



(11)

EP 3 881 742 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.09.2021 Bulletin 2021/38

(51) Int Cl.:
A47K 10/48 (2006.01)

(21) Application number: **21158477.6**

(22) Date of filing: **22.02.2021**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **19.03.2020 US 202062992138 P**
29.04.2020 KR 20200052545
29.04.2020 KR 20200052546
29.04.2020 KR 20200052548
29.04.2020 KR 20200052554
29.04.2020 KR 20200052555

(71) Applicant: **LG Electronics Inc.**
Seoul 07336 (KR)

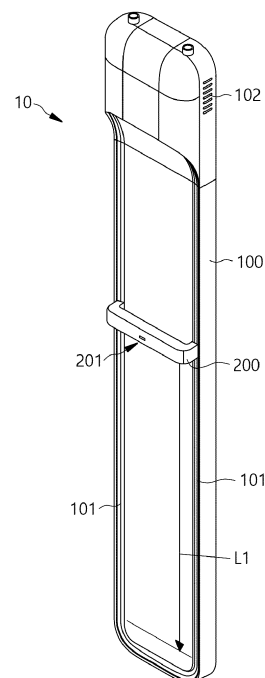
(72) Inventors:
• **Yoo, Hyun Sun**
08592 Seoul (KR)
• **Lee, Seung Yup**
08592 Seoul (KR)
• **Lee, Sang Yoon**
08592 Seoul (KR)
• **Oh, Byung Soo**
08592 Seoul (KR)
• **Jeon, Hyun-Joo**
08592 Seoul (KR)
• **Cheon, So Ra**
08592 Seoul (KR)
• **Yoon, Ji sun**
08592 Seoul (KR)

(74) Representative: **Vossius & Partner**
Patentanwälte Rechtsanwälte mbB
Siebertstrasse 3
81675 München (DE)

(54) **DRYING APPARATUS AND RELATED METHODS**

(57) A drying apparatus includes a body, an air inlet, a flow generator to receive inlet air from the air inlet and generate an airflow, an air outlet at the body for exhausting the airflow from the flow generator, the air outlet extending along a vertical height of the body, and an outlet airflow steering mechanism operable to control a lateral extent of the airflow from the air outlet. A controller is configured to operate the outlet airflow steering mechanism to control the lateral extents of the airflow from the air outlet.

Fig. 1



EP 3 881 742 A1

Description

[0001] The present disclosure relates to drying apparatuses and methods of drying, and more particularly, but not solely, to apparatuses for drying of a person or parts of the person.

[0002] In this specification where a document, act or item of knowledge is referred to or discussed, this reference or discussion is not an admission that the document, act or item of knowledge or any combination thereof was at the priority date, publicly available, known to the public, part of common general knowledge, or otherwise constitutes prior art under the applicable statutory provisions; or is known to be relevant to an attempt to solve any problem with which this specification is concerned.

[0003] Regular showering or bathing are commonplace activities across modern society. In many cultures, a shower bath is taken on a daily basis. People may even wash more than once a day, for example, where they have done some form of exercise during the day.

[0004] As a result of washing, or also due to perspiration, a person may become wet. Drying of this moisture is important to a person's health in order to prevent bacterial and fungal growth on the person.

[0005] Given the right environment, such moisture may evaporate away on its own, but for expediency and comfort, most people towel themselves dry following washing or exercise. Toweling can be a good way to remove water from a person, but drying effectively to prevent bacterial and fungal growth - particularly around the feet - can be time consuming thus such areas may commonly be inadequately dried. Towel drying of hair, particularly for those with long hair, can additionally be a frustrating and involved process.

[0006] Aside from any issues with the use of towels to desirably dry a person, the number towels used and frequency of their use means that towels account for a significant proportion of total laundry loads. This is particularly the case in settings where towels are only used once, such as in gyms, sports clubs, and commonly in hotels.

[0007] Laundering of towels is energy intensive, and consumption of fresh water is also of concern from an environmental point of view. The depletion of fresh water resources is known to be a widespread issue across many parts of the world. The number of towels washed and frequency with which they are commonly washed consumes significant amounts of water resources.

[0008] It is desired to address or ameliorate one or more of the problems discussed above by providing a drying apparatus to at least provide the public with a useful alternative.

[0009] While certain aspects of conventional technologies have been discussed to facilitate the disclosure, Applicants in no way disclaim these technical aspects, and it is contemplated that the claimed invention may encompass or include one or more of the conventional technical aspects discussed herein.

[0010] The present disclosure seeks to address one or more of the above-mentioned issues by providing apparatus and methods that improve health and hygiene, as well as have a positive impact on the environment. For instance, the apparatus and methods of the present disclosure provide for the efficient and effective drying of the person, or parts of the person, that diminishes or eliminates reliance upon towels.

[0011] It should be understood that, unless expressly stated otherwise, the claimed invention comprehends any and all combinations of the individual features, arrangements and/or steps detailed herein, including but not limited to those features, arrangements and/or steps set forth in the appended claims.

[0012] The disclosure describes a drying apparatus that includes a body, an air inlet, a flow generator to receive inlet air from the air inlet and generate an airflow, an air outlet at the body for exhausting the airflow from the flow generator, the air outlet extending along a vertical height of the body, and an outlet airflow steering mechanism operable to control a lateral extent of the airflow from the air outlet. A controller is configured to operate the outlet airflow steering mechanism to control the lateral extents of the airflow from the air outlet.

[0013] As used herein the term "and/or" means "and" or "or", or both.

[0014] As used herein "(s)" following a noun means the plural and/or singular forms of the noun.

[0015] For the purposes of this specification, the term "plastic" shall be construed to mean a general term for a wide range of synthetic or semisynthetic polymerization products, and includes hydrocarbon-based polymer(s).

[0016] For the purpose of this specification, where method steps are described in sequence, the sequence does not necessarily mean that the steps are to be chronologically ordered in that sequence, unless there is no other logical manner of interpreting the sequence, or expressly stated.

[0017] To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

[0018] Other aspects of the embodiments of the invention may become apparent from the following description which is given by way of example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The objects and features of the invention can be better understood with reference to the drawings described below, and the claims. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the drawings, like numerals are used to indicate like parts throughout the various views.

[0020] Preferred embodiments or aspects of the invention will be described by way of example only and with reference to the drawings, in which:

FIG. 1 is a perspective view of a drying apparatus according to an embodiment of the present invention.
 FIG. 2 is a side view of the drying apparatus according to the embodiment of FIG. 1.
 FIG. 3 is a front view of the drying apparatus according to the embodiment of FIG. 1.
 FIG. 4 is a view of an upper region of the drying apparatus according to the embodiment of FIG. 1.
 FIG. 5 is a view showing some internal components of the upper region of FIG. 4.
 FIG. 6 is a view of an air flow through the internal components of the upper region of FIG. 5.
 FIG. 7 is another view of the air flow through the internal components of the upper region.
 FIG. 8 is a view showing a connection between flow generators and a first air outlet according to an embodiment of the present invention.
 FIG. 9A is a view showing a connection between the flow generators and the first air outlet according to another embodiment of the present invention.
 FIG. 9B is a rear perspective view showing a connection between one of the flow generators and the first air outlet of FIG. 9A.
 FIG. 10 is a cross-sectional view of the first air outlet along line A-A' of FIG. 3.
 FIG. 11A is a perspective view of the drying apparatus of FIG. 1 with a bar thereof in a first position.
 FIG. 11B is a perspective view of the drying apparatus of FIG. 1 with the bar thereof in a second position.
 FIG. 12A is a perspective view showing a driving apparatus for a drying apparatus according to an embodiment of the present invention.
 FIG. 12B is a close up view of the portion A of FIG. 12A.
 FIG. 12C is bottom view of FIG. 12B.
 FIG. 12D is a view showing a fastening mechanism of a bar of a drying apparatus according to an embodiment of the present invention.
 FIG. 13 is a perspective view showing a drying apparatus including additional bars according to an embodiment of the present invention.
 FIG. 14A is a perspective 14A view showing a drive apparatus according to an alternative embodiment of the present invention.
 FIG. 14B is a close up view of the portion B of FIG. 14A.
 FIG. 14C is an exploded view of the portion of FIG. 14B.
 FIG. 15 is a top perspective view of a bar of a drying apparatus according to an embodiment of the present invention.
 FIG. 16 is a bottom perspective view of the bar of FIG. 14.
 FIG. 17 is a rear view of a bar according to another embodiment of the present invention.
 FIG. 18 is a partial view of various internal parts of the bar of FIGS. 14-16 according to an embodiment of the present invention.
 FIG. 19 is an exploded view of various parts of the bar of FIGS. 14-17 according to an embodiment of the present invention.
 FIGS. 20 and 21 are views showing exemplary ways in which forced air may be expelled from the bar according to embodiments of the present invention.
 FIG. 22 is an electrical schematic diagram of the drying apparatus according to an embodiment of the present invention.
 FIG. 23 is a flowchart for control of temperature-humidity index (THI) by a controller according to one embodiment of the present invention.
 FIG. 24 is a flowchart for control of wind chill index by a controller according to one embodiment of the present invention.
 FIGS. 25A and 25B are views showing a user being dried with the bar of the drying apparatus according to an embodiment of the present invention.
 FIG. 26 is a flowchart for drying of a user by the controller according to an embodiment of the present invention.
 FIG. 27 is an exploded view of an upper region of the drying apparatus showing an exploded view of a filter unit according to an embodiment of the present invention.
 FIG. 28 is another exploded view of the filter unit of FIG. 27 according to an embodiment of the present invention.

FIG. 29 is a front view of an air inlet and an inlet pathway at a flow generator housing according to an embodiment of the present invention.

FIG. 30 is a partial exploded view of the air inlet of FIG. 29.

FIG. 31 is a front transparent view of an upper region of a drying apparatus according to another embodiment of the invention.

FIG. 32 is a perspective view of a drying apparatus according to an alternative embodiment of the present invention.

FIG. 33 shows a cross-sectional view along line B-B' of FIG. 32.

FIG. 34 is a view of a duct assembly of FIGS. 32-33 according to one embodiment of the present invention.

FIG. 35 is an exploded view of components of a drying apparatus according to an embodiment of the present invention.

FIG. 36A to 36C show examples of front-on profiles of three different users.

FIG. 37A to 37C show three exemplary drying airflows that may be expelled by the drying apparatus based on the body characteristics of users shown in FIGS. 36A-36C.

FIG. 38 is a perspective view of a drying apparatus according to one embodiment of the invention.

FIG. 39 is another perspective view of the drying apparatus of FIG. 38.

FIG. 40 is a close up partial view of the drying apparatus of FIG. 38.

FIG. 41 is a view of an outlet airflow steering mechanism according to one embodiment of the present invention.

FIG. 42 is a view showing direction of forced airflows from the drying apparatus having the outlet airflow steering mechanism set as shown in FIGS. 38-39.

FIG. 43A and FIG. 43B are views illustrating an upper zone and a lower zone of the drying apparatus in relation to a user's body according to an embodiment of the present invention.

FIG. 44 is a front view of a drying apparatus shown in FIG. 38.

FIG. 45 is a front view of a drying apparatus according to another embodiment of the present invention.

FIG. 46 is an electrical schematic diagram of a drying apparatus according to an embodiment of the present invention.

[0021] Reference is made in detail to one or more embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0022] A drying apparatus may be provided according to the disclosure for a range of applications. In at least a primary application, the drying apparatus may be a dryer for drying a person, such as following bathing or showering. The drying apparatus may be provided as a supplement to towel drying, or in various preferred forms may be provided as a substitute for towel drying. By the use of the drying apparatus as a body dryer, a person may present themselves and be dried by one or more forced airflows of the drying apparatus.

[0023] FIG. 1 is a perspective view of a drying apparatus according to an embodiment of the present invention; FIG. 2 is a side view of the drying apparatus; and FIG. 3 is a front view of the drying apparatus.

[0024] Referring to FIG. 1, a drying apparatus 10 may comprise a body 100 and a bar 200. While the term "bar" is used, "bar" should not be construed as being limited to a bar shape but may have various kinds of shapes according a design criteria or an intended result. The bar 200 may be supported by the body 100, and may be moveable relative to the body 100. The bar 200 may be driven relative to the body 100 by a drive apparatus, as will be explained in greater detail herein.

[0025] The drying apparatus 10 may be sized so as to correspond to human body dimensions. For example, in the configuration of the drying apparatus as shown in FIG. 1, the drying apparatus 10, and in particular the body 100, may be sized in proportion to human body dimensions to enable the delivery of the forced airflow across the human body.

[0026] The forced airflow may be provided through a first air outlet 101 distributed along a periphery of the body 100. The forced airflow may also be provided through a second air outlet 201 located at the bar 200. Unlike the first air outlet 101 which is stationary with respect to the body 100, the second air outlet 201 moves as the bar 200 travels along a longitudinal length L1 of the body 100 to expel forced airflow to different parts of the human body.

[0027] The body 100 may define a drying side or face 14 adjacent to which a user may present themselves for drying by the drying apparatus 10. The drying face 14 may generally define a face or plane from which the forced airflow is provided by the drying apparatus 10 through the first air outlet 101 and/or the second air outlet 201. For example, FIG. 2 shows a side view and FIG. 3 shows a front view of such a drying face 14.

[0028] For example, when the drying apparatus 10 is to be provided within a confined space, such as a bathroom, it may be desirable that a minimum of space is taken up by the drying apparatus 10, and perhaps, be aesthetically pleasing. To this end, the portion including the drying face 14 of the body 100 may be provided having a low profile, such as is seen in the side view of FIG. 2. This low profile may provide for a slim look.

[0029] To achieve this low profile, at least some internal components of the body 100 which are bulky may be distributed toward an upper region of the body 100 (in the vicinity of the air inlets 102 shown in FIG. 2), so as not to interfere with the low profile of the portion having the drying face 14. The upper region of the body 100 may be at or above the head of a user. The upper region may include the bulky components such as flow generators, thermoelectric devices, flow guides, and the like. In an alternative embodiment, the internal components of the body 100 may be distributed toward

a lower region of the body 100 (not shown) providing for an upper region of the body to have a minimized depth.

[0030] FIG. 4 is a view of details of an example upper region of the body 100. In particular, in FIG. 4 a front cover of the upper region has been removed to expose an outlet of one of two flow guides 116, adjacent to a filter unit 104. The other air flow guide 116 is not visible in FIG. 4, but may be provided on the other side of FIG. 4. The filter unit 104 is in opposition to and/or cooperation with flow guide 116 and arranged in a recess at the center of the body 100. The filter unit 104 may or may not be replaceable. Front cover (not shown in FIG. 4) may be removed to replace an old filter unit 104 with a new filter unit. FIG. 5 shows the coverings of the upper region removed to expose some internal components of the upper region of the body 100 shown in FIG. 4.

[0031] Referring to FIGS. 4 and 5, together, the upper region of the body 100 may include a pair of flow generators 110, a pair of flow guides 116, a pair of thermoelectric devices 117 (this device includes, for example, a thermoelectric module, a thermoelectric cooler, or other suitable devices), a pair of air inlets 102, the filter unit 104, and the flow generator housing 103 to house the internal components. While one embodiment uses thermoelectric devices 117 which are devices using thermoelectric effect such as Peltier effect, alternative embodiments may include air conditioning or heat-pump systems using a pump, compressors, and evaporators, resistive heating elements, combustion, or other chemical reaction to control temperature. However, other types of air conditioning devices may be used. In one aspect, the upper region may be considered as an air conditioning system of the body 100.

[0032] In the illustrated embodiment, a pair of flow generators 110 are used. In alternative embodiments, only a single flow generator, or a greater number of flow generators, may be used. A flow generator may be an axial fan or the like. Embodiments that include multiple flow generators may cooperate to produce an even airflow into the body 100. Embodiments also include generating independent airflows into the body 100 to vary the strength of the airflow at various portions of the body 100. In the present embodiment, outside air may be received into the flow generator housing 103, by operation of the pair of flow generators 110, through a pair of air inlets 102. The pair of air inlets 102 provide inlet points for outside air into the body 100.

[0033] As seen in FIG. 5, each flow generator 110 has its own respective air inlet 102. However, a single inlet 102 may be used with the pair of flow generators 110. Alternatively, more than two air inlets may be used with the pair of flow generators.

[0034] Air received at the air inlets 102 is ducted by respective flow guides 116 located between the air inlets 102 and the filter unit 104. In the present embodiment, each flow guide 116 may also in part define an outlet air flow pathway 105 (see FIG. 7) which may be a portion of a flow path where filtered air from the filter unit 104 flows to a respective flow generator 110. Further details of the flow path including the outlet air flow pathway 105 will be described in connection with the description of FIGS. 6 and 7.

[0035] Because the present embodiment is described as comprising a pair of flow guides 116, it will be understood that the following description of one flow guide 116 also reflects the other flow guide of the flow guide pair 116. To this end, each flow guide 116 may have a curved form as seen in FIG. 5. One end of each flow guide 116 is connected to a respective air inlet 102, and the other end opens to the upstream side of the filter unit 104. The body of each flow guide 116 includes a curved inner surface and a curved outer surface. The curved inner surface faces the outlet air flow pathway 105 and forms part of the flow path between the downstream side of the filter unit 104 and a respective flow generator 110.

[0036] Thus, each flow guide 116 forms a flow path between a respective air inlet 102 and the upstream side of the filter unit 104. Also each flow guide 116 forms, at least in part, a wall of the flow path between the downstream side of the filter unit 104 and a respective flow generator 110. In this configuration, each flow guide 116 may duct air received from a respective air inlet 102 and pass the air to the filter unit 104. Air passed through the filter unit 104 may flow to the outlet air flow pathway 105 where a flow generator 110 may force the air to the first air outlet 101.

[0037] In the configuration above, each flow guide 116 may function to separate between the inlet side and outlet side of the filter unit 104. Each flow guide 116 may also function to separate the air received from the air inlet 102 from the filtered air flowing towards the flow generator 110.

[0038] In an alternative configuration, the flow guide 116 may not have a dual function of guiding inlet air to the filter unit and guiding filtered air between the filter unit outlet and the flow generator. For example, the air inlets 102, the flow guides 116, the filter unit 104, and the flow generators 110 may be arranged to be linear or sequentially adjacent to each other. Here, each flow guide 116 only ducts the air between the air inlet 102 and the filter unit 104.

[0039] A pair of thermoelectric devices 117 may also be included in the upper region of the body 100. Each thermoelectric device 117 may be a semiconductor device that heats and/or cools air, for example, using the Peltier effect. In alternative embodiments, other types of known thermal elements may be employed, such as, a heater, a cooler, or a combination thereof. For example, a refrigeration cycle, having a compressor, evaporator, and condenser, may be utilized to provide cooling and/or heating of air. In another example, a resistance heater may be utilized to provide heating of the air.

[0040] In the present embodiment, there is a pair of thermoelectric devices 117. Thus, in the following description of one of the thermoelectric device 117, it will be understood that other thermoelectric device is the same. To this end,

each thermoelectric device 117 has a first side 118 and a second side 119. Depending on the direction of current supplied to the thermoelectric device 117, one side may be cooled or heated while the other side is respectively heated or cooled. For example, when the first side (i.e., outward) 118 is cooled, the second side (i.e., inward) 119 is heated. Conversely, when the first side 118 is heated, the second side 119 is cooled.

[0041] Each thermoelectric device 117 may heat or cool the air in the outlet air flow pathway 105 (see FIG. 7) that has passed through the filter unit 104. To facilitate this, the second side 119 of the thermoelectric device 117 may be exposed to the outlet air flow pathway 105. Depending on the operation mode of the thermoelectric device 117, the second side 119 may heat or cool the air passing through the outlet air flow pathway 105. The heated or cooled air may then be sucked into a respective flow generator 110.

[0042] A processor may control the direction of the current flowing through thermoelectric device 117. For example, a voltage source coupled to the thermoelectric device 117 may be coupled to an analog-to-digital converter (A/D). The A/D converter may be able to generate positive or negative values to control the voltage and therefore the current applied to the thermoelectric device 117. In other embodiments, the A/D converter could have half of its output values corresponding to negative current and half corresponding to positive current.

[0043] An exhaust vent 130 may be provided at the upper region of the body 100 when a thermoelectric device 117 is used in the drying apparatus. FIG. 5 shows a pair of exhaust vents 130 associated with the pair of thermoelectric devices 117 that are included in the upper region of the body 100, as illustrated in FIG. 5. Each exhaust vent 130 may be coupled to the first side 118 of a respective one of the thermoelectric devices 117. One or more exhaust vents 130 may be provided at the upper region of the body.

[0044] When the thermoelectric device 117 operates as a heater, the cool exhaust air may be vented by a respective exhaust vent 130 to the outside of the drying apparatus 10. When the thermoelectric devices 117 operates as a cooler, the hot exhaust air may be vented by the exhaust vents 130.

[0045] FIG. 6 is an illustration of air flow through the parts of the upper region of the body 100 according to the embodiment of the present invention. FIG. 7 is another illustration of the air flow through the parts of the upper region of the body 100. The air flow through the components of the upper region of the body 100 will be described with respect to one flow generator 110 as the air flow will be similar for the other flow generator 110.

[0046] The present embodiment will now be described in greater detail with reference to FIGS. 6 and 7. When the flow generator 110 operates, air is received through the air inlet 102 and through the flow guide 116 thereby arriving at the front surface of the filter unit 104 as illustrated by air flow arrows 106 and 107 in FIG. 7. The air then passes through the front surface of the filter unit 104. The filtered air exits through the sides of the filter unit 104.

[0047] The filtered air, after exiting filter unit 104, arrives at the outlet air flow pathway 105 illustrated by air flow arrows 108 in FIG. 7. The filtered air in the outlet air flow pathway 105 may be heated or cooled by the thermoelectric device 117. The exhaust air from the thermoelectric device 117 may then be vented by the exhaust vent 130 as described above, and as illustrated by air flow arrow 131. The heated or cooled air illustrated by air flow arrow 108 is sucked down into and through the flow generator 110, and then forced, by the flow generator 110, onwards to the first air outlet 101, as illustrated by air flow arrow 109 in FIG. 7.

[0048] A configuration of an air conditioning system of the body 100 has been described above. The drying apparatus 10 having the configuration above may vent cool air or hot air to condition a space in which the drying apparatus is occupying. The space may be a bathroom. During hot days the drying apparatus 10 may cool the bathroom. During cold days the drying apparatus 10 may heat the bathroom. The drying apparatus may also use the air conditioning system described herein to dry a user. For example, the cool air or hot air forced by the flow generator 110 is vented by the first air outlet 101 along the periphery of the body 100 at the drying face 14 (see FIGS. 1-3). A user presenting themselves at the drying face 14 may dry themselves through the vented cool air or hot air.

[0049] FIG. 8 is a view illustrating a connection between the flow generators 110 and the first air outlet 101 of the body 100, according to an embodiment of the present invention.

[0050] As shown, the flow generators 110 force the airflow into a duct 121. At the duct 121, the forced airflows from the two flow generators 110 are combined into a single forced airflow. The duct 121 then guides the combined forced airflow through a common opening 125 into the first air outlet 101 of the body 100. In the present embodiment, a resistance heater 120 is disposed at the common opening 125 to further heat the forced airflow. This configuration may be used where it is desirable that a heated forced airflow from the flow generators 110 is further heated prior to being expelled into the first air outlet 101. This configuration may be used, for example, where a quick heating of a bathroom is desired or a more heated forced airflow is desired during a drying of the user.

[0051] While in FIG. 8, a resistance heater has been illustrated, any other suitable thermal elements may be used. In other configurations the thermal element may be a thermoelectric device that may be used to selectively heat or cool the forced airflow flowing out of the common opening 125.

[0052] FIG. 9A illustrates a connection between the flow generators 110 and the first air outlet 101 of the body 100 according to an alternative embodiment of the present invention. Unlike the embodiment illustrated in FIG. 8, the outlet of each of the flow generators 110 directly connects to the first air outlet 101 of the body 100 according to the alternative

embodiment of FIG. 9A. The first air outlet 101 thus includes air openings 128 at the upper side of the first air outlet 101. Each air opening 128 communicates directly with the outlet of respective one of the flow generators 110. By having the outlet of each flow generator 110 directly connect to the first air outlet 101 of the body 100, the connection structure may be simplified and the forced airflow may be directly expelled into the first air outlet 101.

[0053] The forced airflow in the present embodiment may be stronger than the forced airflow of the embodiment of FIG. 8. The reason is that, in the forced airflow of FIG. 8, the vertical direction of the forced airflows of the respective flow generators are forced into a horizontal direction by the duct 121, then made to collide with each other to form a single forced airflow. The duct 121 then forces the single combined forced airflow to flow vertically downward into the first air outlet 101. In contrast, in the embodiment of FIG. 9A, the forced airflows of the respective flow generators flow vertically downward directly into the first air outlet 101.

[0054] FIG. 9B is a rear perspective view showing a connection between one of the flow generators and the first air outlet of FIG. 9A. As shown in FIG. 9B, in this configuration, the flow generator 110 includes a fan assembly 1101 and a conduit 1102. The fan assembly may be an axial fan and the like. Preferably, the fan assembly includes a high speed motor that sucks in air and expels air at high speed. For example, the fan assembly may be Smart Inverter Motor TM available from LG Electronics, Inc., Republic of Korea, that operates at speeds up to 115,000 revolutions per minute (RPM). Similar fan assembly may be used.

[0055] The fan assembly 1101 is connected to the conduit 1102 which may be a cylindrical tube that connects to the first air outlet 101. However, it should be appreciated that the conduit 1102 is not limited to a cylindrical tube and other configurations may be used such as an oval tube, a square tube, a rectangular tube, etc. The conduit 1102 contains the air sucked in by the fan assembly 1101 within the confines of the conduit 1102 thereby increasing the speed of the forced airflow if not maintaining the speed of the forced airflow expelled by the fan assembly 1101. Thus, a forced airflow of relatively high speed is introduced into the first air outlet 101.

[0056] FIG. 10 is a cross-sectional view along line A-A' of FIG. 3 further illustrating the first air outlet 101 of the body according to an embodiment of the present invention. As shown in part, the first air outlet 101 is distributed around at least a partial periphery of the body 100. In the present embodiment, the first air outlet 101 actually follows the contour of the periphery of the drying face 14 of the body 100 (see FIG. 3). However, one skilled in the art will readily appreciate that the air outlet 101 could take on any one of a number of other configurations. For example, in an alternative embodiment, the first air outlet 101 may be configured as a plurality of slits placed vertically and/or horizontally across the drying face 14 (see, for example, FIG., 31).

[0057] Again, referring to FIG. 10, the first air outlet 101 according to the present embodiment, includes a duct 122, a vent 126, and a fin 127. The duct 122 receives the forced airflow from the upper region of the body 100, and ducts the forced airflow along the periphery of the body 100.

[0058] The duct 122 is connected to the vent 126 which also runs along the periphery of the body 100 and is visible from the drying face 14 of the body 100 (see FIGS 1 and 3). The forced airflow exits the body 100 through the vent 126. The fin 127 may be disposed in the vent 126 which also runs along the periphery of the body 100 and divides the space formed by the vent 126 into two. The fin 127 may aid in directing the forced airflow flowing out from the vent 126. In the present embodiment, the fin 127 is fixed in the vent 126 and directs the forced airflow in one direction which is straight outwardly.

[0059] In an alternative configuration, the fin may be adjustable to be moved to the left or to the right to direct the forced airflow exiting the body 100 in the left direction or the right direction, as desired. For example, the fin of the left side of the body 100 may be moved in the right direction and the fin on the right side of the body 100 may be moved in the left direction so that at least a portion of the forced airflow may converge inwardly towards a center with respect to the body 100. Conversely, the fin of the left side of the body 100 may be moved in the left direction and the fin on the right side of the body 100 may be moved in the right direction so that at least a portion of the forced airflow may diverge outwardly away from the center with respect to the body 100.

[0060] Thus far, the body 100 of the drying apparatus 10 according to embodiments of the present invention has been described. The drying apparatus 10 may include a bar 200 that may expel forced airflow. The bar 200 may be movable relative to the body 100, as previously mentioned.

[0061] FIGS. 11A and 11B are views illustrating a bar 200 at two respective driven positions along the longitudinal length L1 of the body 100 according to the embodiment of the present invention.

[0062] The bar 200 may be moveable along the longitudinal length L1 of the body 100 driven by a drive apparatus to be described later. The travel bounds of the bar 200 may be fixed to coincide with longitudinal length L1, of the body 100 or, alternatively, it could be adjustable to more closely coincide with the height by a particular user. Accordingly, the drying apparatus 10 may be configured such that when the user is positioned adjacent to the drying face 14, the desired length (e.g., the height) of the user may be covered by the drying airflow of the second air outlet 201 by the movement of the bar 200. For example, the bar 200 may move from the top position as shown in FIG. 11A to the bottom position as shown in FIG. 11B (and back in repetition if desired) while expelling forced airflow from the second air outlet 201, where the distance traveled between the position of the bar 200 in FIG. 11A and in FIG 11B may correspond with the

height of the user.

[0063] FIG. 12A is a view illustrating a driving apparatus of the bar 200 according to the embodiment of the present invention. FIG. 12B is a close up view of the drive apparatus illustrated in portion A of FIG. 12A. FIG. 12C is bottom view of the drive apparatus illustrated in FIG. 12B, and FIG. 12D is a view illustrating an exemplary fastening mechanism 210 of the bar 200 according to an embodiment of the present invention.

[0064] Referring to FIGS. 12A and 12B, the drive apparatus 11 drives the bar 200 relative to the body 100. The drive apparatus 11 may be provided at the body 100. In accordance with this exemplary embodiment, the drive apparatus 11 includes a lead screw 40, a nut 41, and a motor 50 (see FIG. 13). The lead screw 40 is threaded and may have a length corresponding to the longitudinal length L1 of the drying face 14 of the body 100. The motor 50 may be located at the upper region of the body 100. However, the motor 50 may be located anywhere as long as the motor 50 is able to rotate the lead screw 40 thus causing the nut 41 to move up or down the lead screw 40, depending on the direction of rotation of the lead screw 40, along the longitudinal length L1 of the drying face 14 of the body 100. A shaft of the motor 50 may be coupled to one end of the lead screw 40 (e.g., the upper end of the lead screw 40). Therefore, when the motor 50 rotates the shaft clockwise, the lead screw 40 rotates clockwise. When the motor 50 rotates the shaft counterclockwise the lead screw 40 rotates counterclockwise.

[0065] Referring to FIGS. 12B and 12C, the nut 41 is threaded corresponding to the thread of the lead screw 40 and is thus mated with the lead screw 40. The nut 41 is fixed to the bar 200. In the present embodiment, the nut 41 is fixed to a bracket assembly 44 to which the bar 200 is attached. However, one skilled in the art will appreciate that other configurations for fixing the nut 41 to the bar 200, direct or indirect, are possible. When the lead screw 40 is rotated by the motor 50, the nut 41 rides up or down on the lead screw 40 which, in turn, moves the bar 200 up or down.

[0066] For example, when the motor 50 rotates the lead screw 40 clockwise, the nut 41 moves up the lead screw 40, which in turn moves the bar 200 up with respect to and along the longitudinal length of the body 100. On the other hand, when the motor 50 rotates the lead screw 40 counterclockwise, the nut 41 moves down the lead screw 40, which in turn moves the bar 200 down with respect to and along the longitudinal length of the bar 200.

[0067] In another example, when the motor 50 rotates the lead screw 40 clockwise, the nut 41 moves down the lead screw 40, which in turn moves the bar 200 down with respect to and along the longitudinal length of the body 100. When the motor rotates the lead screw 40 counterclockwise, the nut 41 moves up the lead screw 40, which in turn moves the bar 200 up with respect to and along the longitudinal length of the bar 200.

[0068] Referring to FIGS. 12C and 12D, the bracket assembly 44 may have one or more guide members 45 for running in one or more corresponding guide tracks 46 of the body 100. In the present embodiment, as illustrated in FIG. 13, a dual guide track is used, including a guide track 46 which runs vertically on both sides of the body 100. Together, the guide members 45 and guide tracks 46 guide the bar 200 along a predetermined vertical path.

[0069] For example, the guide members 45 and guide tracks 46 may operate to retain the bar 200 against rotational movement about the longitudinal axis which may be caused due to the rotation of the lead screw 40. The dual guide tracks 46 may also provide stability to the bar 200 as it moves up and down along the body 100.

[0070] In the present embodiment, the bar 200 may include a fastening mechanism 210 to fasten to the guide member 45 of the bracket assembly 44. A fastening mechanism 210 is provided at both ends of the bar 200 in the present embodiment. The guide member 45 may include a recess 47 having a shape corresponding to the shape of the fastening mechanism 210. When the bar 200 is attached to the bracket assembly 44, the fastening mechanism 210 slides into the recess 47 of the guide member 45, thus attaching the fastening mechanism 210 to the guide member 45.

[0071] The fastening mechanism 210 may include one or more protrusions 212 that protrude from the sides of the fastening mechanism 210. The one or more protrusions 212 may be elastically deformable or may be spring loaded. When the fastening mechanism 210 has been fully inserted into the recess 47 of the guide member 45, the one or more protrusions 212 may hook into one or more corresponding slots in the recess 47 to attach the bar 200 to the bracket assembly 44.

[0072] The fastening mechanism 210 may provide for easy detachment of the bar 200 from the bracket assembly 44. Because the protrusions 212 are elastically deformable or spring loaded, the bar 200 may be detachable from the body 100 by exerting sufficient force. The bar 200 may be replaced with another bar 200 or may be serviced without the need for taking the entire drying apparatus 10 for servicing.

[0073] An embodiment of a drive apparatus using a lead screw and nut has been described. In other exemplary configurations, the bar 200 may be driven upon the body 100 by components other than a lead screw and nut. In fact, any suitable drive apparatus capable of providing the desired relative motion may be used. For example, the lead screw and nut may be replaced by a rack and pinion system, a pulley and belt drive, or, where the desired motion is a linear motion, a linear actuator.

[0074] FIG. 13 is a front view showing a drying apparatus including a bar 200 and a second bar 300 according to another embodiment of the present invention.

[0075] Referring to FIG. 13, a drying apparatus 10 may comprise a bar 200 and a second bar 300. The second bar 300 may include a third air outlet 301 and may be moveably driven relative the body 100. The second bar 300 may be

associated with its own nut 43, and the nut 43 with its own lead screw 42. The nut 43 is fixed to its own bracket assembly 48 such that the second bar 300 may be driven relative the body 100. The lead screw 42 may be driven by its own motor 52. The components associated with the driving of the second bar 300, and the functionality thereof, are similar to that described above with respect to the bar 200, and thus further description will be omitted in order to avoid duplicate description.

[0076] Based on the configuration of the exemplary embodiment described above, those skilled in the art will readily appreciate that even more bars may be employed in the drying apparatus 10. The drive apparatus 11 may be modular to accommodate multiple bars at the body 100.

[0077] As an example, as shown in FIG. 13, the bar 200 is associated with its own motor 50, lead screw 40, nut 41, and bracket assembly 44. By operation of the motor 50, the lead screw 40, and the nut 41, the bar 200 moves up and down relative to the body 100. Similarly, the second bar 300 is associated with its own motor 52, lead screw 42, nut 43, and bracket assembly 48. By operation of the motor 52, the lead screw 42, and the nut 43, the second bar 300 moves up and down relative to the body 100. The motor, the lead screw, the nut, and the bracket assembly associated with one bar do not act on the other bar. That is, the motor, the lead screw, the nut, and the bracket assembly of one bar only operate on that bar.

[0078] Accordingly, with each additional bar, a corresponding motor, a lead screw, a nut, and a bracket assembly may be added to the drive apparatus 11 to accommodate that bar. In this manner the drying apparatus 10 may be configured with a number of bars on the body 100 according to the preference of the user. Alternatively, each drive apparatus may accommodate more than one bar spaced apart from each other, which move in unison along the longitudinal length of the body 100.

[0079] FIG. 13 shows the bar 200 and the second bar 300 using the same guide track(s). In alternative exemplary configurations, the bar 200 and the second bar 300 may use separate guide tracks. By this configuration the bar 200 or the second bar 300 may be operated to any desired location along the extent of its drive path, irrespective of the position of the bar 200 or the second bar 300.

[0080] FIG. 14A is a view showing a rack and pinion drive assembly of a drive apparatus according to an alternative embodiment of the present invention; FIG 14B is a close up view of the rack and pinion drive assembly of the portion B; FIG 14C is an exploded view of the rack and pinion drive assembly of FIG. 14B.

[0081] Referring to FIGS. 14A, 14B, and 14C, the bar 200 may move up and down along the elongate height of the body 100 driven by a rack and pinion assembly. The rack and pinion assembly may comprise a rack 54, a stepper motor 55, and a pinion gear 56 coupled to the stepper motor 55. The rack 54 may be provided vertically along a side of the body 100. However, the rack may be provided at any location of the body 100. For example, the rack may be provided longitudinally at the center of the body 100. In another embodiment, the rack may be provided vertically at a side surface of the body 100.

[0082] In the present embodiment, the rack 54 runs vertically along a side of the first body and has a length covering the traveling distance of the bar 200. The rack may be provided at only one side of the body 100. In present embodiment, the rack is provided at both sides of the body 100. Having the rack at both sides of the body 100 may provide for the bar 200 to travel more stably across the body 100.

[0083] The bar 200 may include a guide member 45 installed at either side of the bar 200 (see also FIGS. 12A-12D and 13). In another embodiment, the bar 200 may use only one guide member 45 to correspond to a drying apparatus using a single rack. The guide members 45 of the bar 200 may be movably installed in corresponding guide tracks 46 located at the body 100. Each guide track 46 may be disposed adjacent to a corresponding rack. As the bar 200 moves up and down with respect to the body 100, the guide tracks 46 keep the bar 200 in a predetermined path through the guide members 45.

[0084] The stepper motor including the pinion gear may be installed at the guide member 45. The rack may include a plurality of teeth running along a surface of the rack which may correspond to the traveling distance of the bar 200. The pinion gear at the stepper motor meshes with the teeth of the rack to move the bar 200 along the rack. The stepper motor 55 powers the movement of the bar 200. For example, when the stepper motor 55 is rotated clockwise, the bar 200 may move up the rack. When the stepper motor is rotated counter clockwise, the bar may move down the rack.

[0085] In the present embodiment, one stepper motor 55 may be installed in one guide member 45 to move the bar 200 with the other guide member 45 purely acting as a guide in the other guide track 46. Another rack may be installed at the other side of the body and may include a plurality of teeth. In this configuration, a free rotating pinion gear may be provided at the other guide member 45 to mesh with the teeth of the other rack. Having two guide members 45 working in tandem with two racks may provide for an even support at both ends of the bar 200. In another embodiment, the two pinion gears may be tethered together and be operated by one stepper motor. Alternatively, two stepper motors may be used to operate respective pinion gears.

[0086] The drive apparatus using the rack and pinion drive assembly of FIGS. 14A-14C does not require a drive assembly occupying a space inside the body 100 as in the drive apparatus shown in FIGS 12A-13, where the drive assembly occupies a space inside the body 100 (see FIG. 13). The drive apparatus 11 of FIGS. 14A-14C may allow for

a duct 122 (see FIGS. 32-34) to be provided at the body 100. This may allow for the duct 122 to occupy most if not all the space that can be provided in the body 100 thereby allowing a large volume of forced airflow generated by the flow generators 110 to flow through the duct 122.

[0087] FIG. 15 is a top perspective view of the bar 200 according to the embodiment of the invention; FIG. 16 is a bottom perspective view of the bar 200 according to the embodiment of the invention; and FIG. 17 is a rear view of the bar 200 according to an alternative configuration to that illustrated in FIG 16.

[0088] Referring to FIGS. 15 and 16, the bar 200 may include a second air outlet 201 in which forced airflow is expelled at different locations relative to the body 100 depending on the location of the bar 200 relative to the body 100. As described previously in relation to the drive apparatus 11 between the bar 200 and body 100, two guide members 45 may guide the bar 200 in its movement relative the body 100.

[0089] One or more air inlets 205 may be located at the ends of the bar 200. The air inlet 205 may be protected in a cavity formed between the end of the bar 200 and a shield 206. The shield 206 may extend from the end of the bar 200 to form a shield at the top and side surfaces thereof except for the bottom surface. The open bottom surface of the shield 206 allows for the air inlet 205 to access inlet air. This configuration may act to prevent drips or splashes of water from entering the air inlet 205. The air inlet 205 provides for inlet air to enter into the bar 200 which houses one or more flow generators 204 (see FIG. 18).

[0090] FIG. 17 illustrates two air inlets 202 located at a back side of the bar 200 for supplying air to be vented from the second air outlet 201. In contrast, the air inlets 205 in the configuration of FIG. 16 are located at each end of the bar 200, as explained above. As the bar 200 extends laterally towards a user, more so than the body 100, the bar 200 may be more likely to become wet due to its closer proximity to the user. It may thus be desirable that the one or more air inlets 202 are disposed away from the user. As such, in the configuration of FIG. 17, the air inlets 202 are provided on the back side of the bar 200, as previously explained.

[0091] FIG. 18 is a partial view of various internal parts of the bar 200 according to an embodiment of the present invention. In particular, FIG. 18 shows the bar 200 with its cover removed to reveal a pair of flow generators 204 and an air conduit 207. The bar 200 may include a pair of flow generators 204 that receives inlet air from the air inlets 202 and generates forced airflow through the air conduit 207. The air conduit 207 may include an intermediate outlet 208 through which the forced airflow may pass and be vented out by the second air outlet 201.

[0092] FIG. 19 is an exploded view showing various parts of the bar 200 according to the embodiment of the present invention described above with respect to FIG. 18.

[0093] Referring to FIG. 19, the bar 200 has its cover 230 removed to show various internal parts including a pair of flow generators 204, a pair of motors 220, a pair of thermal devices (for example, resistance heaters, thermoelectric devices, and other suitable devices could be used), and an air conduit 207. The bar 200 has a pair of flow generators 204 which receive inlet air from one or more air inlets (see FIGS. 16 and 17). The pair of flow generators 204 generate forced airflow from the received air which has a relatively high speed. For example, the flow generator may be Smart Inverter Motor TM that sucks in air and expels air at high speed by operating up to 115,000 RPM. However, other types of axial fan assembly may be used.

[0094] The forced airflow from the pair of flow generators 204 pass through the air conduit 207 to be expelled from the intermediate outlet 208. The air conduit 207 is shown to be cylindrical but is not limited to this shape and other configurations may be used such as an oval tube, a square tube, a rectangular tube, etc. The air conduit 207 contains the air sucked in by the pair of flow generators 204 within the confines of the air conduit 207 thereby increasing the speed of the forced airflow if not maintaining the speed of the forced airflow expelled by the pair of flow generators 204. Thus, a forced airflow of relatively high speed is introduced into the intermediate outlet 208. The expelled air is ultimately forced out of the second air outlet 201. While the present embodiment illustrates using a pair of flow generators, in other configurations a single flow generator or more than two flow generators may be used.

[0095] In the present embodiment, a pair of resistance heaters 120 are shown as part of the bar 200. A resistance heater 120 is located downstream of each of the flow generators 204. In alternative configurations, the resistance heater may be located upstream of the flow generator or may be integrated with the flow generator. In the present embodiment, the flow generators 204 and resistance heaters 120 are at least partially enclosed within the air conduit 207 (see FIG. 18). The air conduit 207 may guide the air heated by the resistance heaters 120 towards the intermediate outlet 208 and out through the second air outlet 201.

[0096] While this embodiment uses resistance heaters to heat the inlet air flow, in another exemplary embodiment, a thermoelectric device, for example, using the Peltier effect may be used to heat or cool the inlet air flow. In this configuration, the bar 200 is not limited to expelling heated air but may also expel cold air.

[0097] The bar 200 may further comprise one or more motors 220. As shown in FIG. 19, one or more motors 220 may be provided along a longitudinal axis of the bar 200 which may be parallel to the drying face 14 of body 100. The one or more motors 220 may cause the bar 200 to tilt up or down by rotating about its longitudinal axis. By tilting the bar 200 up or down, the bar 200 may expand the coverage area to which the forced airflow may be applied. Also, by tilting the bar 200 up and down continuously while blowing forced air, the bar may enhance drying performance.

[0098] FIGS. 20 and 21 are views illustrating exemplary ways in which forced air may be expelled from the second air outlet 201, according to exemplary embodiments of the present invention, based on the shape and/or size of the second air outlet 201.

[0099] The second air outlet 201 may be configured such that the expelled airflow may cover a width of the user as the bar 200 moves up or down along the length of the user. The bar 200 may be provided with a suitable second air outlet 201 that may direct the forced airflow across the full width of the user.

[0100] Referring to FIG. 20, more specifically, the second air outlet 201 may be configured to provide a laterally expanding forced airflow. As the forced airflow flows further away from the second air outlet 201, the forced airflow expands at least horizontally to better cover a width of the user's body. An example of a structure to form an expanding forced airflow is shown in FIG. 19.

[0101] The intermediate outlet 208 of the air conduit 207 may be a circular, oval, or quadrilateral air outlet from which the forced airflow may fan out as the air flow travels further from the second air outlet 201. As an example, a circular air outlet may form a relatively narrow but relatively strong forced airflow over a small area of the user's body. A rectangular air outlet may form a relatively wider but relatively weaker forced airflow over a larger area of the user's body.

[0102] The degree to which the forced airflow fans out may be determined by the angle of the arc at the intermediate outlet 208. As an example, a narrow arc may form a narrow but strong airflow covering a small part of the user's body. A wider arc may form a wider but weaker airflow covering a wider part of the user's body. The shape of the intermediate outlet 208 and the angle of the arc may be selected depending on a desired effect of the forced airflow over the user's body.

[0103] Referring now to FIG. 21, the second air outlet 201 may alternatively be an elongated slit across the longitudinal length (in the lateral direction relative to the longitudinal length of the body) of the bar 200 to expel a planar blade of outlet air. In one configuration, the length of the slit may be sufficient to cover a width of the user's body. In this configuration, as the bar 200 travels vertically up and/or down with respect to the body 100, the forced airflow of the second air outlet 201 may cover all parts of the user's body. For this configuration, the intermediate outlet 208 may be formed as an elongated slit running across the longitudinal length of the air conduit 207. The second air outlet 201 being an elongated slit as shown in FIG. 21 corresponds to the slit of the intermediate outlet 208.

[0104] FIG. 22 is an electrical schematic diagram of a drying apparatus 10 according to an embodiment of the present invention. A controller 53 controls the overall operation of the drying apparatus 10. The controller 53 may be a micro-processor, an integrated circuit, an electrical circuit, a logical electrical circuit, and the like.

[0105] The controller 53 may control the operation of the body flow generator 110 and the thermoelectric device 117 of the body 100; the controller 53 may control the operation of the flow generator 204 and the resistance heater 120 associated with the bar, may control the drive apparatus 11, and may control the motor 220, among others. The various operations which are performed by the components have been described above and further description will be omitted. The controller 53 may access or store information in a memory 58 for controlling the operation of the drying apparatus 10.

[0106] The drying apparatus 10 may include one or more sensors 209 which are also controlled by the controller 53. These sensors 209 may variously be associated with the body 100 and the bar 200 (e.g., FIGS. 12C and 16). In some embodiments, one or more sensors 209 may be located remotely from the drying apparatus 10.

[0107] According to various embodiments, such as the embodiments shown in FIGS. 12C and 16, for example, the one or more sensors 209 may be associated with the bar 200. The controller 53 may receive sensor information from the one or more sensors 209 of the bar 200 and the controller 53 may operate the drying apparatus 10 utilizing the sensor information as an operation parameter.

[0108] As an example, sensing information of the one or more sensors may be utilized by the controller 53 to determine various characteristics of the environment surrounding the apparatus and/or various characteristics and/or conditions of a user. For example, the sensing information may be utilized to determine the presence of a user; physical characteristics of the user including their overall and/or particular dimensions; wetness of a user's body and/or different parts of their body; temperature or heat of the ambient air and/or humidity of the ambient air, among others. To achieve this, the drying apparatus 10 may include one or more sensors 209 described below.

[0109] The one or more sensors 209 may include a thermal sensor such as an infrared sensor. The infrared sensor may be used to obtain information on the heat of the surroundings. For example an infrared sensor may be used as a temperature sensor to sense the temperature of the ambient air. Information on the temperature of the ambient air may be obtained to determine whether to condition the ambient air.

[0110] The infrared sensor may be used on a user's body located adjacent to the drying apparatus 10. Information from the infrared sensor may be utilized to infer or determine moisture levels of the user's body, and/or specific parts of the user's body. Information from the infrared sensor may be utilized to obtain an indication of the overall dimensions of a user's body, where body temperature differs from the temperature of the surrounding air.

[0111] The one or more sensors 209 may include a proximity sensor. The proximity sensor may be utilized to determine the proximity of the user to the drying apparatus 10. For example, information from the proximity sensor may be utilized to determine the distance of the user from the drying face 14 of the drying apparatus 10. When the user is within a predetermined distance of the drying face 14, the drying apparatus may be activated to dry the user. Information from

the proximity sensor may be utilized to control a forced airflow speed from the air outlet 101 and/or the air outlet 201 dependent on the distance of the user, in order to obtain a desired forced airflow speed directed at the user.

[0112] The proximity sensor may be utilized to determine if a user is undesirably close to the drying apparatus or a part thereof. For example, for safety reasons, it may be desirable to limit or prevent the movement of the bar 200 when a person is within a particular distance or position relative to it. This may include where part of a person's body is located above or below the bar 200, within its path of movement.

[0113] The one or more sensors 209 may include an image sensor. The image sensor may be utilized to obtain image information of the surroundings, determine the presence of a user, and determine overall dimensions of a user's body and/or specific parts of the user's body. The image sensor may be used in conjunction with or in lieu of the thermal sensor for information such as those mentioned above in order to obtain a more accurate information.

[0114] The one or more sensors 209 may include a humidity sensor. The humidity sensor may also be utilized to obtain information on the humidity of surrounding ambient air, for example, a humidity level of the bathroom in which the drying apparatus is installed. The drying apparatus 10 may be activated or used to remove moisture in the air until the humidity level is below a predetermined level. The humidity sensor may also be utilized to obtain information regarding the level of wetness/dryness of the user's skin. The information may be used to control heat applied to the forced airflow so that the user's skin does not become too dry.

[0115] Besides the exemplary sensors described above, other sensors known in the art may be used to achieve a desired result.

[0116] As previously mentioned, the drying apparatus 10 may perform air conditioning of a given space. For example, the space may be a bathroom. During hot days, the drying apparatus 10 may cool the bathroom and during cold days the drying apparatus 10 may heat the bathroom for the comfort of the user. In such a scenario, the controller 53 may determine the ambient temperature or ambient heat level of the bathroom, and use this information to control the temperature to the satisfaction of the user.

[0117] For example, in a hot bathroom, the user may perspire to keep cool. The perspiration evaporates taking some of the heat from the user's body providing a sensation of coolness. However, when the humidity level is high in the bathroom, the perspiration does not evaporate as efficiently and thus remains as moisture on the user's body. This may cause discomfort to the user as the user feels hotter than the temperature of the bathroom.

[0118] Accordingly, the controller 53 in conditioning the bathroom may need to consider the temperature as well as the humidity. In one embodiment, the controller 53 may consider a comfort level index correlating temperature and humidity to determine user comfort. The temperature-humidity index (THI), also known as the discomfort index, may be used to determine a comfort sensation with respect to the current sensed temperature and the current sensed humidity.

[0119] There are several equations devised to determine THI. One equation may be:

$$THI = T_d - (0.55 - 0.55RH) (T_d - 58)$$

where T_d is the dry-bulb temperature in °F, and RH is the relative humidity in percent, expressed in decimal. For example, 50% relative humidity is 0.5.

[0120] It should be noted that the THI is not absolute but relative. Temperatures affect people differently. Various factors such as height, weight, sex, health condition, etc., may cause one person to feel temperature differently than another person.

[0121] Below is a table that illustrates a THI which reflects the comfort level of a typical person.

Level	THI Range	Comfort Level
Very High	Above 80	Everyone experiences discomfort
High	Between 75 and below 80	50% experiences discomfort
Normal	Between 68 and below 75	Discomfort begins to be felt
Low	Below 68	No discomfort is felt

[0122] FIG. 23 is a flowchart illustrating a method for controlling temperature of a given space using a temperature-humidity index (THI), by a controller, according to one embodiment of the present invention.

[0123] Referring to FIG. 23, in step S100, the controller 53 may receive sense information from the thermal sensor. The information may be an ambient temperature of the bathroom. In step S110, the controller 53 may receive sense information from the humidity sensor. The information may be a humidity level of the bathroom. In step S120, the controller 53 may use the received temperature information and the humidity level information to determine the THI. One equation

that the controller 53 may use to derive the THI may be the equation provided above. The equation may be stored in the memory 58 to be accessed by the controller 53.

[0124] In step S130, the controller 53 may determine whether the derived THI is greater than or equal to 75. The reference index of 75 may be stored in the memory 58. It should be noted that the reference index of 75 is not absolute. For example, the reference index of 75 may be increased or decreased in the memory 58 to tailor to individual user's need. If the THI is less than 75 the controller 53 may continue to step S160 where the controller 53 may terminate the control of the THI.

[0125] Otherwise, in step S130, if the controller 53 determines that the THI is greater than or equal to 75, the controller 53 may continue to step S140. In step S140, the controller 53 may send a signal to activate the flow generator. The flow generator may be either on or off, i.e., producing a constant air flow. Alternatively, the controller 53 can be configured to control a variable air intake amount by using an air intake amount value corresponding to the desired air flow. For example, the flow generator may be the flow generator 110 located at the body 100. At step S150 the controller 53 may activate the thermoelectric device 117. It should be noted that the activation of the flow generator and the thermoelectric device need not be in sequence; it can be simultaneous or in reverse order.

[0126] The controller 53 may send a signal to the thermoelectric device 117 to cool (or warm) the air sucked in through the air inlet 102. The cooled air may reduce the temperature of the intake air as well as dehumidify the air. The cooled, dehumidified air may then be expelled through the air outlet 101. The controller 53 may be configured to adjust the amount of heating or cooling via a heat level value. The heat level value can correspond to a heat level, either cooler or hotter than the ambient air. The controller 53 continues to step S100 to repeat steps S100 to S130.

[0127] At step S130, the controller 53 may again determine whether the THI is greater than or equal to 75. If the controller 53 again determines that the THI is greater than or equal to 75, the controller 53 continues to steps S140 and S150 and continues to intake air and to cool the air. The controller 53 continues unless and until the controller 53 determines at step 130 that the THI is less than 75. In which case, the controller 53 continues to step S160 where the controller 53 terminates the method.

[0128] In some instance, the forced airflow provides a wind chill to the user, which the system can also use as a comfort level to adjust air intake and temperature. This is where the user perceives the airflow at a temperature lower than that of the ambient air temperature. There are several equations devised to determine wind chill. For the purpose of this disclosure, reference may be made to the North American and UK wind chill index as follows:

$$T_{wc}=13.12+0.6215T_a - 35.75v^{+0.16} + 0.4275T_av^{+0.16}$$

where T_{wc} is the wind chill index, based on the Celsius temperature scale; T_a is the air temperature in degrees Celsius; and v is the airflow speed in kilometers per hour.

[0129] Based on the above equation, the higher the forced airflow speed the lower the perceived temperature of the air flow by the user. Thus, when airflow speed increases the controller 53 may increase the temperature of the forced airflow to obtain the target temperature.

[0130] Embodiments may not have a sensor to determine the airflow speed, but can estimate it due to known constraints within the system. For example, the size of chambers for airflow, the power of the air flow generator, and the size of the outlet for the airflow are all known variables. Therefore, embodiments include estimating the airflow speed based on these known parameters. Embodiments may also include a table that correlates airflow speed with the speed at which the airflow generators operate. Therefore, for a known air flow generator input, the system may know the airflow speed based on corresponding predetermined values. In one embodiment, the target surface skin temperature of the user may be about 30 to about 32 degrees Celsius. Thus forced airflow heating or cooling may be provided to maintain or obtain this temperature.

[0131] In one embodiment the temperature of the forced airflow generated by the drying apparatus 10 should be at a temperature that provides little or no discomfort to the user. The Humidex index of apparent temperature may provide a suitable guide on the level of comfort or discomfort provided by a temperature applied to a user's skin. The Humidex index takes into account both temperature and relative humidity in determining the level of comfort or discomfort. The humidex formula is as follows:

$$H = T_{air} + \frac{5}{9} \left[6.11e^{5417.7530 \left(\frac{1}{273.16} - \frac{1}{273.15+T_{dew}} \right)} - 10 \right]$$

[0132] Where H denotes the Humidex, T_{air} is the air temperature in °C, and T_{dew} is the dew point in °C.

[0133] In some embodiments, the apparent temperature to be applied to the user is between 20 to 39 °C. In a preferred

embodiment, the apparent temperature to be applied to the user is between 20 and 29 °C. As mentioned above, the apparent temperature may be determined by taking into account the wind chill factor of the airflow temperature.

[0134] FIG. 24 is a flowchart illustrating a method for controlling temperature using a wind chill index, by a controller, according to one embodiment of the present invention.

[0135] Referring to FIG. 24, the controller 53 may control the flow generator 204 to direct forced airflow to the user's body through the air outlet 201 based on the thermal sensor information and a wind-chill index. At step S200, the controller 53 receives information from the thermal sensor. The information may for example, reflect an air temperature in the vicinity of the bar 200, if the thermal sensor location is the location of sensor 209 as shown in FIG. 16.

[0136] In step S210, the controller 53 receives the revolutions per minute (RPM) of the flow generator 204. In this configuration, the RPM of the flow generator 204 is variable. In a configuration where the flow generator 204 is not variable, but fixed, the controller 53 may retrieve the RPM stored in the memory 58. The RPM of the flow generator 204 is equated to an airflow speed of the forced airflow.

[0137] In step S220, the controller 53, having the air temperature at the bar 200 and the airflow speed of the forced airflow, may determine the wind chill index. One equation that the controller 53 may use to derive the wind chill index may be the equation provided above. The equation may be stored in the memory 58 where it is accessed by the controller 53.

[0138] In step S230, the controller 53 determines whether the derived wind chill index is greater than or equal to a predetermined target. The predetermined target may be chosen from among many different temperatures or temperature ranges. For example, the target may be the target surface skin temperature of about 30 to about 32 degrees Celsius. The target may be stored in the memory 58.

[0139] If the wind chill index is less than the target, the controller 53 may continue to step S240. In step S240, the controller 53 may increase the temperature of the forced airflow by heating the air flow using the resistance heater 120 at the bar 200, for example. The controller 53 may continue to step S200 and then repeat steps S200 to S230. Since the thermal sensor is close to the air outlet 201, the thermal sensor may sense an increase in temperature. Also, step S210 may be skipped where the RPM of the flow generator does not change.

[0140] As indicated, the controller 53 repeats the process unless and until the controller 53 determines, at step S230, that the wind chill index is greater than or equal to the target. If the wind chill index is greater than or equal to the target, the controller 53 continues to step S250, deactivates the resistance heater 120 and terminates the method.

[0141] FIGS. 25A and 25B are views illustrating a user being dried by the bar 200 of the drying apparatus 10 according to an embodiment of the present invention.

[0142] Referring to FIGS. 25A and 25B, the bar 200 includes sensor 209 which may be a thermal sensor positioned such that it faces the user when the user is present at the drying face 14 of the body 100. While the bar 200 may be located at any position along the longitudinal length L1 of the drying face 14 of the body 100, in the present embodiment the starting position of the bar 200 may be somewhere approximating a middle portion of the drying face 14. When the drying apparatus 10 is activated, the bar 200 may be driven upward by the drive apparatus 11 in the direction of arrow 1. Coincidentally, the thermal sensor may be activated.

[0143] As the bar 200 is driven upward, the thermal sensor scans the user. When the thermal sensor no longer detects thermal heat from the user, then the height of the user is determined to have been reached and the drive apparatus 11 may stop the movement of the bar 200. The drive apparatus 11 now may move the bar 200 downwards in the direction of arrow 2. At the same time the thermal sensor scans the user. The thermal sensor may operate to detect wetness at the part of the user being scanned. The thermal sensor may detect wetness on the user as being a cooler temperature and dryness as being a warmer temperature. The flow generator 204 and perhaps the resistive heater 120 may be activated to dry the user.

[0144] In another configuration, the flow generator 110 and perhaps the thermoelectric device 117 may be activated to dry the user. The flow generator 110 and the thermoelectric device 117 may be operated in combination with the operation of the flow generator 204 and the resistive heater 120 of the bar 200. The flow generator 110 and the thermoelectric device 117 may be continuously operated until the bar 200 has reached the bottom of the drying face 14 and then the flow generator 110 and the thermoelectric device 117 may be deactivated.

[0145] As shown in FIG. 25B, the bar 200 may be positioned by the head of the user. Because hair usually retains a lot of water, the thermal sensor may detect significant wetness when the bar 200 is in this position. Accordingly, the bar 200 may not move while the second air outlet 201 expels heated forced airflow to dry the user's head. When the thermal sensor detects that the user's head is sufficiently dry the drive apparatus 11 may move the bar 200 downwards in the direction of the arrow 2.

[0146] As the bar 200 moves downward in the direction of the arrow 2, the heated forced airflow expelled from the second air outlet 201 may dry the head, the body, and eventually the legs. While the bar 200 is transitioning from the head to the legs, the bar may stop, dry parts of the user which are more wet than other parts, before moving further down in the direction of arrow 2, until the bar 200 has reached to the bottom of the drying face 14.

[0147] In another embodiment, the bar 200, after initially reaching the head of the user, may move up and down

repeatedly from head to toe until the thermal sensor senses that the user is dry. The movements of the bar described are exemplary and other forms of movement of the bar to dry the user may be conceived.

[0148] FIG. 26 is a flowchart illustrating an exemplary method for drying a user, by the controller, according to an embodiment of the present invention.

[0149] Referring to FIG. 26, in step S300, the controller 53 moves the bar 200 upward with respect to the body 100. The controller 53 also receives heat information from the thermal sensor. In step S310, the controller 53 determines whether the thermal sensor detects heat. If the thermal sensor detects heat, the controller 53 continues to move the bar 200 upward in step S300. Otherwise, if the thermal sensor does not detect heat, the controller 53 stops the movement of the bar 200, on the assumption the bar 200 has reached the height of the user, and continues to step S320.

[0150] In step S320, the controller 53 moves the bar 200 downward by a predetermined amount, such as one width of the user's body covered by the forced airflow from the bar 200. In step S330, the controller 53 operates the flow generator 204. In this step, the controller 53 may also activate the flow generator 110 and perhaps the thermoelectric device 117. Thus forced airflow from the air outlet 201 may dry a corresponding part of the user adjacent to the bar 200. Also, the forced airflow from the air outlet 101 may aid in the drying of the user. The controller 53 then continues to step S340.

[0151] In step S340, the controller 53 determines whether the thermal sensor detects heat greater than or equal to a predetermined amount. The predetermined amount may indicate that the part of the user is sufficiently dry. If the thermal sensor detects heat less than the predetermined amount, the controller 53 continues with step S330 where the controller 53 continues to dry corresponding the part of the user. Otherwise, the controller 53 continues to step S350.

[0152] In step S350, the controller 53 determines whether the bar 200 has reached the bottom of the drying face 14 of the body 100. If the bar 200 has not reached the bottom of the drying face 14, the controller 53 continues to step S320, and repeats steps S320 to S340. Otherwise, if the bar 200 has reached the bottom of the drying face 14, the controller 53 deactivates the flow generator 204 and the resistance heater 120. If the flow generator 110 and the thermoelectric device 117 were activated, the controller 53 deactivates these as well.

[0153] FIG. 27 is an exploded view of an upper region of the drying apparatus 10 illustrating an exploded view of a filter unit according to an embodiment of the present invention; and FIG. 28 is another exploded view of the filter unit according to an embodiment of the present invention.

[0154] The filter unit 104 may provide one or more filtrations or treatments to inlet air flow. Ambient air, particularly in cities or other urban settings, may contain undesirable levels of particulate matter. Such particulate matter may be harmful to a person's health, and may also have undesired effects on a person's skin if blown onto the person when using the drying apparatus to dry their body.

[0155] For example, particulate matter may be either basic or acidic, and thus cause damage to a user's body. The filter unit 104 may comprise one or more particulate filters 113, such as is seen in FIG. 28, to capture particulate matter. The one or more particulate filters 113 may be in the form of any commonly available filter, for example, a fiberglass filter, a polyester filter, or a High Efficiency Particulate Air (HEPA) filter.

[0156] Ambient air is also likely to contain bacteria and viruses, which may pose a risk of infection to a user of the drying apparatus. If not entrained by a particulate filter 113, a filter unit 104 may include a bacterial and/or viral filter 114. Such a filter may include antimicrobial or antibacterial elements.

[0157] It may be desirable to reduce or remove moisture in inlet air before it is vented for drying. The filter unit 104 may include one or more dehumidifying filters 115, having for example a desiccant material.

[0158] In the present embodiment, a pair of air inlets 102 each pass the inlet air to the filter unit 104. The use of a single filter unit 104 may be desirable particularly where there are multiple flow generators to provide for a single point of servicing of any filters within the filter unit.

[0159] FIG. 29 is a front view of an air inlet and an inlet pathway at a flow generator housing according to an embodiment of the present invention; and FIG. 30 is an exploded view of the air inlet of FIG. 29.

[0160] Referring to FIG. 29, an inlet pathway, which involves the air inlet 102 and the flow guide 116, directs inlet air from the air inlet 102 to the filter unit 104. However, because the drying apparatus 10 may be used in a wet environment, such a bathroom or shower, water may be splashed onto the drying apparatus 10 or into the air surrounding the drying apparatus 10, including the air inlets 102. Additionally, in use, there may be suction at the air inlets 102 due to operation of the flow generators 110 which could pull nearby water into the air inlets 102. It is undesirable that such water enters the drying apparatus 10. In addition to water making its way into the air inlets 102, the flow path may intake other matter passing through the air inlets 102 and into the flow guide 116.

[0161] As shown in FIGS. 29 and 30, the air inlets 102 provide for an upwardly deflected flow path into the flow guide 116. This upward deflection may act as a gravitational barrier to the ingress of water or other solid objects into the drying apparatus 10. To further prevent unwanted water or other matter passing into the flow path, an obstruction in the inlet flow path may additionally or alternatively be provided in the form of an inlet filter 111, for example as seen in FIG. 30. This inlet filter 111 may, more specifically, be in the form of a particulate filter, for filtering particles from the inlet air.

[0162] Alternatively the inlet filter 111 may be in the form of a macroscopic filter, such as a macroscopic mesh filter

for guarding against the inletting of larger matter. Where it is desired to guard against water being drawn in with the inlet air or to dehumidify the inlet air the inlet filter 111 it may include a desiccant material for absorbing water.

[0163] As a further measure to dehumidify the inlet air, a resistance heater (not shown) may be placed adjacent to the inlet filter 111. When operated, the resistance heater may heat the inlet air to remove moisture in the air. Further,

[0164] FIG. 31 is a front transparent view of an upper region of a drying apparatus according to another embodiment of the invention. For example, similar to the configuration shown in FIG. 9A, a connection between the flow generators 110 and the first air outlet 101 of the body 100 is such that the outlet of each of the flow generators 110 directly connects to the first air outlet 101 of the body 100. To provide added comfort for a user and/or increased drying efficiency, it may be desirable to further heat the air heated by the thermoelectric device 117. As seen in FIG. 31, air flowing from the filter unit 104 may pass by one side of the thermoelectric device 117 to be selectively heated or cooled.

[0165] While FIG. 31 shows a square shaped thermoelectric device 117 covering a portion of the outlet air flow pathway 105, it should be appreciated that the thermoelectric device 117 may be rectangular covering all of the outlet air flow pathway 105. That is, the thermoelectric device 117 may have a rectangular shape that covers all of the filtered air airflow pathway starting from the outlet of the filter unit 104 and ending at the inlet of the flow generator 110. Where the air is to be further heated, it may be desirable to heat the heated air downstream of the flow generator 110.

[0166] Thermal elements such as resistance heaters 120 may be provided at the downstream side of respective flow generators 110. The resistance heaters 120 may further heat the air forced by the flow generators 110 towards the first air outlet 101. The resistance heater 120 may be used as a booster to further heat or super heat the air heated by the thermoelectric device 117.

[0167] While in FIG. 31, the thermal elements are shown as resistance heaters, any other suitable thermal elements may be used. In other configurations the thermal element may be a thermoelectric device that may be used to selectively heat or cool the air at the downstream side of the flow generator.

[0168] FIG. 32 illustrates a view of a drying apparatus 20 according to another exemplary embodiment of the present invention. FIG. 33 shows a cross-sectional view of a body 100 and a bar 200 of the drying apparatus of FIG. 32.

[0169] As shown in FIG. 32, in a drying apparatus 20, the first air outlet 101 may be distributed across at least a portion of the drying face of the body 100. Unlike the drying apparatus 10 described above, where the first air outlet 101 runs along a periphery of the body 100, the first air outlet 101 of the drying apparatus 20 includes outlet ducts 123 that are distributed across the face of the drying face 14. In the present embodiment, the outlet ducts 123 are a plurality of vertical slits running along a longitudinal length of the body 100 and disposed across the drying face 14. The outlet ducts 123 are provided in two zones, an upper zone 124 and a lower zone 129. This configuration may allow for differences in venting between different regions of the first air outlet 101.

[0170] FIG. 33 shows a cross-sectional view along line B-B' of FIG. 32 through the body 100 and the bar 200 where the first air outlet 101 is a distributed outlet across the drying face 14 of the body 100. In the drying apparatus 20, a pair of flow generators 110 may expel forced airflow to a duct 121 (similar to that shown in FIG. 8), to a duct 122, or directly into the duct 122 as shown in FIG. 34, and finally on to a plurality of outlet ducts 123 from which the forced airflow is vented from the drying apparatus 20. Shown in cross-section is the duct 122 which may receive the forced airflow from the duct 121. The duct 122 may include a plurality of vertical slits running along a longitudinal length of the body 100 corresponding to the vertical slits of the outlet ducts 123. The duct 122 may vent the forced airflow to the plurality of outlet ducts 123 through the plurality of slits which, in turn is vented to the outside of the body 100 by the outlet ducts 123. The duct 122 and the plurality of outlet ducts 123 may comprise the first air outlet 101.

[0171] FIG. 34 is a view of a duct assembly of FIGS. 32-33 according to one embodiment of the present invention. As shown in FIG. 34, the duct assembly includes a duct 122 that is disposed at the body 100 of the drying apparatus 20. The duct 122 may occupy most if not all of the space provided in the body 100. The outlet ducts 123 run along a periphery of the duct 122. The outlet ducts 123 are distributed across the face of the duct 122. In the present embodiment, the outlet ducts 123 are a plurality of vertical slits running along a longitudinal length of the duct 123 and are disposed across the duct 122. The outlet ducts 123 are provided in two zones, an upper zone 124 and a lower zone 129. Forced airflow may be vented through the upper zone 124, the lower zone 129, or both the upper zone 124 and lower zone 129. The controller 53 may control the venting through the upper zone 124 and the lower zone 129 through one or more dampers disposed in the duct 122.

[0172] The duct assembly further includes a pair of flow generators 110, each provided at a top side surface of the duct assembly. The flow generator 110 includes a fan assembly 1101 and a conduit 1102. The fan assembly may be an axial fan and the like. Preferably, the fan assembly includes a high speed motor that sucks in air and expels air at high speed. For example, the fan assembly may be Smart Inverter Motor™ available from LG Electronics, Inc., Republic of Korea, that operates at speeds up to 115,000 revolutions per minute (RPM). Similar fan assembly may be used.

[0173] The fan assembly 1101 is connected to the conduit 1102 which may be a cylindrical tube that connects to and is in communication with the upper side of the duct 122. However, it should be appreciated that the conduit 1102 is not limited to a cylindrical tube and other configurations may be used such as an oval tube, a square tube, a rectangular

tube, etc. The conduit 1102 contains the air sucked in by the fan assembly 1101 within the confines of the conduit 1102 thereby increasing the speed of the forced airflow if not maintaining the speed of the forced airflow expelled by the fan assembly 1101. Thus, a forced airflow of relatively high speed is introduced into the duct 122. The forced airflow traveling through the duct 122 is expelled through one or more outlet ducts 123 distributed across the upper surface of the duct 122.

[0174] The bar 200 may travel along the longitudinal length of the duct 122. In one embodiment, the bar 200 may be configured as shown in FIGS. 16-19 having its own air inlet and flow generators. In this embodiment, the bar 200 may receive air from the flow generator or generators 110 of the body 100. For example, the bar 200 may have one or more air inlets, such as air inlets 203 as shown in FIG. 33. One example of a bar 200 having this configuration is shown in FIG. 17. Referring to FIG. 17, the bar 200 having a pair of air inlets 202 at the back side of the bar 200 may receive forced airflow from portions of the plurality of outlet ducts 123 which the pair of air outlets 202 covers. Referring to FIG. 33, the one or more air inlets 203 may receive air from the flow generators 110 in the body 100 and vent the air from the second air outlet 201.

[0175] In the present embodiment, the bar 200 is provided with a pair of flow generators 204 that further speeds the forced airflow received from the flow generators 110 of the body 100. However, in other embodiments, the bar 200 is not provided with flow generators 204 and vents the forced airflow received from the flow generators 110 of the body 100 as is. Although not shown, the bar 200 may include resistance heaters 120 as shown in FIG. 19. Although not shown, the bar 200 may include thermoelectric devices instead of resistance heaters. The bar 200 may further air condition the received forced airflow from the body 100. Otherwise, the bar 200 may not include an air conditioning device and may vent forced airflow air conditioned by the thermoelectric devices 117 of the body 100 without further air conditioning the received forced airflow from the body 100.

[0176] Referring back to FIG. 32, the drying apparatus 20 may further include a feet resting portion 400 on which a person may place their feet. The duct 122 may continue on to connect to the feet resting portion 400. The duct 122 may supply air flow to one or more air outlets of the feet resting portion 400 through which air vented from the one or more air outlets may dry the feet of the person. In the configuration shown in FIG. 32, the feet resting portion 400 may be configured to retract into the body 100 of the drying apparatus 20, for example, when not in use. However, in other embodiments, the feet resting portion 400 does not retract and may be stationary supported by the floor.

[0177] FIG. 35 is an exploded view of the body according to an embodiment of the present.

[0178] The body 100 may be covered with molded plastic covering. As shown in FIG. 35, the molded plastic covering may comprise a back panel 140, a side panel 142 and a front panel 144 covering the body 100. In another embodiment, the plastic covering may have a thin metallic plate adhered to its surface. Parts of the plastic covering may be snap fitted together. For example, one part may have a protrusion portion and another part to be fitted to may have a corresponding recess portion. When the two parts are snap fitted together, the protrusion portion fits into the recess portion and the two parts are fixed to each other. The plastic covering form an outer appearance of the body 100 and provide an aesthetically pleasing look. Being snap fitted together, the plastic covering of the body 100 may be removed by pulling the plastic covering off the body 100 and replacing with another plastic covering having a design or pattern meeting the preference of the user, and thereby being customized to the user according to their taste. It should be noted that the plastic covering 230 (see FIG. 19) of the bar 200 may also be removed and replaced with another plastic covering having a design or pattern meeting the preference of the user, and thereby being customized to the user according to their taste.

[0179] A variety of different users may use a given drying apparatus. The variety of users may have different heights. An example of how different heights of users may be accommodated has been described above with respect to FIGS. 25A-25B. However, variety of different users may have different body characteristics such as different statures and different sizes of various body parts. For example, a user may be ectomorph. Ectomorph relates to one of W. H. Sheldon's classification of body types that measures the body's degree of slenderness, angularity, and fragility, and indicates a lean slender body with slight muscular development. A user may be mesomorph. Mesomorph indicates a medium frame body that has more muscle than fat on their bodies, and may be balanced not being overweight or underweight. A user may be endomorph. Endomorph indicates a body with a fat and heavy body build. A drying apparatus should be able to accommodate these various body sizes of users.

[0180] FIG. 36A to 36C show examples of front-on profiles of three different users.

[0181] With reference to FIG. 36A, a user 34 is shown having a thin torso and legs, relatively narrow shoulders, and thin arms. According to W. H. Sheldon's classification of body types, this user may be considered ectomorph. From a front-on or rear-on perspective, the user 34 presents a substantially continuous lateral extent through their torso and legs. The torso and legs may be a significant part of the whole of the body of the user to be dried.

[0182] With reference to FIG. 36B, a user 34 is shown having somewhat more muscular legs but particularly a significantly more muscular upper torso and arms. They also have relatively wider shoulders than the user of FIG. 36A. According to W. H. Sheldon's classification of body types, this user may be considered mesomorph.

[0183] The user 34 of FIG. 36B may present a lateral extent which of their legs and torso which broadens along the height of the person. The muscularity of the person's body also results in a broader overall lateral extent of the person, as their arms are larger and sit relatively further away from the torso at rest.

[0184] With reference to FIG. 36C, this user shows a greater body mass than either FIGS. 36A or 36B. The user 34 of FIG. 36C presents an upper torso of similar dimensions to the user of FIG. 26B, but their lower torso and legs do not narrow nearly as significantly as with that of the user of FIG. 36B. The overall lateral extent of the user 34 of FIG. 36C is significantly greater than that of the user of FIG. 36A. According to W. H. Sheldon's classification of body types, this

user may be considered endomorph.

[0185] FIG. 36A to 36C are intended to illustrate only three example configurations of body sizes and types. Actual users of the drying apparatus may present with any number of possible combinations and variations of these or other body characteristics.

[0186] While FIG. 36A to 36C show front-on views of exemplary users, similar variations in the lateral extents and other body characteristics of users may be seen from side-on views, views between side and front views, and any of these views from somewhat above or somewhat below perspectives.

[0187] The drying apparatus should operate to dry a user by directing a forced airflow onto their body in consideration of their body characteristics. Accordingly, it should be appreciated that for a range of different users with different body characteristics, the drying apparatus may be required to expel different drying airflow characteristics.

[0188] FIG. 37A to 37C show three exemplary drying airflows that may be expelled by the drying apparatus based on the body characteristics of users shown in FIGS. 36A-36C. In FIGS. 37A-37C, the body characteristics of the users of FIGS. 36A-36C are superimposed with exemplary drying airflow configurations that may be expelled by the drying apparatus. These drying airflow configurations are illustrated with respect to the legs and torso of the respective users. It should be appreciated that the configuration of the drying airflow is such that the drying airflow is being expelled through the page. For instance, the drying apparatus would be above the page facing the user and expelling drying airflow towards the user.

[0189] Referring to FIG. 37A, the user 34 is shown receiving the drying airflow 641 from the drying apparatus. The drying airflow 641 comprises a substantially continuous airflow of constant width that may cover the user's legs, torso, and head.

[0190] Referring to FIG. 37B, the user 34 is shown receiving the drying airflow 642 from the drying apparatus. The drying airflow 642 comprises a substantially continuous airflow in which the top of the airflow is wide and the bottom of the airflow is narrower than the top of the airflow. With respect to the user and airflow 641 of FIG. 37A, the v-shaped or partially v-shaped airflow 642 of FIG. 37B may cover the legs and the relatively broader torso and shoulders of the user.

[0191] Referring to FIG. 37C, the user 34 is shown receiving the drying airflow 643 from the drying apparatus. This airflow 643 is substantially continuous in width, similar to the airflow 641 of FIG. 37A but is wider than the airflow 641. The wider airflow 643 may adequately cover the legs and torso of the user.

[0192] In addition to any continuous width or vertically broadening or narrowing drying airflows, more localized changes to an airflow width may be desirable or necessary to provide airflow coverage to particular user.

[0193] While FIGS. 36A-36C and FIGS. 37A-37C illustrate body characteristics and drying airflows of exemplary users from a front view, it will be appreciated that corresponding airflows and airflow customizations may be made even if the user is oriented differently with respect to relevant air outlet providing the drying airflow.

[0194] In particular, a user may turn to different positions with respect to the drying apparatus during a drying program, for example to dry their front, sides, and back. The lateral extents of the person will change during these rotations and at different rotated positions, and a desired drying airflow may also accordingly change.

[0195] FIG. 38 is a perspective view of a drying apparatus according to one embodiment of the invention; FIG. 39 is another perspective view of the drying apparatus of FIG. 38; and FIG. 40 is a close up partial view of the drying apparatus of FIG. 38. As shown in FIGS. 38-40, the drying apparatus 30 includes body 100 having a plurality of individual air outlets 101a-101d as a first air outlet 101 rather than a configuration where the first air outlet 101 is a single unit contouring the periphery of the drying face 14 of the body 100 (see FIG. 3).

[0196] The air outlet 101 is in the form of a plurality of individual air outlets 101a-101d. In the present embodiment, each air outlet is an elongate slot which is oriented along the vertical direction of the body 100. However, in another embodiment, the air outlets 101a-101d may have a different configuration. Four air outlets 101a-101d are shown. However, in a different embodiment, less than or more than four air outlets may be provided.

[0197] Each air outlet 101a-101d may form an elongate slot on the drying face 14 of the drying apparatus 30 which communicates with the duct 122 provided at the body 100. For example, referring to the duct 122 shown in FIG. 34, instead of having a plurality of outlet ducts 123 that are distributed across the face of the duct 122, the duct 122 also has a plurality of elongated slots, each elongated slot corresponding to each air outlet 101a-101d. Thus, in the present embodiment which uses four air outlets 101a-101d, the duct 122 has four slots each corresponding to the respective air outlet 101a-101d.

[0198] An operation of the duct assembly have the duct 122 including a plurality of slots will be described with reference to FIG. 34. The duct 122 will be assumed to have four slots corresponding to four air outlets 101a-101d. When the flow generators 110 are operational, the fan assembly 1101 sucks in air and expels the air as forced airflow through the respective conduits 1102. The respective conduits 1102 channels the forced airflow into the duct 122. As the forced

airflow travels along the duct 122, forced airflow is vented through the air outlet 101a via a corresponding first slot, forced airflow is vented through the air outlet 101b via a corresponding second slot, forced airflow is vented through the air outlet 101c via a corresponding third slot, and forced airflow is vented through the air outlet 101d via a corresponding fourth slot. The forced airflow from the respective air outlets 101a-101d may be steered through an outlet airflow steering mechanism.

[0199] Referring back to FIGS. 38-40, associated with each air outlet 101a-101d is an outlet airflow steering mechanism 150a-150d. Each outlet airflow steering mechanism 150a-150d is operable to control a direction of forced airflow from the respective air outlets 101a-101d. FIG. 41 is a view of an outlet airflow steering mechanism according to one embodiment of the present invention. The outlet airflow steering mechanism 150 corresponding to one of the outlet airflow steering mechanism 150a-150d includes an air guide 151 such as a fin. The air guide 151 may be sized so that the air guide 151 fits into the air outlet 101. In one configuration, the air guide 151 fits exactly into the air outlet 101 to form a seal when the air guide 151 closes the air outlet 101. For example, a gasket which is disposed along the contours of the air guide 151 or the air outlet 101 may form the seal.

[0200] The air guide 151 is rotatable about the air outlet 101 corresponding to one of the air outlets 101a-101d. In one configuration, the air guide 151 is rotational about a vertical axis that bi-sects the air guide 151. The air guide 151 may be pivotally connected to the air outlet 101, and operable to rotate relative to it. For example, the air guide 151 is shown in FIG. 41 operated to two different rotational directions. The orientation of the air guide 151 may act as a direction of forced airflow (breadth of the forced airflow) from the air outlet 101. The air guide 151 is provided with shafts 152 on either end of the air guide 151 on which the air guide 151 rotates. At least one hole at the air outlet 101 may receive one of the shafts 152. One of the shafts may be connected to a motor 153 which rotates the air guide 151 under the control of the controller 53.

[0201] Based on the rotational position of the air guide 151, the air guide 151 directs the forced flow from the air outlet 101. FIGS. 38-39 shows the upper outlet airflow steering mechanisms 150a, 150b being less angled with respect to the drying face 14 than the lower outlet airflow steering mechanisms 150c, 150d. In this configuration, the width of the forced airflow flowing out of the air outlets 101a, 101b, will be wider than the width of the forced airflow flowing out of the air outlets 101c, 101d. Accordingly, this forced airflow configuration may be suitable for a user having wider upper body and narrower lower body. Different lateral breadths of forced airflow that may be provided by the drying apparatus described in FIGS. 38-41 will be further described below.

[0202] FIG. 42 is a view showing direction of forced airflows from the drying apparatus having the outlet airflow steering mechanism set as shown in FIGS. 38-39. Referring to FIG. 42, the air outlets 101a-101d may be viewed as having an upper zone 646 having airflow outlets 101a, 101b and a lower zone 647 having airflow outlets 101c, 101d. The upper and lower zones 646, 647 may be individually controlled with the outlet airflow steering mechanism 150a, 150b controlling the upper zone 646 and the outlet airflow steering mechanism 150c, 150d controlling the lower zone 647. This configuration may provide for an airflow of different lateral breadths at each of the upper and lower zones 646, 647.

[0203] In the configuration shown in FIG. 42, the outlet airflow steering mechanisms 150a, 150b constituting the upper zone 646 are less angled with respect to the drying face 14 than the outlet airflow steering mechanisms 150c, 150d constituting the lower zone 647. In this configuration, the upper zone 646 may provide a relatively wider forced airflow 644, and the lower zone 647 may provide a relatively narrower forced airflow 645. While shown in FIG. 42 as being substantially symmetrical, the forced airflow within a zone may be controlled to different orientations so as to provide an airflow directed more or less to one side. For example, the outlet airflow steering mechanism 150d may be operated to direct the forced airflow 645 further to the right of the page, so that the forced airflow 645 at the right extends further to the right of the figure, thereby the forced airflow 645 on the left side and the forced airflow 645 on the right side are asymmetrical.

[0204] As described above, a wide forced airflow 644 on the upper side of the drying apparatus or upper zone 646 and a narrow forced airflow 645 on the lower side of the drying apparatus or the lower zone 647 may provide for a good coverage of drying airflow to the user having a wide upper body and a narrow lower body.

[0205] Conversely, the outlet airflow steering mechanisms 150a, 150b constituting the upper zone 646 may be more angled with respect to the drying face 14 than the outlet airflow steering mechanisms 150c, 150d constituting the lower zone 647. This is an opposite configuration shown in FIGS. 38-39 and 42. In this configuration, the upper zone 646 may provide a relatively narrow forced airflow 644, and the lower zone 647 may provide a relatively wide forced airflow 645. A narrow forced airflow 644 on the upper side of the drying apparatus or upper zone 646 and a wide forced airflow 645 on the lower side of the drying apparatus or the lower zone 647 may provide for a good coverage of drying airflow to the user having a narrow upper body and a wide lower body. Of course, if the angle of the outlet airflow steering mechanisms 150a, 150c are same or similar and the angle of the outlet airflow steering mechanisms 150b, 150d are same or similar, the width of the forced airflow 644 of the upper zone 646 and the width of the forced airflow 645 of the lower zone 647 may be same or similar. This configuration may provide for a good coverage of drying airflow to the user whose upper body and lower body are same or similar.

[0206] FIG. 43A and FIG. 43B are views illustrating an upper zone and a lower zone of the drying apparatus in relation

to a user's body according to an embodiment of the present invention.

[0207] As described above, the drying apparatus 30 may have an upper zone 646 that provides for adjustable forced airflow and a lower zone 647 that provides for adjustable forced airflow. The forced airflow 644 of the upper zone 646 and the forced airflow 645 of the lower zone 647 may be sized so that a user having their body adjacent to the drying face of the drying apparatus 30 may have their body dried based on their body characteristics. For example, referring to FIG. 43A, the user 34 adjacent to the drying apparatus 30 has a body proportion where the user's upper body is wider than the user's lower body. The upper zone 646 may be sized such that a wide forced airflow 644 from the upper zone 646 is expelled and a narrow forced airflow 645 from the lower zone 647 is expelled so that a good coverage of drying airflow may be provided to the user 34 having a wide upper body and a narrow lower body. This may be performed based on the configuration described with respect to FIGS. 38-41. Referring to FIG. 43B, the user 34 adjacent to the drying apparatus 30 has a body proportion where the user's upper body is narrower than the user's lower body. the upper zone 646 may be sized such that a narrow forced airflow 644 from the upper zone 646 is expelled and a wide forced airflow 645 from the lower zone 647 is expelled so that a good coverage of drying airflow may be provided to the user 34 having a wide upper body and a narrow lower body. This may be performed based on the configuration described with respect to FIGS. 38-41. The description above is exemplary and the drying apparatus may expel different drying airflow characteristics based on a range of different users with different body characteristics.

[0208] While FIGS. 43A-43B shows the drying apparatus as having two zones, in other configurations, the drying apparatus may have more than two zones. Where more than two zones are provided, a user's body may be dried with even greater resolution. For example, using two zones, a user's body may be divided such that the upper zone dries the upper half of the user's body and the lower zone dries the lower half of the user's body. While the user may have a narrower lower body than the upper body, when the user has their arms separated from their body, such as shown in FIGS. 36A-36C, the lower zone may need to provide a wider breadth of forced airflow to accommodate the arms. When three zones are used, the middle zone may be used to accommodate the arms of the user. For example, the upper zone may have a breadth of forced airflow that accommodates the shoulders of the user, the middle zone may have a breadth of forced airflow that accommodates the arms of the user, and the lower zone may have a breadth of forced airflow that accommodates the legs of the user. Other configurations of zones may be considered to accommodate various wider and narrower regions of the user's body.

[0209] Each zone may be formed with its own pair of air outlets 101 and corresponding pair of outlet airflow steering mechanisms 150. Alternatively, a pair of air outlets may be formed to have two or more zones. For example, each air outlet 101 may accommodate two or more air guides 151. Each air guide 151 may be independently operated by their respective motor 153. Thus, for each air outlet 101, two or more outlet airflow steering mechanisms 150 may be accommodated. Each outlet airflow steering mechanism 150 may be operated with an independent angular configuration for its respective zone that provides drying airflow to accommodate the body of the user within that zone.

[0210] FIG. 44 is a front view of a drying apparatus shown in FIG. 38. The drying apparatus 30 has the air guides 151a-151d of the respective outlet airflow steering mechanisms 150a-150d closed on the respective air outlets 101a-101d. In one configuration, the air guides 151a-151d may sealingly close the respective air outlets 101a-101d. For example, a gasket may be disposed along the contours of the respective air guides 151a-151d or the respective air outlets 101a-101d so as to form a seal between the air guide 151a-151d and the respective air outlet 101a-101d. The closed air outlets 101a-101d may prevent forced airflow from exiting the body 100 by those air outlets. It may also operate to prevent things from entering into the airflow outlets from the surroundings such as water. Particularly, where the drying apparatus is for use in a wet environment such as a bathroom but especially in or adjacent to a shower or bath, water may be splashed onto the drying apparatus. This may result in water entering the air outlets 101a-101d. This may be undesirable as the water may stagnate and stimulate mold growth, or cause corrosion or other damage to the drying apparatus. Accordingly, when the drying apparatus 30 is not in use, the air outlets 101a-101d may be closed by the air guides 151a-151d.

[0211] FIG. 45 is a front view of a drying apparatus according to another embodiment of the present invention. Similar to the drying apparatus 30 shown in FIG. 44, the drying apparatus 40 has the air outlets 101a-101d to expel a breadth of forced airflow at the respective air outlets 101a-101d. The air outlets 101a-101d are opened and closed by the respective air guides 151a-151d operated by corresponding outlet airflow steering mechanisms. However, unlike the drying apparatus 30, the drying apparatus 40 includes one or more air outlets 101e-101f at the center of the drying apparatus 40. The one or more air outlets 101e-101f are opened and closed by respective air guides 151e-151f operated by corresponding outlet airflow steering mechanisms. The one or more outlets 101e-101f may provide for additional forced airflow to the user's body. Particularly, the one or more outlets 101e-101f may provide forced airflow towards the center of the user's body. During operation, the one or more air outlets 101e-101f may open to be perpendicular to the user's body and remain stationary or the one or more air outlets 101e-101f may oscillate left and right to direct forced airflow to various parts of the user's body. The air outlets 101e-101f may assist in providing additional drying airflow to the user's body.

[0212] The operation of a drying apparatus with an outlet airflow steering mechanism may be controlled by a controller.

FIG. 46 is an electrical schematic diagram of a drying apparatus according to an embodiment of the present invention. The electrical schematic diagram of FIG. 46 may supplement the electrical schematic diagram of FIG. 22.

[0213] The controller 53 may control at least the operation of the flow generator 110 to cause air to be directed through the air outlet 101. Similarly a thermal element or heater 13 may be controlled by the controller to condition the temperature of the air to be exhausted from the air outlet 101. While a heater 13 is illustrated, the heater 13 may be a thermoelectric device that generates both heated air and cool air.

[0214] The controller 53 may receive inputs from one or more sensors in the operation of a drying apparatus. For example, the thermal sensor 221 may be located at the bar 200 (see FIG. 34, sensor location at sensor 209). Such a thermal sensor may provide a signal indicative of the temperature of the surroundings of the sensor. It may be utilized to distinguish a user from the background of the room, due to their body temperature. It may also be utilized to determine the body characteristics of the user body. The operation of determining the body characteristics of the user will now be described with reference to FIGS. 25A-25B.

[0215] Referring to FIGS. 25A-25B, the bar 200 including the sensor 209 which may be the thermal sensor 221 faces the user when the user is present at the drying face 14 of the body 100. When the drying apparatus 10 is activated, the starting position of bar 200 may be at the bottom of the drying face 14. The bar 200 may be driven upward by the drive apparatus 11 in the direction of arrow 1. As the bar 200 is driven upward, the thermal sensor scans the body of the user. The sensed information is sent to the controller 53 which uses the sensed information to determine the body characteristics of the user. When the thermal sensor no longer detects thermal heat from the user, then the height of the user is determined to have been reached and the drive apparatus 11 may stop the movement of the bar 200.

[0216] Referring now to FIG. 46, once the complete thermal scan of the user's body has been received by the controller 53, the controller 53 may determine the operation of the outlet airflow steering mechanism 150 based on the thermal scan. For example, the controller may operate the outlet airflow steering mechanism 150 to broaden, constrain, or otherwise laterally redirect the airflow to within the bounds of a user's body. For example, if the controller 53 determines that the user's upper body is wide and the user's lower body is narrow, the upper zone may be sized such that a wide forced airflow from the upper zone is expelled and the lower zone may be sized such that a narrow forced airflow from the lower zone is expelled. If the controller 53 determines that the user's upper body is narrow and the user's lower body is wide, the upper zone may be sized such that a narrow forced airflow from the upper zone is expelled and the lower zone may be sized such that a wide forced airflow from the lower zone is expelled.

[0217] A sensor other than a thermal sensor may be used. A proximity sensor or an optical sensor may similarly be utilized for providing inputs to the controller 53 to indicate the presence or extents of the user or other characteristics of their body.

[0218] The controller 53 may actively monitor the signal from a sensor during a drying operation, and actively control the outlet airflow shape dependent on information sensed about the user. For example, during a drying operation, the user may shift, such as from side to side. Where this shifting is sensed, the controller 53 may update the operation of the outlet airflow steering mechanism 150 to direct the airflow to the user's new location. Such updating may involve a simultaneous operation of components of the outlet airflow steering mechanism 150 associated with both sides of the airflow. For example, to cause a symmetrical broadening or narrowing of the airflow lateral width. In other configurations one side of the airflow may be broadened or constrained more or less than the other. For example, the two sides may be operated one to laterally constrain the airflow and the other to laterally broaden it, in order to track a lateral movement of the user's body.

[0219] Exemplary embodiments of the drying apparatus have been described above. Embodiments may be modified for particular usage or suitability.

[0220] Where in the foregoing description reference has been made to elements or integers having known equivalents, then such equivalents are included as if they were individually set forth.

[0221] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. Therefore, the preferred embodiments should be considered in a descriptive sense only and not for purposes of limitation, and also the technical scope of the invention is not limited to the embodiments. Furthermore, the present invention is defined not by the detailed description of the invention but by the appended claims, and all differences within the scope will be construed as being comprised in the present disclosure.

[0222] None of the features recited herein should be interpreted as invoking 35 U.S.C. § 112(f) unless the term "means" is explicitly used.

[0223] Many modifications will be apparent to those skilled in the art without departing from the scope of the present invention as herein described with reference to the accompanying drawings.

Claims

1. A drying apparatus comprising:

5 a body;
 an air inlet;
 a flow generator to receive inlet air from the air inlet and generate an airflow;
 an air outlet at the body for exhausting the airflow from the flow generator, the air outlet extending along a
 vertical height of the body,
 10 an outlet airflow steering mechanism operable to control a lateral extent of the airflow from the air outlet, and
 a controller configured to operate the outlet airflow steering mechanism to control the lateral extents of the
 airflow from the air outlet.

15 2. The drying apparatus of claim 1, wherein the air outlet comprises an elongate slot which extends along a portion of
 the vertical height of the body.

3. The drying apparatus of claim 1 or 2, wherein the air outlet comprises a pair of laterally spaced elongate slots which
 extend along a portion of the vertical height of the body.

20 4. The drying apparatus of any one of claims 1 to 3, wherein the air outlet airflow steering mechanism comprises one
 or more vertically oriented air guides provided within an airflow path to the air outlet.

25 5. The drying apparatus of claim 4, wherein the one or more vertically oriented air guides, each comprise a plurality
 of vertical zones, and position of each vertical zone is independently controlled by the air outlet airflow steering
 mechanism such that the lateral extent of the airflow may vary between adjacent vertical zones.

6. The drying apparatus of claim 4 or 5, wherein the one or more vertically oriented air guides are operable to close
 off the air outlet.

30 7. The drying apparatus of any one of claims 1 to 6, further comprising a thermal sensor, wherein the controller is
 configured to:

receive a signal from the thermal sensor,
 determine based on the signal a lateral physical extent of a user, and
 35 operate the outlet airflow steering mechanism to control the lateral extent of the airflow from the air outlet based
 on the determined lateral physical extent of the user.

40 8. The drying apparatus of claim 7, wherein the controller actively monitors the signal from the thermal sensor and
 updates the operation of outlet airflow steering mechanisms dependent on any sensed change to the lateral physical
 extent of the user.

45 9. The drying apparatus of claim 7 or 8, wherein the air outlet comprises a pair of vertically extending elongate outlets
 and the outlet airflow steering mechanism comprises at least one air guide associated with each elongate outlet,
 wherein the controller is further configured to
 determine based on the signal a lateral offset of the body of the user from the drying apparatus, and
 operate the outlet airflow steering mechanisms of each of the elongate outlets independently based on the determined
 lateral offset.

50 10. The drying apparatus of claim 9, wherein the controller operates the outlet airflow steering mechanisms of each of
 the elongate outlets independently so as to direct the airflow of the first body air outlet towards any laterally offset
 position of the user.

55 11. The drying apparatus of any one of claims 7 to 10, wherein the air outlet comprises a pair of vertically extending
 elongate outlets and the outlet airflow steering mechanism comprises a plurality of vertically adjacent air guides
 associated with each elongate outlet,
 wherein the controller is further configured to
 determine based on the signal a lateral offset of the body of the user from the drying apparatus, and
 operate the outlet airflow steering mechanisms of each of the elongate outlets independently based on the determined

lateral offset.

12. The drying apparatus of any one of claims 1 to 11, wherein the outlet airflow steering mechanism is further operable to control a vertical orientation of the airflow from the air outlet.

5 13. The drying apparatus of any one of claims 1 to 12, wherein the air outlet comprises a pair of vertically extending slots, and the outlet airflow steering mechanism comprises a plurality of air guides provided within an air flow path of each of the vertically extending slots.

10 14. The drying apparatus of claim 13, wherein each air guide is separately operable within the respective vertically extending slot.

15

20

25

30

35

40

45

50

55

Fig. 1

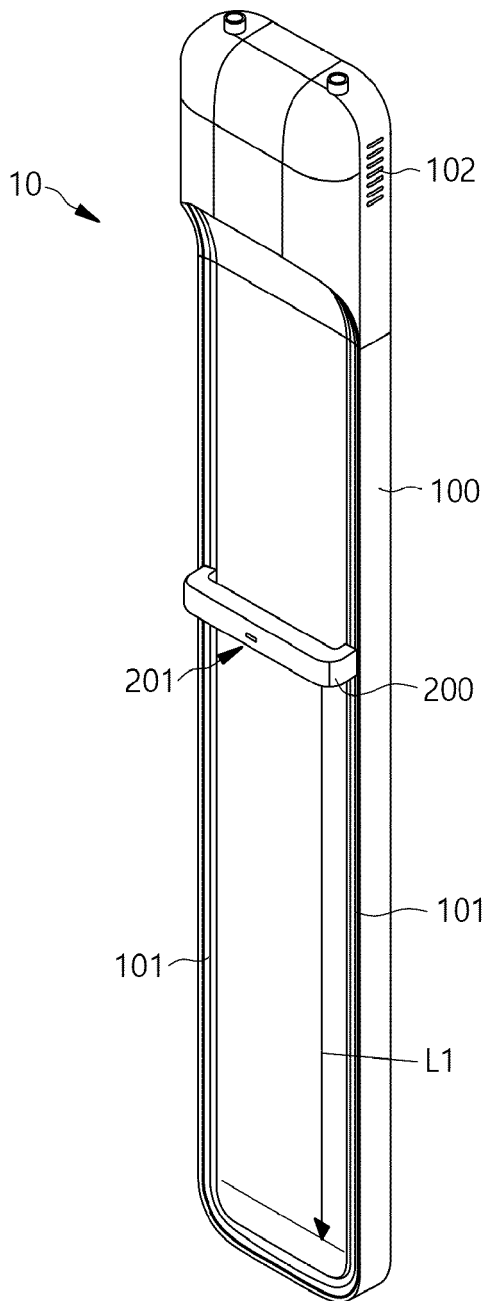


Fig. 2

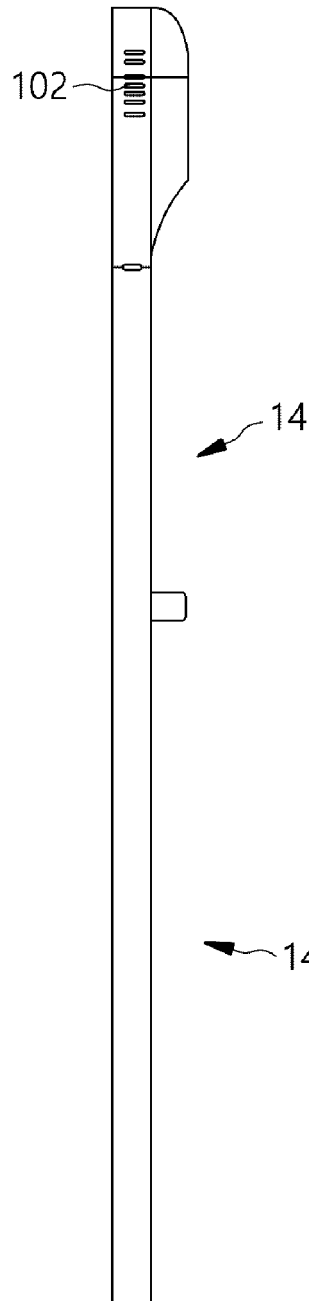


Fig. 3

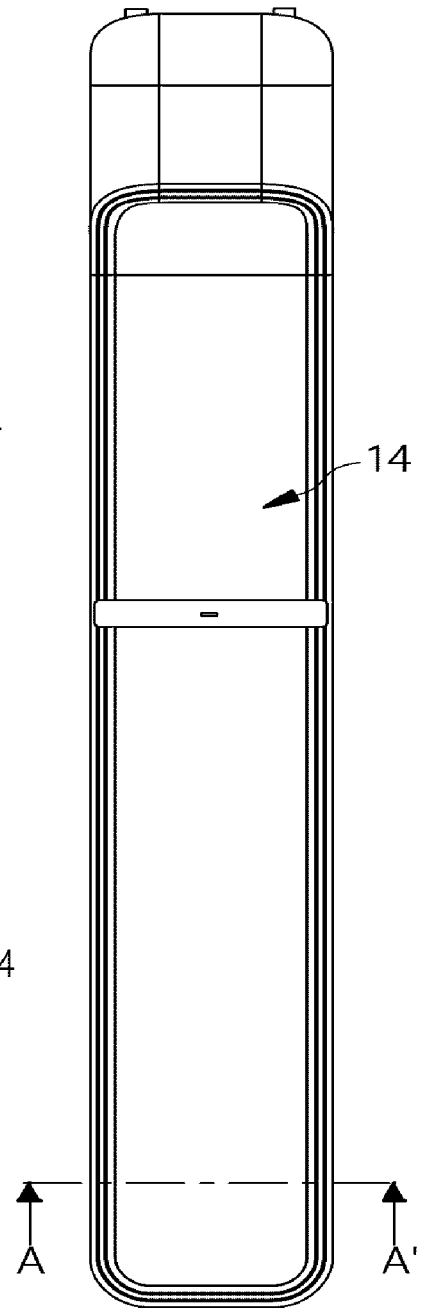


Fig. 4

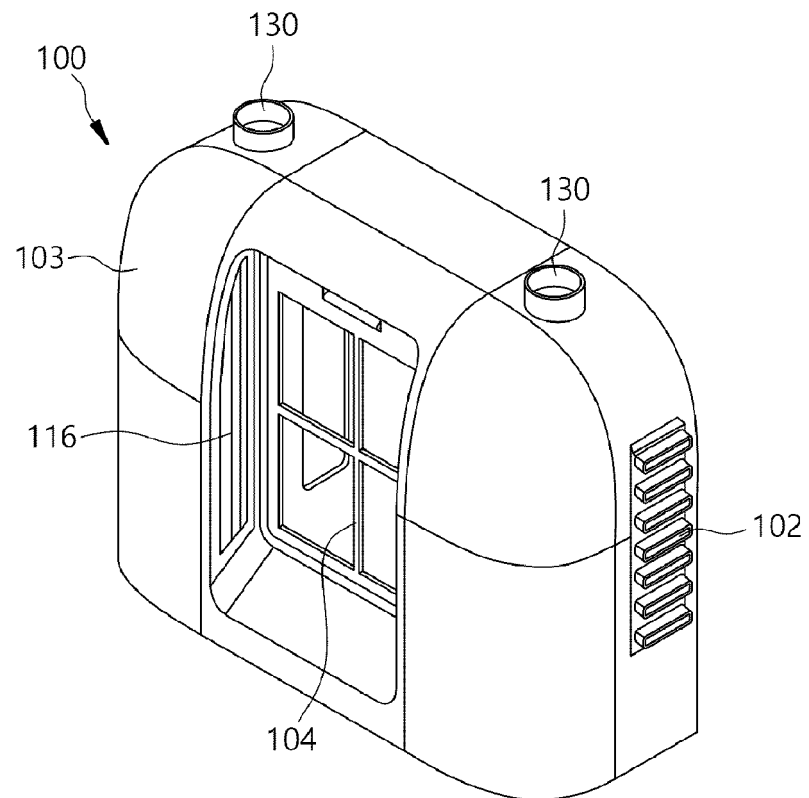


Fig. 5

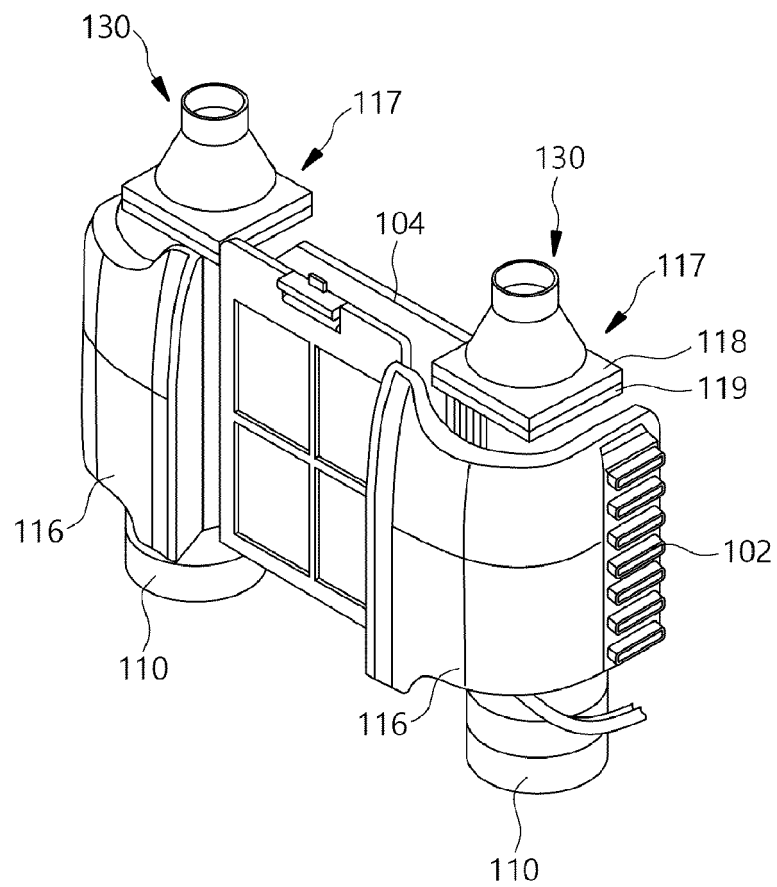


Fig. 6

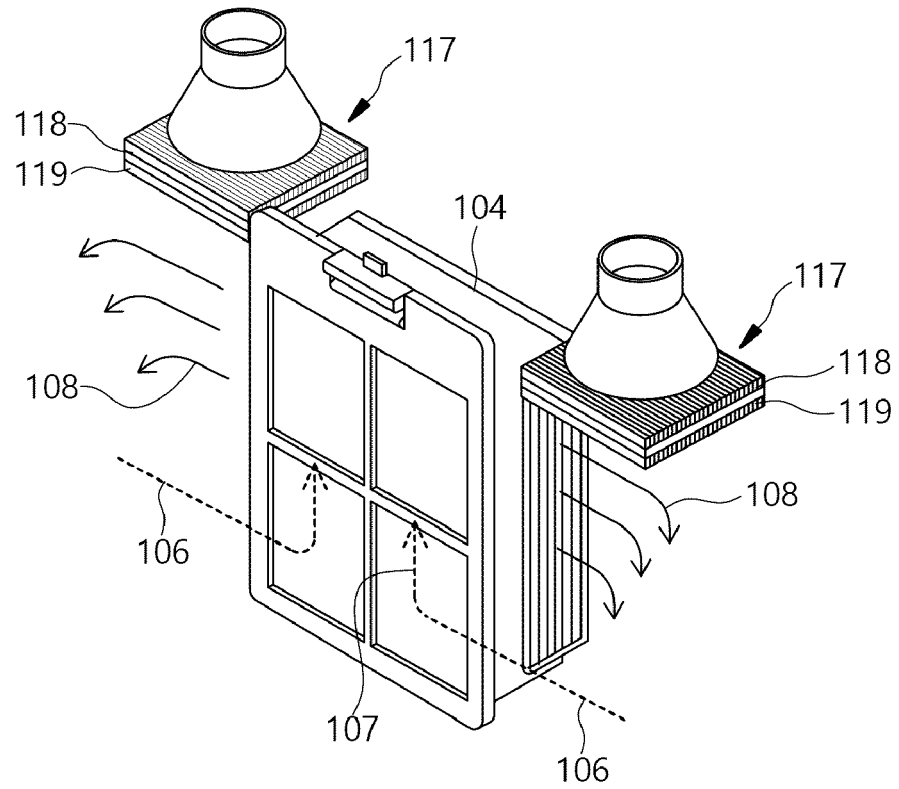


Fig. 7

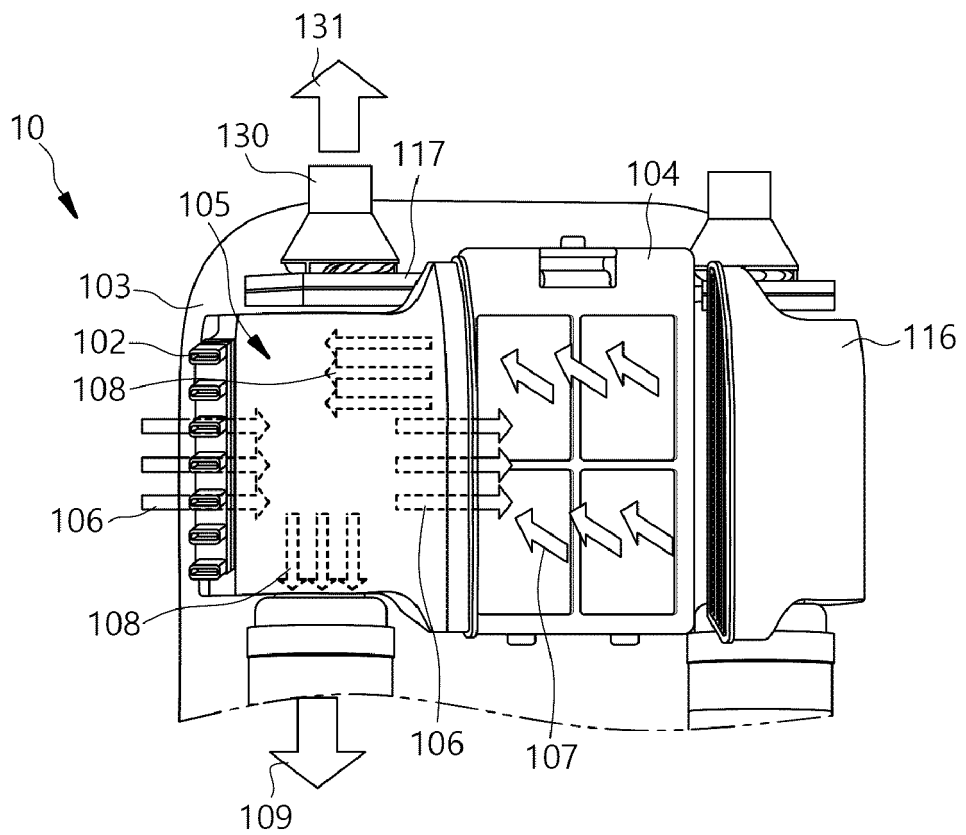


Fig. 8

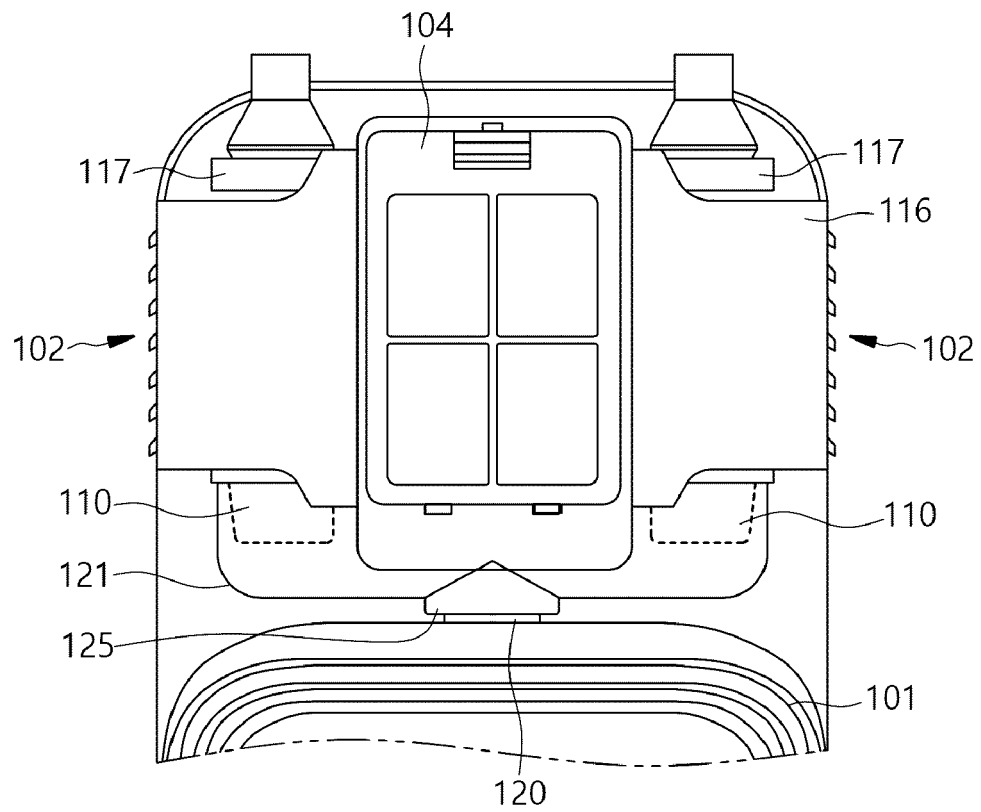


Fig. 9a

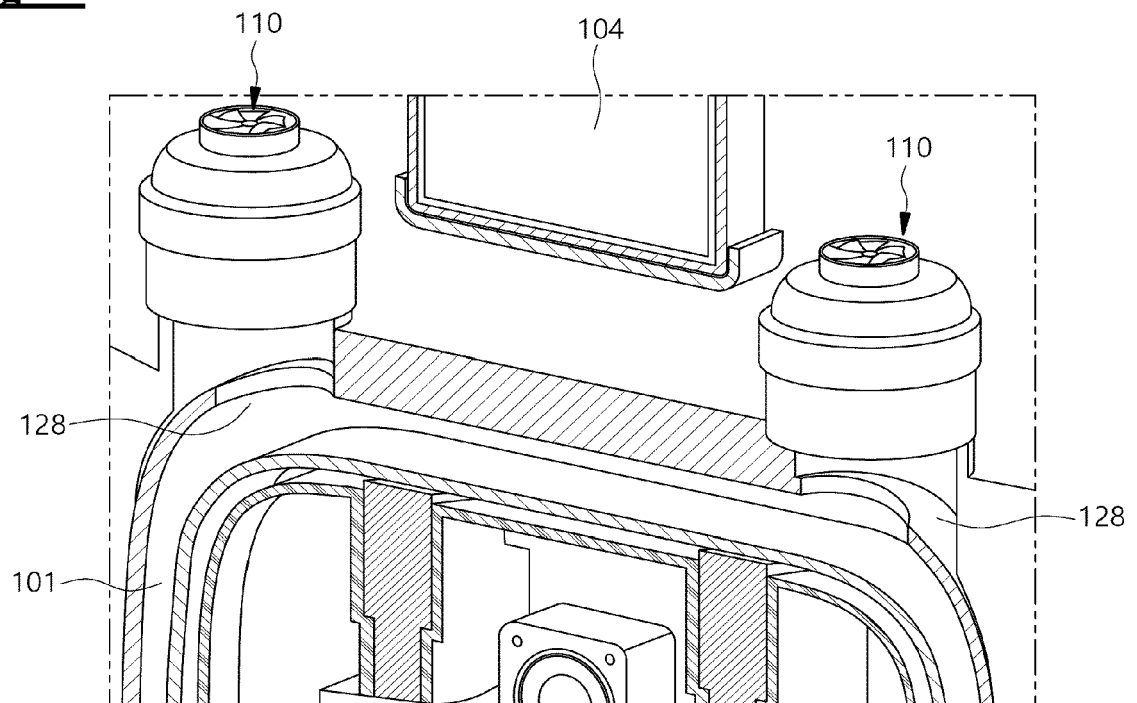


Fig. 9b

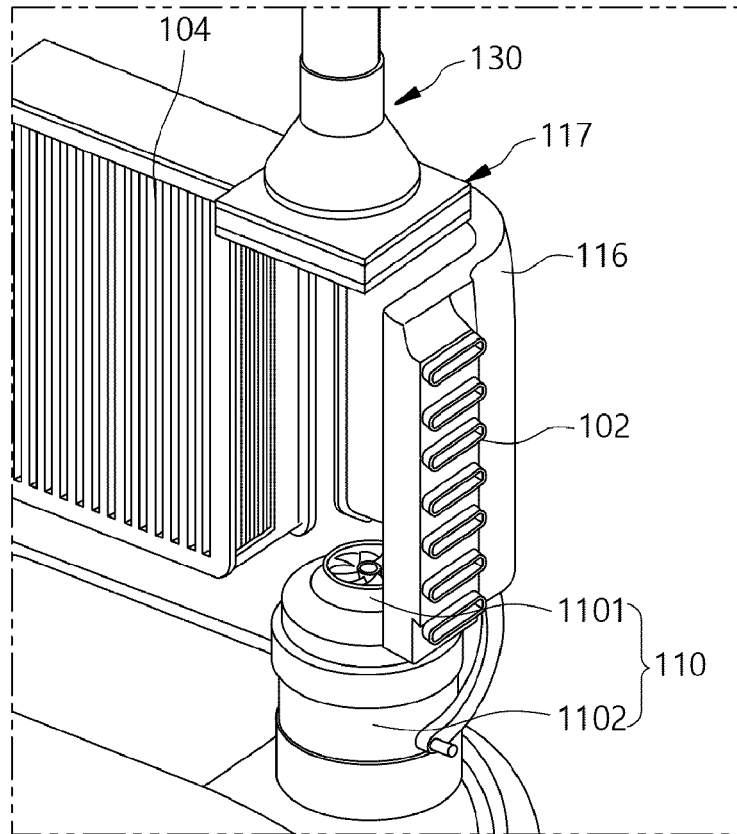


Fig. 10

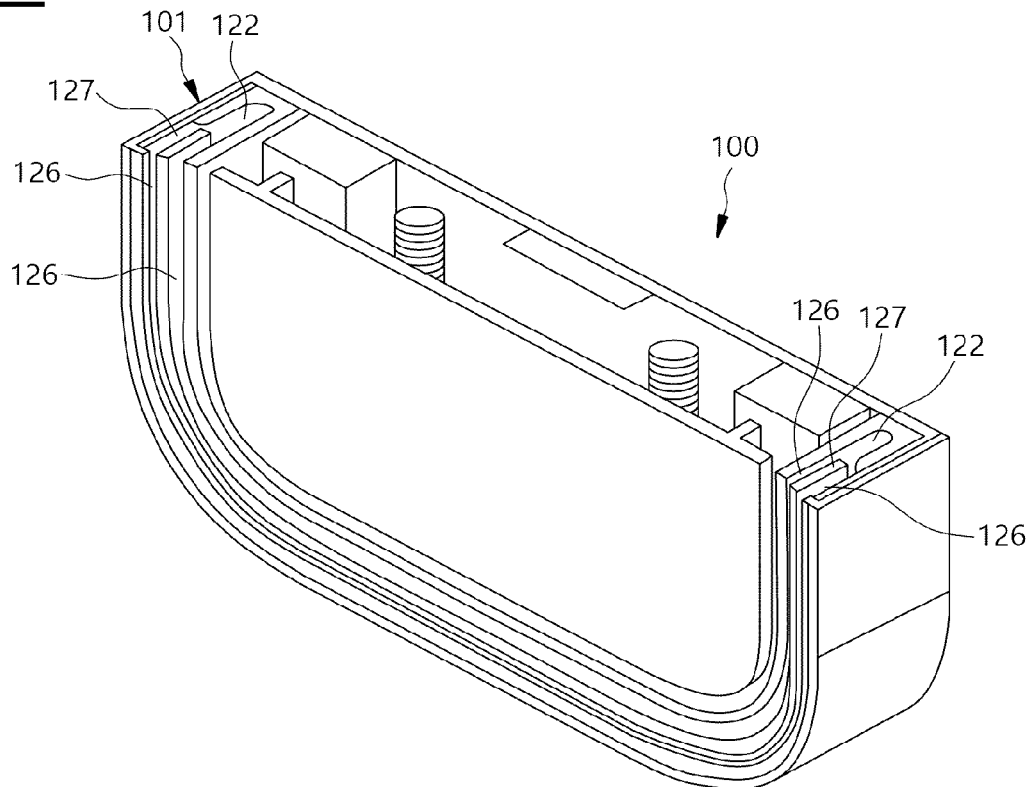


Fig. 11a

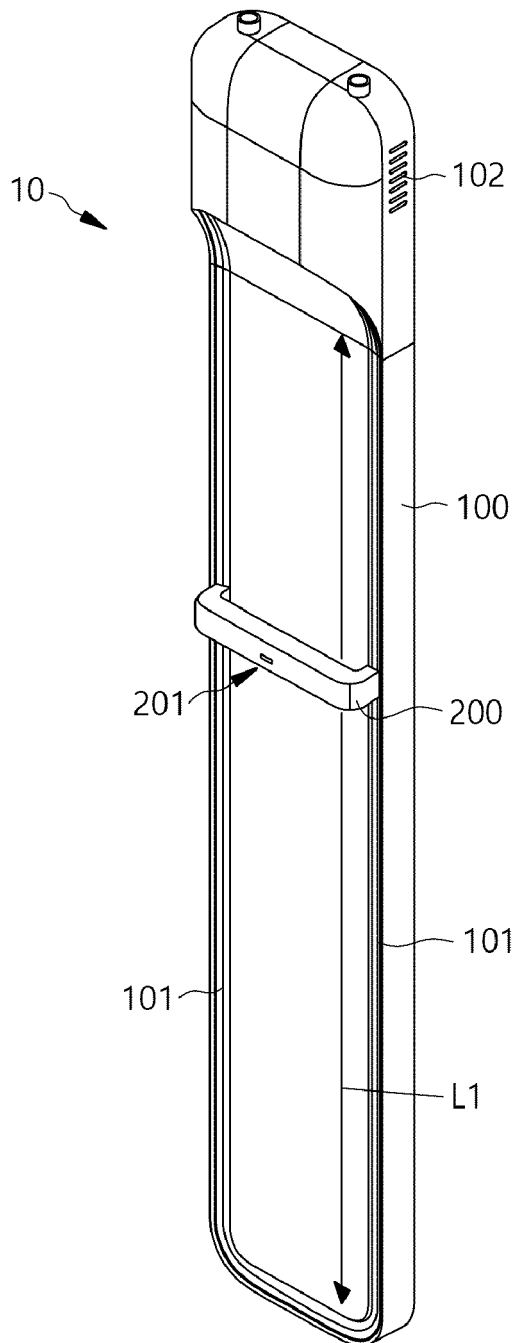


Fig. 11b

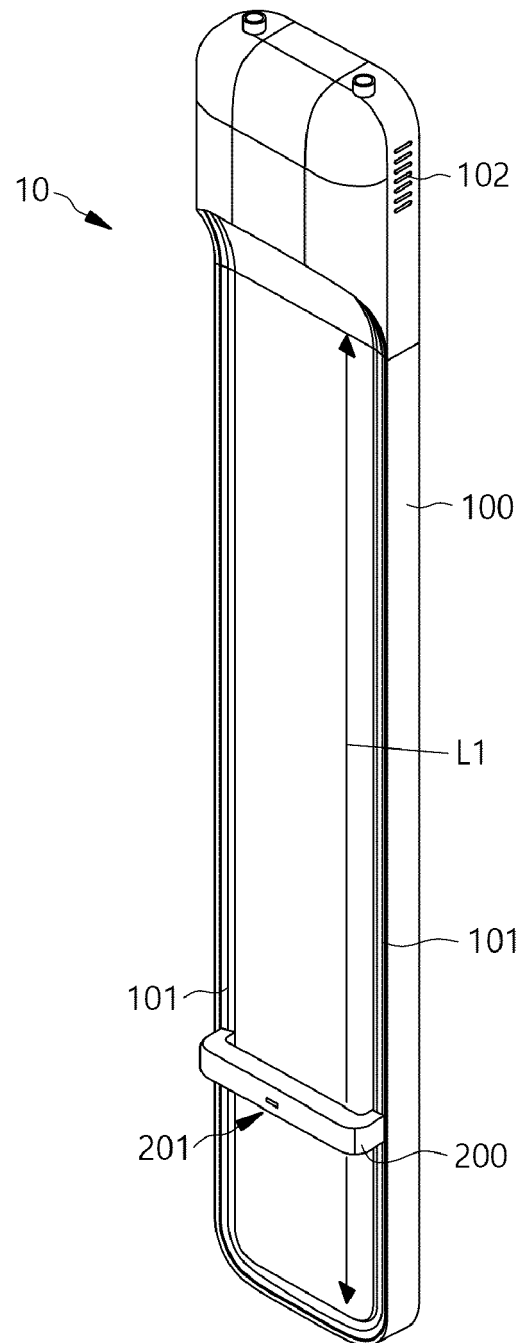


Fig. 12a

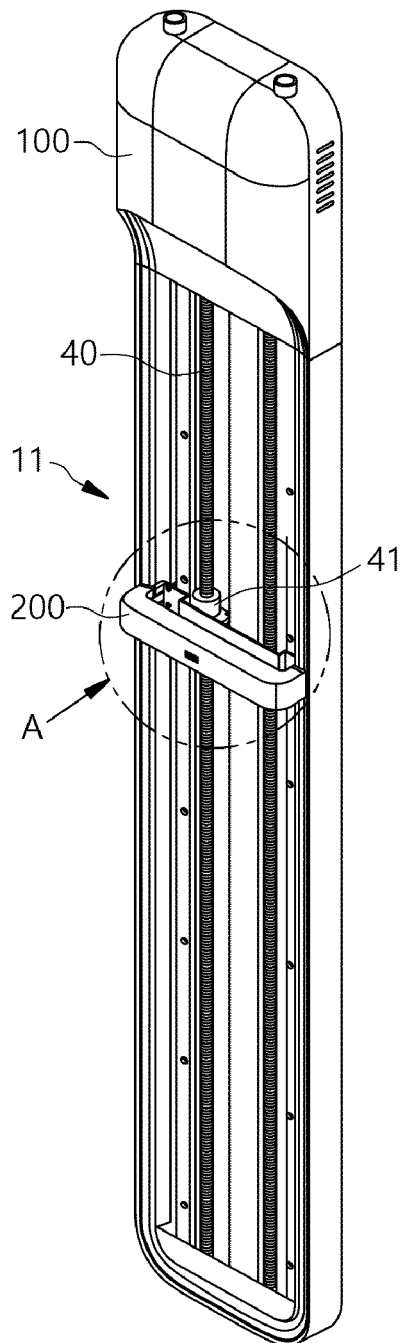


Fig. 12b

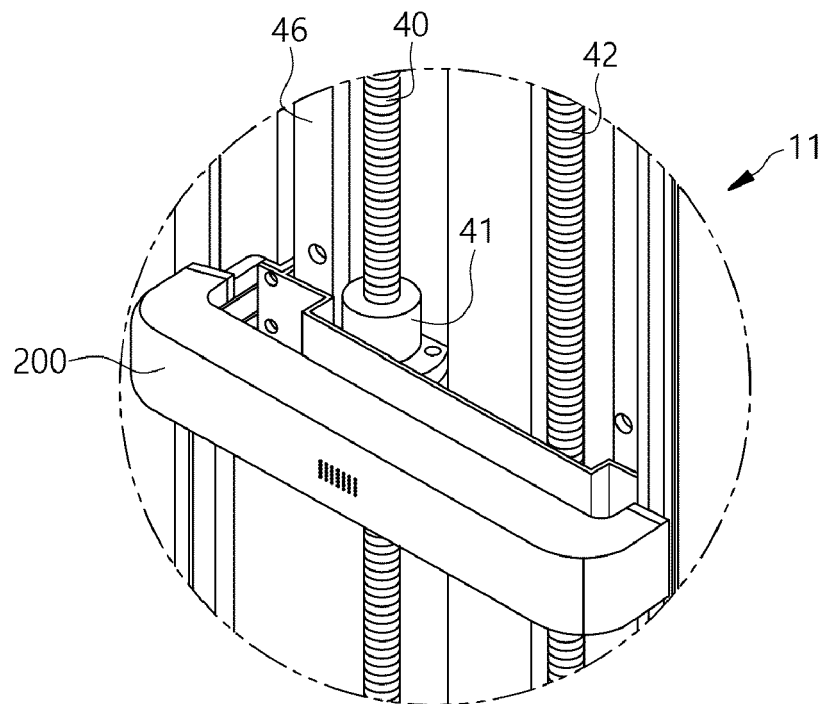


Fig. 12c

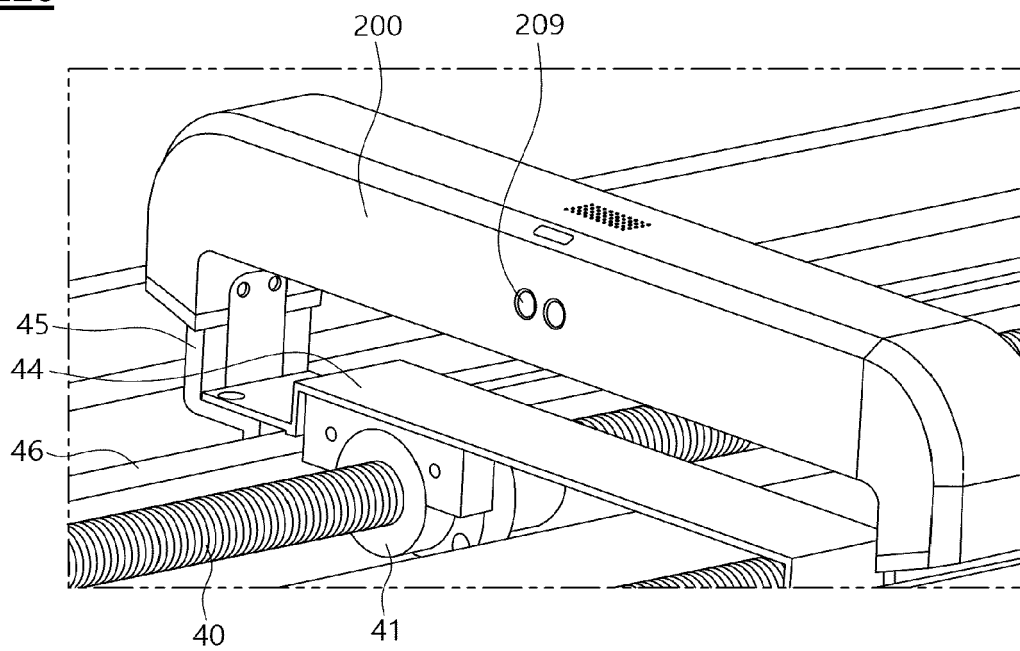


Fig. 12d

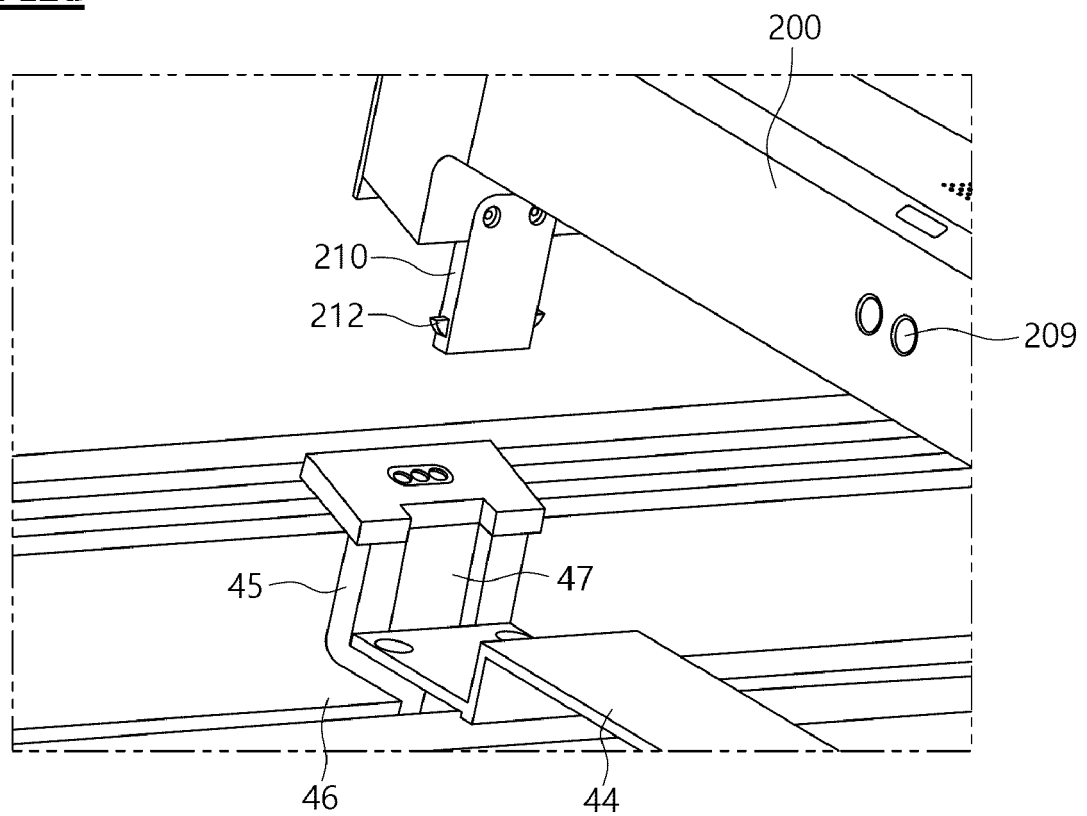


Fig. 13

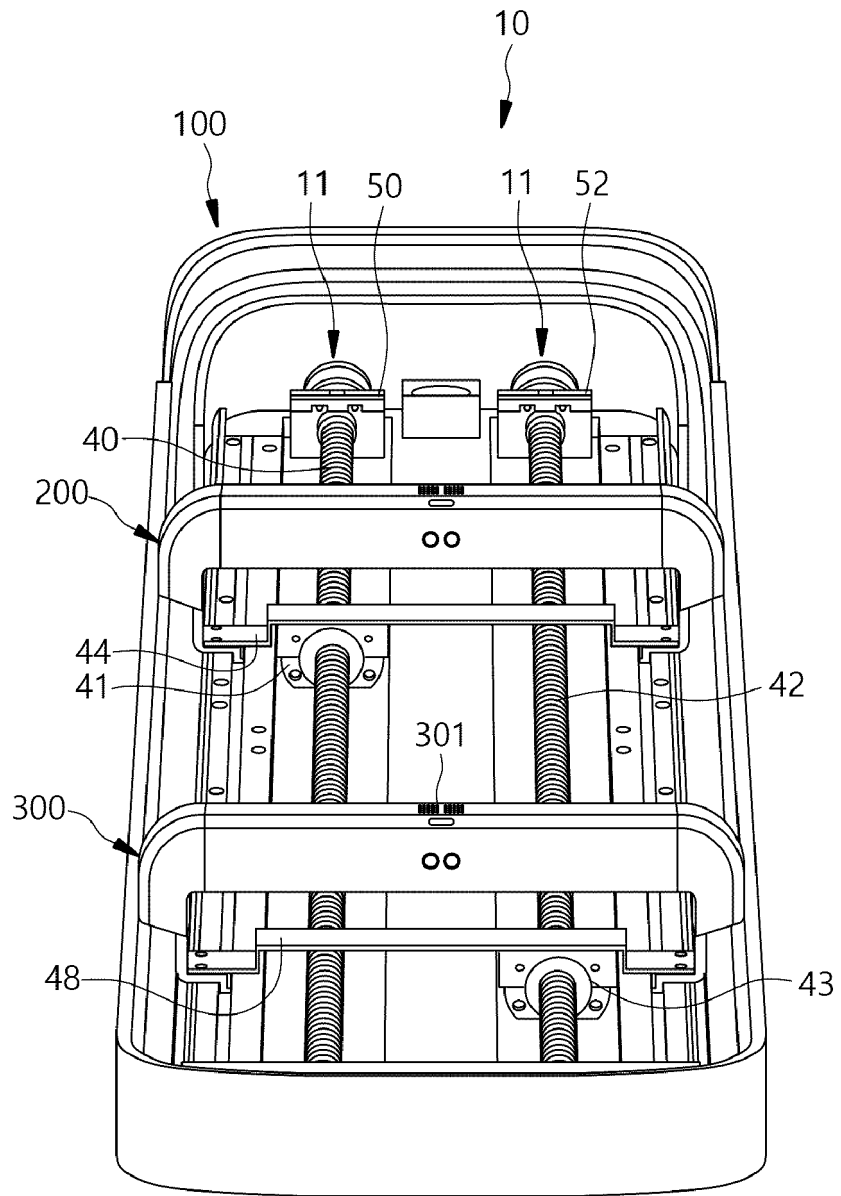


Fig. 14a

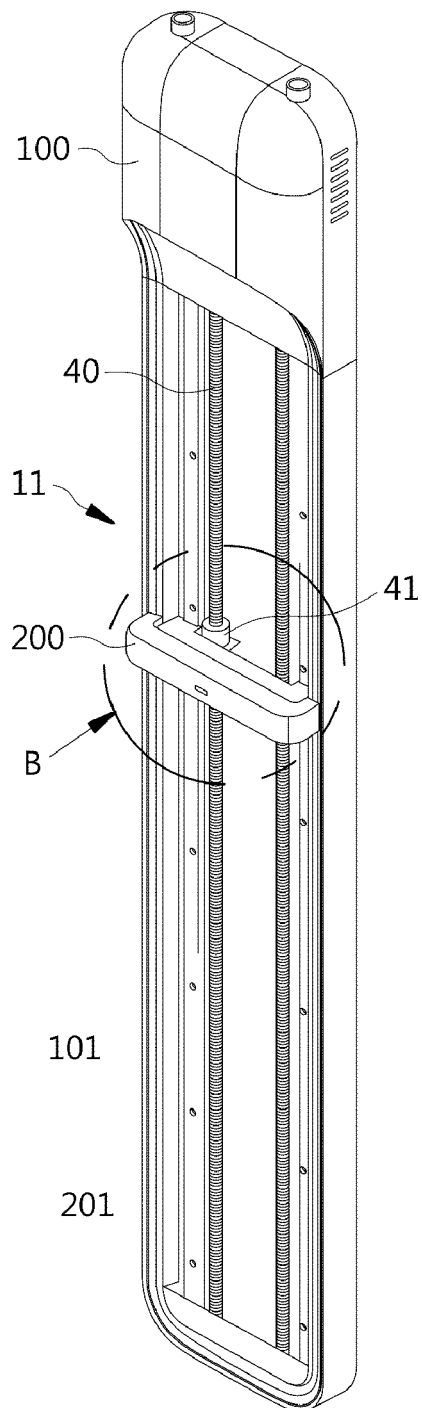


Fig. 14b

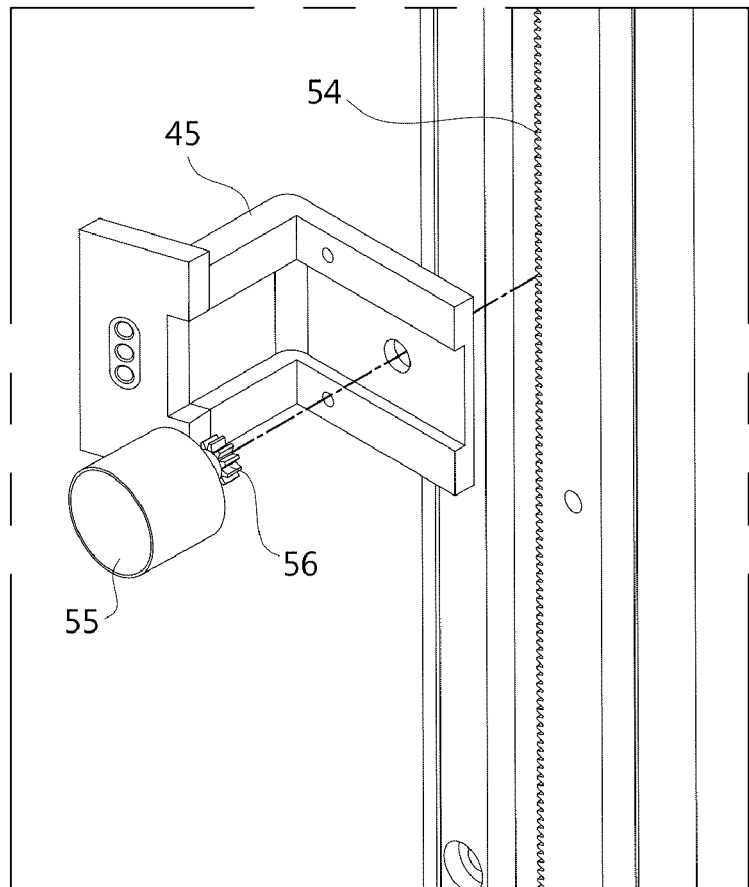


Fig. 14c

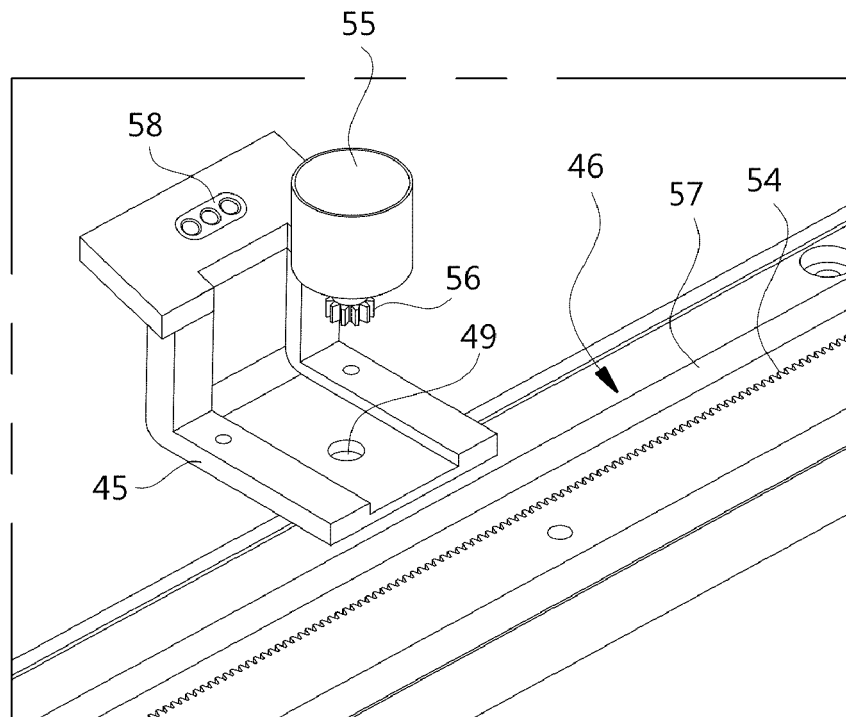


Fig. 15

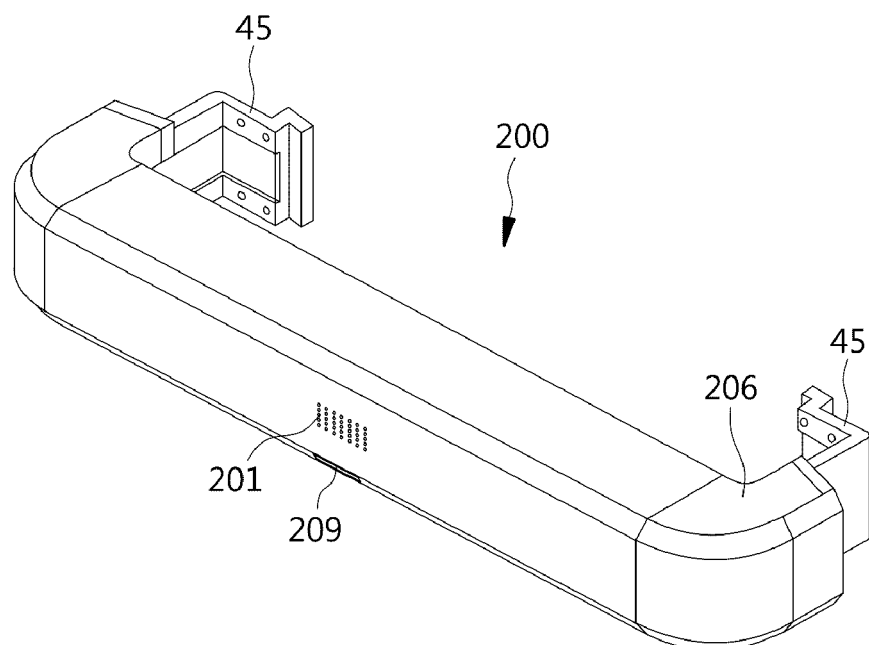


Fig. 16

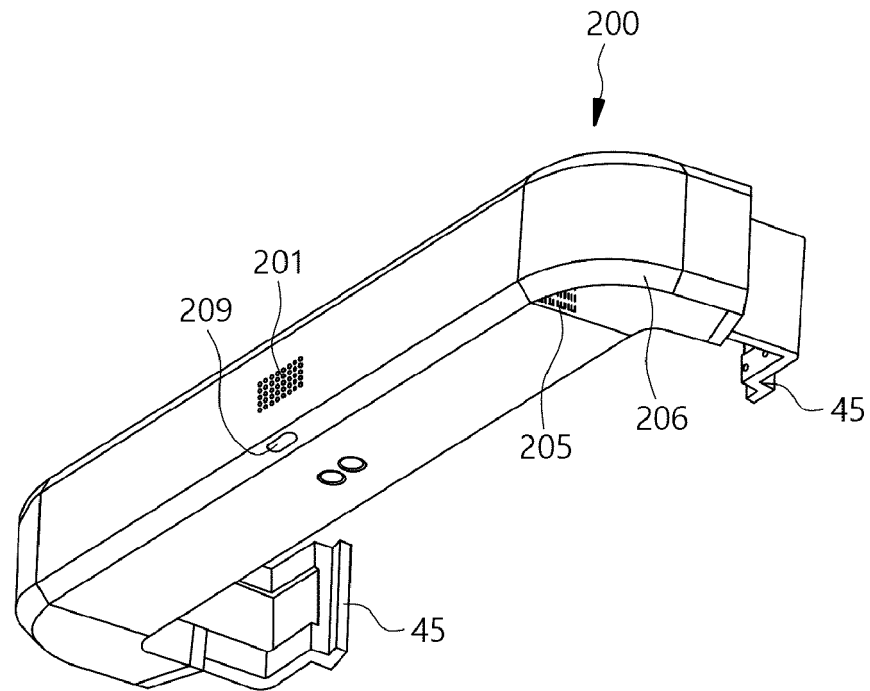


Fig. 17

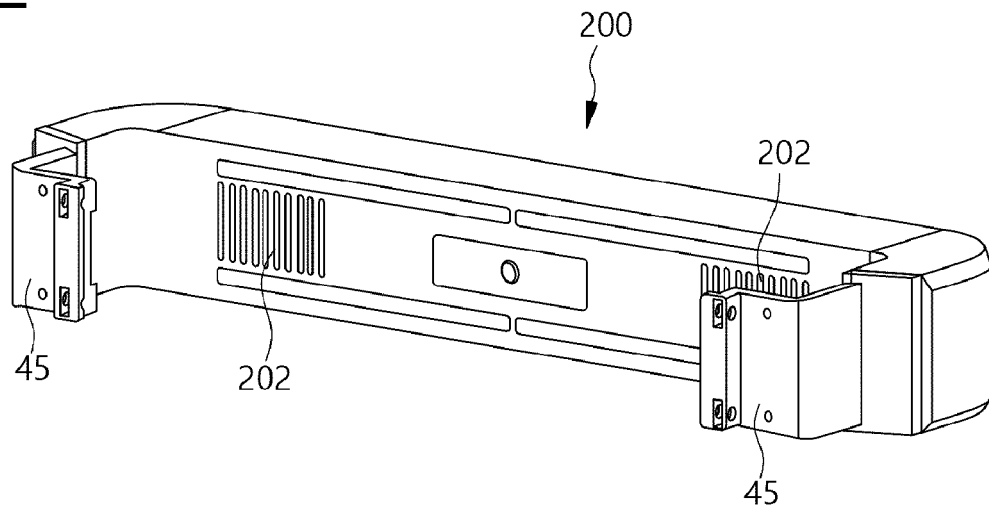


Fig. 18

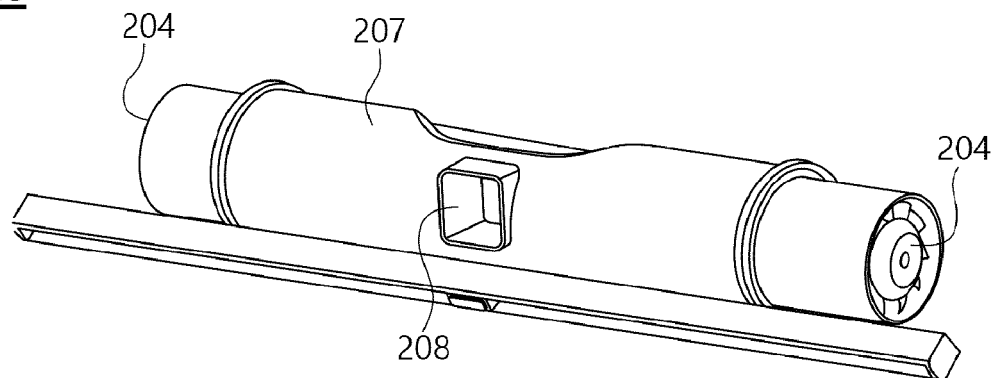


Fig. 19

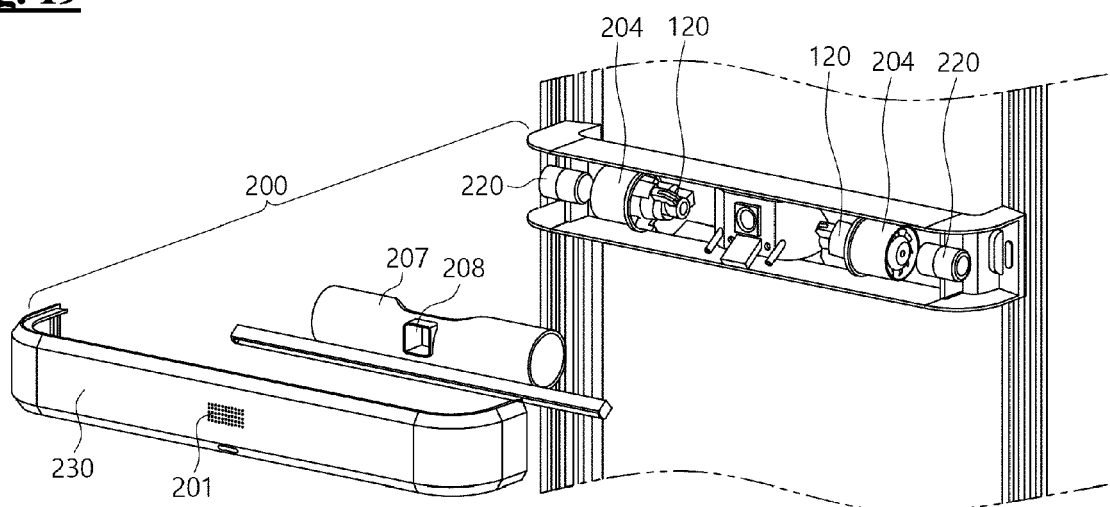


Fig. 20

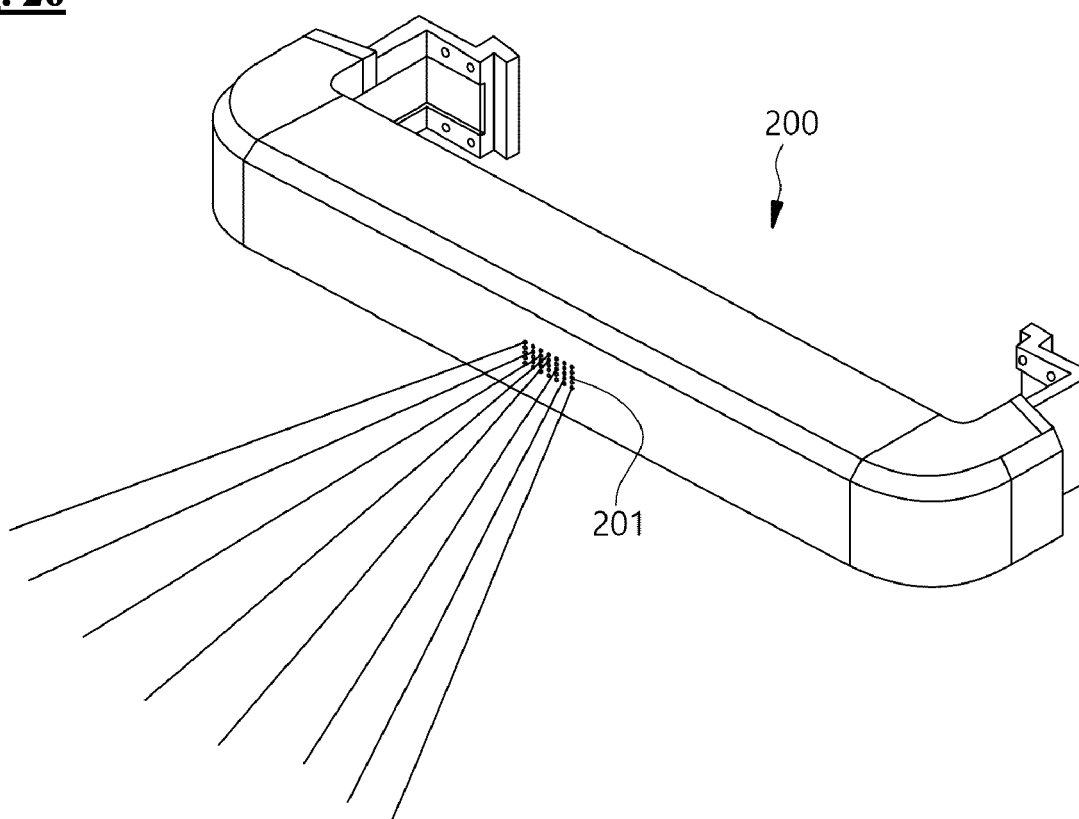


Fig. 21

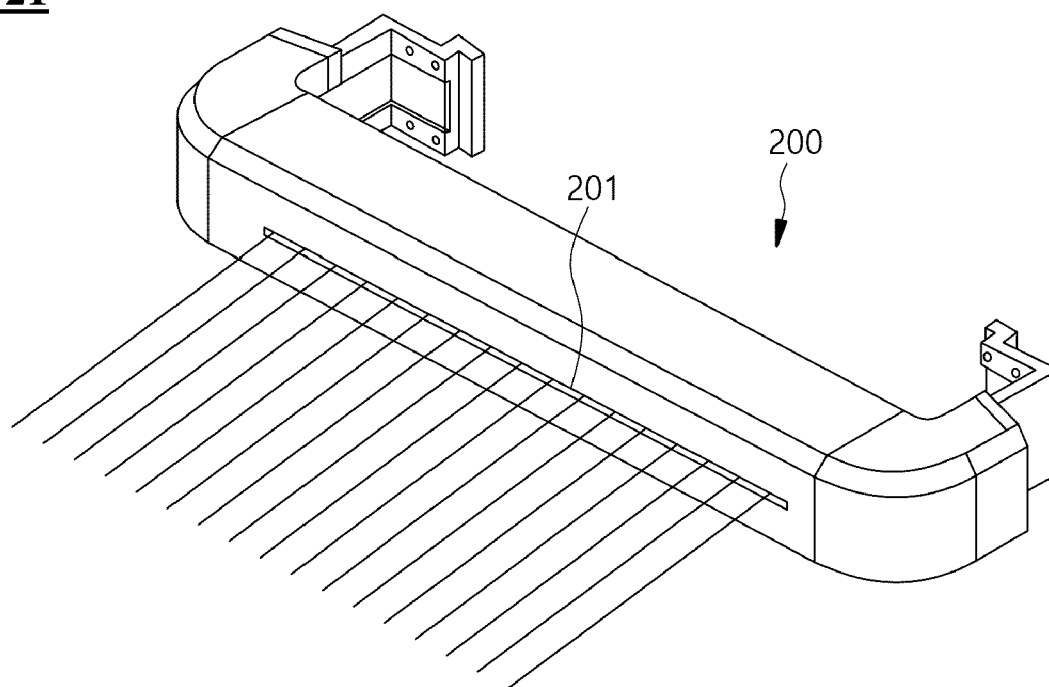


Fig. 22

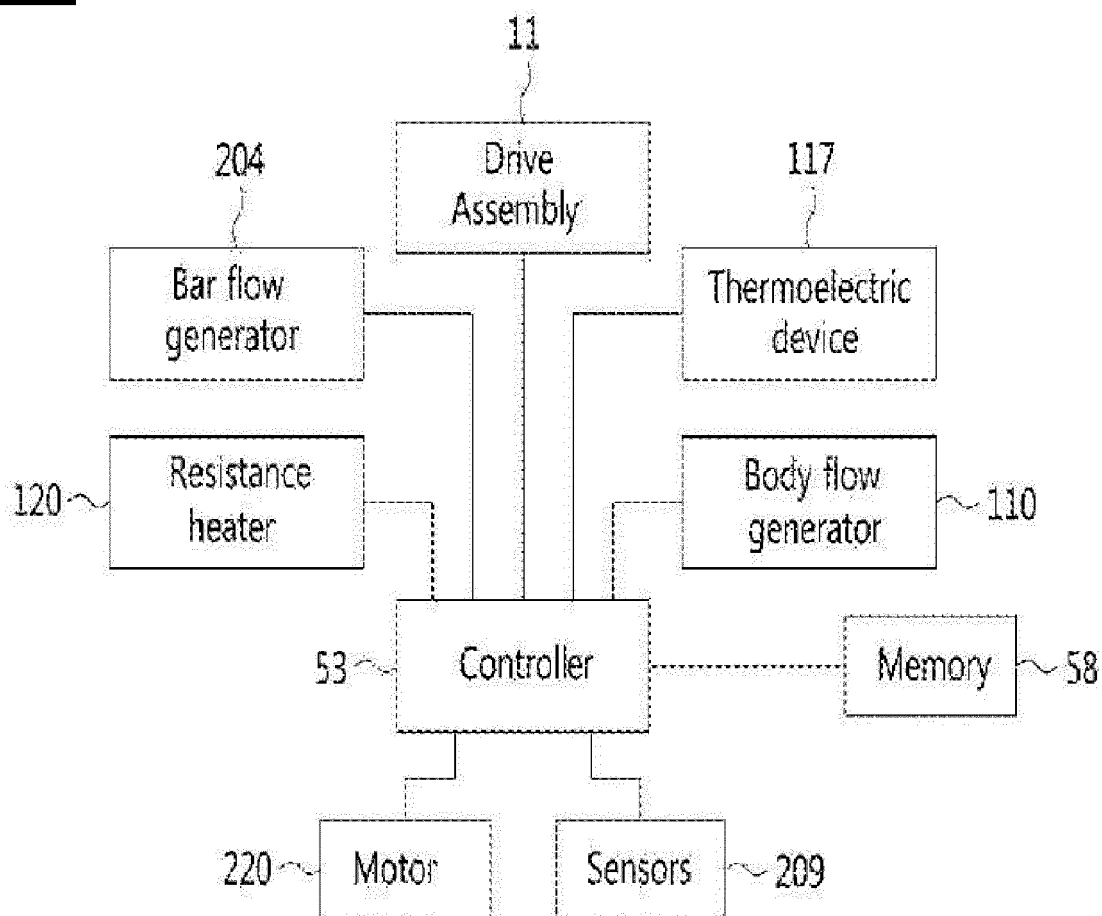


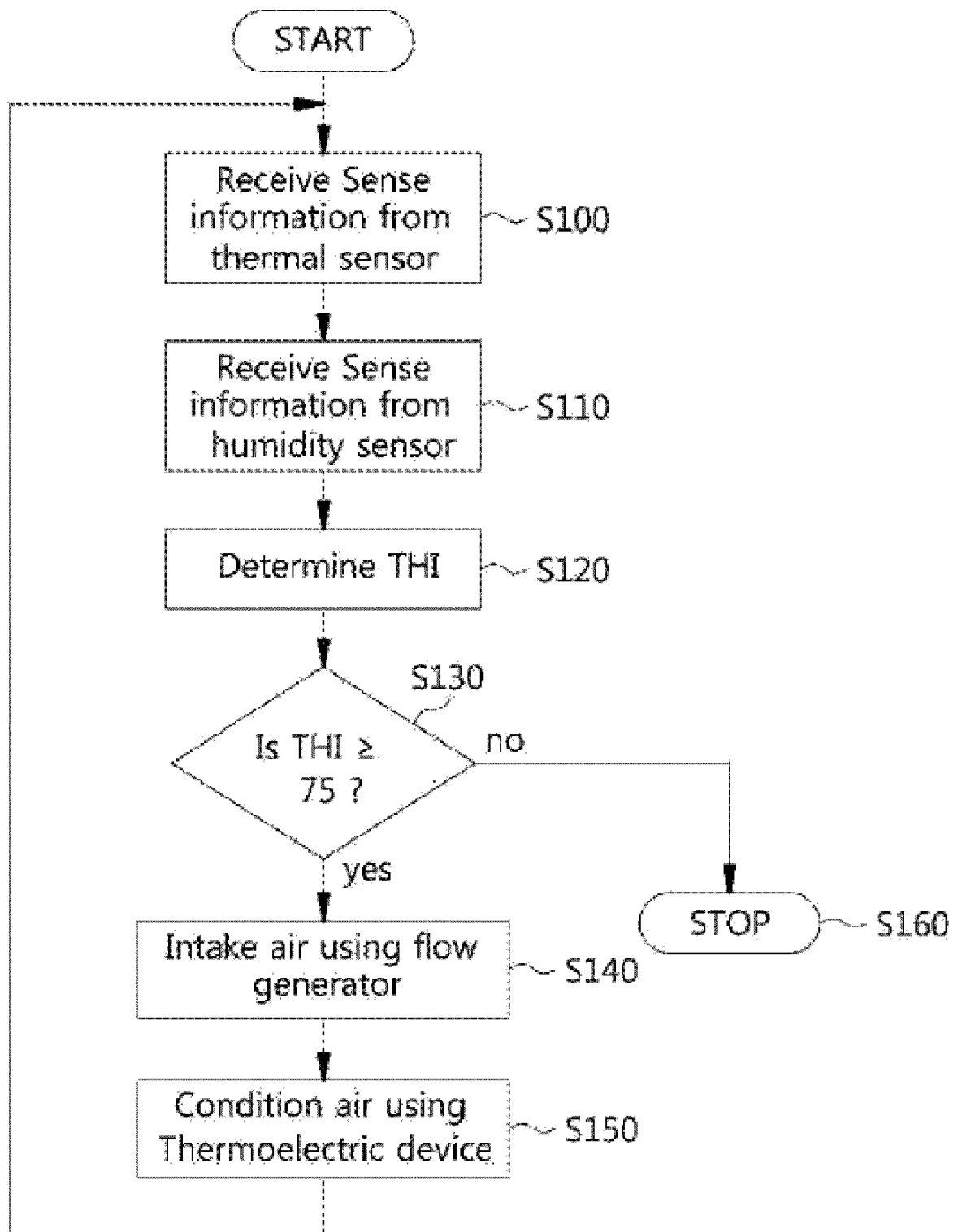
Fig. 23

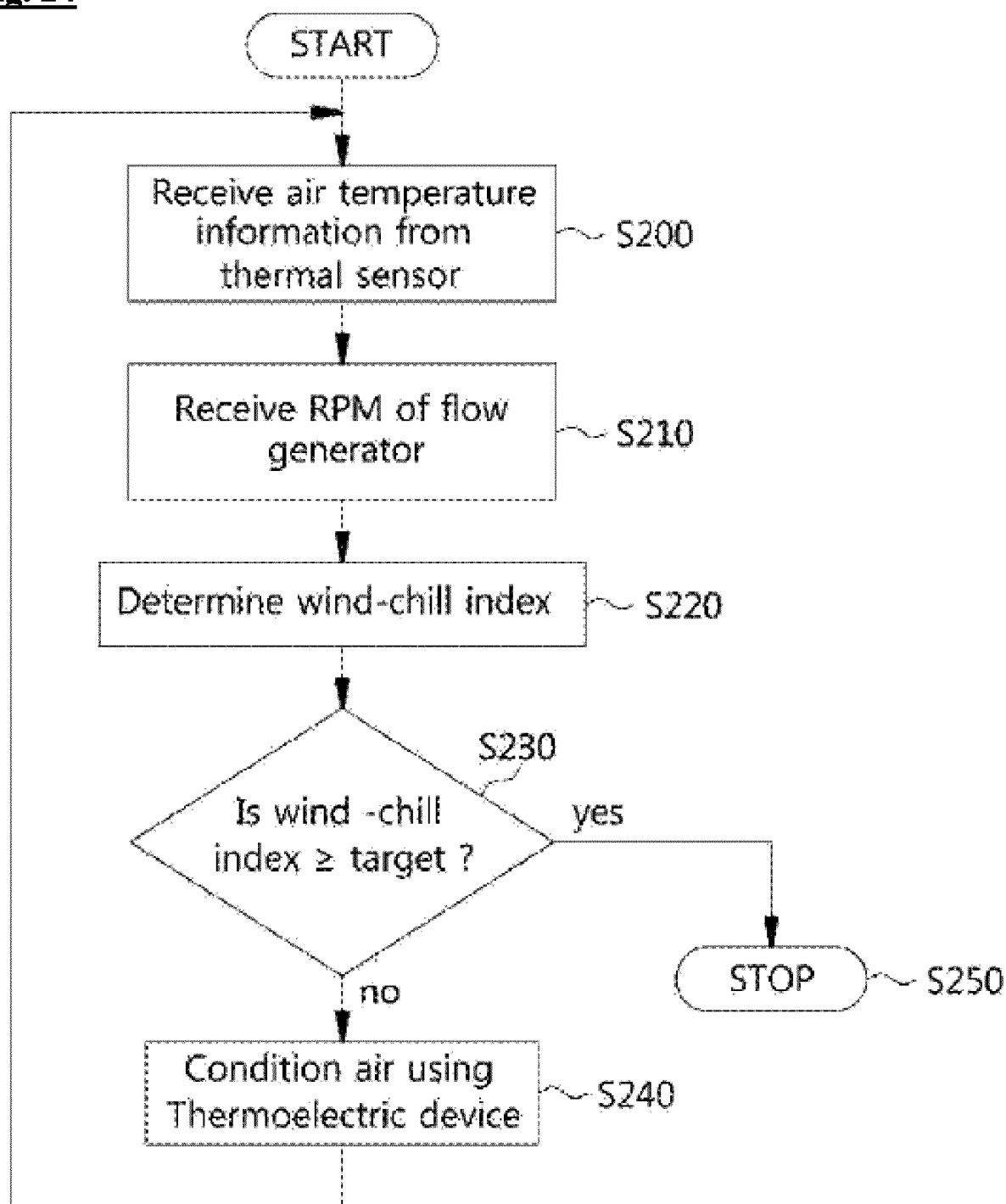
Fig. 24

Fig. 25a

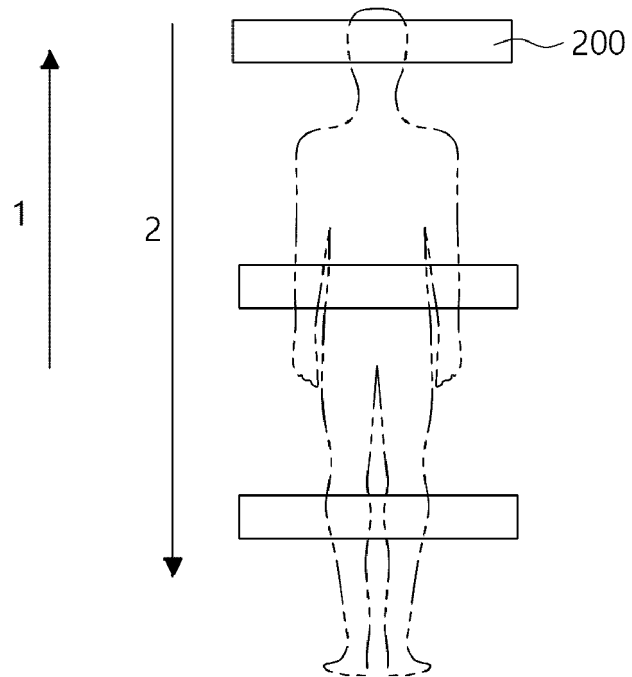


Fig. 25b

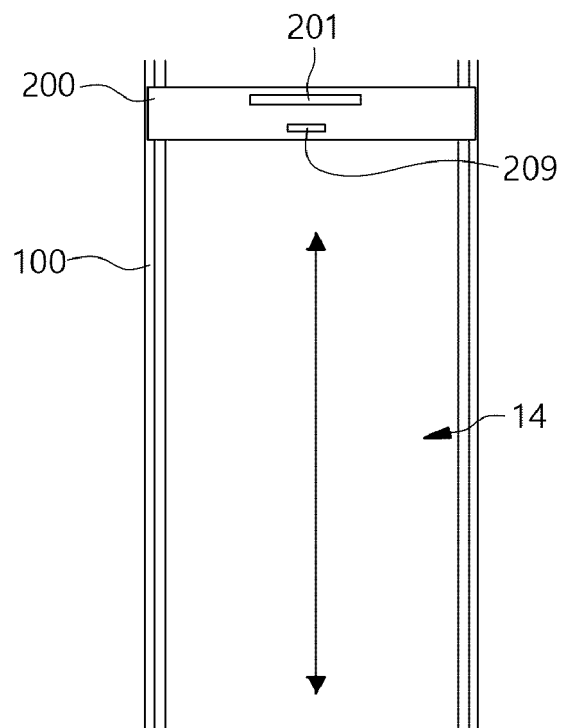


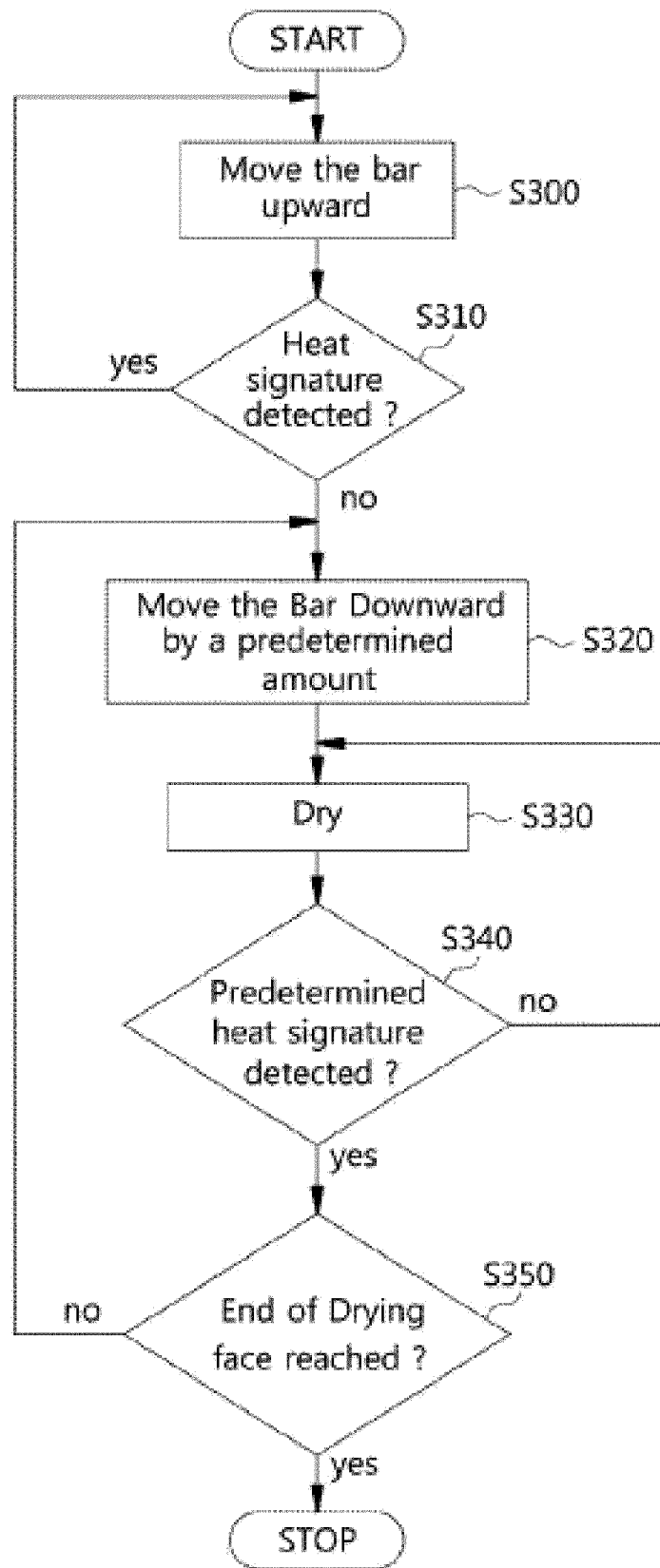
Fig. 26

Fig. 27

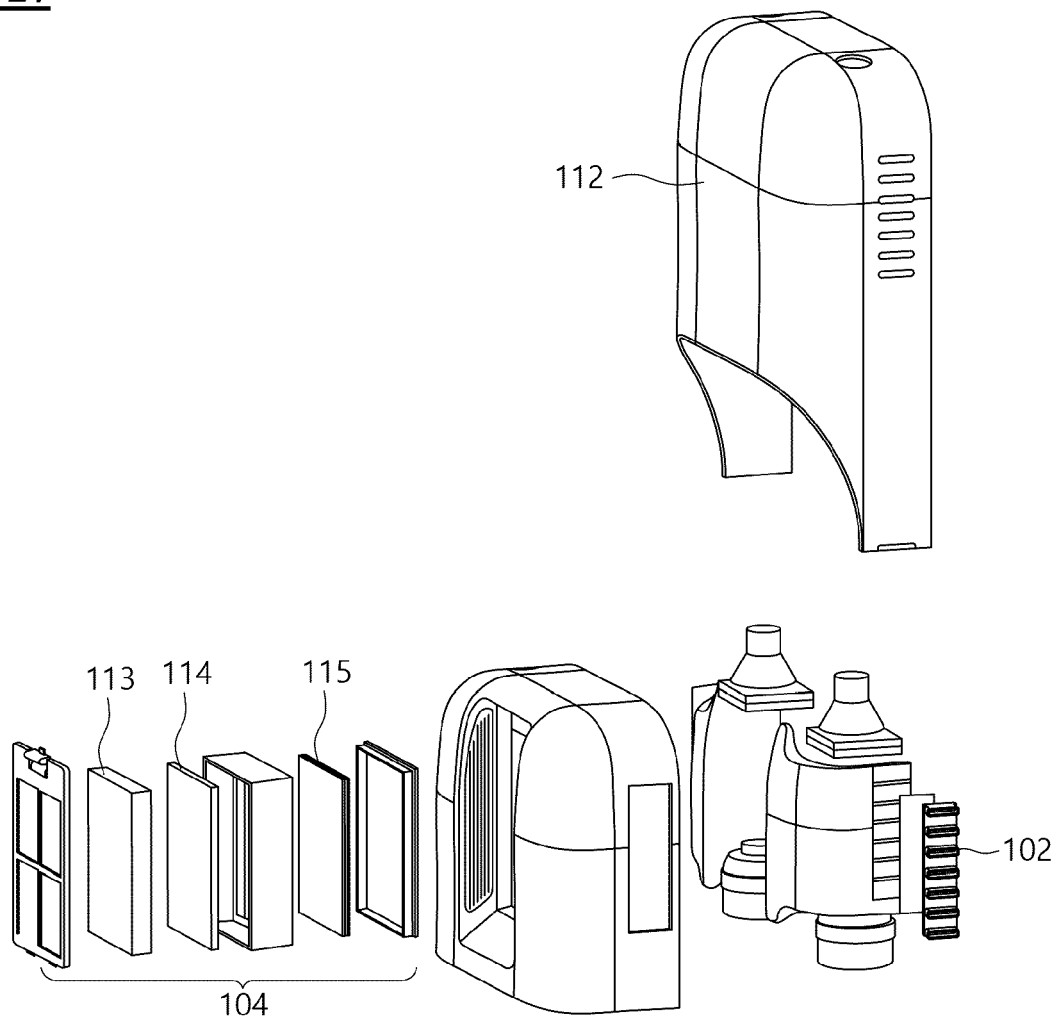


Fig. 28

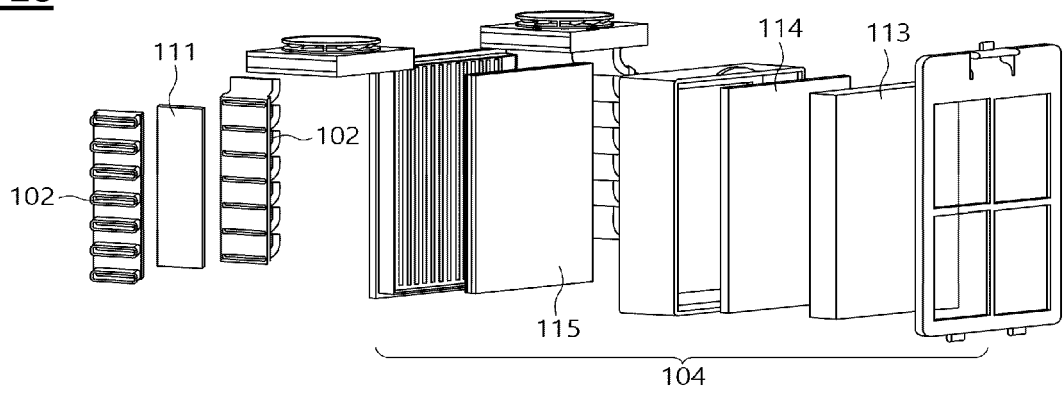


Fig. 29

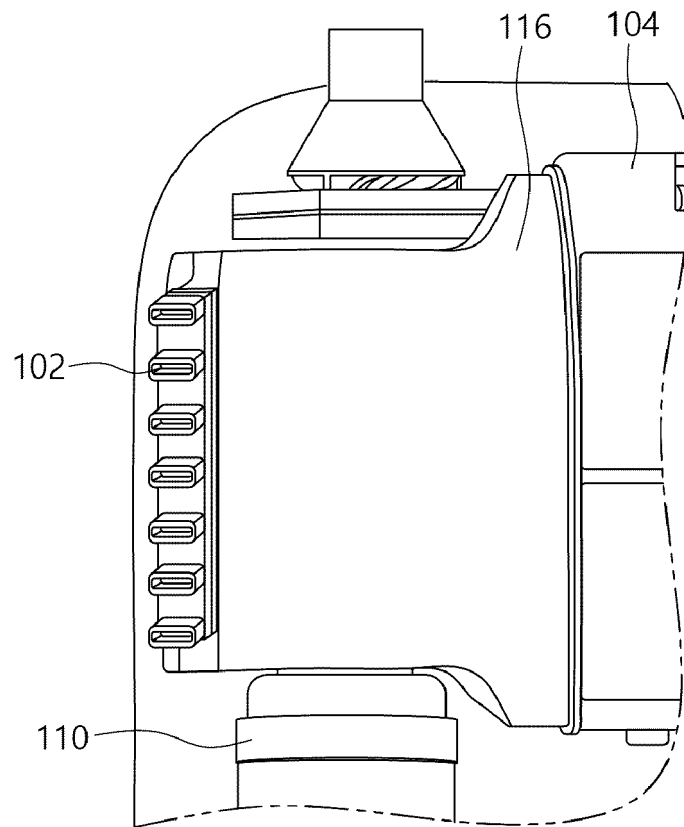


Fig. 30

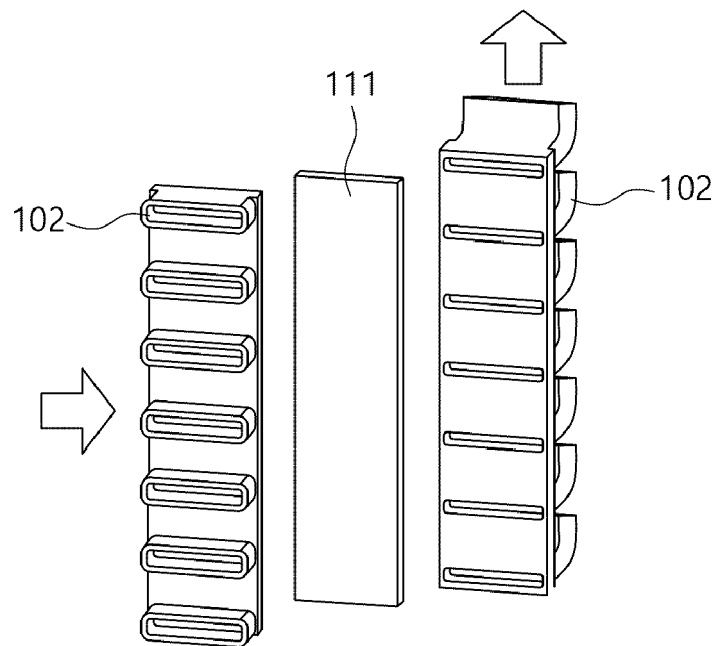


Fig. 31

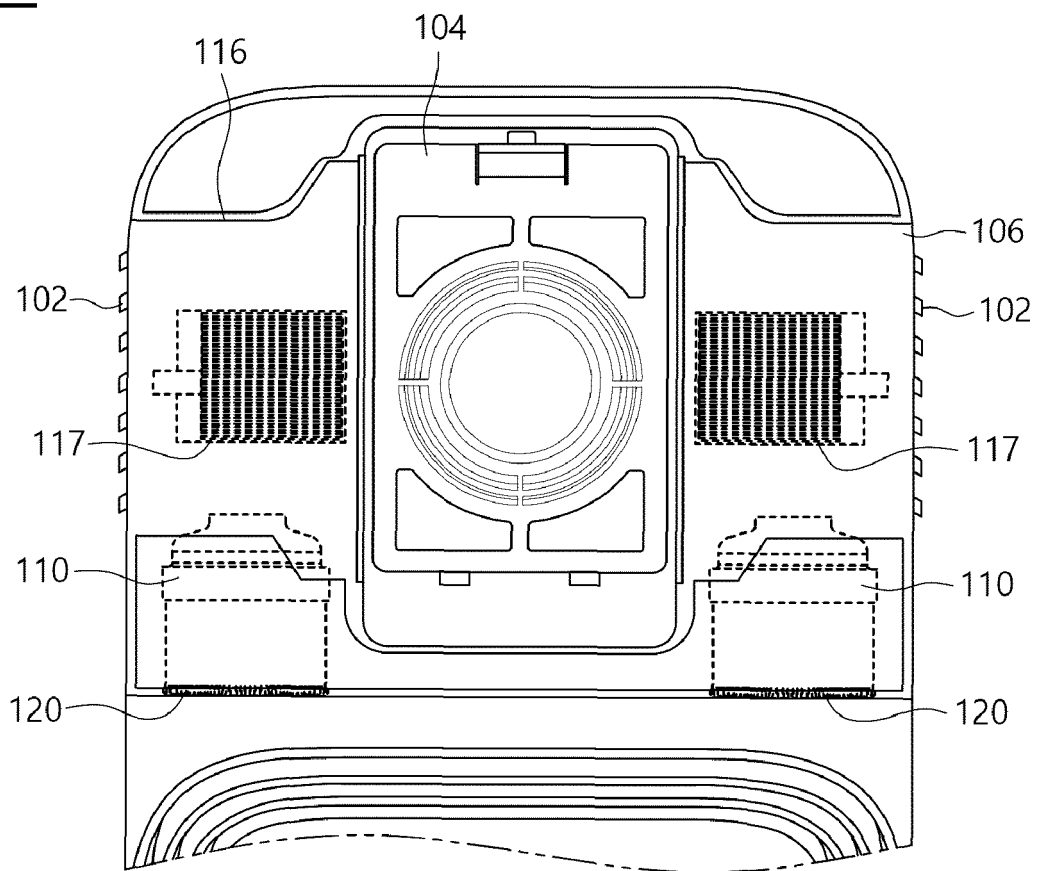


Fig. 32

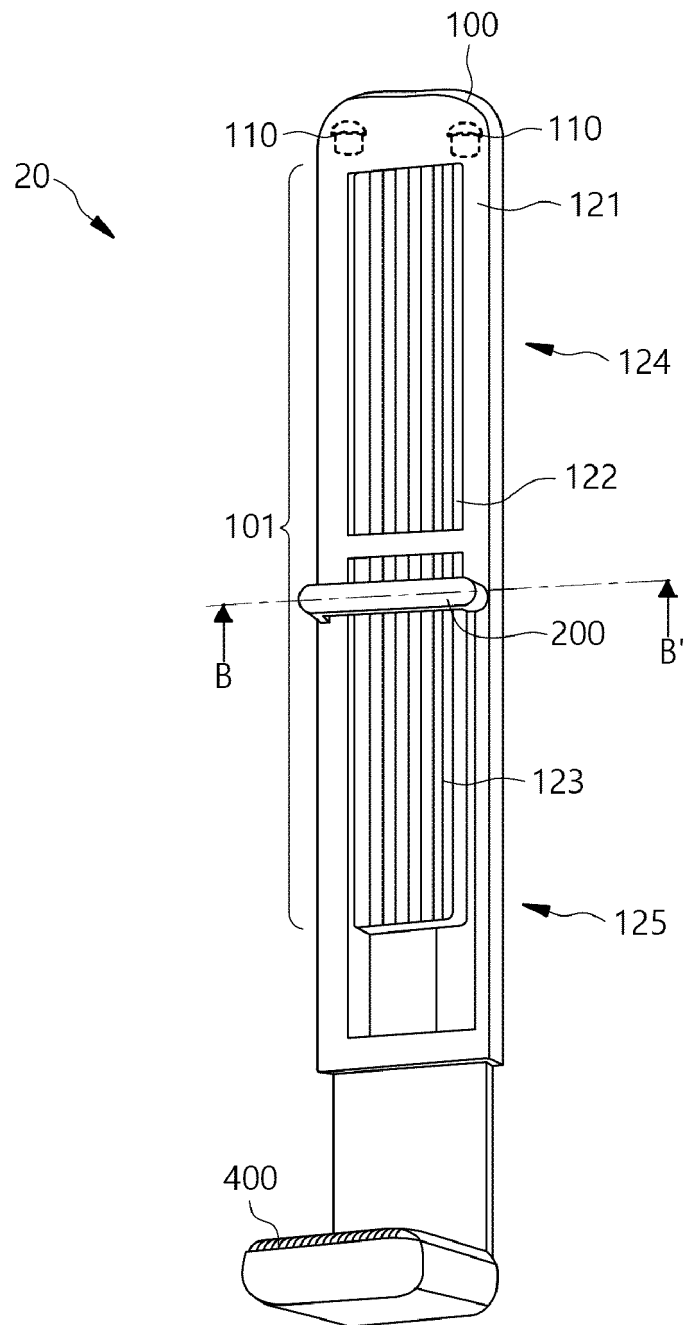


Fig. 33

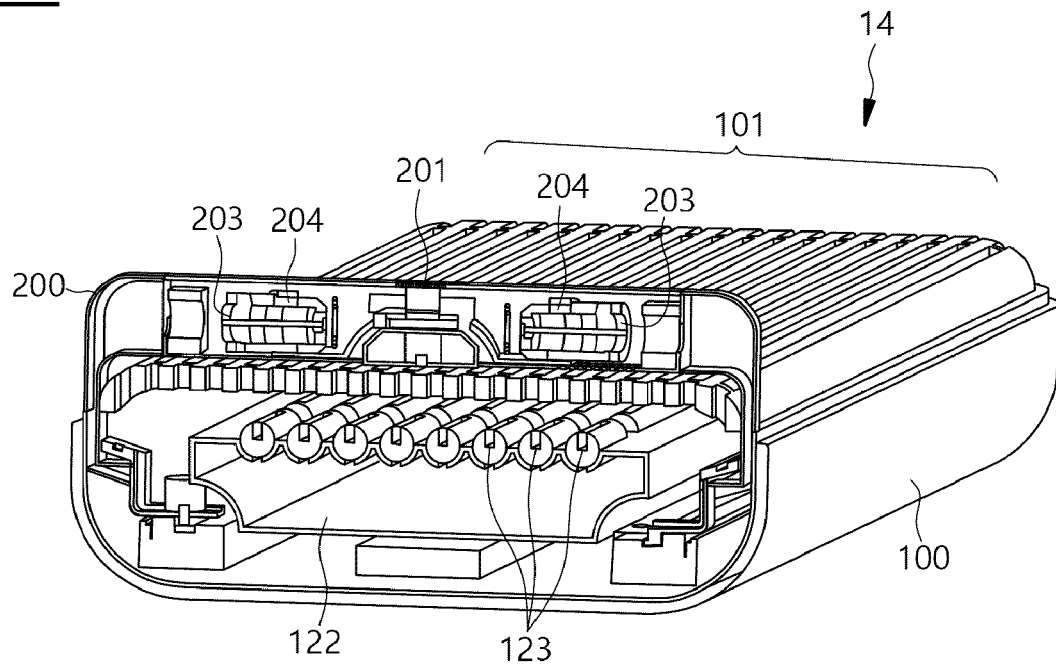


Fig. 34

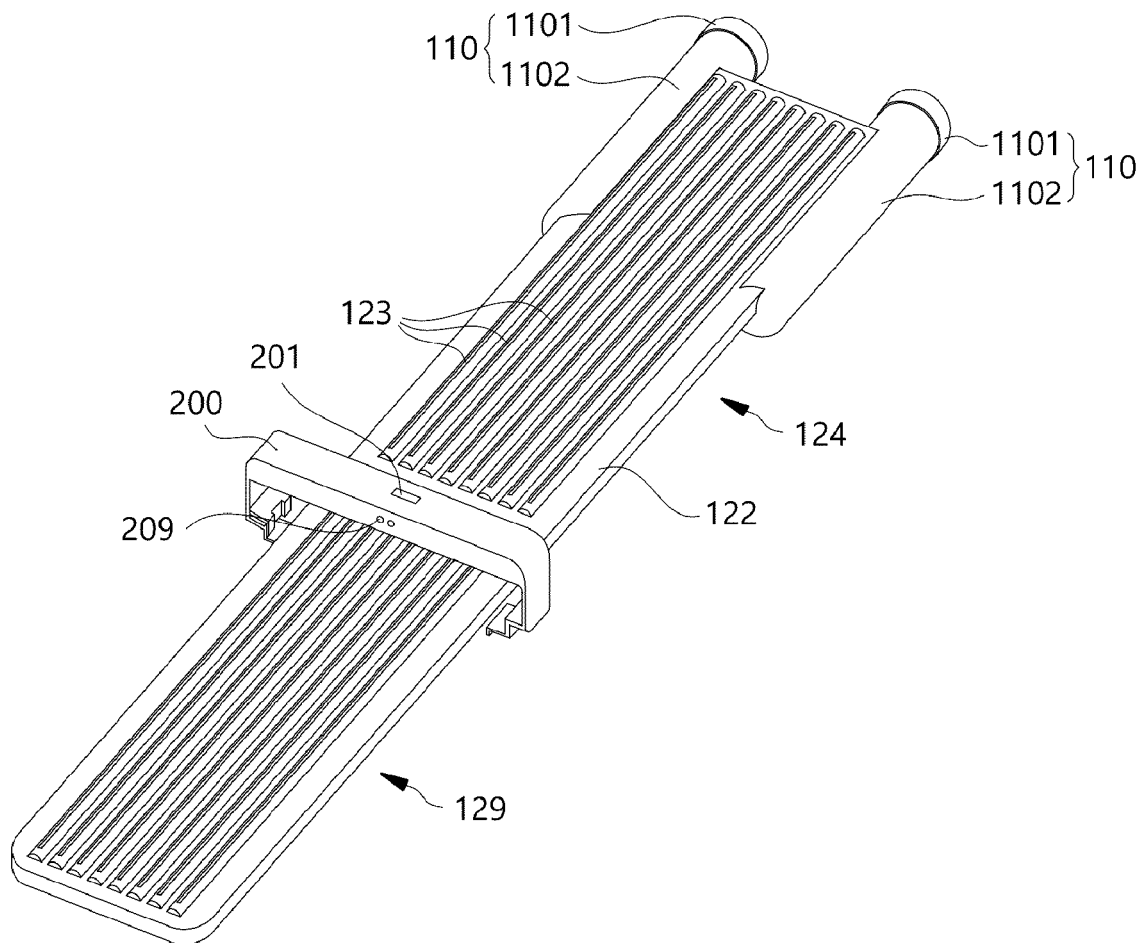


Fig. 35

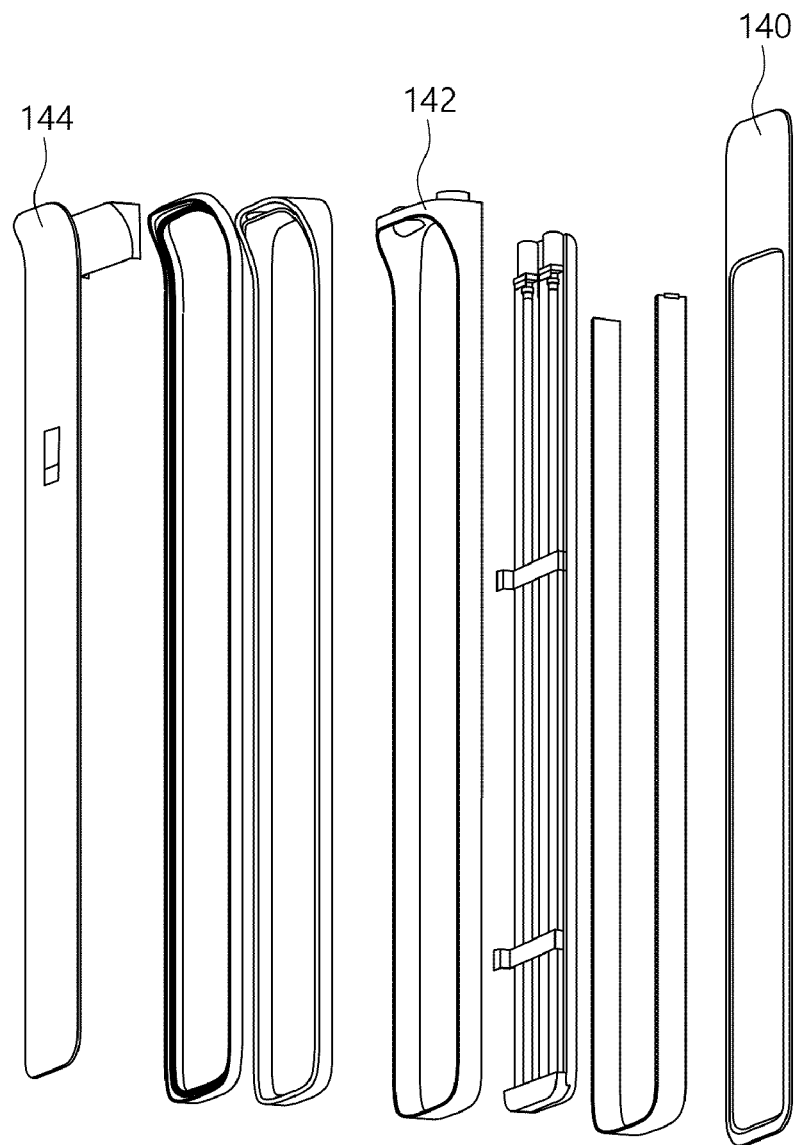


Fig. 36

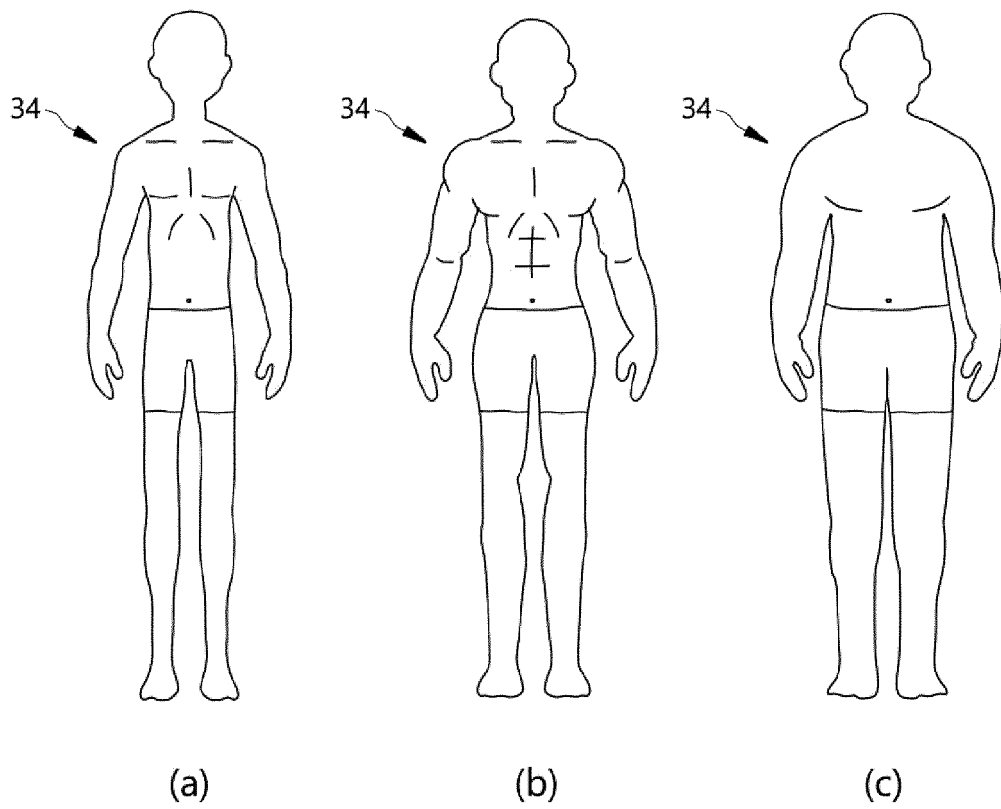


Fig. 37

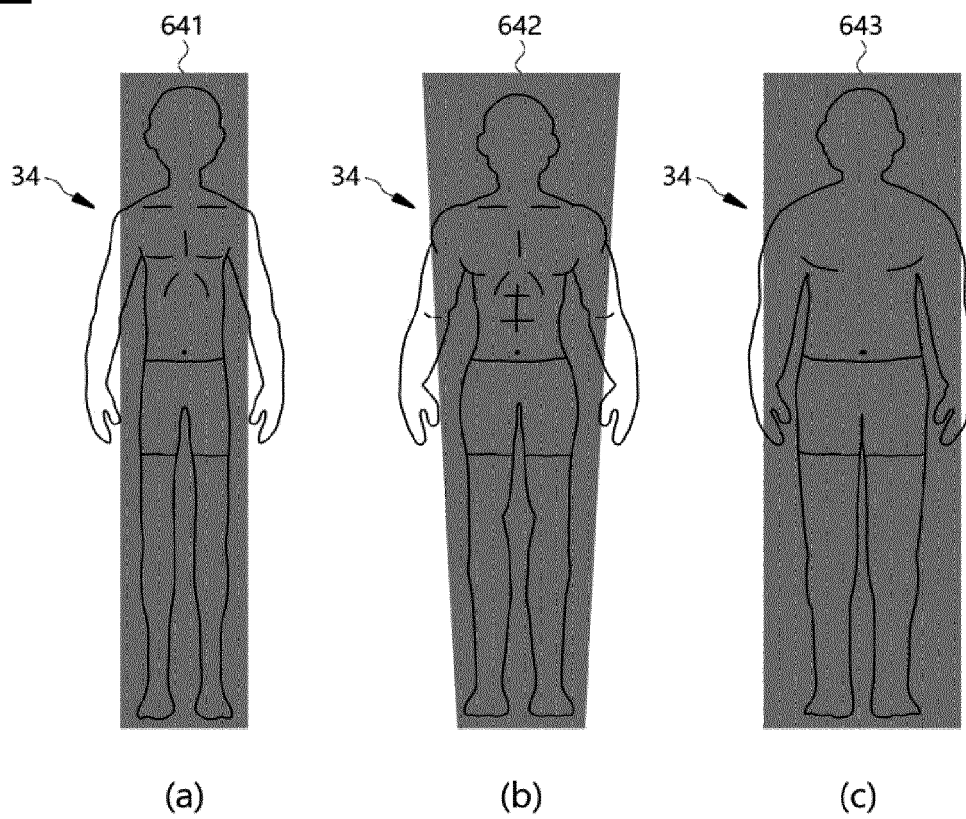


Fig. 38

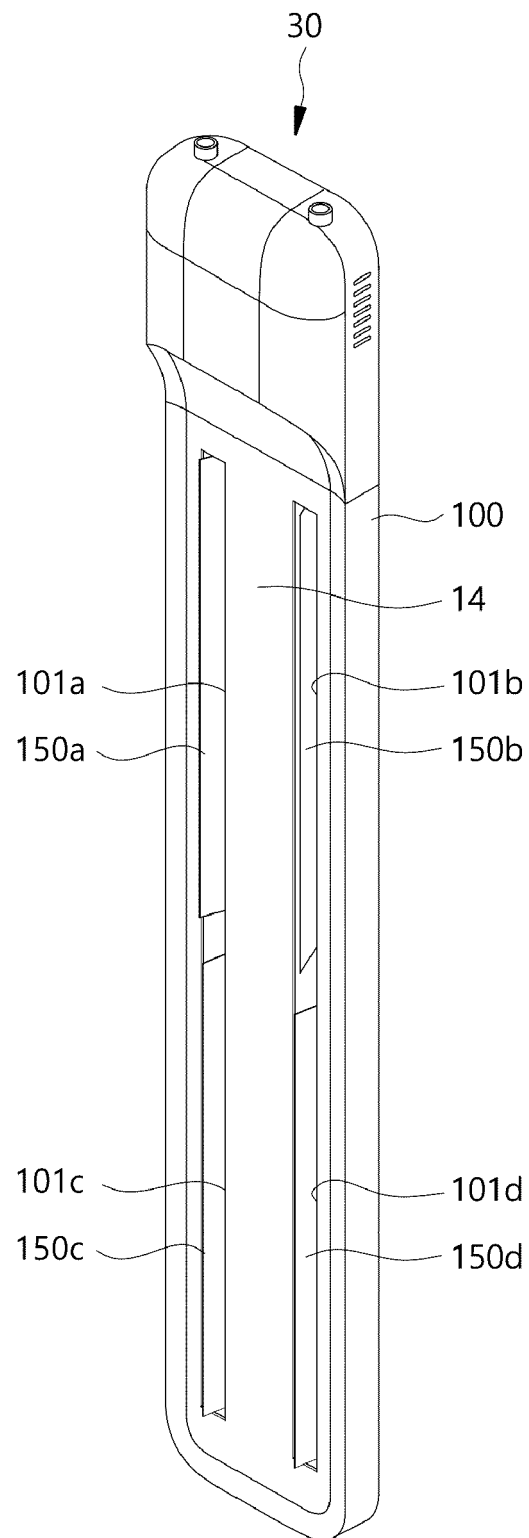


Fig. 39

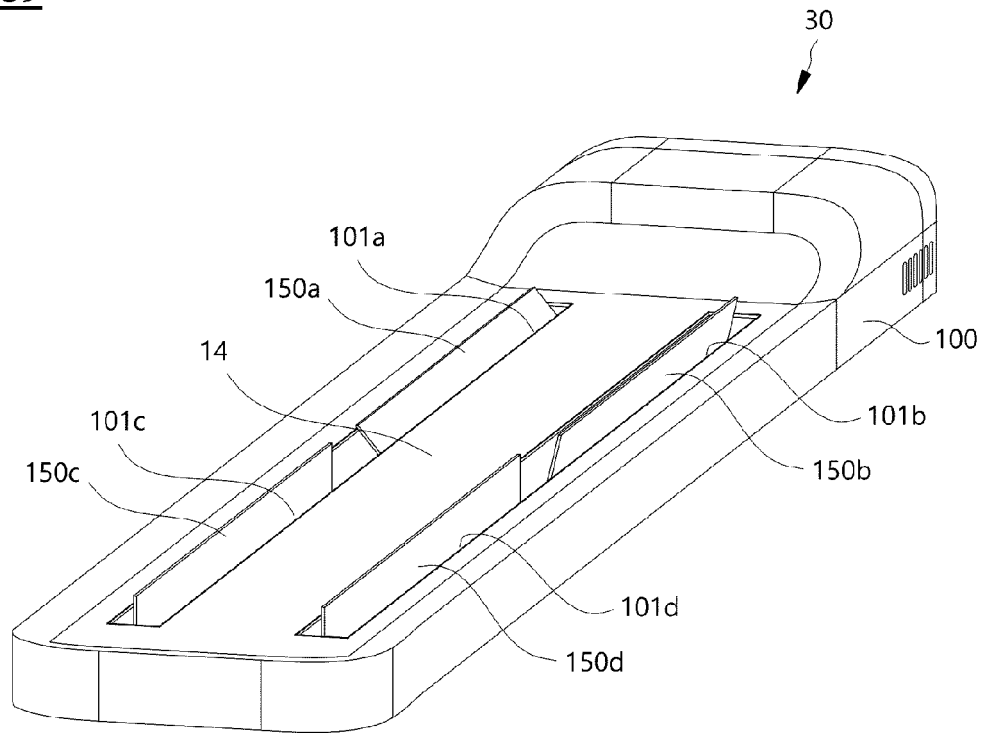


Fig. 40

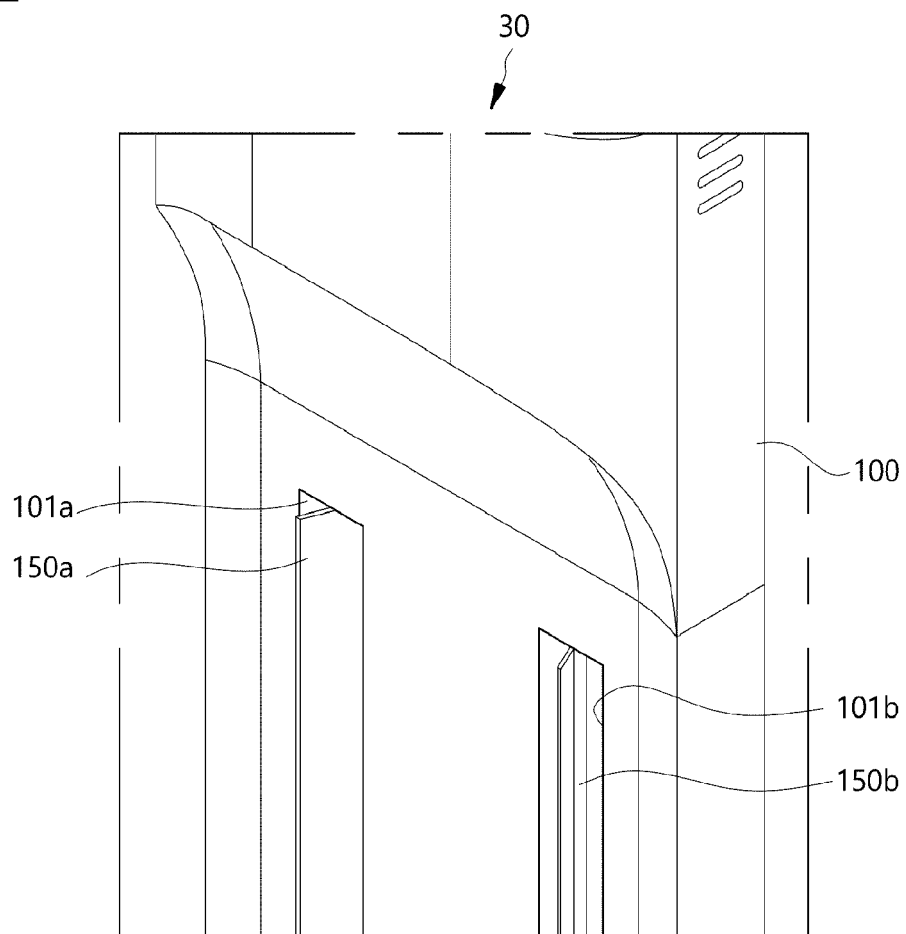


Fig. 41

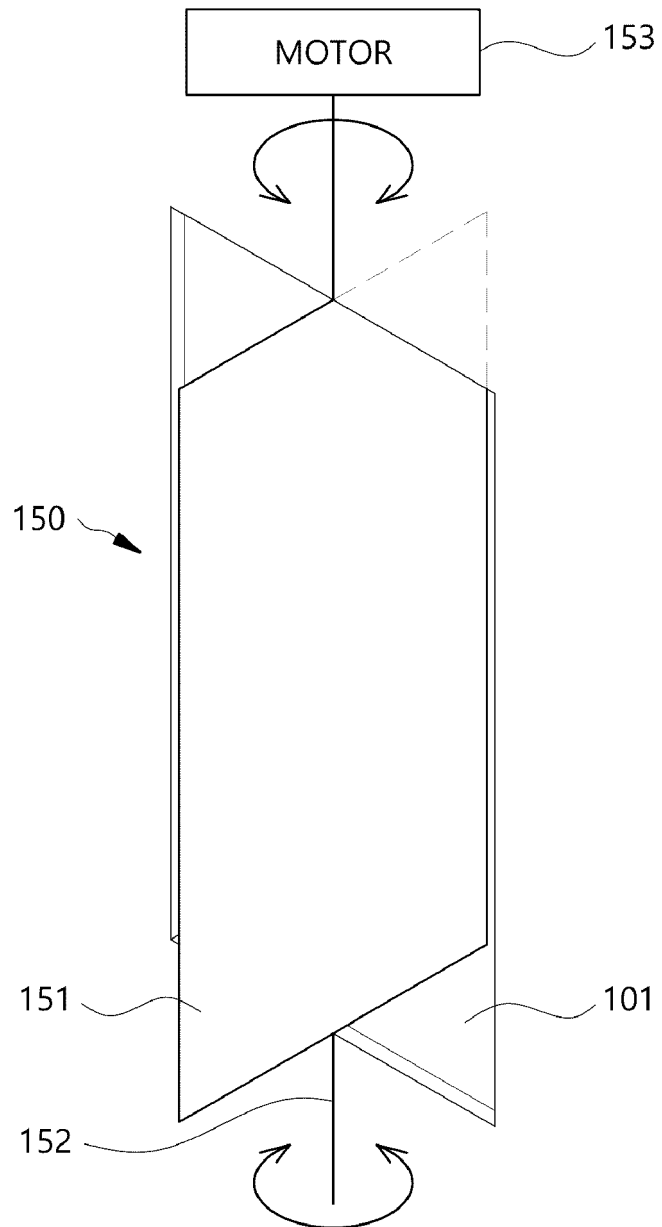


Fig. 42

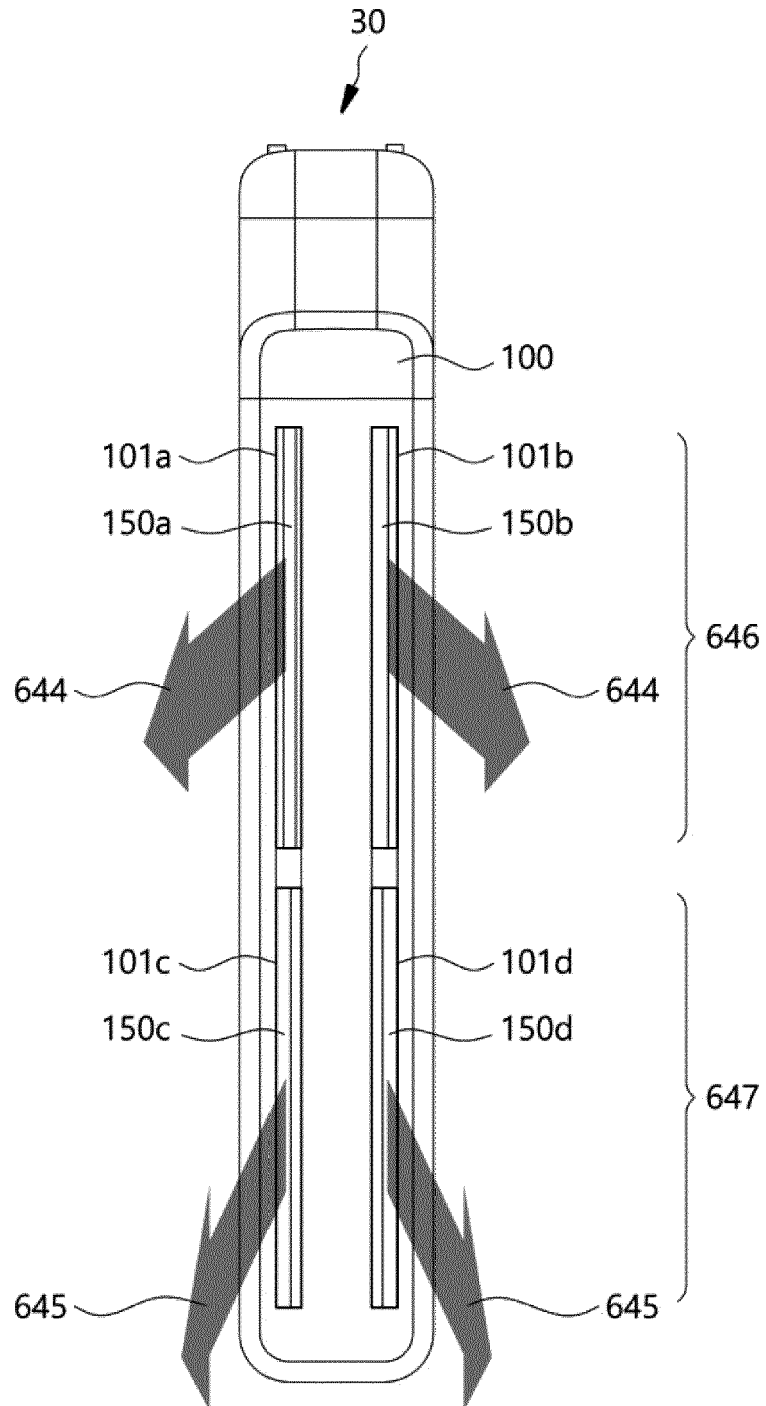


Fig. 43a

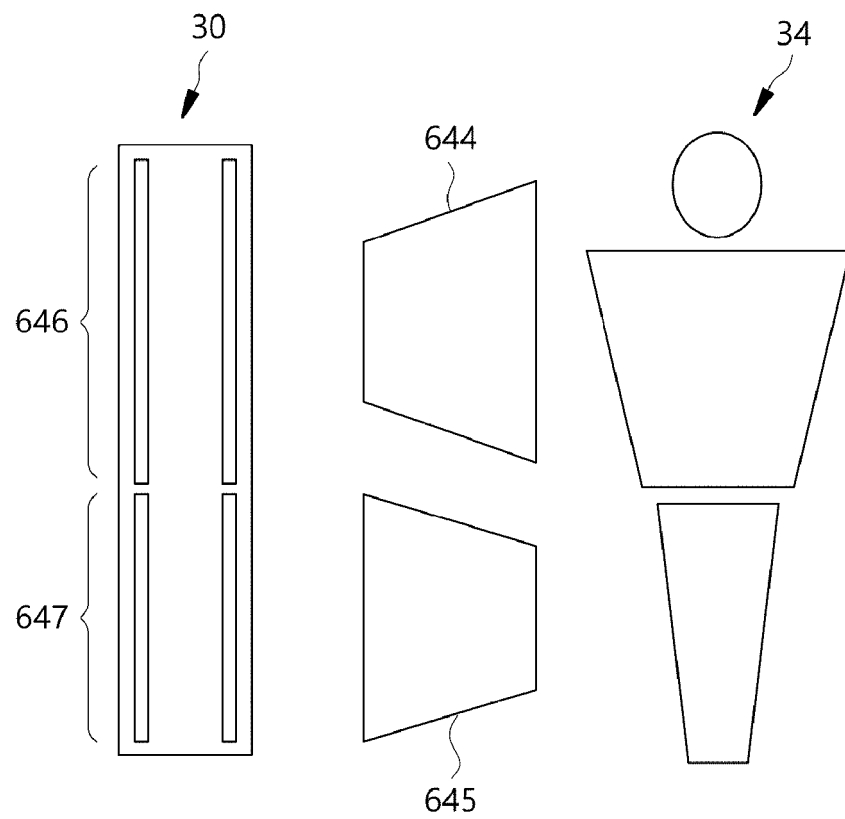


Fig. 43b

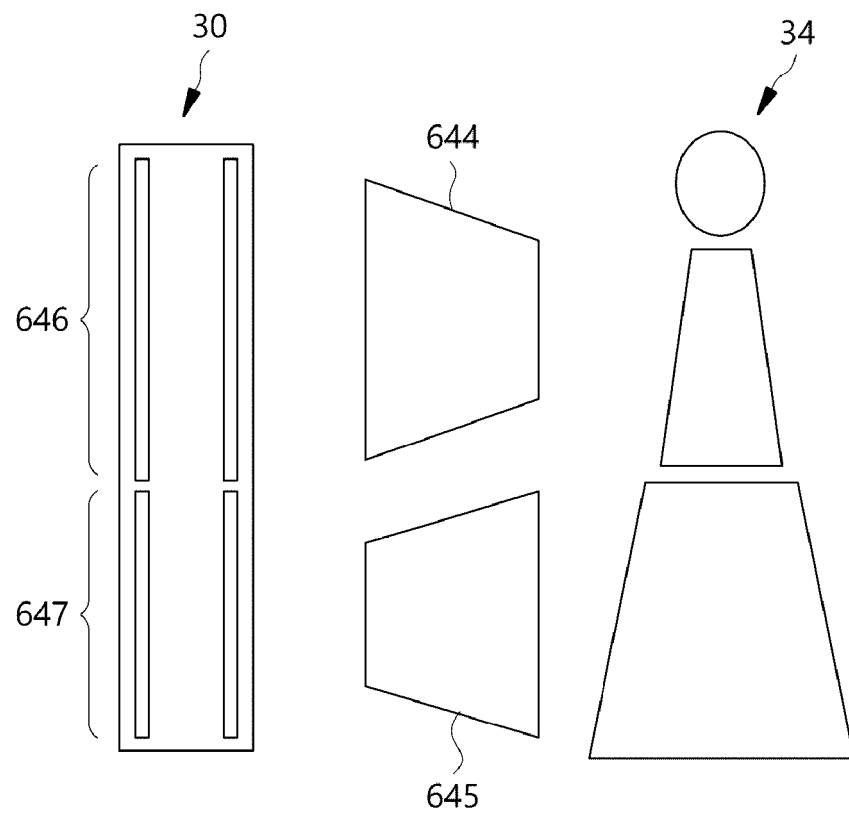


Fig. 44

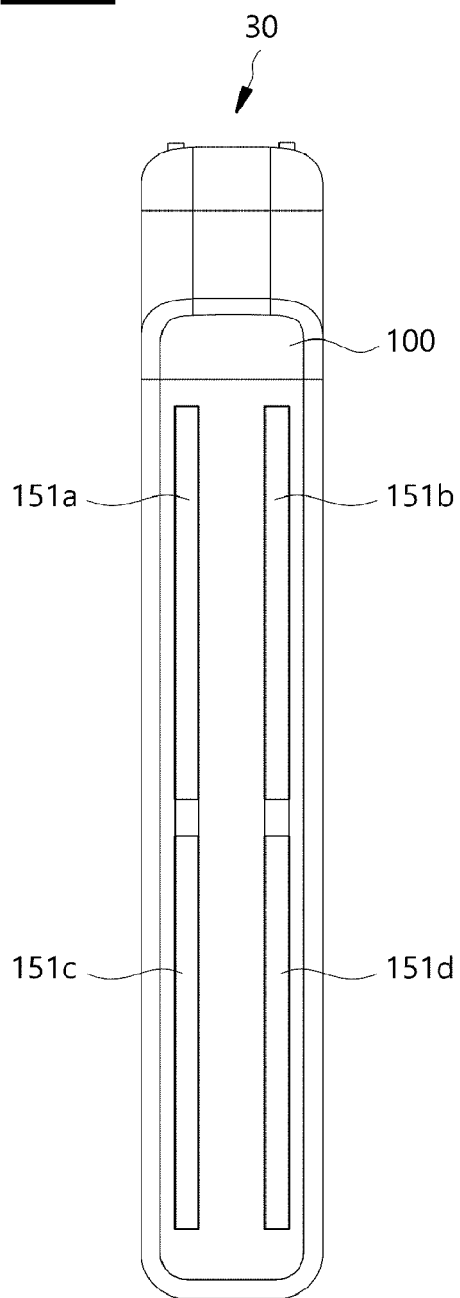


Fig. 45

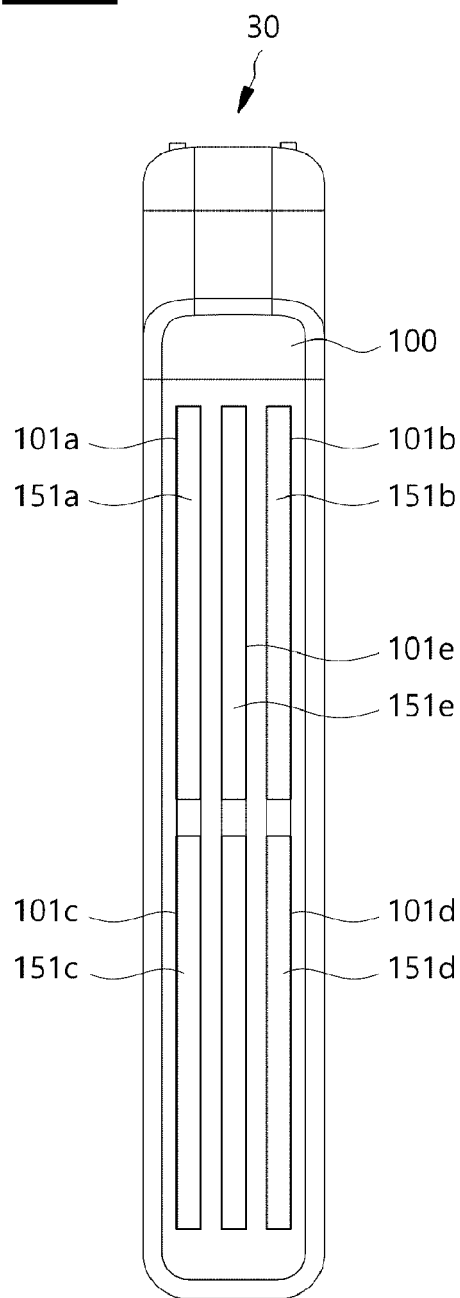
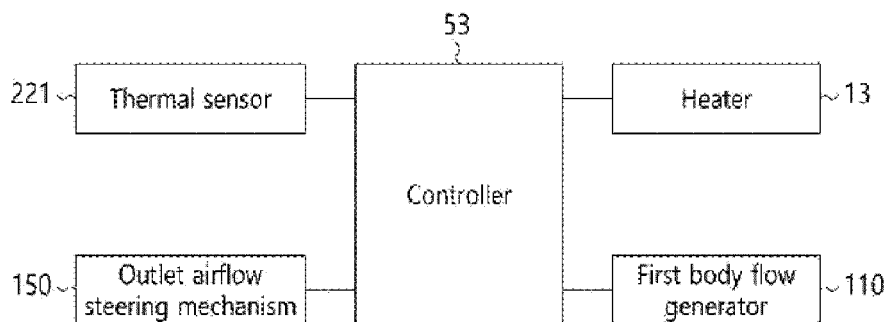


Fig. 46





EUROPEAN SEARCH REPORT

Application Number
EP 21 15 8477

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 109 602 314 A (FANG CHUXIONG) 12 April 2019 (2019-04-12) * abstract; figures 1-3 * * paragraph [0034] - paragraph [0047] * -----	1-4,6-13	INV. A47K10/48
X	DE 296 21 204 U1 (TKV THERMOFORM GMBH [DE]) 23 October 1997 (1997-10-23) * paragraph [0001] - paragraph [0011]; claim 1; figures 1-3 * -----	1,2,4-6, 13,14	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47K
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 July 2021	Examiner Oliveras, Mariana
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 15 8477

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

19-07-2021

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 109602314	A	12-04-2019	NONE
DE 29621204	U1	23-10-1997	NONE

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82