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Generation of Electricity Using Road Transport Pressure

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Abstract: Energy is the basic need for the development of the modern world. For meeting up the regular demand of energy we need to design a system that will produce electricity without destroying the nature. This paper attempts to show how man has been utilizing and optimizing kinetic energy. Researches show that the world has already had its enough shares of its energy resources. Fossil fuels pollute the environment. Nuclear energy requires careful handling of both raw as well as waste material. The focus now is shifting more and more towards the renewable sources of energy, which are essentially, non-polluting. This paper attempts to show how energy can be produced, stored and used using the road transport pressure or any kind of pressure. The number of vehicles passing over the speed breaker in roads is increasing day by day. There is possibility of tapping the energy and generating power by making the speed breaker as a power generation unit. The generated power can be used for the lamps near the speed breakers and this will be a great boon for the rural villages too.

Key words: - Kinetic energy, Speed breaker, Electro-mechanical unit, Non-Conventional Energy.

I. INTRODUCTION

For reduction of carbon dioxide emission, renewable energies are considered as proper alternative energy [1]. Renewable energies mainly refer to the wind, solar, biomass and marine currents which are less harmful to environment, attracting a wide attention of researchers in design and development of renewable energy conversion systems. Although improvement of renewable energy converters is in a fast rate, the systems to extract the wasted energy in conventional energy conversion systems are not developed as much as its technologies. In many systems and processes, dissipation of energy is inevitable whatever renewable or conventional energy was used. For instance, as a car passes over a speed-breaker, most of car kinetic energy will be wasted as heat in it. On other hand, to ensure the security of the populated areas of streets, the speed-breakers are required, whatever we used electrical cars or the cars consuming gasoil. There are numerous similar cases which such vast energies are wasting. Like an elevator during going down, a car during going down on a sloppy street, where regardless the used type of energy or efficiency of systems energy is systematically wasting. It is mainly due to condition that the systems are operation in it. In this paper, we focus on the fixed speed-breaker at the streets since a high amount of vehicles kinetic energy is wasting there. There are thousands of crowded cities with enormous flow of vehicles offers high amount of energy can be considered as near to urban resource of energy. Also, extraction of such energy allows eliminating of transmission system between the remote areas and urban area for lightings purposes. There is a little literature about extraction of kinetic energy from flow of vehicle in the streets. There is so little and invalid literatures in generation of electricity by speed breakers that but the most common approaches can be seen in [2- 3] these proposed systems, mostly small radial flux generators with ineffective topologies have been employed. Therefore it is necessary to design a suitable and efficient topology for design of an energy conversion system for extraction of kinetic energy of vehicles. This paper presents a novel speed-breaker generator (SBG) for extraction of kinetic energy of vehicle flow in the street. This device converts the kinetic energy of the vehicles into electric energy. 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 [3-4].

II. LITERATURE REVIEW

The energy crisis is a great bottleneck in the supply of energy resources to an economy. The studies to sort out the energy crisis led to the idea of generating power using speed breaker. Firstly South African electrical crisis has made them implemented this method to light up small villages of the highway. The idea of basic physics to convert the kinetic energy into electrical energy that gone wasted when the vehicle run over the speed-break[5]. Since then a lot has been done in this field. The idea caught our working team and decides to develop



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such a project that will produce more power and store it for use at night time as it proves to be a boon to the economy of the country.

III. PROPOSED SYSTEM DESIGN & OPERATION

A. System design & configuration

When automobile vehicle are running on the specialized Speed Breaker. This will create pressure on the pressure lever which is kept under specialized speed breaker. As a result flywheel will rotate and this rotation of the flywheel will cause the DC generator to produce electricity. This electricity can be stored by a rechargeable battery by charging the battery. The produced or stored electricity is used for lighting bulb during night time on the road side.

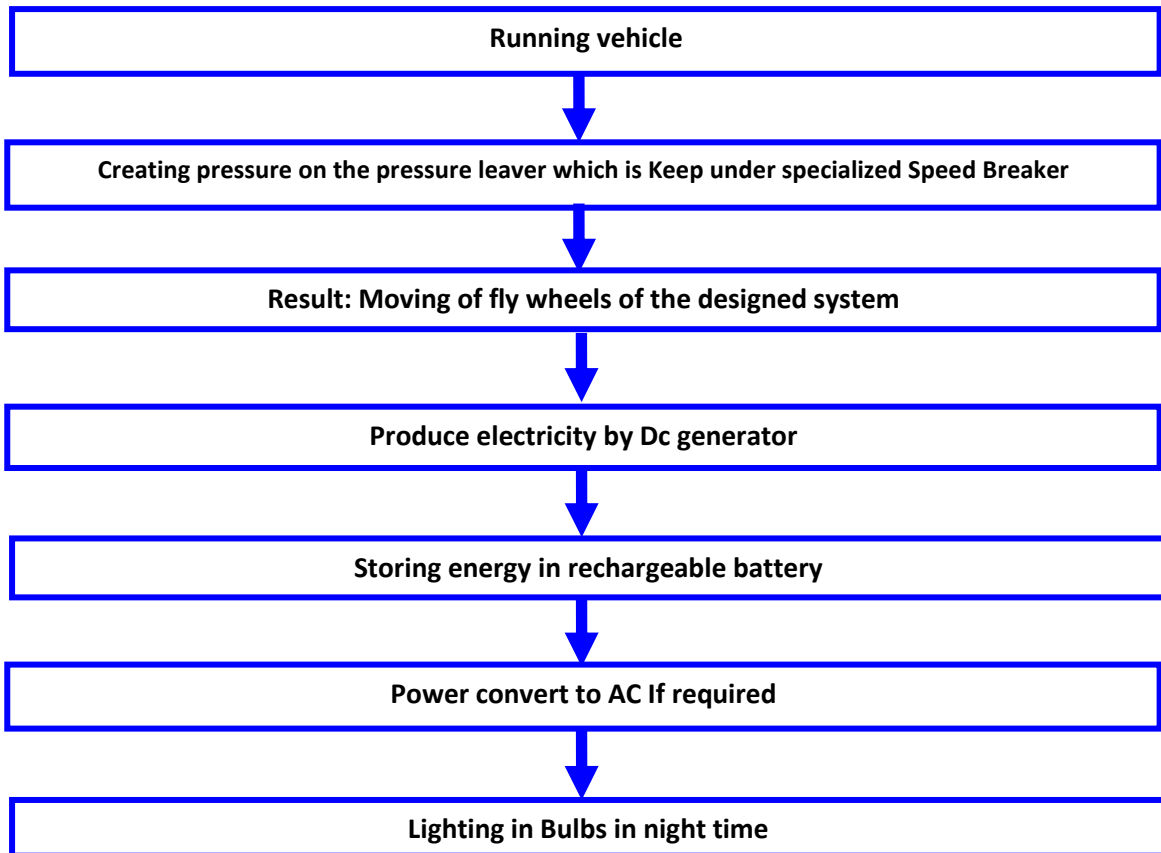


Fig.1 Flowchart of the whole system operation

B. Drawing of the project with AUTOCAD

When imposing pressure on the pressure lever the mechanical gears will rotate, and increase the shaft RPM from shaft 01 to Shaft 05 because these shaft are mechanically coupled with each other. Flywheel and DC Generator are coupled with shaft 05 so flywheel rotates and stores mechanical kinetic energy. This helps to rotate the generator in desired RPM.

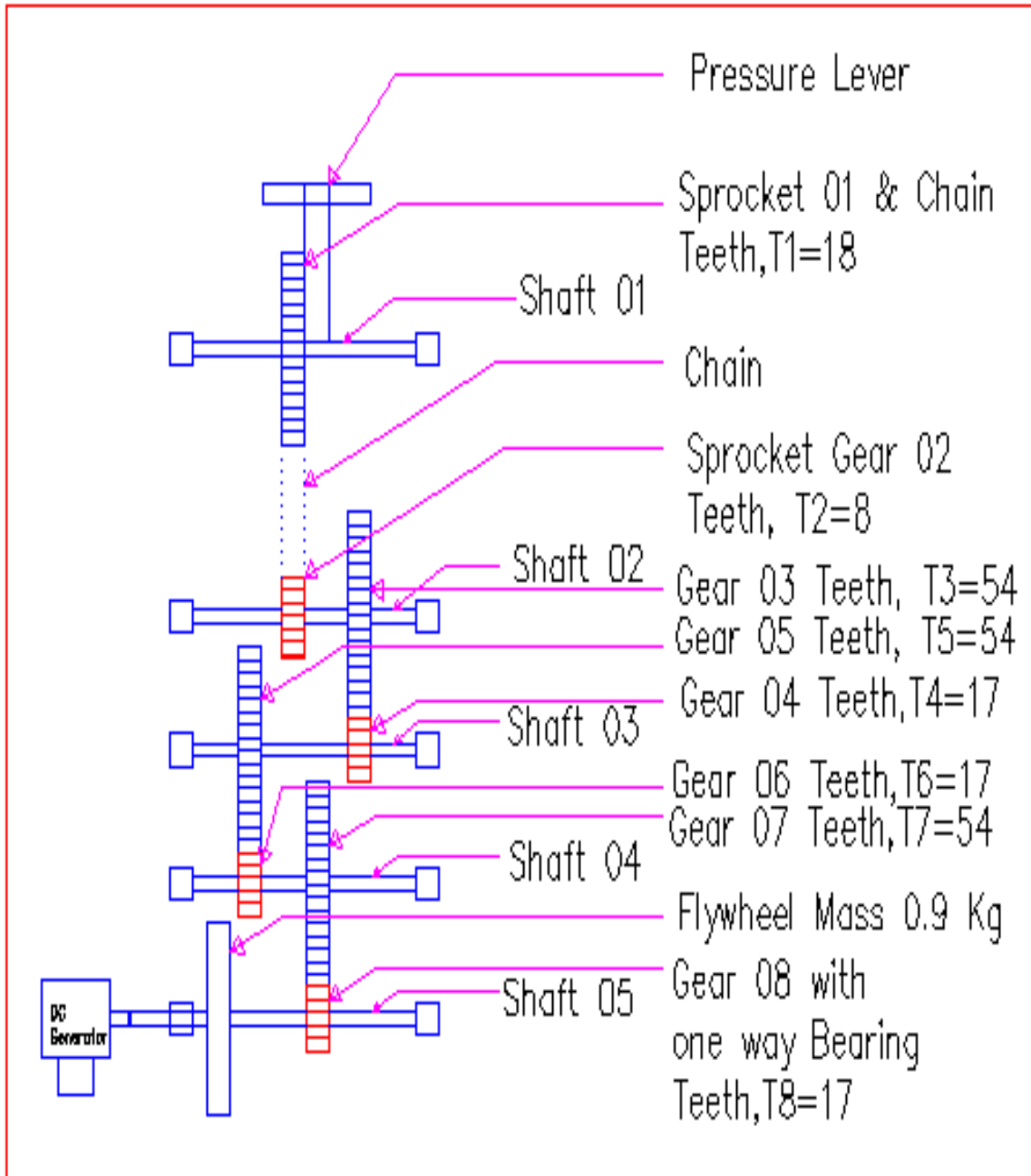


Fig 2: Mechanical drawing of the project

C. Project Electrical Circuit Diagram

Switches that can be turned to different positions to make a connection with the contacts in that particular position. A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead–acid, nickel cadmium (NiCad), nickel metal hydride (NiMH), lithium ion (Li-ion), and lithium ion polymer (Li-ion polymer). When electricity is produced in DC generator, current passes through the rectifier and rechargeable battery is charged. When power is needed during the night time, selector switch is on and rechargeable battery supplies required power.

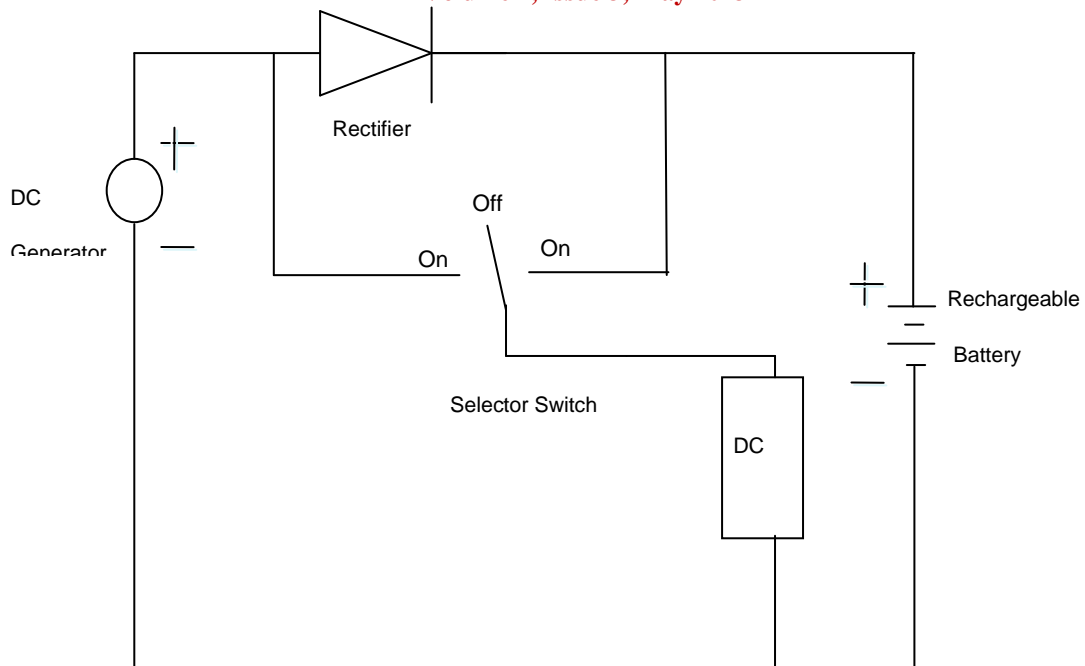


Fig 3: Project electrical circuit diagram

D. Model of the designed project

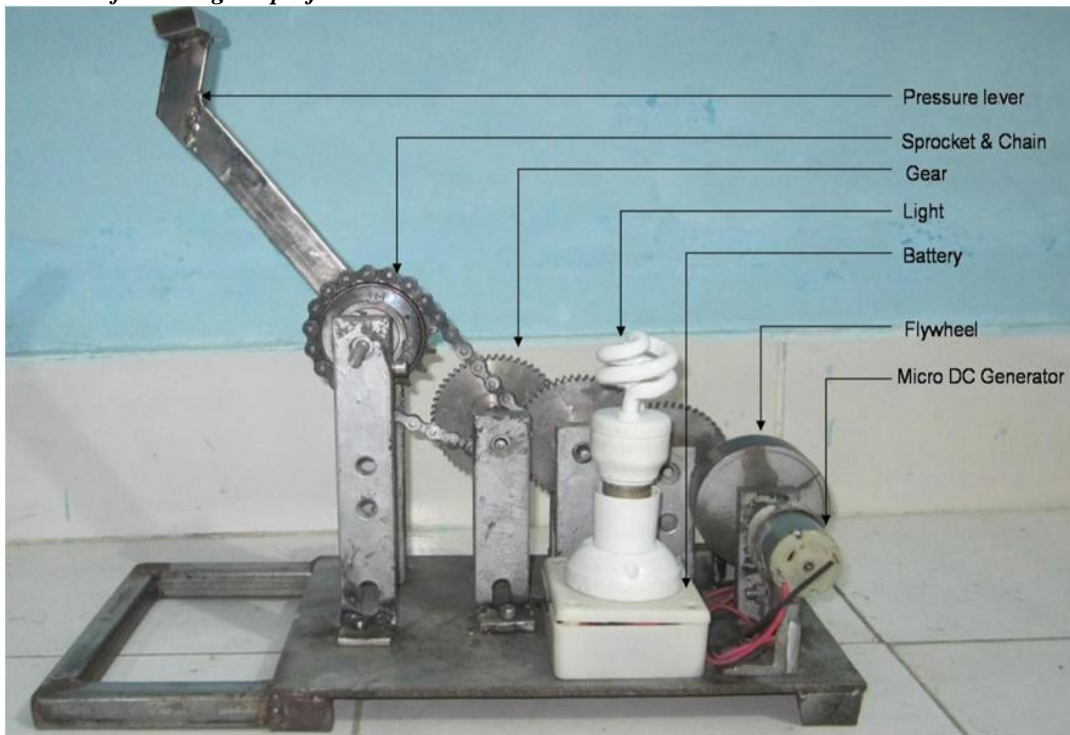


Fig 4: Model of the designed project

When pressure lever is pressed the flywheel will rotate by chine sprocket gear mechanism, it will force to rotate the DC generator because DC generator and flywheel are in same shaft. DC generator will produce electricity by the rotation of armature coil and generated electricity will be stored in a rechargeable battery. This electricity can be used later for lighting bulb during night time on the road side.



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IV.RESULTS

Calculation of input power, output power and efficiency

Input power calculation

Applying 07 kg weight on the pressure lever, the lever travels a distance of 0.152 meter (m) and the total time taken to travel this distance is 0.717 second(s) and the RPM for one Stroke is 1014. (Measured by RPM meter).

By one stroke sprocket gear moves three teeth from its original position.

Gear ratio between sprocket gear 01 & sprocket gear 02

$$\frac{N_1}{N_2} = \frac{T_2}{T_1}$$

$$\frac{3/18}{N_2} = \frac{8}{18}$$

So the calculated N_2 becomes

$$N_2 = \frac{3}{8}$$

As sprocket gear 02 & gear 03 are on the same shaft

So revolution of sprocket gear 03, $N_3 = N_2 = \frac{3}{8}$

Now gear ratio between gear 03 & gear 04

$$\frac{N_3}{N_4} = \frac{T_4}{T_3}$$

$$\frac{3/8}{N_4} = \frac{17}{54}$$

So, $N_4 = 1.19$

As gear 04 & gear 05 are on the same shaft

So revolution of gear 05 becomes $N_5 = N_4 = 1.19$

Gear ratio between gear 05 & gear 06

$$\frac{N_5}{N_6} = \frac{T_6}{T_5}$$

$$\frac{1.19}{N_6} = \frac{17}{54}$$

So, $N_6 = 3.78$

As gear 06 & gear 07 are on the same shaft

So revolution of gear 07 becomes $N_7 = N_6 = 3.78$

Gear ratio between gear 07 & gear 08

$$\frac{N_7}{N_8} = \frac{T_8}{T_7}$$

$$\frac{3.78}{N_8} = \frac{17}{54}$$

$N_8 = 12.01 \approx 12$

So the gear ratio between gear 01 & gear 08

$$N_1 : N_8 = \frac{3}{8} : 12$$

The flywheel, gear 08 & DC generator shaft are connected on the same shaft

So RPM of DC generator shaft becomes $= \frac{12 \times 60}{0.717}$

RPM=1004.1

We know,



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Work done, $W = F \cdot S$

Where, $F = \text{force}$ & $S = \text{distance travel}$

$W = mg \cdot s$

Where, $m = \text{mass}$ & $g = \text{gravitational acceleration}$

$W = 7 \cdot 9.81 \cdot 0.152 = 10.43 \text{ Joule (j)}$

Input Power, $P = \text{Total work done} / \text{total time taken to do the work}$

So, $P = W/t$

$P_i = 10.43/0.717 = 14.55 \text{ Watt (w)}$

Output Power Calculation

Output power, $P_o = \text{Voltage} \cdot \text{Current}$

Output power, $P_o = V \cdot I$

$= 4.0 \cdot 0.5$

$= 2 \text{ Watt (W)}$

Efficiency Calculation

Efficiency = $(\text{Output Power} / \text{Input Power}) \cdot 100 \%$

Efficiency = $(2/14.55) \cdot 100\% = 13.75 \%$

From the results discussed above it is seen that the input power was 14.55W and the founded power at the output is 2W, so the resulted efficiency becomes 13.75% which is much better.

V. ADVANTAGES

- Generation of power without polluting the environment.
- Simple construction, mature technology and easy maintenance.
- No fuel transportation required.
- No consumption of any fossil fuel which is non-renewable source of energy.
- No external source is needed for power generation.

VI. CONCLUSION

In coming days, it will prove a great boon to the world, since it will save a lot of electricity of power plants that gets wasted in illuminating the street lights. As the conventional source are depleting very fast, then it's time to think of alternatives. We got to save the power gained from the conventional sources for efficient use. So this idea not only provides alternative but also adds to the economy of the country. Now vehicular traffic in big cities is more, causing a problem to human being. But this vehicular traffic can be utilized for proper generation by means of a new technique called "power hump". It has advantages that it does not utilize any external source [6]. Now the time has come to put forte this type of innovative ideas, and also researches should be done to upgrade its implication. In future, if the flywheel speed control device and voltage protection devices are added with large generation process, it would be a model all over the world. After some modification of the designed project, the efficiency of the whole system can be increased by increasing the capacity of the generator and applying more weight.

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