



- (51) **International Patent Classification:**
H02J 7/00 (2006.01) *B60L 11/18* (2006.01)
- (21) **International Application Number:**
PCT/KR2012/001369
- (22) **International Filing Date:**
23 February 2012 (23.02.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
10-2011-0015806
23 February 2011 (23.02.2011) KR
- (71) **Applicant (for all designated States except US):** SK IN-
NOVATION CO., LTD. [KR/KR]; 99, Seorin-dong,
Jongno-gu, Seoul 110-110 (KR).
- (72) **Inventor; and**
- (75) **Inventor/Applicant (for US only):** LIM, Jae Hwan
[KR/KR]; #405-1304, Daedeok Techno Valley 4 Danji,
666 Gwanpyeong-dong, Yuseong-gu, Daejeon 305-509
(KR).
- (74) **Agents:** KWON, Oh-Sig et al.; 4F Joeeun Leaderstel, 921
Dunsan-dong, Seo-gu, Daejeon 302-120 (KR).

(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

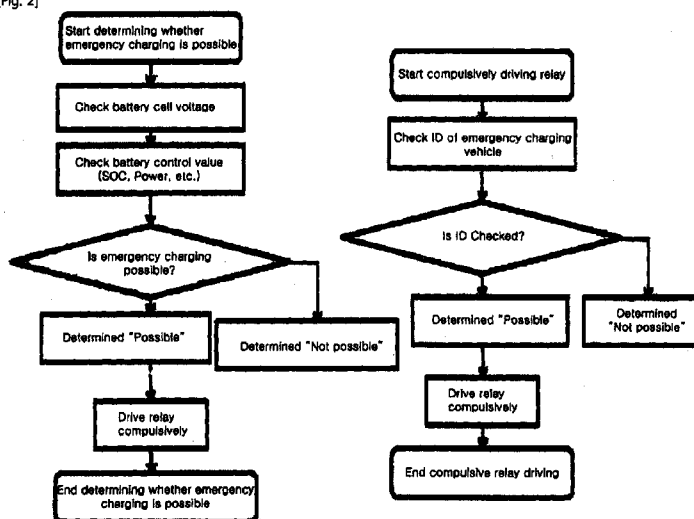
(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) **Title:** BATTERY CHARGING METHOD OF OVER DISCHARGED ELECTRIC VEHICLE BY EMERGENCY CHARGING VEHICLE

[Fig. 2]



(57) **Abstract:** Provided is a method for charging a battery of an overdischarged electric vehicle by an emergency charging vehicle, including: connecting a connector of the emergency charging vehicle to the battery controller of the electric vehicle; receiving power in the battery controller of the emergency charging vehicle; processing a battery diagnosis logic for checking a state of a battery system in the battery controller and determining based on a diagnosis result whether it is possible to charge the battery; processing release of the battery diagnosis logic in the battery controller; and when the determination result shows that it is possible to charge the battery, performing charging by closing a relay disposed between the battery system and the electric vehicle in the battery controller.

Description

Title of Invention: BATTERY CHARGING METHOD OF OVER DISCHARGED ELECTRIC VEHICLE BY EMERGENCY CHARGING VEHICLE

Technical Field

- [1] The present invention relates to a battery charging method of an overdischarged electric vehicle by an emergency charging vehicle, and more particularly, to a method for emergently charging a battery by an emergency charging vehicle when the emergency charging vehicle moves out in an emergency state that the charging level of the battery is low in the electric vehicle.

Background Art

- [2] A vehicle employing an internal combustion engine that uses gasoline and heavy oil as a main fuel causes too much pollution including air pollution. Recently, a lot of efforts have been put into developing an electric car or a hybrid electric vehicle (HEV) in order to reduce environmental pollution.
- [3] A high power secondary battery using non-aqueous liquid electrolyte of high energy consumption density has been recently developed. A plurality of high power secondary batteries are connected in serial to form a high-capacity secondary battery to be used in a device requiring high power for driving a motor such as the electric car.
- [4] As described above, one high-capacity secondary battery, which is hereinafter called "battery", is generally formed of many batteries connected in serial. In case of the battery, particularly, the battery for HEV, it is required to be managed to maintain a proper operation state by controlling charging and discharging since several or tens of batteries alternatively perform charging and discharging
- [5] Accordingly, a Battery Management System (BMS) manages a general status of the batteries. The BMS estimates State of Charge (SOC) through an operation by detecting voltage, current, and temperature of the batteries, and controls the SOC of the battery such that a vehicle has the best fuel efficiency. The charging and discharging battery needs to be accurately measured to precisely control the SOC.
- [6] Performance and technology for the battery are being improved so quickly. However, a high-performance battery for mounting the electric vehicle is too expensive and has a shorter mileage in one time charging than a gasoline vehicle. Also, when the electric vehicle is bought, there are some problems of establishing charging infrastructure such as securing of a charging station, reducing of a charging time, and securing of in-expensive power.
- [7] There is little infrastructure for commercializing an electric vehicle such as de-

velopment of software for operating a charging network, a charging device and a charging station for charging electricity. In addition, demonstration studies are not progressed much. The charging station for charging electricity requires a solution that charges power and checks a charging state and a deterioration level of performance of the battery mounted on the vehicle in real time to transfer the check information to a vehicle owner and a battery service provider.

Disclosure of Invention

Technical Problem

- [8] The present invention is invented to improve the prior arts described above and an embodiment of the present invention is to provide a method for emergently charging a battery by an emergency charging vehicle when the emergency charging vehicle moves out in an emergency state that the charging level of the battery is low in the electric vehicle.

Solution to Problem

- [9] In order to achieve the object and solve the problem of the prior art, provided is a method for charging a battery of an overdischarged electric vehicle by an emergency charging vehicle, including: connecting a connector of the emergency charging vehicle to the battery controller of the electric vehicle; receiving power in the battery controller of the emergency charging vehicle; processing a battery diagnosis logic for checking a state of a battery system in the battery controller and determining based on a diagnosis result whether it is possible to charge the battery; processing release of the battery diagnosis logic in the battery controller; and when the determination result shows that it is possible to charge the battery, performing charging by closing a relay disposed between the battery system and the electric vehicle in the battery controller.
- [10] When State of Charge (SOC) of the battery is a value less than a value that the electric vehicle is operated, e.g., an overdischarged state of SOC 5% or less, the relay is compulsively opened in order to protect the battery system according to compulsive driving of the electric vehicle.
- [11] The connecting of a connector of the emergency charging vehicle to the battery controller, includes: allocating identifiable bits to a charger protocol shared between the emergency charging vehicle and the electric vehicle; and when the bits are transferred to the battery controller, recognizing access of emergency charging vehicle in the battery controller.
- [12] The performing of charging by closing a relay disposed between the battery system and the electric vehicle in the battery controller, includes: determining a target amount of charging of the battery and performing charging based on the target amount of charging; when a temporarily released battery diagnosis logic is recovered, checking a

state of the battery system by the battery diagnosis logic in the battery controller ; and when the check result shows that there is a problem in the battery system, opening the relay to stop charging.

- [13] When the check result shows that there is no problem in the battery system, completing charging as much as the target amount of charging and setting up the target amount of charging as a value, which is the same as or more than a SOC value in the overdischarged electric vehicle.

Advantageous Effects of Invention

- [14] According to a battery charging method of an overdischarged electric vehicle by an emergency charging vehicle in accordance with an embodiment, there is an advantageous effect that technology on a method for emergently charging a battery by an emergency charging vehicle when the emergency charging vehicle moves out in an emergency state that the charging level of the battery is low in the electric vehicle is provided.

Brief Description of Drawings

- [15] The above and other objects, features and advantages of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:
- [16] FIG. 1 is a block diagram showing a battery charging method of an overdischarged electric vehicle by an emergency charging vehicle according to an exemplary embodiment.
- [17] FIG. 2 is a flowchart describing a mode flow before process of charging according to an exemplary embodiment.
- [18] FIG. 3 is a flowchart describing process and completion modes of charging according to an exemplary embodiment.
- [19] [Detailed Description of Main Elements]
- [20] 10: battery
- [21] 20: battery system
- [22] 30: battery controller
- [23] 40: vehicle controller
- [24] 50: relay
- [25] 60: charger (inlet)

Best Mode for Carrying out the Invention

- [26] The present invention may be diversely modified and have a plurality of exemplary embodiments. Accordingly, specific exemplary embodiments will be exemplified on accompanying drawings and described in detail. However, it will be apparent that the present invention is not limited to the above exemplary embodiments. It will be un-

derstood that modifications, equivalents and substitutions for components of the specifically described embodiments of the present invention may be made by those skilled in the art without departing from the spirit and scope of the present invention.

[27] When it is mentioned that any constituent element "is connected to" or "is in contact with another" constituent element, the former may be directly connected to or in contact with the latter. Otherwise, it will be understood that any other constituent elements may exist between the former and the latter.

[28] On the other hand, when it is mentioned that any constituent element "is directly connected to" or "is directly in contact with" another constituent element, it will be understood that there is no constituent element between the former and the latter.

[29] The terms used in this specification is provided to describe the specific exemplary embodiments but they are not provided to limit the scope of the present invention. A singular number includes a plural number unless a concise and apparent meaning is given to the expression.

[30] In this application, it will be understood that the terms "include" or "have" indicate that features, numerals, processes, operations, constituent elements, components or combinations thereof described in the specification exist but does not exclude existing of other features, numerals, processes, operations, constituent elements, components or combinations thereof or additional possibilities.

[31] Unless otherwise defined, all terms including technical or scientific terms used herein have the same meaning as those generally understood by those skilled in the art of the present invention. It will be also understood that such terms that are generally used and defined in the dictionary have contextually identical meaning with the words of related technologies. Unless clearly defined in this application, they will not be understood as ideological or overly formal meanings.

[32] The exemplary embodiments of the present invention will be described in detail with reference to accompanying drawings.

[33] FIG. 1 is a block diagram showing a battery charging method of an overdischarged electric vehicle by an emergency charging vehicle according to an exemplary embodiment.

[34] FIG. 2 is a flowchart describing a mode flow before process of charging according to an exemplary embodiment.

[35] FIG. 3 is a flowchart describing process and completion modes of charging according to an exemplary embodiment.

[36] When State of Charge (SOC) of a battery 10 is a value less than a value that an electric vehicle is operated, e.g., an overdischarged state of SOC 5% or less, a battery controller 30 inside a battery system 20 sets up an output of the battery 10 as "0" and transfers the output to a vehicle controller 40.

- [37] Meanwhile, the battery controller 30 compulsively opens a relay 50, which is an electronic component of the battery system 20, in order to protect the battery system 20 according to compulsive driving of the electric vehicle.
- [38] When the electric vehicle is overdischarged, connection between a cable connector of the emergency charging vehicle and an inlet 60, i.e., a charger 60 of the electric vehicle is tried. When connected, the battery controller 30 receives power according to a controller power signal from the emergency charging vehicle.
- [39] Accordingly, the battery controller 30 checks the state of the battery system 20 based on temperature, current and cell voltage of the battery 10. The battery controller 30 determines based on the check result whether the battery 10 can be charged or not. At the same time, the battery controller 30 releases a battery diagnosis logic as described above.
- [40] When there is no problem in the battery system 20 in the check result, the battery controller 30 grasps that the battery 10 can be charged. When it is grasped that the battery 10 can be charged, the battery controller 30 performs charging by compulsively closing the relay 50, which is disposed between the battery system 20 and the electric vehicle.
- [41] In this case, the battery controller 30 tries to recognize identification (ID) of the emergency charging vehicle. That is, identifiable bits are allocated to a protocol of the charger 60 shared between the emergency charging vehicle and the electric vehicle. When bits are transferred to the battery controller 30, the battery controller 30 recognizes access of the emergency charging vehicle.
- [42] In short, when the battery controller 30 identifies the emergency charging vehicle, the state of the battery 10 is grasped and the relay 50 was compulsively closed. Accordingly, the electric vehicle enters a charging mode.
- [43] Until now, the mode flow before process of charging shown in FIG. 2 is described.
- [44] Hereinafter, the process and completion modes of charging will be described. A target amount of charging of the battery 10 is determined by setting of the user and charging is performed based on the target amount of charging. While the charging is performed, the temporarily released battery diagnosis logic is recovered.
- [45] When the diagnosis result shows that there is a problem of the battery system 20, the battery controller 30 stops charging. That is, the battery controller 30 opens the relay 50.
- [46] However, when the diagnosis result shows that there is no problem of the battery system 20, the battery controller 30 performs charging as much as the target amount of charging.
- [47] The target amount of charging may be set up as a value, which is the same as or higher than SOC in the overdischarged electric vehicle, e.g., SOC 5% or more.

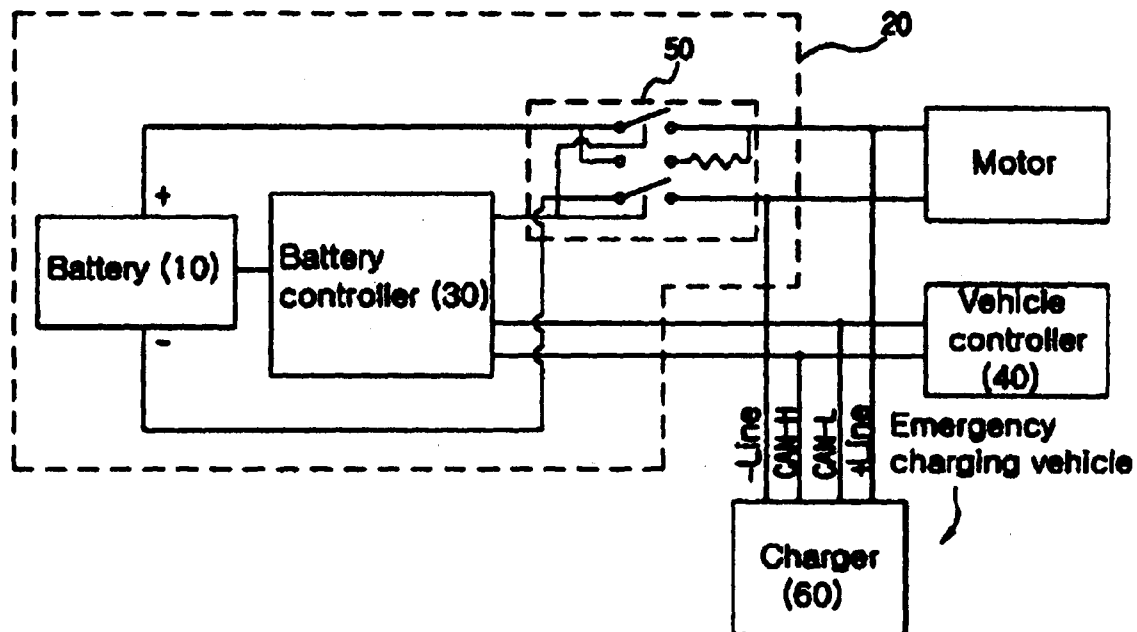
Claims

- [Claim 1] A method for charging a battery of an overdischarged electric vehicle by an emergency charging vehicle, comprising:
connecting a connector of the emergency charging vehicle to the battery controller of the electric vehicle;
receiving power in the battery controller of the emergency charging vehicle;
processing a battery diagnosis logic for checking a state of a battery system in the battery controller and determining based on a diagnosis result whether it is possible to charge the battery;
processing release of the battery diagnosis logic in the battery controller; and
when the determination result shows that it is possible to charge the battery, performing charging by closing a relay disposed between the battery system and the electric vehicle in the battery controller.
- [Claim 2] The method of claim 1, wherein when State of Charge (SOC) of the battery is a value less than a value that the electric vehicle is operated, e.g., an overdischarged state of SOC 5% or less, the relay is compulsively opened in order to protect the battery system according to compulsive driving of the electric vehicle.
- [Claim 3] The method of claim 1, wherein the connecting of a connector of the emergency charging vehicle to the battery controller, comprises:
allocating identifiable bits to a charger protocol shared between the emergency charging vehicle and the electric vehicle; and
when the bits are transferred to the battery controller, recognizing access of emergency charging vehicle in the battery controller.
- [Claim 4] The method of claim 1, wherein the performing of charging by closing a relay disposed between the battery system and the electric vehicle in the battery controller, comprises:
determining a target amount of charging of the battery and performing charging based on the target amount of charging;
when a temporarily released battery diagnosis logic is recovered, checking a state of the battery system by the battery diagnosis logic in the battery controller ; and
when the check result shows that there is a problem in the battery system, opening the relay to stop charging.
- [Claim 5] The method of claim 4, wherein when the check result shows that there

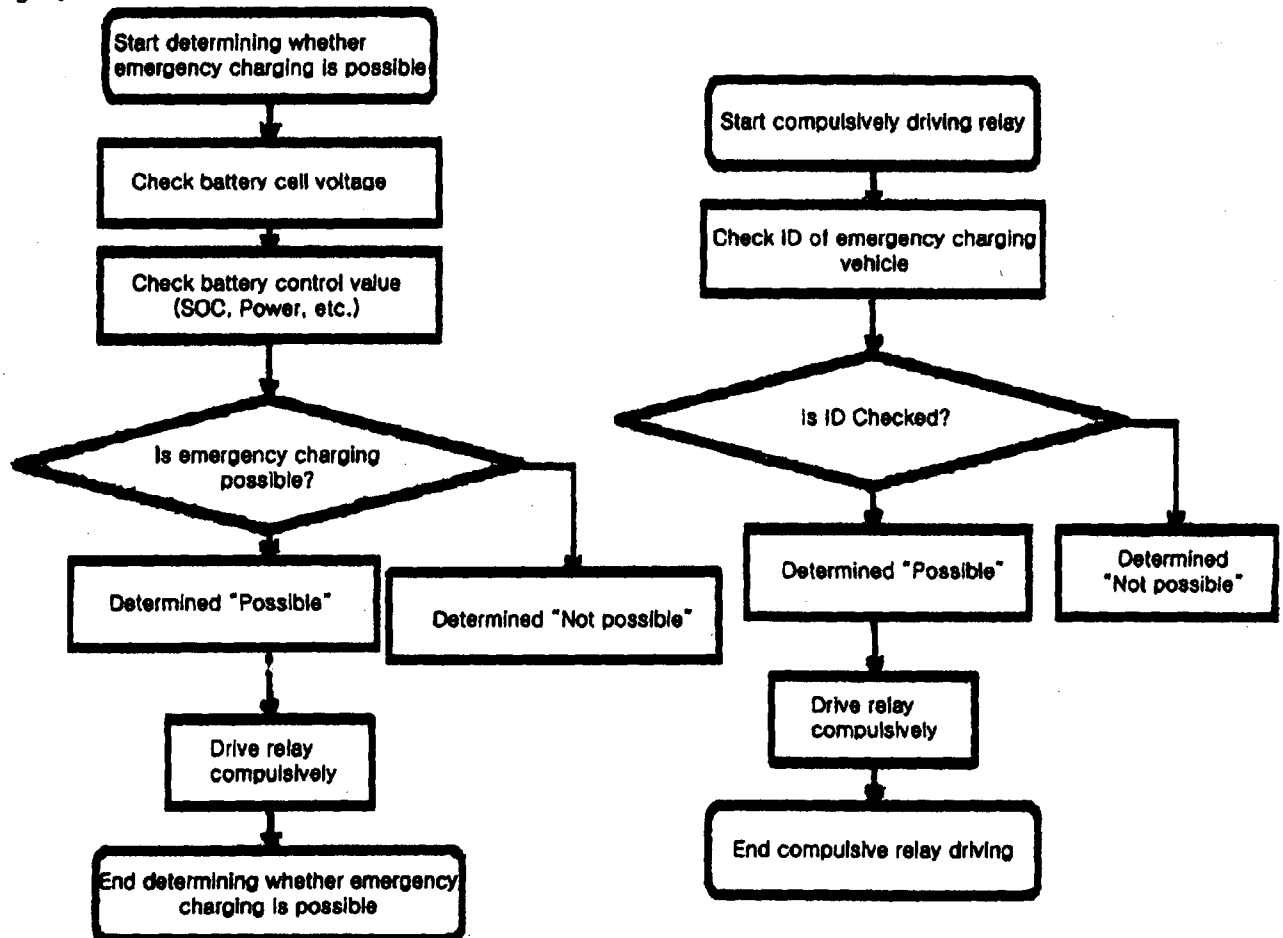
is no problem in the battery system, completing charging as much as the target amount of charging and setting up the target amount of charging as a value, which is the same as or more than a SOC value in the overdischarged electric vehicle.

1/2

[Fig. 1]



[Fig. 2]



[Fig. 3]

