Designing of Rack Pinion Mechanism for Power Generation at Speed Breaker

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***Abstract*- The Far-flung usage of energy has resulted in an energy crisis. So there is a need to develop methods of optimal utilization, which will not only ease the crisis but also preserve the environment. We are using the non-renewable energy sources such as coal, petroleum as well as renewable sources like solar, wind, tidal power etc., but still we couldn't overcome our power needs. With the time technology is advancing, the consumption of power is steadily revolt. So the challenges of power generation and its cost of production, play an important role in the countries competence in the world economy. Among many vital sectors of our social life, transportation sector has a key role to play. We are presenting in this paper that kinetic energy produced by movement of vehicles on speed breaker of road, convert in electrical energy that can produce power. Beneath speed breaker, setting up a gearing unit known to be RACK-PINION, could help us conserving this linear motion into rotational motion and use it for power generation.**

I. INTRODUCTION

The ceremonial sources of energy are generally non-renewable sources of energy, which are being used since a long time. India is already world's third-largest emitter of carbon dioxide and other greenhouse gases. To improve the power generation technologies and to make them more sustainable, non –conventional technologies have been discovered. There is a need for alternate energy which will not only offset the demand of conventional fossil fuel. Ironically, India has world's fifth largest coal reserves and still faces acute power crisis. Energy crisis is due to two reasons, first one is the population of the world has been increased rapidly and secondly standard of living of human beings has increased. India is the country, which majorly suffers with lack of sufficient power generation. India's per capita power sector consumption, around 940 kilo watt-hour (kWh), is among the lowest in the world. Renewable energy is collected from renewable resources, which are naturally replenished on a human timescale, such as wind, rain, tides, waves, sunlight and geothermal heat. But these areas have very high capital cost and not able to work in every condition. For removing this problem, we are working in the field of small scale power generation unit ex. - Harvesting Body Heat, Confiscated Alcohol etc.

Here we are looking forward to conserve the kinetic energy that gone wasted, while vehicles move. The number of vehicles passing over speed breaker on road is increasing day by day. There are thousands of crowed cities with enormous flow of vehicles offers high amount of energy can be considered as near to urban resource of energy.

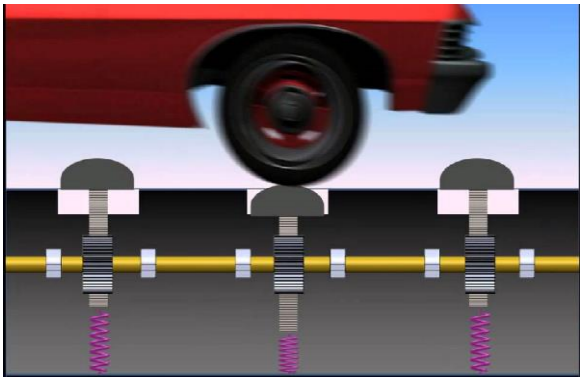

Fig.-1 Arrangement of Rack-pinion

The entire model is built under a speed breaker and when a vehicle passes through the speed breaker it generates electricity. The power thus generated is stored in a rechargeable device such as battery (conservation) for future use[1]. Generation of electricity by speed breakers is an innovative and useful concept. Whenever the vehicle is allowed to pass over the dome it gets pressed downwards rapidly, then the springs that are attached to the dome are compressed and the rack, which is attached to the bottom of the dome moves downward in reciprocating motion. Since by using gearing mechanism we can increase no. of rotational turn and

generate output power. This is known as RACK-PINION mechanism for power generation.

II. RACK-PINION PRINCIPLE

A rack and pinion is a type of straight actuator that comprises a pair of accoutrements which convert rotational motion into linear shift. A circular gear called "the pinion" engross 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.

Fig.-2 Rack-Pinion Working

A rack and pinion is commonly found in the steering mechanism of cars or other wheeled, steered vehicles. The head of rack is brought up to level beneath the speed breaker surface. When vehicle moves on the speed breaker, the rack it will be pushed down. The rack is attached with free wheel type pinion that rotates in one direction only[2]. The rack & pinion arrangement convert reciprocating motion in to rotary motion. Further this motion with the help of pulley and drives are magnified. At the output side, we fixed dc generator for power generation.

III. EQUIPMENT REQUIRED

1. **Rack-pinion gears:** A rack and pinion gears system is composed of two gears. The normal round gear is the pinion gear and the straight or flat gear is the rack. The rack has teeth cut into it and they mesh with the teeth of the pinion gear.
   Rack and pinion gears are available in three variations:
   - **Straight teeth**
   - **Helical teeth**
   - **Roller pinion**

2. **Ball Bearing:** The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. In most applications, one race is stationary and the other is attached to the rotating assembly.

Fig.-3 Ball bearing

3. **Fly Wheel:** Fly wheel used to providing continuous energy when the energy source is discontinuous.

4. **Spur Gear:** Spur gears are the most common type of gears. They have straight teeth, and are mounted on parallel shafts. Sometimes, many spur gears are used at once to create very large gear reductions. Spur gears are used in many devices electric screwdriver, dancing monster, oscillating sprinkler, windup alarm clock, washing machine and clothes dryer.

Fig.-4 Spur gearing

5 **Shaft:** It is a rotating element, which is used to transmit power from one place to another place. The material used for ordinary shafts is mild steel. When high strength is required, an alloy steel such as nickel, nickel-chromium or chromium-vanadium steel is used.

IV. PROPOSED SYSTEM

Power generation from speed breaker (PGFSB) 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 [3].

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 gear arrangement. Here we have two gears with different diameters. The gear wheel with the larger dimension is coupled to the axis of the pinion. Hence the speed that has been multiplied at the smaller sprocket wheel is passed on to this gear wheel of larger dimension.

The smaller gear is coupled to the larger gear. So as the larger gear rotates at the multiplied speed of the pinion, the smaller gear following the larger gear still multiplies the speed to more intensity. Hence, although the speed due to the rotary motion achieved at the pinion is less, as the power is transmitted to gears, finally the speed is multiplied to a higher speed. This speed which is sufficient to rotate the rotor of a generator is fed into to the rotor of a generator. The rotor which rotates within a static magnetic stator cuts the magnetic flux surrounding it, thus producing the electric motive force (emf)[4]. 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.

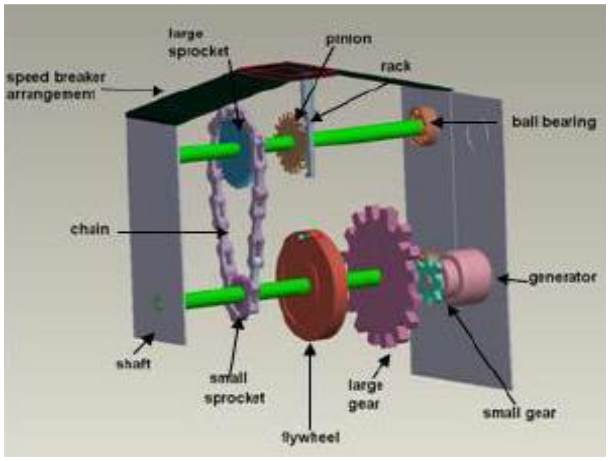

Fig.-5 Working of Model

When automobile vehicle are running on the specialized Speed Breaker. This will create pressure on the pressure leaver 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 [5].

The output of the model is intermittent and is obtained as each vehicle runs over the speed breaker and thus the power developed depends directly on the frequency of the

Fig.- 6 Testing of O/P power

Vehicle movement. Thus it is necessary to select the appropriate location for installing the model for useful outputs.

V. ADVANTAGE

Below is the list of advantages due to the usage of the technique

Mentioned in this paper.

- Pollution free power generation.
- No consumption of any fossil fuel which is non-renewable source of energy [6].
- No fuel transportation required.
- No external source is needed for power generation.
- Energy available all year round.

VI. FUTURE SCOPE

- Suitable at parking of multiplexes, malls, toll booths, signals, etc.
- Uses: Charging batteries and using them to light up the streets, etc.
- Such speed breakers can be designed for heavy vehicles, thus increasing input torque and ultimately output of generator.
- More suitable and compact mechanisms to enhance efficiency.

VII. RESULT

In this paper power was generated by Rack-Pinion mechanism on speed breaker. This is a cheapest and useful process for power generation in metro cities. It has advantage that it does not utilize any external source. Now the time has come to put forward these types of innovative ideas, and researches should be done to upgrade their implication.

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