS OF CONVERSION:

There are three methods to convert sound energy to electrical energy.

METHOD 1:

In this method we can convert sound energy into heat energy as the motion of sound waves by making the particles of the medium vibrate, so that the sound energy disturbs the particles of the medium as they pass through the medium, these disturbances are caused by sound being transformed into heat energy which used, because when the particles of the medium are pushed out of the sound wave, they collide with the neighboring particles of the medium, this collision leads to the generation of heat, the heat generation will be more in the denser medium, so to

produce more heat, we need a material with a very high density tall. This heat energy is converted into electricity.



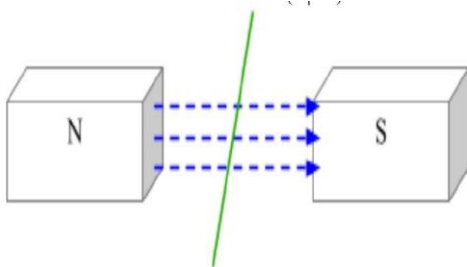
But this method is less efficient due to more loss of energy while converting sound energy to heat energy and then to electrical energy.

METHOD 2:

Use of Diaphragm

Another method of conversion is the use of a Diaphragm. Microphone is an example of transducer. Transducer is a device that converts the energy from one form to another form. We create a thin curtain like diaphragm. A conductor is attached behind the curtain. Whenever sound is produced, the membrane vibrates due to the vibrations created by the sound waves. Hence automatically the conductor also moves which is placed in between the magnetic bars which affect the magnetic field of a magnet. This creates an EMF as it moves and creates a voltage across it. When a closed circuit is formed it produces electricity. Hence sound energy is converted to electrical energy using a diaphragm. This method works on the principle of electromagnetic induction which defines that when a conductor is placed in the varying magnetic field an emf is induced across the conductor.

Induced emf $e = -N(d\phi/dt)$



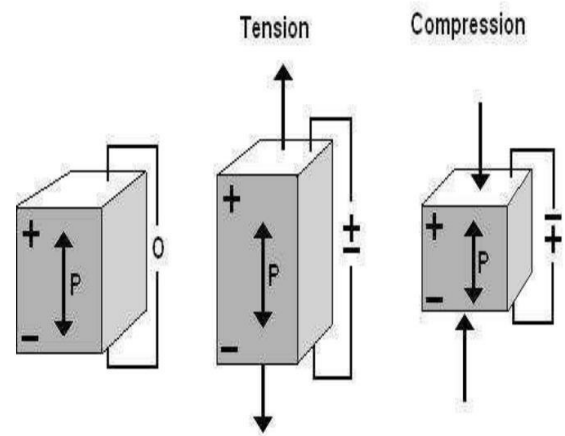
METHOD 3:

Piezo Electric Material:

Piezoelectric materials are transducers crystals could convert mechanical strain to electricity, crystals are formed naturally eg. Quartz, bone, DNA...whereas artificially ZnO, lithium niobate, Lead Metaniobate the sound energy could be converted into electricity using piezoelectric material.

Direct piezoelectric effect:

When a piezoelectric material is subjected to strain or deformed by external stress electric charges appear on the surface of crystal. When the direction of strain reverses the polarity. The polarity of electric charges reversed. This is called as direct piezoelectric effect. Hence, when a sound is produced near the crystal there will be strain on the face of a crystal hence generation of electric charges occurs. Hence sound energy is converted to electrical energy.



Inverse Piezoelectric Effect:

When a piezoelectric material is placed in an electric field or when charges are applied externally to its faces the material exhibits strain i.e., deformation occurs to a crystal. This is known as inverse piezoelectric effect.

CONCLUSION

- Since sound is abundant in nature, it can be harnessed by converting it into suitable electrical energy.
- Sound energy can be converted into electrical form using various methods. This includes the following methods:
 1. Method 1- by converting sound energy into heat, and then into electricity.
 2. Method 2- by making a thin curtain like a diaphragm.
 3. Method 3- Use of piezoelectric materials.

FUTURE SCOPE

If sound energy can be converted into electricity efficiently, this could help us reduce electricity shortages worldwide.

It is clean energy, so it helps reduce carbon emissions. Energy can be stored and used for street lighting, signals, and a variety of other devices.

REFERENCES

- [1] Alankrit, Gupta. "conversion of sound to electrical energy." *International Journal of Scientific & Engineering Research*, January 2014.
- [2] Attia, Mohana Faraougsaed. "Evaluation of Electric Energy Generation from Sound Energy Using Piezoelectric Actuator." *International Journal of Science and Research*, 2014.
- [3] Bhatnagar, Shalabh Rakesh. "Converting Sound Energy to Electric Energy." *International Journal of Emerging Technology and Advanced Engineering* 2, no. 10 (october 2012).
- [4] Cha, Seung Nam. "Sound-Driven Piezoelectri Nanowire Based generator."
- [5] Fang, Liew Hui. "Exploring Piezoelectric for Sound Wave as Energy Harvesteter." *The 8th International Conference on Applied Energy*, 2017.
- [6] G, Revathi. "Piezoelectric Energy Harvesting System in Mobiles with Keypad and Sound Vibrations." *International Journal of Engineering Research & Technology* 1, no. 4 (june 2012).
- [13] Rakin, Jamie Sue. "Study of Piezoelectric Device for Conversion of Sound to Electricity."
- [7] Ge, Qingyu. "Prospect of Electric Generation Using Sound." *AIP conference Proceedings*, 2017.
- [8] Jo, Byung-Wan, and Dong yon Lee. "An Experimental investigation of Noise energy Generation." *ICCECE*, november 2012.
- [9] Neha. "Study of Conversion of Sound Energy into Electrical Energy." *International Journal on Emerging Technologies (Research Trend)* 8, no. 1 (2017): 101-103.
- [10] Jr, cesarioA.Bacosa. "An Electric Source of Noise Pollution Based POver Bank." *IRCHE*, 2017.
- [11] Priya, Shashank, and D Robert. "Piezoelectric Energy Harvester." *United States Patent application Publication*, march 2008.
- [12] Park, joon Cheol, kim Yoon shin, and kang Daejoon. "Propagation Characteristics and Effects of Road Traffic Noise."