

## DESCRIPTION

### TITLE:

## WIRELESS POWER SUPPLY SYSTEM AND OPERATING METHOD FOR WIRELESS POWER SUPPLY SYSTEM

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## BACKGROUND

### Technical Field

[0001] The disclosure relates to a power supply system and an operating method for a power supply system, and in particular to a wireless power supply system and an operating  
10 method for a wireless power supply system.

### Description of Related Art

[0002] FIG. 1 is a schematic diagram of a current wireless power supply system. The wireless power supply system 10 includes multiple charging devices 11\_1 to 11\_n and multiple electric auxiliary vehicles 12\_1 to 12\_n. Each of the electric auxiliary vehicles  
15 12\_1 to 12\_n may be an electric auxiliary transport vehicle. The electric auxiliary vehicles 12\_1 to 12\_n are, for example, electric auxiliary wheelchairs, electric auxiliary bicycles, electric auxiliary scooters, or electric motorcycles respectively. The wireless power supply system 10 utilizes the charging devices 11\_1 to 11\_n in a one-to-one manner to wirelessly charge the electric auxiliary vehicles 12\_1 to 12\_n. For example, the charging  
20 device 11\_1 utilizes power from a grid 13 to wirelessly charge the electric auxiliary vehicle 12\_1, and the charging device 11\_2 utilizes power from the grid 13 to wirelessly charge the electric auxiliary vehicle 12\_2, and so on.

[0003] It should be noted that, in order to supply power to the electric auxiliary vehicles 12\_1 to 12\_n, the charging devices 11\_1 to 11\_n must be disposed in the wireless power

supply system 10. Thus, the construction of the wireless power supply system 10 costs more. Therefore, how to provide a wireless power supply system with a lower cost in terms of system construction is one of the focuses of research for those skilled in the art.

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## SUMMARY

**[0004]** Disclosed are a wireless power supply system with a lower cost in terms of system construction and an operating method for a wireless power supply system.

**[0005]** A wireless power supply system of the disclosure includes a charging device and a plurality of electric auxiliary vehicles. The charging device includes a device converter  
10 and a device induction coil. The device induction coil is electrically connected to the device converter. A first electric auxiliary vehicle among the electric auxiliary vehicles provides a wireless vehicle power to the device induction coil in a first operating mode. The charging device provides the wireless vehicle power to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle in the first operating mode.

**[0006]** An operating method of the disclosure is applicable to a wireless power supply  
15 system. The wireless power supply system includes a charging device and a plurality of electric auxiliary vehicles. The charging device includes a device converter and a device induction coil. The operating method includes the following steps. A wireless vehicle power is provided, by a first electric auxiliary vehicle among the electric auxiliary vehicles,  
20 to the device induction coil in a first operating mode. The wireless vehicle power is provided, by the charging device, to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle in the first operating mode.

**[0007]** Based on the above, the wireless power supply system includes a single charging device. This way, the construction of the wireless power supply system costs less. In

addition, in the first operating mode, the first electric auxiliary vehicle provides the wireless vehicle power to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle. This way, the wireless power supply system provides an innovative method for wireless power supply.

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### **BRIEF DESCRIPTION OF THE DRAWINGS**

**[0008]** FIG. 1 is a schematic diagram of a current wireless power supply system.

**[0009]** FIG. 2 is a schematic diagram of a wireless power supply system illustrated according to an embodiment of the disclosure.

10 **[0010]** FIG. 3 is a flowchart of an operating method illustrated according to an embodiment of the disclosure.

**[0011]** FIG. 4 is a circuit schematic diagram of a wireless power supply system illustrated according to an embodiment of the disclosure.

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### **DESCRIPTION OF THE EMBODIMENTS**

**[0012]** Some embodiments of the disclosure will be described in detail below with reference to the drawings. For the reference numerals cited in the following description, when the same reference numerals appear in different drawings, the reference numerals will be regarded as referring to the same or similar elements. The embodiments are only a part  
20 of the disclosure and do not disclose all possible implementations of the disclosure. More specifically, the embodiments are merely examples in the claims of the disclosure.

**[0013]** Please refer to FIG. 2, which is a schematic diagram of a wireless power supply system illustrated according to an embodiment of the disclosure. In this embodiment, a wireless power supply system 100 includes a charging device 110 and electric auxiliary

vehicles 120\_1 to 120\_n. The wireless power supply system 100 wirelessly supplies power to at least one of the electric auxiliary vehicles 120\_1 to 120\_n. In this embodiment, the charging device 110 includes a device converter 111 and a device induction coil 112. The device induction coil 112 is electrically connected to the device converter 111.

5   **[0014]** In this embodiment, each of the electric auxiliary vehicles 120\_1 to 120\_n may be an electric auxiliary transport vehicle. The electric auxiliary vehicles 120\_1 to 120\_n are, for example, electric auxiliary wheelchairs, electric auxiliary bicycles, electric auxiliary scooters, or electric motorcycles respectively, but the disclosure is not limited thereto. In this embodiment, the wireless power supply system 100 provides different wireless power  
10 supply operations in different operating modes. For example, in a first operating mode, the electric auxiliary vehicle 120\_1 provides a wireless vehicle power PC1 to the device induction coil 112. The charging device 110 provides the wireless vehicle power PC1 to at least one of the electric auxiliary vehicles 120\_2 to 120\_n in the first operating mode.

**[0015]** It is worth mentioning that, in the first operating mode, the electric auxiliary  
15 vehicle 120\_1 provides the wireless vehicle power PC1 to at least one of the electric auxiliary vehicles 120\_2 to 120\_n through the device induction coil 112. This way, the wireless power supply system 100 provides an innovative method for wireless power supply. In addition, the wireless power supply system 100 includes a single charging device 110. This way, the construction of the wireless power supply system 100 costs less.

20   **[0016]** In this embodiment, the electric auxiliary vehicle 120\_1 includes a battery 121\_1, a vehicle induction coil 122\_1, and a vehicle converter 123\_1. The battery 121\_1 stores a battery power PB1. The vehicle converter 123\_1 is electrically connected to the battery 121\_1 and the vehicle induction coil 122\_1. The electric auxiliary vehicle 120\_2 includes a battery 121\_2, a vehicle induction coil 122\_2, and a vehicle converter 123\_2. The

battery 121\_2 stores a battery power PB2. The vehicle converter 123\_2 is electrically connected to the battery 121\_2 and the vehicle induction coil 122\_2.

**[0017]** In the first operating mode, the vehicle converter 123\_1 converts the battery power PB1 to the wireless vehicle power PC1 and provides the wireless vehicle power PC1 to the vehicle induction coil 122\_1. The vehicle induction coil 122\_1 provides the wireless vehicle power PC1 to the device induction coil 112. In the first operating mode, the vehicle induction coil 122\_2 receives the wireless vehicle power PC1 from the device induction coil 112. The vehicle converter 123\_2 converts the wireless vehicle power PC1 to the battery power PB2 and stores the battery power PB2 in the battery 121\_2.

**[0018]** Please refer to FIGs. 2 and 3 at the same time. FIG. 3 is a flowchart of an operating method illustrated according to an embodiment of the disclosure. In this embodiment, an operating method S100 is applicable to the wireless power supply system 100. The operating method S100 shows the operations in the first operating mode. The operating method S100 includes Steps S110 and S120. In Step S110, the electric auxiliary vehicle 120\_1 provides the wireless vehicle power PC1 to the device induction coil 112. In Step S120, the charging device 110 provides the wireless vehicle power PC1 to at least one of the electric auxiliary vehicles 120\_2 to 120\_n. The specific implementation methods of Steps S110 and S120 have been clearly described in the embodiment of FIG. 2 and will not be repeated here.

**[0019]** Referring back to the embodiment of FIG. 2, in a second operating mode, the electric auxiliary vehicle 120\_1 may provide the wireless vehicle power PC1 to at least one of the electric auxiliary vehicles 120\_2 to 120\_n without the device induction coil 112.

**[0020]** For example, in the second operating mode, the vehicle converter 123\_1 of the electric auxiliary vehicle 120\_1 converts the battery power PB1 to the wireless vehicle

power PC1 and provides the wireless vehicle power PC1 to the vehicle induction coil 122\_1.

In the second operating mode, the vehicle induction coil 122\_2 of the electric auxiliary vehicle 120\_2 receives the wireless vehicle power PC1 from the vehicle induction coil 122\_1. The vehicle converter 123\_2 converts the wireless vehicle power PC1 to the battery power PB2 and stores the battery power PB2 in the battery 121\_2.

**[0021]** Taking the electric auxiliary vehicles 120\_1 and 120\_2 as examples, the electric auxiliary vehicles 120\_1 and 120\_2 may operate in correspondence with the first operating mode in a wireless charging field of the charging device 110. The electric auxiliary vehicles 120\_1 and 120\_2 may operate in correspondence with the second operating mode outside the wireless charging field of the charging device 110.

**[0022]** In a third operating mode, the charging device 110 wirelessly supplies power to the electric auxiliary vehicles 120\_1 to 120\_n.

**[0023]** For example, in the third operating mode, the device converter 111 converts a device power PN to wireless device powers PN1 to PNn, and provides the wireless device powers PN1 to PNn to the device induction coil 112. The device induction coil 112 transmits the wireless device powers PN1 to PNn. The vehicle induction coil 122\_1 receives the wireless device power PN1. In the third operating mode, the vehicle converter 123\_1 converts the wireless device power PN1 to the battery power PB1 and stores the battery power PB1 in the battery 121\_1. The vehicle induction coil 122\_2 receives the wireless device power PN2. The vehicle converter 123\_2 converts the wireless device power PN2 to the battery power PB2 and stores the battery power PB2 in the battery 121\_2.

**[0024]** For example, the vehicle converter 123\_1 operates based on an operating frequency F1. The vehicle converter 123\_2 operates based on an operating frequency F2. The operating frequency F1 is different from the operating frequency F2. The device

converter 111 operates based on the operating frequency F1 during a first period and operates based on the operating frequency F2 during a second period. The first period and the second period may alternate with each other. It is worth mentioning that, during the first period, the charging device 110 may transmit the wireless device power PN1 based on  
5 the operating frequency F1 and use the wireless device power PN1 to charge the battery 121\_1 of the electric auxiliary vehicle 120\_1. During the second period, the charging device 110 may transmit the wireless device power PN2 based on the operating frequency F2 and use the wireless device power PN2 to charge the battery 121\_2 of the electric auxiliary vehicle 120\_2. Thus, the charging device 110 may selectively supply power to  
10 the electric auxiliary vehicles 120\_1 and 120\_2 in a time-sharing manner.

**[0025]** In some embodiments, the operating frequency F1 is the same as the operating frequency F2. Thus, the charging device 110 may supply power to the electric auxiliary vehicles 120\_1 and 120\_2 at the same time.

**[0026]** In some embodiments, charging voltages required to charge the batteries 121\_1  
15 and 121\_2 may be different from the wireless device powers PN1 and PN2 and the device power PN. Thus, the electric auxiliary vehicle 120\_1 may use a voltage regulation circuit to adjust a voltage value of the battery power PB1. The electric auxiliary vehicle 120\_2 may use a voltage regulation circuit to adjust a voltage value of the battery power PB2. The charging device 110 may use a voltage regulation circuit to adjust a voltage value of  
20 the device power PN.

**[0027]** In this embodiment, the charging device 110 calculates a common-mode operating frequency of the operating frequencies F1 and F2. The device converter 111 operates based on the common-mode operating frequency to generate the wireless device powers PN1 and PN2. Thus, the charging device 110 may supply power to the electric auxiliary

vehicles 120\_1 and 120\_2 at the same time.

**[0028]** In a fourth operating mode, at least one of the electric auxiliary vehicles 120\_1 to 120\_n may wirelessly supply power to the charging device 110.

**[0029]** Taking the electric auxiliary vehicle 120\_1 for example, in the fourth operating mode, the vehicle converter 123\_1 converts the battery power PB1 to the wireless vehicle power PC1 and provides the wireless vehicle power PC1 to the vehicle induction coil 122\_1. The device induction coil 112 receives the wireless vehicle power PC1. In the fourth operating mode, the device converter 111 converts the wireless vehicle power PC1 to the device power PN and provides the device power PN to a grid ENT.

**[0030]** Please refer to FIG. 4, which is a circuit schematic diagram of a wireless power supply system illustrated according to an embodiment of the disclosure. In this embodiment, a wireless power supply system 200 includes a charging device 210 and electric auxiliary vehicles 220\_1 and 220\_2. The wireless power supply system 200 may be used for the power supply operations in the first operating mode, the second operating mode, the third operating mode, and the fourth operating mode as mentioned in FIG. 2. The power supply operations in the first operating mode, the second operating mode, the third operating mode, and the fourth operating mode have been clearly described in the embodiment of FIG. 2 and will not be repeated here.

**[0031]** In this embodiment, the charging device 210 includes a device converter 211, a device induction coil 212, and a controller 213. The device converter 211 includes a full-bridge device conversion circuit 2111, a device resonance circuit 2112, and a device switch 2113. The device resonance circuit 2112 is electrically connected between the device induction coil 212 and the full-bridge device conversion circuit 2111. A first end of the device switch 2113 is electrically connected to the device resonance circuit 2112. A

second end of the device switch 2113 is electrically connected to the full-bridge device conversion circuit 2111. The switching operation of the device switch 2113 may determine the resonance operation of the device resonance circuit 2112. For example, when the device switch 2113 is turned on, the device resonance circuit 2112 performs a resonance operation on at least one wireless device power based on at least one operating frequency. When the device switch 2113 is turned off, the device resonance circuit 2112 stops the resonance operation.

**[0032]** Furthermore, the full-bridge device conversion circuit 2111 includes multiple power switches (not shown). The device resonance circuit 2112 includes an inductor LR and capacitors CP and CR. A first end of the inductor LR is electrically connected to a first end of the full-bridge device conversion circuit 2111. A first end of the capacitor CP is electrically connected to a second end of the inductor LR. A second end of the capacitor CP is electrically connected to a first end of the device induction coil 212. A first end of the capacitor CR is electrically connected to the second end of the inductor LR. A second end of the capacitor CR is electrically connected to a second end of the device induction coil 212. The first end of the device switch 2113 is electrically connected to the second end of the device induction coil 212 and the second end of the capacitor CR. The second end of the device switch 2113 is electrically connected to a second end of the full-bridge device conversion circuit 2111. An inductance value of the inductor LR, a capacitance value of the capacitor CP, and a capacitance value of the capacitor CR may determine an operating frequency of the device resonance circuit 2112.

**[0033]** In some embodiments, the inductor LR may be a variable inductor. At least one of the capacitors CP and CR may be a variable capacitor. Thus, the operating frequency of the device resonance circuit 2112 may be changed.

**[0034]** In this embodiment, the controller 213 is electrically connected to a control end of the power switches of the full-bridge device conversion circuit 2111 and a control end of the device switch 2113. The controller 213 may control the power switches of the full-bridge device conversion circuit 2111 as well as the device switch 2113 based on the first  
5 operating mode, the second operating mode, the third operating mode, and the fourth operating mode.

**[0035]** In this embodiment, the electric auxiliary vehicle 220\_1 includes a battery 221\_1, a vehicle induction coil 222\_1, a vehicle converter 223\_1, and a controller 224\_1. The vehicle converter 223\_1 includes a full-bridge vehicle conversion circuit 2231\_1, a vehicle  
10 resonance circuit 2232\_1, and a vehicle switch 2233\_1. The full-bridge vehicle conversion circuit 2231\_1 is electrically connected to the battery 221\_1. The vehicle resonance circuit 2232\_1 is electrically connected between a first end of the vehicle induction coil 222\_1 and the full-bridge vehicle conversion circuit 2231\_1. A first end of the vehicle switch 2233\_1 is electrically connected to a second end of the vehicle induction  
15 coil 222\_1. A second end of the vehicle switch 2233\_1 is electrically connected to the full-bridge vehicle conversion circuit 2231\_1.

**[0036]** Furthermore, the full-bridge vehicle conversion circuit 2231\_1 includes multiple power switches (not shown). The vehicle resonance circuit 2232\_1 includes a capacitor CS1. The capacitor CS1 is electrically connected between the first end of the vehicle  
20 induction coil 222\_1 and a first end of the full-bridge vehicle conversion circuit 2231\_1. The second end of the vehicle switch 2233\_1 is electrically connected to a second end of the full-bridge vehicle conversion circuit 2231\_1. A capacitance value of the capacitor CS1 may determine an operating frequency of the vehicle resonance circuit 2232\_1.

**[0037]** In this embodiment, the controller 224\_1 is electrically connected to a control end

of the power switches of the full-bridge vehicle conversion circuit 2231\_1 and a control end of the vehicle switch 2233\_1. The controller 224\_1 may control the power switches of the full-bridge vehicle conversion circuit 2231\_1 as well as the vehicle switch 2233\_1 based on the first operating mode, the second operating mode, the third operating mode, and the  
5 fourth operating mode.

**[0038]** In this embodiment, the electric auxiliary vehicle 220\_2 includes a battery 221\_2, a vehicle induction coil 222\_2, a vehicle converter 223\_2, and a controller 224\_2. The vehicle converter 223\_2 includes a full-bridge vehicle conversion circuit 2231\_2, a vehicle resonance circuit 2232\_2, and a vehicle switch 2233\_2. The full-bridge vehicle  
10 conversion circuit 2231\_2 is electrically connected to the battery 221\_2. The vehicle resonance circuit 2232\_2 is electrically connected between a first end of the vehicle induction coil 222\_2 and the full-bridge vehicle conversion circuit 2231\_2. A first end of the vehicle switch 2233\_2 is electrically connected to a second end of the vehicle induction coil 222\_2. A second end of the vehicle switch 2233\_2 is electrically connected to the  
15 full-bridge vehicle conversion circuit 2231\_2.

**[0039]** Furthermore, the full-bridge vehicle conversion circuit 2231\_2 includes multiple power switches (not shown). The vehicle resonance circuit 2232\_2 includes a capacitor CS2. The capacitor CS2 is electrically connected between the first end of the vehicle induction coil 222\_2 and a first end of the full-bridge vehicle conversion circuit 2231\_2.  
20 The second end of the vehicle switch 2233\_2 is electrically connected to a second end of the full-bridge vehicle conversion circuit 2231\_2. A capacitance value of the capacitor CS2 may determine an operating frequency of the vehicle resonance circuit 2232\_2.

**[0040]** In this embodiment, the controller 224\_2 is electrically connected to a control end of the power switches of the full-bridge vehicle conversion circuit 2231\_2 and a control end

of the vehicle switch 2233\_2. The controller 224\_2 may control the power switches of the full-bridge vehicle conversion circuit 2231\_2 as well as the vehicle switch 2233\_2 based on the first operating mode, the second operating mode, the third operating mode, and the fourth operating mode.

5   **[0041]** In the first operating mode, the controller 213 controls the full-bridge device conversion circuit 2111 so that the full-bridge device conversion circuit 2111 does not operate, and turns off the device switch 2113. In the first operating mode, the controller 224\_1 uses control signals SC6 to SC9 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_1, and uses a control signal SC10  
10   to turn on the vehicle switch 2233\_1. Thus, the vehicle converter 223\_1 forms a resonant DC-AC power converter. The vehicle converter 223\_1 converts the battery power PB1 to the wireless vehicle power PC1. The battery power PB1 is DC power. The wireless vehicle power PC1 is AC power. The vehicle induction coil 222\_1 transmits the wireless vehicle power PC1 to the device induction coil 212. In the first operating mode, the  
15   vehicle induction coil 222\_2 receives the wireless vehicle power PC1 from the device induction coil 212. The controller 224\_2 uses control signals SC11 to SC14 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_2, and uses a control signal SC15 to turn on the vehicle switch 2233\_2. The battery power PB2 is DC power. Thus, the vehicle converter 223\_2 forms a full-bridge rectifier.  
20   The vehicle converter 223\_2 converts the wireless vehicle power PC1 to the battery power PB2.

**[0042]** In the second operating mode, the controller 213 controls the full-bridge device conversion circuit 2111 and the device switch 2113 so that the full-bridge device conversion circuit 2111 and the device switch 2113 do not operate. In the second operating mode, the

controller 224\_1 uses the control signals SC6 to SC9 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_1, and uses the control signal SC10 to turn on the vehicle switch 2233\_1. Thus, the vehicle converter 223\_1 forms a resonant DC-AC power converter. The vehicle converter 223\_1 converts the battery power PB1 to the wireless vehicle power PC1. The vehicle induction coil 222\_1 transmits the wireless vehicle power PC1 to the device induction coil 212. In the second operating mode, the vehicle induction coil 222\_2 receives the wireless vehicle power PC1 from the device induction coil 212. The controller 224\_2 uses the control signals SC11 to SC14 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_2, and uses the control signal SC15 to turn on the vehicle switch 2233\_2. Thus, the vehicle converter 223\_2 forms a full-bridge rectifier. The vehicle converter 223\_2 converts the wireless vehicle power PC1 to the battery power PB2.

**[0043]** In the third operating mode, the controller 213 uses the control signals SC1 to SC4 to control the switching operations of the power switches of the full-bridge device conversion circuit 2111, and uses the control signal SC5 to turn on the device switch 2113. Thus, the device converter 211 forms a resonant DC-AC power converter. The device converter 211 converts the device power PN to at least one of the wireless device powers PN1 and PN2. The device power PN is DC power. The wireless device powers PN1 and PN2 are AC power.

**[0044]** In the third operating mode, the controller 224\_1 uses the control signals SC6 to SC9 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_1, and uses the control signal SC10 to turn on the vehicle switch 2233\_1. Thus, the vehicle converter 223\_1 forms a full-bridge rectifier. The vehicle converter 223\_1 converts the wireless device power PN1 to the battery power PB1. The

controller 224\_2 uses the control signals SC11 to SC14 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_2, and uses the control signal SC15 to turn on the vehicle switch 2233\_2. Thus, the vehicle converter 223\_2 forms a full-bridge rectifier. The vehicle converter 223\_2 converts the wireless device power PN2 to the battery power PB2.

**[0045]** In the fourth operating mode, the controller 224\_1 uses the control signals SC6 to SC9 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_1, and uses the control signal SC10 to turn on the vehicle switch 2233\_1. Thus, the vehicle converter 223\_1 forms a resonant DC-AC power converter.

The vehicle converter 223\_1 converts the battery power PB1 to the wireless vehicle power PC1. In the fourth operating mode, the controller 224\_2 uses the control signals SC11 to SC14 to control the switching operations of the power switches of the full-bridge vehicle conversion circuit 2231\_2, and uses the control signal SC15 to turn on the vehicle switch 2233\_2. Thus, the vehicle converter 223\_2 forms a resonant DC-AC power converter.

The vehicle converter 223\_2 converts the battery power PB2 to a wireless vehicle power PC2.

**[0046]** In the fourth operating mode, the controller 213 uses the control signals SC1 to SC4 to control the switching operations of the power switches of the full-bridge device conversion circuit 2111, and uses the control signal SC5 to turn on the device switch 2113.

Thus, the full-bridge device conversion circuit 2111 forms a full-bridge rectifier. The device converter 211 converts at least one of the wireless vehicle powers PC1 and PC2 to the device power PN.

**[0047]** In this embodiment, the controller 213 may receive feedback current values and feedback voltage values of the device power PN as well as the wireless device powers PN1

and PN2, and control the device power PN and the wireless device powers PN1 and PN2 according to the feedback current values and the feedback voltage values so as to meet the expected power specifications. The controller 224\_1 may receive feedback current values and feedback voltage values of the battery power PB1 and the wireless vehicle power PC1, and control the battery power PB1 and the wireless vehicle power PC1 according to the feedback current values and the feedback voltage values so as to meet the expected power specifications. The controller 224\_2 may receive feedback current values and feedback voltage values of the battery power PB2 and the wireless vehicle power PC2, and control the battery power PB2 and the wireless vehicle power PC2 according to the feedback current values and the feedback voltage values so as to meet the expected power specifications.

**[0048]** In summary, the wireless power supply system of the disclosure only requires a single charging device. This way, the construction of the wireless power supply system costs less. The wireless power supply system provides multiple methods for wireless power supply. It should be noted that, in the first operating mode, a first electric auxiliary vehicle provides the wireless vehicle power to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle. This way, the wireless power supply system provides innovative methods for wireless power supply. In addition, during the first period, the charging device may transmit a first wireless device power based on a first operating frequency and use the first wireless device power to charge a battery of the first electric auxiliary vehicle. During the second period, the charging device may transmit a second wireless device power based on a second operating frequency and use the second wireless device power to charge a battery of a second electric auxiliary vehicle. This way, the charging device may selectively supply power to the electric auxiliary vehicles in a time-sharing manner.

**[0049]** Although the disclosure has been described with reference to the above embodiments, they are not intended to limit the disclosure. It will be apparent to one of ordinary skill in the art that modifications to the described embodiments may be made without departing from the spirit and the scope of the disclosure. Accordingly, the scope  
5 of the disclosure will be defined by the attached claims and their equivalents and not by the above detailed descriptions.

## CLAIMS

### Claim 1:

A wireless power supply system, comprising:

5 a charging device, comprising:

a device converter; and

a device induction coil, electrically connected to the device converter; and

a plurality of electric auxiliary vehicles, wherein a first electric auxiliary vehicle among the plurality of electric auxiliary vehicles provides a wireless vehicle power to the device

10 induction coil in a first operating mode,

wherein the charging device provides the wireless vehicle power to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle in the first operating mode.

### Claim 2:

15 The wireless power supply system according to claim 1, wherein the first electric auxiliary vehicle comprises:

a first battery, configured to store a first battery power;

a first vehicle induction coil; and

a first vehicle converter, electrically connected to the first battery and the first vehicle  
20 induction coil, and configured to convert the first battery power to the wireless vehicle power in the first operating mode and provide the wireless vehicle power to the first vehicle induction coil,

wherein the first vehicle induction coil provides the wireless vehicle power to the device induction coil in the first operating mode.

Claim 3:

The wireless power supply system according to claim 2, wherein a second electric auxiliary vehicle among the plurality of electric auxiliary vehicles comprises:

5 a second battery;

a second vehicle induction coil, configured to receive the wireless vehicle power from the device induction coil in the first operating mode; and

a second vehicle converter, electrically connected to the second battery and the second vehicle induction coil, and configured to convert the wireless vehicle power to a second battery power in the first operating mode and store the second battery power in the second battery.

Claim 4:

15 The wireless power supply system according to claim 3, wherein in a second operating mode:

the first vehicle converter converts the first battery power to the wireless vehicle power and provides the wireless vehicle power to the first vehicle induction coil,

the second vehicle induction coil receives the wireless vehicle power from the first vehicle induction coil, and

20 the second vehicle converter converts the wireless vehicle power to the second battery power and stores the second battery power in the second battery.

Claim 5:

The wireless power supply system according to claim 3, wherein in a third operating

mode:

the device converter converts a device power to a wireless device power and provides the wireless device power to the device induction coil, and

the device induction coil transmits the wireless device power.

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Claim 6:

The wireless power supply system according to claim 5, wherein in the third operating mode:

the first vehicle induction coil receives the wireless device power, and

10 the first vehicle converter converts the wireless device power to the first battery power and stores the first battery power in the first battery.

Claim 7:

The wireless power supply system according to claim 6, wherein:

15 the first vehicle converter operates based on a first operating frequency, and

the second vehicle converter operates based on a second operating frequency.

Claim 8:

The wireless power supply system according to claim 7, wherein during a first period,

20 the device converter operates based on the first operating frequency, and during a second period, the device converter operates based on the second operating frequency.

Claim 9:

The wireless power supply system according to claim 2, wherein in a fourth operating

mode:

the first vehicle converter converts the first battery power to the wireless vehicle power and provides the wireless vehicle power to the first vehicle induction coil,

the device induction coil receives the wireless vehicle power, and

5 the device converter converts the wireless vehicle power to a device power and provides the device power to a grid.

Claim 10:

10 The wireless power supply system according to claim 2, wherein the first vehicle converter comprises:

a full-bridge vehicle conversion circuit, electrically connected to the first battery;

a vehicle resonance circuit, electrically connected between a first end of the first vehicle induction coil and the full-bridge vehicle conversion circuit; and

15 a vehicle switch, wherein a first end of the vehicle switch is electrically connected to a second end of the first vehicle induction coil, and a second end of the vehicle switch is electrically connected to the full-bridge vehicle conversion circuit,

wherein when the vehicle switch is turned on, the vehicle resonance circuit performs a resonance operation on the wireless vehicle power based on a first operating frequency, and

20 when the vehicle switch is turned off, the vehicle resonance circuit stops the resonance operation.

Claim 11:

The wireless power supply system according to claim 1, wherein the device converter comprises:

a full-bridge device conversion circuit;

a device resonance circuit, electrically connected between the device induction coil and the full-bridge device conversion circuit; and

5 a device switch, wherein a first end of the device switch is electrically connected to the device resonance circuit, and a second end of the device switch is electrically connected to the full-bridge device conversion circuit,

wherein when the device switch is turned on, the device resonance circuit performs a resonance operation on at least one wireless device power based on at least one operating frequency, and

10 when the device switch is turned off, the device resonance circuit stops the resonance operation.

#### Claim 12:

An operating method for a wireless power supply system, wherein the wireless power supply system comprises a charging device and a plurality of electric auxiliary vehicles, and  
15 the charging device comprises a device converter and a device induction coil, the operating method comprising:

providing, by a first electric auxiliary vehicle among the plurality of electric auxiliary vehicles, a wireless vehicle power to the device induction coil in a first operating mode; and

20 providing, by the charging device, the wireless vehicle power to at least one electric auxiliary vehicle other than the first electric auxiliary vehicle in the first operating mode.

#### Claim 13:

The operating method according to claim 12, wherein the first electric auxiliary vehicle

comprises a first battery, a first vehicle induction coil, and a first vehicle converter, wherein providing, by the first electric auxiliary vehicle, the wireless vehicle power to the device induction coil in the first operating mode comprises:

converting, by the first vehicle converter, a first battery power from the first battery to  
5 the wireless vehicle power and providing the wireless vehicle power to the first vehicle induction coil; and

providing, by the first vehicle induction coil, the wireless vehicle power to the device induction coil.

10 Claim 14:

The operating method according to claim 13, wherein a second electric auxiliary vehicle among the plurality of electric auxiliary vehicles comprises a second battery, a second vehicle induction coil, and a second vehicle converter, wherein providing, by the charging device, the wireless vehicle power to the at least one electric auxiliary vehicle other  
15 than the first electric auxiliary vehicle in the first operating mode comprises:

converting, by the second vehicle converter, the wireless vehicle power to a second battery power and storing the second battery power in the second battery.

Claim 15:

20 The operating method according to claim 14, further comprising:  
in a second operating mode:

converting, by the first vehicle converter, the first battery power to the wireless vehicle power and providing the wireless vehicle power to the first vehicle induction coil;

receiving, by the second vehicle induction coil, the wireless vehicle power from

the first vehicle induction coil; and

converting, by the second vehicle converter, the wireless vehicle power to the second battery power and storing the second battery power in the second battery.

5    Claim 16:

The operating method according to claim 14, further comprising:

in a third operating mode:

converting, by the device converter, a device power to a wireless device power and providing the wireless device power to the device induction coil; and

10        transmitting, by the device induction coil, the wireless device power.

Claim 17:

The operating method according to claim 16, further comprising:

in the third operating mode:

15        receiving, by the first vehicle induction coil, the wireless device power; and

converting, by the first vehicle converter, the wireless device power to the first battery power and storing the first battery power in the first battery.

Claim 18:

20        The operating method according to claim 17, wherein:

the first vehicle converter operates based on a first operating frequency, and

the second vehicle converter operates based on a second operating frequency.

Claim 19:

The operating method according to claim 18, wherein during a first period, the device converter operates based on the first operating frequency, and during a second period, the device converter operates based on the second operating frequency.

5    Claim 20:

The operating method according to claim 13, further comprising:

in a fourth operating mode:

converting, by the first vehicle converter, the first battery power to the wireless vehicle power and providing the wireless vehicle power to the first vehicle induction coil;

10        receiving, by the device induction coil, the wireless vehicle power; and

converting, by the device converter, the wireless vehicle power to a device power and providing the device power to a grid.