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ROAD POWER GENERATION USING BY SPEED BREAKER

MR. PATIL SHRINIVAS B.
Vidyavardhini Institude Of Technology, Pal.
patilshrinivas010@gmail.com

MR.PATIL ONKAR A.
Vidyavardhini Institude of Technology,
Pal omkarpatilee@gmail.com

MR. LOKHANDE SHIVPRASAD B.
Vidyavardhini Institude Of Technology, Pal.
shivprasadlokhande1998@gmail.com

MR.ASABE RAHUL N.
Vidyavardhini Institude of Technology, Pal
rahulasabe111@gmail.com

MISS.KOLI DHANASHRI R.
Vidyavardhini Institude of Technology, Pal
dhanukoli1999@gmail.com

ABSTRACT
In the current scenario demand of power is increasing day by day with increasing population. On the other hand energy crisis is also a main issue of today's life and all there is a shortage of conventional energy resources due to its large usage. So, we have to sort out this problem with a technique which will not only overcome this energy crisis but also should be eco-friendly. Many conventional resources are creating pollution so that's why focus is towards eco-friendly solution.
This project emphasizes on idea which shows that power could be generated by specially designed speed breakers. A large amount of kinetic energy is being wasted on roads on daily basis in different forms which could be used to generate power and this power can be stored in batteries.
This project shows clearly how we can generate power by using rack-pinion method where basically linear motion is converted into rotary motion and then can be used to generate electricity. Large amount of electricity can be generated using this method and this method is eco-friendly.

KEYWORDS – Shaft, Bearing, Flywheel, Chain &Sprocket, Springs, Pinion Mechanism, DC Motor, Piezoelectric Material, Battery, LED.

I. INTRODUCTION

Energy can neither be created nor be destroyed, But it can be converted from one from to another" This is the law of conservation of energy we regularly read. We obtain the energy from nuclear, hydro, thermal, and number of sources. But there is some area where project is taking such as on the roads. With the development of the automobile sector the traffic density on the road is increasing day by day. Different types of vehicles are introduced on the road and there will be the competition in the world till the world will last.
The government is also implementing new infrastructure to build new and faster ways of traffic and to join one city to another. Highly populated cities are specially connected to each other with national and express highway on these roads vehicle can run at maximum speed. Roads are essential means of transportation and so along with the population the number of wheel on the road are increasing.
Their speed also increasing with the development of the high speed engine. But some areas like market and school where driving at high speed can be dangerous for human life so far safety precaution government road Development Corporation install speed breaker near such areas.

II. BLOCK DIAGRAM

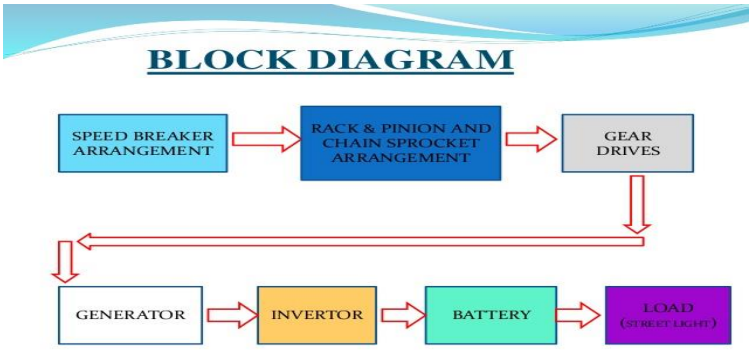

FIG. 1. RACK & PINION MECHANISM

III. COMPONENTS

1. SHAFT:

A shaft is a rotating machine element usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.

The various members such as pulleys and gears are mounted on it. We used are the 25 mm size shaft.

2. BEARING:

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

3. FLYWHEEL:

A flywheel is a mechanical device specifically designed to efficiently store rotational energy. Flywheels resist changes in rotational speed by their moment of inertia. The amount of energy stored in a flywheel is proportional to the square of its rotational speed.

The way to change a flywheel's stored energy is by increasing or decreasing its rotational speed by applying a torque aligned with its axis of symmetry.

4. CHAIN AND SPROCKET:

A sprocket is a toothed wheel that fits onto a shaft. It is prevented from rotating on the shaft by a key that fits into keyways in the sprocket and shaft.

A chain is used to connect two sprockets. One sprocket is the driver sprocket. The other sprocket is the driven sprocket. Motion and force can be transmitted via the chain from one sprocket to another, therefore from one shaft to another.

5. SPRINGS:

A compression springs are coil springs storing energy when they are closed by a force. Compression springs are designed to operate with a compression load, so the compression spring gets shorter as load is applied to the spring. Stored energy in the spring is brought back to original state after force is removed to lengthen the spring and push against the object that compressed it.

Mechanical springs are of many forms out of which most common spring is compression spring.

6. PINION MECHANISM :

A **rack and pinion** is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack";

rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.

7. DC MOTOR:

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances.

8. PIEZOELECTRIC MATERIAL:

Piezoelectric materials are materials that produce an electric current when they are placed under mechanical stress. The piezoelectric process is also reversible, so if you apply an electric current to these materials, they will actually change shape slightly (a maximum of 4%).

There are several materials that we have known for some time that posses piezoelectric properties, including bone, proteins, crystals (e.g. quartz).

9. BATTERY:

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.

The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal.

When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

10.LED:

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. This effect is called electroluminescence.

The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.

White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

IV. PROJECT PHOTO

Fig. 2. ASSEMBLY OF PROJECT

FIG.3 .ACTUAL PROJECT

V. CONSTRUCTION

1. RACK AND PINION MECHANISM:

This 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 rack and pinion arrangements. Here the reciprocating motion of the speed-breaker is converted into rotary motion using the rack and pinion arrangement. The axis of the pinion is coupled to a shaft and shaft connected with flywheel.

The speed due to the rotary motion achieved at the pinion is less. This speed which is sufficient to rotate dynamo. The dynamo which rotates within a static magnetic stator cuts the magnetic flux surrounding it, thus producing the electric motive force (emf). This generated emf is then sent to an inverter, where the generated emf is regulated. This regulated emf is now sent to the storage battery where it is stored during the day time. This current is then utilized in the night time for lighting purposes on the either sides of the road to a considerable distance.

2. PIEZOELECTRIC MATERIAL MECHANISM:

Piezoelectric materials are the crystals that generate electricity when compressed or vibrated. They have the unique opposite property of generating a stress when voltage is applied to them. Piezoelectric material falls within the class of multiple sold state materials that can generate with the help of some stimulus such as heat, stress, or light.

Photovoltaic material generates electricity with the application of light and thermoelectric material generates electricity with the application of heat. Piezoelectric material generates electricity by the application of stress. These materials are all semiconductors, meaning they are much like conventional electronics, generally constructed of silicon or germanium with additional elements.

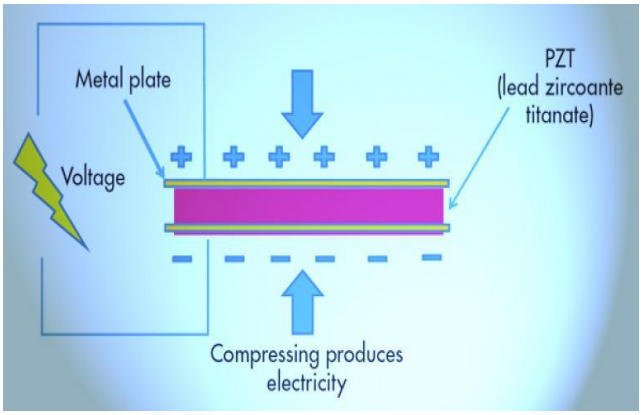

FIG.4. PIEZOELECTRIC MATERIAL MECHANISM

VI. PRINCIPLE OF WORKING

The principle of the electric power generation using speed breaker mechanism is very simple. It is based on the same principle as in the case of electricity generation in case of hydroelectric power plant, thermal electric power plant, nuclear power plant, geothermal energy, wind energy, tidal energy etc.

In all of the above power plant mechanical energy is converted into electrical energy. In this setup also mechanical energy is converted into electrical power using a D.C. generator. Here the vertical motion of the top of the speed breaker is converted into the rotational motion, which in turn rotates the generator and generates electricity.

The basic principle which we use to generate electricity is the piezoelectric effect. A piezoelectric material is that one which converts mechanical energy or vibration energy that is experienced on it, to a charge which can be stored. When a force or pressure is exerted on the elastic piezoelectric crystal material, the crystal gets deformed and this causes it to develop charge between them and the crystal goes back to its original state. This charge flow is converted to a voltage that can be stored in a battery.

VII. ADVANTAGE

- Pollution free electricity generation.
- Power generation at the place of consumption , leading to fewer transmission losses.
- No need fuel input.
- This is a Non-conventional system.
- The battery is used to store the generated power.

VIII. FUTURE SCOPE

Electricity can be produced from wide range of resources but however, their cost is commercially high and hence the concept proposed in this paper would be useful in future for electricity production as the cost for electricity production is comparatively less. Suitable at parking of malls as well as multiplexes. Also can be used for toll booths, signals, etc.

Such speed breakers can also be designed for heavy duty vehicles, thus increasing input torque and ultimately output of generator. Various government departments can take initiative in implementing these power humps on a large scale. This has a huge scope everywhere, provided the resources are channeled well.

IX. APPLICATION

- Street Lights can be provided with electricity generated by this method.
- Traffic Signals.
- Sign boards on the roads can be lit with the help of this method.
- Boards near the bus-stops can be highlighted by using this method generated electricity.
- Shopping complex.

x. POWER CALCULATION

1. The mass of any vehicle travelling over the speed breaker = 300Kg (Approximately)
2. Height of speed breaker = 15 cm
3. Work done = weight of the body x distance travelled by the vehicle
4. Here, Weight of the Body = 300 Kg x 9.81 = 2943 N
5. Power = Work done/Second = (2943 x 0.15)/60 = 7.3575 Watts
6. Output Power developed for 1 vehicle passing over the speed
7. Breaker arrangement for one minute = 7.3575 watts
8. Power developed for 60 minutes (1 hr) = 441.45 watts
9. Power developed for 24 hours = 10.5948 KW

CONCLUSION:

This paper introduces another innovative method of green power generation in order to contribute towards the development of the country by enriching it with utilization of available resources in more useful manner. Due to population explosion, the current power generation has become insufficient to fulfill our requirements. In the upcoming days, as demand of electricity is increasing rapidly, it will prove a great boon to the country and also to the world, since it will save a lot of electricity of power plants which is wasted in illuminating the street light.

This research can be used to develop our country by enhancing more and more utilization of its sources in more appropriate and proficient manner. The development of a country is directly proportional to the way in which it uses power supply sufficiently and efficiently.

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