

Device for Simulating Thermal Characteristics of a Lithium-Ion Battery

Patent #9,622,294

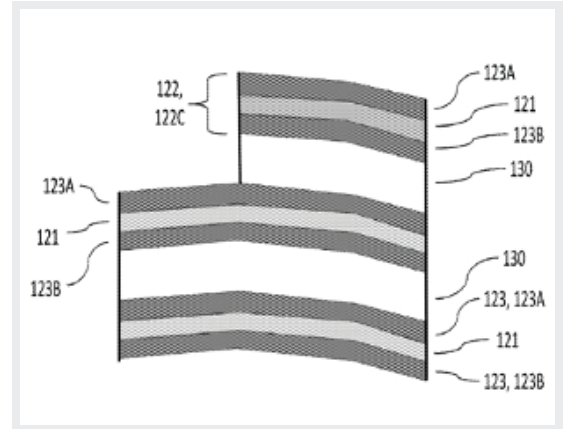
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Patent Overview

Device for Simulating Thermal Characteristics of a Lithium-Ion Battery – Patent # 9,622,294



Key Features

- The invention replaces a Lithium-ion battery with a device that replicates heat characterizing a Lithium-ion battery.
- The invention provides a way to conduct thermal management testing and alleviate the safety concerns associated with high operating temperatures of Lithium-ion batteries.
- The device includes a spiral-wound electrical resistance heater and simulates the heat generation profile within a Lithium-ion cell using the resistance heater.
- The present invention enables an inventive practitioner to account for the temperature-sensitive heat generation that occurs in Lithium-ion batteries.

Technical Information

- The resistance heater is tailored to mimic the located heating profile of the Lithium-ion cell, and to match thermal properties of the Lithium-ion cell.
- The device is constructed of inert materials and is safe to conduct thermal management testing.
- Comprised of a cylindrical heater and a substantially cylindrical casing.
 - The heater includes at least one strip and fits coaxially inside the casing.
 - Each strip is rolled up in a generally cylindrical form and includes an electrically conductive resistance-heating element that extends approximately the length of the strip.
- To mimic the non-uniform heat generation typical of a Lithium-ion battery, the invention's strip heater can be constructed with varying "finger-widths."
- Materials
 - Materials suitable for resistance heaters include, but are not limited to, Inconel and Nichrome.
 - Materials suitable for an insulative covering include, but are not limited to, Kapton.
- Once the heater has been manufactured, it is layered together with an electrically nonconductive separator material that

Potential Markets

This section provides insights into market size, trends, and barriers to entry for the commercial applications of the technology, as well as recommendations for deeper market research. Potential markets include Electric Motor Manufacturing, Power Generation, Battery Industry, and Electric Vehicles. The fastest growing market is the global Electric Vehicle market, with a Compound Annual Growth Rate (CAGR) of just over 18% until 2023.

Potential Markets

Market Insights

Electric Motor Manufacturing

All motors that relate to converting electrical energy to mechanical energy.

Market Size/Trends

- The global Electric Motor market was valued at US \$113 billion in 2021 and is projected to reach USD 181.9 billion by 2028 (a CAGR of 7.0% during the period).
- The global market exhibited a growth rate of -9.6% in 2020; the sudden, predicted rise in CAGR is attributed to the demand and growth returning to pre-pandemic levels.
- The increasing adoption of electrical devices and machines in the industrial and automobile sectors will promote market growth.
- Increasing adoption for HVAC applications will propel market growth through the demand and deployment of electric motors.

Barriers to Entry – High

- Electric motors entail high maintenance (and sometimes operating) costs

Power Generation

All forms of energy consumption related to generating electricity.

Market Size/Trends

- The global Power Generation market was estimated at \$1,800 billion in 2022 and is expected to reach \$3,900 billion by 2032 with a CAGR of 8% during the forecast period from 2023 to 2032.
- The demand for electricity is expected to increase along with household incomes, driven by an increased rate of electrification of transportation, heat, and surging demand for digitally connected devices and air conditioners.
- The Power Generation market has experienced great demand due to various factors, such as increasing population and rapid urbanization.

Barriers to Entry – High:

- Existing generation equipment and systems rely on aging infrastructure, which struggles to meet the growing demand for electricity.
- Declining investment in the power sector is the biggest challenge to market growth.

Potential Markets (cont.)

Potential Markets

Market Insights

Battery Industry

A source of electric power consisting of one or more electrochemical cells.

Market Size/Trends

- The global Battery market size was valued at \$104 billion in 2022 with an expected CAGR of 15.8% from 2023 to 2030.
- The high use of uninterruptible power supply (UPS) devices in the healthcare, chemical, and oil and gas sectors is expected to propel the growth of the battery market.
- Lithium-ion batteries are expected to capture a significant portion of the market due to favorable government policies and increasing electric vehicle and consumer electronics sales.
- There is a growing number of battery manufacturers in the US.

Barriers to Entry – High:

- Constraints exist on the ability to obtain lithium, nickel, and other materials needed to make batteries.

Electric Vehicles (EV)

Vehicle that can be powered by an electric motor that draws electricity from a battery

Market Size/Trends

- The global Electric Vehicle market was estimated to be \$163 billion in 2020, and is projected to reach \$823 billion by 2030 (a CAGR of 18.2% from 2021 to 2030).
- Electric vehicles convert more than 50% of the electrical energy from the grid to power at the wheels, whereas the gas-powered vehicles only
- The demand for fuel-efficient vehicles has increased recently due to rising fuel costs.
- EVs outperform conventional vehicles, providing higher fuel economy, low carbon emission and maintenance, the convenience of charging at home, enhanced ride comfort, high performance, and reduced engine noise.

Barriers to Entry – High:

- Lack of charging infrastructure, high manufacturing costs, and range anxiety and serviceability are the factors expected to hamper growth of the EV market.

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