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Ultrafast contactless charging of electrical vehicles

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In the last decade, wireless transfer of energy using resonant inductive systems has found many applications, from contactless charging of cell phones and medical implants to recharging electric ferries and boats. For the next decade, the most promising area for this technology is estimated to be charging batteries of electric cars and buses. Currently this charging operation is made by galvanic contact using cables that need to be connected to charging poles distributed in cities that have adopted this system. The charging is still slow (a few hours) and impractical. Yet, soon drivers are going to demand very fast (a few minutes) charging, without leaving the vehicle and effective even in heavy rain and storms. In this talk, a resonant inductive device and system based in a split-core medium frequency transformer is proposed which can fulfill these demands. For the core, a soft magnetic material is used with the following main characteristics: high saturation point (Bsat > ca. 1.2 T), high relative permeability (μr > ca. 10,000) and high electrical resistance at operation frequencies, and thus low losses (< ca. 10 W/kg). Examples of suitable materials are soft-magnetic ferrites, amorphous or nanocrystalline steel, or FINEMET™, specially treated to avoid brittleness if necessary. The operation frequency is between 10 kHz and 100 kHz (preferable of 20 kHz and 85 kHz, which are the frequencies suggested in present wireless power transfer standards). The coils are made of Litz wire windings, to minimize skin and proximity effect losses at high frequencies. The presented solution is also applicable to futuristic autonomous vehicle charging, where no human intervention is required.

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