Use of Piezoelectricity for Renewable Source of Electricity

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Abstract.

Heavy noises around us are way too common and disturbing, what if that disturbance could be used in a manner that generates resources for us and our future needs, the time is fast and in near future, there would be a need for various renewable energy resources as the current ones are being used too much.

The data shows that currently, we use 90% of electricity in our daily lives, the usage is mainly inour appliances and our types of equipment for recharging their batteries, theoretically there can be a method using that disturbance of noise or technically the sound waves into electromagnetic waves. The process of modulation and collecting it in a channel to demodulate those input signals the process can be done. The statistics show that India is a hub of mechanical factories with the types of machinery producing a lot of sound in the environment, even vehicles produce a lot of sound for better functioning of those things' silencers are being used.

Piezoelectricity is a technique using which we can store the sound waves or the sound signals and further convert them into electrical signals, the idea is to create a storage unit using piezoelectric principles and store the electric current, the current produced would be direct current and can directly be used to charge the devices like mobile phones, laptops; piezoelectricity can be stored in super capacitors for various purposes and used in different aspects in means of consumption, to have a secure

and safe future there must be some unconventional ways generate renewable resources.

1. INTRODUCTION

Piezoelectricity is the type of electric charge that is generated in some very specific solids like crystals, certain ceramics, and biological matter. The word piezoelectric means the production of electricity due to external factors like pressure and latent heat.

The piezoelectric effect shows relativity to the electric dipole in solids. The induced ions on crystal lattice show asymmetrical charge dipole or can be held by molecular groups. Piezoelectric materials tend to produce the inverse effect, commonly known as the converse piezoelectric effect.

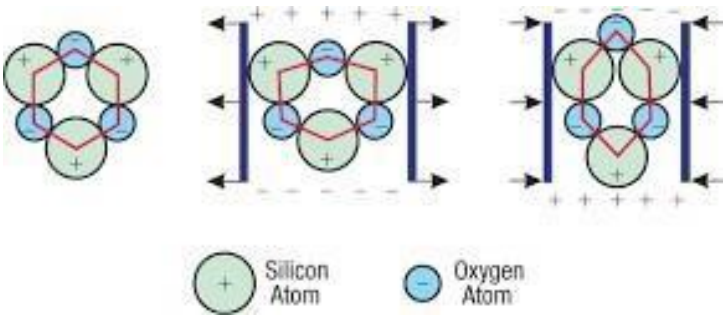

Figure 1.1 : Working of Piezoelectricity

Piezoelectric devices are consuming the industrial, manufacturing, and automotive industries. Demand for medical instruments and telecommunications devices in the field is increasing a lot. The piezoelectric crystals are used in various ways;

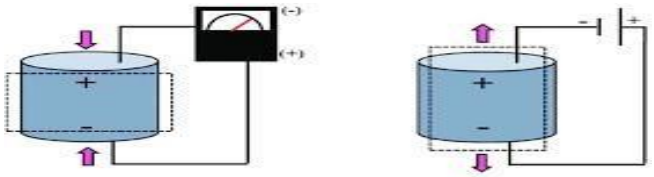

Figure 1.2: Direct & Converse Piezoelectric Effect

High Voltage and power sources - The piezoelectric devices produce a sufficient

high-voltage electric current. A piezoelectric transformer is an AC voltage multiplier, instead of the regular coupling between the input source and output source the piezoelectric transformer uses acoustic coupling (acoustic coupling is an interface device for electric signals by acoustical means, in general, mobile phone signals

Actuators - An actuator is a component in any mechanism that could be made responsible forthe movement of the particular mechanism, in simple terms, it moves the system and can be generalized as a mover. There are piezo actuators and enhanced piezoelectric actuators, which could be helpful in the conversion of sound wave to electrical signals. ex- speakers; voltage is converted to mechanical movement, piezoelectric motors, etc.

Whereas piezo elements present in the atmosphere are responsible for the reduction of sound waves and vibrations in the surrounding by the process of absorption and can later be usedfor the conversion of one form of energy to the other. Piezoelectric devices can be used for infertility treatment, surgeries (piezo-surgery), photovoltaic cells, etc.

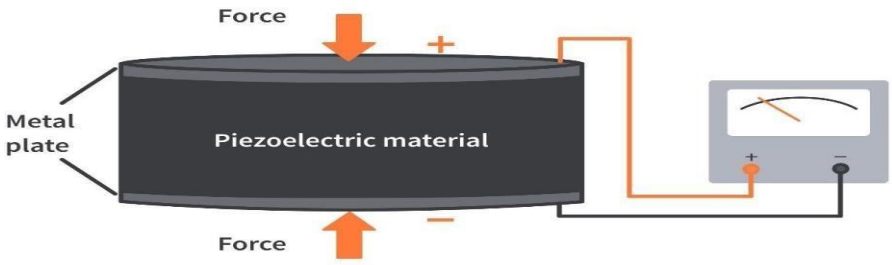

Figure 1.3 : Piezoelectric effect

2. WORKING:

In fig. iv(a) & fig. iv (b) it is visible about the working of piezoelectric devices. Fig-iv(a) shows that the input is receiving the electric signals on its one end and in return, it is providing the sound signals those sound signals are produced via the moving coil of the microphone. Whereasin fig-iv(b) we can see that from the given flow diagram the input source requires a source of sound that further is processed in the magnetic diaphragm or the coil and the produced energy through the coil must be stored in a supercapacitor then according to the requirement of the user one may or may not use the amplifier or the multiplier and finally have the output in the form of battery.

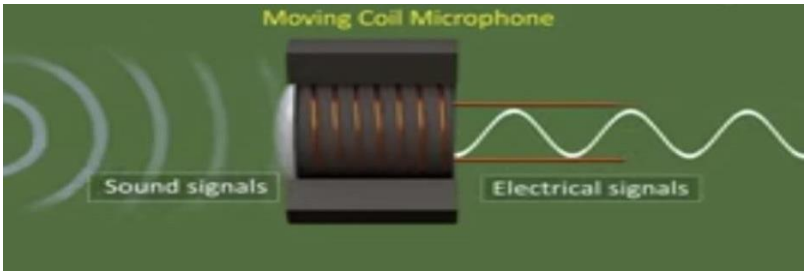

Fig- 2.1(a): Piezoelectric effect working

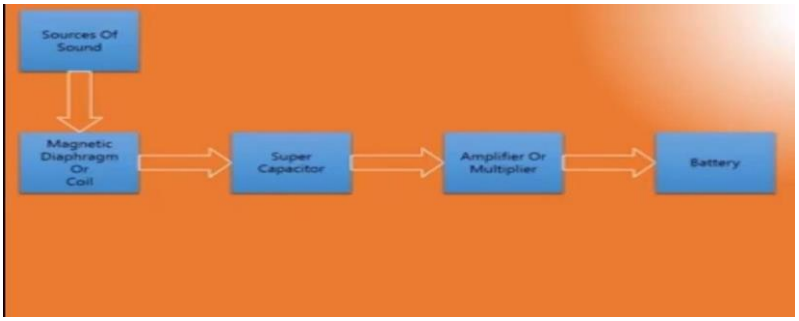

Fig- 2.1(b): Piezoelectric effect working

3. LITERATURE SURVEY:

The piezoelectric devices require the transducer which is of two types the input transducer is a type of sensor which sense the input sound wave and receive it for processing in the magnetic coil and the output transducer is finally an actuator. The actuator is used as the amplifier of the frequency signal used generally in the speakers. The input transducer, or in simple terms the sensor responds to every small change in the surroundings and converts it into a readable electrical signal.

The piezoelectric material's output is combined, rectified, and step up using an accurate circuit, so the energy can be utilized properly. The utilization of energy is done via storing them or harvesting them into batteries. The fullest utilization is done while using them for LEDs, recharging the batteries, fans, etc., the sources of input are majorly the engines producing heavy sounds such as airplanes or horns in trains or some other loud sound. To store a conventional amount of sound and reproduce a convincing number of electric signals. The utmost motive behind is to produce and supply free electricity around the globe or at the cheapest possible price.

The piezoelectric effect is useful and has options in applications that involve the detection of high-frequency sound waves and the production of an ample amount of electric signal and vice-versa as well. The non-acoustic piezoelectric devices include motors and actuators. Sensors, high voltage generators, etc., it is the basis of lots of scientific instruments and instrumental techniques with atomic resolution, such as scanning microscopes.

The level of noise pollution is increasing drastically day by day which is harmful to our nature, it can be converted using piezoelectricity and its concepts. A sound wave is a mechanical wave that is not capable of transmitting its energy through a vacuum,according to this concept we can convert the sound energy into electrical we have to convert our sound energy to one piezoelectric plate as shown in the above fig. iv(b) to compensate the losses we'll have a magnetic diaphragm and further stored in a supercapacitor and used as the input for the amplifier circuit and used as the output in the battery.

A piezoelectric generation device, includes some rectifying means which would rectify the signals to AC voltage and the voltage generated by the vibration is of at least one piezoelectric plate

The energy wave can be one of the biggest possible sources of potential energy, which could easily be used by piezoelectric devices. The coastal areas have high tension of the cruises and the high-frequency water waves and also somewhere the industry of crude oil and salt production that can be used for harnessing the natural resources of the sea through the water-breaking through piezoelectric means for the help in generation of power.

The piezoelectric sensors use the piezoelectric effects are measures to pressure, acceleration, and force by changing them to an electrical signal. Whenever pressure is applied to piezoelectric crystals electricity can be developed over the crystal lattice.The piezo-sensor converts mechanical energy to electrical energy and sends to AC ripple neutralizer to a unidirectional diode that would only allow to flow it in one direction and then stores into the battery which is sent to the inverter that converts direct current to alternating current and switch the circuit on the electrical energy will flow through thecircuit.

Piezoelectric materials are simple, light in weight, cost-efficient, and easy to control as well. The adaptability in a vast range of applications in different structures; piezoelectric materials which are most commonly used in automotive and aerospace engineering, some elements like; Lead Zirconate Titanate (PZT), Lead Titanate (LT), Sodium Potassium Niobate (SBN), etc.

Power consumption is now dominant in the present scenario when it comes to comparison with the past data, it is hard to fulfill needs in terms of electricity of everyone. The conversion of mechanical vibrations into electrical energy can be done by piezoelectric elements and principles. The converted electrical energy is accumulated so that it could attain the required threshold value. The energy used provides feedback for avoiding the external charging in the circuit.

4. CONCLUSION:

The idea states the conversion of mechanical vibrations or mechanical energy into electrical energy, using piezoelectric means. The piezoelectric designs are capable of self-charging using the superconductor, they are much more effective when it comes to supplying the power for the charging of electronic devices such as mobile phones, laptops, etc., without any external charging equipment.

The piezoelectric energy device performance depends on numerous factors such as type of configuration, the material selected, the design of the circuit, etc.

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