Acoustic Energy to Electrical Energy

K. Krishna Das[1], T. Gopi[2]

[1] K.Krishna das, student,Department of mechanical engineering,SRM University, Vadapalani,Chennai, India.
kdas1993@gmail.com
[2] T.Gopi, assistant professor,Department of mechanical engineering,SRM University, Vadapalani,Chennai, India.
gopi.selvan@gmail.com

ABSTRACT

In the present scenario, electricity has become one of the need rather than being a want. So, it is the need of the hour to produce or tap electrical energy in all possible ways from all possible sources. We all are aware of the kinds of pollution caused now-a-days by various sources, one such is the noise pollution. Now let's think in a different way, why not we use this noise (unwanted disturbances causing vibrations) and also the vibrations that cause the noise. We all know according to basic physics sound energy is a form of wave or a disturbance of the particles in atmosphere or air.

Keywords: Electricity, Sound Energy, Unwanted Noise.

1. INTRODUCTION

In physics, sound is a vibration that propagates as a typically audible mechanical wave of pressure and displacement, through a medium such as air, and water. In physiology and psychology, sound is the reception of such waves and their perception by the brain [1]. Acoustics is the interdisciplinary science that deals with the study of mechanical waves in gases, liquids, and solids including vibration, sound, ultrasound, and infrasound. A scientist who works in the field of acoustics is an acoustician, while someone working in the field of acoustical engineering may be called an acoustical engineer.[2] Sound propagates through compressible media such as air, water and solids as longitudinal waves and also as a transverse waves in solids (see Longitudinal and transverse waves, below). The sound waves are generated by a sound source, such as the vibrating diaphragm of a stereo speaker. The sound source creates vibrations in the surrounding medium. As the source continues to vibrate the medium, the vibrations propagate away from the source at the speed of sound, thus forming the sound wave. At a fixed distance from the source, the pressure, velocity, and displacement of the medium vary in time. At an instant in time, the pressure, velocity, and displacement vary in space. Note that the particles of the medium do not travel with the sound wave. This is intuitively obvious for a solid, and the same is true for liquids and gases (that is, the vibrations of particles in the gas or liquid transport the vibrations, while the average position of the particles over time does not change). During propagation, waves can be reflected, refracted, or attenuated by the medium [3].

2. NATURE OF SOUND

The behavior of sound propagation is generally affected by three things:

- A relationship between density and pressure. This relationship, affected by temperature, determines the speed of sound within the medium.
- The propagation is also affected by the motion of the medium itself. For example, sound moving through wind. Independent of the motion of sound through the medium, if the medium is moving, the sound is further transported.
- The viscosity of the medium also affects the motion of sound waves. It determines the rate at which sound is attenuated. For many media, such as air or water, attenuation due to viscosity is negligible [3].

3. NOISE

Noise means any unwanted sound. Noise is not necessarily random. Sounds, particularly loud ones that disturb people or make it difficult to hear wanted sounds, are noise. For example, conversations of other people may be called noise by people not involved in any of them; any unwanted sound such as domesticated dogs barking, neighbors playing loud music, portable mechanical saws, road traffic sounds, or a distant aircraft in quiet countryside, is called noise. Acoustic noise can be anything from quiet but annoying to loud and harmful. At one extreme users of public transport sometimes complain about the faint and tinny sounds emanating from the headphones or ear buds of somebody listening to a portable audio player; at the other the sound of very loud music, a jet engine at close quarters, etc. can cause permanent irreversible hearing damage [4].

4. CAUSES OF NOISE

4.1. Industrialization

Most of the industries use big machines which are capable of producing large amount of noise. Apart from that, various equipment's like compressors, generators, exhaust fans, grinding mills also participate in producing big noise. Therefore, you must have seen workers in these factories and industries wearing ear plugs to minimize the effect of noise.

4.2. Poor Urban Planning

In most of the developing countries, poor urban planning also plays a vital role. Congested houses, large families sharing small space, fight over parking, frequent fights over basic amenities leads to noise pollution which may disrupt the environment of society.

4.3. Social Events

Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally flout rules set by the local administration and create nuisance in the area. People play songs on full volume and dance till midnight which makes the condition of people living nearby pretty worse. In markets, you can see people selling clothes via making loud noise to attract the attention of people.

4.4. Transportation

Large number of vehicles on roads, aero planes flying over houses, underground trains produce heavy noise and people get it difficult to get accustomed to that. The high noise leads to a situation where in a normal person loses the ability to hear properly.

4.5. Construction Activities:

Under construction activities like mining, construction of bridges, dams, buildings, stations, roads, flyovers take place in almost every part of the world. These construction activities take place every day as we need more buildings, bridges to accommodate more people and to reduce traffic congestion. The down point is that these construction equipment's are too noisy.

4.6. Household Chores

We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are minor contributors to the amount of noise that is produced but it affects the quality of life of your neighborhood in a bad way.

While this form of pollution may seem harmless, it in fact has far reaching consequences. The adverse effects on the health of the environment are quite severe. Not only is the local wildlife affected by the pollution, humans also have to face a number of problems due to it [5].

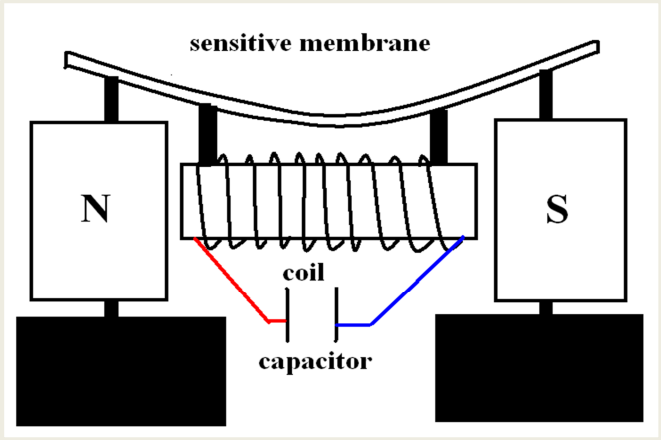
5. KAPTON MEMBRANE PROPERTIES

Kapton is a polyimide film developed by DuPont that remains stable across a wide range of temperatures, from −269 to +400 °C (−452 – 752 °F / 4 – 673 K). Kapton is used in, among other things, flexible printed circuits (flexible electronics) and thermal micrometeoroid garments (the outside layer of space suits). The chemical name for Kapton K and HN is poly (4,4'-oxydiphenylene-pyromellitimide). It is produced from the condensation of pyromellitic dianhydride and 4,4'-oxydiphenylamine. Kapton synthesis is an example of the use of a dianhydride in step polymerization. The intermediate polymer, known as a "poly (amic acid)," is soluble because of strong hydrogen bonds to the polar solvents usually employed

in the reaction. The ring closure is carried out at high temperatures (200–300 °C, 473–573 K) [6].

6. THE CONCEPT

Our concept lies on the fact that noise is a kind of vibration. Then let's make it simple by saying that the vibrations of this noise can be used to create disturbances in magnetic fields thereby producing some difference in potentials of the terminals whose energy can be stored in a battery or a capacitor. The setup is as follows there is a thin elastic kapton membrane sensitive to the noise produced. There is a coil that is attached to back of the membrane and keeps shifting its position based on the vibrations given by the noise source to the membrane. This coil is placed between the north pole of one magnet and the south pole of the other magnet. So, each time there is a disturbance in the magnetic field then we get a small electric current from it.



7. DEFINITIONS

7.1. Attenuation

In physics, attenuation (in some contexts also called extinction) is the gradual loss in intensity of any kind of flux through a medium. For instance, sunlight is attenuated by dark glasses, X-rays are attenuated by lead, and light and sound are attenuated by water [7].

7.2. Battery

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work [8].

7.3. Capacitor

A capacitor (originally known as a condenser) is a passive two-terminal electrical component used to store energy electrostatically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e., insulator). The conductors can be thin films of metal, aluminum foil or disks, etc [9].

7.4. Displacement

Displacement (vector), the difference between the final and initial position of a point (for instance, the center of mass of a moving object). The actual path covered to reach the final position is irrelevant. It can simply be defined as the shortest path between the final point and initial point of a body [10].

7.5. Magnetic Fields

A magnetic field is the magnetic influence of electric currents and magnetic materials. The magnetic field at any given point is specified by both a direction and a magnitude (or strength); as such it is a vector field [11].

7.6. Pollution

Pollution is the introduction of contaminants into the natural environment that cause adverse change [12].

7.7. Pressure

Pressure is force per unit area applied in a direction perpendicular to the surface of an object. Gauge pressure (also spelled gage pressure) [13].

7.8. Temperature

A temperature is a numerical measure of hot and cold. Its measurement is by detection of heat radiation, particle velocity, kinetic energy, or most commonly, by the bulk behavior of a thermometric material. It may be calibrated

in any of various temperature scales, Celsius, Fahrenheit, Kelvin, etc. [14].

7.9. Velocity

Velocity is the rate of change of the position of an object, equivalent to a specification of its speed and direction of motion, e.g. 60 km/h to the north. Velocity is an important concept in kinematics, the branch of classical mechanics which describes the motion of bodies [15].

7.10. Vibration

Vibration is a mechanical phenomenon whereby oscillations occur about an equilibrium point. The oscillations may be periodic such as the motion of a pendulum or random such as the movement of a tire on a gravel road [16].

7.11. Wave

N physics, a wave is disturbance or oscillation that travels through matter or space, accompanied by a transfer of energy. Wave motion transfers energy from one point to another, often with no permanent displacement of the particles of the medium—that is, with little or no associated mass transport. They consist, instead, of oscillations or vibrations around almost fixed locations. Waves are described by a wave equation which sets out how the disturbance proceeds over time. The mathematical form of this equation varies depending on the type of wave [17].

8. CONCLUSION

Thus we have come across the concept of tapping electricity from the noise produced in busy cities like Chennai. The setup, though simple is a very innovative apparatus to tap energy from the unwanted vibrations produced by noise. Thus looking forward to innovate this apparatus we set a new opening in the world of acoustics.

REFERENCES

[1] Western Electric Company, “Fundamentals of Telephone Communication Systems”, 1969. p. 2.1. ANSI S1.1-1994. American National Standard: Acoustic Terminology.

[2] http://www.jhu.edu/virtlab/ray/acoustic.html

[3] http://en.wikipedia.org/wiki/Noise

[4] http://www.conserve-energy-future.com/causes-and-effects-of-noise-pollution.php

[5] http://en.wikipedia.org/wiki/Kapton

[6] http://en.wikipedia.org/wiki/Attenuation

[7] http://en.wikipedia.org/wiki/Battery_%28electricity%29

[8] http://en.wikipedia.org/wiki/Capacitor

[9] http://en.wikipedia.org/wiki/Displacement

[10] Merriam, "Pollution - Definition from the Merriam-Webster Online Dictionary", webster.com. 2010-08-13. Retrieved 2010-08-26.

[11] http://en.wikipedia.org/wiki/Pressure#cite_note-1

[12] http://en.wikipedia.org/wiki/Temperature

[13] http://en.wikipedia.org/wiki/Velocity

[14] http://en.wikipedia.org/wiki/Vibration

[15] http://en.wikipedia.org/wiki/Wave

