Research on liquid cooling technology in the field of electric bicycle charging

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Abstract. The electric vehicle industry is an industry with national characteristics advocating green environmental protection, close to China's livelihood and highly completely independent intellectual property rights. At present, electric bicycles are gradually becoming the most popular category in the market and consumers. The rapid development of electric vehicles can significantly reduce the use of fuel vehicle exhaust emissions, so as to effectively solve the long-term fuel emissions of motor vehicles and other vehicles on the source of environmental pollution. The common cause of electric vehicle fire accidents is the heat dissipation of charger. In order to improve the heat dissipation efficiency of wireless charging, combined with the disadvantages of traditional wireless charging devices, the application of liquid cooling technology in electric vehicle charging devices is studied.

1. Introduction

Electric vehicle products are one of the ten innovative scientific and technological products with Chinese industrial characteristics since China's reform, innovation and opening up. They belong to the industry with national characteristics advocating green environmental protection, being close to people's livelihood and having a highly completely independent intellectual property rights. Deadline to October 30, 2020 Statistics show that China's electric electric bicycle industry has a strong development momentum, and the output of the electric electric bicycle industry increased by more than 20% from the same period last year, and the profit increased by nearly 20% year on year, far surpassing the general expectations in the domestic market. In addition, the electric electric bicycle industry is the first in China's industry. The existing number of electric electric vehicles has rapidly increased from 250 million to nearly 300 million, with an annual output value of more than 100 billion yuan, setting it the "first in the world". In 2019 new electric vehicle national standards officially issued, the new automobile industry standard rules on electric bicycle sales market and manufacturers will have a big impact, but therefore, accelerate the automobile enterprises for electric bicycle research and development and design of production and operation, to promote the development of China's electric bicycle related industry and accelerate the transformation, at present, electric electric bicycle is gradually developing into the international market and the most popular tram category. The continuous development and rapid popularization of electric vehicles can significantly reduce the use of fuel exhaust, so as to effectively solve the serious pollution of electric vehicle fuel exhaust to the vehicle atmosphere at the source. It is a strong representative of Shandong's transformation of old growth drivers with new ones, with green, environmental protection, energy saving and consumption reduction[1]. The rapid development of the electric vehicle manufacturing industry has inevitably brought it new safety management problems, which is to reduce the fire accidents of electric vehicles. According to the latest statistics analysis of the fire management department existing data show that at
least 75% of the electric public bicycle fire accidents in the process of using battery charging, and the heat dissipation of the charger is the biggest problem, the use of liquid cooling technology to solve the charger cooling problem to reduce fire is the biggest hot spot of the project.

2. Electric vehicles

2.1. Early stage of development

The development history of electric vehicles was faster than our most common electric vehicles using internal combustion engines operating at high speed, and in 1828 the Hungarian inventor Anusey Jericknios first tested in his laboratory an electronic driven rotary shaft. Thomas Dabingport of the US first successfully built DC electric cars with a direct start by a DC motor engine in 1834. Thomas obtained the first invention patent of the American electric automobile industry in 1837. Between 1832 and 1838, Robert Anasson, Scotland successfully invented an electric carriage, an electric car driven without charging the original battery. In 1838, Robert Davidson applied an electric vehicle in a driving chariot, and was patented in the UK in 1840.

History of battery electric vehicles. The world's first electric car was born in 1881 and invented by French engineer Gustavtreff. This is a tricycle driven by a lead battery. In 1873, British Robert Davidson invented electric vehicles, which was internationally recognized. Since then, lead fuel cells, cadmium Ni hydride fuel cell, Ni hydrogen cell, lithium ion fuel cell and nickel hydrogen fuel cell as a variety of power cells.

2.2. The medium term of development

1860-1920: With the rapid development of power battery manufacturing technology, electric vehicles were widely used in the United and America in the second half of the 19th century. In 1859, the great French American physicist and photo-inventor Algarston co-invented the rechargeable lead-acid battery.

From the late 19th century to 1920, electric cars already had at least more competitive advantage than electric cars using the four-wheel drive of internal combustion engines. No smell, no vibration, no crawling to climb, low price, combined with large steam, electricity and large internal combustion engines to form three minutes to the world's four car markets.

1920-1990: With the rapid development of PetroChina and the continuous progress of automobile internal combustion engine technology, electric vehicles gradually lost their competitive advantage from the mid-1920, and the automobile electric market was gradually replaced by electric vehicles powered by internal combustion engine. Only a few big cities have trams and trolleybuses, in addition to many limited household electric vehicles (such as golf courses, forklifts, etc., which use lead-acid and ion battery sets).

The rapid development of electric vehicles has been stalled for nearly half a century. With the continuous global influx of oil resources into the car market, the real existence of diesel electric vehicles is almost completely forgotten. Compared to the relevant technologies needed to be used in powered electric vehicles, such as power motor drive, battery composites, power pool and battery pack, battery quality management, etc., may be illegal technology development or illegal applications.

1990: With reduced oil resources and increased air pollution. Until 1990, the use of electric vehicles was mostly private, such as the non-governmental academic society, founded in 1969, held professional electric vehicle seminars and exhibitions (EVS) annually in half of the world. Since the 1990 s, major intelligent car manufacturers have begun to pay great attention to the future market development, capital and related technologies of intelligent electric vehicles. In January 1990, at the Shanghai Auto Show in Los Angeles, the president of General Motors introduced a impact pure-powered electric vehicle to all the world guests. In 1992, Ford's Ecostar used calcium-sulfur batteries, and in 1996, Toyota used nickel-hydrogen batteries. rav4lev,1996's Renault, France, Toyota's Prius offline, 1997 as Nissan's first lithium-ion power battery dedicated electric vehicle praire joy ev, and as
the world's first lithium-ion power battery dedicated electric vehicle in 1997, Honda officially released the hybrid Insight in 1999.

3. Electric vehicle charging principle

At present, Chinese electric power frequency is divided into one active frequency and one no power power frequency. Chargers of freight electric tricycles generally use small power frequency AC transformer as a charger, large volume, heavy weight, large power consumption, but high charging reliability, cheap price. The power supply often used by electric three-wheeled bikes and electric motorcycles is what we call an energy efficient switch power supply or charger, energy efficient but prone to damage.

In the primary room of the frequency transformer is a tap, The AC current at 220V is controlled by the contact point of the electromagnetic relay. At the normally closed position, Is the constant-current charging position. The secondary output voltage is about 40V; When the relay sucks in. The contact is connected to the other tap, Is a trickle charging position, The secondary output voltage is about 40V; The power adapter is secondary by two windings, And two auxiliary windings, The AC voltage of about 14V is used after bridge rectification and filtering of co-cooling fan, Stabilized at the 12V supply relay drive circuit and the charging indication circuit; 12V stabilized to 6V for dual supply, Power the electric vehicles after rectification.

4. Liquid-cooled radiator

Typical water cooling circulation system generally requires the following parts: circulating water and refrigeration block, circulating liquid, pump, pipe, heating water tank or hot and cold exchanger, the water cold block is generally a metal block, around a waterway, made of copper or zinc aluminum alloy, they contact the pipe heating parts can absorb more than the external heat of the heat parts, the liquid in the circulation through the promotion of the water cooling pump into the pipeline if the circulating liquid system is water, it is usually called the water cooling circulation system. The low-cooled water-cooled heating liquid that absorbs all the low-temperature residual liquid heat attached to the heating part will circulate from one low-temperature heating water-cooled heating block attached to this heating part, and the new water-cooled liquid circulating through the water-cooled block will enable it to continue operating normally and absorb all the low-temperature remaining liquid heat attached to the heating part. The water pipe is directly connected with the water pump installed and water pipe connected with the refrigeration block and water tank. The main purpose of its liquid drainage flow action is to ensure that the liquid circulation liquid in a completely closed liquid drainage flow channel can prevent liquid leakage. To effectively avoid the overheating of the liquid inside and outside the box from affecting the normal heating operation and operation of the air cooling system, The main function is used to quickly transport large quantities of liquid during the circulation of the storage air heating system, Water tank sink in a heat switch is a heat dissipation device structured similar to a large liquid central radiator, Large amounts of liquid during circulation rapidly transfer heat inside and outside the box to the heat transfer system to a large liquid central radiator with a large area, A central cooling fan of the radiator is mainly designed to absorb a large amount of liquid tank heat that quickly flows into the entire heating cycle air cooling system cycle[2].

Figure 1. Schematic diagram of the liquid-cold block waterway
The principle of traditional air cooling, but the air cooling fan is a kind of gas heat from a water-cooled block to the water hot and heat exchange for distribution, not any metal or heat pipe blown in the water-cooled fan, but this part of the water hot and heat switch can be almost the perfect version of the current air cooling system radiator. Water cooling cooling system has two main characteristics, that is fast heat dissipation and low noise. Because cold water heat capacity is very large, it not only can not only directly absorb a lot of natural heat, keep the environmental temperature constant, in the water cooled heat exchange system it environmental temperature control of heating parts, suddenly stop operation will not directly cause system heating parts internal environmental temperature change, the overall surface of the heat exchanger heating area is very large, only a low speed fan can heat, the effect is very good. In addition, because the vibration noise of the hydraulic pump is generally not very obvious, the entire cooling system is much quieter than the air cooling system\[3\].

5. Advantages of liquid cooling cooling technology

5.1. Silence
Compared with the current cooling mode, the liquid cooling system uses coolant to circulate heat in the cooling pipe. The biggest advantage of liquid cooling is not increasing the internal temperature of the gas, absorption and heat transfer, fan-free cooling, vibration-free and super-silent state.

5.2. Rapid cooling
Liquid cooling has the characteristics of large heat capacity and slow temperature rise. When it suddenly has time, the parts suddenly do not heat, breaking through the upper temperature limit that the electronic parts can bear, and even playing a buffer effect\[4\].

When we analyze some advantages of water cooled heating cooling, assuming the cooling power density of 3443.04 joule occurs, if the cooling water through manual water cooling heating device is 100L/h, the water temperature is 0.3444℃ per hour, appropriate water is the key to reducing heat, and assuming the electronic part is about 40W, the 10 W submersible pump is used using the windless fan 15L, When the environment is at 25℃, the water temperature rises by 3℃ after 2 hours, forming an equilibrium state. The results showed that the water cooling mode can emit heat efficiently\[5\].

6. Conclusion
Electric vehicle chargers using liquid cooling insulation technology has a good development prospect. At present, in order to quickly occupy the market, the enterprise actively research and launch some low-priced electric vehicles, the safety of these low-priced electric vehicles is very low. Enterprises pay more attention to driving speed and beauty, and lack of safety protection performance consideration, in this case, the use of electric car charger caused by fire safety problem is more common, has become a hot issue of close attention to the current society.

The use of liquid high pressure cooling charging technology can effectively protect car chargers, forming a good market prospects, with certain social and economic benefits.

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