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Green Energy Roads

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Abstract: *In order to satisfy the rising energy demands of global consumption, a new cleaner and renewable power source needs to be explored, conceptualized and developed. This paper attempts to show how electricity produces using the stress experienced by the roads due to the movement of automobiles and pedestrians is proposed. An energy generator comprising a generally flat and partially flexible traffic surfaces.In this paper the comparision between diffrent methods of production of electricity using vibration on road are shown.*
The Road Power Generation (RPG) is one of the most recent power generation concepts. It is best source of energy that we get in day to day life so that this system does not require any external input energy source.
Keywords: *Crank mechanism, Dynamo cell, piezoelectric material, Rack and Pinion mechanism, Stiffness of spring, Vertical motion delivery mechanism.*

I. Introduction

Now a day, in INDIA the annual production of passenger car and commercial vehicle is the most important concept of civillization which is fastest growin globally. Every day millions of vehicles on our roadways. This System converts the kinetic energy of the vehicles into electric energy. In this paper various methods of conversion of kinetic energy into electricity are as follows.

1. Using piezoelectricity and piezoelectric effect which uses pads of metallic crystals when put under the pressure of quickly moving traffic.
2. Using moving plate installed on the road, the stroke motion of vehicles converted to rotary motion of crank by crank mechanism and generates electricity.
3. Using rack and pinion with spring making vertical motion delivery mechanism to produce electricity.
4. Using plurality of dynamo cells placed on road surfaces.

II. Methodology

2.1. APPROACH: In this section, it was tried to understand the working principle of the RPG designed system its practical implementation, and its advantages.

2.2. DISCUSSION: In this section, we are going to discuss about applicability, efficiency, effectiveness, implantation, charecteristics advantages of above four methods.

III. Piezo Smart Roads

The piezo-smart road, can provide the magic of converting pressure exerted by the moving vehicles into electric current. The system is based on piezoelectricity, which uses pads of metallic crystals buried over hundreds of meters of road to generate electricity when put under the pressure of quickly moving traffic. When a vehicle drives over the road, it takes the vertical force and compresses the piezoelectric material, thereby generating electricity.

3.1. PIEZOELECTRICITY AND PIEZOELECTRIC EFFECT:

The word piezoelectricity means electricity resulting from pressure. It is derived from the Greek piezo or piezein, which means to squeeze or press, and electric or electron, which stands for amber, an ancient source of electric charge. Piezoelectricity was discovered in 1880 by French physicists Jacques and Pierre Curie.

The piezoelectric effect is understood as the linear electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry (notably crystals, certain ceramics, and biological matter such as bone, DNA and various proteins). The piezoelectric effect is a reversible process in that materials exhibiting the direct piezoelectric effect (the internal generation of electrical charge resulting from an applied mechanical force) also exhibit the reverse piezoelectric effect (the internal generation of a mechanical strain resulting from an applied electrical field). In fact, however, piezoelectricity is not caused by a change in charge density on the surface, but by dipole density in the bulk.

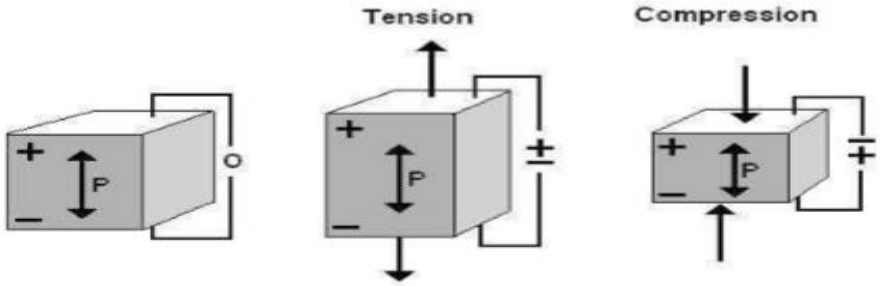

Fig 1. The direct piezoelectric effect

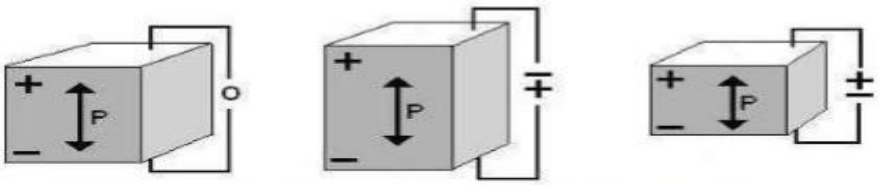

Fig 2. The converse piezoelectric effect

For example, a 1 cm3 cube of quartz with 2 Kilo Newton (500 lbf) of correctly applied force can produce a voltage of 12,500 V.

3.2. APPLICATIONS OF PIEZOELECTRICITY

Piezoelectricity is found in useful applications such as the production and detection of sound, generation of high voltages, sensors, actuators, frequency standard, piezoelectric motors, reduction of vibrations and noise, electronic frequency generation, microbalances, ultrafine focusing of optical assemblies and piezo-smart roads.

3.3. PIEZO-SMART ROADS

The piezo smart road is a revolutionary new surface uses piezoelectric crystals embedded in the asphalt to generate up to 400 kilowatts of energy from a 1 kilo meter stretch (a design, devised by Haim Abramovich, a developer at the Teknion-Israel Institute of Technology in Haifa, Israel) enough to run eight electric cars. A kilo meter of "Piezo-smart road" could generate enough power for 40 houses, and progress in the technology could generate enough electricity to feed the national power grid. Private companies were competing in this sector but recently governments of developed countries are also taking notice to the developments in turning traffic rush into electricity and are funding many projects.

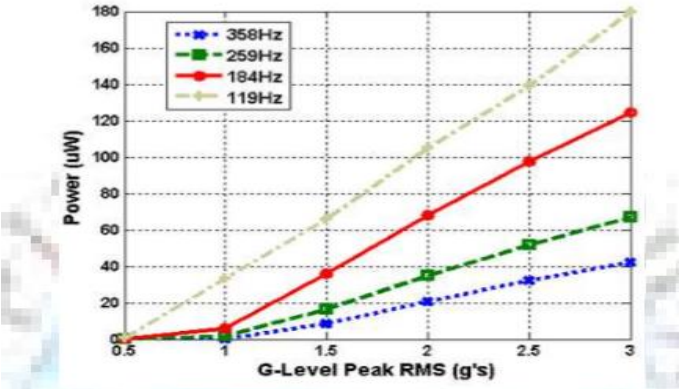

Fig 5. shows the efficiency graph

3.4. ADVANTAGES:

1) Movement of vehicles are always constant on busy roads and highways so, power can be generated constantly by this concept.
2) Power generated from 'Piezo-smart roads' concept is Greenpower and no harm to the environment. 3) This power can be very well utilized for the street lightning and other small scale purposes.
3) This source of electrical energy is a long term investment having merits of being a continuous source, independent and unaffected by climatic conditions.

3.5. DISADVANTAGES:

1) Implementing this concept is a little bit tedious.
2) The present day roads need to be relayed again in order to implement this concept.
3) This will result in traffic congestions all over the city and needs a critical plan of implementation and management.

IV. By Cranking Mechanism

This is done by moving plate installed on the road, this plate take the stroke motion of the vehicles and convert it to the rotary motion by crank mechanism and it generates the electricity.

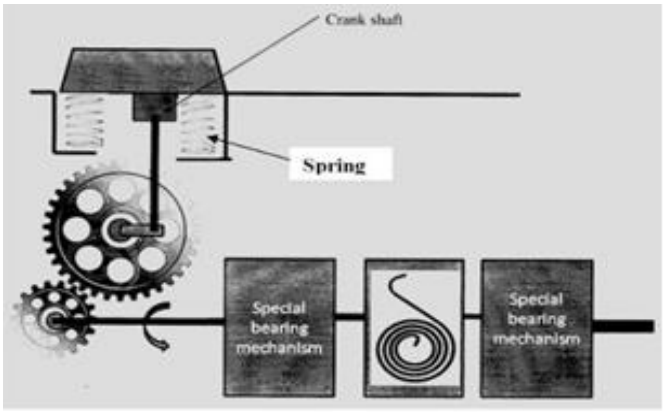

Figure 1: Schematic diagram for the road power generation

4.1. WORKING PRINCIPLE

Road power generation (RPG) is a system design to capture waste and kinetic energy from all vehicles. This device converts the kinetic energy of the vehicles into electric energy. This is done by moving plate installed on the road, this plate captured very small movement from the road surfaces and it transferred to a keyway flywheel system. From hundreds of wheel lies a single flywheel having used to driving machinery. The RPG included the method of driving one flywheel to another, once it reached predetermining velocity. The RPG flywheel system has been developed to achieve large amount of moment of inertia in relatively small space. The captured energy is converted into electricity which is fed into power grid. With the following block diagram we can easily understand the overall working of the automatic street light.

4.2 FEATURES

(i) The units have minimum visual impact on their surrounding environment.
(ii) The RPG emits no noise.
(iii) The unit will have minimum cost of installation and maintenance.
(iv) This unit could be located at the close proximity to services and power grid.
(v) Possible answer for battery charging station.
(vi) Completely isolated street light or traffic lights.

V. Verticle Motion Delivery Mechanism

A System for converting mechanical motion of vehicles into electrical energy comprising: a plurality of motion converter assemblies each including a rod which remains in communication with a vertical motion delivery mechanism via a gearing mechanism for rotating the rod in response to traffic flowing thereover. Wherein the gearing mechanism includes a gear Strip mounted on the Vertical motion delivery mechanism, the gear Strip being in engagement with a ratchet gear mounted on the rod. This System for converting mechanical motion of vehicles into electrical energy.

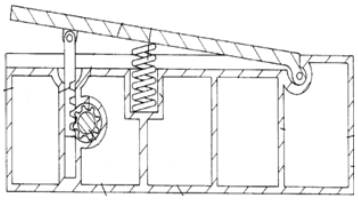

Fig1: Before application of pressure

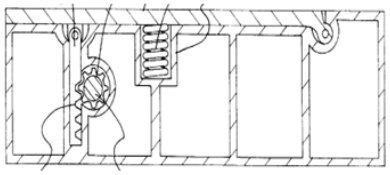

Fig2: After application of pressure

VI. Using Dynamo Cells

Dynamo may be used one of the electricity generating elements. This invention relates generally to energy generation devices, and specifically to waste energy recycling devices. An energy generator comprising a generally flat and partially flexible traffic surface on which pedestrians and traffic may be pass.Each dynamo cell having itself electricity producing device.

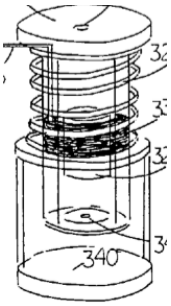

Fig: Dynamo cell

6.1. WORKING PRINCIPLE:

It consist of to conductor plates one is stationary at lower end upper is moving by means of spring when load is applied in between them piezoelectric material is placed which produces electricity. Whenever pedestrian and vehicle exerting load on it then pressure is applied upper conductor is moving near to the bottom conducter so it causes flow of current as well as produce voltage.

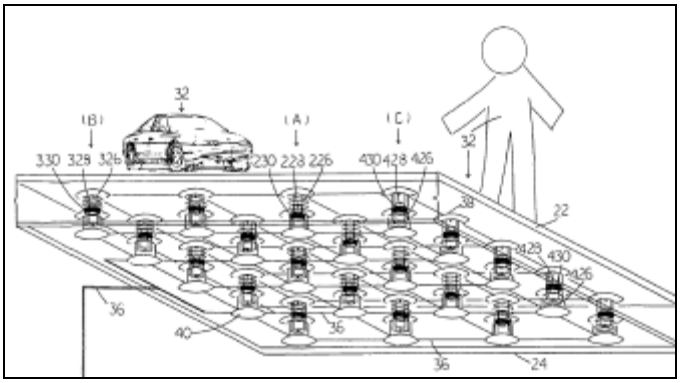

Fig: Plural dynamo cells

VII. Conclusion

BY CRANKING MECHANISM:

- Production of voltage depends on the speed of vehicle as speed of vehicle increases voltage generation decreases.
- Load of man & vehicles increases then voltage generated for designed system increased.

VERTICAL MOTION DELIVERY MECHANISM

- Produced voltage does not depends on speed of vehicles
- It depends on pressure applied
- Voltage also depends on stiffness of springs

USING DYNAMO CELLS

- Voltage production depends on efficiency of piezoelectric material
- Voltage production also depends on area and plurality where the dynamo cell is placed.

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