

Energy Harvesting by Utilizing Weight of Vehicle at Highway Toll Plaza

Vimalkumar A. Patel¹, Akshaykumar D. Tailor², Mehulkumar R. Patel³
^{1, 2, 3} Mechanical Engineering Department, Government Engineering College, India,

Abstract: Electrical power is an important community in nearly all aspect of life. Electrical power is a necessary component for majority operation of modern society. In this paper, gravitational force due to the weight of vehicle is being utilized to rotate dynamo for power generation, is discussed. Electricity production by means of non-conventional methods which can be very useful in future where there is great demand of electric energy but having limited natural recourses. This paper also describes conceptual working model that can be used as prototype at toll plaza for electricity generation.

Keywords: Gear, Generator, Sprocket

I. Introduction

Electric power generation can be classified into hydroelectric power generation using head drop of water, thermal power generation which obtains electric power by means of combustion of fuel, nuclear power generation using nuclear fission and wind power generation using wind. Electric power plants include hydroelectric power plants, thermal power plants and nuclear power plants. This power plant generates electricity and delivers it to consumers though power transmission lines. Thus we get electricity, which is secondary energy source, from the conversion of other sources of energy like coal, natural gas, oil, nuclear power and other natural resources, which are called primary sources.

As discussed about the electricity, so generated using the non-conventional energy as the primary sources. As these sources are limited; there is possibility of its vanishing in near future. So this paper is a step in the direction of generating electricity using non-conventional sources. This paper illustrates innovative and useful concept i.e. "ENERGY HARVESTING BY UTILIZING WEIGHT OF VEHICLE AT HIGHWAY TOLL PLAZA ". The number of vehicles on the road is increasing rapidly and if we convert some of the kinetic energy of these vehicles into the rotational motion of shaft then this can produce considerable amount of the electricity.

II. Working Principle

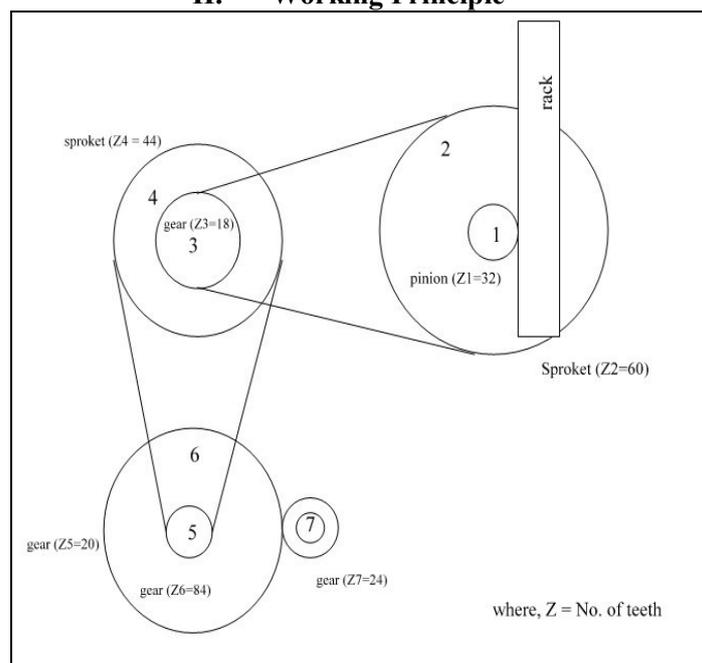


Fig. 1. Schematic diagram of gear mechanism.



Fig.2.Working Model

Main components used in this model are flat platform, springs, gears, and generator. Flat platform is mounted on the compression spring. This platform is connected with the rack and pinion. Main function of the platform is to transmit the load of the vehicle to the rack and pinion. Hence reciprocation motion is being converted into rotating motion which ultimately transmitted to generator shaft to generate the electricity. Ratchet mechanism between the rack & pinion and gear transmission system is provided to transmit the power in only one direction.

When the vehicle gets its position on platform, it will move in downward direction therefore the load of the vehicle rotates pinion by rack and pinion arrangement. The torque of the pinion will be transmitted to the generator shaft through the gear transmission mechanism. Due to high gear ratio, if the pinion will rotate 1 rpm then the generator shaft will rotate nearly about 3500 rpm. Now when the vehicle is moving out from the platform, it will come back to its original position due to the springing action.

As shown in the figure 2, when the weight by means of vehicle is placed on the platform of the model, it descends due to the gravitational force. This vertical moveable platform is welded to the rack which is engaged with the pinion. Hence the reciprocating motion is being converted into rotary motion. On the same shaft sprocket is keyed together with pinion. So rotating motion of pinion, ultimately rotates driver sprocket 2. This driver sprocket is connected to driven sprocket 3 by means of chain drive. The driven sprocket rotates faster than driver sprocket, because of smaller diameter. On this same shaft another sprocket 4 is mounted. This sprocket is again connected with smaller sprocket 5 by means of chain drive. Gear 6 is keyed together with sprocket 5 on same shaft. Lastly gear 7 is meshed with gear 6 which rotates 4 times faster than that of gear 7. On the same shaft of gear 7, a dynamo is mounted with the help of bracket. This dynamo which generates electricity. When vehicle leaves the platform, spring beneath the platform will bring it to initial position for next move.

III. Application, Benefits

3.1 Applications:

There are many areas where this model can be used. Few of them are given below.

- It's based on the concept of the Gravity Power; hence it's very useful in modern electricity generation.
- It can be used at highway toll plaza where intermittent motion of vehicle can be utilize for electricity generation.

3.2 Benefits:

There are many benefits of using this model in practical applications. Few of them are described below.

- It doesn't require any input source like as electricity, costly fuel, etc.
- It's very simple and compact in construction.
- It's very simple concept therefore easily understandable.
- It does not require any supervision.
- Less costly.
- Less maintenance required.
- By use of battery we can get continuous electricity.
- By use of this energy we can save the fuel.

- It is eco-friendly.
- Easy in operation

IV. Conclusion

In this paper authors have tried to discuss only working principle that can be utilize at toll plaza for electricity generation. Same prototype can be made by considering weight of different vehicle. From the calculation it can be found that this kind of arrangement at toll plaza will reduce carbon foot prints due to conventional methods of power generation. By utilizing this kind of principle at different location, more energy can be harvested without depending on natural resources.

References

- [1] Chun-chao Wang, Yuh-suiang Wang "Gravity Power Generation Mechanism" United States patent number: 20090115195 A1 App No.11/935,228 May, 2009.
- [2] Md.Muqtar Ahmed, Heena Naaz, "Power Generation through Gravity and Kinetic Energy", International Journal of Scientific and Research Publications, Volume 4, Issue 1, January 2014.

Books:

- [3] J. B. Gupta, Theory & Performance of Electrical (S. K. Kataria & Sons, 2009).