



Self-Reliant Street Light Using Piezo Electric Plate

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ABSTRACT

This paper demonstrates a prototype for a smart self-reliant street-lighting system, in which a number of DC street lights are powered by a piezoelectric plate. A capacitor is added to store the excess energy of the piezoelectric plate. A charge controller is used to protect the capacitor from overcharging and to control the overall system operation. With this, there is no more dependency on the natural resource like wind or sunlight which requires more maintenance, availability of corresponding natural resources and more over the cost of installation is also high. But with this idea, each vehicle will be responsible for the generation of electricity by the weight of the vehicles exerted on the ground. No more connection is required hence this can also be implemented in intercity as well as highways, making highways safer by the installation of these self-reliant streets light. The overall result is a self-capable street lighting system, which can be implemented as a standalone off-grid system or connected to the rest of the grid as part of a bigger system. Hence we designed a system using Piezoelectric plate which works on Piezo Electric Effect. The main principle of a piezoelectric transducer is that a force, when applied on the quartz crystal, produces electric charges on the crystal surface. The charge thus produced can be called as piezoelectricity. The main aim is to make intercity, sub highways, state highways, national highways safer my making self-reliant street light system.

Keywords: Capacitor, Piezoelectricity, Piezoelectric Effect, Street-Lighting System.

1. INTRODUCTION

Piezoelectricity is the electric charge that accumulates in certain solid materials (such as crystals, certain ceramics, and biological matter such as bone, DNA and various proteins) in response to applied mechanical stress. The word piezoelectricity means electricity resulting from pressure and latent heat. It is derived from the Greek word “piezein”, which means to squeeze or press ,and electron”, which means amber, an ancient source of electric charge. Piezoelectricity was discovered in 1880 by French physicists Jacques and Pierre Curie (1-4).

2. SCHEMATIC DIAGRAM

Figure 1 depicts the arrangement of experimental test set up.

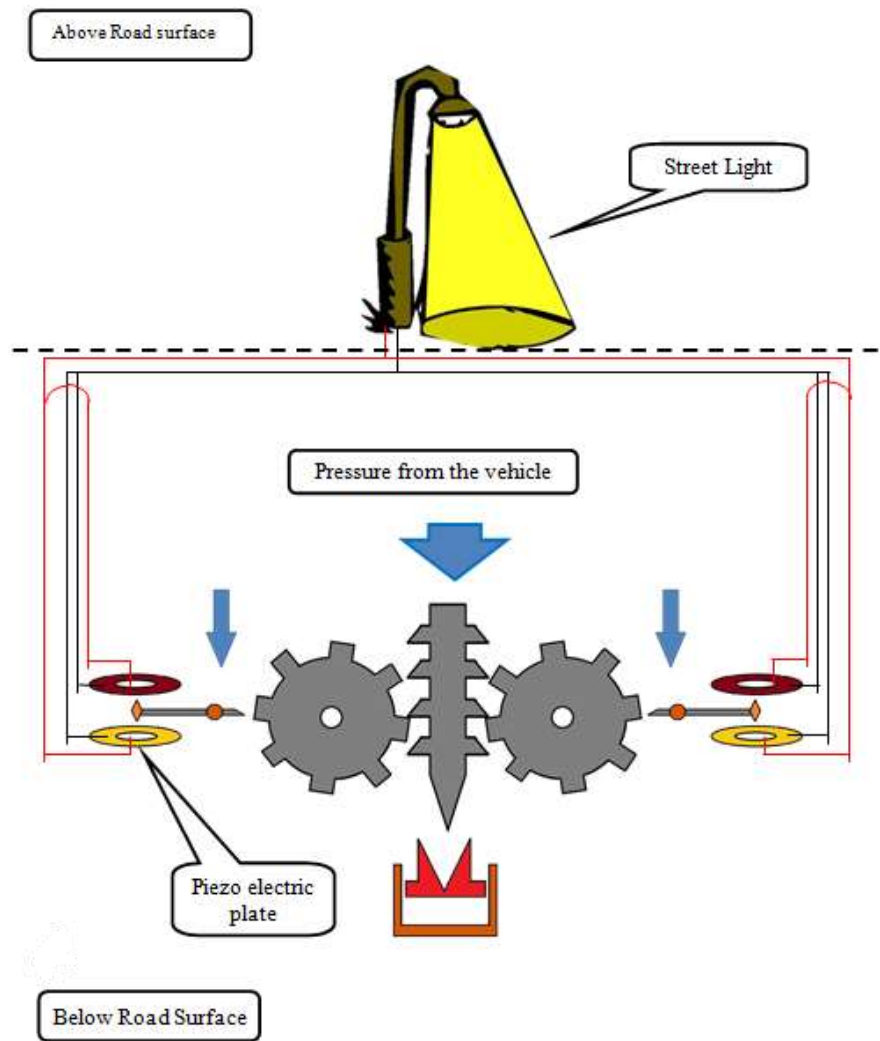


Figure1. Schematic Diagram of experimental setup

2.1 Layers of Road

Figure 2 shows Rack and Pion arrangement on the road surface.

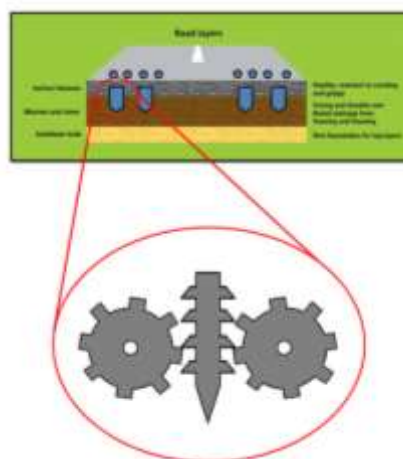
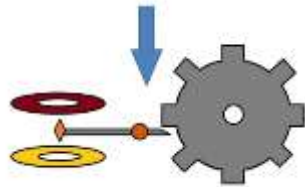
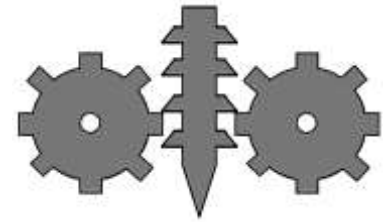


Figure 2 Rack and Pion arrangement

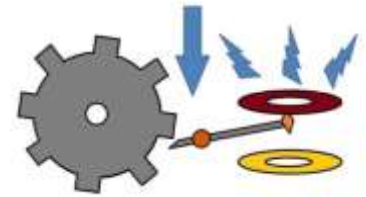
3. WORKING PRINCIPLE

When pressure is applied on top of the road, it exerts pressure on the inner road layer consisting of piston, which further results in movement of gears along sides. More the pressure more is the number of turns of the gears. This results in execution of further mechanism.

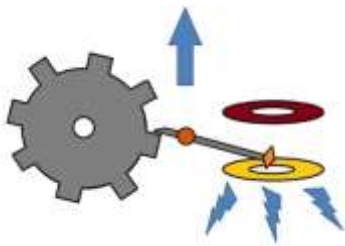


These gears are further attached with bar and spring arrangement. This arrangement on each contact with the gear teeth, hits the bar, which further hits piezo electric plate in opposite direction. This is end hitting of piezo electric plate results in generation of electricity.

This movement in downward direction results in hitting the upward piezo electric plate. Hence we label the generation to be induced one in positive direction by the movement of the vehicle.



Due to the presence of hydraulic chamber the screw piston again moves upward, hence and opposite movement of screw piston is witnessed which results in reverse movement of gears.



Further similar movement is witnessed but in opposite direction. Hence this can also be called as reverse process and now the gears hit the downward piezo electric plate.

Thus even after the vehicle is moved forward the mechanism generates similar and equal power to the primary one. Hence making the design more efficient. And again the upper layer reaches back to its original formation for overcoming next vehicle.

Pressure exerted on the upper surface of the road, applies pressure to the inner most section, that is the hydraulic chamber.



This gets compressed and as soon as vehicles passes by it again gives a repulsive force to make the whole body reach to its original stage. Clearly these two diagrams represent the deformation and formation part of the hydraulic chamber. Where the red and orange colour defines of hydraulic chamber and the grey portion constitutes of the screw piston.



4. CONCLUSION

An attempt has been made to design a system using Piezo electric plate which works on Piezo Electric Effect. Overall result is a self-capable street lighting system, which can be implemented as a standalone off-grid system, or connected to the rest of the grid as part of a bigger system.

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