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(54) **APPARATUS, METHOD AND ARTICLE FOR PROVIDING VEHICLE DIAGNOSTIC DATA**

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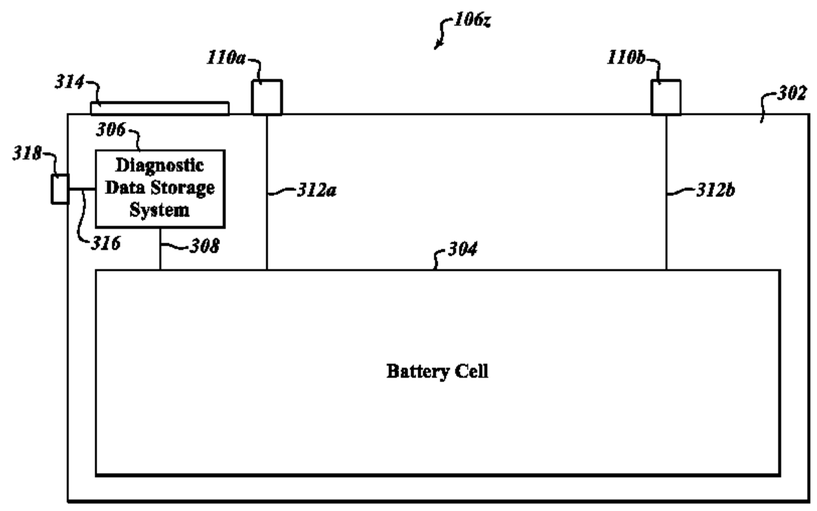
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(57) **ABSTRACT**

A network of collection, charging and distribution machines collects, charges and distributes portable electrical energy storage devices (e.g., batteries, supercapacitors or ultracapacitors). Vehicle diagnostic data of a vehicle using the portable electrical energy storage device is stored on a diagnostic data storage system of the portable electrical energy storage device during use of a respective portable electrical energy storage device by a respective vehicle. Once the user places the portable electrical energy storage device in the collection, charging and distribution machine, or comes within wireless communications range of a collection, charging and distribution machine, a connection is established between the collection, charging and distribution machine and the portable electrical energy storage device. The collection, charging and distribution machine then reads vehicle diagnostic data stored on the diagnostic data storage system of the portable electrical energy storage device and provides information regarding the diagnostic data.

23 Claims, 7 Drawing Sheets



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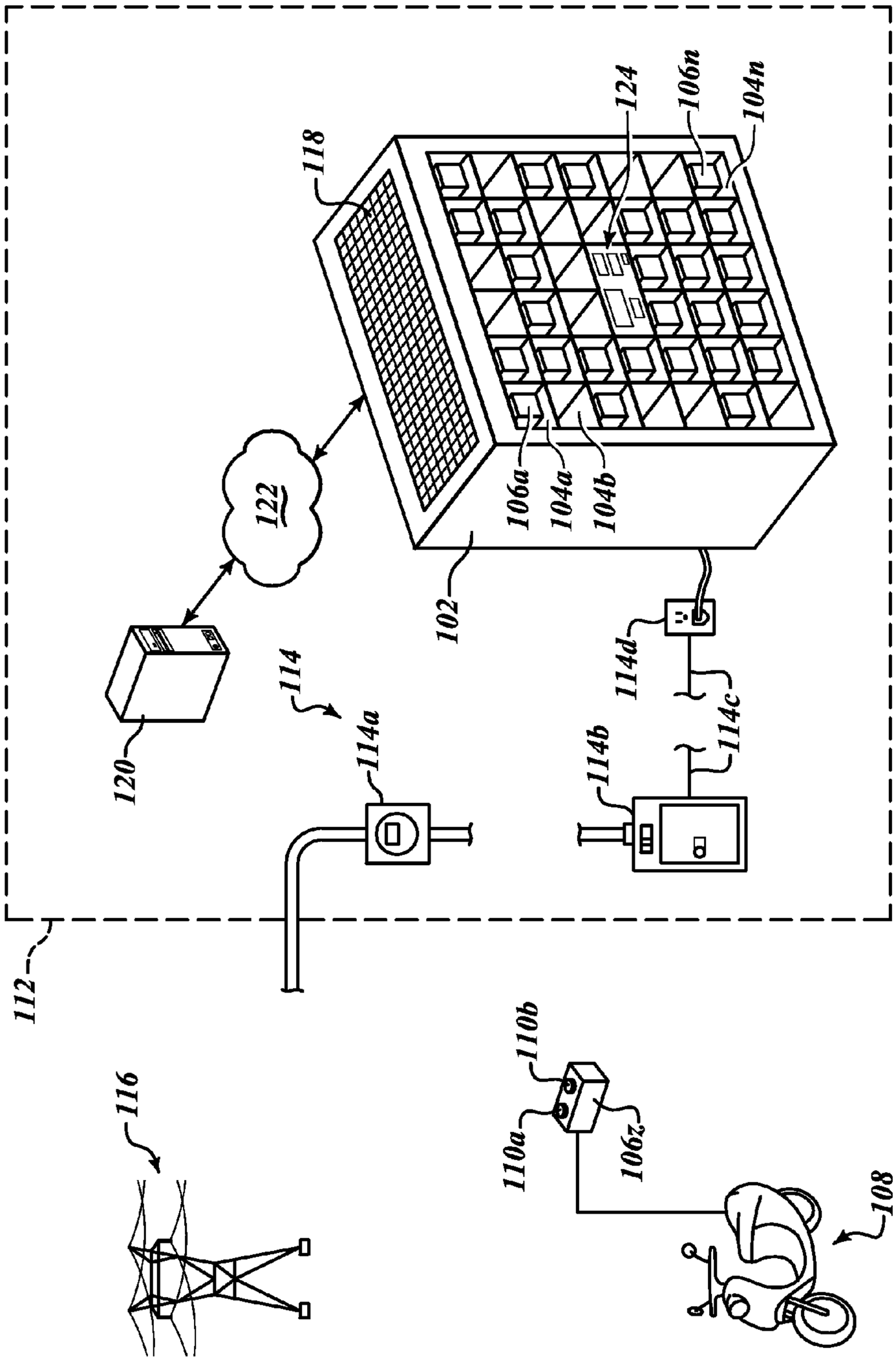

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FIG. 1

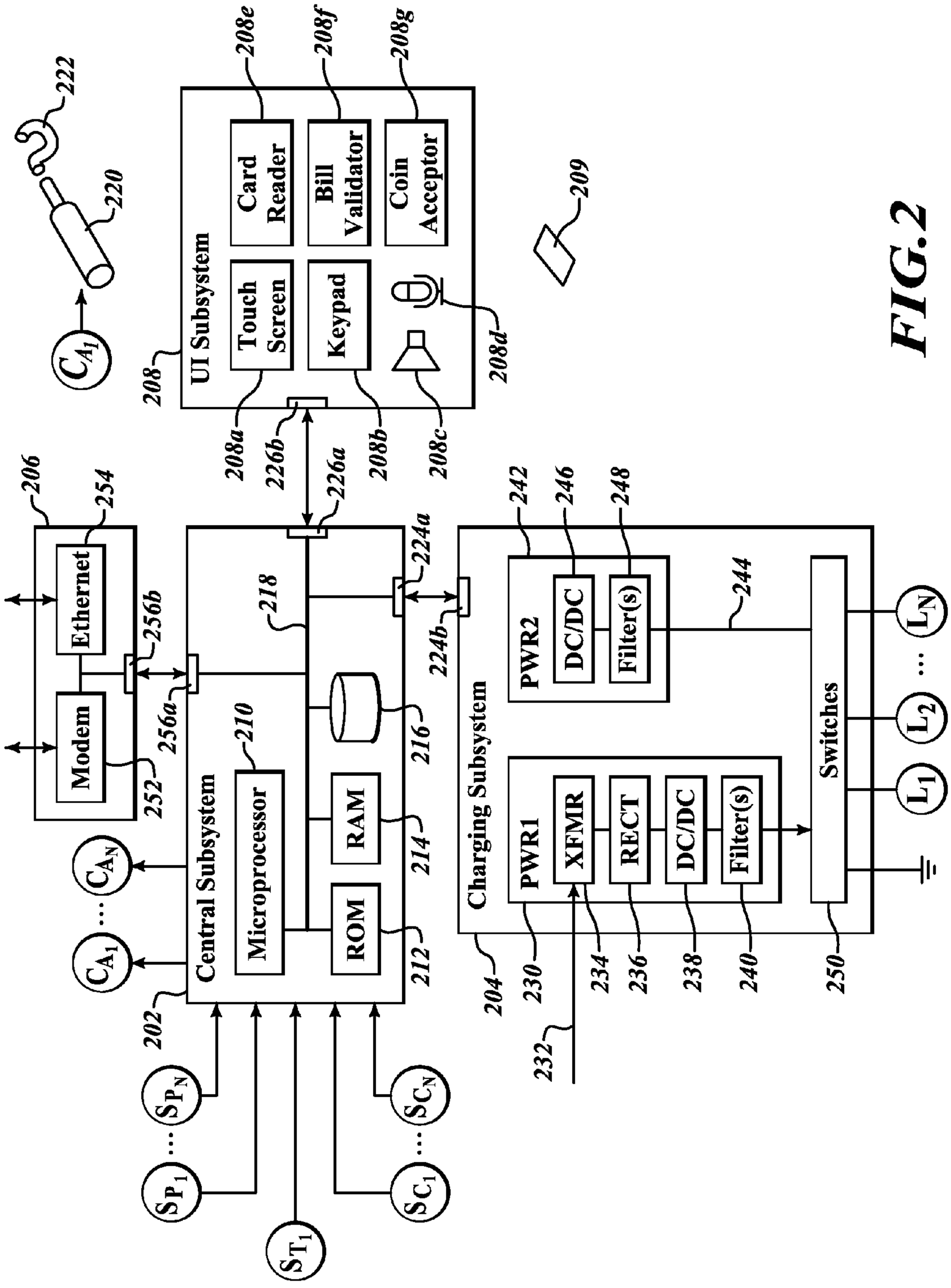

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ROM
RAM
Modem
Ethernet
UI Subsystem
Touch Screen
Keypad
Card Reader
Bill Validator
Coin Acceptor
Charging Subsystem
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XFMR
RECT
DC/DC
Filter(s)
PWR2
DC/DC
Filter(s)
Switches
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S_{C_1}
S_{C_N}
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L_2
L_N

FIG. 2

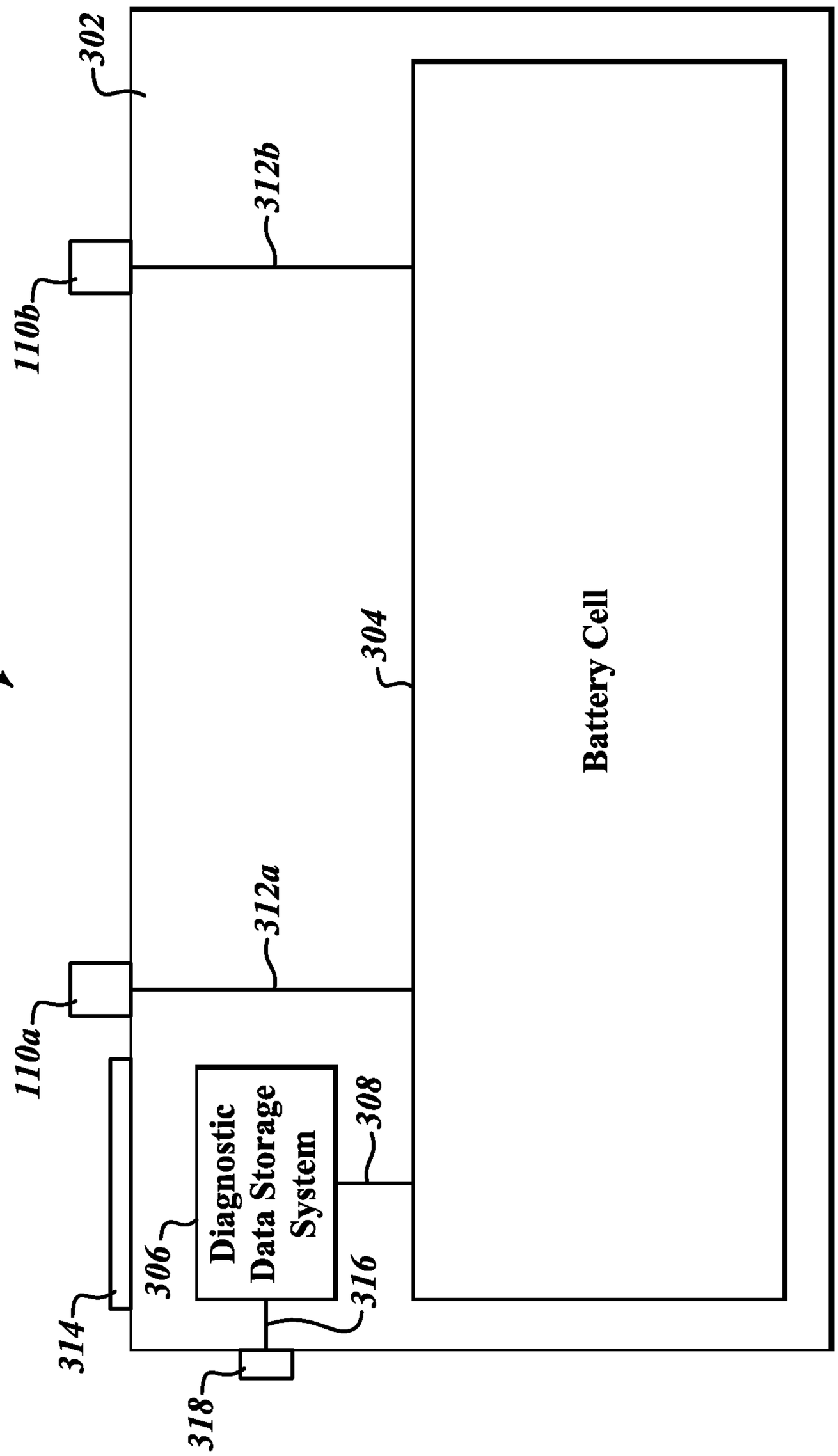

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106z
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Battery Cell
312a
110a
Diagnostic Data Storage System
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FIG.3

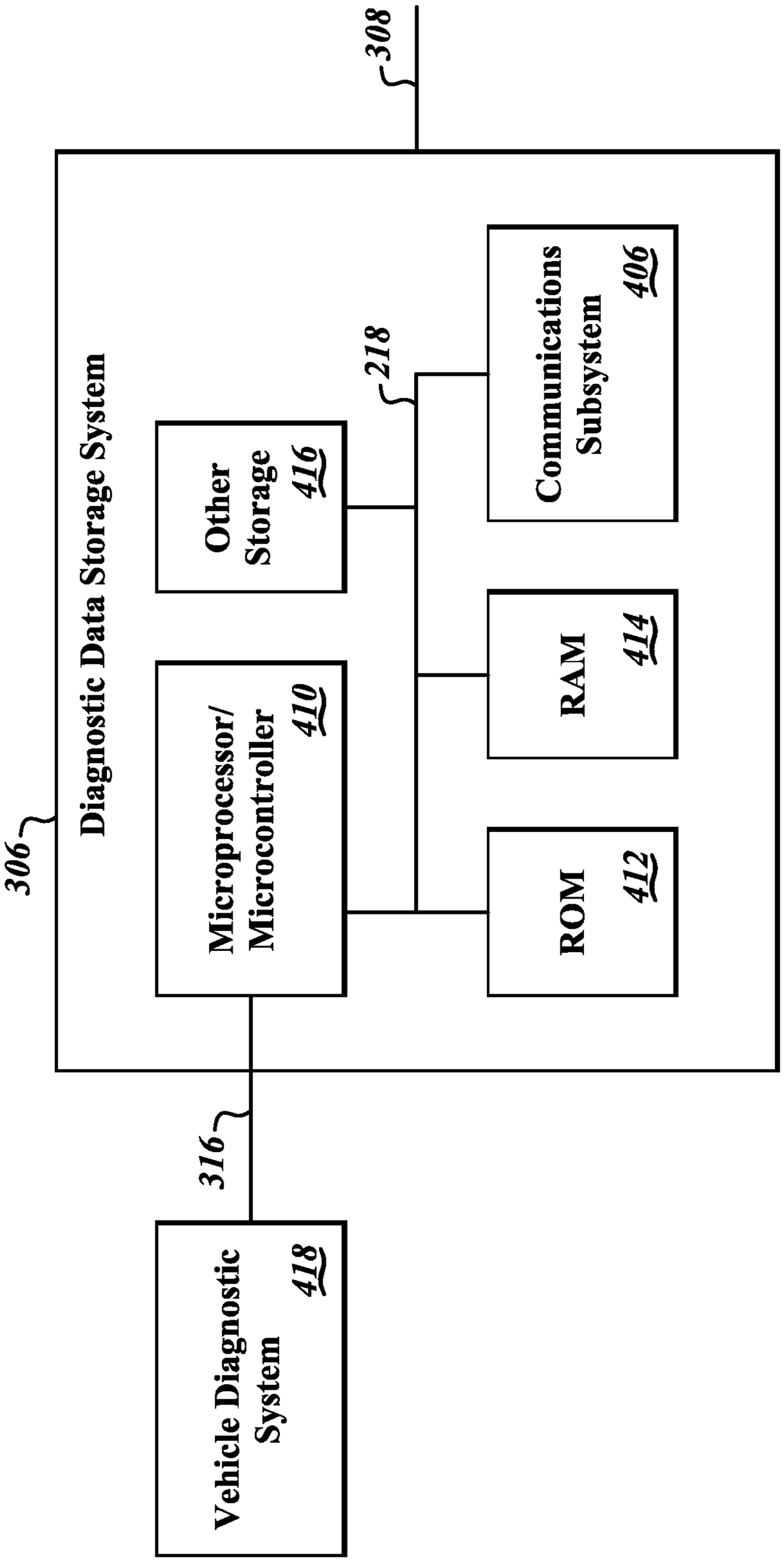

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306
Diagnostic Data Storage System
218
Microprocessor/ Microcontroller 410
Other Storage 416
RAM 414
ROM 412
Communications Subsystem 406
316
Vehicle Diagnostic System 418

FIG. 4A

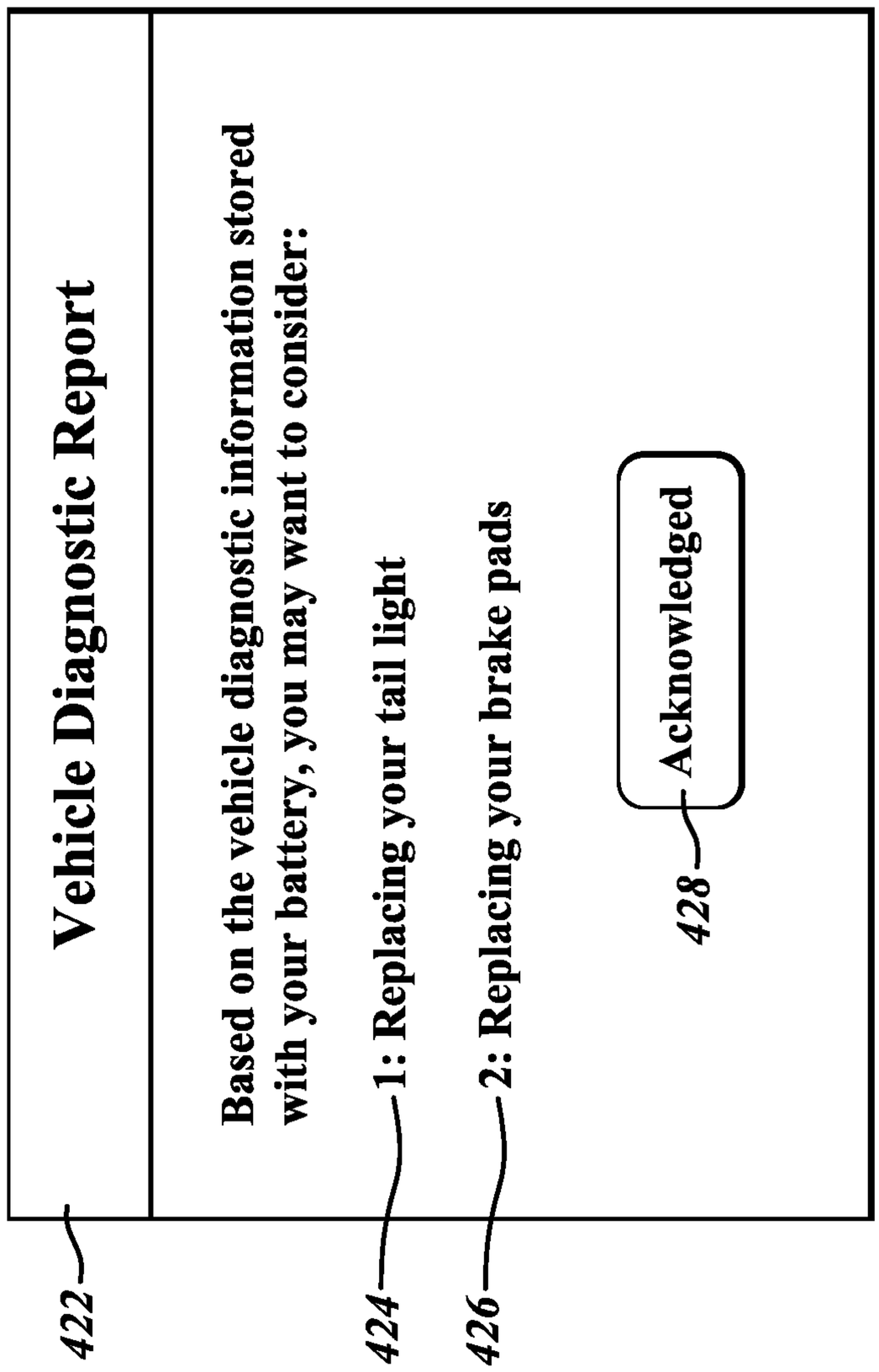

420
Vehicle Diagnostic Report
Based on the vehicle diagnostic information stored
with your battery, you may want to consider:
1: Replacing your tail light
2: Replacing your brake pads
Acknowledged
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422
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426

FIG.4B

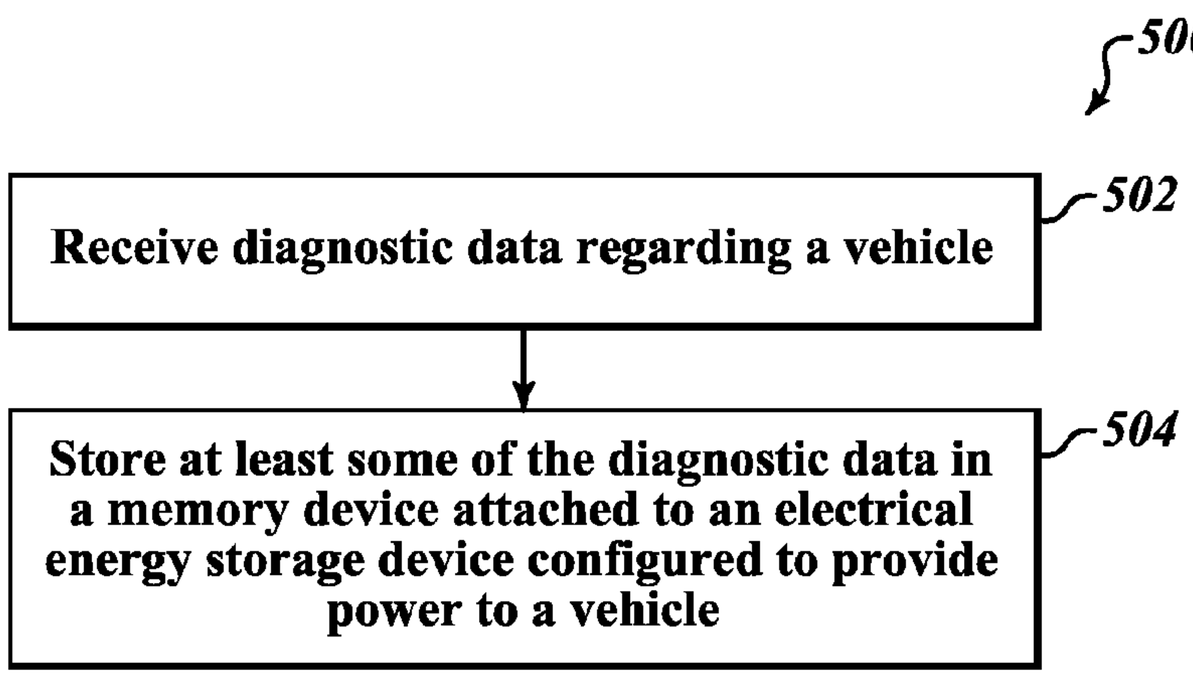


FIG. 5

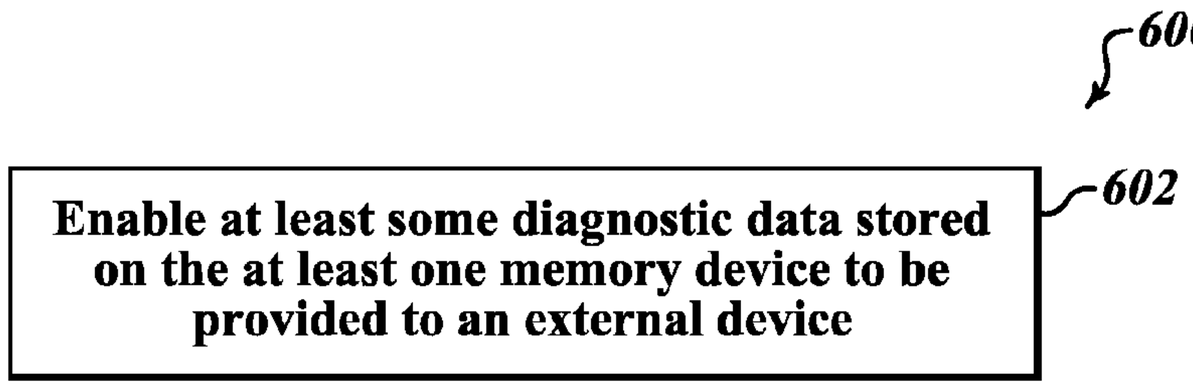


FIG. 6

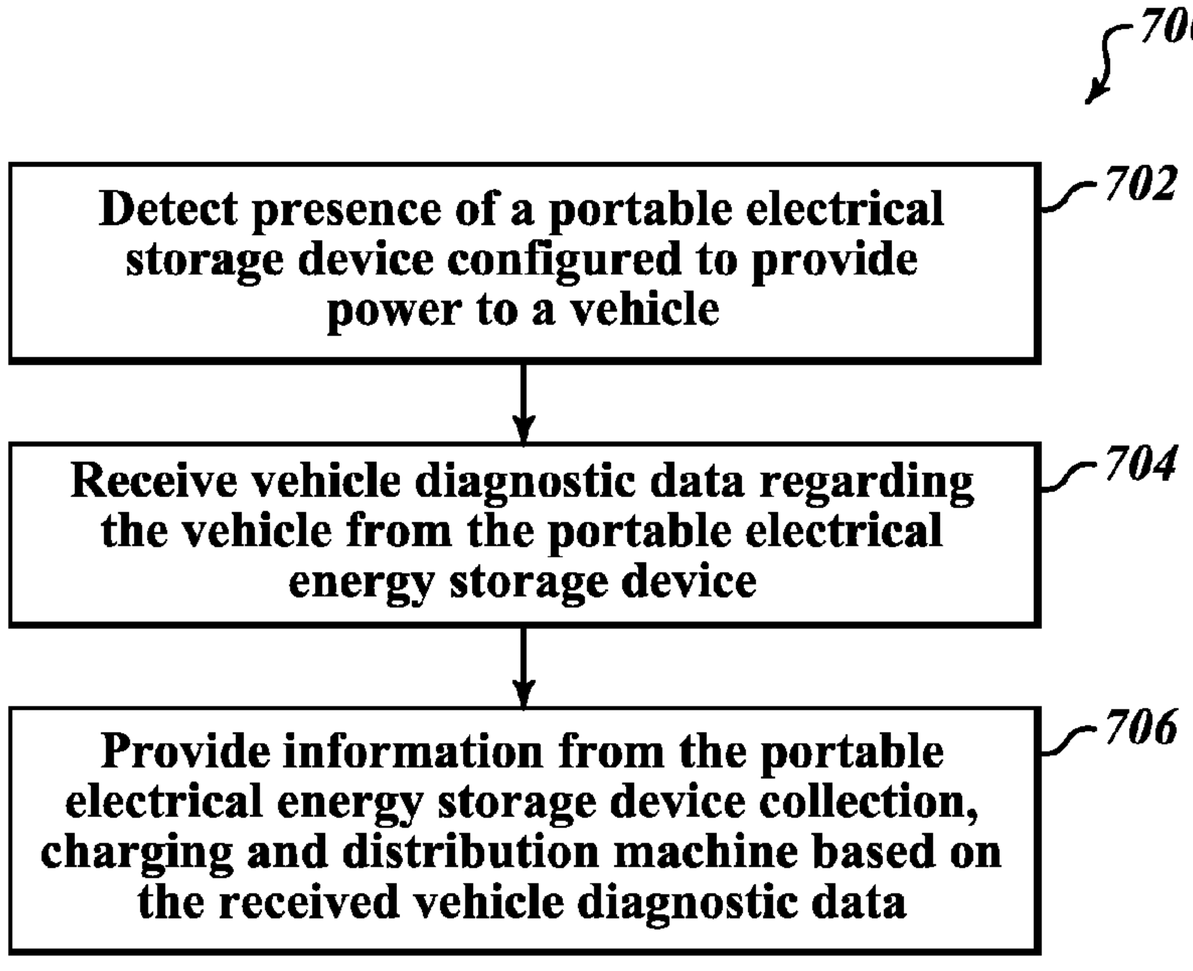


FIG. 7

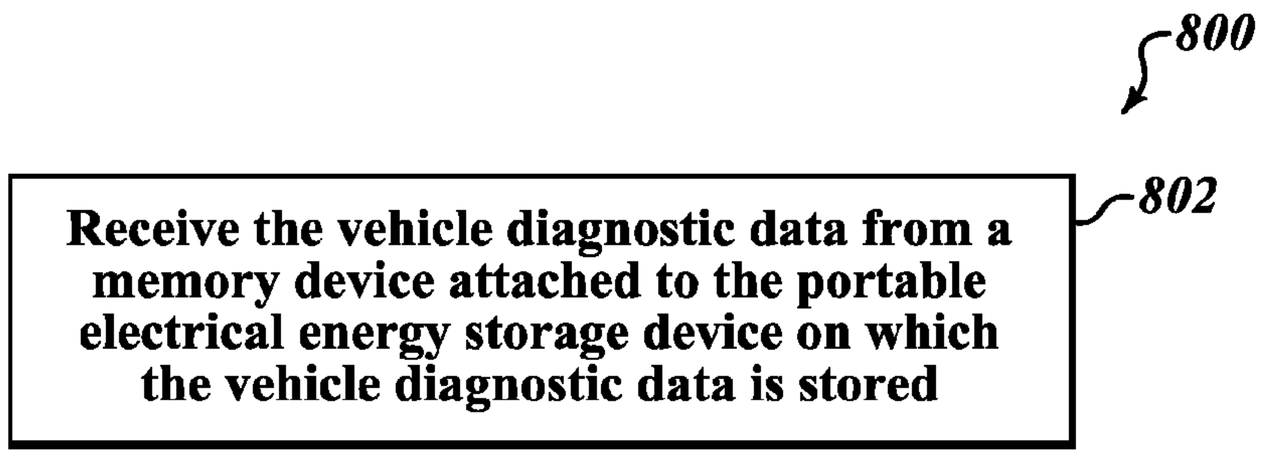


FIG. 8

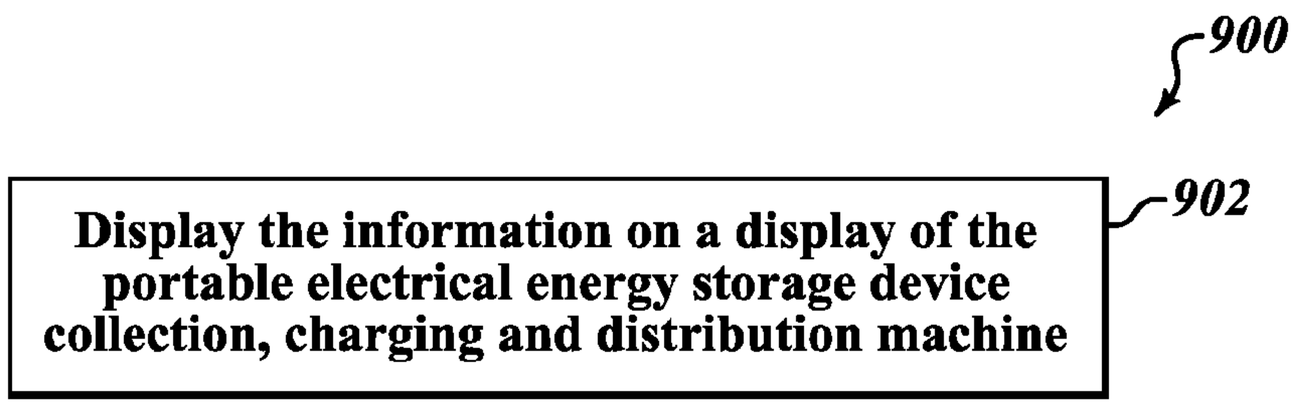


FIG. 9

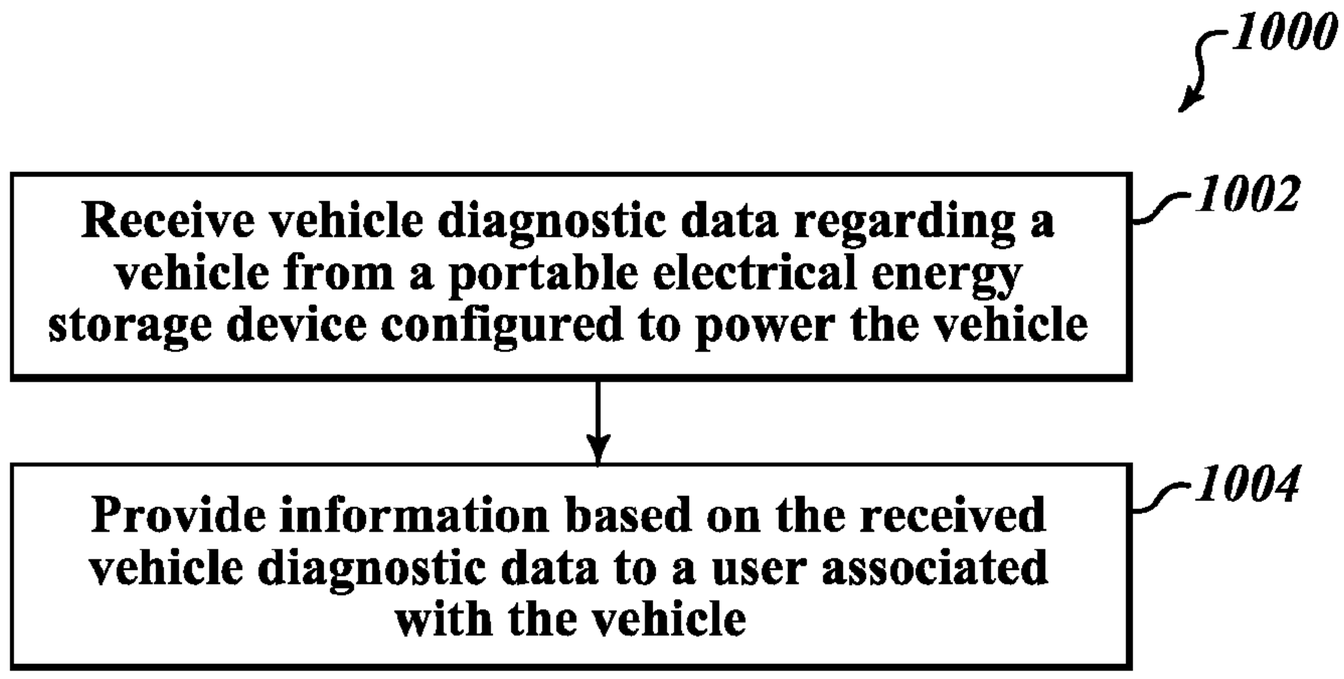


FIG. 10

APPARATUS, METHOD AND ARTICLE FOR PROVIDING VEHICLE DIAGNOSTIC DATA

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. 119(e) of the filing date of U.S. provisional patent application Ser. No. 61/511,900 entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/647,936 entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES," filed May 16, 2012; U.S. provisional patent application Ser. No. 61/534,753 entitled "APPARATUS, METHOD AND ARTICLE FOR REDISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES, BETWEEN COLLECTION, CHARGING AND DISTRIBUTION MACHINES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/534,761 entitled "APPARATUS, METHOD AND ARTICLE FOR AUTHENTICATION, SECURITY AND CONTROL OF POWER STORAGE DEVICES SUCH AS BATTERIES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/534,772 entitled "APPARATUS, METHOD AND ARTICLE FOR AUTHENTICATION, SECURITY AND CONTROL OF POWER STORAGE DEVICES, SUCH AS BATTERIES, BASED ON USER PROFILES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/511,887 entitled "THERMAL MANAGEMENT OF COMPONENTS IN ELECTRIC MOTOR DRIVE VEHICLES," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/647,941 entitled "THERMAL MANAGEMENT OF COMPONENTS IN ELECTRIC MOTOR DRIVE VEHICLES," filed May 16, 2012; U.S. provisional patent application Ser. No. 61/511,880 entitled "DYNAMICALLY LIMITING VEHICLE OPERATION FOR BEST EFFORT ECONOMY," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/557,170 entitled "APPARATUS, METHOD, AND ARTICLE FOR PHYSICAL SECURITY OF POWER STORAGE DEVICES IN VEHICLES," filed Nov. 8, 2011; U.S. provisional patent application Ser. No. 61/581,566 entitled "APPARATUS, METHOD AND ARTICLE FOR A POWER STORAGE DEVICE COMPARTMENT," filed Dec. 29, 2011; U.S. provisional patent application Ser. No. 61/601,404 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING VEHICLE DIAGNOSTIC DATA," filed Feb. 21, 2012; U.S. provisional patent application Ser. No. 61/601,949 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING LOCATIONS OF POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINES," filed Feb. 22, 2012; and U.S. provisional patent application Ser. No. 61/601,953 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING INFORMATION REGARDING AVAILABILITY OF POWER STORAGE DEVICES AT A POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINE," filed Feb. 22, 2012.

BACKGROUND

1. Technical Field

The present disclosure generally relates to providing vehicle diagnostic data and, more particularly, to providing vehicle diagnostic data using electrical power storage devices (e.g., secondary batteries, supercapacitors or ultracapacitors), which may be suitable for use in a variety of fields or applications, for instance transportation and non-transportation uses.

2. Description of the Related Art

Personal transportation vehicles such as combustion engine powered scooters and/or motorbikes are ubiquitous in many places, for example in the many large cities of Asia. Such scooters and/or motorbikes tend to be relatively inexpensive, particularly compared to automobiles, cars or trucks. Cities with high numbers of combustion engine scooters and/or motorbikes also tend to be very densely populated and suffer from high levels of air pollution. When new, many combustion engine scooters and/or motorbikes are a relatively low-polluting source of personal transportation. For instance, such scooters and/or motorbikes may have higher mileage ratings than larger vehicles. Some scooters and/or motorbikes may even be equipped with basic pollution control equipment (e.g., catalytic converter). Unfortunately, factory specified levels of emission are quickly exceeded as the scooters and/or motorbikes are used and either not maintained and/or as the scooters and/or motorbikes are modified, for example by intentional or unintentional removal of catalytic converters. Often owners or operators of scooters and/or motorbikes lack the financial resources or the motivation to maintain their vehicles.

It is known that air pollution has a negative effect on human health, being associated with causing or exacerbating a variety of diseases (e.g., various reports tie air pollution to emphysema, asthma, pneumonia, and cystic fibrosis, as well as various cardiovascular diseases). Such diseases take large numbers of lives and severely reduce the quality of life of countless others.

There are a wide variety of uses or applications for portable electrical energy storage devices. One such application is in the field of transportation. Hybrid and all electrical vehicles are becoming increasingly common. Such vehicles may achieve a number of advantages over traditional internal combustion engine vehicles. For example, hybrid or electrical vehicles may achieve higher fuel economy and may have little or even zero tail pipe pollution. In particular, all electric vehicles may not only have zero tail pipe pollution, but may be associated with lower overall pollution. For example, electrical power may be generated from renewable sources (e.g., solar, hydro). Also for example, electrical power may be generated at generation plants that produce no air pollution (e.g., nuclear plants). Also for example, electrical power may be generated at generation plants that burn relatively "clean burning" fuels (e.g., natural gas), which have higher efficiency than internal combustion engines, and/or which employ pollution control or removal systems (e.g., industrial air scrubbers) which are too large, costly or expensive for use with individual vehicles.

As the popularity of hybrid and electric powered vehicles continues to increase, so will the need to maintain these vehicles in a convenient and cost effective manner.

BRIEF SUMMARY

A vehicle diagnostic data storage system may be summarized as including at least one controller; and at least one memory device configured to be coupled to the at least one controller, wherein the at least one memory device is attached to an electrical energy storage device configured to provide power to a vehicle, and wherein the controller is configured

to: receive diagnostic data regarding the vehicle; and store at least some of the diagnostic data in the memory device.

The at least one memory device may be configured to be coupled to the at least one controller when the electrical energy storage device is operably placed in the vehicle. The at least one controller may be attached to the electrical energy storage device. The at least one memory device may be coupled to the at least one controller. The electrical energy storage device may be a portable electrical energy storage device. The at least one controller may be further configured to receive the diagnostic data regarding the vehicle from a vehicle diagnostic system of the vehicle. The at least one controller may be further configured to wirelessly receive the diagnostic data regarding the vehicle from the vehicle diagnostic system. The at least one memory device may be configured to be wirelessly coupled to the at least one controller. The at least one controller may be further configured to enable the at least some diagnostic data stored on the at least one memory device to be provided to an external device. The at least one controller may be further configured to: receive information regarding authentication of an external device to which to provide the at least some diagnostic data stored on the at least one memory device; and make a determination regarding enabling the at least some diagnostic data stored on the at least one memory device to be provided to the external device, based on the information regarding authentication. The at least one controller may be configured to receive the information regarding authentication via a wireless signal transmitted from the external device. The external device may be a portable electrical energy storage device collection, charging and distribution machine.

The vehicle diagnostic data storage system may further include a wireless communications module coupled to the at least one memory device, and wherein the wireless communications module is configured to enable the at least some diagnostic data stored on the at least one memory device to be provided wirelessly to an external device. The diagnostic data may include at least some information regarding one or more of: status or condition of the vehicle, condition of an engine of the vehicle, one or more electrical systems of the vehicle, health of the vehicle, oil level of the vehicle, brake pad condition of the vehicle, status of one or more vehicle lights, engine temperature of the vehicle, mileage of the vehicle, one or more fluid levels of the vehicle, condition or status of the electrical energy storage device, and current odometer reading of the vehicle. The memory device may be removably attached to the electrical energy storage device.

A method of operating a portable electrical energy storage device collection, charging and distribution machine may be summarized as including detecting presence of a portable electrical energy storage device configured to provide power to a vehicle; receiving vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device; and providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data.

Detecting the presence of a portable electrical energy storage device may include detecting presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine. Detecting the presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine may include detecting an operable physical connection between a diagnostic data storage system of the portable electrical energy storage device and an input of the portable electrical energy storage device collection, charging and distribution machine once the portable electrical energy storage device is placed in the portable electrical energy storage device collection, charging and distribution machine. Detecting the presence of the portable electrical energy storage device may include detecting presence of the portable electrical energy storage device via a wireless signal received from the portable electrical energy storage device. Receiving vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device may include receiving the vehicle diagnostic data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored. Providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data may include displaying the information on a display of the portable electrical energy storage device collection, charging and distribution machine. Displaying the information on a display of the portable electrical energy storage device collection, charging and distribution machine may include displaying the information on the display during a transaction at the portable electrical energy storage device collection, charging and distribution machine involving the portable electrical energy storage device. Providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data may include communicating the information to a mobile device of a user associated with the vehicle. Providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data may include communicating the information to a server computing system. The provided information from the portable electrical energy storage device collection, charging and distribution machine may include notifications regarding potential problems with the vehicle based on the diagnostic data. The provided information from the portable electrical energy storage device collection, charging and distribution machine may further include instructions for resolving the potential problems with the vehicle.

The method of operating a portable electrical energy storage device collection, charging and distribution machine may further include displaying information regarding availability of particular vehicle parts at the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data.

An electrical energy storage device may be summarized as including a battery cell; a battery cell housing; and a diagnostic data storage system attached to the battery cell housing configured to receive and store diagnostic data of a vehicle that the electrical energy storage device is configured to power.

The electrical energy storage device may be a portable electrical energy storage device. The diagnostic data storage system may be attached to an inside of the battery cell housing. The diagnostic data storage system may be attached to an outside of the battery cell housing. The diagnostic data storage system may be configured to communicate the stored diagnostic data of the vehicle to an external device. The diagnostic data storage system may be configured to wirelessly communicate the stored diagnostic data of the vehicle to an external device. The external device may be a portable electrical energy storage device collection, charging and distribution machine. The diagnostic data storage system may include a controller coupled to a memory device, wherein the controller is configured to: receive diagnostic data regarding the vehicle; store at least some of the diagnostic data in the

memory device; and enable the at least some diagnostic data stored in the memory device to be provided to an external device.

A non-transitory computer readable storage medium may be summarized as having computer executable instructions thereon that, when executed, cause a processor to perform: receiving data from a portable electrical energy storage device configured to power the vehicle; and providing information based on the received data to a user associated with the vehicle.

The computer executable instructions, when executed, may further cause the processor to perform detecting presence of the portable electrical energy storage device at a portable electrical energy storage device collection, charging and distribution machine. The data may include one or more of: vehicle diagnostic data regarding the vehicle, user profile information, vehicle profile information, security codes, credentials, security certificates, passwords, a subscription level of a user, demographic information of a user, information regarding user vehicle locations, telematic user vehicle information, telemetric user vehicle information, information regarding portable electrical energy storage device charge capacity, information regarding route information of users, and historic data. The data may include vehicle diagnostic data regarding the vehicle and the receiving the data from the portable electrical energy storage device may include receiving the data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored. Providing information based on the received data may include displaying the information on a display of a portable electrical energy storage device collection, charging and distribution machine in which the portable electrical energy storage device has been placed and in response to the portable electrical energy storage device having been placed in the collection, charging and distribution machine.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

In the drawings, identical reference numbers identify similar elements or acts. The sizes and relative positions of elements in the drawings are not necessarily drawn to scale. For example, the shapes of various elements and angles are not drawn to scale, and some of these elements are arbitrarily enlarged and positioned to improve drawing legibility. Further, the particular shapes of the elements as drawn, are not intended to convey any information regarding the actual shape of the particular elements, and have been solely selected for ease of recognition in the drawings.

FIG. **1** is a schematic view of a collection, charging and distribution machine along with a number of electrical power storage devices according to one non-limiting illustrated embodiment, and along with an electric scooter or motorbike and an electrical service provided via an electrical grid.

FIG. **2** is a block diagram of the collection, charging and distribution machine of FIG. **1**, according to one non-limiting illustrated embodiment.

FIG. **3** is a block diagram of the portable electrical energy storage device of FIG. **1**, according to one non-limiting illustrated embodiment.

FIG. **4**A is a schematic view of the diagnostic data storage system of FIG. **3** coupled to a vehicle diagnostic system, according to one non-limiting illustrated embodiment.

FIG. **4**B is an illustration of example information displayed on a user interface screen regarding vehicle diagnostic data received from the diagnostic data storage system of FIG. **3** and FIG. **4**A, according to one non-limiting illustrated embodiment.

FIG. **5** is a flow diagram showing a high level method of operating the diagnostic data storage system of FIGS. **3** and **4**A, according to one non-limiting illustrated embodiment.

FIG. **6** is a flow diagram showing a low level method of operating the diagnostic data storage system of FIGS. **3** and **4**A, according to one non-limiting illustrated embodiment, including enabling data to be provided to an external device, useful in the method of FIG. **5**.

FIG. **7** is a flow diagram showing a high level method of operating the portable electrical energy storage device and collection, charging and distribution machine of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment.

FIG. **8** is a flow diagram showing a low level method of operating the portable electrical energy storage device and collection, charging and distribution machine of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment, including receiving the vehicle diagnostic data from a memory device, useful in the method of FIG. **7**.

FIG. **9** is a flow diagram showing a low level method of operating the portable electrical energy storage device and collection, charging and distribution machine of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment, including displaying the provided information, useful in the method of FIG. **7**.

FIG. **10** is a flow diagram showing a high level method of operating the portable electrical energy storage device and collection, charging and distribution machine of FIGS. **1** and **2**, according to another non-limiting illustrated embodiment.

DETAILED DESCRIPTION

In the following description, certain specific details are set forth in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that embodiments may be practiced without one or more of these specific details, or with other methods, components, materials, etc. In other instances, well-known structures associated with vending apparatus, batteries, supercapacitors or ultracapacitors, power converters including but not limited to transformers, rectifiers, DC/DC power converters, switch mode power converters, controllers, and communications systems and structures and networks have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.

Unless the context requires otherwise, throughout the specification and claims which follow, the word "comprise" and variations thereof, such as, "comprises" and "comprising" are to be construed in an open, inclusive sense that is as "including, but not limited to."

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment.

The use of ordinals such as first, second and third does not necessarily imply a ranked sense of order, but rather may only distinguish between multiple instances of an act or structure.

Reference to portable electrical power storage device means any device capable of storing electrical power and releasing stored electrical power including but not limited to batteries, supercapacitors or ultracapacitors. Reference to batteries means chemical storage cell or cells, for instance

rechargeable or secondary battery cells including but not limited to gel lead-acid, absorbed glass mat lead acid, nickel cadmium alloy, nickel-zinc, nickel metal hydride or lithium ion battery cells.

The headings and Abstract of the Disclosure provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

FIG. **1** shows an environment **100** including a collection, charging and distribution machine **102**, according to one illustrated embodiment.

The collection, charging and distribution machine **102** may take the form of a vending machine or kiosk. The collection, charging and distribution machine **102** has a plurality of receivers, compartments or receptacles **104***a*, **104***b*-**104***n* (only three called out in FIG. **1**, collectively **104**) to removably receive portable electrical energy storage devices (e.g., batteries, supercapacitors or ultracapacitors) **106***a*-**106***n* (collectively **106**) for collection, charging and distribution. As illustrated in FIG. **1**, some of the receivers **104** are empty, while other receivers **104** hold portable electrical energy storage devices **106**. While FIG. **1** shows a single portable electrical energy storage device **106** per receiver **104**, in some embodiments each receiver **104** may hold two or even more portable electrical energy storage devices **106**. For example, each of the receivers **104** may be sufficiently deep to receive three portable electrical energy storage devices **106**. Thus, for example, the collection, charging and distribution machine **102** illustrated in FIG. **1** may have a capacity capable of simultaneously holding **40**, **80** or **120** portable electrical energy storage devices **106**.

The portable electrical energy storage devices **106** may take a variety of forms, for example batteries (e.g., array of battery cells), supercapacitors or ultracapacitors (e.g., array of ultracapacitor cells). For example, portable electrical energy storage devices **106***z* may take the form of rechargeable batteries (i.e., secondary cells or batteries). The portable electrical energy storage devices **106***z* may, for instance, be sized to physically fit, and electrically power, personal transportation vehicles, such as all-electric scooters or motorbikes **108**. As previously noted, combustion engine scooters and motorbikes are common in many large cities, for example in Asia, Europe and the Middle East. The ability to conveniently access charged batteries throughout a city or region may allow the use of all-electric scooters and motorbikes **108** in place of combustion engine scooters and motorbikes, thereby alleviating air pollution, as well as reducing noise.

The portable electrical energy storage devices **106** (only visible for portable electrical energy storage device **106***z*) may include a number of electrical terminals **110***a*, **110***b* (two illustrated, collectively **110**), accessible from an exterior of the portable electrical energy storage device **106***z*. The electrical terminals **110** allow charge to be delivered from the portable electrical energy storage device **106***z*, as well as allow charge to be delivered to the portable electrical energy storage device **106***z* for charging or recharging the same. While illustrated in FIG. **1** as posts, the electrical terminals **110** may take any other form which is accessible from an exterior of the portable electrical energy storage device **106***z*, including electrical terminals positioned within slots in a battery housing. As the portable electrical energy storage devices **106** may be lent, leased, and/or rented out to the public, it is desirable to provide vehicle diagnostic data to the user of the vehicle in which portable electrical energy storage device **106***z* is currently being used, for example, when the user exchanges or drops off portable electrical energy storage device **106***z* at a collection, charging and distribution machine **102**. Systems and methods for providing vehicle diagnostic data using memory devices removably or fixedly attached to power storage devices, are described in more detail below with reference to FIGS. **2-7**, and are useful in the overall system for collection, charging and distribution of portable electrical energy storage devices **106** described herein.

The collection, charging and distribution machine **102** is positioned at some location **112** at which the collection, charging and distribution machine **102** is conveniently and easily accessible by various end users. The location may take any of a large variety of forms, for example, a retail environment such as a convenience store, supermarket, gas or petrol station, or service shop. Alternatively, the collection, charging and distribution machine **102** may stand alone at a location **112** not associated with an existing retail or other business, for example in a public park or other public place. Thus, for example, collection, charging and distribution machines **102** may be located at each store of a chain of convenience stores throughout a city or region. Such may advantageously rely on the fact that convenience stores are often sited or distributed based on convenience to the target population or demographic. Such may advantageously rely on pre-existing leases on storefronts or other retail locations to allow an extensive network of collection, charging and distribution machines **102** to be quickly developed in a city or region. Quickly achieving a large network which is geographically well distributed to serve a target population enhances the ability to depend on such a system and likely commercial success of such an effort.

The location **112** may include an electrical service **114** to receive electrical power from a generating station (not shown) for example via a grid **116**. The electrical service **114** may, for example, include one or more of an electrical service meter **114***a*, a circuit panel (e.g., circuit breaker panel or fuse box) **114***b*, wiring **114***c*, and electrical outlet **114***d*. Where the location **112** is an existing retail or convenience store, the electrical service **114** may be an existing electrical service, so may be somewhat limited in rating (e.g., 120 volts, 240 volts, 220 volts, 230 volts, 15 amps).

Neither the operator of the retail location **112**, nor the owner, distributor or operator of the collection, charging and distribution machine **102** may wish to bear the costs of upgrading the electrical service **114**. Yet, quick charging is desired in order to maintain an adequate supply of portable electrical energy storage devices **106** available for use by end users. The ability to quickly charge while maintaining existing or otherwise limited rated electrical service is addressed in U.S. provisional patent application Ser. No. 61/511,900, entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES," filed Jul. 26, 2011.

Optionally, the collection, charging and distribution machine **102** may include or be coupled to a source of renewable electrical power. For example, where installed in an outside location the collection, charging and distribution machine **102** may include an array of photovoltaic (PV) cells **118** to produce electrical power from solar insolation. Alternatively, the collection, charging and distribution machine **102** may be electrically coupled to a microturbine (e.g., wind turbine) or PV array positioned elsewhere at the location **112**, for instance on a roof top or pole mounted at a top of a pole (not shown).

The collection, charging and distribution machine **102** may be communicatively coupled to one or more remotely located computer systems, such as back end or back office systems **120** (only one shown). The back end or back office systems **120** may collect data from and/or control a plurality of col-

lection, charging and distribution machine **102** distributed about an area, such as a city. The communications may occur over one or more communications channels including one or more networks **122**, or non-networked communications channels. Communications may be over one or more wired communications channels (e.g., twisted pair wiring, optical fiber), wireless communications channels (e.g., radio, microwave, satellite, 801.11 compliant). Networked communications channels may include one or more local area networks (LANs), wide area networks (WANs), extranets, intranets, or the Internet including the Worldwide Web portion of the Internet.

The collection, charging and distribution machine **102** may include a user interface **124**. The user interface may include a variety of input/output (I/O) devices to allow an end user to interact with the collection, charging and distribution machine **102**. Various I/O devices are called out and described in reference to FIG. **2**, which follows.

FIG. **2** shows the collection, charging and distribution machine **102** of FIG. **1**, according to one illustrated embodiment.

The collection, charging and distribution machine **102** includes a control subsystem **202**, a charging subsystem **204**, a communications subsystem **206**, and a user interface subsystem **208**.

The control subsystem **202** includes a controller **210**, for example a microprocessor, microcontroller, programmable logic controller (PLC), programmable gate array (PGA), application specific integrated circuit (ASIC) or another controller capable of receiving signals from various sensors, performing logical operations, and sending signals to various components. Typically, the controller **210** may take the form of a microprocessor (e.g., INTEL, AMD, ATOM). The control subsystem **202** may also include one or more non-transitory processor- or computer-readable storage media, for example read only memory (ROM) **212**, random access memory (RAM) **214**, and data store **216** (e.g., solid-state storage media such as flash memory or EEPROM, spinning storage media such as hard disk). The non-transitory processor- or computer-readable storage media **212**, **214**, **216** may be in addition to any non-transitory storage medium (e.g., registers) which is part of the controller **210**. The control subsystem **202** may include one or more buses **218** (only one illustrated) coupling various components together, for example one or more power buses, instruction buses, data buses, etc.

As illustrated, the ROM **212**, or some other one of the non-transitory processor- or computer-readable storage media **212**, **214**, **216**, stores instructions and/or data or values for variables or parameters. The sets of data may take a variety of forms, for example a lookup table, a set of records in a database, etc. The instructions and sets of data or values are executable by the controller **210**. Execution of the instructions and sets of data or values causes the controller **210** to perform specific acts to cause the collection, charging and distribution machine **102** to collect, charge, and distribute portable energy storage devices. Specific operation of the collection, charging and distribution machine **102** is described herein and also below with reference to various flow diagrams (FIGS. **7-10**) in the context of being an external device to charge the portable electrical energy storage devices **106** and provide information based on vehicle diagnostic data received from the portable electrical energy storage devices **106**.

The controller **210** may use RAM **214** in a conventional fashion, for volatile storage of instructions, data, etc. The controller **210** may use data store **216** to log or retain information, for example, vehicle diagnostic data received from the portable electrical energy storage devices **106** and telemetric information related to collection, charging and/or distribution of the portable electric power storage devices **106** and/or operation of the collection, charging and distribution machine **102** itself. The instructions are executable by the controller **210** to control operation of the collection, charging and distribution machine **102** in response to end user or operator input, and using data or values for the variables or parameters.

The control subsystem **202** receives signals from various sensors and/or other components of the collection, charging and distribution machine **102** which include information that characterizes or is indicative of operation, status, or condition of such other components. Sensors are represented in FIG. **2** by the letter S appearing in a circle along with appropriate subscript letters.

For example, one or more position sensors S_{P1}-S_{PN} may detect the presence or absence of portable electrical power storage device **106** at each of the receivers **104**. The position sensors S_{P1}-S_{PN} may take a variety of forms. For example, the position sensors S_{P1}-S_{PN} may take the form of mechanical switches that are closed, or alternatively opened, in response to contact with a portion of a respective portable electrical power storage device **106** when the portable electrical power storage device **106** is inserted into the receiver **104**, or contact with a memory device of the portable electrical power storage device **106**. Also for example, the position sensors S_{P1}-S_{PN} may take the form of optical switches (i.e., optical source and receiver) that are closed, or alternatively opened, in response to contact with a portion of a respective portable electrical power storage device **106** when the portable electrical power storage device **106** is inserted into the receiver **104**. Also for example, the position sensors S_{P1}-S_{PN} may take the form of electrical sensors or switches that are closed, or alternatively opened, in response to detecting a closed circuit condition created by contact with the terminals **110** of a respective portable electrical power storage device **106** when the portable electrical power storage device **106** is inserted into the receiver **104**, or an open circuit condition that results from the lack of a respective portable electrical power storage device **106** in the receiver **104**. These examples are intended to be non-limiting, and it is noted that any other structures and devices for detecting the presence/absence or even the insertion of the portable electrical power storage devices **106** into receivers may be employed.

For example, one or more charge sensors S_{C1}-S_{CN} may detect charge of the portable electrical power storage devices **106** at each of the receivers **104**. Charge sensors S_{C1}-S_{CN} may detect the amount of charge stored by the portable electrical power storage devices **106**. Charge sensors S_{C1}-S_{CN} may additionally detect an amount of charge and/or rate of charging being supplied to ones of the portable electrical power storage devices **106** at each of the receivers **104**. Such may allow assessment of current (i.e., temporal) charge condition or status of each portable electrical power storage device **106**, as well as allow feedback control over charging of same, including control over rate of charging. Charge sensors S_{C1}-S_{CN} may include any variety of current and/or voltage sensors.

For example, one or more charge sensors S_{T1} (only one shown) may detect or sense a temperature at the receivers **104** or in the ambient environment.

The control subsystem **202** provides signals to various actuators and/or other components responsive to control signals, which signals include information that characterizes or is indicative of an operation the component is to perform or a

state or condition in which the components should enter. Control signals, actuators or other components responsive to control signals are represented in FIG. **2** by the letter C appearing in a circle along with appropriate subscript letters.

For example, one or more engine control signals C_{A1}-C_{AN} may affect the operation of one or more actuators **220** (only one illustrated). For instance, a control signal C_{A1} may cause movement of an actuator **220** between a first and a second position or change a magnetic field produced by the actuator **220**. The actuator **220** may take any of a variety of forms, including but not limited to a solenoid, an electric motor such as a stepper motor, or an electromagnet. The actuator **220** may be coupled to operate a latch, lock or other retainer mechanism **222**. The latch, lock or other retainer mechanism **222** may selectively secure or retain one or more portable electrical power storage devices **106** (FIG. **1**) in the receiver **104** (FIG. **1**). For instance, the latch, lock or other retainer mechanism **222** may physically couple to a complimentary structure that is part of a housing of the portable electrical power storage devices **106** (FIG. **1**). Alternatively, the latch, lock or other retainer mechanism **222** may magnetically couple to a complimentary structure that is part of a housing of the portable electrical power storage devices **106** (FIG. **1**). Also for instance, the latch, lock or other mechanism may open a receiver **104** (FIG. **1**), or may allow a receiver **104** to be opened, to receive a partially or fully discharged portable electrical power storage device **106** for charging. For example, the actuator may open and/or close a door to the receiver **104** (FIG. **1**), to selectively provide access to a portable electrical power storage device **106** (FIG. **1**) received therein. Also, for example, the actuator may open and/or close a latch or lock, allowing an end user to open and/or close a door to the receiver **104** (FIG. **1**), to selectively provide access to a portable electrical power storage device **106** (FIG. **1**) received therein.

The control subsystem **202** may include one or more ports **224***a* to provide control signals to one or more ports **224***b* of the charging subsystem **204**. The ports **224***a*, **224***b* may provide bi-directional communications. The control subsystem **202** may include one or more ports **226***a* to provide control signals to one or more ports **226***b* of the user interface subsystem **208**. The ports **226***a*, **226***b* may provide bi-directional communications.

The charging subsystem **204** includes various electrical and electronic components to charge portable electrical power storage devices **106** when positioned or received in the receivers **104**. For example, the charging subsystem **204** may include one or more power buses or power bus bars, relays, contactors or other switches (e.g., insulated gate bipolar transistors or IGBTs, metal oxide semiconductor transistors or MOSFETs), rectifier bridge(s), current sensors, ground fault circuitry, etc. The electrical power is supplied via contacts that can take any of a variety of forms, for instance terminals, leads, posts, etc. The contacts allow electrical coupling of various components. Some possible implementations are illustrated in FIG. **2**. Such is not intended to be exhaustive. Additional components may be employed while other components may be omitted.

The illustrated charging subsystem **204** includes a first power converter **230** that receives electrical power from the electrical service **114** (FIG. **1**) via a line or cord **232**. The power will typically be in the form of single, two or three phase AC electrical power. As such, the first power converter **230** may need to convert and otherwise condition the electrical power received via the electrical services **114** (FIG. **1**), for example, rectifying an AC waveform to DC, transforming voltage, current, and phase, as well as reducing transients and noise. Thus, the first power converter **230** may include a transformer **234**, rectifier **236**, DC/DC power converter **238**, and filter(s) **240**.

The transformer **234** may take the form of any variety of commercially available transformers with suitable ratings for handling the power received via the electrical service **114** (FIG. **1**). Some embodiments may employ multiple transformers. The transformer **234** may advantageously provide galvanic isolation between the components of the collection, charging and distribution machine **102** and the grid **116** (FIG. **1**). The rectifier **236** may take any of variety of forms, for example a full bridge diode rectifier or a switch mode rectifier. The rectifier **236** may be operated to transform AC electrical power to DC electrical power. The DC/DC power converter **238** may be any of a large variety of forms. For example, DC/DC power converter **238** may take the form of a switch mode DC/DC power converter, for instance employing IGBTs or MOSFETs in a half or full bridge configuration, and may include one or more inductors. The DC/DC power converter **238** may have any number of topologies including a boost converter, buck converter, synchronous buck converter, buck-boost converter or fly-back converter. The filter(s) **240** may include one or more capacitors, resistors, Zener diodes or other elements to suppress voltage spikes, or to remove or reduce transients and/or noise.

The illustrated charging subsystem **204** may also receive electrical power from a renewable power source, for example the PV array **118** (FIG. **1**). Such may be converted or conditioned by the first power converter **230**, for example, being supplied directly to the DC/DC power converter **238**, bypassing the transformer **234** and/or rectifier **236**. Alternatively, the illustrated charging subsystem **204** may include a dedicated power converter to convert or otherwise condition such electrical power.

The illustrated charging subsystem **204** may optionally include second power converter **242** that receives electrical power from one or more portable electrical power storage devices **106** (FIG. **1**) via one or more lines **244**, for charging other ones of the portable electrical power storage devices **106**. As such, the second power converter **242** may need to convert and/or otherwise condition the electrical power received from portable electrical power storage devices **106**, for example optionally transforming voltage or current, as well as reducing transients and noise. Thus, the second power converter **242** may optionally include a DC/DC power converter **246** and/or filter(s) **248**. Various types of DC/DC power converters and filters are discussed above.

The illustrated charging subsystem **204** includes a plurality of switches **250** responsive to the control signals delivered via ports **224***a*, **224***b* from the control subsystem **202**. The switches may be operable to selectively couple a first number or set of portable electrical power storage devices **106** to be charged from electrical power supplied by both the electrical service via the first power converter **230** and a second number or set of portable electrical power storage devices **106**. The first number or set of portable electrical power storage devices **106** may include a single portable electrical power storage device **106**, two, or even more portable electrical power storage devices **106**. The second number or set of portable electrical power storage devices **106** may include one, two, or more portable electrical power storage devices **106**. The portable electrical power storage devices **106** are represented in FIG. **2** as loads L_1,L_2-L_N.

The communications subsystem **206** may additionally include one or more communications modules or components which facilitate communications with the various components of a back end or back office system **120** (FIG. **1**) and/or

various components of the portable electrical power storage devices **106**. The communications subsystem **206** may, for example, include one or more modems **252** or one or more Ethernet or other types of communications cards or components **254**. A port **256***a* of the control subsystem **202** may communicatively couple the control subsystem **202** with a port **256***b* of the communications subsystem **206**. The communications subsystem **206** may provide wired and/or wireless communications. For example, the communications subsystem **206** may provide components enabling short range (e.g., via Bluetooth, near field communication (NFC), radio frequency identification (RFID) components and protocols), or longer range wireless communications (e.g., over a wireless LAN, satellite, or cellular network) with various other devices external to the collection, charging and distribution machine **102**, including the portable electrical energy storage devices **106**. The communications subsystem **206** may include one or more ports, wireless receivers, wireless transmitters or wireless transceivers to provide wireless signal paths to the various remote components or systems. The remote communications subsystem **206** may include one or more bridges or routers suitable to handle network traffic, including switched packet type communications protocols (TCP/IP), Ethernet or other networking protocols.

The user interface system **208** includes one or more user input/output (I/O) components. For example, user interface system **208** may include a touch screen display **208***a*, operable to present information and a graphical user interface (GUI) to an end user and to receive indications of user selections. The user interface system **208** may include a keyboard or keypad **208***b*, and/or a cursor controller (e.g., mouse, trackball, trackpad) (not illustrated) to allow an end user to enter information and/or select user selectable icons in a GUI. The user interface system **208** may include a speaker **208***c* to provide aural messages to an end user and/or a microphone **208***d* to receive spoken user input such as spoken commands.

The user interface system **208** may include a card reader **208***e* to read information from card type media **209**. The card reader **208***e* may take a variety of forms. For instance, the card reader **208***e* may take the form of, or include, a magnetic stripe reader for reading information encoded in a magnetic stripe carried by a card **209**. For instance, the card reader **208***e* may take the form of, or include, a machine-readable symbol (e.g., barcode, matrix code) card reader for reading information encoded in a machine-readable symbol carried by a card **209**. For instance, the card reader **208***e* may take the form of, or include, a smart card reader for reading information encoded in a non-transitory medium carried by a card **209**. Such may, for instance, include media employing radio frequency identification (RFID) transponders or electronic payment chips (e.g., near filed communications (NFC) chips). Thus, the card reader **208***e* may be able to read information from a variety of card media **209**, for instance credit cards, debit cards, gift cards, prepaid cards, as well as identification media such as drivers licenses. The card reader **208***e* may also be able to read information encoded in a non-transitory medium carried by the portable electrical energy storage devices **106**, and may also include RFID transponders, transceivers, NFC chips and/or other communication devices to communicate information to the portable electrical energy storage devices **106** (e.g., for authentication of the portable electrical energy storage devices **106** and/or authentication of the collection, charging and distribution machine **102** to the portable electrical energy storage devices **106**).

The user interface system **208** may include a bill acceptor **208***f* and a validator and/or coin acceptor **208***g* to accept and validate cash payments. Such may be highly useful in servicing populations who lack access to credit. Bill acceptor and validator **208***f* and/or coin acceptor **208***g* may take any variety of forms, for example, those that are currently commercially available and used in various vending machines and kiosks.

FIG. **3** is a block diagram of the portable electrical energy storage device **106***z* of FIG. **1**, according to one non-limiting illustrated embodiment.

Shown is a portable electrical energy storage device housing **302**, electrical terminals **110***a*, **110***b*, a battery cell **304**, diagnostic data storage system **306**, a secure access panel **314** and a diagnostic data storage system connection port **318**. The battery cell **304** is any rechargeable type of electrochemical cell that converts stored chemical energy into electrical energy. As described above, the electrical terminals **110***a*, **110***b* are accessible from an exterior of the portable electrical energy storage device **106***z*. The electrical terminals **110** allow charge to be delivered from the portable electrical energy storage device **106***z*, as well as allow charge to be delivered to the portable electrical energy storage device **106***z* for charging or recharging the same through conductive terminal connections **312***a*, **312***b* to the battery cell **304**. While illustrated in FIG. **3** as posts, the electrical terminals **110***a*, **110***b* may take any other form which is accessible from an exterior of the portable electrical energy storage device **106***z*, including electrical terminals positioned within slots in the battery housing **302**.

The diagnostic data storage system **306** is attached (fixedly or removably) directly or indirectly to an interior of the housing **302** and is operably coupled to the diagnostic data storage system connection port **318** via communications line **316** which travels through the housing **302** to the system connection port **318** that is accessible from the exterior of the portable electrical energy storage device **106***z*. The communications line **316** is configured to receive vehicle diagnostic data from external sources (e.g., a vehicle diagnostic system) through the diagnostic data storage system connection port **318** and communicate such data to the diagnostic data storage system **306** for storage in the diagnostic data storage system **306**. For example, the communications line **316** is configured to receive vehicle diagnostic data from a vehicle while the portable electrical energy storage device **106***z* is operably installed in the vehicle. In other embodiments, the communications line **316** is configured to receive vehicle diagnostic data from a vehicle while the portable electrical energy storage device **106***z* is not operably installed in the vehicle. For example, the portable electrical energy storage device **106***z* may be connected by the communications line **316** to a diagnostic system of the vehicle and be able to receive diagnostic data from the vehicle, while the electrical terminals **110** of the portable electrical energy storage device **106***z* are not operably connected to the vehicle (such as when the portable electrical energy storage device **106***z* is in the process of being installed or uninstalled, or is placed in the vehicle temporarily for the purpose of downloading vehicle diagnostic data, but not for powering the vehicle).

Such diagnostic data includes, but is not limited to, information regarding one or more of: status or condition of the vehicle or engine systems, for example, data available through on-board diagnostics interfaces such as ALDL, OBD-1, OBD-1.5, OBD-II, EOBD, EOBD2, JOBD, and ADR. Specific examples of diagnostic data include information regarding the status or condition of a vehicle systems or subsystems, engine systems or subsystems, one or more electrical systems of the vehicle, health of the vehicle, oil level of the vehicle, brake pad condition of the vehicle, one or more vehicle lights, engine temperature of the vehicle, mileage of

the vehicle, one or more fluid levels of the vehicle, the electrical energy storage device, and current odometer reading of the vehicle.

The diagnostic data storage system connection port **318** may be operably connected to a vehicle diagnostic system or may be configured to be operably connected to any number of vehicle subsystems configured to output diagnostic data regarding the particular corresponding vehicle subsystem. The diagnostic data storage system connection port **318** is configured to be compatible with one or more output ports of the respective vehicle diagnostic system or vehicle subsystem to which it is connected. In some embodiments, the diagnostic data storage system connection port **318** is operably coupled to a vehicle diagnostic system (e.g., the vehicle diagnostic system **418** shown in FIG. **4**) as the portable electrical energy storage device **106***z* is operably placed or installed in the vehicle. For example, the diagnostic data storage system connection port **318** may be positioned on the exterior of the portable electrical energy storage device housing **302** such that it aligns and connects with a corresponding output port of the vehicle diagnostic system **418** (shown in FIG. **4**) when the portable electrical energy storage device **106***z* is properly placed or installed in the vehicle. The communications line **316** is also configured to send vehicle diagnostic data to external sources (e.g., a portable electrical energy storage device collection, charging and distribution machine **102**, a mobile device, a server, etc.) from the diagnostic data storage system **306** through the diagnostic data storage system connection port **318**.

The diagnostic data storage system **306** is operably coupled to the battery cell **304** via one or more power lines **308** in a manner such that the diagnostic data storage system **306** may receive power for operation of the diagnostic data storage system **306** to store vehicle diagnostic data. In other embodiments, the diagnostic data storage system **306** may receive power from other external sources or may be a system which does not require its own power to store the diagnostic data.

The access panel **314** is located on the housing **302** and is configured to provide access to the diagnostic data storage system **306** for inspection, diagnosis, replacement, and/or repair of the diagnostic data storage system **306** and/or any components of the diagnostic data storage system **306**. The access panel **314** may also include a lock, be tamper resistant or include other security elements to limit access to the diagnostic data storage system **306**. The access panel **314** may also include weather proofing components such as a seal or other protective components to protect the diagnostic data storage system **306** from external elements. In other embodiments, the diagnostic data storage system **306** may instead be fixedly or removably attached to an exterior of the housing **302**. In such instances, the communications line would not travel through the housing **302**. However, in such embodiments, the power line **308** to the battery cell **304**, if present, would travel through the housing **302**.

In some embodiments, the diagnostic data storage system **306** is configured to receive and/or send vehicle diagnostic data wirelessly to or from an external device. For example, the diagnostic data storage system **306** may be configured to receive vehicle diagnostic data wirelessly from the vehicle or external diagnostics system and/or send stored vehicle diagnostic data wirelessly to the portable electrical energy storage device collection, charging and distribution machine **102** or other remote device, such as a portable computer or smartphone. In such embodiments, the communications line **316** and the diagnostic data storage system connection port **318** may or may not be present as the diagnostic data storage system **306** may be configured to send and/or receive vehicle diagnostic data wirelessly instead of, or in addition to, being configured to send and/or receive vehicle diagnostic data via the communications line **316** and the diagnostic data storage system connection port **318**.

The housing **302** is constructed of a polymer or other durable material of sufficient thickness to protect the battery cell **304** and diagnostic data storage system **306** from outside elements and tampering. For example the walls of the housing may be at least approximately 0.25 inch thick and completely surround the battery cell **304** and diagnostic data storage system **306** (except for, in some embodiments, a small vent hole in the housing) such that the battery cell **304** and diagnostic data storage system **306** cannot be accessed without a key or other specialized tool to open the locked access panel **314**.

The housing **302** may provide a protection to prevent or deter tampering, and may be formed of suitably strong and resilient materials (e.g., ABS plastic). Such may not only prevent or deter tampering, but may leave a visible indication of any tampering attempts. For example, the housing **302** may include a strong outer layer of a first color (e.g., black) within an inner layer of a second color (e.g., fluorescent orange) there beneath. Such will render attempts to cut through the housing **302** visibly apparent.

FIG. **4**A is a schematic view of the diagnostic data storage system **306** of FIG. **3** coupled to a vehicle diagnostic system **418**, according to one non-limiting illustrated embodiment.

The diagnostic data storage system **306** includes a controller **410**, a communications subsystem **406**, read only memory (ROM) **412**, random access memory (RAM) **414** and other storage **416**.

The controller **410**, for example is a microprocessor, microcontroller, programmable logic controller (PLC), programmable gate array (PGA), application specific integrated circuit (ASIC) or another controller capable of receiving signals from various sensors, performing logical operations, and sending signals to various components. Typically, the controller **410** may take the form of a microprocessor (e.g., INTEL, AMD, ATOM). The diagnostic data storage system **306** may also include one or more non-transitory processor- or computer-readable storage media, for example read only memory (ROM) **412**, random access memory (RAM) **414**, and other storage **416** (e.g., solid-state storage media such as flash memory or EEPROM, spinning storage media such as hard disk). The non-transitory processor- or computer-readable storage media **412**, **414**, **416** may be in addition to any non-transitory storage medium (e.g., registers) which is part of the controller **410**. The diagnostic data storage system **306** may include one or more buses **218** (only one illustrated) coupling various components together, for example one or more power buses, instruction buses, data buses, etc.

As illustrated, the ROM **412**, or some other one of the non-transitory processor- or computer-readable storage media **412**, **414**, **416**, stores instructions and/or data or values for variables or parameters. The sets of data may take a variety of forms, for example a lookup table, a set of records in a database, etc. The instructions and sets of data or values are executable by the controller **410**. Execution of the instructions and sets of data or values causes the controller **410** to perform specific acts to cause the diagnostic data storage system **306** to receive, store and send vehicle diagnostic data, such as data received from the vehicle diagnostic system. The diagnostic data may be stored in one or more of the ROM **412**, RAM **414** and other storage **416** in a variety of forms and formats including, but not limited to a lookup table, a set of records in a database, etc. The diagnostic data may be stored

in a format, or converted to and then stored in a format, in compliance with a standard format for vehicle diagnostic data or other format compatible or readable by various external devices. Also, various metadata related to the diagnostic data may also be stored in one or more of the ROM **412** and other storage **416**, including but not limited to: associations or indications of associations of the diagnostic data with a particular vehicle and/or user, date and time information associated with particular diagnostic data, vehicle information associated with the diagnostic data, categories or types of the diagnostic data, vehicle part information associated with parts needing replaced based on the diagnostic data, etc. Specific operation of the diagnostic data storage system **306** is described herein and also below with reference to various flow diagrams (FIGS. **5-10**).

The controller **410** may use RAM **414** in a conventional fashion, for volatile storage of instructions, data, etc. The controller **410** may use data store **416** to log or retain information, for example, information regarding user profile information, vehicle profile information, security codes, credentials, security certificates, passwords, the subscription level of users, demographic information of users (such as income level, gender, age, net worth, marital status, etc.), information regarding user vehicle locations and telematic and/or telemetric user vehicle information, vehicle diagnostic data, information regarding portable electrical energy storage device charge capacity, information regarding route information of users, historic data, etc. The instructions are executable by the controller **410** to control operation of the diagnostic data storage system **306** in response to input from remote and/or external systems such as those of external devices including but not limited to: the vehicle diagnostic system **418**; charging devices; vehicles; user identification devices (cards, electronic keys, etc.); portable electrical energy device collection, charging and distribution machines; collection, charging and distribution machine service systems; user mobile devices; user vehicles; and end user or operator input.

The controller **410** may also receive signals from various sensors and/or components of an external device via the communications subsystem **206** of collection, charging and distribution machine **102**. This information may include information that characterizes or is indicative of the authenticity, authorization level, operation, status, or condition of such components.

The communications subsystem **406** may include one or more communications modules or components which facilitates communications with the various components of external devices (e.g., such as to receive vehicle diagnostic data from the vehicle diagnostic system **418**) and also the various components of the collection, charging and distribution machine **102** of FIG. **1** (e.g., such as to send vehicle diagnostic data, profile and/or vehicle profile information, and/or historic data stored by the diagnostic data storage system **306**, receive software updates or data updates of user profile and/or vehicle profile information) and one or more user mobile communication devices, such that data may be exchanged between the devices for authentication purposes. Such diagnostic data and software updates, and data updates of user profile and/or vehicle profile information may include information received from or originating from (either directly or indirectly) an external device or system (e.g., a user's mobile device) or from other external systems such as via web sites configured to prompt for and/or accept such data from a user, web servers, collection charging and distribution machines, collection charging and distribution machine managements systems, other network nodes or locations, etc. These instructions and/or other data may include information that may be used to automatically adjust settings of the vehicle or make other modifications to the vehicle by the vehicle diagnostic system or other vehicle system when the corresponding electrical energy storage device is placed in or is in (or at which point it becomes in) communication with the vehicle via the communications subsystem **406**. These settings of the vehicle or other modifications to the vehicle may include settings regarding, but not limited to, one or more of: user preference settings, user profile preference settings, engine settings, electrical system settings, seat settings, steering settings, braking system settings, turn signal settings, navigation system settings, electrical energy storage device usage preference settings, electrical energy storage device usage level settings, electrical energy storage device usage limit settings, driving preferences, limits or preferences on vehicle electrical energy use, electrical energy storage device type preference settings, vehicle security settings, electrical energy storage device security settings, vehicle user interface settings, vehicle maintenance settings, vehicle maintenance reminder settings, vehicle usage authorization settings, electrical energy storage device usage authorization settings, vehicle communication system preference settings, reminder settings, collection, charging and distribution machine location preferences, route settings, vehicle warning or alarm settings, vehicle range or distance settings, vehicle option settings, etc.

The communications subsystem **406** may provide wired and/or wireless communications. The communications subsystem **406** may include one or more ports, wireless receivers, wireless transmitters or wireless transceivers to provide wireless signal paths to the various remote components or systems. The communications subsystem **406** may, for example, include components enabling short range (e.g., via Bluetooth, near field communication (NFC), or radio frequency identification (RFID) components and protocols) or longer range wireless communications (e.g., over a wireless LAN, satellite, or cellular network) and may include one or more modems or one or more Ethernet or other types of communications cards or components for doing so. The remote communications subsystem **406** may include one or more bridges or routers suitable to handle network traffic including switched packet type communications protocols (TCP/IP), Ethernet or other networking protocols.

The controller **410** may be also configured to receive information regarding the vehicle and/or user with which the vehicle diagnostic system **418** is associated and store the received diagnostic data accordingly. For example, diagnostic data for a variety of particular vehicles may be stored in ROM **412** by the processor and associated with the corresponding vehicle in metadata stored in ROM **412**. The controller **410** may be configured to receive requests for the diagnostic data from various external devices, and in response, provide such requested data, or indicate that such data is not available. In some embodiments, the controller **410** may be configured to perform search, edit, sort, delete and other database functionalities to manage the stored vehicle diagnostic data and identify and retrieve particular requested vehicle diagnostic data. The controller **410** may be configured to identify or authenticate various external devices before providing such vehicle diagnostic data by verifying codes, credentials or other information received from external devices with stored information. In some embodiments, the controller and/or communications subsystem **406** is configured to encrypt and/or decrypt information communicated between the diagnostic data storage system **306** and external devices (e.g., between the diagnostic data storage system **306**

and the portable electrical energy storage device collection, charging and distribution machine **102** or user mobile device).

In some embodiments, some of the components of the diagnostic data storage system **306** shown in FIG. **4**A may not be present or may be located outside the diagnostic data storage system **306**. For example, in some embodiments, the diagnostic data storage system **306** may comprise a memory device such as the ROM **412** configured to store vehicle diagnostic data while the other components shown in FIG. **4**A (e.g., the controller **410** and communications subsystem **406**) are not present or are located outside the diagnostic data storage system **306** (e.g., are instead part of the vehicle diagnostic system **418**).

The vehicle diagnostic system **418** may be one or more diagnostic systems of a vehicle and is configured to track and/or store and communicate vehicle diagnostic data. Such diagnostic data includes, but is not limited to, information regarding one or more of: status or condition of the vehicle, condition of an engine of the vehicle, one or more electrical systems of the vehicle, health of the vehicle, oil level of the vehicle, brake pad condition of the vehicle, status of one or more vehicle lights, engine temperature of the vehicle, mileage of the vehicle, one or more fluid levels of the vehicle, condition or status of the electrical energy storage device, and current odometer reading of the vehicle.

The power line **308** is configured to provide power for operation of one or more of the various components of the diagnostic data storage system including the controller **410**, a communications subsystem **406**, read only memory (ROM) **412**, random access memory (RAM) **414** and other storage **416**. For example, the power line **308** may be operably coupled to a power source such as the battery cell **304** of the portable electrical energy storage device **106***z* (as shown in FIG. **3**) and/or another power source located in the vehicle.

FIG. **4**B is an illustration of example information displayed on a user interface screen **420** regarding vehicle diagnostic data received from the diagnostic data storage system **306** of FIG. **3** and FIG. **4**A, according to one non-limiting illustrated embodiment.

For example, the information shown in FIG. **4**B may be displayed on a user interface screen **420** of the portable electrical energy storage device collection, charging and distribution machine **102** after the user places the portable electrical energy storage device **106***z* in the portable electrical energy storage device collection, charging and distribution machine **102**. In one embodiment, once the user places the portable electrical energy storage device **106***z* in the portable electrical energy storage device collection, charging and distribution machine **102**, a connection is established between the portable electrical energy storage device collection, charging and distribution machine **102** and the portable electrical energy storage device **106***z* (wirelessly and/or via the via the diagnostic data storage system connection port **318**). The portable electrical energy storage device collection, charging and distribution machine **102** then reads vehicle diagnostic data stored on the diagnostic data storage system **306** of the portable electrical energy storage device **106***z* and provides information regarding the diagnostic data to the user. FIG. **4**B shows one example of providing such information regarding the diagnostic data read from the diagnostic data storage system **306** of the portable electrical energy storage device **106***z*. For example, shown in FIG. **4**B is a vehicle diagnostic report **422** displaying a suggestion **424** to consider replacing the vehicle tail light and a suggestion **426** to consider replacing the vehicle brake pads. This information is provided based on the diagnostic data read from the diagnostic data storage system **306** indicating excessive brake pad wear and a faulty tail light. Additional related information may be provided including, but not limited to: information regarding availability of particular vehicle parts at the portable electrical energy storage device collection, charging and distribution machine **102** that may be useful in resolving an identified potential problem, instructional information regarding resolving an identified problem, location information of where to locate replacement vehicle parts, time remaining until a system check is recommended, etc. Also shown is a selectable button or icon **428** that the user may select to acknowledge the user has seen the information and to continue to a next screen or quit.

The information shown in FIG. **4**B may be displayed on a screen of the portable electrical energy storage device collection, charging and distribution machine **102** or otherwise communicated to a user as part of, or independently from, the process of exchanging or returning a portable electrical energy storage device **106***z* at the portable electrical energy storage device collection, charging and distribution machine **102** by the user. For example, a user may stop at the portable electrical energy storage device collection, charging and distribution machine **102** solely to check on the status or condition of the vehicle by obtaining information regarding the vehicle diagnostic data stored on the diagnostic data storage system **306** without needing to exchange, drop off or even remove the portable electrical energy storage device **106***z* from the vehicle in some embodiments (such as in embodiments where the vehicle diagnostic data is communicated wirelessly from the diagnostic data storage system **306** to the portable electrical energy storage device collection, charging and distribution machine **102**).

In some embodiments, the information shown in FIG. **4**B may be displayed on a user interface screen **420** of a mobile device of a user associated with the vehicle currently using (or that had previously used) the portable electrical energy storage device **106***z*. For example, once within wireless communications range of the diagnostic data storage system **306**, the diagnostic data storage system **306** may authenticate the wireless mobile device and push the stored vehicle diagnostic data to the mobile device automatically or upon request from the mobile device for the vehicle diagnostic data. The diagnostic data storage system **306** may also authenticate the user associated with the mobile device as being a user associated with the vehicle and/or the diagnostic data storage system **306**. For example, such authentication information regarding the association of the user with the vehicle and/or the diagnostic data storage system **306** may be communicated to the diagnostic data storage system **306** from the portable electrical energy storage device collection, charging and distribution machine **102** when the portable electrical energy storage device **106***z* having the diagnostic data storage system **306** is retrieved from the portable electrical energy storage device collection, charging and distribution machine **102** by the user who has been identified by the portable electrical energy storage device collection, charging and distribution machine **102**.

Once the portable electrical energy storage device **106***z* is placed in the portable electrical energy storage device collection, charging and distribution machine **102** in the process of a user returning or exchanging the portable electrical energy storage device **106***z* at the portable electrical energy storage device collection, charging and distribution machine **102**, and the information regarding the vehicle diagnostic data has been provided to the user or otherwise utilized, the portable electrical energy storage device collection, charging and distribution machine **102** may initiate a deletion of the vehicle

diagnostic data from the diagnostic data storage system **306** or cause the stored vehicle identification data to be able to be overwritten (e.g., to make room for storage of vehicle diagnostic data of other vehicles in which the portable electrical energy storage device **106***z* will be used). In some embodiments, the currently stored vehicle diagnostic data may be deleted or caused to be able to be overwritten by the diagnostic data storage system **306** or vehicle diagnostic system **418** upon re-connection of the diagnostic data storage system **306** to the vehicle diagnostic system **418**, or upon connection to a different vehicle than that which is associated with the currently stored vehicle diagnostic data on the diagnostic data storage system **306**.

FIG. **5** shows a high level method **500** of operating the diagnostic data storage system **306** of FIGS. **3** and **4**A, according to one non-limiting illustrated embodiment.

At **502**, the diagnostic data storage system **306** receives diagnostic data regarding a vehicle.

At **504**, the diagnostic data storage system **306** stores at least some of the diagnostic data in a memory device attached to an electrical energy storage device configured to provide power to a vehicle.

FIG. **6** shows a low level method **600** of operating the diagnostic data storage system **306** of FIGS. **3** and **4**A, according to one non-limiting illustrated embodiment, including enabling data to be provided to an external device, useful in the method of FIG. **5**.

At **602**, the diagnostic data storage system **306** enables at least some diagnostic data stored on the at least one memory device (e.g., at least some of the diagnostic data stored on the at least one memory device in the method **500**) to be provided to an external device

FIG. **7** shows a high level method **700** of operating the portable electrical energy storage device collection, charging and distribution machine **102** of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment.

At **702**, the portable electrical energy storage device collection, charging and distribution machine **102** detects the presence of a portable electrical energy storage device configured to provide power to a vehicle.

At **704**, the portable electrical energy storage device collection, charging and distribution machine **102** receives vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device.

At **706**, the portable electrical energy storage device collection, charging and distribution machine **102** provides information from the portable electrical energy storage device collection, charging and distribution machine **102** based on the received vehicle diagnostic data.

FIG. **8** shows a low level method **800** of operating the portable electrical energy storage device collection, charging and distribution machine **102** of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment, including receiving the vehicle diagnostic data from a memory device, useful in the method of FIG. **7**.

At **802**, the portable electrical energy storage device collection, charging and distribution machine **102** receives the vehicle diagnostic data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored.

FIG. **9** shows a low level method **900** of operating the portable electrical energy storage device collection, charging and distribution machine **102** of FIGS. **1** and **2**, according to one non-limiting illustrated embodiment, including displaying the provided information, useful in the method of FIG. **7**.

At **902**, the portable electrical energy storage device collection, charging and distribution machine **102** displays the information on a display of the portable electrical energy storage device collection, charging and distribution machine **102**.

FIG. **10** shows a high level method **1000** of operating the portable electrical energy storage device collection, charging and distribution machine **102** of FIGS. **1** and **2**, according to another non-limiting illustrated embodiment.

At **1002**, the portable electrical energy storage device collection, charging and distribution machine **102** receives vehicle diagnostic data regarding a vehicle from a portable electrical energy storage device configured to power the vehicle.

At **1004**, the portable electrical energy storage device collection, charging and distribution machine **102** provides information based on the received vehicle diagnostic data to a user associated with the vehicle (e.g., to a user's mobile device).

The foregoing detailed description has set forth various embodiments of the devices and/or processes via the use of block diagrams, schematics, and examples. Insofar as such block diagrams, schematics, and examples contain one or more functions and/or operations, it will be understood by those skilled in the art that each function and/or operation within such block diagrams, flowcharts, or examples can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or virtually any combination thereof. In one embodiment, the present subject matter may be implemented via one or more microcontrollers. However, those skilled in the art will recognize that the embodiments disclosed herein, in whole or in part, can be equivalently implemented in standard integrated circuits (e.g., Application Specific Integrated Circuits or ASICs), as one or more computer programs executed by one or more computers (e.g., as one or more programs running on one or more computer systems), as one or more programs executed by on one or more controllers (e.g., microcontrollers) as one or more programs executed by one or more processors (e.g., microprocessors), as firmware, or as virtually any combination thereof, and that designing the circuitry and/or writing the code for the software and/or firmware would be well within the skill of one of ordinary skill in the art in light of the teachings of this disclosure.

When logic is implemented as software and stored in memory, logic or information can be stored on any non-transitory computer-readable medium for use by or in connection with any processor-related system or method. In the context of this disclosure, a memory is a nontransitory computer- or processor-readable storage medium that is an electronic, magnetic, optical, or other physical device or means that non-transitorily contains or stores a computer and/or processor program. Logic and/or the information can be embodied in any computer-readable medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions associated with logic and/or information.

In the context of this specification, a "computer-readable medium" can be any physical element that can store the program associated with logic and/or information for use by or in connection with the instruction execution system, apparatus, and/or device. The computer-readable medium can be, for example, but is not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus or device. More specific examples (a non-exhaustive list) of the computer readable medium would include the

following: a portable computer diskette (magnetic, compact flash card, secure digital, or the like), a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM, EEPROM, or Flash memory), a portable compact disc read-only memory (CDROM), and digital tape.

The various embodiments described above can be combined to provide further embodiments. To the extent that they are not inconsistent with the specific teachings and definitions herein, all of the U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in the Application Data Sheet, including but not limited to: U.S. provisional patent application Ser. No. 61/511,900 entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/647,936 entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES," filed May 16, 2012; U.S. provisional patent application Ser. No. 61/534,753 entitled "APPARATUS, METHOD AND ARTICLE FOR REDISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES, BETWEEN COLLECTION, CHARGING AND DISTRIBUTION MACHINES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/534,761 entitled "APPARATUS, METHOD AND ARTICLE FOR AUTHENTICATION, SECURITY AND CONTROL OF POWER STORAGE DEVICES SUCH AS BATTERIES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/534,772 entitled "APPARATUS, METHOD AND ARTICLE FOR AUTHENTICATION, SECURITY AND CONTROL OF POWER STORAGE DEVICES, SUCH AS BATTERIES, BASED ON USER PROFILES," filed Sep. 14, 2011; U.S. provisional patent application Ser. No. 61/511,887 entitled "THERMAL MANAGEMENT OF COMPONENTS IN ELECTRIC MOTOR DRIVE VEHICLES," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/647,941 entitled "THERMAL MANAGEMENT OF COMPONENTS IN ELECTRIC MOTOR DRIVE VEHICLES," filed May 16, 2012; U.S. provisional patent application Ser. No. 61/511,880 entitled "DYNAMICALLY LIMITING VEHICLE OPERATION FOR BEST EFFORT ECONOMY," filed Jul. 26, 2011; U.S. provisional patent application Ser. No. 61/557,170 entitled "APPARATUS, METHOD, AND ARTICLE FOR PHYSICAL SECURITY OF POWER STORAGE DEVICES IN VEHICLES," filed Nov. 8, 2011; U.S. provisional patent application Ser. No. 61/581,566 entitled "APPARATUS, METHOD AND ARTICLE FOR A POWER STORAGE DEVICE COMPARTMENT," filed Dec. 29, 2011; U.S. provisional patent application Ser. No. 61/601,404 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING VEHICLE DIAGNOSTIC DATA," filed Feb. 21, 2012; U.S. provisional patent application Ser. No. 61/601,949 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING LOCATIONS OF POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINES," filed Feb. 22, 2012; U.S. provisional patent application Ser. No. 61/601,953 entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING INFORMATION REGARDING AVAILABILITY OF POWER STORAGE DEVICES AT A POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINE," filed Feb. 22, 2012; U.S. Application Ser. No. 13/559,314, filed Jul. 26, 2012, naming Hok-Sum Horace Luke, Matthew Whiting Taylor and Huang-Cheng Hung as inventors and entitled "APPARATUS, METHOD AND ARTICLE FOR COLLECTION, CHARGING AND DISTRIBUTING POWER STORAGE DEVICES, SUCH AS BATTERIES"; U.S. application Ser. No. 13/559,038, filed Jul. 26, 2012, naming Hok-Sum Horace Luke and Matthew Whiting Taylor as inventors and entitled "APPARATUS, METHOD AND ARTICLE FOR AUTHENTICATION, SECURITY AND CONTROL OF POWER STORAGE DEVICES SUCH AS BATTERIES"; U.S. application Ser. No. 13/559,264, filed Jul. 26, 2012, naming Hok-Sum Horace Luke and Matthew Whiting Taylor as inventors and entitled "DYNAMICALLY LIMITING VEHICLE OPERATION FOR BEST EFFORT ECONOMY"; U.S. application Ser. No. 13/559,054, filed Jul. 26, 2012, naming Matthew Whiting Taylor, Yi-Tsung Wu, Hok-Sum Horace Luke and Huang-Cheng Hung as inventors and entitled "APPARATUS, METHOD, AND ARTICLE FOR PHYSICAL SECURITY OF POWER STORAGE DEVICES IN VEHICLES"; U.S. application Ser. No. 13/559,343, filed Jul. 26, 2012, naming Yi-Tsung Wu, Matthew Whiting Taylor, Hok-Sum Horace Luke and Jung-Hsiu Chen as inventors and entitled "APPARATUS, METHOD AND ARTICLE FOR PROVIDING INFORMATION REGARDING AVAILABILITY OF POWER STORAGE DEVICES AT A POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINE"; and U.S. application Ser. No. 13/559,064, filed Jul. 26, 2012, naming Hok-Sum Horace Luke, Yi-Tsung Wu, Jung-Hsiu Chen, Yulin Wu, Chien Ming Huang, TsungTing Chan, Shen-Chi Chen and Feng Kai Yang as inventors and entitled "APPARATUS, METHOD AND ARTICLE FOR RESERVING POWER STORAGE DEVICES AT RESERVING POWER STORAGE DEVICE COLLECTION, CHARGING AND DISTRIBUTION MACHINES" are incorporated herein by reference, in their entirety. Aspects of the embodiments can be modified, if necessary, to employ systems, circuits and concepts of the various patents, applications and publications to provide yet further embodiments.

While generally discussed in the environment and context of collection, charging and distribution of portable electrical energy storage devices for use with personal transportation vehicle such as all-electric scooters and/or motorbikes, the teachings herein can be applied in a wide variety of other environments, including other vehicular as well as non-vehicular environments.

The above description of illustrated embodiments, including what is described in the Abstract of the Disclosure, is not intended to be exhaustive or to limit the embodiments to the precise forms disclosed. Although specific embodiments and examples are described herein for illustrative purposes, various equivalent modifications can be made without departing from the spirit and scope of the disclosure, as will be recognized by those skilled in the relevant art.

These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

We claim:

1. A system for operating a portable electrical energy storage device collection, charging and distribution machine comprising:

at least one computer processor; and

at least one non-transitory memory coupled to the at least one computer processor, wherein the at least one memory has computer-executable instructions stored thereon that, when executed, cause the at least one computer processor to:

detect presence of a portable electrical energy storage device configured to provide power to a vehicle;

receive vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device, wherein the vehicle diagnostic data at least includes data regarding condition or status of a vehicle system other than the portable electrical energy storage device; and

provide information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data.

2. The system of claim **1** wherein the detecting presence of a portable electrical energy storage device includes detecting presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine.

3. The system of claim **2** wherein the detecting the presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine includes detecting an operable physical connection between a diagnostic data storage system of the portable electrical energy storage device and an input of the portable electrical energy storage device collection, charging and distribution machine once the portable electrical energy storage device is placed in the portable electrical energy storage device collection, charging and distribution machine.

4. The system of claim **1** wherein the detecting presence of the portable electrical energy storage device includes detecting presence of the portable electrical energy storage device via a wireless signal received from the portable electrical energy storage device.

5. The system of claim **1** wherein the receiving vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device includes receiving the vehicle diagnostic data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored.

6. The system of claim **1** wherein the providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes displaying the information on a display of the portable electrical energy storage device collection, charging and distribution machine.

7. The system of claim **6** wherein the displaying the information on a display of the portable electrical energy storage device collection, charging and distribution machine includes displaying the information on the display during a transaction at the portable electrical energy storage device collection, charging and distribution machine involving the portable electrical energy storage device.

8. The system of claim **1** wherein the providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes communicating the information to a mobile device of a user associated with the vehicle.

9. The system of claim **1** wherein the providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes communicating the information to a server computing system.

10. A computer-implemented method comprising executing on a processor the following:

receiving data from a portable electrical energy storage device configured to power a vehicle wherein the data at least includes diagnostic data regarding condition or status of a vehicle system other than the portable electrical energy storage device; and

providing information based on the received data to a user associated with the vehicle.

11. The method of claim **10** further comprising detecting presence of the portable electrical energy storage device at a portable electrical energy storage device collection, charging and distribution machine.

12. The method of claim **10** wherein the data includes one or more of: vehicle diagnostic data regarding the vehicle, user profile information, vehicle profile information, security codes, credentials, security certificates, passwords, a subscription level of the user, demographic information of the user, information regarding user vehicle locations, telematic user vehicle information, telemetric user vehicle information, information regarding portable electrical energy storage device charge capacity, information regarding route information of users, and historic data.

13. The method of claim **12** wherein the receiving the data from the portable electrical energy storage device includes receiving the data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored.

14. The method of claim **10** wherein the providing information based on the received data includes displaying the information on a display of a portable electrical energy storage device collection, charging and distribution machine in which the portable electrical energy storage device has been placed and in response to the portable electrical energy storage device having been placed in the collection, charging and distribution machine.

15. A system for operating a portable electrical energy storage device collection, charging and distribution machine comprising:

means for detecting presence of a portable electrical energy storage device configured to provide power to a vehicle;

means for receiving vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device, wherein the vehicle diagnostic data at least includes data regarding condition or status of a vehicle system other than the portable electrical energy storage device; and

means for providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data.

16. The system of claim **15** wherein the means for detecting presence of a portable electrical energy storage device includes means for detecting presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine.

17. The system of claim **16** wherein the means for detecting the presence of the portable electrical energy storage device in the portable electrical energy storage device collection, charging and distribution machine includes means for detecting an operable physical connection between a diagnostic data storage system of the portable electrical energy storage device and an input of the portable electrical energy storage device collection, charging and distribution machine once the portable electrical energy storage device is placed in the portable electrical energy storage device collection, charging and distribution machine.

18. The system of claim **15** wherein the means for detecting presence of the portable electrical energy storage device

includes means for detecting presence of the portable electrical energy storage device via a wireless signal received from the portable electrical energy storage device.

19. The system of claim **15** wherein the means for receiving vehicle diagnostic data regarding the vehicle from the portable electrical energy storage device includes means for receiving the vehicle diagnostic data from a memory device attached to the portable electrical energy storage device on which the vehicle diagnostic data is stored.

20. The system of claim **15** wherein the means for providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes means for displaying the information on a display of the portable electrical energy storage device collection, charging and distribution machine.

21. The system of claim **20** wherein the means for displaying the information on the display of the portable electrical energy storage device collection, charging and distribution machine includes means for displaying the information on the display during a transaction at the portable electrical energy storage device collection, charging and distribution machine involving the portable electrical energy storage device.

22. The system of claim **15** wherein the means for providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes means for communicating the information to a mobile device of a user associated with the vehicle.

23. The system of claim **15** wherein the means for providing information from the portable electrical energy storage device collection, charging and distribution machine based on the received vehicle diagnostic data includes means for communicating the information to a server computing system.

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