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(54) **RECREATIONAL VEHICLES WITH HEATED COMPONENTS**

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**Publication Classification**

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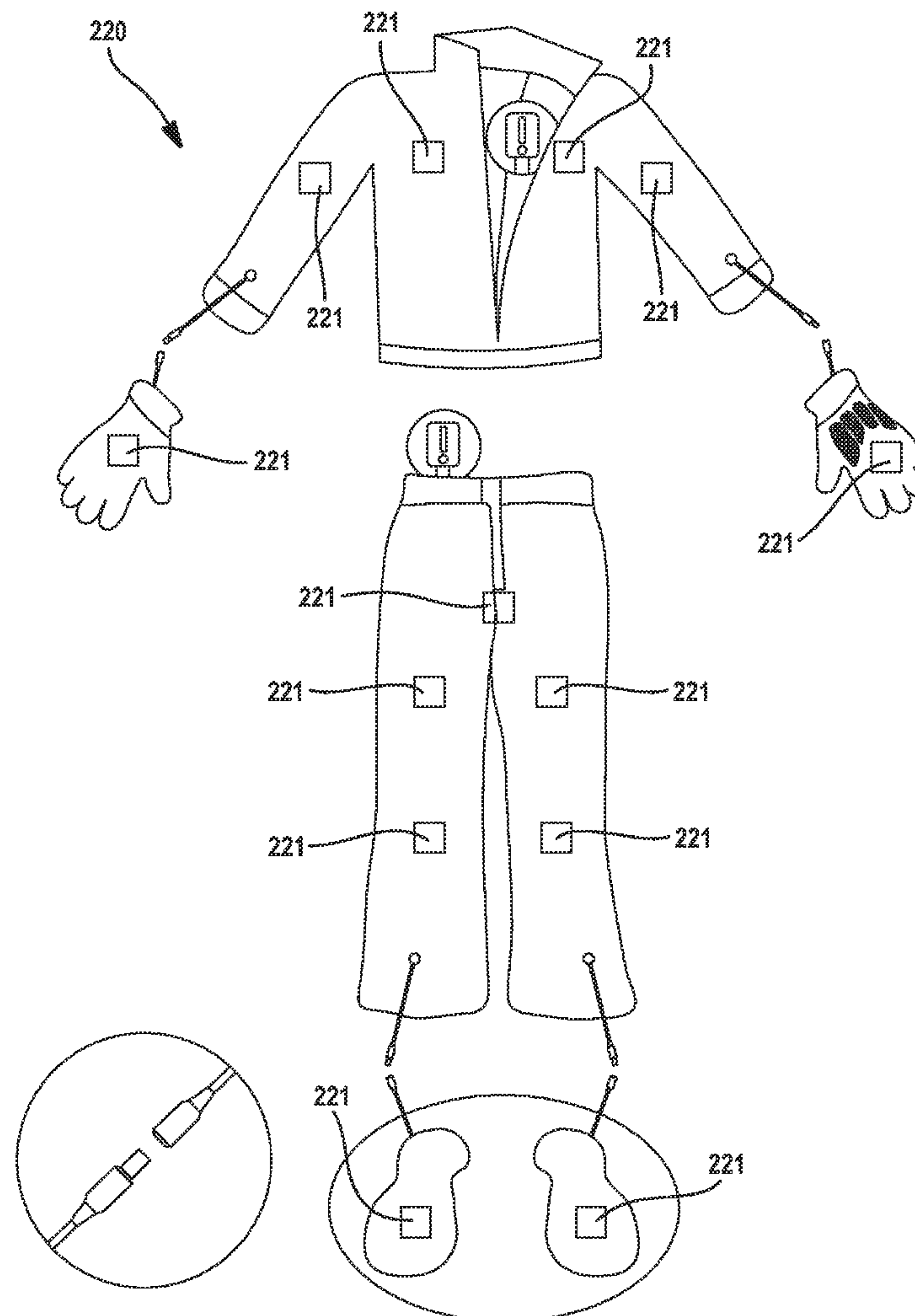
(57) **ABSTRACT**

(22) Filed: **Jul. 26, 2023**

**Related U.S. Application Data**

(63) Continuation of application No. 16/734,846, filed on Jan. 6, 2020, now Pat. No. 11,760,434.

A vehicle including a system for transferring energy between on-board vehicle components and/or between on-board and external components. The vehicle is configured to heat various components through induction to provide comfort to the rider and/or to transfer energy for charging one or more vehicle components.



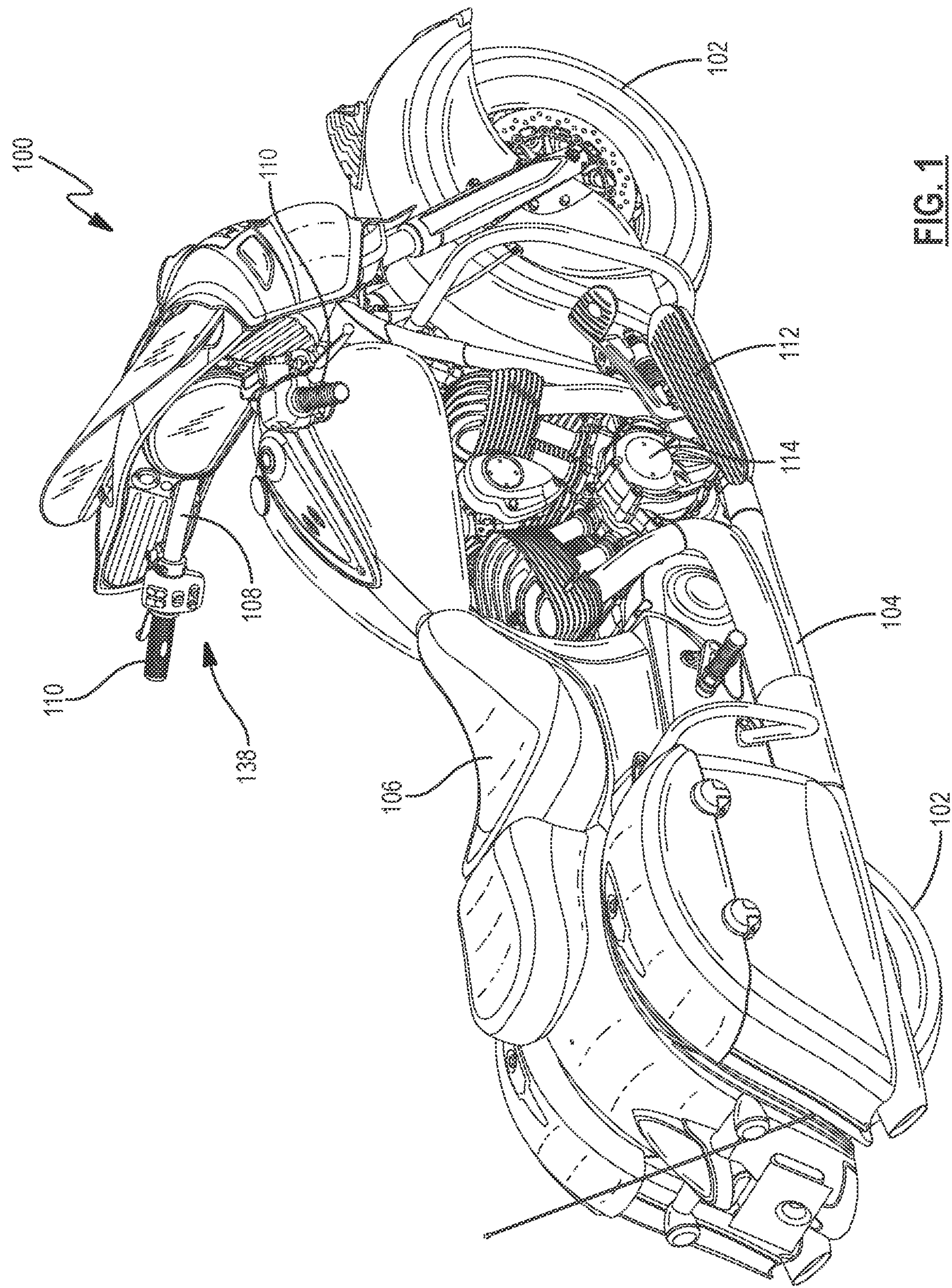
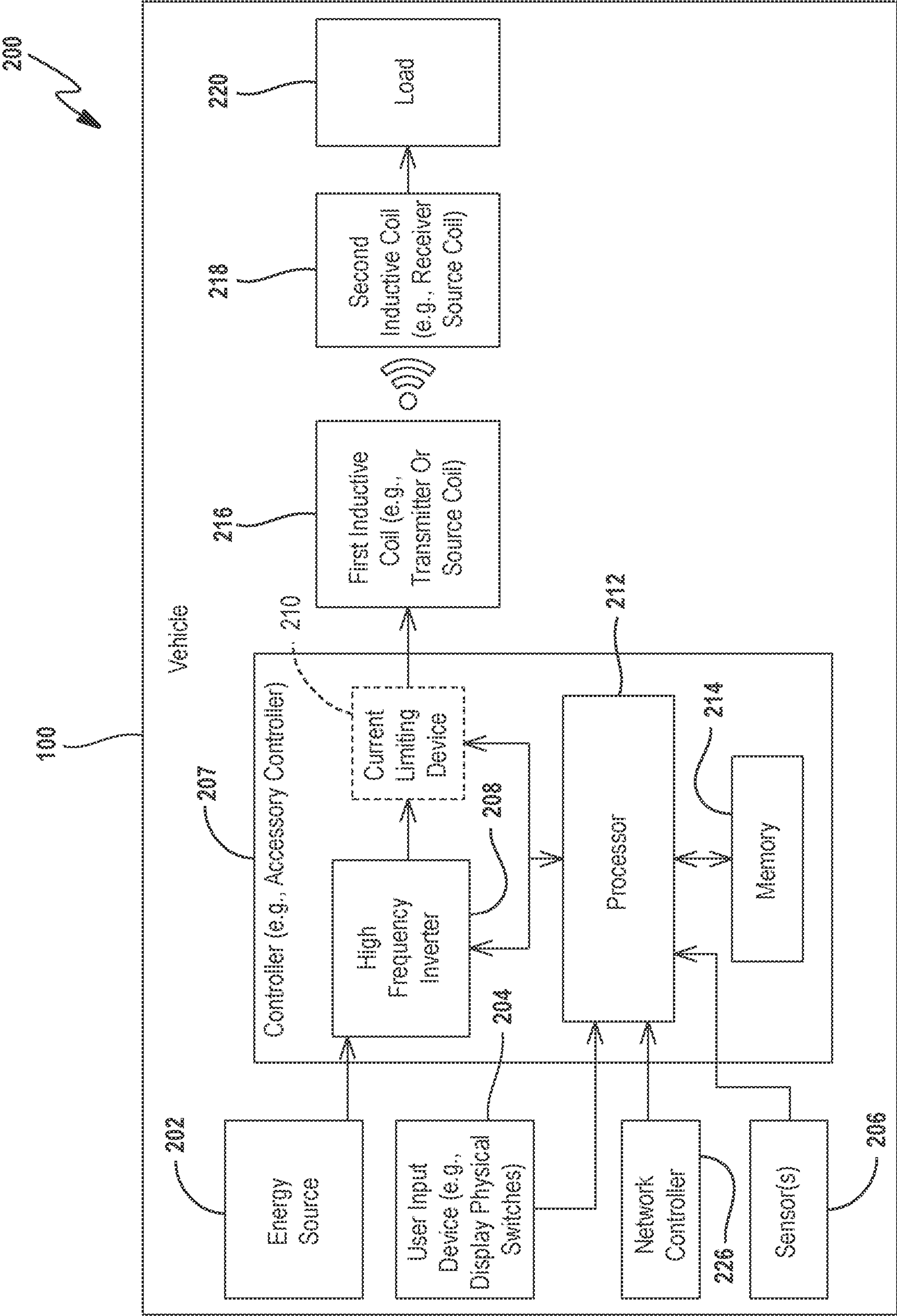
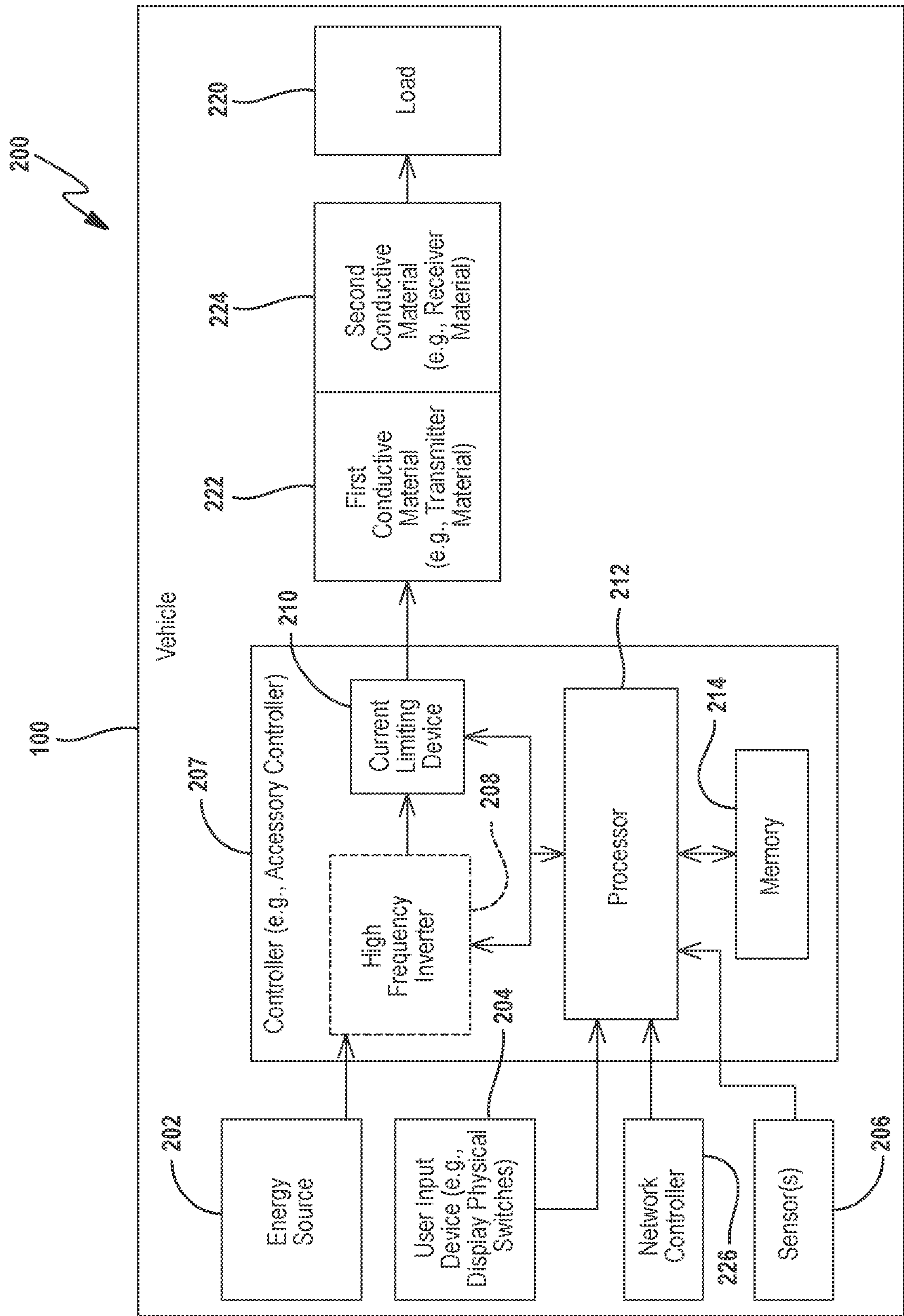


FIG. 1





**FIG. 2**



**FIG. 3**

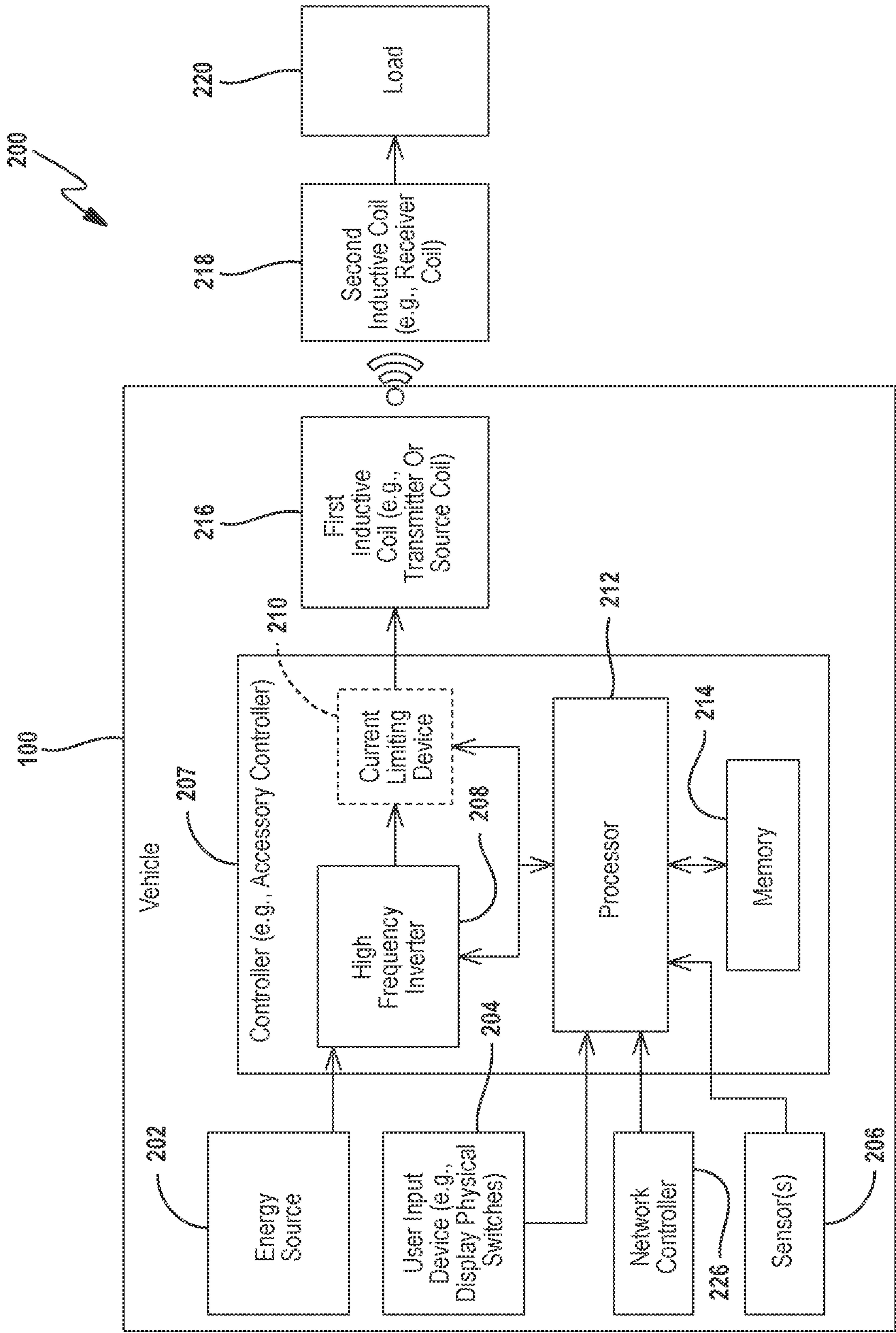
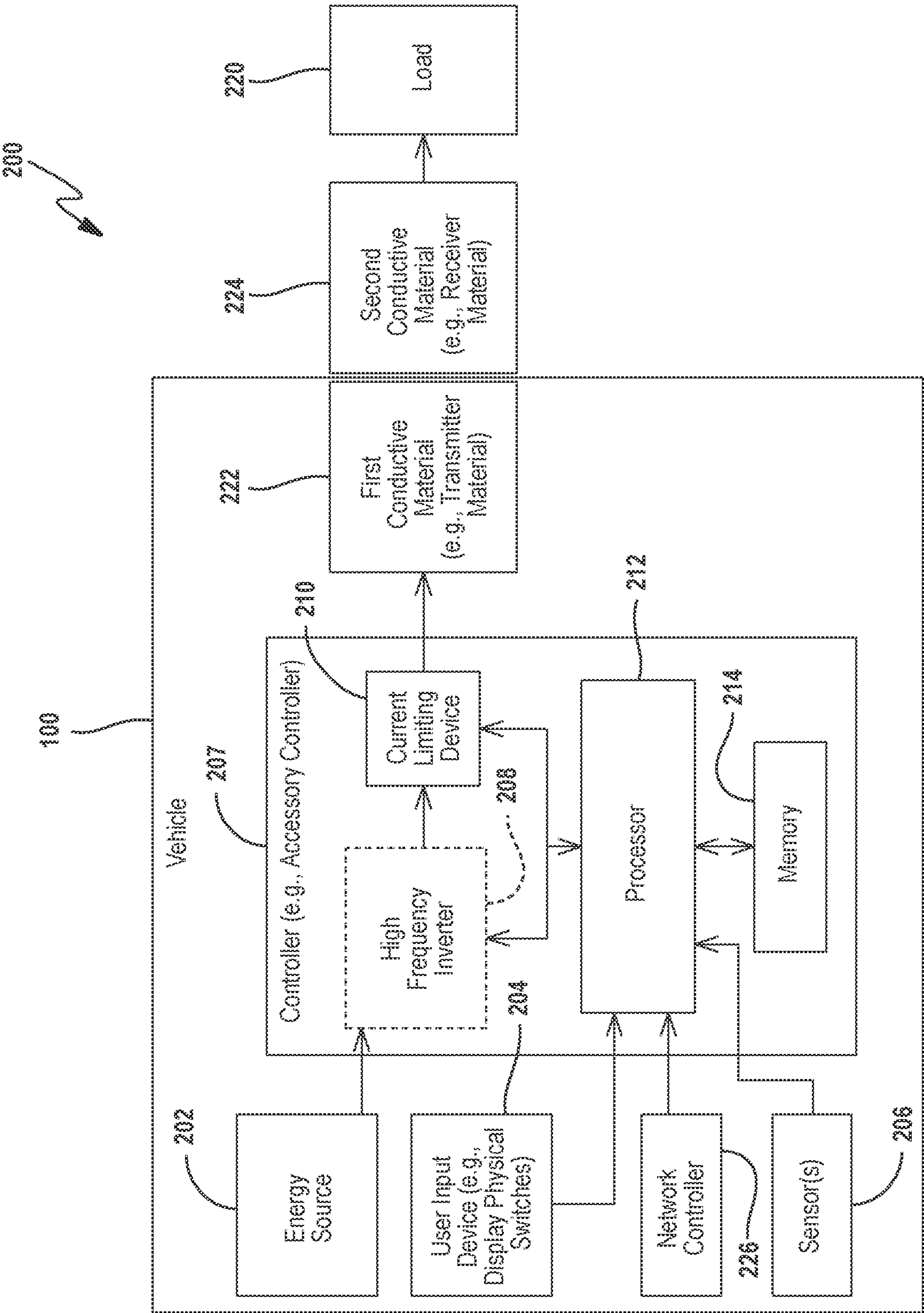
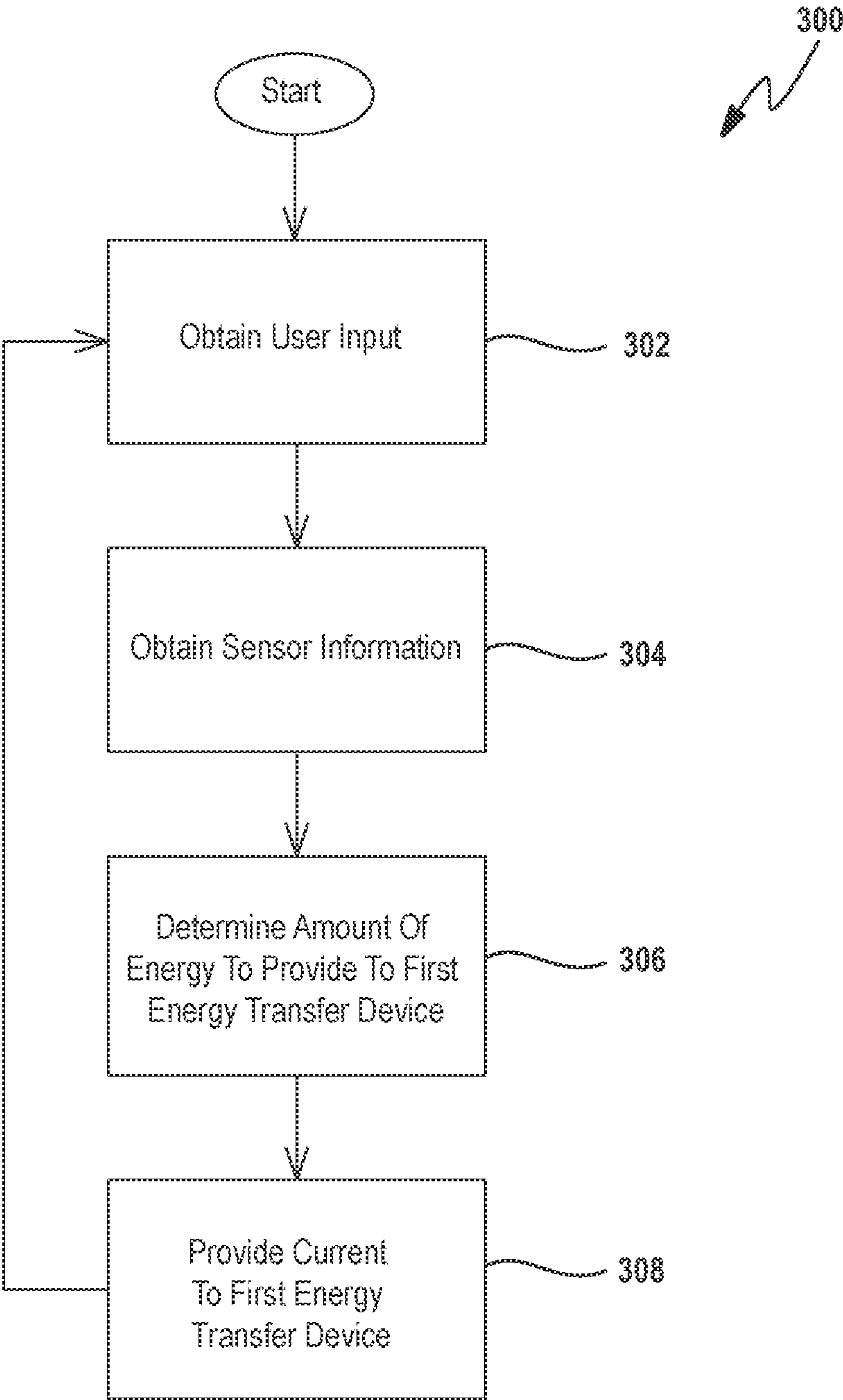


FIG. 4



**FIG. 5**



**FIG. 6**



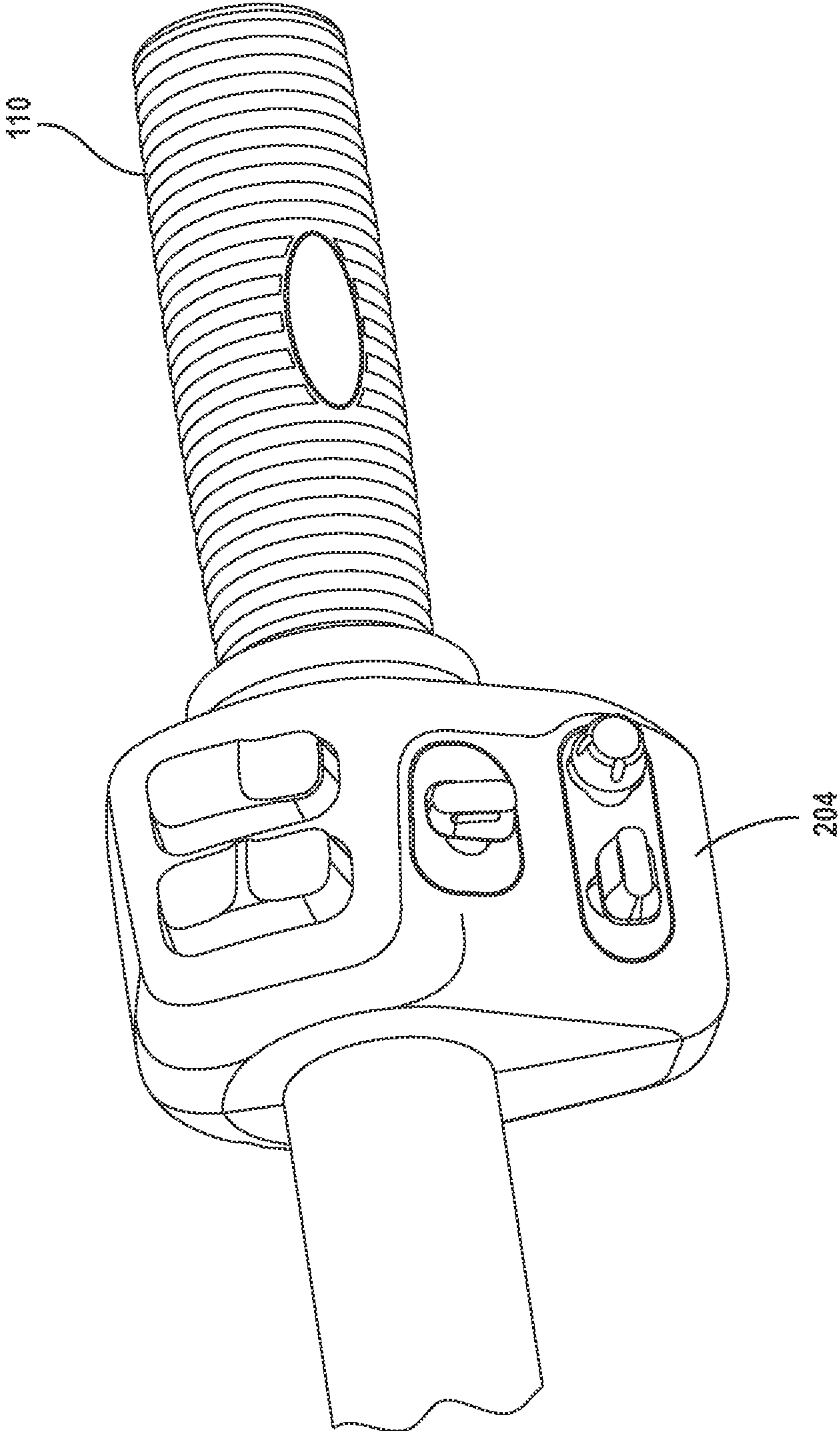


FIG. 7



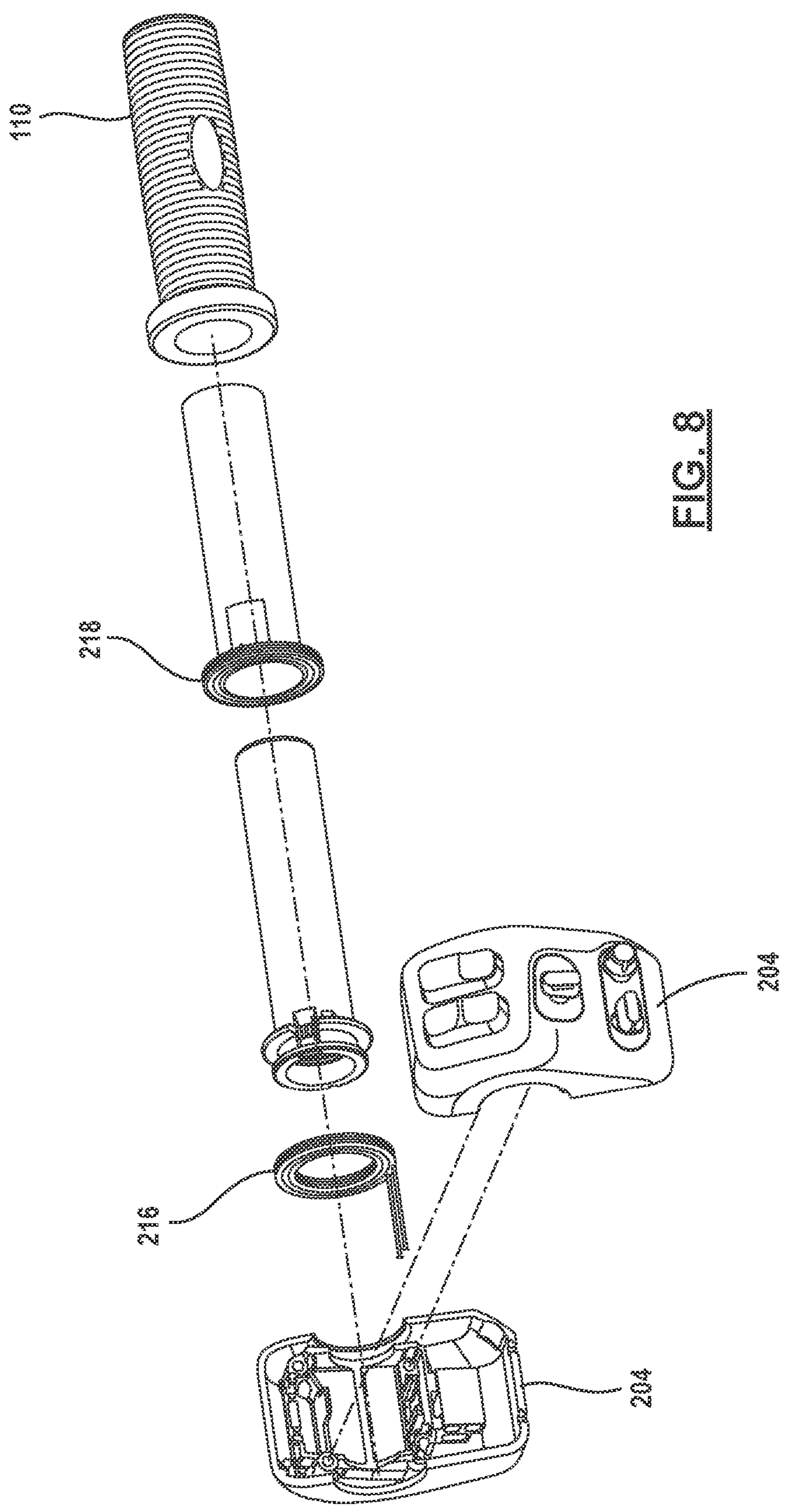


FIG. 8

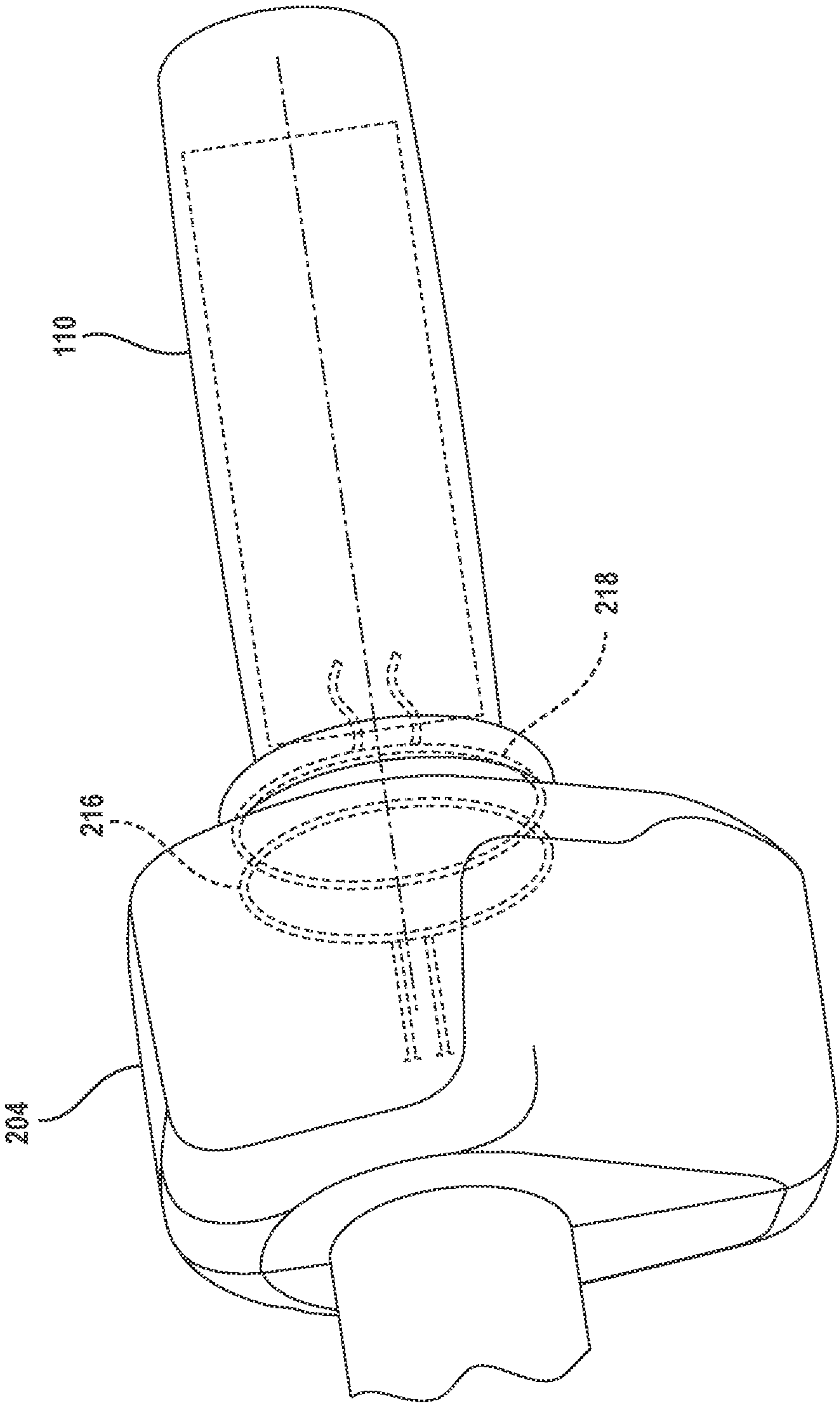


FIG. 9

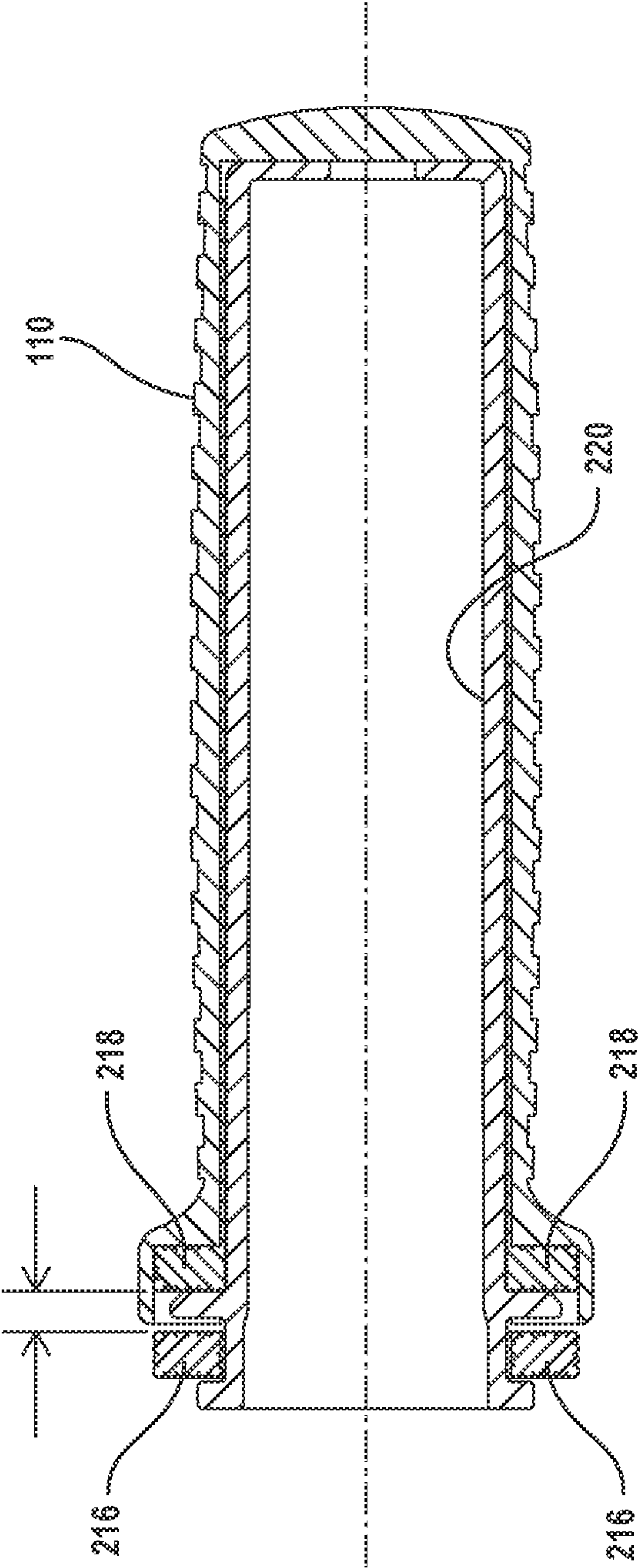


FIG. 10

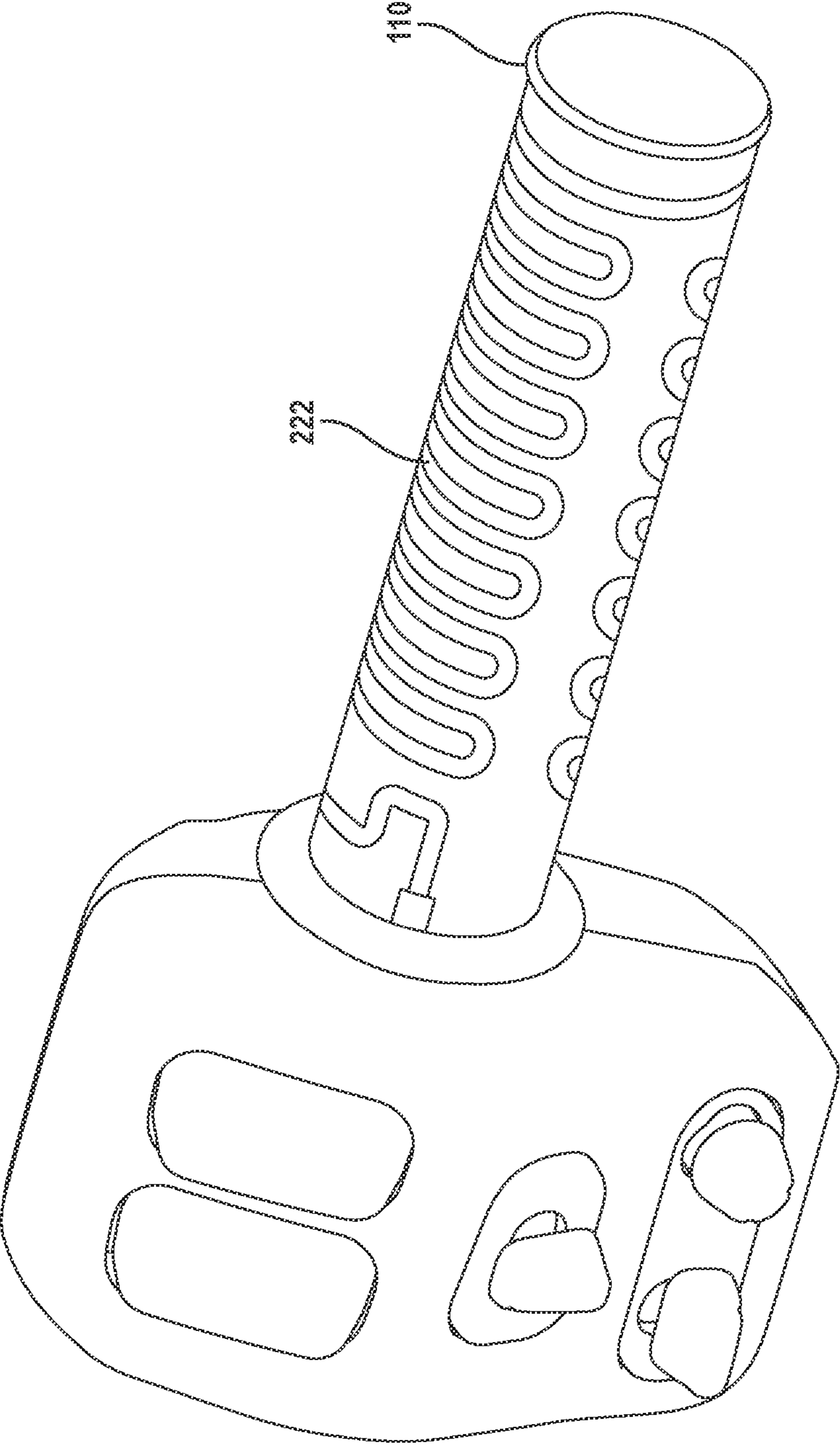
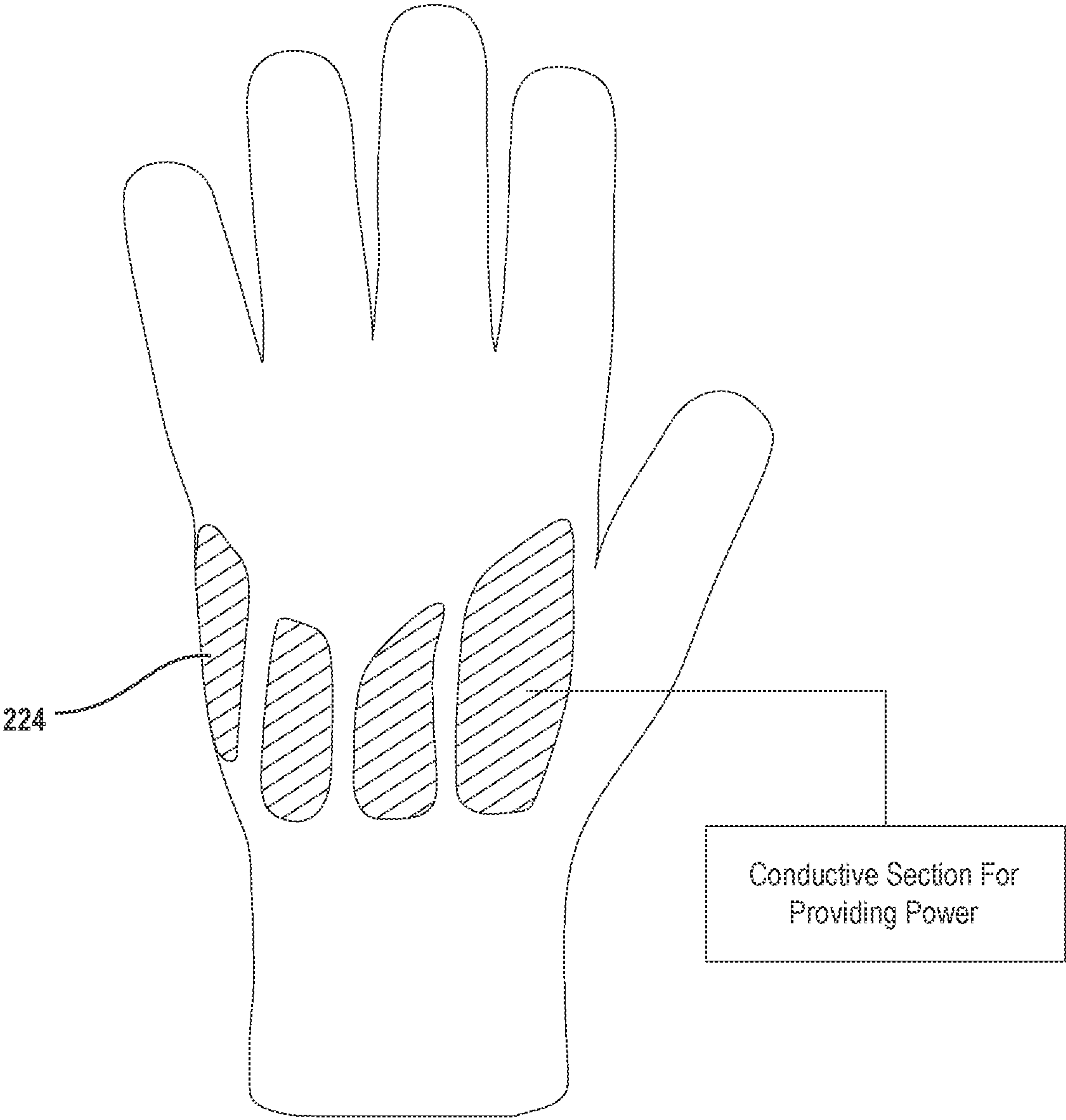
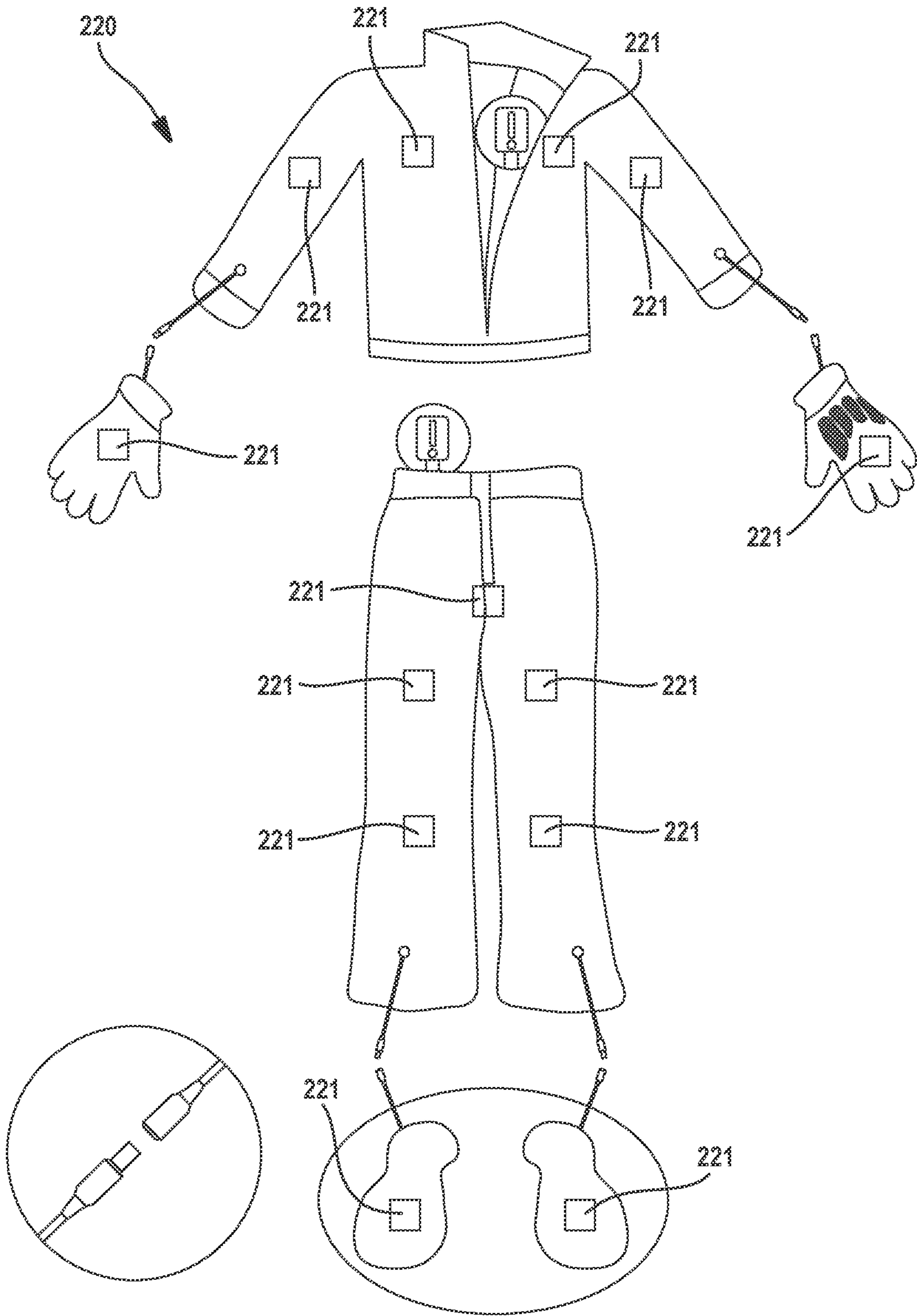


FIG. 11

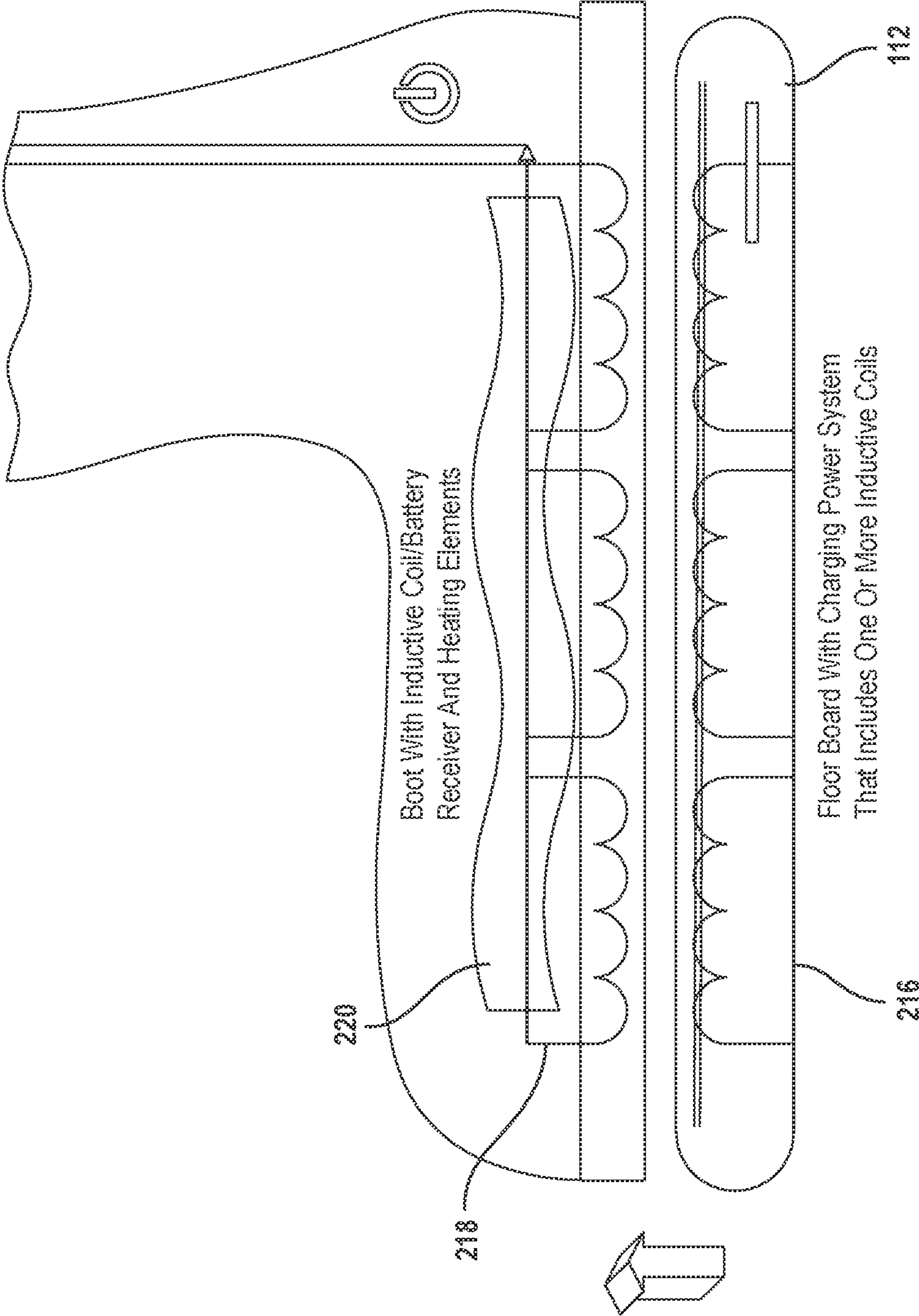




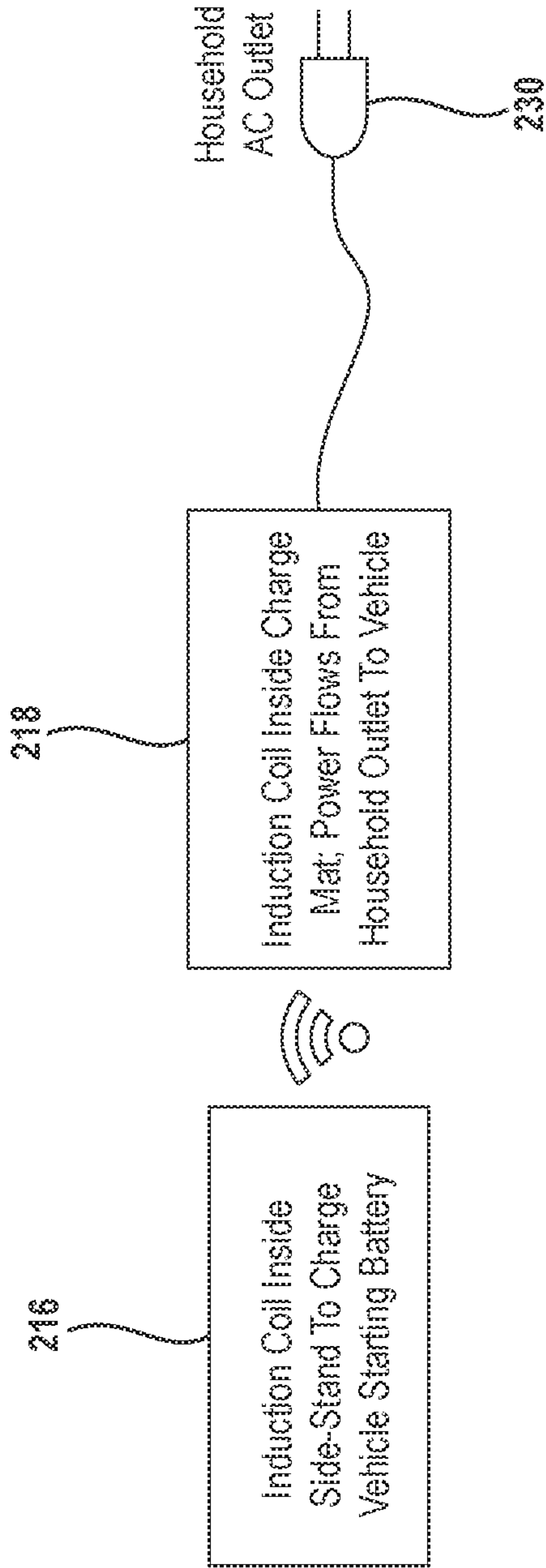
**FIG. 12A**



**FIG. 12B**

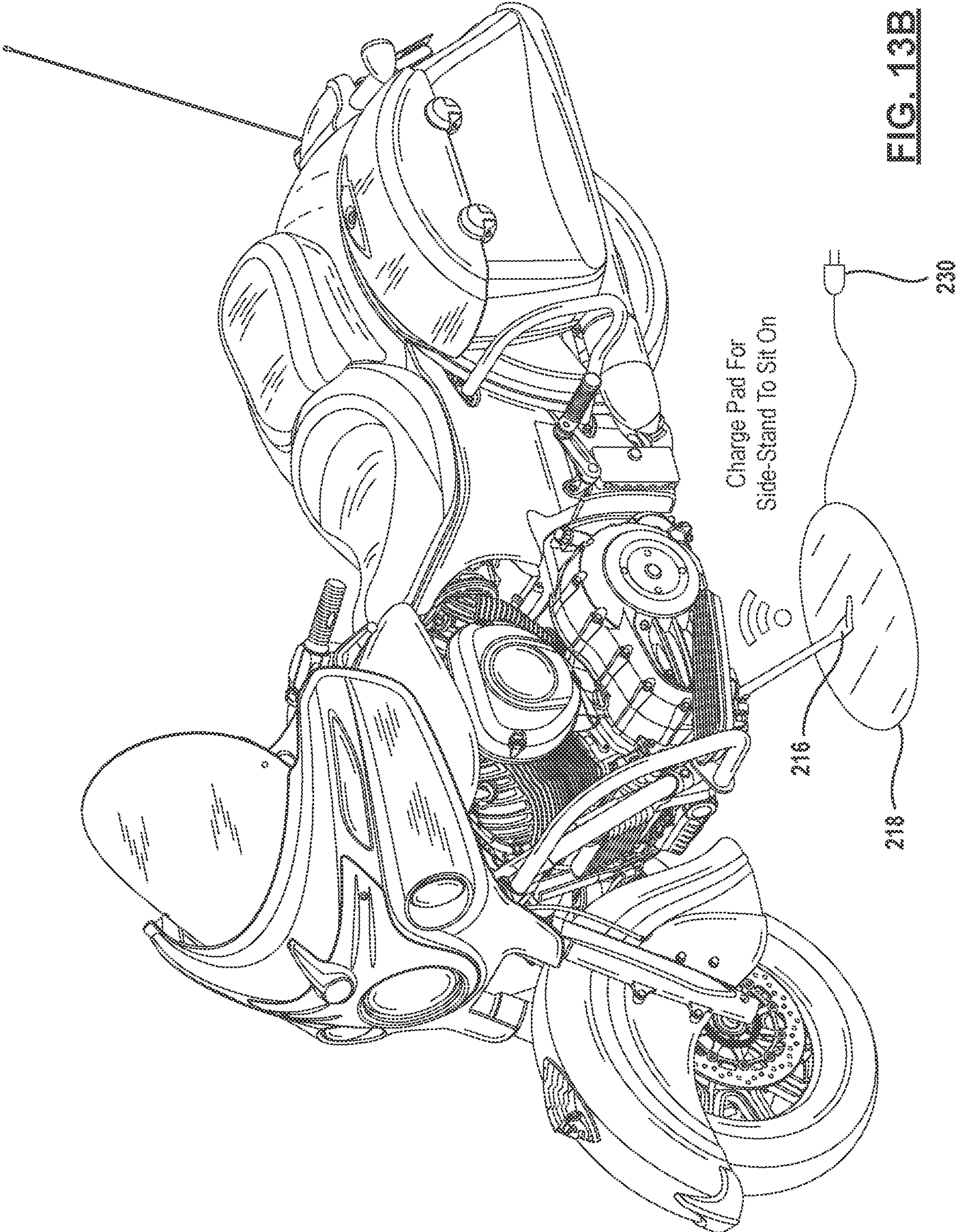


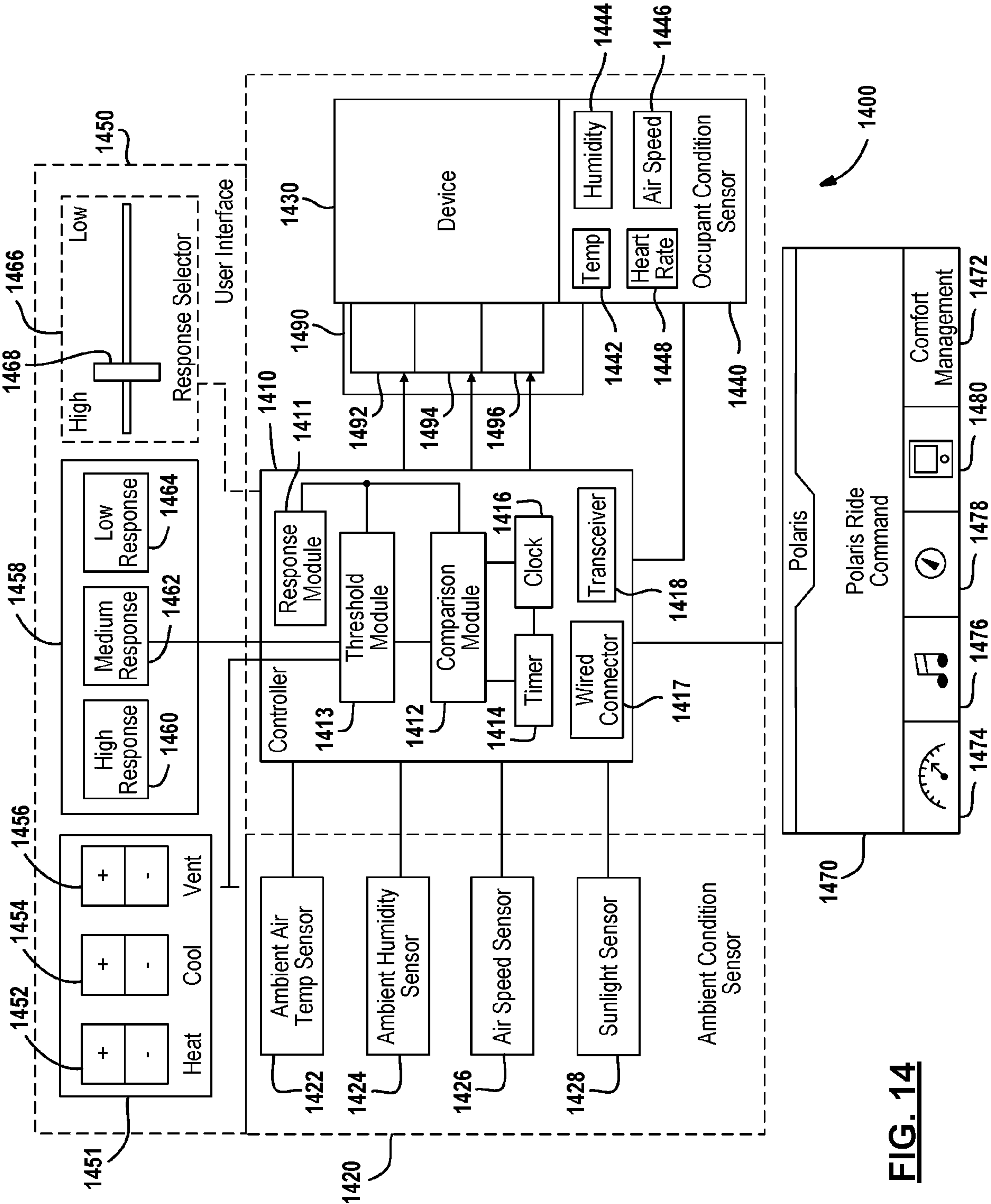
**FIG. 12C**



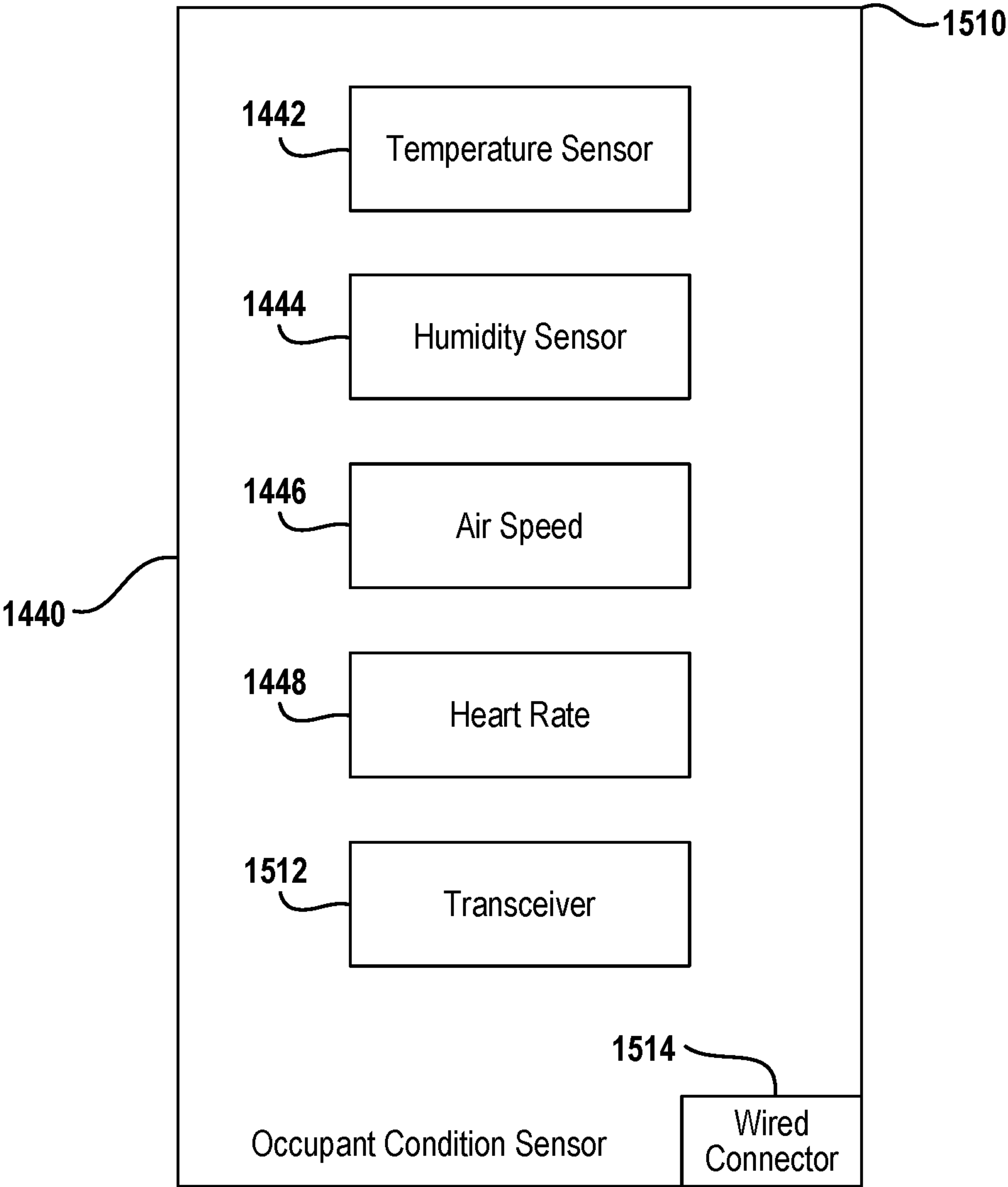
**FIG. 13A**



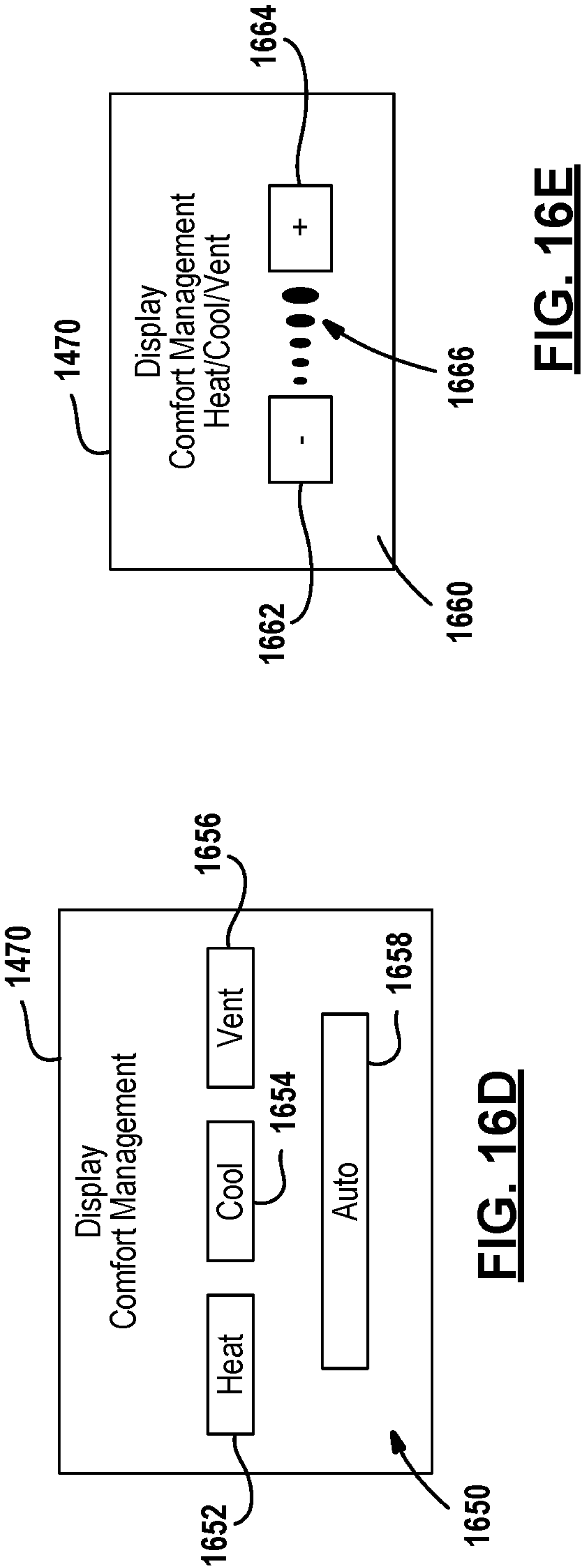
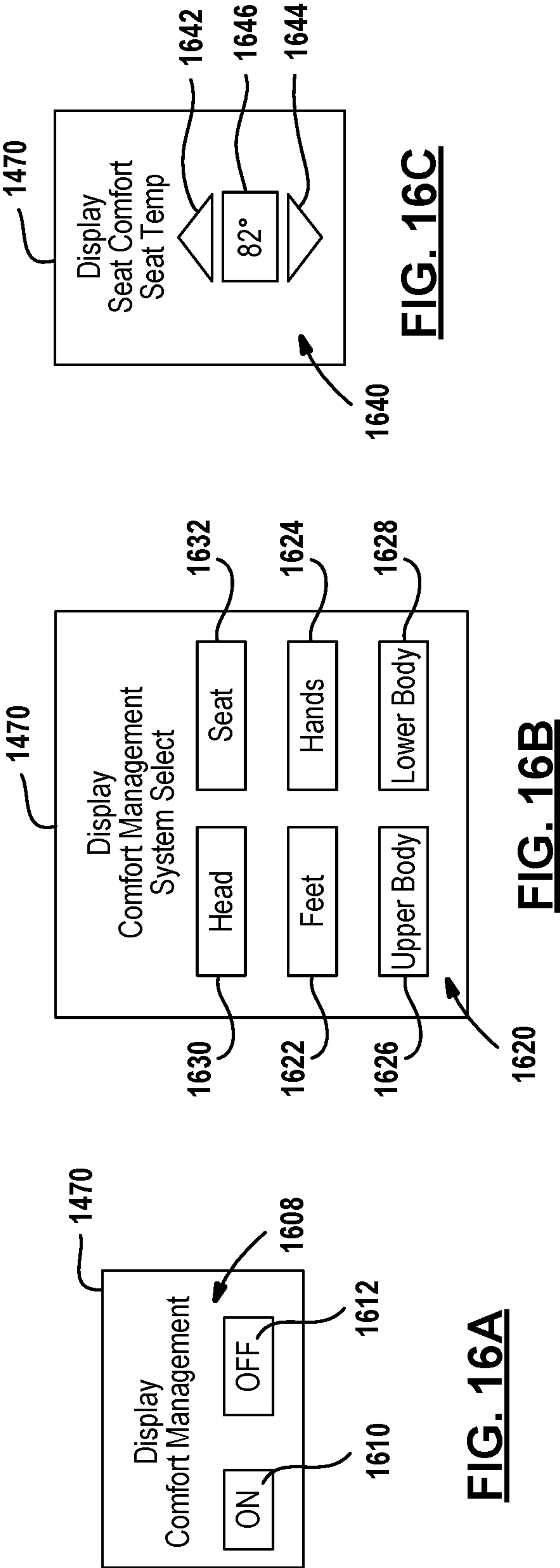




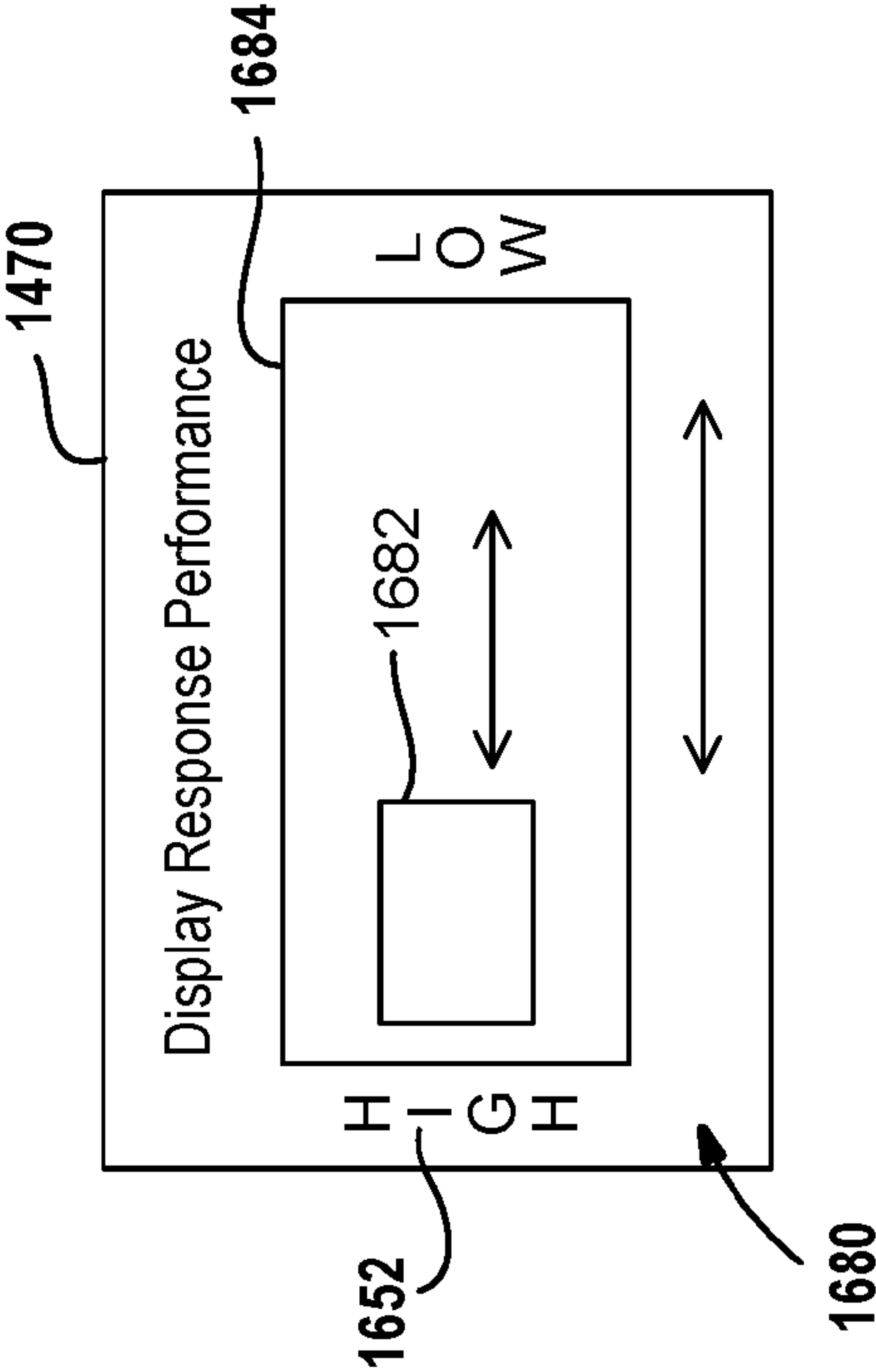
**FIG. 14**



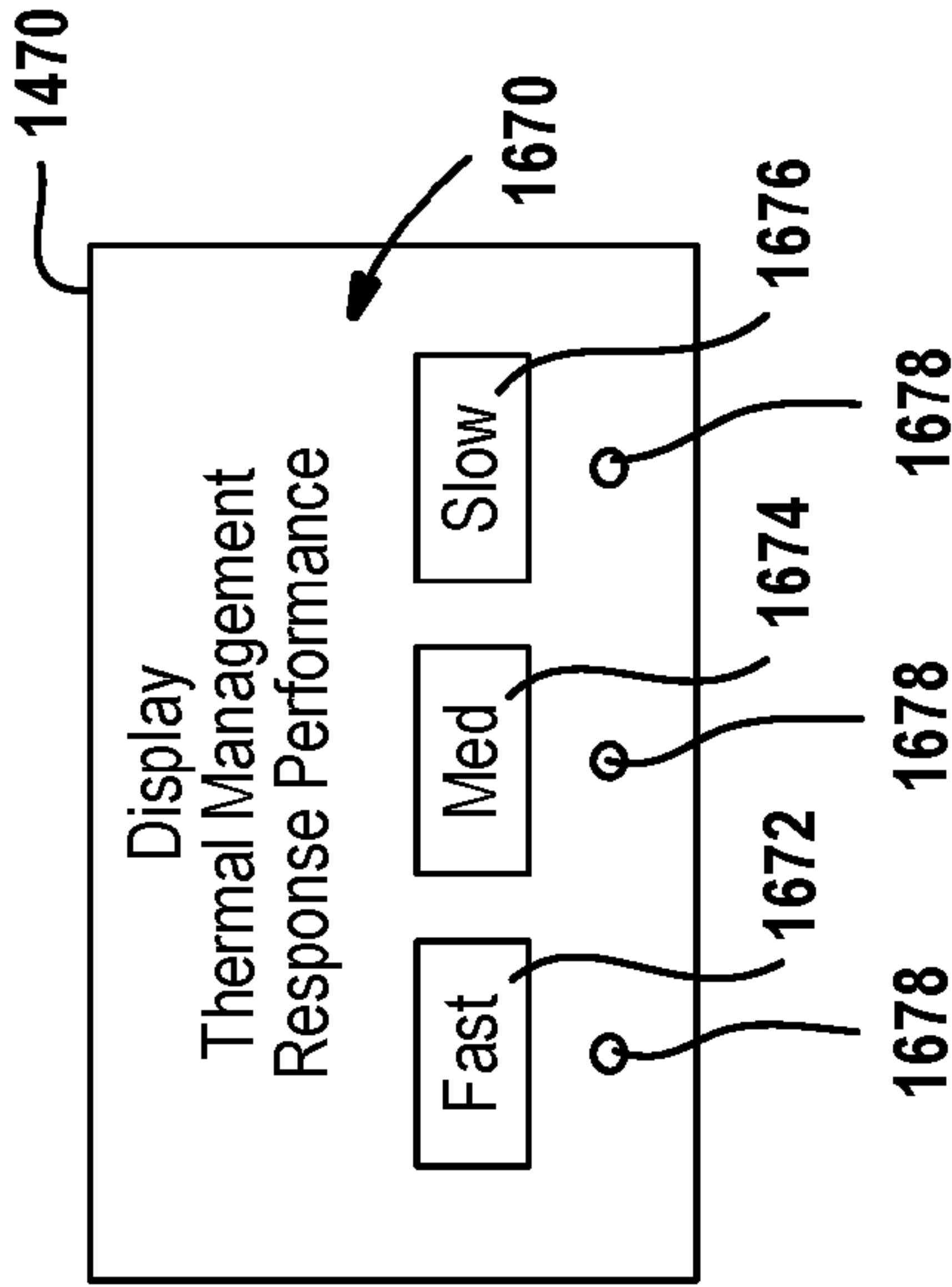
**FIG. 15**



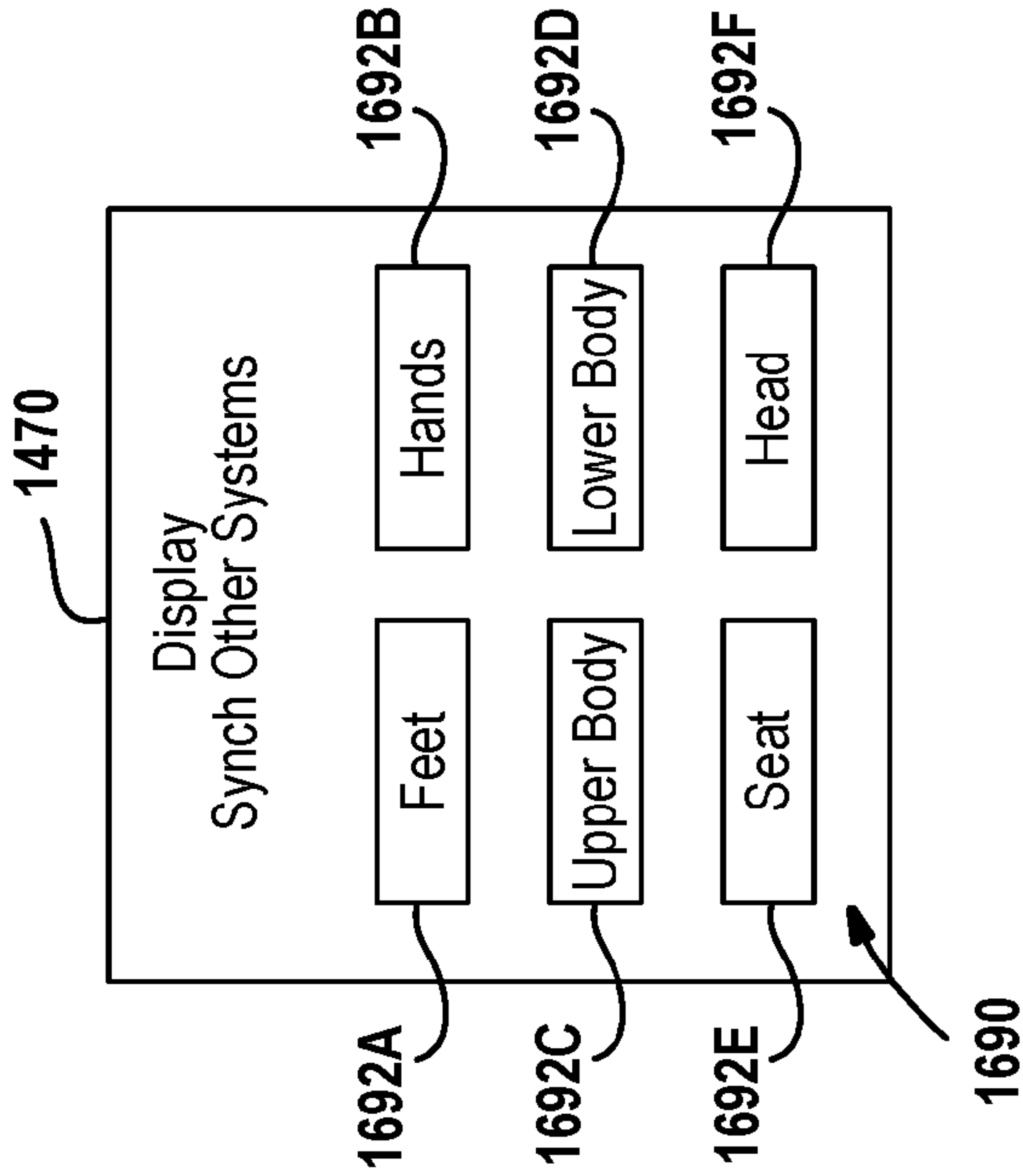




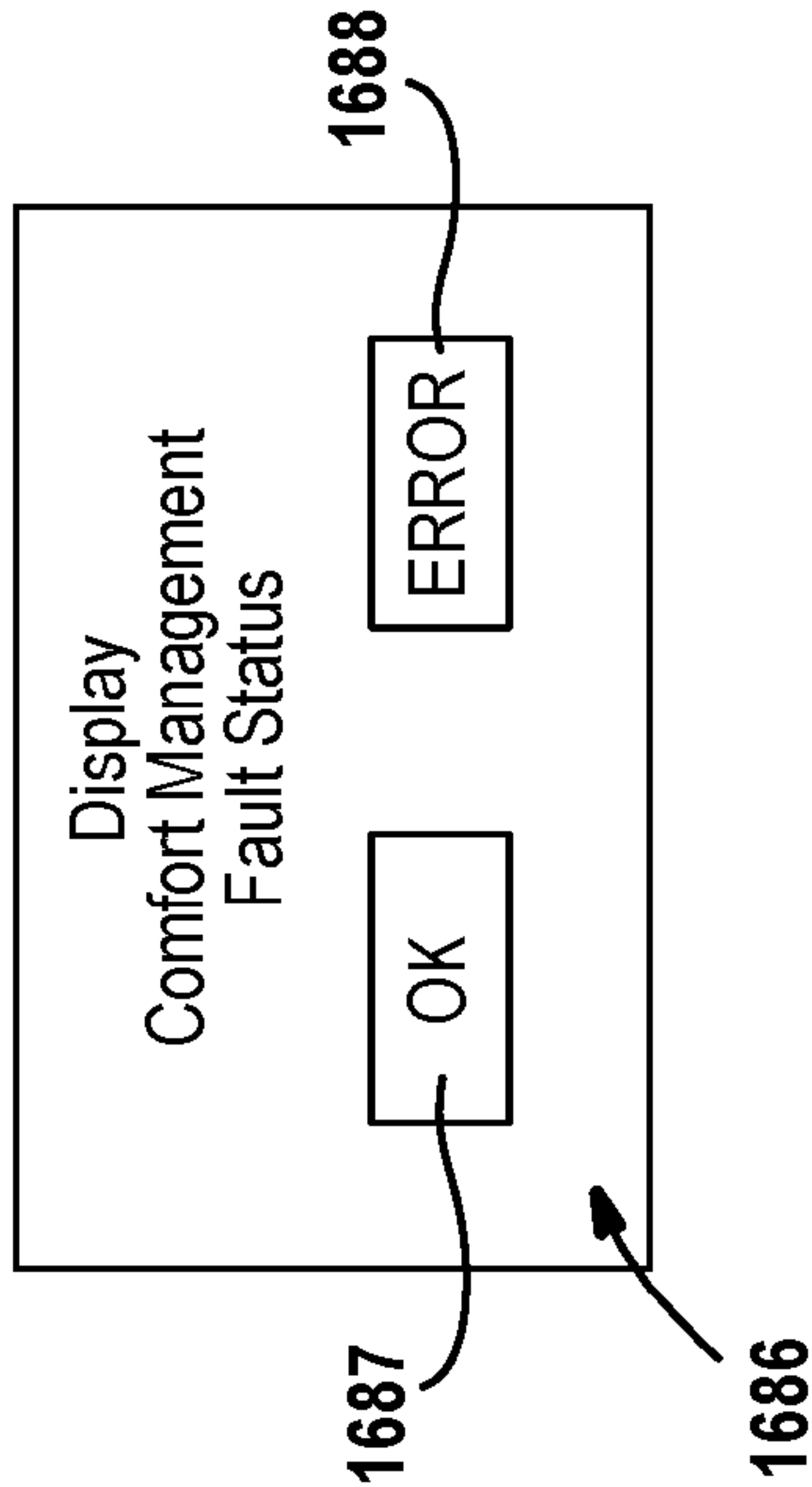
**FIG. 16G**



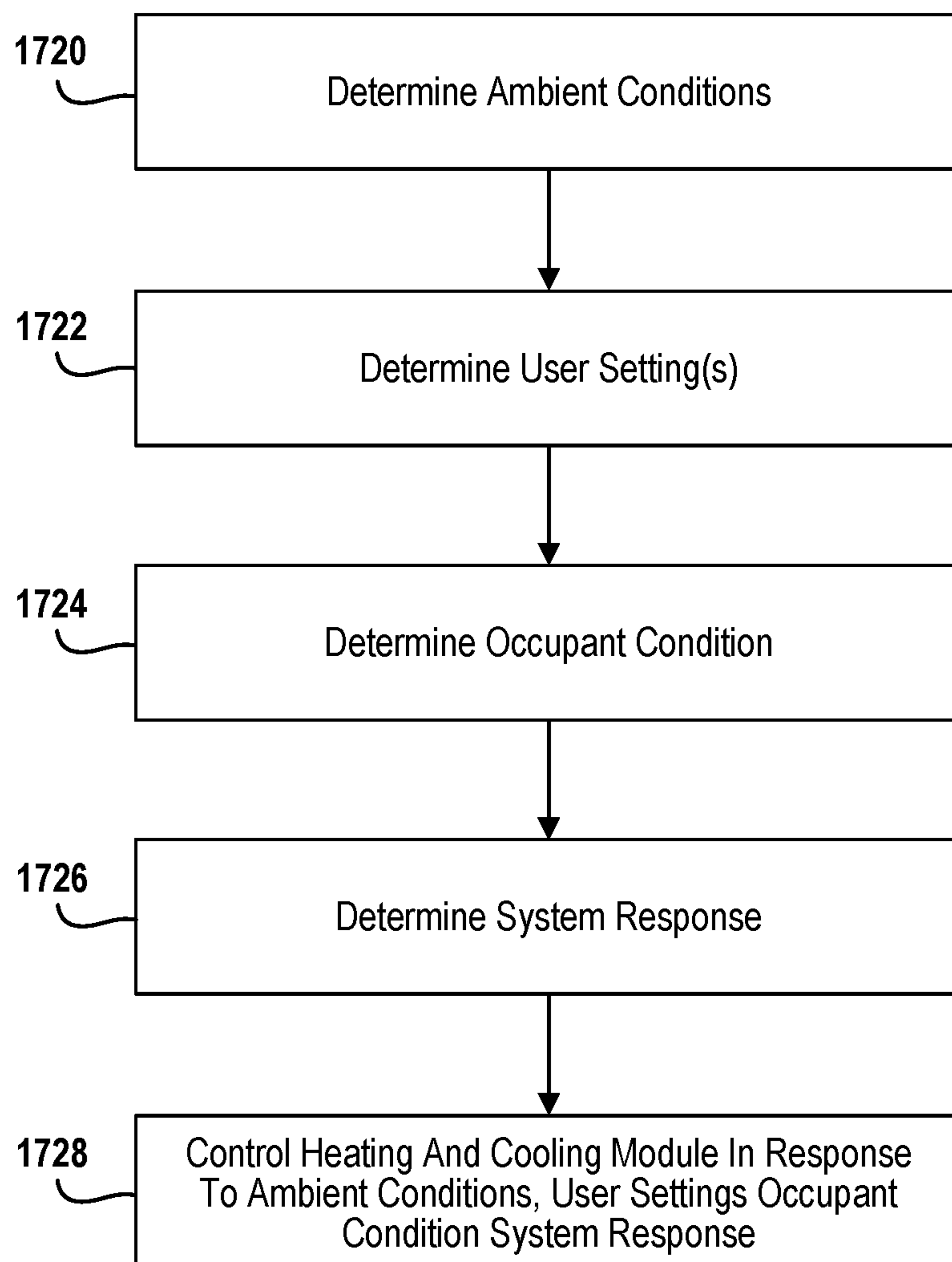
**FIG. 16F**



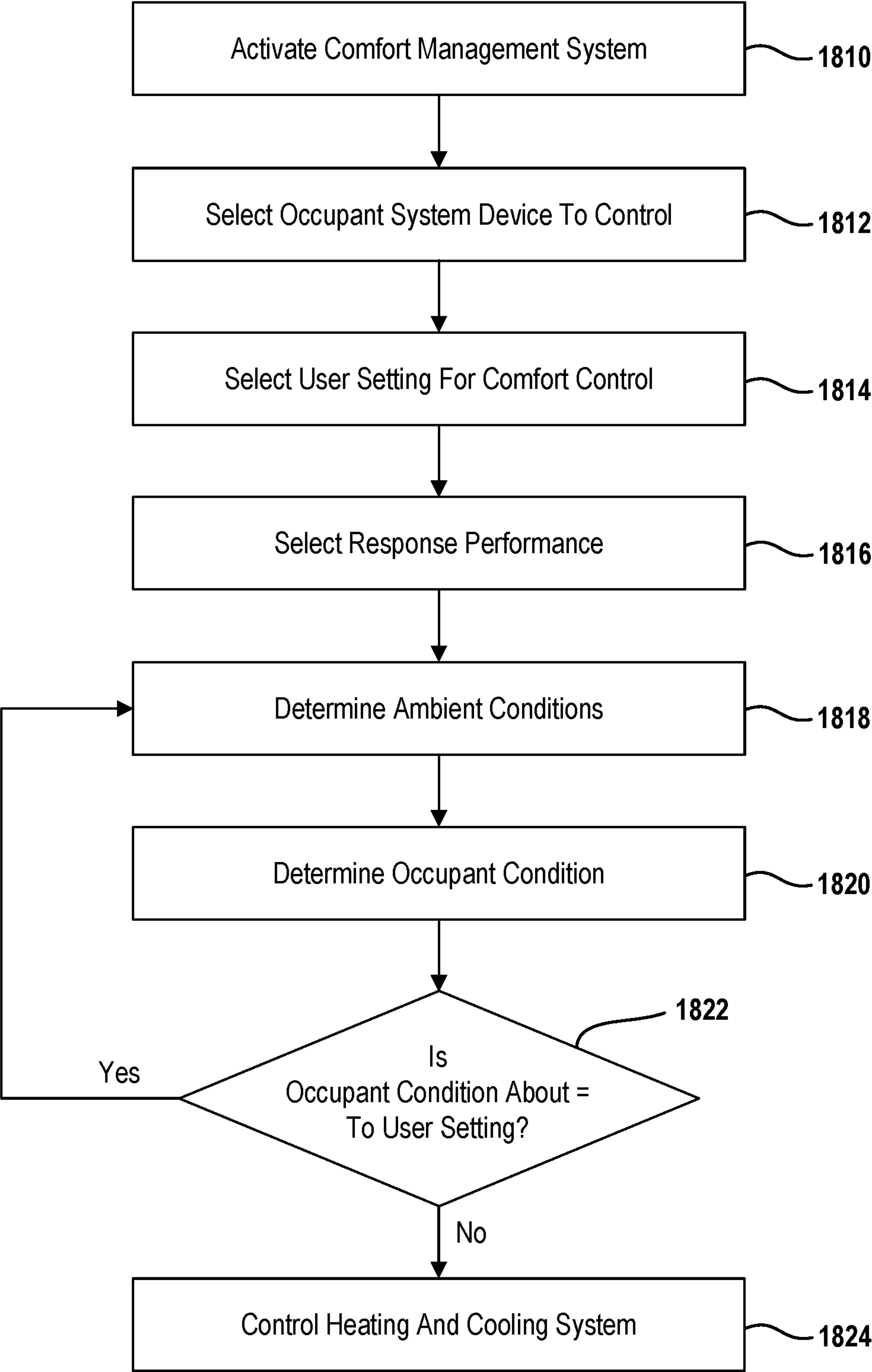
**FIG. 16I**



**FIG. 16H**



**FIG. 17**



**FIG. 18**



## RECREATIONAL VEHICLES WITH HEATED COMPONENTS

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application is a continuation of U.S. Application No. 16/734,846 filed Jan. 6, 2020, which claims the benefit of U.S. Serial No. 62/789,269 filed on Jan. 7, 2019. This application is related to U.S. Application 16/735,077 filed on Jan. 6, 2020 filed on Jan. 6, 2020. The entire disclosures of the above application is incorporated herein by reference.

### FIELD

**[0002]** The present disclosure relates to systems and methods for a vehicle, and in particular to systems and methods for wirelessly transferring power to components on and/or off of the vehicle (e.g., heated handgrips, seats and/or user garments).

### BACKGROUND

**[0003]** Vehicles may be open-air vehicles that do not include a roof and/or outer housing. As the ambient temperature surrounding the vehicle decreases, the user of the vehicle may get colder. As such, to provide additional comfort to the user, heated features may be provided. However, the heated features may include many wired connections and/or additional heated components. For example, a heated garment or article may include battery packs, controllers, and/or other wired components to provide heat to the user. Adding these components to the heated garment may make it more cumbersome for the user to operate the vehicle.

**[0004]** Further, in some examples, off-road and on-road vehicles may include a steering system with one or more steering inputs, such as handlebars and/or handgrips. The handgrips may be heated using wires and/or other circuitry connected to a controller and/or a battery. However, the wires may wear down as a user continuously rotates the handgrips to operate the two-wheeled vehicle. Eventually, the user may need to replace the wires and/or handgrips to prevent malfunction of the heated feature for the handgrips.

**[0005]** Also, to charge a battery of the vehicle, a user may need to physically plug the vehicle into a charging source via a wired connection. This may provide an additional hassle to the user, especially if the vehicle is not driven daily. Additionally, providing a wired connection requires multiple different charging components and/or steps to charge the vehicle. Accordingly, there exists a need for one or more improved methods or systems in order to address one or more of the above-noted drawbacks.

### SUMMARY

**[0006]** In an exemplary example of the present disclosure, a method for providing current to energy transfer devices is provided. For example, a controller receives user input indicating a temperature setting, determines, based on the temperature setting, an amount of current to provide to a first energy transfer device, wherein the first energy transfer device is operatively coupled to a frame of a recreational vehicle, and provides, based on the determined amount of current and by the controller, a current to the first energy

transfer device. The first energy transfer device is configured to wirelessly provide power to a second energy transfer device, and the second energy transfer device is configured to provide the power to a load.

**[0007]** In some instances, the first energy transfer device is a first inductive coil. The second energy transfer device is a second inductive coil. The first inductive coil is configured to wirelessly provide the power to the second inductive coil based on inducing a second current. In some examples, the recreational vehicle comprises a steering assembly having a handgrip. The first inductive coil and the second inductive coil are located on an interior portion of the handgrip. In some variations, the load is an article worn by the user. The load comprises a climate control element corresponding to the article. The second inductive coil is operatively coupled to the article and configured to provide the second current to the heating element to control a climate of the article.

**[0008]** In some instances, the first energy transfer device is a first conductive material and the second energy transfer device is a second conductive material. The first conductive material provides a conductive current to the second conductive material based on a physical contact between the first conductive material and the second conductive material. In some examples, the load is an article worn by the user and the load comprises a heating element corresponding to the article. The second conductive material is operatively coupled to the article and configured to provide the current to the climate control element to control a climate of the article.

**[0009]** In some variations, the second energy transfer device is operatively coupled to a contact point between the recreational vehicle and an operator. In some instances, the controller receives, from at least one sensor, sensor information. The controller determines the amount of current to provide to the first energy transfer device is based on the sensor information. In some examples, the at least one sensor comprises a vehicle speed sensor, and the sensor information comprises information indicating a vehicle speed. In some variations, the at least one sensor comprises a battery voltage sensor, and the sensor information comprises information indicating a battery voltage. In some instances, the at least one sensor comprises an ambient temperature sensor, and the sensor information comprises information indicating an ambient temperature.

**[0010]** In some examples, the load comprises a body temperature sensor, the at least one sensor comprises radio frequency receiver, and the sensor information comprises information indicating a body temperature of a user. In some variations, the controller increases the amount of current to provide the first energy transfer device in response to the body temperature of the user being less than a temperature corresponding to the temperature setting. In some instances, the controller decreases the amount of current to provide the first energy transfer device in response to the body temperature of the user being greater than a temperature corresponding to the temperature setting.

**[0011]** In another exemplary example of the present disclosure, a recreational vehicle is provided. The recreational vehicle includes a frame, front and rear ground-engaging members supporting the frame, a powertrain drivably coupled to one of the front and rear ground-engaging members, a steering assembly coupled to the front ground-engaging member for steering the vehicle, the steering assembly



comprising a steering portion having a user grip or steering wheel, wherein the steering portion comprises a first inductive coil, and wherein the user grip or steering wheel comprises climate control circuitry comprising a second inductive coil, and at least one programmable controller operatively coupled to the first inductive coil and configured to control a temperature of the user grip or steering wheel by providing a current to the first inductive coil. The first inductive coil wirelessly transfers the current to the second inductive coil and the second inductive coil causes the temperature of the user grip or steering wheel to change.

**[0012]** In some instances, the vehicle further comprises a user input device operatively coupled to the frame and configured to provide user input indicating a temperature setting to the at least one programmable controller. The at least one programmable controller is configured to control the temperature of the user grip or steering wheel based on the user input indicating the temperature setting. In some examples, the user input device is at least one of: an analog temperature selector, a touch screen, and a digital input device. In some variations, the vehicle further comprises at least one sensor operatively coupled to the frame and configured to provide sensor information to the at least one programmable controller. The at least one programmable controller is configured to control the temperature of the user grip based on the sensor information.

**[0013]** In some instances, the first inductive coil wirelessly transfers the current to the second inductive coil based on a separation between the first inductive coil and the second inductive coil. In some examples, the first inductive coil is positioned radially around a first axis, the second inductive coil is positioned radially around the first axis, and the separation is a distance along the first axis. In some variations, the vehicle further comprises a battery operatively coupled to the frame, and a high frequency inverter electrically coupled to the battery. The high frequency inverter is configured to convert a direct current (DC) from the battery to an alternating current (AC), and the current to the first inductive coil is the alternating current from the high frequency inverter.

**[0014]** In another exemplary example of the present disclosure, a vehicle control system is provided. The vehicle control system includes a vehicle and an article worn by a user. The vehicle includes a frame, front and rear ground-engaging members supporting the frame, a powertrain drivably coupled to one of the front and rear ground-engaging members, a battery operatively coupled to the frame, a first energy transfer device supported by the frame, and at least one programmable controller electrically coupled to the battery and the first energy transfer device configured to provide a current to the first energy transfer device. The article worn by the user comprises heating circuitry comprising a second energy transfer device configured to receive the current from the first energy transfer device and heating elements operatively coupled to the second energy transfer device and configured to control a temperature of the article worn by the user using the current from the second energy transfer device.

**[0015]** In some instances, the vehicle further comprises a user input device operatively coupled to the frame and configured to provide user input indicating a temperature setting to the at least one programmable controller. The at least one programmable controller is configured to provide the current to the first energy transfer device based on the user

input indicating the temperature setting. In some examples, the vehicle further comprises at least one sensor operatively coupled to the frame and configured to provide sensor information to the at least one programmable controller. The at least one programmable controller is configured to provide the current to the first energy transfer device based on the sensor information.

**[0016]** In some instances, the vehicle further comprises a steering assembly coupled to the front ground-engaging member for steering the vehicle and the steering assembly comprising a steering portion having a user grip. The user grip comprises the first energy transfer device and the article worn by the user is a glove. In some examples, the first energy transfer device is a first conductive material, and the second energy transfer device is a second conductive material. In some variations, the vehicle further includes a floorboard operatively coupled to the frame. The floorboard is operatively coupled to the first energy transfer device, and the article worn by the user is a boot. In some instances, the first energy transfer device is a first inductive coil, and the second energy transfer device is a second inductive coil.

**[0017]** In another exemplary example of the present disclosure, a vehicle charging system is provided. The vehicle control system includes a vehicle and a charging device. The vehicle includes a frame, front and rear ground-engaging members supporting the frame, a powertrain drivably coupled to one of the front and rear ground-engaging members, and a battery operatively coupled to the frame. The charging device comprises an outlet component operatively coupled to an electrical outlet and configured to provide a current and a second energy transfer device operatively coupled to the outlet component and configured to receive the current from the outlet component. The second energy transfer device transfers the current to the first energy transfer device, and the first energy transfer device is configured to provide the current to the battery to charge the battery.

**[0018]** In one aspect of the disclosure, a seat assembly for a vehicle having a longitudinal axis has a seat pan, a cover support adjacent to the seat pan and a seat cover comprising an upper surface and a first longitudinally extending side surface and a second longitudinally extending side surface. A heating and cooling module is disposed at least partially within the cover support. An air inlet is in communication with the heating and cooling module. The air inlet communicates air from a port in the seat cover to the heating and cooling module. An ambient condition sensor generates an ambient condition signal. A user interface generates a user setting corresponding to a comfort condition. A controller is coupled to the ambient condition sensor and the heating and cooling module. The controller controls the heating and cooling module in response to the user setting and the ambient condition signal.

**[0019]** In a further aspect of the disclosure, method of controlling a seat includes generating ambient condition signal from an ambient condition sensor, generating an occupant condition signal from an occupant condition sensor, generating a user setting corresponding to a comfort condition at a user interface, and controlling a heating and cooling module in response to the user setting and the ambient condition signal.

**[0020]** In some instances, the charging device is a charging mat or a docking station. In some examples, the first energy transfer device is a first inductive coil and the second energy transfer device is a second inductive coil. In some



variations, the first energy transfer device is first conductive material and the second energy transfer device is a second conductive material.

[0021] Additional features of the present disclosure will become apparent to those skilled in the art upon consideration of the following detailed description of illustrative examples exemplifying the best mode of carrying out the invention as presently perceived.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The foregoing aspects and many additional features of the present system and method will become more readily appreciated and become better understood by reference to the following detailed description when taken in conjunction with the accompanying drawings, where:

[0023] FIG. 1 is a rear, right perspective view of a vehicle of the present disclosure;

[0024] FIG. 2 shows a block diagram of a vehicle control system with inductive coils;

[0025] FIG. 3 shows a block diagram of a vehicle control system with conductive materials;

[0026] FIG. 4 shows another block diagram of a vehicle control system with inductive coils;

[0027] FIG. 5 shows another block diagram of a vehicle control system with conductive materials;

[0028] FIG. 6 shows a flowchart describing the operation of a controller to control a temperature of a load;

[0029] FIG. 7 is a rear perspective view of a steering input that is controlled by the controller of FIG. 6;

[0030] FIG. 8 is an exploded view of the steering input of FIG. 7;

[0031] FIG. 9 is a front perspective view of the steering input of FIG. 7;

[0032] FIG. 10 is a cross-sectional view of the steering input of FIG. 7;

[0033] FIG. 11 is another perspective view of the steering input;

[0034] FIG. 12A shows an example of an article worn by the user and for use with the steering input of FIG. 11;

[0035] FIG. 12B shows another example of the articles worn by the user and or use with the vehicle of FIG. 1;

[0036] FIG. 12C shows an example of one or more induction coils and an article worn by a user;

[0037] FIG. 13A shows an example of recharging an energy source of the vehicle control system; and

[0038] FIG. 13B shows another example of recharging an energy source of the vehicle control system.

[0039] FIG. 14 is a comfort management system for controlling a device.

[0040] FIG. 15 is a block diagram of an occupant sensor.

[0041] FIGS. 16A-16I are screen displays of various screens in the control of the comfort management system.

[0042] FIG. 17 is a simplified flowchart of a method for operating a comfort control system.

[0043] FIG. 18 is a detailed flowchart of the method for operating the comfort control system.

#### DETAILED DESCRIPTION

[0044] For the purposes of promoting an understanding of the principles of the present disclosure, reference will now be made to the examples illustrated in the drawings, which are described below. The examples disclosed below are not intended to be exhaustive or limited to the precise form dis-

closed in the following detailed description. Rather, the examples are chosen and described so that others skilled in the art may utilize their teachings.

[0045] Although a heating of a heating element is described, a cooling element or ventilation element may transfer energy to change the environment of a device whether it be heating, cooling, or ventilation.

[0046] FIG. 1 shows one type of a recreational vehicle 100, such as a two-wheeled vehicle. However, in examples, the vehicle 100 may be any vehicle, such as a two-wheel vehicle, a three-wheel vehicle, a four-wheel vehicle, and/or other types of recreational vehicles that may used on roads, trails, and/or both. Some examples of the recreational vehicle 100 include, but are not limited to, motorcycles, all-terrain vehicles (ATVs), side-by-side recreational vehicles, snowmobiles, and utility vehicles.

[0047] Additional details regarding the examples of the recreational vehicle 100 are provided in U.S. Pat. No. 8,827,019 (filed Dec. 18, 2013, titled SIDE-BY-SIDE VEHICLE), U.S. Pat. No. 9,211,924 (filed Mar. 25, 2014, titled SIDE-BY-SIDE VEHICLE), U.S. Pat. No. 8,544,587 (filed Mar. 21, 2012, titled THREE-WHEELED VEHICLE), U.S. Application No. 15/387,504 (filed Dec. 21, 2016, titled TWO-WHEELED VEHICLE), U.S. Pat. No. 9,738,134 (filed Jun. 23, 2016, titled UTILITY VEHICLE), and U.S. Pat. No. 9,809,195 (filed Nov. 22, 2013, titled SNOWMOBILE), all assigned to the present assignee, the entire disclosures of which are expressly incorporated by reference herein.

[0048] As shown in FIG. 1, the recreational vehicle 100 includes a plurality of ground engaging members 102. Illustrative ground engaging members 102 include wheels, treads, skis, and other suitable devices which support the vehicle 100 relative to the ground. The recreational vehicle 100 further includes a frame 104 supported by the plurality of ground engaging members 102.

[0049] The front and/or rear wheels 102 are coupled to a powertrain assembly 114, to propel the vehicle 100 during operation thereof. Powertrain assembly 114 includes both an engine and a transmission. The transmission is coupled to the engine and provides power to the front and/or rear wheels 102.

[0050] A seat 106 is operatively supported by the frame 104. The illustrative seats 106 include straddle seats, bench seats, bucket seats, and other suitable support members. In addition to the seat 106, the recreational vehicle 100 may further include a passenger seat. Illustrative passenger seats include straddle seats, bench seats, bucket seats, and other suitable support members. In some instances, the passenger seat is positioned directly rearward of the user seat. One or more floorboards 112 are supported by the frame 104. The vehicle floorboards 112 are adapted to support a lower portion of the user when the user is operating the vehicle 100. For example, when a user is sitting on the seat 106, the user may place their shoes, boots, and/or other accessories on the floorboards 112.

[0051] The recreational vehicle 100 further includes a steering system 138. The steering system 138 is coupled to at least one of the ground engagement members 102 and generally includes a user input or steering member 108 adapted to be grasped by a user of the vehicle 100. The illustrative steering members 108 include handlebars and/or steering wheels. Additionally, and/or alternatively, the steering member 108 includes one or more user grips 110.



An illustrative user grip **110** is a handgrip (e.g., a motorcycle handgrip).

[0052] FIGS. 2-5 show illustrative block diagrams of a vehicle control system **200**, such as a vehicle control system **200** and/or a vehicle energy source charging system. Referring to FIGS. 2 and 3, the vehicle **100** includes components, sub-systems, and/or devices of the vehicle control system **200**. For example, the vehicle control system **200** and/or the vehicle **100** includes an energy source **202**, a user interface **204**, one or more sensor **206**, a controller (e.g., an accessory controller) **207**, a network controller **226**, a high frequency inverter **208**, a current limiting circuitry **210**, a processor **212**, a memory **214**, a first energy transfer device (e.g., a first inductive coil **216** as shown in FIG. 2 and/or a first conductive material **222** as shown in FIG. 3), a second energy transfer device (e.g., a second inductive coil **218** as shown in FIG. 2 and/or a second conductive material **224** as shown in FIG. 3), and/or a load **220**. The load **220** may be a heating, cooling, or ventilation device.

[0053] Referring to FIGS. 4 and 5 and in some examples, the vehicle **100** does not include some components, sub-systems, and/or devices of the vehicle control system **200**, such as the second energy transfer device (e.g., a second inductive coil **218** as shown in FIG. 4 and/or a second conductive material **224** as shown in FIG. 5) and/or the load **220**, and rather, those components or systems are external to vehicle **100**. In some examples and as will be described below, the second inductive coil **218**, the second conductive material **224**, and/or the load **220** are included within a second component and/or system external to the vehicle **100**, such as an article worn by a user (e.g., jackets, shirts, coats, pants, shoes, boots, helmets, gloves, shorts, and/or other types of wearable objects / clothing / garments) and/or a charging sub-system or device (e.g., a charging mat, a charging puck, stand, and/or other types of charging devices).

[0054] Referring to FIGS. 2 and 4, the current limiting device **210** is optional. When present, the current limiting device **210** assists the high frequency inverter **208** in limiting the current, voltage, and/or power from the energy source **202** to the first inductive coil **216**. Referring to FIGS. 3 and 5, the high frequency inverter **208** is optional. When present, the high frequency inverter **208** assists the current limiting device **210** in limiting the current, voltage, and/or power from the energy source **202** to the first conductive material **222**. The high frequency inverter **208** and the current limiting device **210** will be described in further detail below.

[0055] Referring to FIGS. 2-5, the vehicle control system **200** includes at least one energy source (e.g., batteries, starters, regulators, ferrous cores, and/or other types of energy sources) **202**. The energy source **202** provides power (e.g., 12 or 14 Volts) to one or more components, devices, and/or sub-systems of the vehicle control system **200**. In some examples, the energy source **202** provides power to one or more energy transfer devices (e.g., energy transfer circuitry), such as the first inductive coil **216**, the second inductive coil **218**, the first conductive material **222**, and/or the second conductive material **224**. Additionally, and/or alternatively, the energy source **202** of the vehicle **100** provides power to a second component and/or system, such as the load **220** in an article worn by a user.

[0056] The user input device **204** includes one or more digital input devices (e.g., switches on the steering members **108** and/or voice command devices), physical switches,

push buttons, levers, knobs, hard keys, soft keys, temperature selectors (e.g., analog or digital), user interfaces (e.g., displays and/or touch screens), and/or other types of devices capable of receiving user input from a user. Additionally, and/or alternatively, the user input device **204** is a voice command device, such as a headset and/or a microphone array. For example, the user may provide voice commands using the headset and/or microphone array. The headset and/or microphone array provides the voice commands (e.g., one or more temperature settings) to the processor **212**.

[0057] The network controller **226** controls communications between recreational vehicle **100** and other devices using one or more network components. In some instances, network controller **226** of recreational vehicle **100** communicates with paired devices over a wireless network (e.g., via a wireless or WiFi chip). An illustrative wireless network is a radio frequency network utilizing a BLUETOOTH protocol. In this example, the network controller **226** is operatively coupled to and/or includes a radio frequency antenna. Network controller **226** controls the pairing of devices, other recreational vehicles, and/or servers to recreational vehicle **100** and the communications between recreational vehicle **100** and the remote devices or other recreational vehicles. Further, the network controller **226** communicates with the controller **207**, such as receiving information from the processor **212** and/or providing information to the processor **212**.

[0058] The vehicle control system **200** is configured to transfer energy between on-board vehicle components and/or between on-board components and external components. For example, in one example, the vehicle control system **200** is configured to provide energy transfer in the form of heat energy to various vehicle components to increase the comfort of the rider, especially when the rider or user is operating the vehicle **100** in colder weather and due to the open-air nature of vehicle **100**. More particularly, the vehicle control system **200** may be configured to provide heat energy to the handgrips **110**, the articles / garments worn by the user, and any other component on the vehicle **100** that is in contact with and/or in proximity of the user. In addition to heat transfer, the vehicle control system **200** is configured to provide alternative energy transfer to vehicle components using external sources. For example, in such instances, the vehicle control system **200** may be configured to wirelessly charge vehicle components through energy transfer between an external charging stand, station, mat, puck, or other similar device and a vehicle component, such as the energy source **202**. Additional disclosure of these functions of the vehicle control system **200** is disclosed herein.

#### Vehicle Control System Configured for Heating

[0059] Using the vehicle system **200** and/or the method **300** described below in FIG. 6 to heat various components may be useful for “twist throttle” instances (e.g., twisting of the user grips **110**). For example, by using the inductive coils **216** and **218**, wire fatigue issues may be reduced and/or eliminated. This may also remove corrosion concerns since the components may be formed of thermoplastic elastomers (TPE) or another soft rubber-based material. In other words, by using inductive coils in the handgrips, there may be little or no component fatigue, corrosion issues, and/or connections for a customer to install.



[0060] Further, by using inductive and/or conductive power transfer to heat articles worn by the user, the articles may be heated beyond the surface of the article and/or provide better heating to the user. The articles do not need an onboard power source, such as batteries and/or a controller that can add weight, bulk, or a cord to power the article. In other words and as will be described below in FIGS. 11-13, by using the vehicle energy source 202, the garments of the user can be heated such that many heating components from the garments may be removed.

[0061] Referring to using the vehicle control system 200 to heat various components, the user input device 204 may be configured to control a temperature of one or more components and/or systems in the vehicle control system 200. For example, in examples of FIGS. 1-5, the user input device 204 may be provided on a portion of the steering members 108 and/or the handgrips 110 such that any inputs (e.g., switches, buttons, levers, etc.) are configured to receive a user input. In some instances, the physical switches of user input device 204 may cause a temperature increase or decrease of the vehicle handgrips 110. Additionally, and/or alternatively, the physical switches may cause a temperature increase or decrease of the article worn by the user. In some examples, the user input device 204 includes a touch screen display and the controller 207 interprets various types of touches to the touch screen display as inputs and controls the content displayed on touch screen display. This will be described in further detail below.

[0062] The sensor(s) 206 includes one or more sensors and/or devices that detect, determine, monitor and/or provide sensor information indicating various parameters of the vehicle 100 or the environment surrounding the vehicle 100. The types of sensors and/or operations of sensors will be described below.

[0063] The controller 207 (e.g., an accessory controller and/or a controller for the steering assembly 138) includes one or more processors (e.g., processor 212), the memory (e.g., memory 214), the high frequency inverters 208, and/or the current limiting device 210. The controller 207 may be a single device or a distributed device, and the functions of the controller 207 (e.g., processor 212) may be performed by hardware and/or as computer instructions on a non-transient computer readable storage medium, such as the memory 214. In some instances, the controller 207 forms a portion of a processing subsystem including one or more computing devices having memory, processing, and communication hardware. The controller 207 may alternatively include one or more application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), digital signal processors (DSPs), hardwired logic, or combinations thereof.

[0064] The memory 214, is computer-readable medium in the form of volatile and/or nonvolatile memory and is removable, nonremovable, a combination, and/or non-transitory. Computer-readable medium examples include Random Access Memory (RAM), Read Only Memory (ROM), Electronically Erasable Programmable Read Only Memory (EEPROM), flash memory, optical or holographic media, magnetic storage devices, and/or any other medium that can be used to store information and can be accessed by an electronic device, such as the processor 212. Additionally, and/or alternatively, the memory 214 is representative of multiple memories.

[0065] Referring to FIGS. 2-5, when present, the high frequency inverter(s) 208 is any type of circuitry that converts between DC current and alternating current (AC). For example, the energy source 202 provides DC current to the controller 207. A first energy transfer device (e.g., the first inductive coil 216 and/or the first conductive material 222) may use AC current to transfer energy to a second energy transfer device (e.g., the second inductive coil 218 and/or the second conductive material 224). The high frequency inverter 208 converts the DC current from the energy source 202 to the AC current and provides the AC current to the current limiting circuitry 210 and/or the first energy transfer device.

[0066] When present, the current limiting device 210 includes one or more devices and/or circuitry that limits the current provided to the energy transfer devices. For example, the current limiting device 210 is any type of circuitry and/or device that limits the current, power, and/or voltage. The current limiting device 210 is operatively coupled to the processor 212. The processor 212 provides signals, instructions, and/or other indications to the current limiting device 210 to limit the current output to the first and second energy transfer devices.

[0067] In some variations, the current limiting device 210 is included within the high frequency inverter 208. For instance, referring to FIGS. 2 and 4, the high frequency inverter 208 converts the DC current to the AC current and limits the current and/or voltage based on instructions from the processor 212. After converting and/or limiting the current, the high frequency inverter 208 provides the current to the first energy transfer device, such as the first inductive coil 216.

[0068] In some examples and as mentioned above, the high frequency inverter 208 is optional. For example, referring to FIGS. 3 and 5, when present, the high frequency inverter 208 converts the DC current to the AC current and provides the current to the current limiting device 210. When absent, the energy source 202 provides the DC current to the current limiting device 210. Based on instructions from the processor 212, the current limiting device 210 limits the current and/or voltage and provides the output to the first energy transfer device, such as the first conductive material 222. In some instances, the current limiting device 210 is a buck converter (e.g., a DC to DC converter) and/or a slip ring.

[0069] The controller 207 is operatively coupled to, communicates with, and/or controls the devices, components, and/or sub-systems of the vehicle 100. For example, the controller 207 communicates with the energy source 202, the user input device 204, and/or the sensors 206. In some instances, the controller 207 receives a current from the energy source 202. The current may be a DC current. The high frequency inverter 208 converts the DC current to AC current and provides the AC current to the current limiting device 210.

[0070] In some examples, the controller 207 (e.g., processor 212) receives user input from the user input device 204. In some variations, the controller 207 (e.g., processor 212) receives sensor information from the sensors 206. In some instances, based on the sensor information and/or the user input, the controller 207 (e.g., processor 212) provides and/or limits the current to one or more energy transfer devices. For example, the processor 212 provides a signal to the current limiting device 210 to provide and/or limit the current



to the energy transfer devices. In other words, to provide power to the heated handgrips and/or articles worn by the user, the processor **212** may control, monitor, and/or manage the operation of the transfer of energy between the vehicle **100** and the components of the vehicle **100** (e.g., the handgrips **110**) and/or between the vehicle **100** and the components exterior to the vehicle **100** (e.g., the articles worn by the user).

[0071] In some variations, the controller **207** is an accessory controller that controls operations for the vehicle **100**. In other variations, the controller **207** is a controller for the steering assembly **138**, such as a switch cube controller. For example, the controller **207** includes one or more controllers within the steering assembly **138**, such as one or more controller within the steering member **108**. The controllers may receive information (e.g., user input and/or sensor information), and provide power to control a temperature of a load **220**, such as the user grips **110**). The operation of the controller **207** and/or processor **212** will be described in further detail below.

[0072] The illustrative vehicle control system **200** and/or the vehicle **100** is not intended to suggest any limitation as to the scope of use or functionality of examples of the present disclosure. Neither should the illustrative vehicle control system **200** and/or the vehicle **100** be interpreted as having any dependency or requirement related to any single component and/or system or combination of components and/or systems illustrated therein. Additionally, various components and/or systems depicted in FIGS. 1-5, in examples, may be integrated with various ones of the other components and/or systems depicted therein (and/or components and/or systems not illustrated). The functionalities of the vehicle control system **200** and/or the vehicle **100** will be described below.

[0073] The energy transfer devices, such as the first inductive coil **216**, the second inductive coil **218**, the first conductive material **222**, and the second conductive material **224**, are any type of devices that transfer energy wirelessly (e.g., without a wired connection). For example, the energy transfer devices may transfer energy from the vehicle **100** (e.g., from the energy source **202**) to one or more components and/or systems in the vehicle **100**, such as the heated handgrips **110**, and/or one or more components and/or systems exterior to the vehicle **100**, such as articles worn by the user. Additionally, and/or alternatively, the energy transfer devices may be used to charge the energy source **202**. In other words, a plug and/or outlet may be used to provide power (e.g., current and/or voltage) to an energy transfer device. The energy transfer device provides the current to another energy transfer device in the vehicle **100**, which then provides the current to the energy source **202**.

[0074] For example, the first inductive coil **216** uses inductance (e.g., inductive power transfer) to transfer energy (e.g., current) to the second inductive coil **218**. For example, providing a current to the first inductive coil **216** causes the first inductive coil **216** to create a magnetic field. By bringing the second inductive coil **218** in close enough proximity to the first inductive coil **216** (e.g., the created magnetic field), the magnetic field induces the second inductive coil **218** to provide a current to the load **220**. In other words, by providing a current from the controller **207** to the first inductive coil **216**, the first inductive coil **216** induces a current on the second inductive coil **218**. The second inductive coil **218** provides the current to the load **220**. In some instances,

using induction, the first inductive coil **216** does not need to physically touch the second inductive coil **218** transfer energy to the second inductive coil **218** (e.g., the coils **216**, **218** are separated by a certain distance). In some examples, the first inductive coil **216** and/or the second inductive coil **218** may include one or more coils. In other words, the first and second inductive coils **216** and **218** may include multiple inductive coils (e.g., three coils) used to supply power to the load **220** and/or recharge the energy source **202**. The controller **207** may provide the current and/or voltage to the one or more first inductive coils **216** and the second inductive coils **218**.

[0075] Further, the first conductive material **222** uses conductance (e.g., conductive power transfer) to transfer energy to the second conductive material **224**. The first conductive material **222** is a power transmitter that delivers power to the second conductive material **224** (e.g., a receiver). For example, after the first conductive material **222** makes a physical connection to the second conductive material **224**, the first conductive material **222** transfers a current from the energy source **202** to the second conductive material **224**. The second conductive material **224** provides the current to the load **220**. The first and second conductive material **222**, **224** is any type of conductive material including, but not limited to copper wires, aluminum, steel, gold, ferrous cores, and/or other types of wires.

[0076] In some examples, the first energy transfer device (e.g., the first inductive coil **216** and/or the first conductive material **222**) is operatively coupled to the frame **104** of the vehicle **100**. For example, the first energy transfer device may be located anywhere on the vehicle **100** including, but not limited to, the vehicle steering member **108**, the vehicle user grips **110**, the seat **106**, the floorboards **112**, a backrest of vehicle **100**, and/or a vehicle side-stand.

[0077] In some variations, the second energy transfer device (e.g., the second inductive coil **218** and/or the second conductive material **224**) is operatively coupled to the frame **104** and/or the load **220**. For example, the second energy transfer device may be located anywhere on the vehicle **100** (e.g., the vehicle handgrips **110**) and/or the load **220**. Additionally, and/or alternatively, the second energy transfer device may be located at and/or operatively coupled to a contact point between the user and the vehicle **100**, such as, but not limited to, the vehicle steering member **108**, the vehicle user grips **110**, the seat **106**, the floorboards **112**, a backrest of vehicle **100**, and/or a vehicle side-stand.

[0078] The load **220** receives current from the second inductive coil **218** and/or the second conductive material **224**. The load **220** includes heating circuitry and/or elements that increase the temperature of the load using the current from the second energy transfer device. In some instances, the load **220** includes one or more components, devices, wires, and/or sub-systems that converts the electricity (e.g., the current) to heat. For example, the load **220** is an article worn by a user (shown on FIGS. 4 and 5) and/or one or more vehicle handgrips, such as handgrips **110** (shown on FIGS. 2 and 3). The load **220** converts the current to heat up the article and/or handgrips **110**. In some examples, the load **220** includes non-heating circuitry and/or components. For instance, the load **220** is a USB, a light (e.g., a light operatively coupled to an article), and/or a vented helmet. The processor **212** may provide the current and/or the voltage to the first and second energy transfer devices to power up the non-heating circuitry and/or components.



[0079] FIG. 6 shows an example flowchart describing a method 300 for the controller 207 (e.g., the processor 212) to control a temperature of the load 220. In operation, at step 302, the processor 212 receives user input from the user input device 204. In some examples, the user input device 204 is an analog temperature selector, such as one or more physical switches and/or buttons. For example, a user may use the user input device 204 to set a heat setting for the load 220. In response to a user pressing and/or actuating a button, lever, and/or switch, the user input device 204 provides the user input indicating the actuation to the processor 212. The processor 212 receives the user input from the input device 204 and then changes the current output based on the user input. For example, the user input device 204 may control a temperature of the load 220. In some instances, there may be multiple different temperature settings (e.g., 0, 1, 2, ... etc.). For example, 0 may indicate to apply no heat to the load 220, 1 may indicate a low heat setting, 2 may indicate a middle heat setting, and 3 may indicate a high heat setting. By actuating and/or pressing the user input device 204 (e.g., pressing a button), the processor 212 changes from a first temperature setting (e.g., a low heat setting) to a second temperature setting (e.g., a high heat setting).

[0080] In some variations, the user input device 204 is a digital temperature selector, such as a touch screen, user interface, and/or display device. For example, the user input device 204 may cause display of an image and/or prompt indicating the current heat setting (e.g., current heated grip level). The user may use the user input device 204 to set a new heat setting (e.g., new heated grip level). The user input device 204 obtains the new heat setting, and provides the new heat setting to the processor 212. In some examples, there may be multiple different heat settings that the user can select.

[0081] At step 304, the processor 212 receives sensor information from one or more sensors, components and/or systems. For example, the processor 212 receives sensor information from multiple different sensors 206, components, and/or systems, including an ambient temperature sensor, a vehicle speed sensor, a battery voltage sensor (e.g., an energy source sensor), and/or one or more body temperature sensors. For example, the vehicle speed sensor provides information indicating a vehicle speed to the processor 212. The vehicle speed sensor is any type of sensor that detects a vehicle speed of the vehicle 100.

[0082] The battery voltage sensor provides information indicating a battery voltage (e.g., a state of charge of the energy source 202) to the processor 212. The battery voltage sensor may be operatively coupled to the energy source 202 and may be any type of sensor that detects the state of charge of the energy source 202. For example, the battery voltage sensor is a battery monitoring sensor that monitors and detects/determines a charge of the energy source 202.

[0083] The ambient temperature sensor provides information to the processor 212 indicating a detected ambient temperature reading. In some examples, the ambient temperature reading is a temperature reading of the environment surrounding the vehicle 100.

[0084] The body temperature sensor provides information to the processor 212 indicating one or more body temperatures of a user. For example, one or more body temperature sensors may be attached to the article worn by the user and/or the body of the user. The body temperature sensor may detect and/or determine a temperature reading of the

attached location (e.g., a body temperature of the user). The body temperature sensor may provide, via a communication method (e.g., wired and/or a radio frequency, such as a WiFi protocol and/or BLUETOOTH), the temperature reading to the processor 212. In some instances, the controller 207 includes a radio frequency receiver. The controller 207 uses the radio frequency receiver to receive the temperature readings and provides the temperature readings to the processor 212. In some instances, the article worn by the user includes multiple body temperature sensors at various locations within the article. For example, the article is clothing, such as a jacket, shirt, pants, and/or gloves. Each article of clothing includes a body temperature sensor that provides a body temperature reading to the processor 212 via the radio frequency receiver.

[0085] At step 306, the processor 212 determines an amount of current to provide to the first energy transfer device (e.g., the first inductive coil 216 and/or the first conductive material 222). For example, based on the user input and/or the sensor information, the processor 212 determines an amount of current to provide to the first energy device. In some examples, the processor 212 determines a voltage and/or an amount of power to provide to the first energy device.

[0086] At step 308, the processor 212 provides the determined amount of current, voltage, and/or power to the first energy transfer device. In other words, the processor 212 provides a signal and/or command to the current limiting device 210 to limit the current, voltage, and/or power from the energy source 202 via the high frequency inverter 208 based on the determined current amount. For example, if the processor 212 determines the current to provide to the first energy transfer device is 2 Amps, the processor 212 provides the signal or command to the current limiting device 210. The current limiting device 210 limits the AC current such that the magnitude of the current is 2 Amps.

[0087] In some variations, after providing the determined current, voltage, and/or power to the first energy transfer device and based on the first energy transfer device being in proximity to the second energy transfer device, the first energy transfer device may transfer the current, voltage, and/or power to the second energy transfer device. For example, as a user wearing an article that includes the second energy transfer device (e.g., the second inductive coil 218 and/or the second conductive material 224) moves within a certain proximity to the first energy transfer device (e.g., a component of the vehicle 100, such as the first coil 216 and/or the first material 222), the first energy transfer device may transfer energy to the second energy transfer device. In other words, if the first and second conductive materials 222 and 224 are in physical contact, then the first conductive material 222 may transfer energy to the second conductive material 224. Additionally, and/or alternatively, if the second coil 218 is within a certain proximity and/or distance from the first coil 216, the first coil 216 may transfer energy to the second coil 218.

[0088] In some instances, based on the user input indicating a heat setting, the processor 212 determines and/or provides an amount of current, voltage, and/or power to the first energy transfer device (e.g., the first inductive coil 216 and/or the first conductive material 222). For example, for a low heat setting, the processor 212 provides 1 to 1.5 Amps. For a high heat setting, the processor 212 provides 2 to 2.6 Amps.

[0089] Additionally, and/or alternately, based on the vehicle speed, the processor 212 determines and/or provides an



amount of current, voltage, and/or power to the first energy transfer device (e.g., the first inductive coil **216** and/or the first conductive material **222**). For example, based on the vehicle speed satisfying one or more thresholds (e.g., over 10 mph, over 20 mph), the processor **212** determines a different amount of current to provide to the first energy transfer device. Additionally, and/or alternatively, the processor **212** uses a function and/or algorithm and the vehicle speed to determine an amount of current to provide the first energy transfer device. In some instances, as the vehicle speed increases, the processor **212** increases the amount of current, which causes the temperature of the load **220** to increase.

[0090] Additionally, and/or alternately, based on the ambient temperature, the processor **212** determines and/or provides an amount of current, voltage, and/or power to the first energy transfer device (e.g., the first inductive coil **216** and/or the first conductive material **222**). For example, based on the ambient temperature satisfying one or more thresholds (e.g., below 50 degrees, below 30 degrees), the processor **212** determines a different amount of current to provide to the first energy transfer device. Additionally, and/or alternatively, the processor **212** uses a function and/or algorithm and the ambient temperature to determine an amount of current to provide the first energy transfer device. In some instances, as the ambient temperature decreases, the processor **212** increases the amount of current causing the temperature of the load **220** to increase.

[0091] Additionally, and/or alternately, based on the battery voltage, the processor **212** determines and/or provides an amount of current, voltage, and/or power to the first energy transfer device (e.g., the first inductive coil **216** and/or the first conductive material **222**). For example, based on the battery voltage satisfying one or more thresholds, the processor **212** determines a different amount of current to provide to the first energy transfer device. For instance, if the battery voltage drops below a threshold, the processor **212** determines and/or reduces the current provided to the first energy transfer device.

[0092] Additionally, and/or alternately, based on the one or more body temperature readings, the processor **212** determines and/or provides an amount of current, voltage, and/or power to the first energy transfer device (e.g., the first inductive coil **216** and/or the first conductive material **222**). For example, the user input may indicate a heat setting, such as a low, medium, or high heat setting. Each heat setting may include a corresponding body temperature. The processor **212** may compare the body temperature readings with the user input heat setting. If the body temperature reading is above the user input heat setting, the processor **212** may reduce the current to the first energy transfer device. If the body temperature reading is below the user input heat setting, the processor **212** may increase the current to the first energy transfer device. If it is equal, the processor **212** may maintain the current to the first energy transfer device.

[0093] In some examples, the article worn by the user includes a maximum temperature limit switch. For example, a maximum temperature limit switch may be included between the load **220** and the second inductive coil **218** and/or the second conductive material **224**. The maximum temperature limit switch may detect and/or monitor a temperature of the load **220** (e.g., the article worn by the user). If the temperature is greater than a maximum temperature limit, the maximum temperature limit switch may open the

circuit to the load **220** (e.g., turn off the heating capabilities of the load **220**).

[0094] FIGS. 7-10 show an illustrative implementation of method **400** and the vehicle control temperature system **200**. In other words, FIGS. 7-10 show the operation of the processor **212** providing a current, voltage, and/or power to the first and second energy transfer devices to power the load **220** (e.g., a vehicle handgrip **110**). For example, FIG. 7 shows the handgrip **110** and the user input device **204** (e.g., an analog temperature selector). As mentioned previously, a user may use the analog temperature selector **204** to change a temperature setting for the load **220**, such as the handgrip **110** and/or the heating elements within the handgrip. FIG. 8 shows an exploded view of the handgrip **110** and the user input device **204** of FIG. 7. For example, FIG. 8 shows the first energy transfer device (e.g., the first inductive coil **216**) and the second energy transfer device (e.g., the second inductive coil **218**).

[0095] FIG. 9 shows the interior of the user input device **204** and the handgrip **110** when assembled. For example, as shown, the first and second inductive coils **216** and **218** are positioned such that there is a separation (e.g., a few millimeters separation) between them. In some examples, the coils **216** and **218** are circular in shape, and both are wound relative to a first axis. FIG. 10 shows a cross-section view of the handgrip **110**. As shown, the two coils **216** and **218** are separated by a certain distance. Further, the second inductive coil **218** is operatively coupled to (e.g., connected) to the load **220**. For example, the load **220** includes one or more wires, heated circuitry, material, heating elements, and/or other components located in the interior of the handgrip **110**.

[0096] The first inductive coil **216** and second inductive coil **218** are operatively coupled to the frame **104** and located at the handgrips **110**. In operation, the first inductive coil **216** receives current from the controller **217**. The first inductive coil **216** provides, using an inductive power and/or current transfer, the received current to the second inductive coil **218**. The second inductive coil **218** provides a current to the load **220** such that the load provides heat to the handgrips **110**.

[0097] FIGS. 11, 12A and 12B show another illustrative implementation of method **400** and the vehicle control temperature system **200**. For example, FIG. 11 shows the first energy transfer device (e.g., the first conductive material **222**) and the handgrip **110**. The first conductive material **222** is located at the handgrip **110** (e.g., on a surface or exterior of the handgrip **110**) and operatively coupled to the frame **104**. FIG. 12A shows the second energy transfer device (e.g., the second conductive material **224**). The second conductive material **224** is located and/or attached to an article worn by the user (e.g., on the outside of the glove). In operation, the user wearing the article (e.g., the second conductive material **224**) may touch, connect, interacts, and/or physically makes contact with the handgrip **110** (e.g., the first conductive material **222**) such that a conductive power transfer occurs. In other words, the current provided by the controller **217** is transferred to the second conductive material **224** (e.g., glove).

[0098] FIG. 12B shows the load **220**. For example, the load **220** includes the glove (e.g., the second conductive material **224**), pants, shoes, and a jacket. The load **220** may also include one or more wires that provides power from the second conductive material **224** throughout the



load **220** (e.g., to the jackets, pants, shoes, and/or gloves). In some examples, the shoes, pants, and/or jacket may include the second conductive material **224**. In such examples, the floorboards **112** and/or other portions of the vehicle **100** may include the first conductive material **222** that provides power to the second conductive material **224**.

[0099] In some instances, the article worn by the user is powered using the first and second inductive coils **216** and **218**. For example, similar to above, the first inductive coil **216** may be located in the handgrips **110** and/or other portions of the vehicle **100**. The second inductive coil **218** may be in an article worn by the user, such as the pants, gloves, jackets, and/or shoes.

[0100] The article may include occupant condition sensors **221** in one or more locations of the article to be worn. Individual control of heating and cooling of various regions around the occupant or within the occupants articles to be worn may be performed. As is described in detail below.

[0101] FIG. 12C shows an example of powering the article worn by the user using the first and second inductive coil(s) **216** and **218**. For example, the one or more first inductive coil(s) **216** may be located in the floorboards **112**. The one or more second inductive coil(s) **218** may be located in an article worn by the user, such as in a boot, shoe, and/or other footwear worn by the user. In operation, the first coils **216** transfer power to the second coils **218** to heat up the load **220** (e.g., the heating elements within the footwear). Additionally, and/or alternatively, the load **220** may include additional heating elements in other articles worn by the user, such as in one or more gloves, pants, and/or jacket worn by the user.

[0102] In some examples, the first inductive coil **216** and the second inductive coil **218** are located in the handgrips **110**. For example, as explained above, the first inductive coil **216** provides a current, voltage, and/or power to the second inductive coil **218** to heat the handgrips. Additionally, and/or alternatively, the second inductive coil **218** provides the current, voltage, and/or power to a first conductive material **222** located at the handgrips **110** (e.g., shown in FIG. 11). When the article (e.g., the second conductive material **224**) physically makes contact with the first conductive material **222**, the current from the first conductive material **222** (provided by the second inductive coil **218** via the first inductive coil **216**) is transferred to the second conductive material **224**. The second conductive material **224** provides the current to the load **220** (e.g., shown in FIG. 12B). In other words, the examples shown in FIG. 7-12B are combined such that a current provided from the energy source **202** is transferred from the heated handgrips to the load **220** (e.g., the jacket, pants, shoes, and/or gloves shown in FIG. 12B).

#### Vehicle Control System Configured for Charging

[0103] FIGS. 13A and 13B show another illustrative implementation the vehicle control system **200**. However, instead of providing power from the energy source **202** to the load **220**, FIGS. 15 and 16 show a method of charging the energy source **202** of the vehicle **100**. In some instances, the battery state degrades between rides. As such, using a wireless charging map may help make charging easier and allow little to no wiring between the charging device and the vehicle to charge the battery between rides.

[0104] Referring to FIGS. 13A and 13B, an AC outlet **230** (e.g., a household outlet or electrical outlet) may be coupled

to a charging device. The charging device may include an outlet component (e.g., plug, socket) that is operatively coupled to the AC outlet. The charging device may also include one or more wires that electrically connect the outlet component to the second inductive coil **218**. The second inductive coil **218** is located outside of the vehicle **100**. For example, the second inductive coil **218** is located within a charging mat (e.g., wireless charging mat), docking stations, charging platform, pad, and/or other materials, devices, or objects that are able to include an inductive coil.

[0105] The first inductive coil **216** is located, operatively coupled to, and/or attached to the vehicle **100**. For example, the first inductive coil **216** is within a side-stand of the vehicle **100**. Additionally, and/or alternatively, the first inductive coil **216** is located on one portion of the vehicle **100** (e.g., at a closest portion of the vehicle **100** to the charging device).

[0106] In operation, the AC outlet **230** may power and/or provide a current to the second inductive coil **218** via the outlet component. The second inductive coil **218** inductively transfers power (e.g., provides a current) to the first inductive coil **216**. Then, referring to FIG. 4, the first inductive coil **216** provides the current to the energy source **202** via the controller **207**. In some examples, the current may bypass the controller **207** and be provided to the energy source **202**.

[0107] In some instances, the energy source **202** may be charged using the first and second conductive materials **222**, **224**. For example, instead of the inductive coils **216** and **218**, the AC outlet **230** may power and provide a current to the second conductive material **224**. The second conductive material **224** may provide the current to the first conductive material **222** and then to the energy source **202**. The second conductive material **224** may be located within a charging mat (e.g., wireless charging mat), docking stations, charging platform, pad, and/or other materials or objects that are able to include a conductive material. The first conductive material **222** may be located at the side-stand and/or another portion of the vehicle **100** (e.g., at a closest portion of the vehicle **100** to the charging device).

[0108] Referring now to FIG. 14, a comfort management system **1400** may be used for controlling a seat or another device in response to a user input and other inputs such as the ambient conditions in and around the vehicle occupant or occupants or the conditions of the occupants themselves. A controller **1410** may be a microprocessor-based controller that is programmed to perform various functions. In this example, the controller **1410** is in communication with an ambient condition sensor **1420** and a device **1430**. An occupant condition sensor **1440** is used to generate an occupant condition signal that has occupant condition data. A user interface **1450** provides a way for a user to provide data for desired settings to be communicated to the controller **1410**. The user interface **1450** may also use the various user interfaces set forth in FIGS. 12 and 13A-13C.

[0109] The user interface may also be implemented with a touch screen display **1470** that is in communication through the controller area network. The touch screen display **1470**, in addition to providing a user interface, may also provide various descriptions and the like for the user. Of course, the display **1470** may be used for other functions such as the radio, navigation, and vehicle conditions.

[0110] The ambient condition sensor **1420** may be one or more sensors that are used by the controller **1410** to control various conditions. In this example, an ambient air tempera-



ture sensor **1422** generates an ambient air temperature sensor signal that has data corresponding to the ambient air temperature at or within the vehicle. The ambient air temperature sensor **1422** may be located near one or more of the occupants. The ambient humidity sensor **1424** generates an ambient humidity signal that has data corresponding to the ambient humidity. The ambient humidity may be determined around the occupant or around the vehicle. An air speed sensor **1426** generates an air speed signal that has data corresponding to the speed of the air in or around the occupant or vehicle. A sunlight sensor **1428** generates a sunlight signal having data corresponding to an amount of direct sunshine directed to the sensor.

[0111] Although one ambient air temperature sensor **1422**, one ambient humidity sensor **1424**, one air speed sensor **1426** and one sunlight sensor **1428** are illustrated, more than one of the sensors may be provided in a system. For example, more than one vehicle location for an occupant is provided in many vehicles. An ambient condition sensor **1420** may thus be provided at or near one or more of the occupants. The ambient condition **1420** may also be located in various locations of the vehicle. For example, an ambient condition sensor may be located around the lower extremities of an occupant (e.g., the foot well) and another ambient condition sensor may be located toward the head or torso of a vehicle occupant.

[0112] The device **1430** may be a seat or another type of device, such as a hand grip, a foot rest, or clothing that the occupant wears as described above.

[0113] The occupant condition sensor **1440** generates a signal corresponding to the conditions or adjacent to the occupant. The occupant condition sensor **1440** may be one or more sensors selected from a temperature sensor **1442**, a humidity sensor **1444**, an air speed sensor **1446**, and a heart rate sensor **1448**. The temperature sensor **1442** generates a temperature signal having data corresponding to the temperature of the location of the occupant condition sensor. The data from the temperature sensor signal may be used by the controller **1410**. The humidity sensor **1444** generates a humidity signal having data corresponding to the humidity at the location of the occupant condition sensor, namely, the position relative to the occupant.

[0114] The air speed sensor **1446** generates an air speed signal having data corresponding to the air speed at the occupant. The air speed allows the controller **1410** to compensate for the chilling effects of wind.

[0115] The heart rate sensor **1448** generates a signal having data corresponding to the heart rate of the occupant. Increased heart rate may cause the controller to provide lower heating, increase cooling or increase venting.

[0116] The occupant condition sensor **1440** may be located in various positions. In a seat, the occupant condition sensor **1440** may be located on or near the seating location. The occupant condition sensor **1440** may also be located in clothing that the occupant is wearing. One or more occupant condition sensors may be provided in an article of clothing. For example, the occupant condition sensor **1440** may be located in an helmet, within a shirt or outerwear, within pants, within sockets or within gloves. Of course, other positions for the occupant condition sensor **1440** may be provided.

[0117] The user interface **1450** may provide one or more ways in which to provide user input to the system. A set **1451** of switches **1452**, **1454** and **1456** may be used to con-

trol various functions. A switch **1452** is used to control the heating. A switch **1454** is used to control the cooling and the switch **1456** is used to control the vent. In this example, the system may control the providing of heat with the switch **1452** and increasing or decreasing the heat. The switch **1454** is used to increase or decrease the amount of cooling. The switch **1456** is used to increase or decrease the vent air. The vent may provide ambient or unconditioned air to the occupant without heating or without cooling.

[0118] A response of the heating or cooling module **1490** may be provided with a switch **1458**. The response of the system refers to how fast the system reacts or changes based on inputs from the ambient condition sensors. That is, the response refers to the amount or how quickly the system provides heating, cooling or venting in response to the sensed condition from the ambient condition sensor **1420** or the occupant condition sensor **1440**. A high response is obtained by selecting the high response button **1460** which provides a quick response from the heating and cooling module **1490**. Selecting the medium response button **1462** provides a slower response than the high response button **1460**. A low response button **1464** provides a lower response than the medium response button **1462**. The difference between the different buttons **1460-1464** may be determined using a timer or the like as will be described below. Thus, a longer delay before the activation of one of the components of the heating and cooling module may be provided.

[0119] A slide dial response selector **1466** is another possible type of switch that may be provided. In this example, the slide dial **1468** may be selected by the vehicle occupant to provide the appropriate level of response. The slide dial **1468** has numerous positions and thus different inputs may be provided to the controller **1410** corresponding to a high position, a low position or anywhere in between. The portion of the user interface **1450** described above may be implemented as hard wire switches that are disposed on the vehicle or on the device itself. The user interface **1450** may also be implemented in a touch screen as will be described below.

[0120] The touch screen **1470** has various inputs including a comfort management button **1472**. The comfort management button **1472** may initiate the activation and feedback for the comfort management system. Of course, other buttons may be provided on the user interface that corresponds to the vehicle conditions at button **1474**, the entertainment system **1476**, the navigation system **1478**, and the mobile device interface **1480**. The buttons **1472-1480** may be implemented as hard switches or as touch screen commands.

[0121] The controller **1410** includes response module **1411** that receives the desired response from the user interface and provides the signal or a time of delay to a comparison module **1412**. A threshold module **1413** provides a threshold used by the comparison module **1412**. The threshold module **1413** may receive a threshold from the user interface **1450** or the touch screen **1470**. Thresholds may, for example, be determined by direct user input. The threshold module **1413** may, for example, be a desired temperature. The threshold **1413** may also take in consideration the humidity in and around the occupant, the ambient humidity, the air speed in and around the vehicle and the air speed in and around the occupant. The threshold **1413** may be adjusted by the response module **1411**. For example, bands around the threshold may be provided that correspond to the desired response, wider bands correspond to lower



responses. The system reacts when the bands are crossed rather than the specific temperature setting, for example, not being met. The bands may be set at percentages, five percent, 10 percent, 15 percent, may correspond to high response, medium response and low response, for example. The comparison module **1412** works in conjunction with a timer **1414** and a clock **1416**. In another way to implement the response, the timer **1414** may time the change in the conditions and not provide a response until after a time period from the change in condition from the comparison module **1412** indicates a change. After the time period that a higher or lower response by the heating and cooling module **1490** is desired. The comparison module **1412** may thus provide a delay which may be increased or decreased by the occupant. The change of the response of the controller **1410** relative to the heating and cooling module **1490** is advantageous in that when very temporary conditions are experienced such as driving into a tunnel, driving in and out of the sun (wooded area) or other temporary cool or hot areas, the system does not overact.

[0122] The controller **1410** may also include a wire connector **1417** and/or a transceiver **1418**. The wire connector **1417** communicates with various user interface or the touch screen display **1470** through a hard wire. A wired connector **1417** may also be used to communicate with the occupant condition sensor **1440**. A transceiver **1418** may be used to wirelessly communicate with the display **1470**, with the user interface **1450**, and with the occupant condition sensor **1440**. The transceiver transmits and receives data signals to and from the controller **1410**.

[0123] The heating and cooling module **1490** may include a heater **1492**, a cooler **1494** or a vent **1496**. The heater **1492** may be implemented in various ways including heating elements used for heating air blowing through a duct. The cooler **1494** may provide cooling air by removing heat from the air within the duct of the system. The vent **1496** provides moving air without heating or cooling the air. The heater **1492** may also be implemented in a resistive wire within the device **1430** that heats. Any of the devices **1492-1496** may be also implemented using conduction provided power.

[0124] Referring now to FIG. 15, the occupant sensor **1440** is illustrated in a housing **1510**. The housing **1510** may be located on the vehicle or within clothing of the occupant. For example, the temperature sensor **1442**, the humidity sensor **1444**, the air speed sensor **1446** and the heart rate sensor **1448** may be located in one housing **1510**. Discrete sensors may also be provided. The housing **1510** may be removably coupled to clothing or to the occupant. For clothing, the sensors may be permanently attached on or within the clothing. A transceiver **1512** may be provided within the housing **1510** to communicate wirelessly to and from the controller **1510**. More specifically, the transceiver **1512** may communicate with the transceiver **1418** illustrated in FIG. 14. Other examples of mounting the occupant sensors may include in a watch, mobile device or wearable device. Articles of clothing such as a glove, shoe, sock, undergarments, outerwear, base layers and the like.

[0125] A wire connector **1514** may also be provided through which a wire may be coupled by wire to the wire connector **1417** illustrated in FIG. 14.

[0126] As mentioned above, one or more housings **1510** having one or more of the occupant condition sensors may be provided. If more than one housing **1510** is provided, not

all of the sensors **1442-1448** may be provided therein. Also, the housing **1510** may only include a single sensor. Either the temperature sensor **1442**, the humidity sensor **1444**, the air speed sensor **1446** or the heart rate sensor **1448** may be provided. However, more than one of the sensors may be provided within the housing or individually.

[0127] Referring now to FIGS. 16A-16I, a plurality of screen displays for controlling the device, such as the seat, is set forth. The screen displays correspond to ways in which to coordinate device, set various user setting and provide other data to the occupant.

[0128] Referring now specifically to FIG. 16A, the comfort management system may have an on button **1610** and an off button **1612** used to turn on and off the comfort management system displaced on the display **1470**. The screen display **1608** may be reached after selection of the comfort management button **1472** illustrated in FIG. 14. The on button **1610** turns on the comfort management system and thus allows the user to enter a mode for providing various user settings. The off button **1612** turns the comfort management system off. If multiple devices for control are provided, individual control for the system may be provided.

[0129] Referring now to FIG. 16B, a screen display **1620** on the display **1470** may be reached once the comfort management system is turned "on" at the display **1610** above. The screen display **1470** may be used to select various components of the comfort management system to control. In one aspect, a feet button **1622** may be used to adjust the comfort control system, control a feet, a boot or lower extremity system. A hands button **1624** may be used to control the grips or gloves for an occupant. An upper body button **1626** may be used to control the temperature of the upper body or thorax of an occupant. The lower body button **1628** may be used to control the area around the hip section of the occupant. The head button **1630** may be used to control the temperature around the head, helmet or hat associated with an occupant. A seat button **1632** is used to control the heating, cooling, or ventilation of the seat of a vehicle.

[0130] Referring now to FIG. 16, a screen display **1640** is illustrated. In this example, a seat control having an up button **1642** and a down button **1644** are set forth. The center display **1646** is used to display a temperature. By selecting the up button, the temperature in the display **1646** changes. The temperature in the display **1646** corresponds to the desired temperature. The button **1644** reduces the temperature in the display **1646**. Although a seat control is illustrated in the screen display **1640**, a similar interface could be used for various other positions such as those illustrated in FIG. 16B.

[0131] Referring now to FIG. 16D, a screen display **1650** is set forth. The screen display **1650** allows manually selecting the heating portion of the heating and cooling module, the cooling portion of the heating and cooling module or the vent portion of the heating and cooling module. To this end, a heating button **1652** allows selection of the heating control of the heating and cooling module **1490**. The cooling button **1654** allows the controlling of the cooler portion of the heating and cooling module **1490**. Selecting the vent button **1656** allows the control of the vent of the heating and cooling module **1490**.

[0132] The "auto" button **1658** is used to automatically select the desired operation. For example, the selection of the auto button **1658** will allow the system to change between heating and cooling to seek the desired temperature



such the temperature set forth in the display **1646** above. By changing the response of the system described above, the system is prevented from rapidly and inefficiently changing between the heating, cooling and venting operations

[0133] Referring now to FIG. **16E**, the screen display **1660** is illustrated for increasing or decreasing the amount of heating, cooling or venting provided. The screen display **1660** may be generated after the selection of one of the heating, cooling or venting buttons **1652-1656** illustrated in FIG. **16D**. In this example, a “minus” button **1662** and a “plus” button **1664** may be provided. Indicator **1666** may be displayed to illustrate the intensity of the amount of heating, cooling and venting provided. The screen display **1660** may display the word “heat” when heating is selected in screen display **1650**, may display “cooling” when the cooling button **1654** is selected from the screen display **1650** or “venting” when the selector **1656** is selected in the screen display **1650**.

[0134] Referring now to FIG. **16F**, a screen display **1670** is set forth. The screen display **1670** is used for selecting the response performance of the thermal management system. A fast response selector **1670**, a medium response selector **1674** or a slow response selector **1676** may be activated to control the speed at which the heating and cooling module **1490** is commanded to response to the desired temperature. An indicator **1678** may be illuminated corresponding to which selector **1672-1676** have been selected. Other ways of conveying the selection are by highlighting or coloring differently the selectors **1670-1676** of the screen touch display **1470**.

[0135] Referring now to FIG. **16G**, a screen display **1680** is illustrated as an alternate way to control the response performance of the system. In this example, a button **1682** may be moved to the desired response within the box **1684**. For example, by touching the screen closer to the “low” side of the box **1684**, the button **1682** would be moved to the corresponding location of the touch on the touch screen.

[0136] Referring now to FIG. **16H**, a screen display **1686** is set forth for displaying a fault status of the system. In this example, an “okay” button **1687** and an “error” button **1688** are used for displaying either an okay status or an error status. The error status may be provided with an indication as to the source of the error or a numerical or alpha numerical code that corresponds to a particular fault. Warnings and instructions may also be provided within or adjacent to the error button **1688**.

[0137] Referring now to FIG. **16I**, a screen display **1690** present a synch screen for synching various systems within the vehicle. In this example, a seat button **1692A**, a hand button **1692B**, an upper body button **1692C**, a lower body button **1692D**, a seat button **1692D**, and a head button **1692E** may be selected to synch the comfort control system with other systems. For example, the feet and hands may be selected so that the temperatures and response performance are the same. By selecting or deselecting, the synchronization of various heating and cooling modules, an improved riding experience is generated. In the screen display **1690**, synched systems may have the buttons **1692A-1692E** highlighted, colored or otherwise changed to indicated that they have been synched.

[0138] Referring now to FIG. **17**, a high level method for controlling the heating and cooling module is set forth. In step **1720**, the ambient conditions of the vehicle or around the user are determined. The sensors illustrated in FIG. **14**

may be used. In step **1722**, the user settings are determined. As mentioned, the user settings may be provided through a user interface generating user setting signals with user data. The user interface may be a discrete switch or a touch screen. The settings may indicated how much heating, cooling or ventilation is desired. The settings may also indicate a desired temperature or humidity. In step **1724**, the occupant conditions are determined. This is an optional set if the occupant conditions are to be taken into account for controlling the heating and cooling module. The occupant conditions may be determined from sensors provided within or on clothing such as boots or shoes, pants, jackets, shirts, helmets or the like.

[0139] In step **1726**, the desired response of the system is determined by the user settings. As mentioned above, the response of the system corresponds to how quickly the occupant would like the system to change in order to try to meet the desired or target temperature or humidity. For example, when the user would not like to feel humidity (sweaty), the venting system or cooling system may be increased to drive the user.

[0140] In step **1728**, the heating and controlling module is controlled in response to the ambient conditions, the user settings, the occupant conditions and the system response. With respect to temperature, if the temperature is not high enough, heating is provided. If the temperature is too high, heating may be turned off. Likewise, should excess moisture be detected, ventilation or cooling may be provided. Also, as the ambient temperature changes, the amount of heating and the amount of cooling may be increased or decreased to maintain the occupant at a desired level of comfort.

[0141] Referring now to FIG. **18**, the overall operation of the system is set forth. In step **1810**, the comfort management system is activated. As mentioned above, this may take place using discrete switches or a touch screen such as in the Polaris® Ride Command® System. In step **1812**, the occupant system to control is selected. In some vehicles, only the seats may be able to be controlled. Therefore, step **1812** need not be performed when only a single comfort system is provided. In step **1814**, the user settings are provided for the comfort control system. User settings may, for example, provide a desired temperature. In step **1816**, the response performance is also selected by the user. In some systems, a response performance may not be provided. As mentioned above, the response is how quickly the system is controlled to obtain the desired user settings. In step **1818**, the ambient conditions around the occupant is determined. These step may be performed for one occupant or may be performed individually for any number of occupants within the vehicle. The ambient conditions may include the temperature, the wind speed, the amount of sunlight and the humidity. When the vehicle is traveling a high rate of speed, for example, the driver may experience “wind chill”. The effect is less as the vehicle slows.

[0142] Should the occupant have individual occupant condition sensors, the occupant conditions are sensed and provided to the controller. As mentioned above, in certain conditions, the clothing of the occupant may have sensors therein. The sensors provide feedback to the controller so that adequate changes may be made to the heating and cooling module. In step **1822**, the occupant condition is compared to the user settings. When the occupant conditions are the same or about the same as the user settings, steps **1818** and **1820** are performed. The word “about” in used



in step **1822** to indicate the amount of response. When the temperature, for example, is within a certain range of the desired temperature, a change in the amount of heating or cooling provided by the heating or cooling module may not be adjusted. This is part of the response of the system.

**[0143]** In step **1822**, when the occupant condition is not equal to the user setting or outside the range around the user setting, the heating and cooling system is operated to seek the desired user setting in step **1824**.

**[0144]** Examples are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of examples of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that examples may be embodied in many different forms and that neither should be construed to limit the scope of the disclosure. In some examples, well-known processes, well-known device structures, and well-known technologies are not described in detail.

**[0145]** The foregoing description of the examples has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular example are generally not limited to that particular example, but, where applicable, are interchangeable and can be used in a selected example, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

What is claimed is:

1. A method, comprising:
  - receiving, by a controller, user input indicating a temperature setting;
  - receiving, from at least one sensor, sensor information;
  - determining, based on the temperature setting and the sensor information, an amount of current to provide to a first energy transfer device, wherein the first energy transfer device is coupled to a frame of a recreational vehicle; and
  - providing, based on the amount of current and by the controller, a current to the first energy transfer device, wherein the first energy transfer device is configured to wirelessly provide power to a second energy transfer device, and wherein the second energy transfer device is configured to provide the power to a load comprising a body temperature sensor, wherein the at least one sensor comprises radio frequency receiver, and wherein the sensor information comprises information indicating a body temperature of a user.
2. The method of claim 1, wherein determining the amount of current to provide to the first energy transfer device comprises:
  - increasing the amount of current to provide the first energy transfer device in response to the body temperature of the user being less than a temperature corresponding to the temperature setting.
3. The method of claim 1, wherein determining the amount of current to provide to the first energy transfer device further comprises:

decreasing the amount of current to provide the first energy transfer device in response to the body temperature of the user being greater than a temperature corresponding to the temperature setting.

4. A recreational vehicle, comprising:
  - a frame;
  - a front ground-engaging member and a rear ground-engaging members supporting the frame;
  - a powertrain drivably coupled to one of the front ground-engaging member and the rear ground-engaging members;
  - a steering assembly coupled to the front ground-engaging member for steering the vehicle, the steering assembly comprising a steering portion having a user grip or wheel, wherein the steering portion comprises a first inductive coil, and wherein the user grip comprises heating circuitry comprising a second inductive coil; and
  - a user input device coupled to the frame and configured to provide user input indicating a temperature setting;
  - at least one sensor generating sensor information corresponding to an ambient temperature and an ambient humidity or a body temperature or both;
  - at least one programmable controller coupled to the first inductive coil, the user input device and the at least one sensor and configured to:
    - control a temperature of the user grip by providing a current to the first inductive coil, wherein the first inductive coil wirelessly transfers the current to the second inductive coil, and wherein the second inductive coil causes a heating, cooling, or ventilation circuitry to change the temperature of the user grip.
5. The vehicle of claim 4, further comprising:
  - a user input device coupled to the frame and configured to provide user input indicating a temperature setting to the at least one programmable controller, and
  - wherein the at least one programmable controller is configured to control the temperature of the user grip or wheel based on the user input indicating the temperature setting.
6. The vehicle of claim 5, wherein the user input device is at least one of: an analog temperature selector, a touch screen, and a digital input device.
7. The vehicle of claim 4, further comprising:
  - at least one sensor coupled to the frame and configured to provide sensor information to the at least one programmable controller, and
  - wherein the at least one programmable controller is configured to control the temperature of the user grip based on the sensor information.
8. The vehicle of claim 7, wherein the at least one sensor comprises an occupant.
9. The vehicle of claim 7, wherein the at least one sensor comprises an occupant condition sensor.
10. The vehicle of claim 4, wherein the first inductive coil wirelessly transfers the current to the second inductive coil using inductive power transfer.
11. The vehicle of claim 10, wherein the first inductive coil and the second inductive coil are positioned around a first axis, and wherein the first inductive coil and the second inductive coil are separated in the direction in which the first axis extends.
12. The vehicle of claim 4, further comprising:
  - a battery coupled to the frame; and
  - a high frequency inverter electrically coupled to the battery, wherein the high frequency inverter is configured to



convert a direct current (DC) from the battery to an alternating current (AC), and wherein the current to the first inductive coil is the alternating current from the high frequency inverter.

**13.** A vehicle control system, comprising:  
a vehicle comprising:

- a frame;
- front and rear ground-engaging members supporting the frame; a powertrain drivingly coupled to one of the front and rear ground-engaging members;
- a battery coupled to the frame;
- a first energy transfer device supported by the frame; and
- at least one programmable controller electrically coupled to the battery and the first energy transfer device, wherein the at least one programmable controller is configured to:
  - provide a current to the first energy transfer device; and
  - an article worn by a user comprising:
    - temperature circuitry comprising:
      - a second energy transfer device configured to receive the current from the first energy transfer device; and
      - heating elements coupled to the second energy transfer device and configured to control a temperature of the article worn by the user using the current from the second energy transfer device

wherein the vehicle further comprises:

- a steering assembly coupled to the front ground-engaging member for steering the vehicle, the steering assembly comprising a steering portion having a user grip or wheel, wherein the user grip or wheel comprises the first energy transfer device, and wherein the article worn by the user is a glove,
- wherein the first energy transfer device is a first conductive material, and wherein the second energy transfer device is a second conductive material.

**14.** The vehicle control system of claim **13**, wherein the vehicle further comprises:

- a user input device coupled to the frame and configured to provide user input indicating a temperature setting to the at least one programmable controller, and wherein the at least one programmable controller is configured to provide the current to the first energy transfer device based on the user input indicating the temperature setting.

**15.** The vehicle control system of claim **13**, wherein the vehicle further comprises:

- at least one sensor coupled to the frame and configured to provide sensor information to the at least one programmable controller, and

- wherein the at least one programmable controller is configured to provide the current to the first energy transfer device based on the sensor information.

**16.** The vehicle control system of claim **15**, wherein the at least one sensor comprises an ambient condition sensor, and

wherein the ambient condition sensor is one or more sensors selected from a temperature sensor, a humidity sensor, an air speed sensor, and a sunlight sensor.

**17.** The vehicle control system of claim **15**, wherein the at least one sensor comprises an ambient temperature and an ambient humidity sensor.

**18.** The vehicle control system of claim **15**, wherein the at least one sensor comprises an occupant condition sensor, and wherein the occupant condition sensor is one or more sensors selected from a temperature sensor, a humidity sensor, an air speed sensor, and a heart rate sensor.

**19.** The vehicle control system of claim **15**, wherein the at least one sensor comprises an ambient condition sensor and an occupant condition sensor, wherein the ambient condition sensor is one or more sensors selected from a temperature sensor, a humidity sensor, an air speed sensor, and a sunlight sensor, and wherein the occupant condition sensor is one or more sensors selected from a temperature sensor, a humidity sensor, an air speed sensor, and a heart rate sensor.

**20.** The vehicle control system of claim **13**, wherein the vehicle further comprises:

- a floorboard coupled to the frame, wherein the floorboard is coupled to the first energy transfer device, and wherein the article worn by the user is a boot.

**21.** A vehicle charging system, comprising:

- a recreational vehicle comprising:

- a frame;
- front and rear ground-engaging members supporting the frame;
- a powertrain drivingly coupled to one of the front and rear ground-engaging members;
- a battery coupled to the frame; and
- a first energy transfer device supported by the frame; and
- a charging device comprising:

- an outlet component coupled to an electrical outlet and configured to provide a current; and

- a second energy transfer device coupled to the outlet component and configured to receive the current from the outlet component, wherein the second energy transfer device transfers the current to the first energy transfer device, and wherein the first energy transfer device is configured to provide the current to the battery to charge the battery.

**22.** The vehicle charging system of claim **21**, wherein the charging device comprises one of a charging mat or a docking station.

**23.** The vehicle charging system of claim **21**, wherein the first energy transfer device is first conductive material and the second energy transfer device is a second conductive material.

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