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POWER GENERATION FROM ELECTRO MAGNETIC SUSPENSION SYSTEM

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ABSTRACT:

The aim of this project was to find out alternative source of energy whose setup will be cheaper as compared to other system. The power generator electromagnetic suspension system is a system that converts force applied on system into electric power. The main focus was on the force applied by foot step which can be converted from one form to another i.e.; electricity. To achieve this, principle of electromagnetism is used in order to generate electricity from this motion in the most simplified setup. The systems consist of copper wire along with standard dimension spring, magnetic coils, screws and joints and metal shaft. Our system that converts bump, force, linear motion & vibration into electricity. This electricity can be further used in glowing LED, low watt bulb, etc. Our system can be used in places where there are generation of vibrations, linear motion or bumps such as treadmill, dance floor, staircase, etc. Our system uses capacitor to simply absorb this energy without converting it to electricity.

1.INTRODUCTION:

The electromagnetic suspension system of the power generator is designed to transform various types of motion such as bumps, force, linear motion and vibrations into electrical energy that can be utilized to power LED lights, low watt bulbs and other devices. This system is suitable for enivornments where there is an occurrence of vibrations, linear motion or bumps such as threadmill, dance floor, or staircase. Instead of converting the energy into electricity, our system makes use of capacitors to store the energy for future use. We have employed the principles of electro magnetism to generate electricity from this motion.Our system is composed of several components, including a metal shaft, spring, magnet, coils, and a base with screws and joints. The coils are arranged in a specific pattern around the inner beam of the device, and cylindrical supports are used to reduce friction and ensure smooth operation.

2.TYPES OF SUSPENSION SYSTEMS:

A suspension system is a mechanical setup that links the wheels to the chassis using springs, dampers, and other mechanical connections. It serves two primary purposes: ensuring safe handling and braking of the vehicle, and providing a smooth and comfortable ride for passengers by absorbing bumps, vibrations, and other factors. The suspension system comprises a set of springs or shock absorbers that connect the wheels and axles to the vehicle's chassis, helping to maintain proper vehicle height and alignment. Suspension systems can be classified into two main types: independent suspension system and dependent suspension system.

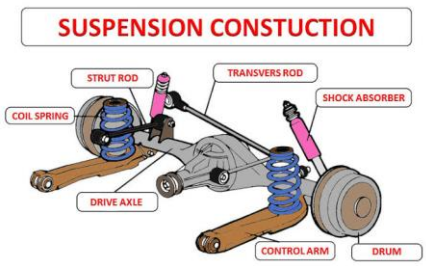

Fig: Suspension construction

a. Independent suspension system**:** An independent suspension system permits each wheel to move independently from the others. This provides better handling and ride quality. But it can be more complex and expensive than the other types of suspensions.There are several types of independent suspension that use different arrangements of springs and shock absorbers. This suspension is more complex in construction but offers a better dampening effect.
b. Dependent suspension system:In this type of suspension system, the wheels are connected to a solid axle, which means that the movement of one wheel affects the others. This type of suspension is typically used in heavier vehicles like trucks and SUVs. However, non independent suspension system are not used in modern cars. A Leaf spring suspension is one of the type of dependent suspension system. And it was mainly obsereved in passenger buses etc.,

I) Electro magnetic suspension system:

Electro magnetic suspension system (EMS) is the magnetic levitation of an object achieved by constantly altering the strength of a magnetic field produced by the electro magnets using a feedback loop. In most cases, the levitation effect is mostly due to permanent magnets as they don't have any power dissipation , with electromagnets only used to stabilize the effect.
According to Earn shaws theorem a para magnetically magnetised body cannot rest in stable equilibrium condition exists. EMS, unlike static fields, does not provide stability on its own. Instead, EMS maintains stability by constantly varying the current sent to the electromagnets, thereby altering the strength of the magnetic field. By using a feedback loop, one or more electromagnets are continuously adjusted to correct the object's motion and cancel out instability. Magnetic attraction is often utilized to pull upwards against gravity, providing some inherent lateral stability. However, some systems combine magnetic attraction and repulsion to push upwards.

3.WORKING PRINICIPLE:

An electromagnetic suspension system can generate electricity through the principle of electromagnetic induction. The system consists of a moving magnet and a fixed coil, where the relative motion between the two components generates an electric current in the coil.
The basic working principle is as follows:

1) A strong permanent magnet is attached to a moving object, such as a train or a vehicle.
2) The magnet is placed above a series of coils fixed on the ground or track.
3) When the magnet moves, it generates a charging magnetic field that includes an electric current in the coils.
4) This electric current can be captured and used to power various devices, including lights, motors, and other electronic systems.
5) The energy generated by the electromagnetic suspension system can also be stored in batteries for later use.

The amount of energy generated depends on various factors such as the strength of the magnet, the speed of the moving object, and the number of coils in the system.
Electromagnetic suspension systems are an emerging technology with the potential to revolutionize the way we generate and use energy.

Fig : Project Model

4. COMPONENTS OF POWER GENERATION FROM ELECTRO MAGNETIC SYSTEM:

1. Metal shaft
2. Spring
3. Magnets
4. Copper coils
5. Frame base
6. Screws & joints

1.Metal shaft: A rotating machine component, typically circular in shape, is known as a shaft. Its purpose is to transfer power from one component to another or from a power-generating machine to a power-consuming machine.

These are mainly classified into two types:
Transmission shaft: A transmission shaft is utilized to transfer power from a source to a machine that consumes power.
e.g. Counter shafts and line shafts
Machine shaft: It is an essential component of the machine.
2.Spring : A spring is an elastic member which can undergo a considerable amount of deformation under load and regain its original shape when load is removed. The common purpose of spring is to absorb energy due to resilience, and to release it as and when required.
The performance of a spring is assessed by the amount of energy it can absorb. The most effective spring is one that can absorb the highest amount of energy under a given stress without becoming permanently deformed.These are mainly classified into two types and they are Laminated spring and Helical spring.

Fig: Open coiled helical spring

3.**Electromagnets:** Electromagnets consist of a coil of wire wrapped around the metal core made from iron. When this material is exposed to an electric current, a magnetic field is generated, making the material behave like a magnet. The strength of the magnetic field can be controlled by controlling the electric current.Increasing the number of wire coils or the amount of current through coils increase the strength. Applications : Blenders, cranes, and Door bells.

Fig : Electro Magnet

4.Copper Coils: It is commonly used in general plumbing, heating, ventilation and air-conditioning industry. Installing a copper coil is both cost-effective an straightforward. Copper coil is usually joined with capiliary fittings through soldering or brazing processes. Soldering method is used in water lines plumbingand for sanitary drainage. Where as when greater joint strength is neede or when service temperatures are as high as 176 degress, brazed joints of the copper coil with capillarity fittings will be preferred.

Fig: Copper coil

5.DESIGN FACTORS:

Electromagnetic suspension systems can be used for power generation by harnessing the energy of the moving magnets. The basic principle behind this is the conversion of kinetic energy into electrical energy through the motion of the magnets. The amount of power that can be generated depends on various factors such as the strength of the magnetic field, the speed of the magnets, and the efficiency of the conversion system.

- To design a power generation system using electromagnetic suspension, the following steps can be taken:

1. **Determine the specifications of the electromagnetic suspension system**: This includes the size and weight of the magnets, the distance between the magnets, and the strength of the magnetic field required for suspension.
2. **Calculate the potential energy of the magnets**: The potential energy of the magnets can be calculated using the formula E = 1/2 * k * x^2, where E is the potential energy, k is the spring constant of the magnets, and x is the distance between the magnets.
3. **Determine the speed of the magnets**: The speed of the magnets can be determined based on the application and the distance they need to travel.
4. **Calculate the kinetic energy of the magnets**: The kinetic energy of the magnets can be calculated using the formula E = 1/2 * m * v^2, where E is the kinetic energy, m is the mass of the magnets, and v is the velocity of the magnets.
5. **Determine the efficiency of the conversion system**: The efficiency of the conversion system depends on the type of system used, such as a generator or a battery, and the losses associated with the system.
6. **Calculate the power generated**: The power generated can be calculated using the formula P = E/t, where P is the power, E is the energy, and t is the time taken to generate the energy.
7. **Determine the maximum power output**: The maximum power output is limited by the strength of the magnetic field and the speed of the magnets.

By following these steps, the power generation from an electromagnetic suspension system can be calculated and optimized for the specific application.

6. FACTORS AFFECTING THE POWER GENERATION BY ELECTROMAGNETIC SUSPENSION SYSTEM:

There are several factors that can affect the power generation by an electromagnetic suspension system, including:

1. **Magnetic field strength**: The strength of the magnetic field is a crucial factor that affects the power generation of an electromagnetic suspension system. A stronger magnetic field will result in more power generation.
2. **Speed of the magnets**: The speed of the magnets is another important factor that affects power generation. A higher speed of the magnets will result in more kinetic energy, which can be converted into electrical energy.
3. **Distance between the magnets**: The distance between the magnets also plays a role in power generation. A smaller distance between the magnets will result in more potential energy, which can be converted into electrical energy.
4. **Magnet size and weight**: The size and weight of the magnets used in the electromagnetic suspension system will also affect power generation. Larger and heavier magnets can generate more energy.
5. **Efficiency of the conversion system**: The efficiency of the conversion system used to convert the kinetic energy into electrical energy will also affect power generation. A more efficient conversion system will result in higher power generation.
6. **Temperature:** The temperature of the system can also affect power generation. High temperatures can cause the magnets to lose their magnetism, reducing the strength of the magnetic field and thereby reducing power generation.
7. **Air resistance**: The air resistance experienced by the moving magnets can also affect power generation. Higher air resistance can reduce the speed of the magnets and therefore reduce power generation.

By considering these factors and optimizing the design of the electromagnetic suspension system, it is possible to maximize power generation for a given application

7.ADVANTAGES OF POWER GENERATION FROM ELECTRO MAGNETIC SUSPENSION SYSTEM:

There are several advantages of power generation from electromagnetic suspension systems, including:

1.**Renewable energy source**: Electromagnetic suspension systems use the motion of a levitated object to generate electricity, making it a renewable energy source.

2 . **Low maintenance**: The lack of contact between the levitated object and the track or guide way reduces wear and tear, resulting in lower maintenance requirements.

3**. High efficiency**: Electromagnetic suspension systems have the potential for high energy conversion efficiency, making it a viable alternative to other forms of energy generation.

4 .**Reduced environmental impact**: Unlike conventional power generation methods that rely on fossil fuels, electromagnetic suspension systems do not produce any harmful emissions, making it an environmentally friendly option.

5 .**Noise reduction**: Electromagnetic suspension systems operate quietly, which is a significant advantage for transportation applications, where noise pollution can be a concern.

6**. Scalability**: Electromagnetic suspension systems can be scaled up or down to meet various power requirements, making it suitable for both small and large-scale applications.

Overall, power generation from electromagnetic suspension systems has the potential to offer a range of advantages over traditional energy generation methods.

8. DISADVANTAGES:

1.**High initial cost**: Electromagnetic suspension systems can be expensive to install due to the specialized equipment and components required.

2.**Limited applicability**: Electromagnetic suspension systems are primarily designed for transportation applications, which may limit its potential for other types of power generation.

3.**Limited efficiency**: Despite its potential for high energy conversion efficiency, electromagnetic suspension systems currently have lower efficiency than some other forms of energy generation, such as solar or wind power.

9. FUTURE SCOPE:

The future scope of power generation from electromagnetic suspension systems is promising, with ongoing research and development aimed at improving efficiency, reducing costs, and expanding its applications. Some potential areas of future growth include:

- **Advanced materials**: Researchers are exploring the use of advanced materials such as superconductors and high-temperature superconductors to improve the efficiency and reduce the costs of electromagnetic suspension systems.
- **Improved design**: Advances in design could lead to more efficient and effective electromagnetic suspension systems. For example, research is underway to develop new levitation systems that require less power to maintain stability.
- **New applications**: While electromagnetic suspension systems are primarily used for transportation, there are opportunities to expand its applications to other industries such as renewable energy and emergency power generation.
- **Integration with other technologies**: Electromagnetic suspension systems could be integrated with other technologies, such as batteries or solar panels, to create hybrid energy systems that offer even greater efficiency and reliability.
- **Sustainable transportation**: The growing focus on sustainability and reducing carbon emissions could drive increased adoption of electromagnetic suspension systems for transportation, particularly in urban areas where congestion and pollution are significant issues.

10 CONCLUSION:

Power generation from electromagnetic suspension systems offers several advantages, including being a renewable energy source, low maintenance, high efficiency, reduced environmental impact, noise reduction, and scalability. However, there are also potential disadvantages, such as high initial costs, limited efficiency, limited applicability, infrastructure requirements, and safety concerns.

Despite these challenges, the technology offers significant potential for a range of applications, including transportation, renewable energy, industrial power generation, emergency power generation, and space applications. Ongoing research and development aimed at improving efficiency, reducing costs, and expanding its applications are expected to lead to increased adoption of electromagnetic suspension systems in the future.

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