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Power Generation by Using Suspension

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A B S T R A C T

The electromagnetic suspension system for power generation is a groundbreaking method to harness linear reciprocating motion and convert it into valuable electrical energy. While conventional vehicle shock absorbers solely absorb mechanical shock, this system innovatively utilizes the absorbed kinetic energy to generate electricity. The generated electrical power can be utilized to power various vehicle components such as lights, cooling systems, and indicator lights.

This system operates on the principle of electromagnetism, as discovered by Michael Faraday. It leverages the motion of a magnet resulting from the absorption of shock within the shock absorber. Comprising a metal shaft, suspension spring, magnet, and conducting coils mounted on a structure, the shock absorber facilitates the to-and-fro motion of the magnet during vehicle suspension, inducing the generation of electromotive force (emf) based on electromagnetic principles.

The versatility of this power generation system extends beyond vehicles; it can be implemented in various industrial applications where linear or rotary motion, converted to linear reciprocatory motion by a slider crank mechanism, can produce electricity. Additionally, manual application of suspension load can yield power generation, which holds potential for household applications in rural areas.

The primary objective of this innovation is to effectively utilize surplus kinetic energy in vehicles to address power shortages, particularly in remote areas where alternative energy resources are imperative. By harnessing the untapped potential of vehicle motion, this system offers a sustainable solution to mitigate energy deficits and contribute to broader electrification efforts.

1. Introduction

Fossil fuels are being consumed with very fast rate. Also the cost of fuel is increasing with a very fast rate. So somebody has to work on saving of the fuel consumption. Our aim is to demonstrate how the kinetic energy from the suspension of a vehicle can be utilized to achieve our goal of obtaining maximum energy that would otherwise have gone waste. We propose a design plan that converts the mechanical energy in vehicles to electrical energy much more efficiently than it has been done before. The electricity generated will then be used to recharge the vehicle battery for further use for functioning of the vehicle.

There is a wide scope for regeneration of energy like regeneration of breaking systematic. We have decided to work on utilization of suspending mass of a vehicle through regeneration system with the help of shock absorber. Shock absorbers are having reciprocating motion in it. Although the reciprocating distance is very low the suspending mass is very high i.e. the mass of total vehicle. When vehicle is on a normal road then also shock absorbers are working due to uneven roads, sudden breaking or sudden acceleration and also a running conditions. So this reciprocating motion of shock absorbers can be converted into rotary motion and through small gearbox arrangement, i.e. rack &pinion attached to doubly fed induction generator, electricity will be generated when shock absorbers will be reciprocating.

2. Purpose of Power Generation by Using Suspension.

- In the contemporary era, there's a pressing need for environmentally friendly and sustainable methods of electricity generation.
- The proposed system is designed to efficiently convert kinetic energy into electricity, utilizing a Linear Motion Electromagnetic System instead of dissipating it as heat.
- The generated electricity is then transformed into direct current using a full wave rectifier and stored in the vehicle's batteries, thereby enhancing battery longevity.
- This system can be seamlessly integrated into vehicle suspensions with minimal alterations, capable of harvesting energy from both compression and expansion motions.

- Notably, this mechanism boasts reliability and can be manufactured at a low cost, making it accessible for adoption in both large-scale and small-scale automobile industries.
- Such technology finds applicability across various sectors of the automobile industry, owing to its versatility and effectiveness

3. Methodology

Implementation and Deployment:

- Develop installation blueprints and collaborate with construction teams to deploy the suspension-based power generation system.
- Ensure adherence to safety protocols, building standards, and environmental mandates during the installation phase.
- Conduct comprehensive commissioning and testing of the deployed system to validate its operational efficiency and functionality.

Monitoring and Maintenance:

- Deploy a remote monitoring infrastructure to consistently monitor system performance and health indicators.
- Establish a maintenance timetable for regular inspections, lubrication, and replacement of worn components.
- Provide training to maintenance staff for troubleshooting and repair tasks to minimize downtime.

Feasibility Assessment:

- Utilize traffic data collection tools such as sensors, traffic cameras, or historical traffic reports to analyze traffic patterns and volume.
- Conduct on-site assessments to observe suspension characteristics, including movement amplitude and frequency.
- Evaluate economic viability by estimating potential energy generation and comparing it against implementation and maintenance costs.
- Assess regulatory and environmental constraints that may impact project feasibility.

Monitoring and Maintenance:

- Implement a remote monitoring system to continuously monitor system performance and health parameters.
- Establish a maintenance schedule for routine inspections, lubrication, and replacement of worn-out components.

4. Working.

This project, "Suspension-Based Power Generation," represents a pioneering concept in alternative energy production. It operates as an electro-mechanical energy converter, wherein the reciprocating motion derived from the suspension is transformed into rotary motion. The resulting rotational energy is stored within a flywheel, which subsequently drives a dynamo, producing electricity. The flywheel effectively accumulates energy from the power source over the majority of the operational cycle, releasing it over a brief period. This ensures a relatively constant supply of energy to the machinery throughout operation.

This prototype serves as a scaled-down model aimed at elucidating the foundational principles of the project. The underlying concept aligns with similar mechanisms utilized in previous endeavors aimed at generating electricity from vehicle movement over speed bumps.

Our task involves constructing a suspension energy generation unit employing the rack and pinion method, a cost-effective alternative to hydraulic units.

Part of the system:

A] Std. Part

1. Suspension unit

2. Rack and pinion

3. Generator.

B] Manufacturing part:

1. Chassis.

2. Drive to run generator (gear box)

5. Design

- Main Component of Power Generation by Using Suspension.
- Shock absorber with coil spring.
- Dc generator.
- Gear box.
- LED & Wiring.
- Battery (If for energy storage).
- Primary shaping: Preliminary shaping of machine components.
- Surface finishing: polishing, lapping, filing.

6. Calculations

Model Calculations

Electrical Calculation

When a vehicle is running at a speed of 20 to 30 km/hr we observe 6 to 9 volts with the help of multi meter. Voltage Generated (V) = 9 volt

Current Generated (I) = 3.2 amp

As Electrical Power (P) = V x I = 9 x 3.2 = 28.8 Watts

TO CALCULATE CHARGING TIME FOR 6 VOLT BATTERY

Charging time =battery current (Ah) / current generated (A)

=4.5 (Ah) /3.2(A)

= 1.40 hr

But it was noted that during charging 40% get loss

=4.5 x 40 /100

=1.8 Ah

Charging time = 4.5 +1.8 /3.2

=1.9 hr

To charge a 6 volt battery with this suspension including 40% loss we can charge the battery with 1.9 hr.

TO CALCULATE CHARGING TIME FOR 12 VOLT BATTERY

Consider that the suspension system is mounted on both side of the front suspension.

Total voltage produced by this suspension system in 18 volt, 64A

Therefore time required to charge a 12 volt, 33 Ah battery is,

Charging Time =Battery current (Ah) / current generated (A)

=33 (Ah)/ 6.4 (A)

=5.15 hr

But it was noted that 40% loss during battery charging

=33 x 40/100

=13.2 (Ah)

But it was noted that 40% loss during battery charging

=33 x 40/100

=13.2 (Ah)

Charging time = 33 + 13.2 /6.4

=7.21 hr

7. Results

- Making use of the energy that's going in vain is the highlighted scenario witnessed here.
- Technical advancement.
- No toxic outlets from the generation point of view.
- Running cost is less.
- User friendly and anyone can understand it.
- Easy to install.
- At least, small electrical components in that particular vehicle can make use of the energy generated in this process.

8. Applications

- Shock absorbers have a great for performance.
- Handling and stability.
- They are best choice for work and severe use vehicle.
- It improves fuel economy and cost saving.
- Continuous supply of energy.
- Simple in design
- Energy efficient performance and long lasting reliability
- In military areas
- Commercial trucking industry
- This technology can be applied to any type of vehicle
- In industrial access

9. Conclusion

Vehicle Suspension Energy Generation presents an efficient solution for harnessing kinetic energy from vehicle movement, particularly from the suspension, which would otherwise be wasted. This energy is converted into electric power, offering a means to power auxiliary systems within the vehicle. Traditionally, automobile batteries are charged by alternators connected to the internal combustion engine (IC engine) shaft. However, with the newly designed suspension regeneration system, the dependence on the engine is reduced. By integrating this system into all four wheels, a substantial amount of electric power can be generated, suitable for powering car air conditioners or refrigeration systems. This suspension system holds significant potential for heavy-duty vehicles such as milk trucks and fire brigade trucks, as well as those requiring ample onboard electricity. Analysis reveals that a smaller number of gear teeth yield maximum voltage and current, as indicated in the result table.

10. Future Scope

The project's scope revolves around simplicity in construction and design, as well as affordability. It offers easy integration onto the vehicle chassis and consistently produces 2 to 3 volts on smooth roads, increasing to 6 to 9 volts on uneven terrain. This output is sufficient to charge the vehicle battery while in motion, thereby enhancing the efficiency of electric vehicles by up to 10%. Further enhancements in suspension design render it adaptable for use in electric two-wheelers. Increasing the number of DC motors augments power generation, which can be utilized for charging higher voltage batteries. The system can also be adapted for use with mono suspension systems through appropriate design modifications. Moreover, with suitable modifications, this system can be implemented in electric cars, showcasing its versatility across different vehicle types.

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Certainly, here are the revised references with altered wording:

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