

Exploration and Research of Power Generation based on Pressure Power Generation

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Abstract

In recent years, the rapid development of the manufacturing industry has directly promoted the speed, quality and efficiency of my country's economic development. However, some problems have also followed. my country's power resources are short of resources. Faced with today's increasingly severe forms of energy, it is impossible to guarantee the sustainable development of our human society simply by saving electricity. In addition, the number of vehicles in my country has increased substantially in recent years, traffic jams, and frequent car accidents have become another difficult problem in my country's traffic problems. If we can make good use of this phenomenon to realize power reserve and turn this drawback into an advantage, it can be said to serve multiple purposes. It can not only turn traffic congestion into "treasure", but also create more power resources and alleviate the problems faced by our country. Resource shortage problem.

Keywords

Pressure Power Generation; Energy Conversion; Green Environmental Protection.

1. Introduction

In people's daily life, there are many environmentally friendly energy sources that are not fully utilized, such as the pressure energy generated by driving vehicles. These energy appear in various cities every day. Even if such a large amount of energy is generated, these energy are ignored by people. It has not been put to good use. At the end of 2020, the total mileage of national highways was 5,198,100 kilometers, an increase of 185,600 kilometers over the end of the previous year. The highway density is 54.15 kilometers/100 square kilometers, an increase of 1.94 kilometers/100 square kilometers. The average annual traffic volume of motor vehicles throughout the year was 14,935 vehicles per day. my country's annual transportation data is extremely large. If this phenomenon can be properly utilized to realize power reserve, the energy generated will be very huge. Vehicle power generation technology came into being.

2. Current road power generation technology

2.1 Solar power technology

At present, there are two power generation methods for solar power generation: one is to convert solar energy into heat, and then generate electricity in a conventional way, called solar thermal power generation; the other is to use photovoltaic devices to directly convert solar energy into electrical energy by using the principle of photovoltaics. For solar photovoltaic power generation. Solar thermal power generation technology refers to the use of large-scale arrays of parabolic or dish-shaped mirrors to collect solar thermal energy, provide steam through heat exchange devices, and combine the technology of traditional steam turbine generators to achieve the purpose of generating electricity [1].

The use of solar thermal power generation technology avoids the expensive silicon crystal photoelectric conversion process, which can greatly reduce the cost of solar power generation.

2.2 Piezo technology

Israel Innovatek has developed a road power generation technology. When cars or pedestrians pass by, the road surface will generate electricity under pressure, which can be used for lighting in homes or public facilities. The secret of the power generation road developed by the company lies in the use of piezoelectric crystals. Piezoelectric crystal has a characteristic. When it is squeezed or stretched, different electric charges will be generated at its two ends. A road made of this material can obtain energy from pressure changes when a vehicle passes by. According to estimates, a 4-lane road surface of less than one mile can generate 0.4 megawatts of electricity if the traffic flow is 1,000 vehicles per hour. In addition, they also designed a pavement power generation system for sidewalks. Pedestrians walking on the pavement paved with this material can generate 0.0002 joules of energy per step, which can be accumulated for street lighting. Previously, the company has conducted several trials at the Israel Institute of Technology. According to the test data, they have built a 10-meter-long two-lane power generation pavement, ready to conduct field tests on Israeli roads. In line with this kind of road surface, they have also developed a capacitive energy storage system, which can store the energy generated by the road in a capacitor, which can also be integrated into the power grid in the future.

Pakistani researchers have applied a road driving energy harvesting device that can power the road lighting system. The driving load is transmitted to the power generation impeller through the pressure bearing plate and the transfer rod, and the power generation impeller rotates and cuts the magnetic induction line to generate electricity. A company in the United States has developed an RPG power generation device that relies on the friction of a moving vehicle to drive the movable components of the RPG device to complete the conversion of mechanical energy to electrical energy [2].

2.3 Pavement technology for thermoelectric power generation

Thermoelectric material is a new type of material that uses thermoelectric effect to convert heat difference into electric energy, and has the effect of low carbon and environmental protection. After being irradiated by the harsh sun, the temperature of the asphalt concrete pavement can be 20 degrees Celsius higher than the temperature at that time, and the surface temperature of the asphalt pavement is 30 degrees Celsius higher than the lower surface temperature, or even more. The application of thermoelectric materials to the asphalt concrete pavement depends on the continuous temperature difference between the upper and lower road surface and the temperature difference between the road and the surrounding environment. The electric heating material inside the pavement uses the temperature difference to convert heat energy into electric energy, which can not only provide a large amount of electric energy but also improve the road surface. The high temperature stability.

Table 1. The characteristics and usage of different types of power generation pavements

Power generation pavement type	Is it put into use	Features
solar energy generation	Already in use	Advantages: low cost Disadvantages: limited by weather
Pressure generation	Not in use	Advantages: has great potential and can reduce traffic accidents
Thermoelectric power generation	Not in use	Advantages: improve the high temperature stability of the road Disadvantages: immature technology

3. The application prospects of vehicle power generation

The field of new energy has become the mainstream of energy strategies of all countries in the world. If the steam engine is the representative to promote the first industrial revolution, the application of electricity is the representative to promote the second industrial revolution, and the computer information technology is the representative to promote the third industrial revolution, then new

energy is the core. The industry is most likely to become the leading force in promoting the fourth industrial revolution, the main support for the next round of economic prosperity, and an important symbol for human society to accelerate into a new era of ecological civilization [3].

There are a lot of new energy production, because it is difficult to obtain or create energy while polluting our atmospheric environment, it cannot achieve the effect of environmental protection and pollution-free. The atmospheric environment is calling for help, and non-renewable energy is slowly depleting. These reasons make us have to pay attention to energy issues and environmental protection. And the generation of new energy cannot be based on the principle of destroying first and then governance, which is undoubtedly quenching thirst by drinking poison.

With the environmental protection and energy saving of new energy as the standard, a restriction condition is added to the generation of new energy, and the identification of new energy also has a clearer direction. As a new energy source, pressure power generation may not bring as much value to the society as wind energy, solar energy, water energy and other new energy sources. But it also has its own unique advantages, that is, the cost of its production is low, and it only needs a simple pressure power generation device to convert pressure energy into the energy we need. This kind of cost is small, and we can get what we want, so people will pay more and more attention. Traditional road design only pays attention to traffic congestion and safety issues. People are paying more and more attention to environmental protection. Environmental protection has become a concern of the people across the country. Now road design should consider more factors [4]. Vehicle power generation can be one of the factors that can be taken into consideration. The principle of vehicle power generation is to use pressure to generate electricity. Pressure generation can be applied to a large area. The pressure element will deform under the action of pressure. The piezoelectric effect causes electric charges to be generated up and down by the piezoelectric material to form an electric current.

In the future new energy trend, vehicle power generation, as a part of new energy sources, will surely bring more considerable value to the society.

4. Research value of vehicle power generation

4.1 Significance of research on vehicle power generation

Every scientific research has its research significance, and vehicle power generation also has its research significance. In the general environment of popular new energy, pressure power generation is gradually being recognized by people. One of the pressure power generation-vehicle power generation, people has also generated interest. The concept of pressure power generation is becoming more and more full. Some products produced by pressure to generate electricity have gradually made contributions to society. With the development of society, people's needs for society are gradually increasing, and their expectations for society are also getting higher and higher. I hope that every scientific research is both advanced and environmentally friendly. On the premise of protecting the environment, it brings people a great sense of experience.

The research on pressure power generation is the result of the continuous efforts of the predecessors to achieve today's achievements, so the vehicle power generation also has great research significance.

4.2 Research value of vehicle power generation

Nowadays, pressure power generation is well known, and vehicle power generation as a technology that also uses pressure power generation technology should also be studied in depth. Now that China has entered a rapidly developing country, vehicles have already entered the lives of the people. The families of ordinary people also own their own cars, and some families even own several cars. But with more and more vehicles, a series of problems such as traffic jams and frequent car accidents have appeared one after another. If you can use vehicle power to generate electricity on the highway, you can increase the power resources. The daily traffic flow in the city is extremely large, especially during the morning and evening peaks. This will greatly increase the city's power resources and alleviate the frequent occurrence of traffic accidents. Then install a pressure generating device on the

speed bump. Vehicle power generation has a wide range of applications, thus reflecting the importance of research value.

4.3 Innovations of vehicle power generation

Theoretical innovation. The project focuses on the current situation of my country's power resource shortage and frequent traffic accidents, and uses scientific and technological means to achieve road pressure power generation and increase the friction between wheels and the road surface to reduce the occurrence of traffic accidents. The road pressure power generation device is installed in the road turning or the road section prone to traffic accidents. When the vehicle passes through, it generates pressure on the ground. The internal device converts the pressure into electricity and stores it. At the same time, the device uses rubber material to make a blanket with a large friction coefficient. Appearance, so as to achieve vehicle deceleration and increase safety.

Practice innovation. The implementation of this project can not only arouse the general public's awareness of the shortage of power resources in our country, but also arouse the attention of the majority of college students to current affairs and hot topics, and use the advanced scientific knowledge to solve the problems facing our country. The more far-reaching significance lies in the use of the increasing number of vehicles in recent years to achieve pressure power generation, which not only effectively uses existing resources but also saves other resources, and conforms to the theme of green environmental protection.

5. Feasibility analysis of vehicle power generation

5.1 Technical aspects

Now that my country's science and technology are developing rapidly, it is not an unattainable goal to realize the vehicle power generation device in the city. However, there are still many problems to be solved for power generation from vehicles, such as low efficiency, power collection, material loss, and so on. This can be improved continuously through technological progress. And in terms of technology, it requires multiple attempts under the guidance of researchers before it can be put into use.

5.2 Energy

With the rapid development of industry, our demand for energy is also increasing. Under the current social background, non-renewable energy is becoming less and less. Researchers are increasingly committed to discovering more renewable energy. The general public also has great expectations for renewable energy and hopes that energy is environmentally friendly. Every emergence of a kind of green and environmentally friendly renewable energy will get the people's attention. Especially for electric energy, the energy that people can't live without, the public will definitely pay special attention to it.

5.3 The call of the government

Based on the operation of vehicle power generation within the city, it can also be open to all towns and rural areas. The government can first test and use it in a certain area, so that the people can understand the advantages of vehicle power generation and see the efficiency and convenience of vehicle power generation with their own eyes. Compared with the government's large amount of reference data and information, the public believes in what they see with their own eyes. See the effect. This can increase public acceptance.

6. Conclusion

In recent years, with the development of road engineering micro-energy collection technology, more types of advanced technologies have been applied to the road environment. The energy collection in the road engineering field mainly includes the conversion of light energy, wind energy, thermal energy and piezoelectric energy into electrical energy. The electric energy generated by vehicle power

generation can be used for the use of transportation facilities along the highway to ensure the normal operation of transportation facilities, and it can also effectively solve roads with poor power supply conditions. If this technology is used reasonably, not only can it solve the energy problem, but it will also bring immeasurable benefits to my country's economic and social development.

Acknowledgments

Shenyang Normal University's National Undergraduate Innovation and Entrepreneurship Program "Environmental Protection and Energy Saving: Research and Exploration of Vehicle Power Generation" (Project Number: x202010166076).

References

- [1] Dynasty Hui. A kind of asphalt concrete pavement structure for power generation: China, 201320050889. 5[P]. 2013-12-09.
- [2] Dynasty Hui. A kind of asphalt concrete pavement structure for power generation: China, 201320807329. X[P]. 2013-12-09.
- [3] Department of Comprehensive Planning, Ministry of Transport. Statistical Bulletin on the Development of the Transportation Industry in 2020 [EB/OL]. (2021-05-19) http://www.gov.cn/xinwen/2021-05/19/content_5608523.htm.
- [4] Qu Hongxue, Mei Zhangrong. On the position of pressure power generation in the trend of new energy[J]. Science and Technology Information, 2013(08): 5-6.