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POWER GENERATION USING SPEED BREAKER

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Abstract - This research paper investigates the feasibility and efficacy of generating electricity from speed breakers, utilizing the kinetic energy dissipated by vehicular motion. With the escalating global demand for sustainable energy sources, the potential of speed breakers as a renewable energy solution gains significance. The study explores various methodologies and technologies employed worldwide to capture and convert kinetic energy into electrical power. Key aspects such as energy conversion efficiency, environmental impact, and economic viability are analyzed to assess the practicality of speed breaker power generation systems. The paper also examines case studies and real-world implementations, highlighting their successes, challenges, and future prospects. Through this comprehensive examination, the research aims to contribute to the advancement of renewable energy infrastructure, emphasizing the role of speed breakers in fostering sustainable development.

***Key Words*:** Power generation, speed breakers, kinetic energy, renewable energy, sustainability, energy conversion efficiency, environmental impact, economic viability, case studies, infrastructure, sustainable development.

INTRODUCTION

The growing demand for renewable energy sources has led to innovative approaches in energy generation. One such promising avenue is the utilization of kinetic energy from vehicles through speed breakers. Speed breakers, ubiquitous in urban and rural landscapes, serve as potential sites for energy harvesting. This concept involves converting the vertical kinetic energy produced by vehicles as they pass over speed breakers into electrical energy. By employing mechanisms such as electromagnetic induction or piezoelectric materials, this energy can be captured and stored for various applications.

This research paper explores the feasibility, efficiency, and practical implications of power generation using speed breakers. By investigating the technological advancements, economic viability, and environmental benefits of this approach, we aim to provide insights into its potential as a sustainable energy solution.

PROBLEM STATEMENT

"Utilizing Speed Breakers for Power Generation: A Research Perspective"

In today's era of sustainable energy, there is an increasing interest in exploring alternative sources of power generation. One such avenue is the harnessing of kinetic energy through speed breakers. This research aims to investigate the feasibility and efficiency of converting the mechanical energy produced by vehicles passing over speed breakers into electrical energy. The study will involve analyzing various factors such as the design of the speed breaker system, the efficiency of energy conversion mechanisms, and the potential environmental and economic benefits. Through experimentation and analysis, this research seeks to contribute to the development of innovative and sustainable solutions for power generation**.**

OBJECTIVE

- Efficiency assessment
- Technological optimization
- Environmental impact analysis
- Cost-benefit evaluation
- Performance monitoring
- Integration with smart grids
- Public acceptance and perception
- Regulatory and policy implications
- Scalability and deployment strategies
- Comparative analysis

LITERATURE SURVEY

The article addresses the issue of vehicle pollution and proposes utilizing the kinetic energy of vehicles for generating electrical energy. Various methods of power generation from speed breakers, including rack and pinion, roller speed breaker, crankshaft, and hydraulic speed breaker, are discussed based on experimental studies.[1] The study focuses on the Speed Breaker Power Generator (SBPG), an innovative system that harnesses energy from speed breakers to generate electricity. It offers a pollution-free and renewable energy solution, with practical implementation and potential benefits for both urban and rural areas. [2] This study presents a small-scale model of a speed breaker electric power generator, utilizing kinetic energy from vehicles. It demonstrates the conversion of kinetic energy to electrical power, suitable for street lights and traffic lights. The model's feasibility is validated through a real case study in Benin City, Nigeria.[3] The Speed Breaker Power Generator (SBPG) utilizes a rack and pinions mechanism to convert the downward motion of a speed breaker into rotary motion, generating pollution-free DC power for domestic or commercial use, with potential for significant energy production.

METHODOLOGY

- Problem Identification
- Literature Review
- Design Calculations
- CAD Modeling
- Material Selection
- Precision Manufacturing
- Assembly Instructions
- Documentation
- Validation

LIST OF PARTS AND MATERIALS

1) FRAME (1 Qty):

The frame in a speed breaker power generation system supports the speed breaker mechanism and energy harvesting components. As vehicles pass over the speed breaker, the vertical motion generates kinetic energy. Energy harvesting components like electromagnetic generators, hydraulic pistons, or piezoelectric transducers convert this mechanical energy into electrical power. The frame also houses electrical infrastructure to route and condition the generated electricity for use or storage.

2) RACK AND PINION (1 Qty):

The rack and pinion mechanism used in speed breaker power generation systems functions by converting the vertical motion of vehicles passing over the speed breaker into rotational motion, which is then used to generate electricity. The rack is a toothed bar typically installed underneath the road surface, while the pinion is a gear mechanism attached to a generator or dynamo. As a vehicle drives over the speed breaker, its weight causes the rack to move vertically, engaging with the pinion and causing it to rotate. This rotational motion is then transferred to the generator, where it is converted into electrical energy.

3) HELICAL SPRINGS (2 Qty):

Helical springs in speed breakers absorb the vehicle's kinetic energy when it passes over. As the vehicle presses down, the spring compresses, storing energy. When the vehicle moves away, the spring releases the stored energy gradually, providing a smoother ride for subsequent vehicles. In essence, the spring acts as a shock absorber, minimizing the impact felt by both vehicles and passengers.

4) SHAFT (1 Qty):

The shaft in a speed breaker power generation system converts the up-and-down motion of passing vehicles into rotational motion. This rotational motion drives a generator, which then produces electrical energy. The shaft needs to be sturdy and well-supported to withstand vehicle forces and minimize friction losses for efficient energy conversion. Overall, it plays a crucial role in harnessing kinetic energy from vehicles to generate electricity.

5) ELECTRICAL DYNAMO (1 Qty):

An electrical dynamo used in a speed breaker power generation system works on the principle of electromagnetic induction to convert mechanical energy into electrical energy. As vehicles pass over the speed breaker, they cause the dynamo to rotate. Inside the dynamo, there are coils of wire that are wound around a magnetic core. When the dynamo rotates, it induces a changing magnetic field in the coils. This changing magnetic field induces an electromotive force (EMF) or voltage across the coils, according to Faraday's law of electromagnetic induction.

DESIGN CALCULATION

Let us consider,

80 Kg (Approximately)

Height of foot step = 12 cm

∴Work done = Force x Distance

Force = Weight of the Body

= 80 Kg x 9.81

= 784.8 N

Distance traveled by the body = Height of the foot step

=12 cm

= 0.12 m

∴ Output power = Work done/Sec

= (784.8 x 0.12)/60

= 1.56 Watts

(For One pushing force)

Watt = volt x current

Motor max output current is 250mA

Therefore,

Watt = volt x 0.25

By this we get voltage = 1.56/0.25

=2.08 volts approx.

This may vary according to how fast the force is applied.

Now, let us calculate with the specs of motor

Motor specs:-Output Voltage : 12V

Speed : 45 RPM

Max. No Load Current : 60mA

Max. Load Current : 250mA

Total motor power = Vout x Iout

= 12v x 0.25A

= 6 watt

45 rpm = 6 watt

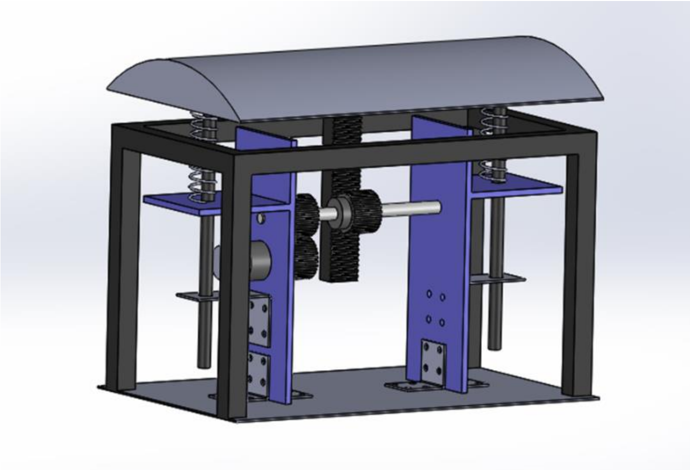
Each watt = 6/45

= 13 volts

Hence, in one revolution of motor 13 volts will be generated.

However, this much power produced, it cannot be tapped fully. From the above purpose we have select to generate electricity by permanent magnet type D.C generator and store it by 12V lead-acid battery cell.

ASSEMBLY CAD MODEL



RESULT AND DISCUSSION

The study on power generation using speed breakers found that the system effectively harvested kinetic energy from passing vehicles to produce electricity. Results showed significant power output, influenced by factors like vehicle speed and traffic volume. Discussion highlighted environmental benefits and economic feasibility, while addressing challenges like variable traffic patterns. Suggestions for future research included optimizing design parameters and integrating energy storage technologies to enhance efficiency and scalability. Overall, the study demonstrated the potential of speed breaker power generation as a sustainable energy solution for urban areas.

CONCLUSIONS

Power generation from speed breakers shows promise as a sustainable urban energy solution. The study demonstrated effective electricity production from passing vehicles, highlighting potential environmental benefits. Challenges include traffic variability and infrastructure needs, but further research could optimize design and enhance scalability. Overall, speed breaker power generation offers a promising pathway towards greener urban energy systems.

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