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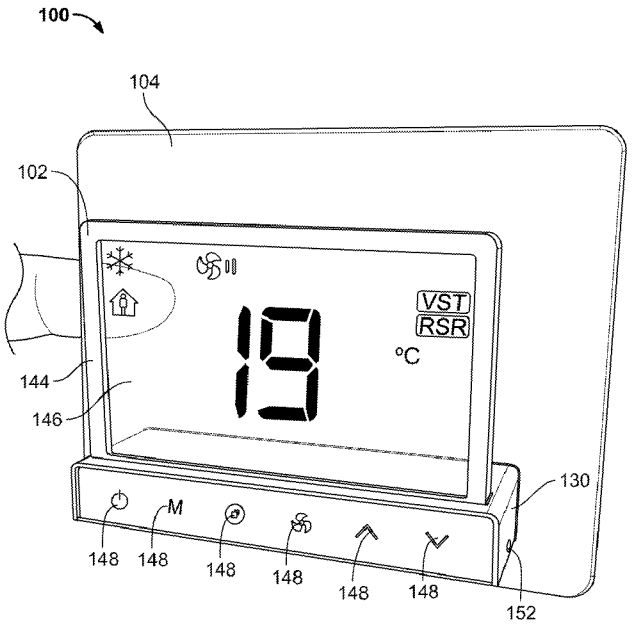

FIG. 1

(57) Abstract: Systems and apparatuses include a thermostat. The thermostat includes an input/output module (106), a plate (104) coupled to the input/output module (106), and a control panel (102). The input/output module (106) is configured to communicate with an HVAC system. The plate (104) defines a receptacle formed by at least one wall having a first electrical terminal (124) in electrical communication with the input/output module. The control panel (106) is at least partially received within the receptacle and is releasably coupled to the plate (104). The control panel (106) includes a base (130), a frame extending away from the base (130) to support a display (146), processing electronics (150) positioned within an interior volume of the base, a power Source (156) received within the interior volume of the base, and a communication module (154) received within the interior volume of the base (130). The communication module (154) transmits instruction.

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THERMOSTAT WITH DETACHABLE CONTROL PANEL

TECHNICAL FIELD

[1] The present disclosure relates to control panels for use in thermostats controlling heating, ventilation, and air conditioning (HVAC) systems. More particularly, the present disclosure relates to thermostats for controlling fan coil units (FCUs).

BACKGROUND

[2] A thermostat is, in general, a component of an HVAC control system. Traditional thermostats sense the temperature or other parameters (e.g., humidity) of a system and control components of the HVAC system in order to maintain a set point for the temperature or other parameter. A thermostat may be designed to control an FCU in the form of a heating or cooling system or an air conditioner. Thermostats are manufactured in many ways, and use a variety of sensors to measure temperature and other desired parameters of a system.

[3] Conventional thermostats are configured for one-way communication to connected components, and to control HVAC systems by turning on or off certain components or by regulating flow. Each thermostat may include a temperature sensor and a user interface. The user interface typically includes a display for presenting information to a user and one or more user interface elements for receiving input from a user. To control the temperature of a building or space, a user adjusts the set point via the thermostat's user interface.

SUMMARY

[4] At least one embodiment relates to a thermostat. The thermostat includes an input/output module, a plate coupled to the input/output module, and a control panel releasably coupled to the plate. The input/output module has a plurality of relays configured to communicate with an HVAC system. The plate defines a receptacle formed by at least one wall having a first electrical terminal in electrical communication with the input/output module. The control panel is at least partially received within the receptacle. The control panel includes a base structure that defines an interior volume and supports a second electrical terminal formed on an outer surface of the base structure to selectively contact the first electrical

terminal. A frame extends away from the base structure to support a display. Processing electronics are positioned within the interior volume of the base structure. A power source is also received within the interior volume of the base structure. The power source is electrically connected to the second electrical terminal and electrically connected to the processing electronics. A communication module is received within the interior volume of the base structure as well. The communication module is coupled to the processing electronics and configured to transmit instructions generated by the processing electronics to the input/output module based upon receipt of an input from one of a plurality of inputs presented by the control panel.

[5] Another embodiment relates to a control panel for a thermostat. The control panel includes a base structure, a frame extending away from the base structure, processing electronics positioned within an interior volume of the base structure, a power source received within the interior volume of the base structure, and a wireless communication module received within the interior volume of the base structure. The base structure has a first side supporting a plurality of inputs, a second side having an electrical terminal, a support side connecting the first side and the second side, and a base side connecting the first side and the second side opposite the support side. The first side, the second side, the support side, and the base side collectively define the interior volume. The frame extends away from the support side of the base structure and circumscribes a display. The processing electronics are configured to operate with and in response to interaction with the plurality of inputs. The power source is electrically connected to the electric terminal and selectively powers the processing electronics. The wireless communication module is coupled to the processing electronics and configured to transmit instructions generated by the processing electronics based upon interaction with an input in the plurality of inputs.

[6] Another embodiment relates to a control panel. The control panel includes a base structure defining an interior volume. The base structure also supports an electrical terminal formed on an outer surface of the base structure. A frame extends away from the base structure to support a display. Processing electronics are positioned within the interior volume of the base structure. A power source is received within the interior volume of the base structure. The power source is electrically connected to the electrical terminal and electrically connected

to the processing electronics. A wireless communication module is received within the interior volume of the base structure. The wireless communication module is coupled to the processing electronics and configured to transmit instructions generated by the processing electronics based upon receipt of an input from one of a plurality of inputs supported by the base structure of the display.

[7] This summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the devices or processes described herein will become apparent in the detailed description set forth herein, taken in conjunction with the accompanying figures, wherein like reference numerals refer to like elements.

BRIEF DESCRIPTION OF THE FIGURES

[8] FIG. 1 is a front perspective view of a thermostat according to an exemplary embodiment, with visual media displayed.

[9] FIG. 2 is an exploded view of the thermostat of FIG. 1.

[10] FIG. 3 is a front perspective view of a detachable control panel of the thermostat of FIG. 1, with visual media displayed.

[11] FIG. 4 is a front perspective view of a wall plate of the thermostat of FIG. 1, in isolation.

[12] FIG. 5 is a top, rear perspective view of the control panel of FIG. 3 received on a dock.

[13] FIG. 6 is an exploded view of the control panel and dock assembly of FIG. 5.

[14] FIG. 7A is a front view of a thermostat according to another exemplary embodiment, with visual media displayed.

[15] FIG. 7B is a front view of a thermostat according to another exemplary embodiment, with visual media displayed.

[16] FIG. 7C is a front view of a thermostat according to yet another exemplary embodiment, with visual media displayed.

[17] FIG. 7D is a front view of a thermostat according to still another exemplary embodiment, with visual media displayed.

[18] FIG. 8 is a front view of a thermostat according to still another exemplary embodiment, with visual media displayed.

[19] FIG. 9A is a front view of a control panel according to another exemplary embodiment, with visual media displayed.

[20] FIG. 9B is a front view of a control panel according to another exemplary embodiment, with visual media displayed.

[21] FIG. 9C is a front view of a control panel according to another exemplary embodiment, with visual media displayed.

[22] FIG. 9D is a front view of a control panel according to still another exemplary embodiment, with visual media displayed.

[23] FIG. 10 is a schematic view of electronic components that can be incorporated into any of the control panels of FIGS. 3 and 7A-9D.

[24] FIG. 11A is a top, front perspective view of a detachable control panel according to another exemplary embodiment.

[25] FIG. 11B is a front view of the control panel of FIG. 11A.

[26] FIG. 11C is a right side view of the control panel of FIG. 11A.

[27] FIG. 11D is a left side view of the control panel of FIG. 11A.

[28] FIG. 11E is a top view of the control panel of FIG. 11A.

[29] FIG. 11F is a bottom view of the control panel of FIG. 11A.

[30] FIG. 11G is a rear view of the control panel of FIG. 11A.

[31] FIG. 11H is a bottom, front perspective view of the detachable control panel of FIG. 11A.

DETAILED DESCRIPTION

[32] Before turning to the figures, which illustrate certain exemplary embodiments in detail, it should be understood that the present disclosure is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology used herein is for the purpose of description only and should not be regarded as limiting.

[33] Referring generally to the figures, a thermostat and a control panel that can be incorporated into the thermostat are shown according to various exemplary embodiments. The control panel and/or the thermostat can be used to control an HVAC system. The control panel may be implemented as a smart hub and may be connected to any of a variety of controllable systems and devices. For example, the control panel may be connected to a home automation system, a building automation system, an HVAC system, a lighting system, a security system, an electrical system, a sprinkler system, a home entertainment system, and/or any type of other system that can be monitored or controlled via a control panel. The control panel may be implemented in any of a variety of environments (e.g., a home, a building, a classroom, a hotel, a healthcare facility, an office, a vehicle, etc.) and used to monitor, control, and/or facilitate user interaction with controllable systems or devices in such environments. For example, the control panel can be used as a part of a thermostat installed in a home or building (e.g., mounted on a wall or ceiling).

[34] The control panel includes a housing that contains electronic components and a display for presenting visual media (e.g., information, text, graphics, etc.) to a user. The control panel can be selectively and removably attached (e.g., magnetically) to a mounting plate to mount the control panel to a mounting surface such as a wall. The housing includes a frame that supports the display. The frame can be cantilevered vertically, horizontally (e.g., leftward or rightward), or downwardly away from the base of the housing so that the entire display and frame are spaced apart from the mounting plate when the control panel is coupled to the mounting plate.

The display, the frame, and a protective cover for the display can be transparent or translucent to minimize the visible footprint of the control panel to a user relative to conventional opaque control panels. The housing may also include on or more light sources. The light sources can be configured to emit light toward the wall and/or the mounting plate to create lighting effects on the wall and/or mounting plate. The light sources may also emit light in alternative or additional directions.

[35] The control panel includes a plurality of inputs that can be selected by a user to produce different outputs both on the control panel (e.g., changing media displayed by the user interface) and remotely (e.g., adjusting the thermostat to operate HVAC equipment to adjust temperature, humidity, or other room conditions). The inputs can take the form of physical or capacitive buttons that can be actuated or otherwise interacted with. The inputs can be supported by and positioned about the housing. The inputs can be coupled to and in communication with the electronic components within the housing. Interaction and actuation of the inputs can be received by the electronic components, which can then interpret the received input(s) and communicate the received inputs to an external device, which can optionally be controlled by the received inputs.

[36] The control panel is detachable from the mounting plate and/or the wall and can operate coupled to the mounting plate or remotely (e.g., away from the mounting plate). When the control panel is attached to the mounting plate, a magnetic coupling (e.g., an electromagnetic coupling) is formed between the control panel and the mounting plate. The control panel includes one or more electrical terminals located on the exterior of the housing that can engage one or more electrical terminals located on the mounting plate to facilitate the transfer of information and/or electrical power between the control panel and the mounting plate. The terminals presented in the mounting plate can be in communication with the input/output module, a power source, additional control panels, or a network, for example, to communicate commands received via interaction and actuation of the plurality of inputs in multiple different ways. Electrical energy can be supplied through the electrical terminals of the mounting plate to the electrical terminals on the control panel to power an on-board power source (e.g., a battery, capacitor, etc.) contained within the housing of the control panel. The power source contained within the housing of the control panel can store electrical power, which can then

enable extended use of the control panel when the electrical terminals of the control panel are not engaged with the electrical terminals of the mounting plate.

[37] When operating away from the mounting plate and/or the external power source (e.g., a 220 V outlet), a communication module on the control panel powered by the on-board power source can transmit data using 1-way or multi-way wireless communication. The communication module is configured to facilitate communications between the control panel and remote sensor units, a building automation system, a home automation system, HVAC equipment, mobile devices (e.g., via WiFi, Bluetooth, NFC, LTE, LAA LTE, etc.), a communications network (e.g., a LAN, WAN, 802.11, the Internet, a cellular network, etc.), additional control panels (e.g., in a master-slave control relationship) and/or any other systems or devices to which the control panel may be connected. In each type of communication, the control panel is able to transmit data in the form of commands to a device (e.g., an FCU) to be controlled.

[38] The magnetic nature of the coupling between the control panel and the mounting plate provides several advantages over prior art control panels and thermostats. Depending on the strength of the magnetic coupling, a user may be able to remove the control panel from the mounting plate by hand, without additional tools. Maintenance on the control panel can be readily performed and control panels can be replaced without replacing entire thermostat assemblies. New control panels can be programmed to operate in existing thermostats, which can reduce the cost typically associated with maintenance and replacement in HVAC control systems. The control panels can be modularized, which further facilitates replacement and assembly processes. Each control panel can be programmed with a specific address which corresponds to the mounting plate and/or area it is typically associated with and intended to control. In some examples, the address for the control panel can be updated or changed by magnetically coupling the control panel to a mounting plate, which even further improves the ease of assembly and replacement for thermostat systems.

[39] The control panel can be equipped with one or more of a variety of sensors (e.g., temperature, humidity, air quality, proximity, light, vibration, motion, optical, audio, occupancy, power, security, etc.) configured to sense a variable state or condition of the

environment which the control panel is installed. The control panel may include a variety of user interface devices (e.g., a touch-sensitive panel, an electronic display, speakers, haptic feedback, microphone, ambient lighting, etc.) configured to facilitate user interaction with the control panel. Based upon data received and analyzed by the sensors, the control panel can issue a command through the communication module to adjust an operating parameter of a controllable device (e.g., a thermostat).

[40] The control panel can be configured to function as a connected smart hub. For example, the control panel can be configured to receive voice commands from a user and control connected equipment in response to the voice commands. The control panel can be configured to connect to mobile devices (e.g., a user's phone, tablet, laptop, etc.) or other networked devices (e.g., a desktop computer) to allow remote monitoring and control of connected systems. The control panel may be configured to detect the occupancy of a room or space in which the control panel is installed and may perform a variety of occupancy-based control processes. The user control device may monitor the performance of connected equipment (e.g., HVAC equipment) and may perform diagnostics based on data received from the HVAC equipment.

[41] The control panel may function as a wireless communications hub (e.g., a wireless router, an access point, etc.) and may be configured to bridge communications between various systems and devices. For example, the control panel may include a cellular communications transceiver, a modem, an Ethernet transceiver, or other communications hardware configured to communicate with an external communications network (e.g., a cellular network, a WAN, the Internet, etc.). The control panel may include a WiFi transceiver configured to communicate with nearby mobile devices. The control panel may be configured to bridge communications between mobile devices and external communications networks. The functionality allows the control panel to replace networking equipment (e.g., a modem, a wireless router, etc.) in building or vehicle and to provide Internet connectivity. For example, the control panel may function as a WiFi hotspot or a micro cell within a building or vehicle and may communicate with the Internet via an integrated Ethernet transceiver, a cellular transceiver (e.g., for locations not serviced by an Internet service provider), a coaxial cable, or other data communications hardware.

[42] The control panel may receive weather forecasts from a weather service and severe weather alerts. The control panel can have ambient lighting components that emit specific light colors or patterns to indicate severe weather alerts or other alerts. The user control may use the weather forecast in conjunction with the utility rate information to optimize (e.g., minimize) the energy consumption of the home or building. In some embodiments, the control panel generates a utility bill forecast and recommends set point modifications to reduce energy consumption or energy cost. In some embodiments, the control panel receives energy consumption information for other homes/buildings from a remote system and compares the energy consumption of connected HVAC equipment to the energy consumption of the other homes/buildings.

[43] Referring now to FIGS. 1-2, a thermostat 100 is depicted. The thermostat 100 includes, generally, a control panel 102, a mounting plate 104, and an input/output module 106 in communication with an HVAC system (not shown), such as an FCU, for example. The input/output module 106 can be contained within a housing 108 that is adapted to be received within or otherwise coupled to a wall or ceiling of a building that the HVAC system is designed to operate in. One or more relays 110 can be received within the housing 108 that can communicate with the HVAC system to effect different functions. For example, different relays 110 can control fan function, cooling (e.g., water chiller) function, heating functions, and the like to in turn control ambient conditions within a room or building. Additionally or alternatively, switches, transistors, rectifiers, TRIACs, DIACs, thyristors, and other suitable electronic switching devices can be received within the housing 108 of the input/output module 106 to communicate with the HVAC system to communicate different output commands as well. The input/output module 106 can be provided with or coupled to a power source 109, such as a 220 V outlet, 110 V outlet, 440 V outlet, or cables supplying a 110 V, 220 V, or 440 V potential, for example. The power source 109 can in turn power circuits, controllers, and/or operation of the relays 110 and other electronic switching components contained within the housing 108. As explained below, the power source 109 can also supply electrical power to the control panel 102 when the control panel 102 is coupled to the mounting plate 104 and the input/output module 106.

[44] The mounting plate 104 is coupled to the input/output module 106 to act as a cover for electronic components contained within the housing 108 of the input/output module 106. As depicted in FIG. 2, the mounting plate 104 has a tiered structure having a coupling section 112 extending rearward away from a presenting section 114 that is adapted to be exposed, at least partially, from a wall or ceiling that the thermostat 100 is mounted to. The presenting section 114 can be defined by a rectangular shape having rounded edges. The coupling section 112 can also be defined by a generally rectangular shape having a perimeter smaller than a perimeter defining the presenting section 114. The coupling section 112 can extend into and engage an outer wall 116 of the input/output housing 108. In some embodiments, the coupling section 112 is press-fit into the outer wall 116 of the housing 108, which secures the mounting plate 104 to the input/output module 106 to protect electronic components contained therein. The mounting plate 104 can be removably coupled to the input/output module 106 to allow necessary maintenance and repair to electronics contained within the housing after the thermostat 100 has been installed within a building. In some embodiments, each of the mounting plate 104 and the housing 108 are formed of an insulating, polymeric material.

[45] With additional reference to FIG. 4, a receptacle 118 is formed in the mounting plate 104 to receive and secure the control panel 102 in electrical communication with the input/output module 106. The receptacle 118 can have a rectangular shape that is sized to receive a portion of the control panel 102, as described below. The receptacle 118 is defined by a side wall 120 extending inward from the presenting section 114 toward the coupling section 112 of the mounting plate 104. The side wall 120 surrounds an inner wall 122 of the receptacle 118, which is formed approximately perpendicular to the wall 120. The inner wall 122 can have one or more electrical terminals 124, which are coupled to a power source. For example, the electrical terminals 124 can be placed in electrical communication with the power source of the input/output module 106 (e.g., via a wired connection) to transmit electrical energy outward from the input/output module 106 through the mounting plate 104. The electrical terminals 124 can also be used to transmit and receive data from the control panel 102, for example. In some embodiments, an on/off switch 126 is positioned within a wall 120, 122 of the receptacle 118 that determines whether electrical power and/or data is supplied to the electrical terminals 124. The switch 126 can be responsive to the presence of the control panel

102 within the receptacle 118. For example, the switch 126 is "on" when the control panel 102 is received within the receptacle 118 and "off" when the control panel 102 is not received within the receptacle 118, which can avoid the unnecessary waste and loss of electrical energy.

[46] One or more of the side wall 120 and the inner wall 122 can include magnetic properties that facilitate a removable coupling between the control panel 102 and the mounting plate 104. In some embodiments, an electromagnet (not shown) is coupled to one of the side wall 120 or the inner wall 122 that can be selectively activated when the control panel 102 is received within the receptacle 118. Security measures can be added to the thermostat 100 by requiring the entry of a code (e.g., a personal identification number) into the control panel 102 to deactivate the electromagnet and decouple the control panel 102 from the receptacle 118. Alternatively, a permanent magnet 123 can be attached to one of the walls 120, 122 that can couple with a second permanent magnet attached to the control panel 102. In other embodiments, the inner wall 122 is formed of a ferromagnetic material that attracts and selectively couples with a magnet received upon the control panel 102.

[47] The mounting plate 104 can be customizable in a variety of different colors and designs based upon aesthetic preferences and needs of a user. In some examples, the mounting plate 104 is provided with a color that generally matches the wall or ceiling that the thermostat 100 is mounted to. Different textures, gradients, transitioning, and designs can be applied to the mounting plate 104 to create a nearly fully-customizable mounting plate 104. In some embodiments, the walls 120, 122 defining the receptacle 118 are formed of a different color than the main plate surface 128 to help a user locate the receptacle 118 relative to the rest of the mounting plate 104 when, for example, the control panel 102 is being re-coupled to the mounting plate.

[48] Referring now to FIGS. 2-3, the control panel 102 is shown in additional detail. The control panel 102 includes a base structure 130 that acts as a housing for electronic components including, for example, processing electronics, a power source, and a communication module. The base structure 130 can have a generally block-shaped base defined by a top, support side 132, and a bottom, base side 134 opposite the support side 132. A front side 136, a rear side 138, and right and left sides 140, 142 extend between and connect the base side 134 to the

support side 132. The sides 130, 132, 134, 136, 138, 140, 142 collectively define an interior volume that receives electronic components, as described below. The base structure can be a single, continuous polymeric component, for example.

[49] The shape of the base structure 130 of the control panel 102 can be complimentary to the shape of the receptacle 118 in the mounting plate 104, which allows the base structure 104 to extend into and be received within the receptacle 118. The outer perimeter of the base structure 130 can form a clearance fit with the receptacle 118, which allows the side wall 120 to act as a guide for the control panel 102 when it is being positioned within the receptacle 118. One or more of the sides 130, 132, 134, 136, 138, 140, 142 can be equipped with a magnet 143 or a magnetic material that interacts with the magnet 123 of the receptacle to form a magnetic coupling between the control panel 102 and the mounting plate 104. For example, the rear side 138 of the control panel can be formed of a ferromagnetic material that interacts with an electromagnet present within the receptacle. The magnetic coupling can help position the control panel 102 within the receptacle 118 as well. Alternatively, a magnet can be received within the interior volume of the base structure 130 to interact with the magnet 123 of the receptacle 118. In still other embodiments, other releasable couplings can be formed between the control panel 102 and the mounting plate 104. For example, the control panel 102 can be adhesively coupled to the mounting plate 104. Hook and loop fastener panels can also be used to selectively couple the control panel 102 to the mounting plate 104. In still other embodiments, releasable fasteners can be used to couple the control panel 102 to the mounting plate 104.

[50] The magnetic coupling formed between the control panel 102 and the mounting plate 104 can create electrical communication between the control panel 102 and the input/output module 106, as well as the power source connected to the input/output module 106. The rear side 138 of the base structure 130 can include exposed electrical terminals 145 that are in communication with electrical components contained within the base structure 130 of the control panel 102. When the control panel 102 is magnetically coupled to the mounting frame 104, the electrical terminals 145 on the control panel 102 contact the electrical terminals 124 present in the receptacle 118. The contact between the electrical terminals 124, 145 creates an electrical connection between the control panel 102 and the input/output module 106 and

associated power source. The electrical connection between electrical terminals 124, 145 allows electrical energy to transfer from the power source to the control panel 102 and can allow data to be transmitted from the control panel 102 to the input/output module. Information can also be transmitted to and from the control panel 102 through the connection between the terminals 124, 145 as well, including operational parameters of the thermostat and/or HVAC system, address information associated with the mounting plate 104, or information from an external network, for example.

[51] A frame 144 extends away from the support side 132 of the base structure 130 and circumscribes at least a portion of a display 146. The frame 144 can extend vertically away from the support side 132, cantilevering away from the base structure 130. The frame 144 can be formed of opaque, translucent, or transparent materials that can support and otherwise protect the outer perimeter of the display 146. The display 146 can be transparent or translucent and configured to present information to a user in a visual format (e.g., as text, graphics, etc.) and receive input from a user (e.g., via a touch-sensitive panel or inputs). The display 146 may be of any of a variety of display technologies such as light emitting diode (LED), organic light-emitting diode (OLED), liquid-crystal display (LCD), organic light-emitting transistor (OLET), surface-conduction electron-emitter display (SED), field emission display (FED), digital light processing (DLP), liquid crystal on silicon (LCoC), or any other display technologies known in the art. In some embodiments, the display 146 is configured to present visual media (e.g., text, graphics, etc.) without requiring a backlight.

[52] The display 146 can interact with and respond to commands corresponding to interaction with one or more of the inputs 148 positioned about the control panel 102. In some embodiments, the front side 136 supports several inputs 148 in the form of buttons that can be actuated by a user. A variety of different buttons can be included on the control panel to allow a user to initiate commands to the input/output module 106 and therefore, the HVAC system. For example, a power button for the control panel 102, a mode button that can cycle through possible thermostat operations, a select button for affirmatively choosing an option presented on the display 146, a fan control button, and up-and-down arrow buttons can each be provided as separate options on the control panel 102. The buttons 148 can be readily interacted with by a user (e.g., by touching or pressing the buttons 148) which can in turn adjust the media

displayed on the display 146 and issue commands or control signals to the input/output module 106 and HVAC system. In some embodiments, the front side 136 of the base structure 130 is a touch screen, which can detect pressure changes or changes in an electrical field caused by a finger or other object pressing a location associated with a button to assign an input to the received command. Alternatively, each input 148 can be a depressible button that produces an electrical signal when depressed.

[53] Interaction with the inputs 148 on the display 146 can be transferred as electrical signals to processing electronics 150 contained within the base structure 130, as shown in FIG. 10. The processing electronics 150 can include, for example, a series of components configured to perform control functions (e.g., circuit boards, processing circuits, memory, a processor, etc.) and components configured to provide an interface on the display 146. The processing electronics 150 are configured to receive data from any of the inputs 148, assign values to the data received, and output instructions, information, and/or commands based upon the values that are assigned to the inputted data. The data received from the inputs 148 can come in a variety of forms, including physical interaction with the inputs 148 or data taken from one or more sensors 152 on the control panel 102. The processing electronics 150 can communicate with the components configured to provide an interface on the display 146 as well. Accordingly, when inputs 148 are interacted with or actuated by a user, the processing electronics can decipher which input was received and communicate the input received to the display 146, which can subsequently react (e.g., adjust the media on the display) to the input provided by the user. For example, if a user presses the input 148 corresponding to "power," the processing electronics 150 can terminate the connection between an on-board power source 156 (e.g., a battery) and the components configured to provide an interface on the display 146 to remove all media from the display 146. If a user presses the input 148 corresponding to the "mode" button, the processing controls can command the display 146 to present a menu of different options, which can then be selected by a user interacting with the "up" and "down" input options. Various examples of processing electronics 150 and displays 146 that can be present in or otherwise incorporated into the control panel 102 and/or thermostat 106 are shown and described in additional detail in commonly-owned U.S. Patent No. 9,964,328, entitled

"User Control Device with Cantilevered Display," which is hereby incorporated by reference in its entirety.

[54] When an input 148 is selected, the processing electronics 150 can then communicate the selected input 148 externally, through an on-board communications module 154. The communications module 154 is located within the base structure 130 and can be coupled to and in electrical communication with the processing electronics 150 and the on-board power source 156. The communications module 154 is configured to receive signals from the processing electronics 150 and transmit data externally, either through a wired or wireless connection, to a separate electronic component. In some embodiments, the communications module 154 can operate in both wired and wireless communications modes, depending on whether the control panel 102 is coupled to the mounting plate 104. When the control panel 102 is coupled to the mounting plate 104, information can be passed to and from the control panel 102 through the wired connections created between terminals 124, 145. When the control panel 102 is decoupled from the mounting plate 104, the communications module can transmit and receive data using a wireless communications method. For example, the communications module 154 can include both a transmitter and a receiver that communicate electronic signals using Bluetooth Low Energy, Wi-Fi, or Zigbee technology. Information can be transferred to a counterpart communications module present on the input/output module 106, for example, which can interact with the relays 108 to in turn adjust operational parameters of the HVAC system.

[55] The control panel 102 can be configured to communicate with one or several input/output modules 106 positioned throughout a building as well. Using the display 146 and inputs 148 on the control panel 102, different input/output modules 106 (and therefore different HVAC systems or FCUs) can be selected and subsequently controlled using a single control panel 102. In some examples having multiple control panels 102, each control panel 102 can be arranged to communicate with multiple input/output modules 106 positioned throughout the building. Alternatively, each control panel 102 can be arranged to communicate only with a dedicated, counterpart input/output module 106 associated with each individual control panel 102. In some examples, multiple control panels 102 can be arranged to communicate only with the same dedicated counterpart input/output module 106. Accordingly, several control panels

102 that can control the climate of a common area can be positioned throughout the area, making climate control more readily accessible to a user. For example, different control panels 102 for controlling the climate of a residential building using a single input/output module 106 (and single HVAC system) may be positioned throughout a home, such as on a wall, next to a bed, on a kitchen counter, at a desk, or other readily accessible locations. In still other examples, multiple control panels 102 can be arranged to communicate with only a dedicated, counterpart input/output module 106 associated with each individual control panel 102, and one or more master control panels 102 are arranged to communicate with multiple (or all) input/output modules 106. By having the input/output modules 106 separate from the control panel 102, each of the different types of control panel 102 - input/output module 106 relationships described can be created and tailored to the preference or needs of a user. In some embodiments, the communications module 154 communicates with a network 155 associated with the HVAC system.

[56] The processing electronics 150, display 146, communications module 154 can each be powered by an on-board power source 156. The on-board power source 156 can be a lithium-ion battery, for example, that is rechargeable. The on-board power source 156 can be placed in electrical communication with the terminals 145, which can enable the transmission of electrical power from an external source into the power source 156 for recharging purposes. Other types of batteries and capacitors can be used to operate as the power source 156 as well, including nickel cadmium, nickel metal hydride, alkaline, or lead acid, for example. The power source 156 is electrically coupled to and provides energy for the processing electronics 150. The supply of power from the power source 156 to the processing electronics 150 can optionally be controlled by one or more of the inputs 148 on the control panel 102. The on-board power source 156 also powers the display 146 and the communications module 154. In some embodiments, a selective coupling is formed between the power source 156 and the display 146, processing electronics 150, and the communications module 154. For example, a switch can be coupled to the power source 156 that selectively opens depending on the relationship between the control panel 102 and the mounting plate 104. When the control panel 102 is coupled to the mounting plate 104 and receiving electrical power from the external power source coupled to the input/output module 106, the switch can be opened, so that the

external power source supplies power directly through to the display 146, processing electronics 150, and communications module 154, and separately and simultaneously passes electrical power to the power source 156 to recharge the power source 156. When the control panel 102 is detached from the mounting plate 104, the switch can close, and electrical communication between the power source 156 and the display 146, processing electronics 150, and communications module 154 can be restored. In some embodiments, power is supplied from the power source 156 to the communications module 154 selectively. For example, power can be supplied to the communications module 154 only upon the processing electronics 150 determining that an input 148 has been entered by a user.

[57] As shown in FIGS. 5-6, the control panel 102 can also work in conjunction with a docking station 160. The docking station 160 can be coupled to an external power source (not shown) using a cord 162 extending away from a dock base 164. Electrical power can be supplied through the cord, to the dock base 164, and through terminals 166 formed in the dock base 164. Electrical contact between the terminals 166 and the electrical terminals 145 in the control panel 102 can then supply electrical power through to the on-board power source 156 and/or the display 146, the processing electronics 150, and the communication module 156.

[58] The dock base 164 has a base surface 168 extending perpendicularly away from a wall 170. Like the mounting plate 104, the wall 170 can include a magnet to help couple the control panel 102 to the docking station 160. In some embodiments, the dock base 164 and wall 170 have shapes and sizes that are generally complimentary to the base structure 130 of the control panel 102. When the control panel 102 is received upon the docking station 160, the base surface 168 can extend parallel to and support the base side 134 of the base structure 130. The wall 170, which supports the terminals 166, extends parallel to and engages the rear side 138 of the base structure 130. The height of the wall 170 can be approximately equal to the height of the base structure 130, which creates a flush mounting arrangement between the dock base 164 and the control panel 102. The dock base 164 can be formed of a polymeric, insulating material, for example.

[59] The docking station 160 can be placed in various locations throughout a building, including a desk, shelf, table, or other suitable surface. The docking station 160 can provide

power to the control panel 102, which can in turn be used to transmit wired or wireless control signals to the input/output module 106, for example. The wired or wireless control signals can be transmitted in the form of commands to the input/output module 106 (e.g., instructions on how to operate the HVAC system) using any of the wired or wireless protocols described previously. The command signals can be transmitted through the communications module 154 on the control panel 102 or through the docking station 160. In some embodiments, the docking station 160 includes its own communications module (not shown), or could be equipped with a communications module 154 as described above. Using the communications module 154 (on either or both of the control panel 102 or docking station 160), both wired or wireless communications can be performed. In some examples, the docking station 160 is hardwired to the input/output module 106, which allows one or two-way communication between the docking station 160 and the HVAC system. The docking station 160 can be in communication with the input/output module 106 and/or with additional wireless or wired networks to receive and install software and/or security updates automatically, as needed, onto either of the docking station 160 or the control panel 102. In some embodiments, the communications module 154 on the control panel 102 communicates with the communications module on the docking station 160, which in turn communicates with the input/output module 106 and HVAC system.

[60] As depicted in FIGS. 7A-9D and 11A-11H, the control panel 102, mounting plate 104, and input/output module 106 are highly customizable to provide different aesthetic effects, match surroundings, and otherwise allow a user or a contractor to select a desired device. For example, the shape, color, size, and lighting of the mounting plate 104 can be varied to produce a customizable thermostat 100. As shown in FIGS. 7A-7D, the mounting plate 104 can be formed of or otherwise provided with various different colors or shading. If the mounting plate 104 is formed of a lighter color, the display 146 can display media in a darker color (e.g., black). Contrarily, the display 146 can display media in a lighter color (e.g., white, light gray) when the mounting plate 104 is formed of a darker color, as shown in FIGS. 7C and 7D.

[61] As shown in FIG. 8, a control panel 202 can have a display 246 formed within or coupled to the base structure 230 of the control panel 202. The inputs 248 and display 246 can each be presented on the front side 236 of the base structure 230. As shown, the overall visual

footprint of the control panel 202 is reduced from that shown in the control panel 102, which can be preferable depending upon the surroundings. In some embodiments, the control panel 202 can operate or otherwise be interchangeable with control panels 102. The sizes of the base structures 130, 230 can be identical, which allows each of the control panels 102, 202 to fit within the receptacle 118 of the mounting plate 104. With a limited display 246 size, the control panel 202 may provide less control options to a user than the control panel 102. In such systems, a control panel 102 may act as a master controller for the entire HVAC system and corresponding thermostat 106, while control panels 202 spaced throughout the building can receive commands and operate based upon input received by the control panel 102. Control panels 202 can still be adjusted by a user both remotely and coupled to the mounting plates 104, to override a predetermined set of operational conditions deemed appropriate. For example, the control panels 202 can be used to adjust temperature, heating type, and fan speed within an area it is designated to control, while the master control panel 102 can control additional parameters, including humidity, maximum and minimum operational parameters, and other suitable HVAC system operations preferably kept constant.

[62] FIGS. 9A-9D and 11A-11F depict still additional configurations for control panels 302, 402, 502, 602, 702 that can be incorporated into thermostats 100 to control HVAC systems. The orientations of the base structures 330, 430, 530, 630, inputs 348, 448, 548, 648, and displays 346, 446, 546, 646 can each be adjusted to provide different control panels 302, 402, 502, 602 that still provide the same general structure and operation as the control panels 102, 202 described above. The frames 344, 444, 544, 644 can cantilever away from any of the top side 332, 432, 532, 632, bottom side 334, 434, 534, 634, right side 340, 440, 540, 640, or left side 342, 442, 542, 642 of the base structure 330, 430, 530, 630.

[63] With additional reference to FIGS. 3 and 8, variations of the control panel can be created in response to interactions with a user. In some embodiments, the inputs 348, 448, 548, 648 can be adjusted based upon the detected orientation of the control panel 302, 402, 502, 602. For example, an accelerometer can be included in the processing electronics 150 that detects the orientation of the base structure 130, 230, 330, 430, 530, 630 relative to the ground. Based upon the detected orientation of the control panel 102, 202, 302, 402, 502, 602, the inputs 148, 248, 348, 448, 548, 648 can be rotated so that the inputs 148, 248, 348, 448, 548, 648 are

displayed right-side up. This may allow a user to easily select a desired input, regardless of the orientation of the control panel 102, 202, 302, 402, 502, 602.

[64] No claim element herein is to be construed under the provisions of 35 U.S.C. § 112(f), unless the element is expressly recited using the phrase "means for."

[65] As utilized herein, the terms "approximately," "about," "substantially", and similar terms are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. It should be understood by those of skill in the art who review this disclosure that these terms are intended to allow a description of certain features described and claimed without restricting the scope of these features to the precise numerical ranges provided. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the disclosure as recited in the appended claims.

[66] It should be noted that the term "exemplary" and variations thereof, as used herein to describe various embodiments, are intended to indicate that such embodiments are possible examples, representations, or illustrations of possible embodiments (and such terms are not intended to connote that such embodiments are necessarily extraordinary or superlative examples).

[67] The term "coupled" and variations thereof, as used herein, means the joining of two members directly or indirectly to one another. Such joining may be stationary (e.g., permanent or fixed) or moveable (e.g., removable or releasable). Such joining may be achieved with the two members coupled directly to each other, with the two members coupled to each other using a separate intervening member and any additional intermediate members coupled with one another, or with the two members coupled to each other using an intervening member that is integrally formed as a single unitary body with one of the two members. If "coupled" or variations thereof are modified by an additional term (e.g., directly coupled), the generic definition of "coupled" provided above is modified by the plain language meaning of the additional term (e.g., "directly coupled" means the joining of two members without any

separate intervening member), resulting in a narrower definition than the generic definition of "coupled" provided above. Such coupling may be mechanical, electrical, or fluidic. For example, circuit A communicably "coupled" to circuit B may signify that the circuit A communicates directly with circuit B (i.e., no intermediary) or communicates indirectly with circuit B (e.g., through one or more intermediaries).

[68] The term "or," as used herein, is used in its inclusive sense (and not in its exclusive sense) so that when used to connect a list of elements, the term "or" means one, some, or all of the elements in the list. Conjunctive language such as the phrase "at least one of X, Y, and Z," unless specifically stated otherwise, is understood to convey that an element may be either X, Y, Z; X and Y; X and Z; Y and Z; or X, Y, and Z (i.e., any combination of X, Y, and Z). Thus, such conjunctive language is not generally intended to imply that certain embodiments require at least one of X, at least one of Y, and at least one of Z to each be present, unless otherwise indicated.

[69] References herein to the positions of elements (e.g., "top," "bottom," "above," "below") are merely used to describe the orientation of various elements in the FIGURES. It should be noted that the orientation of various elements may differ according to other exemplary embodiments, and that such variations are intended to be encompassed by the present disclosure.

[70] The hardware and data processing components used to implement the various processes, operations, illustrative logics, logical blocks, modules and circuits described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose single- or multi-chip processor, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A general purpose processor may be a microprocessor, or, any conventional processor, controller, microcontroller, or state machine. A processor also may be implemented as a combination of computing devices, such as a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

In some embodiments, particular processes and methods may be performed by circuitry that is specific to a given function. The memory (e.g., memory, memory unit, storage device) may include one or more devices (e.g., RAM, ROM, Flash memory, hard disk storage) for storing data and/or computer code for completing or facilitating the various processes, layers and modules described in the present disclosure. The memory may be or include volatile memory or non-volatile memory, and may include database components, object code components, script components, or any other type of information structure for supporting the various activities and information structures described in the present disclosure. According to an exemplary embodiment, the memory is communicably connected to the processor via a processing circuit and includes computer code for executing (e.g., by the processing circuit or the processor) the one or more processes described herein.

[71] The present disclosure contemplates methods, systems and program products on any machine-readable media for accomplishing various operations. The embodiments of the present disclosure may be implemented using existing computer processors, or by a special purpose computer processor for an appropriate system, incorporated for this or another purpose, or by a hardwired system. Embodiments within the scope of the present disclosure include program products comprising machine-readable media for carrying or having machine-executable instructions or data structures stored thereon. Such machine-readable media can be any available media that can be accessed by a general purpose or special purpose computer or other machine with a processor. By way of example, such machine-readable media can comprise RAM, ROM, EPROM, EEPROM, or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to carry or store desired program code in the form of machine-executable instructions or data structures and which can be accessed by a general purpose or special purpose computer or other machine with a processor. Combinations of the above are also included within the scope of machine-readable media. Machine-executable instructions include, for example, instructions and data which cause a general purpose computer, special purpose computer, or special purpose processing machines to perform a certain function or group of functions.

[72] It is important to note that the construction and arrangement of the thermostat and control panels as shown in the various exemplary embodiments are illustrative only.

Additionally, any element disclosed in one embodiment may be incorporated or utilized with any other embodiment disclosed herein. Although only one example of an element from one embodiment that can be incorporated or utilized in another embodiment has been described above, it should be appreciated that other elements of the various embodiments may be incorporated or utilized with any of the other embodiments disclosed herein.

WHAT IS CLAIMED IS:

1. A thermostat comprising:

an input/output module configured to communicate with an HVAC system;

a plate coupled to the input/output module and defining a receptacle therein, the receptacle formed by at least one wall having a first electrical terminal in electrical communication with the input/output module; and

a control panel at least partially received within the receptacle and releasably coupled to the plate, the control panel comprising:

a base defining an interior volume and supporting a second electrical terminal formed on an outer surface thereof selectively contacting the first electrical terminal,

a frame extending away from the base to support a display,

processing electronics positioned within the interior volume of the base,

a power source received within the interior volume of the base, electrically connected to the second electrical terminal, and electrically connected to the processing electronics, and

a communication module received within the interior volume of the base, coupled to the processing electronics, and configured to transmit instructions generated by the processing electronics to the input/output module based upon receipt of an input from one of a plurality of inputs presented by the control panel.

2. The thermostat of claim 1, wherein the communication module is configured to communicate with the input/output module through the electrical connection between the first terminal and the second terminal when the base structure is received within the receptacle and coupled to the wall plate, and wherein the communication module is configured to communicate with the input/output module through wireless communication when the base is removed from the receptacle.

3. The thermostat of claim 1, wherein the base and the receptacle each include a magnetic material to selectively couple the control panel to the plate.

4. The thermostat of claim 3, wherein the magnetic material includes at least one magnet.

5. The thermostat of claim 4, wherein the at least one magnet is an electromagnet.

6. The thermostat of claim 1, comprising:

a second control panel comprising:

a second base defining a second interior volume,

a second frame extending away from the second base to support a second display,

processing electronics positioned within the second interior volume of the second base,

a second power source received within the second interior volume of the second base, electrically connected to the processing electronics, and

a second communication module received within the second interior volume of the second base, coupled to the processing electronics, and configured to transmit instructions generated by the processing electronics to the input/output module based upon receipt of an input from one of a plurality of inputs presented by the second control panel.

7. The thermostat of claim 1, wherein the power source is a rechargeable power source that can receive and store current supplied through the first electrical terminal to the second electrical terminal.

8. The thermostat of claim 1, wherein the communication module is configured to transmit information wirelessly.

9. The thermostat of claim 8, wherein the communication module is configured to transmit information wirelessly to the input/output module and further configured to transmit information wirelessly to a second input/output module in communication with a second HVAC system.

10. The thermostat of claim 8, wherein the wireless communication module includes both a transmitter and a receiver.

11. A control panel for a thermostat, comprising:

a base having a first side supporting a plurality of inputs, a second side having an electrical terminal, a support side connecting the first side and the second side, and a base side connecting the first side and the second side opposite the support side, the first side, second side, support side, and base side collectively defining an interior volume;

a frame extending away from the support side of the base and circumscribing a display;

processing electronics positioned within the interior volume of the base and configured to operate with and in response to interaction with the plurality of inputs;

a power source received within the interior volume of the base and electrically connected to the electrical terminal, the power source selectively powering the processing electronics; and

a wireless communication module received within the base, coupled to the processing electronics, and configured to transmit instructions generated by the processing electronics based upon interaction with an input in the plurality of inputs.

12. The control panel of claim 11, wherein one of the second side, support side, or base side includes a magnet.

13. The control panel of claim 11, wherein the base is a single, continuous component.

14. The control panel of claim 11, wherein the power source is a rechargeable power source that can receive and store current supplied through the electrical terminal.

15. The control panel of claim 11, wherein the wireless communication module is configured to transmit using a protocol chosen from the group consisting of Bluetooth Low Energy, Wi-Fi, and Zigbee.

16. The control panel of claim 11, wherein a temperature and humidity sensor is supported by the base, in electrical communication with the processing electronics.

17. The control panel of claim 11, wherein the plurality of inputs includes buttons corresponding to different functions.

18. The control panel of claim 17, wherein the buttons are displayed through a common, capacitive surface screen.

19. The control panel of claim 11, further comprising:

a dock including a base surface and a wall extending away from the base surface, the wall including a second electrical terminal configured to engage the electrical terminal of the base to transmit electrical power from the dock to the control panel.

20. A control panel comprising:

a base defining an interior volume and supporting an electrical terminal formed on an outer surface thereof;

a frame extending away from the base structure to support a display;

processing electronics positioned within the interior volume of the base;

a power source received within the interior volume of the base, electrically connected to the electrical terminal, and electrically connected to the processing electronics; and

a wireless communication module received within the interior volume of the base, coupled to the processing electronics, and configured to transmit instructions generated by the processing electronics based upon receipt of an input from one of a plurality of inputs supported by the base or the display.

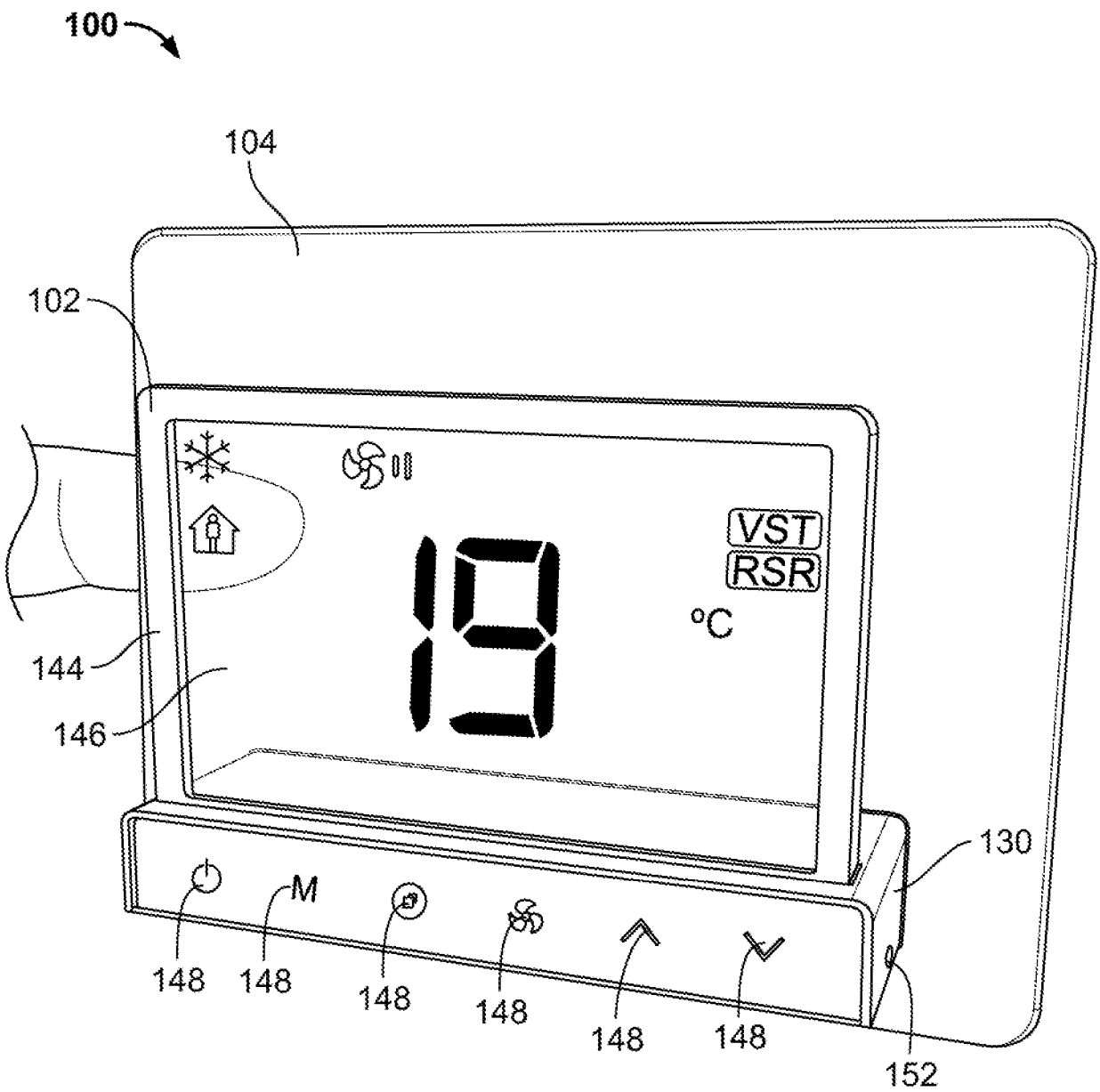
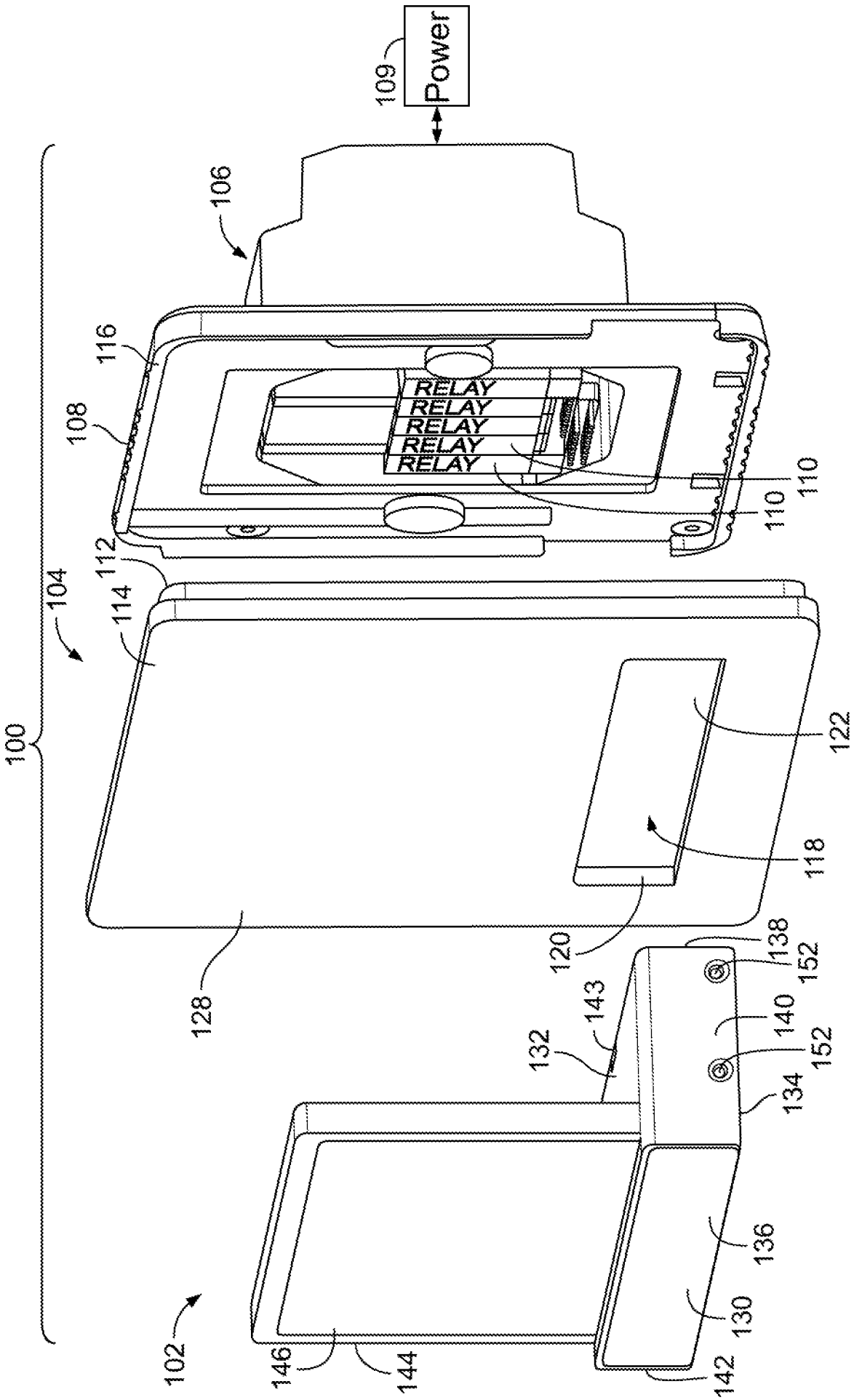


FIG. 1


Power
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106
116
108
RELAY
RELAY
RELAY
RELAY
RELAY
110
110
112
114
104
100
122
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138
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143
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132
134
136
130
142
144
146
102

FIG. 2

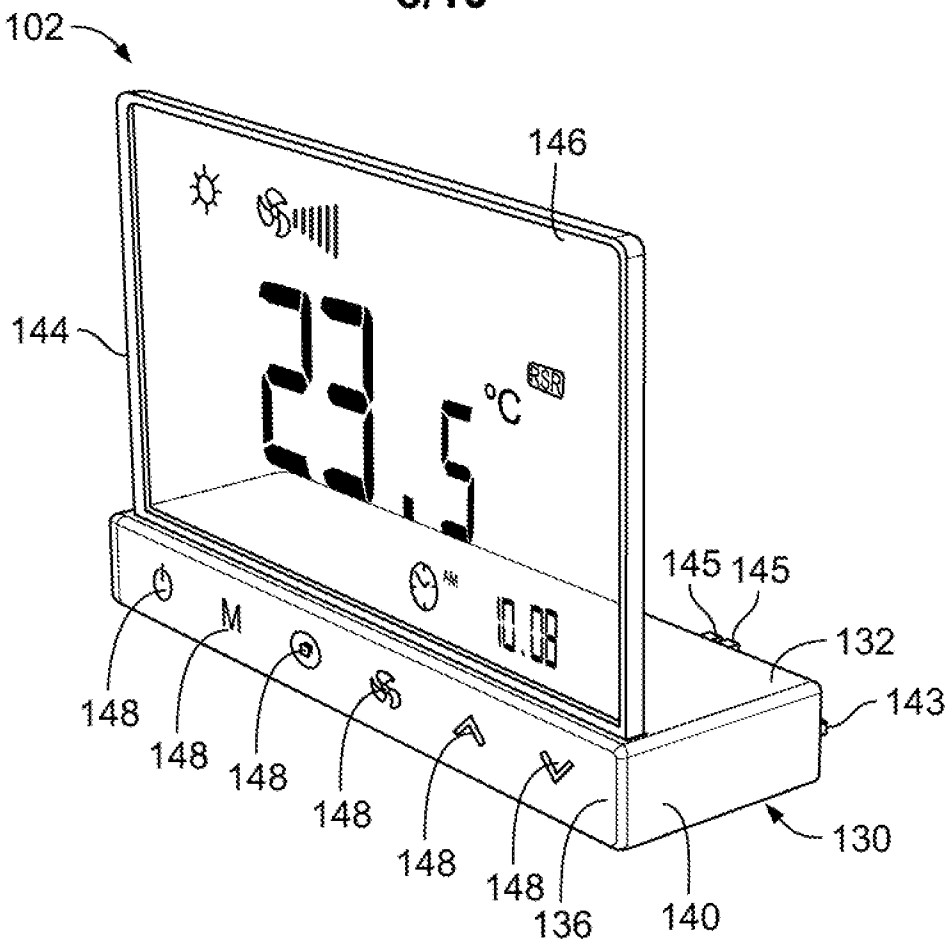
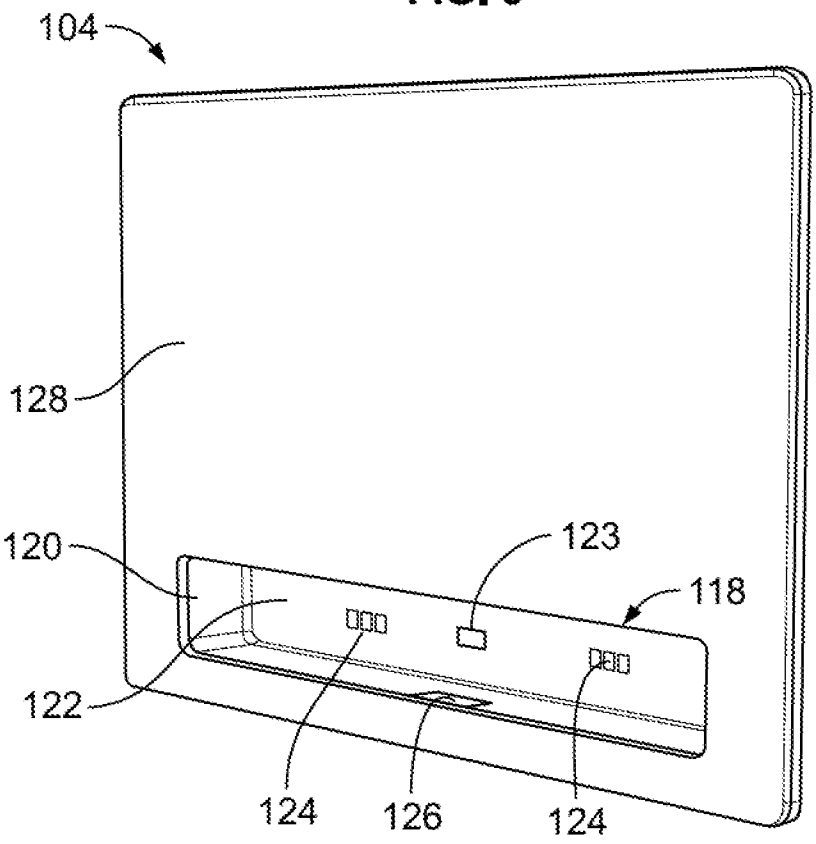

102
146
144
23.5
°C
145
145
132
143
148
148
148
148
148
148
130
136
140

FIG. 3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128
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122
124
126
124

FIG. 4

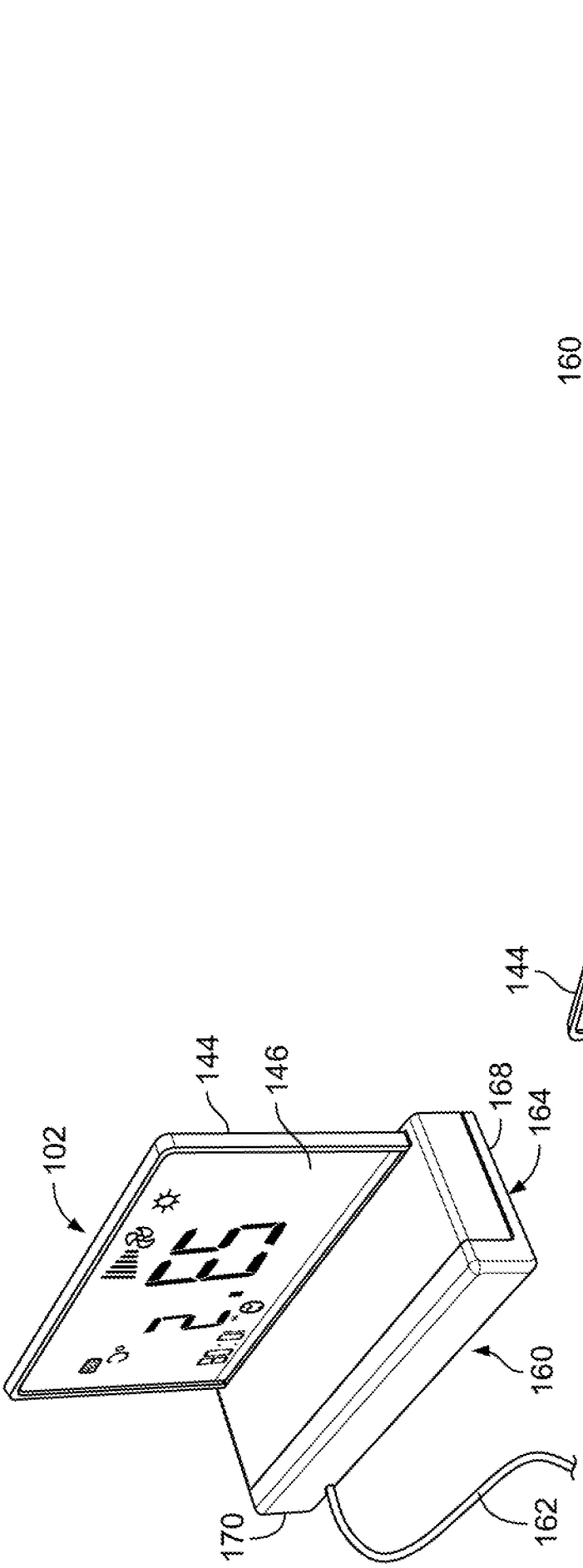
102
144
146
168
164
160
170
162

FIG. 5

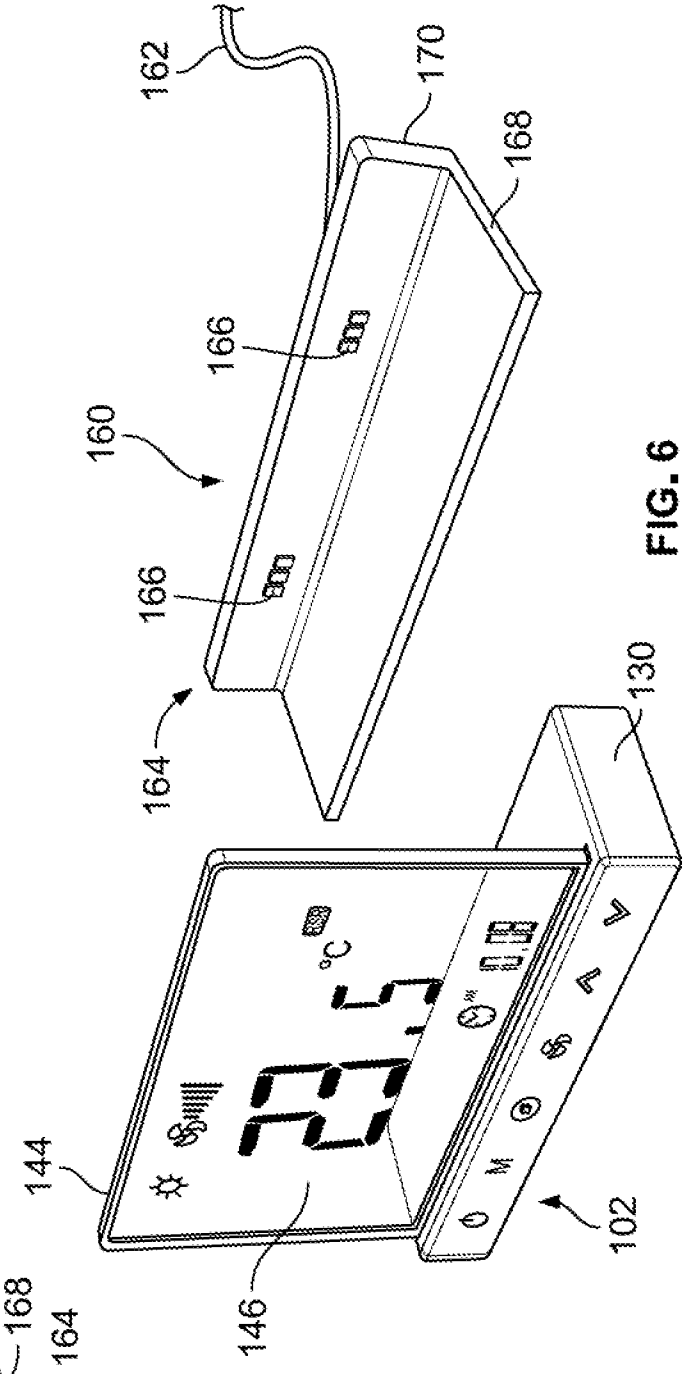
162
170
168
166
160
166
164
130
144
146
102

FIG. 6

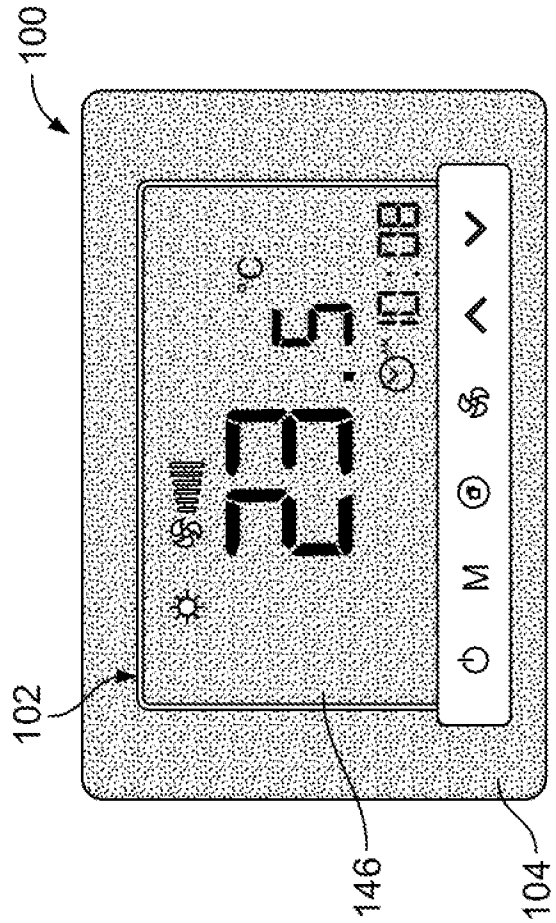

FIG. 7A

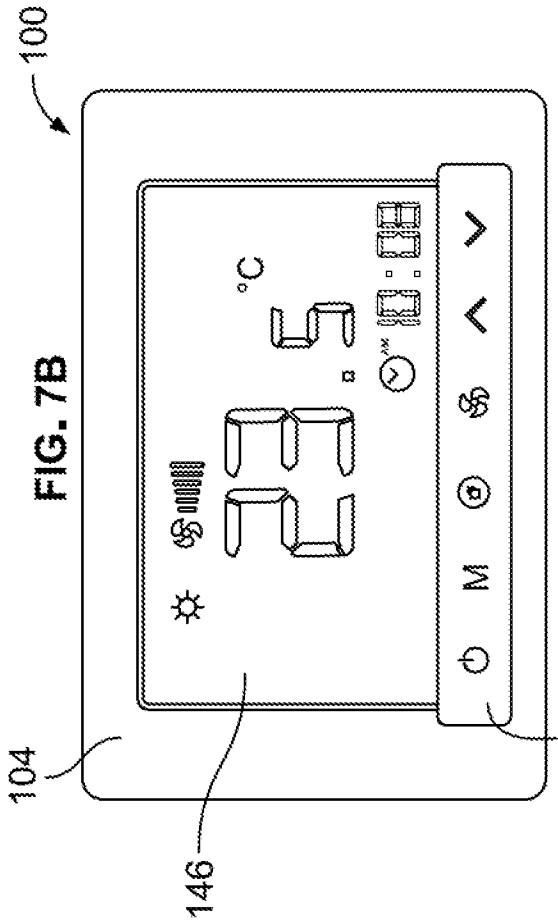

FIG. 7B

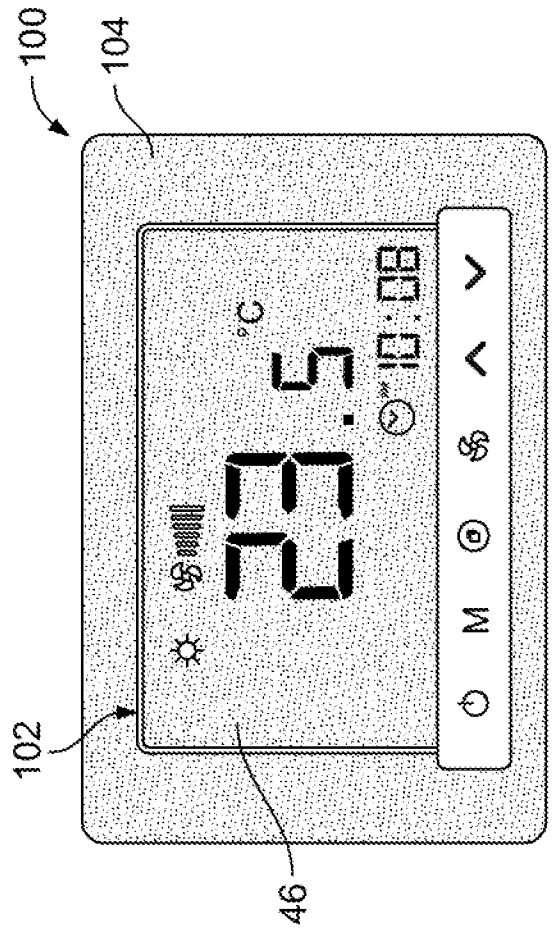

FIG. 7C

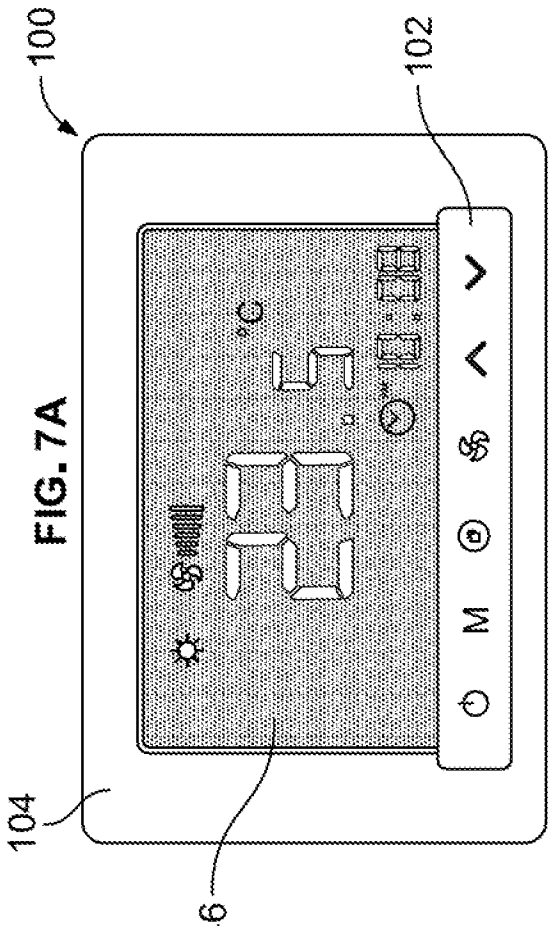

FIG. 7D

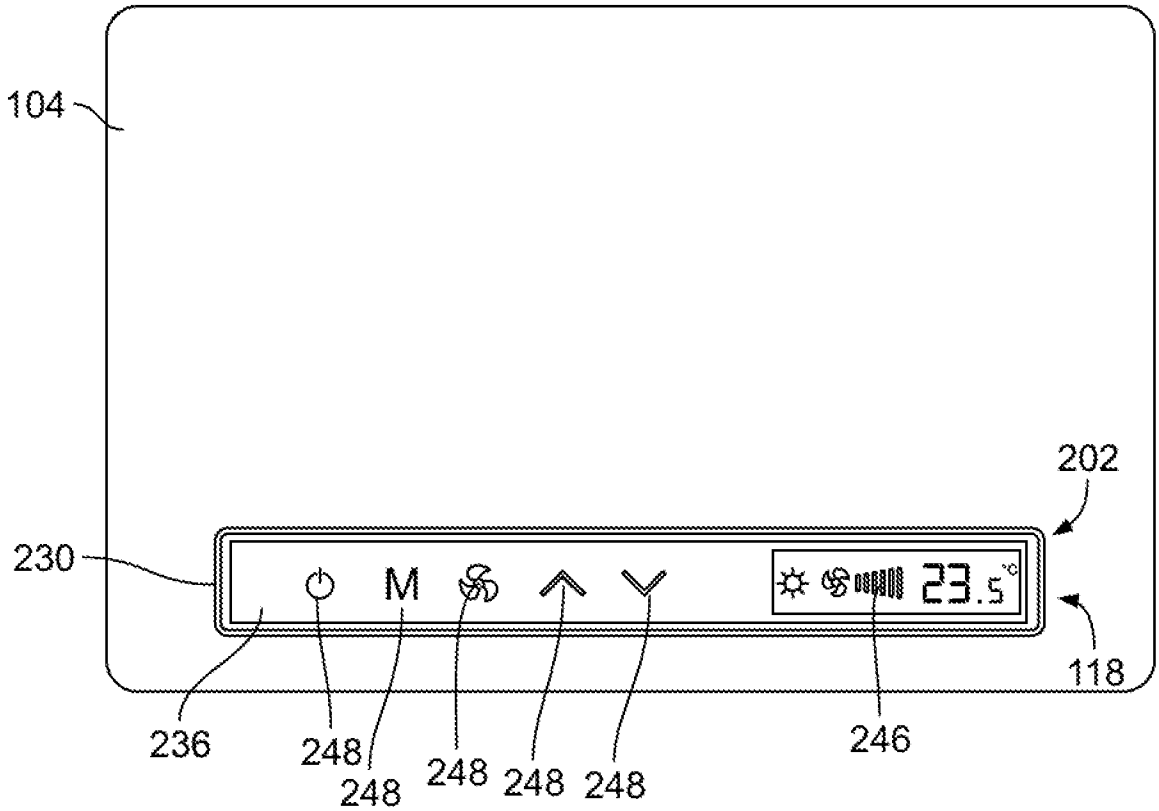

FIG. 8

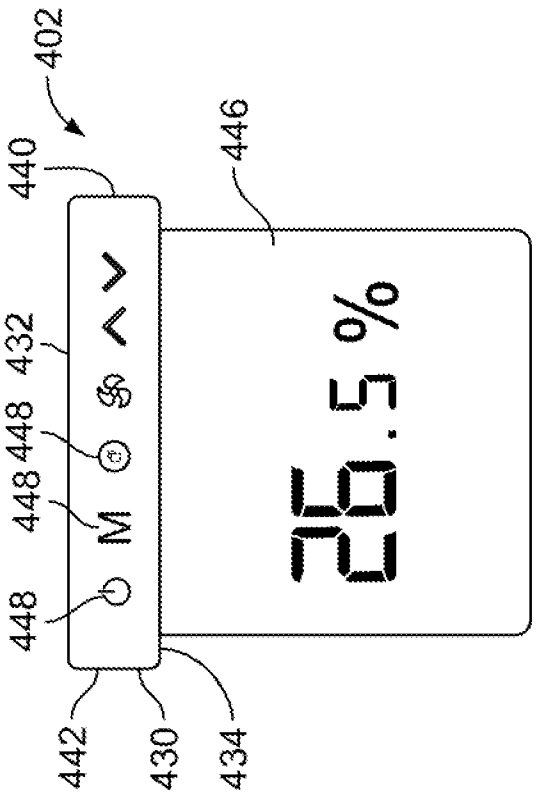

FIG. 9B

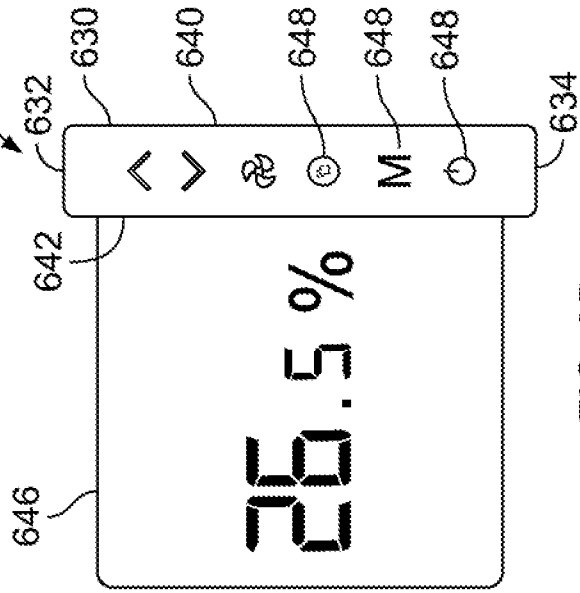

FIG. 9D

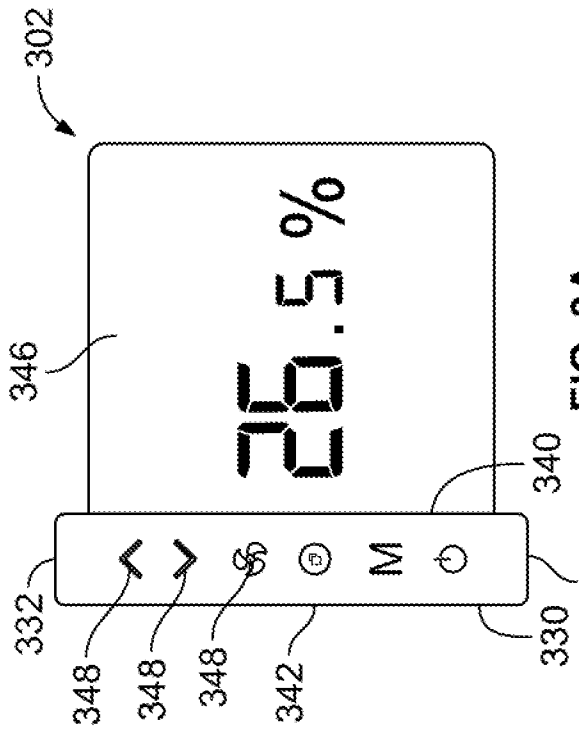

FIG. 9A

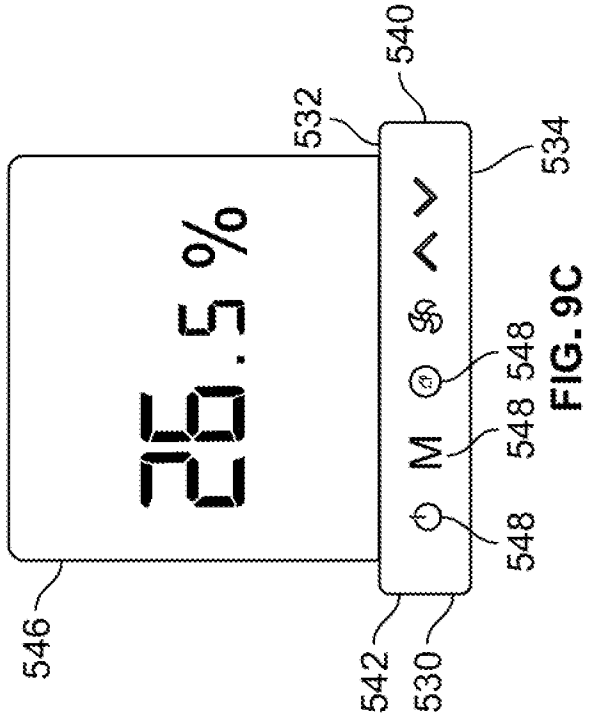

FIG. 9C

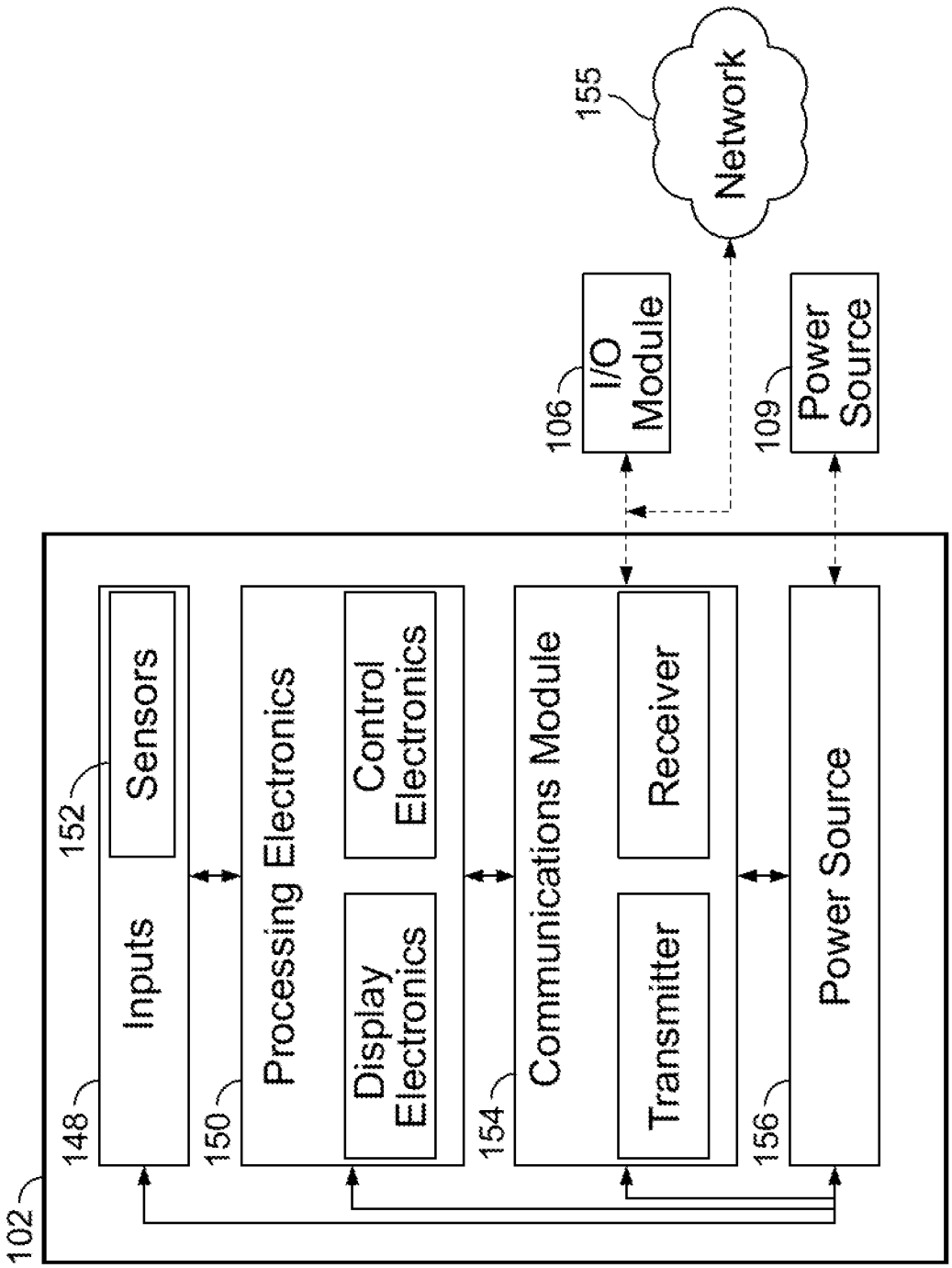
155
Network
106
I/O Module
109
Power Source
102
148
Inputs
152
Sensors
150
Processing Electronics
Display Electronics
Control Electronics
154
Communications Module
Transmitter
Receiver
156
Power Source

FIG. 10

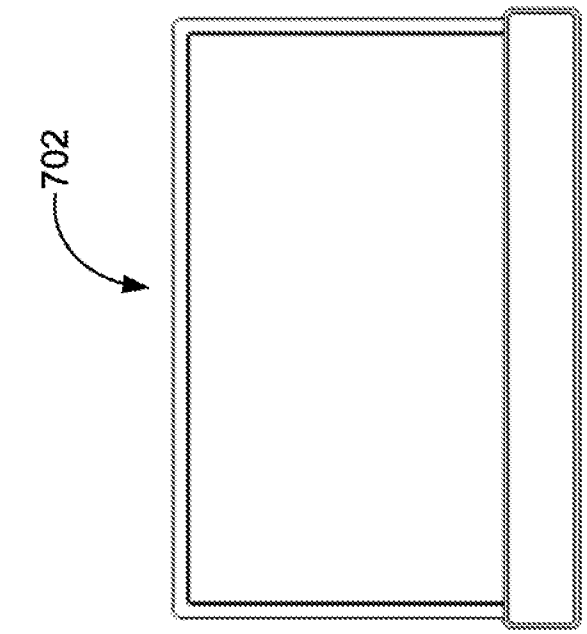

FIG. 11B

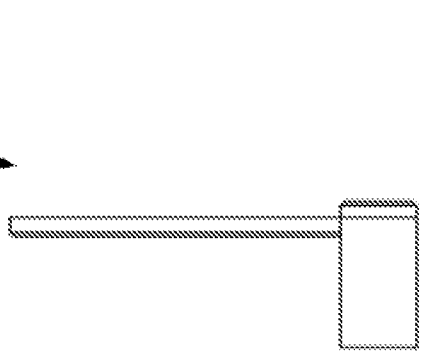

FIG. 11D

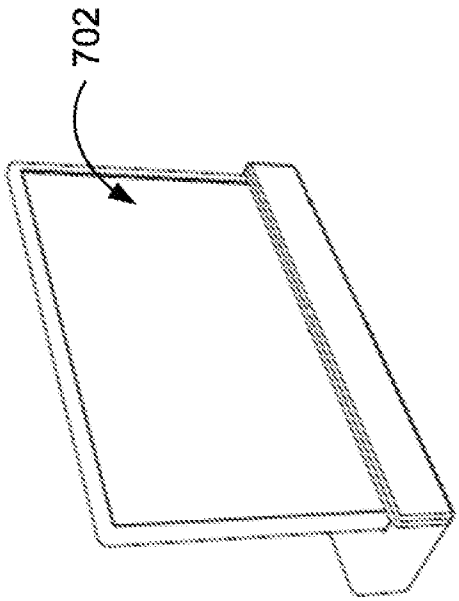

FIG. 11A

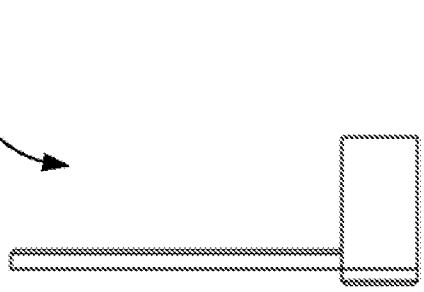

FIG. 11C

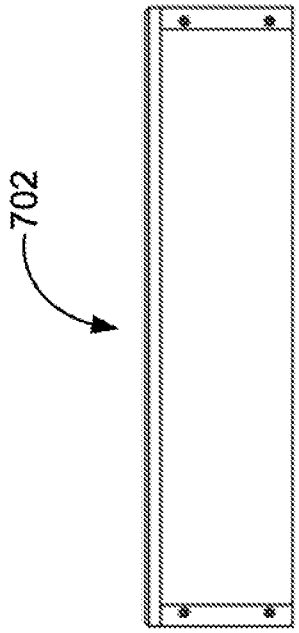

FIG. 11F

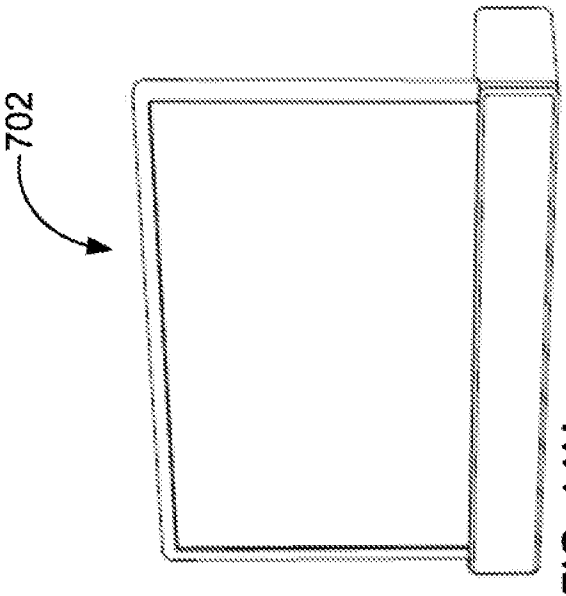

FIG. 11H

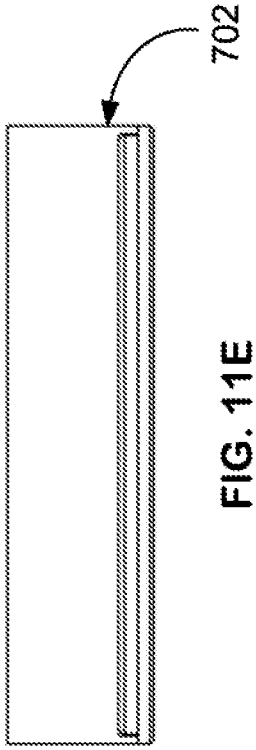

FIG. 11E

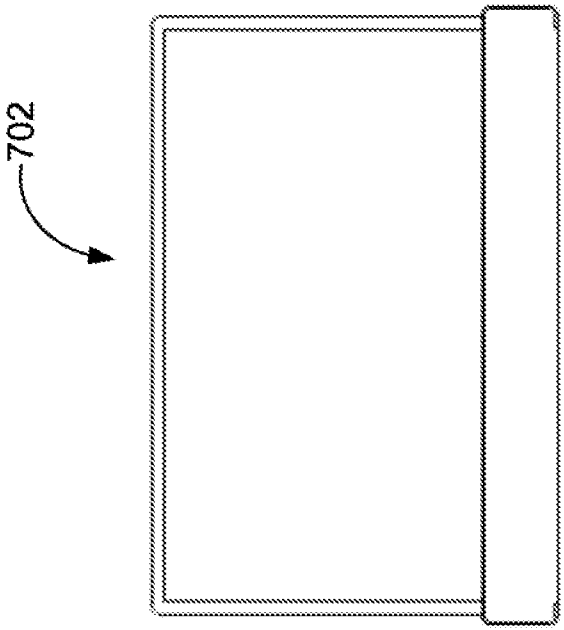

FIG. 11G

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/075423

A. CLASSIFICATION OF SUBJECT MATTER

G05D 23/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G05D

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

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

VEN;CNTXT,CNKI,CNABS:panel，control，thermostat，plate，detachable，控制面板，温度调节，可拆卸

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 205015762 U (MAANSHAN FENGYUN TIMES COMMUNICATION TECHNOLOGY CO.， LTD.) 03 February 2016 (2016-02-03) paragarphs 0014-0018，figures 1-2	1-20
A	CN 105222512 A (GUANGDONG AOMA ELECTRIC CO.， LTD.) 06 January 2016 (2016-01-06) the whole document	1-20
A	CN 206806250 U (GUANGDONG YOUHUA IOT INTELLIGENT CONTROL TECHNOLOGY CO.， LTD.) 26 December 2017 (2017-12-26) the whole document	1-20
A	CN 106873659 A (HEFEI SHUSHI INDUSTRY AND TRADE CO.， LTD.) 20 June 2017 (2017-06-20) the whole document	1-20
A	CN 108459635 A (SHANGHAI YUCHUANG AUTOMATION TECHNOLOGY CO.，LTD.) 28 August 2018 (2018-08-28) the whole document	1-20
A	US 8089032 B2 (BELAND STEPHANEET AL.) 03 January 2012 (2012-01-03) the whole document	1-20

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
	22 November 2019
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC** **6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer **DENG,Wei** Telephone No. **62085578**

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	CN 208269392 U (ZHONGSHAN HAIDIWEI ELECTRIC APPLIANCE CO LTD) 21 December 2018 (2018-12-21) the whole document	1-20
A	CN 203520205 U (TIANJIN JINFENG LAIYI TECHNOLOGY CO., LTD.) 02 April 2014 (2014-04-02) the whole document	1-20
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/075423

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