Executive Summary

FUEL CELL COOLING and QUICK CHARGE BATTERY

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The thermal management of electrochemical cells, both in secondary (rechargeable) storage batteries and PEM (proton exchange membrane) fuel cells, is critical to good cell performance and longevity. Solid-state thermoelectric coolers are used here to remove the parasitic heat from inside the cell where the heat is produced. The one major drawback to all-electric vehicles is heat build-up in the batteries during usage and recharge; this cooling system will eliminate the problem, making it a major advance in transportation power systems to replace gasoline and diesel driven vehicles. The internal cooler improves the performance of PEM fuel cells by preventing the waste heat generated in the cell from drying out the membrane, eliminating the need for external humidification, improving cell efficiency and reducing system bulk.

The recharging time of all-electric vehicles can be reduced significantly, especially when continuous cooling is necessary for the battery or fuel cell; electric transportation will be a reality with this cooling system. By removing the detrimental heat internal to the battery during charging, vehicle downtime is reduced significantly, returning the vehicle to service more quickly, hence improving all-electric transportation.

The cooling (or heating, if necessary) of the fuel cell/battery takes place internally to the cell where the heat is generated (or the warming is needed), improving battery or fuel cell life and performance.

This technology is unique: only minimal geometry changes are required for today's batteries or fuel cells.

This internal cooling/heating system can be used with current gasoline and diesel powered vehicles as well as in future hybrid electric and all-electric battery and fuel cell powered vehicles. The battery life-cycle time is increased significantly with internal cooling for currently used automotive rechargeable batteries while the basic design is unchanged. This gives battery manufacturers greater life expectancy in warranty issues.

This cooling technique will improve fuel cell performance by reducing auxiliary equipment requirements, thereby reducing fuel stack volume and weight, and increase power output for a given standard fuel cell geometry.

Detailed parametric studies with prototype design and testing are required to determine individual component costs. Designs, bench scale models, and meaningful testing would require an estimated $225,000 to $275,000 to complete. Additional funds would be required for market research and to determine automobile manufacturers' requirements to implement the new cooling device.

The device has three issued US patents, Nos. 5,871,859, 6,057,050, 6,653,002, and Patent Pending, for the Quick Charge Battery with Thermal Management and Fuel Cell Cooling.

Will license/sell technology or sponsored support is requested to build a prototype thermoelectric cooler/heater in the separators of a secondary battery and/or PEM fuel cells.

[3 References]