

High-Efficiency Step-Up Converter for EV Charging

Technology Domain: Automobile

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Status (Patent/TRL): Granted Patent / TRL 4

Technology Summary:

This invention presents a novel fuel cell-powered high voltage charging circuit for electric vehicles, designed to overcome the limitations of conventional charging systems. The key technical solution integrates a current-fed primary side inverter, an optimized transformer with a low turns ratio (1:4), and a unique multistage voltage multiplier.

The key inventive feature lies in the voltage multiplier's use of optimal, dissimilar capacitance values in each stage, which are progressively reduced, ensuring efficient voltage multiplication while mitigating issues like high inrush currents and instability. Additionally, the current-fed inverter topology effectively suppresses input current ripples and reverse flow, and a snubber-less soft switching technique minimizes losses.

As a result, the circuit efficiently steps up low fuel cell voltages (24-41V) to the high levels required by modern EVs (800V) with a remarkable 93.2% efficiency, significantly reducing the charger's size and weight. This system is highly useful for sustainable EV charging infrastructure, enabling cleaner transportation by reducing reliance on grid-generated electricity.

