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Christopher B. Austin

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"VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD"

Attorney Docket No. 013350-9003-US35

**PRELIMINARY AMENDMENT**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

Entry of this Preliminary Amendment is respectfully requested prior to examination of the present application. Please charge any required fees for this communication to Deposit Account No. 13-3080.

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** are reflected in the listing of claims which begins on page 3 of this paper.

**Remarks** begin on page 7 of this paper.

## AMENDMENTS TO THE SPECIFICATION

Please amend Paragraph [0001] of the application as filed (amendments shown in markup).

**[0001]** The present patent application is a continuation of U.S. Patent Application No. 16/056,059, filed August 6, 2018, which is a continuation of U.S. Patent Application No. 12/737,803, filed February 17, 2011, which application is a national stage filing under 35 U.S.C. § 371 of International Application No. PCT/US2009/054174, filed on August 18, 2009, which claims the benefit of U.S. Provisional Patent Application No. 61/189,353 filed on August 18, 2008, the entire contents of which are incorporated herein by reference in their entireties.



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## AMENDMENTS TO THE CLAIMS

This listing of the claims will replace all prior versions and listings of claims in the application.

1-20. (Canceled)

21. (New) A vehicle alignment system for an inductive vehicular battery charger having a first core movable with respect to a second core to charge a battery of a vehicle, the vehicle alignment system comprising:

a controller; and

a display mounted within the vehicle, oriented for view by a user seated in the vehicle, and coupled to the controller;

wherein the controller is configured to:

detect a first positional relationship between the first core and the second core at a first time,

detect a misalignment of the first core with respect to the second core based at least in part on the first positional relationship between the fire core and the second core,

in response to detecting the misalignment, disable at least one user control on the display usable to control the inductive charging of the battery,

detect a second positional relationship between the first core and the second core at a second time occurring after movement of the vehicle,

detect an alignment of the first core with respect to the second core within a threshold based at least in part on the second positional relationship between the first core and the second core,

in response to detecting the alignment, enable the user control on the display, and



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in response to receiving a selection of the user control, initiate inductive charging via the first core and the second core.

22. (New) The vehicle alignment system of claim 21, wherein the second core is part of a pad over which the first core is movable.

23. (New) The vehicle alignment system of claim 21, wherein the controller is configured to detect the first positional relationship between the first core and the second core based at least in part on detection of a magnetic field.

24. (New) The vehicle alignment system of claim 21, wherein the controller is further configured to, in response to detecting the misalignment, generate an indicator for display on the display, the indicator indicating a direction of movement of the vehicle for improved alignment of the first core with respect to the second core.

25. (New) The vehicle alignment system of claim 24, wherein the indicator comprises an arrow indicating the direction of movement.

26. (New) The vehicle alignment system of claim 24, wherein the controller is configured to generate the indicator in a position relative to a graphical representation of at least part of the vehicle displayed on the display.

27. (New) A method of charging a battery of a vehicle, the method comprising:

detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;

detecting a misalignment of the first core with respect to the second core based at least in part on the positional relationship between the first core and the second core; and

in response detecting the misalignment of the first core with respect to the second core, disabling a user control displayed on a display for controlling the induction charging of the battery.

28. (New) The method of claim 27, further comprising, in response to detecting the misalignment of the first core with respect to the second core, generating an indicator for display on the display, the indicator indicating a direction of movement of the vehicle for improved alignment of the first core with respect to the second core.

29. (New) The method of claim 28, wherein the indicator comprises an arrow indicating the direction of movement.

30. (New) The method of claim 28, wherein the indicator is displayed in a position relative to a graphical representation of at least part of the vehicle displayed on the display.

31. (New) The method of claim 27, wherein the second core is part of a pad over which the first core is movable.

32. (New) The method of claim 27, wherein the positional relationship is a first positional relationship and further comprising:

detecting a second positional relationship between the first core on the vehicle and the second core after detecting the first positional relationship,

detecting an alignment of the first core with respect to the second core based within a predetermined threshold at least in part on the second positional relationship, and

in response detecting the alignment misalignment of the first core with respect to the second core, enabling the user control.

33. (New) The method of claim 32, further comprising, in response to receiving a selection of the user control, initiating induction charging via the first core and the second core.

34. (New) The method of claim 27, wherein the display is mounted within the vehicle.

35. (New) A method of charging a battery of a vehicle, the method comprising:

detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;



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detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and

in response detecting the alignment of the first core with respect to the second core, enabling a user control displayed on a display for controlling the induction charging of the battery.

36. (New) The method of claim 35, wherein the positional relationship is a first positional relationship and further comprising:

detecting a second positional relationship between the first core on the vehicle and the second core before detecting the second positional relationship;

detecting a misalignment of the first core with respect to the second core based at least in part on the second positional relationship between the first core and the second core; and

in response detecting the misalignment of the first core with respect to the second core, disabling the user control displayed on a display for controlling the induction charging of the battery.

37. (New) The method of claim 36, further comprising providing information indicative of the second positional relationship to a user seated within the vehicle.

38. (New) The method of claim 36, further comprising providing information indicative of the misalignment to a user seated within the vehicle.

39. (New) The method of claim 36, further comprising providing information indicative of changes of position of the vehicle with respect to the second core to a user seated within the vehicle.

40. (New) The method of claim 35, further comprising initiating induction charging via the first core and the second core in response to receiving a selection of the user control.

## REMARKS

By this Preliminary Amendment, Applicant has canceled Claims 1-20 and added new Claims 21-40. The "Related Applications" paragraph has also been amended to recite the priority claim of this continuation application. Entry of these amendments prior to substantive examination of the present application is respectfully requested. The undersigned is available for telephone consultation at the below number.

Respectfully submitted,

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# VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** The present patent application is a continuation of U.S. Patent Application No. 12/737,803, filed February 17, 2011, which application is a national stage filing under 35 U.S.C. § 371 of International Application No. PCT/US2009/054174, filed on August 18, 2009, which claims the benefit of U.S. Provisional Patent Application No. 61/189,353 filed on August 18, 2008, the entire contents of which are incorporated herein by reference in their entireties.

## BACKGROUND

**[0002]** In light of the ever-rising costs of energy in the global market, energy consumers of all types seek to reduce the impact such costs to the greatest extent possible. One popular manner of doing so is the use of vehicles that do not rely solely (and in some cases, at all) upon petroleum products as a source of energy. Many such vehicles have been developed that rely exclusively or in large part on batteries that must be recharged from a source of electrical power external to the vehicle. Such vehicles are referred to hereinafter simply as "electric vehicles," it being understood that this term refers to any vehicle requiring an external supply of electrical power to charge the vehicle for normal use. By way of example and without limitation, the term "electric vehicle" therefore refers to vehicles whose primary source of power is electrical batteries, as well as vehicles that have other sources of power (e.g., biofuel, fuel cells, natural gas, compressed air, and the like) in addition to or in lieu of electrical batteries, but that are designed to be supplied with electrical power from an external source to improve efficient operation of the vehicle.

**[0003]** Unfortunately, significant limitations exist to the widespread utilization of electric vehicles. For example, most households have a small number of appliances, devices, and systems that require a significant draw of electrical power from a power supplier. The introduction of an electrical vehicle as another daily draw of electric power for a household would place unprecedented strain on community power systems, many of which are already incapable of meeting peak demands. This problem is exacerbated by the fact that in some cases, the daily draw of electric power to charge the battery of an electric vehicle may be the highest of a household.



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**[0004]** Simply put, existing power infrastructure for most communities is incapable of meeting the demand that widespread use of rechargeable electric vehicles would place on the infrastructure. Until electrical power distribution infrastructure is updated to meet this demand (and even after such a time), improvements in energy distribution and utilization for charging electric vehicle batteries are welcome in the art.

## SUMMARY OF THE INVENTION

**[0005]** In some embodiments, a vehicle charger for charging a battery of a vehicle and adapted for communication with a first controller remote from the vehicle and vehicle charger, wherein the vehicle charger comprises an electrical power cord releasably attachable to at least one of the vehicle and a source of power; a second controller electrically coupled to the electrical power cord; and at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger.

**[0006]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle in the course of a charging session, wherein the vehicle charger comprises a controller; a display coupled to the controller and adapted to display a time; and a user-manipulatable control coupled to the controller and operable by a user to enter a time of day at which the charging session will end, the controller changing the supply of electric power to the vehicle battery during the course of the charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon the time needed to charge the vehicle battery by the time of day entered by the user.

**[0007]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, wherein the vehicle charger comprises a display mounted within the vehicle within reach of a user seated within the vehicle; a user-manipulatable control within reach of the user seated within the vehicle and by which a user can enter a time of day; a controller coupled to the display and to the battery, the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon the time of day entered by the user.



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**[0008]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle, wherein the vehicle charger comprises: a controller; and a memory coupled to the controller and in which to save a time of day entered by a user; the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon the time of day entered by the user; and wherein the controller supplies electric power to the battery if a level of battery charge is below a threshold level of battery charge independent of the time of day entered by the user, the controller supplying electric power to the battery until the threshold level of battery charge is reached.

**[0009]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, wherein the vehicle charger comprises a controller; a display coupled to the controller; and a memory accessible by the controller and in which to save a time of day; the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon the time of day; the controller operable to display at least two different screens upon the display, at least one of the screens displaying information regarding a charging session, and at least one of the screens displaying settings at least partially defining the manner of operation of the vehicle charger.

**[0010]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle and adapted for communication with a first controller remote from the vehicle and vehicle charger, wherein the vehicle charger comprises a display; a second controller coupled to the display and operable to change a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon a time of day; and at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller, wherein the second controller displays an indicator indicating a status of communication between the first and second controllers.

**[0011]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, and comprises a controller; and a display coupled to the controller; the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon a time of day; the controller operable to display on the display an amount of time remaining to complete charging of the battery.

**[0012]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle, wherein the vehicle charger comprises a controller; and a display coupled to the controller; the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon a time of day; the controller operable to display on the display an amount of power consumed by the battery during the charging session.

**[0013]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, and comprises a controller; and a display coupled to the controller; the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon a time of day; the controller operable to display on the display a cost of power supplied to the vehicle charger.

**[0014]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle in the course of a charging session, wherein the vehicle charger comprises an electrical power cord releasably attachable to at least one of the vehicle and a source of power; a controller; a housing attached to the electrical cord; a display on the housing, coupled to the controller, and adapted to display a time; and a user-manipulatable control coupled to the controller and operable by a user to enter a time of day; the controller changing the supply of electric power to the vehicle battery during the course of the charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon the time of day entered by the user.

**[0015]** In some embodiments, a vehicle charger for charging a battery of a vehicle and adapted for communication with a first controller remote from the vehicle and vehicle charger is provided, and comprises a display; a user-manipulatable control; a second controller coupled to the display and operable to change a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging; and at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger based at least in part upon the time of day entered by the user.

**[0016]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle, wherein the vehicle charger comprises a controller operable to change a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging based at least in part upon a time of day, wherein the controller transmits a signal responsive to detection of an interruption of power supply to the vehicle charger.

**[0017]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, and comprises a controller; a vehicle charger battery coupled to the controller; and an electrical power cord releasably attachable to at least one of the vehicle and the vehicle charger battery to supply power from the vehicle charger battery to the battery of the vehicle, wherein the controller is operable to change a supply of electric power to the vehicle charger battery during the course of a charging session by at least one of increasing a rate of charge of the vehicle charger battery, decreasing the rate of charge of the vehicle charger battery, starting charging of the vehicle charger battery, or stopping charging of the vehicle charger battery based at least in part upon a time of day.

**[0018]** Some embodiments of the present invention provide a vehicle charger for charging a battery of a vehicle, wherein the vehicle charger comprises a first core on the vehicle; a second core in a location stationary with respect to the first core, the second core providing an inductive charge to the first core in at least one position of the first core with respect to the second core; at least one sensor positioned to detect the position of the first core with respect to the second core; a display mounted within the vehicle within view of a user seated within the vehicle; and a controller coupled to the display and responsive to signals from the sensor to display at least one indicator on the display indicating a direction in which the vehicle must move for an improved positional relationship between the first and second cores.

**[0019]** In some embodiments, a vehicle charger for charging a battery of a vehicle is provided, and comprises a controller; a first electrical connector coupled to the battery and the controller and located on one side of the vehicle; and a second electrical connector coupled to the battery and the controller and located on a different side of the vehicle, the first and second electrical connectors both shaped and dimensioned for releasable connection to an electrical power cord supplying power to the vehicle from an external power source.

**[0020]** Some embodiments of the present invention provide a method of controlling charging of batteries of multiple vehicles each electrically connected to a power generation and distribution system, wherein the method comprises establishing communication with a controller associated with a battery charger of each vehicle; obtaining from each battery charger a time of day by which battery charging for the vehicle associated with the battery charger must be completed; and changing power supply to at least some of the battery chargers based at least in part upon the time of day received from the battery chargers.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0021]** FIG. 1 is a schematic diagram of a power generation and distribution system for a community.

**[0022]** FIG. 2 illustrates a vehicular charging system according to an embodiment of the present invention.

**[0023]** FIG. 3 illustrates a vehicular charging system according to another embodiment of the present invention.

**[0024]** FIG. 4 illustrates a vehicular charging system according to another embodiment of the present invention.

**[0025]** FIG. 5 is a perspective view of a vehicle charger according to an embodiment of the present invention.

**[0026]** FIG. 6 is a perspective view of a portion of the vehicular charger illustrated in FIG. 5, shown in a first state.

**[0027]** FIG. 7 is a perspective view of the vehicular charger illustrated in FIGs. 5 and 6, showing the vehicular charger in a second state.

**[0028]** FIG. 8 is a perspective view of the vehicular charger illustrated in FIGs. 5-7, showing the vehicular charger in a third state.

**[0029]** FIG. 9 is a perspective view of the vehicular charger illustrated in FIGs. 5-8, showing the vehicular charger in a fourth state.

**[0030]** FIG. 10 is a perspective view of the vehicular charger illustrated in FIGs. 5-9, showing the vehicular charger in a fifth state.

**[0031]** FIG. 11 is a perspective view of the vehicular charger illustrated in FIGs. 5-10, showing the vehicular charger in a sixth state.

**[0032]** FIG. 12 is a perspective view of a portion of a vehicular charger according to another embodiment of the present invention.



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**[0033]** FIG. 13 illustrates a vehicle display according to an embodiment of the present invention.

**[0034]** FIG. 14 illustrates another vehicle display according to an embodiment of the present invention.

**[0035]** FIG. 15 is a schematic electrical diagram of a vehicular charging system according to an embodiment of the present invention.

**[0036]** FIG. 16 is a schematic electrical diagram of a vehicular charging system according to another embodiment of the present invention.

**[0037]** FIG. 17 is a schematic electrical diagram of a vehicular charging system according to another embodiment of the present invention.

**[0038]** FIG. 18 a schematic diagram of a portion of a inductive vehicular charging system according to an embodiment of the present invention.

**[0039]** FIG. 19 illustrates a vehicular display for the inductive vehicular charging system illustrated in FIG. 18.

**[0040]** FIG. 20 is a side view of a vehicle and vehicular charger according to an embodiment of the present invention.

**[0041]** FIG. 21 is a top view of the vehicle and vehicular charger shown in FIG. 19.

**[0042]** FIG. 22 is a perspective view of the vehicle and vehicular charger shown in FIGs. 19 and 20.

**[0043]** FIG. 23 is a perspective detail view of the vehicle and vehicular charger shown in FIGs. 19-21.

**[0044]** FIG. 24 is a flowchart illustrating a method of operation of a vehicular charger according to an embodiment of the present invention.

**[0045]** FIG. 25 is a flowchart illustrating a method of operation of a vehicular charger according to another embodiment of the present invention.



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**[0046]** FIG. 26 is a flowchart illustrating a method of operation of a vehicular charger according to another embodiment of the present invention.

**[0047]** FIG. 27 is a flowchart illustrating a method of operation of a vehicular charger according to another embodiment of the present invention.

**[0048]** FIG. 28 is a flowchart illustrating a method of operation of a vehicular charging system according to an embodiment of the present invention.

**[0049]** FIG. 29 illustrates power draw from a power grid over a period of time, as controlled in part by a vehicular power charging system according to an embodiment of the present invention.

DETAILED DESCRIPTION

**[0050]** Before any embodiments of the present invention are explained in detail, it is to be understood that the present invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the accompanying drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description, and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings.

**[0051]** A power generation and distribution system in which vehicle chargers and vehicle charging systems according to the present invention can be used is illustrated schematically in FIG. 1, and is indicated generally at 10. The system 10 includes one or more sources of power 12 that supply a community, such as one or more power plants generating electric power from natural gas, coal, water flow, nuclear power, geo-thermal power, wind, solar power, other power sources, and any combination thereof. Any number of sources of power 12 can supply the electricity needs of the community, and can be located within the

community and/or located distant from the community. For example, electric power can be generated in one or more power plants located in or nearby the community, whereas additional electric power can be supplied from other more distant power plants as needed in times of peak demand.

**[0052]** Electric power is distributed from the sources of power 12 in any conventional manner, such as by a number of power lines 14 running from the sources of power 12 to various locations in the community. Electric power can be further distributed within the community by additional power lines 14 and power distribution infrastructure. Such power lines and power distribution infrastructure (in their various forms) are known to those skilled in the art, and are not therefore described further herein.

**[0053]** Electric power is transmitted over the power lines 14 to a number of different locations 16 in the community, each of which draws and uses the electrical power for various purposes. One or more electric vehicles 18, 618, 1018 are at some of these locations, and draw an amount of electric power for purposes of charging one or more batteries 20, 620, 1020 (see FIGs. 2-4) of each electric vehicle 18, 618, 1018. Each electric vehicle 18, 618, 1018 in the community is releasably connected to the vehicular charging system 10. In the illustrated embodiment of FIGs. 2 and 3, each electric vehicle 18, 618 is releasably electrically and mechanically connected by a respective cord 22, 744 as will be described in greater detail below. In other embodiments (e.g., FIG. 4), one or more of the electric vehicles 1018 are releasably electrically connected to the vehicular charging system 10, but are not mechanically connected thereto. In such cases, the electric vehicles 1018 can be electrically connected by use of induction charging as described in greater detail below.

**[0054]** A vehicle charging cord 22 according to an embodiment of the present invention is illustrated in FIG. 5, and is shown in use in FIG. 2. The illustrated vehicle charging cord 22 has a first end 24 adapted to releasably connect to an electrical outlet (not shown) of a business, residence, or other building or facility, and a second end 26 adapted to releasably connect to the electric vehicle 18. In this regard, the first end 24 can have, for example, a standard U.S. two-prong or three-prong male electrical connector (i.e., grounded or ungrounded) intended for connection to a 120V AC supply of electric current, a U.S. Type B electrical connector intended for connection to a 220V AC supply of electric current, any electrical connector suitable for a 240V AC supply of electrical current, a Japanese Type B electrical connector meeting JA1-15 electrical standards, a British Type G electrical



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connector meeting British BS 1363 electrical standards, a European Type F electrical connector meeting CENELEC electrical standards, a French Type E electrical connector meeting French electrical standards, a Chinese Type I electrical connector meeting Chinese electrical standards, or a Type D or M electrical connector meeting Indian electrical standards. Any other releasable electrical connector suitable for connection to an electrical outlet of a building or facility, or for connection to a power cord, power device, or other power interface with the electrical system of the building or facility can be used as desired. In this regard, although the first end 24 of the vehicle charging cord 22 shown in FIG. 5 has a U.S. Type B plug, it will be appreciated that the first end 24 can have any number and arrangement of blades, pins, and apertures for releasable mating engagement with an electrical connector of a power cord, power device, or other power interface as just described.

**[0055]** The second end 26 of the vehicle charging cord 22 can have any suitable plug for releasable connection with a mating electrical connector of the vehicle. In this regard, the second end 26 of the vehicle charging cord 22 can have any number of blades and/or pins for mating with associated apertures of the mating electrical connector of the vehicle, and can also or instead have any number of apertures for mating with associated blades and/or pins of the mating electrical connector of the vehicle. The second end 26 can be connected directly to an electrical connector of a vehicle, or to a power cord, power device, or other power interface with the electrical power system of a vehicle.

**[0056]** The vehicle charging cord 22 can be any gauge suitable for carrying electric current to charge the vehicle 18 and for also meeting country and local electrical codes. Also, the vehicle charging cord 22 illustrated in FIG. 5 is insulated with flexible plastic or other suitable material.

**[0057]** The vehicle charging cord 22 illustrated in FIGs. 2 and 5 also has a housing 28 intermediate the ends 24, 26 of the cord 22. In other embodiments, the housing 28 can be located at or define an end of the cord 22, in which case the housing 28 can carry any of the electrical connectors described above with regard to ends 24, 26 of the vehicle charging cord 22.

**[0058]** The illustrated housing 28 has a substantially parallelepiped shape. Depending at least in part upon the shape and size of the electronics within the housing (described below) for performing any desired electrical transformer function, and the shape and size of the

electrical elements used for the control features described below, the housing 28 can be larger or smaller than that shown in FIG. 5, and can have any other shape desired, (e.g., a cube shape, a spherical, elliptical, or other rotund shape, an irregular shape, and the like).

**[0059]** With reference now to FIGs. 5-11, and also with reference to FIG. 15 (which illustrates a vehicular charging system utilizing the vehicular charger of FIGs. 2, 5-11, a number of user-manipulatable controls 30 and a display 32 are provided on the housing 28. The illustrated housing 28 also contains electrical components for transforming power supplied thereto (indicated generally at 136), and control circuitry for performing the vehicle battery charging management functions described in greater detail below. The display 32 shown in FIGs. 5-11 and 15 is an LCD display 32, although any other type of display can be used as desired. The user-manipulatable controls 30 include a power button 34, a number of navigation buttons 36, and a select button 38 (see FIGs. 6-11). The power button 34 can be pressed by a user to turn the vehicle charging cord 22 on and off, thereby enabling and disabling the vehicle charging cord 22 to charge one or more batteries 20 of a vehicle 18 connected thereto. The navigation buttons 36 can be pressed by a user to navigate through one or more screens upon the display 32 (described in greater detail below), whereas the select button 38 can be pressed by a user to select one or more options on the screen(s).

**[0060]** In the illustrated embodiment, four navigation buttons 36 (up, down, left, and right) are positioned around the select button 38, all of which are adjacent the power button 34. However, in other embodiments, the navigation buttons 36, select button 38, and power button 34 can be in any other arrangement on the housing 28. Also, it will be appreciated that the user-manipulatable controls 30 can be buttons as shown in FIGs. 5-11, but can instead or also be any other type of user-manipulatable control. For example, any of the user-manipulatable controls 30 can be dome or tact switch, heat-sensitive, or other types of buttons, can be knobs or dials, and the like. Also, fewer or more user-manipulatable controls 30 can be used in other embodiments, such as for vehicle charging cords 22 not having a power button 34 (i.e., automatically powered upon connection to a power source), vehicle charging cords 22 having more or fewer navigation buttons (depending in some embodiments upon the arrangement of options on screens 32 shown on the display 32), and the like.

**[0061]** Although a display 32 in conjunction with a number of button-type user-manipulatable controls 34, 36, 40 is employed in the embodiment of FIGs. 2, 5-11 and 15, in other embodiments, the display 32 and any number of the button-type user-manipulatable

controls 34, 36, 40 can be replaced by a touch screen (not shown). The touch screen can enable a user to display options, navigate between two or more screens, and select options by inputting commands directly into the display 32, and in some embodiments can simplify control of the vehicle charging cord 22.

**[0062]** With reference now to FIG. 15, in some embodiments, the vehicle charging cord 22 has a controller 44 located within the housing 28 and at least partially controlling operations of the vehicle charging cord 22. The controller 44 in the illustrated embodiment of FIGs. 2, 5-11 and 15 is a programmable processor of any suitable type, but in some embodiments can take other forms such as non-programmable processor, a system of discrete logic elements, and any combination thereof. The illustrated vehicle charging cord 22 also has a transceiver 46 coupled to the controller 44, enabling the controller 44 to communicate with another controller. The other controller can be one or more processors of a personal computer, phone, PDA, or other processor-based device associated with a user of the vehicle charging cord 22, one or more processors of a server or other computer associated with a power utility providing power to the vehicle charging cord 22, and the like). In the illustrated embodiment of FIGs. 2, 5-11 and 15, the other controller is a remote computer of a power utility 48, and is indicated at 50. The controller 50 of the power utility 48 is coupled to a power utility transceiver 52 to enable the power utility 48 to communicate with the controller 44 of the vehicle charging cord 22.

**[0063]** The transceiver 46 of the vehicle charging cord 22 and the transceiver 52 for the computer of the power utility 48 can each take any suitable form. However, it will be appreciated that the transceiver 52 for the computer of the power utility 48 can be selected to enable the computer of the power utility 48 to communicate with multiple vehicle charging cord controllers 44 of the same or different users. Also, the transceiver 46 of the vehicle charging cord 22 and/or the transceiver 52 for the computer of the power utility 48 can be replaced by a separate transmitter and a separate receiver enabling two-way communication between the controller 50 of the power utility 48 and the controller 44 of the vehicle charging cord 22. Such communication can be via the power lines 14 (see FIG. 1) between the computer of the power utility 48 and the locations 16 at which the vehicle charging cord 22 is used. In this regard, reference herein and in the appended claims to a "receiver" and a "transmitter" is intended to encompass transceivers as well as separate receivers and transceivers.

**[0064]** Any power line communication (PLC) system or combination of PLC systems adapted for carrying data over power lines 14 can be used for communication between the controllers 44, 50 described above, such as distribution line carrier (DLC) PLC systems, broadband over lines carrier (BLC) systems, low-speed narrow-band communication systems (proposed and used in Demand Side Management systems), and the like. Communication between the controller 50 of the power utility 48 and the controller 44 of the vehicle charging cord 22 can be through any number of substations between the power utility 48 and the location 16 at which the vehicle charging cord 22 is used. Also, depending at least in part upon the PLC system(s) used, such communication can be through any number of repeaters as is well known to those skilled in the art of PLC systems.

**[0065]** The controller 50 of the power utility 48 (with which the controller 44 of the vehicle charging cord 22 communicates) can be located anywhere between the location 16 of the user and the sources of power 12. For example, the controller 50 of the power utility 48 can be located at a facility where power is generated, at an office of the power utility 48, at any of a number of substations between the source of power 12 and the location 16 of the user, and the like.

**[0066]** By connecting the first end 24 of the vehicle charging cord 22 to an electrical outlet of a building or facility (or to a power cord, power device, or other power interface with the electrical system of the building or facility), communication can be established over the vehicle charging cord 22, the electrical system of the home, building, or other facility (e.g., through wiring and one or more circuit breakers thereof), and low and high-voltage power lines to the power utility 48 and the controller 50 of the power utility 48 described above. In some embodiments, this communication can be established automatically upon plugging in the first end 24 of the vehicle charging cord 22, whereas in other embodiments, this communication is established when the vehicle charging cord 22 is turned on or when a user enters an appropriate command to establish this communication (described in greater detail below), or in any other suitable manner. Communication between processors established automatically upon their connection are well known to those skilled in the art, and are not therefore described further herein.

**[0067]** As discussed above, communication between the controller 44 of the vehicle charging cord 22 and the controller 50 of the power utility 48 can be over power lines, wiring, or other conductors. However, it will be appreciated that communication along any

portion or all of the distance between the controller 50 of the power utility 48 and the vehicle charging cord 22 can include wireless communication. In such cases, any number of wireless transmitters and receivers (and associated antennae) can be used to send and receive communications between the controller 50 of the power utility 48 and the vehicle charging cord 22. By way of example only, the vehicle charging cord 22 can have a wireless processor and associated antenna, receiver, and transmitter enabling wireless communication with a wireless service provider, and ultimately to the controller 50 of the power utility 48. Like the PLC communication described above, wireless communication between the controller 50 of the power utility 48 and the vehicle charging cord 22 can be established automatically upon plugging in the first end 24 of the vehicle charging cord 22, when the vehicle charging cord 22 is turned on, or when a user enters an appropriate command to establish this communication (described in greater detail below).

**[0068]** In some embodiments, the controller 44 of the vehicle charging cord 22 communicates with a user's computer rather than, or in addition to, communicating with the controller 50 of the power utility 48. This communication can be any combination of wired or wireless communication. For example, a residence-based, office-based, or other facility-based PLC system can be used to communicate between the controller 44 of the charging cord 22 and a user's computer (via the electrical system of the residence, office, or other facility). In other embodiments, the vehicle charging cord 22 can have a wireless processor adapted for communication with a user's computer. Such communication can be through any suitable wireless personal area network (WPAN) (using, for example, ZigBee®, Bluetooth®, or any other WPAN wireless technology), wireless local area network (WLAN), and the like. Like the PLC communication described above, communication between the controller 50 of the power utility 48 and the user's computer can be established automatically upon plugging in the first end 24 of the vehicle charging cord 22, when the vehicle charging cord 22 is turned on, or when a user enters an appropriate command to establish this communication (described in greater detail below).

**[0069]** Upon connection with a user's computer (wireless or otherwise), a user can control the vehicle charging cord 22 in any of the same manners as a power utility 48 described in greater detail below. Alternatively or in addition, communication between the controller 44 of the vehicle charging cord 22 and the controller of 50 of the power utility 48 can be established through the user's computer. Specifically, wired or wireless

communication between the controller 44 of the vehicle charging cord 22 and the user's computer can be used in conjunction with a connection between the user's computer and the controller 50 of the power utility 48 to enable communication between the controller 44 of the vehicle charging cord 22 and the controller 50 of the power utility 48. Such communication can thereby enable the power utility 48 to control the vehicle charging cord 22 (in any of the manners described below) via the user's computer.

**[0070]** With reference now to FIGs. 6-11, the illustrated vehicle charging cord 22 has a first screen 40 providing information regarding the vehicle charging cord 22, a battery connected thereto, and the status of charging operations of the vehicle charging cord 22. In the illustrated embodiment of FIGs. 2, 5-11 and 15, the screen 40 has a vehicle charging cord status indicator 42, which displays the status of charging operations. The status indicator 42 can indicate whether the vehicle charging cord 22 is charging a battery, the type of charging operations being performed by the vehicle charging cord 22, and/or whether an error in charging the battery has been detected.

**[0071]** In the state of the vehicle charging cord 22 shown in FIGs. 6, 10, and 11, the vehicle charging cord 22 is not charging a battery connected thereto, nor is the vehicle charging cord 22 programmed or otherwise controlled to charge a battery (described in greater detail below). Accordingly, the status indicator 42 displays "OFF". In the state of the vehicle charging cord 22 shown in FIG. 7, the vehicle charging cord 22 is in the process of charging a vehicle battery in "manual" mode (i.e., not based upon a time of day). Therefore, the status indicator 42 displays "MANUAL CHARGE IN PROCESS" in FIG. 7. In the state of the vehicle charging cord 22 shown in FIG. 8, the vehicle charging cord 22 is in the process of charging a battery based upon one or more instructions that can include a time of day to begin charging the battery and/or a time of day to stop battery charging (discussed in greater detail below). Accordingly, the status indicator 42 displays "PROGRAMMED CHARGE IN PROCESS" in FIG. 8. Finally, in the state of the vehicle charging cord 22 shown in FIG. 9, an error has been detected by the vehicle charging cord 22 in the process of attempting to charge the battery. Therefore, the status indicator 42 display "ERROR – BATTERY FAULT" in FIG. 9. In some embodiments, the vehicle charging cord 22 can have appropriate circuitry to detect a variety of charging problems, including without limitation a damaged battery, a damaged vehicle charging cord 22, a disconnection between the vehicle charging cord 22 and a source of power used to charge the vehicle battery, and/or

a disconnection between the vehicle charging cord 22 and the battery to be charged. A large number of conventional circuits capable of detecting such problems exist, and are not therefore described further herein. Such circuits fall within the spirit and scope of the present invention.

**[0072]** The first screen 40 of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 also has a communication status indicator 54. The communication status indicator 54 indicates whether communication exists between the controller 44 of the vehicle charging cord 22 and a computer (e.g., a computer of the power utility 48, the user's computer, a mobile phone, PDA, or other processor-based device as described above, and the like). For example, in the "OFF" state of the vehicle charging cord 22 illustrated in FIG. 6, no communication exists between the controller 44 of the vehicle charging cord 22 and a computer, so the communication status indicator 54 displays an appropriate indicator. In the other states of the vehicular charging cord 22 illustrated in FIGs. 7-11, including the states of FIGs. 10 and 11 where the vehicle charging cord 22 is in an "OFF" state but is not set to charge a battery, communication has been established and maintained between the controller 44 and a computer, so the communication status indicator 54 displays an indicator showing this status.

**[0073]** The first screen 40 of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 also has a power connection status indicator 56. The power connection status indicator 56 indicates whether an electrical connection exists between the vehicle charging cord 22 and a source of power (e.g., an electrical system of a house, office, facility, or other location) to charge a battery. When the first end 24 of the illustrated vehicle charging cord 22 is unplugged or is connected to an electrical system not providing power to the vehicle charging cord 22, the power connection status indicator 56 displays such an indicator (see, for example, FIG. 6). Otherwise, if a proper power connection is made, the connection status indicator 56 displays an appropriate indicator showing that such a connection has been made (see, for example, FIGs. 7-11).

**[0074]** A clock 58 is also displayed on the first screen 40 shown in FIGs. 6-9. Any form of clock can be displayed as desired, preferably indicating whether the displayed time is "A.M." or "P.M.". In some embodiments, time on the clock 58 is maintained by the controller 44 of the vehicle charging cord 22, and can be maintained even if no power is supplied to the vehicle charging cord 22 (e.g., when the vehicle charging cord 22 is

unplugged) by a battery of the vehicle charging cord 22. Such a battery (not shown) can be connected to the controller 44 of the vehicle charging cord 22, can be located within the housing 28, and in some embodiments can be removed and replaced by a user as necessary via a door or other battery cover (also not shown). In these and other embodiments, the time displayed upon the clock 58 can be retrieved and displayed by the controller 44 from a computer upon establishment of communication with the computer in any of the manners described above.

**[0075]** The first screen 40 of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 also has a battery charge level indicator 60. Using any battery diagnostic circuitry desired, the controller 44 of the vehicle charging cord 22 can detect the level of charge of a battery 20 to which the vehicle charging cord 22 is connected (e.g., by the plug on the second end 26 of the vehicle charging cord 22 described above). The battery charge level indicator 60 illustrated in FIGs. 6-9 is a bar chart displaying charges ranging from 0% to 100%, and also displaying the percentage of full charge of a vehicle battery 20 to which the vehicle charging cord 22 is connected (e.g., 31% in FIG. 6). However, other types of battery charge level indicators 60 can be used in other embodiments.

**[0076]** For example, the battery charge level indicator 60 can be simply a number (e.g., the percentage of full charge of the battery 20, the exact charge level of the battery in amp-hours or in another unit of measurement, another number representative of the amount of charge of the battery 20 but not necessarily in units conventionally used to indicate battery charge, and the like). As another example, the battery charge level indicator 60 can also or instead include any other chart or visual representation, such as a pie chart, an escalating series of bars having different lengths, a symbol having different colors and/or brightness levels representing different battery charge levels, a gauge with a needle or other pointer, text in any language indicating the level of battery charge (e.g., "empty, very low, low, high, full"), and the like. The battery charge level indicator 60 can comprise any graphics, text, or combination of graphics and text to convey the level of charge of the battery 20 to a user, and can be any size desired on the first screen 40. The controller 44 of the vehicular charging cord 22 can monitor the charge level of the battery 20 being charged, and can update the battery charge level indicator 60 continuously or on a periodic basis.

**[0077]** In some embodiments, the first screen 40 of the vehicular charging cord 22 also displays the voltage and/or amperage used to charge a battery 20 connected thereto. These

voltage and/or amperage indicators are included in the embodiment of the vehicle charging cord 22 shown in FIGs. 2, 5-11 and 15, and are given reference numbers 62 and 64, respectively.

**[0078]** As also shown in FIGs. 6-9, the first screen 40 of the vehicle charging cord 22 can include other information regarding the status of a battery charging session performed by the vehicular charging cord 22, including the amount of time estimated to completely charge the battery 20 (in minutes, minutes and hours, or in any other format), the estimated or actual amount of power already consumed during the present charging session (in kWh or in any other unit of measurement), the actual or estimated cost of charging the connected battery 20 per hour or other unit time, and/or the total actual or estimated cost of the current charging session to the present time. Each of these examples of information is displayed on the first screen 40 shown in FIGs. 6-9, and is indicated with reference numbers 66, 68, 70, and 72, respectively.

**[0079]** The charge time remaining indicator 66 and the power used indicator 68 can be calculated by the controller 44 in any of a number of manners well known to those in the art of battery charging and electrical power metering technology. In this regard, it will be appreciated that the charge time remaining can be calculated taking into account the non-linear rate of charging for many batteries 20, wherein the rate of battery charge at different levels of battery charge changes. Formulas for such estimates are well known to those skilled in the art of battery charging, and are not therefore described further herein. The charge cost per hour indicator 70 can be retrieved and displayed by the controller 44 from a computer upon establishment of communication with the computer in any of the manners described above, or can be manually entered into the vehicle charging cord 22 by a user using the user-manipulatable controls 30 and an appropriate data entry cell or menu on the display 32 (not shown). In those embodiments in which the charge cost per hour is retrieved from another computer as described above, the controller 44 can retrieve a cost per kWh figure directly from the power utility 48 (e.g., from the controller 50 of a computer of the power utility 48), from the user's computer in which is stored a cost per kWh figure entered there or retrieved by the user's computer, and the like, and can multiply that figure by an estimated kWh level at which the vehicle charging cord 22 will charge the battery 20 to display the charge cost per hour 70 for the current battery charging session. The total cost to the present time for a



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charging session 72 can be calculated by the controller 44 simply by multiplying the values of indicators 68 and 70 together.

**[0080]** In some embodiments, any or all of the indicators 66, 68, 70, and 72 can be updated periodically during a charging session, such as every second, minute, or other time interval. Any or all of the indicators 66, 68, 70, 72 can be continually updated by receiving streaming data from the controller 50 of the power utility 48 or from the user's computer. For example, the charge time remaining indicator 66 can be updated by the controller 44 every second or minute based upon battery charge calculations made at the beginning of the charging session or made periodically during the charging session. As another example, the power used indicator can be updated by the controller 44 every second, minute, or in greater periods of time based upon the actual or estimated power delivered via the vehicle charging cord 22. As yet another example, the charge cost per hour indicator 70 can be updated every second, minute or other time period based upon cost information retrieved by the controller 44 from the controller 50 of the power utility 48 or the user's computer, and/or can be updated immediately upon receiving streaming or batch-loaded power cost information from the controller 50 of the power utility 48 or the user's computer.

**[0081]** The first screen 40 of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 also has a battery charge selector 74 by which a user can select the manner in which the vehicle charging cord 22 will charge a vehicle battery 20. By pressing the navigation buttons 36 and then the select button 38 described above, a user can highlight a desired manner in which the vehicle charging cord 22 will charge a vehicle battery 20 connected thereto. The battery charge selector options illustrated in FIGs. 6-9 include "OFF", "PROGRAMMED CHARGE", AND "MANUAL CHARGE", any of which can be highlighted and selected by a user as just described. Although a radio button format of the battery charge selector 74 is illustrated in the embodiment of FIGs. 2, 5-11 and 15, the battery charge selector 74 can have any other form desired, including without limitation a drop-down or pop-up menu, and the like. Upon selecting the desired charge state as just described, the vehicle charging cord 22 can immediately begin a charging session by beginning to supply current to the battery 20 to which the vehicle charging cord 22 is connected (e.g., by closing a switch 92 coupled to the controller 44 as described in greater detail below), or can begin such a session after a user then presses the power button 34. For example, if the power button 34 is selected after the "MANUAL CHARGE" button has been selected, the controller 44 can

causes the switch 92 to close without delay in order to begin charging the vehicle battery 20, whereas if the power button 34 is selected after the "PROGRAMMED CHARGE" button has been selected, the controller 44 can cause the switch 92 to close only after one or more conditions have been met as will be described in greater detail below. In any case, once a user commands and enables the vehicle charging cord 22 to begin charging immediately or to begin charging at a later time based upon a set of instructions as described elsewhere herein, a vehicle charging session begins.

**[0082]** The operational status of the vehicle charging cord 22 can be displayed by the vehicle charging cord 22 in a number of different manners and locations. For example, the vehicle charging cord status indicator 42 described above can be provided. Alternatively or in addition, one or more graphics (e.g., symbols, colors, and the like) providing the same general status indicators (e.g., off, charging in process, error) can be displayed elsewhere on the housing 28, such as through a translucent or transparent portion of the housing 28, through a lens located on the housing 28, and the like. In this regard, one or more graphics can be printed on the interior and/or exterior of the housing 28, can be invisible or substantially not visible to a user when not illuminated, and can be illuminated by one or more lamps, LEDs or other light sources within the housing 28 when such graphics are to be displayed. By way of example only, the controller 44 can display a battery charging symbol such as that shown in FIGs. 7 and 8 in a first charge status display area 76A when a charging session is in process, or when the vehicle charging cord 22 is in the process of charging a battery 20 (as described in greater detail below, the battery 20 may not be actively charging the battery 20 at one or more times during a charging session). As another example, the controller 44 can display an error symbol such as that shown in FIG. 9 in the same or a different charge status display area 76B when any of the battery charging errors described above have been detected. Still other battery charging symbols indicating any other information regarding the status of the vehicle charging cord 22 and its operation can be displayed anywhere on the housing as a supplement to or in addition to the information shown on the display 32 described above. In some embodiments, one or more status display areas 76 as just described can even replace the display 32.

**[0083]** With continued reference to the illustrated embodiment of FIGs. 2, 5-11 and 15, in some embodiments, the controller 44 of the vehicle charging cord 22 can display two or more different screens upon the display 32. This control enables a user to view substantially



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more information than that available from other types of displays and from other types of controls and indicators on the housing 28. By way of example only, two such alternative screens 40A, 40B are illustrated in FIGs. 10 and 11, respectively, and can be accessed in a number of different manners. In some embodiments, each screen 40, 40A, 40B is accessed by selecting a navigation button, such as by using navigation button 36 in the illustrated embodiment to highlight a desired navigation button on the screen 40, 40A, 40B. In other embodiments, one or more navigation buttons 36 on the housing 28 are provided to move between screens 40, 40A, 40B, such as forward and back buttons, a single button to scroll though two or more screens 40, 40A, 40B, and the like. Although three different screens 40, 40A, 40B can be shown upon the display 32 in the illustrated embodiment of FIGs. 2, 5-11 and 15, any other number of displays (e.g., 1, 2, 4, or more) can be shown upon the display 32, and can include any number and arrangement of the indicators, selectors, and other information described herein. In still other embodiments, a single screen 40 is provided, only a portion of which is visible on the display 32 at any given time. In such cases, other portions of the screen 40 can be viewed by scrolling in any desired direction using one or more navigation buttons 36 or other user-manipulatable controls on the housing 28.

**[0084]** In the illustrated embodiment of FIGs. 2, 5-11 and 15, the first screen 40 has two navigation buttons 78, 80, each of which causes the controller to display a different screen 40A, 40B when selected by a user in the manner described above. When a first "PROGRAM A CHARGE" navigation button 78 is selected by a user, the controller 44 replaces the first screen 40 with a second screen 40A shown in FIG. 10. This second screen 40A enables a user to change the manner in which the vehicle charging cord 22 will operate to charge one or more batteries 20 connected thereto. The second screen 40A also has navigation buttons 82, 84 that can be selected by a user to return to the first screen 40, whether by making one or more changes to operation of the vehicle charging cord 22 (by selecting the "GO" navigation button 84), or by making no changes to operation of the vehicle charging cord 22 (by selecting the "CANCEL" navigation button 84). In the illustrated embodiment, selection of either navigation button 82, 84 on the second screen 40A will return the user to the first screen 40.

**[0085]** A valuable feature of the vehicle charging cord 22 of FIGs. 2, 5-11 and 15 is the ability of a user to at least partially control when the vehicle charging cord 22 will begin to charge one or more batteries 20 connected thereto. In many geographic locations, times of



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day, and times of the year, the ability of power utilities 48 to supply the full power demand of users is limited or is inadequate. Although power utilities can often generate or otherwise obtain additional power at peak periods, such power often comes at a higher price to the power utility 48. Regardless of whether a higher price is paid by the utility, higher power prices are often charged to consumers of the power utility 22 during peak periods. In many cases, power utilities 48 encourage their customers to consume power at non-peak periods, such as a nighttime, and often give significant discounts to those who consume power during such periods. The vehicle charging cord 22 of FIGs. 2, 5-11 and 15 enables the user to take advantage of such cost savings by controlling when vehicle battery charging will occur. Even in those cases where savings to the power consumer are not provided, the vehicle charging cord 22 can be used to reduce power draw upon power utilities 48 at peak times and/or to better manage power consumption.

**[0086]** With reference to FIG. 10, the second screen 40A (entitled the "Programmed Charge" screen in FIG. 10) can show any amount of the information shown on the first screen 40 described above, such as the vehicle charging cord status indicator 42, the communication status indicator 54, the power connection status indicator 56, and the clock 58. The second screen 40A enables a user to select a time at which the vehicle charging cord 22 will begin charging a battery 20 connected thereto. For this purpose, the second screen 40A has a button 86 that can be selected (e.g., by user manipulation of the navigation and select buttons 36, 38 as described above) to set the vehicle charging cord 22 to begin charging at a desired time of day. This time of day can be changed and set by one or more time change buttons 88, such as by using the navigation buttons 36 to highlight one of the time change buttons 88 and by using the select button 38 to change the charge start time 90 displayed on the second screen 40A. Any other manner of changing and selecting a desired time can be used as desired, including without limitation drop down or pull-up menus displaying various charge start times that can be selected.

**[0087]** Once a charge start time has been selected by a user as just described, the user can select the navigation button 82 described above to return to the first screen 40, and can command the vehicle charging cord 22 to begin a charging session by pressing the power button 34. By doing so, the controller 44 of the vehicle charging cord 22 will compare the start time 90 entered by the user to the current time of day (e.g., displayed by the clock 58 as described above), and will begin charging the battery 20 at the entered charge start time 90.



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With reference to FIG. 15, the vehicle charging cord 22 can have a relay or other electrical switch 92 coupled to the controller 44 and operable by the controller 40 to close at the charge start time 90. Once the charge start time 90 has been reached, the controller 40 can automatically close the switch 92, thereby supplying a current to the battery 20 for charging the battery 20. The switch 92 can remain closed until the controller 40 detects that the battery 20 is fully or sufficiently charged, until an error in charging is detected (as described above), or in some embodiments until a charge stop time or other triggering event occurs. When any such condition is reached, the switch 92 can open, thereby stopping current flow to the battery 20 and stopping the battery charging process. The vehicle charging cord 22 can be provided with any battery charge circuitry suitable for charging the battery 20. Such battery charge circuitry is well know, and can include one or more voltmeters and/or amp meters for this purpose.

**[0088]** For example, the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 includes an amp meter 94 and a volt meter 96 electrically coupled to a power line 98 supplying power to the battery 20. The controller 44 can utilize information from the amp meter 94 and/or volt meter 96 to determine whether the battery 20 is fully charged, and to automatically stop charging the battery 20 (e.g., by opening the switch 92) when the battery 20 is fully charged.

**[0089]** Accordingly, the vehicle charging cord 22 can be programmed to begin charging a battery 20 connected thereto at any time of day desired by a user. A user can therefore select an off-peak power time, and in some applications when the cost of power is reduced.

**[0090]** It will be appreciated that the time selected by a user to begin charging the battery 20 may not be the most optimal time for a power utility 48 to supply power for charging the battery 20. For example, in an emergency or during an unexpected surge of power demand, an otherwise off-peak time to begin charging the battery 20 may not be desirable for the power utility 20. As another example, widespread use of the vehicle charging cord 22 may result in surges of power demand at particular off-peak times, such as at midnight, 1 a.m., 2 a.m., or other charge start times that may be commonly selected by users in programming the vehicle charging cord 22 as described above. Another valuable feature of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 can help to reduce or eliminate these problems. With reference again to FIG. 10, the second screen 40A has another button 100 that can be selected (e.g., by user manipulation of the navigation and select buttons 36, 38 as



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described above) to set the vehicle charging cord 22 to complete charging by a desired time of day. This time of day can be changed and set by one or more time change buttons 102, such as by using the navigation buttons 36 to highlight one of the time change buttons 102 and by using the select button 38 to change the charge completion time 104 displayed on the second screen 40A. Any other manner of changing and selecting a desired time can be used as desired, including without limitation drop down or pull-up menus displaying various charge start times that can be selected.

**[0091]** Once a charge start time has been selected by a user as just described, the user can select the navigation button 82 described above to return to the first screen 40, and can command the vehicle charging cord 22 to begin a charging session by pressing the power button 34. In such cases, the controller 44 receives the charge completion time 90 and can delay the start time at which battery charging will commence based upon one or more factors (described below).

**[0092]** In some embodiments, the controller 44 automatically retrieves power information from a memory 106 coupled to the controller 44. This power information can include the cost of power per unit time, one or more pre-set times, and the like, and can be saved in the memory 106 by the controller 44. The controller 44 can receive the power information from the transceiver 46 of the vehicle charging cord 22, which can receive the power information in communication with the controller 50 and transceiver 52 of the power utility 48 and/or in communication with the user's computer. This communication can occur in any of the manners described above regarding the communication between the controllers 44, 50 and/or between the controller 44 and the user's computer. In this regard, the information can be originally produced by the power utility 48, or can be produced by a user entering the information into the user's computer for transfer to the controller 44 and memory 106 of the vehicle charging cord 22.

**[0093]** The controller 44 can delay the time at which battery charging will begin based upon the power information just described, whether stored in the memory 106 of the vehicle charging cord 22 or retrieved from the power utility 48 without being stored in the memory 106. In some embodiments, the battery charging start determined by the controller 44 can be based upon a threshold cost of power reached over a period of time. This cost of power can be received periodically by the controller 44 from the power utility 48, such as by the controller 44 of the vehicle charging cord 22 polling the controller 50 of the power utility 48,



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or by the controller 50 of the power utility 48 regularly sending or streaming updated cost of power information to the controller 44 of the vehicle charging cord 22. Upon reaching a desired cost of power (e.g., $0.50/hr., $0.45/hr., $0.40/hr.), the controller 44 of the vehicle charging cord 44 can automatically cause the switch 92 to close, thereby charging the vehicle battery 20. This threshold cost of power can be input by a user into the vehicle charging cord 22 in any of the manners described above in connection with other information entry, such as by another data entry field similar to that of the desired charge start time 90 or the desired charge completion time 104.

**[0094]** In some embodiments, the controller 44 can also automatically cause the switch 92 to open if a desired cost of power threshold is reached, thereby interrupting battery charging. In such cases, battery charging can resume in the same manner as it began when the cost of power lowers as detected by the controller 44 of the vehicle charging cord 22. Any number of interruptions and resumptions in charging the vehicle battery 20 can take place in this manner.

**[0095]** In some embodiments, the controller 44 detects a command from the user to begin a charging session, and through communication with the controller 50 of the power utility 48 (whether initiated by the controller 44 of the vehicle charging cord 22 or initiated by the controller 50 of the power utility 48 by periodic polling or in any other manner), provides a signal to the controller 50 of the power utility 48 that a charging session has been requested. Upon receiving this signal, the controller 50 of the power utility 48 can request or otherwise receive the charge completion time 104 from the controller 44 of the vehicle charging cord 22. In some embodiments, additional information regarding the charging session can also be received, such as the level of charge of the battery 20 connected to the vehicle charging cord 22, and/or the estimated charge time remaining (discussed above in connection with the charge time remaining indicator 66). Still other information can be received by the controller 50 of the power utility 48, such as the capacity of the battery 20, the battery type, the manufacturer of the battery 20, the model or other identification information of the battery 20, and/or the battery age.

**[0096]** Any or all of this information can be retrieved by or transmitted to the controller 44 of the vehicle charging cord 44 by communication with a controller 108 of the battery 20 (i.e., for batteries 20 having an integrated circuit or other controller adapted for communication with another controller, otherwise known as "smart batteries") or vehicle.

For example, the battery capacity, type, manufacturer, model or other identification information, and/or age can be stored in a memory (not shown) of the battery 20 coupled to and accessible by a controller 108 of the battery 20. This information can be stored in the memory of the battery 20 by the manufacturer, supplier, and/or servicer of the battery 20, or in some embodiments by a user. As another example, any or all of this information can be stored in a memory (not shown) of the vehicle 18 coupled to and accessible by a controller 108 of the vehicle 18. This information can be stored in the memory of the vehicle 18 by the manufacturer, supplier, and/or servicer of the vehicle 18, or in some embodiments by a user. For example, upon installation of a battery into the vehicle 18, the installer can access the controller 108 of the vehicle 18 in a conventional manner to record the battery capacity, type, manufacturer, model or other identification information, and/or age in a memory associated with the vehicle 18. Any of this information can be transmitted to or retrieved by the controller 44 of the vehicle charging cord 22 automatically upon connection to the vehicle 18 or at any other time, and in some embodiments can be stored in the memory 106 of the vehicle charging cord 22. In some embodiments, any of this information can then be retrieved from the memory 106 of the vehicle charging cord 22 and/or from the memory of the vehicle 18 for transmission to the controller 50 of the power utility 48 or for determining when to begin charging a battery 20 based upon any of the embodiments described herein.

**[0097]** Based upon the battery information obtained by the power utility 48 as described above, the power utility 48 can determine an desirable time to begin charging the battery 20 connected to the vehicle charging cord 22. This time can be based upon a number of factors that are specific to the requested charging session, such as the charge time completion for the requested charging session, as well as other factors that are independent of the requested charging session, such as the current and anticipated power draw by other customers of the power utility 48, and/or the current and anticipated cost of power to the power utility 48. Accordingly, based upon the battery information obtained by the power utility 48, the power utility 48 can control when the vehicle charging cord 22 starts to charge the battery 20 connected thereto. This control can occur, for example, by sending a signal from the controller 50 of the power utility 48 to the controller 44 of the vehicle charging cord 22 at a desired start time to trigger closure of the switch 92, or by sending a signal from the controller 50 of the power utility 48 to the controller 44 of the vehicle charging cord 22 to close the switch 92 at a particular future time (which time can be stored in the memory 106 of the vehicle charging cord 22 or can begin a timer counting to that particular time of day), or

in other manners. In this manner, the power utility 48 can maintain a degree of control over power draw while still following an instruction by the user to complete a vehicle charging session by a desired time.

**[0098]** As just described, in some embodiments the power utility 48 can control when the vehicle charging cord 22 begins charging a battery 20 connected thereto. Alternatively or in addition, in some embodiments the power utility 48 can interrupt charging of a vehicle battery 20 in the event that it is desirable to delay the remainder of the charging process, such as during a surge of demand occurring while a battery 20 is being charged, in an emergency, and the like. This interruption can occur, for example, by sending a signal from the controller 50 of the power utility 48 to the controller 44 of the vehicle charging cord 22 at a desired interruption time to trigger the switch 92 to open, or by sending a signal from the controller 50 of the power utility 48 to the controller 44 of the vehicle charging cord 22 to open the switch 92 at a particular future time (which time can be stored in the memory 106 of the vehicle charging cord 22 or can begin a timer counting to that particular time of day), or in other manners. The power utility 48 can resume charging the vehicle battery 20 in the same manner as described above in connection with beginning to charge the vehicle battery 20. Any number of interruptions and resumptions in charging the vehicle battery 20 can take place based upon the desires and needs of the power utility 48 and the power draw upon the power utility 48.

**[0099]** Although it is desirable in some applications to delay the time at which charging of the vehicle battery 20 will begin based upon any of the embodiments described herein, it is also desirable in many cases to insure that a minimum level of battery power is immediately available to the user. This minimum level of battery power can be needed, for example, in case of emergency, or in the event that the user unexpectedly needs use of the vehicle 18. In such cases, the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 has another valuable feature. With particular reference to FIG. 10, the second screen 40A of the illustrated vehicle charging cord 22 has a button 110 that can be selected (e.g., by user manipulation of the navigation and select buttons 36, 38 as described above) to set the vehicle charging cord 22 to immediately begin charging the battery 20 until a minimum threshold level of battery charge has been reached regardless of whether a programmed charge has also been selected as described above. This minimum threshold level of battery charge can be changed and set by one or more charge level buttons 112, such as by using the navigation

buttons 36 to highlight one of the charge level buttons 112 and by using the select button 38 to change the minimum threshold level of battery charge 114 displayed on the second screen 40A. Any other manner of changing and selecting a desired minimum level of battery charge can be used as desired, including without limitation drop down or pull-up menus displaying various levels of battery charge that can be selected.

**[00100]** When the button 110 is selected (and in some embodiments, after the user selects the navigation button 82 described above to return to the first screen 40, and after the user commands the vehicle charging cord 22 to begin a charging session by pressing the power button 34), the controller 44 determines whether the charge level of the vehicle battery 20 connected thereto is below the threshold input by the user. The battery charge level can be determined as described above. If the battery charge level is below the threshold input by the user, or in some cases at or below the threshold input by the user, the controller 44 of the vehicle charging cord 22 automatically causes the switch 92 to close, thereby charging the vehicle battery 20 without delay. If the user has also requested a programmed charge as described above, the vehicle charging cord 22 continues to charge the vehicle battery 20 until the minimum threshold level of battery charge 114 has been reached. At this time, the vehicle charging cord 22 resumes operation in programmed mode. For example, if the charge start time 90 has already passed or if the current cost of power is below the desired cost of power as described above, the controller 44 can continue to charge the vehicle battery 20, and can do so without interruption following battery charging to the minimum threshold level of battery charge as just described. As another example, if the power utility 48 had determined that the vehicle battery 20 should be charged (e.g., based at least in part upon a charge completion time 104 entered by a user as also described above), the controller 44 can continue to charge the vehicle battery 20, and can do so without interruption following battery charging to the minimum threshold level of battery charge as just described.

**[00101]** Of course, if the vehicle charging cord 22 is operating in a manual charge mode (e.g., not based upon a time of day as selected using buttons 86 and 100), the vehicle charging cord 22 can begin to charge the vehicle battery 20 immediately after the user presses the power button 34, regardless of the degree to which the battery charge has been depleted.

**[00102]** In some embodiments, user control over additional functions and features of the vehicle charging cord 22 is enabled by further controls and menus. Additional controls and menus can be shown on the display 32 in either or both of the screens 40, 40A described

above, or in any number of additional screens. By way of example only, the vehicle charging cord 22 of the embodiment illustrated in FIGs. 2, 5-11 and 15 has a third screen 40B shown in FIG. 11. This third screen 40B can be a utilities screen accessed by a user when the "UTILITIES" navigation button 80 is selected in a manner as described above. The third screen 40B also has navigation buttons 116, 118 that can be selected by a user to return to the first screen 40, whether by making one or more changes to operation of the vehicle charging cord 22 (by selecting the "GO" navigation button 116), or by making no changes to operation of the vehicle charging cord 22 (by selecting the "CANCEL" navigation button 118). In the illustrated embodiment, selection of either navigation button 116, 118 on the third screen 40B will return the user to the first screen 40.

**[00103]** With continued reference to FIG. 11, the third screen 40B can show any amount of the information shown on the first screen 40 described above, such as the vehicle charging cord status indicator 42, the communication status indicator 54, the power connection status indicator 56, and the clock 58. The third screen 40B can include a battery charge rate selector 120 enabling a user to change the amperage at which the vehicle charging cord 22 charges a battery 20 connected to the vehicle charging cord 22. This amperage can be changed and set by one or more amperage level buttons 122, such as by using the navigation buttons 36 to highlight one of the amperage level buttons 122 and by using the select button 38 to change the amperage of the vehicle charging cord 22 displayed on the third screen 40B. Any other manner of changing and selecting a charging amperage can be used as desired, including without limitation drop down or pull-up menus displaying various charging amperages that can be selected. Although not shown in FIG. 11, in other embodiments, a similar selector can be used to also or instead change the voltage at which the vehicle charging cord 22 charges a battery 20 connected to the vehicle charging cord 22.

**[00104]** Additional features that can be used in any of the vehicle charging cord embodiments described and/or illustrated herein relate to communication settings of the vehicle charging cord 22. For example, the third screen 40B of the vehicle charging cord 22 illustrated in FIGs. 2, 5-11 and 15 includes a selector 124 that can be selected by a user to enable and disable Bluetooth® wireless communication with another controller, such as the processor of a user's computer. In other embodiments, the same or different selector can be used to enable and disable other types of wireless and wired communication with another controller. The third screen 40B of the illustrated embodiment also has a selector 126 that



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can be selected by a user to enable and disable wireless and/or wired communication with a power utility 48.

**[00105]** In some embodiments, the controller 44 of the vehicle charging cord 22 can send a communication to the user in the event that one or more different events associated with a vehicle charging session occur. By way of example only, by using conventional power detection circuitry, the controller 44 can detect when a supply of power to the vehicle charging cord 22 has been interrupted, such as in a power failure in the electrical system of the user, at the power utility, or anywhere in between. Identifying and communicating this status to a user can be very important to the user, enabling the user to find another source of electrical power to charge the user's vehicle 18, or at least enabling the user to make appropriate plans based upon the existing level of charge in the vehicle battery 20. As another example, and by using conventional battery diagnostic circuitry, the controller 44 can detect when the battery 20 connected thereto is fully charged or has reached any other level of charge (e.g., a minimum battery charge level as described above). Still other events that can be detected and communicated to the user include a battery fault condition, a problem with the vehicle charging cord 22, and the like.

**[00106]** Upon detection of any of the events just described, the controller 44 of the vehicle charging cord 22 can send a communication to the user providing notice of the event. For example, the third screen 40B of the vehicle charging cord 22 shown in FIG. 11 includes a selector 128 that can be selected by a user to enable and disable the controller 44 automatically sending a communication indicating that power supply to the vehicle charging cord 22 has been interrupted. As another example, the third screen 40B of the vehicle charging cord 22 shown in FIG. 11 includes a selector 130 that can be selected by a user to enable and disable the controller 44 automatically sending a communication indicating that the battery 20 to which the vehicle charging cord 22 is connected is fully charged.

**[00107]** The controller 44 of the vehicle charging cord 22 can communicate any of the events described above in a number of different manners. For example, the vehicle charging cord 22 can have a speaker or other sound emitting device (not shown) coupled to the controller 44 and capable of emitting an auditory alarm when any of the above-described events have occurred. The audible alarm can be emitted once upon the occurrence of the event, or can be emitted upon the occurrence of the event and at periodic times (e.g., every 5 minutes, every hour, and the like) after the occurrence of the event. As another example, the



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controller 44 of the vehicle charging cord 22 can transmit a wired or wireless signal to the user's computer and/or to the power utility 48 (i.e., to the controller 50 of the power utility 48) in any of the manners of communication described above in connection with the controller 50. Such a signal can automatically trigger a visual or auditory alarm or other notice via the user's computer and/or the controller 50 of the power utility 48, such as by automatically generating a text message or e-mail from the controller 50 of the power utility 48 to a computer, phone, PDA, or other device of the user, by automatically generating a text message or e-mail from the user's computer to a phone, PDA, or other device of the user, by displaying an alert on the user's computer, and the like. Another mode of communication to the user include an automatically generated telephone call from the power utility 48 (triggered by and/or under control of the controller 50) or the user's computer to a phone of the user, followed by an automatically generated voice message communicating the event and played by phone to the user when the phone is answered. Still other modes of alerting the user to any of the events described above are possible, and fall within the spirit and scope of the present invention.

**[00108]** In the illustrated embodiment of FIGs. 2, 5-11 and 15, the controller 44 of the vehicle charging cord 22 responds to detection of power interruption or completion of battery charge by either causing an e-mail to be sent to the user and/or by generating an auditory alarm from the vehicle charging cord 22 based upon whether respective selectors 132, 134 for such modes of communication are selected on the third screen 40B illustrated in FIG. 11. In other embodiments, other modes of communication can be similarly enabled and disabled by selection of other selectors.

**[00109]** FIG. 12 illustrates another embodiment of a vehicle charging cord according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the vehicle charging cord described above in connection with FIGs. 2, 5-11 and 15. Accordingly, the following description focuses primarily upon the structure and features that are different the embodiments described above in connection with FIGs. 2, 5-11 and 15. Reference should be made to the description above in connection with FIGs. 2, 5-11 and 15 for additional information regarding the structure and features, and possible alternatives to the structure and features of the vehicle charging cord illustrated in FIG. 12 and described below. Structure and features of the embodiment shown



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in FIG. 12 that correspond to structure and features of the embodiment of FIGs. 2, 5-11 and 15 are designated hereinafter in the 200 and 300 series of reference numbers.

**[00110]** The embodiment of the vehicle charging cord 222 shown in FIG. 12 provides an example of how the various indicators, selectors, and user-manipulatable controls can take different forms and be located in different positions and arrangements on the housing 228, and how the vehicle charging cord 222 can have any sub-combination of the features and elements described above (e.g., any sub-combination of the various indicators, selectors, and user-manipulatable controls described above). The illustrated vehicular charging cord 222 does not have an LCD display as shown in the embodiment of FIGs. 2, 5-11 and 15, and instead has a number of LED displays and indicators. For example, the illustrated vehicular charging cord 222 utilizes an LED display for the battery charge level indicator 260, clock 258, charge time remaining indicator 266, power used indicator 268, charge cost per hour indicator 270, total cost indicator 272, and charge start time/charge completion time indicator 290, 304 (both of which are combined into a common indicator as shown). As another example, the illustrated vehicular charging cord 222 utilizes individual LED lights for the vehicle charging cord status indicator 242 and the communication status indicator 254. The use of LED displays and LED lights can reduce manufacturing costs of the vehicle charging cord 222, and in some embodiments can provide a design of the vehicle charging cord 222 less susceptible to damage compared to the use of LCD and other displays.

**[00111]** As described above in connection with the illustrated embodiment of FIGs. 2, 5-11 and 15, the battery charge level indicator 260 and clock 258 can display information in any form desired. For example, the battery charge level indicator 260 shown in FIG. 12 is a numerical percentage of full charge, but can take any of the other forms described above in connection with the battery charge level indicator 60 of the embodiment of FIGs. 2, 5-11 and 15.

**[00112]** In contrast to the selectors 74 on the first screen 40 in the embodiment of FIGs. 2, 5-11 and 15, the selectors 274 in the illustrated embodiment of FIG. 12 are individual buttons of any conventional type, including any of the button types described above in connection with the power, navigation, and select buttons 34, 36, 38 of the embodiment of FIGs. 2, 5-11 and 15. By pressing any of the four buttons 274, a user can start a manual charge, start a programmed charge of the type described above in connection with the charge start time 90 illustrated in FIG. 10 (i.e., start charging at a time entered by the user), start a programmed

charge of the type described above in connection with the charge completion time 104 illustrated in FIG. 10 (i.e., start charging based upon power utility control and complete charging by a time entered by the user), and stop the vehicle charging cord 222 from charging a battery 20 connected thereto.

**[00113]** Also, in contrast to the time change buttons 88, 102 on the second screen 40A in the embodiment of FIGs. 2, 5-11 and 15, the time change buttons 288, 302 in the illustrated embodiment of FIG. 12 are mechanical buttons of any type, including any of the button types described above in connection with the power, navigation, and select buttons 34, 36, 38 of the embodiment of FIGs. 2, 5-11 and 15. By pressing on the buttons 288, 302 to the left of the charge start time/charge completion time indicator 290, 304, the hour of the time displayed by the charge start time/charge completion time indicator 290, 304 can be adjusted, whereas by pressing on the buttons 288, 302 to the right of the charge start time/charge completion time indicator 290, 304, the minutes of the time displayed by the charge start time/charge completion time indicator 290, 304 can be adjusted. In other embodiments, any other number, position, and type of time change buttons can be used to adjust the time on the charge start time/charge completion time indicator 290, 304. Following entry of a desired time, a user can press any of the first three selectors 274 (followed in some embodiments by pressing the power button 234) to begin a charging session.

**[00114]** Although LEDs are used in the illustrated embodiment of FIG. 12 for various indicators and selectors 258, 260, 242, 254, 266, 268, 270, 272, 290, 304, any other type of light-emitting device can instead be used as desired.

**[00115]** The various embodiments of the vehicle charging cords 22, 222 described above and illustrated in FIGs. 2, 5-12 and 15 can provide significant advantages relating to the portability of the vehicle charging cords 22, 222. By virtue of the fact that the opposite ends 24, 26 of the vehicle charging cords 22, 222 are releasably connected to an electrical system providing a source of electrical power and to the battery 20 of a vehicle, respectively, and by virtue of the fact that the other components of the vehicle charging cord cords 22, 222 are contained within a housing to define a single integral unit, the vehicle charging cords 22, 222 are portable, can be readily moved from vehicle to vehicle, can thereby be used to charge any number of different vehicles, and can be moved into and out of (and can be transported by) vehicles with ease. Also, portable charging cords 22, 222 of the type described above and illustrated in FIGs. 2, 5-12 and 15 can be purchased by a user and can be releasably



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connected to the battery 20 of a vehicle 18, thereby eliminating the need to service the vehicle 18 or to the electrical system at which the vehicle will be charged. This can be particularly useful in cases where the ability to charge the battery 20 of the vehicle 18 in different locations only having standard electrical outlets (and otherwise not being specially adapted to charge electric vehicles) is important or desirable.

**[00116]** In other embodiments, either end 24, 26 of the charging cord 22, 222 can be permanently secured to the electrical system of the house, building, or other facility and/or to the vehicle 18, 218, respectively. For example, one end 24 of the charging cord 22, 222 can be permanently secured to the electrical system of the house, building, or other facility (i.e., not intended or adapted for removal by a user, such as by being wired directly into a junction box or circuit breaker of the electrical system of the house, building, or other facility). In such cases, the charging cord 22, 222 can be wound upon and stored in a floor standing, wall-mounted, or ceiling-mounted reel (not shown), such as those disclosed in U.S. Patent No. 6,439,360, the entire disclosure of which is incorporated herein by reference. The reel can be spring-loaded to enable the vehicle charging cord 22, 222 to be easily wound upon the reel for storage, or can be manually turned for this purpose. In such embodiments, the majority, all, or almost all of the length of the charging cord 22, 222 can be defined between the housing 28, 228 and the end 226 of the charging cord 22, 222 intended for connection to the electrical system of the facility. In this manner, the majority or almost all of the vehicle charging cord 22, 222 can be conveniently stored. Such vehicle charging cords provide a significant benefit to users desiring to charge two or more vehicles 18, 218 at the same facility using the same vehicle charging cord 22, 222, such as for charging one vehicle 18, 218 during the day and for charging another vehicle 18, 218 at night using the same vehicle charging cord 22, 222. The use of one vehicle charging cord 22, 222 for two or more vehicles 18, 218 can provide significant cost savings to the user(s) of the vehicles 18, 218.

**[00117]** As another example, one end 26 of the charging cord 22, 222 can be permanently secured to the vehicle 18, 218 (i.e., not intended or adapted for removal by a user, such as by being permanently connected to one or more wiring harnesses of the vehicle, or by being connected to an electrical junction box or fuse box of the vehicle 18, 218). In such cases, the charging cord 22, 222 can also be wound upon and stored on a reel (not shown) carried by the vehicle 18, 218, such as the reels disclosed in U.S. Patent No. 6,439,360 and incorporated by reference above. The reel can be mounted directly to the frame of the vehicle 18, 218, an

interior surface of a body part of the vehicle 18, 218, to a bracket or other fixture (e.g., radiator mounting bracket, alternator or battery mounting bracket, and the like) of the vehicle 18, 218, to the front or rear bumper of the vehicle 18, 218, or to any other location providing suitable strength to carry the reel and vehicle charging cord 18, 218. As described above, the reel can be spring-loaded to enable the vehicle charging cord 22, 222 to be easily wound upon the reel for storage on the vehicle, or can be manually turned for this purpose. In such embodiments, the majority, all, or almost all of the length of the charging cord 22, 222 can be defined between the housing 28, 228 and the end 224 of the charging cord 22, 222 intended for connection to the vehicle 18, 218. In this manner, the majority or almost all of the vehicle charging cord 22, 222 can be conveniently stored on the vehicle. The vehicle-mounted vehicle charging cord 22, 222 provides a significant benefit for users needing to charge their vehicle battery 20, 220 in multiple locations, as the vehicle charging cord 22, 222 is conveniently carried by the vehicle 18, 218 from destination to destination.

**[00118]** Although reel-based vehicle charging cords as just described are described in connection with vehicle charging cords 22, 222 not intended for release by a user from both the vehicle 18, 218 and the electrical system of the facility, it should be noted that the other portable vehicle charging cord embodiments described and/or illustrated herein (i.e., those intended for user release at both ends) can also include a spring-loaded or non-spring-loaded reel as just described. In this manner, such vehicle charging cords 22, 222 can be quickly and conveniently placed in a relatively portable and compact state.

**[00119]** FIGs. 13, 14, and 16 illustrate an embodiment of a vehicle charging system according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the vehicle charging cord described above in connection with FIGs. 2, 5-12 and 15. Accordingly, the following description focuses primarily upon the structure and features that are different the embodiments described above in connection with FIGs. 2, 5-12 and 15. Reference should be made to the description above in connection with FIGs. 2, 5-12 and 15 for additional information regarding the structure and features, and possible alternatives to the structure and features of the vehicle charging system illustrated in FIGs. 13, 14, and 16 and described below. Structure and features of the embodiment shown in FIGs. 13, 14, and 16 that correspond to structure and features of the embodiment of FIGs. 2, 5-12 and 15 are designated hereinafter in the 400 and 500 series of reference numbers.

**[00120]** Despite the significant advantages provided by the portable vehicle charging cords 22, 222 described above in connection with FIGs. 2, 5-12 and 15, other significant advantages are realized by incorporating the elements and features of the vehicle charging cords 22, 222 into a vehicle 18. With reference to FIGs. 13, 14, and 16, the illustrated vehicle charging system uses much of the same elements and features described above in connection with the various embodiments of the vehicle charging cords 22, 222. In this regard, FIG. 13 illustrates a portion of the dashboard of a vehicle 18, and includes a battery charge level indicator 460 integrated into the same part of the vehicle dashboard as an oil temperature indicator 538. Also integrated into the same portion of the dashboard, by way of example only, is a vehicle charging status indicator 442. The vehicle charging status indicator 442 shown in FIG. 13 can be similar to the charge status display area 76 described above in connection with the vehicle charging cord 22 of FIGs. 2, 5-11 and 15. Accordingly, one or more lights can be used to illuminate the words "MANUAL CHARGING IN PROCESS" when the vehicle battery charging system is in a manual charging mode as described above, whereas one or more other lights can be used to illuminate the words "PROGRAMMED CHARGE IN PROCESS" when the vehicle battery charging system is in a programmed charging mode as also described above. Any other manner of displaying the vehicle charging status indicator 442 can be used as desired, including without limitation an LED or LCD display, one or more lamps adjacent printed graphics, and the like.

**[00121]** With continued reference to the illustrated embodiment of FIGs. 13, 14, and 16, the illustrated vehicle charging system can include a display 432 located in the console of the vehicle 18. As used herein, the term "console" refers to any portion of the interior of a vehicle (i.e., in the interior passenger cabin of the vehicle) having one or more manual or electronic controls for controlling operation of a vehicle 18 and/or one or more indicators showing the status of vehicle operation. For example, the console of a vehicle 18 can include a dashboard having a speedometer, odometer, RPM gauge, oil temperature gauge, and the like, a navigation screen with associated indicators and/or controls, HVAC indicators and controls, an entertainment center (e.g., radio, DVD or other video system, CD, MP3 or other audio system, and the like) with associated indicators and controls, environmental temperature indicators, travel direction indicators, and the like. The console can be located immediately in front of the driver, to either side of the driver, in central forward area of the vehicle cabin, in an area between the driver's seat and an adjacent passenger seat, in an interior location on the roof or otherwise at a higher elevation than a horizontal line of sight

of the user, and the like. Also, the console of the vehicle can extend to and be positioned in any combination of these interior vehicle locations, such as a single console including the dashboard and central area between the driver and passenger seats.

**[00122]** In some embodiments, the selectors and indicators (including any displays) of the vehicle charging system are located in their own dedicated console, whereas in other embodiments, the console carrying such features also carries other vehicle indicators and controls. Also, the selectors and indicators (including any displays) of the vehicle charging system can be located in two or more consoles, if desired, such as one or more indicators located in the dashboard console of the vehicle 18 and the remainder located in another console located between the driver and passenger at the front of the passenger compartment. Any combination of selectors and indicators located in any combination of vehicle consoles is possible, and falls within the spirit and scope of the present invention.

**[00123]** The display 432 shown in FIG. 14 is a touch screen display 432, and includes many of the same indicators and selectors used in the vehicle charging cord embodiments described above in connection with FIGs. 2, 5-11 and 15. In particular, the display 432 includes a charge time remaining indicator 466, power used indicator 468, charge cost per hour indicator 470, and total cost indicator 472 like those of the vehicle charging cords 22, 222 described and illustrated above. Also, the illustrated display 432 includes another vehicle charging status indicator 442 that can be used in addition to or in place of that shown in FIG. 13, and a communication status indicator 454 and power connection status indicator 456 similar to those described above in connection with the illustrated embodiment of FIGs. 2, 5-11 and 15. Although a clock can also be included on the display 432, a clock is not included in the display 432 of FIG. 14 in lieu of another clock of the vehicle 18 located elsewhere on the dashboard or console of the vehicle 18. This other clock can be connected to the same controller 444 (see FIG. 16) as the rest of the vehicle charging system, thereby providing the controller 444 with the time of day information needed to begin programmed charging operations as described above.

**[00124]** The display 432 illustrated in FIG. 14 can display multiple screens 440 to be shown upon the display 432, thereby enabling a significantly greater amount of battery and battery charging information to be shown on the display, and/or enabling a greater degree of control over the vehicle charging system. Like the vehicle charging cords 22, 222 described above, navigation between screens 440 on the display 432 is enabled by navigation buttons

on the screens. For example, the screen 440 shown in FIG. 14 includes two navigation buttons 478, 480 like those of the illustrated embodiment of FIGs. 2, 5-11 and 15 described above. By pressing one of the navigation buttons 478 (entitled "PROGRAMMED CHARGE SETUP"), the screen 440 is replaced by a charge programming screen (not shown) having any or all of the indicators and selectors 42, 54, 56, 58, 82, 84, 86, 88, 90, 100, 102, 104, 110, 112, and/or 114 described above in connection with the second screen 40A in FIG. 10. These indicators and selectors can have the same or any other arrangement upon the programming screen. By pressing the other navigation button 480 (entitled "UTILITIES"), the screen 440 is replaced by a utilities screen (also not shown) having any or all of the indicators and selectors 42, 54, 56, 58, 116, 118, 120, 122, 124, 126, 128, 130, 132, and/or 134 described above in connection with the third screen 40B in FIG. 11. These indicators and selectors can have the same or any other arrangement upon the utilities screen.

**[00125]** To begin or stop a manual or programmed charging session, the embodiment of the present invention illustrated in FIGs. 13, 14, and 16 can include a single power button that in some embodiments can change text to indicate whether a selection can be made by a user to start or stop a charging session (e.g., changing from "START CHARGE" to "STOP CHARGE" once a user selects "START CHARGE", or changing from "STOP CHARGE" to "START CHARGE" once the user selects "STOP CHARGE"). In other embodiments, such as that shown in FIGs. 13, 14, and 16, the screen 440 can include separate buttons 434A, 434B to start or stop a charging session, such as to start a manual charge if none of the selectors for a programmed charge have been selected on a programming screen, or to start a programmed charge of any type described herein.

**[00126]** Although the in-console display 432 illustrated in FIG. 14 is a touch screen display 432, the display 432 can be any other type of display, such as the other types of displays described and illustrated herein. For example, the touch screen display 432 can be replaced by a display such as that shown in FIGs. 5-11 or FIG. 12, in which cases the vehicle charging system can include navigation buttons (e.g., adjacent the display 432) enabling a user to navigate through a screen and to select any selectors upon the display 432. As another example, the touch screen display 432 can be replaced by any combination of buttons, switches, dials, or other user-manipulatable controls; LEDs and other lights; and displays (e.g., see FIG. 12).



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**[00127]** A schematic diagram of the vehicle charging system in which an in-console display 432 is utilized and/or in which the in-console vehicle charging selectors and indicators are otherwise utilized is shown in FIG. 16. Like the embodiments of FIGs. 2, 5-12 and 15 described above, the system illustrated in FIG. 16 is releasably coupled to a source of power 412 operated and controlled by a power utility 448 having a transceiver 452 and controller 444 (e.g., a computer) that can communicate via a PLC system with the controller 444 of the vehicle charging system. In the illustrated embodiment of FIG. 16, however, the display 432 and other controls and indicators are located in one or more in-cabin consoles of the vehicle 418. Therefore, a power cord 540 having ends 424, 426 described above in connection with the embodiments of FIGs. 2, 5-12 and 15 (but without the housing and other components carried in or on the housing) can be used to releasably connect the battery 420 of the vehicle 418 with the electrical system of the facility used to charge the battery 420 as also described above. As with the earlier-described embodiments, the power cord 540 can be releasably coupled to the vehicle 418, and in other embodiments can instead be stored on-board the vehicle 418 when not in use (e.g., by a cord reel mounted on the vehicle as described above). Also as with the earlier-described embodiments, the power cord 540 can also or instead be releasably coupled to the electrical system of the house, office, or other facility to enable the power cord 540 to be more readily and easily moved within and removed from the facility, or can be permanently connected to the electrical system.

**[00128]** With continued reference to FIG. 16, the illustrated vehicle charging system also includes a transceiver 446 for communication between the controller 444 on board the vehicle 418 and the transceiver 452 and controller 440 of the power utility 448, a power transformer 536, an amp meter 494, a volt meter 496, a switch 492, and a memory 506 performing the same functions described above in conjunction with the embodiments of FIGs. 2, 5-12, and 15. It should be noted that the controller 444 of the vehicle charging system can be a dedicated controller (e.g., a processor or set of discrete logic elements) separate from the other controllers of the vehicle (e.g., those used to control vehicle startup, vehicle access and security, and engine operation, smart battery controllers, and the like), or can be the same as such other controller(s). Accordingly, the electronics of the vehicle charging system according to some embodiments of the present invention can be fully or partially integrated into one or more other controllers of the vehicle, or can be separate therefrom. In either case, the controller 444 can be located within a housing (not shown), and can be connected via suitable wiring harnesses or other wired or wireless electrical

connections to an electrical connector on the vehicle (adapted for releasable mating connection to an external power cord as described above) or to a power cord carried by the vehicle as also described above. Similarly, the memory 506, transceiver 446, and clock can be dedicated solely for operation of the vehicle charging system as described in earlier embodiments, or can instead be shared by other systems of the vehicle 418.

**[00129]** The vehicle charging system shown in FIG. 16 can function in the same manners described above in connection with the embodiments of FIGs. 2, 5-12, and 15, it being understood that communications, power control, programming, and other features of the vehicle charging system are performed on-board the vehicle 418 rather than in a vehicle charging cord as shown in FIGs. 2, 5-12, and 15. Accordingly, power supply and communications in the embodiment of FIG. 16 can include power supply and communications over one or more suitable power cords, wiring harnesses, and the like of the vehicle performing the same functions (including PLC and power transmission functions) as the flexible power cords on both sides of the housings 28, 228 illustrated in FIGs. 2 and 5-12.

**[00130]** FIG. 3 illustrates another embodiment of a vehicle charging system according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the vehicle charging cord described above in connection with FIGs. 2, 5-12 and 15. Accordingly, the following description focuses primarily upon the structure and features that are different the embodiments described above in connection with FIGs. 2, 5-12 and 15. Reference should be made to the description above in connection with FIGs. 2, 5-12 and 15 for additional information regarding the structure and features, and possible alternatives to the structure and features of the vehicle charging system illustrated in FIG. 3 and described below. Structure and features of the embodiment shown in FIG. 3 that correspond to structure and features of the embodiment of FIGs. 2, 5-12 and 15 are designated hereinafter in the 600 and 700 series of reference numbers.

**[00131]** The vehicle charging system illustrated in FIG. 3 operates in substantially the same manner as that of FIGs. 2, 5-12 and 15. However, in the illustrated embodiment of FIG. 3, the vehicle charging system is embodied in a cabinet 742. The cabinet 742 performs functions similar to the housings 28, 228 described and illustrated herein, such as to house the controller, transformer, and other electronics of the vehicle charging system. In some embodiments, the cabinet 742 can be wall-mounted and/or floor-mounted (such as that shown in FIG. 3).

**[00132]** The cabinet 742 of the vehicle charging system can include a display 732 having any of the features and performing any of the functions described above in connection with the displays 32 of the embodiments shown in FIGs. 2, 5-11, 14, and 15. The display 732 can be a touch screen display or any other type of display as described herein, and can be accompanied by any number and type of user manipulatable controls (e.g., navigation buttons) as also described herein. Any combination of selectors and indicators (including displays) described and/or illustrated herein can be provided on the cabinet to perform the vehicle charging functions also described herein.

**[00133]** In some embodiments, the cabinet 742 is provided with a power cord 744 terminating in a plug 624 that can be releasably connected to a vehicle 618 (and to the battery 620 thereof). The plug 624 can take any of the forms described above in connection with the embodiments of FIGs. 2, 5-12, and 15. In some embodiments, the power cord 744 can be stored on a reel (not shown) in or adjacent the cabinet 742. The reel can take any of the forms described above in connection with other embodiments of the present invention. Although the cabinet 742 can provide a convenient location for storage of the power cord 744, the power cord 744 can instead be permanently or releasably coupled to the vehicle 618 for storage on the vehicle 618 when the power cord 744 is not in use. For example, the power cord 744 can be stored upon a reel of the vehicle 618 as described in greater detail above. In those embodiments in which the power cord 744 is intended to be stored and carried by the vehicle 618, the power cord 744 can have an opposite end terminating in a plug (such as any of the plugs described above in connection with plug 26 shown in FIG. 5). The cabinet 742 can be provided with any number of electrical connectors for releasable mating engagement with the plug (and for any number of other plugs on power cords 744 extending to other vehicles 618).

**[00134]** FIG. 17 illustrates another embodiment of a vehicle charging system according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the vehicle charging system described above in connection with FIGs. 2, 3, and 5-16. Accordingly, the following description focuses primarily upon the structure and features that are different the embodiments described above in connection with FIGs. 2, 3, and 5-16. Reference should be made to the description above in connection with FIGs. 2, 3, and 5-16 for additional information regarding the structure and features, and possible alternatives to the structure and features of the vehicle charging system

illustrated in FIG. 17 and described below. Structure and features of the embodiment shown in FIG. 17 that correspond to structure and features of the embodiments of FIGs. 2, 3, and 5-16 are designated hereinafter in the 800 and 900 series of reference numbers.

**[00135]** Like the embodiment of FIGs. 2, 3, and 5-16, the vehicle charging system of FIG. 17 also includes a transceiver 846 for communication between a controller 844 and the transceiver 852 and controller 840 of the power utility 848, a power transformer 836, an amp meter 894, a volt meter 896, a switch 892, and a memory 906 performing the same functions described above in conjunction with the embodiments of FIGs. 2, 5-12, and 15. A clock 858, display 832, and associated user-manipulatable controls as described above (or other types and combinations of selectors and indicators, with or without displays) are also included for providing information to the user and for receiving instructions from the user in any of the manners also described above.

**[00136]** The vehicle charging system of FIG. 17 includes a battery 946 that can be charged in any of the same manual or programmed manners described above in connection with the embodiments of FIGs. 2, 3, and 5-16. The battery 946 is separate from the battery 920 of the vehicle 918, and can have any size sufficient for at least partially charging the battery 920 of the vehicle 918 when connected thereto. Rather than or in addition to charging a battery 920 of the vehicle 918 as described herein in connection with other embodiments of the present invention, the vehicle charging system of FIG. 17 operates to charge the battery 946 that remains at the house, building, or other facility at which vehicle charging takes place. The battery 946 therefore functions as a reservoir of power that can collect and store a charge for later transfer to batteries 946 of one or more vehicles 918. Accordingly, although the battery 946 can have any size suitable for charging a battery 920 of a vehicle 918, in some embodiments the battery 946 has a capacity capable of fully charging the battery 920 of at least one vehicle 918 when the battery 920 of the vehicle 918 has no charge or substantially no charge.

**[00137]** The battery 946 can be located anywhere in a house, building, or other facility where vehicle battery charging is desired, and in some embodiments is located an a garage in which the vehicle is stored. For example, the battery 946 can be stored in a cabinet also housing the rest of the vehicle charging system (e.g., in a lower portion of the cabinet 742 illustrated in FIG. 3). In some embodiments, the battery 946 can be sufficiently oversized (in voltage, current, or capacity) for completely charging a drained vehicle battery 920 connected

thereto so that improved or optimized battery charging conditions can be achieved. The battery 946 can also be oversized to carry sufficient charge for charging two or more fully or substantially discharged vehicle batteries 920. Also, in some embodiments, the vehicle charging system can have one or more power converters (e.g., DC to DC converters) to increase the output voltage of the battery 946 sufficiently for charging the vehicle battery 920.

**[00138]** With continued reference to the illustrated embodiment of FIG. 17, the vehicle charging system can include an additional relay or other electrical switch 948 coupled to the controller 844. The switch 948 can enable a user to begin charging the battery 920 of a vehicle 918 connected to the vehicle charging system only when desired. Accordingly, the controller 844 can send a signal to close the switch 948 upon receiving a command from a user (e.g., via a user-manipulatable control having any of the forms described herein) to begin charging the battery 920 of a vehicle 918 connected thereto. Like the other embodiments described and illustrated herein, the switch 948 can be controlled by a user and/or can be controlled by a power utility 948 via the transceivers 846, 852 and controllers 840, 844.

**[00139]** By virtue of the battery 946 in the embodiment of FIG. 17, control over a community's power draw needed for charging vehicles 918 is greatly increased. Rather than wait until a vehicle 918 is connected to the electrical system of a house, building, or other facility in order to supply power to charge the battery 920 of the vehicle 918, the user or power utility 848 can be free to supply vehicle battery charging power at any convenient time. For example, if the power utility 848 has a period of relatively low daytime demand that is unexpected (such as a drop in power draw during an otherwise peak or high demand time), the power utility 848 can begin charging the battery 946 regardless of whether the vehicle 918 is in another location. This flexibility can enable the power utility 848 to independently send relatively low-cost battery charging power – and/or for the user to independently draw relatively low-cost battery charging power - at times of power surplus regardless of the location of the vehicle 918 to be charged.

**[00140]** In some embodiments, the vehicle charging system of FIG. 17 can also operate in a manner similar to the embodiments of FIGs. 2, 3, and 5-16, whereby a user can connect the battery 920 of the vehicle 918 for charging, and the battery 920 can be charged in any manual or programmed mode by closure of the switches 892, 948 under control of the controller 844. Such charging can take place without draining the battery 946 described above (such as by a

suitable electrical bypass around the battery 946), or can be supplemented by any amount of charge existing in the battery 946. In this regard, if the cost for charging or partially charging the battery 946 of the vehicle charging system is higher than the calculated cost of charging the battery 920 of the vehicle 918 at the desired charging start time (both figures being available to the controller 844 as described above, and being storable in and retrievable from the memory 906 as desired), the controller 844 can control the switches 892, 948 to charge the vehicle battery 920 using the charge from the system battery 946 first. If the opposite is true, the controller 844 can control the switches 892, 948 to charge the vehicle battery 920 using power directly from the power utility 848 without draining the system battery 946. These operating conditions can be continually monitored by the controller 844, which in some embodiments can automatically react to changing power supply costs while charging is in process by changing the source of charging current (i.e., system battery 946 or power utility 848).

**[00141]** The vehicle charging system of FIG. 17 is illustrated in the form of a portable vehicle charging cord, such as the embodiments of FIGs. 2, 5-12, and 15. However, the features of the vehicle charging system of FIG. 17 can be incorporated into any of the vehicle charging system embodiments described and/or illustrated herein, including those illustrated in FIGs. 3, 13, 14, 16, and FIGs. 4, 18, and 19 (described below).

**[00142]** FIGs. 4, 18, and 19 illustrate another embodiment of a vehicle charging system according to the present invention. This embodiment employs much of the same structure and has many of the same properties as the embodiments of the vehicle charging systems described above in connection with FIGs. 2, 3, and 5-17. Accordingly, the following description focuses primarily upon the structure and features that are different the embodiments described above in connection with FIGs. 2, 3, and 5-17. Reference should be made to the description above in connection with FIGs. 2, 3, and 5-17 for additional information regarding the structure and features, and possible alternatives to the structure and features of the vehicle charging system illustrated in FIGs. 4, 18, and 19 and described below. Structure and features of the embodiment shown in FIGs. 4, 18, and 19 that correspond to structure and features of the embodiments of FIGs. 2, 3, and 5-17 are designated hereinafter in the 1000 and 1100 series of reference numbers.

**[00143]** The vehicle charging system illustrated in FIGs. 4, 18, and 19 has the same components and features as described above in connection with the on-board vehicle



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charging system of FIGs. 13, 14, and 16, but is further adapted for charging the battery 1020 of the vehicle 1018 by induction charging. Accordingly, the vehicle charging system illustrated in FIGs. 4, 18, and 19 has a touch screen display 1032 having a charge time remaining indicator 1066, power used indicator 1068, charge cost per hour indicator 1070, and total cost indicator 1072 as described in greater detail in the embodiments above. Also, the illustrated display 1032 includes a vehicle charging status indicator 1042 (not shown in FIG. 19, but in the text banner at the top of the illustrated display 1032 in FIG. 19 when docking is not in process), a communication status indicator 1054, and a power connection status indicator 1056 as described in greater detail in the embodiments above.

**[00144]** The display 1032 illustrated in FIG. 19 can display multiple screens 1040 to be shown upon the display 1032, thereby enabling a significantly greater amount of battery and battery charging information to be shown on the display, and/or enabling a greater degree of control over the vehicle charging system. Navigation between screens 1040 on the display 1032 is enabled by navigation buttons on the screens 1040. For example, the screen 1040 shown in FIG. 19 includes two navigation buttons 1078, 1080 for navigation to programming and utility screens as described in greater detail in the embodiments above. Also, the screen 1040 has separate buttons 1034A, 1034B to start or stop a charging session.

**[00145]** Although the in-console display 1032 illustrated in FIG. 19 is a touch screen display 1032, the display 1032 can be any other type of display, such as the other types of displays described and illustrated herein. For example, the touch screen display 1032 can be replaced by a display such as that shown in FIGs. 5-11 or FIG. 12, in which cases the vehicle charging system can include navigation buttons (e.g., adjacent the display 1032) enabling a user to navigate through a screen and to select any selectors upon the display 1032. As another example, the touch screen display 1032 can be replaced by any combination of buttons, switches, dials, or other user-manipulatable controls; LEDs and other lights; and displays (e.g., see FIG. 12).

**[00146]** With reference now to FIG. 4, the vehicle charging system of FIGs. 4, 18, and 19 utilizes a conventional battery induction charging system in order to charge the battery 1020 of the vehicle 1018, and includes a charging pad 1150 having a power supply core (not shown) energized to supply power via induction to a power receiving core of the vehicle (shown schematically at 1152 in FIG. 18). By way of example only, an inductive vehicular battery charger system that can be used is disclosed in U.S. Patent No. 6,525,510, the entire

contents of which are incorporated herein by reference. The power supply core of the charging pad 1150 is electrically connected to and receives power from a vehicular charger that is the same as that described above in connection with the embodiment of FIG. 3. In particular, the core of the charging pad 1150 is electrically connected to the electrical system of the house, building, or other facility at which charging is to take place via a below-ground or above-ground power line 1144 extending to a cabinet 1142 having any of the selectors and indicators (including display(s)) described above in connection with FIG. 3. In this regard, any of the alternative vehicle charger features and structures also described above in connection with the embodiment of FIG. 3 can also be applied in the inductive vehicular charging system of FIGs. 4, 18, and 19.

**[00147]** As is well known to those in the art of inductive battery charging, proper alignment between the power supply core and the power receiving core of the battery charger is important for efficient battery charging. In the illustrated embodiment of FIGs. 4, 18, and 19, this alignment can be achieved by user operation of the vehicle 1018. In particular, one or more sensors 1154 can be provided on the vehicle 1018 and can be positioned to detect the presence and proximity of the vehicle charging pad 1150 and core thereof. The sensors 1154 can be inductive sensors adapted to detect the presence of metallic elements 1156 in the vehicle charging pad 1150 or having known positions with respect to the vehicle charging pad 1150 and core. Alternatively, the sensors 1154 can be Hall Effect sensors adapted to detect the magnetic field of magnets or electromagnets having known positions on or with respect to the vehicle charging pad 1150 and core. In other embodiments, the sensors 1154 can be RFID sensors adapted to detect the position of one or more RFID transmitters having known positions on or with respect to the vehicle charging pad 1150 and core. Still other types of sensors 1154 can instead be used, including without limitation optical sensors, eddy current sensors, and ultrasonic sensors for use in conjunction with optical, eddy current, and ultrasonic sensing and position systems, all of which operate on principles well-known to those skilled in the art. By detecting the distance between the sensor(s) 1154 on the vehicle 1018 and one or more reference points on the charging pad 1150 (or having known positions with respect to the charging pad 1150), the position of the sensor(s) 1154 with respect to the charging pad 1150 can be identified via triangulation. Triangulation systems operating to detect the relative position of objects based upon any of these technologies are well-known to those skilled in the art, and are not therefore described further herein.

**[00148]** In other embodiments, the locations of the sensors 1154 and the elements 1156 (e.g., metallic elements 1156, magnets or electromagnets, RFID transmitters, and the like, as described above) detected by the sensors 1154 can be reversed, whereby one or more of the sensors 1154 can be located on the charging pad 1150 or located at known positions with respect to the charging pad 1150 for detecting one or more elements 1156 (e.g., metallic elements 1156, magnets or electromagnets, RFID transmitters, and the like, as described above) of the vehicle 1018.

**[00149]** The controller (not shown) of the inductive vehicle charging system illustrated in FIGs. 4, 18, and 19 receives signals from the sensor(s) 1154 described above, and based upon a conventional triangulation algorithm as described above, determines the direction in which the vehicle 1018 must move for desired alignment of the vehicle 1018 (and power receiving core connected to the battery 1020 of the vehicle 1018) with respect to the charging pad 1150 and core thereof. Upon making this determination, the controller can display directional instructions to the user. In the illustrated embodiment of FIGs. 4, 18, and 19, directional indicators 1160 are displayed on the same touch screen display 1032 described above, along with a text line 1162 noting the direction the vehicle 1018 should move for proper charging alignment. In other embodiments, this information can be provided on another display (e.g., on a display located in a console of the vehicle 1018), or can be located on another type of display (not necessarily a touch screen). Also, in some embodiments, this information can be presented without a display 1032, such as by illumination of one or more LEDs or other lights to illuminate an arrow or other symbol, text, or any combination of symbols and text providing directional instructions to the user.

**[00150]** By way of example only, the touch screen display 1032 illustrated in FIG. 19 presents text 1162 indicating the direction in which the user should move the vehicle 1018 for proper charging alignment, presents arrow symbols 1160 in any combination (e.g., forward, rearward, left, right) around a graphical depiction of the vehicle 1164, and also displays a graphical depiction of the front wheels 1166 turned in the direction needed for proper charging alignment. Any combination of these and other alignment symbols and text instructions 1168 can be displayed to the user to indicate how the vehicle 1018 should be moved for proper charging alignment. Such symbols and/or text 1168 can be updated continuously or periodically as the position of the sensors 1154 and vehicle 1018 change with respect to the charging pad 1150 and core thereof, until alignment within a predetermined

acceptable error calculated by the controller is achieved. In some embodiments, the control(s) selected to begin a charging session (e.g., the "START CHARGE" selector 1034A on the touch screen display 1032 of the illustrated embodiment) are disabled until such alignment is achieved.

**[00151]** By utilizing the sensors 1154, sensed elements 1156, and alignment indicators 1168 as just described, proper alignment of the vehicle 1018 with respect to the charging pad 1150 can be conveniently and quickly achieved without requiring the user to leave the vehicle 1018. Also, a charging session can be started without the need to plug in the vehicle 1018.

**[00152]** Although the induction-based vehicle charging system described above in connection with FIGs. 4, 18, and 19 is presented in the context of an on-board vehicle charging system (i.e., where the display 1032, and other indicators and selectors are located in one or more consoles of the vehicle 1032, it should be noted that the vehicle alignment features described above can be used in connection with any of the other vehicle charging systems herein.

**[00153]** Another feature of the present invention regards the location at which a cord-based vehicle charging system is attached to the vehicle. As described above, some vehicle charging systems according to the present invention utilize a cord 22, 222, 540, 744, 944 that is releasably or permanently attached to the vehicle 18, 218, 418, 618, 818. It will be appreciated that such a tethered connection can present the danger of a user accidentally moving the vehicle 18, 218, 418, 618, 818 before disconnecting the cord 22, 222, 540, 744, 944 from the vehicle 18, 218, 418, 618, 818. Depending upon the position and orientation of the electrical connector of the vehicle 18, 218, 418, 618, 818 to which the cord 22, 222, 540, 744, 944 is connected, and the manner in which the opposite end of the cord 22, 222, 540, 744, 944 is attached to the electrical system of the house, building, or other facility, such movement can create significant damage to the vehicle 18, 218, 418, 618, 818, cord 22, 222, 540, 744, 944, and/or the electrical system of the house, building, or other facility. In some embodiments of the present invention, this damage can be mitigated or avoided by virtue of the position of the electrical connector of the vehicle 18, 218, 418, 618, 818.

**[00154]** With reference now to FIGs. 20-23, another embodiment of the present invention is illustrated, and is presented in the context of the vehicle charging cords 22, 122 in the embodiments of FIGs. 2, 5-12, and 15 by way of example only. In this regard, the features

described below in connection with FIGs. 20-23 can be utilized in conjunction with any of the vehicle charging systems disclosed herein in which a power cord 22, 222, 540, 744, 944 is attached to a vehicle 18, 218, 418, 618, 818 for purposes of charging the battery 20, 222, 422, 622, 822 of the vehicle 18, 218, 418, 618, 818.

**[00155]** As shown in FIGs. 20-22, the plug 26 of the vehicle charging cord 22, 222 releasably connects to the electrical connector 170 of the vehicle 18, 218. In the illustrated embodiment of FIGs. 20-22, the electrical connector 170 of the vehicle is located in a front surface 172 of the vehicle 18, 218. Accordingly, in the event a user moves the vehicle 18, 218 in a rearward direction without disconnecting the vehicle charging cord 22, 222, the opportunity for the plug 26 of the vehicle charging cord 22, 222 to automatically disconnect by virtue of rearward movement of the vehicle 18, 218 is significantly increased. Of course, a significant factor in the amount of shear and tension force exerted upon the plug 26, vehicle charging cord 22, 222, and electrical connector 170 prior to this disconnection is the location of the other end of the vehicle charging cord 22, 222. In those embodiments where the other end (e.g., plug 24) of the vehicle charging cord 22, 222 is connected to the electrical system of a house, building, or other facility substantially in front of the vehicle 18, 218, this force can be significantly less than the disconnection force needed in those embodiments in which the other end of the vehicle charging cord 22 is connected at a location laterally disposed from the vehicle 18, 218. However, for those applications in which the vehicle 18, 218 must be backed up to exit the vehicle charging area, this location of the electrical connector 170 can significantly reduce the amount of disconnection force compared to locations of the electrical connector 170 located on a side or rear of the vehicle 18, 210.

**[00156]** Although not illustrated, in some embodiments, the electrical connector 170 of the vehicle 18, 218 is located in a rear surface 174 of the vehicle 18, 218. Accordingly, in the event a user moves the vehicle 18, 218 in a forward direction without disconnecting the vehicle charging cord 22, 222, the opportunity for the plug 26 of the vehicle charging cord 22, 222 to automatically disconnect by virtue of forward movement of the vehicle 18, 218 is significantly increased. As described above, a significant factor in the amount of shear and tension force exerted upon the plug 26, vehicle charging cord 22, 222, and electrical connector 170 prior to this disconnection is the location of the other end of the vehicle charging cord 22, 222. In those embodiments where the other end (e.g., plug 24) of the vehicle charging cord 22, 222 is connected to the electrical system of a house, building, or



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other facility substantially behind the vehicle 18, 218, this force can be significantly less than the disconnection force needed in those embodiments in which the other end of the vehicle charging cord 22 is connected at a location laterally disposed from the vehicle 18, 218. However, for those applications in which the vehicle 18, 218 must be moved forward to exit the vehicle charging area, this location of the electrical connector 170 can significantly reduce the amount of disconnection force compared to locations of the electrical connector 170 located on a side or front of the vehicle 18, 218.

**[00157]** In some embodiments, a clearance or light interference fit is provided between the plug 24 of the vehicle charging cord 22, 222 and the electrical connector 170 (located in a front or rear surface 172, 174 of the vehicle 18, 218 as described above), thereby providing a reduced amount of force needed to disconnect the plug 24 from the electrical connector 170. In some embodiments, a force needed for disconnection of the plug 24 from the electrical connector 170 is no greater than about 20 pounds (measured in a direction parallel to motion of the plug 24 with respect to the electrical connector 170 during connection) to avoid or reduce damage to the vehicle charging cord 22, 222, electrical connector 170, and vehicle 18, 218. In other embodiments, this force is no greater than about 10 pounds to avoid or reduce damage to the vehicle charging cord 22, 222, electrical connector 170, and vehicle 18, 218. In still other embodiments, this force is no greater than about 5 pounds to avoid or reduce damage to the vehicle charging cord 22, 222, electrical connector 170, and vehicle 18, 218.

**[00158]** As indicated above, the angle at which the force of disconnection is applied upon the electrical connector 170 and plug 24 can have a significant impact upon the shear and tension forces experienced by the electrical connector 170 and plug 24 when the vehicle 18, 218 is moved without unplugging the vehicle charging cord 22, 222. To reduce or mitigate these forces, the orientation of the electrical connector 170 with respect to the vehicle 18, 218 is selected to fall within a range of angles measured from a forward direction of the vehicle 18, 218. In particular, in some embodiments, the electrical connector 170 is oriented so that an angle 176 (see FIG. 21) between the forward direction of the vehicle 18, 218 (defined by proper alignment of the vehicle under normal operating conditions) and the direction of motion of the plug 24 with respect to the electrical connector 170 during connection is no greater than about 50 degrees. In other embodiments, this angle 176 is no greater than about 40 degrees to reduce or mitigate the disconnection force. In still other embodiments, this angle 176 is no greater than about 30 degrees to reduce or mitigate the disconnection force.

In combination with the maximum disconnection forces according to some embodiments as described above, these orientation angles 176 of the electrical connector 170 can help to ensure damage-free disconnection of the vehicle charging cord 22, 222 from the electrical connector 170 of the vehicle 18, 218 regardless of whether the electrical connector 170 is located in the front or rear surface 172, 174 of the vehicle 18, 218 as described above.

**[00159]** In some embodiments, the vehicle 18, 218 is provided with two or more electrical connectors 170 in different locations (e.g., different sides) on the exterior of the vehicle 18, 218, any of which can be connected to a vehicle charging cord 22, 222 to charge the battery 20, 220 of the vehicle 18, 218. For example, one electrical connector 170 can be located in a front surface 172 of the vehicle 18, 218, and another electrical connector 170 can be located in a rear surface 172 of the vehicle 18, 218. Both such electrical connectors 170 can be connected to the battery 20, 220 and controller 44, 244 of the vehicle 18, 218 by suitable power wiring (e.g., wiring harnesses) extending along the vehicle 18, 218. In such embodiments, a user can choose to connect the vehicle charging cord 22, 222 to the electrical connector 170 closest to the location at which the vehicle charging cord 22, 222 is connected to the electrical system of the house, building, or other charging facility, or can connect the vehicle charging cord 22, 222 to the electrical connector 170 oriented at the smallest angle with respect to such a location upon accidental movement of the vehicle 18, 218. This ability to choose between two or more electrical charging connectors 170 can present significant convenience to the user while helping to prevent damage to the vehicle charging cord 22, 222 and vehicle 18, 118 upon accidental movement of the vehicle 18, 118 while still plugged in.

**[00160]** The illustrated embodiment of FIGs. 20-23 is presented with reference to a vehicle charging cord 22, 222 intended for releasable connection at an electrical connector 170 of the vehicle 18, 218. However, it should be noted that the same principles of disconnect force, disconnect angle, and cord-to-vehicle interface location apply regardless of whether the vehicle charging cord 22, 222 is intended to be disconnected at the vehicle 18, 218. In this regard, some embodiments of the present invention provide a vehicle charging cord 22, 222 that is not intended for disconnection from the vehicle 18, 218 (as presented above in connection with earlier-described embodiments). However, in such embodiments, the vehicle charging cord 22, 222 and/or the electrical wiring of the vehicle 18, 218 can be provided with an electrical connector that can automatically disconnect upon experiencing a threshold force. Any electrical connector located in the wiring of the vehicle 18, 218 or in



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the cord extending therefrom to a source of electrical power can be used. For example, in embodiments in which a power cord extending from the vehicle 18, 218 can be retracted onto a reel located on the vehicle 18, 218 as described above, the power cord can have a releasable electrical connection at a point along the length of the cord. As another example, the power cord can be provided with a releasable electrical connector located at the housing 28, 228 or cabinet 742, 1142 of the vehicle charging system. In any such case, the power cord can automatically disconnect upon experiencing a threshold force such as those described above, thereby preventing damage (or further damage) to the vehicle 18, 218 or the electrical system of the house, building, or other charging facility. Such disconnection can be frangible, meaning that the cord and/or connector is at least partially destroyed upon disconnection, or can be re-connectable by a user or service technician.

**[00161]** In some embodiments, the electrical connector 170 is located in a surface of the vehicle 18, 218 that is recessed with respect to adjacent (e.g., surrounding) exterior body surfaces of the vehicle 18, 218. This feature can help to reduce exposure of the electrical connector 170 to the environment around the vehicle 18, 218. In these and other embodiments, the electrical connector 170 is located behind a door 178 that can either slide or pivot with respect to the electrical connector 170 in order to reveal the electrical connector 170 for connection and charging. The door 178 can also help to reduce exposure of the electrical connector 170 to the environment around the vehicle 18, 218. In some embodiments, the door 178 can be opened manually by a user pushing, pulling, and/or rotating the door 178. However, in other embodiments, the door 178 can be at least partially opened remotely by a cable, solenoid and associated power wiring, mechanical linkage, and other elements connected to a user-manipulatable control in the vehicle 18, 218. Any mechanism used to open a fuel door for a gasoline or diesel-powered vehicle can be used for this purpose, and falls within the spirit and scope of the present invention.

**[00162]** As described in greater detail above, the controller 44, 244 of the vehicle charging cords 22, 222 can communicate with a controller 108 of the vehicle 18, 218, such as by PLC-based communication. As an alternative or in addition to such communication, the vehicle charging cord 22, 222 (and all other vehicle charging cords described and/or illustrated herein) can enable such communication by dedicated wiring in the same cord 22, 222. An example of such a cord 22, 222 is illustrated in FIGs. 20-23, and with particular reference to FIG. 23. In this embodiment, the plug 26 of the vehicle charging cord 26 has two

communication pins 180 in addition to power and ground blades 182. The communication pins 180 are electrically coupled to wires or other electrical lines extend along the cord 22, 222, and can extend into and establish electrical communication with sockets 184 of the electrical connector 170. By this connection, communication along the cord 22, 222 on one or more electrical lines separate from power and ground lines of the cord 22, 222 can be established. It will be appreciated that such communication lines can be appropriately shielded for better performance, in some embodiments. Also, any number of such communication lines and associated pins 180 can be provided on the cord 22, 222. Furthermore, although pins 180 are illustrated in the embodiment of FIGs. 20-23, any other type of electrical connector (e.g., sockets adapted for connection to pins on the electrical connector 170) can instead be used. Such communication lines can also be used on the opposite end of the cord 22, 222 for communication between the controller 44, 244 and a controller 50, 250 of a power utility 48, 248, and can be used in any of the cord-based vehicle charging system embodiments disclosed herein.

**[00163]** Operation of a vehicle charging system according to an embodiment of the present invention to perform a manual charging session will now be described with reference to FIG. 24. By way of example only, operation will be described in connection with the illustrated embodiment of FIGs. 2, 5-11, and 15, it being understood that any portion or all of the operation described in connection with FIG. 24 can be applied in any of the other vehicle charging system embodiments described and/or illustrated herein. With continued reference to FIG. 24, power is first established 11 to the vehicle charging cord 22, such as (in some embodiments) by plugging the vehicle charging cord 22 into an electrical outlet of the house, building or other facility at which charging is to take place, or by pressing the power button 34 in these and other embodiments. Upon receiving power, the controller 44 can retrieve any charge settings 13 previously entered and saved into memory 106, and can display such settings when the appropriate screen(s) 40 are shown upon the display 32. Next, the controller 44 can receive charge time and other settings 15 entered by a user via the display 32 and associated navigation buttons 36, 38, and in some embodiments can store such settings in memory 106 (at 17).

**[00164]** Following a command to start a manual battery charging session (at 19) based upon a start time selected by a user (such as by the user selecting selector 86 in the second screen 40A shown in FIG. 10 and entering a charge start time in selector 90), the controller



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44 can continue to compare the time of the clock 58 with the charge start time entered by the user (at 21) until the start time is reached by the clock 58. Until the start time is reached, the controller continues to delay 23 charging of the battery 20 connected thereto. Once the start time is reached, the controller 44 closes the electrical switch 92 at 25, and begins charging the battery 20. Next, using the battery diagnostic circuitry described above, the controller 44 determines the charge level of the battery 20 at 27. If a determination is made that the battery 20 is not fully charged at 29, the controller 44 continues to keep the electrical switch 92 closed, thereby continuing to charge the battery 20 at 31. Otherwise, the controller 44 ends the charging session by opening the electrical switch 92 at 33.

**[00165]** Operation of a vehicle charging system according to another embodiment of the present invention to perform a programmed charging session will now be described with reference to FIG. 25. In this embodiment, additional features are provided compared to the charging session described above in connection with FIG. 24. By way of example only, operation will be described in connection with the illustrated embodiment of FIGs. 2, 5-11, and 15, it being understood that any portion or all of the operation described in connection with FIG. 25 can be applied in any of the other vehicle charging system embodiments described and/or illustrated herein. With continued reference to FIG. 25, power is first established 11 to the vehicle charging cord 22, such as (in some embodiments) by plugging the vehicle charging cord 22 into an electrical outlet of the house, building or other facility at which charging is to take place, or by pressing the power button 34 in these and other embodiments. Upon receiving power, the controller 44 can retrieve any charge settings 13 previously entered and saved into memory 106, and can display such settings when the appropriate screen(s) 40 are shown upon the display 32.

**[00166]** Next, at 35, the controller 44 can employ the battery diagnostic circuitry described above to detect one or more properties of the battery 20 connected to the vehicle charging cord 22, such as the charge level of the battery 20, the voltage of the battery 20, the condition of the battery 20 (e.g., whether the battery 20 is faulty), and the like, and can display (at 37) any or all of this information to the user in any of the manners described above in connection with the embodiment of FIGs. 2, 5-11, and 15. The controller 44 can also establish communication with the controller 108 of the vehicle 18 at 39, and can retrieve information regarding the battery 20 (e.g., battery make, model, age, and the like) at 41 via the controller 108 of the vehicle 18 or directly from a memory of the vehicle 18.



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**[00167]** At step 43, the controller 44 can receive charge time and other settings entered by a user via the display 32 and associated navigation buttons 36, 38, and in some embodiments can store such settings in memory 106 (at 45). The controller 44 can also display the charge time remaining 66 at 47. Following a command to start a programmed battery charging session (at 49) based upon a start time selected by a user (such as by the user selecting selector 86 in the second screen 40A shown in FIG. 10 and entering a charge start time in selector 90), the controller 44 can continue to compare the time of the clock 58 with the charge start time entered by the user (at 51) until the start time is reached by the clock 58. Until the start time is reached, the controller continues to delay 53 charging of the battery 20 connected thereto. Once the start time is reached, the controller 44 closes the electrical switch 92 at 55 to begin charging the battery 20.

**[00168]** Next, at 57, the controller 44 compares the time of the clock 58 with an end time setting that can be entered into the vehicle charging cord 22 according to some alternative embodiments of the present invention. If the end time has been reached, the controller 44 ends the charging session by opening the electrical switch 92 at 65. Otherwise, if the end time setting has not yet been reached, battery charging continues, and using the battery diagnostic circuitry described above, the controller 44 determines the charge level of the battery 20 at 59. If a determination is made that the battery 20 is not fully charged at 61, the controller 44 continues to keep the electrical switch 92 closed, thereby continuing to charge the battery 20 at 63. Otherwise, the controller 44 ends the charging session by opening the electrical switch 92 at 65.

**[00169]** Operation of a vehicle charging system according to another embodiment of the present invention to perform a programmed charging session will now be described with reference to FIG. 26. By way of example only, operation will be described in connection with the illustrated embodiment of FIGs. 2, 5-11, and 15, it being understood that any portion or all of the operation described in connection with FIG. 26 can be applied in any of the other vehicle charging system embodiments described and/or illustrated herein. With continued reference to FIG. 26, power is first established 11 to the vehicle charging cord 22, such as (in some embodiments) by plugging the vehicle charging cord 22 into an electrical outlet of the house, building or other facility at which charging is to take place, or by pressing the power button 34 in these and other embodiments. Upon receiving power, the controller 44 can

retrieve any charge settings 13 previously entered and saved into memory 106, and can display such settings when the appropriate screen(s) 40 are shown upon the display 32.

**[00170]** Next, at 35, the controller 44 can employ the battery diagnostic circuitry described above to detect one or more properties of the battery 20 connected to the vehicle charging cord 22, such as the charge level of the battery 20, the voltage of the battery 20, the condition of the battery 20 (e.g., whether the battery 20 is faulty), and the like, and can display (at 37) any or all of this information to the user in any of the manners described above in connection with the embodiment of FIGs. 2, 5-11, and 15. The controller 44 can also establish communication with the controller 108 of the vehicle 18 at 39, and can retrieve information regarding the battery 20 (e.g., battery make, model, age, and the like) at 41 via the controller 108 of the vehicle 18 or directly from a memory of the vehicle 18.

**[00171]** At step 43, the controller 44 can receive charge time and other settings entered by a user via the display 32 and associated navigation buttons 36, 38, and in some embodiments can store such settings in memory 106 (at 45). Following a command to start a programmed battery charging session (at 49) based upon a battery charging end time selected by a user (such as by the user selecting selector 100 in the second screen 40A shown in FIG. 10 and entering a charge end time in selector 104), the controller 44 can establish communication with the power utility 48 at 67, and can transmit (or enable the power utility 48 to retrieve) the charge time settings, any other settings, and the battery property information to the power utility 48 at 69.

**[00172]** Next, the controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can calculate the power required to fully charge the battery 20 based at least in part upon the level of charge of the battery 20 at 71. The controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can then calculate the amount of time needed to fully charge the battery 20 based upon the power required to do so, and can thereby estimate the time of day at which charging can begin based at least in part upon the battery charging end time and the estimated duration of time necessary to fully charge the battery 20 (at 73).

**[00173]** At step 75, the controller 44 can continue to compare the time of the clock 58 with the charge start determined as described above until the start time is reached by the clock 58. Until the start time is reached, the controller continues to delay 77 charging of the battery 20

connected thereto. Once the start time is reached, the controller 44 closes the electrical switch 92 at 79 to begin charging the battery 20.

**[00174]** Next, at 81, the controller 44 compares the time of the clock 58 with an end time setting that can be entered into the vehicle charging cord 22 according to some alternative embodiments of the present invention. If the end time has been reached, the controller 44 ends the charging session by opening the electrical switch 92 at 83. Otherwise, if the end time setting has not yet been reached, battery charging continues, and using the battery diagnostic circuitry described above, the controller 44 determines the charge level of the battery 20 at 85. If a determination is made that the battery 20 is not fully charged at 87, the controller 44 continues to keep the electrical switch 92 closed, thereby continuing to charge the battery 20 at 89. Otherwise, the controller 44 ends the charging session by opening the electrical switch 92 at 83.

**[00175]** Operation of a vehicle charging system according to another embodiment of the present invention to perform a programmed charging session will now be described with reference to FIG. 27. By way of example only, operation will be described in connection with the illustrated embodiment of FIGs. 2, 5-11, and 15, it being understood that any portion or all of the operation described in connection with FIG. 27 can be applied in any of the other vehicle charging system embodiments described and/or illustrated herein. With continued reference to FIG. 27, power is first established 11 to the vehicle charging cord 22, such as (in some embodiments) by plugging the vehicle charging cord 22 into an electrical outlet of the house, building or other facility at which charging is to take place, or by pressing the power button 34 in these and other embodiments. Upon receiving power, the controller 44 can retrieve any charge settings 13 previously entered and saved into memory 106, and can display such settings when the appropriate screen(s) 40 are shown upon the display 32.

**[00176]** Next, at 35, the controller 44 can employ the battery diagnostic circuitry described above to detect one or more properties of the battery 20 connected to the vehicle charging cord 22, such as the charge level of the battery 20, the voltage of the battery 20, the condition of the battery 20 (e.g., whether the battery 20 is faulty), and the like, and can display (at 37) any or all of this information to the user in any of the manners described above in connection with the embodiment of FIGs. 2, 5-11, and 15. With this information, the controller 44 can determine whether the battery 20 is defective or otherwise has a fault at 91, and can communicate a battery fault message to the user in any of the manners also described above

in connection with the embodiment of FIGs. 2, 5-11, and 15 if a fault exists (at 93). The controller 44 can also establish communication with the controller 108 of the vehicle 18 at 95, and can retrieve information regarding the battery 20 (e.g., battery make, model, age, and the like) at 97 via the controller 108 of the vehicle 18 or directly from a memory of the vehicle 18.

**[00177]** At step 99, the controller 44 can receive charge time and other settings entered by a user via the display 32 and associated navigation buttons 36, 38, and in some embodiments can store such settings in memory 106 (at 101). Following a command to start a programmed battery charging session (at 103) based upon a battery charging end time selected by a user (such as by the user selecting selector 100 in the second screen 40A shown in FIG. 10 and entering a charge end time in selector 104), the controller 44 can establish communication with the power utility 48 at 105, and can transmit (or enable the power utility 48 to retrieve) the charge time settings, any other settings, and the battery property information to the power utility 48 at 107.

**[00178]** Next, the controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can calculate the power required to fully charge the battery 20 based at least in part upon the level of charge of the battery 20 at 109. The controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can then calculate the amount of time needed to fully charge the battery 20 based upon the power required to do so, and can thereby estimate the latest time of day at which charging can begin based at least in part upon the battery charging end time and the estimated duration of time necessary to fully charge the battery 20 (at 111). Also, at 113, the controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can set an acceptable threshold cost of power (e.g., per unit time) at or below which battery charging will begin. In some embodiments, this threshold cost of power is entered by a user into the vehicle charging cord 22 in any of the manners of user interface described herein, or can be set by the power utility 48 based upon the desired maximum power cost determined by the power utility 48.

**[00179]** At step 115, the controller 44 can compare the time of the clock 58 with the latest estimated charge time, and at step 117 can compare the current cost of power (e.g., per unit time) with the threshold cost of power determined at step 113. If the latest estimated charge start time has been reached or if the threshold cost of power has been reached, the controller



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44 closes the electrical switch 92 at 119 to begin charging the battery 20. Otherwise, the controller 44 continues to delay 121 charging of the battery 20 connected thereto.

**[00180]** Next, at 123, the controller 44 can check or otherwise determine whether communication has been lost with the controller 50 of the power utility 48. If communication has been lost, the controller 44 can send a communication fault message to the user in any of the manners described above in connection with the embodiment of FIGs. 2, 5-11, and 15 (at 125). Otherwise, the controller 44 can check or otherwise determine whether the supply of power to the vehicle charging cord 22 has been interrupted at 127. If the supply of power has been interrupted, the controller 44 can send a power interrupt fault message to the user in any of the manners also described above in connection with the embodiment of FIGs. 2, 5-11, and 15 (at 129).

**[00181]** On a continuing basis as the battery 20 is being charged, the controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can monitor the cost of power supplied to the battery 20, and can compare this cost with the threshold cost of power described above (at 131). If the cost of power supplied to the battery 20 exceeds the threshold cost of power, the controller 44 of the vehicle charging cord 22 or the controller 50 of the power utility 48 can interrupt charging of the battery at 133, such as by opening the electrical switch 92 of the vehicle charging cord 92. Otherwise, using the battery diagnostic circuitry described above, the controller 44 determines the charge level of the battery 20 at 135. If a determination is made that the battery 20 is not fully charged at 137, the controller 44 continues to keep the electrical switch 92 closed, thereby continuing to charge the battery 20 at 139. Otherwise, the controller 44 ends the charging session by opening the electrical switch 92 at 141.

**[00182]** Four examples of vehicle charging operation according to embodiments of the present invention are described above in connection with FIGs. 24-27. It should be noted any sub-combination of the steps described in connection with FIGs. 24-27 can be performed in other embodiments. Also, although the steps of the various processes presented above are described as occurring in a particular order, a number of the steps of each process can occur in different orders without departing from the spirit and scope of the present invention. Furthermore, steps and combinations of steps described in combination with one or more of the embodiments of FIGs. 24-27 can be employed in the processes of the other embodiments of FIGs. 24-27. For example, the battery fault check and notification steps 91, 93, the

communication fault and notification steps 123, 125, and/or the power interruption fault check and notification steps 127, 129 in the process illustrated in FIG. 27 can be utilized in any of the other embodiments disclosed herein, including those of FIGs. 24-26.

**[00183]** Also, in the various processes described and illustrated herein, the controller 44 is described as performing a number of functions. Based upon the ability of those vehicle charging systems herein to communicate with a processor of a power utility, any of these functions can instead or also be performed by the processor of the power utility communicating and controlling the vehicle charging cords 22 or systems.

**[00184]** As described above, the use of any of the vehicle charging systems described and/or illustrated herein can provide significant control to a user in determining the conditions under which vehicle battery charging will occur. This control can result in cost savings to the user without impacting the user's daily routine. However, other benefits accrue to power utilities providing power to users of these vehicle charging systems. By at least partially controlling the time at which battery charging will occur and/or by having the ability to interrupt and re-start battery charging by a large number of users in a community, the power utility can better distribute power usage over a period of time, thereby providing significant cost savings to the power utility.

**[00185]** An example of how a power utility can control multiple vehicle charging systems according to the present invention is illustrated in FIGs. 28 and 29. By way of example only, operation will be described in connection with users employing vehicle charging cords 22, 222 such as those illustrated in FIGs. 2, 5-11, and 15, it being understood that any portion or all of the operation described in connection with FIGs. 28 and 29 can be applied in any of the other vehicle charging system embodiments described and/or illustrated herein.

**[00186]** With reference first to FIG. 28, the controller 50 of the power utility 48 (which can be defined by one or more servers and associated computer equipment) can communicate with the vehicle charging cords 22, 222 of multiple users, and can continuously or periodically update a queue or other list of on-line users who have requested a battery charge session as described above (at 143).

**[00187]** In some embodiments, the controller 50 sorts the on-line users based upon one or more factors, such as the charge time end setting (i.e., earlier charge time end settings having priority), the estimated charge time needed for fully charging each battery 20 (i.e., longer

charge times having priority), the time at which the battery charge session was requested, and the like. By way of example only, the controller 50 in the process of FIG. 28 checks at 145 whether any of the batteries 20 that are on-line have a very low charge, such as a charge below a minimum level set by the user at selector 112 on the second screen 40B shown in FIG. 10, or a charge below a minimum level set by the power utility 48. As another example, the controller 50 in the process of FIG. 28 checks at 149 whether the estimated time to fully charge any battery 20 is equal to or greater than the time available for battery charging (i.e., to the battery charge completion time entered by the user at selector 100 on the second screen 40B shown in FIG. 10). If the controller 50 determines that a battery 20 has a very low charge or will require a charging duration equal to or greater than the charging time available, the controller 50 can flag or otherwise indicate that the vehicle charging cord 22, 222 has priority over other vehicle charging cords 22, 222 (at 147 and 151, respectively).

**[00188]** The controller 50 can also remove a priority designation from any on-line vehicle charging cord 22, 222 no longer meeting this criteria (at 153), such as on-line charging cords 22, 222 that have been supplied with power based upon the fact that their respective batteries 20 had a very low charge, but that now have supplied their batteries 20 with a sufficient minimum threshold charge. At step 155, the queue of on-line vehicle charging cords 22, 222 can be re-ordered based upon the determination of which vehicle charging cords 22, 222 are flagged as having priority (described above), and upon any of the other factors also described above.

**[00189]** Next, the controller 50 at 157 can determine whether the total power draw from the community or the total power draw of all vehicle charging cords 22, 222 exceeds a threshold maximum level of power draw. This maximum level of power draw can be set by a power utility 48 based upon a threshold level of power cost to the power utility 48, the maximum output of power that can be supplied by the power utility 48 to the community, an amount of power budgeted by the power utility 48 for charging vehicle batteries via the vehicle charging cords 22, 222, other factors, and any combination thereof. If the total power draw does not exceed the maximum level of power draw set by the power utility 48, and if the queue of vehicle charging cords 22, 222 awaiting charging is empty (at 159), the controller 50 can re-initiate the vehicle charging cord management process by again updating the vehicle charging cord queue at 143. Otherwise, the controller 50 of the power utility 48 can send signals at 161 to one or more vehicle charging cords 22, 222 to begin charging their

respective batteries 20 by closing their electrical switches 92. Such signals can be sent to any vehicle charging cords 22, 222 flagged with priority, and then to any other vehicle charging cords 22, 222. In either case, such signals are sent to vehicle charging cords 22, 222 in the order presented in the vehicle charging queue (ordered as described above). Following this step, the controller 50 can re-initiate the vehicle charging cord management process by again updating the vehicle charging cord queue at 143.

**[00190]** If the total power draw described above exceeds the maximum level of power draw set by the power utility 48 as determined by the processor at step 157, and if any vehicle charging cords 22, 222 are not flagged as having priority (check by the processor 50 made at step 163) as described above, the controller 50 can send signals to one or more vehicle charging cords 22, 222 not flagged as having priority to at least temporarily stop charging the batteries 20 connected thereto (e.g., by opening the electrical switches 92 of such vehicle charging cords 22, 222) at step 165. In some embodiments, such signals can be sent by the power utility in batches, such as signals sent to two or more of such vehicle charging cords 22, 222 at a given time or under a common command. Following this step, the controller 50 can re-initiate the vehicle charging cord management process by again updating the vehicle charging cord queue at 143. Otherwise, if the processor 50 determines that all vehicle charging cords 22, 222 are flagged as having priority at 163, the controller 50 can re-initiate the vehicle charging cord management process by again updating the vehicle charging cord queue at 143.

**[00191]** In light of the fact that the vehicle charging cord management process illustrated in FIG. 28 can be performed on a continual basis, it will be appreciated that the steps described above in connection with FIG. 28 can be carried out in a number of different orders without departing from the spirit and scope of the present invention.

**[00192]** With reference now to FIG. 29, an example application of the vehicle charging cord management process of FIG. 28 is provided. FIG. 29 illustrates the total power draw (in kW) of a community upon a power utility 48 over a 24-hour period of time. As shown in FIG. 29, the maximum preferred power draw of the power utility 48 described above in connection with FIG. 28 is 200 kW. As also shown in FIG. 29, the power draw of the community varies significantly over the 24-hour period, peaking around 3pm and falling to a lowest level between 2am and 3am. Any number of factors can define this power draw over the 24-hour period, including without limitation the number of users using air conditioning or

electrical heating units during the day and the times at which such units are operated by the users, the times at which any large manufacturing operations begin and end operations, and the like. For example, the second peak shown in FIG. 29 can be the result of one or more manufacturing plants in a community drawing significant power during a second shift.

**[00193]** Based upon the amount of power drawn from the power utility 29 as shown in FIG. 29, the power utility 48 can control and operate a number of vehicle charging systems according to the present invention based upon non-peak time periods and upon other factors as described above (charge time end settings, estimated charge times needed to fully charge batteries 20, times at which battery charge sessions were requested, and the like). For example, a first group of users requesting charge sessions at 2pm (point 167 in FIG. 29) can have priority over other groups of users requesting charge sessions at 4pm and 6pm (points 169 and 171), respectively. Accordingly, once the controller 50 of the power utility 48 determines that the power draw by the community has fallen below the preferred maximum level of power draw (e.g., step 157 in FIG. 28; point 173 in FIG. 29), the controller 50 can send signals to the vehicle charging systems of the first group of users to begin battery charging. Taking this additional power draw into account, the controller 50 of the power utility 48 can later determine that the power draw by the community has fallen further (point 175 in FIG. 29), and that the vehicle charging systems of the second user group can be turned on. However, if the total power draw by the community rises again, such as based upon a large draw from a manufacturing facility operating a second shift, the controller 50 of the power utility 48 can temporarily turn off the vehicle charging systems of the second user group and then the first user group in series (points 177 and 179, respectively), and can turn on the vehicle charging systems of the first and second user groups in series once the total power draw by the community falls again (points 181 and 183, respectively).

**[00194]** Although the third user group requested charging sessions much earlier as described above, the total power draw by the community remained too high to permit the controller 50 of the power utility 48 to turn on the vehicle charging systems of the third user group until 11pm. At this point (185 in Fig. 29), the total power draw taking into account the first and second groups of users falls sufficiently to permit the controller 50 to turn on the vehicle charging systems of the third user group while still remaining below the preferred maximum power draw described above. The batteries corresponding to the first, second, and



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third groups of users illustrated in FIG. 29 become fully charged at different times, and cause battery charging to stop at points 187, 189, and 191, respectively.

**[00195]** Application of a vehicle charging system management process (using vehicle charging systems of the present invention) is shown by way of example in FIG. 29. It will be appreciated that a similar process can be implemented for any other power draw profile of a community, and that any number of charging initiations, interruptions, and re-initiations can occur for any number of users or groups of users throughout the course of a 24-hour period based at least in part upon the needs of the users and any preferred maximum level of power draw determined by the power utility.

**[00196]** The embodiments described above and illustrated in the figures are presented by way of example only and are not intended as a limitation upon the concepts and principles of the present invention. As such, it will be appreciated by one having ordinary skill in the art that various changes in the elements and their configuration and arrangement are possible without departing from the spirit and scope of the present invention. For example, the vehicle charging systems described above and illustrated in connection with the embodiments of FIGs. 2, 5-11 and 15; FIG. 3; FIGs. 4, 18, and 19; FIG. 12; FIGs. 13, 14, and 16; FIG. 17; FIGs. 20-23; FIG. 24, FIG. 25, FIG. 26, FIG. 27, and FIGs 28 and 29 each have a number of features, elements, and/or steps. Although these features, elements, and steps are described and illustrated in connection with each embodiment, it should be noted that any sub-combination of such features, elements, and steps can be utilized in other embodiments of the present invention. The particular combination of features, elements, and steps in each illustrated embodiment is presented by way of example only, and does not indicate or imply that embodiments of the present invention must have all such features, elements, and steps.



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I claim:

1. A vehicle charger for charging a battery of a vehicle and adapted for communication with a first controller remote from the vehicle and vehicle charger, the vehicle charger comprising:

an electrical power cord releasably attachable to at least one of the vehicle and a source of power;

a second controller electrically coupled to the electrical power cord; and

at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller,

the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger.

2. The vehicle charger of claim 1, wherein the electrical power cord is releasably attachable to the vehicle and the source of power.

3. The vehicle charger of claim 1, further comprising a housing in which the second controller is located, the housing coupled to and at least partially located between opposite ends of the electrical power cord.

4. The vehicle charger of claim 3, wherein the housing at least partially defines one of the opposite ends of the electrical power cord.

5. The vehicle charger of claim 1, wherein the second controller is adapted for communication with the first controller over the electrical power cord.

6. The vehicle charger of claim 1, wherein the second controller is adapted for wireless communication with the first controller via the at least one of the transmitter and receiver.

7. The vehicle charger of claim 1, wherein the second controller is adapted for automatic establishment of communication with the first controller upon connection of the vehicle charger with at least one of the battery and the source of power.



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8. The vehicle charger of claim 1, wherein the second controller is adapted for communication with a computer receiving electric power information from the Internet.

9. The vehicle charger of claim 8, wherein the second controller is adapted for wireless communication with the computer via the at least one of the transmitter and receiver.

10. The vehicle charger of claim 1, wherein the vehicle charger has a first charging state in which the vehicle charger is not charging the battery, and a second charging state in which the vehicle charger is charging the battery.

11. The vehicle charger of claim 1, further comprising a display coupled to the second controller, the display displaying a level of charge of the battery.

12. The vehicle charger of claim 1, further comprising a display coupled to the second controller, the display displaying an amount of time for the battery to be fully charged based upon information regarding the battery received by the second controller.

13. The vehicle charger of claim 12, wherein the amount of time is an amount of time that is estimated by the second controller or received by the second controller.

14. The vehicle charger of claim 13, wherein the amount of time is updated on the display by the second controller during a charge session.

15. The vehicle charger of claim 1, further comprising a display coupled to the second controller, the display displaying an amount of power consumed by the battery during a vehicle charging session.

16. The vehicle charger of claim 15, wherein the amount of power consumed by the battery is an amount of power that is estimated by the second controller or is received by the second controller.

17. The vehicle charger of claim 16, wherein the amount of power consumed is updated on the display by the second controller during the charging session.

18. The vehicle charger of claim 1, further comprising a display displaying a cost of power to the battery per unit time.

19. The vehicle charger of claim 18, wherein the cost of power to the battery is received from the second controller by the first controller.

20. The vehicle charger of claim 1, further comprising a display displaying a total power cost of a charging session.



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ABSTRACT

A vehicle battery charger and a vehicle battery charging system are described and illustrated, and can include a controller enabling a user to enter a time of day at which the vehicle battery charger or system begins and/or ends charging of the vehicle battery. The vehicle battery charger can be separate from the vehicle, can be at least partially integrated into the vehicle, can include a transmitter and/or a receiver capable of communication with a controller that is remote from the vehicle and vehicle charger, and can be controlled by a user or another party (e.g., a power utility) to control battery charging based upon a time of day, cost of power, or other factors.



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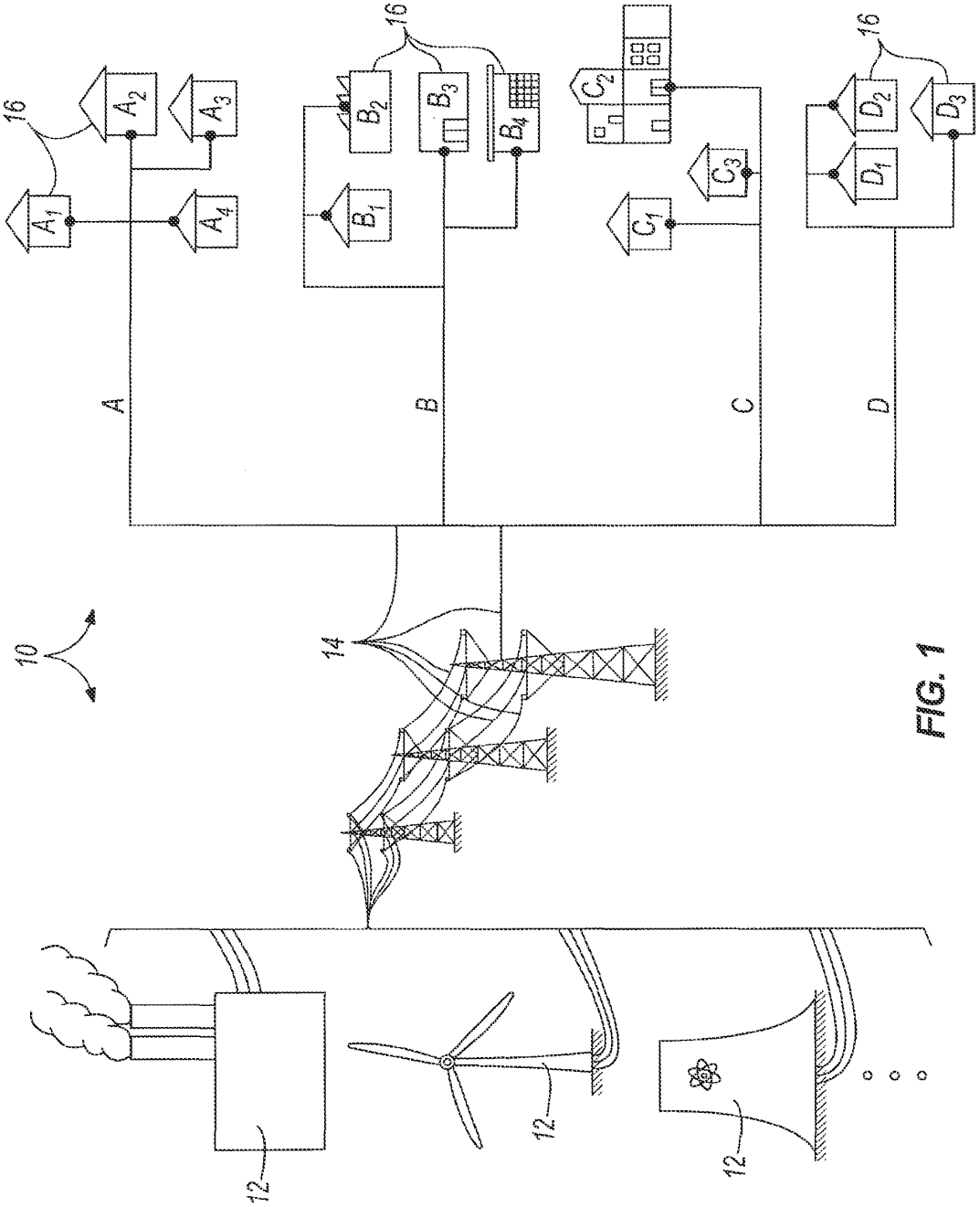



FIG. 1

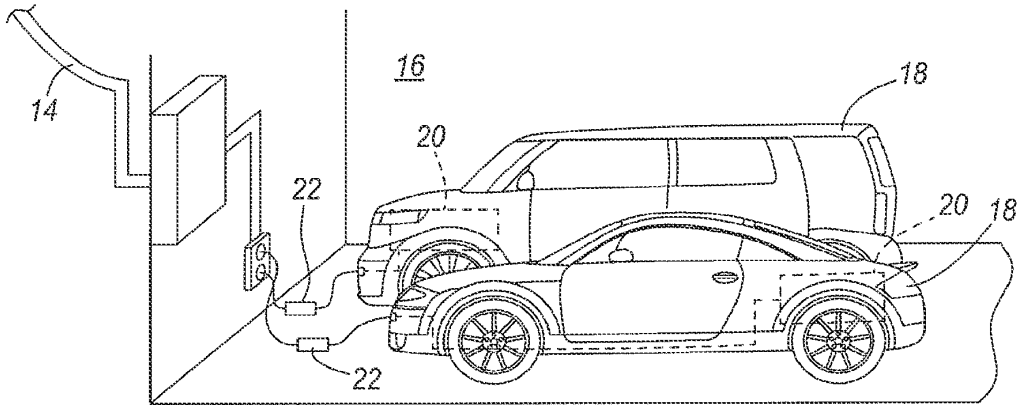



FIG. 2

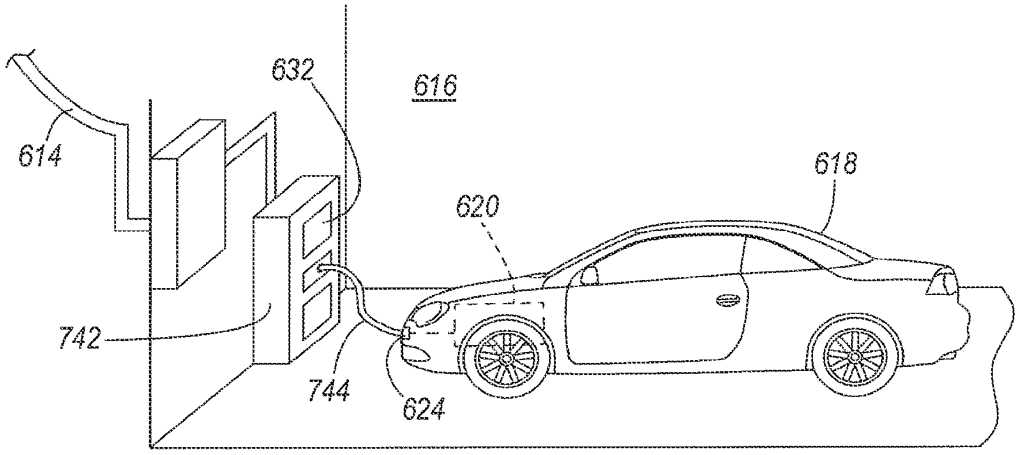



FIG. 3

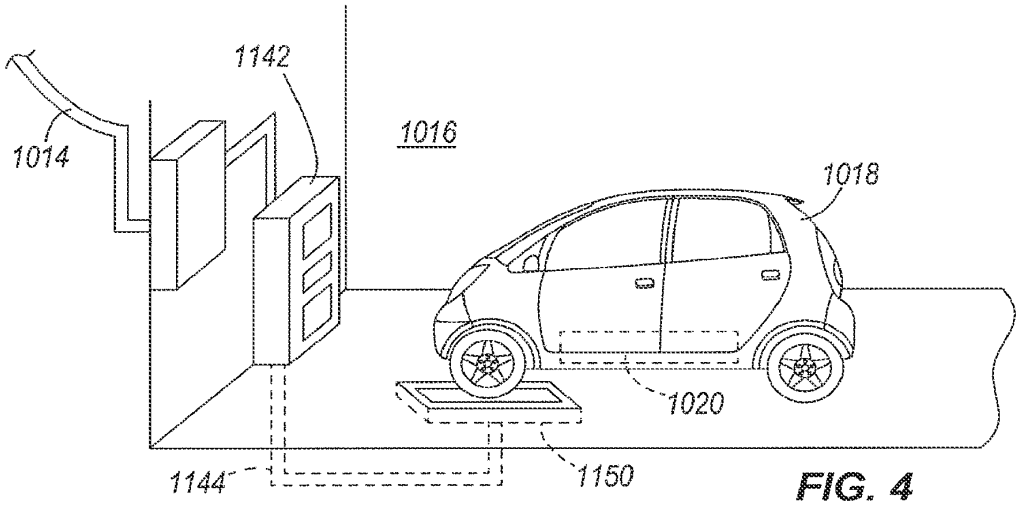



FIG. 4

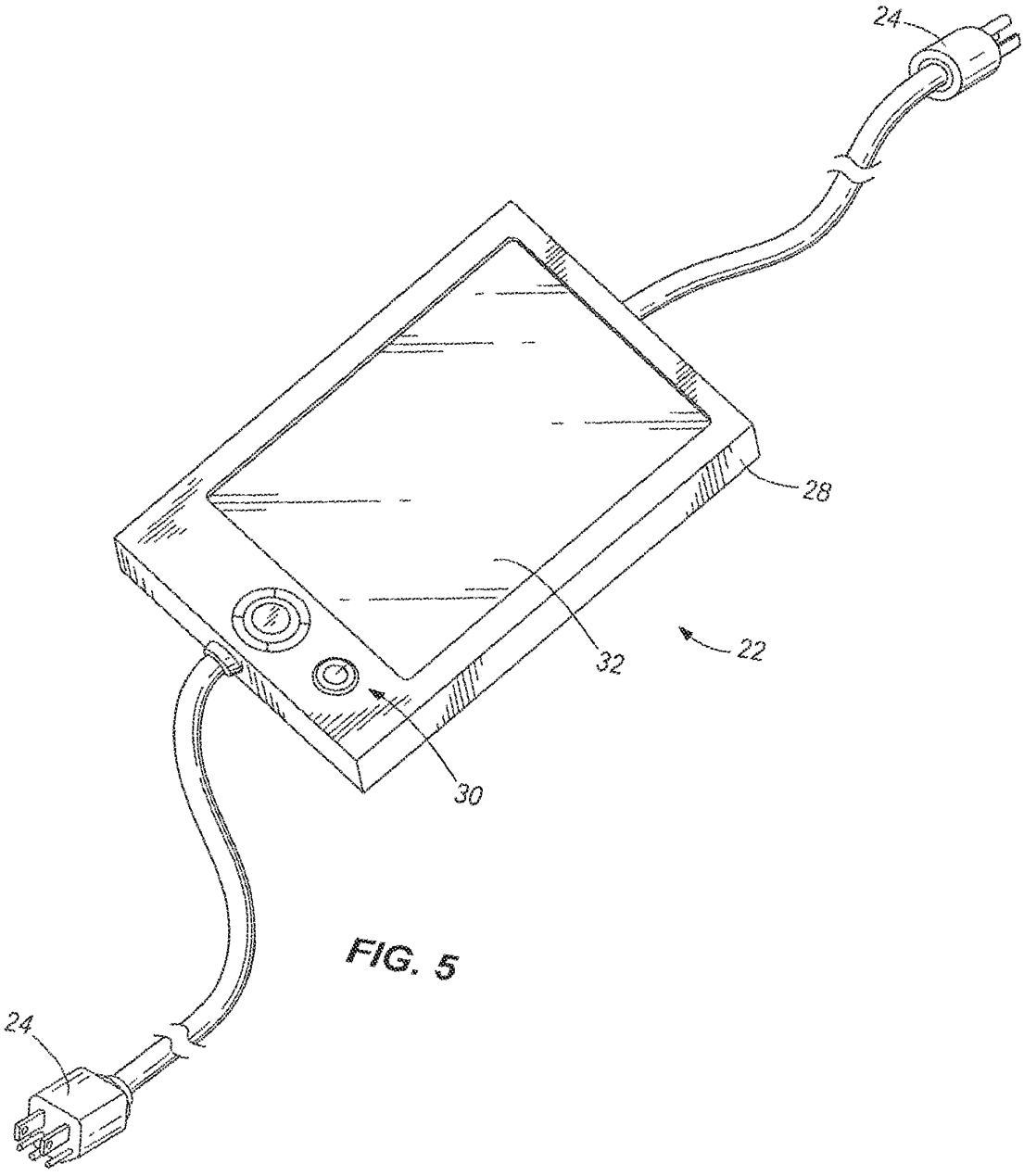



FIG. 5

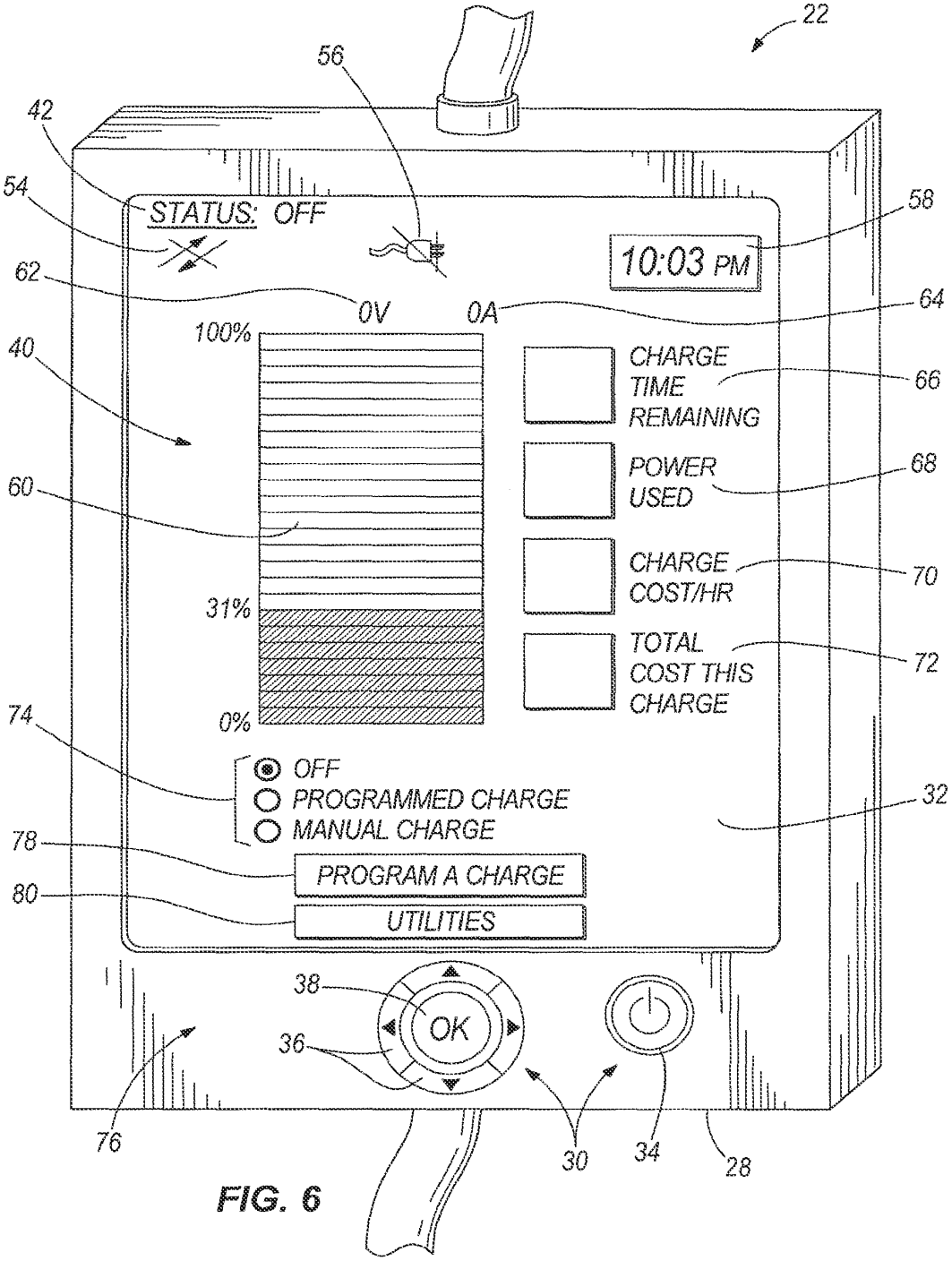

22
56
42
54
STATUS: OFF
58
10:03 PM
62
0V
0A
64
100%
40
CHARGE TIME REMAINING
66
60
POWER USED
68
CHARGE COST/HR
70
31%
TOTAL COST THIS CHARGE
72
0%
74
OFF
PROGRAMMED CHARGE
MANUAL CHARGE
32
78
PROGRAM A CHARGE
80
UTILITIES
38
OK
36
76
30
34
28

FIG. 6

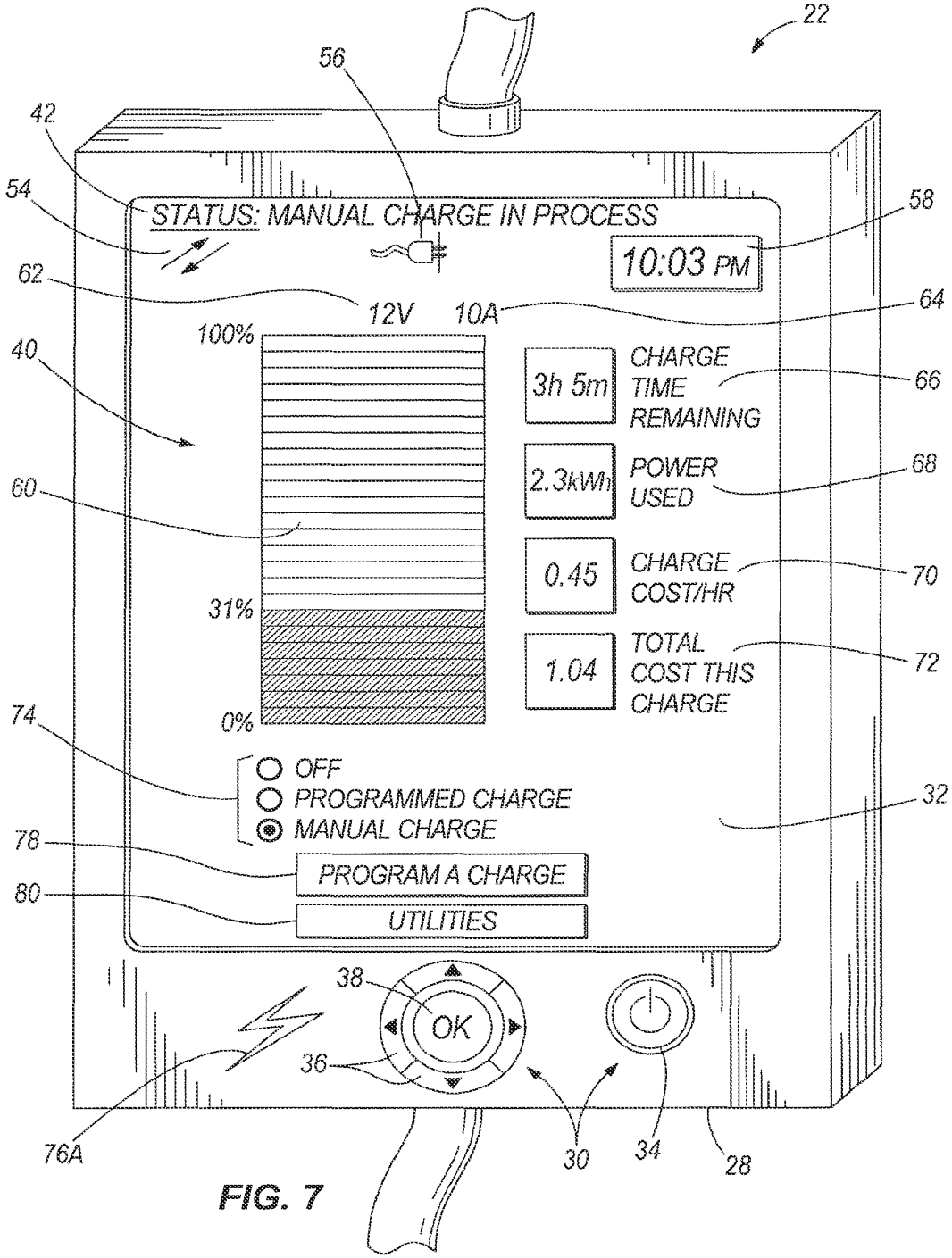

22
56
42
54
STATUS: MANUAL CHARGE IN PROCESS
58
10:03 PM
62
12V
10A
64
100%
40
3h 5m
CHARGE TIME REMAINING
66
2.3kWh
POWER USED
68
60
0.45
CHARGE COST/HR
70
31%
1.04
TOTAL COST THIS CHARGE
72
0%
74
OFF
PROGRAMMED CHARGE
MANUAL CHARGE
32
78
PROGRAM A CHARGE
80
UTILITIES
38
OK
36
76A
30
34
28

FIG. 7

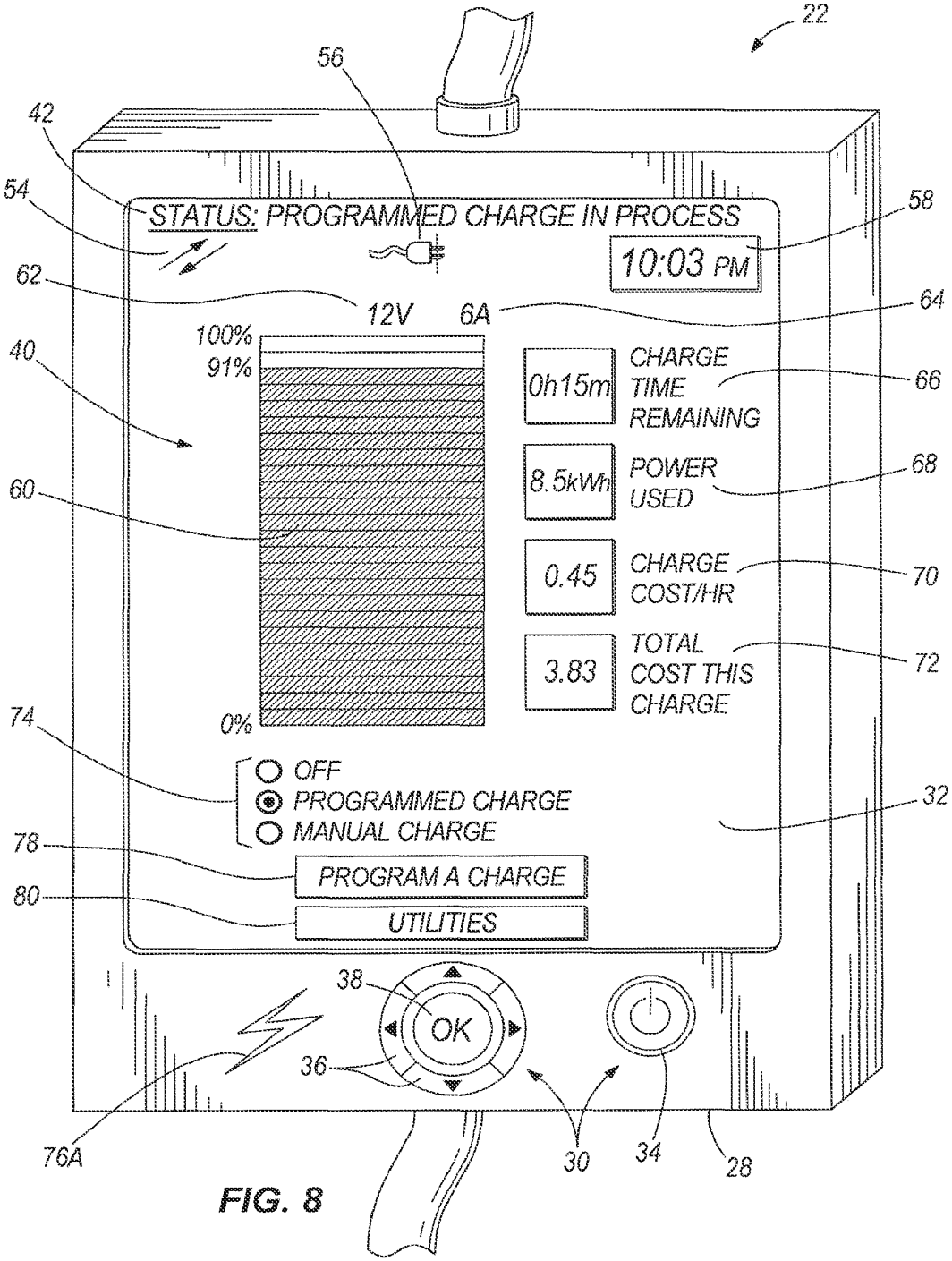

22
56
42
54
STATUS: PROGRAMMED CHARGE IN PROCESS
58
10:03 PM
62
12V
6A
64
100%
91%
40
0h15m
CHARGE TIME REMAINING
66
60
8.5kWh
POWER USED
68
0.45
CHARGE COST/HR
70
3.83
TOTAL COST THIS CHARGE
72
0%
74
OFF
PROGRAMMED CHARGE
MANUAL CHARGE
32
78
PROGRAM A CHARGE
80
UTILITIES
38
OK
36
76A
30
34
28

FIG. 8

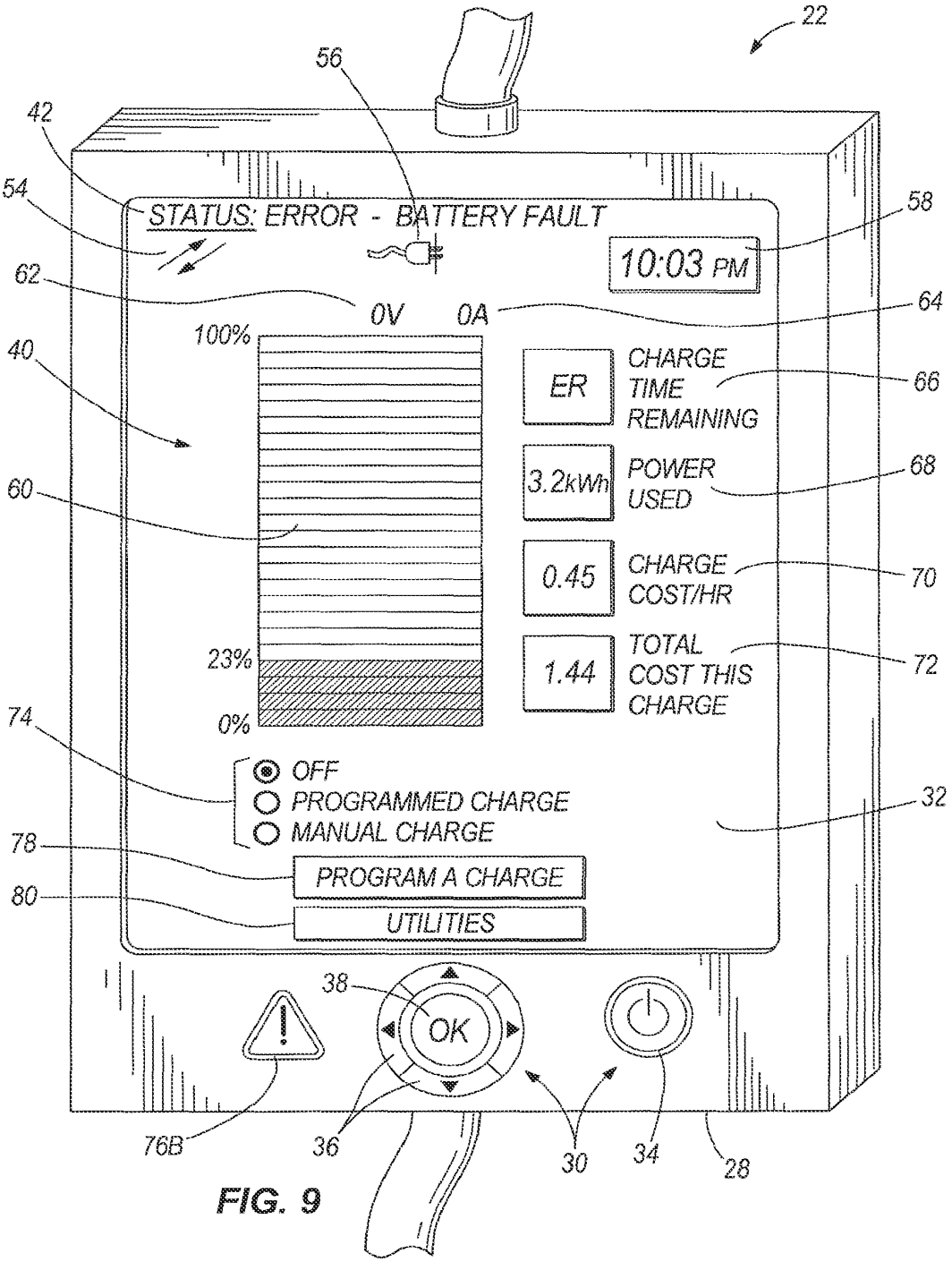

22
56
42
54
STATUS: ERROR - BATTERY FAULT
58
10:03 PM
62
0V
0A
64
100%
40
ER
CHARGE TIME REMAINING
66
60
3.2kWh
POWER USED
68
0.45
CHARGE COST/HR
70
23%
1.44
TOTAL COST THIS CHARGE
72
0%
74
OFF
PROGRAMMED CHARGE
MANUAL CHARGE
32
78
PROGRAM A CHARGE
80
UTILITIES
38
OK
76B
36
30
34
28

FIG. 9

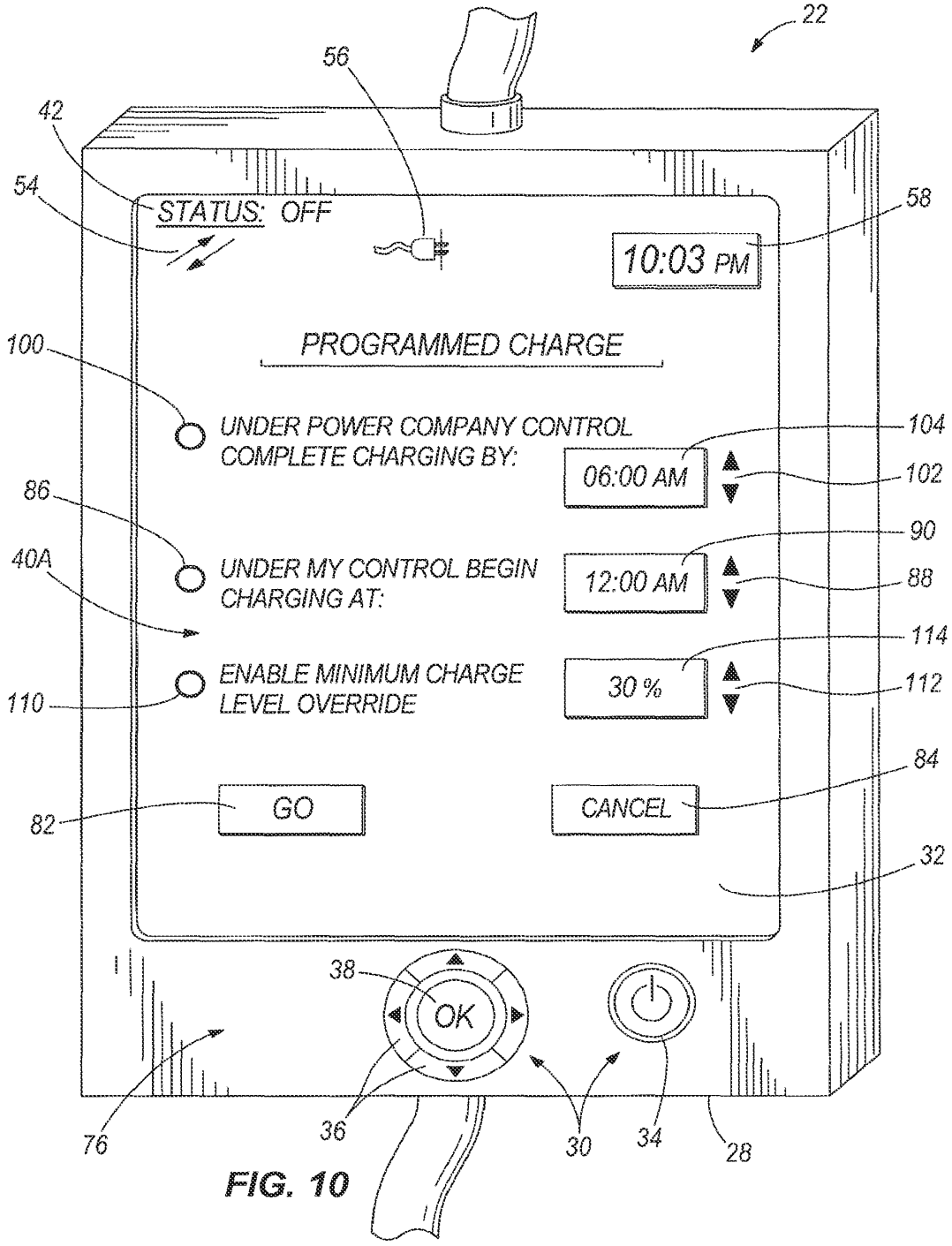

22
56
42
54
STATUS: OFF
58
10:03 PM
PROGRAMMED CHARGE
100
UNDER POWER COMPANY CONTROL
COMPLETE CHARGING BY:
104
06:00 AM
102
86
UNDER MY CONTROL BEGIN
CHARGING AT:
90
12:00 AM
88
40A
ENABLE MINIMUM CHARGE
LEVEL OVERRIDE
114
30 %
112
110
84
GO
CANCEL
82
32
38
OK
76
36
30
34
28

FIG. 10

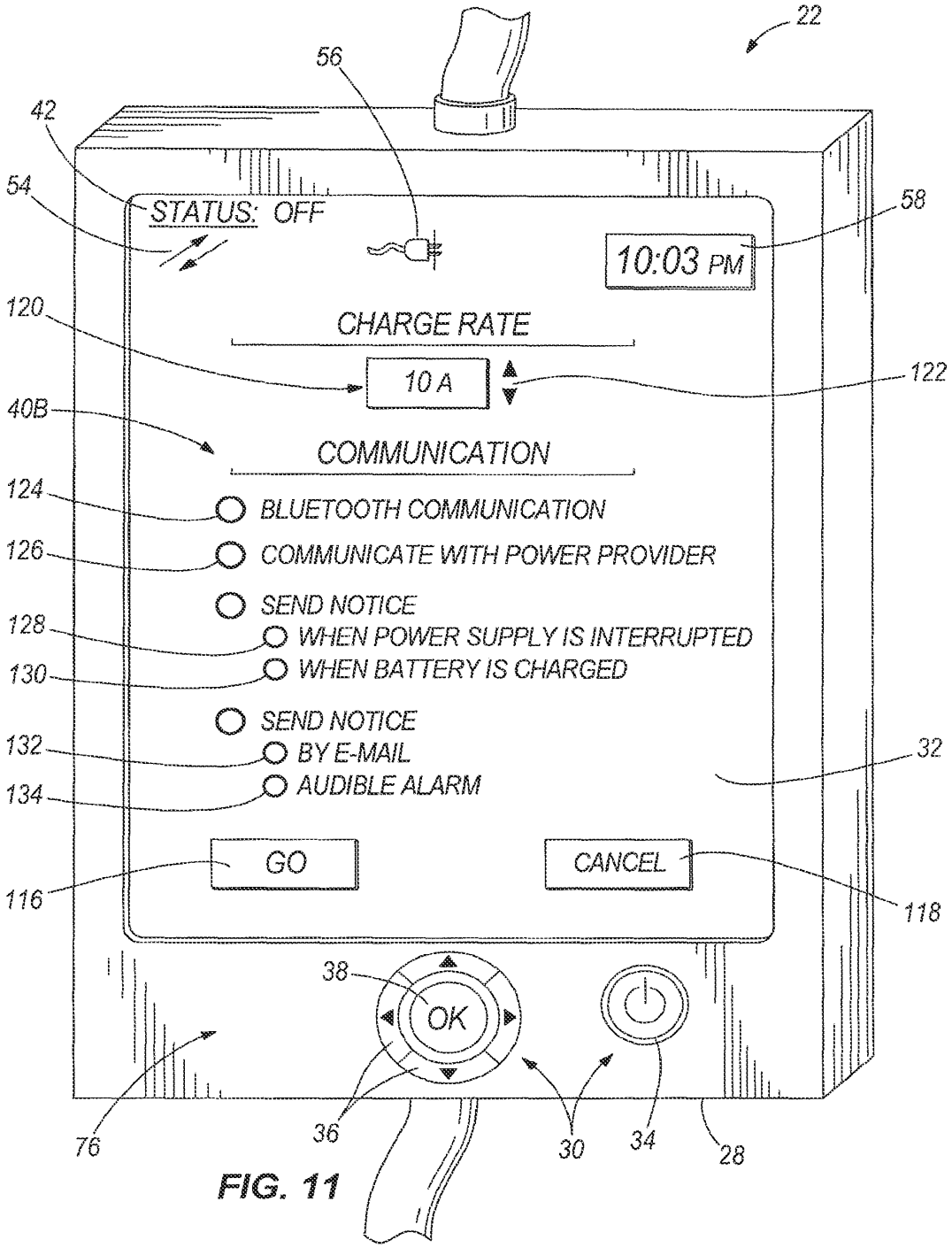

22
56
42
54
STATUS: OFF
58
10:03 PM
120
CHARGE RATE
10 A
122
40B
COMMUNICATION
124
BLUETOOTH COMMUNICATION
126
COMMUNICATE WITH POWER PROVIDER
SEND NOTICE
128
WHEN POWER SUPPLY IS INTERRUPTED
130
WHEN BATTERY IS CHARGED
SEND NOTICE
132
BY E-MAIL
134
AUDIBLE ALARM
32
GO
CANCEL
116
118
38
OK
76
36
30
34
28

FIG. 11

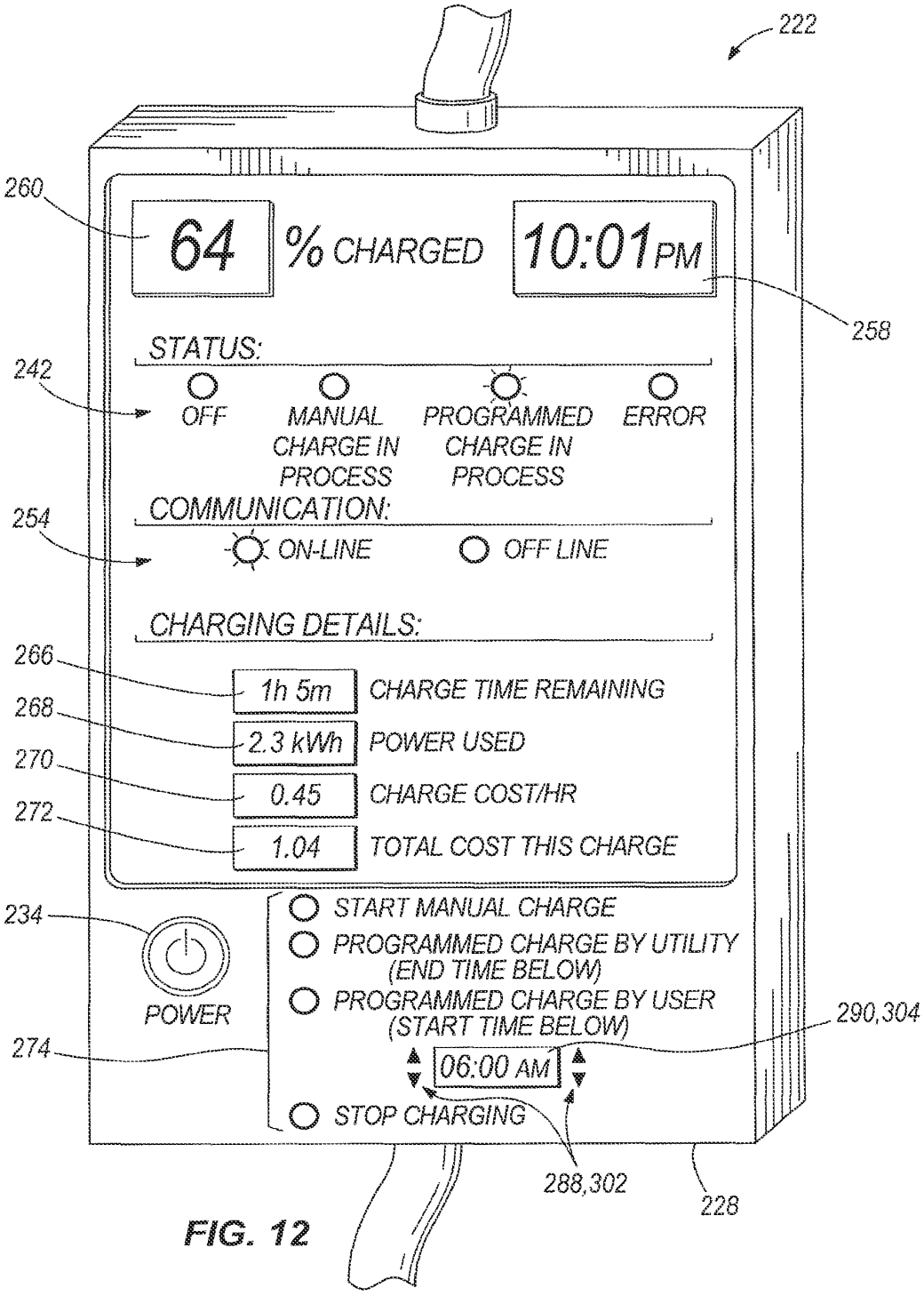

222
260
64
% CHARGED
10:01 PM
258
STATUS:
242
OFF
MANUAL CHARGE IN PROCESS
PROGRAMMED CHARGE IN PROCESS
ERROR
COMMUNICATION:
254
ON-LINE
OFF LINE
CHARGING DETAILS:
266
1h 5m
CHARGE TIME REMAINING
268
2.3 kWh
POWER USED
270
0.45
CHARGE COST/HR
272
1.04
TOTAL COST THIS CHARGE
234
POWER
START MANUAL CHARGE
PROGRAMMED CHARGE BY UTILITY (END TIME BELOW)
PROGRAMMED CHARGE BY USER (START TIME BELOW)
290,304
274
06:00 AM
STOP CHARGING
288,302
228

FIG. 12

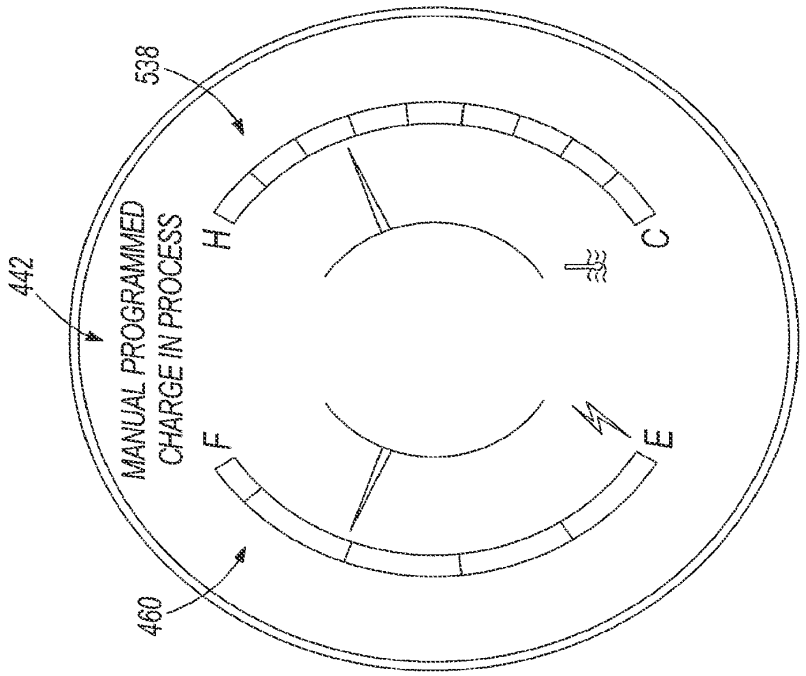

442
MANUAL PROGRAMMED
CHARGE IN PROCESS
538
H
C
F
E
460

FIG. 13

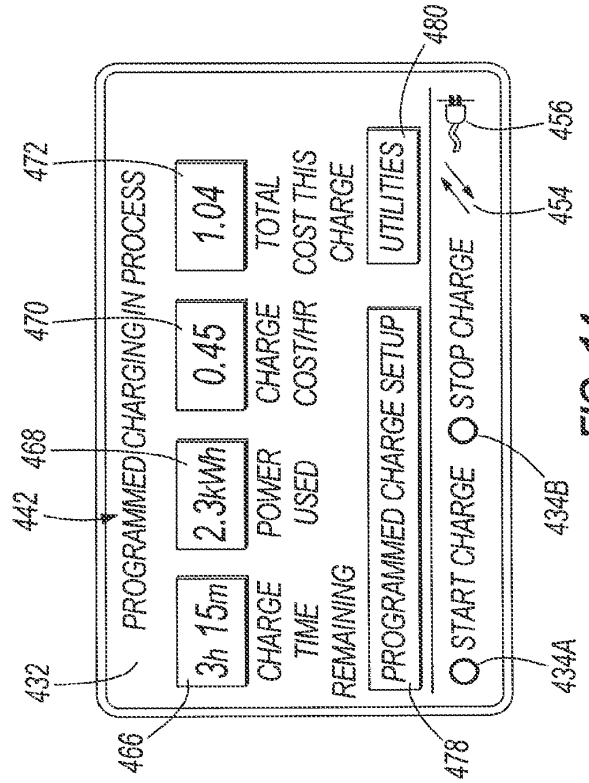

PROGRAMMED
CHARGING
IN PROCESS
3h 15m
CHARGE TIME REMAINING
2.3kWh
POWER USED
0.45
CHARGE COST/HR
1.04
TOTAL COST THIS CHARGE
PROGRAMMED CHARGE SETUP
UTILITIES
START CHARGE
STOP CHARGE
432
442
468
470
472
480
466
478
434A
434B
454
456

FIG. 14

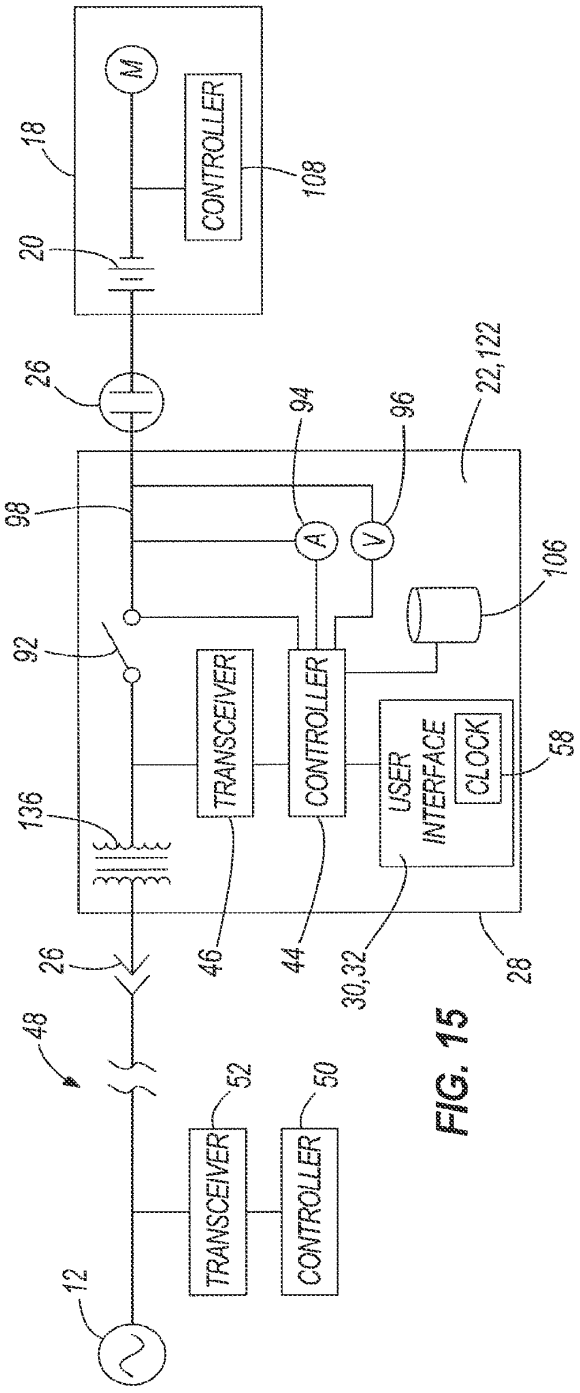

M
CONTROLLER
18
20
108
26
94
96
22,122
98
A
V
106
92
TRANSCEIVER
CONTROLLER
USER INTERFACE
CLOCK
58
136
46
44
30,32
28
26
48
52
50
TRANSCEIVER
CONTROLLER
12

FIG. 15

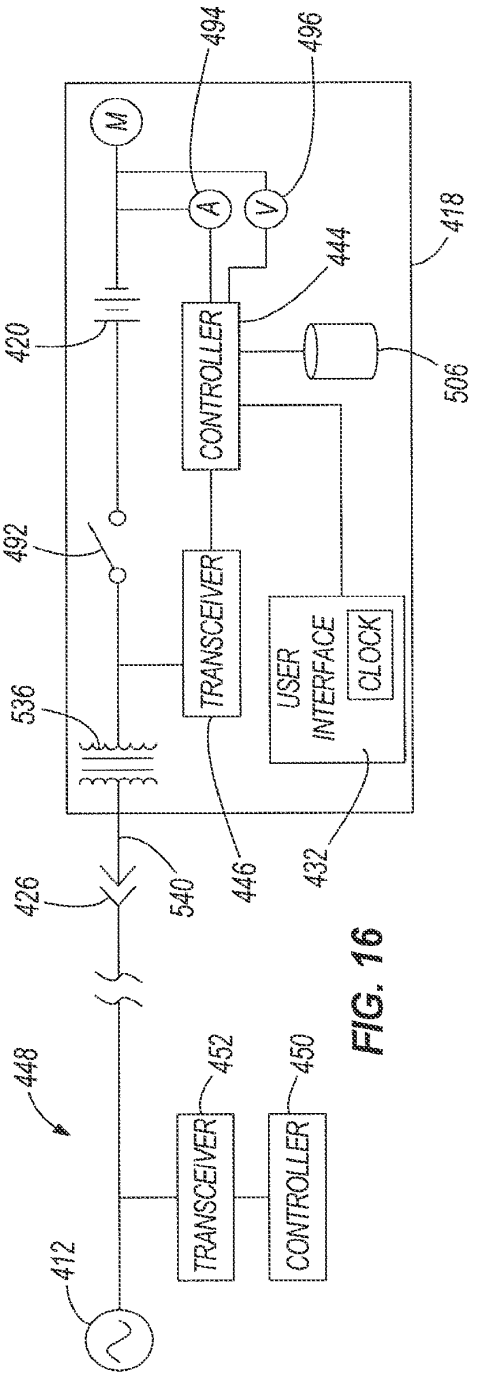

M
494
496
A
V
418
420
444
CONTROLLER
506
492
TRANSCEIVER
USER INTERFACE
CLOCK
536
426
540
446
432
448
452
450
TRANSCEIVER
CONTROLLER
412

FIG. 16

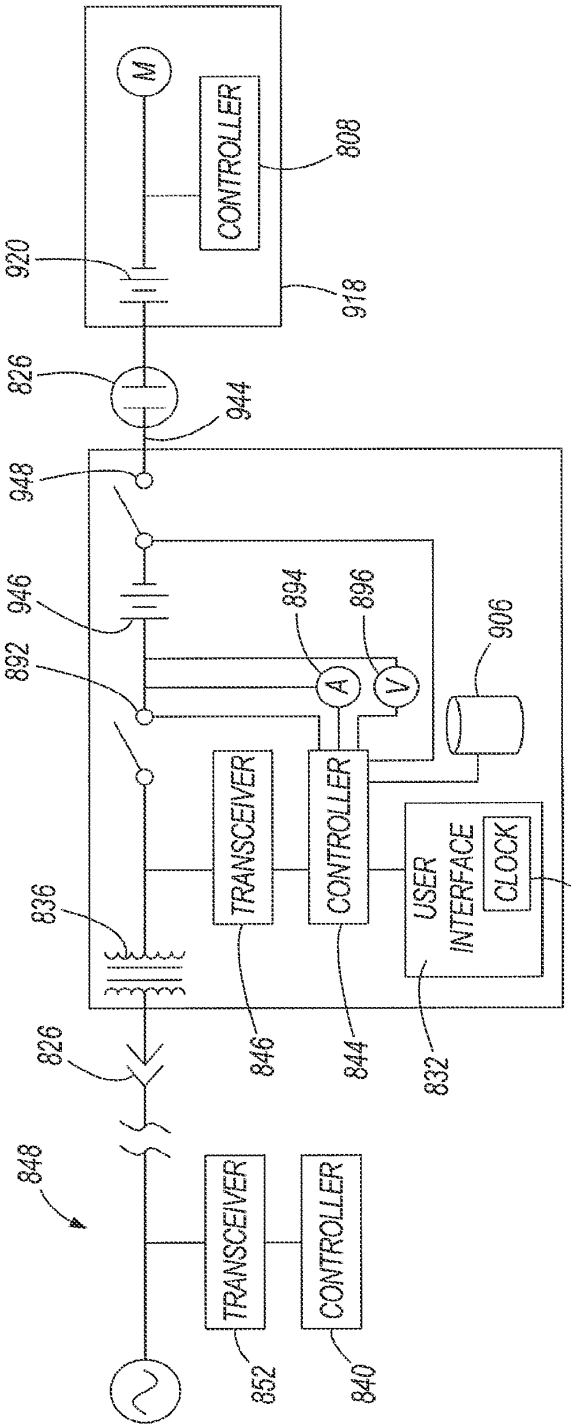

M
CONTROLLER
808
920
918
826
944
948
946
894
896
906
892
A
V
836
TRANSCEIVER
CONTROLLER
USER INTERFACE
CLOCK
858
826
846
844
832
848
TRANSCEIVER
CONTROLLER
852
840

FIG. 17

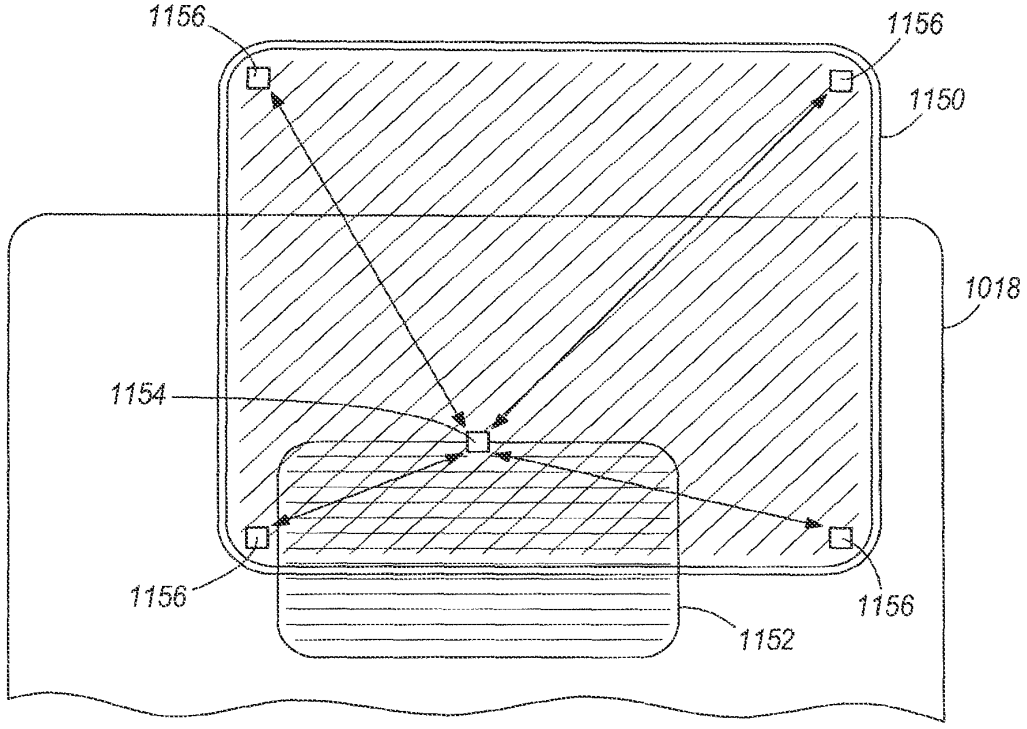

1156
1156
1150
1018
1154
1156
1156
1152

FIG. 18

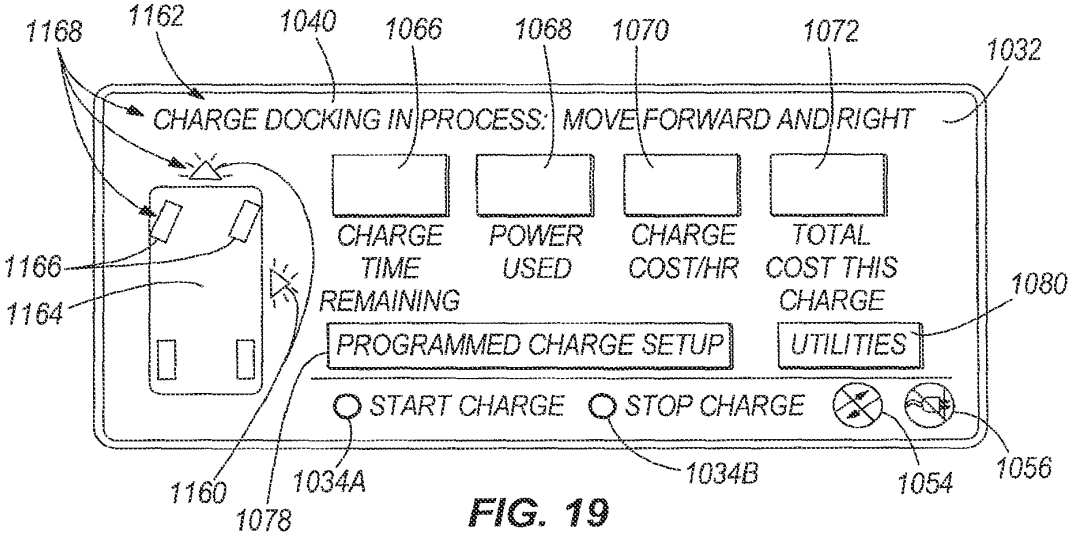

1168
1162
1040
1066
1068
1070
1072
1032
CHARGE DOCKING IN PROCESS: MOVE FORWARD AND RIGHT
CHARGE TIME REMAINING
POWER USED
CHARGE COST/HR
TOTAL COST THIS CHARGE
1166
1164
1080
PROGRAMMED CHARGE SETUP
UTILITIES
START CHARGE
STOP CHARGE
1160
1078
1034A
1034B
1054
1056

FIG. 19

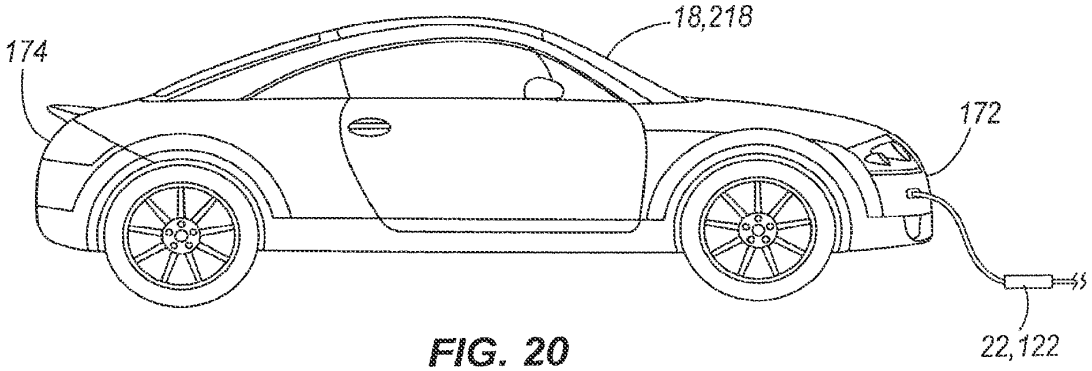



FIG. 20

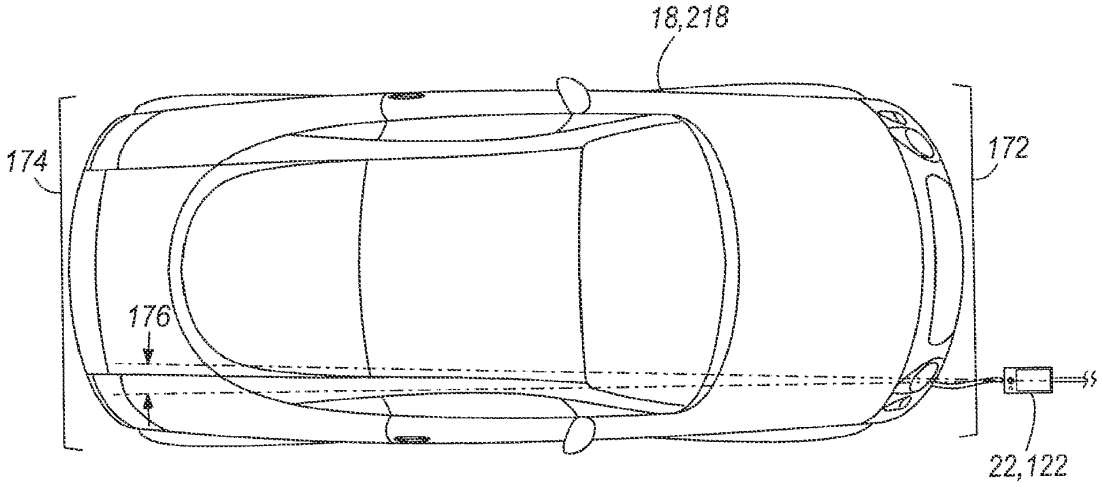



FIG. 21

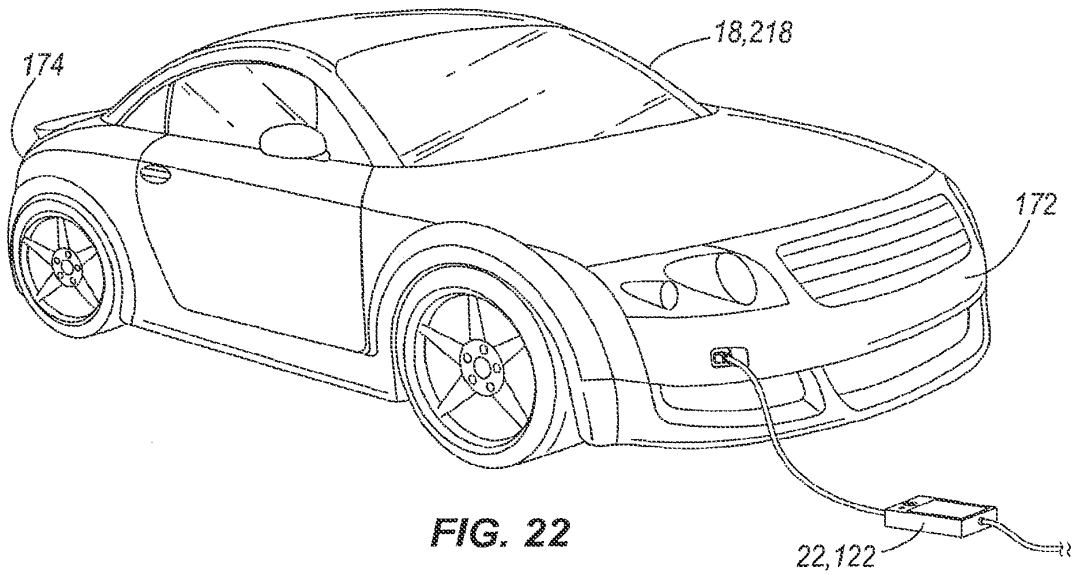



FIG. 22

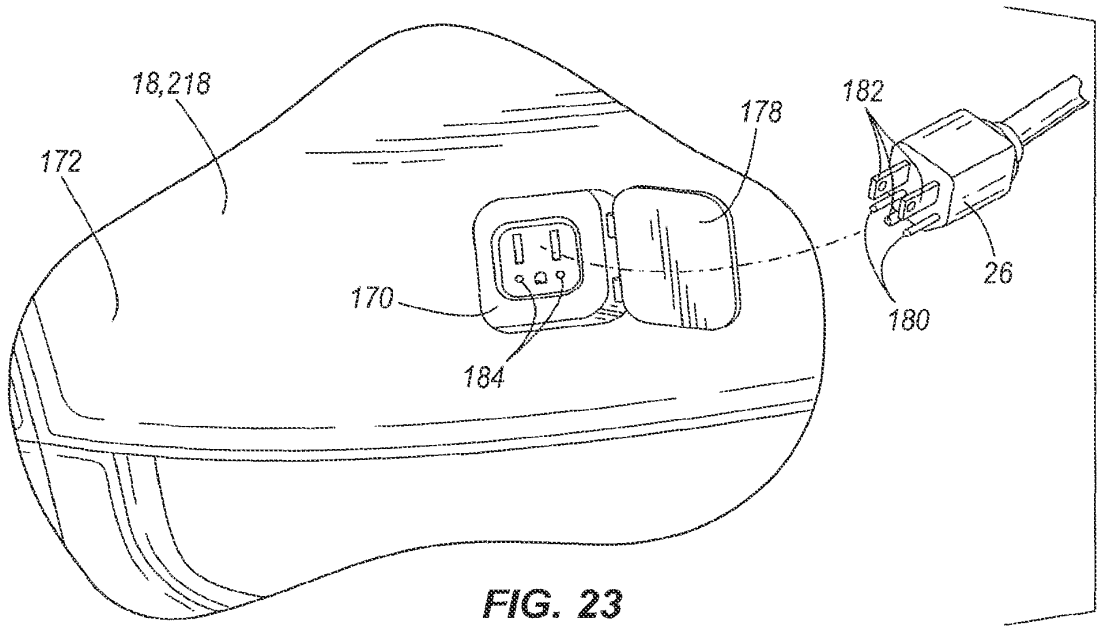



FIG. 23

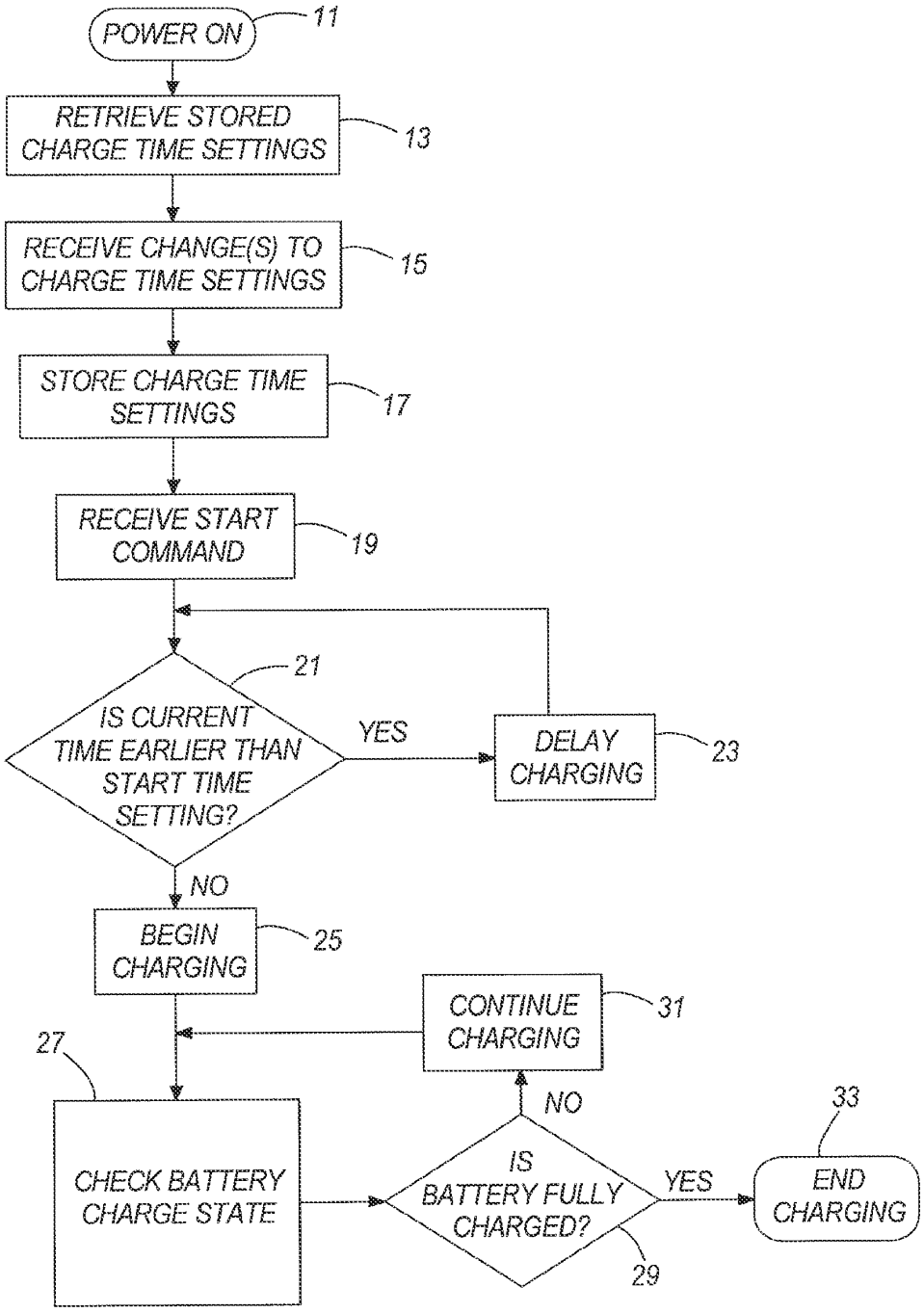

POWER ON
11
RETRIEVE STORED CHARGE TIME SETTINGS
13
RECEIVE CHANGE(S) TO CHARGE TIME SETTINGS
15
STORE CHARGE TIME SETTINGS
17
RECEIVE START COMMAND
19
21
IS CURRENT TIME EARLIER THAN START TIME SETTING?
YES
DELAY CHARGING
23
NO
BEGIN CHARGING
25
CONTINUE CHARGING
31
27
CHECK BATTERY CHARGE STATE
NO
IS BATTERY FULLY CHARGED?
29
YES
33
END CHARGING

FIG. 24

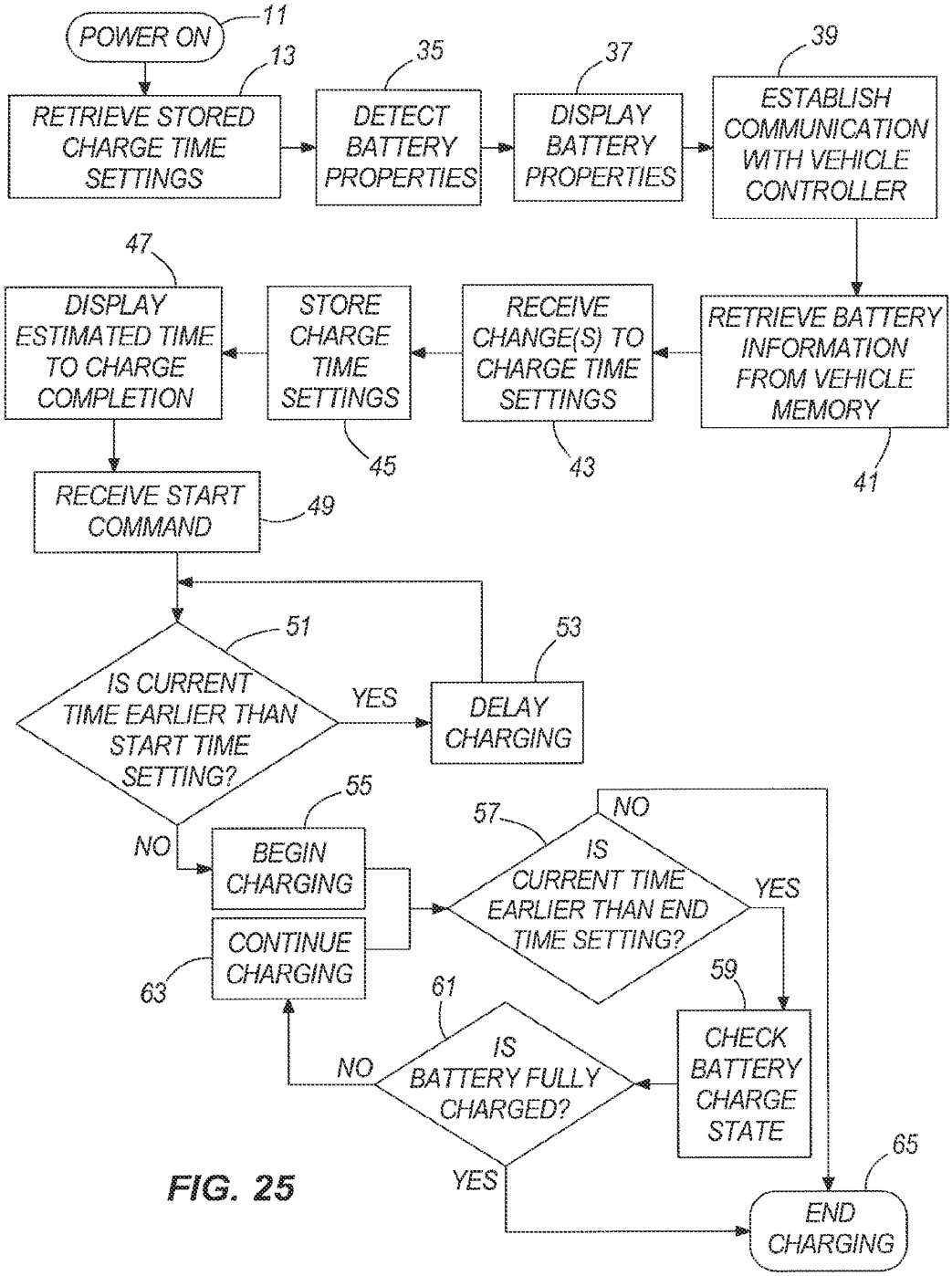

POWER ON
11
RETRIEVE STORED CHARGE TIME SETTINGS
13
DETECT BATTERY PROPERTIES
35
DISPLAY BATTERY PROPERTIES
37
ESTABLISH COMMUNICATION WITH VEHICLE CONTROLLER
39
RETRIEVE BATTERY INFORMATION FROM VEHICLE MEMORY
41
RECEIVE CHANGE(S) TO CHARGE TIME SETTINGS
43
STORE CHARGE TIME SETTINGS
45
DISPLAY ESTIMATED TIME TO CHARGE COMPLETION
47
RECEIVE START COMMAND
49
IS CURRENT TIME EARLIER THAN START TIME SETTING?
51
YES
DELAY CHARGING
53
NO
BEGIN CHARGING
55
CONTINUE CHARGING
63
IS CURRENT TIME EARLIER THAN END TIME SETTING?
57
NO
YES
CHECK BATTERY CHARGE STATE
59
IS BATTERY FULLY CHARGED?
61
NO
YES
END CHARGING
65

FIG. 25

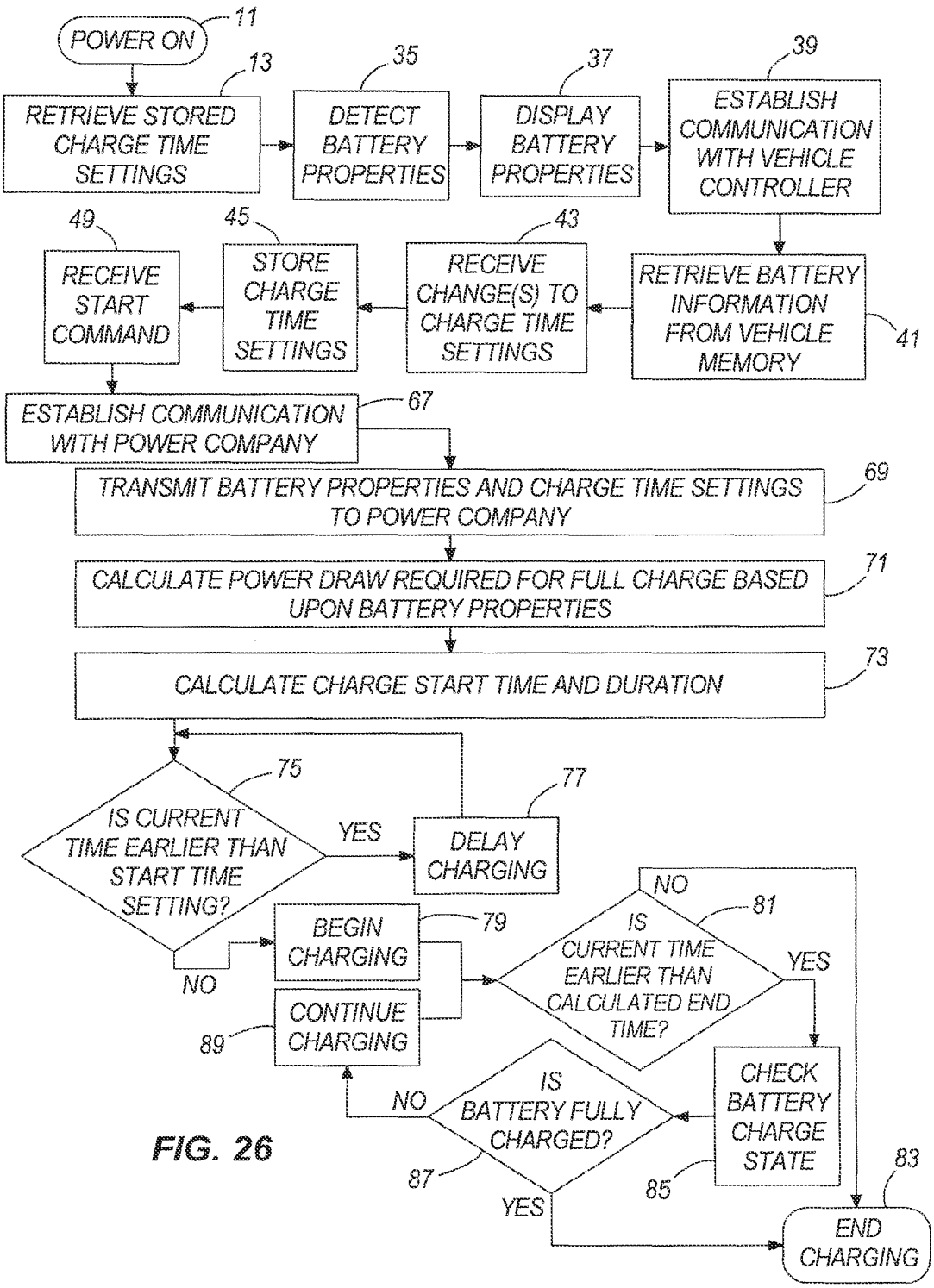

POWER ON
11
RETRIEVE STORED CHARGE TIME SETTINGS
13
DETECT BATTERY PROPERTIES
35
DISPLAY BATTERY PROPERTIES
37
ESTABLISH COMMUNICATION WITH VEHICLE CONTROLLER
39
RETRIEVE BATTERY INFORMATION FROM VEHICLE MEMORY
41
RECEIVE CHANGE(S) TO CHARGE TIME SETTINGS
43
STORE CHARGE TIME SETTINGS
45
RECEIVE START COMMAND
49
ESTABLISH COMMUNICATION WITH POWER COMPANY
67
TRANSMIT BATTERY PROPERTIES AND CHARGE TIME SETTINGS TO POWER COMPANY
69
CALCULATE POWER DRAW REQUIRED FOR FULL CHARGE BASED UPON BATTERY PROPERTIES
71
CALCULATE CHARGE START TIME AND DURATION
73
IS CURRENT TIME EARLIER THAN START TIME SETTING?
75
YES
DELAY CHARGING
77
NO
BEGIN CHARGING
79
CONTINUE CHARGING
89
IS CURRENT TIME EARLIER THAN CALCULATED END TIME?
81
NO
YES
IS BATTERY FULLY CHARGED?
87
NO
YES
CHECK BATTERY CHARGE STATE
85
END CHARGING
83

FIG. 26

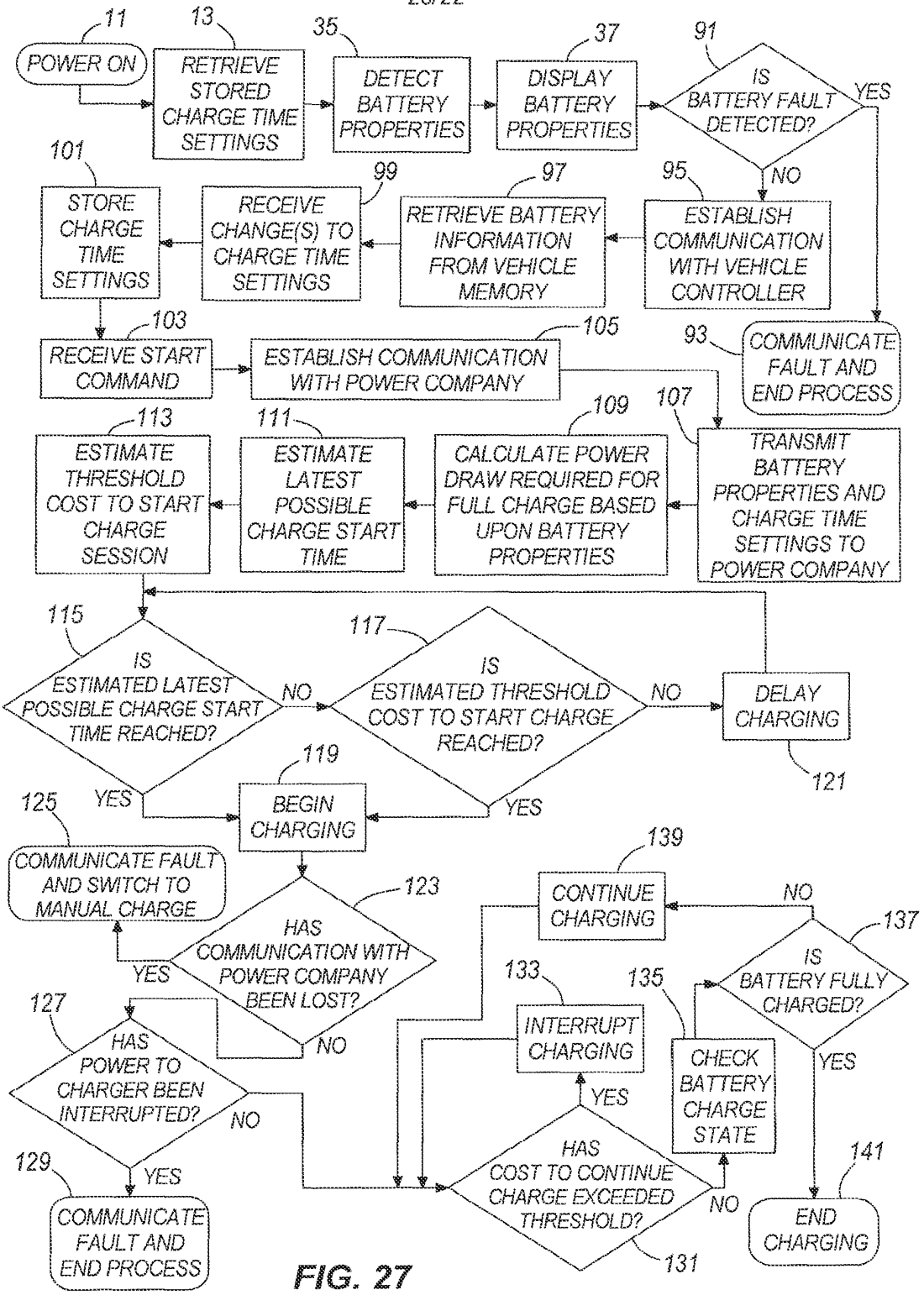

11
POWER ON
13
RETRIEVE STORED CHARGE TIME SETTINGS
35
DETECT BATTERY PROPERTIES
37
DISPLAY BATTERY PROPERTIES
91
IS BATTERY FAULT DETECTED?
YES
NO
101
STORE CHARGE TIME SETTINGS
99
RECEIVE CHANGE(S) TO CHARGE TIME SETTINGS
97
RETRIEVE BATTERY INFORMATION FROM VEHICLE MEMORY
95
ESTABLISH COMMUNICATION WITH VEHICLE CONTROLLER
103
RECEIVE START COMMAND
105
ESTABLISH COMMUNICATION WITH POWER COMPANY
93
COMMUNICATE FAULT AND END PROCESS
113
ESTIMATE THRESHOLD COST TO START CHARGE SESSION
111
ESTIMATE LATEST POSSIBLE CHARGE START TIME
109
CALCULATE POWER DRAW REQUIRED FOR FULL CHARGE BASED UPON BATTERY PROPERTIES
107
TRANSMIT BATTERY PROPERTIES AND CHARGE TIME SETTINGS TO POWER COMPANY
115
IS ESTIMATED LATEST POSSIBLE CHARGE START TIME REACHED?
NO
117
IS ESTIMATED THRESHOLD COST TO START CHARGE REACHED?
NO
DELAY CHARGING
121
YES
119
BEGIN CHARGING
YES
125
COMMUNICATE FAULT AND SWITCH TO MANUAL CHARGE
123
HAS COMMUNICATION WITH POWER COMPANY BEEN LOST?
YES
NO
139
CONTINUE CHARGING
NO
137
IS BATTERY FULLY CHARGED?
YES
133
INTERRUPT CHARGING
135
CHECK BATTERY CHARGE STATE
127
HAS POWER TO CHARGER BEEN INTERRUPTED?
NO
YES
129
COMMUNICATE FAULT AND END PROCESS
HAS COST TO CONTINUE CHARGE EXCEEDED THRESHOLD?
YES
NO
131
141
END CHARGING

FIG. 27

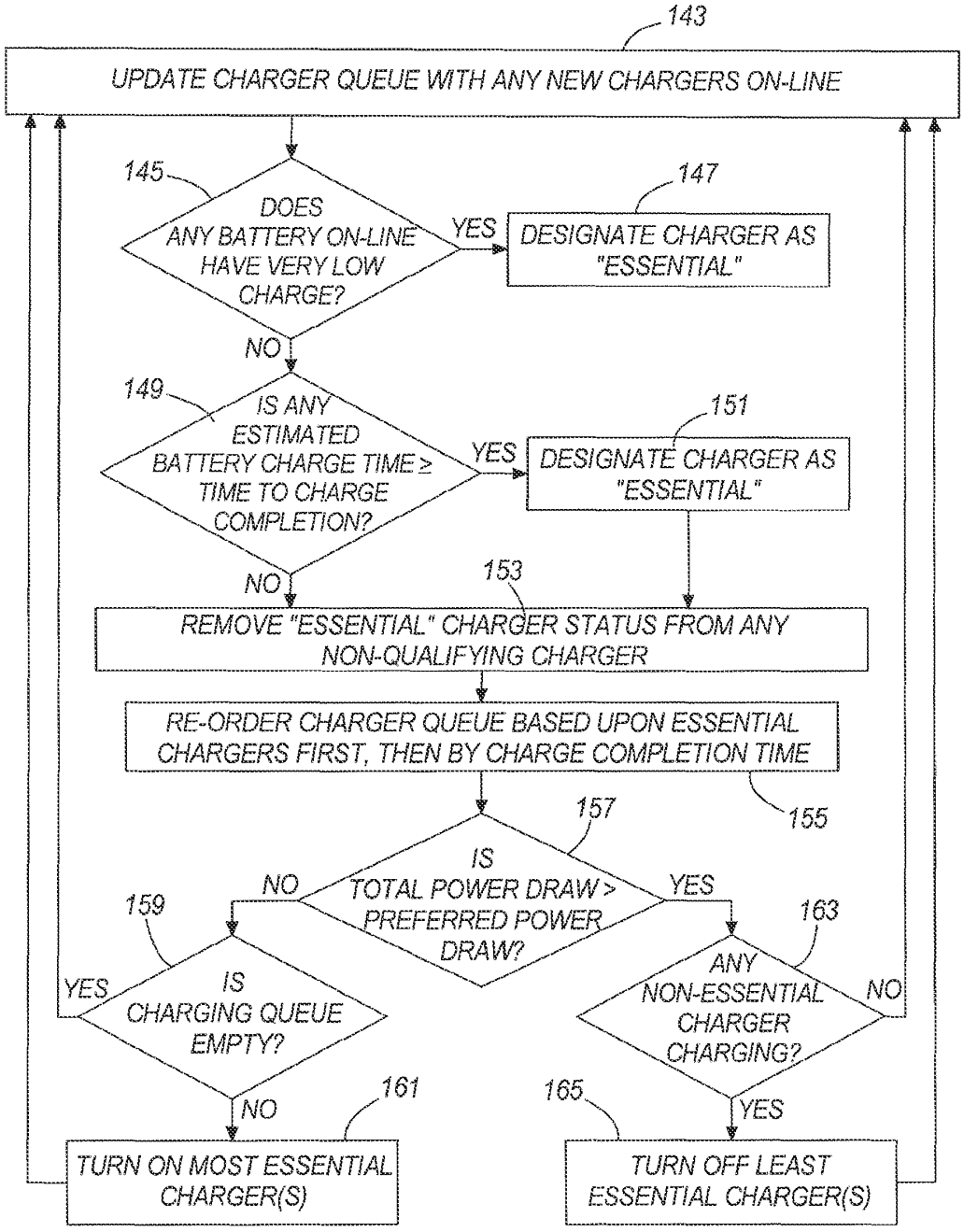

143
UPDATE CHARGER QUEUE WITH ANY NEW CHARGERS ON-LINE
145
DOES ANY BATTERY ON-LINE HAVE VERY LOW CHARGE?
YES
147
DESIGNATE CHARGER AS "ESSENTIAL"
NO
149
IS ANY ESTIMATED BATTERY CHARGE TIME ≥ TIME TO CHARGE COMPLETION?
YES
151
DESIGNATE CHARGER AS "ESSENTIAL"
NO
153
REMOVE "ESSENTIAL" CHARGER STATUS FROM ANY NON-QUALIFYING CHARGER
RE-ORDER CHARGER QUEUE BASED UPON ESSENTIAL CHARGERS FIRST, THEN BY CHARGE COMPLETION TIME
155
157
IS TOTAL POWER DRAW > PREFERRED POWER DRAW?
NO
YES
159
IS CHARGING QUEUE EMPTY?
YES
NO
161
TURN ON MOST ESSENTIAL CHARGER(S)
163
ANY NON-ESSENTIAL CHARGER CHARGING?
NO
YES
165
TURN OFF LEAST ESSENTIAL CHARGER(S)

FIG. 28

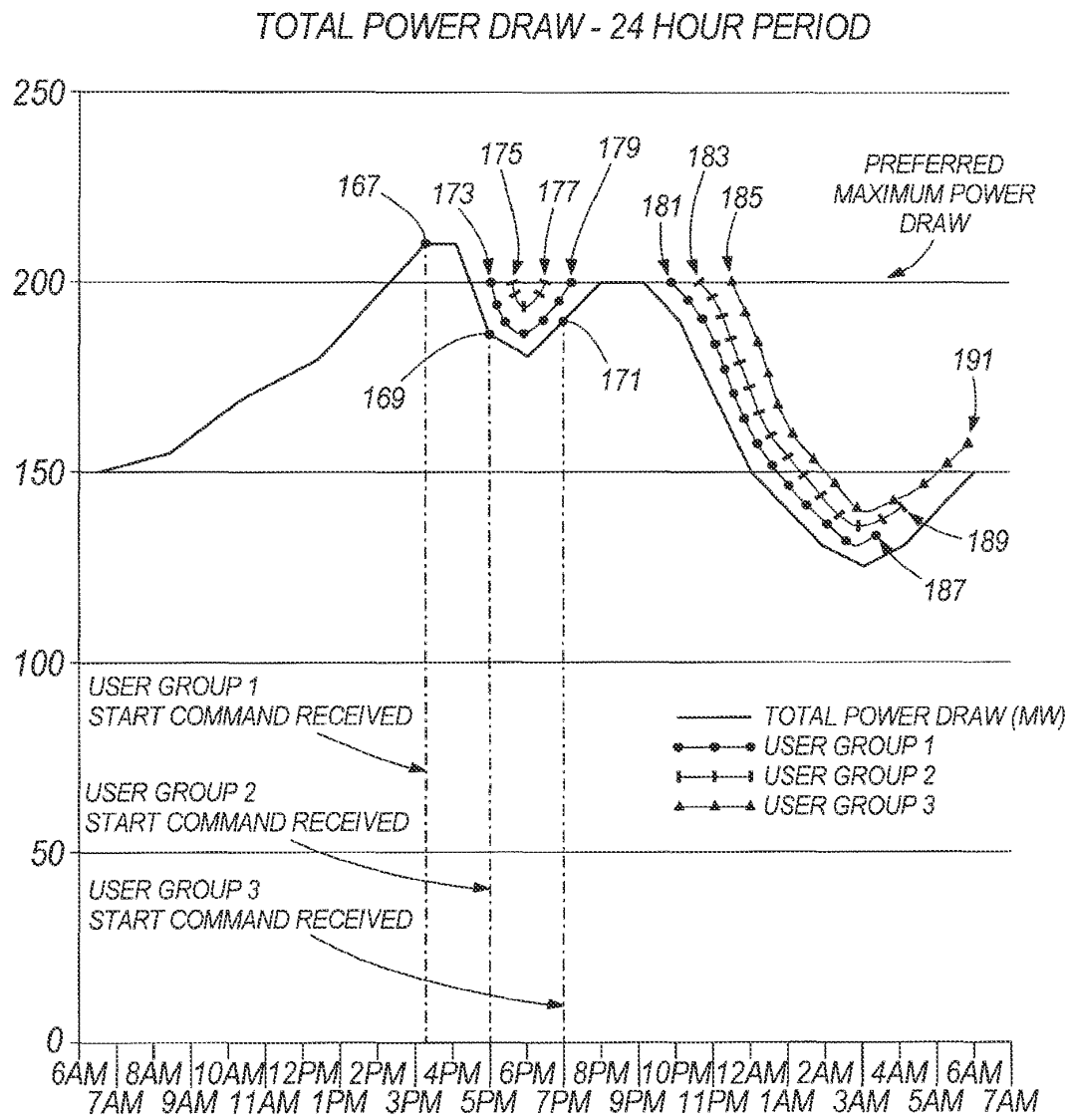

TOTAL POWER DRAW - 24 HOUR PERIOD
250
200
150
100
50
0
167
173
175
177
179
181
183
185
PREFERRED MAXIMUM POWER DRAW
169
171
191
189
187
USER GROUP 1 START COMMAND RECEIVED
USER GROUP 2 START COMMAND RECEIVED
USER GROUP 3 START COMMAND RECEIVED
TOTAL POWER DRAW (MW)
USER GROUP 1
USER GROUP 2
USER GROUP 3
6AM 7AM
8AM 9AM
10AM 11AM
12PM 1PM
2PM 3PM
4PM 5PM
6PM 7PM
8PM 9PM
10PM 11PM
12AM 1AM
2AM 3AM
4AM 5AM
6AM 7AM

FIG. 29

| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Filer:** | Molly S. Lawson/Dorothy Hauser |
| **Attorney Docket Number:** | 013350-9003-US35 |
| Filed as Small Entity | |
| **Filing Fees for Utility under 35 USC 111(a)** | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| UTILITY FILING FEE (ELECTRONIC FILING) | 4011 | 1 | 80 | 80 |
| UTILITY SEARCH FEE | 2111 | 1 | 350 | 350 |
| UTILITY EXAMINATION FEE | 2311 | 1 | 400 | 400 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **830** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 42043747 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Molly S. Lawson/Dorothy Hauser |
| **Filer Authorized By:** | Molly S. Lawson |
| **Attorney Docket Number:** | 013350-9003-US35 |
| **Receipt Date:** | 01-MAR-2021 |
| **Filing Date:** | |
| **Time Stamp:** | 14:26:31 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $830 |
| RAM confirmation Number | E202131E28413816 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Application Data Sheet | WebADS.pdf | 127923<br>4cf56e4c259bc8d8e24e41c6f5fbd9e56f914d92 | no | 8 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Oath or Declaration filed | 013350-9003-US35_As_Filed_Declaration.pdf | 3291181<br>64c3e39cca2a9bf06497432faea5ed89d0c96848 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | | 013350-9003-US35_As_Filed_Preliminary_Amendment.pdf | 106080<br>1ab6f8b9403457eb50e98d16a690a18e5dcdbe1d | yes | 7 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Preliminary Amendment | 1 | 1 |
| | Specification | 2 | 2 |
| | Claims | 3 | 6 |
| | Applicant Arguments/Remarks Made in an Amendment | 7 | 7 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | | 013350-9003-US35_As_Filed_Application.pdf | 15999756<br>91ab16c4e24043551779e212eb6b63ce0b47a5c2 | yes | 91 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |

| | | | | | |
|---|---|---|---|---|---|
| | Specification | | 1 | | 65 |
| | Claims | | 66 | | 68 |
| | Abstract | | 69 | | 69 |
| | Drawings-only black and white line drawings | | 70 | | 91 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Fee Worksheet (SB06) | fee-info.pdf | 35156<br>a500fb59ca326be40662b45bda06727957a6f083 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 19560096 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Inventor Information:

**Inventor 1**

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Christopher | B. | Austin | |

**Residence Information (Select One)** ◉ US Residency ○ Non US Residency ○ Active US Military Service

| City | Grafton | State/Province | WI | Country of Residence i | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 935 17th Avenue | | |
|---|---|---|---|
| Address 2 | | | |
| City | Grafton | State/Province | WI |
| Postal Code | 53024 | Country i | US |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 23409 | | |
|---|---|---|---|
| Email Address | mkeipdocket@michaelbest.com | Add Email | Remove Email |

## Application Information:

| Title of the Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | | |
|---|---|---|---|
| Attorney Docket Number | 013350-9003-US35 | Small Entity Status Claimed | ☒ |
| Application Type | Nonprovisional | | |
| Subject Matter | Utility | | |
| Total Number of Drawing Sheets (if any) | 22 | Suggested Figure for Publication (if any) | 1 |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|---|---|---|
| | | |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

| Please Select One: | ◉ Customer Number | ○ US Patent Practitioner | ○ Limited Recognition (37 CFR 11.9) |
|---|---|---|---|
| Customer Number | 23409 | | |

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix | |
|---|---|---|---|---|---|
| | | | | | Remove |
| Registration Number | | | | | |
| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix | |
| | | | | | Remove |
| Registration Number | | | | | |

Additional Representative Information blocks may be generated within this form by selecting the **Add** button.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

| Prior Application Status | Pending | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| | Continuation of | 16056059 | 2018-08-06 |

| Prior Application Status | Patented | | | | Remove |
|---|---|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number | Issue Date (YYYY-MM-DD) |
| 16056059 | Continuation of | 12737803 | 2011-02-17 | 10090567 | 2018-10-02 |

| Prior Application Status | | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| 12737803 | a 371 of international | PCT/US2009/054174 | 2009-08-18 |

| Prior Application Status | Expired | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
| PCT/US2009/054174 | Claims benefit of provisional | 61189353 | 2008-08-18 |

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

| Application Number | Country[i] | Filing Date (YYYY-MM-DD) | Access Code[i] (if applicable) |
|---|---|---|---|
| | | | |

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE**: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

**1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)**

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

**2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)**

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Applicant 1**

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| ◯ Assignee | ◯ Legal Representative under 35 U.S.C. 117 | ◯ Joint Inventor |
|---|---|---|
| ◯ Person to whom the inventor is obligated to assign. | ◯ Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☐

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix |
|---|---|---|---|---|
| | | | | |

**Mailing Address Information For Applicant:**

| | | | |
|---|---|---|---|
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country**[i] | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Applicant Data may be generated within this form by selecting the Add button.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix |
|---|---|---|---|---|
| | | | | |

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

| | | | |
|---|---|---|---|
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country** i | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 013350-9003-US35 |
|---|---|---|
| | Application Number | |
| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD | |

## Signature:

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

| **Signature** | /molly s. lawson/ | | | Date (YYYY-MM-DD) | |
|---|---|---|---|---|---|
| First Name | Molly | Last Name | Lawson | Registration Number | 58890 |

Additional Signature may be generated within this form by selecting the Add button.

IAP03Rec'd PCT 17 FEB 2011

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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

12/737803

| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
|---|---|

As the below named inventor(s), I/we declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☑ United States application or PCT international application number PCT/US2009/054174 filed on 18 August 2009
- ☐ As amended on _____ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

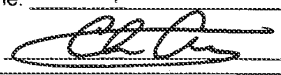
## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

All statements made herein of my/our own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR(S)

Inventor one: Christopher B. Austin Date: 2/17/11

Signature  Citizen of: United States of America

Inventor two: _____ Date: _____

Signature: _____ Citizen of: _____

☐ Additional inventors or a legal representative are being named on _____ additional form(s) attached hereto

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

IAP03Rec'd PCT 17 FEB 2011
12/737803

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant ( *i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | 3763 | 830 | 013350-9003-US35 | 20 | 3 |

**CONFIRMATION NO. 8606**

23409
MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

**FILING RECEIPT**

OC000000123962371

Date Mailed: 03/11/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

**Please verify the accuracy of the data presented on this receipt.** If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

**Inventor(s)**

Christopher B. Austin, Grafton, WI;

**Applicant(s)**

Christopher B. Austin, Grafton, WI;

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This application is a CON of 16/056,059 08/06/2018
which is a CON of 12/737,803 02/17/2011 PAT 10090567
which is a 371 of PCT/US2009/054174 08/18/2009
which claims benefit of 61/189,353 08/18/2008

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes



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Tesla EX1002 Page 114

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 03/09/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/188,269**

**Projected Publication Date:** 06/17/2021

**Non-Publication Request:** No

**Early Publication Request:** No
**** SMALL ENTITY ****
**Title**

VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

**Preliminary Class**

165

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific



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Tesla EX1002 Page 115

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

## LICENSE FOR FOREIGN FILING UNDER

## Title 35, United States Code, Section 184

## Title 37, Code of Federal Regulations, 5.11 & 5.15

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

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## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/188,269

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | 80 | | N/A | |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | 350 | | N/A | |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | 400 | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 20 minus 20 = | * | x 50 = | 0.00 | OR | | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 3 minus 3 = | * | x 240 = | 0.00 | | | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | 0.00 | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | 0.00 | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | 830 | | TOTAL | |

### APPLICATION AS AMENDED - PART II

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| | Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
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www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 |

**CONFIRMATION NO. 8606**

23409
MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

**INFORMAL NOTICE**

*OC000000123962372*

Date Mailed: 03/11/2021

## INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

**A new inventor's oath or declaration that identifies this application (e.g., by Application Number and filing date) is required. The inventor's oath or declaration does not comply with 37 CFR 1.63 in that it:**

- does not state that the above-identified application was made or authorized to be made by the person executing the oath or declaration.

Christopher B. Austin

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/qnguyen/



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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 |

**CONFIRMATION NO. 8606**

23409
MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

**PUBLICATION NOTICE**

*OC000000126386071*

**Title:**VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

**Publication No.**US-2021-0184275-A1
**Publication Date:**06/17/2021

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

---

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



IPR2026-00379
Tesla EX1002 Page 120

# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| Title of Invention | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 17/188,269 filed on March 1, 2021.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the above identified application, including the claims.

I acknowledge the duty to disclose to the United States Patent & Trademark Office all information known to me to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Christopher B. Austin Date (Optional): September 29, 2021

Signature: /christopher b. austin/

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use an additional PTO/AIA/01 form for each additional inventor.

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 43899043 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Christopher B. Austin/Dorothy Hauser |
| **Filer Authorized By:** | Christopher B. Austin |
| **Attorney Docket Number:** | 013350-9003-US35 |
| **Receipt Date:** | 29-SEP-2021 |
| **Filing Date:** | 01-MAR-2021 |
| **Time Stamp:** | 13:03:27 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Oath or Declaration filed | 013350-9003-US35_Declaration_Executed_9-29-21.pdf | 82098<br>8d2fea6f13668d5e781034c8aeb831a873082ab4 | no | 1 |
| **Warnings:** | | | | | |

| Information: | |
|---|---|
| Total Files Size (in bytes): | 82098 |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/08a (03-15)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | |
| Examiner Name | |
| Attorney Docket Number | 013350-9003-US35 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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**U.S.PATENT APPLICATION PUBLICATIONS** Remove

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**FOREIGN PATENT DOCUMENTS** Remove

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|
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**NON-PATENT LITERATURE DOCUMENTS** Remove

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | Search Report issued in corresponding PCT/US2009/054174; December 3, 2009 | |
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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Attorney Docket Number | 013350-9003-US35 |

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| | 6 | Official Action issued in corresponding EP09808718.2; July 20, 2021 | |

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**EXAMINER SIGNATURE**

| Examiner Signature | | Date Considered | |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 013350-9003-US35 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2021-09-29 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



IPR2026-00379
Tesla EX1002 Page 132

PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference 00000-0977WO | FOR FURTHER ACTION | see Form PCT/ISA/220 as well as, where applicable, item 5 below. |
|---|---|---|
| International application No. PCT/US2009/054174 | International filing date *(day/month/year)* 18 August 2009 | (Earliest) Priority Date *(day/month/year)* 18 August 2008 |
| Applicant AUSTIN, CHRISTOPHER | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed.

☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☒ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 22

☒ as suggested by the applicant.

☐ as selected by this Authority, because the applicant failed to suggest a figure.

☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figures is to be published with the abstract.

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/US2009/054174

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

1-139, 142, 146-147

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/054174

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - H01M 10/44 (2009.01)
USPC - 320/128
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - H01J 7/00; H01M 10/44 (2009.01)
USPC - 180/6.5; 320/114, 128; 439/34; 705/1, 8

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent, GooglePatent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y | US 6,963,186 B2 (HOBBS) 08 November 2005 (08.11.2005) entire document | 1-3, 6, 10-14, 18, 20-21, 30-33, 38, 40-41, 44-45<br>---<br>4-5, 7-9, 15-17, 19, 22-29, 34-37, 39, 42-43, 46-139, 142, 146-147 |
| Y | US 2007/0164704 A2 (MCGINLEY et al) 19 July 2007 (19.07.2007) entire document | 4, 53 |
| Y | US 2008/0052145 A1 (KAPLAN et al) 28 February 2008 (28.02.2008) entire document | 5, 7-9, 22-25, 36-37, 42-43, 54, 56-58, 70-72, 82-83, 87-90, 99, 101-103, 115-117, 127-128, 132-135 |
| Y | US 5,462,439 A (KEITH) 31 October 1995 (31.10.1995) entire document | 15-17, 19, 63-65, 67, 108-110, 112, 142 |
| Y | US 7,243,746 B1 (VASANT) 17 July 2007 (17.07.2007) entire document | 34-35, 39, 48-50, 80-81, 85, 96-97, 125-126, 130 |
| Y | US 5,548,200 A (NOR et al) 20 August 1996 (20.08.1996) entire document | 26-29, 46-139, 142, 146-147 |

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 27 November 2009 | 03 DEC 2009 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/054174

Continuation of Box III.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-45, 142, 147, drawn to a vehicle charger comprising a first remote controller and a second controller, a transmitter and a receiver coupled to the second controller, and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger.
Group II, claims 46-139,146 drawn to a vehicle charger comprising a user manipulatable control and operable by a user to enter a time of day at which a charging session will end.
Group III, claim 140, drawn to a vehicle charger comprising a controller which supplies electric power to the battery if a level of battery charge is below a threshold level, until the threshold level of battery charge is reached.
Group IV, claims 141,143-145 drawn to a vehicle charger comprising a display and a controller operable to display at least two different screens upon the display, at least one of the screens displaying information regarding a charging session, and at least one of the screens displaying settings at least partially defining the manner of operation of the battery charger.
Group V, claims 148, drawn to a vehicle charger comprising a controller which transmits a signal responsive to detection of an interruption of power supply to the vehicle charger.
Group VI, claims 149, 152, drawn to a vehicle charger or method for controlling batteries of multiple vehicles comprising a controller capable of increasing or decreasing a rate of charge, starting charging or stopping charging based at least in part on the time of day.
Group VII, claims 150, drawn to a vehicle charger comprising a first core on a vehicle, a second core in a location stationary with respect to the vehicle, the second core providing an inductive charge to the first core; at least one sensor positioned to detect the position of the first core with respect to the second core; a display; and a controller coupled to the display and responsive to signals from the sensor to display at least one indicator on the display indicating a direction in which the vehicle must move for an improved positional relationship betweent he first and second cores.
Group VIII, claim 151, drawn to a vehicle charger comprising a first connector coupled to the battery and controller and located on one side of the vehicle; a second connector coupled to the battery and controller and located on a different side of the vehicle.

The inventions listed as Groups I-VIII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a first remote controller, a transmitter and a receiver coupled to the second controller, and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger as claimed therein is not present in the invention of Groups II-VIII. The special technical feature of the Group II invention: a user manipulatable control and operable by a user to enter a time of day at which a charging session will end as claimed therein is not present in the invention of Groups I, III-VIII. The special technical feature of the Group III invention: a controller which supplies electric power to the battery if a level of battery charge is below a threshold level, until the threshold level of battery charge is reached as claimed therein is not present in the invention of Groups I, II, IV-VIII. The special technical feature of the Group IV invention: a display having at least two different screens upon the display, at least one of the screens displaying information regarding a charging session, and at least one of the screens displaying settings at least partially defining the manner of operation of the battery charger as claimed therein is not present in the invention of Groups I, II, III or V-VIII. The special technical feature of the Group V invention: the controller transmitting a signal responsive to detection of an interruption of power supply to the vehicle charger as claimed therein is not present in the invention of Groups I-IV, VI-VIII. The special technical feature of the Group VI invention: a controller capable of increasing or decreasing a rate of charge, starting charging or stopping charging based at least in part on the time of day as claimed therein is not present in the invention of Groups I-V, VII-VIII. The special technical feature of the Group VII invention: a first core on a vehicle, a second core in a location stationary with respect to the vehicle, the second core providing an inductive charge to the first core; at least one sensor positioned to detect the position of the first core with respect to the second core; a display; and a controller coupled to the display and responsive to signals from the sensor to display at least one indicator on the display indicating a direction in which the vehicle must move for an improved positional relationship betweent he first and second cores as claimed therein is not present in the invention of Groups I-VI or VIII. The special technical feature of the Group VIII invention: a first connector coupled to the battery and controller and located on one side of the vehicle; a second connector coupled to the battery and controller and located on a different side of the vehicle as claimed therein is not present in the invention of Groups I-VII.

Groups I, II, III, IV, V, VI, VII and VIII lack unity of invention because even though the inventions of these groups require the technical features of a battery charger controller having a display, communications means, releasable connectors to connect power to the battery, the controller and a power source; a display and a memory, and increasing or decreasing power depending on a state of charge of the battery, these technical features are not special technical features as thet do not make a contribution over the prior art in view of US 6,963,186 B2 (HOBBS) 08 November 2005, column 10, lines 31-43; column11, lines 15-24; column17, lines 38-41; figures 2, 3.

Since none of the special technical features of the Group I, II, III, IV, V, VI, VII or VIII inventions are found in more than one of the inventions, unity of invention is lacking.

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## Title of Invention

VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

## Application Information

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| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | - |
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| DOCUMENT | PAGES | DESCRIPTION | SIZE (KB) |
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| Foreign_Reference_2_WO2008026390.pdf | 28 | Foreign Reference | 1315 KB |
| Foreign_Reference_1_JP2006074868_w_English_Translation.pdf | 20 | Foreign Reference | 3893 KB |
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If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

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If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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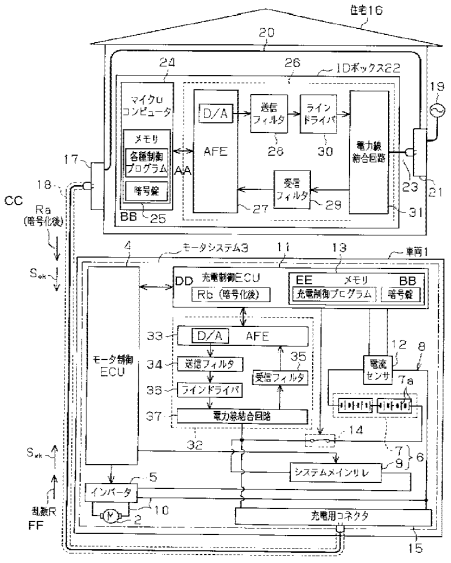
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(54) Title: CHARGING SYSTEM

(54) 発明の名称: 充電システム




16 DWELLING HOUSE
24 MICROCOMPUTER
25 MEMORY
AA VARIOUS CONTROL PROGRAMS
BB CIPHER LOCK
28 TRANSMISSION FILTER
29 RECEPTION FILTER
30 LINE DRIVER
22 ID BOX
31 POWER LINE COUPLING CIRCUIT
CC Ra (AFTER ENCRYPTION)
3 MOTOR SYSTEM
1 VEHICLE
4 MOTOR CONTROL ECU
11 CHARGE CONTROL ECU
DD Rb (AFTER ENCRYPTION)
13 MEMORY
EE CHARGE CONTROL PROGRAM
34 TRANSMISSION FILTER
36 LINE DRIVER
35 RECEPTION FILTER
37 POWER LINE COUPLING CIRCUIT
12 CURRENT SENSOR
9 SYSTEM MAIN RELAY
5 INVERTER
FF RANDOM NUMBER R
15 CONNECTOR FOR CHARGING

(57) **Abstract:** Provided is a charging system by which theft of an object to be charged is sufficiently prevented. An object (1) to be charged includes a rechargeable battery (6). The rechargeable battery (6) of the object (1) is connected to a power supply (19) of a dwelling house through power lines (20, 18). An authentication control apparatus (22) performs authentication of the object (1) by communicating with the object (1) through the power lines (20, 18), and only when the object is authenticated, charging from the power supply (19) of the dwelling house to the rechargeable battery (6) is permitted.

(57) 要約: 充電対象の盗難予防性を充分に高くすることができる充電システム。充電対象（１）は、蓄電池（６）を含む。充電対象（１）の蓄電池（６）は、住宅の電源（１９）と電力線（２０，１８）を通じて接続される。認証管理機器（２２）は、電力線（２０，１８）を通じて充電対象（１）と通信することにより充電対象（１）の認証を行い、該認証が成立したときにのみ住宅の電源（１９）から蓄電池（６）への充電を許可するように構成されている。

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**(81) 指定国 (表示のない限り、全ての種類の国内保護が可能):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, KE, KG, KM, KN, KP, KR, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

**(84) 指定国 (表示のない限り、全ての種類の広域保護が可能):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), **ユーラシア** (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), **ヨーロッパ** (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**添付公開書類:**
— **国際調査報告書**

# 明 細 書

## 充電システム

## 技術分野

[0001] 本発明は、住宅の電源を充電対象に供給することにより充電対象の蓄電池に充電を行う充電システムに関する。

## 背景技術

[0002] 近年、エンジンのみで動くエンジン自動車以外の車種として、エンジン及びモータの両方を駆動源として動くハイブリッド車や、モータで動く電気自動車の普及が広まりつつある。この種の電動車両においては、バッテリの電圧が低下した場合、バッテリに充電を行う必要がある。例えば家庭用電源（商用電源：交流100V）で充電を行う場合、充電ケーブル等の外部充電機器の入力を家庭用コンセントに接続するとともに、その出力を車両の充電用コネクタに接続することにより充電を行う。

[0003] ところで、家庭用電源でバッテリに充電を行う場合、外部充電機器を家庭用コンセントに繋げれば、この家庭用コンセントから供給される電力で制限無く電動車両のバッテリに充電ができてしまう。従って、仮に電動車両が盗難に遭った場合を考えると、この盗難車両は外部充電機器を用いて家庭用電源でバッテリに繰り返し充電ができることから、この盗難車両は盗難者によって乗り続けられてしまうことになる。このことは電動車両が盗難に遭う原因の一つにもなっていると思われ、車両盗難の発生件数を減らすための何らかの盗難予防対策が望まれる。

[0004] そこで、電動車両の盗難予防性を高めるために、電動車両のバッテリに充電を行う際において充電行為を認証制にする技術が例えば特許文献1に開示されている。この技術は、車両キーとして用いるICカードの情報を読み取り可能、或いはICカードへ情報を書き込み可能なリードライト装置を用いる。正規利用者は、充電装置で充電を行うに際しては、車両からICカードを抜きとってリードライト装置に挿入し、ICカードによる認証が成立すれば、充電行為が許可されてバッテリへの充電が可能になる。

[0005] ところで、ICカードの認証成立可否により充電行為を制限する技術を用いたとしても、ICカードが盗難にあってしまっては、バッテリへの充電を行えることになり、効果を

発揮しない。特に、この種のICカードは携帯されるものであるため、カード所有者が目を離した隙にICカードが盗難されてしまうなどの状況にも遭い易い。従って、家庭用電源による充電行為を認証制にしたとしても、車両盗難の予防性が充分に確保できない問題があった。

特許文献1:特開平10－262303号公報

## 発明の開示

[0006] 本発明は、充電対象の盗難予防性を充分に高くすることができる充電システムを提供する。

本発明の第1側面は、住宅の電源を用いた充電システムである。当該充電システムは、蓄電池を含む充電対象と、前記充電対象の蓄電池と前記住宅の電源とを接続可能な電力線と、前記電源に接続可能に構成され、前記電力線の少なくとも一部を通じて前記充電対象の認証を行うための認証管理機器と、を備え、前記充電対象は、前記認証管理機器と前記充電対象とによる前記認証が成立したときに前記電源から前記蓄電池への充電を許可するように構成されている。

[0007] 本発明の第2側面は、住宅の電源を用いた充電システムである。当該充電システムは、蓄電池を含む充電対象と、前記充電対象の蓄電池と前記住宅の電源とを接続可能な電力線と、前記電源に接続可能に構成され、前記電力線と独立して設けられた電気配線を通じて前記充電対象の認証を行うための認証管理機器と、を備え、前記充電対象は、前記認証管理機器と前記充電対象とによる前記認証が成立したときに前記電源から前記蓄電池への充電を許可するように構成されている。

## 図面の簡単な説明

[0008] [図1]本発明の第1実施形態による充電システムの概略構成を示すブロック図。

[図2]車両の充電接続にコイルを用いた充電システムの概略構成を示す模式図。

[図3]本発明の第2実施形態によるIDボックスの概略構成を示すブロック図。

[図4]データ通信専用の制御線を用いた本発明の第3実施形態による充電システムの概略構成を示すブロック図。

[図5]本発明の第4実施形態によるIDボックス系機器の概略構成を示すブロック図。

[図6]本発明の第5実施形態によるIDボックス系機器のプラグ付き車両キーの概略構

成を示す斜視図。

## 発明を実施するための最良の形態

[0009] （第1実施形態）

以下、本発明の第1実施形態の充電システムを図1及び図2に従って説明する。

図1に示すように、車両1が電気自動車の場合には、この電気自動車を走行させる際において車両動力源となるモータ2を駆動制御するモータシステム3が車両1に搭載されている。モータシステム3は、システム停止時においてシフトレバーが駐車位置でブレーキペダルが踏まれつつエンジン系のスタートスイッチ（図示略）が操作されると起動する。システム起動時においてシフトレバーが駐車位置で車速が「0」の時にスタートスイッチが操作されるとモータシステム3は停止する。なお、車両1が充電対象に相当する。

[0010] モータシステム3は、車両1の走行制御を司るモータ制御ECU4を含む。モータ制御ECU4には、走行駆動源となるモータ2がインバータ5を介して接続されている。モータ制御ECU4は、アクセル開度、シフトポジション、各種センサからの出力信号を基に運転状態に応じたモータトルクを求め、その算出モータトルクに応じた電流をモータ2に流すことにより、モータ2の駆動を制御する。

[0011] 車両1には、モータ2の電源となるバッテリ6が搭載されている。バッテリ6は、直列接続された複数のセル7aを含む電池モジュール7と、この電池モジュール7の高電圧電源回路8に直列接続されたシステムメインリレー9とを有する。インバータ5は、高電圧大電流を供給可能なパワーケーブル10でモータ2と接続されている。また、インバータ5は、別のパワーケーブル10でバッテリ6と接続されている。システムメインリレー9は、電気配線を通じてモータ制御ECU4に接続され、このモータ制御ECU4からの指令により、高電圧電源回路8の接続又は遮断を行う。なお、バッテリ6が蓄電池に相当する。

[0012] モータ制御ECU4には、バッテリ6の充電監視を行う充電制御ECU11が、例えばCAN(Controller Area Network)通信により接続されている。また、この充電制御ECU11には、高電圧電源回路8に流れる電流量を検出する電流センサ12が接続されている。電流センサ12は、高電圧電源回路8の配線途中に電池モジュール7と直列

に設けられ、高電圧電源回路8に流れる電流値に応じた検出信号を充電制御ECU11に供給する。

[0013] 充電制御ECU11内のROMやEEPROM等から成るメモリ13には、充電監視用の制御プログラムが書き込まれている。充電制御ECU11は、この充電監視用の制御プログラムに従い作動することにより、バッテリ6の充電状態監視(充電中か否か)や充電量監視(バッテリ残量確認)等の処理を行い、その処理結果(充電情報)をモータ制御ECU4に供給する。モータ制御ECU4は、充電制御ECU11から供給される充電情報を基にバッテリ6の充電状態や充電量を把握する。

[0014] 高電圧電源回路8には、高電圧電源回路8の通電のオンオフを切り換える切換スイッチ14が直列接続されている。バッテリ6、電流センサ12及び切換スイッチ14から成る直列回路は、充電用コネクタ15に対して並列に接続されている。切換スイッチ14は、通常の状態においてオン状態に制御される。充電制御ECU11による制御が充電不許可状態下にあるとき切換スイッチ14はオフされる。このとき、バッテリ6を充電することはできない。切換スイッチ14は、電気配線を通じて充電制御ECU11に接続されるとともに、充電制御ECU11からの指令に基づきオンオフ状態が切り換えられる。

[0015] 車両1には、バッテリ6へ充電を行う際の電気導入口となる充電用コネクタ15が設けられている。充電用コネクタ15は、電池モジュール7及び電流センサ12の直列回路に対して直列に接続されている。充電用コネクタ15には、充電ケーブル18の一端が接続可能である。充電ケーブル18の他端は、住宅16の屋外コンセント17に挿し込み可能に形成されている。作業者が充電ケーブル18を充電用コネクタ15及び屋外コンセント17に接続すると、住宅16の家庭用電源19(商用電源:例えば交流100V)から流れ出す電流が充電ケーブル18内の電力線を通じてバッテリ6に流れ込み、バッテリ6が充電される。なお、充電ケーブル18が電力線を構成し、家庭用電源19が電源に相当する。

[0016] 屋外コンセント17は、電流流路として屋内に設けられた屋内電力線20を介して屋内コンセント21に接続されている。屋内コンセント21は家庭用電源19に接続されている。即ち、第1実施形態の充電システムは、屋外コンセント17から延びる屋内電力

線20が屋内コンセント21に直接繋がる直接方式である。また、屋内コンセント21には、バッテリ6へ充電を行うに際して充電制御ECU11との間で暗号を用いた認証を行うためのIDボックス22が接続されている。IDボックス22は、自身1つで独立した部品を成す認証機器であって、自身のケースから外部に飛び出した接続コード23を含む。この接続コード23は屋内コンセント21に挿し込み可能に形成されている。なお、屋内電力線20が電力線（第2電力線、または分岐電力線）を構成する。また、屋内コンセント21がコンセントに相当し、IDボックス22が認証管理機器を構成する。

[0017] IDボックス22は、充電制御ECU11とのデータ通信処理を電力線通信で行うマイクロコンピュータ24を含む。マイクロコンピュータ24内のメモリ25には、充電制限プログラムが記憶されている。マイクロコンピュータ24は、この充電制限プログラムに従って充電制御ECU11とIDボックス22との間で認証を行い、認証が成立したことを条件にバッテリ6への充電を許可する。また、マイクロコンピュータ24のメモリ25には、認証時に用いられる暗号鍵が登録されている。一方、充電制御ECU11のメモリ13にも同様の暗号鍵が登録されている。充電制御ECU11とIDボックス22とが正規のペアを成すものであれば、これら暗号鍵は互いに一致する。

[0018] マイクロコンピュータ24には、電力線通信を行う際に作動する住宅用電力線通信モジュール26が接続されている。この住宅用電力線通信モジュール26には、信号変換器として作動するアナログフロントエンド（AFE）27が設けられ、このアナログフロントエンド27がマイクロコンピュータ24に接続されている。

[0019] アナログフロントエンド27には、マイクロコンピュータ24から充電制御ECU11に送られる各種信号に送信処理を施す送信フィルタ28と、屋内電力線20等の電力線を通じてIDボックス22に取り込まれた各種信号に受信処理を施す受信フィルタ29とが接続されている。例えば、送信フィルタ28は、データをパケット単位で送信するための処理を行う。送信フィルタ28は、必要なデータを統合して単一のデータユニットを生成し、それをパケットに分割することにより伝送速度調整や重複送信制御を行う。受信フィルタ29は、受信した複数のパケットからデータユニットを復元し、そのデータユニットから必要なデータを取り出す処理を行う。

[0020] 送信フィルタ28には、送信フィルタ28の出力信号を差動出力に変換するラインドラ

イバ30が接続されている。受信フィルタ29及びラインドライバ30には、住宅用電力線通信モジュール26内の各種信号線を電力線系配線に結合する電力線結合回路31が接続されている。この電力線結合回路31から延びる接続コード23が屋内コンセント21に接続可能となっている。

[0021] 充電制御ECU11のメモリ13には、IDボックス22に登録されたものと同様の充電制限プログラムが記憶されている。また、車両1には、高電圧電源回路8から分岐され、充電制御ECU11に繋がる経路上に、住宅16に設けられた住宅用電力線通信モジュール26と同様に構成された車両用電力線通信モジュール32が設けられている。なお、車両用電力線通信モジュール32は、住宅用電力線通信モジュール26と同じように、アナログフロントエンド33、送信フィルタ34、受信フィルタ35、ラインドライバ36及び電力線結合回路37を含む。

[0022] 次に、第1実施形態の充電システムの動作を説明する。

まず、車両1のバッテリ6に充電を行うに際しては、充電ケーブル18の一端を充電用コネクタ15に挿し込み、充電ケーブル18の他端を住宅16の屋外コンセント17に接続する。すると、住宅16の家庭用電源19の電流が屋内電力線20及び充電ケーブル18を介して高電圧電源回路8に流れ込み始める。なお、このとき、システムメインリレー9はオフされておりモータシステム3は起動していない。充電制御ECU11は、高電圧電源回路8へ流入する電流を車両用電力線通信モジュール32を通じて検出することにより、バッテリ6への充電操作が開始されたと認識する。

[0023] 充電操作が開始されると、充電制御ECU11は、IDボックス22を起動するためのIDボックス起動信号Swkを、アナログフロントエンド33、送信フィルタ34、ラインドライバ36及び電力線結合回路37を介して、充電ケーブル18(即ち、電力線)に送出する。そして、充電制御ECU11は、充電ケーブル18及び屋内電力線20を用いた電力線通信により、IDボックス起動信号SwkをIDボックス22に送信する。

[0024] IDボックス22は、充電ケーブル18及び屋内電力線20を通じてIDボックス起動信号Swkを受信する。マイクロコンピュータ24は、このIDボックス起動信号Swkを電力線結合回路31、受信フィルタ29及びアナログフロントエンド27を介して取得する。

[0025] マイクロコンピュータ24は、IDボックス起動信号Swkに応答して、IDボックス起動信

号Swkのデータ内容を解読することにより起動を開始する。マイクロコンピュータ24は、初期化等の各種処理を行って起動完了を認識すると、起動完了信号Sokをアナログフロントエンド27、送信フィルタ28、ラインドライバ30及び電力線結合回路31を介して屋内電力線20に送出する。そして、マイクロコンピュータ24は、屋内電力線20及び充電ケーブル18を用いた電力線通信により、起動完了信号Sokを充電制御ECU11に送信する。

[0026] 充電制御ECU11は、この起動完了信号Sokを電力線結合回路37、受信フィルタ35及びアナログフロントエンド33を介して受け取る。そして、充電制御ECU11は、起動完了信号Sokに応答して、暗号化された通信経路を確立し、暗号通信を用いてIDボックス22の認証を行う。この認証として、例えばチャレンジ・レスポンス方式を用いることができる。この場合、充電制御ECU11は所定の乱数Rを生成し、その乱数Rを電力線通信によりIDボックス22に送信する。IDボックス22のマイクロコンピュータ24は、自身が持つ暗号鍵(公開鍵)で、その受信した乱数Rを暗号化することにより暗号化乱数Raを生成する。そして、マイクロコンピュータ24は、この暗号化乱数Raを、電力線通信により充電制御ECU11に返信する。

[0027] 充電制御ECU11は、乱数RをIDボックス22に送信する際に、自身が持つ暗号鍵(公開鍵)で乱数Rを暗号化することにより暗号化乱数Rbを生成する。そして、充電制御ECU11は、IDボックス22から受信した暗号化乱数Raと、自身で生成した暗号化乱数Rbとを比較することによりIDボックス22の認証を行う。

[0028] ここで、充電制御ECU11とIDボックス22とが正規のペアを成すものであれば、両者の暗号鍵が一致する。つまり、暗号化乱数Raと暗号化乱数Rbとが一致する。この場合、充電制御ECU11は、通信先のIDボックス22が正規の通信相手であると判断し、認証成立を認識する。充電制御ECU11は、認証成立を認識すると、切換スイッチ14をオン状態に維持することにより、高電圧電源回路8を閉回路のままに保つ。これにより、住宅16の商用電源の電流がバッテリ6に流れ込み続け、バッテリ6が充電される。

[0029] 一方、充電制御ECU11は、暗号化乱数Ra, Rbの不一致を検知した場合、即ち、認証不成立を認識した場合、オン状態の切換スイッチ14をオフに切り換えることによ

り高電圧電源回路8を開回路にする。これにより、住宅16の商用電源の電流がバッテリ6に流れ込まないため、バッテリ6への充電が行われなくなる。その後、例えば充電ケーブル18が充電用コネクタ15から抜かれる等により高電圧電源回路8に電流が流れ込まなくなると、充電制御ECU11は、この状態を車両用電力線通信モジュール32を通じて検出し、切換スイッチ14をオン状態に戻す。

[0030] ところで、仮に第三者が車両1を盗難した場合、その盗難者は、この盗難車両を乗り続けるには住宅16内に設置されたIDボックス22も同時に盗まないと、その盗難車両のバッテリ6に充電を行うことができない。しかし、このIDボックス22は住宅16内にあるため盗難に困難性を有し、しかもIDボックス22を見つけ難い場所に配置しておけば、盗難困難性は更に顕著になる。よって、車両1とIDボックス22との両方を盗み出すことは難しいと盗難者に思わせられる。従って、盗難者の車両盗難意欲を殺ぐことが可能となり、これは車両1の盗難予防性を高めることに非常に効果が高い。

[0031] なお、車両1のバッテリ6と住宅16の家庭用電源19との充電接続は、充電ケーブル18を用いた有線に限定されない。例えば、図2に示すように、充電接続は、1次コイル38及び2次コイル39を用いて車両1と家庭用電源19とを磁気的に接続する磁気配線でもよい。即ち、屋外コンセント17に接続された1次コイル38を地中に埋設し、車両1に2次コイル39を設ける。この2次コイル39は、2次コイル39に誘起される電流がバッテリ6に流れ込むように同バッテリ6に接続されている。

[0032] バッテリ6を充電するに際しては、ユーザは車両1の2次コイル39が1次コイル38と向き合うように車両1を駐車する。この状態で1次コイル38を屋外コンセント17に接続して1次コイル38に電流を流す。すると、1次コイル38に磁束が発生することから、この磁束が2次コイル39に印加されて、2次コイル39に電流が誘起される。その結果、2次コイル39に流れる電流によってバッテリ6が充電される。この場合、認証時においては、データ通信の際にやり取りされる送受信信号の周波数を、充電電流の周波数よりも充分に高く設定することにより、充電電流周波数よりも充分に高い周波数の電流変動を与えて通信を行う。

[0033] 第1実施形態の充電システムは、以下の利点を有する。

(1)電気自動車等の車両1を継続使用するにはバッテリ6に定期的に充電を行う必

要がある。従って、盗難者が車両1を盗難した場合、この車両1を乗り続けるべくバッテリ6に充電を行うには、住宅16内のIDボックス22も盗み出す必要がある。しかし、住宅16内に設置してあるIDボックス22を盗み出すことは困難性を要することから、盗難者は車両盗難意欲が殺がれることになり、車両盗難予防性が高くなる。また、充電制御ECU11とIDボックス22とを繋ぐ充電ケーブル18及び屋内電力線20をデータ通信経路として用いるので、例えば両者を無線で接続する場合の懸案事項となる電波ノイズ影響等の問題を考えずに済む。よって、充電制御ECU11がIDボックス22と認証を行う際に通信が途中で途絶えるような状況が生じ難く、認証の信頼性も確保することができる。

[0034] (2)充電制御ECU11とIDボックス22とのデータ通信に電力線通信を用いるので、充電ケーブル18と屋内電力線20とが電力系配線及び制御系配線の両方を兼ねることになる。従って、充電制御ECU11及びIDボックス22間で認証を行う際に、そのデータ通信経路となる制御系配線を新たに設ける必要がなく、部品点数が増えずに済む。

[0035] (3)充電制御ECU11とIDボックス22との間の認証に暗号を用いているので、充電行為の許可・不許可を判断する際の認証の信頼性が高くなる。従って、充電制御ECU11とIDボックス22との間で不正に認証が成立されてしまうような状況が生じ難く、無断充電防止に効果が高い。

[0036] (4)車両1のバッテリ6に家庭用電源19を用いて充電を行うに際しては、充電ケーブル18を用いた有線方式が採用されるので、元々ある比較的安価なシステムでバッテリ6へ充電を行うことができる。

[0037] (5)充電システムには、屋外コンセント17から延びる屋内電力線20がIDボックス22を経由せずに屋内コンセント21に直接繋がる直接方式が採用されている。また、IDボックス22は、自身1つで独立した部品を成している。従って、IDボックス22を住宅にセットする際には、IDボックス22から延びる接続コード23を屋内コンセント21に繋ぐというワンアクションの作業だけで済み、取り付け作業が楽である。

[0038] (6)1次コイル38及び2次コイル39による磁気配線でバッテリ6に充電を行うこともできる。この場合には、バッテリ6の充電作業時において車両1を充電系のケーブル

部品で家庭用電源19と接続する必要がなくなり、手間のかからない楽な作業でバッテリ6に充電を行うことができる。

[0039] （第2実施形態）

次に、本発明の第2実施形態の充電システムを図3に従って説明する。なお、第2実施形態は、第1実施形態に記載されたIDボックス22への屋内電力線20の別の接続形式を示すものである。第1実施形態と同様の部分については同一符号を付して詳しい説明を省略する。

[0040] 図3に示すように、第2実施形態の充電システムでは、屋内電力線20がIDボックス22を経由して家庭用電源19に繋がる分割方式が採用されている。第2実施形態のIDボックス22は、第1実施形態のIDボックス22（図1）の構成要素に加えて、入力信号の低周波数成分をカットするローパスフィルタ（LPF）40を含む。ローパスフィルタ40は、IDボックス22内において電力線結合回路31に接続されるとともに、接続コード23を介してIDボックス22外の屋内コンセント21に接続されている。ローパスフィルタ40は、屋内電力線20に重畳した高周波成分を家庭用電源19に出さないようにするものである。

[0041] IDボックス22には、外部の電力線系配線を接続可能なコネクタ41が設けられている。コネクタ41は、IDボックス22内において電力線結合回路31及びローパスフィルタ40の両者に電気的に接続されている。屋内電力線20はIDボックス22のコネクタ41に接続可能である。IDボックス22は屋内コンセント21に接続された接続コード23を通じて家庭用電源19から電力を受けていることから、屋内電力線20をIDボックス22のコネクタ41に繋いだ時には、家庭用電源19の電流が屋内電力線20に流れる状態となる。

[0042] さて、充電制御ECU11は、車両1の充電用コネクタ15に接続された充電ケーブル18を通じてバッテリ6に流入する電流を検出すると、充電ケーブル18及び屋内電力線20を通じた電力線通信によりIDボックス22にIDボックス起動信号Swkを送信する。IDボックス22は、このIDボックス起動信号Swkをコネクタ41を通じて受け取り、それに応答して起動を開始する。なお、起動完了信号Sokの送信や、充電制御ECU11及びIDボックス22間の認証処理は、第1実施形態と同様であるので、これら処理の

説明については省略する。家庭用電源19の電流は、IDボックス22内のローパスフィルタ40を通って屋内電力線20を流れ、その後、充電ケーブル18を通って車両1のバッテリ6に流れ込む。

[0043] 従って、第2実施形態においては充電システムに分割方式が採用されているので、IDボックス22のコネクタ41に充電ケーブル18を直接接続することにより、車両1のバッテリ6に充電することが可能となる。よって、バッテリ6に充電を行う際に仮に近くに屋外コンセント17が無かったとしても、IDボックス22が手元にあれば、それに充電ケーブル18を接続することによりバッテリ6に充電できる。

[0044] 第2実施形態の充電システムは、第1実施形態の(1)～(4)，(6)に記載の利点に加え、以下の利点を有する。

(7)分割方式の充電システムでは、バッテリ6への充電を行う際に近くに屋外コンセント17が無い状況にあったとしても、充電ケーブル18をIDボックス22のコネクタ41に接続すれば、バッテリ6は家庭用電源19と繋がった状態となる。従って、近くに屋外コンセント17が無い充電作業状況下であっても、バッテリ6に充電を行うことができる。

[0045] (第3実施形態)

次に、本発明の第3実施形態の充電システムを図4に従って説明する。なお、第3実施形態は、第1実施形態に記載された充電制御ECU11及びIDボックス22間の通信の別の形態を示すものである。第1実施形態と同様の部分については同一符号を付して詳しい説明を省略する。

[0046] 第3実施形態では充電制御ECU11とIDボックス22との通信形式を、電力線通信に代えてデータ通信専用の制御系配線を用いて行う。IDボックス22には、制御系配線を用いたデータ通信処理を実行するマイクロコンピュータ42が設けられている。マイクロコンピュータ42には、該マイクロコンピュータ42によるデータ通信時に出力データの変調や入力データの復調等の各種処理を施す通信回路43が接続されている。

[0047] IDボックス22の通信回路43には、データ通信経路となる屋内制御線44の一端が接続されている。屋内制御線44の他端は、屋外コンセント17に接続されている。即

ち、IDボックス22は、屋内制御線44を通じて屋外コンセント17に接続されている。第3実施形態の屋外コンセント17は、屋内電力線20を介した電流の受け渡しだけでなく、屋内制御線44によるデータ転送も可能なコンセント部品である。なお、屋内制御線44が電気配線を構成する。

[0048] 充電ケーブル18は、家庭用電源19から流入する電流の流路となる電力線18aと、充電制御ECU11及びIDボックス22間のデータ通信経路となる制御線18bとから成る。充電ケーブル18は1本のケーブル部品であり、例えばカーボン等の被覆材の中に電力線18a及び制御線18bが収納されている。充電ケーブル18が充電用コネクタ15に接続されると、充電ケーブル18内の制御線18bは、充電用コネクタ15と充電制御ECU11とを繋ぐ車両1内の通信線45を介して充電制御ECU11と接続される。なお、電力線18aが電力線を構成し、制御線18bが電気配線を構成する。

[0049] 充電制御ECU11は、充電ケーブル18と充電用コネクタ15との接続通知を、待機状態のIDボックス22から、屋内制御線44、制御線18b及び通信線45を介して受け取る。充電制御ECU11は、このケーブル接続通知に応答して、IDボックス22を起動するためのIDボックス起動信号Swkを、通信線45、制御線18b及び屋内制御線44を通じてIDボックス22に送信する。マイクロコンピュータ24は、充電制御ECU11から送られたIDボックス起動信号Swkを通信回路43を介して受け取り、それに応答してIDボックス22の起動を開始する。

[0050] マイクロコンピュータ42は、IDボックス22の起動完了を認識すると、起動完了信号Sokを、屋内制御線44、制御線18b及び通信線45を通じて充電制御ECU11に送信する。そして、充電制御ECU11は、IDボックス22の認証を、屋内制御線44、制御線18b及び通信線45を用いて行う。このとき、家庭用電源19の電流は、屋内電力線20及び電力線18aを通じ、車両1のバッテリ6に流れ込む。なお、充電制御ECU11は、充電ケーブル18が例えば充電用コネクタ15から抜き取られてケーブル用制御線18bから信号を受け付けなくなると、切換スイッチ14をオン状態に戻す。

[0051] ところで、電力線はもともと高い周波数の電気信号を流すことを想定していない。このため、仮に電力線通信を用いると電力線から漏洩電波が生じ、しかもその電波の周波数が短波帯の電波と重なることがある。その結果、短波ラジオやアマチュア無線

等に悪影響を及ぼす可能性も否めない。しかし、第3実施形態においては、充電制御ECU11及びIDボックス22との間のデータ通信に、データ通信専用の制御線18b，44を用いるので、電力線通信採用時に生じ得る各種問題については考えなくて済む。

[0052] 第3実施形態の充電システムは、第1実施形態の(1)，(3)～(6)に記載の利点に加え、以下の利点を有する。

(8)充電制御ECU11とIDボックス22との間のデータ通信経路に専用の制御線18b，44が用いられる。このため、電力線通信を用いた際に生じ得る漏洩電波の問題を考えずに済み、周囲の短波ラジオやアマチュア無線などに悪影響を及ぼす状況にならずに済む。なお、充電制御ECU11とIDボックス22との間のデータ通信経路に専用の制御線18b，44を用いた場合、これを充電システムの直接方式及び分割方式のどちらにも適用可能である。

[0053] (第4実施形態)

次に、本発明の第4実施形態の充電システムを図5に従って説明する。なお、第4実施形態は、第1実施形態に記載のIDボックス22の別の構造を示すものである。第1実施形態と同様の部分については同一符号を付して詳しい説明を省略する。

[0054] 図5に示すように、第4実施形態のIDボックス系機器は、図1に示すような自身で1つの独立した認証機器を成すIDボックス22に代えて、車両キー46と、車両キー46を差し込み可能な通信ボックス47とを含む。車両キー46には、図1に示すようなマイクロコンピュータ24が組み込まれ、このマイクロコンピュータ24にキー固有の暗号鍵が登録されている。なお、この車両キー46は通常のメカニカルキーの他に、車両1を作動させる時に自身に登録されたIDコードを車両1に無線で発信可能な電子キーであってももちろんよい。車両キー46が電子キーの場合、この無線通信機構をマイクロコンピュータ24に組み込んでもよい。

[0055] 図5に示すように、通信ボックス47には、車両キー46の挿込口となるスロット47aが設けられている。車両キー46がスロット47aに全挿しされた際、マイクロコンピュータ24は通信ボックス47内の住宅用電力線通信モジュール26のアナログフロントエンド27とデータ通信可能に接続される。なお、上記したように、データ通信の形態は有線

或いは無線のいずれでもよい。IDボックス系機器として通信ボックス47を用いた場合、バッテリ6への充電を許可するか否かの認証通信は、車両キー46のマイクロコンピュータ24と充電制御ECU11との間で行われることになる。なお、車両キー46及び通信ボックス47が認証管理機器を構成する。

[0056] 家庭用電源19でバッテリ6に充電を行うに際しては、まず屋外コンセント17に繋いだ充電ケーブル18を車両1の充電用コネクタ15に接続する。続いて、作業者は住宅16内に入り、屋内コンセント21に接続された通信ボックス47のスロット47aに、自身が所有する車両キー46を挿し込む。車両キー46がスロット47aに全挿しされた状態になると、車両キー46内のマイクロコンピュータ24が通信ボックス47の住宅用電力線通信モジュール26と電気接続される。そして、住宅用電力線通信モジュール26が起動を開始する。

[0057] マイクロコンピュータ24は、自身も含めて住宅用電力線通信モジュール26の起動が完了したことを認識すると、起動完了信号Sokを電力線通信（制御線通信も可）で充電制御ECU11に送信する。充電制御ECU11は、この起動完了信号Sokに応答して、車両キー46が正規の相手か否かを確認する。なお、認証処理は第1実施形態と同様であるので、詳細については省略する。

[0058] 第4実施形態の充電システムは、第1実施形態の（1）～（6）の利点に加え、以下の利点を有する。

（9）盗難者が車両1を盗み出してその盗難車両のバッテリ6に充電を行うには、IDボックス22の他に車両キー46も盗み出す必要がある。従って、盗難者は、盗難車両に充電を行うには、IDボックス22及び車両キー46の2部品を盗難しなければならない。このため、盗難困難性を高めることができる。しかも車両キー46は車両所有者が常時持ち歩くことが多いことから、両者を盗み出すことは実際のところ非常に難しい。従って、盗難者の車両盗難意欲を大きく殺ぐことになり、盗難予防性を大きく向上することが可能となる。

[0059] （第5実施形態）

次に、本発明の第5実施形態の充電システムを図6に従って説明する。なお、第5実施形態は、IDボックス系機器の別の構造を示すものである。第1実施形態と同様

の部分については同一符号を付して詳しい説明を省略する。

[0060] 図6に示すように、第5実施形態のIDボックス系機器は、図1に示すIDボックス22や、図5に示すIDボックス系機器(車両キー46及び通信ボックス47)に代えて、プラグ付き車両キー48で構成されている。この車両キー48は、図1のマイクロコンピュータ24及び住宅用電力線通信モジュール26を内蔵するキー本体48aと、キー本体48aから引き出し可能に構成されたプラグ49とを含む。キー本体48aには、車両1とIDコードの無線通信を行う無線通信機構50が内蔵されている。プラグ49は、住宅16の屋内コンセント21に接続可能であって、非使用時においてはキー本体48a内に収納される。なお、プラグ付き車両キー48が認証管理機器を構成する。

[0061] 家庭用電源19でバッテリ6に充電を行うに際しては、まず屋外コンセント17に繋いだ充電ケーブル18を車両1の充電用コネクタ15に接続する。続いて、作業者は住宅16内に入り、自身が所有する車両キー48からプラグ49を抜き出し、これを屋内コンセント21に接続する。

[0062] 車両キー48内のマイクロコンピュータ24は、屋内コンセント21に接続されたプラグ49を介してプラグ付き車両キー48に流入する電流を検出すると、起動を開始する。マイクロコンピュータ24は、起動完了を認識すると、起動完了信号Sokを電力線通信(制御線通信も可)で充電制御ECU11に送信する。充電制御ECU11は、この起動完了信号Sokに応答して、車両キー48が正規の相手か否かを確認する。この認証処理については第1実施形態と同じであるので、詳細な説明は省略する。

[0063] 第5実施形態の充電システムは、第1実施形態の(1)～(6)の利点に加え、以下の利点を有する。

(10)盗難者は車両1を盗んでも、車両所有者が通常持ち歩く車両キー48を同時に盗み出さないとバッテリ6に充電することができない。よって、車両キー48の盗み出しは困難であることから、盗難者の車両盗難意欲を殺ぐことになり、車両1の盗難予防性を確保することが可能となる。また、図1のようなIDボックス22を用いた場合は、それが常に屋内コンセント21に接続されるため、待機電力が必要となる。しかしながら、第5実施形態の場合は使用時のみにおいてプラグ49を屋外コンセント17に接続するので、待機電力を要さず、家庭用電源19の省電力化に効果がある。

[0064] なお、上記各実施形態は以下の態様に変更してもよい。

・ 第1～第5実施形態において、充電許可判定時に行われる認証は、必ずしもチャレンジ・レスポンス方式に限定されない。例えば、充電制御ECU11とIDボックス22との各々に固有のIDコードを持たせ、両者のコードが一致するか否かを判定することによりID照合を行ってもよい。また、ID照合は、充電を行う際に指紋を収集し、これをIDボックス22に登録された指紋データと比較するバイオメトリクス認証でもよい。

[0065] ・ 第1～第5実施形態において、チャレンジ・レスポンス方式のような暗号を用いた認証を行う場合、この時に用いる暗号鍵は公開鍵に限定されず、秘密鍵でもよい。

・ 第1～第5実施形態において、充電制御ECU11及びIDボックス22の間のデータ通信に暗号通信を用いてもよい。この場合の暗号としては、例えばDES(Data Encryption Standard)、AES(Advanced Encryption Standard)、RC(Rivest Code)などの秘密鍵暗号や、Diffie－Hellman方式、RSA、ElGamal方式などの公開鍵暗号や、秘密鍵及び公開鍵を組み合わせたハイブリッド暗号が挙げられる。

[0066] ・ 第1～第5実施形態において、IDボックス系機器は、必ずしも家庭用電源19に接続すると自動で内部に電流が流れ込む構造に限定されない。例えば、IDボックス系機器の機器本体に電源スイッチを設け、家庭用電源19に接続された状態で電源スイッチがオン操作されたときに、家庭用電源19の電力が機器本体内に流れ込む構造でもよい。

[0067] ・ 第3実施形態では、電力線18aと制御線18bとは必ずしも1本のケーブル(18)として構成されることに限定されず、これらは別々の配線であってもよい。

・ 第1～第5実施形態において、車両1は必ずしも電気自動車に限らず、モータとエンジンとの両方を走行駆動源とするハイブリッド車でもよい。また、充電対象としては、バッテリ6を駆動源に動く装置や機器であれば、車両に限定されない。

# 請求の範囲

[1] 住宅の電源を用いた充電システムであって、

蓄電池を含む充電対象と、

前記充電対象の蓄電池と前記住宅の電源とを接続可能な電力線と、

前記電源に接続可能に構成され、前記電力線の少なくとも一部を通じて前記充電対象の認証を行うための認証管理機器と、を備え、

前記充電対象は、前記認証管理機器と前記充電対象とによる前記認証が成立したときに前記電源から前記蓄電池への充電を許可するように構成されていることを特徴とする充電システム。

[2] 住宅の電源を用いた充電システムであって、

蓄電池を含む充電対象と、

前記充電対象の蓄電池と前記住宅の電源とを接続可能な電力線と、

前記電源に接続可能に構成され、前記電力線と独立して設けられた電気配線を通じて前記充電対象の認証を行うための認証管理機器と、を備え、

前記充電対象は、前記認証管理機器と前記充電対象とによる前記認証が成立したときに前記電源から前記蓄電池への充電を許可するように構成されていることを特徴とする充電システム。

[3] 前記認証管理機器は、前記電力線の少なくとも一部をデータ通信経路として用いて前記充電対象と電力線通信を行うことにより前記認証を行うことを特徴とする請求項1に記載の充電システム。

[4] 前記認証管理機器は、前記充電対象と暗号による通信を行って前記認証を行うことを特徴とする請求項1～3のいずれか一項に記載の充電システム。

[5] 前記電力線は、前記蓄電池及び前記電源に直接接続されることを特徴とする請求項1～4のうちいずれか一項に記載の充電システム。

[6] 前記電力線を通じて前記電源と接続可能な1次コイルと、

前記蓄電池に接続された2次コイルと、をさらに備え、

前記蓄電池は、前記1次コイルと前記2次コイルとを通じて前記電源に磁気的に接続されることを特徴とする請求項1～4のうちいずれか一項に記載の充電システム。

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[7] 前記電力線は、

前記蓄電池に接続可能な第1電力線と、

前記住宅に設けられ、前記電源に接続されたコンセントから延出され、前記第1電力線と接続可能な第2電力線と、を含み、

前記認証管理機器は、前記コンセントに接続可能に構成され、前記第1電力線及び前記第2電力線を使用して前記充電対象と前記認証を行うことを特徴とする請求項1～6のうちいずれか一項に記載の充電システム。

[8] 前記電力線は、

前記蓄電池に接続可能な第1電力線と、

前記第1電力線と前記認証管理機器とを接続可能な分岐電力線と、を含み、

前記認証管理機器は、前記住宅に設けられ、前記電源に接続されたコンセントに前記分岐電力線を自身を通じて接続可能に構成され、前記第1電力線及び前記分岐電力線を使用して前記充電対象と前記認証を行うことを特徴とする請求項1～6のうちいずれか一項に記載の充電システム。

[9] 前記認証管理機器は、固有の識別子を有し、前記識別子を用いて前記充電対象との前記認証を実行可能な単一のIDボックスとして構成されることを特徴とする請求項1～8のうちいずれか一項に記載の充電システム。

[10] 前記IDボックスは、車両キーであることを特徴とする請求項9に記載の充電システム。

[11] 前記認証管理機器は、

固有の識別子を有する通信端末と、

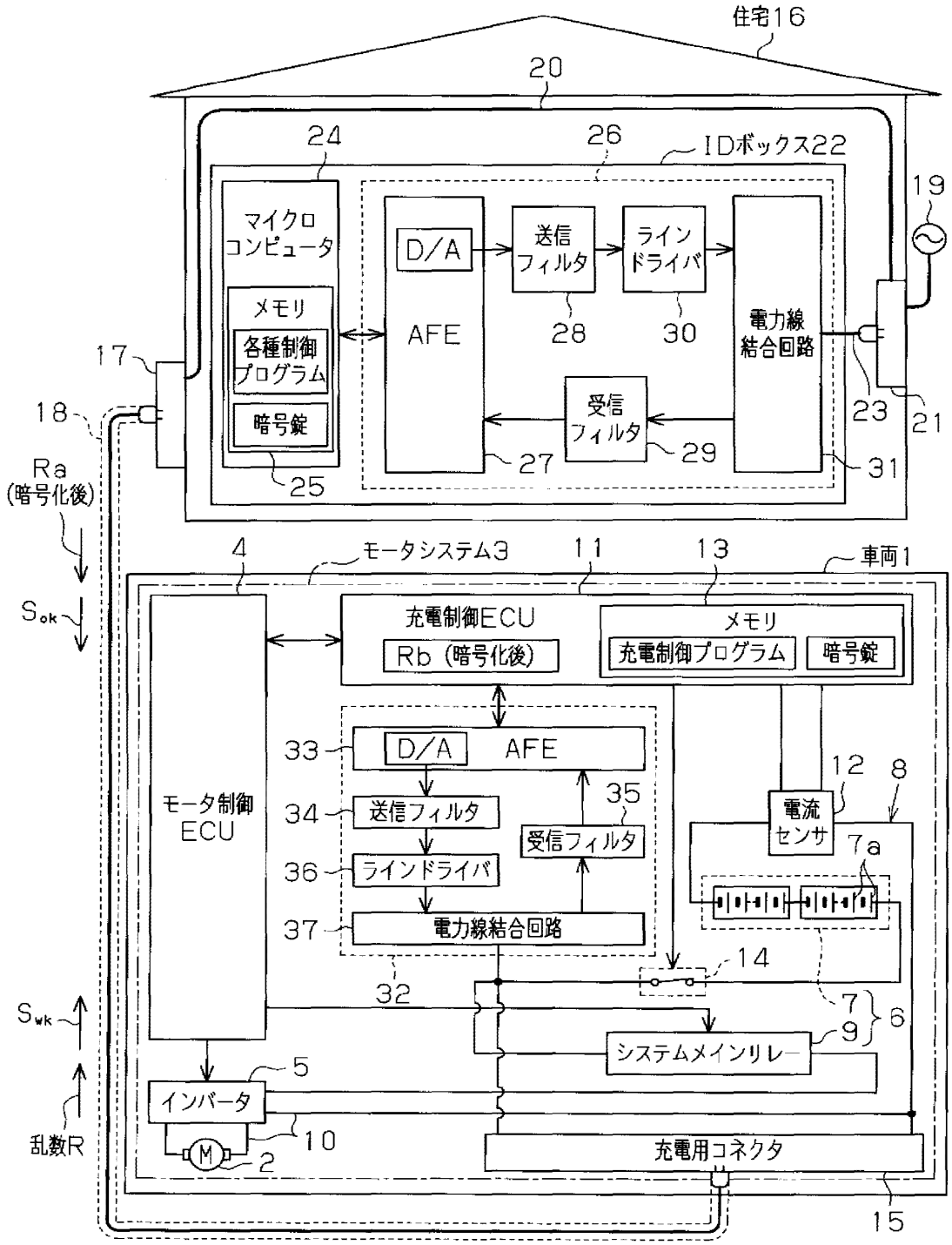
前記通信端末を着脱可能であり、前記通信端末から前記識別子を受け取り、前記識別子を用いて前記充電対象との前記認証を実行可能な機器本体と、

を含むことを特徴とする請求項1～8のうちいずれか一項に記載の充電システム。

[12] 前記充電対象は、前記認証管理機器と協働して前記認証を行い、該認証結果に基づいて前記電源から前記蓄電池への充電を制御する充電制御部を含むことを特徴とする請求項1～11のうちいずれか一項に記載の充電システム。

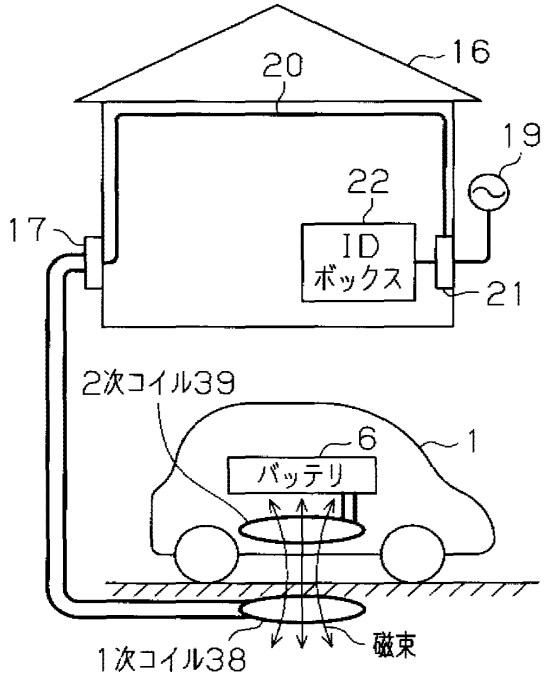
WO 2008/026390 PCT/JP2007/063857

[図1]

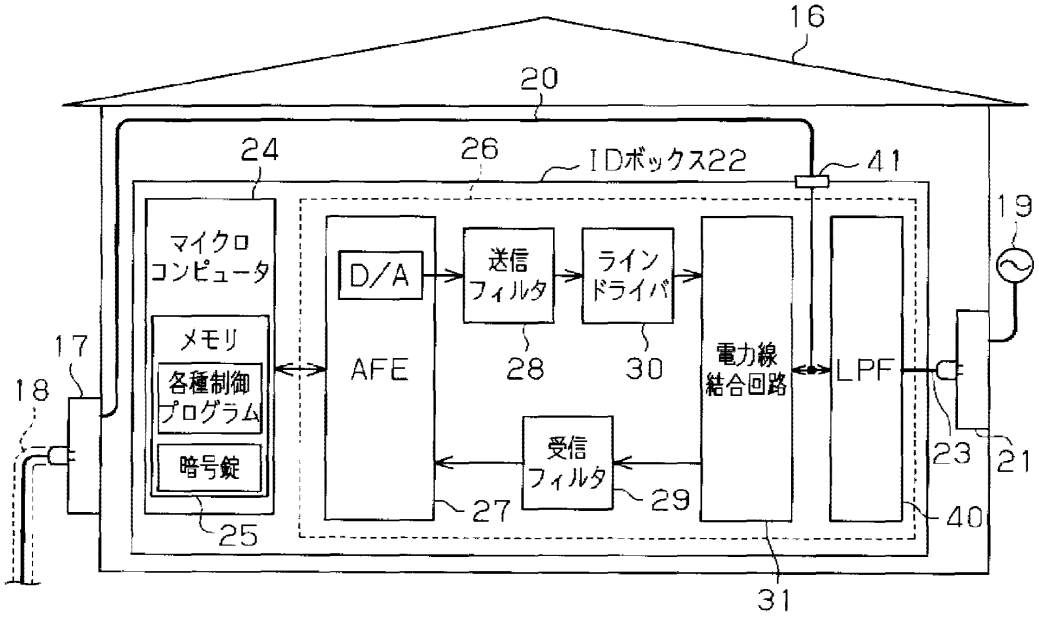



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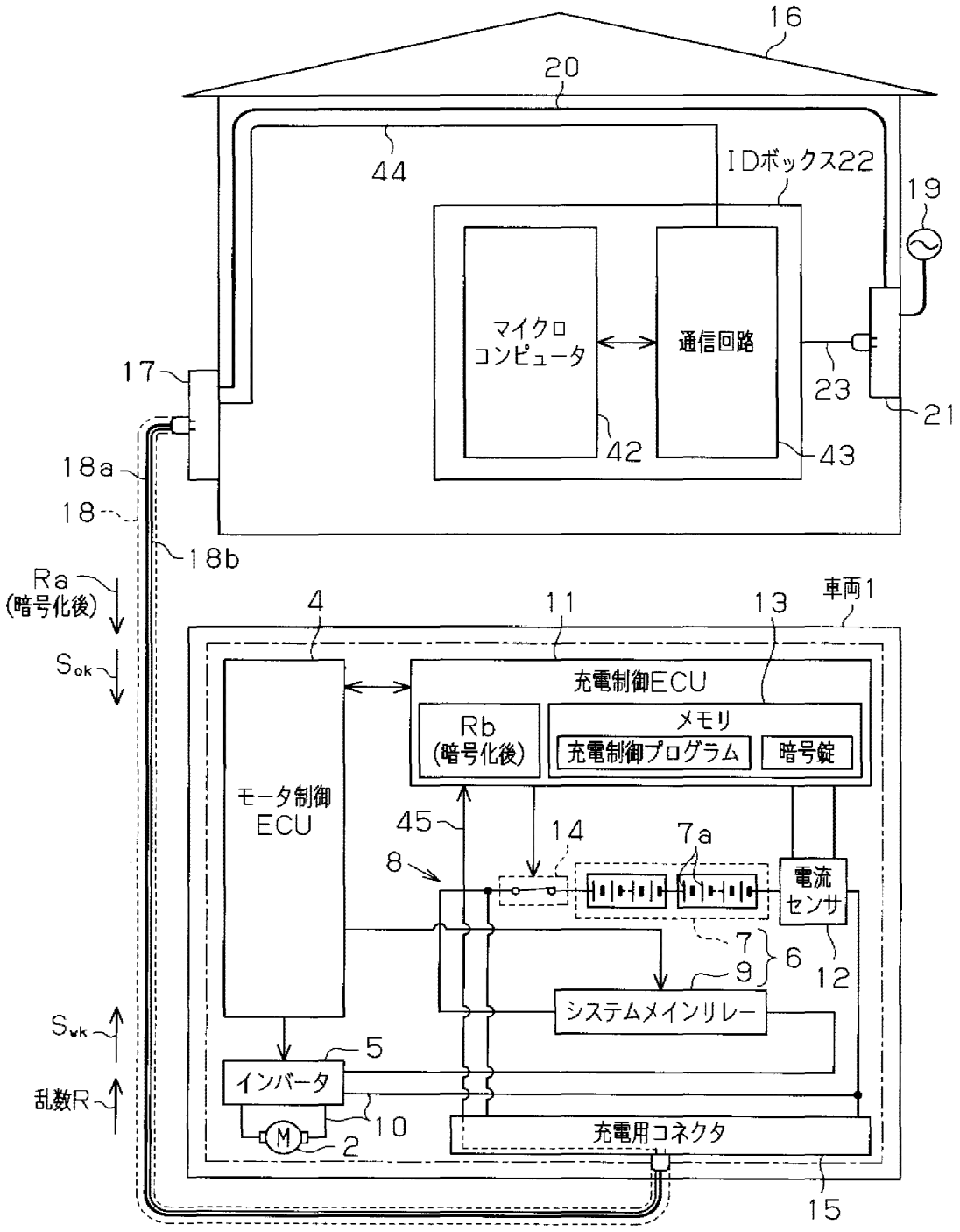
[図2]


20
16
19
22
17
ID
ボックス
21
2次コイル39
6
1
バッテリ
磁束
1次コイル38

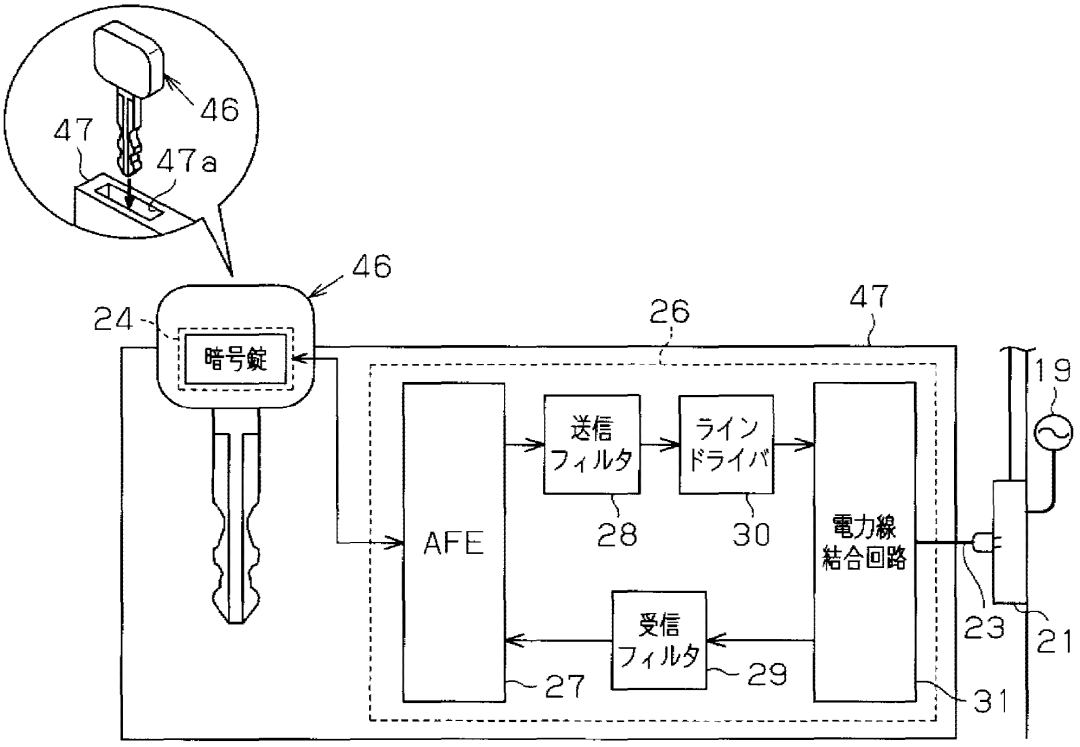
[図3]


16
20
24
26
IDボックス22
41
19
マイクロ
コンピュータ
D/A
送信
フィルタ
ライン
ドライバ
電力線
結合回路
LPF
メモリ
各種制御
プログラム
暗号錠
AFE
28
30
17
18
受信
フィルタ
23
21
27
29
40
25
31

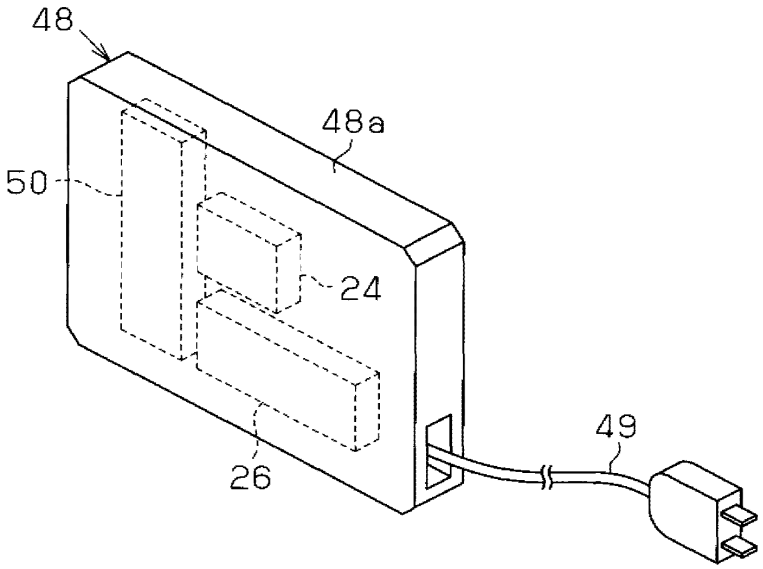
[図4]


16
20
44
IDボックス22
19
マイクロ
コンピュータ
通信回路
17
23
21
42
43
18a
18
18b
Ra
(暗号化後)
車両1
4
11
13
Sok
充電制御ECU
Rb
(暗号化後)
メモリ
充電制御プログラム
暗号錠
モータ制御
ECU
45
14
7a
8
電流
センサ
7
9
6
12
システムメインリレー
Swk
5
乱数R
インバータ
10
M
2
充電用コネクタ
15

[図5]


46
47
47a
46
24
暗号錠
26
47
19
送信
フィルタ
ライン
ドライバ
AFE
28
30
電力線
結合回路
受信
フィルタ
23
21
27
29
31

[図6]


48
48a
50
24
49
26

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2007/063857

A. CLASSIFICATION OF SUBJECT MATTER
*H02J7/00*(2006.01)i, *B60L11/18*(2006.01)i, *G08B13/00*(2006.01)i, *H01M10/44*(2006.01)i, *H02J13/00*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02J7/00, B60L11/18, G08B13/00, H01M10/44, H02J13/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2006-164547 A (Sony Corp.), 22 June, 2006 (22.06.06), Par. Nos. [0029] to [0043]; Figs. 1 to 3 & US 2006/0119315 A1 & US 2006/0119316 A1 & EP 1667306 A1 | 1-12 |
| A | JP 2001-078302 A (Tokyo R & D Co., Ltd.), 23 March, 2001 (23.03.01), Par. Nos. [0004], [0018] to [0083]; Figs. 1 to 3 & WO 2001/017829 A1 & US 6833784 B1 & EP 1223092 A1 | 1-12 |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 07 September, 2007 (07.09.07) | 25 September, 2007 (25.09.07) |
| Name and mailing address of the ISA/ Japanese Patent Office<br>Facsimile No. | Authorized officer<br>Telephone No. |

Form PCT/ISA/210 (second sheet) (April 2005)

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2007/063857

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | JP 2000-050508 A (Kabushiki Kaisha Takayanagi Kenkyusho),<br>18 February, 2000 (18.02.00),<br>Par. Nos. [0028] to [0035], [0041]; Figs. 1, 13, 14<br>(Family: none) | 1-12 |
| A | JP 2000-517487 A (BTG International Ltd.),<br>26 December, 2000 (26.12.00),<br>Full text; all drawings<br>& WO 1997/023986 A1 | 1-12 |

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２００７／０６３８５７

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.　H02J7/00(2006.01)i, B60L11/18(2006.01)i, G08B13/00(2006.01)i, H01M10/44(2006.01)i, H02J13/00(2006.01)i

Ｂ．　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.　H02J7/00, B60L11/18, G08B13/00, H01M10/44, H02J13/00

最小限資料以外の資料で調査を行った分野に含まれるもの

| | |
|---|---|
| 日本国実用新案公報 | １９２２－１９９６年 |
| 日本国公開実用新案公報 | １９７１－２００７年 |
| 日本国実用新案登録公報 | １９９６－２００７年 |
| 日本国登録実用新案公報 | １９９４－２００７年 |

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| A | JP ２００６－１６４５４７ A（ソニー株式会社）２００６．０６．２２，段落【００２９】－【００４３】、第１－３図 & US ２００６／０１１９３１５ A1 & US ２００６／０１１９３１６ A1 & EP １６６７３０６ A1 | １－１２ |
| A | JP ２００１－０７８３０２ A（株式会社東京アールアンドデー）２００１．０３．２３，段落【０００４】、【００１８】－【００８３】、第１－３図 & WO ２００１／０１７８２９ A1 & US ６８３３７８４ B1 & EP １２２３０９２ A1 | １－１２ |

☑　Ｃ欄の続きにも文献が列挙されている。　　☐　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの
「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「Ｏ」口頭による開示、使用、展示等に言及する文献
「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「＆」同一パテントファミリー文献

| | |
|---|---|
| 国際調査を完了した日<br>０７．０９．２００７ | 国際調査報告の発送日<br>２５．０９．２００７ |
| 国際調査機関の名称及びあて先<br>日本国特許庁（ＩＳＡ／ＪＰ）<br>郵便番号１００－８９１５<br>東京都千代田区霞が関三丁目４番３号 | 特許庁審査官（権限のある職員）　５Ｔ　３３５７<br>宮本　秀一<br>電話番号　０３－３５８１－１１０１　内線　３５６８ |

様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（２００５年４月）

Ｃ（続き）．　関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| A | JP ２０００－０５０５０８ A（株式会社高柳研究所）２０００．０２．１８，段落【００２８】－【００３５】、【００４１】、第１、１３、１４図 （ファミリーなし） | １－１２ |
| A | JP ２０００－５１７４８７ A（ビーティージー・インターナショナル・リミテッド）２０００．１２．２６，全文、全図 & WO １９９７／０２３９８６ A1 | １－１２ |



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(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2006-74868
(P2006-74868A)
(43)公開日　平成18年3月16日(2006.3.16)

| (51)Int.Cl. | | F I | | テーマコード（参考） |
|---|---|---|---|---|
| B60L 11/18 | (2006.01) | B60L 11/18 | C | 5H115 |

審査請求 未請求　請求項の数 2　OL　（全 8 頁）

(21)出願番号　特願2004-252786 (P2004-252786)
(22)出願日　平成16年8月31日 (2004.8.31)

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(72)発明者　大出　宏
東京都新宿区西新宿一丁目７番２号　富士重工業株式会社内

Fターム(参考)　5H115 PA01　PC06　PG04　PI16　PO07　PO16　QN03

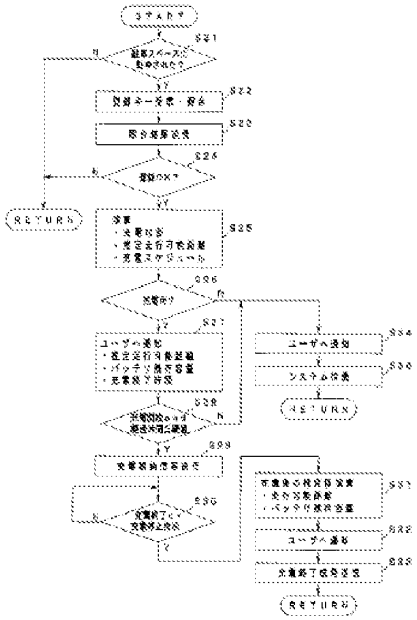
(54)【発明の名称】電気自動車のバッテリ充電システム

(57)【要約】

【課題】電気自動車のバッテリ充電を自動化し、充電操作の煩雑さを解消する。

【解決手段】車両が充電用駐車スペースの規定の位置に駐車して認証がＯＫの場合、充電の可否、推定走行可能距離、充電スケジュール等を演算する（Ｓ２５）。そして、充電可能のとき、推定走行可能距離、バッテリ残存容量、充電終了時間をユーザに通知し（Ｓ２７）、充電開始指示があり且つ充電開始指示までの経過時間が閾値未満の場合、充電開始信号を充電ステーションに送信して充電を開始させる（Ｓ２９）。その後、充電終了或いは充電停止を受信したとき、充電後の走行可能距離やバッテリ残存容量等の推定値を演算してユーザへ通知し（Ｓ３１、Ｓ３２）、充電終了信号を充電ステーションへ送信する（Ｓ３３）。これにより、充電操作の煩雑さを解消して充電の忘れや充電の機会を逸することを防止し、常に快適な使用可能状態に電気自動車を維持することができる。

【選択図】図４



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【特許請求の範囲】
【請求項１】
電気自動車に搭載されるバッテリの充電情報を外部に送信可能な通信手段を備えた電気自動車のバッテリ充電システムであって，
予め登録された個々のユーザのバッテリ情報を一括して管理し、各車両から送信された現在のバッテリ情報と予め蓄積されたバッテリ情報とに基づいて充電スケジュールを設定するサービスシステムと、
上記サービスシステムと通信可能に接続され、上記サービスシステムからの指示により、上記バッテリを充電するための電力を上記車両と非接触で供給する非接触充電電力供給システムとを備えたことを特徴とする電気自動車のバッテリ充電システム。
【請求項２】
上記サービスシステムに接続し、上記サービスシステムから自己の車両のバッテリ情報を取得可能な通信端末を更に備えたことを特徴とする請求項１記載の電気自動車のバッテリ充電システム。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、電気自動車に搭載されるバッテリの充電情報を外部に送信可能な通信手段を備えた電気自動車のバッテリ充電システムに関する。
【背景技術】
【０００２】
近年、ガソリン等を燃料として動力を発生するエンジンによって走行する従来の自動車に対し、低公害、省資源の促進を目的として、エンジンに加えてバッテリからの電力で動力を発生するモータを搭載したハイブリッド自動車や、エンジンを搭載せずに電動モータのみで走行する電気自動車が開発されている。
【０００３】
これらのハイブリッド自動車や電気自動車においては、前者がエンジンにより電動モータを駆動してバッテリに充電できることから、基本的に外部の電力源による充電を不要としているのに対し、後者は、電動モータによってバッテリの電力を消費する一方であるため、所定の期間で市街地や自宅の車庫等に設けられた充電設備を利用してバッテリを充電する必要がある。
【０００４】
この外部の電力源による車載バッテリの充電に際しては、ユーザがバッテリの充電状態を把握しなければならず、煩雑な操作と管理が必要となってユーザの負担が大きくなる。従って、このユーザのバッテリ充電に係わる負担を軽減するための種々の提案がなされており、例えば、特許文献１には、遠隔地に置かれている充電管理装置から車両ステーションに設置されている充電器の状態や、保管されている車両の充電状態を監視し、車両の充電を行う車両ステーションを無人化する技術が開示されている。
【０００５】
また、特許文献２には、電気自動車を使用するユーザが、電気自動車から離れた遠隔地に居ながらも、充電に関する充電情報を所望のタイミングで取得することのできる電気自動車の充電システムが開示されている。
【特許文献１】特開２００２－１２３８８８号公報
【特許文献２】特開２００４－４８９００号公報
【発明の開示】
【発明が解決しようとする課題】
【０００６】
しかしながら、特許文献１や特許文献２に開示されているような従来の充電システムは、バッテリの充電状態に関する情報をユーザが遠隔地で取得可能にすることを主目的としており、実際に充電を開始させるには，ユーザが充電スタンド等の外部の充電器と車両と

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を充電パドル等のコネクタを介して手動で接続する必要がある。従って、コミュータ的な乗り方をされることの多い電気自動車では、バッテリ充電に際しての手動による接続操作という煩雑な操作が支障となり、充電の機会が減少して十分に活用されない虞がある。

【０００７】

本発明は上記事情に鑑みてなされたもので、電気自動車のバッテリ充電を自動化し、充電操作の煩雑さを解消することのできる電気自動車のバッテリ充電システムを提供することを目的としている。

【課題を解決するための手段】

【０００８】

上記目的を達成するため、本発明による電気自動車のバッテリ充電システムは、電気自動車に搭載されるバッテリの充電情報を外部に送信可能な通信手段を備えた電気自動車のバッテリ充電システムであって、予め登録された個々のユーザのバッテリ情報を一括して管理し、各車両から送信された現在のバッテリ情報と予め蓄積されたバッテリ情報とに基づいて充電スケジュールを設定するサービスシステムと、上記サービスシステムと通信可能に接続され、上記サービスシステムからの指示により、上記バッテリを充電するための電力を上記車両と非接触で供給する非接触充電電力供給システムとを備えたことを特徴とする。

【０００９】

その際、サービスシステムに接続して自己の車両のバッテリ情報を取得可能な通信端末を更に備えることが望ましい。

【発明の効果】

【００１０】

本発明の電気自動車のバッテリ充電システムは、電気自動車のバッテリ充電を自動化して充電操作の煩雑さを解消することができ、充電の忘れや充電の機会を逸することを防止し、常に快適な使用可能状態に維持することができる。

【発明を実施するための最良の形態】

【００１１】

以下、図面を参照して本発明の実施の形態を説明する。図１～図５は本発明の実施の一形態に係わり、図１はバッテリ充電システムの全体構成図、図２は車両システムの構成図、図３は車両システム側の処理を示すフローチャート、図４はサービスシステムサーバ側の処理を示すフローチャート、図５は充電ステーション側の処理を示すフローチャートである。

【００１２】

図１に示すように、本形態におけるバッテリ充電システムは，ユーザの電気自動車に備えられた車両システム１０と、ユーザが車両情報を遠隔操作で把握するための通信端末５０と、予め設定された充電スペースに駐車した車両のバッテリを非接触で充電可能な充電ステーション６０と、予め登録された個々のユーザの車両情報を一括して管理するサービスシステムの中核となるサービスシステムサーバ１００とを主として構成される。このバッテリ充電システムにおいては、車両システム１０と通信端末５０と充電ステーション６０とが通信網を介してサービスシステムサーバ１００に接続され，サービスシステムサーバ１００の管理下で自動的に車載バッテリを充電することができる。

【００１３】

通信端末５０としては、ユーザが所有する携帯型の情報端末（Personal Digital Assistant:PDA）、ノート型のコンピュータ（ノートパソコン）、携帯電話機等を用いることができる。ユーザは、自己の車両のバッテリを充電する際に、通信端末５０をパケット通信網等を介してサービスシステムサーバ１００に接続することにより、自己の車両のバッテリの充電量、充電状態、満充電までの時間、残存容量等のバッテリ状態や推定走行可能距離等の情報を受信し、表示や音声によって確認することができる。

【００１４】

また、通信端末５０として、ユーザの車両の車両システム１０内に備えられた表示装置

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や音声装置であっても良く、更には、通信端末５０として、ユーザの自宅等に設置するデスクトップ型のコンピュータを用いることも可能である。車両システム１０内の表示装置や音声装置を用いる場合には、車両システム１０をサービスシステム専用の無線通信網を介してサービスシステムサーバ１００に接続することが望ましく、サービスシステムサーバ１００からの情報を表示或いは音声によって自動的に確認することができる。また、デスクトップ型のコンピュータを用いる場合には、インターネット等のネットワークを経由してサービスシステムサーバ１００に接続することにより、サービスシステムサーバ１００からの情報をディスプレイに表示させて確認することができる。

【００１５】

車両システム１０は、図２に例示するように、マイクロコンピュータ及び各種インターフェースや周辺回路等を備えて構成される電子制御装置（ＥＣＵ）１１を中心として、バッテリ１２、バッテリ１２からの直流電圧を交流電圧に変換してモータ２０に供給するインバータ１３等を備えて構成されている。更に、本形態においては、電磁誘導による非接触のインダクティブ充電方式に対応して、充電カプラ１５ａからの交流電力を直流に変換して平滑化し、バッテリ１２を充電する整流・平滑化回路１４を備えている。充電カプラ１５ａは、充電ステーション６０の後述する充電カプラ１５ｂに対向されて絶縁変圧器を構成するものであり、例えば、車体の下部に配設されている。

【００１６】

ＥＣＵ１１は、インバータ１３を介したモータ２０の制御やバッテリ１２の管理を主として実行する制御装置であり、図２においては、システム全体を統括する単一のユニットとして図示しており、バッテリ１２の充電情報を外部に送信可能な通信手段としての通信モジュール１１ａをユニット内に備えている。この場合、ＥＣＵ１１は、各制御項目毎の複数のユニットで構成するようにしても良く、各ユニットを、例えばＣＡＮ（Controller Area Network）等の通信ラインを介して双方向通信可能に接続し、互いの制御情報や制御対象の動作状態に係わるセンシング情報を相互に通信するようにしても良い。

【００１７】

ＥＣＵ１１によるモータ制御においては、ＥＣＵ１１は、図示しないアクセルペダルの踏込み量を検出するセンサからの信号に基づいてドライバーの要求する駆動力を算出し、モータ２０の回転数や電圧・電流等の情報に基づいて、モータ２０の出力をドライバーの要求駆動力に一致させるべく、インバータ１３を制御する。また、ＥＣＵ１１によるバッテリ管理においては、ＥＣＵ１１は、バッテリ１２の充電状態(State of charge;SOC)で示される残存容量やバッテリ１２の劣化度等によるバッテリ状態を把握し、このバッテリ状態を把握した上でのバッテリ１２の冷却、サービスシステムを介した充電ステーション６０における充電状態の監視、異常検出及び異常検出時の保護動作等を行う。

【００１８】

特に、バッテリ１２の充電に際しては、ＥＣＵ１１は、ユニット内に備えた通信モジュール１１ａを介してサービスシステムサーバ１００との通信を行い、バッテリ１２の電圧、残存容量、フェール情報等のバッテリ情報をサービスシステムサーバ１００へ送信する。サービスシステムサーバ１００では、車両システム１０（ＥＣＵ１１）からのバッテリ情報とサービスシステムサーバ１００内に蓄積された情報とに基づいて最適な充電スケジュールを設定し、ユーザ側からの指示に応じて充電ステーション６０に充電開始／充電終了信号を送信し、バッテリの充電を制御する。

【００１９】

充電ステーション６０は、本形態においては、電磁誘導による非接触の充電方式を採用することにより、バッテリを充電するための電力を車両と非接触で供給する非接触充電電力供給システムを形成している。従って、充電ステーション６０には、ノイズフィルタ、整流・力率改善回路、共振型コンバータ等によって構成される充電装置６０ａが備えられ、更に、サービスシステムサーバ１００との通信を制御する通信装置６０ｂが備えられている。

【００２０】

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充電装置６０ａは、ノイズフィルタを介して入力される商用の交流電源を一旦直流に変換し、歪みを補正しつつ高周波の交流に変換して、充電用駐車スペースに設置された充電カプラ１５ｂ及び車両側の充電カプラ１５ａを介して車載のバッテリ１２を充電する。すなわち、車体下部に充電カプラ１５ａを配設した車両を、充電ステーション６０の予め規定された充電用駐車スペースに駐車すると、車両の充電カプラ１５ａと充電用駐車スペースに配置された充電カプラ１５ｂとが対向配置され、電磁誘導による非接触でのバッテリ１２の充電が可能となる。

【００２１】

尚、充電ステーション６０とサービスシステムサーバ１００との通信は、本形態においては、無線通信による通信網を利用するものとするが、光ファイバケーブル等による有線の通信網を利用しても良い。

【００２２】

サービスシステムサーバ１００は、定期的にユーザの車両情報を取得して保管管理しており、最適且つ柔軟な充電制御及び監視を可能としている。具体的には、サービスシステムサーバ１００は、サーバ内に蓄積されている車両情報とＥＣＵ１１から送信されたバッテリ状態とに基づいて、充電の可否を判断すると共に、満充電までの充電量及び充電時間、現在及び充電後の推定走行可能距離等を演算し、ユーザの通信端末５０或いは車両システム１０に充電情報を送信する。そして、ユーザが選択した自動充電、充電開始、充電終了等の選択結果に応じて、充電ステーション６０に充電指示を送信する。

【００２３】

以下、バッテリ１２の充電制御に係わる処理について、図３に示す車両システム１０側の処理、図４に示すサービスシステムサーバ１００側の処理、図５に示す充電ステーション６０側の処理に分けて、対応するフローチャートを用いて説明する。

【００２４】

図３のフローチャートに示す車両システム１０側の処理では、先ず、最初のステップＳ１において、通信モジュール１１ａ等のサービスシステム用通信機器を含む充電システムを起動させる。そして、ステップＳ２でサービスシステムサーバ１００との通信を開始し、ステップＳ３でサービスシステムサーバ１００における車両認証用の登録キーを送信する。

【００２５】

次いで、ステップＳ４へ進んでサービスシステムサーバ１００から登録キーの照合結果を受信し、ステップＳ５で登録キーによる認証がＯＫとなったか否かを調べる。その結果、未登録等でサービスシステムの認証が得られない場合には、ステップＳ５からステップＳ１２へ進み、ユーザの通信端末５０或いは車両システム１０の表示装置や音声装置を介して、ユーザに登録車両でない旨を通知し、処理を抜ける。

【００２６】

また、ステップＳ５において、登録キーによる車両認証を経てサービスシステムの認証ユーザであることが確認された場合には、ステップＳ６へ進み、サービスシステムサーバ１００に自己の車両のバッテリ電圧、バッテリ残存容量、フェール情報等の車両情報を送信する。次に、ステップＳ７へ進み、サービスシステムサーバ１００から送信された充電スケジュールを受信する。

【００２７】

その後、ステップＳ８において、ユーザの充電モードの選択が自動充電か否かを調べる。ユーザによる充電モードの選択は、例えば、自己の通信端末５０、或いは車両システム１０内の入力装置を使用して行われ、設定時間内にユーザが意図的に充電停止或いは充電操作のキャンセルを選択しない場合には、自動的に充電が行われる自動充電モードが選択されたものとして扱う。その結果、自動充電である場合には、ステップＳ８からステップＳ９へ進んでサービスシステムサーバ１００に自動充電の充電モード選択信号を送信し、処理を抜ける。

【００２８】

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また、ステップＳ８において自動充電でない場合には、ステップＳ８からステップＳ１０へ進み、ユーザが充電停止或いは充電操作のキャンセルを選択したか否かを調べる。そして、ユーザが未だ充電モードを選択しておらず、設定時間が経過していない場合には、ステップＳ８へ戻り、充電停止或いはキャンセルが選択されている場合、ステップＳ１０からステップＳ１１へ進み、サービスシステムサーバ１００へ充電停止或いは充電キャンセル信号を送信し、処理を抜ける。

【００２９】

次に、サービスシステムサーバ１００側の処理について、図４のフローチャートを用いて説明する。

【００３０】

サービスシステムサーバ１００側の処理は、充電ステーション６０の充電用駐車スペースに車両が進入したとき、システム待機状態から最初のステップＳ２１が実行され、このステップＳ２１で、車両が充電用駐車スペースの規定の位置に駐車されたか否かを調べる。そして、車両の駐車位置が規定位置でない場合には処理を抜け、車両が規定位置に駐車された場合、ステップＳ２２へ進んで車両システム１０から送信される登録キーを受信し、サーバ内に予め登録されている登録キーと照合して登録ユーザの車両か否かの認証を行う。

【００３１】

そして、ステップＳ２３で、登録キーの照合結果を、ユーザの通信端末５０（車両システム１０の表示装置や音声装置でも良い）及び充電ステーション６０に送信し、ステップＳ２４で、登録キーによる認証がＯＫか否かを調べる。登録キーが予め登録してある内容と一致せず、車両認証結果がＮＧの場合には、ステップＳ２４から処理を抜け、登録キーによる車両認証がＯＫの場合、ステップＳ２４からステップＳ２５へ進み、サービスシステムサーバ１００内に蓄積されている車両情報と受信した車両情報（バッテリ状態）とに基づいて、充電の可否、現在のバッテリ残存容量での推定走行可能距離、充電スケジュール等を演算する。

【００３２】

充電スケジュールは、例えば、車両システム１０から送信された現在のバッテリ１２の残存容量や電圧、サービスシステムサーバ１００に蓄積されているバッテリ１２の初期及び途中経過時の残存容量や電圧からバッテリ劣化状態を推定し、現在の残存容量や推定した劣化状態を考慮して決定される。すなわち、バッテリの劣化が少なく且つ充電効率の高い最適な充電電圧・充電電流・充電時間を設定し、これらの組合せを充電スケジュールとして決定する。

【００３３】

そして、ステップＳ２６で充電の可否を判断し、充電不可であれば、ステップＳ２６からステップＳ３４へ進んで充電不可であることをユーザに通知し、ステップＳ３５でシステム待機状態となる。ユーザへの充電不可の通知は、例えば、通信端末５０が携帯電話機である場合には、予め登録したユーザの電話番号を参照して充電不可を送信する。

【００３４】

また、充電可能であれば、ステップＳ２６からステップＳ２７へ進んで推定走行可能距離、バッテリ残存容量、充電スケジュールから演算される充電終了時間等をユーザに通知する。そして、ステップＳ２８で、ユーザからの充電開始指示があり、且つ充電開始指示までの経過時間が閾値未満であるか否かを調べる。その結果、充電開始指示がないまま閾値以上の時間が経過した場合には、ステップＳ２８から前述のステップＳ３４へ進んでユーザに時間切れである旨を通知し、ステップＳ３５でシステム待機状態となる。また、ユーザからの充電開始指示が閾値の時間内にあった場合には、ステップＳ２８からステップＳ２９へ進んで充電開始信号を充電ステーション６０に送信し、充電を開始させる。

【００３５】

その後、ステップＳ３０へ進み、車両システム１０でバッテリ１２の満充電を検出して送信された充電終了信号、或いはユーザからの充電停止指示の受信待ちとなり、充電終了

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或いは充電停止を受信したとき、ステップＳ３１へ進んで充電後の走行可能距離やバッテリ残存容量等の推定値を演算する。そして、ステップＳ３２でこれらの推定値をユーザへ通知し、ステップＳ３３で充電ステーション６０での充電を終了或いは停止させるための充電終了信号を充電ステーション６０へ送信し、処理を抜ける。

【００３６】

以上の車両システム１０及びサービスシステムサーバ１００側の処理に対応する充電ステーション６０側の処理は、図５のフローチャートに示される。この充電ステーション６０側の処理は、サービスシステムサーバ１００における車両認証結果を受けて起動し、最初のステップＳ４１で登録車両としての認証がＯＫか否かを調べる。

【００３７】

そして、登録ＮＣの場合には、車両に対する充電電力を出力することなくステップＳ４１から処理を抜け、登録ＯＫの場合、ステップＳ４１からステップＳ４２へ進んで、サービスシステムサーバ１００から充電開始信号を受信したか否かを調べる。その結果、充電開始信号を受信していない場合には、ステップＳ４２から処理を抜け、充電開始信号を受信した場合、ステップＳ４２からステップＳ４３へ進んで、充電装置６０ａから高周波の充電電力を出力し、充電用駐車スペースの充電カプラ１５ｂと車両側の充電カプラ１５ａとを介して、電磁誘導による非接触での車両のバッテリ１２に対する充電を開始する。

【００３８】

その後、ステップＳ４４へ進んでサービスシステムサーバ１００からの充電終了信号の受信待ちとなる。そして、サービスシステムサーバ１００から充電終了信号を受信したとき、ステップＳ４４からステップＳ４５へ進んで充電装置６０ａを停止させ、車両のバッテリ１２に対する充電を終了させる。

【００３９】

以上のように、本形態においては、電気自動車を充電用の駐車スペースに駐車するだけで自動的に充電を開始することができ、しかも、自己の車両から離れても、サービスシステムから送信される情報によって充電状態を把握することができる。これにより、充電操作の煩雑さを解消することができ、充電の忘れや充電の機会を逸することを防止し、常に快適な使用可能状態に維持することができる。

【図面の簡単な説明】

【００４０】

【図１】バッテリ充電システムの全体構成図

【図２】車両システムの構成図

【図３】車両システム側の処理を示すフローチャート

【図４】サービスシステムサーバ側の処理を示すフローチャート

【図５】充電ステーション側の処理を示すフローチャート

【符号の説明】

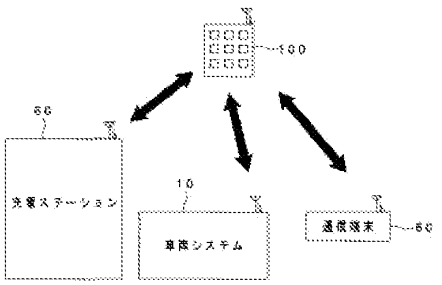
【００４１】

１０　車両システム
１１　電子制御装置
１１ａ　通信モジュール（通信手段）
１２　バッテリ
５０　通信端末
６０　充電ステーション（非接触充電電力供給システム）
１００　サービスシステムサーバ

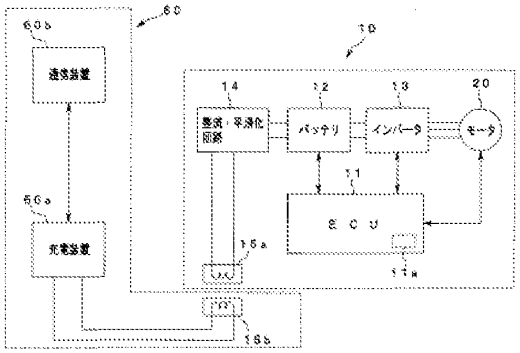
代理人　弁理士　伊　藤　進

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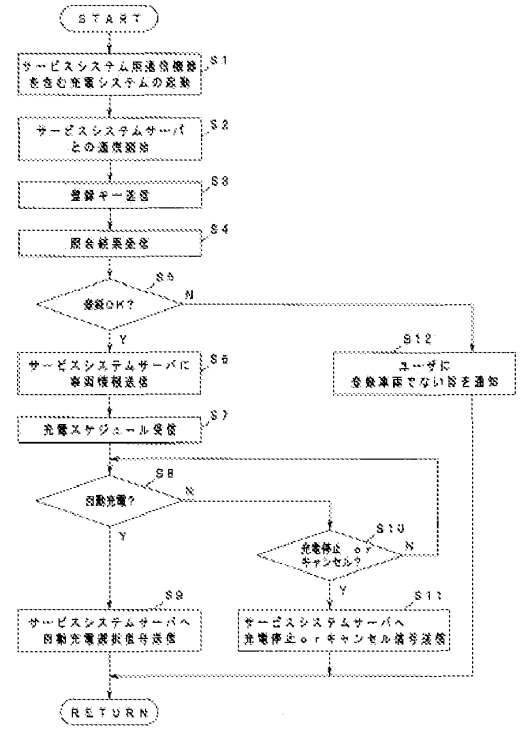
【図１】


100
50
充電ステーション
10
車両システム
通信端末
60

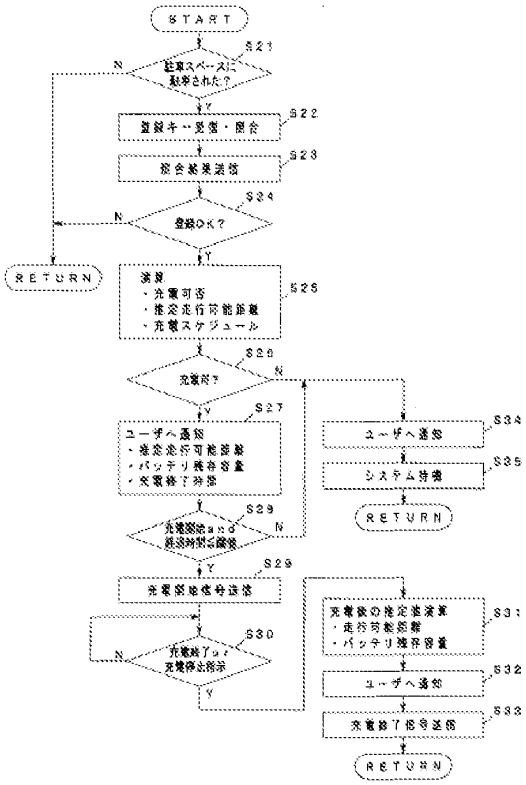
【図２】


60
60b
通信装置
60a
充電装置
10
14
12
13
20
整流・平滑化回路
バッテリ
インバータ
モータ
11
ECU
15a
15b

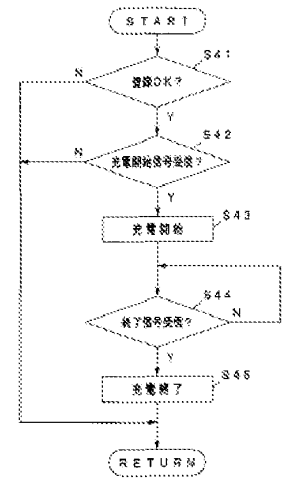
【図３】


START
サービスシステム照合機器を含む充電システムの起動
S1
サービスシステムサーバとの通信開始
S2
登録キー送信
S3
照合結果受信
S4
登録OK?
S5
N
Y
サービスシステムサーバに車両情報送信
S6
ユーザに登録車両でない旨を通知
S12
充電スケジュール受信
S7
自動充電?
S8
N
Y
充電停止 or キャンセル?
S10
N
Y
サービスシステムサーバへ自動充電開始信号送信
S9
サービスシステムサーバへ充電停止 or キャンセル信号送信
S11
RETURN

【図４】


START
駐車スペースに駐車された?
S21
N
Y
登録キー受信・照合
S22
照合結果送信
S23
登録OK?
S24
N
Y
RETURN
演算
・充電可否
・推定走行可能距離
・充電スケジュール
S25
充電可?
S26
N
Y
ユーザへ通知
・推定走行可能距離
・バッテリ残存容量
・充電終了時間
S27
ユーザへ通知
S34
システム待機
S35
RETURN
充電開始and照合開始信号受信
S28
N
Y
充電開始信号送信
S29
充電終了or充電停止指示
S30
N
Y
充電後の推定走行演算
・走行可能距離
・バッテリ残存容量
S31
ユーザへ通知
S32
充電終了信号送信
S33
RETURN

【図５】


START
登録OK?
S41
N
Y
充電開始信号受信?
S42
N
Y
充電開始
S43
終了信号受信?
S44
N
Y
充電終了
S45
RETURN

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THOMSON NATIVE MAT through DFP

SUBJECT OF THE INVENTION

SUBJECT OF THE INVENTION

The battery charge of an electric vehicle is automated,
The complexity of charge operation is eliminated.
PROBLEM to be solved
A vehicle parks a car at the position of prescription of the parking space for charge, and when a certification|authentication is OK, the propriety of charge, estimation runnable distance, a charge schedule, etc. are calculated (S25).
And by notifying a user of estimation runnable distance, a battery remaining capacity, and charge completion time (S27), and there existing charge start instructions, when, and the elapsed time to charge start instructions is under a threshold-value, a charge start signal is transmitted to a charge station, and charge is started (S29).
Then, when the charge completion or a charge stop is received, assessed values, such as runnable distance after charge and a battery remaining capacity, are calculated, a user is notified (S31, S32), and a charge completion signal is transmitted to a charge station (S33).
It prevents eliminating the complexity of charge operation and missing the forgetfulness of charge, and the opportunity of charge by this,
An electric vehicle can be maintained in an always comfortable useable state.

DETAILED DESCRIPTION of the INVENTION

[**0001**] TECHNICAL FIELD
This invention is related to the battery charge system of the electric vehicle equipped with a communication means by which the charge information of the battery mounted on an electric vehicle can be transmitted outside.

DESCRIPTION OF RELATED ART

[**0002**] The hybrid vehicle which mounted low pollution and the motor which generate|occur|produces power with the electric power from a battery for the purpose of promotion of saving resources in addition to an engine, and the electric vehicle it travel|drive|works only by an electric motor without



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mounting an engine are developed to the conventional motor vehicle it travel|drive|works with the engine which generate|occur|produces power by using gasoline etc. as a fuel in recent years.

[0003] In these hybrid vehicles and electric vehicles, the former drives an electric motor with an engine and can charge to a battery,
Since it is one in which the latter consumes the electric power of a battery by an electric motor to making unnecessary fundamentally charge by an external electric power source from this, it is necessary to charge a battery with a predetermined period using the charging equipment provided at the city area, the garage|carriage_shed of a house, etc.

[0004] In the case of the charge of the vehicle-mounted battery by this external electric power source, a user has to grasp|ascertain the charge state of a battery, complicated operation and management are needed, and a user's burden becomes larger.
Therefore, the various proposal for reduce|lightening the burden concerning this user's battery charge is comprised,
For example, to patent documents 1, the state of the charger currently installed in the vehicle station from the charge management apparatus currently put on the remote place and the charge state of the vehicle currently stored are monitored,
The technique which fully automates the vehicle station which charges a vehicle is disclosed.

[0005] Moreover, though the user who uses an electric vehicle is in the remote place distant from the electric vehicle, the charge system of the electric vehicle which can acquire the charge information related to charge at a desired timing is disclosed by patent documents 2.
Unexamined-Japanese-Patent No. 2002-123888
Unexamined-Japanese-Patent No. 2004-48900

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION



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[0006] However
The conventional charge system which is disclosed by patent documents 1 and patent documents 2 makes it the main purpose that a user enables it to acquire the information related to the charge state of a battery in a remote place,
In order to actually start charge, a user needs to connect an external charger and external vehicles, such as a charge stand, by manual operation through connectors, such as a charge paddle.
Therefore, in an electric vehicle with adopting much commuter how riding, complicated operation called connection operation by manual operation becomes trouble in the case of battery charge,
There exists a possibility that the opportunity of charge may reduce and it may not fully use.

[0007] This invention was comprised in view of said situation, and automates the battery charge of an electric vehicle,
It aims at providing the battery charge system of the electric vehicle which can eliminate the complexity of charge operation.

MEANS TO SOLVE THE PROBLEM

[0008] In order to achieve said objective, the battery charge system of the electric vehicle by this invention is a battery charge system of the electric vehicle equipped with a communication means by which the charge information of the battery mounted on an electric vehicle can be transmitted outside,
Comprising:
Each user's battery information registered beforehand is managed collectively,
The service system which sets a charge schedule based on the present battery information transmitted from each vehicle, and the battery information accumulate|stored beforehand,
It connects so that it can communicate with said service system,
The non-contact charge electric power supply system which is non-contact and supplies the electric power for charging said battery with said vehicle with the instructions from said service system was provided.
It is characterized by the above-mentioned.

[0009] It is desirable in that case to provide further the communication terminal which connects to a service system and can acquire the battery information of a self vehicle.



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[0010] ADVANTAGE OF THE INVENTION

The battery charge system of the electric vehicle of this invention can automate the battery charge of an electric vehicle, and can eliminate the complexity of charge operation, and it prevents missing the forgetfulness of charge, and the opportunity of charge,
It can maintain in an always comfortable useable state.

PREFERRED EMBODIMENT OF THE INVENTION

[0011] Hereafter, Embodiment of this invention is demonstrated with reference to drawing.
FIGS. 1-5 is involved in one Embodiment of this invention,
FIG. 1 is the whole block diagram of a battery charge system,
FIG. 2 is the block diagram of a vehicle system,
FIG. 3 is a flowchart which shows processing of the vehicle system side,
FIG. 4 is a service-system server.
The flowchart which shows processing of the side, and FIG. 5 are flowcharts which show processing of the charge station side.

[0012] As shown in FIG. 1, the battery charge system in this form
The vehicle system 10 with which a user's electric vehicle was equipped, and the communication terminal 50 for a user to grasp|ascertain vehicle information by remote operation,
The service-system server 100 used as the charge station 60 which is non-contact and can charge the battery of the vehicle parked at the predetermined charge space, and the core of the service system which manages collectively each user's vehicle information registered beforehand can mainly be comprised.
In this battery charge system, the vehicle system 10, the communication terminal 50, and the charge station 60 are connected to the service-system server 100 through a communication network, and a vehicle-mounted battery can be automatically charged under management of the service-system server 100.

[0013] The computer (notebook personal computer) of the portable information terminal (Personal Digital Assistant;PDA) and the note(book) type|mold which a user owns, a mobile phone etc. can be used as a communication terminal 50.
When a user charges the battery of a self vehicle, he receives information, such as battery states, such as the charge amount of the battery of a self vehicle, a charge state, the time to a full charge, a remaining capacity, and estimation runnable distance, by connecting the communication terminal 50 to the service-system server 100 through a packet communication network etc.,
It can confirm by the display or an audio|voice.



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[0014] Moreover, the display device and audio|voice apparatus which were provided in the vehicle system 10 of a user's vehicle may be used as a communication terminal 50.
Furthermore, it is also possible to use the computer of the desk-top type|mold installed in a user's house etc. as a communication terminal 50.
When using the display device and audio|voice apparatus in the vehicle system 10, it is desirable to connect to the service-system server 100 through the radio|wireless-communication net|network only for the vehicle system 10 a service system, and the information from the service-system server 100 can be automatically confirmed by the display or an audio|voice.
Moreover, when using the computer of a desk-top type|mold, by going through networks, such as the internet, and connecting to the service-system server 100, the information from the service-system server 100 can be displayed on a display, and can be confirmed.

[0015] The vehicle system 10 centers on the electronic controller (ECU) 11 which is equipped with a microcomputer, various interface, a periphery circuit, etc., and is comprised, is equipped with inverter 13 grade which transform|converts the DC voltage from battery 12 and battery 12 into an alternating voltage, and is supplied to motor 20, and is comprised so that it may illustrate in FIG. 2.
Furthermore, in this form, it respond|corresponds to the non-contact inductive charge system by an electromagnetic induction, and the alternating current electric power from the charge coupler 15a is transform|converted into direct current|flow, and is smoothed,
The rectification * smoothing circuit 14 which charges battery 12 is provided.
The charge coupler 15a can oppose the charge coupler 15b which the charge station 60 mentions later, and an insulating transformer is comprised.
For example, it arranges at the lower part of a vehicle body.

[0016] ECU11 is a control apparatus which mainly performs control of motor 20 and management of battery 12 via inverter 13,
In FIG. 2, it is illustrating as a single unit which generalizes system whole,
The communication module 11a as a communication means by which the charge information of battery 12 can be transmitted outside is provided in the unit.
In this case, it is sufficient to make it comprise ECU11 in several units for each control item.
Each unit is connected so that two-way communication can be carried out, for example through communication lines, such as CAN(Controller Area Network).
It is sufficient to make mutual control information and the sensing information concerning the operation state of a control object communicate mutually.



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[0017] In the motor control by ECU11, ECU11 calculates the driving force which a driver requires based on the signal from the sensor which detects the treading-in amount of the accelerator pedal which is not illustrated,
Based on information, such as a rotation speed|number of motor 20, and a voltage * electric current, inverter 13 is controlled in order to coincide the output of motor 20 with the requirement driving force of a driver.
Moreover, in the battery management by ECU11, ECU11 grasps|ascertains the battery state by a remaining capacity, a degradation degree of battery 12, etc. which are shown in the charge state (State of charge;SOC) of battery 12,
It is the protected operation at the time of monitoring of the charge state in the charge station 60, abnormality detection, and abnormality detection via cooling of battery 12 when this battery state has been grasped|ascertained, and a service system etc. is performed.

[0018] In particular ECU11 performs communication with the service-system server 100 through the communication module 11a provided in the unit in the case of the charge of battery 12,
Battery information, such as a voltage of battery 12, a remaining capacity, and fail information, is transmitted to the service-system server 100.
In the service-system server 100, an optimal charge schedule is set based on the battery information from the vehicle system 10 (ECU11), and the information accumulate|stored into the service-system server 100,
According to the instructions from the user side, charge start / charge completion signal is transmitted to the charge station 60,
The charge of a battery is controlled.

[0019] The charge station 60 has formed the non-contact charge electric power supply system which is non-contact and supplies the electric power for charging a battery with a vehicle by employing the non-contact charge system by an electromagnetic induction in this form.
Therefore, the charge station 60 is equipped with charger 60a comprised by a noise filter, a rectification * power-factor-improvement circuit, a resonance type|mold converter etc.,
Furthermore, the communication apparatus 60b which controls communication with the service-system server 100 is provided.

[0020] Charger 60a once transform|converts into direct current|flow the commercial AC power supply input through a noise filter,
It transform|converts into alternating current of a high frequency, correcting distortion,
The vehicle-mounted battery 12 is charged through the charge coupler 15b installed in the parking space for charge, and the charge coupler 15a of the vehicle side.
That is, when the vehicle which arranged the charge coupler 15a at the vehicle-body lower part is parked at the parking space for charge as which it prescribed to the charge station 60 beforehand,



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the charge coupler 15a of a vehicle and the charge coupler 15b arranged at the parking space for charge will arrange opposite, and charge of battery 12 non-contact by an electromagnetic induction can be performed.

[0021] In addition, the communication with the charge station 60 and the service-system server 100 shall utilize the communication network by the radio|wireless communication in this form.
However
It is sufficient to utilize the wired communication network by an optical fiber cable etc.

[0022] The service-system server 100 is acquiring and carrying out storage management of a user's vehicle information regularly,
Optimal and flexible charge control and monitoring are enabled.
Specifically, the service-system server 100 calculates the estimation runnable distance after the charge amount to a full charge and charge time, the present, and charge etc. while judging the propriety of charge based on the vehicle information accumulate|stored into the server, and the battery state transmitted from ECU11,
Charge information is transmitted to a user's communication terminal 50 or vehicle system 10.
And according to selection results, such as automatic battery charge which the user selected, a charge start, and the charge completion, charge instructions are transmitted to the charge station 60.

[0023] Hereafter, it divides into the processing of the vehicle system 10 side shown in FIG. 3, the processing of the service-system server 100 side shown in FIG. 4, and the processing of the charge station 60 side shown in FIG. 5, and the processing concerning the charge control of battery 12 is demonstrated using the flowchart which respond|corresponds.

[0024] First in the processing of the vehicle system 10 side shown to the flowchart of FIG. 3, the charge system which contains communication apparatuses for service systems, such as a communication module 11a, in the first step S1 is started.
And communication with the service-system server 100 is started in step S2,
The register key for a vehicle certification|authentication in the service-system server 100 is transmitted in step S3.

[0025] Subsequently, it progresses to step S4 and the collation result of a register key is received from the service-system server 100,
It is investigated whether the certification|authentication by a register key was set to OK in step S5.
As a result, when the certification|authentication of a service system is not obtained by un-registering etc., it progresses to step S12 from step S5, and a user is notified of the purport which



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is not a registration vehicle through the display device and audio|voice apparatus of a user's communication terminal 50 or the vehicle system 10,
It pulls out from processing.

[0026] Moreover, when it is confirmed through the vehicle certification|authentication by a register key in step S5 that he is the certification|authentication user of a service system, it progresses to step S6 and vehicle information, such as the battery voltage of the vehicle of self server / 100 / service-system , a battery remaining capacity, fail information, is transmitted.
Next, it progresses to step S7 and the charge schedule transmitted from the service-system server 100 is received.

[0027] Then, in step S8, it is investigated whether the selection in a user's charge mode is automatic battery charge.
The selection (for example) in the charge mode by a user is handled as that by which the automatic-battery-charge mode in which charge was performed automatically was selected, when it is carried out by using the communication terminal 50 of self, or the input device in the vehicle system 10 and a user does not select cancellation of a charge stop or charge operation intentionally within setup time.
As a result, in being automatic battery charge, it progresses to step S9 from step S8, and transmits the charge mode-selection signal of automatic battery charge to the service-system server 100,
It pulls out from processing.

[0028] Moreover, in not being automatic battery charge in step S8, it progresses to step S10 from step S8, and it investigates whether the user selected cancellation of a charge stop or charge operation.
And when a user does not yet select charge mode and setup time is not passing, it returns to step S8, and when a charge stop or cancellation is selected, it progresses to step S11 from step S10, and a charge stop or a charge cancellation signal is transmitted to the service-system server 100,
It pulls out from processing.

[0029] Next, processing of the service-system server 100 side is demonstrated using the flowchart of FIG. 4.



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[0030] As for processing of the service-system server 100 side, when a vehicle approachs into the parking space for charge of the charge station 60, the first step S21 is performed from a system standby state,
It is investigated whether in this step S21, the vehicle parked a car at the position of prescription of the parking space for charge.
And when the parking position of a vehicle is not a prescription position, it pulls out from processing, and when a vehicle parks a car at a prescription position, the register key which progresses to step S22 and is transmitted from the vehicle system 10 is received,
It collates with the register key beforehand registered into the server, and certify|authenticates that it is a registered user's vehicle.

[0031] And the collation result of a register key is transmitted to a user's communication terminal 50 (The display device and audio|voice apparatus of the vehicle system 10 may be used.) and charge station 60 in step S23.
In step S24, it is investigated whether the certification|authentication by a register key is OK.
It does not correspond with the content into which the register key is registered beforehand, but when a vehicle certification|authentication result is NG|no_good, it pulls out from processing from step S24, and when the vehicle certification|authentication by a register key is OK, it progresses to step S25 from step S24, and the estimation runnable distance in the propriety of charge and the present battery remaining capacity, a charge schedule, etc. are calculated based on the vehicle information accumulate|stored into the service-system server 100, and the received vehicle information (battery state).

[0032] A charge schedule (for example) estimates a battery degradation state from the remaining capacity and voltage at the time of the initial stage of battery 12 accumulate|stored in the remaining capacity and voltage of the present battery 12 transmitted from the vehicle system 10, and the service-system server 100, and progress,
It determines in consideration of a present remaining capacity and the estimated present degradation state.
That is, degradation of a battery sets the few|small and high optimal charge voltage * charging-current * charge time of charge efficiency,
Such combination is determined as a charge schedule.



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[0033] And the propriety of charge is judged in step S26,
If charge is improper, a user will be notified of the ability for it not to progress to step S34 and not charge from step S26,
It will be in a system standby state in step S35.
The notification (for example) which cannot charge a user transmits a charge failure with reference to the telephone number of the user who registered beforehand, when the communication terminal 50 is a mobile phone.

[0034] Moreover, if chargeable, a user will be notified of the charge completion time which progresses to step S27 from step S26, and is calculated from estimation runnable distance, a battery remaining capacity, and a charge schedule.
And there exist charge start instructions from a user in step S28,
And it is investigated whether the elapsed time to charge start instructions is under a threshold-value.
As a result, when the time more than a threshold-value passes with no charge start instructions, it progresses to above-mentioned step S34 from step S28, and a user is notified of the purport which is the deadline,
It will be in a system standby state in step S35.
Moreover, when the charge start instructions from a user suit within the time of a threshold-value, it progresses to step S29 from step S28, and a charge start signal is transmitted to the charge station 60,
Charge is started.

[0035] Then, it progresses to step S30 and becomes the charge completion signal which detected the full charge of battery 12 and was transmitted by the vehicle system 10, or the receiving waiting of the charge stop instructions from a user,
When the charge completion or a charge stop is received, it progresses to step S31 and assessed values, such as runnable distance after charge and a battery remaining capacity, are calculated.
And a user is notified of these assessed values in step S32,
The charge completion signal for completing or stopping the charge in the charge station 60 in step S33 is transmitted to the charge station 60,
It pulls out from processing.



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[0036] Processing of the charge station 60 side which respond|corresponds to processing of the above vehicle system 10 and the service-system server 100 side is shown by the flowchart of FIG. 5. Processing of this charge station 60 side receives and starts the vehicle certification|authentication result in the service-system server 100,
It is investigated in the first step S41 whether the certification|authentication as a registration vehicle is OK.

[0037] And in the case of registration NG, it is investigated whether it pulled out from processing from step S41, without outputting the charge electric power with respect to a vehicle, in Registration OK, it progressed to step S42 from step S41, and the charge start signal was received from the service-system server 100.
As a result, when the charge start signal is not received, it pulls out from processing from step S42, and when a charge start signal is received, it progresses to step S43 from step S42, and the charge electric power of a high frequency is output from Charger 60a,
The charge with respect to battery 12 of a vehicle non-contact by an electromagnetic induction is started through the charge coupler 15b of the parking space for charge, and the charge coupler 15a of the vehicle side.

[0038] Then, it progresses to step S44 and becomes the receiving waiting of the charge completion signal from the service-system server 100.
And when a charge completion signal is received from the service-system server 100, it progresses to step S45 from step S44, and Charger 60a is stopped,
The charge with respect to battery 12 of a vehicle is terminated.

[0039] As mentioned above, in this form, even if it can start charge automatically only by parking an electric vehicle at the parking space for charge and separates from the vehicle of further self, a charge state can be grasped|ascertained with the information transmitted from a service system. Thereby, the complexity of charge operation can be eliminated and it prevents missing the forgetfulness of charge, and the opportunity of charge,
It can maintain in an always comfortable useable state.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0040]

FIG. 1: The whole block diagram of a battery charge system

FIG. 2: The block diagram of a vehicle system



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FIG. 3: The flowchart which shows processing of the vehicle system side

FIG. 4: The flowchart which shows processing of the service-system server side

FIG. 5: The flowchart which shows processing of the charge station side

DESCRIPTION OF SYMBOLS

[0041] 10 vehicle system
Eleven electronic controllers
11a communication module (communication means)
Twelve batteries
50 communication terminal
60 charge station (non-contact charge electric power supply system)
100 service-system server
Representative
Patent attorney

i

1. 1. It is the battery charge system of the electric vehicle equipped with a communication means by which the charge information of the battery mounted on an electric vehicle can be transmitted outside,
Comprising:
Each user's battery information registered beforehand is managed collectively,
The service system which sets a charge schedule based on the present battery information transmitted from each vehicle, and the battery information accumulate|stored beforehand,
It connects so that it can communicate with said service system,
The non-contact charge electric power supply system which is non-contact and supplies the electric power for charging said battery with said vehicle with the instructions from said service system was provided.
The battery charge system of the electric vehicle characterized by the above-mentioned.
2. 2. It connects to said service system,
The communication terminal which can acquire the battery information of a self vehicle from said service system was provided further.
The battery charge system of the electric vehicle of Claim 1 characterized by the above-mentioned.



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# PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: CHRISTOPHER AUSTIN
935 17TH AVENUE
GRAFTON, WI 53024

# PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 03 DEC 2009 |
| Applicant's or agent's file reference<br>00000-0977WO | **FOR FURTHER ACTION**<br>See paragraph 2 below |

| International application No. | International filing date *(day/month/year)* | Priority date *(day/month/year)* |
|---|---|---|
| PCT/US2009/054174 | 18 August 2009 | 18 August 2008 |

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H01M 10/44 (2009.01)
USPC - 320/128

Applicant AUSTIN, CHRISTOPHER

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

| Name and mailing address of the ISA/US | Date of completion of this opinion | Authorized officer: |
|---|---|---|
| Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | 27 November 2009 | Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/237 (cover sheet) (July 2009)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2009/054174

**Box No. I Basis of this opinion**

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

   ☐ on paper

   ☐ in electronic form

   b. (time)

   ☐ in the international application as filed

   ☐ together with the international application in electronic form

   ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY**

International application No.
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**Box No. IV Lack of unity of invention**

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the appicable time limit:
   - ☒ paid additional fees
   - ☐ paid additional fees under protest and, where applicable, the protest fee
   - ☐ paid additional fees under protest but the applicable protest fee was not paid
   - ☐ not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
   - ☐ complied with
   - ☒ not complied with for the following reasons:

See supplemental box.

4. Consequently, this opinion has been established in respect of the following parts of the international application:
   - ☐ all parts
   - ☒ the parts relating to claims Nos. 1-139, 142, 146-147

Form PCT/ISA/237 (Box No. IV) (July 2009)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2009/054174

**Box No. V** **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Claims | 4-5, 7-9, 15-17, 19, 22-29, 34-37, 39, 42-43, 46-139, 142, 146-147 | YES |
| | Claims | 1-3, 6, 10-14, 18, 20-21, 30-33, 38, 40-41, 44-45 | NO |
| Inventive step (IS) | Claims | None | YES |
| | Claims | 1-139, 142, 146-147 | NO |
| Industrial applicability (IA) | Claims | 1-139, 142, 146-147 | YES |
| | Claims | None | NO |

2. Citations and explanations:

Claims 1-3, 6, 10-14, 18, 20-21, 30-33, 38, 40-41, 44-45 lack novelty under PCT Article 33(2) as being anticipated by Hobbs.

Regarding claim 1, Hobbs discloses a vehicle charger for charging a battery of a vehicle (abstract) and adapted for communication with a first controller remote from the vehicle and vehicle charger (diagnostic device 130, which may be a PDA, and be wireless "cellular telephony" col. 7, lines 30-48), the vehicle charger comprising:
an electrical power cord 125 releasably attachable to at least one of the vehicle (by plug 126, fig. 1; col. 8, lines 1-5) and a source of power (power grid, 105);
a second controller electrically coupled to the electrical power cord (see cord 125 connected to the controller 100); and
at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller (network 275, fig. 2),
the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger (diagnostic device 130 can program charger 100, col. 7, lines 30-43).

Regarding claim 2, Hobbs discloses the electrical power cord 125 is releasably attachable to the vehicle (by connector 126, col. 6, lines 4-11 ) and the source of power 105/205 (via cable 120 and fuse or circuit breaker 222, fig. 1, 2; col. 5, lines 55-63; col. 9, lines 10-12).

Regarding claim 3, Hobbs discloses a housing 102 in which the second controller is located, the housing coupled to and at least partially located between opposite ends of the electrical power cord (see housing 102 between power cord end 126 and 120, fig. 1).

Regarding claim 6, Hobbs discloses the second controller is adapted for wireless communication with the first controller via the at least one of the transmitter and receiver (controller 270 communicates with internet through network 275, col. 11, lines 15-24; controller 270 communicates with diagnostic device 130, col. 11, lines 1-2; diagnostic device 130 may be wireless, col. 7, lines 30-48).

Regarding claim 10, Hobbs discloses the vehicle charger has a first charging state in which the vehicle charger is not charging the battery, and a second charging state in which the vehicle charger is charging the battery (see start 302, for not charging and start charging 315 for charging, fig. 3).

Regarding claim 11, Hobbs discloses a display 107 coupled to the second controller 100 (fig 1), the display displaying a level of charge of the battery (indication to alert user when battery is charged, col. 3, lines 15-26).

Regarding claim 12, Hobbs discloses a display 107 coupled to the second controller 100, the display displaying an amount of time for the battery to be fully charged (time to complete charge, col. 7, lines 16-19) based upon information regarding the battery received by the second controller (controller 270 controls display, col. 10, lines 31-38).

Regarding claim 13, Hobbs discloses the amount of time is an amount of time that is estimated by the second controller (amount of time estimated, col. 7, lines 17-18) or received by the second controller.

Regarding claim 14, Hobbs discloses the amount of time is updated on the display 107 by the second controller 100 during a charge session (time estimated is displayed, col. 7, lines 17-18; this is done in real time, col. 22, lines 44-46).

Regarding claim 18, Hobbs discloses a display 107 displaying a cost of power to the battery per unit time (time for charge and bill for fuel are displayed, col. 7, lines 16-19).

Regarding claim 20, Hobbs discloses a display displaying a total power cost of a charging session (bill for the fuel (charge) is displayed, col. 7, lines 16-19).

Regarding claim 21, Hobbs discloses the total power cost is updated on the display by the second controller during a charging session (bill for the fuel (charge) is displayed, col. 7, lines 16-19; power level is displayed in real time, col. 22, lines 44-46).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
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**Supplemental Box**

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:
Continuation of Box IV:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-45, 142, 147, drawn to a vehicle charger comprising a first remote controller and a second controller, a transmitter and a receiver coupled to the second controller, and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger.
Group II, claims 46-139,146 drawn to a vehicle charger comprising a user manipulatable control and operable by a user to enter a time of day at which a charging session will end.
Group III, claim 140, drawn to a vehicle charger comprising a controller which supplies electric power to the battery if a level of battery charge is below a threshold level, until the threshold level of battery charge is reached.
Group IV, claims 141,143-145 drawn to a vehicle charger comprising a display and a controller operable to display at least two different screens upon the display, at least one of the screens displaying information regarding a charging session, and at least one of the screens displaying settings at least partially defining the manner of operation of the battery charger.
Group V, claims 148, drawn to a vehicle charger comprising a controller which transmits a signal responsive to detection of an interruption of power supply to the vehicle charger.
Group VI, claims 149, 152, drawn to a vehicle charger or method for controlling batteries of multiple vehicles comprising a controller capable of increasing or decreasing a rate of charge, starting charging or stopping charging based at least in part on the time of day.
Group VII, claims 150, drawn to a vehicle charger comprising a first core on a vehicle, a second core in a location stationary with respect to the vehicle, the second core providing an inductive charge to the first core; at least one sensor positioned to detect the position of the first core with respect to the second core; a display; and a controller coupled to the display and responsive to signals from the sensor to display at least one indicator on the display indicating a direction in which the vehicle must move for an improved positional relationship betweent he first and second cores.
Group VIII, claim 151, drawn to a vehicle charger comprising a first connector coupled to the battery and controller and located on one side of the vehicle; a second connector coupled to the battery and controller and located on a different side of the vehicle.

The inventions listed as Groups I-VIII do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a first remote controller, a transmitter and a receiver coupled to the second controller, and adapted for communication with the first controller, the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger as claimed therein is not present in the invention of Groups II-VIII. The special technical feature of the Group II invention: a user manipulatable control and operable by a user to enter a time of day at which a charging session will end as claimed therein is not present in the invention of Groups I, III-VIII. The special technical feature of the Group III invention: a controller which supplies electric power to the battery if a level of battery charge is below a threshold level, until the threshold level of battery charge is reached as claimed therein is not present in the invention of Groups I, II, IV-VIII. The special technical feature of the Group IV invention: a display having at least two different screens upon the display, at least one of the screens displaying information regarding a charging session, and at least one of the screens displaying settings at least partially defining the manner of operation of the battery charger as claimed therein is not present in the invention of Groups I, II, III or V-VIII. The special technical feature of the Group V invention: the controller transmitting a signal responsive to detection of an interruption of power supply to the vehicle charger as claimed therein is not present in the invention of Groups I-IV, VI-VIII. The special technical feature of the Group VI invention: a controller capable of increasing or decreasing a rate of charge, starting charging or stopping charging based at least in part on the time of day as claimed therein is not present in the invention of Groups I-V, VII-VIII. The special technical feature of the Group VII invention: a first core on a vehicle, a second core in a location stationary with respect to the vehicle, the second core providing an inductive charge to the first core; at least one sensor positioned to detect the position of the first core with respect to the second core; a display; and a controller coupled to the display and responsive to signals from the sensor to display at least one indicator on the display indicating a direction in which the vehicle must move for an improved positional relationship betweent he first and second cores as claimed therein is not present in the invention of Groups I-VI or VIII. The special technical feature of the Group VIII invention: a first connector coupled to the battery and controller and located on one side of the vehicle; a second connector coupled to the battery and controller and located on a different side of the vehicle as claimed therein is not present in the invention of Groups I-VII.

Groups I, II, III, IV, V, VI, VII and VIII lack unity of invention because even though the inventions of these groups require the technical features of a battery charger controller having a display, communications means, releasable connectors to connect power to the battery, the controller and a power source; a display and a memory, and increasing or decreasing power depending on a state of charge of the battery, these technical features are not special technical features as thet do not make a contribution over the prior art in view of US 6,963,186 B2 (HOBBS) 08 November 2005, column 10, lines 31-43; column11, lines 15-24; column17, lines 38-41; figures 2, 3.

Since none of the special technical features of the Group I, II, III, IV, V, VI, VII or VIII inventions are found in more than one of the inventions, unity of invention is lacking.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

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**Supplemental Box**

**In case the space in any of the preceding boxes is not sufficient.**
Continuation of:
Continuation of Box V, 2:

Regarding claim 30, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of a level of charge of the vehicle battery via the at least one transmitter (diagnostic device 130 and charger communicate to control charging, col. 7, lines 30-48).

Regarding claim 31, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of an estimated amount of battery charge time via the at least one transmitter (col. 7, lines 11-48).

Regarding claim 32, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of a characteristic of the battery via the at least one transmitter (diagnostic device 130 and charger communicate to control charging, col. 7, lines 30-48).

Regarding claim 33, Hobbs discloses at least one user-manipulatable control (diagnostic device 130) to change at least one of the charging voltage and the charging amperage of the vehicle charger (col. 7, lines 30-48).

Regarding claim 38, Hobbs discloses a display 107 coupled to the second controller to display information regarding a charging session (col. 7, lines 16-19), wherein the display is an LCD display or a LED display (col. 7, lines 19-23).

Regarding claim 40, Hobbs discloses the controller is adapted to communicate with the first controller by power line communication (cord 131, col. 7, lines 30-32).

Regarding claim 41, Hobbs discloses the electrical power cord comprises both power transmission and communication lines electrically connected to the second controller (wiring from input power 205 to controller 270 to diagnostic device 130 (fig. 2), which is shown physically connected to the controller by power/communication cord 131 in fig. 1; and which has communication with the controller, col. 7, lines 30-48).

Regarding claim 44, Hobbs discloses the at least one signal comprises data representative of a cost of electrical power (bill for the fuel, col. 7, lines 16-19).

Regarding claim 45, Hobbs discloses the at least one signal comprises at least one of data representative of a time of day and a signal to start or stop charging the battery of the vehicle (diagnostic device controls charger, col. 7, lines 34-48).

Claim 4 lacks an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of McGinley et al., hereinafter referred to as McGinley.

Regarding claim 4, Hobbs lacks the teaching the housing at least partially defines one of the opposite ends of the electrical power cord.
McGinley teaches a charger (abstract) where the housing at least partially defines one of the opposite ends of the electrical power cord (fig. 1).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have a housing which at least partially defines one of the opposite ends of the electrical power cord as taught by McGinley as the grid connection end of the plug of Hobbs in order to have a small charger which is easily transportable (McGinley, para. 0005).

Claims 5, 7-9, 22-25, 36-37, 42-43 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Kaplan et al., hereinafter referred to as Kaplan.

Regarding claim 5, Hobbs lacks the teaching wherein the second controller is adapted for communication with the first controller over the electrical power cord 125.
Kaplan teaches a vehicle charger (para. 0044) in which the controller 102 (para. 0043) is adapted for communication with a first controller (network communications, para. 0047) over the electrical power cord 208. Kaplan teaches this enables communication with a remote IPF module 134 (para. 0045) with no need for other special wiring.
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the power and communications cord of Kaplan as the cord of Hobbs in order to connect with a remote network without need for special wiring.

Regarding claim 7, Hobbs discloses the second controller is adapted for automatic establishment of communication with the first controller upon connection of the vehicle charger with at least one of the battery and the source of power.
Kaplan teaches automatic establishment of communication with the first controller upon connection of the vehicle charger with at least one of the battery and the source of power (remote IPF module 134 initials connection to adjust flow of power, para. 0135).
It would have been obvious to one of ordinary skill in the art at the time of the invention to establish automatic communication with the first controller as taught by Kaplan in the invention of Hobbs in order to notify grid operators when there is a problem (para. 0140-0142).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
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**Supplemental Box**

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of:

Regarding claim 8, Hobbs discloses the second controller is adapted for communication with a computer, but lacks the teaching of receiving electric power information from the Internet.
Kaplan teaches receiving electric power information from the Internet (para. 0078-0080, 0083). Kaplan further teaches this allows the invention to to optimize power transfer (para. 0093).
It would have been obvious to one of ordinary skill in the art at the time of the invention to receive electric power information from the internet as taught by Kaplan in the invention of Hobbs in order to optimize power transfer.

Regarding claim 9, Hobbs discloses the second controller is adapted for wireless communication with the computer via the at least one of the transmitter and receiver (network 275, fig. 2).

Regarding claims 22-24, Hobbs discloses the second controller automatically changes the charging state of the vehicle charger based at least in part upon a threshold (current threshold, col. 22, lines 17-20), but lacks the teaching the threshold is a cost of power to the battery (claim 22) or is received from a user (claim 23), or is input by a user-manipulatable control of the vehicle charger (claim 24).
Kaplan teaches the threshold is a cost of power to the battery received from a user (user controls participation in power aggregation preferences, para. 0227-0228; power aggregation includes a power cost by bidding, para. 0167), the user using a user-manipulatable control of the vehicle charger (para. 0227).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the cost of power to the battery be part of a charging threshold as taught by Kaplan in the threshold of Hobbs in order to allow the user to receive the best cost for the power by bidding.

Regarding claim 25, Hobbs discloses the second controller automatically changes the charging state of the vehicle charger by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56).

Regarding claims 36-37, Hobbs discloses there are two displays (107 and indicator lights 108, fig.1) at least one of the screens 108 displaying information regarding a charging session (charging complete or whether there is a fault, col. 7, lines 11-15), and at least one of the screens 107 displaying settings at least partially defining the manner of operation of the vehicle charger (amount of time to complete charging, etc., col. 7, lines 14-18), but lacks the teaching of a single display with at least two different screens upon the display or of a user manipulatable control enabling a user to navigate to another screen.
Kaplan teaches the display may be a user manipulatable control of a portable computer (para. 0227). It is inherent that a portable computer display can have two screens, where a user manipulatable control, such as a mouse, can toggle between two screens.
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the two screens of Hobbs both displayed on the computer screen of Kaplan, with a user manipulatable control to choose the screen as is known in the art, in order to allow the user to receive easily viewed updates to his charging session upon his laptop computer.

Regarding claim 42, Hobbs lacks the teaching of a battery of the vehicle charger, the battery of the vehicle charger coupled to the second controller and the electrical power cord, and supplying power to charge the battery of the vehicle in at least one state of the vehicle charger.
Kaplan teaches a battery 1508 of the vehicle charger, the battery of the vehicle charger coupled to a second controller and the electrical power cord, and supplying power to charge the battery of the vehicle in at least one state of the vehicle charger (backup battery for operation in case of power outage, para. 0198).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the vehicle charger of Hobbs include a battery as taught by Kaplan in order to retain setting during a power outage.

Regarding claim 43, Hobbs lacks the teaching the battery of the vehicle charger supplies power to charge the battery of the vehicle based at least in part upon the at least one signal from the first controller.
Kaplan teaches the battery of the vehicle charger supplies power to charge the battery of the vehicle (para. 0198) based at least in part upon the at least one signal from the first controller (processor 1502 receives signals from the processor 1502, which communicates with the remote system, para. 0196).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the battery of the vehicle charger upon a signal from the first controller as taught by Kaplan in the invention of Hobbs in order to provide the battery charging of the vehicle during a power outage.

Claims 15-17, 19 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Keith.

Regarding claims 15-17, Hobbs discloses a display 107 coupled to the second controller 100, the display displaying a power level by the battery during a vehicle charging session (power level displayed, col. 22, lines 44-46), but lacks the teaching of displaying an amount of power consumed (claim 15), the amount of power consumed by the battery is an amount of power that is estimated by the second controller or is received by the second controller (claim 16) or that the amount of power consumed is updated on the display by the second controller during the charging session (claim 17).
Keith teaches diplaying the amount of power consumed, which is estimated by the second controller and the amount of power consumed is updated (if voltage is within limits, the kilowatt hours are calculated and displayed, col. 22, lines 18-23).
It would have been obvious to one of ordinary skill in the art at the time of the invention to provide an update on the display of the power consumed as taught by Keith in the invention of Hobbs in order to allow the user to estimate a total power bill he may incur, and stop the charging if the bill is too large.

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Regarding claim 19, Hobbs teaches displaying the cost of power (col. 7, lines 16-19), but lacks the teaching the cost of power to the battery is received from the second controller by the first controller.
Keith teaches the cost of power to the battery is received from the second controller by the first controller (cost of power information transmitted, col. 19, lines 40-51; fig. 13).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the cost of power to the battery be accessed from the first controller as taught by Keith in the invention of Hobbs in order to receive the best price for the power used.

Claims 34-35, 39 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Vasant.

Regarding claims 34-35, Hobbs lacks the teaching of a reel upon which the electrical power cord is retractable (claim 34), wherein the reel is located on the vehicle (claim 35).
Vasant teaches a vehicle charger a reel upon which the electrical power cord is retractable, wherein the reel is located on the vehicle (retractable cord on the vehicle, col. 5, lines 4-6).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use a retractable reel on the vehicle as taught by Vasant with the cord of Hobbs, in order to keep the cord from extending from the vehicle body when not in use (Vasant, col. 5, lines 4-6).

Regarding claim 39, Hobbs teaches a display 107 coupled to the second controller 100 to receive vehicle charge setting commands from a user (by key pad 104 or diagnostic device 130) and to display information regarding a charging session (col. 7, lines 11-51; fig. 1).
Hobbs lacks the teaching the display is a touch screen display.
Vasant teaches a vehicle charger having a touch screen display (col. 10, lines 18-24, 45-50; fig. 11).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the touch screen display of Vasant as the display of Hobbs in order to have a display which will record responses which is more rugged in open air environments.

Claims 26-29, 46-47, 51-52, 55, 59-62, 66, 68-69, 73-79, 84, 86, 91-95, 98, 100, 104-107, 111, 113-114, 118-124, 129, 131, 136-139, 146-147 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Nor et al., hereinafter referred to as Nor.

Regarding claim 26, Hobbs lacks the teaching the second controller automatically changes the charging state of the vehicle charger based at least in part upon a time of day (claim 26); the time of day is received by the second controller from a user of the vehicle charger (claim 27), or the time of day is input to the vehicle charger via a user-manipulatable control of the vehicle charger (claim 28).
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49).
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

Regarding claim 29, Hobbs discloses the second controller automatically changes the charging state of the vehicle charger by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56).

Regarding claim 46, Hobbs discloses a vehicle charger for charging a battery of a vehicle in the course of a charging session (abstract), the vehicle charger comprising:
a controller 100;
a display 107 coupled to the controller 100 and adapted to display a time (time estimated to complete charge, col. 7, lines 17-18); and
a user-manipulatable control 130 coupled to the controller 100 (col. 6, line 59 to col. 7, line 27);
the controller changing the supply of electric power to the vehicle battery during the course of the charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56);
based at least in part upon the time needed to charge the vehicle battery and adapted to display a time (time estimated is displayed, col. 7, lines 17-18).
Hobbs lacks the teaching the user-manipulatable control is operable by a user to enter a time of day at which the charging session will end, or the controller changes the supply of electric power supplied based on the time of day entered by the user.
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49)
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

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Regarding claim 95, Hobbs discloses a vehicle charger for charging a battery of a vehicle (abstract), the vehicle charger comprising:
a display 107;
a user-manipulatable control 130 within reach of the user seated within the vehicle (the diagnostic device may be a hand held PDA, col. 7, lines 34-40; and may be wireless "cellular telephony" col. 7, lines 30-48);
a controller 100 coupled to the display 107 and to the battery 152 (fig. 1-2);
the controller changing a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56) based at least in part upon the time (time estimated is displayed, col. 7, lines 17-18), but lacks the teaching the user-manipulatable control is operable by a user to enter a time of day at which the charging session will end, or the controller changes the supply of electric power supplied based on the time of day entered by the user.
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49).
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

Regarding claim 146, Hobbs discloses a vehicle charger for charging a battery of a vehicle in the course of a charging session (abstract), the vehicle charger comprising:
an electrical power cord 125 releasably attachable to the vehicle (by connector 126, col. 6, lines 4-11 ) and the source of power 105/205 (via cable 120 and fuse or circuit breaker 222, fig. 1, 2; col. 5, lines 55-63; col. 9, lines 10-12);
a controller 100/270 (fig. 1-2);
a housing 102 attached to the electrical cord 125;
a display 107 on the housing 102, coupled to the controller (see fig. 1), and adapted to display a time (time estimated is displayed, col. 7, lines 17-18); and
a user-manipulatable control 130 coupled (by wire 131 or wirelessly, col. 7, lines 30-48) to the controller 100 and operable by a user (technician, col. 7, line 37-40);
the controller changing the supply of electric power to the vehicle battery during the course of the charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56) based at least in part upon the time (time estimated is displayed, col. 7, lines 17-18), but lacks the teaching the user-manipulatable control is operable by a user to enter a time of day or the charging is based at least in part upon the time of day entered by the user.
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49)
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

Regarding claim 147, Hobbs discloses a vehicle charger for charging a battery of a vehicle in the course of a charging session (abstract), and adapted for communication with a first controller 130 remote from the vehicle and vehicle charger 100 (diagnostic controller 130 may be a handheld PDA and may be "cellular telephony", col. 7, lines 29-48), the vehicle charger comprising:
a display 107;
a user-manipulatable control 130;
a second controller 100 coupled to the display 107 and operable to change a supply of electric power to charge the battery during the course of a charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56; fig. 1-2); and
at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller (network 275, fig. 2),
the second controller responsive to at least one signal from the first controller by changing a charging state of the vehicle charger (diagnostic device 130 can program charger 100, col. 7, lines 30-43), but lacks the teaching of changing the charging based at least in part upon the time of day entered by the user.
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49).
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

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Regarding claims 47, 98, Hobbs discloses the electrical power cord 125 is releasably attachable to the vehicle (by connector 126, col. 6, lines 4-11 ) and the source of power 105/205 (via cable 120 and fuse or circuit breaker 222, fig. 1, 2; col. 5, lines 55-63; col. 9, lines 10-12).

Regarding claim 51, Hobbs discloses the electrical power cord 125 is releasably attachable to the vehicle (by connector 126, col. 6, lines 4-11 ) and the source of power 105/205 (via cable 120 and fuse or circuit breaker 222, fig. 1, 2; col. 5, lines 55-63; col. 9, lines 10-12).

Regarding claim 52, Hobbs discloses a housing 102 in which the second controller is located, the housing coupled to and at least partially located between opposite ends of the electrical power cord (see housing 102 between power cord end 126 and 120, fig. 1).

Regarding claims 55, 100, Hobbs discloses at least one of a transmitter and a receiver (network 275, fig. 2), wherein the controller is adapted for wireless communication with a computer via the at least one of the transmitter and receiver (col. 11, lines 15-24).

Regarding claims 59, 104, Hobbs discloses a display 107 coupled to the second controller 100 (fig 1), the display displaying a level of charge of the battery (indication to alert user when battery is charged, col. 3, lines 15-26).

Regarding claims 60, 105, Hobbs discloses a display 107 coupled to the second controller 100, the display displaying an amount of time for the battery to be fully charged (time to complete charge, col. 7, lines 16-19) based upon information regarding the battery received by the second controller (controller 270 controls display, col. 10, lines 31-38).

Regarding claims 61, 106, Hobbs discloses the amount of time is an amount of time that is estimated by the second controller (amount of time estimated, col. 7, lines 17-18) or received by the second controller.

Regarding claims 62, 107, Hobbs discloses the amount of time is updated on the display 107 by the second controller 100 during a charge session (time estimated is displayed, col. 7, lines 17-18; this is done in real time, col. 22, lines 44-46).

Regarding claim 66, 111, Hobbs discloses a display 107 displaying a cost of power to the battery per unit time (time for charge and bill for fuel are displayed, col. 7, lines 16-19).

Regarding claims 68, 113, Hobbs discloses a display displaying a total power cost of the charging session (bill for the fuel (charge) is displayed, col. 7, lines 16-19).

Regarding claims 69, 114, Hobbs discloses the total power cost is updated on the display by the second controller during a charging session (bill for the fuel (charge) is displayed, col. 7, lines 16-19; power level is displayed in real time, col. 22, lines 44-46).

Regarding claim 73-75, 118-120, Hobbs lacks the teaching the second controller automatically changes the charging state of the vehicle charger based at least in part upon a time of day the charging of the battery will begin (claims 73, 118); the time of day the charging will begin is received by the second controller from a user of the vehicle charger (claims 74, 119), or the time of day is input to the vehicle charger via a user-manipulatable control of the vehicle charger (claims 75, 120).
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49)
Nor further teaches the time of day is input to the controller of the vehicle charger via a user-manipulatable control of the vehicle charger (manual interface for personality data, col. 10, lines 17-33).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

Regarding claims 76, 121, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of a level of charge of the vehicle battery via the at least one transmitter (diagnostic device 130 and charger communicate to control charging, col. 7, lines 30-48).

Regarding claims 77, 122, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of an estimated amount of battery charge time via the at least one transmitter (col. 7, lines 11-48).

Regarding claims 78, 123, Hobbs discloses the vehicle charger comprises at least one transmitter coupled to the second controller (network 275, fig. 2), and wherein the second controller is adapted to transmit at least one electrical signal representative of a characteristic of the battery via the at least one transmitter (diagnostic device 130 and charger communicate to control charging, col. 7, lines 30-48).

Regarding claims 79, 124, Hobbs discloses at least one user-manipulatable control (diagnostic device 130) to change at least one of the charging voltage and the charging amperage of the vehicle charger (col. 7, lines 30-48).

Regarding claims 84, 129, Hobbs discloses the display is an LCD display or a LED display (col. 7, lines 19-23).

Regarding claims 86, 131, Hobbs discloses the controller is adapted to communicate with another controller remote from the vehicle charger and the vehicle by power line communication (cord 131, col. 7, lines 30-32).

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Regarding claims 91, 136, Hobbs the controller of the vehicle charger is responsive to at least one signal from a controller remote from the vehicle charger and the vehicle by changing the supply of electric power to the battery (programming of the controller 100 by diagnostic device 130, col. 7, lines 29-43), but lacks the teaching wherein the at least one signal comprises data representative of a time of day. Nor teaches a time of day signal received from a remote controller, and using the signal to change the supply of electric power to the battery (setting the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.

Regarding claims 92, 137, Hobbs discloses the controller of the vehicle charger is responsive to at least one signal from a controller remote from the vehicle charger 130 and the vehicle by changing the supply of electric power to the battery, and wherein the at least one signal comprises a signal to start or stop charging the battery of the vehicle (diagnostic device 130 controls programming of charger, col. 7, lines 34-48).

Regarding claims 93, 138, modified Hobbs teaches a time of day as shown above, and Hobbs further teaches the controller supplies electric power to the battery if a level of battery charge is below a threshold level of battery charge independent of the time of day entered by the user, the controller supplying electric power to the battery until the threshold level of battery charge is reached (predetermined limit of charging monitored, col. 18, lines 42-60).

Regarding claims 94, 139, Hobbs discloses the controller transmits a signal to another controller remote from the vehicle charger in the event of power loss to the vehicle charger (charger 100 communicates with remote diagnostic device 130 to diagnose faults, col. 7, lines 45-48; loss of power is a type of fault).

Claims 48-50, 80-81, 85, 96-97, 125-126, 130 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view Nor and further in view of Vasant.

Regarding claims 48-49, 96-97, Hobbs lacks the teaching the display is mounted in a console or a dashboard within the vehicle.
Vasant teaches the display may be mounted in a console or a dashboard within the vehicle (display 110 in dashboard, fig. 11; a dashboard is inherently a console).
It would have been obvious to one of ordinary skill in the art at the time of the invention to mount the display in a console or dashboard as taught by Vasant in the invention of Hobbs in order to enable the user to monitor or control the charge the vehicle without exposing himself to the elements.

Regarding claim 50, Hobbs lacks teaching the user-manipulatable control is within reach of the user while the user is seated within the vehicle.
Vasant teaches the user-manipulatable control is within reach of the user while the user is seated within the vehicle (display 110 in dashboard, fig. 11; the display may be a touch screen, col. 10, lines 18-24, 45-50).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the user-manipulatable control is within reach of the user while the user is seated within the vehicle as taught by Vasant in the invention of Hobbs in order to enable the user to monitor or control the the charge the vehicle without exposing himself to the elements.

Regarding claims 80-81, 125-126, Hobbs lacks the teaching of a reel upon which the electrical power cord is retractable (claim 80, 125), wherein the reel is located on the vehicle (claims 81, 126).
Vasant teaches a vehicle charger a reel upon which the electrical power cord is retractable, wherein the reel is located on the vehicle (retractable cord on the vehicle, col. 5, lines 4-6).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use a retractable reel on the vehicle as taught by Vasant with the cord of Hobbs, in order to keep the cord from extending from the vehicle body when not in use (Vasant, col. 5, lines 4-6).

Regarding claims 85, 130, Hobbs teaches a display 107 coupled to the second controller 100 to receive vehicle charge setting commands from a user (by key pad 104 or diagnostic device 130) and to display information regarding a charging session (col. 7, lines 11-51; fig. 1).
Hobbs lacks the teaching the display is a touch screen display.
Vasant teaches a vehicle charger having a touch screen display (col. 10, lines 18-24, 45-50; fig. 11).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the touch screen display of Vasant as the display of Hobbs in order to have a display which will record responses which is more rugged in open air environments.

Claim 53 lacks an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Nor and further in view of McGinley.

Regarding claim 53, Hobbs lacks the teaching the housing at least partially defines one of the opposite ends of the electrical power cord.
McGinley teaches a charger (abstract) where the housing at least partially defines one of the opposite ends of the electrical power cord (fig. 1).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have a housing which at least partially defines one of the opposite ends of the electrical power cord as taught by McGinley as the grid connection end of the plug of Hobbs in order to have a small charger which is easily transportable (McGinley, para. 0005).

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Claims 54, 56-58, 70-72, 82-83, 87-90, 99, 101-103, 115-117, 127-128,132-135 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Nor and further in view of Kaplan.

Regarding claim 54, 99, Hobbs discloses the controller 100 is adapted for communication (through network 275 or through wired or wireless connection 131 with another controller 131 remote from the vehicle and the vehicle charger, col. 7, lines 29-43), but lacks the teaching the communication is over the power cord.
Kaplan teaches a vehicle charger (para. 0044) in which the controller 102 (para. 0043) is adapted for communication with a first controller (network communications, para. 0047) over the electrical power cord 208. Kaplan teaches this enables communication with a remote IPF module 134 (para. 0045) with no need for other special wiring.
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the power and communications cord of Kaplan as the cord of Hobbs in order to connect with a remote network without need for special wiring.

Regarding claims 56, 101, Hobbs lacks the teaching the second controller is adapted for automatic establishment of communication with the first controller upon connection of the vehicle charger with at least one of the battery and the source of power.
Kaplan teaches automatic establishment of communication with the first controller upon connection of the vehicle charger with at least one of the battery and the source of power (remote IPF module 134 initials connection to adjust flow of power, para. 0135).
It would have been obvious to one of ordinary skill in the art at the time of the invention to establish automatic communication with the first controller as taught by Kaplan in the invention of Hobbs in order to notify grid operators when there is a problem (para. 0140-0142).

Regarding claims 57, 102, Hobbs discloses the second controller is adapted for communication with a computer (controller 100/270 communicates over line 131 or wirelessly with diagnostic controller 130, col. 7, lines 10-48), but lacks the teaching of receiving electric power information from the Internet.
Kaplan teaches receiving electric power information from the Internet (para. 0078-0080, 0083). Kaplan further teaches this allows the invention to to optimize power transfer (para. 0093).
It would have been obvious to one of ordinary skill in the art at the time of the invention to receive electric power information from the internet as taught by Kaplan in the invention of Hobbs in order to optimize power transfer.

Regarding claims 58, 103, Hobbs discloses the second controller is adapted for wireless communication with the computer via the at least one of the transmitter and receiver (network 275, fig. 2).

Regarding claims 70-72, 115-117,Hobbs discloses the second controller automatically changes the charging state of the vehicle charger based at least in part upon a threshold (current threshold, col. 22, lines 17-20), but lacks the teaching the threshold is a cost of power to the battery (claims 70, 115) or is received from a user (claims 71, 116), or is input by a user-manipulatable control of the vehicle charger (claims 72, 117).
Kaplan teaches the threshold is a cost of power to the battery received from a user (user controls participation in power aggregation preferences, para. 0227-0228; power aggregation includes a power cost by bidding, para. 0167), the user using a user-manipulatable control of the vehicle charger (para. 0227).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the cost of power to the battery be part of a charging threshold as taught by Kaplan in the threshold of Hobbs in order to allow the user to receive the best cost for the power by bidding.

Regarding claims 82-83, 127-128, Hobbs discloses there are two displays (107 and indicator lights 108, fig.1) at least one of the screens 108 displaying information regarding a charging session (charging complete or whether there is a fault, col. 7, lines 11-15), and at least one of the screens 107 displaying settings at least partially defining the manner of operation of the vehicle charger (amount of time to complete charging, etc., col. 7, lines 14-18), but lacks the teaching of a single display with at least two different screens upon the display or of a user manipulatable control enabling a user to navigate to another screen.
Kaplan teaches the display may be a user manipulatable control of a portable computer (para. 0227). It is inherent that a portable computer display can have two screens, where a user manipulatable control, such as a mouse, can toggle between two screens.
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the two screens of Hobbs both displayed on the computer screen of Kaplan, with a user manipulatable control to choose the screen as is known in the art, in order to allow the user to receive easily viewed updates to his charging session upon his laptop computer.

Regarding claims 87, 132, Hobbs lacks the teaching wherein the electrical power cord comprises both power transmission and communication lines electrically connected to the controller.
Kaplan teaches a vehicle charger (para. 0044) in which the controller 102 (para. 0043) is adapted for communication with a first controller (network communications, para. 0047) over the electrical power cord 208. Kaplan teaches this enables communication with a remote IPF module 134 (para. 0045) with no need for other special wiring.
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the power and communications cord of Kaplan as the cord of Hobbs in order to connect with a remote network without need for special wiring.

Regarding claims 88, 133, Hobbs lacks the teaching of a battery of the vehicle charger, the battery of the vehicle charger coupled to the second controller and the electrical power cord, and supplying power to charge the battery of the vehicle in at least one state of the vehicle charger.
Kaplan teaches a battery 1508 of the vehicle charger, the battery of the vehicle charger coupled to the second controller and the electrical power cord, and supplying power to charge the battery of the vehicle in at least one state of the vehicle charger (backup battery for operation in case of power outage, para. 0198).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the vehicle charger of Hobbs include a battery as taught by Kaplan in order to retain setting during a power outage.

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Regarding claims 89, 134, Hobbs lacks the teaching the battery of the vehicle charger supplies power to charge the battery of the vehicle based at least in part upon the at least one signal from the first remote controller.
Kaplan teaches the battery of the vehicle charger supplies power to charge the battery of the vehicle (para. 0198) based at least in part upon the at least one signal from a controller remote from the vehicle charger and the vehicle (processor 1502 receives signals from the processor 1502, which communicates with the remote system, para. 0196).
It would have been obvious to one of ordinary skill in the art at the time of the invention to use the battery of the vehicle charger upon a signal from the first controller as taught by Kaplan in the invention of Hobbs in order to provide the battery charging of the vehicle during a power outage.

Regarding claims 90, 135,Hobbs discloses the at least one signal comprises data representative of a cost of electrical power (bill for the fuel, col. 7, lines 16-19), but lacks the teaching that the at least one signal is responsive to a signal from a controller remote from the vehicle charger and the vehicle by changing the supply of electric power to the battery.
Kaplan teaches the at least one signal is responsive to a signal from a controller remote from the vehicle charger and the vehicle by changing the supply of electric power to the battery (receiving electrical power information from the internet, para. 0078-0080, 0083).
Kaplan further teaches this allows the invention to to optimize power transfer (para. 0093).
It would have been obvious to one of ordinary skill in the art at the time of the invention to receive electric power information from the internet as taught by Kaplan in the invention of Hobbs in order to optimize power transfer.

Claims 63-65, 67, 108-110, 112, 142 lack an inventive step under PCT Article 33(3) as being obvious over Hobbs in view of Nor and further in view of Keith.

Regarding claims 63-65, 108-110, Hobbs discloses a display 107 coupled to the second controller 100, the display displaying a power level by the battery during a vehicle charging session (power level displayed, col. 22, lines 44-46), but lacks the teaching of displaying an amount of power consumed (claims 63, 108), the amount of power consumed by the battery is an amount of power that is estimated by the second controller or is received by the second controller (claims 64, 109) or that the amount of power consumed is updated on the display by the second controller during the charging session (claims 65, 110).
Keith teaches displaying the amount of power consumed, which is estimated by the second controller and the amount of power consumed is updated (if voltage is within limits, the kilowatt hours are calculated and displayed, col. 22, lines 18-23).
It would have been obvious to one of ordinary skill in the art at the time of the invention to provide an update on the display of the power consumed as taught by Keith in the invention of Hobbs in order to allow the user to estimate a total power bill he may incur, and stop the charging if the bill is too large.

Regarding claims 67, 112, Hobbs teaches displaying the cost of power (col. 7, lines 16-19), but lacks the teaching the cost of power to the battery is received from the second controller by the first controller remote from the second controller.
Keith teaches the cost of power to the battery is received from the second controller by the first controller (cost of power information transmitted, col. 19, lines 40-51; fig. 13).
It would have been obvious to one of ordinary skill in the art at the time of the invention to have the cost of power to the battery be accessed from the first controller as taught by Keith in the invention of Hobbs in order to receive the best price for the power used.

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2009/054174

**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Regarding claim 142, Hobbs discloses a vehicle charger for charging a battery of a vehicle in the course of a charging session (abstract), and adapted for communication with a first controller 130 remote from the vehicle and vehicle charger 100 (diagnostic controller 130 may be a handheld PDA and may be "cellular telephony", col. 7, lines 29-48), the vehicle charger comprising:
a controller 100;
a display 107;
the second controller changing the supply of electric power to the vehicle battery during the course of the charging session by at least one of increasing a rate of charge of the battery, decreasing the rate of charge of the battery, starting battery charging, or stopping battery charging (col. 14, lines 47-56);
based at least in part upon the time (time estimated is displayed, col. 7, lines 17-18);
and at least one of a transmitter and a receiver coupled to the second controller and adapted for communication with the first controller (network 275 communicates with diagnostic device 130, in the embodiment where it is wireless, col. 7, lines 29-48; fig. 1-2).
Hobbs lacks the teaching the charging is based on a time of day or second controller displays an indicator indicating a status of communication between the first and second controllers.
Nor teaches a vehicle charger (abstract) in which the controller 82 automatically changes the charging state of the vehicle the charger based at least in part upon a time of day (set the price depending on the time of day, and operate the charging during that time, col. 10, lines 34-49).
It would have been obvious to one of ordinary skill in the art at the time of the invention to update the charging state of the vehicle charger with respect to a user defined time of day as taught by Nor in the invention of Hobbs in order to allow the user to charge the vehicle during times when the prices are lower.
Hobbs as modified lacks the teaching of the second controller displaying an indicator indicating a status of communication between the first and second controllers.
Keith teaches a second controller (charge station computer 34, col. 5, lines 10-19) displaying an indicator indicating a status of communication (proper connection made between the controllers, and displayed to operator, col. 15, lines 25-53) between the first 34 and second (vehicle charge controller 72, col. 5, lines 57-61) controllers.
It would have been obvious to one of ordinary skill in the art at the time of the invention to display a communications indicator as taught by Keith in the invention of Hobbs in order to allow the operator to know when it is appropriate to proceed to the next step, such as entering the credit card for payment of the fuel.

Claims 1-139, 142, 146-147 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 013350-9003-US35 |

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| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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| | 1 | 6424158 | | 2002-07-23 | Klang | |
| | 2 | 7917179 | | 2011-03-29 | Kokubo | |

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|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
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|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 013350-9003-US35 |

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☒ A certification statement is not submitted herewith.

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| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-01-07 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

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| **EFS ID:** | 44734142 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Christopher B. Austin/Eliana Carter |
| **Filer Authorized By:** | Christopher B. Austin |
| **Attorney Docket Number:** | 013350-9003-US35 |
| **Receipt Date:** | 13-JAN-2022 |
| **Filing Date:** | 01-MAR-2021 |
| **Time Stamp:** | 07:40:05 |
| **Application Type:** | Utility under 35 USC 111(a) |

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| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
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| | 1 | JP2004142661 | JP | | 2004-05-20 | Kawakami et al. | | X |

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|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

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| | 1 | English Translation of relevant text for WO 0118899, 3 pages (Year: 2001). | |

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| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

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| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-04-11 |
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| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

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(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2004-142661
(P2004-142661A)
(43)公開日　平成16年5月20日(2004.5.20)

| (51)Int.Cl.[7] | F I | | テーマコード（参考） |
|---|---|---|---|
| B60R 16/04 | B60R | 16/04 W | 2G016 |
| B60R 16/02 | B60R | 16/04 S | 5G003 |
| G01R 31/36 | B60R | 16/02 670P | 5H030 |
| H01M 10/48 | G01R | 31/36 A | |
| H02J 7/00 | H01M | 10/48 P | |

審査請求 未請求　請求項の数 9　OL　（全 21 頁）　最終頁に続く

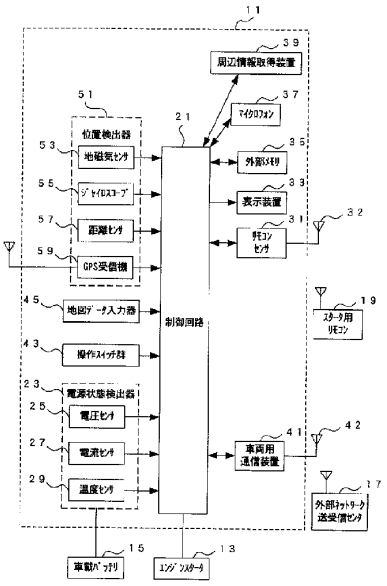
(21)出願番号　特願2002-311388(P2002-311388)
(22)出願日　平成14年10月25日(2002.10.25)

(71)出願人　000004260
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愛知県刈谷市昭和町１丁目１番地　株式会社デンソー内

最終頁に続く

(54)【発明の名称】車両用電源管理装置

(57)【要約】
【課題】車両利用者が車両から離れていても、車載バッテリの充電残容量低下を警告できる車両用電源管理装置を提供する。
【解決手段】車両用電源管理装置１１は、車載バッテリ１５が残容量不足状態であると判定されると、車載バッテリ１５が残容量不足状態であることを表す警告通知信号を、無線通信により、車両側通信装置４１から外部ネットワーク送受信センタ１７を経由して利用者側通信装置２０に対して出力する。無線通信により警告通知情報を出力することで、車両から離れた場所に居る車両利用者に対して、車載バッテリ１５が残容量不足状態に陥ったことを通知できる。これにより、長期間にわたり駐車状態となる場合においても、車両利用者は、バッテリ充電残容量の減少を知ることができ、車載バッテリ１５がバッテリ上がり状態に至る前に車載バッテリ１５の交換或いは充電などの対策を施すことが可能となる。
【選択図】　図２






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【特許請求の範囲】
【請求項１】
車両に備えられる電源装置の充電残容量を検出する電源状態検出手段と、
前記電源状態検出手段による検出結果に基づき、前記電源装置の充電残容量が適正容量下限値を下回る場合に、前記電源装置が残容量不足状態であると判定する電源残容量不足判定手段と、
を備えて、前記電源装置の充電状態を管理する車両用電源管理装置であって、前記電源残容量不足判定手段により前記電源装置が残容量不足状態であると判定されると、前記電源装置が残容量不足状態であることを表す警告通知情報を、無線通信により、前記車両から離れた場所で車両利用者により使用される利用者側通信装置に対して出力する残容量不足通知手段を備えること、
を特徴とする車両用電源管理装置。
【請求項２】
前記車両に搭載される電気機器のうち稼働中の電気機器を表す稼働機器情報を、無線通信により、前記利用者側通信装置に対して出力する稼働機器情報出力手段を備えること、
を特徴とする請求項１に記載の車両用電源管理装置。
【請求項３】
前記電源装置の充電残容量を増加させるために前記車両のエンジンを始動するエンジン始動手段を備えること、
を特徴とする請求項１または請求項２に記載の車両用電源管理装置。
【請求項４】
前記エンジン始動手段は、前記電源残容量不足判定手段により前記電源装置が残容量不足状態であると判定されると、前記車両のエンジンを始動すること、
を特徴とする請求項３に記載の車両用電源管理装置。
【請求項５】
前記エンジン始動手段は、無線通信により前記利用者側通信装置からエンジン始動指令を受信すると、前記車両のエンジンを始動すること、
を特徴とする請求項３に記載の車両用電源管理装置。
【請求項６】
前記電源装置の充電残容量を増加させるために前記車両のエンジンが始動された後に、前記電源装置の充電完了を判断する充電完了判断手段と、
前記充電完了判断手段により前記電源装置の充電が完了したと判断されると、前記エンジンを停止させるエンジン停止手段と、
を備えることを特徴とする請求項１から請求項５のいずれかに記載の車両用電源管理装置。
【請求項７】
前記エンジン停止手段により前記エンジンが停止されると、前記電源装置の充電完了を表す充電完了通知情報を、無線通信により前記利用者側通信装置に対して出力する充電完了通知手段を備えること、
を特徴とする請求項６に記載の車両用電源管理装置。
【請求項８】
少なくとも前記車両の周辺の映像または前記車両の周辺の音のいずれかを含む車両周辺情報を取得する周辺情報取得手段と、
前記周辺情報取得手段により取得された前記車両周辺情報を、無線通信により前記利用者側通信装置に対して出力する周辺情報出力手段と、
を備えることを特徴とする請求項１から請求項７のいずれかに記載の車両用電源管理装置。
【請求項９】
請求項１から請求項８のいずれかに記載の車両用電源管理装置であって、
前記車両の走行経路を案内する走行経路案内装置と共に前記車両に搭載されること、



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を特徴とする車両用電源管理装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、車両に備えられる電源装置の充電状態を管理する車両用電源管理装置に関する。
【０００２】
【従来の技術】
従来より、車両には所定の駆動電圧（例えば１２［Ｖ］）を出力できるように充電された電源装置（バッテリ）が備えられており、電源装置は、車載電気機器などの車両各部に対して電力供給を行っている。
【０００３】
そして、電源装置は、充電残容量が適正容量範囲内に設定されることで車両各部に十分な電力を供給でき、電力供給を受ける車載電気機器は、正常動作することができる。
しかし、車載電気機器の電力消費量が過剰に増加することや、駐車期間が長期化することなどの要因により、電源装置に蓄積されている電気エネルギが過剰に消費されると、電源装置の充電残容量が減少する場合がある。
【０００４】
なお、電源装置における充電残容量の適正容量範囲は、少なくとも車載電気機器への電力供給が可能な最小容量である容量下限値と、電源装置として蓄積可能な最大容量である容量上限値とが境界となる容量範囲に設定される。また、充電残容量の適正容量範囲は、電圧変動の影響などを考慮して、一定の余裕を含んで設定されることから、充電残容量が適正容量下限値（適正容量範囲の下限値）よりも僅かに下回る状態の電源装置は、一部の車載電気機器の稼働に必要な電力を供給することは可能である。
【０００５】
しかし、充電残容量が適正容量下限値（適正容量範囲の下限値）よりもさらに低下して、電源装置の出力電圧レベルが許容電圧下限値（車載電気機器の駆動に必要な電圧の下限値）を下回る場合には、電源装置が供給する電力が不足するため、車載電気機器の正常動作が不可能となる。なお、このように電源装置の出力電圧レベルが許容電圧下限値を下回り、必要最低限の電力供給が不可能な状態となる電源装置は、いわゆるバッテリ上がり状態の電源装置である。
【０００６】
この問題に対して、主たる電源装置（車載バッテリ）とは別に、補助電源装置（補助バッテリ）を備えておき、車載バッテリの充電残容量が低下した場合には、補助バッテリが車両各部に電力供給を行うよう構成された電源管理装置（電源電圧監視システム）が提案されている（特許文献１参照）。
【０００７】
また、この電源管理装置は、車載バッテリの出力電圧レベルが悪化した場合には、警告表示を行うことで、運転者（車両利用者）に対して車載バッテリの出力電圧レベル悪化を通知するよう構成されている。
【０００８】
【特許文献１】
特開２００１－１６６０１７号公報（図１、段落番号［００１８］、［００２３］参照）
【０００９】
【発明が解決しようとする課題】
しかし、上記特許文献に記載された電源管理装置（以下、従来電源管理装置ともいう）では、車載バッテリの出力電圧レベル低下に加えて、補助バッテリの出力電圧レベルまでもが許容電圧下限値を下回る状態まで低下した場合には、車両各部への電力供給が不可能となる虞がある。
【００１０】



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これに対しては、補助バッテリとして大容量電源装置（大容量バッテリ）を備えて、補助バッテリの出力電圧レベルが低下するまでの時間を長くすることで、車両各部への電力供給が不可能となるのを回避する対策方法が考えられる。しかし、大容量バッテリは体積が大きくなるために、車両での設置スペースの確保が難しいという問題がある。また、大容量バッテリであっても、充電容量は有限であることから、出力電圧レベルの低下を完全に解消することは難しい。

【００１１】

なお、従来電源管理装置は、上記のように警告表示を行う構成であることから、警告表示を見た車両利用者が、補助バッテリによる電力供給が可能な期間内に車載バッテリを交換することで、車両各部への電力供給が不可能となるのを防ぐことができる。

【００１２】

しかし、車両において従来電源管理装置による警告表示が行われたとしても、車両利用者が車両から離れている場合には、車両利用者は、警告表示を見ることが出来ないため、車載バッテリの出力電圧レベルが悪化していることを知ることができない。とりわけ、長期間にわたり車両が駐車状態となる場合には、車両利用者への通知ができず、また、駐車中に稼働する車載電気機器（例えば、イモビライザなど）での電力消費量が累積されるために、車載バッテリおよび補助バッテリのそれぞれの出力電圧レベルが許容電圧下限値を下回る状態に陥る可能性が高くなる。

【００１３】

本発明は、こうした問題に鑑みなされたものであり、車両利用者が車両から離れていても、車載バッテリの充電残容量低下を警告できる車両用電源管理装置を提供することを目的とする。

【００１４】

【課題を解決するための手段】

上記目的を達成するためになされた請求項１に記載の発明は、車両に備えられる電源装置の充電状態を管理する車両用電源管理装置であって、電源装置の充電残容量が適正容量下限値を下回り、電源装置が残容量不足状態であると判定されると、電源装置が残容量不足状態であることを表す警告通知情報を、無線通信により、利用者側通信装置に対して出力することを特徴とする。

【００１５】

このように、無線通信によって警告通知情報を出力することで、車両から離れた場所にいる車両利用者に対して、電源装置が残容量不足状態に陥ったことを通知することができる。これにより、長期間にわたり駐車状態となる場合においても、電源装置（バッテリ）がバッテリ上がり状態に至る前までに、車載バッテリの交換或いは充電などの対策を施す等の対策を施すことが可能となり、車載電気機器を正常動作させることができる。

【００１６】

なお、上述（請求項１）の車両用電源管理装置は、請求項２に記載のように、稼働機器情報出力手段が、車両に搭載される電気機器のうち稼働中の電気機器を表す稼働機器情報を、無線通信により利用者側通信装置に対して出力するとよい。これにより、車両利用者は、車両から離れていても、稼働機器情報を取得（受信）することで、充電残容量の低下原因である電気機器を容易に特定することができ、車両利用者がその電気機器を停止することで、電源装置の充電残容量が更に低下するのを抑制することができる。

【００１７】

そして、上述（請求項１または請求項２）の車両用電源管理装置は、請求項３に記載のように、エンジン始動手段が、車両のエンジンを始動して電源装置の充電残容量を増加させるとよく、これにより、電源装置がバッテリ上がり状態に至るのを防止できる。

【００１８】

なお、エンジン始動手段は、例えば、請求項４に記載のように、電源装置が残容量不足状態と判定された場合に車両のエンジンを始動することで、充電残容量が適正容量下限値を大幅に下回る前に、電源装置の充電残容量を増加させることができ、バッテリ上がり状態



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に至るのを防ぐことができる。

【００１９】

また、エンジン始動手段は、例えば、請求項５に記載のように、無線通信により、利用者側通信装置からエンジン始動指令を受信した場合に、車両のエンジンを始動するとよい。これにより、車両利用者が車両まで移動することなく、バッテリの充電残容量を増加させることができ、車両まで移動するという煩雑さを解消できる。

【００２０】

次に、上述（請求項１から請求項５のいずれか）の車両用電源管理装置は、請求項６に記載のように、バッテリ充電残容量を増加させるためのエンジン始動後に、充電完了判断手段により電源装置の充電が完了したと判断されると、エンジン停止手段がエンジンを停止させるとよい。これにより、エンジンの動作時間のうち、電源装置の充電に貢献しない無駄な時間を短縮でき、無駄な燃料の消費を抑えることができる。

【００２１】

なお、充電完了判断手段およびエンジン停止手段を備える車両用電源管理装置は、請求項７に記載のように、エンジンが停止された場合に、充電完了通知手段が、電源装置の充電完了を表す充電完了通知情報を無線通信により利用者側通信装置に対して出力するとよい。これにより、車両利用者は、車両から離れていても、利用者側通信装置を用いて充電完了通知情報を取得（受信）することで、電源装置の充電残容量が適正容量範囲内まで増加したことを確認できる。

【００２２】

次に、上述（請求項１から請求項７のいずれか）の車両用電源管理装置は、請求項８に記載のように、周辺情報取得手段が、少なくとも車両の周辺の映像または車両の周辺の音のいずれかを含む車両周辺情報を取得した後、周辺情報出力手段が、無線通信により、車両周辺情報を利用者側通信装置に対して出力するように構成すると良い。

【００２３】

これにより、車両利用者は、車両から離れた場所であっても、車両周辺情報を取得（受信）することにより、車両周辺の状況に基づき、電源装置の充電残容量の低下原因を推測することができる。また、エンジン始動手段を備える場合には、車両利用者が、車両周辺に人が存在していないことを確認することで、エンジン始動による危険性が無いことを確認することができる。

【００２４】

そして、上述（請求項１から請求項８のいずれか）の車両用電源管理装置は、請求項９に記載のように、車両の走行経路を案内する走行経路案内装置と共に車両に搭載されるとよく、これにより、電源装置の充電残容量の低下に伴う走行経路案内装置の動作不良を防止でき、走行経路案内装置の正常動作を維持することができる。

【００２５】

【発明の実施の形態】

以下に、本発明が適用された実施例について図面を用いて説明する。なお、本発明の実施の形態は、下記の実施例に何ら限定されることなく、本発明の技術的範囲に属する限り、種々の形態を採り得ることは言うまでもない。

【００２６】

図１に、本発明の実施例である車両用電源管理装置１１を有する車両３を備えて構成される電源管理システム１の概略構成図を示す。なお、電源管理システム１は、車両用電源管理装置１１を有する車両３と、無線通信により車両用電源管理装置１１との間で各種データの送受信を行う外部ネットワーク送受信センタ１７と、無線通信により車両用電源管理装置１１との間で各種データ（エンジン始動に関するデータなど）の送受信を行うスタータ用リモコン１９と、外部ネットワーク送受信センタ１７との間で各種データの送受信を行うために車両利用者により使用される利用者側通信装置２０と、を備えて構成されている。

【００２７】



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外部ネットワーク送受信センタ１７は、インターネットや各種情報センタなどの外部情報源と接続されており、外部情報源から取り込んだ各種情報を車両用電源管理装置１１に対して出力（送信）することができる。
スタータ用リモコン１９は、車両利用者による操作に応じて、無線通信により車両用電源管理装置１１に対して各種指令信号（エンジン始動指令など）を出力（送信）でき、また、車両用電源管理装置１１から各種情報（エンジン運転状態、エンジン回転速度など）を受信できるよう構成されている。そして、スタータ用リモコン１９は、小型の液晶パネルからなる表示部を備えており、受信した各種情報の内容や送信した各種指令信号の内容などを表示部に表示するよう構成されている。

【００２８】

利用者側通信装置２０は、携帯電話あるいは無線通信が可能なパソコンなどで構成されており、外部ネットワーク送受信センタ１７との間で各種情報の送受信を行うことが可能であり、さらに、外部ネットワーク送受信センタ１７を介して車両用電源管理装置１１との間で各種情報を送受信することができる。

【００２９】

車両３は、車両用電源管理装置１１と、エンジンスタータ１３（ハイブリッド車の場合には、モータジェネレータがエンジンスタータと同様の機能を有する）と、車載バッテリ１５（車載電源装置１５）とを備えている。
エンジンスタータ１３は、セルモータを有しており、車両用電源管理装置１１からの始動指令信号が入力されると、セルモータを駆動してクランク軸を回転させることにより、エンジンを始動させる。

【００３０】

車載バッテリ１５は、車両３に備えられる発電機（オルタネータ。ハイブリッド車の場合にはモータジェネレータが同様の機能を有する（図示省略））からの電力供給を受けて、充電残容量が適正容量範囲内となるように充電されることで、車両３に備えられる各種電気機器（車両用電源管理装置、エンジンスタータ、エアコン、カーステレオなど）に電力供給を行うことができる。なお、車載バッテリ１５における充電残容量の適正容量範囲は、少なくとも車載電気機器への電力供給が可能な最小容量である容量下限値、および電源装置として蓄積可能な最大容量である容量上限値が、境界値となる容量範囲に設定される。つまり、適正容量範囲は、容量下限値が下限境界値として、容量上限値が上限境界値として規定される容量範囲に設定される。

【００３１】

なお、充電残容量の適正容量範囲は、電圧変動などの影響を考慮して、一定の余裕を含むように設定されることから、充電残容量が適正容量下限値（適正容量範囲の下限値）よりも僅かに下回る状態の車載バッテリ１５は、一部の車載電気機器（例えば、エンジンスタータなど）の稼働に必要な電力を供給することは可能である。つまり、充電残容量が適正容量下限値よりも僅かに下回る状態の車載バッテリ１５は、車両３のエンジンを始動するために、エンジンスタータを駆動することができる。

【００３２】

しかし、充電残容量が適正容量範囲の下限値（適正容量下限値）よりも更に低下して、車載バッテリ１５の出力電圧レベルが許容電圧下限値（車載電気機器の駆動に必要な電圧の下限値）を下回る場合には、車載バッテリ１５からの供給電力が不足するため、車載電気機器の正常動作が不可能となる。このため、車載バッテリ１５は、充電残容量が適正容量範囲内となるように充電されることで、車両３に備えられる各種電気機器への電力供給が可能となる。

【００３３】

次に、車両用電源管理装置１１について説明する。
車両用電源管理装置１１は、車載バッテリ１５の出力電圧レベルが許容電圧下限値を下回らないよう車載バッテリ１５の充電状態を管理する機能を有すると共に、目的地までの走行経路の案内を行う走行経路案内機能（カーナビゲーション機能（以下、カーナビ機能と



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もいう））を有するように構成された装置である。つまり、車両用電源管理装置１１は、車両用経路案内装置（カーナビゲーション装置）と共に一体に構成された装置である。

【００３４】

図２に、車両用電源管理装置１１の構成図を示す。なお、図２では、車両用電源管理装置１１に接続される車載バッテリ１５、エンジンスタータ１３、外部ネットワーク送受信センタ１７およびスタータ用リモコン１９についても記載している。

【００３５】

図２に示すように、車両用電源管理装置１１は、コンピュータを主体として構成される制御回路２１と、車載バッテリ１５の状態を検出する電源状態検出器２３と、スタータ用リモコン１９との間でデータ送受信を行うリモコンセンサ３１と、各種情報を表示する表示装置３３と、各種データを記憶する外部メモリ３５と、車両３の周辺で発生する音を取り込むマイクロフォン３７と、車両３の周辺状況に関する情報（映像や障害物の有無など）を取得する周辺情報取得装置３９と、外部ネットワーク送受信センタ１７との間でデータ送受信を行う車両側通信装置４１と、車両利用者が各種操作を行うための操作スイッチ群４３と、カーナビ機能に用いる地図データを入力するための地図データ入力器４５と、車両３の現在位置を検出するための位置検出器５１と、を備えて構成されている。

【００３６】

制御回路２１は、通常のコンピュータと同様に、公知のＣＰＵ、ＲＯＭ、ＲＡＭ、Ｉ／Ｏおよびこれらを接続するバスラインを備えて構成されており、後述する各種制御処理を実行することで、車載バッテリ１５の充電状態を管理するための制御処理や、走行経路を案内するための制御処理などを実行する。

【００３７】

電源状態検出器２３は、車載バッテリ１５の出力電圧レベルを検出する電圧センサ２５と、車載バッテリ１５の出力電流レベルを検出する電流センサ２７と、車載バッテリ１５の温度を検出する温度センサ２９と、を備えており、検出結果（検出電圧値、検出電流値、検出温度）を制御回路２１に出力するよう構成されている。

【００３８】

位置検出器５１は、公知の地磁気センサ５３と、公知のジャイロスコープ５５と、公知の距離センサ５７（車速センサ５７）と、ＧＰＳ（Ｇｌｏｂａｌ Ｐｏｓｉｔｉｏｎｉｎｇ Ｓｙｓｔｅｍ ）衛星からの電波に基づいて車両３の現在位置を検出する公知のＧＰＳ受信機５９と、を有しており、これら４個の検出部によるそれぞれの検出結果（車両３の現在位置）を制御回路２１に出力するよう構成されている。

【００３９】

なお、４個の検出部（地磁気センサ５３、ジャイロスコープ５５、距離センサ５７、ＧＰＳ受信機５９）は、様々な要因により検出結果に誤差が生じる場合があるが、それぞれ検出特性が違うため誤差の性質が異なっている。このことから、制御回路２１は、位置検出器５１から入力される４個の検出結果について、それぞれの検出特性を考慮して相互に誤差を補完することで、車両３の現在位置の検出精度を向上させている。

【００４０】

表示装置３３は、カラー表示が可能な液晶パネルで構成されており、制御回路２１を介して位置検出器５１から入力される車両現在位置マークと、地図データ入力器４５より入力された地図データと、地図上に表示する誘導経路（案内経路）などの付加データと、を含むカーナビ画面を表示することができる。なお、表示装置３３は、カーナビ画面の他に、テレビ映像画面や車両各部の動作状態（例えば、ハイブリッド車の発電状態など）表示画面などの各種情報を表示することができる。

【００４１】

操作スイッチ群４３は、車両利用者が車両用電源管理装置１１に対して各種指令を入力するための各種操作スイッチが備えられて構成されている。なお、操作スイッチ群４３は、機械式スイッチに限ることはなく、表示装置３３がタッチ操作パネルを有する場合には、タッチ操作パネルを操作スイッチ群４３として用いることができる。



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【００４２】
地図データ入力器４５は、位置検出の精度向上のための各種データ（いわゆるマップマッチング用データ、地図データおよび目印データなど）を記録媒体から読込み、制御回路２１に入力するための装置である。記録媒体としては、ＣＤ－ＲＯＭ、ＤＶＤ－ＲＯＭ、メモリカードなどを用いることができる。
【００４３】
リモコンセンサ３１は、リモコン用アンテナ３２を備えており、無線通信によりスタータ用リモコン１９との間で電波の送受信を行うと共に、制御回路２１との間で各種データの送受信を行う。つまり、リモコンセンサ３１は、制御回路２１とスタータ用リモコン１９との間で送受信される各種情報（各種データ）を中継するよう構成されている。
【００４４】
外部メモリ３５は、制御回路２１の内部で実行される各種制御処理の書き込み要求に応じて各種情報（変数値など）を記憶すると共に、記憶した各種情報を各種制御処理の読み出し要求に応じて制御回路２１に対して出力する。
マイクロフォン３７は、車両３の周辺で発生する音を取り込み、取り込んだ音に応じた周辺音声信号を制御回路２１に対して出力する。
【００４５】
周辺情報取得装置３９は、車両３の周辺映像を撮影する外部カメラと、超音波などの反射状況に基づき車両３の周辺に存在する障害物を検出する全方位センサとを備えており、車両３の周辺状況に関する情報（映像信号および障害物検出信号など）を制御回路２１に出力する。なお、外部カメラは、例えば、車両後退時に車両後方の映像を撮影するために用いるバックモニタカメラや、車両前方の映像を撮影するための交差点モニタカメラを用いて構成することができる。
【００４６】
車両側通信装置４１は、通信用アンテナ４２を備えており、無線通信により外部ネットワーク送受信センタ１７との間で電波の送受信を行うと共に、制御回路２１との間で各種データの送受信を行うことで、制御回路２１と外部ネットワーク送受信センタ１７との間で送受信される各種情報（データ）を中継する。なお、外部ネットワーク送受信センタ１７は、前述のように、外部情報源から取り込んだ各種情報を車両用電源管理装置１１に対して無線通信によって出力（送信）する。
【００４７】
次に、制御回路２１で実行される各種制御処理について説明する。
まず、カーナビ機能を実現するために、制御回路２１の内部で実行される経路案内処理について簡単に説明する。
経路案内処理は、車両利用者が操作スイッチ群４３を操作するなどして目的地が設定されると起動される処理であり、車両３の現在位置から目的地までの最適な走行経路を自動的に選択して誘導経路を決定する処理を行う。
【００４８】
なお、最適な走行経路を自動的に設定する手法としては、例えば、ダイクストラ法などを用いることができる。また、目的地の設定方法は、操作スイッチ群４３を用いる場合に限られず、スタータ用リモコン１９に目的地設定用スイッチを備えて、スタータ用リモコン１９を用いて目的地を設定してもよい。
【００４９】
また、カーナビ機能に関しては、外部ネットワーク送受信センタ１７が常に最新の情報を格納することができるため、車両用電源管理装置１１が、カーナビ機能に必要な各種情報を外部ネットワーク送受信センタ１７から取得することで、車両に搭載されるＤＶＤなどに記録された情報よりも新しい情報に基づいた正確な経路案内が可能となる。
【００５０】
次に、車載バッテリ１５の充電状態を管理するために、制御回路２１の内部で実行される電源マネジメント処理について説明する。図３に、電源マネジメント処理の処理内容を表



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すフローチャートを示す。なお、電源マネジメント処理は、一定周期（例えば、３０分周期）毎に繰り返し実行される。

【００５１】

電源マネジメント処理が開始されると、まず、Ｓ２１０（Ｓはステップを表す。以下同様。）では、車両が駐車状態であるか否かを判定しており、肯定判定されると（駐車状態であると）Ｓ２２０に移行し、否定判定されると（駐車状態ではないと）電源マネジメント処理を終了する。Ｓ２１０では、車両３の現在位置を用いた判定方法を用いており、カーナビ機能で目的地が設定されている場合には、車両３の現在位置が目的地になると肯定判定し、車両３の現在位置が出発地から目的地までの案内経路の途中である場合には否定判定する。なお、目的地が設定されていない場合には、過去の走行履歴情報に基づき目的地を推定し、推定した目的地に到達したか否かで判断することができる。

【００５２】

Ｓ２１０で肯定判定されてＳ２２０に移行すると、Ｓ２２０では、外部ネットワーク送受信センタ１７との間で、無線通信を用いた通信経路を確立する接続確立処理を行う。通信経路が確立されることで、車両用電源管理装置１１と外部ネットワーク送受信センタ１７との間でのデータ送受信が可能となる。

【００５３】

次のＳ２３０では、外部ネットワーク送受信センタ１７から車両３の現在地における最新の環境情報を受信し、また、外部メモリ３５から駐車時電力消費量を読み込み、さらに、環境情報および駐車時電力消費量に応じて車載バッテリ１５のバッテリ充電残容量における適正容量下限値を設定する処理を行う。

【００５４】

なお、環境情報には、少なくとも予想温度（予想気温）、予想湿度、天気予報が含まれており、また、駐車時電力消費量は、後述するＳ３００で算出されており、Ｓ２３０では、過去にＳ３００が実行された際に外部メモリ３５に記憶された値を用いて処理を実行することになる。

【００５５】

また、適正容量下限値の設定方法としては、例えば、予め基準値を定めておき、受信した環境情報および駐車時電力消費量に基づき、基準値を補正して、適正容量下限値として設定する方法がある。なお、基準値は、車載バッテリ１５の仕様（スペック）で定められた定格容量に基づいて、決定することができる。

【００５６】

そして、補正は、例えば、車載バッテリの出力電圧レベルが低下する環境になるほど、適正容量下限値が大きい値となるように、反対に、車載バッテリの出力電圧レベルが上昇する環境になるほど、適正容量下限値が小さい値となるように実行する。具体的には、予想温度が低くなるほど適正容量下限値が大きい値となるように、反対に、予想温度が高くなるほど適正容量下限値が小さい値となるように、補正を行う。また、駐車時電力消費量が大きくなるほど適正容量下限値が大きい値となるように、反対に、駐車時電力消費量が小さくなるほど適正容量下限値が小さい値となるように、補正を行う。

【００５７】

続くＳ２４０では、電源判断準備が完了したか否か、換言すれば、電源状態検出器２３による車載バッテリ１５の電源状態検出が可能であるか否かを判断しており、肯定判定されるとＳ２５０に移行し、否定判定されると電源マネジメント処理を終了する。なお、Ｓ２４０では、電源状態検出器２３に備えられる各センサ（電圧センサ２５、電流センサ２７、温度センサ２９）による検出結果を取り込み可能な状態で、かつ、車載バッテリ１５の充電残容量の算出が可能な状態である場合に、電源判断準備が完了したと判断する。

【００５８】

Ｓ２４０で肯定判定されてＳ２５０に移行すると、Ｓ２５０では、車両３のエンジンが停止しているか否かを判断しており、肯定判定される（エンジン停止中である）場合はＳ２６０に移行し、否定判定される（エンジン運転中である）場合は電源マネジメント処理を



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終了する。エンジンが停止状態であるか否かは、例えば、エンジン回転速度（エンジン回転数）に基づいて判断することができる。

【００５９】

Ｓ２５０で肯定判定されてＳ２６０に移行すると、Ｓ２６０では、車載バッテリ１５の充電残容量を算出する処理を行う。なお、制御回路２１では、別途、電源状態検出器２３に備えられる各センサ（電圧センサ２５、電流センサ２７、温度センサ２９）の検出結果を履歴データとして蓄積する履歴データ蓄積処理を実行している。Ｓ２６０では、蓄積された履歴データに基づいて、車載バッテリ１５から出力された出力電力量、および車載バッテリ１５に蓄積された蓄積電力量を算出し、出力電力量と蓄積電力量との差に基づいて、車載バッテリ１５の充電残容量を算出する処理を行う。

【００６０】

次のＳ２７０では、Ｓ２６０で算出した充電残容量とＳ２３０で設定された適正容量下限値とを比較し、両者の差を算出する処理を行う。

続くＳ２８０では、Ｓ２７０での比較結果に基づき、車載バッテリ１５の充電残容量が不足しているか否かの判断を行い、肯定判定（充電残容量が不足と判定）される場合にはＳ２９０に移行し、否定判定（充電残容量が足りていると判定）される場合にはＳ３００に移行する。Ｓ２８０では、充電残容量が適正容量下限値以下である場合に肯定判定し、充電残容量が適正容量下限値より大きい場合に否定判定する。

【００６１】

Ｓ２８０で肯定判定されてＳ２９０に移行すると、Ｓ２９０では、サブルーチンとしてのエンジン始動処理を起動することで、車両３のエンジンを始動する処理を行う。なお、エンジン始動処理の処理内容を表すフローチャートを、図４（ａ）に示す。

【００６２】

エンジン始動処理が開始されると、Ｓ４１０では、エンジンスタータ１３に対して始動指令信号を出力し、エンジンスタータ１３により車両３のエンジンを始動させる処理を行う。

次のＳ４２０では、エンジンが運転状態（ＯＮ状態）に移行したことを確認した後、無線通信を通じて、車載バッテリ１５が残容量不足状態であること、およびエンジンがＯＮ状態に移行したこと、を車両利用者に通知する処理を行う。なお、Ｓ４２０では、エンジン回転速度が所定の運転状態判断基準値（例えば２００［ｒｐｍ］）より大きい場合に、エンジンが運転状態に移行したと判断する。

【００６３】

また、Ｓ４２０では、通知処理に関しては、車載バッテリ１５が残容量不足状態であることを表す警告通知信号と、エンジンが運転状態であることを表すエンジンＯＮ通知信号（エンジン始動通知信号）とを、車両側通信装置４１から外部ネットワーク送受信センタ１７に向けて出力するための処理を行う。つまり、Ｓ４２０では、車両側通信装置４１から外部ネットワーク送受信センタ１７を経由して、車両利用者が使用する利用者側通信装置２０に対して警告通知信号とエンジンＯＮ通知信号とを出力（送信）する処理を行う。これにより、車両３から離れた場所に居る車両利用者に対して、車載バッテリ１５が残容量不足状態であること、および車載バッテリ１５の充電残容量を増加させるためにエンジンが運転状態（ＯＮ状態）に移行したことを通知する。

【００６４】

また、Ｓ４２０では、駐車中には稼働状態となる必要のない電気機器（例えば、ヘッドランなど）の中に、稼働中（動作中）の電気機器があるか否かを判断し、稼働中の電気機器が存在する場合には、その電気機器が稼働中であることを、無線通信を通じて車両利用者に通知する。具体的には、車両側通信装置４１が、稼働中の電気機器を表す稼働機器情報信号を出力し、外部ネットワーク送受信センタ１７を経由して車両の利用者が使用する利用者側通信装置２０に稼働機器情報信号を出力（送信）することで、車両利用者に対して、稼働中の電気機器が存在することを通知する。

【００６５】



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さらに、Ｓ４２０では、駐車中に稼働状態となるべき電気機器（例えば、イモビライザ（盗難防止装置）など）の中に、停止中の電気機器があるか否かを判断し、停止中の電気機器が存在する場合には、その電気機器が停止中であることを、無線通信を通じて車両利用者に通知する。具体的には、車両側通信装置４１が、停止中の電気機器を表す停止機器情報信号を、利用者側通信装置２０に対して出力（送信）することで、車両利用者に対して、停止中の電気機器が存在することを通知する。

【００６６】

なお、Ｓ４２０では、例えば、ドアがアンロック状態（施錠忘れ状態）であるか、また、窓がオープン状態であるかを判断し、ドアがアンロック状態である場合にはアンロック状態であることを、窓がオープン状態である場合にはオープン状態であることを、それぞれ無線通信を通じて車両利用者に通知する処理を実行してもよい。これにより、盗難などに対するセキュリティの強化を図ることが出来る。

【００６７】

Ｓ４２０での処理が終了すると、エンジン始動処理が終了し、再び電源マネジメント処理に移行する。

電源マネジメント処理のＳ２８０で否定判定されてＳ３００に移行すると、Ｓ３００では、車両駐車時の電気機器で消費される総消費量である駐車時電力消費量（暗電流による電力消費量）を算出し、算出結果を外部メモリ３５に記憶させる処理を行う。なお、駐車時電力量は、稼働中の電気機器を特定し、各消費電力量を合計することで算出できる。また、エンジン停止状態の車両での電力供給源は、車載バッテリ１５のみであることから、駐車時電力量は、電源状態検出器２３にて検出される車載バッテリ１５の出力電流値および出力電圧値に基づいて算出することも可能である。

【００６８】

なお、電源マネジメント処理は一定周期で繰り返し実行されることから、Ｓ３００では、外部メモリ３５に記憶される駐車時電力量を上書き更新することで、最新の算出結果を外部メモリ３５に記憶させるよう処理を行う。これにより、前述のＳ２３０において車両３の最新状態に応じた駐車時電力消費量を用いることができ、適正容量下限値を、車両３の最新状態に応じた適切な値に設定することができる。

【００６９】

続くＳ３１０では、駐車中には稼働状態となる必要のない電気機器（例えば、ヘッドランプなど）の中に、稼働中（動作中）の電気機器があるか否かを判断し、稼働中の電気機器が存在する場合には、その電気機器が稼働中であることを、無線通信を通じて車両利用者に通知する。具体的には、車両側通信装置４１が、稼働中の電気機器を表す稼働機器情報信号を出力し、外部ネットワーク送受信センタ１７を経由して車両の利用者が使用する利用者側通信装置２０に稼働機器情報信号を出力（送信）することで、車両利用者に対して、稼働中の電気機器が存在することを通知する。

【００７０】

さらに、Ｓ３１０では、駐車中に稼働状態となるべき電気機器（例えば、イモビライザ（盗難防止装置）など）の中に、停止中の電気機器があるか否かを判断し、停止中の電気機器が存在する場合には、その電気機器が停止中であることを、無線通信を通じて車両利用者に通知する。具体的には、車両側通信装置４１が、停止中の電気機器を表す停止機器情報信号を、利用者側通信装置２０に対して出力（送信）することで、車両利用者に対して、停止中の電気機器が存在することを通知する。

【００７１】

なお、Ｓ３１０では、例えば、ドアがアンロック状態（施錠忘れ状態）であるか、また、窓がオープン状態であるかを判断し、ドアがアンロック状態である場合にはアンロック状態であることを、窓がオープン状態である場合にはオープン状態であることを、それぞれ無線通信を通じて車両利用者に通知する処理を実行しても良い。これにより、盗難などに対するセキュリティの強化を図ることが出来る。

【００７２】



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Ｓ２４０で否定判定されるか、Ｓ２５０で否定判定されるか、Ｓ２９０またはＳ３１０の処理が終了すると、電源マネジメント処理が終了する。
次に、電源マネジメント処理によりエンジンが始動された後、車載バッテリ１５が充電完了状態に移行したことを判断するために、制御回路２１の内部で実行される充電完了判断処理について説明する。

【００７３】

図５に、充電完了判断処理の処理内容を表すフローチャートを示す。なお、充電完了判断処理は、電源マネジメント処理によるエンジン始動後、一定周期（例えば、１分周期）毎に繰り返し実行される。
充電完了判断処理が開始されると、まず、Ｓ６１０では、車両３のエンジンが運転状態であるか否かを判断しており、肯定判定される（エンジン運転中である）とＳ６２０に移行し、否定判定される（エンジン停止中である）と充電完了判断処理を終了する。エンジンが運転状態であるか否かは、例えば、エンジン回転速度（エンジン回転数）に基づいて判断することができる。

【００７４】

Ｓ６１０で肯定判定されてＳ６２０に移行すると、Ｓ６２０では、車載バッテリ１５の充電残容量を算出する処理を行う。なお、Ｓ６２０での処理内容は、前述の電源マネジメント処理のＳ２６０での処理内容と同様である。
次のＳ６３０では、Ｓ６２０で算出した充電残容量と充電完了基準値とを比較し、両者の差を算出する処理を行う。なお、充電完了基準値は、電源マネジメント処理のＳ２３０で設定された適正容量下限値よりも大きい値が設定されており、例えば、車載バッテリ１５における充電残容量の適正容量範囲のうち、上限値と下限値との中間値（平均値）に設定されている。

【００７５】

続くＳ６４０では、Ｓ６３０での比較結果に基づき、車載バッテリ１５の充電残容量が充電完了基準値を満足しているか（上回っているか）否かの判断を行い、肯定判定（充電残容量が充電完了基準値を上回っていると判定）される場合にはＳ６５０に移行し、否定判定（充電残容量が充電完了基準値を上回っていないと判定）される場合にはＳ６８０に移行する。

【００７６】

Ｓ６４０で肯定判定されてＳ６５０に移行すると、Ｓ６５０では、車載バッテリ１５の充電が完了したと判断し、今回の動作状況（日時など）を外部メモリ３５に記憶させる処理を行う。
続くＳ６６０では、エンジンを停止させる処理を行う。具体的には、点火系統や燃料系統などの制御を行う制御装置の動作を停止させることで、エンジンを停止させる。

【００７７】

次のＳ６７０では、エンジンが停止状態（ＯＦＦ状態）であることを確認した後、無線通信を通じて、エンジンが停止状態となったこと、および車載バッテリ１５の充電状態が正常状態になったことを、車両利用者に通知する処理を行う。なお、Ｓ６７０では、エンジン回転速度が所定の停止状態判断基準値（例えば０［ｒｐｍ］）以下である場合に、エンジンが停止状態に移行したと判断する。

【００７８】

また、Ｓ６７０では、通知処理に関しては、車両側通信装置４１が充電完了通知信号およびエンジンＯＦＦ通知信号（エンジン停止通知信号）を出力し、外部ネットワーク送受信センタ１７を経由して車両利用者が使用する利用者側通信装置２０に対して、充電完了通知信号およびエンジンＯＦＦ通知信号を出力（送信）する処理を行う。これにより、車両３から離れた場所に居る車両利用者に対して、エンジンが停止状態に移行したこと、および車載バッテリ１５の充電状態が残容量不足状態から正常状態に移行したことを通知する。

【００７９】



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Ｓ６４０で否定判定されてＳ６８０に移行すると、Ｓ６８０では、発電機から車載バッテリ１５に対して供給される単位時間当たりの供給電力量（充電量）を算出する処理を行う。そして、算出した供給電力量に基づき、Ｓ６３０で算出した充電残容量と充電完了基準値との差分電力量（差分充電容量）を供給するために必要な時間（充電完了予測所要時間）を算出し、算出した充電完了予測所要時間を、無線通信を通じて車両利用者に通知する処理を行う。これにより、車両利用者は、充電完了までの概略時間を把握することが出来る。

【００８０】

Ｓ６１０で否定判定されるか、Ｓ６７０またはＳ６８０の処理が終了すると、充電完了判断処理が終了する。なお、Ｓ６７０が実行されると、それ以降は、充電完了判断処理の周期的な実行は停止される。なお、その後、電源マネジメント処理により再度エンジンが始動されると、改めて充電完了判断処理の周期的な実行が開始される。

【００８１】

なお、本実施例においては、車両用電源管理装置１１が特許請求の範囲に記載の車両用電源管理装置に相当し、車載バッテリ１５が電源装置に相当し、電源状態検出器２３およびＳ２６０が電源状態検出手段に相当し、電源マネジメント処理のＳ２８０が電源残容量不足判定手段に相当し、エンジン始動処理のＳ４２０および車両側通信装置４１が残容量不足通知手段に相当し、警告通知信号が警告通知情報に相当し、利用者側通信装置２０が利用者側通信装置に相当する。

【００８２】

また、電源マネジメント処理のＳ３１０、エンジン始動処理のＳ４２０および車両側通信装置４１が稼働機器情報出力手段に相当し、エンジン始動処理のＳ４１０およびエンジンスタータ１３がエンジン始動手段に相当し、充電完了判断処理のＳ６４０が充電完了判断手段に相当し、充電完了判断処理のＳ６６０がエンジン停止手段に相当し、充電完了判断処理のＳ６７０および車両側通信装置４１が充電完了通知手段に相当する。さらに、マイクロフォン３７および周辺情報取得装置３９が周辺情報取得手段に相当し、車両側通信装置４１が周辺情報出力手段に相当する。

【００８３】

以上説明したように、本実施例の電源管理システム１に備えられる車両用電源管理装置１１は、電源状態検出器２３および電源マネジメント処理のＳ２６０が、車両３に備えられる車載バッテリ１５（電源装置）の充電残容量を検出し、電源マネジメント処理のＳ２８０が、電源状態検出器２３およびＳ２６０による検出結果に基づき、車載バッテリ１５の充電残容量が適正容量下限値を下回る場合に、車載バッテリ１５が残容量不足状態であると判定するよう構成されている。

【００８４】

そして、車両用電源管理装置１１は、Ｓ２８０により車載バッテリ１５が残容量不足状態であると判定されると、エンジン始動処理のＳ４２０および車両側通信装置４１が、車載バッテリ１５が残容量不足状態であることを表す警告通知信号を、無線通信により、車両３から離れた場所で車両利用者により使用される利用者側通信装置２０に対して出力することで、車載バッテリ１５の充電状態を管理するよう構成されている。

【００８５】

つまり、車両用電源管理装置１１は、車載バッテリ１５が残容量不足状態であることを車両利用者に通知するにあたり、車両内に備えられる表示装置などにより通知する構成ではなく、無線通信によって利用者側通信装置に対して警告通知信号（警告通知情報）を出力する構成である。

【００８６】

このように、無線通信によって警告通知情報を出力することで、車両から離れた場所に居る車両利用者に対して、車載バッテリ１５が残容量不足状態に陥ったことを通知できる。これにより、長期間にわたり駐車状態となる場合においても、車両利用者は、警告通知情報によってバッテリ充電残容量の減少を知ることができるため、車載バッテリ１５がバッ



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テリ上がり状態に至る前に車載バッテリ１５の交換或いは充電などの対策を施すことが可能となり、車載電気機器を正常動作させることができる。

【００８７】

また、車両用電源管理装置１１は、電源マネジメント処理のＳ３１０、エンジン始動処理のＳ４２０および車両側通信装置４１が、車両３に搭載される電気機器のうち稼働中の電気機器を表す稼働機器情報信号を、無線通信によって利用者側通信装置２０に対して出力（送信）するよう構成されている。

【００８８】

つまり、車両利用者は、稼働機器情報信号を受信した利用者側通信装置２０を用いることで、どの電気機器が稼働中であるかを知ることが出来るため、充電残容量の低下原因である電気機器を容易に特定することができる。そして、車両利用者が、充電残容量の低下原因である電気機器を停止することで、車載バッテリ１５の充電残容量が更に低下するのを抑制することができる。

【００８９】

さらに、車両用電源管理装置１１は、エンジン始動処理のＳ４１０およびエンジンスタータ１３が、車載バッテリ１５の充電残容量を増加させるために車両３のエンジンを始動するよう構成されている。

このように、エンジンを始動して運転状態にすることで、発電機（オルタネータ）で発電される電力を車載バッテリ１５に充電することができ、車載バッテリ１５の充電残容量を増加させることが出来るため、車載バッテリ１５がバッテリ上がり状態に至るのを防止できる。

【００９０】

なお、Ｓ４１０は、Ｓ２８０で肯定判定される場合、つまり、車載バッテリ１５の充電残容量が不足状態（残容量不足状態）と判断される場合に、車両利用者による操作を待つことなく、車両３のエンジンを始動する処理を実行する。つまり、車両用電源管理装置１１は、車載バッテリ１５が残容量不足状態に陥った際に、車両利用者による操作を経ることなく、自動的にエンジンを始動して充電残容量を増加させることが出来る。

【００９１】

よって、車両用電源管理装置１１によれば、車両利用者がエンジン始動する作業を省略できるため、始動作業の煩雑さを解消することができる。また、車載バッテリ１５が残容量不足状態になると、即座にエンジン運転による車載バッテリ１５の充電作業が行われるため、残容量不足状態に陥った時点から充電開始までの充電待機時間が長期化するのを避けることができる。このため、充電待機時間の長期化による充電残容量のさらなる低下を防止でき、バッテリ上がり状態に陥るのを防ぐことが出来る。

【００９２】

また、車両用電源管理装置１１では、車載バッテリ１５の充電残容量を増加させるためにエンジン始動処理により車両３のエンジンが始動された後、充電完了判断処理のＳ６４０にて、車載バッテリ１５の充電が完了したか否かを判断しており、Ｓ６４０により車載バッテリ１５の充電が完了したと判断されると、充電完了判断処理のＳ６６０がエンジンを停止させる処理を行う。つまり、車両用電源管理装置１１は、車載バッテリ１５の充電が完了した際に、車両利用者による操作を待つことなく、自動的にエンジンを停止させることが出来る。

【００９３】

このように構成された車両用電源管理装置１１によれば、車両利用者がエンジン停止する作業を省略できるため、停止作業の煩雑さを解消することができる。また、車載バッテリ１５が充電完了状態になると、即座にエンジンを停止することが出来るため、充電完了状態になった時点からエンジン停止までの停止待機時間が長期化するのを避けることが出来る。このため、停止待機時間の長期化による燃料消費量の増大を防止でき、燃費の低下を防ぐことが出来る。

【００９４】



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そして、Ｓ６６０での処理により車両３のエンジンが停止されると、Ｓ６７０が、車載バッテリ１５の充電完了を表す充電完了通知信号を、無線通信によって利用者側通信装置２０に対して出力する処理を行う。つまり、車両利用者は、充電完了通知信号を受信した利用者側通信機器を用いることで、バッテリ充電残容量が適正値まで増加したこと（換言すれば、充電完了状態になったこと）を知ることができる。

【００９５】

また、車両用電源管理装置１１は、マイクロフォン３７および周辺情報取得装置３９が車両周辺情報（少なくとも、車両周辺の音および車両周辺の映像を含む情報）を取得し、マイクロフォン３７および周辺情報取得装置３９により取得された車両周辺情報を、車両側通信装置４１が、無線通信により出力（送信）するよう構成されている。

【００９６】

これにより、車両利用者は、車両３から離れていても、無線通信を介して車両周辺情報を取得（受信）することで車両周辺の状況を知ることができ、車両周辺の状況に基づき、電源装置の充電残容量の低下原因を推測することができる。

さらに、車両用電源管理装置１１は、車両の走行経路を案内するカーナビゲーション機能（走行経路案内機能）を有しており、カーナビゲーション装置（走行経路案内装置）としても動作する。つまり、本実施例の車両用電源管理装置１１は、カーナビゲーション装置と共に車両３に搭載される構成であり、このように構成される車両用電源管理装置１１は、車載バッテリ１５の充電残容量の低下に伴う走行経路案内装置としての動作不良を防止でき、走行経路案内装置としての正常動作を維持することができる。

【００９７】

以上、本発明の実施例について説明したが、本発明は、上記実施例に限定されることはなく、種々の態様をとることができる。

例えば、エンジン始動処理は、車両利用者の操作を介することなく自動的にエンジンを始動するものに限ることはなく、車両利用者からエンジン始動指令を受けた場合に、車両のエンジンを始動するように構成しても良い。

【００９８】

そこで、上記実施例の車両用電源管理装置１１に対して、エンジン始動処理に代えて第２エンジン始動処理を実行するよう構成変更された第２車両用電源管理装置について説明する。なお、第２エンジン始動処理は、車両利用者からエンジン始動指令を受けた場合に車両のエンジンを始動するよう構成されており、第２エンジン始動処理の処理内容を表すフローチャートを、図４（ｂ）に示す。

【００９９】

第２エンジン始動処理が開始されると、まず、Ｓ４５０では、無線通信により、車載バッテリ１５が残容量不足状態であることを車両利用者に通知する処理と共に、エンジン始動を行うか否かを車両利用者に問い合わせる処理を行う。具体的には、無線通信により、車両側通信装置４１から外部ネットワーク送受信センタ１７を経由して利用者側通信装置２０に対して、車載バッテリ１５が残容量不足状態であることを表す警告通知信号と、エンジン始動を問い合わせるための始動問合せ信号を出力する処理を行う。

【０１００】

また、Ｓ４５０では、車両の駐車中には稼働状態となる必要のない電気機器（例えば、ヘッドランなど）の中に、稼働中（動作中）の電気機器があるか否かを判断し、稼働中の電気機器が存在する場合には、その電気機器が稼働中であることを、無線通信を通じて車両利用者に通知する。具体的には、車両側通信装置４１が、稼働中の電気機器を表す稼働機器情報信号を出力し、外部ネットワーク送受信センタ１７を経由して利用者側通信装置２０に稼働機器情報信号を出力（送信）することで、車両利用者に対して、稼働中の電気機器が存在することを通知する。

【０１０１】

これにより、車両利用者は、車両３から離れていても、無線通信を介して稼働機器情報を取得（受信）することで車両３で稼働している電気機器をリアルタイムで知ることができ



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る。この結果、車両利用者は、稼働する必要の無い電気機器が稼働しているか否かを確認することができ、車載バッテリ１５に蓄積されている電力が無駄に消費されているか否かを判断することが出来る。

【０１０２】

さらに、Ｓ４５０では、マイクロフォン３７および周辺情報取得装置３９により取得した車両周辺情報を、無線通信により車両利用者に送信する処理を行う。具体的には、車両側通信装置４１が、車両周辺情報信号を出力し、外部ネットワーク送受信センタ１７を経由して利用者側通信装置２０に車両周辺情報信号を出力（送信）することで、車両利用者に対して車両周辺情報を送信する。

【０１０３】

これにより、車両利用者は、車両３から離れていても、無線通信を介して車両周辺情報を取得（受信）することで車両３の周辺状況をリアルタイムで知ることができる。この結果、車両利用者は、車両周辺に人が存在しないことを確認できると共に、エンジン始動による危険性が無いことを確認することができる。

【０１０４】

続くＳ４６０では、車両利用者からエンジン始動指令が入力されたか否かを判断しており、肯定判定される（エンジン始動指令が入力される）とＳ４７０に移行し、否定判定される（エンジン始動指令が入力されない）と同ステップを繰り返し実行することで、エンジン始動指令が入力されるまで待機する。なお、車両利用者は、利用者側通信装置２０で受信した稼働機器情報信号や車両周辺情報信号の内容に基づいて、エンジン始動の必要性があると判断した場合には、車両に移動し、操作スイッチ群４３を用いて車両用電源管理装置に対してエンジン始動指令を入力することにより、エンジン始動を許可する。

【０１０５】

Ｓ４６０で肯定判定されてＳ４７０に移行すると、Ｓ４７０では、前述のＳ４１０と同様に、エンジンスタータ１３に対して始動指令信号を出力し、エンジンスタータ１３により車両３のエンジンを始動させる処理を行う。

次のＳ４８０では、エンジンが運転状態（ＯＮ状態）に移行したことを確認した後、無線通信を通じて、エンジンがＯＮ状態に移行したことを車両利用者に通知する処理を行う。なお、Ｓ４８０では、エンジン回転速度が所定の運転状態判断基準値（例えば２００［ｒｐｍ］）より大きい場合に、エンジンが運転状態に移行したと判断する。

【０１０６】

Ｓ４８０での処理が終了すると、第２エンジン始動処理が終了する。

つまり、第２エンジン始動処理は、車両のエンジンを始動するにあたり、車両周辺情報および稼働機器情報を車両利用者に対して無線通信により送信して、車両利用者にエンジン始動をするか否かの判断を促し、車両利用者からエンジン始動指令が入力されると、車両のエンジンを始動する処理を行う。

【０１０７】

よって、第２車両用電源管理装置によれば、車両利用者が、稼働機器情報や車両周辺情報に基づき、車両周囲に人が存在するなどの危険の有無を判断した上でエンジン始動が必要と判断した場合に、エンジン始動を行うことから、エンジン始動に伴う危険を確実に回避することが出来る。

【０１０８】

なお、第２エンジン始動処理においては、Ｓ４７０が、特許請求の範囲に記載のエンジン始動手段に相当し、Ｓ４５０が、稼働機器情報出力手段および周辺情報出力手段に相当する。また、第２車両用電源管理装置を用いる場合には、車両利用者はエンジン始動のために車両まで移動することから、エンジン始動が行われたことを直接確認できるため、無線通信によりエンジンがＯＮ状態に移行したことを通知する処理（Ｓ４８０での処理）を省略しても良い。

【０１０９】

また、車両のエンジンを始動するにあたり、車両利用者が車両まで移動してエンジン始動



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指令を入力するのではなく、無線通信によりエンジン始動指令信号を受信した場合に車両のエンジンを始動するよう車両用電源管理装置を構成しても良い。具体的には、エンジン始動処理として、第３エンジン始動処理を実行するのである。図４（ｃ）に、第３エンジン始動処理の処理内容を表すフローチャートを示す。

【０１１０】

なお、第３エンジン始動処理は、Ｓ５１０、Ｓ５２０、Ｓ５３０およびＳ５４０の各ステップを備えて構成されており、Ｓ５１０、Ｓ５３０およびＳ５４０での処理内容は、それぞれ第２エンジン始動処理におけるＳ４５０、Ｓ４７０およびＳ４８０での処理内容と同様である。そこで、処理内容が異なるＳ５２０について説明する。

【０１１１】

Ｓ５２０では、無線通信により車両利用者からエンジン始動指令信号を受信したか否かを判断しており、肯定判定される（エンジン始動指令信号を受信する）とＳ５３０に移行し、否定判定される（エンジン始動指令信号が受信されない）と同ステップを繰り返し実行することで、エンジン始動指令信号を受信するまで待機する。なお、車両利用者は、利用者側通信装置２０で受信した稼働機器情報信号や車両周辺情報信号の内容に基づいて、エンジン始動の必要性があると判断した場合には、利用者側通信装置２０を用いて、エンジン始動指令信号を車両用電源管理装置に対して送信（出力）することにより、エンジン始動を許可する。

【０１１２】

つまり、第３エンジン始動処理は、車両のエンジンを始動するにあたり、車両周辺情報および稼働機器情報を車両利用者に送信して、車両利用者にエンジン始動をするか否かの判断を促し、無線通信により利用者側通信装置２０からエンジン始動指令を受けると、車両のエンジンを始動する処理を行う。

【０１１３】

よって、第２エンジン始動処理に代えて第３エンジン始動処理を実行する第３車両用電源管理装置によれば、車両利用者は、車両から離れた場所にいる場合であっても、無線通信により、第３車両用電源管理装置に対してエンジン始動指令を送信することで、車両のエンジンを始動することができる。つまり、車両利用者は、車両３まで移動する労力を費やすことなくエンジンを始動でき、車載バッテリ１５の充電残容量を増加させることができるため、バッテリ上がりを防止するための作業の煩雑さを解消できる。

【０１１４】

なお、第３エンジン始動処理では、Ｓ５３０が、特許請求の範囲に記載のエンジン始動手段に相当し、Ｓ５１０が、稼働機器情報出力手段および周辺情報出力手段に相当する。また、第３エンジン始動処理のＳ５２０では、利用者側通信装置２０ではなくスタータ用リモコン１９から送信されるエンジン始動指令信号を受信した場合に、肯定判定するように処理を実行しても良い。

【０１１５】

次に、上記実施例の車両用電源管理装置は、車両の走行経路を案内する装置（車両用経路案内装置、カーナビゲーション装置）と一体に構成された車両用電源管理装置であるが、カーナビゲーション装置と分割された状態で同一の車両に搭載される車両用電源管理装置として構成しても良い。

【０１１６】

さらに、車両側通信装置４１は、電源管理機能を実現するための専用の通信装置に限られることはなく、例えば、自動車電話で構成しても良い。また、車両側通信装置４１は、車両に固定設置された装置に限られることはなく、携帯電話などの移動体通信装置で構成しても良い。この場合、車両用電源管理装置は、移動体通信装置との間で情報伝達経路を形成するための伝達経路接続手段（接続コネクタ）を備える必要がある。

【０１１７】

また、上記実施例に記載された各数値は、上記数値に限定されることはなく、例えば、上記各制御処理の実行周期は、車両の用途や使用環境などに応じて適切な値に設定すると良



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い。つまり、電源マネジメント処理の実行周期は、３０分周期に限らず、１時間周期あるいはその他の周期に設定しても良い。

【０１１８】

次に、上記の車両用電源管理装置は、Ｓ４２０での処理により、警告通知信号とエンジンＯＮ通知信号（エンジン始動通知信号）とを、外部ネットワーク送受信センタ１７に向けて出力する構成であるが、信号の出力先がスタータ用リモコン１９となるように構成してもよい。つまり、リモコンセンサ３１からスタータ用リモコン１９に対して、警告通知信号とエンジンＯＮ通知信号とを出力することにより、車両利用者に対して、車載バッテリの残容量不足状態およびエンジンのＯＮ状態移行を通知しても良い。この場合、スタータ用リモコン１９が、特許請求の範囲に記載の利用者側通信装置に相当する。

【０１１９】

さらに、Ｓ６３０で用いる充電完了基準値は、予め定められた固定値に限ることはなく、Ｓ２３０での適正容量下限値の設定処理のように、環境情報や駐車時電力消費量などに基づいて補正・更新しても良い。

また、車両利用者が車両まで移動してエンジンを始動させる場合には、操作スイッチ群４３を用いるのではなく、イグニッションキーによる通常のエンジン始動によりバッテリの充電残容量を増加させても良い。

【０１２０】

さらに、周辺情報取得装置３９は、要求される検出精度を満足する場合には、外部カメラまたは全方位センサのいずれか一方を備えて構成しても良く、あるいは、外部カメラおよび全方位センサに加えて更に他のセンサなどを備えて構成してもよい。

【０１２１】

また、上記実施例では、４個の検出部を有する位置検出器５１を用いるが、必要な精度を確保できる場合には、３個以下の検出部を有する位置検出器を用いても良く、あるいは、より高い精度が求められる場合には、５個以上の検出部を有する位置検出器を用いてもよい。上記以外の検出部としては、例えば、ステアリングの回転センサや、各転動輪の車輪センサなどが挙げられる。

【０１２２】

なお、上記実施例では、エンジンを自動的に停止する手段（充電完了判断処理のＳ６６０）を備える車両用電源管理装置について説明したが、エンジンを自動的に停止する手段を備えていない車両用電源管理装置においては、充電完了通知信号を出力するように構成することで、車両から離れた場所に居る車両利用者に対して、充電完了時期を知らせることができる。これにより、充電完了後もエンジンの運転が継続されて無駄に燃料が消費されるのを抑制することができる。

【図面の簡単な説明】

【図１】実施例の車両用電源管理装置を有する車両を備えて構成される電源管理システムの概略構成図である。

【図２】車両用電源管理装置の構成図である。

【図３】電源マネジメント処理の処理内容を表すフローチャートである。

【図４】（ａ）は、エンジン始動処理の処理内容を表すフローチャートであり、（ｂ）は、第２エンジン始動処理の処理内容を表すフローチャートであり、（ｃ）は、第３エンジン始動処理の処理内容を表すフローチャートである。

【図５】充電完了判断処理の処理内容を表すフローチャートである。

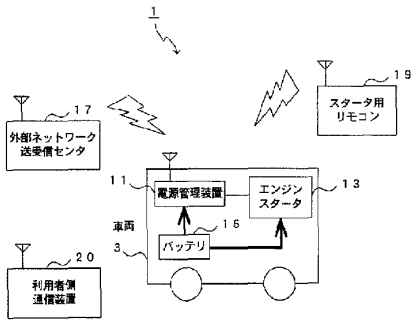
【符号の説明】

１…電源管理システム、３…車両、１１…車両用電源管理装置、１３…エンジンスタータ、１５…車載バッテリ（車載電源装置）、１７…外部ネットワーク送受信センタ、１９…スタータ用リモコン、２０…利用者側通信装置、２１…制御回路、２３…電源状態検出器、３１…リモコンセンサ、３７…マイクロフォン、３９…周辺情報取得装置、４１…車両側通信装置、４３…操作スイッチ群。

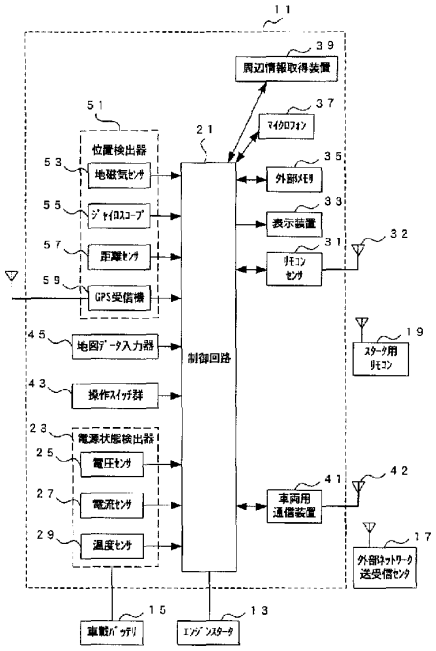


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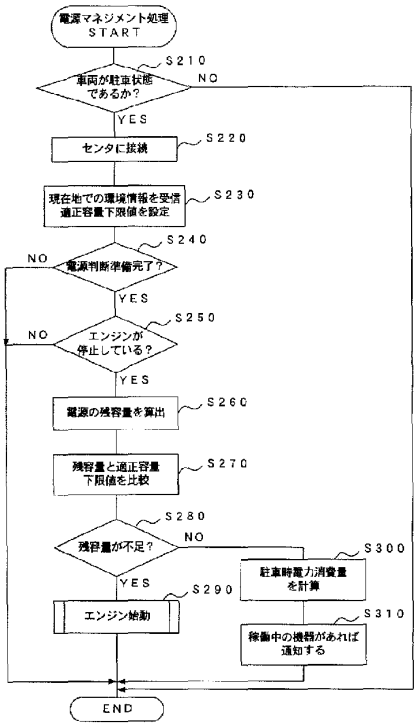
【図１】


1
17
外部ネットワーク送受信センタ
19
スタータ用リモコン
11
電源管理装置
エンジンスタータ
13
車両
15
バッテリ
3
20
利用者側通信装置

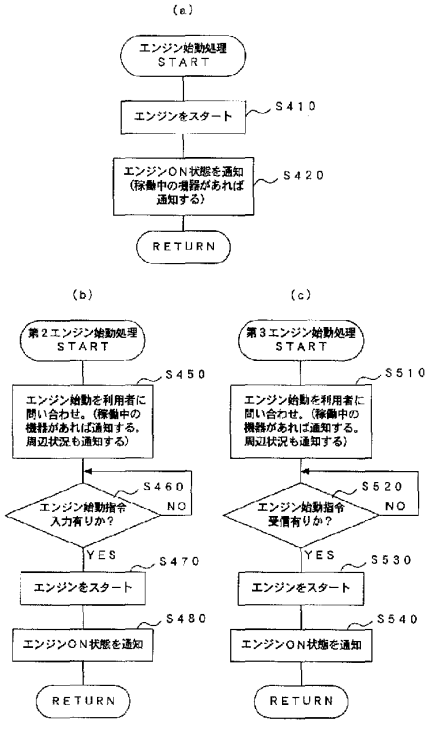
【図２】


11
39
周辺情報取得装置
51
位置検出器
37
マイクロフォン
21
53
地磁気センサ
35
外部メモリ
55
ジャイロスコープ
33
表示装置
57
距離センサ
31
32
リモコンセンサ
59
GPS受信機
19
スタータ用リモコン
45
地図データ入力器
制御回路
43
操作スイッチ群
23
電源状態検出器
25
電圧センサ
41
42
27
電流センサ
車両用通信装置
29
温度センサ
17
外部ネットワーク送受信センタ
15
車載バッテリ
13
エンジンスタータ

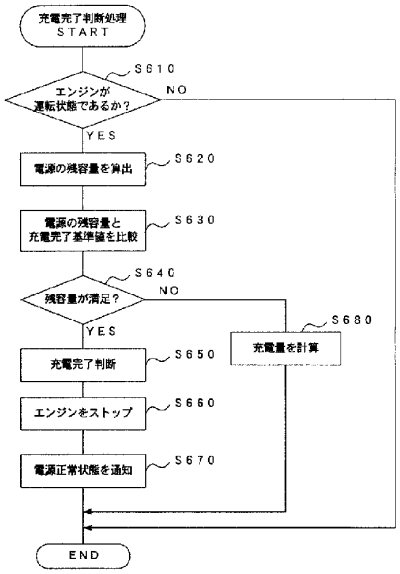
【図３】


電源マネジメント処理 START
S210
車両が駐車状態であるか？
NO
YES
センタに接続
S220
現在地での環境情報を受信 適正容量下限値を設定
S230
S240
電源判断準備完了？
NO
YES
S250
エンジンが停止している？
NO
YES
電源の残容量を算出
S260
残容量と適正容量下限値を比較
S270
S280
残容量が不足？
NO
YES
S290
エンジン始動
S300
駐車時電力消費量を計算
S310
稼働中の機器があれば通知する
END

【図４】


(a)
エンジン始動処理 START
S410
エンジンをスタート
S420
エンジンON状態を通知（稼働中の機器があれば通知する）
RETURN
(b)
第2エンジン始動処理 START
S450
エンジン始動を利用者に問い合わせ。（稼働中の機器があれば通知する。周辺状況も通知する）
S460
エンジン始動指令入力有りか？
NO
YES
S470
エンジンをスタート
S480
エンジンON状態を通知
RETURN
(c)
第3エンジン始動処理 START
S510
エンジン始動を利用者に問い合わせ。（稼働中の機器があれば通知する。周辺状況も通知する）
S520
エンジン始動指令受信有りか？
NO
YES
S530
エンジンをスタート
S540
エンジンON状態を通知
RETURN

【図５】






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フロントページの続き

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5G003 BA01 EA05
5H030 AA04 AS08 FF41 FF44



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# POWER SUPPLY MANAGEMENT DEVICE FOR VEHICLE

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| CPCI | B 60 L 50/66 | 2019-02-01 |
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| CPCA | B 60 L 2240/12 | 2013-01-01 |
| CPCA | B 60 L 2240/549 | 2013-01-01 |
| CPCA | B 60 L 2250/30 | 2013-01-01 |
| CPCA | B 60 L 2250/10 | 2013-01-01 |
| CPCA | B 60 L 2250/16 | 2013-01-01 |
| CPCA | Y 02 T 90/16 | 2013-01-01 |
| CPCA | B 60 L 2240/80 | 2013-01-01 |
| CPCA | Y 02 T 10/70 | 2013-01-01 |
| CPCA | B 60 L 2240/14 | 2013-01-01 |
| CPCA | B 60 L 2240/662 | 2013-01-01 |
| CPCA | B 60 L 2240/622 | 2013-01-01 |
| CPCA | Y 02 T 10/72 | 2013-01-01 |
| CPCA | B 60 L 2240/441 | 2013-01-01 |
| CPCA | B 60 L 2240/62 | 2013-01-01 |
| CPCA | B 60 L 2240/34 | 2013-01-01 |
| CPCA | B 60 L 2240/70 | 2013-01-01 |
| CPCA | B 60 L 2260/44 | 2013-01-01 |
| CPCA | B 60 L 2240/547 | 2013-01-01 |
| CPCA | B 60 L 2240/545 | 2013-01-01 |
| CPCA | B 60 L 2260/22 | 2013-01-01 |
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APPLICATION FILING DATE

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**Abstract**

<P>PROBLEM TO BE SOLVED: To provide a power supply management device for vehicle capable of giving an alarm concerning the reduction of remaining charged capacity of an on-board battery even when a vehicle user is apart from the vehicle. <P>SOLUTION: This power supply management device 11 for vehicle outputs a warning informing signal indicating that the on-board battery 15 is in a remaining capacity shortage condition to a communication device 20 on the user side through an external network transmission and reception center 17 from a communication device 41 on the vehicle side by radio communication when it is determined that the on-board battery 15 is in the remaining capacity shortage condition. It is possible to inform the vehicle user who is apart from the vehicle, of the remaining capacity shortage condition of the on-board battery 15 by outputting warning informing information by radio communication. Consequently, the vehicle user can know about the reduction of battery charging remaining capacity even when the vehicle is parked for a long period of time to take measures such as replacement or charging of the on-board battery 15 before the on-board battery 15 reaches a battery dead condition. <P>COPYRIGHT: (C)2004,JPO


**Description**

[0001]

TECHNICAL FIELD OF THE INVENTION

The present invention relates to a vehicle power management device that manages the state of charge of a power device provided in a vehicle.

[0002]

[Prior art]

2. Description of the Related Art Conventionally, a vehicle is provided with a power supply device (battery) charged so as to output a predetermined drive voltage (for example, 12 [V]). Power is being supplied.

[0003]

Then, the power supply device can supply sufficient power to each part of the vehicle by setting the remaining charge capacity within the appropriate capacity range, and the on-vehicle electric device receiving the power supply can operate normally.

However, when the electric energy stored in the power supply device is excessively consumed due to factors such as an excessive increase in the power consumption of the on-vehicle electric device and a prolonged parking period, the power supply device is charged. The remaining capacity may decrease.

[0004]

The appropriate capacity range of the remaining charge capacity of the power supply device is defined by a capacity lower limit value that is at least a minimum capacity capable of supplying power to the on-vehicle electric device and a capacity upper limit value that is a maximum capacity that can be stored as the power supply device. Is set in the capacity range. In addition, the appropriate capacity

range of the remaining charge capacity is set to include a certain margin in consideration of the influence of voltage fluctuations and the like, so that the remaining charge capacity is lower than the proper capacity lower limit (lower limit of the proper capacity range). The power supply device in a state slightly lower than the power supply device can supply the electric power necessary for the operation of some vehicle-mounted electric devices.

[0005]

However, the remaining charge capacity further falls below the proper capacity lower limit value (lower limit value of the proper capacity range), and the output voltage level of the power supply unit becomes lower than the allowable voltage lower limit value (the lower limit value of the voltage required for driving the vehicle-mounted electric equipment). If the power is below the threshold, the power supplied by the power supply device is insufficient, so that the normal operation of the vehicle-mounted electric device becomes impossible. Note that the power supply device in which the output voltage level of the power supply device falls below the allowable voltage lower limit value and the power supply of the required minimum is impossible is a so-called dead battery power supply device.

[0006]

In order to solve this problem, an auxiliary power supply (auxiliary battery) is provided separately from the main power supply (vehicle battery), and when the remaining charge of the on-vehicle battery decreases, the auxiliary battery supplies power to various parts of the vehicle. (Refer to Patent Document 1).

[0007]

Further, the power management device is configured to notify the driver (vehicle user) of the deterioration of the output voltage level of the vehicle battery by displaying a warning when the output voltage level of the vehicle battery deteriorates. Have been.

[0008]

[Patent Document 1]

JP 2001-166017 A (see FIG. 1, paragraphs [0018] and [0023])

[0009]

[Problems to be solved by the invention]

However, in the power management device described in the above-mentioned patent document (hereinafter, also referred to as a conventional power management device), not only the output voltage level of the vehicle-mounted battery but also the output voltage level of the auxiliary battery is lower than the allowable voltage lower limit. When the state is reduced to a state, there is a possibility that power supply to each part of the vehicle becomes impossible.

[0010]

On the other hand, by providing a large-capacity power supply (large-capacity battery) as an auxiliary battery and extending the time until the output voltage level of the auxiliary battery decreases, it becomes impossible to supply power to various parts of the vehicle. Countermeasures can be considered to avoid this. However, a large-capacity battery has a problem that it is difficult to secure an installation space in a vehicle because the volume is large. Further, even with a large capacity battery, since the charging capacity is limited, it is difficult to completely eliminate the decrease in the output voltage level.

[0011]

In addition, since the conventional power management device is configured to perform the warning display as described above, the vehicle user who sees the warning display can replace the vehicle-mounted battery within a period in which the auxiliary battery can supply power. Thus, it is possible to prevent the power supply to each part of the vehicle from becoming impossible.

[0012]

However, even if the warning display is performed by the conventional power management device on the vehicle, if the vehicle user is away from the vehicle, the vehicle user cannot see the warning display, so that the output of the vehicle-mounted battery is not output. It cannot be known that the voltage level has deteriorated. In particular, when the vehicle is parked for a long period of time, the vehicle user cannot be notified, and the power consumption of the on-vehicle electric device (for example, an immobilizer) that operates during parking is accumulated. Therefore, there is a high possibility that the output voltage level of each of the vehicle-mounted battery and the auxiliary battery falls below the allowable voltage lower limit.

[0013]

The present invention has been made in view of such a problem, and an object of the present invention is to provide a vehicle power management device that can warn of a decrease in the remaining charge of an in-vehicle battery even when a vehicle user is away from the vehicle.

[0014]

[Means for Solving the Problems]

The invention according to claim 1 for achieving the above object is a vehicle power management device for managing a charge state of a power supply device provided in a vehicle, wherein the remaining charge capacity of the power supply device is an appropriate capacity lower limit value. When the power supply device is determined to be in the remaining capacity shortage state, the warning notification information indicating that the power supply device is in the remaining capacity shortage state is output to the user side communication device by wireless communication. It is characterized by.

[0015]

In this way, by outputting the warning notification information by wireless communication, it is possible to notify the vehicle user who is away from the vehicle that the power supply device has run out of the remaining capacity. Thereby, even when the vehicle is in the parking state for a long period of time, it is possible to take measures such as taking measures such as replacing or charging the vehicle-mounted battery before the power supply device (battery) reaches the dead battery state, The in-vehicle electric device can be operated normally.

[0016]

In the above-described power supply management device for a vehicle (claim 1), the operating device information output means may include an operating device representing an operating electrical device among the electrical devices mounted on the vehicle. The information may be output to the user communication device by wireless communication. Thereby, even if the vehicle user is away from the vehicle, by acquiring (receiving) the operating device information, the electric device which is the cause of the decrease in the remaining charge capacity can be easily specified, and the vehicle user can By stopping the electric device, it is possible to suppress a further decrease in the remaining charge capacity of the power supply device.

[0017]

In the vehicle power management device described above (claim 1 or claim 2), the engine starting means starts the engine of the vehicle to increase the remaining charge capacity of the power supply

device, as described in claim 3. This can prevent the power supply from reaching a dead battery state.

[0018]

The engine starting means may start the vehicle engine when the power supply device is determined to be in a state of insufficient remaining capacity, for example, so that the remaining charge capacity greatly increases the lower limit of the appropriate capacity. Before falling below the threshold, the remaining charge capacity of the power supply device can be increased, and the battery can be prevented from running out.

[0019]

The engine starting means may start the engine of the vehicle, for example, when receiving an engine start command from the user-side communication device by wireless communication. Thus, the remaining charge capacity of the battery can be increased without the vehicle user moving to the vehicle, and the trouble of moving to the vehicle can be eliminated.

[0020]

Next, in the vehicle power management device described above (in any one of claims 1 to 5), after the engine is started to increase the remaining charge capacity of the battery, the charge completion determination means is provided. When it is determined that the charging of the power supply device is completed, the engine stop means may stop the engine. As a result, of the operating time of the engine, wasted time that does not contribute to charging the power supply device can be reduced, and wasteful fuel consumption can be suppressed.

[0021]

According to a seventh aspect of the present invention, when the engine is stopped, the charge completion notifying means may provide a charge completion notifying means indicating the completion of charging of the power supply device. The completion notification information may be output to the user communication device by wireless communication. Thereby, even if the vehicle user is away from the vehicle, the charging remaining notification information is acquired (received) by using the user-side communication device, so that the remaining charging capacity of the power supply device is increased to within the appropriate capacity range. You can confirm that.

[0022]

Next, in the vehicle power management device described above (any one of claims 1 to 7), as described in claim 8, the peripheral information acquisition unit is configured to determine whether at least a video around the vehicle or a video around the vehicle is generated. After acquiring the vehicle surrounding information including any of the sounds, the surrounding information output means may be configured to output the vehicle surrounding information to the user side communication device by wireless communication.

[0023]

This allows the vehicle user to obtain (receive) the vehicle surrounding information even at a place away from the vehicle, thereby inferring the cause of the decrease in the remaining charge of the power supply device based on the situation around the vehicle. Can be. In the case where the engine start means is provided, the vehicle user can confirm that there is no danger by starting the engine by confirming that no person is present around the vehicle.

[0024]

Then, the vehicle power management device described above (any one of claims 1 to 8) is mounted on the vehicle together with the traveling route guidance device that guides the traveling route of the vehicle, as described in claim 9. By doing so, it is possible to prevent a malfunction of the traveling

route guidance device due to a decrease in the remaining charge capacity of the power supply device, and to maintain a normal operation of the traveling route guidance device.

[0025]

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, embodiments to which the present invention is applied will be described with reference to the drawings. It is needless to say that the embodiments of the present invention are not limited to the following examples, and can take various forms as long as they belong to the technical scope of the present invention.

[0026]

FIG. 1 is a schematic configuration diagram of a power management system 1 including a vehicle 3 having a vehicle power management device 11 according to an embodiment of the present invention. The power management system 1 includes a vehicle 3 having a vehicle power management device 11, an external network transmission / reception center 17 for transmitting and receiving various data to and from the vehicle power management device 11 by wireless communication, and a vehicle 3 by wireless communication. Starter remote controller 19 that transmits and receives various data (such as data related to engine startup) to and from the external power transmitting and receiving center 17 and is used by a vehicle user to transmit and receive various data to and from the external network transmission and reception center 17. And a user-side communication device 20 to be used.

[0027]

The external network transmission / reception center 17 is connected to an external information source such as the Internet or various information centers, and can output (transmit) various information taken from the external information source to the vehicle power management device 11.

The starter remote controller 19 can output (transmit) various command signals (such as an engine start command) to the vehicle power management device 11 by wireless communication in response to an operation by the vehicle user, and can also output the vehicle power management device. It is configured to be able to receive various information (engine operation state, engine rotation speed, etc.) from the CPU 11. The starter remote controller 19 includes a display unit composed of a small liquid crystal panel, and is configured to display the contents of various kinds of received information and the contents of various kinds of transmitted command signals on the display unit.

[0028]

The user-side communication device 20 is configured by a mobile phone or a personal computer capable of wireless communication, and can transmit and receive various information to and from the external network transmission / reception center 17. Various kinds of information can be transmitted and received to and from the vehicle power management device 11 via the center 17.

[0029]

The vehicle 3 includes a vehicle power management device 11, an engine starter 13 (in the case of a hybrid vehicle, a motor generator has the same function as the engine starter), and a vehicle-mounted battery 15 (vehicle-mounted power supply device 15). I have.

The engine starter 13 has a starter motor. When a start command signal is input from the vehicle power management device 11, the engine starter 13 starts the engine by driving the starter motor and rotating the crankshaft.

[0030]

The on-vehicle battery 15 receives power supply from a generator (alternator; in the case of a hybrid vehicle, a motor generator has a similar function (not shown)) provided in the vehicle 3 so that the remaining charge capacity is within an appropriate capacity range. As a result, power can be supplied to various electric devices (vehicle power management device, engine starter, air conditioner, car stereo, etc.) provided in vehicle 3. Note that the appropriate capacity range of the remaining charge capacity of the vehicle-mounted battery 15 is at least a capacity lower limit value that is a minimum capacity capable of supplying power to the vehicle-mounted electric device and a capacity upper limit value that is a maximum capacity that can be stored as a power supply device. The capacity range is set to the boundary value. That is, the appropriate capacity range is set to a capacity range in which the lower limit of the capacity is defined as the lower limit boundary value and the upper limit of the capacity is defined as the upper limit boundary value.

[0031]

Note that the appropriate capacity range of the remaining charge capacity is set to include a certain margin in consideration of the influence of voltage fluctuation and the like, so that the remaining charge capacity is the lower limit of the appropriate capacity (lower limit of the appropriate capacity range). The in-vehicle battery 15 in a state slightly lower than that can supply power required for operation of some in-vehicle electric devices (for example, an engine starter). That is, the in-vehicle battery 15 in a state where the remaining charge is slightly lower than the lower limit of the appropriate capacity can drive the engine starter to start the engine of the vehicle 3.

[0032]

However, the remaining charge capacity further falls below the lower limit value of the proper capacity range (lower limit value of the proper capacity), and the output voltage level of the vehicle-mounted battery 15 becomes lower than the allowable voltage lower limit value (the lower limit value of the voltage required for driving the vehicle-mounted electric device). If the value falls below (), the electric power supplied from the vehicle-mounted battery 15 is insufficient, so that the normal operation of the vehicle-mounted electric device becomes impossible. For this reason, the vehicle-mounted battery 15 is charged so that the remaining charge is within the appropriate capacity range, so that power can be supplied to various electric devices provided in the vehicle 3.

[0033]

Next, the vehicle power management device 11 will be described.

The vehicle power management device 11 has a function of managing the state of charge of the vehicle-mounted battery 15 so that the output voltage level of the vehicle-mounted battery 15 does not fall below the lower limit of the allowable voltage, and also provides a travel route for guiding the travel route to the destination. It is a device configured to have a guidance function (car navigation function (hereinafter, also referred to as car navigation function)). That is, the vehicle power management device 11 is a device integrally formed with the vehicle route guidance device (car navigation device).

[0034]

FIG. 2 shows a configuration diagram of the vehicle power management device 11. FIG. 2 also shows the vehicle-mounted battery 15, the engine starter 13, the external network transmission / reception center 17, and the starter remote controller 19 connected to the vehicle power management device 11.

[0035]

As shown in FIG. 2, the vehicle power management device 11 includes a control circuit 21 mainly composed of a computer, a power state detector 23 that detects a state of the vehicle-mounted battery 15, and a starter remote controller 19. A remote control sensor 31 for transmitting and receiving data, a display device 33 for displaying various information, an external memory 35 for storing various data, a microphone 37 for capturing sounds generated around the vehicle 3, and information about a situation around the vehicle 3 Peripheral information acquisition device 39 for acquiring images

(presence or absence of obstacles, etc.), vehicle-side communication device 41 for transmitting / receiving data to / from external network transmission / reception center 17, and operation for vehicle user to perform various operations A switch group 43, a map data input device 45 for inputting map data used for a car navigation function, and a switch for detecting the current position of the vehicle 3. And it is configured to include a position detector 51, a.

[0036]

The control circuit 21 includes a well-known CPU, ROM, RAM, I / O, and a bus line connecting these, as in a normal computer. A control process for managing the state of charge of the battery 15 and a control process for guiding a traveling route are executed.

[0037]

The power supply state detector 23 includes a voltage sensor 25 that detects an output voltage level of the vehicle-mounted battery 15, a current sensor 27 that detects an output current level of the vehicle-mounted battery 15, a temperature sensor 29 that detects the temperature of the vehicle-mounted battery 15, And outputs the detection result (detected voltage value, detected current value, detected temperature) to the control circuit 21.

[0038]

The position detector 51 determines the current position of the vehicle 3 based on radio waves from a known geomagnetic sensor 53, a known gyroscope 55, a known distance sensor 57 (vehicle speed sensor 57), and a GPS (Global Positioning System) satellite. And a known GPS receiver 59 for detecting, and configured to output the detection results (the current position of the vehicle 3) by the four detection units to the control circuit 21.

[0039]

The four detectors (the geomagnetic sensor 53, the gyroscope 55, the distance sensor 57, and the GPS receiver 59) may have an error in the detection result due to various factors. The nature is different. Accordingly, the control circuit 21 complements the errors of the four detection results input from the position detector 51 in consideration of the respective detection characteristics, thereby improving the detection accuracy of the current position of the vehicle 3. Have improved.

[0040]

The display device 33 is composed of a liquid crystal panel capable of color display, and includes a vehicle current position mark input from the position detector 51 via the control circuit 21 and map data input from the map data input device 45. And additional data such as a guidance route (guidance route) to be displayed on a map. In addition to the car navigation screen, the display device 33 can display various kinds of information such as a television image screen and an operation state (for example, a power generation state of a hybrid vehicle) of each part of the vehicle.

[0041]

The operation switch group 43 is provided with various operation switches for the vehicle user to input various commands to the vehicle power management device 11. The operation switch group 43 is not limited to a mechanical switch. When the display device 33 has a touch operation panel, the touch operation panel can be used as the operation switch group 43.

[0042]

The map data input unit 45 is a device for reading various data (so-called map matching data, map data, landmark data, and the like) for improving the accuracy of position detection from a recording medium and inputting the data to the control circuit 21. As a recording medium, a CD-ROM, a DVD-ROM, a memory card, or the like can be used.

[0043]

The remote control sensor 31 includes a remote control antenna 32, and transmits and receives radio waves to and from the starter remote control 19 by wireless communication, and transmits and receives various data to and from the control circuit 21. That is, the remote control sensor 31 is configured to relay various information (various data) transmitted and received between the control circuit 21 and the starter remote controller 19.

[0044]

The external memory 35 stores various information (variable values, etc.) in response to a write request of various control processes executed inside the control circuit 21 and controls the stored various information in response to a read request of various control processes. Output to the circuit 21.

The microphone 37 captures a sound generated around the vehicle 3 and outputs a peripheral sound signal corresponding to the captured sound to the control circuit 21.

[0045]

The peripheral information acquisition device 39 includes an external camera that captures a peripheral image of the vehicle 3, and an omnidirectional sensor that detects an obstacle existing around the vehicle 3 based on a reflection state such as an ultrasonic wave. The control circuit 21 outputs information (a video signal, an obstacle detection signal, and the like) relating to the surrounding state of the vehicle. The external camera can be configured using, for example, a back monitor camera used to capture an image behind the vehicle when the vehicle retreats, or an intersection monitor camera used to capture an image ahead of the vehicle.

[0046]

The vehicle-side communication device 41 includes a communication antenna 42. The vehicle-side communication device 41 transmits and receives radio waves to and from the external network transmission / reception center 17 by wireless communication, and transmits and receives various data to and from the control circuit 21. Relays various information (data) transmitted and received between the control circuit 21 and the external network transmission / reception center 17. As described above, the external network transmission / reception center 17 outputs (transmits) various information taken from the external information source to the vehicle power management device 11 by wireless communication.

[0047]

Next, various control processes executed by the control circuit 21 will be described.

First, a route guidance process executed inside the control circuit 21 to realize the car navigation function will be briefly described.

The route guidance process is a process that is started when a destination is set by the vehicle user operating the operation switch group 43 or the like, and automatically determines an optimal traveling route from the current position of the vehicle 3 to the destination. To determine the guidance route.

[0048]

In addition, as a method of automatically setting the optimal traveling route, for example, the Dijkstra method or the like can be used. The method of setting the destination is not limited to the case where the operation switch group 43 is used, and the starter remote controller 19 may be provided with a destination setting switch and the starter remote controller 19 may be used to set the destination.

[0049]

In addition, regarding the car navigation function, the external network transmission / reception center 17 can always store the latest information, so that the vehicle power management device 11 acquires various information required for the car navigation function from the external network transmission / reception center 17. Thus, accurate route guidance based on information newer than information recorded on a DVD or the like mounted on the vehicle can be performed.

[0050]

Next, a power management process executed inside the control circuit 21 to manage the state of charge of the vehicle-mounted battery 15 will be described. FIG. 3 is a flowchart showing the contents of the power management process. The power management process is repeatedly executed at regular intervals (for example, every 30 minutes).

[0051]

When the power management process is started, first, in S210 (S represents a step; the same applies hereinafter), it is determined whether or not the vehicle is in a parking state, and if a positive determination is made (the vehicle is in a parking state). And S220, and if a negative determination is made (not in the parking state), the power management process ends. In S210, the determination method using the current position of the vehicle 3 is used. When the destination is set by the car navigation function, an affirmative determination is made that the current position of the vehicle 3 is the destination, and the current position of the vehicle 3 is determined. If the position is in the middle of the guidance route from the departure point to the destination, a negative determination is made. If a destination has not been set, the destination can be estimated based on past travel history information, and it can be determined based on whether or not the estimated destination has been reached.

[0052]

When the determination at S210 is affirmative and the process proceeds to S220, a connection establishment process for establishing a communication path using wireless communication with the external network transmission / reception center 17 is performed at S220. By establishing the communication path, data transmission / reception between the vehicle power management device 11 and the external network transmission / reception center 17 becomes possible.

[0053]

In the next S230, the latest environmental information at the current location of the vehicle 3 is received from the external network transmission / reception center 17, and the electric power consumption during parking is read from the external memory 35. Then, a process of setting an appropriate lower limit value of the remaining battery charge of the vehicle-mounted battery 15 is performed.

[0054]

The environmental information includes at least an expected temperature (expected temperature), an expected humidity, and a weather forecast. The electric power consumption during parking is calculated in S300 described later. Will be executed using the value stored in the external memory 35 when is executed.

[0055]

As a method of setting the appropriate capacity lower limit value, for example, a method of setting a reference value in advance, correcting the reference value based on the received environment information and the power consumption during parking, and setting it as the appropriate capacity lower limit value. There is. Note that the reference value can be determined based on the rated capacity defined in the specifications (specifications) of the vehicle-mounted battery 15.

[0056]

The correction is performed, for example, so that the lower the output voltage level of the vehicle-mounted battery becomes, the larger the appropriate capacity lower limit value becomes. Execution is performed so that the lower limit becomes a small value. More specifically, the correction is performed such that the lower the expected temperature, the lower the appropriate capacity lower value becomes, and conversely, the higher the predicted temperature becomes, the smaller the appropriate capacity lower limit becomes. In addition, the correction is performed such that the lower the proper capacity lower limit becomes, the smaller the proper power lower limit becomes as the parking-time power consumption increases.

[0057]

In subsequent S240, it is determined whether or not the power supply determination preparation has been completed, in other words, whether or not the power supply state detector 23 can detect the power supply state of the vehicle-mounted battery 15; Then, if a negative determination is made, the power management process ends. In step S240, the detection results obtained by the sensors (the voltage sensor 25, the current sensor 27, and the temperature sensor 29) provided in the power supply state detector 23 can be captured, and the remaining charge of the vehicle-mounted battery 15 is calculated. If it is possible, it is determined that the power supply determination preparation is completed.

[0058]

When the affirmative determination is made in S240 and the process proceeds to S250, it is determined in S250 whether or not the engine of the vehicle 3 is stopped. When the affirmative determination is made (the engine is being stopped), the process proceeds to S260 and negative. If it is determined (the engine is running), the power management process ends. Whether or not the engine is stopped can be determined, for example, based on the engine speed (engine speed).

[0059]

When the determination at S250 is affirmative and the process proceeds to S260, a process of calculating the remaining charge of the vehicle-mounted battery 15 is performed at S260. Note that the control circuit 21 separately executes a history data accumulation process of accumulating detection results of the sensors (the voltage sensor 25, the current sensor 27, and the temperature sensor 29) provided in the power supply state detector 23 as history data. . In S260, the output power amount output from the vehicle-mounted battery 15 and the stored power amount stored in the vehicle-mounted battery 15 are calculated based on the stored history data, and based on the difference between the output power amount and the stored power amount. Then, a process of calculating the remaining charge capacity of the vehicle-mounted battery 15 is performed.

[0060]

In the next step S270, the remaining charge calculated in S260 is compared with the appropriate capacity lower limit set in S230, and a process of calculating the difference between the two is performed.

In subsequent S280, it is determined whether or not the remaining charge capacity of the vehicle-mounted battery 15 is insufficient based on the comparison result in S270. If the determination is affirmative (determined that the remaining charge capacity is insufficient), the process proceeds to S290. If a negative determination is made (determined that the remaining charge capacity is sufficient), the process proceeds to S300. In S280, an affirmative determination is made when the remaining charge is less than or equal to the lower limit of the appropriate capacity, and a negative determination is made when the remaining charge is greater than the lower limit of the appropriate capacity.

[0061]

When the determination at S280 is affirmative and the process proceeds to S290, at S290, the process of starting the engine of the vehicle 3 is performed by activating the engine start process as a subroutine. FIG. 4A is a flowchart showing the details of the engine start process.

[0062]

When the engine start process is started, in S410, a start command signal is output to the engine starter 13, and a process of starting the engine of the vehicle 3 by the engine starter 13 is performed.

In the next S420, after confirming that the engine has transitioned to the operating state (ON state), the vehicle communicates, via wireless communication, that the vehicle-mounted battery 15 is in a state of insufficient remaining capacity and that the engine has transitioned to the ON state. Perform processing to notify the user. In S420, it is determined that the engine has shifted to the operating state when the engine rotation speed is greater than a predetermined operating state determination reference value (for example, 200 [rpm]).

[0063]

In S420, regarding the notification processing, a warning notification signal indicating that the vehicle-mounted battery 15 is in a state of insufficient remaining capacity and an engine ON notification signal (engine start notification signal) indicating that the engine is in an operating state are provided. Processing for outputting from the vehicle side communication device 41 to the external network transmission / reception center 17 is performed. That is, in S420, a warning notification signal and an engine ON notification signal are output (transmitted) from the vehicle-side communication device 41 to the user-side communication device 20 used by the vehicle user via the external network transmission / reception center 17. Is performed. As a result, the on-board battery 15 is in an insufficiency state and the engine is in the operating state (ON state) in order to increase the remaining charge capacity of the on-board battery 15 for a vehicle user who is located away from the vehicle 3. ).

[0064]

In S420, it is determined whether there is an operating (operating) electric device among the electric devices (for example, a head run) that do not need to be in the operating state during parking, and the operating electric device is determined. If the device exists, the vehicle user is notified via wireless communication that the electric device is operating. Specifically, the vehicle-side communication device 41 outputs an operating device information signal indicating the operating electrical device, and sends the operating device information signal to the user-side communication device 20 used by the vehicle user via the external network transmission / reception center 17. By outputting (transmitting) the operating device information signal, the vehicle user is notified that there is an operating electrical device.

[0065]

Further, in S420, it is determined whether or not there is a stopped electrical device among the electrical devices (for example, an immobilizer (an anti-theft device) or the like) which are to be in an operating state during parking. If there is, the vehicle user is notified via wireless communication that the electric device is stopped. Specifically, the vehicle-side communication device 41 outputs (transmits) a stop device information signal indicating the stopped electrical device to the user-side communication device 20 to stop the vehicle user. Notifies that there is an electrical device inside.

[0066]

In S420, for example, it is determined whether the door is in an unlocked state (forgot to lock) or the window is in an open state. If the door is in an unlocked state, it is determined that the door is in an unlocked state. If the window is in the open state, the process of notifying the vehicle user of the open state through wireless communication may be executed. Thereby, security against theft and the like can be enhanced.

[0067]

When the process in S420 ends, the engine start process ends, and the process returns to the power management process.

When a negative determination is made in S280 of the power management process and the process proceeds to S300, in S300, the power consumption during parking (the power consumption due to dark current), which is the total consumption consumed by the electric device when the vehicle is parked, is calculated. A process of storing the calculation result in the external memory 35 is performed. In addition, the electric energy at the time of parking can be calculated by specifying the electric equipment in operation and summing the respective electric power consumption. In addition, since the power supply source in the vehicle in the engine stopped state is only the vehicle-mounted battery 15, the electric energy during parking is determined by the output current value and the output voltage value of the vehicle-mounted battery 15 detected by the power state detector 23. It is also possible to calculate based on.

[0068]

Since the power management process is repeatedly executed at a fixed cycle, in S300, the latest calculation result is stored in the external memory 35 by overwriting and updating the electric energy during parking stored in the external memory 35. I do. Accordingly, in step S230, the power consumption during parking according to the latest state of the vehicle 3 can be used, and the lower limit of the appropriate capacity can be set to an appropriate value according to the latest state of the vehicle 3.

[0069]

In subsequent S310, it is determined whether or not there is an operating (operating) electric device among the electric devices (for example, headlamps, etc.) that do not need to be in the operating state during parking. If the device exists, the vehicle user is notified via wireless communication that the electric device is operating. Specifically, the vehicle-side communication device 41 outputs an operating device information signal indicating the operating electrical device, and sends the operating device information signal to the user-side communication device 20 used by the vehicle user via the external network transmission / reception center 17. By outputting (transmitting) the operating device information signal, the vehicle user is notified that there is an operating electrical device.

[0070]

Further, in S310, it is determined whether or not there is a stopped electrical device among the electrical devices (for example, an immobilizer (an anti-theft device) or the like) that should be in an operating state during parking. If there is, the vehicle user is notified via wireless communication that the electric device is stopped. Specifically, the vehicle-side communication device 41 outputs (transmits) a stop device information signal indicating the stopped electrical device to the user-side communication device 20 to stop the vehicle user. Notifies that there is an electrical device inside.

[0071]

In S310, for example, it is determined whether the door is in an unlocked state (forgotten to be locked) or the window is open. If the door is in the unlocked state, it is determined that the door is in the unlocked state. If the window is in the open state, the process of notifying the vehicle user of the open state through wireless communication may be executed. Thereby, security against theft and the like can be enhanced.

[0072]

When a negative determination is made in S240, a negative determination is made in S250, or the process of S290 or S310 ends, the power management process ends.

Next, a charge completion determination process executed inside the control circuit 21 to determine that the vehicle-mounted battery 15 has shifted to the charge completion state after the engine is started by the power supply management process will be described.

[0073]

FIG. 5 is a flowchart illustrating the processing contents of the charging completion determination processing. Note that the charging completion determination process is repeatedly executed at regular intervals (for example, one-minute intervals) after the engine is started by the power management process.

When the charging completion determination process is started, first, in S610, it is determined whether or not the engine of the vehicle 3 is in an operating state. If an affirmative determination is made (the engine is operating), the process proceeds to S620. If a negative determination is made (the engine is being stopped), the charging completion determination processing ends. Whether or not the engine is operating can be determined, for example, based on the engine speed (engine speed).

[0074]

When the affirmative determination is made in S610 and the process proceeds to S620, a process of calculating the remaining charge capacity of the vehicle-mounted battery 15 is performed in S620. The processing in S620 is the same as the processing in S260 in the power management processing described above.

In the next S630, a process of comparing the remaining charge capacity calculated in S620 with the reference value of the completion of charging, and calculating a difference between the two is performed. Note that the charge completion reference value is set to a value larger than the lower limit of the appropriate capacity set in S230 of the power management process. For example, the upper limit and the upper limit of the appropriate capacity range of the remaining charge in the vehicle-mounted battery 15 are set. It is set to an intermediate value (average value) with the lower limit.

[0075]

In subsequent S640, it is determined whether or not the remaining charge of the vehicle-mounted battery 15 satisfies (exceeds) the charge completion reference value based on the comparison result in S630. If it is determined that the charge amount exceeds the reference value, the process proceeds to S650. If a negative determination is made (the charge remaining amount does not exceed the charge completion reference value), the process proceeds to S680.

[0076]

When the affirmative determination is made in S640 and the process proceeds to S650, it is determined in S650 that the charging of the vehicle-mounted battery 15 has been completed, and a process of storing the current operation status (such as date and time) in the external memory 35 is performed.

At S660, a process for stopping the engine is performed. Specifically, the operation of the control device that controls the ignition system, the fuel system, and the like is stopped to stop the engine.

[0077]

In the next step S670, after confirming that the engine is in the stopped state (OFF state), it is notified through wireless communication that the engine is in the stopped state and the charging state of the vehicle-mounted battery 15 is in the normal state. A process for notifying the vehicle user is performed. In S670, when the engine rotation speed is equal to or less than a predetermined stop state determination reference value (for example, 0 [rpm]), it is determined that the engine has shifted to the stop state.

[0078]

In step S670, regarding the notification process, the vehicle-side communication device 41 outputs a charge completion notification signal and an engine OFF notification signal (engine stop notification signal), and the vehicle user uses the notification via the external network transmission / reception center 17. A process of outputting (transmitting) a charge completion notification signal and an engine OFF notification signal to the user communication device 20 is performed. This notifies the vehicle user located away from the vehicle 3 that the engine has transitioned to the stopped state and that the state of charge of the vehicle-mounted battery 15 has transitioned from the state of insufficient remaining capacity to the normal state.

[0079]

When a negative determination is made in S640 and the process proceeds to S680, in S680, a process of calculating the amount of supplied power (charge amount) per unit time supplied from the generator to the vehicle-mounted battery 15 is performed. Then, based on the calculated supplied power amount, the time required to supply the difference power amount (differential charging capacity) between the remaining charge amount calculated in S630 and the reference value for charging completion (difference required charging time) is calculated. Then, a process of notifying the vehicle user of the calculated required time for completion of charging through wireless communication is performed. Thereby, the vehicle user can grasp the approximate time until the charging is completed.

[0080]

When a negative determination is made in S610, or when the process of S670 or S680 ends, the charging completion determination process ends. After the execution of S670, the periodic execution of the charging completion determination process is stopped thereafter. After that, when the engine is started again by the power management process, the periodic execution of the charging completion determination process is started again.

[0081]

In this embodiment, the vehicle power management device 11 corresponds to the vehicle power management device described in the claims, the vehicle-mounted battery 15 corresponds to the power supply device, and the power supply state detector 23 and S260 correspond to the power supply device. S280 in the power management process corresponds to the remaining power shortage determination unit, S420 in the engine start process and the vehicle-side communication device 41 correspond to the remaining capacity shortage notification unit, and the warning notification signal corresponds to the warning notification. This corresponds to information, and the user-side communication device 20 corresponds to the user-side communication device.

[0082]

In addition, S310 of the power management process, S420 of the engine start process, and the vehicle-side communication device 41 correspond to the operating device information output unit, and S410 of the engine start process and the engine starter 13 correspond to the engine start unit. S640 of the charging completion determination processing corresponds to the engine stop means, and S670 of the charging completion determination processing and the vehicle side communication device 41 correspond to the charging completion notification means. Further, the microphone 37 and the peripheral information acquisition device 39 correspond to a peripheral information acquisition unit, and the vehicle-side communication device 41 corresponds to a peripheral information output unit.

[0083]

As described above, the vehicle power management device 11 provided in the power management system 1 of the present embodiment is different from the vehicle power management device 11 in that the power supply state detector 23 and the power management process S260 are provided in the vehicle 3. S280 of the power supply management process determines whether the in-vehicle battery

15 has a remaining charge when the remaining charge of the in-vehicle battery 15 falls below the appropriate capacity lower limit based on the detection results by the power supply state detector 23 and S260. It is configured to determine that the capacity is insufficient.

[0084]

Then, when it is determined in S280 that the in-vehicle battery 15 is in the state of insufficient remaining capacity, the vehicle power supply management apparatus 11 determines in S420 of the engine start process and the vehicle-side communication device 41 that the in-vehicle battery 15 is in the state of insufficient remaining capacity. The charge state of the vehicle-mounted battery 15 is managed by outputting a warning notification signal indicating the presence to the user-side communication device 20 used by the vehicle user at a location away from the vehicle 3 by wireless communication. It is configured as follows.

[0085]

In other words, the vehicle power management device 11 does not notify the vehicle user of the in-vehicle battery 15 being in a state of insufficient remaining capacity by a display device or the like provided in the vehicle, but does not notify the user by wireless communication. The configuration is such that a warning notification signal (warning notification information) is output to the communication device on the side.

[0086]

As described above, by outputting the warning notification information by wireless communication, it is possible to notify the vehicle user who is away from the vehicle that the in-vehicle battery 15 has run out of the remaining capacity. Thus, even when the vehicle is in the parking state for a long period of time, the vehicle user can know the decrease in the remaining battery charge capacity by the warning notification information. It is possible to take countermeasures such as replacement or charging of the vehicle, and the vehicle-mounted electric device can be operated normally.

[0087]

In addition, the vehicle power management device 11 performs the power management process in step S310, the engine start process in step S420, and the vehicle-side communication device 41 outputs the operating device information signal representing the operating electrical device among the electrical devices mounted on the vehicle 3. Is output (transmitted) to the user-side communication device 20 by wireless communication.

[0088]

In other words, the vehicle user can know which electric device is operating by using the user side communication device 20 which has received the operating device information signal. The device can be easily specified. Then, the vehicle user stops the electric device that is the cause of the decrease in the remaining charge capacity, so that the remaining charge capacity of the vehicle-mounted battery 15 can be suppressed from further decreasing.

[0089]

Further, the vehicle power management device 11 is configured so that S410 of the engine start process and the engine starter 13 start the engine of the vehicle 3 to increase the remaining charge capacity of the vehicle-mounted battery 15.

In this way, by starting the engine and bringing it into the operating state, the electric power generated by the generator (alternator) can be charged to the vehicle-mounted battery 15, and the remaining charge capacity of the vehicle-mounted battery 15 can be increased. Therefore, it is possible to prevent the in-vehicle battery 15 from reaching a dead battery state.

[0090]

In S410, when the affirmative determination is made in S280, that is, when it is determined that the remaining charge capacity of the in-vehicle battery 15 is insufficient (the remaining capacity is insufficient), the vehicle 3 does not wait for an operation by the vehicle user. A process for starting the engine is executed. In other words, the vehicle power management device 11 can automatically start the engine and increase the remaining charge capacity without any operation by the vehicle user when the in-vehicle battery 15 falls into a state of insufficient remaining charge. I can do it.

[0091]

Therefore, according to the vehicle power management device 11, since the operation of starting the engine by the vehicle user can be omitted, the complexity of the starting operation can be eliminated. Further, when the in-vehicle battery 15 is in the state of remaining capacity shortage, the charging operation of the in-vehicle battery 15 by the engine operation is immediately performed. Can be avoided. For this reason, it is possible to prevent a further decrease in the remaining charge capacity due to a prolonged charging standby time, and to prevent the battery from falling into a dead state.

[0092]

Further, in the vehicle power management device 11, after the engine of the vehicle 3 is started by the engine start process in order to increase the remaining charge capacity of the vehicle battery 15, the charging of the vehicle battery 15 is performed in S640 of the charge completion determination process. Is completed, and when it is determined in S640 that the charging of the vehicle-mounted battery 15 has been completed, S660 of the charging completion determination process performs a process of stopping the engine. That is, when the charging of the vehicle-mounted battery 15 is completed, the vehicle power management device 11 can automatically stop the engine without waiting for an operation by the vehicle user.

[0093]

According to the vehicle power management device 11 configured as described above, since the operation of stopping the engine by the vehicle user can be omitted, the complexity of the stop operation can be eliminated. Further, the engine can be stopped immediately when the vehicle-mounted battery 15 is in the charging completed state, so that it is possible to avoid a prolonged stop standby time from the point in time when the charging is completed to the stop of the engine. Therefore, it is possible to prevent an increase in fuel consumption due to a prolonged stop standby time, and to prevent a decrease in fuel efficiency.

[0094]

Then, when the engine of the vehicle 3 is stopped by the process in S660, S670 performs a process of outputting a charge completion notification signal indicating completion of charging of the vehicle-mounted battery 15 to the user-side communication device 20 by wireless communication. Do. That is, the vehicle user knows that the remaining battery charge has increased to an appropriate value (in other words, that the battery has been charged) by using the user-side communication device that has received the charge completion notification signal. be able to.

[0095]

In the vehicle power management device 11, the microphone 37 and the peripheral information acquiring device 39 acquire the vehicle peripheral information (at least information including sound around the vehicle and video around the vehicle), and the microphone 37 and the peripheral information acquiring device 39. The vehicle-side communication device 41 is configured to output (transmit) the vehicle surrounding information acquired by the wireless communication.

[0096]

Thereby, even if the vehicle user is away from the vehicle 3, the vehicle user can know the situation around the vehicle by acquiring (receiving) the information around the vehicle via wireless communication, and based on the situation around the vehicle, can obtain the power supply. The cause of the decrease in the remaining charge capacity of the device can be estimated.

Further, the vehicle power management device 11 has a car navigation function (travel route guidance function) for guiding the traveling route of the vehicle, and also operates as a car navigation device (travel route guidance device). That is, the vehicle power management device 11 of this embodiment is configured to be mounted on the vehicle 3 together with the car navigation device. It is possible to prevent a malfunction as the traveling route guidance device due to the decrease, and to maintain a normal operation as the traveling route guidance device.

[0097]

Although the embodiments of the present invention have been described above, the present invention is not limited to the above-described embodiments, and can take various aspects.

For example, the engine start process is not limited to the process of automatically starting the engine without intervention of the vehicle user, and may be configured to start the vehicle engine when an engine start command is received from the vehicle user. May be configured.

[0098]

Thus, a description will be given of a second vehicle power supply management device in which the configuration of the vehicle power supply management device 11 of the above embodiment is changed to execute a second engine start process instead of the engine start process. The second engine start process is configured to start the engine of the vehicle when an engine start command is received from the vehicle user. FIG. 4 (b) is a flowchart showing the contents of the second engine start process. ).

[0099]

When the second engine start process is started, first, in S450, the process of notifying the vehicle user that the in-vehicle battery 15 is in a state of insufficient remaining capacity by wireless communication, and determining whether to start the engine by the vehicle. Performs processing to inquire the user. Specifically, a warning notification signal indicating that the in-vehicle battery 15 is in a state of insufficient remaining capacity from the vehicle-side communication device 41 to the user-side communication device 20 via the external network transmission / reception center 17 by wireless communication. And outputting a start inquiry signal for inquiring about engine start.

[0100]

In S450, it is determined whether there is an operating (operating) electric device among the electric devices (for example, the head run) that do not need to be in the operating state while the vehicle is parked. If the electric device exists, the vehicle user is notified through wireless communication that the electric device is operating. Specifically, the vehicle-side communication device 41 outputs an operating device information signal indicating the operating electrical device, and outputs the operating device information signal to the user-side communication device 20 via the external network transmission / reception center 17 ( The transmission notifies the vehicle user that there is an operating electrical device.

[0101]

Thereby, even if the vehicle user is away from the vehicle 3, by acquiring (receiving) the operating device information via the wireless communication, the vehicle user can know the electric device operating in the vehicle 3 in real time. As a result, the vehicle user can confirm whether or not the electric device that does not need to operate is operating, and determines whether or not the electric power stored in the vehicle-mounted battery 15 is wasted. I can do it.

[0102]

Further, in S450, a process of transmitting the vehicle peripheral information acquired by the microphone 37 and the peripheral information acquiring device 39 to the vehicle user by wireless communication is performed. Specifically, the vehicle-side communication device 41 outputs a vehicle-periphery information signal, and outputs (transmits) the vehicle-periphery information signal to the user-side communication device 20 via the external network transmission / reception center 17. The vehicle surrounding information is transmitted to the user.

[0103]

Thereby, even if the vehicle user is away from the vehicle 3, the vehicle user can know the surrounding state of the vehicle 3 in real time by acquiring (receiving) the vehicle surrounding information via wireless communication. As a result, the vehicle user can confirm that there is no person around the vehicle and can confirm that there is no danger caused by starting the engine.

[0104]

In subsequent S460, it is determined whether or not an engine start command has been input from the vehicle user. If an affirmative determination is made (the engine start command is input), the process proceeds to S470, and a negative determination is made (the engine start command). Is not input), and the same step is repeatedly executed to wait until an engine start command is input. If the vehicle user determines that there is a need to start the engine based on the contents of the operating device information signal and the vehicle surrounding information signal received by the user-side communication device 20, the vehicle user moves to the vehicle, By inputting an engine start command to the vehicle power management device using the operation switch group 43, the engine start is permitted.

[0105]

When the determination in S460 is affirmative and the process proceeds to S470, in S470, a process of outputting a start command signal to the engine starter 13 and causing the engine starter 13 to start the engine of the vehicle 3 is performed as in S410.

In the next S480, after confirming that the engine has transitioned to the operating state (ON state), a process of notifying the vehicle user that the engine has transitioned to the ON state via wireless communication is performed. In S480, when the engine rotation speed is higher than a predetermined operating state determination reference value (for example, 200 [rpm]), it is determined that the engine has shifted to the operating state.

[0106]

When the process in S480 ends, the second engine start process ends.

That is, in starting the engine of the vehicle, the second engine start process transmits the vehicle peripheral information and the operating device information to the vehicle user by wireless communication to determine whether or not to start the engine for the vehicle user. When the determination is prompted and an engine start command is input from the vehicle user, a process for starting the engine of the vehicle is performed.

[0107]

Therefore, according to the second vehicle power management device, the vehicle user needs to start the engine after determining whether there is a danger such as the presence of a person around the vehicle based on the operating device information and the vehicle surrounding information. When the determination is made, the engine is started, so that the danger associated with the engine start can be reliably avoided.

[0108]

In the second engine start process, S470 corresponds to the engine start means described in the claims, and S450 corresponds to the operating device information output means and the peripheral information output means. In addition, when the second vehicle power management device is used, the vehicle user moves to the vehicle to start the engine, and thus can directly confirm that the engine has been started. The process of notifying the transition to the state (the process in S480) may be omitted.

[0109]

Also, when starting the vehicle engine, the vehicle user does not move to the vehicle and inputs the engine start command, but instead starts the vehicle engine when receiving the engine start command signal by wireless communication. A power management device may be configured. Specifically, a third engine start process is executed as the engine start process. FIG. 4C is a flowchart showing the processing content of the third engine start processing.

[0110]

The third engine start process includes the steps of S510, S520, S530, and S540, and the contents of the processes in S510, S530, and S540 correspond to S450, S470, and S480 in the second engine start process, respectively. Is the same as the content of the processing. Therefore, S520 having different processing contents will be described.

[0111]

In S520, it is determined whether or not an engine start command signal has been received from the vehicle user by wireless communication. If an affirmative determination is made (an engine start command signal is received), the process proceeds to S530, and a negative determination is made ( By repeatedly executing the same step when the engine start command signal is not received), the process stands by until the engine start command signal is received. When the vehicle user determines that the engine needs to be started based on the contents of the operating device information signal and the vehicle peripheral information signal received by the user communication device 20, the vehicle communication device By using (20), an engine start command signal is transmitted (output) to the vehicle power management device, thereby permitting engine start.

[0112]

That is, in starting the engine of the vehicle, the third engine start process transmits the vehicle peripheral information and the operating device information to the vehicle user to urge the vehicle user to determine whether to start the engine, When an engine start command is received from the user-side communication device 20 through communication, a process for starting the engine of the vehicle is performed.

[0113]

Therefore, according to the third vehicle power management device that executes the third engine start process instead of the second engine start process, even when the vehicle user is away from the vehicle, the vehicle user can use the wireless communication. By transmitting an engine start command to the third vehicle power management device, the engine of the vehicle can be started. In other words, the vehicle user can start the engine without spending the labor of moving to the vehicle 3 and increase the remaining charge capacity of the vehicle-mounted battery 15, thereby eliminating the complexity of the operation for preventing the battery from running down. it can.

[0114]

In the third engine start process, S530 corresponds to the engine start means described in the claims, and S510 corresponds to the operating device information output means and the peripheral

information output means. Further, in S520 of the third engine start process, when an engine start command signal transmitted from the starter remote controller 19 instead of the user-side communication device 20, the process may be executed so as to make a positive determination.

[0115]

Next, the vehicle power management device of the above embodiment is a vehicle power management device integrally formed with a device (vehicle route guidance device, car navigation device) for guiding a traveling route of a vehicle. It may be configured as a vehicle power management device mounted on the same vehicle in a state where the device is divided.

[0116]

Further, the vehicle-side communication device 41 is not limited to a dedicated communication device for realizing the power management function, and may be configured by, for example, an automobile telephone. Further, the vehicle-side communication device 41 is not limited to a device fixedly installed in the vehicle, and may be configured by a mobile communication device such as a mobile phone. In this case, the vehicle power management device needs to include a transmission path connection unit (connector) for forming an information transmission path with the mobile communication device.

[0117]

Further, each numerical value described in the above embodiment is not limited to the above numerical value.For example, when the execution cycle of each of the above control processes is set to an appropriate value according to the application or use environment of the vehicle, etc. good. That is, the execution cycle of the power management process is not limited to the 30 minute cycle, and may be set to one hour cycle or another cycle.

[0118]

Next, the above-described vehicle power management apparatus is configured to output a warning notification signal and an engine ON notification signal (engine start notification signal) to the external network transmission / reception center 17 by the processing in S420. The output destination of the signal may be the remote control 19 for the starter. In other words, by outputting a warning notification signal and an engine ON notification signal from the remote control sensor 31 to the starter remote control 19, the vehicle user can be notified of the insufficient remaining battery power state and the transition of the engine ON state to the vehicle user. You may notify. In this case, the starter remote controller 19 corresponds to the user-side communication device described in the claims.

[0119]

Furthermore, the charging completion reference value used in S630 is not limited to a predetermined fixed value, but is corrected based on environmental information, electric power consumption during parking, and the like as in the setting processing of the lower limit of the appropriate capacity in S230. · It may be updated.

When the vehicle user moves to the vehicle and starts the engine, the charge remaining capacity of the battery may be increased by normal engine start using an ignition key instead of using the operation switches 43.

[0120]

Furthermore, when the required detection accuracy is satisfied, the peripheral information acquisition device 39 may be configured to include either an external camera or an omnidirectional sensor, or may be configured in addition to the external camera and the omnidirectional sensor. Further, another sensor or the like may be provided.

[0121]

In the above embodiment, the position detector 51 having four detection units is used. However, if required accuracy can be ensured, a position detector having three or less detection units may be used, or When higher accuracy is required, a position detector having five or more detection units may be used. Examples of the detection unit other than those described above include a rotation sensor of the steering wheel and a wheel sensor of each rolling wheel.

[0122]

In the above-described embodiment, the vehicle power management apparatus including the means for automatically stopping the engine (S660 of the charge completion determination process) has been described. However, the vehicle power management apparatus having no means for automatically stopping the engine is described. By configuring the management device to output the charge completion notification signal, it is possible to notify the vehicle user who is away from the vehicle of the charge completion time. As a result, it is possible to prevent the operation of the engine from being continued even after the charging is completed, and to suppress wasteful consumption of fuel.

[Brief description of the drawings]

FIG. 1 is a schematic configuration diagram of a power management system including a vehicle having a vehicle power management device according to an embodiment.

FIG. 2 is a configuration diagram of a vehicle power management device.

FIG. 3 is a flowchart illustrating processing contents of a power management processing.

FIG. 4A is a flowchart showing a process of an engine start process, FIG. 4B is a flowchart showing a process of a second engine start process, and FIG. 4C is a flowchart showing a third engine start process. 6 is a flowchart showing the processing contents of FIG.

FIG. 5 is a flowchart illustrating processing contents of a charging completion determination processing.

[Explanation of symbols]

DESCRIPTION OF SYMBOLS 1 ... Power supply management system, 3 ... Vehicle, 11 ... Vehicle power supply management device, 13 ... Engine starter, 15 ... Vehicle battery (vehicle power supply device), 17 ... External network transmission / reception center, 19 ... Remote control for starter, 20 ... User Side communication device, 21 control circuit, 23 power state detector, 31 remote control sensor, 37 microphone, 39 peripheral information acquisition device, 41 vehicle-side communication device, 43 operation switch group.

**Claims**

Power supply state detection means for detecting the remaining charge of a power supply device provided in the vehicle,

Based on the detection result by the power supply state detection means, when the remaining charge capacity of the power supply apparatus is less than the appropriate capacity lower limit, power supply remaining capacity shortage determination means that determines that the power supply apparatus is in a remaining capacity shortage state,

A power management device for a vehicle that manages a charging state of the power supply device, wherein when the power supply remaining capacity determination unit determines that the power supply device is in a remaining capacity shortage state, the power supply device is It is provided with a remaining capacity shortage notifying unit that outputs, by wireless communication, warning notification information indicating that the remaining capacity is insufficient to a user-side communication device used by a vehicle user at a location away from the vehicle. ,

A power supply management device for vehicles.

Operating device information indicating an operating electrical device among the electrical devices mounted on the vehicle, by wireless communication, comprising operating device information output means for outputting to the user side communication device,

The vehicle power management device according to claim 1, wherein:

An engine starting unit that starts an engine of the vehicle to increase a remaining charge capacity of the power supply device,

The power management device for a vehicle according to claim 1 or 2, wherein:

The engine starting means starts the engine of the vehicle when the power supply device is determined to be in a remaining capacity shortage state by the power supply remaining capacity determination means.

The power management device for a vehicle according to claim 3, wherein:

The engine starting means, when receiving an engine start command from the user side communication device by wireless communication, to start the engine of the vehicle,

The power management device for a vehicle according to claim 3, wherein:

After the engine of the vehicle is started to increase the remaining charge capacity of the power supply device, a charge completion determination unit that determines completion of charging of the power supply device,

An engine stop unit that stops the engine when the charging completion determination unit determines that the charging of the power supply device is completed;

The power management device for a vehicle according to any one of claims 1 to 5, further comprising:

When the engine is stopped by the engine stop unit, the system further includes a charge completion notification unit that outputs charging completion notification information indicating completion of charging of the power supply device to the user-side communication device by wireless communication.

The power management device for a vehicle according to claim 6, wherein:

Peripheral information acquiring means for acquiring vehicle peripheral information including at least one of a video around the vehicle or a sound around the vehicle,

A peripheral information output unit that outputs the vehicle peripheral information acquired by the peripheral information acquisition unit to the user-side communication device by wireless communication;

The power management device for a vehicle according to any one of claims 1 to 7, further comprising:

The power management device for a vehicle according to any one of claims 1 to 8, wherein:

Being mounted on the vehicle together with a travel route guidance device for guiding the travel route of the vehicle,

A power supply management device for vehicles.

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| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 45447509 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Christopher B. Austin/Eliana Carter |
| **Filer Authorized By:** | Christopher B. Austin |
| **Attorney Docket Number:** | 013350-9003-US35 |
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| **Filing Date:** | 01-MAR-2021 |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | 013350-9003-US35_IDS_as_filed_04-11-22.pdf | 1034406<br>5c7e4ba2478b1c7b6c849d0a5a7d5360f04a9053 | no | 4 |
| **Warnings:** | | | | | |

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| **Information:** | | | | | |
| 2 | Foreign Reference | JP2004142661.pdf | 11996332<br>4171a806b5c5c0d7a131894c7d496b8587543047 | no | 44 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Non Patent Literature | WO0118899_English_Translation.pdf | 1302731<br>353dbcaa92e7b5e516a737d4732571a97cf9add7 | no | 3 |
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PTO/SB/08a (02-18)
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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

**( Not for submission under 37 CFR 1.99)**

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| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | 3763 |
| Examiner Name | Not Yet Assigned |
| Attorney Docket Number | 013350-9003-US35 |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

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| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

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A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-07-18 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

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Tesla EX1002 Page 262

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| **EFS ID:** | 46207937 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Christopher B. Austin/Eliana Carter |
| **Filer Authorized By:** | Christopher B. Austin |
| **Attorney Docket Number:** | 013350-9003-US35 |
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|---|---|---|---|---|---|
| 1 | Foreign Reference | WO2001018899.pdf | 2350592<br>ac51a2d9afe46fb83b424a60e6c15ed8f47ad7a2 | no | 36 |
| **Warnings:** | | | | | |

| Information: | | | | | |
|---|---|---|---|---|---|
| 2 | Information Disclosure Statement (IDS) Form (SB08) | 013350-9003-US35_IDS_as_filed_07-18-22.pdf | 1034392<br>bec431b7f783e9faa5152d84176a38ee96449832 | no | 4 |

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(12)特許協力条約に基づいて公開された国際出願

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国際事務局

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2001 年3 月15 日 (15.03.2001)

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(81) 指定国 (国内): BR, CA, CN, ID, IN, KR, US.

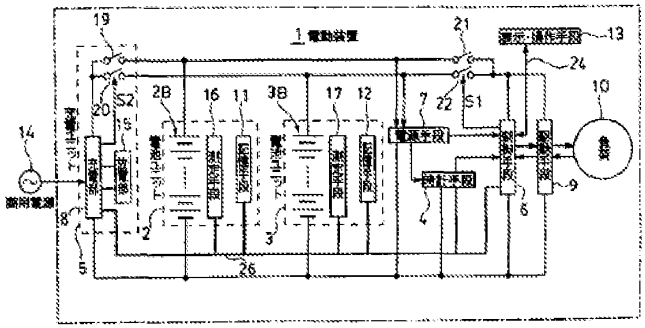
(84) 指定国 (広域): ヨーロッパ特許 (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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..... 国際調査報告書

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(54) Title: ELECTRIC DEVICE WITH TIMER MEANS

(54) 発明の名称: 時計手段を有する電動装置




(57) Abstract: An electric device comprises rechargeable batteries (2B, 3B); measuring means (16, 17) for measuring the states of the batteries; storage means (11, 12) for storing measured data and the characteristic data of the batteries; control means (6) for controlling load (10); timer means (4); display and control means (13) capable of setting the timer means (4) and indicating time; and a charger unit (5). The rechargeable batteries (2B, 3B) are charged under control based on the data in the storage means (11, 12) and/or the data from the measuring means (16, 17) and on the time data from the timer means (4).

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(57) 要約:

電動装置に、二次電池（２Ｂ，３Ｂ）と、その状態を測定する測定手段（１６，１７）及びその測定情報及び二次電池の特性に関する情報を記憶する記憶手段（１１，１２）と、負荷（１０）の駆動を制御する制御手段（６）と、時計手段（４）と、その時計手段（４）に対する時刻設定機能及び時刻表示機能を持つ表示・操作手段（１３）と、充電ユニット（５）とを備え、測定手段（１６，１７）及び／又は記憶手段（１１，１２）の情報と時計手段（４）による時刻情報とに基づいて二次電池（２Ｂ，３Ｂ）の管理及び充電を行う。

# 明　細　書

## 時計手段を有する電動装置

### 技術分野

この発明は、二次電池を搭載してその電力によって走行する小型電気自動車，電動二輪車，電動スクータ，電動車椅子などの電動装置に関するものである。

### 背景技術

小型電気自動車，電動二輪車，電動スクータ，電動車椅子などのように、複数の二次電池である蓄電池からなる組電池を電力源として搭載した電動車両等の電動装置がある。これらには、組電池の電力で電動機（モータ）を駆動し、そのモータの駆動のみで走行する車両、人力とモータの駆動力との合力で走行する車両、あるいは通常のガソリンエンジンの駆動力と組電池の電力によるモータの駆動力とを切り替えて使用する車両等がある。

これらの電動装置に使用される電力源である組電池は、頻繁に充電する必要がある。その充電方法としては、その組電池を搭載している電動装置から取り外して充電する方法、あるいは電動装置に搭載したままで充電するいわゆる車載充電方法などが日常行われている。

ところで、このような従来の電動装置においては、充電前の二次電池の残存容量の把握が不充分であり、勘や経験等によって、電動車両が遊休している時間帯に充電時間を設定して充電する方法が採られている。

さらに、二次電池の残存容量の把握が不充分であるため、実際に使用するときに残存容量がなかったり、稼働後に残存容量が不足していたため目的地まで走行できなかったりすることが生じていた。また、充電の終了時間を正確に予測したり、指定時間に充電したり、指定時間までに最大の充電を行ったりすることもできなかった。

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これらの欠陥を補う手段として、例えば充電後の見かけ上高く出る二次電池の出力電圧を落ち着かせるために、充電完了後予め定めた時間だけ計時した後に二次電池の出力電圧を計って残容量を決めるようにしたもの（特開平８－１０６９２７号公報）、あるいは、電動装置起動時の電圧変動の多いときを避け、起動後予め定めた時間経過してから二次電池の出力電圧を測定して残存容量を判定するようにしたもの（特開平１１－３２４０１号公報）等が提案されている。

しかし、これらの従来技術は、上記したような勘や経験等による充電時間管理の域を脱せず、時刻（経過時間ではなく何時何分等）管理を行っていないため、使用者の生活に密着した時刻管理は不可能であった。

この発明は、上述したような従来技術の不具合を改善するためになされたものであり、二次電池の残存容量の把握精度を向上し、二次電池の充電を適時に行えるようにすることを目的とする。さらに、時刻指定による充電の開始や、充電終了時刻指定による充電、あるいは充電終了時刻の算出と表示、二次電池の自動リフレッシュ及び自動充電なども行えるようにし、特に電動車両における二次電池の管理精度及び取扱い性を向上することを目的とする。

発 明 の 開 示

この発明は上記の目的を達成するため、充電可能な二次電池と、その二次電池の状態を測定する測定手段及びその測定情報及び二次電池の特性に関する情報を記憶する記憶手段と、上記二次電池によって供給される電力によって駆動される電動機等の負荷と、その負荷の駆動を制御する制御手段と、計時機能を持つ時計手段と、その時計手段に対する時刻設定機能及び時刻表示機能を持つ表示・操作手段と、上記測定手段及び／又は記憶手段の情報と上記時計手段による時刻情報とに基づいて上記二次電池の管理を行う電池管理手段とを備えた時計手段を有する電動装置を提供する。

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上記制御手段が上記電池管理手段の機能も持つようにすることができる。

また、上記電池管理手段に代えて、好ましくは上記電池管理手段に加えて、上記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の充電を行う充電手段とを備えるとよい。

あるいは、上記充電手段に代えて、上記二次電池の充電を行うための充電手段を接続可能なインタフェイスを設けるようにしてもよい。

上記二次電池と測定手段及び記憶手段を一体の電池ユニットとして構成し、その電池ユニットを電動装置本体に対して着脱可能に搭載するようにしてもよい。

また、上記充電手段を、商用電源又はそれに代わる電源から給電されて上記二次電池の充電を行う充電部を内蔵する充電ユニットとして構成し、その充電ユニットを電動装置本体に対して着脱可能に搭載するようにしてもよい。

上記充電手段を設けた電動装置においては、上記表示・操作手段に充電開始時刻を指定する手段を設け、上記充電手段にその指定された時刻に二次電池の充電を開始する手段を設けることができる。

あるいは、上記表示・操作手段に充電終了時刻を指定する手段を設け、上記充電手段に、その指定された時刻に二次電池の充電を終了するように該充電を開始する手段を設けることもできる。

さらに、上記充電手段に、上記二次電池がメモリ効果を有するとき、その二次電池を充電する前に残存電荷を放電させてリフレッシュするための放電部を設けるとよい。

また、これらの電動装置において、上記時計手段によって指定された時刻に起動して上記測定手段及び記憶手段を動作させ、上記二次電池の特性に応じた自己放電量及び消費容量により該二次電池の残存容量を管理する手段を設けることができる。

上記充電手段を設けた電動装置においては、上記時計手段によって指定された時刻に起動して上記測定手段及び記憶手段を動作させ、上記二次電池の特性に応じた

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自己放電量及び消費容量により該二次電池の残存容量を管理し、その二次電池の充電が必要なときに上記充電手段に充電させる手段を設けるとよい。

図面の簡単な説明

第１図は、この発明の一実施形態を示す電動装置のブロック回路図である。

第２図は、第１図における電池ユニット内の測定手段の具体例を示すブロック回路図である。

第３図は、第１図に示した電動装置における時刻指定充電の設定動作を示すフローチャートである。

第４図は、同じく時刻指定充電の動作を示すフローチャートである。

第５図は、同じく二次電池のリフレッシュ後に時刻指定充電を行う動作を示すフローチャートである。

第６図は、同じく充電終了時刻指定充電の設定動作を示すフローチャートである。

第７図は、同じく充電終了時刻指定充電の動作を示すフローチャートである。

第８図は、第１図に示した電動装置の非稼働時の二次電池の残存容量補正動作を示すフローチャートである。

第９図は、同じく二次電池の残存容量補正後に充電が必要な場合には自動充電を行う動作を示すフローチャートである。

発明を実施するための最良の形態

以下、この発明の実施形態を図面に基づいて具体的に説明する。

第１図は、この発明による電動装置の一実施形態例を示すブロック回路図である。

この電動装置１は、電池ユニット２，３（この実施形態では２つの電池ユニットで構成する例を示すが、１つ以上であればよい）、時計手段４、充電ユニット５、制御手段６、電源手段７、表示・操作手段１３、駆動手段９、および負荷１０によって構成される。

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充電ユニット５は、マイクロコンピュータ等による制御機能を備え、商用電源１４或いはそれに代わる電源から電力の供給を受け、電池ユニット２，３への充電を行う充電部８と、充電部８からのスイッチ制御信号Ｓ２に制御されて、電池ユニット２，３のいずれに充電するかを切り替えるスイッチ１９，２０と、メモリ効果が生ずるニッケル・カドミウム（Ｎｉ－Ｃｄ）二次電池あるいはニッケル水素（Ｎｉ－ＭＨ)二次電池のリフレッシュのため、電池ユニット２，３を充電部８の制御機能による制御の下に放電させる放電部１５と、システムバス２６とのインタフェイス（図示せず）により構成されている。

電池ユニット２，３は、それぞれ充電可能な二次電池（複数の蓄電池からなる組電池またはそれに変わるエネルギー蓄積体を含む）２Ｂ，３Ｂと、その二次電池２Ｂ，３Ｂの必要な部分（電池の特性、電動装置が必要とするセル単位、複数セル、全体等）の電圧検知や充放電電流検知と、その必要な部分の温度および周囲温度等の温度検知を行う測定回路およびその測定データをシステムバス２６に出力するためのインタフェイスからなる測定手段１６，１７と、電池の特性及び電動装置が必要とする少なくとも二次電池２Ｂ，３Ｂの残存容量を含む電池情報を記憶するＥＥＰＲＯＭ等の不揮発性メモリ及びそのデータをシステムバス２６を介して読み書き可能にするためのインタフェイスとからなる記憶手段１１，１２とにより構成されている。

制御手段６は、マイクロコンピュータ等による制御機能を備えており、後述する表示・操作手段１３からの稼働情報と電池ユニット２，３の記憶手段１１，１２に記憶されている電池情報等により、どの電池ユニットを使用するかを決め、スイッチ制御信号Ｓ１によりスイッチ２１，２２を切り替えて電池ユニット２，３のどちらを使用するかを選択したり、駆動手段９をどのように動作させるか等の電動装置の稼働の主制御を行う機能を持つ。さらに、この発明による電池管理手段の機能も有する。

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また、表示・操作手段１３及びシステムバス２６とのインタフェイスと、非稼働時に電動装置を省電力状態に移行させる機能と、時計手段４からのウエイクアップ信号ＷＵにより省電力状態から復帰する機能も有する。

電源手段７は、電池ユニット２，３及び充電ユニット５からの電力供給により制御手段６及び後述する時計手段４に必要な電力を供給する。

時計手段４は、電源手段７からの電力供給により常時動作しており、決められた時刻及び／又は決められた時間経過後にウエイクアップ信号ＷＵを出力する機能を持つ。

また、表示・操作手段１３の表示部へ制御手段６を経由して時刻を表示することが可能であると共に、その操作部の操作により時刻設定が可能に構成されている。

表示・操作手段１３は、電動装置１の状態、充電ユニット５の充電部８の状態及び時刻の表示等、必要な状態および情報を表示するＬＣＤ表示器等による表示部と、電動装置１の稼働指示、時計手段４の時刻設定（後述する充電開始時刻、充電終了時刻の指定を含む）、その他の必要な指示操作が可能な複数のキーあるいはボタンやタッチパネルなどによる操作部とから構成されている。そして、オペレーションバス２４を介して、表示は制御手段６からの信号により行われ、操作情報は制御手段６に送られる。また、必要に応じて制御手段６からの指示に応じて鳴動するブザーなども含む。

システムバス２６は、充電ユニット５の充電部８、電池ユニット２，３の測定手段１６，１７と記憶手段１１，１２、時計手段４、制御手段６の間での情報授受に用いられるバスであり、一般にデータバスとアドレスバスとコントロールバスからなるが、各部間の情報の授受が行えればシリアルバス、パラレルバスあるいは他のどのような構成を取ってもよい。

駆動手段９は、電池ユニット２，３からの電力を受け、制御手段６からの信号により負荷１０の制御及び駆動を行う。

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負荷１０は、電動装置１の目的を果たすための電動機（モータ）、アクチュエータ、ランプ類等である。その電動機は車輪等の走行部を駆動して電動装置１を走行させる。アクチュエータはブレーキなどを作動する。ランプ類はヘッドライト、テールライト、ウインカなどのランプである。

なお、電池ユニット２，３及び充電ユニット５は、電動装置本体（車体）に固定して設けてもよいが、着脱可能なユニットとして設けると便利である。

その場合は、電池ユニット２，３及び充電ユニット５内の電源線およびバスと、電動装置本体側の電源線およびシステムバス２６とを、電池ユニット２，３及び充電ユニット５の着脱に応じてそれぞれ接続／切断するコネクタや、搭載したユニットを容易に離脱しないようにロックするロック機構などを設けるとよい。

そのようにすれば、電池ユニット２，３のうち一方の二次電池の残存容量が少なくなって充電する必要が生じたとき、その電池ユニット（２又は３）と充電ユニット５を電動装置から取り外して、商用電源１４のある場所で充電を行い、その間はもう１個の電池ユニットから負荷１０等への給電を行って、電動装置１を稼働することができるので便利である。

また、この実施形態では、電動装置１に充電手段である充電ユニット５を搭載しているので、電動装置に電池ユニット２，３を搭載したままで充電することもできるが、電動装置に充電手段を設けずに、電動装置外の商用電源１４あるいはそれに代わる電源がある場所に充電装置を設置しておいて、電池ユニット２，３を電動装置１から取り外してその充電装置に接続して充電するようにしてもよい。　したがって、電動装置としては、充電手段を搭載することは必須ではない。

ここで、電池ユニット２に設けられる測定手段１６の具体例を第２図に示す。なお、電池ユニット３に設けられる測定手段１７もこれと同じ構成である。

この測定手段１６は、二次電池２Ｂに直列に接続した電流測定用の抵抗値の小さい抵抗１６１と、二次電池２Ｂに密着するかその近傍に配設した温度測定用のセン

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サであるサーミスタ１６２と、温度測定回路１６３、電圧測定回路１６４、電流測定回路１６５と、Ａ／Ｄ変換回路１６６，１６７，１６８と、システムバス２６とのインタフェイス１６９とからなる。

温度測定回路１６３は、サーミスタ１６２の温度による抵抗値変化を電圧に変換して二次電池２Ｂあるいはその周囲の温度を測定し、その測定値をＡ／Ｄ変換回路１６６でデジタル値に変換し、インタフェイス１６９を介してシステムバス２６へ出力する。なお、このサーミスタ１６２，温度測定回路１６３，及びＡ／Ｄ変換回路１６６を、二次電池２Ｂの各セル毎、あるいは複数のセル群毎に設けるようにすれば、より細かく温度測定を行うことができる。

電圧測定回路１６４は、二次電池２Ｂの端子電圧を測定し、その測定値をＡ／Ｄ変換回路１６７でデジタル値に変換し、インタフェイス１６９を介してシステムバス２６へ出力する。なお、電圧測定回路１６４及びＡ／Ｄ変換回路１６７を、二次電池２Ｂの各セル毎、あるいは複数のセル群毎に設けるようにすれば、より細かく電圧測定を行うことができる。

電流測定回路１６５は、抵抗１６１による電圧降下の測定によって二次電池２Ｂの放電電流あるいは充電電流の値を測定し、その測定値をＡ／Ｄ変換回路１６８でデジタル値に変換し、インタフェイス１６９を介してシステムバス２６へ出力する。なお、抵抗１６１に代えて、ホール素子やカレントトランス等を用いて二次電池２Ｂに流れる電流を測定することもできる。

次に、この実施形態における充電ユニット５による電池ユニット２，３の充電動作について説明する。

この実施形態において、充電は、充電ユニット５が商用電源１４あるいはそれに代わる電源に接続されて、充電部８に電力が供給されると開始される。充電部８は供給される交流入力を充電に適した直流電圧にして出力する。

また、この充電部８はマイクロコンピュータ等による制御機能を備えており、充

電モードとして、時刻指定充電、即時充電、充電終了時刻設定充電等を実行できるが、これらの充電モードは、電動装置１の稼働時あるいは充電時に、表示・操作手段１３による予め定められた操作により設定可能である。また、充電部８は充電モードの設定内容を保持し、充電毎にそれを参照してその保持した充電モードで充電を開始する。

また、電池ユニット２，３の各二次電池２Ｂ，３Ｂの使用回数、周囲温度、充電効率等の電池特性及び放電電流積算値あるいは検出電圧等による残存容量管理を行うため、その精度やシステム特性等による影響はあるが、この発明には直接関係しないものは無視している。電池容量は電池の持つ基本的容量である。

まず、第３図のフローチャートによって、充電開始時刻を指定して充電する充電時刻指定充電の設定方法について説明する。

その時刻指定充電の設定は、表示・操作手段１３からの指示により、制御手段６を介して充電ユニット５の充電部８によって、第３図のステップＡ１～Ａ６の手順で行われる。

Ａ１：表示・操作手段１３の予め定められた操作により充電モードの設定に入る。

Ａ２：そこで、時刻指定充電モードの指定（操作部のキー等により指定）がなされると、充電開始時刻の入力を要求する。

Ａ３：そこで、表示・操作手段１３のキー操作によって充電開始時刻が入力されると、それを設定（充電部８のメモリに記憶）する。

Ａ４：そして、充電部８はシステムバスを介して電池ユニット２，３の各記憶手段１１，１２から残存容量情報を、時計手段４から現在時刻情報を得て、その残存容量から充電時間（充電所要時間）を算出する。

充電時間は、定電流充電電池の場合は次式によって算出する。

充電時間＝(電池容量－残存容量)÷充電電流

定電流定電圧充電の場合は、予め定電流充電終了時の残存容量(充電容量)を調べ

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ておくとともに、定電圧充電時の時間対残存容量(充電容量)を調べてテーブル化しておき、次のように算出する。

定電流期間がある時：(電池容量－残存容量)÷充電電流＝Ｔ１

定電圧充電時間＝Ｔ２　として、充電時間＝Ｔ１＋Ｔ２

定電流期間がない時：充電時間＝(電池容量－残存容量)にて

テーブルより算出する。

上記により算出した充電時間と現在時刻により、予め定められた表示、例えば充電所要時間及び／又は入力された充電開始時刻か充電所要時間後の時刻、すなわち充電終了時刻の表示を、表示・操作手段１３に表示させる。

Ａ５，Ａ６：このあと、設定操作の終了を確認（確認キーの押下を検知する）すると、時刻指定充電の設定を終了する。

次に、第４図のフローチャートによって、時刻指定充電が設定されているときの充電動作について説明する。

その時刻指定充電は、充電ユニット５の充電部８によって、第４図のステップＢ１～Ｂ７の手順で行われる。

Ｂ１：商用電源１４あるいはそれに代わる電源から電力が充電部８に供給されると、充電部８は充電モードになる。

Ｂ２：時刻指定充電かどうかをチェックし、他の充電モードの場合には直ちにＢ４へ進んで充電開始する。時刻指定充電の時はＢ３へ進む。

Ｂ３：時計手段４から現在時刻情報を得て、記憶している充電開始指定時刻を比較し、指定時刻になるのを待つ。現在時刻が充電開始時刻と一致するとＢ４へ進む。

Ｂ４：充電を開始する。すなわち、充電部８はスイッチ制御信号Ｓ２によってスイッチ１９，２０のいずれかをＯＮにして、充電する電池ユニット２又は３を選択し、その選択した電池ユニットの二次電池２Ｂ又は３Ｂに充電電力を供給して充電を開始する。

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Ｂ５：この充電開始時に、充電時刻指定充電の設定時に求めた充電所要時間及び／又は充電終了時刻を表示し、充電が進むにつれ残存容量に充電容量を加えた値として充電時間を算出して、逐次充電終了までの時間及び／又は充電終了時刻を表示する。

Ｂ６，Ｂ７：その後、充電の終了をチェックし、未終了の場合はＢ５で充電を続け、充電終了を確認すると充電処理を終了する。

この例では、電池ユニット２，３のうちの一方を選択してその二次電池を充電することとしたが、二つの電池ユニット２，３に充電が必要な場合には、一方の二次電池を充電した後に、他方の二次電池を選択して充電することになる。このときは当然のことであるが、充電所要時間は各二次電池の充電所要時間を加えたものとなる。

次に、第５図によって、ニッケル・カドミウム二次電池やニッケル水素二次電池等のメモリ効果があるためリフレッシュが必要な電池について、リフレッシュ動作を行った後に時刻指定充電する動作について説明する。

このメモリ効果は、充電深度が浅い状態で充電と放電を繰り返して使用すると、電池の容量が減少することをいう。

この場合の動作は、充電部８によって第５図のステップＣ１～Ｃ１０の手順で行われる。

Ｃ１：商用電源あるいはそれに代わる電源から電力が充電部８に供給されると、充電部８はリフレッシュ・時刻指定充電モードに入る。

Ｃ２，Ｃ３：そしてまず、時刻指定充電かどうかがチェックし、違う充電モードの場合には直ちにＣ４へ進んでリフレッシュを開始する。時刻指定充電の時は、Ｃ３で時計手段４から現在時刻情報を得て記憶している充電開始指定時刻と比較する。現在時刻が充電開始時刻と一致すると、Ｃ４へ進んでリフレッシュを開始する。

Ｃ４：リフレッシュを開始する。すなわち、充電部８はスイッチ制御信号Ｓ２に

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よってスイッチ１９，２０のいずれかをＯＮにして、電池ユニット２，３のいずれかを選択し、その二次電池２Ｂ又は３Ｂを放電部１５に接続して放電させることにより行う。

Ｃ５：リフレッシュ開始後、後述のように算出するリフレッシュ時間と、時刻指定充電が設定されているときの充電動作で説明したのと同様にして求めた充電所要時間とを加えた時間を基に、表示・操作手段１３にリフレッシュと充電の合計所要時間及び／又はリフレッシュ後の充電の終了時刻の表示を行う。

リフレッシュ時間の算出は、次の式によって行う。

リフレッシュ時間＝残存容量÷放電電流

ただし、放電部１５の放電として、定電流放電、定電力放電、定抵抗放電等が考えられるが、この説明においては定電流放電とする。

放電が進むにつれて残存容量から放電容量を減じた値としてリフレッシュ時間を算出して、逐次時間表示及び／又は時刻表示を更新する。

Ｃ６：　リフレッシュの実行中、充電部８はシステムバス２６を介して測定手段１６又は１７からの情報を得て、電池特性により予め定められた条件によりリフレッシュ動作の終了をチェックする。リフレッシュが終わるまでＣ５で放電を続け、リフレッシュが終了すると、Ｃ７へ進む。

Ｃ７：リフレッシュした二次電池２Ｂ又は３Ｂに充電電力を供給して充電を開始する。

Ｃ８：充電開始時には、求めた充電所要時間及び／又は充電終了時刻をまず表示し、充電が進むにつれ残存容量に充電容量を加えた値として充電所要時間を算出して、逐次充電時間及び／又は充電終了時刻の表示を更新する。

Ｃ９，Ｃ１０：そして、充電の終了をチェックし、未終了の場合は充電を続け、充電終了を確認するとこの充電処理を終了する。

この例では、電池ユニット２，３の一方を選択してその二次電池２Ｂ又は３Ｂを

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リフレッシュ後に充電することとしたが、二つの電池ユニット２，３の二次電池２Ｂ，３Ｂの両方にリフレッシュ後の充電が必要な場合には、一方の二次電池をリフレッシュ後に充電した後に、残りの電池ユニットを選択してその二次電池をリフレッシュ後に充電をすることになる。このときは当然のことであるが、リフレッシュ時間と充電所要時間は二つの二次電池のリフレッシュ時間と充電時間を加えたものとなる。

次に、第６図のフローチャートによって、充電終了時刻指定充電の設定動作について説明する。この設定動作は第６図のステップＤ１～Ｄ６の手順で行なわれる。

Ｄ１：表示・操作手段１３の予め定められた操作によりこの充電モードの設定に入る。

Ｄ２：そして、充電終了時刻指定充電モードの指定がなされると、充電終了時刻の入力を要求する。

Ｄ３：要求した充電終了時刻が入力されると、充電部８はそれをメモリに記憶する。

Ｄ４：システムバス２６を介して電池ユニット２又は３の記憶手段１１又は１２から残存容量情報を、時計手段４から現在時刻情報を得る。そして、その現在時刻から充電可能時間を算出し、終了時間での残存容量を求める。

残存容量の算出は、以下のように行う。

定電流充電電池の場合、

残存容量＝残存容量＋充電電流×充電可能時間

（電池容量が最大で、これを超える場合は充電が終了する。）

定電流定電圧充電の場合、

予め定電流充電終了時の残存容量(充電容量)を調べておくと共に、定電圧充電時の時間対残存容量(充電容量)を調べてテーブル化しておく。そして、

定電流期間がある時；

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残存容量（Ｔ１）＝充電開始時残存容量＋充電電流×Ｔ１

充電容量＝(充電可能時間－Ｔ１）の充電容量をテーブルより算出

残存容量＝残存容量（Ｔ１）＋充電容量

（電池容量が最大で、これを超える場合は充電が終了する。）

定電流期間がない時；

残存容量＝充電開始時残存容量＋（充電可能時間にてテーブルより算出した充電容量）

（電池容量が最大値で、これを超える場合は充電が終了する。）

このようにして算出した残存容量を表示・操作手段１３に表示する。

Ｄ５，Ｄ６：その後、設定操作の終了を確認すると、この動作を終了する。

次に、第７図のフローチャートによって、充電終了時刻指定充電が設定されているときの充電動作について説明する。この充電動作は第７図のステップＥ１～Ｅ６の手順で行われる。

Ｅ１：商用電源１４あるいはそれに代わる電源から電力が充電部８に供給されると、充電動作に入る。

Ｅ２：充電を開始する。すなわち、充電部８はスイッチ制御信号によってスイッチ１９，２０のいずれかをＯＮにし、電池ユニット２，３のいずれかを選択して、その二次電池２Ｂ又は３Ｂを接続して充電を開始する。

Ｅ３：充電中は、指定された終了時刻と現在時刻により求めた充電の残り時間及び／又は充電経過時間により変化した残存容量(経過時間を基に、充電終了時刻設定について説明したのと同様な方法で求める)を表示する。

Ｅ４，Ｅ５，Ｅ６：充電部８は、Ｅ４で充電の終了をチェックし、充電が終了するとＥ６へ進んで充電を終了する。未終了の場合は充電をＥ５で指定された充電終了時刻と現在時刻を比較し、充電終了時刻（指定時刻）になるとＥ６へ進んで充電を終了する。充電終了時刻（指定時刻）でなければＥ３へ戻って充電を続ける。

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この例では、電池ユニット２，３の一方を選択してその二次電池２Ｂ又は３Ｂを充電することとしたが、二つの電池ユニット２，３の二次電池２Ｂ，３Ｂの両方に充電が必要な場合には、一方の二次電池を充電した後に、残りの電池ユニットを選択してその二次電池を充電をすることになる。このときは、残存容量表示を電池部毎にすることで対応する。

図示しないが、リフレッシュが必要な場合は、リフレッシュ時間を除いた時間を充電可能時間とすればよい。

次に、第８図のフローチャートによって、電動装置１の非稼働時の二次電池の残存容量補正について説明する。この動作は、第１図における時計手段４と制御手段６によって、第８図のステップＦ１～Ｆ７の手順で行われる。

この実施形態では、充電動作及び稼働状態と時計機能の動作を除いて省電力状態となり、二次電池２Ｂ，３Ｂの残存容量の低減を極力減らすようにしている。

Ｆ１：この電動装置１が非稼働状態で充電動作も行われない状態が所定時間継続すると、制御手段６が電動装置１を最低限必要な部分（時計手段４と制御手段６など）以外への給電を停止して省電力状態とし、この残容量補正の動作に入る。

Ｆ２：時計手段４が指定時刻（指定経過時間でも可）になったか否かの判断を行い、指定時刻になるとウエイクアップ信号ＷＵを出力する。

Ｆ３：そのウエイクアップ信号ＷＵにより制御手段６が動作を開始し、関連部分例えば測定手段１６，１７を動作状態にする。

Ｆ４：続いて、制御手段６はシステムバス２６を介して測定手段１６，１７および記憶手段１１，１２等から、温度等の二次電池の特性に応じた残存容量補正に必要な情報を取得する。

Ｆ５：そして、前回からの経過時間及び取得情報から補正容量を算出して、二次電池２Ｂ，３Ｂの残容量を補正する。例えば、二次電池２Ｂ，３Ｂの自己放電が時間と温度により決まるとすると、前回温度と取得温度の平均値を取り、予め記憶手

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段１１，１２等に記憶された情報を基に時間との関係で自己放電容量を求める等により補正情報を得る。

また、省電力状態での使用電力と経過時間により、省電力状態での二次電池の使用容量を求め、上記の自己放電量とこの動作での使用容量を含めて、記憶手段１１，１２に記憶している残存容量の値を補正する。

Ｆ６，Ｆ７：補正後、再び電動装置を省電力状態に設定してこの動作を終了する。

次に、第９図のフローチャートによって、残存容量補正時に予め決められた残存容量となったときに、充電を行い予め設定された残存容量を維持するための動作について説明する。この動作は第１図における時計手段４、制御手段６、および充電部８によって、第９図のステップＧ１～Ｇ９の手順で行われる。

この動作を実行するには、充電ユニット５の充電部８が商用電源１４あるいはそれに変わる電源から電力の供給を受けている必要がある。

ステップＧ１～Ｇ５は、第８図で説明したステップＦ１～Ｆ５と同じである。

Ｇ６～Ｇ９：Ｇ５で残存容量を補正した後、Ｇ６でその残存容量が予め設定された容量以下であるかの判断によって、充電の要否を判断する。そして、設定された容量を越える場合は、充電不要と判断してＧ８へ進み、再び電動装置を省電力状態に設定し、Ｇ９でこの動作を終了する。

設定された容量以下の場合は、充電要と判断し、Ｇ７で予め決められた残存容量まで充電動作を行い、充電が終了した時点でその残存容量を電池の残存容量として記憶手段１１又は１２記憶させてから、Ｇ８で電動装置１を省電力状態に設定し、Ｇ９でこの動作を終了する。

この実施形態の電動装置によれば、以下に列挙する効果を得ることができる。

①時刻指定充電により、例えば深夜電力を使用して電池ユニットの二次電池の充電を行うことができ、充電コストの低減や電力設備の平均化使用が行える。

②二次電池の残存容量記憶と充電開始時刻の設定により、充電終了時刻の算出と

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表示が可能になる。二次電池のリフレッシュを行うときには、残存容量からリフレッシュ時間を算出してその時間が加味される。

③二次電池の残存容量の記憶と充電終了時刻の設定により、設定時刻までに充電が終了するか否かの判定，表示，警報（充電が完了しない場合）などが行えると共に，充電を行った場合の充電量の算出および表示が可能になる。また、複数の二次電池を搭載している場合には、決められた時間内に最も多く充電できる電池を選択して充電を行うことも可能になる。

定電流定電圧充電方式で充電する場合、残存容量が少なく定電流充電領域にある電池の方が充電量が多くなる。二次電池のリフレッシュを行う場合には、残存容量から算出したリフレッシュ時間が加味される。

④非稼働時に時計機能部のみを動作させておき、予め定められた時間にその時計機能により、必要な部分を稼働させて電池の周囲環境を検知し、非稼働時の消費電流、その検知データ、二次電池の特性、時計手段による時刻情報等を基に二次電池の残存容量の補正を行うことにより、残存容量の把握精度の向上を図ることが出来る。

また、充電が必要な場合には表示や警報を行うことが出来、電動装置を有効に使用可能な状態に保つことが出来る。このとき、商用電源あるいはそれに代わる電源が充電手段に接続されている場合は、表示や警報に代えて二次電池を自動充電することも可能であり、さらに電動装置の使い勝手が向上する。

## 産業上の利用可能性

以上説明してきたように、この発明による電動車両等の電動装置は、二次電池の残存容量の把握精度を向上し、二次電池の充電を適時に行うことが可能になる。さらに、時刻指定による充電の開始や、充電終了時刻指定による充電、あるいは充電終了時刻の算出と表示、二次電池の自動リフレッシュ及び自動充電なども行うこ

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とができ、特に電動車両における二次電池の管理精度及び取扱い性を向上することができる。

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請 求 の 範 囲

1．充電可能な二次電池と、

その二次電池の状態を測定する測定手段及びその測定情報及び前記二次電池の特性に関する情報を記憶する記憶手段と、

前記二次電池によって供給される電力によって駆動される電動機等の負荷と、

該負荷の駆動を制御する制御手段と、

計時機能を持つ時計手段と、

その時計手段に対する時刻設定機能及び時刻表示機能を持つ表示・操作手段と、

前記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の管理を行う電池管理手段と

を備えたことを特徴とする時計手段を有する電動装置。

2．請求の範囲第1項記載の時計手段を有する電動装置において、

前記制御手段が前記電池管理手段の機能も持っていることを特徴とする時計手段を有する電動装置。

3．充電可能な二次電池と、

その二次電池の状態を測定する測定手段及びその測定情報及び前記二次電池の特性に関する情報を記憶する記憶手段と、

前記二次電池によって供給される電力によって駆動される電動機等の負荷と、

該負荷の駆動を制御する制御手段と、

計時機能を持つ時計手段と、

その時計手段に対する時刻設定機能及び時刻表示機能を持つ表示・操作手段と、

前記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の充電を行う充電手段と

を備えたことを特徴とする時計手段を有する電動装置。

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4．請求の範囲第３項記載の時計手段を有する電動装置において、

前記制御手段が、前記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の管理を行う電池管理手段の機能も持っていることを特徴とする時計手段を有する電動装置。

5．請求の範囲第１項記載の時計手段を有する電動装置において、

前記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の充電を行うための充電手段を接続可能なインタフェイスを設けたことを特徴とする時計手段を有する電動装置。

6．請求の範囲第２項記載の時計手段を有する電動装置において、

前記測定手段及び／又は記憶手段の情報と前記時計手段による時刻情報とに基づいて前記二次電池の充電を行うための充電手段を接続可能なインタフェイスを設けたことを特徴とする時計手段を有する電動装置。

7．請求の範囲第１項記載の時計手段を有する電動装置において、

前記二次電池と前記測定手段及び記憶手段を一体の電池ユニットとして構成し、該電池ユニットを電動装置本体に対して着脱可能に搭載したことを特徴とする時計手段を有する電動装置。

8．請求の範囲第３項記載の時計手段を有する電動装置において、

前記二次電池と前記測定手段及び記憶手段を一体の電池ユニットとして構成し、該電池ユニットを電動装置本体に対して着脱可能に搭載したことを特徴とする時計手段を有する電動装置。

9．請求の範囲第３項記載の時計手段を有する電動装置において、

前記充電手段を、商用電源又はそれに代わる電源から給電されて前記二次電池の充電を行う充電部を内蔵する充電ユニットとして構成し、該充電ユニットを電動装置本体に対して着脱可能に搭載したことを特徴とする時計手段を有する電動装置。

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１０．請求の範囲第４項記載の時計手段を有する電動装置において、

前記充電手段を、商用電源又はそれに代わる電源から給電されて前記二次電池の充電を行う充電部を内蔵する充電ユニットとして構成し、該充電ユニットを電動装置本体に対して着脱可能に搭載したことを特徴とする時計手段を有する電動装置。

１１．請求の範囲第３項記載の時計手段を有する電動装置において、

前記表示・操作手段に充電開始時刻を指定する時刻指定手段を設け、前記充電手段に該時刻指定手段によって指定された時刻に前記二次電池の充電を開始する手段を設けたことを特徴とする時計手段を有する電動装置。

１２．請求の範囲第４項記載の時計手段を有する電動装置において、

前記表示・操作手段に充電開始時刻を指定する時刻指定手段を設け、前記充電手段に該時刻指定手段によって指定された時刻に前記二次電池の充電を開始する手段を設けたことを特徴とする時計手段を有する電動装置。

１３．請求の範囲第３項記載の時計手段を有する電動装置において、

前記表示・操作手段に充電終了時刻を指定する時刻指定手段を設け、前記充電手段に該時刻指定手段によって指定された時刻に前記二次電池の充電を終了するように該充電を開始する手段を設けたことを特徴とする時計手段を有する電動装置。

１４．請求の範囲第４項記載の時計手段を有する電動装置において、

前記表示・操作手段に充電終了時刻を指定する時刻指定手段を設け、前記充電手段に該時刻指定手段によって指定された時刻に前記二次電池の充電を終了するように該充電を開始する手段を設けたことを特徴とする時計手段を有する電動装置。

１５．請求の範囲第３項記載の時計手段を有する電動装置において、

前記充電手段に、前記二次電池がメモリ効果を有するとき、該二次電池を充電する前に残存電荷を放電させてリフレッシュするための放電部を設けたことを特徴とする時計手段を有する電動装置。

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１６．請求の範囲第４項記載の時計手段を有する電動装置において、

前記充電手段に、前記二次電池がメモリ効果を有するとき、該二次電池を充電する前に残存電荷を放電させてリフレッシュするための放電部を設けたことを特徴とする時計手段を有する電動装置。

１７．請求の範囲第１項記載の時計を有する電動装置において、

前記時計手段によって指定された時刻に起動して前記測定手段及び記憶手段を動作させ、前記二次電池の特性に応じた自己放電量及び消費容量により該二次電池の残存容量を管理する手段を設けたことを特徴とする時計を有する電動装置。

１８．請求の範囲第３項記載の時計を有する電動装置において、

前記時計手段によって指定された時刻に起動して前記測定手段及び記憶手段を動作させ、前記二次電池の特性に応じた自己放電量及び消費容量により該二次電池の残存容量を管理する手段を設けたことを特徴とする時計を有する電動装置。

１９．請求の範囲第３項記載の時計を有する電動装置において、

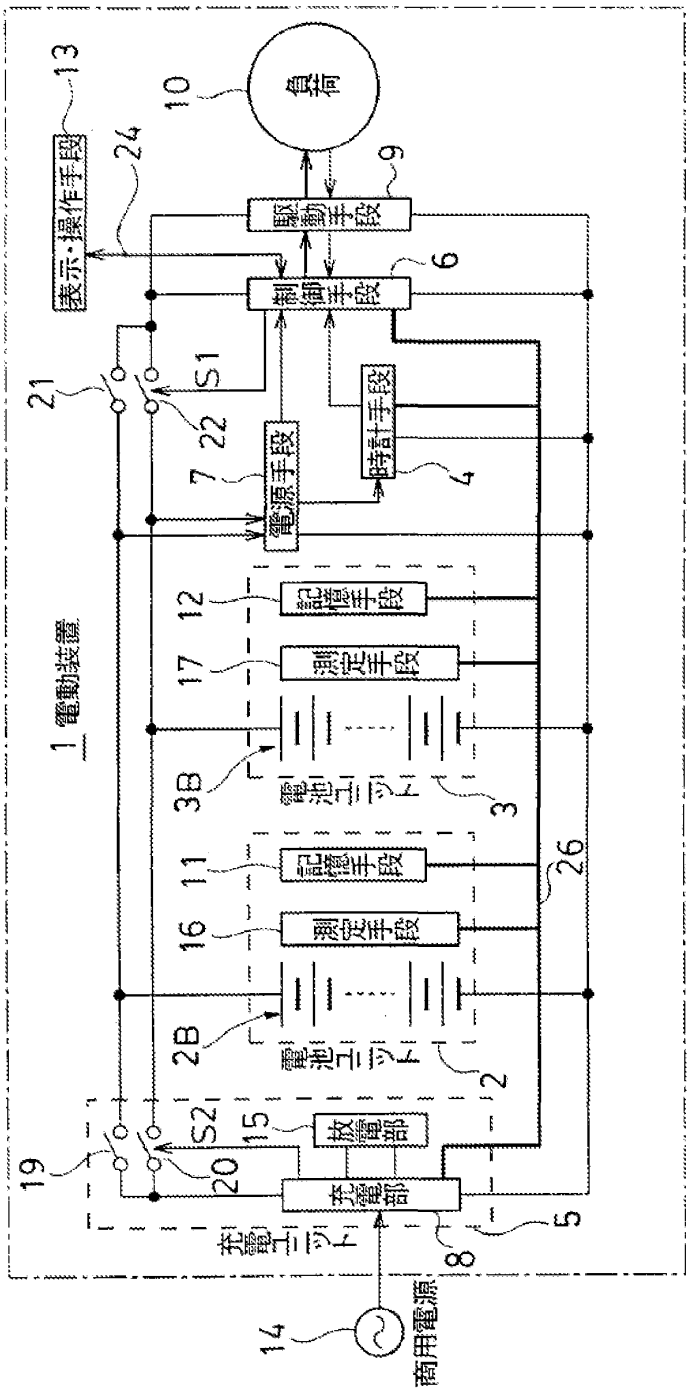
前記時計手段によって指定された時刻に起動して前記測定手段及び記憶手段を動作させ、前記二次電池の特性に応じた自己放電量及び消費容量により該二次電池の残存容量を管理し、該二次電池の充電が必要なときに前記充電手段に充電させる手段を設けたことを特徴とする時計を有する電動装置。

２０．請求の範囲第４項記載の時計を有する電動装置において、

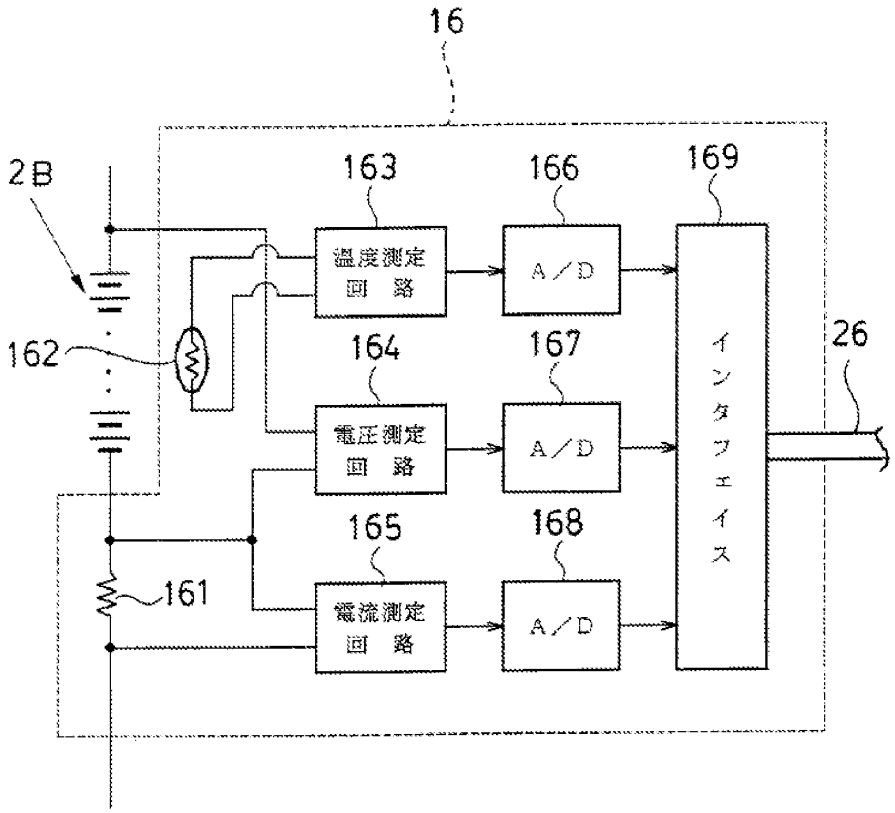
前記時計手段によって指定された時刻に起動して前記測定手段及び記憶手段を動作させ、前記二次電池の特性に応じた自己放電量及び消費容量により該二次電池の残存容量を管理し、該二次電池の充電が必要なときに前記充電手段に充電させる手段を設けたことを特徴とする時計を有する電動装置。

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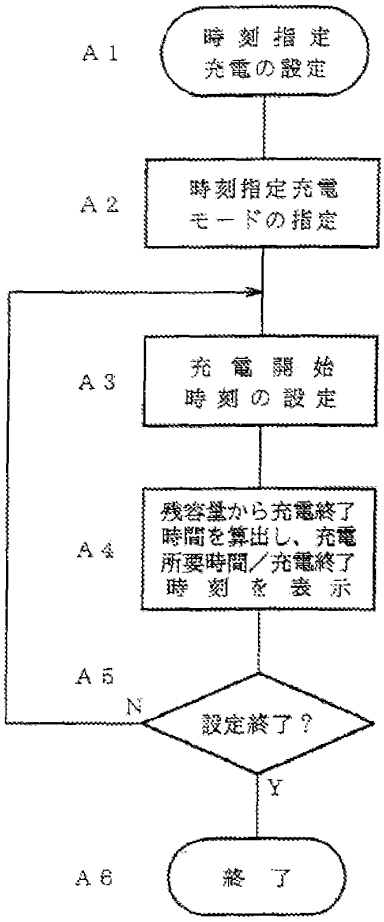
第1図


1 電動装置
負荷
10
駆動手段
9
制御手段
6
表示・操作手段
13
24
S1
21
22
電源手段
7
時計手段
4
記憶手段
12
測定手段
17
電池ブロック
3B
3
記憶手段
11
測定手段
16
電池ブロック
2B
2
26
S2
19
20
放電部
15
充電部
5
8
14
商用電源

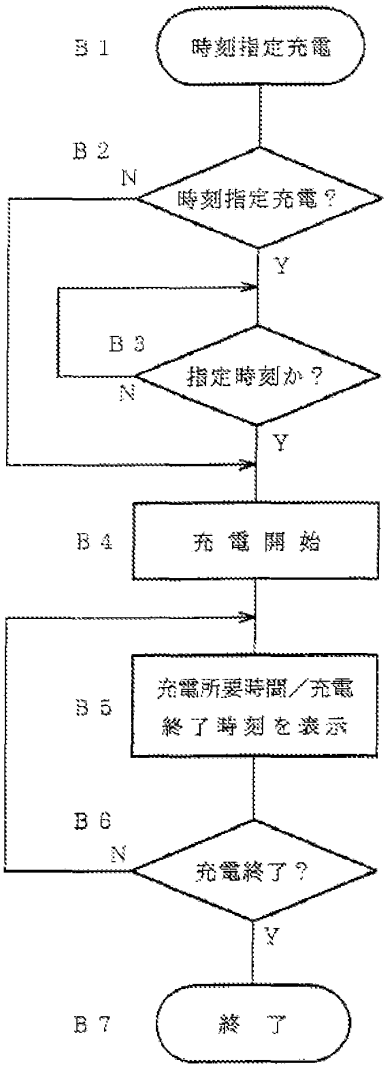
第2図


16
2B
162
161
163
温度測定回路
164
電圧測定回路
165
電流測定回路
166
A/D
167
A/D
168
A/D
169
インタフェイス
26

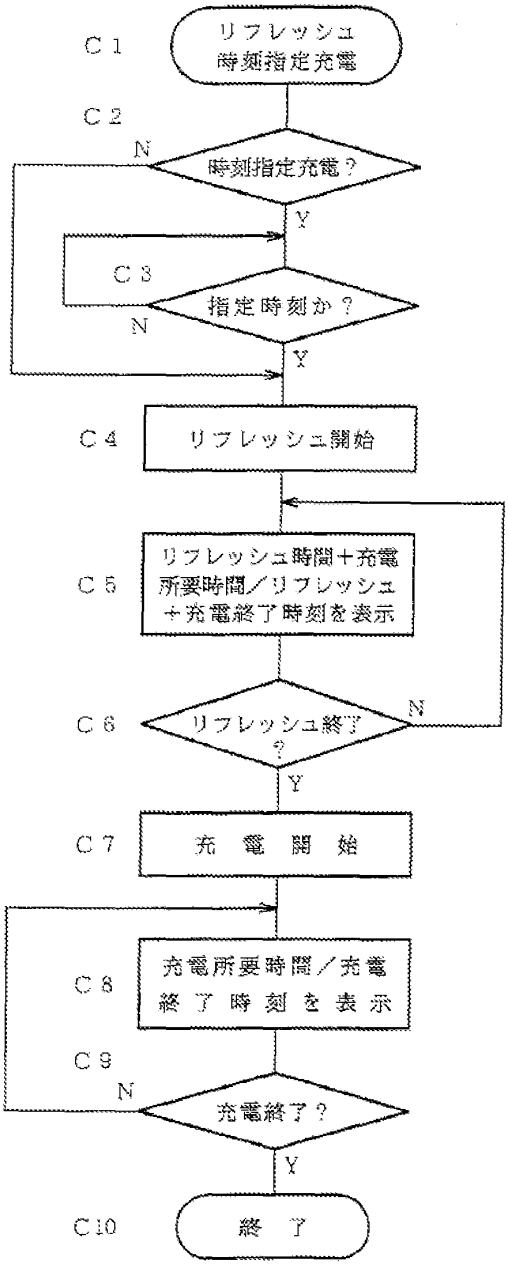
第3図


A1
時刻指定充電の設定
A2
時刻指定充電モードの指定
A3
充電開始時刻の設定
A4
残容量から充電終了時間を算出し、充電所要時間／充電終了時刻を表示
A5
N
設定終了？
Y
A6
終了

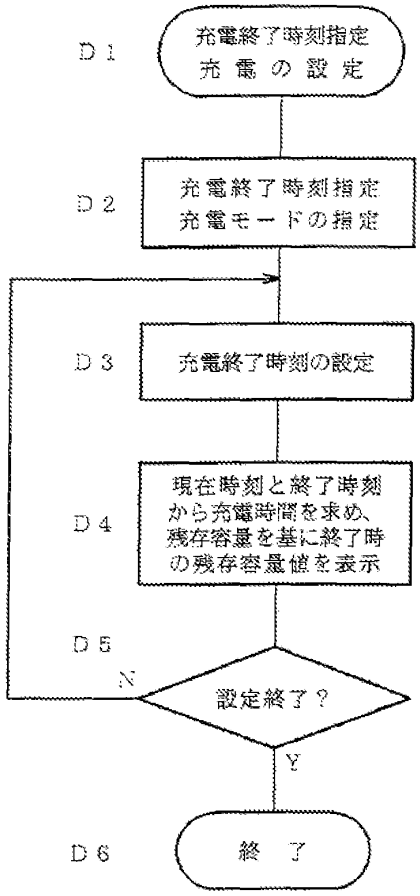
第4図


B 1
時刻指定充電
B 2
N
時刻指定充電？
Y
B 3
指定時刻か？
N
Y
B 4
充 電 開 始
B 5
充電所要時間／充電
終了時刻を表示
B 6
N
充電終了？
Y
B 7
終 了

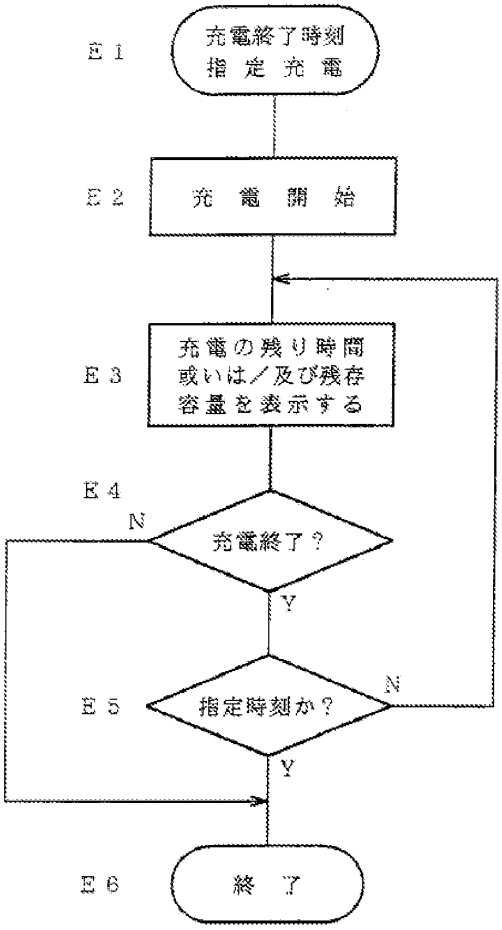
第5図


C1
リフレッシュ時刻指定充電
C2
時刻指定充電？
N
Y
C3
指定時刻か？
N
Y
C4
リフレッシュ開始
C5
リフレッシュ時間＋充電所要時間／リフレッシュ＋充電終了時刻を表示
C6
リフレッシュ終了？
N
Y
C7
充電開始
C8
充電所要時間／充電終了時刻を表示
C9
充電終了？
N
Y
C10
終了

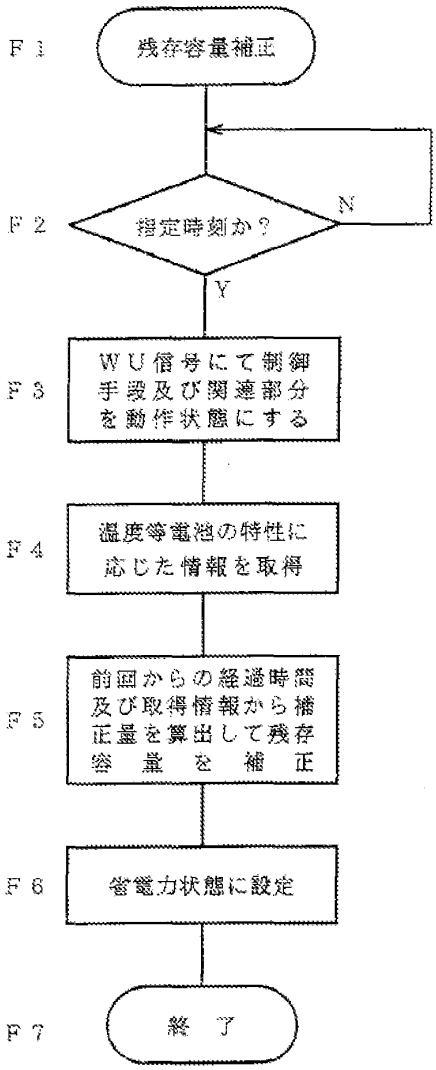
第6図


D1
充電終了時刻指定
充電の設定
D2
充電終了時刻指定
充電モードの指定
D3
充電終了時刻の設定
D4
現在時刻と終了時刻から充電時間を求め、残存容量を基に終了時の残存容量値を表示
D5
N
設定終了？
Y
D6
終了

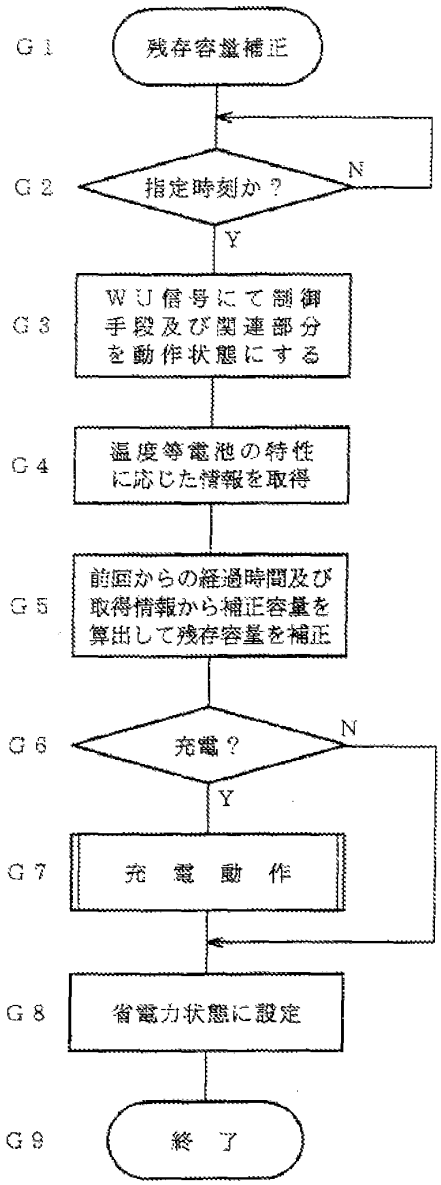
第7図


E1
充電終了時刻
指定充電
E2
充電開始
E3
充電の残り時間
或いは／及び残存
容量を表示する
E4
充電終了？
N
Y
E5
指定時刻か？
N
Y
E6
終了

第8図


F 1
残存容量補正
F 2
指定時刻か？
N
Y
F 3
WU信号にて制御手段及び関連部分を動作状態にする
F 4
温度等電池の特性に応じた情報を取得
F 5
前回からの経過時間及び取得情報から補正量を算出して残存容量を補正
F 6
省電力状態に設定
F 7
終了

第9図


G1
残存容量補正
G2
指定時刻か？
N
Y
G3
WU信号にて制御手段及び関連部分を動作状態にする
G4
温度等電池の特性に応じた情報を取得
G5
前回からの経過時間及び取得情報から補正容量を算出して残存容量を補正
G6
充電？
N
Y
G7
充電動作
G8
省電力状態に設定
G9
終了

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/05925

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] H01M 10/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] H01M 10/42-48, H02J 7/00-7/36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Jitsuyo Shinan Toroku Koho 1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | JP, 11-136870, A (Sharp Corporation), 21 May, 1999 (21.05.99), Claims 1 to 3; Par. Nos. [0009], [0012], [0014], [0017] to [0022] (Family: none) | 1-2 |
| X | JP, 5-153733, A (Hitachi, Ltd.), 18 June, 1993 (18.06.93), Claims 1, 3 (Family: none) | 3-4 |
| Y | | 1-2 |
| | | 15-16 |
| Y | JP, 8-138748, A (Canon Inc.), 31 May, 1996 (31.05.96), Claim 1; Par. No. [0018] (Family: none) | 15-16 |
| A | JP, 7-194017, A (Canon Inc.), 28 July, 1995 (28.07.95) (Family: none) | 1-20 |

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 28 November, 2000 (28.11.00) | 05 December, 2000 (05.12.00) |
| Name and mailing address of the ISA/ Japanese Patent Office | Authorized officer |
| Facsimile No. | Telephone No. |

Form PCT/ISA/210 (second sheet) (July 1992)

国際調査報告

国際出願番号 PCT／JP00／05925

A. 発明の属する分野の分類（国際特許分類（IPC））

Int. Cl' H01M 10／42

B. 調査を行った分野

調査を行った最小限資料（国際特許分類（IPC））

Int. Cl' H01M 10／42－48、 H02J 7／00－7／36

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報 1926－1996年
日本国公開実用新案公報 1971－2000年
日本国登録実用新案公報 1994－2000年
日本国実用新案登録公報 1994－2000年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C. 関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名 及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| Y | JP,11－136870,A(シャープ株式会社),21.5月.1999(21.05.99),【請求項1】～【請求項3】,【0009】,【0012】,【0014】,【0017】～【0022】(ファミリーなし) | 1－2 |
| X<br>Y | JP,5－153733,A(株式会社日立製作所),18.6月.1993(18.06.93),【請求項1】、【請求項3】(ファミリーなし) | 3－4<br>1－2<br>15－16 |
| Y | JP,8－138748,A(キャノン株式会社),31.5月.199 | 15－16 |

☒ C欄の続きにも文献が列挙されている。 ☐ パテントファミリーに関する別紙を参照。

＊ 引用文献のカテゴリー
「A」特に関連のある文献ではなく、一般的技術水準を示すもの
「E」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」同一パテントファミリー文献

| 国際調査を完了した日 | 国際調査報告の発送日 |
|---|---|
| 28. 11. 00 | 05.12.00 |

| 国際調査機関の名称及びあて先 | 特許庁審査官（権限のある職員） | 4X | 8939 |
|---|---|---|---|
| 日本国特許庁（ISA／JP）<br>郵便番号100－8915<br>東京都千代田区霞が関三丁目4番3号 | 三宅 正之 | | |
| | 電話番号 03－3581－1101 内線 3435 | | |

様式PCT／ISA／210（第2ページ）（1998年7月）

C（続き）．　関連すると認められる文献

| 引用文献のカテゴリー＊ | 引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示 | 関連する請求の範囲の番号 |
|---|---|---|
| | 6(31.05.96),【請求項1】及び【0018】(ファミリーなし) | |
| A | JP,7－194017,A(キャノン株式会社),28.7月.1995(28.07.95)(ファミリーなし) | 1－20 |



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Tesla EX1002 Page 300

PLUS Search Results for S/N 17188269, Searched Wed Sep 21 09:42:45 EDT 2022

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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PLUS Search Results for S/N 17188269, Searched Wed Sep 21 09:43:26 EDT 2022

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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7490909 63

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

# NOTICE OF ALLOWANCE AND FEE(S) DUE

23409 7590 09/29/2022

MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

| EXAMINER | |
|---|---|
| PELTON, NATHANIEL R | |
| ART UNIT | PAPER NUMBER |
| 2859 | |

DATE MAILED: 09/29/2022

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 | 8606 |

TITLE OF INVENTION: VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $600 | $0.00 | $0.00 | $600 | 12/29/2022 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.**



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## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23409 7590 09/29/2022

MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

| (Typed or printed name) |
|---|
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 | 8606 |

TITLE OF INVENTION: VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $600 | $0.00 | $0.00 | $600 | 12/29/2022 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| PELTON, NATHANIEL R | 2859 | 320-109000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____



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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 | 8606 |

23409 7590 09/29/2022

MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

| EXAMINER | |
|---|---|
| PELTON, NATHANIEL R | |
| **ART UNIT** | **PAPER NUMBER** |
| 2859 | |

DATE MAILED: 09/29/2022

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.





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## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Notice of Allowability | Application No. 17/188,269 | Applicant(s) Austin, Christopher B. | |
|---|---|---|---|
| | Examiner NATHANIEL R PELTON | Art Unit 2859 | AIA (FITF) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--*

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the application filed on 03/01/2021.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 21-40 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All b) ☐ Some* c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date See Continuation Sheet.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☑ Other see detailed action.

/NATHANIEL R PELTON/
Primary Examiner, Art Unit 2859



IPR2026-00379
Tesla EX1002 Page 307

Continuation of Attachment(s) 2. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 09/29/2021,01/13/2022,04/11/2022,07/18/2022

**DETAILED ACTION**

***Notice of Pre-AIA or AIA Status***

The present application is being examined under the pre-AIA first to invent provisions.

***Information Disclosure Statement***

The information disclosure statements (IDS) submitted on 09/29/2021, 01/13/2022, 04/11/2022, 07/18/2022 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statements are being considered by the examiner.

***Response to Amendment***

Acknowledgement is made of the preliminary amendment filed on 03/01/2021 in which claims 1-20 were canceled and claims 21-40 added. Therefore, claims 21-40 are pending for examination below.

***Allowable Subject Matter***

**Claims 21-40 are allowed.**

The following is an examiner's statement of reasons for allowance:

With respect to claims 21 and 35, the prior art of record does not suggest or disclose the claimed combination of elements or steps as recited, most particularly the claimed, "detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another; detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and in response detecting the alignment of the first core with respect to the

second core, enabling a user control displayed on a display for controlling the induction charging of the battery."

Claims 22-26 and 36-40 depend from the claims above and are allowed for the same reasons.

With respect to claim 27, the prior art of record does not suggest or disclose the claimed combination of elements or steps as recited, most particularly the claimed, "detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another; detecting a misalignment of the first core with respect to the second core based at least in part on the positional relationship between the first core and the second core; and in response detecting the misalignment of the first core with respect to the second core, disabling a user control displayed on a display for controlling the induction charging of the battery."

Claims 28-34 depend from the claims above and are allowed for the same reasons.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,462,439 to Keith discloses a recharging station for an electric vehicle wherein a laser signal is used to detect alignment of the receptacle with the vehicle and displays an indication of alignment failure on a display when misaligned. However, Keith fails to disclose in response to the

alignment/misalignment disabling/enabling a user control on a display for controlling the induction charging of the battery as claimed.

US 5,461,298 to Lara et al. discloses an automatic vehicle charging system wherein the vehicle automatically aligns core for inductive power transfer to ensure proper connection and thus proper recharging. However, Lara fails to disclose in response to the alignment/misalignment disabling/enabling a user control on a display for controlling the induction charging of the battery as claimed.

US 2009/0047991 to ELG discloses an automatically enabling and disabling wireless network wherein an interface scans an area and when it is determined another device is detected allows the enabling of additional secondary interfaces to establish communication in order to allow low power usage. However, ELG fails to disclose detecting alignment/misalignment of first and second cores allowing induction charging and enabling/disabling a user control based on the detection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHANIEL R PELTON whose telephone number is (571)270-1761. The examiner can normally be reached M-F 9am to 5pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ricardo Isla can be reached on 571-272-5056. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To

file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/NATHANIEL R PELTON/
Primary Examiner, Art Unit 2859

| Notice of References Cited | Application/Control No. 17/188,269 | Applicant(s)/Patent Under Reexamination Austin, Christopher B. | |
|---|---|---|---|
| | Examiner NATHANIEL R PELTON | Art Unit 2859 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-5462439-A | 10-1995 | Keith; Arlie L. | B60L53/305 | 439/246 |
| * | B | US-5461298-A | 10-1995 | Lara; Jesus D. | B60L53/37 | 320/109 |
| * | C | US-20090047991-A1 | 02-2009 | ELG; Johannes | H02J7/342 | 455/552.1 |
| | D | | | | | |
| | E | | | | | |
| | F | | | | | |
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**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
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| | R | | | | | |
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**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



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Tesla EX1002 Page 313

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | Examiner | Art Unit |
| | NATHANIEL R PELTON | 2859 |

| CPC - Searched* | | |
|---|---|---|
| **Symbol** | **Date** | **Examiner** |
| H01M 10/44 | 09/21/2022 | nrp |
| H02J7/0042 | 09/21/2022 | nrp |
| B60L 53/12,122,126 | 09/21/2022 | nrp |
| Y02T 90/14,16 | 09/21/2022 | nrp |
| Y04S 10/126 | 09/21/2022 | nrp |

| CPC Combination Sets - Searched* | | |
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| **Symbol** | **Date** | **Examiner** |
| | | |

| US Classification - Searched* | | | |
|---|---|---|---|
| **Class** | **Subclass** | **Date** | **Examiner** |
| 320 | 109 | 09/21/2022 | nrp |

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

| Search Notes | | |
|---|---|---|
| **Search Notes** | **Date** | **Examiner** |
| performed inventor and assignee searches | 09/21/2022 | nrp |
| requested PLUS search on spec and claims | 09/21/2022 | nrp |
| text searched for key concepts | 09/21/2022 | nrp |
| IP.com search on inventive idea | 09/21/2022 | nrp |
| A.I. similarity searches | 09/21/2022 | nrp |

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|---|---|
| /NATHANIEL R PELTON/<br>Primary Examiner, Art Unit 2859 | |



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| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | Examiner | Art Unit |
| | NATHANIEL R PELTON | 2859 |

| Interference Search | | | |
|---|---|---|---|
| **US Class/CPC Symbol** | **US Subclass/CPC Group** | **Date** | **Examiner** |
| | ((charg$5 or recharg$5)(batter$3 or cell or accumulator or stor$4)(vehicle or auto or automobile or car or hev)(induct$3 or wireless$2 or non$1contact$3 or electromagnetic$4)(core or coil or winding)(misalign$4 or align$4)(enabl$3 or disabl$3)(user or button or control or display$3 or interface)).clm. | 09/21/2022 | nrp |

| | |
|---|---|
| /NATHANIEL R PELTON/<br>Primary Examiner, Art Unit 2859 | |



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| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | **Examiner** | **Art Unit** |
| | NATHANIEL R PELTON | 2859 |

| CPC | | | | | | | | |
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| **Symbol** | | | | | | | **Type** | **Version** |
| H01M | / | 10 | / | 44 | | | F | 2013-01-01 |
| B60L | / | 53 | / | 14 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 38 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 63 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 18 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 305 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 68 | | | I | 2019-02-01 |
| B60L | / | 53 | / | 126 | | | I | 2019-02-01 |
| G01R | / | 31 | / | 371 | | | A | 2019-01-01 |
| H02J | / | 7 | / | 0042 | | | A | 2013-01-01 |
| Y02T | / | 90 | / | 14 | | | A | 2013-01-01 |
| Y02T | / | 90 | / | 16 | | | A | 2013-01-01 |
| Y04S | / | 10 | / | 126 | | | A | 2013-01-01 |
| Y02E | / | 60 | / | 00 | | | A | 2013-01-01 |
| Y02T | / | 10 | / | 70 | | | A | 2013-01-01 |
| Y02T | / | 10 | / | 7072 | | | A | 2013-01-01 |
| Y02T | / | 90 | / | 12 | | | A | 2013-01-01 |
| H02J | / | 7 | / | 0048 | | | A | 2020-01-01 |
| H02J | / | 7 | / | 0047 | | | A | 2013-01-01 |

| CPC Combination Sets | | | | | | | | |
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| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 20 | |
| /NATHANIEL R PELTON/<br>Primary Examiner, Art Unit 2859 | 21 September 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 19 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220921



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Tesla EX1002 Page 316

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | **Examiner** | **Art Unit** |
| | NATHANIEL R PELTON | 2859 |

| INTERNATIONAL CLASSIFICATION | | | | |
|---|---|---|---|---|
| **CLAIMED** | | | | |
| H01M | / | 10 | / | 44 |

| NON-CLAIMED | | | | |
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| US ORIGINAL CLASSIFICATION | |
|---|---|
| **CLASS** | **SUBCLASS** |
| 320 | 109 |

| CROSS REFERENCES(S) | | | | | | |
|---|---|---|---|---|---|---|
| **CLASS** | **SUBCLASS (ONE SUBCLASS PER BLOCK)** | | | | | |
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| NONE | | **Total Claims Allowed:** | |
|---|---|---|---|
| (Assistant Examiner) | (Date) | 20 | |
| /NATHANIEL R PELTON/<br>Primary Examiner, Art Unit 2859 | 21 September 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 19 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220921



IPR2026-00379
Tesla EX1002 Page 317

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | **Examiner** | **Art Unit** |
| | NATHANIEL R PELTON | 2859 |

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

**CLAIMS**

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
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| NONE | | **Total Claims Allowed:** | |
| (Assistant Examiner) | (Date) | 20 | |
| /NATHANIEL R PELTON/<br>Primary Examiner, Art Unit 2859 | 21 September 2022 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 19 |

U.S. Patent and Trademark Office — Part of Paper No.: 20220921



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Tesla EX1002 Page 318

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 17/188,269 | Austin, Christopher B. |
| | Examiner | Art Unit |
| | NATHANIEL R PELTON | 2859 |

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| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

**CLAIMS**

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
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| Final | Original | 09/21/2022 | | | | | | | | |
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | 3763 |
| Examiner Name | Not Yet Assigned |
| Attorney Docket Number | 013350-9003-US35 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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|---|---|---|---|---|---|---|---|---|
| | 1 | WO2001018899 | WO | | 2001-03-15 | TOKYO R & D CO., LTD. | | X |

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| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.R.P/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

| | | |
|---|---|---|
| | 1 | |

If you wish to add additional non-patent literature document citation information please click the Add button Add

**EXAMINER SIGNATURE**

| Examiner Signature | /NATHANIEL R PELTON/ | Date Considered | 09/21/2022 |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.R.P/

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 3763 |
| | Examiner Name | Not Yet Assigned |
| | Attorney Docket Number | 013350-9003-US35 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-07-18 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**



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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



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Tesla EX1002 Page 323

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

**( Not for submission under 37 CFR 1.99)**

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|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | 3763 |
| Examiner Name | Not Yet Assigned |
| Attorney Docket Number | 013350-9003-US35 |

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| | 1 | 7881957 | | 2011-02-01 | Cohen et al. | |

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|---|---|---|---|
| | 1 | English Translation of relevant text for WO 0118899, 3 pages (Year: 2001). | |

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☒ A certification statement is not submitted herewith.

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| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-04-11 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

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IPR2026-00379
Tesla EX1002 Page 327

## Bibliographic Data

Application No: 17/188,269

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /NATHANIEL R PELTON/ Examiner's Signature | Initials

Title: VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

| FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 03/01/2021 | 320 | 2859 | 013350-9003-US35 |
| RULE | | | |

**APPLICANTS**

**INVENTORS**

Christopher B. Austin, Grafton, WI, UNITED STATES

**CONTINUING DATA**

This application is a CON of 16056059 08/06/2018ABN

16056059 is a CON of 12737803 02/17/2011 PAT 10090567

12737803 is a 371 of PCT/US2009/054174 08/18/2009

PCT/US2009/054174 has PRO of 61189353 08/18/2008

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Doc code: IDS
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| | 3 | Search Report issued in corresponding EP09808718.2; September 21, 2017 | |
| | 4 | Official Action issued in corresponding EP09808718.2; April 29, 2020 | |
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.R.P/

## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| L1 | 2 | "US 20110175569" | (US-PGPUB; USPAT; USOCR; DERWENT) | OR | OFF | OFF | 2013/07/14 09:18 PM |
| L2 | 0 | 302/109.ccls. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2013/07/14 09:18 PM |
| L3 | 1050 | 320/109.ccls. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2013/07/14 09:18 PM |
| L4 | 48 | ((CHRISTOPHER) near2 (AUSTIN)).INV. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2013/07/14 09:18 PM |
| L5 | 138 | US-5194799-$.DID. OR US-5760569-$.DID. OR US-4389608-$.DID. OR US-5765656-$.DID. OR US-5793185-$.DID. OR US-5772309-$.DID. OR US-5444352-$.DID. OR US-5798630-$.DID. OR US-5631536-$.DID. OR US-5803760-$.DID. OR US-5670861-$.DID. OR US-5844384-$.DID. OR US-5773962-$.DID. OR US-5889384-$.DID. OR US-4248942-$.DID. OR US-5905360-$.DID. OR US-4334819-$.DID. OR US-5933010-$.DID. OR US-5202617-$.DID. OR US-6036574-$.DID. OR US-5219034-$.DID. OR US-6087805-$.DID. OR US-5229703-$.DID. OR US-6104312-$.DID. OR US-5397991-$.DID. OR US-6114833-$.DID. OR US-5402056-$.DID. OR US-6154005-$.DID. OR US-5528148-$.DID. OR US-6160374-$.DID. OR US-5545046-$.DID. OR US-6242889-$.DID. OR US-5548200-$.DID. OR US-5583418-$.DID. OR US-3603860-$.DID. OR US-5602459-$.DID. OR US-3694729-$.DID. OR US-5610499-$.DID. OR US-3673379-$.DID. OR US-5710502-$.DID. OR US-3898547-$.DID. OR US-5807129-$.DID. OR US-3870855-$.DID. OR US-3841428-$.DID. OR | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2013/07/14 09:19 PM |



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | US-5952813-$.DID. OR US-4012681-$.DID. OR US-5997333-$.DID. OR US-4139896-$.DID. OR US-6225780-$.DID. OR US-4141425-$.DID. OR US-4252217-$.DID. OR US-4286911-$.DID. OR US-4292578-$.DID. OR US-4309644-$.DID. OR US-4333134-$.DID. OR US-4435675-$.DID. OR US-4435486-$.DID. OR US-4450400-$.DID. OR US-4777416-$.DID. OR US-4906815-$.DID. OR US-4983904-$.DID. OR US-5179494-$.DID. OR US-5206578-$.DID. OR US-5281792-$.DID. OR US-5351283-$.DID. OR US-5369352-$.DID. OR US-5396162-$.DID. OR US-5539296-$.DID. OR US-5563491-$.DID. OR US-5594318-$.DID. OR US-5606239-$.DID. OR US-5690503-$.DID. | | | | | |
| L6 | 99 | US-5289103-$.DID. OR US-20070090810-$.DID. OR US-5418437-$.DID. OR US-20070169970-$.DID. OR US-5524726-$.DID. OR US-20070181547-$.DID. OR US-5596258-$.DID. OR US-20070284159-$.DID. OR US-5646507-$.DID. OR US-20080169138-$.DID. OR US-5910714-$.DID. OR US-20080203973-$.DID. OR US-5926004-$.DID. OR US-20090075704-$.DID. OR US-5952813-$.DID. OR US-20090309422-$.DID. OR US-5977744-$.DID. OR US-20090315328-$.DID. OR US-6021862-$.DID. OR US-6104160-$.DID. OR US-6184656-$.DID. OR | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2013/07/14 09:19 PM |



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | US-6243644-$.DID. OR US-6664757-$.DID. OR US-6822425-$.DID. OR US-6917180-$.DID. OR US-6963186-$.DID. OR US-7096984-$.DID. OR US-7411371-$.DID. OR US-7497285-$.DID. OR US-7679336-$.DID. OR US-7681676-$.DID. OR US-7687934-$.DID. OR US-7778746-$.DID. OR US-7859224-$.DID. OR US-7884569-$.DID. OR US-7999403-$.DID. OR US-8047316-$.DID. OR US-8089249-$.DID. OR US-8115455-$.DID. OR US-8125183-$.DID. OR US-8143843-$.DID. OR US-8143859-$.DID. OR US-8180509-$.DID. OR US-8298692-$.DID. OR US-20040069549-$.DID. OR US-20040100225-$.DID. OR US-20040169489-$.DID. OR US-20040239288-$.DID. OR US-20050141154-$.DID. OR US-20050285564-$.DID. OR US-20060028178-$.DID. OR US-20060052918-$.DID. OR US-20060135035-$.DID. OR US-20060208570-$.DID. OR US-20060267552-$.DID. | | | | | |
| L7 | 12 | US-6983186-$.DID. OR US-5462439-$.DID. OR US-7243746-$.DID. OR US-5548200-$.DID. OR US-20070164704-$.DID. OR US-20080052145-$.DID. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2013/07/14 09:20 PM |
| L8 | 1 | "6963186".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2013/07/14 09:21 PM |
| L9 | 2 | "20110175569".pn. | (US-PGPUB; USPAT; USOCR; DERWENT) | OR | OFF | OFF | 2016/03/21 11:27 AM |
| L10 | 1 | "20110175569".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/03/21 11:27 AM |
| L11 | 74 | ((Christopher) near2 (Austin)).INV. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/03/21 11:28 AM |
| L12 | 1 | L11 and ((vehicle or car | (US-PGPUB; USPAT; | OR | ON | ON | 2016/03/21 |



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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | or automobile) with (charg$5 or recharg$5)) | USOCR) | | | | 11:29 AM |
| L13 | 3 | L11 and (charg$5 or recharg$5) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/21 11:30 AM |
| L14 | 7153 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/21 11:38 AM |
| L15 | 2140 | L14 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/21 11:38 AM |
| L16 | 287 | L15 and (tim$3 near5 (end$3 or complet$4 or finish$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/21 11:39 AM |
| L17 | 2 | "6963186".pn. or "5548200".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/21 11:39 AM |
| L18 | 1 | "2007029965".pn. or "7495414".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/22 02:56 PM |
| L19 | 1 | "20070029965".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/22 02:57 PM |
| L20 | 2 | "20100194336".pn. or "7180265".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/03/22 03:00 PM |
| L21 | 32353 | h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/088.cpc. or h01m10/44.cpc. or b60l11/1824.cpc. or 320/109 | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 01:15 PM |
| L22 | 3660 | L21 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 01:16 PM |
| L23 | 2 | "6963186".pn. or "5548200".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 01:17 PM |
| L24 | 2 | "6963186".pn. or "5548200".pn. or "7243746".pc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 01:24 PM |
| L25 | 3 | "6963186".pn. or "5548200".pn. or "7243746".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 01:24 PM |
| L26 | 12280 | L21 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 01:27 PM |
| L27 | 369 | L26 and ((enter$3 or input$4) near5 time) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 01:28 PM |
| L28 | 1 | "20090243549".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 02:04 PM |
| L29 | 1 | L27 and L28 | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 02:04 PM |
| L30 | 1 | "20080052145".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/04/27 02:49 PM |
| L31 | 39 | L26 and (automatic$4 | (US-PGPUB; USPAT; | OR | ON | ON | 2016/04/27 |



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|---|---|---|---|---|---|---|---|
| | | near3 communicat$3) | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | | | | 02:55 PM |
| L32 | 6 | "20140253024".pn. or "20130214931".pn. or "20100194336".pn. | (US-PGPUB; USPAT; USOCR; DERWENT) | OR | OFF | OFF | 2016/04/27 03:44 PM |
| L33 | 3 | "20140253024".pn. or "20130214931".pn. or "20100194336".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/04/27 03:45 PM |
| L34 | 1 | "8193769".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/04/27 04:00 PM |
| L35 | 1 | "20150229158".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/04/27 07:35 PM |
| L36 | 3 | "9054749".pn. or "20090096422".pn. or "20110234157".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/04/27 07:51 PM |
| L37 | 7940 | 320/108 or h02j7/025.cpc. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/04/27 07:59 PM |
| L38 | 20884 | 320/108 or h02j7/025.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2016/04/27 08:00 PM |
| L39 | 10630 | L38 and @ad<"20120321" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2016/04/27 08:00 PM |
| L40 | 42 | L39 and ((first and second) near5 regulat$3) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2016/04/27 08:04 PM |
| L41 | 6455 | (g01r19/0084.cpc. or h04b5/0037.cpc. or h04b5/0081.cpc.) and @ad<"20120321" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2016/04/27 08:26 PM |
| L42 | 33 | L41 and ((first and second) near5 regulat$3) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 08:26 PM |
| L43 | 127 | L41 and ((first and second) near5 (regulat$3 or convert$3)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 08:27 PM |
| L44 | 265 | L39 and ((first and second) near5 (regulat$3 or convert$3)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 08:27 PM |
| L45 | 368 | L43 or L44 | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/04/27 08:27 PM |
| L46 | 1 | "US 20110175569" | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/08/09 04:11 PM |
| L47 | 29042 | 320/109 or | (US-PGPUB; USPAT; | OR | ON | ON | 2016/08/09 |



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|---|---|---|---|---|---|---|---|
| | | h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. or b60l11/1816.cpc. or b60l11/1824.cpc. | USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | | | | 04:17 PM |
| L48 | 8357 | L47 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 04:19 PM |
| L49 | 16 | L48 and (automatic$4 with ((cost$3 or pric$3 or money) near5 (power or electricity or energy))) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 04:22 PM |
| L50 | 5 | "5548200".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 04:23 PM |
| L51 | 1 | "5548200".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2016/08/09 04:23 PM |
| L52 | 1 | "20090243549".pn. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2016/08/09 04:32 PM |
| L53 | 10 | L48 and (overrid$3 with (below or lower or less)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 04:35 PM |
| L54 | 51 | "320".clas. and (overrid$3 with (below or lower or less)) and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 04:39 PM |
| L55 | 2 | "20020079868".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2016/08/09 05:33 PM |
| L56 | 38844 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. or b60l11/1816.cpc. or b60l11/1824.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/14 02:21 PM |
| L57 | 9252 | L56 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/14 02:21 PM |
| L58 | 363 | L57 and (((cost$3 or pric$3 or money) near5 (power or electricity or energy))) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/14 02:21 PM |
| L59 | 3 | "8772970".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/15 01:19 PM |
| L60 | 1 | "8772970".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/04/15 01:20 PM |



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|---|---|---|---|---|---|---|---|
| L61 | 3 | "6963186".pn. or "20090243549".pn. or "5548200".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/04/16 09:33 AM |
| L62 | 1 | "20020079868".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/04/16 09:48 AM |
| L63 | 38868 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. or b60l11/1816.cpc. or b60l11/1824.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/16 10:53 AM |
| L64 | 9253 | L63 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/16 10:53 AM |
| L65 | 10 | L64 and (overrid$3 with (below or lower or less)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/04/16 10:53 AM |
| L66 | 41747 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. or b60l11/1816.cpc. or b60l11/1824.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 10:39 AM |
| L67 | 9450 | L66 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 10:39 AM |
| L68 | 0 | L67 and (automatic$4 with ((cost$3 or pric$3 or money) near5 (power or electricity or energy)) with (start$4 or initiat$3)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 10:42 AM |
| L69 | 8 | ("320".clas. or h02j7/$$.cpc. or b60l11/$$.cpc.) and (automatic$4 with ((cost$3 or pric$3 or money) near5 (power or electricity or energy)) with (start$4 or initiat$3)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 10:43 AM |
| L70 | 83 | L67 and (((cost$3 or pric$3 or money) near5 (power or electricity or energy)) with (below or lower or less)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 10:59 AM |
| L71 | 2 | "20040164711".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2017/09/30 11:53 AM |
| L72 | 1 | "20040164711".pn. | (US-PGPUB; USPAT; | OR | ON | ON | 2017/09/30 |

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|---|---|---|---|---|---|---|---|
| | | | USOCR) | | | | 11:53 AM |
| L73 | 171 | "320".clas. and (decrypt$3) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 11:56 AM |
| L74 | 5 | "320".clas. and (decrypt$3 with (manufacturer or supplier)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 11:57 AM |
| L75 | 1 | "20100076825".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:00 PM |
| L76 | 2222 | (decrypt$3 with (manufacturer or supplier)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:04 PM |
| L77 | 1513 | L76 and @ad<"20110114" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:04 PM |
| L78 | 1216 | ((decrypt$3 near5 key) with (manufacturer or supplier)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:05 PM |
| L79 | 856 | L78 and @ad<"20110114" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:05 PM |
| L80 | 82 | ((decrypt$3 near5 key) with (manufacturer or supplier) with server) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:07 PM |
| L81 | 47 | L80 and @ad<"20110114" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:07 PM |
| L82 | 242 | ((decrypt$3 near5 key) with (manufacturer or supplier) with request$3) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:13 PM |
| L83 | 131 | L82 and @ad<"20110114" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2017/09/30 12:13 PM |
| L84 | 11740 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/02 09:06 AM |
| L85 | 2157 | L84 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/02 09:06 AM |
| L86 | 293 | L85 and (tim$3 near5 (end$3 or complet$4 or finish$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/02 09:06 AM |
| L87 | 50398 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. or b60l11/1816.cpc. or b60l11/1824.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/02 01:43 PM |
| L88 | 9772 | L87 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/02 01:43 PM |
| L89 | 372 | L88 and (((cost$3 or pric$3 or money) near5 (power or electricity or | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; | OR | ON | ON | 2018/10/02 01:43 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | energy))) | IBM_TDB) | | | | |
| L90 | 1291 | ((decrypt$3 near5 key) with (manufacturer or supplier)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/02 05:10 PM |
| L92 | 1675 | L91 and @ad<"20080101" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/03 12:22 PM |
| L93 | 1401 | L91 and @ad<"20040101" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/03 12:22 PM |
| L95 | 2033 | 320/109.ccls. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2018/10/03 05:09 PM |
| L96 | 53838 | h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/088.cpc. or h01m10/44.cpc. or b60l11/1824.cpc. or 320/109 | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/03 05:09 PM |
| L97 | 1324 | (L95 or L96) and (vehicle with (charg$5 or recharg$5) with control$4 with transmit$4) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/03 05:09 PM |
| L98 | 11740 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. or h02j7/0088.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/05 08:44 AM |
| L99 | 2157 | L98 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/05 08:44 AM |
| L100 | 293 | L99 and (tim$3 near5 (end$3 or complet$4 or finish$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/05 08:44 AM |
| L101 | 2 | "20110175569".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/13 02:00 PM |
| L102 | 1 | "20110175569".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:00 PM |
| L103 | 4 | "6963186".pn. or "20090243549".pn. or "5548200".pn. or "20090313034".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:48 PM |
| L104 | 11629 | 320/109 or h02j7/0042.cpc. or h02j7/0047.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:49 PM |
| L105 | 4808 | h01m10/44.cpc. or g01r31/3689.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:50 PM |
| L106 | 3622 | (L104 or L105) and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:50 PM |
| L107 | 194 | L106 and (((charg$5 or recharg$5 or re$1charg$5) near5 (cable or cord or plug)) with (vehicle or car or | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 02:55 PM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | auto or automobile)) | | | | | |
| L108 | 40433 | (b60l11/1816 or b60l11/182 or b60l11/1824 or b60l11/1829 or b60l11/1844 or b60l2230/12 or b60l2230/16 or b60l2230/40).cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2018/10/13 03:36 PM |
| L109 | 876 | L108 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2018/10/13 03:36 PM |
| L110 | 2 | "20180375175".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/16 03:26 PM |
| L111 | 103122 | h01m10/44.cpc. or 320/109 or b60l53/12,68,14,305,18,30,38,63.cpc. or h02j7/0042,0047.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/17 02:03 PM |
| L112 | 5602 | L111 and ((coil or core or inductiv$3) near5 (position$3 or align$3)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/17 02:05 PM |
| L113 | 262 | L112 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/17 02:05 PM |
| L114 | 4054 | b60l53/12,126.cpc. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 09:41 AM |
| L115 | 178 | L114 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 09:42 AM |
| L116 | 843 | L114 and ((display$3 or screen or show$3) with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 09:44 AM |
| L117 | 20 | L116 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 09:44 AM |
| L118 | 1 | "5595271".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 09:48 AM |
| L119 | 951 | 320/108 and ((display$3 or screen or show$3) with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 10:04 AM |
| L120 | 57 | L119 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 10:05 AM |
| L121 | 157 | ("320".clas. or h02j7/$$.cpc. or b60l53/$$.cpc. or b60l50/$$.cpc.) and (display$4 with (coil or induct$4 or core) with align$4) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 10:11 AM |
| L122 | 5 | L121 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 10:13 AM |
| L123 | 307 | ("320".clas. or | (US-PGPUB; USPAT; | OR | ON | ON | 2020/06/18 |



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|---|---|---|---|---|---|---|---|
| | | h02j7/$$.cpc. or b60l53/$$.cpc. or b60l50/$$.cpc.) and (display$4 with (coil or induct$4 or core) with (vehicle or car or auto or automobile)) | USOCR) | | | | 10:15 AM |
| L124 | 12 | L123 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 10:15 AM |
| L125 | 1 | "5311973".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:12 AM |
| L126 | 217 | L114 and (display$3 with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:37 AM |
| L127 | 3 | L126 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:37 AM |
| L128 | 302 | b60l53/$$.cpc. and (display$3 with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:38 AM |
| L129 | 13 | L128 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:38 AM |
| L130 | 71 | 320/109 and (display$3 with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:43 AM |
| L131 | 3 | L130 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:43 AM |
| L132 | 193 | 320/108 and (display$3 with (align$4 or misalign$4)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:43 AM |
| L133 | 10 | L132 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:44 AM |
| L134 | 1 | "20080296978".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:54 AM |
| L135 | 1810 | L114 and ((display$3 or screen or show$3) near5 (coil or inductiv$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:58 AM |
| L136 | 145 | L114 and ((display$3 or screen) near5 (coil or inductiv$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:59 AM |
| L137 | 1 | L136 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 11:59 AM |
| L138 | 28 | 320/109 and ((display$3 or screen) near5 (coil or inductiv$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 12:00 PM |
| L139 | 2 | L138 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 12:00 PM |
| L140 | 12 | "180".clas. and ((display$3 or screen) near5 (coil or inductiv$3)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 12:01 PM |
| L141 | 26603 | b60l53/12,126.cpc. or | (US-PGPUB; USPAT; | OR | ON | ON | 2020/06/18 |



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| | | 320/108 or h02j50/$$.cpc. | USOCR) | | | | 01:48 PM |
| L142 | 387 | L141 and ((stop$4 or cancel$3 or cancell$3 or postpon$4) with (recharg$3 or charg$3) with (align$4 or efficiency)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 01:49 PM |
| L143 | 6 | L142 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/18 01:49 PM |
| L144 | 13 | (US-20090243549-$ or US-20080156553-$ or US-20020079868-$ or US-20060276938-$ or US-20090313034-$ or US-20090243538-$ or US-20080265684-$ or US-20100081378-$).did. or (US-5595271-$ or US-6421600-$ or US-4742283-$ or US-5461298-$ or US-8229356-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2020/06/18 06:13 PM |
| L145 | 128 | ((CHRISTOPHER) near2 (AUSTIN)).INV. | (US-PGPUB; USPAT; USOCR) | OR | OFF | OFF | 2020/06/18 06:21 PM |
| L146 | 10 | "5595271".pn. or "20080296978".pn. or "5311793".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/19 08:58 AM |
| L147 | 3 | "5595271".pn. or "20080296978".pn. or "5311793".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/19 08:58 AM |
| L148 | 13 | (US-20090243549-$ or US-20080156553-$ or US-20020079868-$ or US-20060276938-$ or US-20090313034-$ or US-20090243538-$ or US-20080265684-$ or US-20100081378-$).did. or (US-5595271-$ or US-6421600-$ or US-4742283-$ or US-5461298-$ or US-8229356-$).did. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2020/06/19 10:01 AM |
| L149 | 1 | "5311793".pn. | (US-PGPUB; USPAT) | OR | OFF | OFF | 2020/06/19 10:06 AM |
| L150 | 2 | "20180375175".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/19 10:29 AM |
| L151 | 2 | "6963186".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/19 12:02 PM |



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|---|---|---|---|---|---|---|---|
| L152 | 7 | "20130181667".pn. or "20170237295".pn. or "20090085706".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/06/22 09:23 AM |
| L153 | 3 | "20130181667".pn. or "20170237295".pn. or "20090085706".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/22 09:23 AM |
| L154 | 66 | (320/108 and h02j50/$$.cpc.) and (coil with ((wind$3 or wound$3) near5 opposite)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/22 10:29 AM |
| L155 | 2 | "20130264881".pn. or "20190187221".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/06/22 10:49 AM |
| L156 | 2 | "20150318730".pn. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/07/01 09:23 AM |
| L157 | 25361 | (h02j50/$$.cpc. or h02j5/005.cpc. or h02j7/025.cpc.) and @ad<"20121105" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/07/01 09:31 AM |
| L158 | 14 | L157 and (foreign or object or metal) and (inrush$3) and (flat or flat$3 or flaten$3 or level) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/07/01 09:33 AM |
| L159 | 0 | L157 and ((inrush$3) with (flat or flat$3 or flaten$3 or level)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/07/01 09:39 AM |
| L160 | 3 | "5595271".pn. or "20080296978".pn. or "5311973".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 09:10 AM |
| L161 | 88351 | b60l53/12,126.cpc. or 320/108 or h02j50/$$.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/11/24 09:11 AM |
| L162 | 976785 | b60l53/$$.cpc. or 320/108 or h02j50/$$.cpc. or h01m10/$$.cpc. or g01r31/$$.cpc. or h02j7/$$.cpc. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/11/24 09:12 AM |
| L163 | 73070 | L162 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 09:23 AM |
| L164 | 327816 | L162 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/11/24 09:24 AM |
| L165 | 140 | L164 and ((display$3 or screen or show$3 or graph$3 or graphical or HUD) with (align$4 or | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 09:26 AM |



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|---|---|---|---|---|---|---|---|
| | | misalign$4 or orientat$3) with (coil or core or inductive$2)) | | | | | |
| L166 | 61 | L164 and ((display$3 or screen or show$3 or graph$3 or graphical or HUD) with (align$4 or misalign$4 or orientat$3) with (vehicle or car or auto or automobile)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 09:51 AM |
| L167 | 4 | "5595271".pn. or "20080296978".pn. or "5311973".pn. or "20100081378".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 10:01 AM |
| L168 | 4319 | L164 and ((display$3 or screen or show$3 or graph$3 or graphical or HUD) near5 (vehicle or car or auto or automobile)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 10:27 AM |
| L169 | 64 | L164 and ((display$3 or screen or show$3 or graph$3 or graphical or HUD) with (align$4 or misalign$4 or orientat$3) with (vehicle or car or auto or automobile)) | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2020/11/24 10:28 AM |
| L170 | 75 | L168 and ((align$4 or misalign$4 or orientat$3) with (coil or core or inductive$2)) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2020/11/24 10:38 AM |
| L171 | 1 | "20210184275".pn. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/20 08:18 PM |
| L177 | 182981 | b60l53/12,122,126.cpc. OR h02j7/025.cpc. OR h02j50/$$.cpc. | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 09:00 AM |
| L178 | 12232 | l177 AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 09:01 AM |
| L179 | 63 | L178 AND ((enabl$3 OR disabl$3) WITH (align$4 OR misalign$4)) | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, | OR | ON | ON | 2022/09/21 09:02 AM |



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|---|---|---|---|---|---|---|---|
| | | | GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | | | | |
| L180 | 1 | ("7881957").pn. | (US-PGPUB; USPAT) | OR | ON | ON | 2022/09/21 09:17 AM |
| L181 | 4 | ("20090063183" OR "20100106631" OR "6424158" OR "7917179").pn. | (US-PGPUB; USPAT) | OR | ON | ON | 2022/09/21 09:17 AM |
| L182 | 53 | ("20020079868" OR "20030015995" OR "20030127155" OR "20030209375" OR "20050046387" OR "20060276938" OR "20070080827" OR "20070144605" OR "20070164704" OR "20080007202" OR "20080040223" OR "20080040296" OR "20080052017" OR "20080052145" OR "20080054845" OR "20080103370" OR "20080156553" OR "20080203973" OR "20080238355" OR "20080265684" OR "20080281168" OR "20080296978" OR "20090021213" OR "20090063193" OR "20090139781" OR "20090237034" OR "20090243538" OR "20090243549" OR "20090278492" OR "20090313034" OR "20090313103" OR "20090313174" OR "20100010698" OR "20100030389" OR "20100081378" OR "20100169008" OR "20100228405" OR "20100281183" OR "20110266996" OR "4532418" OR "4742283" OR "5202617" OR "5311973" OR "5461298" OR "5462439" OR "5548200" OR "5594318" OR | (US-PGPUB; USPAT) | OR | ON | ON | 2022/09/21 09:18 AM |

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| | | "5595271" OR "5650710" OR "6281663" OR "6421600" OR "6963186" OR "7243746").pn. | | | | | |
| L183 | 58 | L180 OR L181 OR l182 | (US-PGPUB; USPAT) | OR | ON | ON | 2022/09/21 09:18 AM |
| L186 | 41 | L183 AND (enabl$3 OR disabl$3 OR align$4 OR misalign$4) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/21 09:20 AM |
| L187 | 317 | L178 AND ((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(input OR buttom OR interface)) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 09:28 AM |
| L188 | 40 | (Artificial Intelligence) Similar to: 17/188,269 with 0 CPC Selections and 0 Text Selections<br>Text: (KR-20040059337-A OR KR-920007283-Y1 OR JP-H03239128-A OR ES-2106034-T3 OR US-392826-A OR US-20210031640-A1 OR EP-3651307-A1 OR US-720327-A OR US-10604024-B2 OR IN-20140CN02919-A OR MX-2014004043-A OR KR-950021947-A OR EP-1880904-A4 OR KR-20040085949-A OR KR-20050031332-A OR US-2000571-A OR JP-H0311937-A OR US-3017570-A OR TW-342452-B OR US-1182241-A OR US-9203251-B2 OR KR-20010082961-A OR EP-0258850-A3 OR EP-0773618-A3 OR WO-9100623-A3 OR KR-102395078-B1 OR US-5408177-A OR US-1123275-A OR KR-20220001944-U OR US-5623194-A OR CN-112379281-A OR US- | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)) | OR | ON | ON | 2022/09/21 10:04 AM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 20180269704-A1 OR KR-20050123238-A OR JP-H08146105-A OR US-6340876-B1 OR KR-100328190-B1 OR US-20190308518-A1 OR KR-20210145466-A OR KR-20210145465-A OR BR-PI0509663-A OR CA-2034490-A1 OR US-5438270-A OR WO-2005101609-A3 OR KR-20180053508-A OR WO-2005050332-A3 OR US-5557189-A OR US-4764715-A OR KR-102395084-B1 OR CN-101223056-B OR DE-102016002465-B4).did. | | | | | |
| L189 | 50 | (Artificial Intelligence) Similar to: 17/188,269 with 0 CPC Selections and 3 Text Selections<br>Text: (CN-107548535-B OR US-4542462-A OR EP-0143780-B1 OR FR-2714337-A1 OR US-20200244091-A1 OR CA-1213642-A OR KR-20060056442-A OR CN-112350394-A OR US-5623194-A OR WO-2011050603-A1 OR JP-2021027798-A OR DE-102014208991-A1 OR JP-2996559-B2 OR US-2332951-A OR KR-20210018104-A OR JP-6986122-B2 OR US-20180241255-A1 OR EP-3167519-B1 OR US-3086159-A OR US-8751062-B2 OR US-20110163721-A1 OR DE-4344368-C1 OR CN-107548535-A OR JP-H05211724-A OR US-5952813-A OR FR-2525039-A1 OR KR-20150093050-A OR US-5339017-A OR DE-4406064-B4 OR US-10992187-B2 OR CN-111483285-A OR US-20110163718-A1 OR | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO)) | OR | ON | ON | 2022/09/21 10:05 AM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | CN-111052538-A OR US-7795841-B2 OR US-20090085522-A1 OR US-20170141591-A1 OR US-5614808-A OR US-8907620-B2 OR DE-102020101901-A1 OR CN-106816929-A OR KR-100361456-B1 OR US-4031449-A OR DE-10050737-A1 OR EP-1396388-B1 OR US-5596261-A OR JP-3028704-B2 OR DE-4331721-A1 OR CA-1051515-A OR US-2114827-A OR US-11152810-B2).did. | | | | | |
| L190 | 19 | (L188 OR l189) AND (enabl$3 OR disabl$3 OR align$4 OR misalign$4) | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/21 10:07 AM |
| L191 | 68 | L178 AND ((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(button)) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 10:15 AM |
| L192 | 148 | (h02j7/$$.cpc. OR "320".clas. OR b60l53/$$.cpc. OR b60l58/$$.cpc. OR h01m10/$$.cpc. OR h02j50/$$.cpc.) AND (((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(input OR button OR interface)) WITH (align$4 OR misalign$4 OR mis$1align$4)) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 10:22 AM |
| L193 | 4 | L192 AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 10:23 AM |
| L194 | 3787 | (((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(input OR button OR interface)) WITH | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, | OR | ON | ON | 2022/09/21 10:25 AM |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | (align$4 OR misalign$4 OR mis$1align$4)) AND @ad<"20080818" | SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | | | | |
| L195 | 18 | (h02j7/$$.cpc. OR "320".clas. OR b60l53/$$.cpc. OR b60l58/$$.cpc. OR h01m10/$$.cpc. OR h02j50/$$.cpc.) AND (((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(user)) WITH (align$4 OR misalign$4 OR mis$1align$4)) AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 12:29 PM |
| L196 | 0 | (h02j7/$$.cpc. OR "320".clas. OR b60l53/$$.cpc. OR b60l58/$$.cpc. OR h01m10/$$.cpc. OR h02j50/$$.cpc.) AND (((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(touch$4)) WITH (align$4 OR misalign$4 OR mis$1align$4)) AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 12:45 PM |
| L197 | 36 | (((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(input OR button OR interface)) WITH ((align$4 OR misalign$4 OR mis$1align$4)) near8 (coil OR inductiv$3 OR core OR winding OR wireless$2 OR non$1contact$3 OR electromagnetic$4)) AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 12:46 PM |
| L198 | 17 | ((US-20090243549-A1 OR US-20080156553-A1 OR US-20020079868-A1 OR US-20060276938-A1 OR US-20090313034-A1 OR US-20090243538-A1 OR US-20080265684-A1 OR US-20100081378-A1 OR US-20100181841-A1 OR US-20090047991-A1).did. AND PGPB.dbnm.) OR ((US- | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 12:58 PM |



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Tesla EX1002 Page 356

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5595271-A OR US-6421600-B1 OR US-4742283-A OR US-5461298-A OR US-8229356-B2 OR US-5462439-A OR US-11152810-B2).did. AND USPT.dbnm.) | | | | | |
| L199 | 201 | ((("AUSTIN") near3 ("Christopher"))).INV. | (US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT) | OR | ON | ON | 2022/09/21 01:36 PM |
| L200 | 8 | L199 AND (align$4 OR misalign$4).clm. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/21 01:36 PM |
| L201 | 25 | L199 AND (enabl$3 OR disabl$3).clm. | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/21 01:37 PM |
| L202 | 2292 | (320/109 OR h01m10/44.cpc. OR h02j7/0042.cpc. OR y02t90/14,16.cpc. OR y04s10/126.cpc.) AND ((enabl$3 OR disabl$3) WITH (align$4 OR misalign$4)) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 01:48 PM |
| L203 | 134 | L202 AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 01:48 PM |
| L204 | 10359 | (320/109 OR h01m10/44.cpc. OR h02j7/0042.cpc. OR y02t90/14,16.cpc. OR y04s10/126.cpc.) AND ((enabl$3 OR disabl$3 OR activat$3 OR de$1activat$3) near5(input OR button OR interface)) | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 02:58 PM |
| L205 | 1197 | L204 AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 02:58 PM |
| L206 | 97 | L178 AND ((detect$4 OR monitor$3 OR notify$3 OR notificat$3) WITH (align$4 OR misalign$4) WITH (coil OR inductiv$3 OR core | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; | OR | ON | ON | 2022/09/21 05:08 PM |

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|---|---|---|---|---|---|---|---|
| | | OR non$1contact$3 OR electromagnetic$4)) | JPO; DERWENT; IBM_TDB) | | | | |
| L207 | 89 | h02j50/$$.cpc. AND ((detect$4 OR monitor$3 OR notify$3 OR notificat$3) WITH (align$4 OR misalign$4) WITH (coil OR inductiv$3 OR core OR non$1contact$3 OR electromagnetic$4)) AND @ad<"20080818" | (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | ON | ON | 2022/09/21 06:43 PM |
| L208 | 249 | L112 and @ad<"20080818" | (US-PGPUB; USPAT; USOCR) | OR | ON | ON | 2022/09/21 08:34 PM |

## PE2E SEARCH - Search History (Interference)

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | British Equivalents | Time Stamp |
|---|---|---|---|---|---|---|---|
| N1 | 39 | ((charg$5 OR recharg$5)(batter$3 OR cell OR accumulator OR stor$4)(vehicle OR auto OR automobile OR car OR hev)(induct$3 OR wireless$2 OR non$1contact$3 OR electromagnetic$4)(cor e OR coil OR winding)(misalign$4 OR align$4)(enabl$3 OR disabl$3)(user OR button OR control OR display$3 OR interface)).clm. | (US-PGPUB; USPAT) | AND | ON | ON | 2022/09/21 01:45 PM |

## PE2E SEARCH - Search History (Similarity Search)

| Ref # | Application Number | Text Selections | CPC Selections |
|---|---|---|---|
| L188 | 17/188,269 | No selections | No selections |
| L189 | 17/188,269 | (Claims) A method of charging a battery of a vehicle, the method comprising:<br><br>detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;<br><br>detecting a misalignment of the first core with respect to the second core based at least in part on the positional relationship between the first core and the second core; and | No selections |

| | | | |
|---|---|---|---|
| | | in response detecting the misalignment of the first core with respect to the second core, disabling a user control displayed on a display for controlling the induction charging of the battery.<br><br>(Claims) A method of charging a battery of a vehicle, the method comprising:<br><br>detecting a positional relationship between a first core on the vehicle and a second core in a location exterior to the vehicle, the first and second cores enabling induction charging of the battery when sufficiently aligned with respect to one another;<br><br>detecting an alignment of the first core with respect to the second core within a predetermined threshold based at least in part on the positional relationship between the first core and the second core; and<br><br>in response detecting the alignment of the first core with respect to the second core, enabling a user control displayed on a display for controlling the induction charging of the battery.<br><br>(Claims) detect an alignment of the first core with respect to the second core within a threshold based at least in part on the second positional relationship between the first core and the second core, in response to detecting the alignment, enable the user control on the display, | |

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | |
| Examiner Name | |
| Attorney Docket Number | 013350-9003-US35 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 6424158 | | 2002-07-23 | Klang | |
| | 2 | 7917179 | | 2011-03-29 | Kokubo | |

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|---|---|---|---|---|---|---|
| | 1 | 20090063183 | | 2009-03-05 | McNeely et al. | |
| | 2 | 20100106631 | | 2010-04-29 | Kurayama et al. | |

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|---|---|---|---|---|---|---|---|---|
| | 1 | | | | | | | |



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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 013350-9003-US35 |

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**EXAMINER SIGNATURE**

| Examiner Signature | /NATHANIEL R PELTON/ | Date Considered | 09/21/2022 |
|---|---|---|---|

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.



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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 013350-9003-US35 |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-01-07 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
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| | |
|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | 2859 |
| Examiner Name | Nathaniel R. Pelton |
| Attorney Docket Number | 013350-9003-US35 |

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|---|---|---|---|---|---|---|
| | 1 | 7782021 | | 2010-08-24 | Kelty et al. | |
| | 2 | 6928372 | | 2005-08-09 | Pozsgay et al. | |
| | 3 | 8193766 | | 2012-06-05 | Rondoni et al. | |

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| | 1 | 20080039989 | | 2008-02-14 | Pollack et al. | |
| | 2 | 20090312903 | | 2009-12-17 | Hafner et al. | |
| | 3 | | | | | |

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|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 2859 |
| | Examiner Name | Nathaniel R. Pelton |
| | Attorney Docket Number | 013350-9003-US35 |

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|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 17188269 |
| | Filing Date | 2021-03-01 |
| | First Named Inventor | Christopher B. Austin |
| | Art Unit | 2859 |
| | Examiner Name | Nathaniel R. Pelton |
| | Attorney Docket Number | 013350-9003-US35 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-10-10 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



IPR2026-00379
Tesla EX1002 Page 367

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

# ELECTRONIC PAYMENT RECEIPT

| APPLICATION # | RECEIPT DATE / TIME | ATTORNEY DOCKET # |
|---|---|---|
| 17/188,269 | 10/10/2022 12:21:29 PM ET | 013350-9003-US35 |

## Title of Invention

VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

## Application Information

| | | | |
|---|---|---|---|
| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | - |
| CONFIRMATION # | 8606 | FILED BY | Eliana Carter |
| PATENT CENTER # | 61048868 | AUTHORIZED BY | Christopher Austin |
| CUSTOMER # | 23409 | FILING DATE | 03/01/2021 |
| CORRESPONDENCE ADDRESS | - | FIRST NAMED INVENTOR | Christopher B. Austin |

## Payment Information

| PAYMENT METHOD | PAYMENT TRANSACTION ID | PAYMENT AUTHORIZED BY |
|---|---|---|
| CARD / 6504 | E202200C22412535 | Eliana Carter |

| FEE CODE | DESCRIPTION | ITEM PRICE($) | QUANTITY | ITEM TOTAL($) |
|---|---|---|---|---|
| 2806 | SUBMISSION OF AN INFORMATION DISCLOSURE STATEMENT | 130.00 | 1 | 130.00 |
| | | | TOTAL AMOUNT: | $130.00 |

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

# ELECTRONIC ACKNOWLEDGEMENT RECEIPT

| APPLICATION # | RECEIPT DATE / TIME | ATTORNEY DOCKET # |
|---|---|---|
| **17/188,269** | **10/10/2022 12:21:29 PM ET** | **013350-9003-US35** |

## Title of Invention

VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

## Application Information

| | | | |
|---|---|---|---|
| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | - |
| CONFIRMATION # | 8606 | FILED BY | Eliana Carter |
| PATENT CENTER # | 61048868 | FILING DATE | 03/01/2021 |
| CUSTOMER # | 23409 | FIRST NAMED INVENTOR | Christopher B. Austin |
| CORRESPONDENCE ADDRESS | - | AUTHORIZED BY | Christopher Austin |

## Documents

**TOTAL DOCUMENTS: 1**

| DOCUMENT | PAGES | DESCRIPTION | SIZE (KB) |
|---|---|---|---|
| 013350-9003-US35_IDS_as_filed_10-10-22.pdf | 4 | Information Disclosure Statement (IDS) Form (SB08) | 1010 KB |

## Digest

| DOCUMENT | MESSAGE DIGEST(SHA-512) |
|---|---|
| 013350-9003-US35_IDS_as_filed_10-10-22.pdf | AA0EED71DA4E23B08F020D39AFAD8B249B967A05C29B1BE8<br>05B74632F882873B11CB21DD858B0C25BED8082D23CE5E06C<br>02E27AD006A89431D79EEEBA1DC8BDB |

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

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**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Group Art Unit 2859

In re

Patent Application of

Christopher B. Austin

Application No.: 17/188,269

Confirmation No.: 8606

Filed: March 1, 2021

Examiner: Nathaniel P. Pelton

"VEHICULAR BATTERY CHARGER,
CHARGING SYSTEM, AND METHOD"

Atty. Docket No. 013350-9003-US35

**COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The following comments are submitted in response to the Notice of Allowance issued on September 29, 2022. In the Notice, the Examiner provides Reasons for Allowance for the allowed claims. Applicant respectfully submits that the Examiner's statement regarding the Reasons for Allowance refers only to steps and features found in independent claims 27 and 35 of the present application, references text that is not found in independent claim 21, and are not the only reasons why the allowed claims are allowable.

The allowed claims include other patentable features, combinations of features, and steps not mentioned by the Examiner, or taught or suggested by the prior art. Each allowed claim is allowable based upon the combination of features, elements, and steps set forth in the claim, rather than upon any specific feature, element, or step (or sub-combination of features, elements, or steps) recited in the claim or other claims.

Respectfully submitted,

/christopher b. austin/

Christopher B. Austin
Reg. No. 41,592

MICHAEL BEST & FRIEDRICH LLP
790 N. Water Street, Suite 2500
Milwaukee, Wisconsin 53202
Phone: 414-271-6560
Fax: 414-277-0656

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23409 7590 09/29/2022
MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
ELECTRONICALLY FILED (Signature)
(Date)

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 | 8606 |

TITLE OF INVENTION: VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $600 | $0.00 | $0.00 | $600 | 12/29/2022 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| PELTON, NATHANIEL R | 2859 | 320-109000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Michael Best & Friedrich LLP
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 133080

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /christopher b. austin/ Date 10/13/22

Typed or printed name Christopher B. Austin Registration No. 41,592



IPR2026-00379
Tesla EX1002 Page 374

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 17188269 |
| **Filing Date:** | 01-Mar-2021 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Filer:** | Christopher B. Austin/Dorothy Hauser |
| **Attorney Docket Number:** | 013350-9003-US35 |

Filed as Small Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| UTILITY APPL ISSUE FEE | 2501 | 1 | 600 | 600 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **600** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 46815212 |
| **Application Number:** | 17188269 |
| **International Application Number:** | |
| **Confirmation Number:** | 8606 |
| **Title of Invention:** | VEHICULAR BATTERY CHARGER, CHARGING SYSTEM, AND METHOD |
| **First Named Inventor/Applicant Name:** | Christopher B. Austin |
| **Customer Number:** | 23409 |
| **Filer:** | Christopher B. Austin/Dorothy Hauser |
| **Filer Authorized By:** | Christopher B. Austin |
| **Attorney Docket Number:** | 013350-9003-US35 |
| **Receipt Date:** | 13-OCT-2022 |
| **Filing Date:** | 01-MAR-2021 |
| **Time Stamp:** | 17:00:56 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $600 |
| RAM confirmation Number | E20220CH01150062 |
| Deposit Account | |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Post Allowance Communication - Incoming | 013350-9003-US35_As_Filed_Comments.pdf | 82106<br>7eb94fa3fcfa1d699bb2752fc34c8b53a8a2d657 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Issue Fee Payment (PTO-85B) | 013350-9003-US35_As_Filed_Issue_Fee_Transmittal.pdf | 1220287<br>220b38a82f9971bd58ac3d65b3594dfbc67e0f4c | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 37964<br>bdd41d346c5c414ae3f692ac35f8a5fbffa3e2c4 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 1340357 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**
**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**
**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 03/01/2021 | Christopher B. Austin | 013350-9003-US35 | 8606 |

23409 7590 10/17/2022

MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

| EXAMINER | |
|---|---|
| PELTON, NATHANIEL R | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2859 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 10/17/2022 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mkeipdocket@michaelbest.com

| **Supplemental**<br>***Notice of Allowability*** | **Application No.**<br>17/188,269 | **Applicant(s)**<br>Austin, Christopher B. | |
|---|---|---|---|
| | **Examiner**<br>NATHANIEL R PELTON | **Art Unit**<br>2859 | **AIA (FITF) Status**<br>No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the IDS filed on 10/10/2022.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 21-40 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All  b) ☐ Some*  c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 10/10/2022.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NATHANIEL R PELTON/
Primary Examiner, Art Unit 2859



IPR2026-00379
Tesla EX1002 Page 380

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 17188269 |
| Filing Date | 2021-03-01 |
| First Named Inventor | Christopher B. Austin |
| Art Unit | 2859 |
| Examiner Name | Nathaniel R. Pelton |
| Attorney Docket Number | 013350-9003-US35 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 7782021 | | 2010-08-24 | Kelty et al. | |
| | 2 | 6928372 | | 2005-08-09 | Pozsgay et al. | |
| | 3 | 8193766 | | 2012-06-05 | Rondoni et al. | |

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|---|---|---|---|---|---|---|
| | 1 | 20080039989 | | 2008-02-14 | Pollack et al. | |
| | 2 | 20090312903 | | 2009-12-17 | Hafner et al. | |
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| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
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**EXAMINER SIGNATURE**

| Examiner Signature | /NATHANIEL R PELTON/ | Date Considered | 10/13/2022 |
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /N.R.P/

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| | Attorney Docket Number | 013350-9003-US35 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /christopher b. austin/ | Date (YYYY-MM-DD) | 2022-10-10 |
|---|---|---|---|
| Name/Print | Christopher B. Austin | Registration Number | 41,592 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**



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The information provided by you in this form will be subject to the following routine uses:

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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



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| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 17/188,269 | 11/22/2022 | 11508996 | 013350-9003-US35 | 8606 |

23409 7590 11/02/2022

MICHAEL BEST & FRIEDRICH LLP (Mke)
790 N WATER ST
SUITE 2500
MILWAUKEE, WI 53202

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 140 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PAIR WEB site http://pair.uspto.gov for additional inventors):

Christopher B. Austin, Grafton, WI;

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

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AO 120 (Rev. 08/10)

| TO: | REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK |
|---|---|
| **Mail Stop 8<br>Director of the U.S. Patent and Trademark Office<br>P.O. Box 1450<br>Alexandria, VA 22313-1450** | |

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas - Midland-Odessa Division on the following

☐ Trademarks or ☑ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.):

| DOCKET NO. | DATE FILED | U.S. DISTRICT COURT |
|---|---|---|
| 7:26-cv-00100 | 3/23/2026 | Western District of Texas - Midland-Odessa Division |

| PLAINTIFF | DEFENDANT |
|---|---|
| ChargeLogic LLC | Tesla, Inc. |

| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
|---|---|---|---|
| 1 | 10,090,567 | 10/2/2018 | ChargeLogic LLC |
| 2 | 11,258,107 | 2/22/2022 | ChargeLogic LLC |
| 3 | 11,721,844 | 8/8/2023 | ChargeLogic LLC |
| 4 | 11,508,996 | 11/22/2022 | ChargeLogic LLC |
| 5 | 11,909,010 | 2/20/2024 | ChargeLogic LLC |

In the above---entitled case, the following patent(s)/ trademark(s) have been included:

| DATE INCLUDED | INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading | | |
|---|---|---|---|
| | PATENT OR TRADEMARK NO. | DATE OF PATENT OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK |
| 1 | 11,909,011 | 2/20/2024 | ChargeLogic LLC |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

In the above---entitled case, the following decision has been rendered or judgement issued:

| DECISION/JUDGEMENT |
|---|
| |

| CLERK | (BY) DEPUTY CLERK | DATE |
|---|---|---|
| | | |

**Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director**
**Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy**