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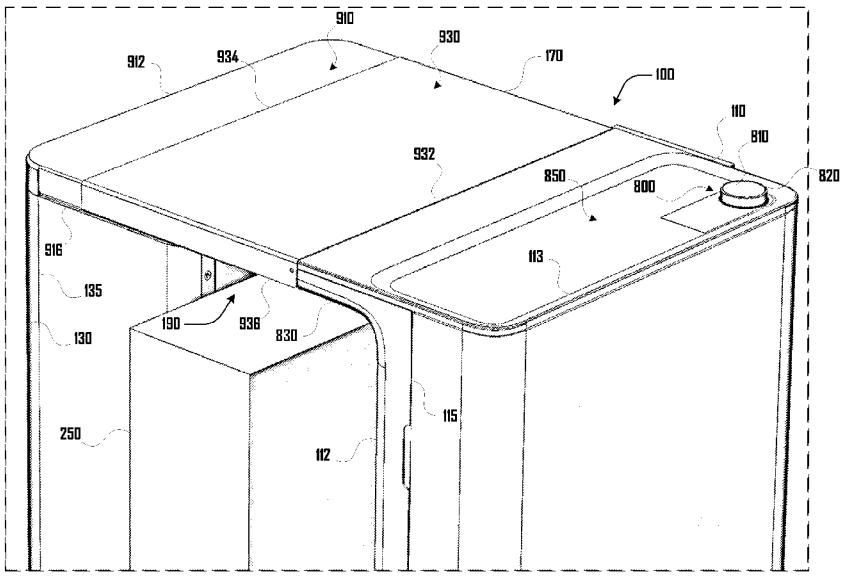


*Fig. 8*

(57) Abstract: An air conditioning unit that includes an interior unit, an exterior unit comprising a top face, a front face and a pair of opposing sidewalls, and a top cover.

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WO 2023/070117 A1

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# ADJUSTABLE TOP COVER FOR SPLIT-SYSTEM HVAC UNITS

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** This application is a non-provisional of and claims the benefit of U.S. Provisional Application No. 63/270,215, filed October 21, 2021, entitled "ADJUSTABLE TOP COVER FOR SPLIT-SYSTEM HVAC UNITS," with attorney docket number 0111058-010PR0. This application is hereby incorporated herein by reference in its entirety and for all purposes.

**[0002]** This application is also a non-provisional of and claims the benefit of U.S. Provisional Application No. 63/270,209, filed October 21, 2021, entitled "USER INTERFACES AND CONTROLS FOR HVAC SYSTEM," with attorney docket number 0111058-009PR0. This application is hereby incorporated herein by reference in its entirety and for all purposes.

**[0003]** This application is also related to U.S. Patent Application No. 17/017,066, filed September 10, 2020, entitled "WINDOW INSTALLATION SYSTEM AND METHOD FOR SPLIT-ARCHITECTURE AIR CONDITIONING UNIT," with attorney docket number 0111058-003US0. This application is hereby incorporated herein by reference in its entirety and for all purposes.

**[0004]** This application is also related to U.S. Patent Application No. 12/724,036, filed March 15, 2010, entitled "MODULAR AIR CONDITIONING SYSTEM," with attorney docket number 0111058-004US0. This application is hereby incorporated herein by reference in its entirety and for all purposes.

**[0005]** This application is also related to U.S. Patent Application No. XX/YYY,ZZZ, filed contemporaneously herewith, entitled "USER INTERFACES AND CONTROLS FOR HVAC SYSTEM," with attorney docket number 0111058-009US0. This application is hereby incorporated herein by reference in its entirety and for all purposes.

## BACKGROUND

**[0006]** In 1931, H.H. Schultz and J.Q. Sherman invented the first room air conditioner. The unit sat on the ledge of a window, just as many modern air conditioners do. They were not widely purchased, however, due to their high cost at the time. It was not until the 1970s that window AC units made it into most homes in the United States, with over one million

units sold in just 1953. Residential air conditioning has progressed a long way in the past several decades in terms of noise, efficiency, and cost. However, some features have remained unchanged, namely the installation process. Traditional room air conditioning units still sit on window ledges and are mounted in the sash of double-hung windows. The units usually require the user to screw in the unit, accordion panels, and/or an additional external bracket for support. During the installation process, users often have to precariously balance the air conditioning unit between the window sill and the windowpane while securing the system, which leads to units falling outside if the user accidentally loses his or her grip.

**[0007]** An alternative to window air conditioning units are ductless systems comprised of at least two units, one outdoor unit and one indoor unit. These systems either contain a singular indoor unit coupled with a singular outdoor unit and are referred to as mini-splits, or several indoor units coupled with a singular outdoor unit and are referred to as multi-splits. Ductless systems do not need a duct to carry cooled or warmed air as central or packaged systems do, but they still use ducts to contain the coolant fluid carrying heat in and out of the room. These systems must be installed through a wall by a professional HVAC technician. The professional installation process is typically expensive and time-consuming. The installed cost of a high-performance mini-split air conditioner for a single room can be more than 10 times that of a window unit capable of cooling the same space. However, the advantage of ductless systems is that they allow for much higher efficiency than window air conditioning units and are often much quieter.

**[0008]** With demand for air conditioners continuing to grow, decreasing the cost and increasing the convenience of installing high-efficiency HVAC systems would help to remove barriers to adoption. In addition, a safer and more user-friendly installation process would remove the dangers associated with configuring current air conditioning units.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0009]** Fig. 1 illustrates a split-architecture air conditioning unit in accordance with one example embodiment.

**[0010]** Fig. 2 illustrates a split-architecture air conditioning unit disposed within a window in accordance with one example embodiment.

**[0011]** Fig. 3a illustrates a modular climate control unit in accordance with one example embodiment.

**[0012]** Fig. 3b illustrates a circulation hose in accordance with one example embodiment.

**[0013]** Fig. 4 illustrates an external unit comprising a heat pump/air conditioning cycle in accordance with one example embodiment.

**[0014]** Fig. 5 illustrates circulating fluid directed to reduce the overall temperature of a fluid storage tank within the interior unit in accordance with one example embodiment.

**[0015]** Fig. 6 and Fig. 7 illustrate an example of a bracket that can be mounted over the sill of a window in a wall and slidably adapted to the size of the sill and wall via a first bracket portion and a second bracket portion.

**[0016]** Fig. 8 illustrates an example embodiment of a modular air conditioner unit having an interface disposed on the top face of the internal unit and a top cover extending between internal and external units.

**[0017]** Fig. 9 illustrates a top cover can comprising a first portion and a second portion that are slidably nested together such that a length of the top cover can be changed to adapt to the distance between the internal and external units.

**[0018]** Fig. 10 illustrates an example embodiment where the external unit comprises coupling slots defined by the sidewalls of the external unit proximate to the top face.

**[0019]** Fig. 11 illustrates a top cover in accordance with an embodiment.

**[0020]** Fig. 12 illustrates an example embodiment where the top cover comprises a railing for holding items on the top cover.

**[0021]** Fig. 13 illustrates an embodiment where a modular air conditioning system comprises a screen that extends within a window.

**[0022]** Fig. 14 illustrates an embodiment where a modular air conditioning system comprises a hole that can be used for storage of various items such as a potted plant.

**[0023]** It should be noted that the figures are not drawn to scale and that elements of similar structures or functions are generally represented by like reference numerals for illustrative purposes throughout the figures. It also should be noted that the figures are only intended to facilitate the description of the preferred embodiments. The figures do not

illustrate every aspect of the described embodiments and do not limit the scope of the present disclosure.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0024]** The description below discloses various embodiments of a novel installation system and method for installing a split-architecture air conditioning unit through a window. As discussed herein, the term air conditioning unit can apply to a unit configured to condition air in various suitable ways including one or more of heating, cooling, moving air with a fan, de-humidifying, humidifying, filtering, and the like.

**[0025]** The systems and methods described herein, in some examples, allow for the installation of an air conditioner/heat pump with split-architecture through a standard window opening with no specialized tools (removing the need of a professional HVAC technician), no modification of the building envelope, and preventing the possibility of the unit accidentally falling out of the window during installation.

**[0026]** Various embodiments can include an air conditioning unit installation that can comprise, consist of, or consist essentially of an outdoor unit, an indoor unit, a bracket assembly configured to facilitate installation and holding of the outdoor and indoor units on opposing sides of the sill of a window, and an operable coupling between the outdoor unit and indoor unit that provides for operation of the air conditioning unit (e.g., one or more fluid lines, power lines, communication lines, and the like). As discussed herein, one or more of such elements can be modular.

**[0027]** Various embodiments can minimize the number of steps required for installation of elements of the air conditioning unit, can reduce user error during installation of the air conditioning unit, and the like. For example, some embodiments include a weight offset mechanism that is directly incorporated into the bracket.

**[0028]** Various embodiments can provide for a smooth transition of the outdoor unit to a final position outside of the window including preventing the outdoor unit from falling out the window and providing for easy manipulation of the outdoor unit when initially engaging the outdoor unit with the bracket, and moving the outdoor unit through the window and rotating the outdoor unit from a horizontal installation orientation to a vertical installed

orientation. For example, as discussed in more detail herein, some embodiments can include flanges on the sides of the bracket that help guide the user in safely pushing the unit out of the window. Additionally, various embodiments can be configured to be adapted to a variety of windows or openings.

**[0029]** Additionally, various embodiments can be configured to be adapted to a variety of windows in terms of size and shape, including width of the window, thickness of the window sill, distance between an internal wall face and an external wall face, height of the window sill from the floor of an indoor area, and the like.

**[0030]** As global demand for heating and cooling surges with rising temperatures and extreme weather events, it will be increasingly important to lower the barriers to installing and using higher efficiency split-system heating and cooling systems. Compared to traditional window air conditioning units, ductless split-system HVAC units of some embodiments are quieter and more efficient due to their configuration of at least one outdoor unit and one indoor unit.

**[0031]** There can be several advantages to various embodiments of the split-system design. For example, separation of the outdoor unit and indoor unit can allow for better efficiency because of the ability to provide localized heating or cooling and the added insulation provided by the wall and window between the two units. Another advantage of the split-system configuration in some embodiments can be that some of the noisiest portions of the device (e.g., the compressor, pump, and fan of the outdoor unit) can be positioned behind the wall and outside of the building. Additionally, in various embodiments, the architecture of a ductless split-system HVAC unit that is user-installable through the window can eliminate the need for a professional HVAC technician and hence expensive installation costs that are often more than the cost of the unit itself.

**[0032]** This disclosure covers various example embodiments of an adjustable top cover that can connect the indoor and outdoor units of a ductless split-system HVAC unit and accommodates considerable variation in wall thicknesses and window geometries. The adjustable top cover in various embodiments can also serve to protect the connections between the two units, facilitate window sealing, and/or prevent water and other debris from

entering indoors. Visually, in various examples, the top cover ties together the modular indoor and outdoor units as one cohesive device.

**[0033]** In various embodiments, an adjustable top cover connects the outdoor unit to the indoor unit and has the ability to accommodate large variations in wall thicknesses and window geometries. In some examples, after the user connects the electrical and hydronic lines of the indoor and outdoor units, the adjustable top cover provides protection of these connections from the elements, such as rain, snow, ice, and UV radiation. The adjustable top cover in various embodiments provides a flat surface for easier window sealing and aesthetically makes the system appear more cohesive and polished.

**[0034]** Turning to Fig. 1, an example embodiment of an air conditioning unit 100 is illustrated, which can comprise an indoor unit 110, an outdoor unit 130, a bracket assembly 150 and top cover 170, which can define an air conditioning unit cavity 190 between the indoor and outdoor units 110, 130 and below the top cover 170. The air conditioning unit 100 can further comprise an operable coupling (not shown) between the outdoor unit 130 and indoor unit 110, such as below or within the top cover 170, that provides for operation of the air conditioning unit 100, which can include one or more fluid lines, power lines, communication lines, and the like.

**[0035]** As discussed in more detail herein (see e.g., Fig. 2), in various embodiments, the bracket assembly 150 can be configured to couple with the sill of a window with the wall below the window sill being disposed within the cavity 190 such that the indoor unit 110 is disposed within an indoor space proximate to the window; the outdoor unit 130 is disposed in an outdoor space proximate to the window; and with the top cover 170 and operable coupling extending through the window and over the sill of the window.

**[0036]** As shown in the example of Fig. 1, the internal unit 110 can be generally cuboid and define a front face 111, internal face 112, top face 113, bottom face 114 and side faces 115. A pair of internal unit handles 116 can be disposed on the opposing side faces 115 proximate to the top face 113 of the internal unit 110. The internal unit handles 116 can be used for lifting the internal unit during installation of the internal unit 110 as discussed in more detail herein. A grille 118 can be defined by a portion of the front face 111, which can provide a passage from inside the internal unit 110 through which conditioned air can be

expelled into an internal environment and/or air can be taken in from the internal environment as discussed in more detail herein.

**[0037]** The external unit 130 can be generally cuboid and define a front face 131, internal face 132, top face 133, bottom face 134 and side faces 135. A pair of external unit side-handles 136 can be disposed on the opposing side faces 135 proximate to the bottom face 134 of the external unit 130. The external unit side-handles 136 can be used for lifting the external unit 130. During installation of the external unit 130 as discussed in more detail herein. One or more external unit top-handles 137 can be disposed on the top face 133 of the external unit 130 and can be used for lifting and manipulating the external unit 130 during installation of the external unit 130 as discussed in more detail herein. The external unit 130 can further include one or more grille, port or other suitable structure(s) (not shown), which can provide a passage from inside the external unit 130 through which conditioned air can be expelled into an external environment and/or air can be taken in from an external environment as discussed in more detail herein.

**[0038]** Turning to Fig. 2, an example building 200 is shown that includes a wall assembly 210 with a window 230 disposed within a wall 250, which separates an internal environment 260 within the building 200 (e.g., a room) from an external environment 270 that is external to the building 200 (e.g., an outdoor area). The example window 230 comprises a sash 231 and pane 232 that moveably reside within a frame 233 that includes a sill 234. The sash 231 can be configured to raise and lower within the frame 233, and when open, define an opening between the internal and external environments 260, 270.

**[0039]** An example air conditioning unit 100 is shown disposed extending through the window 230 with the internal unit 110 disposed within the internal environment 260 and the external unit 130 disposed in the external environment 270. The internal and external units 110, 130 extend below the sill 234 toward a floor 280 of the building 200 with a portion of the wall 250 below the sill 234 disposed within the cavity 190 of the air conditioning unit 100. As discussed herein, the air conditioning unit 100 can be used to condition air in the internal and/or external environments 260, 270. For example, in various embodiments, the air conditioning unit 100 can be configured to cool the internal environment 260. In various

embodiments, the air conditioning unit 100 can be configured to heat the internal environment 260.

**[0040]** While some embodiments are configured for residential use of an air conditioning unit within windows 230 of a home, it should be clear that an air conditioning unit 100 of further embodiments can be used in various other suitable ways, including in commercial settings such as in an office, factory, laboratory, school, vehicle, or the like. Also, the terms internal and external should not be construed to be limiting and are merely intended to represent separate environments, which can be partially or completely separated in various suitable ways, including by structures such as walls, windows, doors, screens, shades, partitions, sheets, and the like. Additionally, while various examples can relate to air conditioners disposed within a window 230, it should be clear that further examples can be disposed in any suitable opening between internal and external environments, such as a door, slot, flue, vent, skylight, drain, or the like. Accordingly, the specific examples discussed herein should not be construed to be limiting on the wide variety of air conditioning units that are within the scope and spirit of the present disclosure.

**[0041]** In various embodiments, an air conditioning unit 100 can be modular with the internal and external units 110, 130 configured to be separated from the bracket assembly 150. Such embodiments can be desirable in some examples because having such elements separate can make installation of the air conditioner unit 100 easier compared to an air conditioning unit 100 that is a unitary structure.

**[0042]** In various embodiments, the bracket assembly 150 can be configured to facilitate installation of the internal and external units 110, 130, including facilitating moving the external unit 130 through an opening (e.g., a window 230) and positioning the external unit in an external environment 270 proximate to the opening.

**[0043]** Turning to Figs. 3a, 3b, 4 and 5, an example embodiment of a modular climate control unit 100 is illustrated. As shown in Fig. 3a, the modular climate control unit 100 can include at least one user-positionable interior unit 110 wherein the interior unit 110 includes a fluid-to-air heat exchanger 312 and a fan 314 to circulate air across the fluid-to-air heat exchanger 312, an exterior unit 130 including a fluid-to-fluid heat exchanger 318 and a system 320 for supplying a working fluid having a controlled temperature to a first side of the

fluid-to-fluid heat exchanger 318 and a circulation hose 322 defining one or more operable connections 321 between a fluid side of the fluid-to-air heat exchanger 312 and a second side of the fluid-to-fluid heat exchanger 318, wherein the circulation hose 322 allows a circulating fluid to transport heat between the at least one interior unit 110 and the exterior unit 130. As will be discussed in more detail below, the circulating fluid can be a non-toxic, user serviceable fluid and the circulation hose 322 can be coupled to at least one interior unit 110 and the exterior unit 130 in a releasable manner.

**[0044]** Turning to the example exterior unit 130 in more detail, the exterior unit 130 can comprise a system 320 for controlling the temperature of a working fluid. The system 320 for controlling the temperature may be a heat pump, compressor or the like. In the case of a heat pump, the system 320 may provide, add or remove heat to/from the working fluid. In contrast, if only a compressor is provided, the system 320 may remove heat from the working fluid. Further, the exterior unit 130 can include a fluid-to-fluid heat exchanger 318 that can allow the exchange of heat between the working fluid on one side of the heat exchanger 318 and the circulating fluid on the other side of the heat exchanger 318. A fan and various other components such as controls may also be included in the exterior unit 130 in some embodiments.

**[0045]** The interior unit 110 can comprise a fan 314 and a fluid-to-air heat exchanger 312. In some examples, the interior unit 110 includes a fluid pump and a circulating fluid storage tank that will operate as described below in more detail.

**[0046]** The circulation hose 322 can comprise a detachable hose that extends between the interior unit 110 and exterior unit 130. For example, as can be seen at Fig. 3b, the circulation hose 322 can include three lumens therein that act as a fluid supply 324, a fluid return 326 and wiring 328 for power and/or control signals between the interior unit 110 and exterior unit 130. The circulation hose 322 may further optionally include a fourth lumen 330 to serve as a conduit to convey condensate back to the exterior unit 130 from the interior unit 110 preventing the need for a condensate drain therein.

**[0047]** It can be appreciated by one skilled in the art that within the scope of the present disclosure an outdoor unit 130 has been described, however, it should be appreciated that the outdoor unit 130 may be positioned indoors as well at a location wherein the user is not

concerned about the potential for heat gain. Further, it is anticipated within the scope of the present disclosure that the air-cooled condenser may be a fluid-cooled condenser and more particularly a condenser that is cooled using ground source water.

**[0048]** As illustrated in Fig. 4, the outdoor unit 130 can operate using a heat pump/air conditioning cycle to reduce the temperature of working fluid 432 or coolant, which in turn extracts heat from a circulating fluid 434 via the fluid-to-fluid heat exchanger 318. The cooled circulating fluid 434 is then circulated, via the circulation hose 322, between the exterior and interior units 130, 110. As was illustrated in Fig. 3a, the circulating fluid 434 may be directed through the fluid-to-air heat exchanger 312 in the interior unit 130 to cool the air directly.

**[0049]** Further, as can be seen in Fig. 5, the circulating fluid 434 may be directed to reduce the overall temperature of a fluid storage tank 536 within the interior unit 110. In this embodiment, when cooling is needed in the indoor space, cold fluid from the cold fluid storage tank 536 is circulated through the fluid-to-air heat exchanger 312 where the fan 314 circulates room air across the heat exchanger 312 producing a cooling effect. One skilled in the art should appreciate that while the fluid storage tank 536 is shown in the interior unit 110 it could also be positioned within the exterior unit 130 or independently at an intermediate position along the circulation hose 322.

**[0050]** The example arrangement of Fig. 5 can allow a room cooling function and a fluid cooling function to be decoupled from one another in a temporal sense in that the control system may only operate the outdoor unit 130 when the temperature of the circulating fluid rises above a certain set point. Similarly, the indoor unit 110 can independently increase or decrease fan speed and fluid circulation rate in order to provide a great deal of control over the cooling effect as compared to the prior art on or off cooling systems. This decoupling of the indoor cooling loop and the outdoor cooling loop can further allow the outdoor unit 130 to cool the fluid when it is most efficient to do so. For example, the outdoor unit 130 may cool the fluid stored in the interior insulated cold fluid storage tank at night for cooling use during the day when the outdoor ambient temperatures increase.

**[0051]** In various embodiments, the circulating fluid can be a non-toxic, low freezing point coolant such as salt brine of water mixed with polyethylene glycol. This can be

contrasted with some systems that circulate a refrigerant such as Freon or R-10 between the indoor and outdoor units 110, 130. The arrangement of various embodiments allows a user to selectively connect an indoor unit 110 with an outdoor unit 130 using a modular hose arrangement thereby eliminating a great deal of complexity and cost. Further, this arrangement can allow for freedom in placing the indoor unit 110 as needed for maximum cooling effect and occupant comfort. The circulation hose(s) 322 can be attached to the indoor and outdoor units 110, 130 using a quick release style coupler 342. Such quick release couplers 342 can include valving therein that prevents leakage of circulating fluid 434 when the circulation hose(s) 322 are disconnected.

**[0052]** To further enhance the modularity of the air conditioning unit 100, the indoor and/or outdoor units 110, 130 can be arranged such that they include multiple hose connection points so that multiple indoor units 110 can be connected to a single outdoor unit 130. Such connections may be parallel or made directly from each of the indoor units 110 to the outdoor unit 130. Alternately the indoor units 110 may be connected in series or in a daisy chain arrangement with the outdoor unit 130. Turning back to Fig. 5, the indoor unit 110 may include such functionality as heat sensors 538 and servo directed louvers 540 to direct cooling airflow to hotspots in a room (e.g., room occupants). Further, the indoor unit 110 may be configured to collect condensate and deposit the condensate back into the loop of circulating fluid 434. The outdoor unit 130 can then be configured to eject some fluid from the loop of circulating fluid 434 should the fluid capacity of the loop of circulating fluid 434 be exceeded by the addition of condensate.

**[0053]** It should be further appreciated by one skilled in the art that the arrangement of the various examples could operate equally well as a heating system. In operation, change that could be made is that the outdoor unit 130 would be run as a heat pump rather than as an air conditioner. In this manner, rather than cooling the circulating fluid, the outdoor unit 130 would heat the circulating fluid. Optionally, the indoor unit(s) 110 may instead include a supplemental heating arrangement such as an electrical heating coil.

**[0054]** It can therefore be seen that the present disclosure illustrates examples of a modular air conditioner unit 100 that can operate on the basic principle of a split system yet allows user serviceability and modular components such that the system is flexible. Further,

various embodiments provide a modular air conditioning unit 100 that includes at least one indoor cooling unit 110 that has an integrated cold storage therein such that the temperature of the cold store is maintained by a circulating coolant fluid through user serviceable hose connections with an outdoor heat dissipation unit.

**[0055]** In various embodiments, the modular air conditioning unit 100 can comprise various suitable sensors and other additional hardware. For example, the indoor unit 110 and/or outdoor unit 130 can comprise a temperature sensor, humidity sensor, barometric pressure sensor, light sensor, and the like. It can be desirable for both the indoor and outdoor units to both have such sensors so that environmental conditions of both an indoor and outdoor environment can be determined.

**[0056]** Also, in various embodiments the modular air conditioning unit 100 can comprise a suitable computing device configured to perform one or more steps of at least one of the methods discussed herein, with such a computing system including elements such as a processor, memory, power source, sensor, communication unit, and the like. For example, a memory can store instructions, that when executed by the processor, cause performance of one or more steps of at least one of the methods discussed herein. In various embodiments, such a computing system can be complex or simple, with some embodiments operating via firmware instead of a processor executing instruction stored on a computer-readable medium. In further embodiments, a computing device can be absent, with functionalities achieved via physical components or under the control of an external device.

**[0057]** In various embodiments, the modular air conditioner unit 100 can comprise various suitable types of user interfaces. For example, Fig. 8 illustrates an example embodiment of a modular air conditioner unit 100 having an interface 800 disposed on the top face 113 of the internal unit 110. In this example, the interface 600 has a cylindrical body with a display 810 on the top of the interface 800 with a rotatable interface ring 820 defining a peripheral sidewall of the interface 800.

**[0058]** The display 810 can comprise a screen in various embodiments, which may or may not be a touch screen that allows for input in addition to providing visual presentations. Examples of interfaces provided by the display 810 are shown and described herein. The interface ring 820 can provide for one or more types of input in various embodiments,

including via rotating of the interface ring 820, pressing the interface ring 820 downward toward the top face 113 of the internal unit 110, pulling the interface ring 820 upward away from the top face 113 of the internal unit 110, and the like. In some embodiments, the interface ring 820 can be configured to rotate indefinitely without any stops or can be configured to rotate with one or more stop positions that stop rotation of the interface ring 820 in the clockwise and counter-clockwise direction. In some embodiments, the interface ring 820 can comprise additional interface elements such as one or more buttons, scroll, wheels, touch screens, or the like. In some embodiments, the interface ring 820 can be absent. In some embodiments, the interface 800 can provide for various types of input or output including, voice input, haptic output, sound output, and the like.

**[0059]** In some embodiments, the interface 800 can be the only interface element of the modular air conditioner unit 100, with other interface elements being absent. However, in further embodiments, any suitable additional and/or alternative interface elements can be present on the modular air conditioner unit 100.

**[0060]** In various embodiments, the top cover 170 can be configured to be adjustable to accommodate different widths of openings between an internal and external environment 260, 270 such as the width of a wall 250, sill 234 or the like. For example, Figs. 6 and 7 illustrate an example of a bracket 150 that can be mounted over the sill 234 of a window 230 in a wall 250 and slidably adapted to the size of the sill 234 and wall 250 via a first bracket portion 605 and a second bracket portion 610. The first and second bracket portions 605, 610 can be coupled together in a given configuration via a latch 615 or other suitable element (e.g., a screw, clamp, or the like).

**[0061]** The internal and external units 110, 130 can be mounted on respective sides of the bracket 150 and a plurality of lines 620 (e.g., fluid, communication and/or power lines) can be extended through the window 230 and can be coupled with respective ports 625 to operably couple the internal and external units 110, 130. Further examples of installing a modular air conditioning unit can be found in U.S. Patent Application No. 17/017,066, filed September 10, 2020, entitled "WINDOW INSTALLATION SYSTEM AND METHOD FOR SPLIT-ARCHITECTURE AIR CONDITIONING UNIT," with attorney docket number

0111058-003US0, which is incorporated herein by reference in its entirety and for all purposes.

**[0062]** A top cover 170 can be installed over and/or about one or both of the internal and external units 110, 130. For example, as shown in Fig. 8, a top cover 170 can be installed over the top face 133 of the external unit 130 and surrounding portions of the front face 131 and/or sidewalls 135 of the external unit 130. The top cover 170 in various embodiments can extend through the window 230 and partially or fully over the wall 250, sill 234, and the like. The top cover 170 can further engage the internal unit 110 including over the top face 113 of the internal unit 110 and in some embodiments surrounding portions of the front face 111 and/or sidewalls 115 of the internal unit 110.

**[0063]** In various embodiments, the top cover 170 can be configured to adapt to the distance between the internal and external units 110, 130, which can be generated by the size of the bracket 150, which can be defined as discussed herein. For example, as shown in Figs. 8 and 9 in some embodiments the top cover 170 can comprise a first portion 910 and a second portion 930 that are slidably nested together such that a length of the top cover 170 can be changed to adapt to the distance between the internal and external units 110, 130.

**[0064]** The first portion 910 can extend between an external first portion end 912 and an internal first portion end 914 with a pair of first portion flanges 916 extending from opposing sides of the first portion 910. The first portion flanges 916 can comprise respective coupling pins 918 and can define respective guide slots 920. The second portion 930 can extend between an external second portion end 932 and an internal second portion end 934 with a pair of second portion flanges 936 extending from opposing sides of the second portion 930. The first portion flanges 916 can comprise respective guide pins 938, that are configured to travel in the respective slots 920 defined by the first portion flanges 916, which can generate a slidable coupling of the first and second portion 910, 930.

**[0065]** As shown in the example of Fig. 8, the first portion 910 of the top cover 170 can be disposed over the top face 133 of the external unit 130 with the external first portion end 912 disposed at the front face 131 of the external unit 130, which can include in some embodiments a lip of the external first portion end 912 engaging the front face 131 of the external unit 130. In various embodiments, the external first portion end 912 can be

contoured to match the profile of the top face 133 of the external unit 130 at the front face 131. For example, as shown in Figs. 8 and 9, the external first portion end 912 can be linear in the center and curved at the ends to match the profile of the top face 133 of the external unit 130 at the front face 131. The first portion flanges 916 can engage the sidewalls 135 of the external unit 130 and in some embodiments can extend past the faces of the sidewalls 135 into or about the cavity 190 between the internal and external units 110, 130.

**[0066]** The second portion 930 of the top cover 170 can be slidably disposed over the first portion 910 with the external second portion end 932 of the second portion 930 engaging the top face 113 of the internal unit 110. In some embodiments, after the top cover 170 is fully attached to the outdoor unit, the user can extend the top cover 170 via sliding the second portion 930 until the second portion 930 reaches the indoor unit 110. In one embodiment, the top cover 170 is attached to the indoor unit 110 via spring plungers that are installed on each side of the indoor unit 110. In other embodiments, the top cover 170 can be attached to the indoor unit 130 via other suitable mechanisms such as clips, hooks, a lip, a ledge, or the like.

**[0067]** For example, as shown in the embodiment of Fig. 8, the internal unit 110 can comprise a lip 830 extending from the internal face 112 of the internal unit 110 within the cavity 190 between the internal and external units 110, 130 and the external second portion end 932 of the second portion 910 can engage this lip 830.

**[0068]** The second portion flanges 936 can slidably engage the first portion flanges 916 over at least a portion of the sidewalls 135 of the external unit 130 and into or about the cavity 190 between the internal and external units 110, 130. In various embodiments, the first and second portions 910, 930 of the top cover 170 can be made of various suitable materials such as sheet metal, plastic, or the like.

**[0069]** In some embodiments, the top cover 170 consists of, consists essentially of or comprises two or more pieces (e.g., portions 910, 930) that slide against each other. In one preferred embodiment, the two or more pieces are unable to be separated and are joined together by a sliding connector such as a pin and slot connection (e.g., guide pins 938 in guide slots 920 as discussed herein). In some examples, this can comprise one or more pin attached to one of the pieces that engages with a slot on a hem of the other; and/or the two pieces can slide via rails, trackers, or rollers; or the like.

**[0070]** In various embodiments, the top cover 170 can be coupled to the modular air conditioning system 100 in various suitable ways. For example, Fig. 10 illustrates an example embodiment where the external unit 130 comprises coupling slots 1000 defined by the sidewalls 135 of the external unit 130 proximate to the top face 131 (only one side of the external unit 130 is shown in Fig. 10). The coupling slots 1000 comprise an opening 1010 defined by the top face 131 and a sidewall 135 that extends downward at an angle to a linear slot portion 1020.

**[0071]** For example, to install the top cover 170 on the external unit 130 respective coupling pins 918 at an end of the top cover 170 (see e.g., Figs. 9 and 11) can be inserted into the opening 1010 and be moved downward to the linear slot portion 1020 and moved toward the front face 131 of the external unit 130 within the linear slot portion 1020. The top cover 170 and coupling pins 918 can be sized such that the coupling pins 918 can move within the coupling slot 1000, but are prevented from leaving the coupling slot 1000 once inserted. In some embodiments, when the coupling pins 918 reach the end of the linear slot portion 1020, they can "click" into place (e.g., based on a depression or bump at the end of the linear slot portion, a clip, or the like).

**[0072]** Such embodiments can allow a user to secure the top cover 170 closer to the window, minimizing potential drop hazard concerns. The engagement of the coupling pins 918 in the slots 1000 of the outdoor unit 130 may minimize concerns over wind loading on the top cover 170 in various examples, which can be a concern for windows on high-rise buildings. In another embodiment, the top cover 170 can be secured using clips or a tether to prevent the potential to drop the top cover 170 out of the window. In some embodiments, the top cover 170 can be attached to the indoor unit 110 via a spring plunger on each side of the indoor unit 110. The top cover 170 in various examples obscures the electrical and/or hydronic connections between the outdoor and indoor units 110, 130, creating a more seamless transition between the outdoor and indoor units 110, 130.

**[0073]** In some embodiments, the top cover 170, when installed on the modular air conditioning system 100, can be sloped towards the outdoors or include features that allow for easier water drainage and prevent any rain from entering indoors through a window or other opening. For example, there can be a 3° slant from the back of the indoor unit 110 to the

outer edge of the outdoor unit 130 so rain does not collect on the surface of the top cover 170. Further embodiments can have a slant on 1.0º, 1.5º, 2.0 º, 2.5º, 3.0º, 3.5º, 4.0º, 4.5º, 5.0º, or the like including a suitable range between such example values.

**[0074]** Instead of first attaching the top cover 170 to the outdoor unit 130 and then to the indoor unit 110, in some embodiments the top cover 170 can first connect to the indoor unit 110 and then be connected to the outdoor unit 130. For example, a user could attach the top cover 170 to the indoor unit 110 and then slide a movable portion of the top cover 170 to match the outer edge, inner edge or top portion of the outdoor unit 130.

**[0075]** In various embodiments, the top cover 170, internal unit 110 and/or external unit 130 can include various suitable features that provide for various functionalities. For example, Fig. 8 illustrates an example of the internal unit 110 having a rectangular tray 850, which can include a concave depression defined by the top portion 113 of the internal unit 110. Such a feature can be configured for holding various items on the modular air conditioning system 100. In another example, Fig. 12 illustrates an example embodiment wherein the top cover 170 comprises a railing 1200, which can be desirable for holding items on the top cover 170 (e.g., plants). For example, such a railing 1200 can help prevent items stored outside of a window 230 from falling off the modular air conditioning system 100. In another example, Fig. 13 illustrates an embodiment where a modular air conditioning system 100 comprises a screen 1300 that extends within a window 230. In yet another example, Fig. 14 illustrates an embodiment where the top cover 170 and/or internal unit 110 comprises a hole 1400, which can be used for storage of various items such as a potted plant, or the like. In some examples, to improve window sealing, some embodiments can include foam or other sealing mechanisms on the underside of the top cover 170 to block any remaining gaps between the modular air conditioning system 100 and the window 230, wall 250, or the like. In various embodiments, such elements can be integral parts of the internal unit 110, external unit 130, top cover 170, or the like, or can be add-ons or modular components of such portions of the modular air conditioning system 100.

**[0076]** Embodiments of the present disclosure can be described in view of the following clauses:

1. An air conditioning unit comprising:

an interior unit disposed at a window within an indoor area of a building below a horizontal level of a sill of the window, the window separating the indoor area within the building and an exterior area external to the building, the interior unit comprising a fan disposed behind a heat exchanger that is proximate to an external face of the interior unit;

an exterior unit disposed at the window in the exterior area below the horizontal level of the sill, the exterior unit comprising a top face, a front face and a pair of opposing sidewalls;

a bracket disposed over the sill of the window, the bracket extending through the window and below the sill of the window in both the indoor area within the building and the exterior area external to the building with the interior unit and exterior unit coupled to and hanging from the bracket, the bracket configured to slidably widen and narrow to correspond to a width of the sill of the window and defining a distance between the interior unit and the exterior unit;

one or more connectors between the interior unit and the exterior unit that extend through the window and over the sill, the one or more connectors including a circulation hose that extends through the window and over the sill to connect the exterior unit and the interior unit; and

a top cover comprising a first portion and a second portion that are slidably nested together such that a length of the top cover can be changed to adapt to the distance between the interior unit and the exterior unit defined by the bracket,

wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots,

wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in the respective guide slots defined by the first portion flanges to generate a slidable coupling of the first and second portions,

wherein the first portion of the top cover is disposed over the top face of the exterior unit with the external first portion end disposed at the front face of the exterior unit, the external first portion end contoured to match a curved profile of the top face of the exterior unit at the front face, and

wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior

unit, the second portion of the top cover slidably disposed over the first portion with the external second portion end of the second portion engaging a top face of the interior unit.

2. The air conditioning unit of clause 1, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, the coupling slots comprising:

an opening defined by the top face and one of the sidewalls, and

a linear slot portion;

wherein installation of the top cover on the exterior unit includes the respective coupling pins at an end of the top cover being:

inserted into the opening,

moved downward to the linear slot portion, and

moved toward the front face of the exterior unit within the linear slot portion, wherein the top cover and coupling pins are sized such that the coupling pins can move within the coupling slots, but are prevented from leaving the coupling slots once inserted aside from back out the openings.

3. The air conditioning unit of clause 1 or 2, wherein the top cover is disposed on the exterior unit at least at a 3.0° slant from the interior unit to the front face of the exterior unit to reduce rain collecting on a surface of the top cover.

4. The air conditioning unit of any of clauses 1-3, wherein the top cover obscures the one or more connectors between the interior unit and the exterior unit that extends through the window and over the sill in the cavity between the interior unit and the exterior unit.

5. An air conditioning unit comprising:

an interior unit;

an exterior unit comprising a top face, a front face and a pair of opposing sidewalls; and

a top cover comprising a first portion and a second portion that are slidably nested ftogether such that a length of the top cover can be changed to adapt to a distance between the interior unit and the exterior unit,

wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots,

wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in the respective guide slots defined by the first portion flanges to generate a slidable coupling of the first and second portions,

wherein the first portion of the top cover is disposed over the top face of the exterior unit with the external first portion end disposed at the front face of the exterior unit, and

wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior unit, the second portion of the top cover slidably disposed over the first portion with the external second portion end of the second portion engaging a top face of the interior unit.

6. The air conditioning unit of clause 5, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, the coupling slots comprising:

an opening defined by the top face and one of the sidewalls, and

a linear slot portion;

wherein the top cover is configured for the respective coupling pins at an end of the top cover being:

inserted into the opening,

moved downward to the linear slot portion, and

moved toward the front face of the exterior unit within the linear slot portion, wherein the top cover and coupling pins are sized such that the coupling pins can move within the coupling slots, but are prevented from leaving the coupling slots once inserted, aside from back out the openings.

7. The air conditioning unit of clause 5 or 6, further comprising a bracket with the interior unit and the exterior unit coupled to the bracket, the bracket configured to slidably widen and narrow to define the distance between the interior unit and the exterior unit.

8. The air conditioning unit of any of clauses 5-7, wherein the interior unit is disposed at an opening within an indoor area of a building below a horizontal level of the opening, the opening separating the indoor area within the building and an exterior area external to the building, and wherein the exterior unit is disposed at the opening in the exterior area below the horizontal level of the opening.

9. The air conditioning unit of clause 8, further comprising: one or more connectors between the interior unit and the exterior unit that extends through the opening, the one or more connectors including a circulation hose that extends through the opening to connect the exterior unit and the interior unit.

10. An air conditioning unit comprising:

an interior unit;

an exterior unit comprising a top face, a front face and a pair of opposing sidewalls; and

a top cover.

11. The air conditioning unit of clause 10, wherein the top cover comprises a first portion and a second portion that are slidably nested together such that a length of the top cover can be changed to adapt to a distance between the interior unit and the exterior unit.

12. The air conditioning unit of clause 11, wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots.

13. The air conditioning unit of clause 12, wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior unit.

14. The air conditioning unit of any of clauses 11-13, wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in guide slots defined by the first portion to generate a slidable coupling of the first and second portions.

15. The air conditioning unit of any of clauses 11-14, wherein the first portion of the top cover is disposed over the top face of the exterior unit with an external first portion end disposed at the front face of the exterior unit.

16. The air conditioning unit of any of clauses 11-15, wherein the second portion of the top cover is slidably disposed over the first portion with an external second portion end of the second portion engaging the interior unit.

17. The air conditioning unit of any of clauses 10-16, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, wherein the top cover is configured for respective coupling pins at an end of the top cover being inserted into and coupled within the coupling slots.

18. The air conditioning unit of clause 17, wherein the coupling pins of the top cover being inserted into and coupled within the coupling slots includes:

the coupling pins being inserted into respective openings of the coupling slots, and

the coupling pins being moved toward the front face of the exterior unit within a linear slot portion.

19. The air conditioning unit of any of clauses 10-18, further comprising a bracket with the interior unit and the exterior unit coupled to the bracket, the bracket configured to slidably widen and narrow to define a distance between the interior unit and the exterior unit.

20. The air conditioning unit of any of clauses 10-19, wherein the interior unit is disposed at an opening within an indoor area below an opening of a structure, the opening separating the indoor area and an exterior area, and wherein the exterior unit is disposed at the opening in the exterior area below the opening.

**[0077]** The described embodiments are susceptible to various modifications and alternative forms, and specific examples thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the described embodiments are not to be limited to the particular forms or methods disclosed, but to the contrary, the present disclosure is to cover all modifications, equivalents, and alternatives. Additionally, elements of a given embodiment should not be construed to be applicable to only that example embodiment and therefore elements of one example

embodiment can be applicable to other embodiments. Additionally, in some embodiments, elements that are specifically shown in some embodiments can be explicitly absent from further embodiments. Accordingly, the recitation of an element being present in one example should be construed to support some embodiments where such an element is explicitly absent.

# CLAIMS

What is claimed is:

1. An air conditioning unit comprising:

an interior unit disposed at a window within an indoor area of a building below a horizontal level of a sill of the window, the window separating the indoor area within the building and an exterior area external to the building, the interior unit comprising a fan disposed behind a heat exchanger that is proximate to an external face of the interior unit;

an exterior unit disposed at the window in the exterior area below the horizontal level of the sill, the exterior unit comprising a top face, a front face and a pair of opposing sidewalls;

a bracket disposed over the sill of the window, the bracket extending through the window and below the sill of the window in both the indoor area within the building and the exterior area external to the building with the interior unit and exterior unit coupled to and hanging from the bracket, the bracket configured to slidably widen and narrow to correspond to a width of the sill of the window and defining a distance between the interior unit and the exterior unit;

one or more connectors between the interior unit and the exterior unit that extend through the window and over the sill, the one or more connectors including a circulation hose that extends through the window and over the sill to connect the exterior unit and the interior unit; and

a top cover comprising a first portion and a second portion that are slidably nested together such that a length of the top cover can be changed to adapt to the distance between the interior unit and the exterior unit defined by the bracket,

wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots,

wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in the respective guide slots defined by the first portion flanges to generate a slidable coupling of the first and second portions,

wherein the first portion of the top cover is disposed over the top face of the exterior unit with the external first portion end disposed at the front face of the exterior unit, the

external first portion end contoured to match a curved profile of the top face of the exterior unit at the front face, and

wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior unit, the second portion of the top cover slidably disposed over the first portion with the external second portion end of the second portion engaging a top face of the interior unit.

2. The air conditioning unit of claim 1, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, the coupling slots comprising:

an opening defined by the top face and one of the sidewalls, and

a linear slot portion;

wherein installation of the top cover on the exterior unit includes the respective coupling pins at an end of the top cover being:

inserted into the opening,

moved downward to the linear slot portion, and

moved toward the front face of the exterior unit within the linear slot portion, wherein the top cover and coupling pins are sized such that the coupling pins can move within the coupling slots, but are prevented from leaving the coupling slots once inserted aside from back out the openings.

3. The air conditioning unit of claim 1, wherein the top cover is disposed on the exterior unit at least at a 3.0° slant from the interior unit to the front face of the exterior unit to reduce rain collecting on a surface of the top cover.

4. The air conditioning unit of claim 1, wherein the top cover obscures the one or more connectors between the interior unit and the exterior unit that extends through the window and over the sill in the cavity between the interior unit and the exterior unit.

5. An air conditioning unit comprising:

an interior unit;

an exterior unit comprising a top face, a front face and a pair of opposing sidewalls; and

a top cover comprising a first portion and a second portion that are slidably nested ftogether such that a length of the top cover can be changed to adapt to a distance between the interior unit and the exterior unit,

wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots,

wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in the respective guide slots defined by the first portion flanges to generate a slidable coupling of the first and second portions,

wherein the first portion of the top cover is disposed over the top face of the exterior unit with the external first portion end disposed at the front face of the exterior unit, and

wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior unit, the second portion of the top cover slidably disposed over the first portion with the external second portion end of the second portion engaging a top face of the interior unit.

6. The air conditioning unit of claim 5, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, the coupling slots comprising:

an opening defined by the top face and one of the sidewalls, and

a linear slot portion;

wherein the top cover is configured for the respective coupling pins at an end of the top cover being:

inserted into the opening,

moved downward to the linear slot portion, and

moved toward the front face of the exterior unit within the linear slot portion, wherein the top cover and coupling pins are sized such that the coupling pins can move within the coupling slots, but are prevented from leaving the coupling slots once inserted, aside from back out the openings.

7. The air conditioning unit of claim 5, further comprising a bracket with the interior unit and the exterior unit coupled to the bracket, the bracket configured to slidably widen and narrow to define the distance between the interior unit and the exterior unit.

8. The air conditioning unit of claim 5, wherein the interior unit is disposed at an opening within an indoor area of a building below a horizontal level of the opening, the opening separating the indoor area within the building and an exterior area external to the building, and wherein the exterior unit is disposed at the opening in the exterior area below the horizontal level of the opening.

9. The air conditioning unit of claim 8, further comprising: one or more connectors between the interior unit and the exterior unit that extends through the opening, the one or more connectors including a circulation hose that extends through the opening to connect the exterior unit and the interior unit.

10. An air conditioning unit comprising:

an interior unit;

an exterior unit comprising a top face, a front face and a pair of opposing sidewalls; and

a top cover.

11. The air conditioning unit of claim 10, wherein the top cover comprises a first portion and a second portion that are slidably nested together such that a length of the top cover can be changed to adapt to a distance between the interior unit and the exterior unit.

12. The air conditioning unit of claim 11, wherein the first portion extends between an external first portion end and an internal first portion end with a pair of first portion flanges extending from opposing sides of the first portion, the first portion flanges comprising respective coupling pins and defining respective guide slots.

13. The air conditioning unit of claim 12, wherein the first portion flanges engage the sidewalls of the exterior unit and extend past faces of the sidewalls into or about a cavity between the interior unit and the exterior unit.

14. The air conditioning unit of claim 11, wherein the second portion extends between an external second portion end and an internal second portion end with a pair of second portion flanges extending from opposing sides of the second portion, the second portion flanges comprising respective guide pins that are configured to travel in guide slots defined by the first portion to generate a slidable coupling of the first and second portions.

15. The air conditioning unit of claim 11, wherein the first portion of the top cover is disposed over the top face of the exterior unit with an external first portion end disposed at the front face of the exterior unit.

16. The air conditioning unit of claim 11, wherein the second portion of the top cover is slidably disposed over the first portion with an external second portion end of the second portion engaging the interior unit.

17. The air conditioning unit of claim 10, wherein the exterior unit comprises respective coupling slots defined by the sidewalls of the exterior unit proximate to the top face, wherein the top cover is configured for respective coupling pins at an end of the top cover being inserted into and coupled within the coupling slots.

18. The air conditioning unit of claim 17, wherein the coupling pins of the top cover being inserted into and coupled within the coupling slots includes:

the coupling pins being inserted into respective openings of the coupling slots, and

the coupling pins being moved toward the front face of the exterior unit within a linear slot portion.

19. The air conditioning unit of claim 10, further comprising a bracket with the interior unit and the exterior unit coupled to the bracket, the bracket configured to slidably widen and narrow to define a distance between the interior unit and the exterior unit.

20. The air conditioning unit of claim 10, wherein the interior unit is disposed at an opening within an indoor area below an opening of a structure, the opening separating the indoor area and an exterior area, and wherein the exterior unit is disposed at the opening in the exterior area below the opening.

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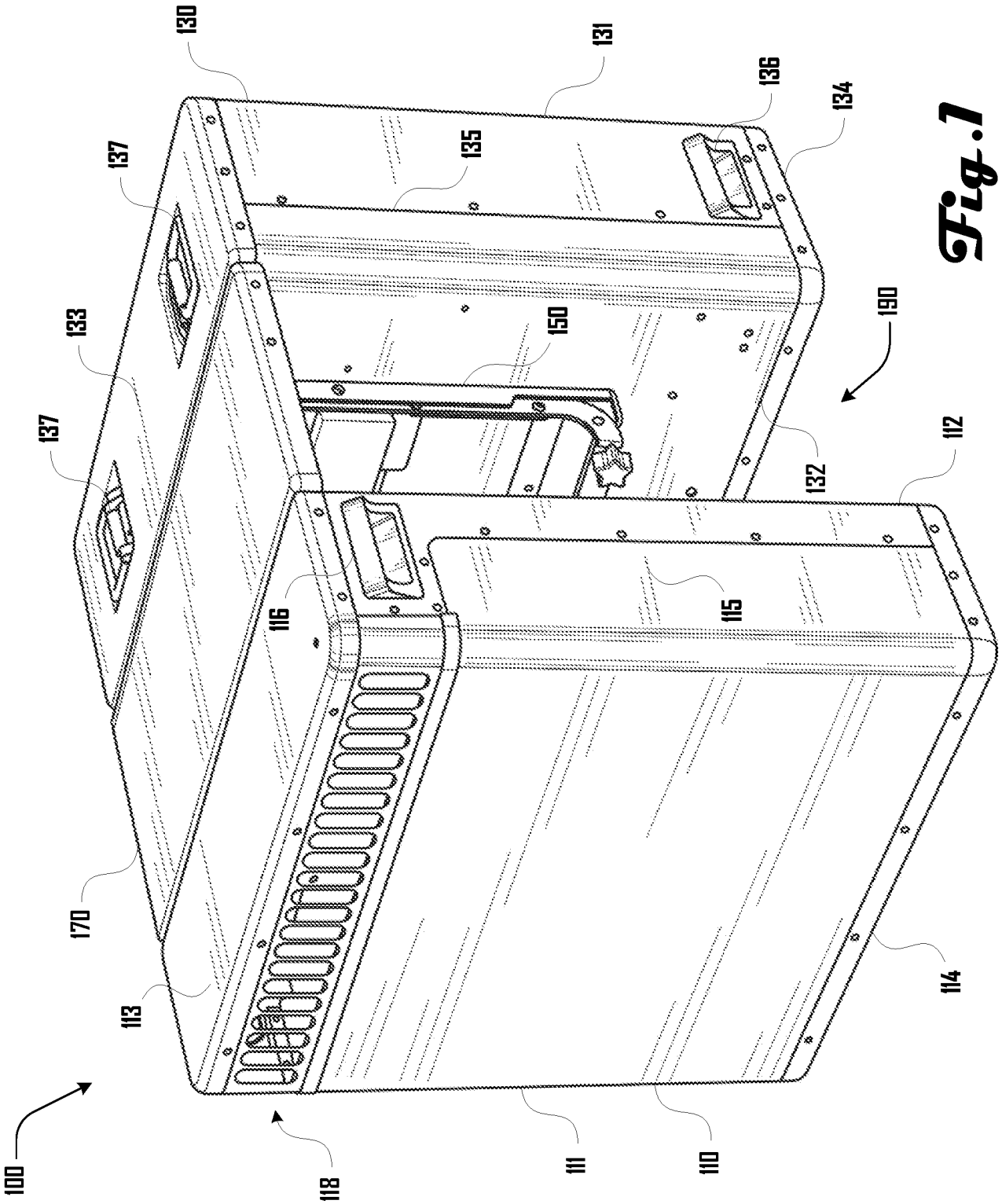
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Fig.1

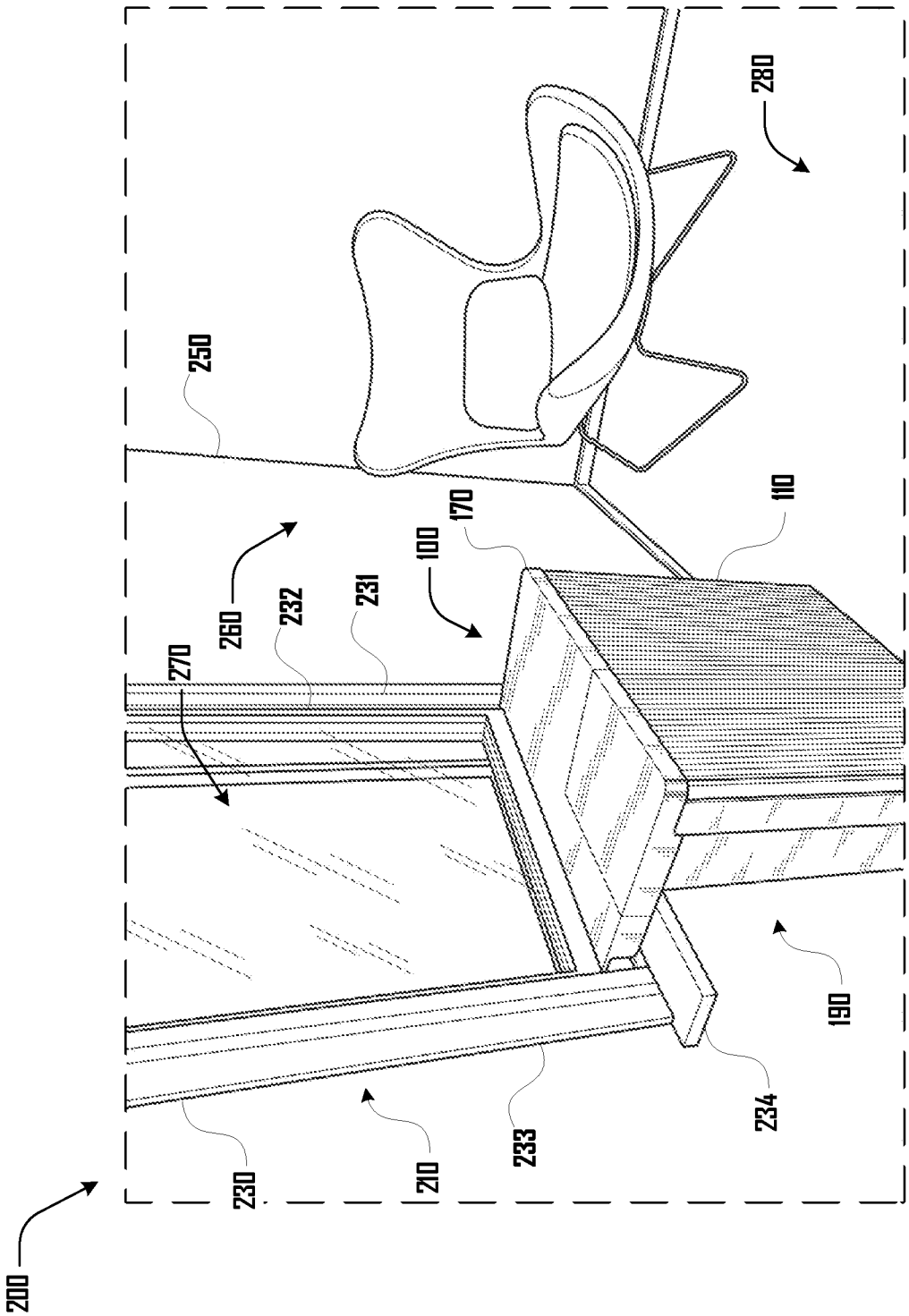


Fig.2

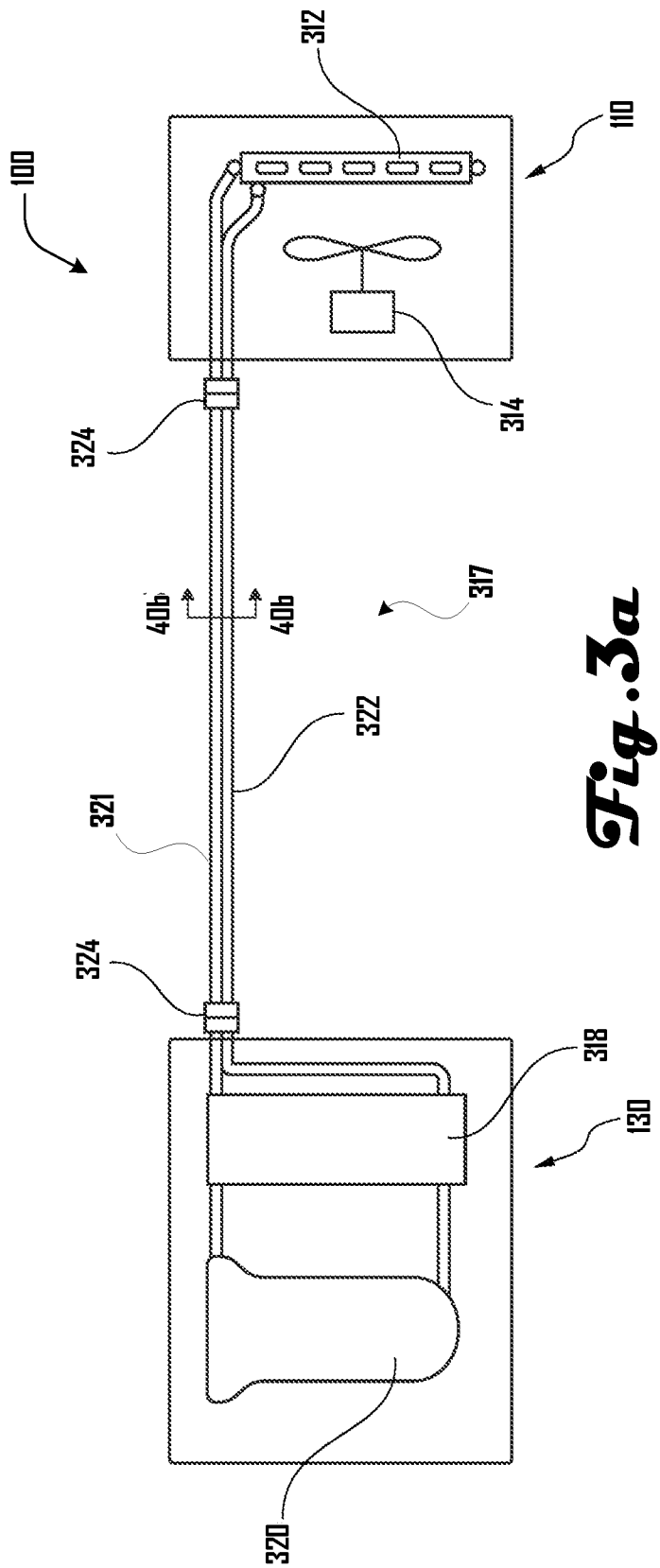
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Fig.3a

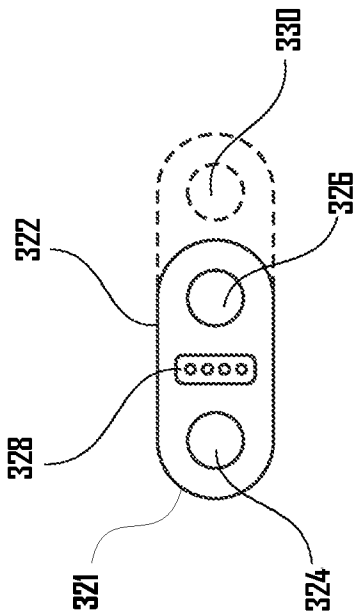
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Fig.3b

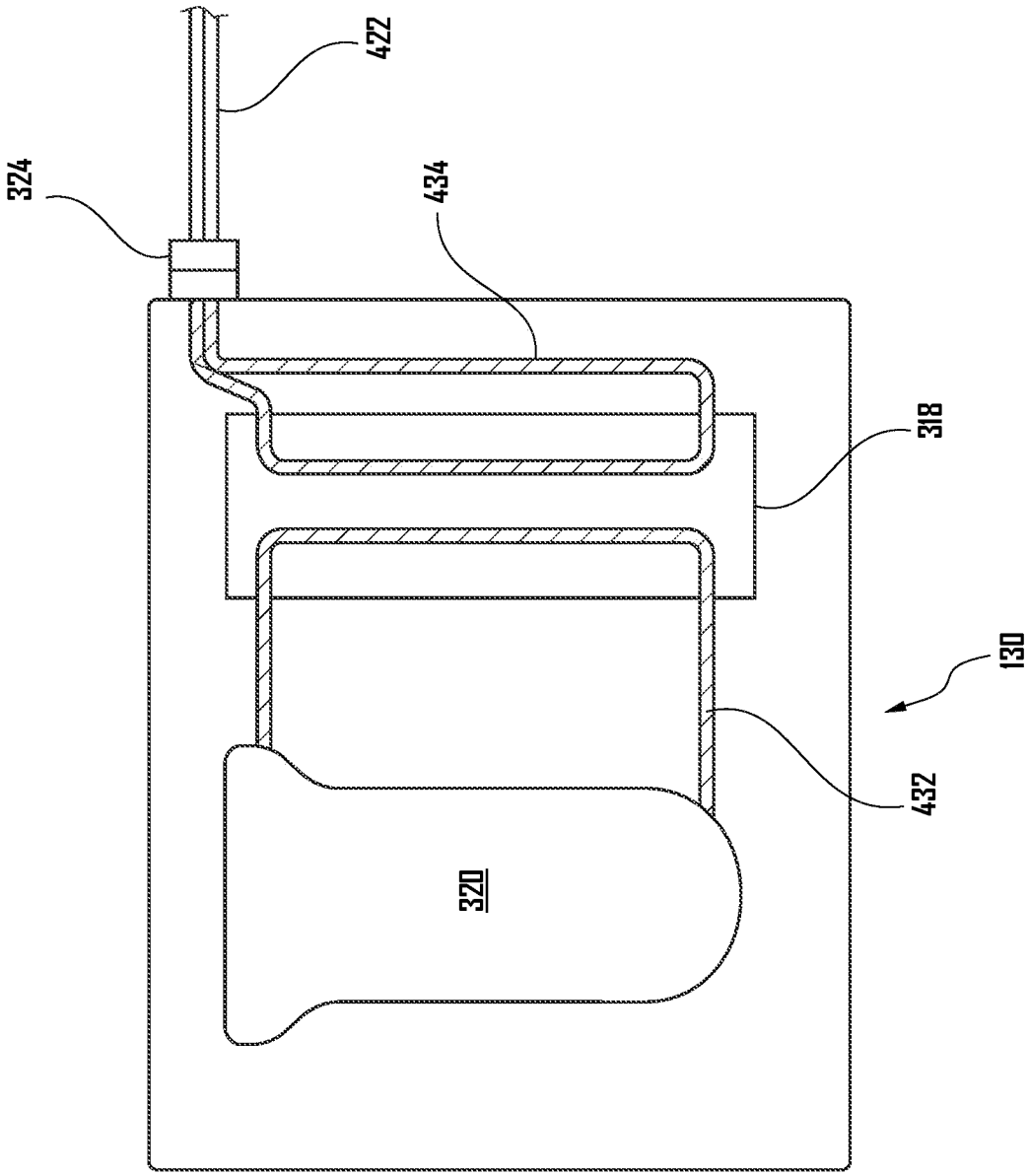


Fig. 4

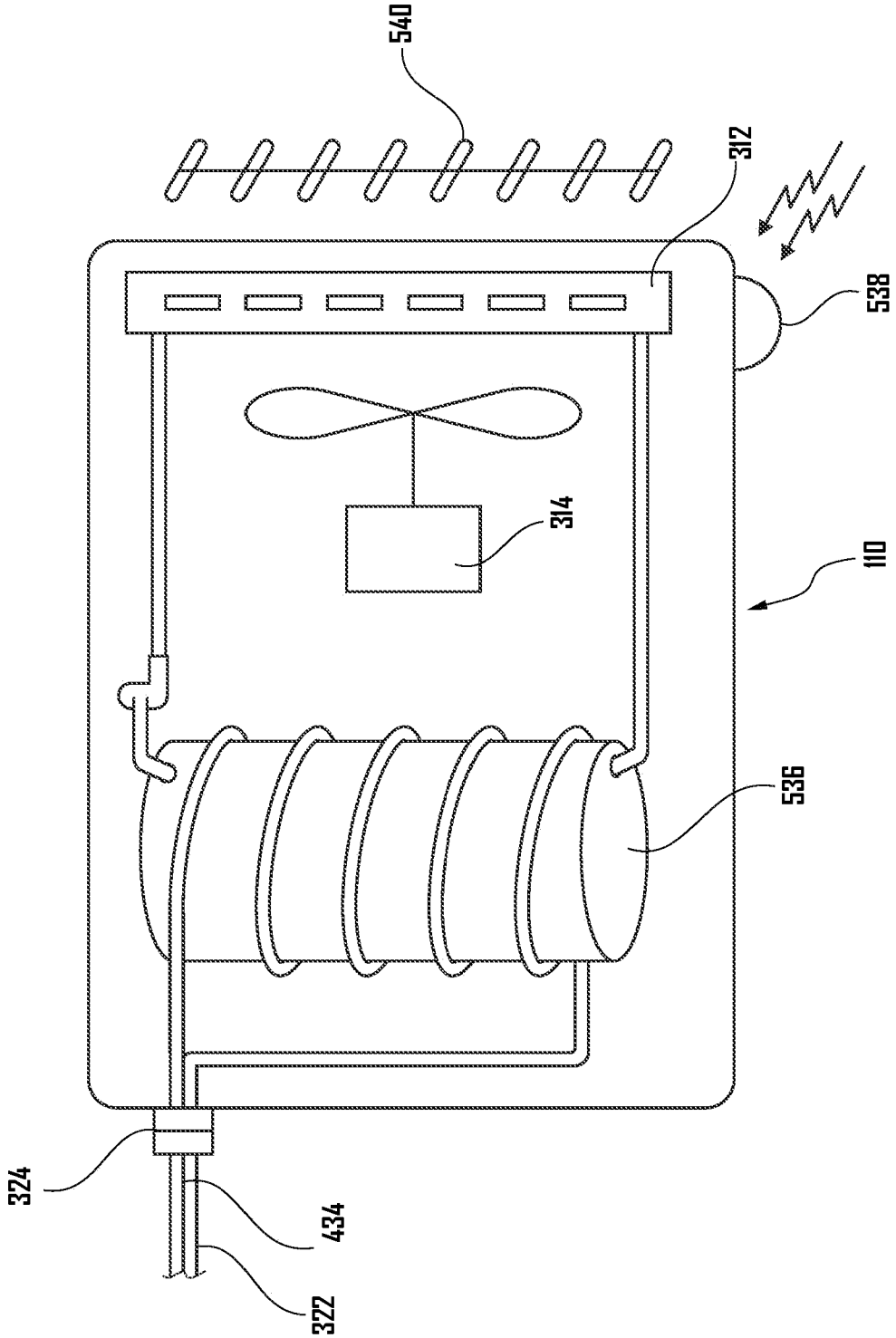


Fig.5

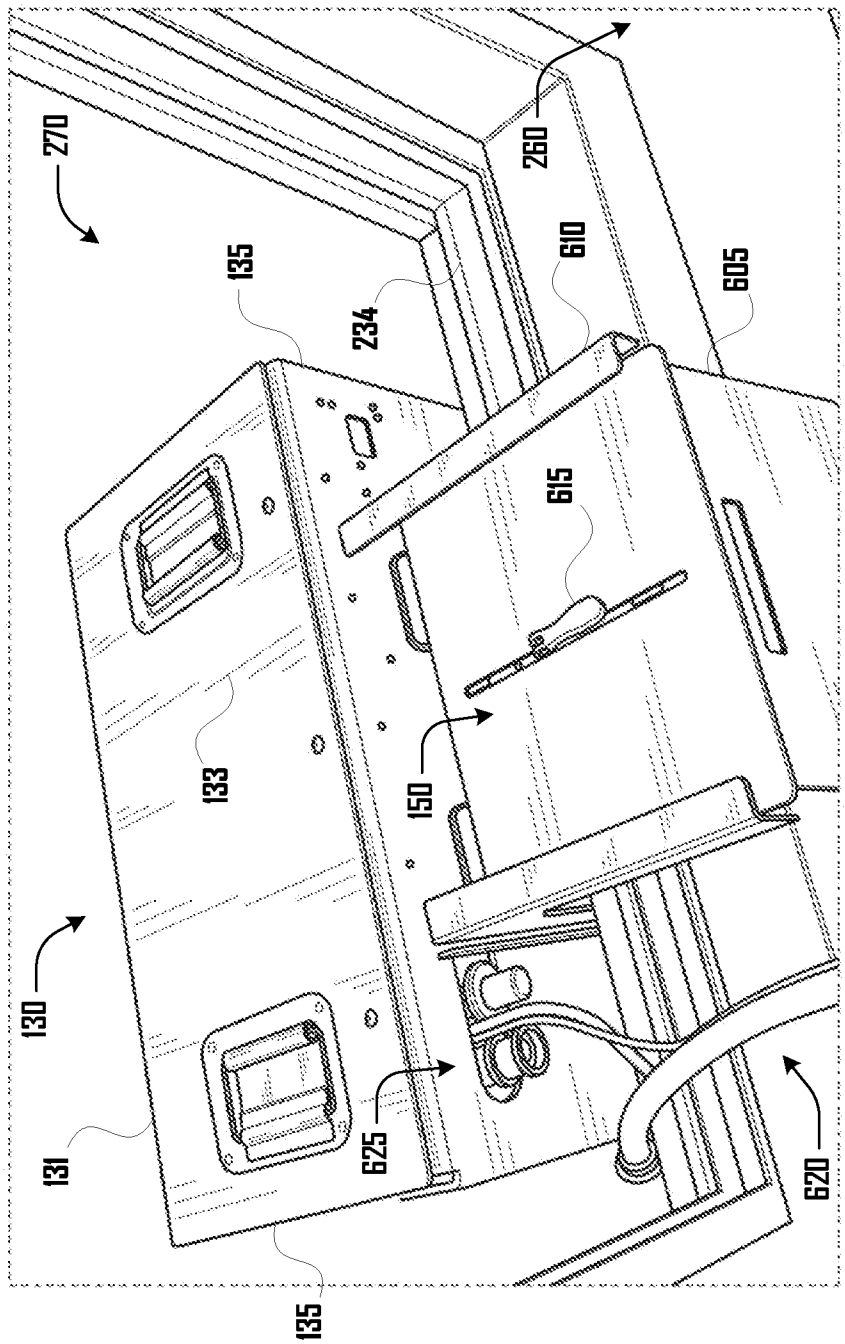


Fig.6

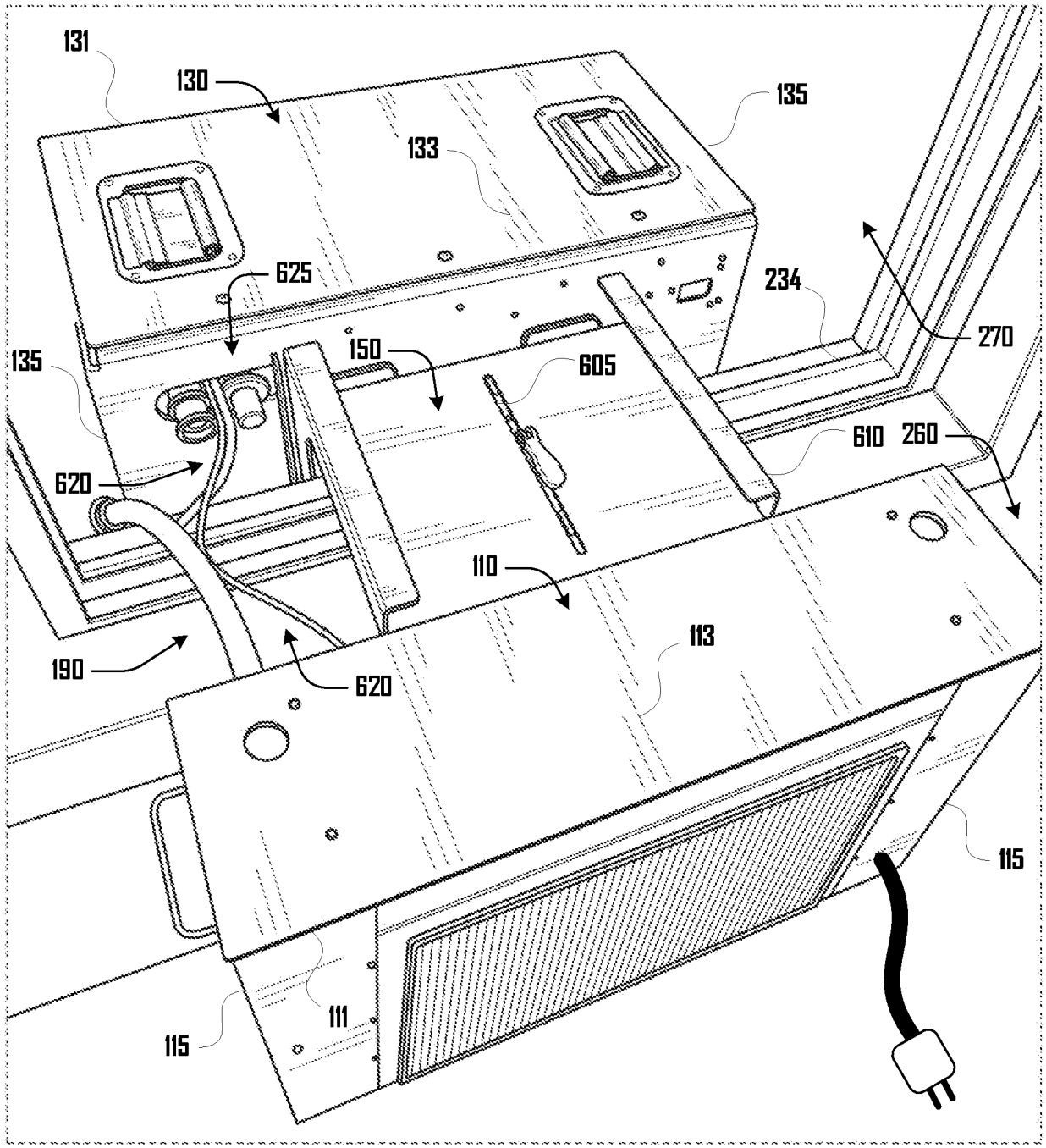
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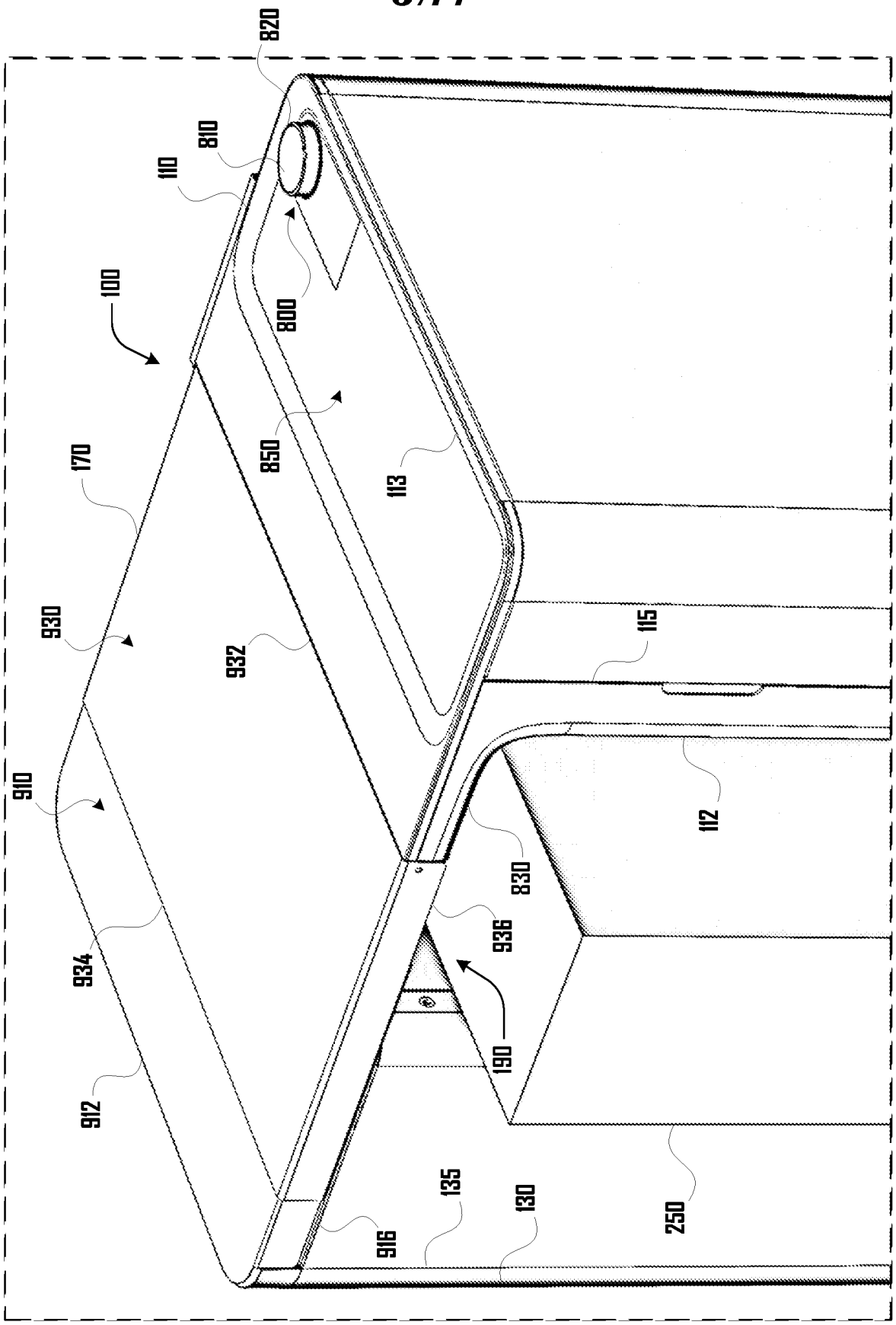
Fig.7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115
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130
250

Fig.8

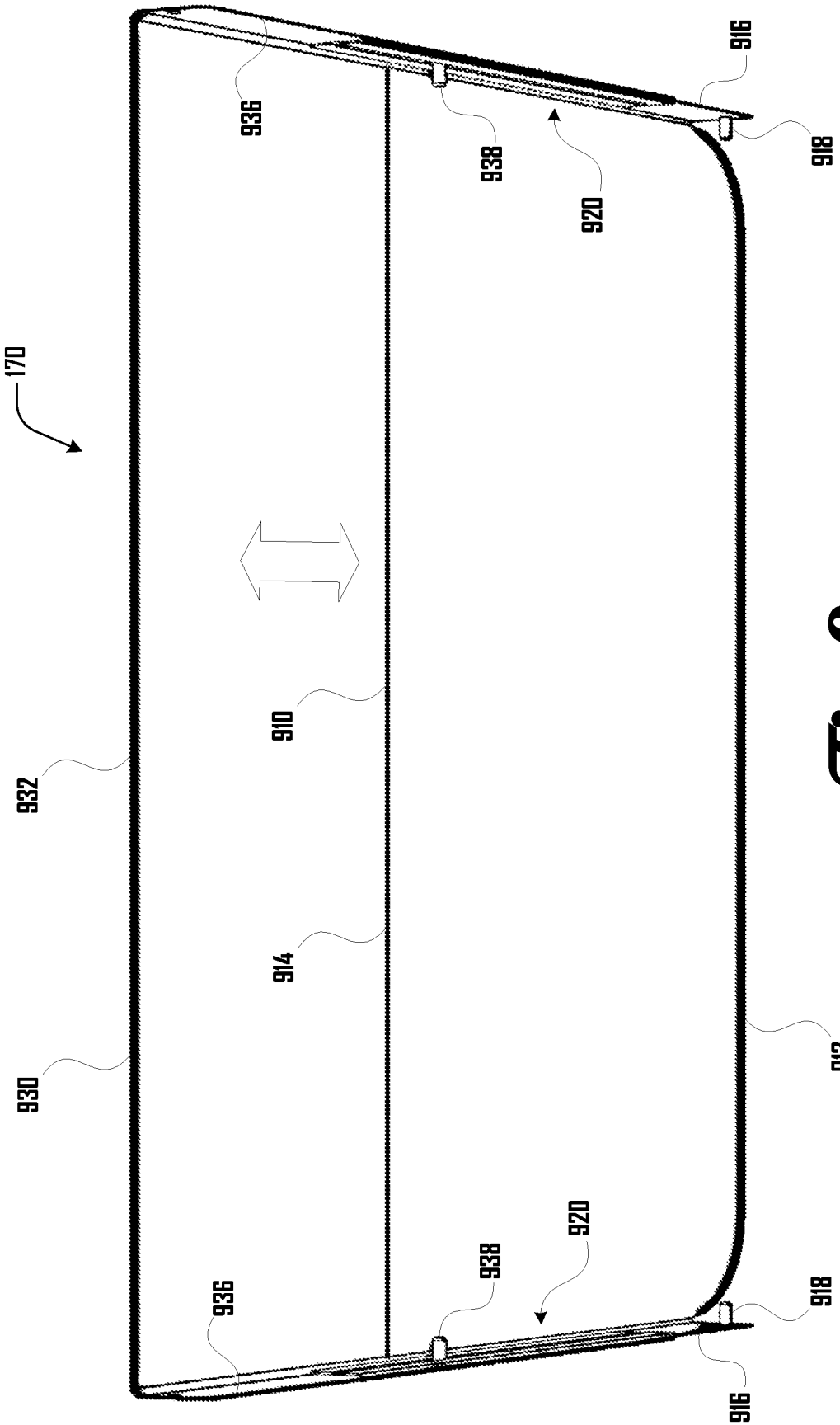
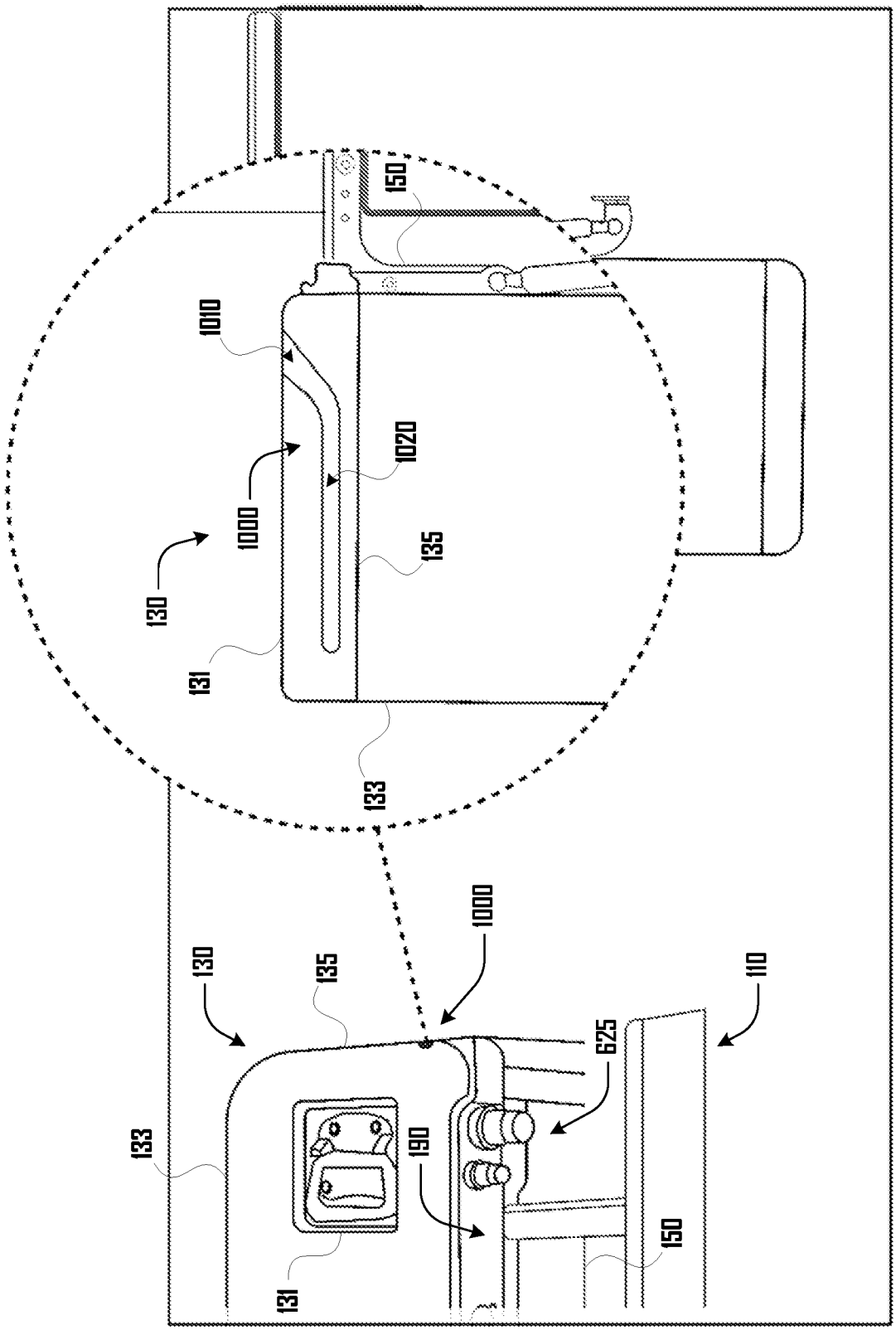



Fig. 9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150

Fig.10

11/14

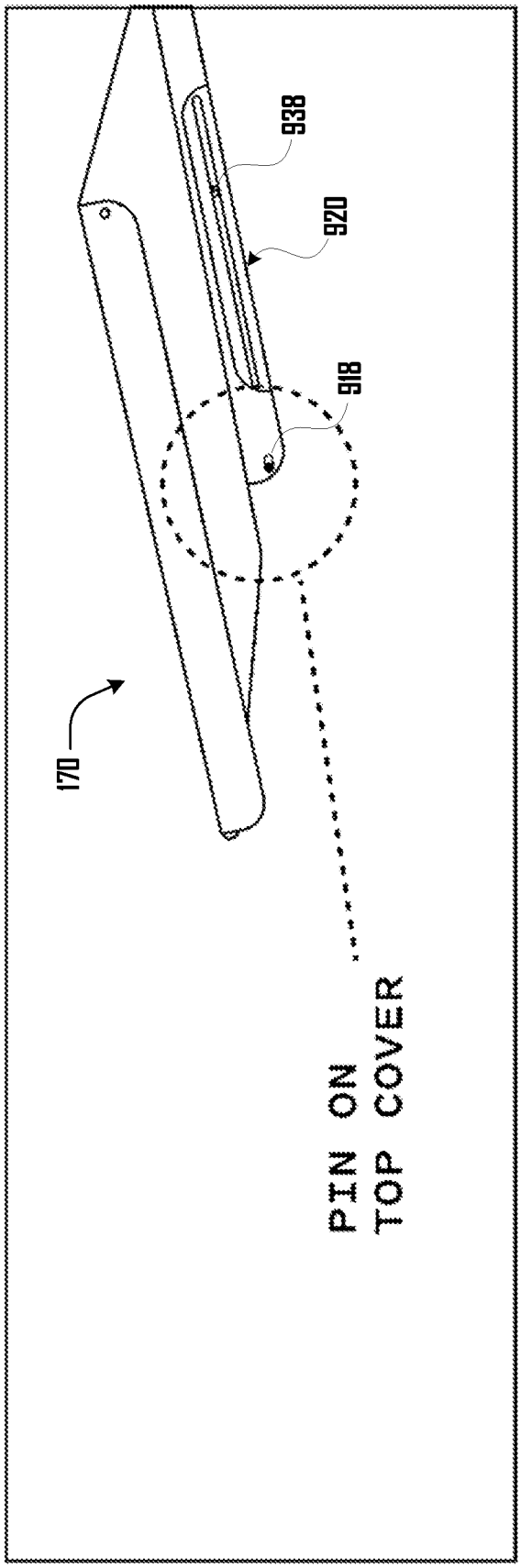


Fig.11

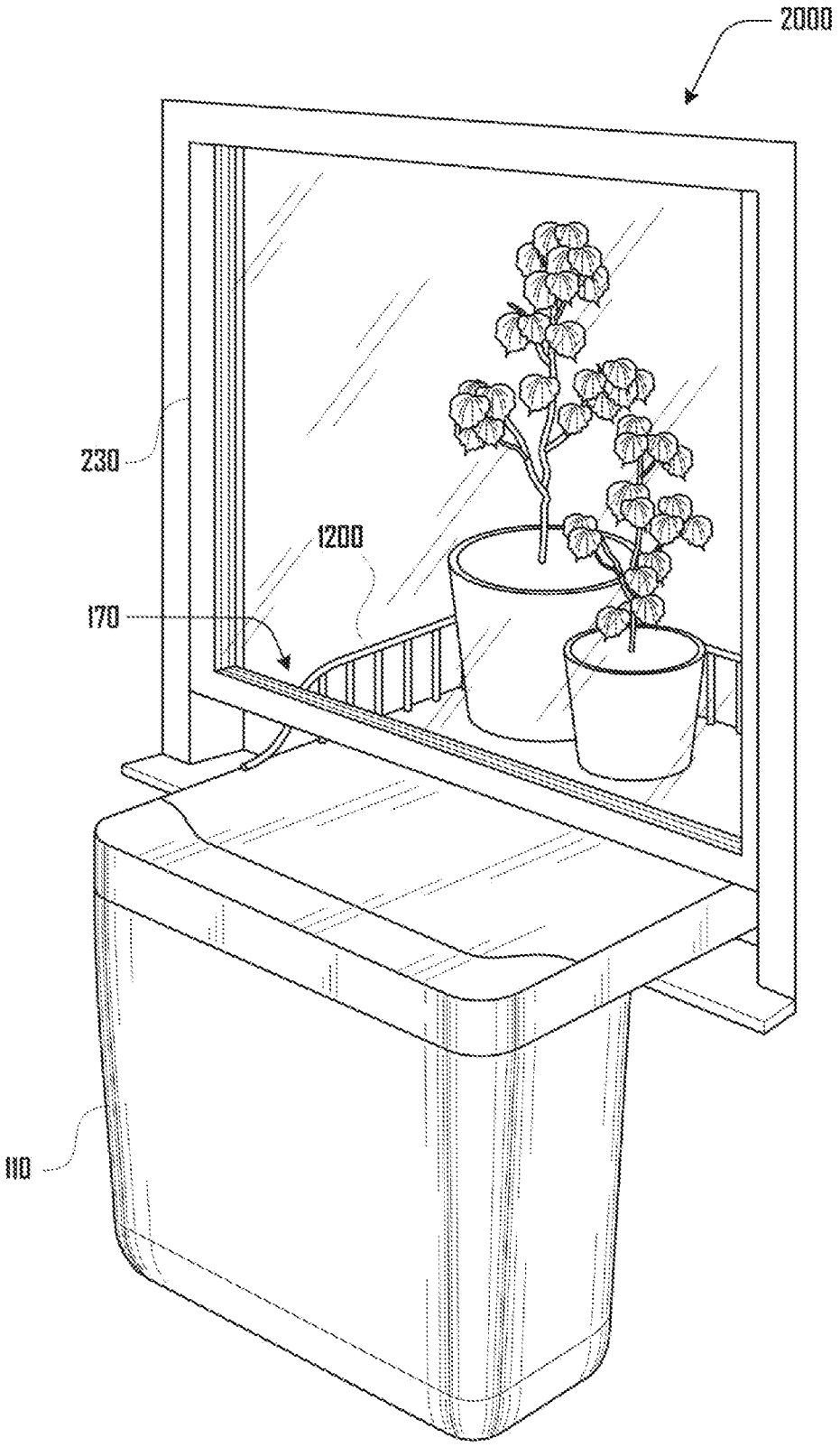


Fig.12

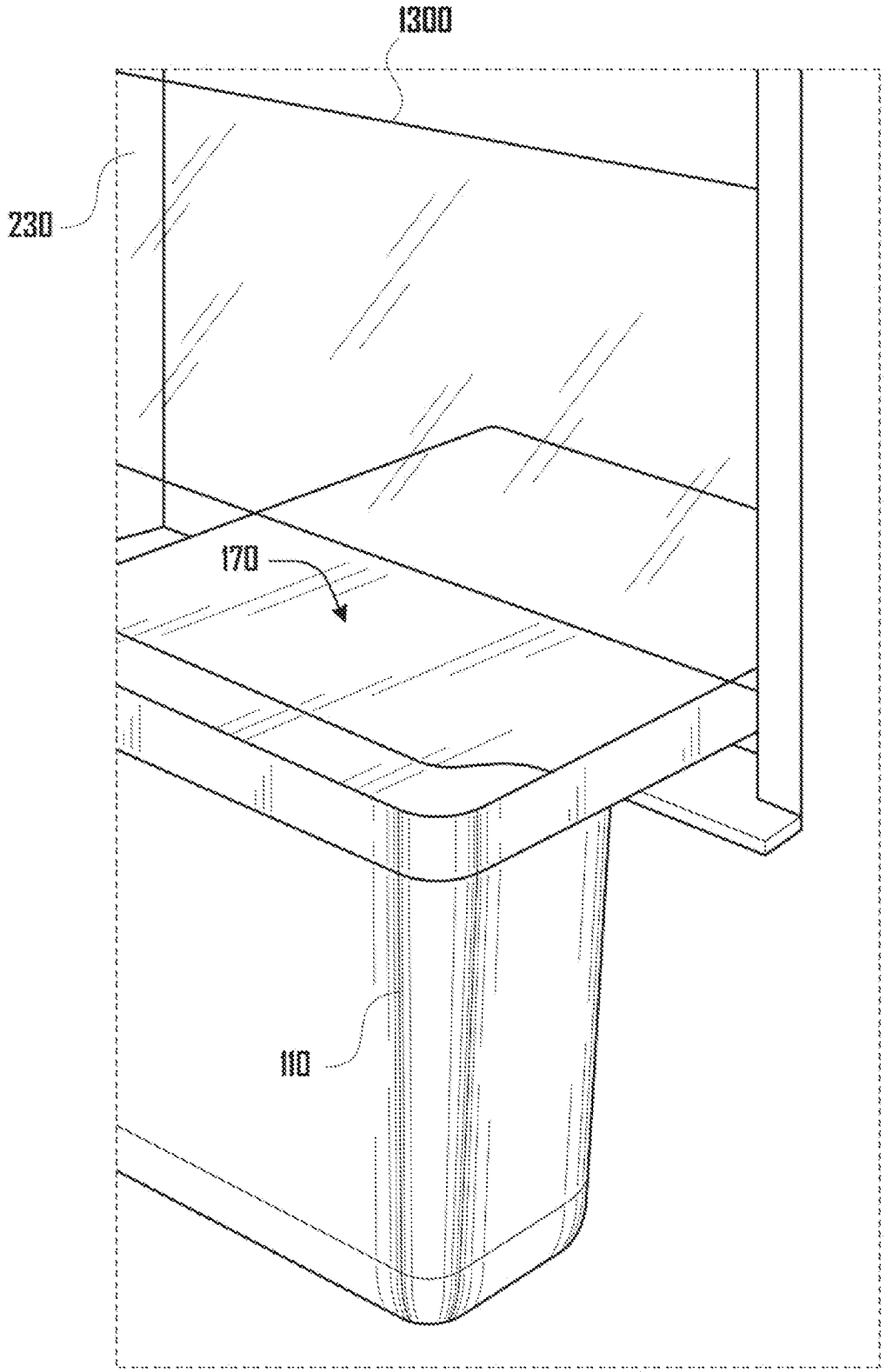


Fig.13

14/14

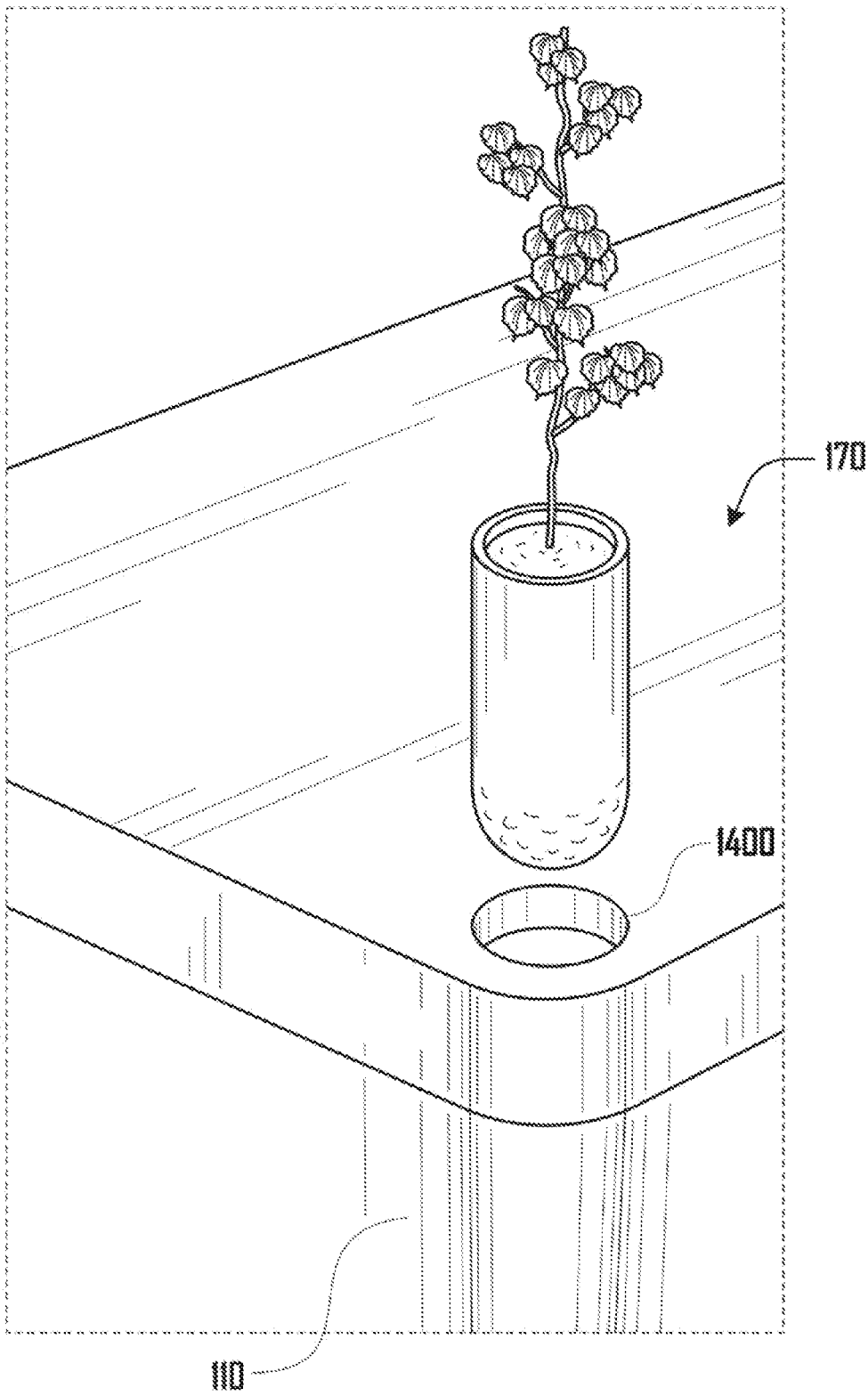


Fig.14

# INTERNATIONAL SEARCH REPORT

International application No.
**PCT/US2022/078562**

## A. CLASSIFICATION OF SUBJECT MATTER

**F24F 1/56**(2011.01)i; **F24F 1/60**(2011.01)i; **F24F 13/20**(2006.01)i; **F24F 1/031**(2019.01)i; **F24F 1/0007**(2019.01)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)

F24F 1/56(2011.01); B23P 11/00(2006.01); B23P 15/26(2006.01); B65D 21/08(2006.01); F16M 13/00(2006.01); F24F 1/02(2011.01); F24F 13/32(2006.01); F25D 23/10(2006.01); F25D 23/12(2006.01)

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: air conditioner, window, interior unit, exterior unit, bracket, connector, top cover, sliding

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2020-0124296 A1 (HAIER US APPLIANCE SOLUTIONS, INC.) 23 April 2020 (2020-04-23)<br>paragraphs [0019], [0027], [0028], [0030], [0033]-[0036], [0040], [0041] and figures 1-8 | 10,11,16,19,20 |
| Y | | 1,3-5,7-9,12-15 |
| A | | 2,6,17,18 |
| Y | US 2017-0297768 A1 (GAMBOA, JOSE) 19 October 2017 (2017-10-19)<br>paragraphs [0026]-[0031], [0041] and figures 1-5 | 1,3-5,7-9,12-15 |
| DX | US 2021-0078118 A1 (TREAU, INC.) 18 March 2021 (2021-03-18)<br>paragraphs [0059]-[0062] and figures 11-17 | 10,19,20 |
| X | US 5582025 A (DUBIN et al.) 10 December 1996 (1996-12-10)<br>column 4, lines 14-39 and figure 1 | 10,20 |

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

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"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
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"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 |
|---|---|
| **21 February 2023** | **22 February 2023** |

| Name and mailing address of the ISA/KR | Authorized officer |
|---|---|
| **Korean Intellectual Property Office**<br>**189 Cheongsa-ro, Seo-gu, Daejeon**<br>**35208, Republic of Korea** | **PARK, Tae Wook** |
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# INTERNATIONAL SEARCH REPORT

International application No.
**PCT/US2022/078562**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2014-0020421 A1 (GALLO, CHRISTOPHER J.) 23 January 2014 (2014-01-23)<br>paragraphs [0030]-[0033], claims 1, 2 and figures 1-3, 8 | 1-20 |

**INTERNATIONAL SEARCH REPORT**
**Information on patent family members**

International application No.
**PCT/US2022/078562**

| Patent document cited in search report | Publication date (day/month/year) | Patent family member(s) | Publication date (day/month/year) |
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