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Electrical Power Generation through Speed Breaker

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Abstract: *In the present scenario, electrical powers are the basic needs for human life and living organism in these universes. Energy is responsible for major developments of any country's economy such as most developing countries like India. Everything that happens in the environment is the example of a flow of energy in one of its forms. But in this fast-moving world, the population is increasing day by day and the conventional energy sources are diminishing, so its becomes necessary that we must depend upon non-conventional energy sources for power generation. Moreover, these conventional energy sources are polluting and responsible for an increase in global warming. So, non-conventional energy sources are needed to be developed for power generation which is clean, eco-friendly and sustainable [1]. Therefore, to overcome this problem we need to implement the techniques of the minimum utilization of conventional sources for energy conservation. This project includes the utilization of energy which is wasted when the vehicles pass over a speed breaker. While moving, the vehicles possess some kinetic energy which is being wasted. This kinetic energy can be utilized for the production of power. These can be done by a special arrangement called "POWER HUMPS". The Kinetic energy of the vehicles can be converted into mechanical energy of the shaft through rack and pinion mechanism and this shaft is connected to the electrical dynamo and it convert the mechanical energy into electrical energy proportional to traffic density. This generated power can be regulated with the help of Zener diode for a continuous supply. The power can be used for the general purpose like streetlights, traffic signals etc. The electrical output can be improved by arranging these power humps in series and this generated power can be amplified and stored by using different electric devices [2]. The maintenance cost of the hump is almost nullified. By adopting this method, we can fulfill future demands to some extent and save a lot of energy.*

Keywords: Kinetic energy, Speed Breaker, Rack & Pinion, Generator, Non-Conventional Energy, Street light.

I. INTRODUCTION

Now a day, power has become the major requirement for human life. Energy is an important input in all the sectors of any countries economy and standard of living. The availability of the conventional fossil fuels will be the main sources for power generation, but there is a fear that it will be exhausted in 100 years. Therefore, we have to adopt the other types of renewable energy sources. The day-to-day increase in the population and decrease in the conventional sources for power generation, provides a need to think for non-conventional energy resources. Another major problem now a day is the pollution. Power stations and automobiles are the major cause of pollution [3]. Therefore, we have to investigate non-conventional power source to reduce this problem. There are already existing renewable source of energy such as solar energy, wind energy, tidal energy etc. Therefore, we proposed a latest technology of non-conventional power generating system based on speed breaker mechanism or power hump. Due to increase in population there is annual growth in vehicles. To control the traffics lots of speed breaker are made, where lot of potential energy of vehicle is been wasted. In this paper, our aim is to conserve the potential energy generated by the vehicle and convert it into kinetic energy, that gone wasted while vehicle moves. Then these kinetic energy is convert into electrical energy.



Fig.1.Street Breaker

II. METHODOLOGY

Power can be produced from both the way conventional and nonconventional energy sources. In this paper, there will be conversion of energy from potential energy to kinetic energy and then to rotational energy. Rotational energy is then converted into electrical energy. This paper will examine us from mechanism conversion of energy from speed breaker. It is a simple and optimum process to generate energy from speed breaker arrangements. In present there are a large number of vehicles running on the road and these vehicles passes over a large number of speed breakers present on the road [4]. We have to replace this traditional speed breaker with our proposed speed breaker. It is an Electro-Mechanical unit. This system utilizes both mechanical technology and electrical techniques for the power generation and its storage. The generation will be proportional to density of the traffic.

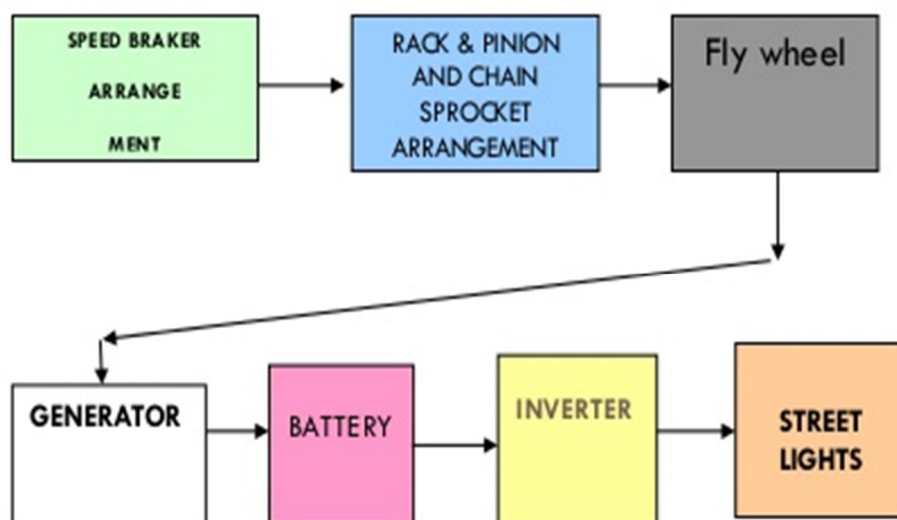


Fig. 1. Block diagram

III. SYSTEM DESIGN & FUNCTION

In this research paper, the pressure of the vehicle on the speed breaker is converted into rotary energy through rack and pinion using hydraulic press. Consequently, this rotary energy rotates the generator and the generated electrical power which is being stored through battery using charging circuit.

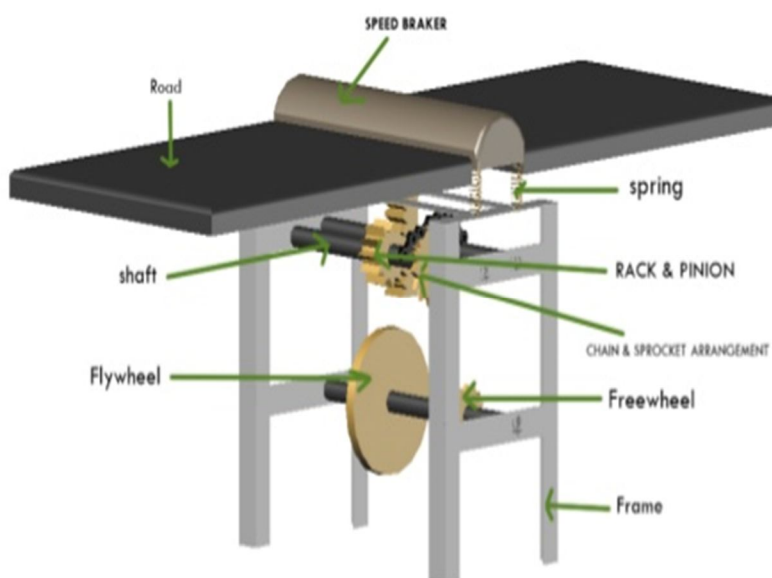


Fig. 2. Speed breaker mechanism

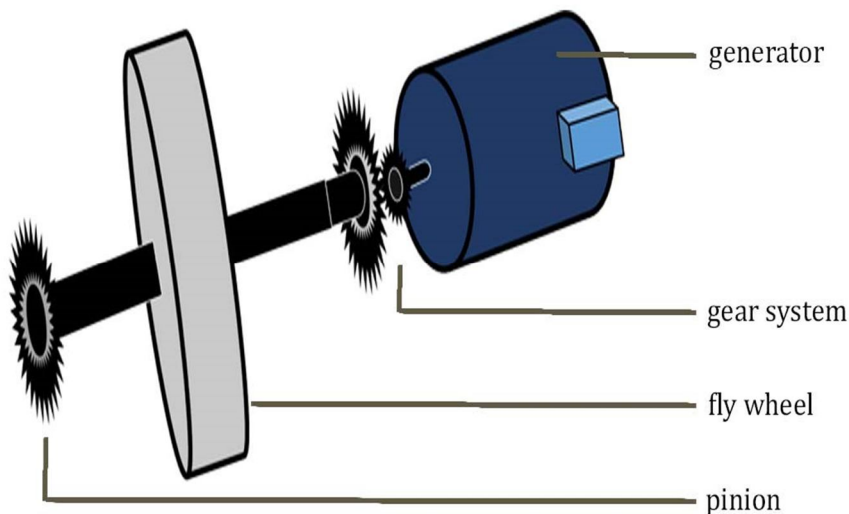


Fig. 3. Fly wheel and generator mechanism

A. Speed Breaker

It's the top portion of the system which is made of iron in curved shape. The main function of this speed breaker is to sustain the pressure of vehicle and squeezes it when vehicle passes through it.

B. Spring Arrangement

A spring is an elastic body and its function is to distort when loaded and to recover its original shape when unloaded or its removed. It absorbs or controls, energy either produce due to shocks or vibrations. There are four helical springs below the speed breaker which are squeezed when vehicle pressurizes upon it and it bring the speed breaker at previous state.

C. Hydraulic Press

In hydraulic press a small amount of force is applied on a column of liquid and its converted into a much greater force available to another column of liquid. It is an application of Pascale law. In our proposed system it converts the force into 4times from small piston to large piston when the pressure created on speed breaker using this equation,

$$R2 = (R1/b) \times J$$

R1 = created force on small piston by speed breaker

F2= converted force by hydraulic press

b= area of small piston

= area of large piston

D. Rack & Pinion

Its convert rotary to linear or from linear to rotary motion. Rack is a linear gear and pinion is a circular gear. Applied force on rack is converted to rotation by pinion. The mechanical force is converted into rotational force

E. Fly wheel

The function of flywheel is to act as an energy accumulator. It reduces the fluctuations in speed. It absorbs the energy when there is less demand and releases the same when it is required.

F. Generator

The device which converts mechanical energy into electrical energy is called generator. An AC generator is used for producing alternating current which contains an assembly of stationary (stator) and moving parts (rotor). The rotor is connected with the gear [9]. The torque which are generated by gear rotates the rotor of the generator. The rotor creates the moving magnetic fields around the stator, which induces a voltage difference between the winding of the stator and produce the alternating current (AC) output through generator.

G. Charging Circuit

Charging circuit is used to charge the battery.

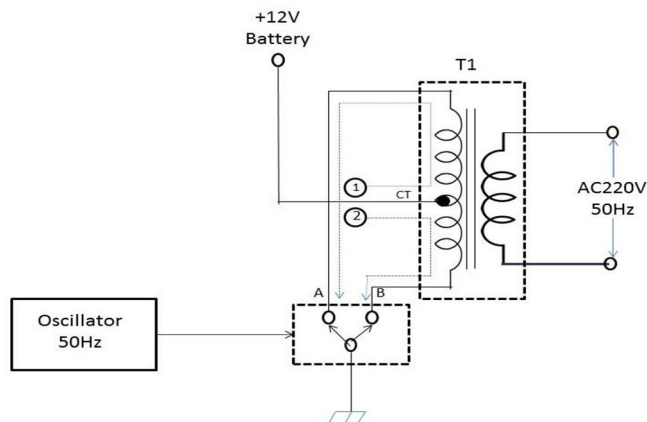


Fig. 4. Charging circuit

H. Dark Sensing And Switching Circuit

Dark sensing circuit sense the dark and switch the light on

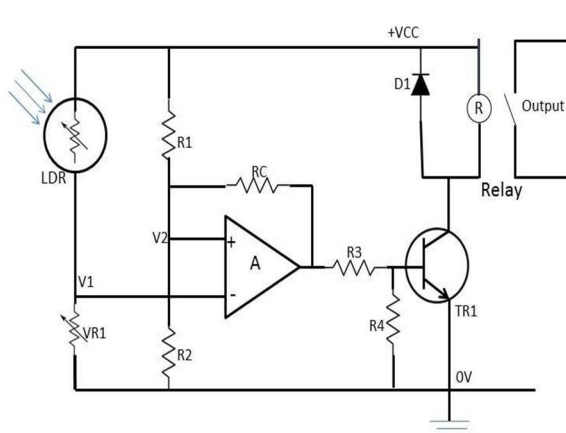


Fig. 5. Dark sensing & switching circuit.

I. Inverter circuit & step-up transformer

Inverter convert DC voltage to AC voltage and step up transformer is a type of transformer which stepped up the AC voltage. In this system inverter circuit converts 12V DC to 15V AC. Step up Transformer makes the voltage to 250 V AC from 15 V AC.

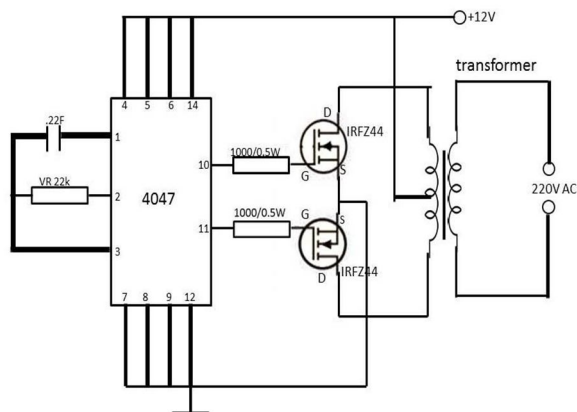


Fig. 6. Inverter circuit & step-up transformer.

IV. WORKING PRINCIPLE

While running, the vehicles generates some kinetic energy. This energy can be utilized to produce power by using a special arrangement called POWER HUMP. It is known as Electro-Mechanical unit. It utilizes both mechanical and electrical techniques for the generation of power and its storage. POWER HUMP is a dome like device similar to be speed breaker. Whenever the vehicle passes over the dome it gets pressed down and the springs are attached to the dome gets compressed and the rack which is attached at the bottom of the dome displace downward in reciprocating motion [4].

The rack teeth are connected to gears and there exists a conversion of reciprocating motion of rack into the rotary motion of gears but the two gears rotate in opposite direction. A flywheel is mounted on the shaft whose work is to regulate the fluctuation in the energy and to make it uniform. So that its shafts the shaft will with certain R.P.M. and these shafts are connected through a belt drive to the dynamos, which converts the mechanical energy into electrical energy [6]. The conversion will be proportional to density of the traffic. Whenever an armature rotates between the magnetic fields of two poles, an E.M.F (electro motive force) is induced in it. So, for inducing an E.M.F armature coil has to be rotates.

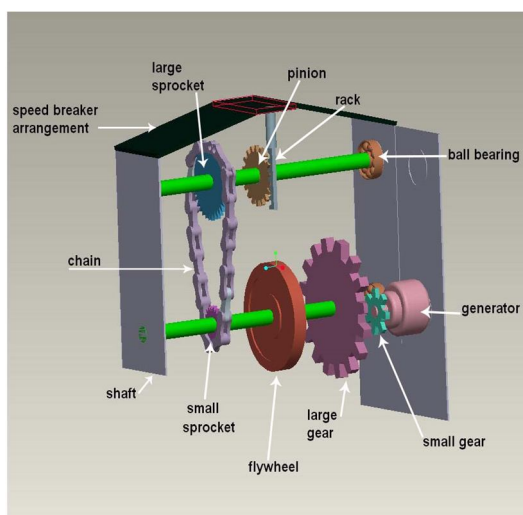


Fig 7: Schematic Diagram

By rotating at same e.m.f is induced, for this rotation kinetic energy of moving vehicles is utilized. The power is generated in both the directions and to convert this power in one way a special component is used called zenor diode. It is for continuous supply. All this mechanism can be housed under the dome, like speed breaker, which is known as HUMP. The electrical output can be improved by arrangement of POWER HUMPS in series. The generated power can be utilized or can be amplified and stored with the help of different electrical devices [5].

V. POWER CALCULATION & RESULT ANALYSIS

Let's consider, the mass of vehicle moving over the speed breaker = 350Kg (Approximately) Height of speed breaker = 15 cm

Weight of the Body = $350 \text{ Kg} \times 9.8 = 3430 \text{ N}$

Distance travelled = Height of the speed breaker = 15cm

Work done = weight of the body \times distance travelled by the pressure of vehicle

Power = Work done/Second = $(3430 \times 0.15) / 60 = 8.58$

Watts Output Power developed for 1 vehicle passing over the speed Power developed for 60 minutes (1 hr.) = 514.5 watts, Power developed for 24 hours = 12.35 Kw

Our proposed system can provide 250 v and 24 amps.

We are using CFL bulb (100 watt) In one km 60 bulbs are needed.

Total watt = $60 \times 100 = 6000 \text{ watt} = 6 \text{ Kw}$

This power generated by vehicles is sufficient to runs the street lights in the night time.

VI. ADVANTAGE

- A. Power generation cost is low by using non-conventional energy sources which will help us to conserve the conventional energy sources to meet the future demand.
- B. Non-polluting power generating source.
- C. Easy to maintenance and no fuel transportation problem.
- D. Low installation and maintenance cost.
- E. Simple construction, mature technology.
- F. No need of manpower during power generation.

VII. CONCLUSION

Electricity plays a very important role in everyone's life. Due to increase in population, the current power generation has become insufficient to fulfil everyone's requirements. In this project we have discovered a technology to generate electricity from the speed breakers in which the system used is reliable and this technique will help in conservation of natural resources. In coming days, this will prove to be a great boon to the country, since it will save a lot of electricity that are wasted in illuminating the street lights [7]. As the conventional sources are exhausting very fast, it's high time to think of alternative resources. We can also use it for signal system on road, tollbooth or any other useful work. So from every angle we can see this system is very much effective to reducing the power crisis [8].

VIII. ACKNOWLEDGMENT

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