

contemplated that the additional open loop channel may be added to one or both side assemblies.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In addition to the features mentioned above, other aspects of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments, wherein like reference numerals across the several views refer to identical or equivalent features, and wherein:

[0013] **Figure 1** is a front perspective view of an exemplary assembly in accordance with the present invention;

[0014] **Figure 2** is a front perspective of the assembly of figure 1 illustrated with the stand removed to illustrate additional components of the assembly;

[0015] **Figure 3** is a front perspective of the assembly of figure 2 illustrated with one of the assemblies in the open position;

[0016] **Figure 4** is a front perspective view of the assembly of figure 2 illustrated with one of the assemblies removed;

[0017] **Figure 5** is a front perspective view of the assembly of figure 4, illustrated with exemplary flow paths for circulating gas and ambient air;

[0018] **Figure 6** is a top sectional view of an exemplary display assembly illustrated in isolation from other components to illustrate exemplary flow paths for circulating gas and ambient air;

[0019] **Figure 7** is a front perspective view of another exemplary embodiment of the assembly also indicating section lines A-A and B-B;

[0020] **Figure 8** is a front perspective view of the assembly of figure 7 illustrated with both display assemblies in the open position;

[0021] **Figure 9** is an exploded front perspective view of the assembly of figure 8;

[0022] **Figure 10** is a top sectional view taken along section line A-A of figure 7;

[0023] **Figure 11** is a side sectional view taken along section line B-B of figure 7;

[0024] **Figure 12A** is a rear perspective view of another exemplary assembly;

[0025] **Figure 12B** is a rear perspective view of another exemplary assembly;

[0026] **Figure 13** is a front perspective view of another exemplary assembly also indicating Detail A;

[0027] **Figure 14** is a front perspective view of the assembly of figure 13 illustrated with one of the display assemblies in the open position;

[0028] **Figure 15** is a rear perspective view of the assembly of figure 13 illustrated with both of the display assemblies in the open position also indicating Detail B;

[0029] **Figure 16** is a front perspective view of the assembly of figure 14 illustrated with one of the display assemblies removed;

[0030] **Figure 17** is a detailed top perspective view of Detail A of figure 13;

[0031] **Figure 18A** is a detailed perspective view of Detail B of figure 15 with the display assembly in the closed position and illustrating an otherwise hidden strut;

[0032] **Figure 18B** is a detailed top perspective view of the assembly of figure 18A illustrated with the display assembly in the open position;

[0033] **FIGURE 19A** is a vertical cross-sectional view of another exemplary assembly;

[0034] **FIGURE 19B** is a vertical cross-sectional view of another exemplary assembly; and

[0035] **Figure 20** is a horizontal cross-sectional view of the assembly of figure 19A.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

[0036] Various embodiments of the present invention will now be described in detail with reference to the accompanying drawings. In the following description, specific details such as detailed configuration and components are merely provided to assist the overall understanding of these embodiments of the present invention. Therefore, it should be apparent to those skilled in the art that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the present invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

[0037] **Figure 1** is a front perspective view of an exemplary assembly 10 in accordance with the present invention. The assembly 10 may comprise one or more side assemblies 14 placed within a housing 6. The housing 6 may comprise a stand 8 for mounting the assembly 10 to the ground. However, in other exemplary embodiments, the assembly 10 may be mounted to another object such as, but not limited to, a bus shelter, a post, a wall, a building, a roof rack for a vehicle, or the like. Regardless, an intake 16 may be located on the top of the housing 6. As will be described in greater detail herein, an exhaust 9 may be located on the bottom of the housing 6. However, it is contemplated that the intake 16 may be located on the bottom of the housing 6 with the exhaust 9 being located on the top of the housing 6. Any other location for the intake 16 and the exhaust 9 is contemplated. Regardless, the intake 16 may likewise extend through the frame 12.

Similarly, the exhaust 9 may extend through the frame 12. Alternatively, the air may flow into the exhaust 9 and out of the intake 16.

[0038] **Figure 2** is a front perspective of the assembly 10 of figure 1 illustrated with the stand 6 removed to illustrate additional components of the assembly 10. The side assemblies 14 may be mounted to a frame 12. The frame 12 may be substantially rectangular in shape and may have interior and exterior surfaces or panels. In exemplary embodiments, the frame 12 may comprise an interconnected upper, lower, right side, and a left side piece, but may be substantially open on the front or rear sides thereof such that a side assembly 14 may be mounted to the frame 14 to substantially cover said front and rear openings. The frame 12 may be configured to receive a first and second side assembly 14 in a back to back arrangement. The side assemblies 14 may comprise digital displays, covers (i.e., access panels), poster holders (illuminated or unilluminated), some combination thereof, or the like. The poster holders may be configured to receive a static poster and may be back or edge illuminated. In exemplary embodiments, the covers and the poster holders may serve as access panels, though any of the foregoing may be moved or removed to allow access to the interior of the assembly 10. For example, without limitation, the assembly 10 may comprise two electronic displays placed back-to-back, or a single electronic display placed back-to-back with a poster holder. Regardless, the frame 12 may be configured to be connected to the stand 8, another object, or directly to the ground.

[0039] In embodiments comprising a single side assembly 14, the frame 12 may be a five-sided box. Namely, the frame 12 may comprise an interconnected upper, lower, right side, and a left side piece as well as a front or rear panel. However, the frame 12 may be substantially open on the rear or front sides thereof, respectively, such that the side assembly 14 may be mounted to substantially cover said opening.

[0040] As will be explained in greater detail herein, the assembly 10 may further comprise an electronics cavity 18 for storing electronic components 30 for operating the assembly 10. The electronics cavity 18 may be located in the space between the side assemblies 14 and the frame 12. Stated another way, the first and second side assemblies 14 may share a common electronics cavity 18.

[0041] Figures 1 and 2 illustrate the side assemblies 14 in a closed position such that the side assemblies 14 are in contact with the frame 12 or are located substantially parallel to the ground. As will be explained in greater detail herein, the side assemblies 14 may be hingedly mounted to the frame 12 by way of a hinging device 22. A first and

second hinging device 22 may be located on either side of the frame 12 so as to connect the first and second side assembly 14 to the frame 12 in a hinged fashion. The first and second hinging devices 22 may be the same or may be different. For example, without limitation, the hinging devices 22 used to hingedly mount a side assembly 14 comprising a digital display may be the same or may be different from the hinging device 22 used to mount a side assembly 14 comprising a poster holder. In exemplary embodiments, the hinging devices 22 may be located on an upper portion of the frame 12, such that the side assemblies 14 rotate outward along a substantially horizontal axis. In other exemplary embodiments, the hinging devices 22 may be located along an edge of the frame 12, such that the side assemblies 14 rotate outward along a substantially vertical axis. Any location of the hinging devices 22 is contemplated.

[0042] **Figure 3** is a front perspective view of the assembly 10 of figure 2 illustrated with one of the side assemblies 14 in an open position. The side assembly 14 may rotate via the hinging device 22 into the opened position such that the bottom of the side assembly 14 is swung outward and away from the frame 12. This may allow access to the electronics cavity 18 such that personnel may service the electronic components 30 located therein.

[0043] The assembly 10 may further comprise a pair of aid devices 20, preferably having a first end and a second end, though such is not required. In exemplary embodiments, the aid devices 20 may be gas springs, though any type of aid device is contemplated. Such aid devices 20 may include, but are not limited to, any device which utilizes a mechanical advantage in order to assist in moving the side assemblies 14 between an open position or closed positions as well as, or alternatively, to temporarily secure the side assemblies 14 in the open position or closed position. Other exemplary aid devices 20 include, but are not limited to, struts, springs, block and tackle, counterweights, levers, gears, tethers, belts, chains, motors, screws, some combination thereof, or the like.

[0044] The first end of the aid devices 20 may be mounted to either side of the side assembly 14 and the second end of the aid devices 20 may be mounted to either side of the interior of the frame 12. In exemplary embodiments, the first end of the aid devices 20 is mounted lower relative to second end of the aid devices 20, though the opposite is contemplated. The aid devices 20 may be configured to assist with movement of the side assemblies 14 between the open and the closed positions as well as temporarily securing the side assemblies 14 in the opened or the closed positions.

[0045] In exemplary embodiments, the side assemblies 14 may be lockable to the frame 12 or the housing 6 such that the side assemblies 14 cannot normally be moved from the closed position unless unlocked. This may assist in restricting access to the electronics cavity 18 to authorized personnel.

[0046] **Figure 4** is a front perspective view of the assembly 10 of figure 2 illustrated with one of the side assemblies 14 removed so as to illustrate the electronics cavity 18. A gasket 28 may extend around the perimeter of either or both sides of the frame 12. The gaskets 28 may provide a substantially air tight seal when the side assemblies 14 are placed in the closed position. The gaskets 28 may ensure or assist in allowing the electronics cavity 18 to maintain a substantially air tight seal, though such is not required.

[0047] A plate 19 may be located in the electronics cavity 18 and the electronic components 30 may be mounted thereto. Alternatively, or in addition, an electronics plate 42 may be located in the electronics cavity 18. In exemplary embodiments, the electronics plate 42 may be mounted to the frame 12 such that the electronics plate 42 extends substantially parallel to the front surface of the electronic side assemblies 14. Similarly, in exemplary embodiments the plate 19 may be mounted to, or form, the rear surface of one or more of the side assemblies 14. However, any location and orientation of the plate 19 and the electronics plate 42 is contemplated.

[0048] The electronic components 30 may comprise any number of components used to operate the assembly 10 and its various components. Such electronic components 30 may include, but are not limited to, power sources, power distribution components, video players, video receiver boards, processors, electronic storage devices, communications equipment, wireless transmitter/receivers, network connectivity devices, printed circuit boards, and the like. In exemplary embodiments, a number of the electronic components 30 may be utilized to operate both side assemblies 14. For example, but not to serve as a limitation, at least the video players, video receiver boards, communications equipment, wireless transmitter/receivers, and network connectivity devices may be shared. This may reduce the number of electronic components 30 required. In exemplary embodiments, the plate 19 or the electronics plate 42 may comprise a server rack, though such is not required.

[0049] Each hinging device 22 may comprise a frame hinge plate 26 and a first and second display hinge plate 24. The frame hinge plate 26 may be located on the exterior panels on either side of an upper portion of the frame 12 such that the frame hinge plate 26 extends substantially perpendicular relative to the electronics plate 42. The display

hinge plates 24 may be located on either side of an upper portion of each of the side assemblies 14 such that the display hinge plates 26 extend substantially perpendicular relative to the electronics plate 42. The display hinge plate 24 may comprise one or more notches or apertures corresponding to notches or apertures located on the frame hinge plate 26. Any number of fasteners 27 may extend through the corresponding notches or apertures in the display hinge plate 24 and the frame hinge plate 26 such that the frame hinge plate 26 may be hingedly secured to the display hinge plate 24. The fasteners 27 may include threaded fasteners, pins, bolts, screws, nails, or the like. This is merely exemplary, any type of hinge device 22 is contemplated. In exemplary embodiments, the frame hinge plates 26, the display hinge plates 24 and the fasteners 27 may be configured to serve as the main or sole mechanical attachment points for mounting the side assemblies 14 to the frame 12.

[0050] The hinge device 22 may provide for easy removal of one or both of the side assemblies 14 when servicing the assembly 10. The fasteners 27 may simply be removed from either side of the side assembly 14 and the entire side assembly 14 may be removed. Additionally, removal may require relatively minor additional steps such as, but not limited to, the disconnection of various electrical wires and other components as further described herein. A replacement side assembly 14 may then be installed. Installation may comprise, but is not limited to, moving the Additionally, installation of the new side assembly 14 may require relatively minor additional steps such as, but not limited to, the connection of the aforementioned various electrical wires and other components as further described herein. The side assembly 14 being serviced may then be returned to a service center for servicing. This may minimize downtime of the assembly 10.

[0051] Additionally, the assembly 10 may require connection to an external power source, communications network, and the like to operate. This may require connecting into utility lines. In exemplary embodiments, connection to said utility lines may be made through separate connectors 72 located on the frame 12, within the cavity 18, on the plate 19, on the electronics plate 42, or at another location. These connectors 72 may be connected to the other various electronic components 30 via electrical wiring, ethernet cable, telephone cable, axial cable, fiber optic cable, or the like. The disconnection and reconnection of such wiring from the connectors 72 may be required when removing or installing a side assembly 14. In this way, the connection into the utility lines may not be disturbed when servicing the assembly 10. In exemplary embodiments, the connectors 72 may also act as pass through devices 35.

[0052] **Figure 5** illustrates exemplary flow paths through the assembly 10 of figure 4. **Figure 6** illustrates a top sectional view of an exemplary side assembly 14 to further illustrate said exemplary flow paths. Each side assembly 14 may comprise a cover panel 17 that faces an intended viewer. An electronic display 11 may be located behind, spaced apart from, and substantially parallel to the cover panel 17. Cover panel 17 may be comprised of any substantially transparent or translucent material and may be comprised of multiple layers. The cover panel 17 may be comprised of a toughened material or may comprise optical adhesive placed between the multiple layers such that the cover panel 17 is strengthened against vandalism. The electronic display 11 may be any type of electronic display 11, including but not limited to, a liquid crystal display (LCD), light emitting diode (LED) display, organic LED (OLED) display, plasma display, or the like. The space between the rear surface of the cover panel 17 and the front surface of the electronic display 11 may define a first channel 25. A side assembly housing 15 may surround the electronic display 11 such that the combination of the cover panel 17 and the side assembly housing 15 substantially encloses the electronic display 11. One or more of the side assemblies 14 may further configured to receive touch input. For example, without limitation, the electronic display 11 may comprise a capacitive or resistive touch screen and related components required to operate said touch screen, though any type of touch screen is contemplated.

[0053] A backlight 21 may be located behind and substantially parallel to the electronic display 11. The backlight 21 may be spaced apart from the electronic display 11, though such is not required. A second channel 23 may be located within the side assembly 14 and may be configured to receive ambient air 38. The second channel 23 may permit ambient air 38 to flow substantially vertically through the side assembly 14 from top to bottom, or from the bottom to the top. In exemplary embodiments, the second channel 23 is defined, at least in part, by the space between the rear surface of the backlight 21 and the rear surface of the side assembly housing 15, though any location is contemplated.

[0054] A first and a second side channel 32 may extend along either side of the side assembly 14. The side channels 32 may be configured to receive circulating gas 36. In exemplary embodiments, the side channels 32 are defined, at least in part, by the space between the second channel 23 and the side of the side assembly housing 15, though any location is contemplated.

[0055] One or both sides of the frame 12 may comprise a side gap 13 located between interior and exterior side panels. As such, the assembly 10 may comprise a first and a second side gap 13, where each is located on either side of the frame 12. In other exemplary embodiments, the assembly 10 may comprise only a first side gap 13. Apertures may be located along the interior panels of the side(s) of the frame 12 having the side gap(s) 13 such that circulating gas 36 may be passed from the electronics cavity 12 into and out of the side gap(s) 13. In exemplary embodiments, the circulating gas 36 may flow from the first side gap 13, through the first side channel 32, through the first channel 25, through the second side channel 32, through the second side gap 13, through the electronics cavity 18, and be returned to the first side gap 13, thereby forming a closed loop. In exemplary embodiments where the assembly 10 comprises only the first side gap 13, the circulating gas 36 may pass directly from the electronics cavity 18 into or out of the first or the second side channel 32. Additionally, the circulating gas 36 may be split and travel through first channel 25 located in each respective side assembly 14. Stated another way, the closed loop may pass through each side assembly 14 and return to the cavity 18. It is notable that the side gaps 13 are optional.

[0056] One or more fans 34 may be mounted to said apertures in the interior panels of the side of the frame 12 to force the circulating gas 36 through the closed loop, though it is contemplated that any number of fans 34 may be placed at any number of locations along the path of the circulating gas 36.

[0057] The bottom and top of the frame 12 may similarly comprise interior and exterior panels with an upper gap 41 and a lower gap 40 located therebetween, though such is not required. Apertures may be located along the exterior panels of the bottom and top of the frame 12 such that ambient air 38 may be ingested from outside of the assembly 10 and exhausted from inside of the assembly 10. These apertures may form the exhaust 9 and the intake 16. In exemplary embodiments, ambient air 38 may be ingested from the bottom of the assembly 10 into the lower gap 40. The ambient air 38 may then travel vertically upwards through the second channel 23 in the side assembly 14 and into the upper gap 41. The ambient air 38 may then be exhausted through the intake 16, thus forming an open loop. In the exemplary embodiments, the ambient air 38 may be split and travel through each of the second channels 23 located in each of the respective side assemblies 14.

[0058] One or more fans 34 may be mounted to said apertures in the exterior panels of the bottom of the frame 12 to force the ambient air 38 through the open loop,

though it is contemplated that any number of fans 34 may be located in any number of locations along the path of the ambient air 38.

[0059] In exemplary embodiments where the side assembly 14 is an electronic display, the ambient air 38 flowing through the second channel 23 may be in thermal communication with the backlight 21 so as to absorb heat generated therefrom, though such is not required. In exemplary embodiments where the side assembly 14 is an illuminated poster holder, the ambient air 38 flowing through the second channel 23 may be in thermal communication with the illumination devices so as to absorb heat generated therefrom, though such is not required. In still other exemplary embodiments where the side assembly 14 is a cover, the ambient air 38 may optionally flow through a second channel 23 located in the cover, though such is not required. Regardless, the ambient air 38 flowing through the second channel 23 may be in thermal communication with circulating gas 36 flowing through the closed loop such that the relatively cool ambient air 38 may remove heat from the relatively warm circulating gas 36. The ambient air 38 flowing through the open loop may be in thermal communication with the circulating gas 32 flowing through the closed loop so as to absorb heat therefrom while not allowing the ambient air 38 and the circulating gas 32 to substantially mix. For example, without limitation, the ambient air 28 traveling through the second channel 23 may be in thermal communication with the circulating gas 38 flowing through the cavity 18.

[0060] It is notable that the use of airflow channels, such as but not limited to, the first channel 25, the second channel 23, and the side channels 32 may not be required in embodiments where the side assembly 14 is a poster holder or cover. In such embodiments, the airflow may be directed into the remaining side assembly 14 comprising such airflow channels. If no such side assembly 14 is utilized, the airflow may simply circulate within the cavity 18. In some exemplary embodiments, the poster holder or cover may still utilize some or all of aforementioned the airflow channels. Regardless, the number of fans utilized may be reduced or increased to accommodate the number of airflow channels used.

[0061] **Figure 7** is a front perspective view similar to figure 1 of another exemplary embodiment of the assembly 10 also indicating section lines A-A and B-B.

[0062] **Figure 8** is a front perspective view of the assembly 10 of figure 7 illustrated with both side assemblies 14 in the open position. The plate 19 may be mounted to one of the side assemblies 14. In other exemplary embodiments, the plate 19 may form a part

of the side assembly 14. Many or all of the electronic components 30 may still be shared by the side assemblies 14.

[0063] The shared electronic components 30 may be located on the plate, though such is not required. In exemplary embodiments, the side assemblies 14 of the same type (*e.g.*, electronic displays, poster holders, or covers), including the electronic components 30 located on or in the side assemblies 14, are substantially identical for the front or rear facing side assembly 14 of the same type (*e.g.*, when both side assemblies 14 comprise electronic displays or both side assemblies 14 comprise poster holders) such that the two may be interchanged. In this way, a single type of side assembly 14 to be used to replace any of that type side assembly 14 or may be freely substituted with a different type side assembly 14. For example, without limitation, a separate front and back side assembly 14 need not be stored as spares for a single assembly 10. Instead, a single spare side assembly 14 may be used to replace either the front or back side assembly 14. This may reduce the need to store additional spare side assemblies 14. Stated another way, a side assembly 14 comprising an electronic display may be placed on either the front or the rear of the assembly. Likewise, a side assembly 14 comprising an electronic display may be freely substituted with a side assembly 14 comprising a cover.

[0064] **Figure 9** is a front perspective exploded view of the assembly of figure 8. An electronics plate 42 may be mounted to the frame 12, though such is not required. The electronics plate 42 may be located in an upper portion of the electronics cavity 18, though any location is contemplated. The electronics plate 42 may be mounted so as to extend substantially parallel with the front surface of the side assemblies 14 when the side assemblies 14 are in the closed position. The electronics plate 42 may be configured to receive the electronics components 30 and additional electronic components 44, which may be mounted thereto. In exemplary embodiments, the additional electronic components 44 may comprise customer-specific or customer-installed electronic components or other components for operating the assembly 10. However, any type of electronic components 44 and 30 are contemplated, such as but not limited to, computers, processors, routers, servers, machine to machine communications equipment, wireless connectivity devices, Bluetooth connectivity devices, near field communication devices, cameras, electronic storage devices, memory, and the like. In exemplary embodiments, the electronics plate 42 may comprise a server rack, such as but not limited to, a 1U server rack.

[0065] By placing the side assemblies 14 in the opened position, the electronics cavity 18, the plate 19, the electronics plate 42, the related electronic components 30 and additional electronic components 44 may be serviced. Additionally, the side assemblies 14 themselves may be serviced by removing the display assemblies from the hinging device 22 as previously discussed.

[0066] Various pass through devices 35 may be located in the frame 12 or other walls defining the cavity 18 such that power lines, communication lines, and the like may be passed into the cavity 18 from outside. These pass through devices 35 may be configured to provide a substantially air and water tight seal, though such is not required. In other embodiments, the pass through devices 35 may provide a level of ingress and egress protection. Any number and location of said pass through devices 35 are contemplated. This may help to reduce the number of entry and exit points in the assembly 10 and simplify the cabling. The pass through devices 35 may provide a connection/disconnection point for wiring and cabling. The cavity 18 may provide a substantially sealed, cooled, connected, and/or powered electronics cavity 18 for mounting electronic components, such as but not limited to, the additional electronic components 44 and the electronic components 30.

[0067] Figure 9 illustrates an exemplary assembly 10 where the fans 34 for the ambient air 38 may be located on the top of the frame 12 in the apertures of the upper gap 41.

[0068] **Figure 10** is a top sectional view taken along section line A-A of figure 7 and illustrating exemplary side assemblies 14 in the closed position, where the side assemblies 14 comprise electronic displays. The second channel 23 may comprise a corrugation layer 46 located between the backlight 21 and the electronics cavity 18. The ambient air 38 may pass through the corrugation layer 46. As illustrated in figure 10, the assembly 10 may only comprise the first side gap 13. It is contemplated that the first side gap 13 may be located on either side of the assembly 10 or may not be required at all. It is further contemplated that a corrugation layer 46 may be utilized in side assemblies 14 comprising a poster holder or cover.

[0069] **Figure 11** is a side sectional view taken along section line B-B of figure 7. As illustrated in figure 11, the lower gap 40 is optional. Instead, ambient air 38 may enter via the intake 41 and be ingested directly into the side assemblies 14 where it may travel through the second channel 23 to the upper gap 41 and exit via the exhaust 9. Alternatively, the air may enter via the exhaust 9 and exit via the intake 41.

[0070] **Figure 12A** and **figure 12B** is a rear perspective view of another exemplary assembly 10. Figures 12A-12B illustrates how the side assemblies 14 may be rotated outward along a substantially horizontal axis or a substantially vertical axis. The side assemblies 14 may act as an access panel. In exemplary embodiments where the side assemblies 14 are covers, the side assembly 14 may be comprised of sheet metal or black glass, though any type of material is contemplated. In exemplary embodiments comprising black glass, the black glass may be comprised of one or more transparent or translucent panels wherein one or more of the panels are printed with black ink. In exemplary embodiments, the panels may alternatively or additionally be printed with a logo or other information. The panels may be comprised of a toughened material or may comprise optical adhesive placed between two panels such that the cover is strengthened against vandalism.

[0071] In other exemplary embodiments, where the side assembly 14 comprises a poster holder configured to hold a static poster, the side assembly 14 may comprise a transparent cover located above a plate to define a poster cavity, which may be configured hold the poster therebetween. Illumination devices may be placed within, around, or along the poster cavity to provide backlighting or edge lighting to illuminate the poster.

[0072] In exemplary embodiments, the side assemblies 14 may swing open horizontally (as shown in figure 12A) or vertically (as shown in figure 12B). In exemplary embodiments where the side assembly 14 swings open vertically, aid devices 20 may likewise be used to assist in moving the side assembly 14 between the open and closed positions as well as securing the side assembly 14 in the open and closed positions.

[0073] Although the flow of the ambient air 38 and the circulating gas 36 may be shown and described herein with respect to particular directions and orientations, it is contemplated that the ambient air 38 and the circulating gas 36 may flow in other directions. For example, without limitation, ambient air 38 and circulating gas 36 shown as flowing clockwise may flow counter-clockwise, when shown flowing vertically from top to bottom may flow from bottom to top, when shown flowing horizontally from right to left may flow from left to right, when shown flowing vertically may flow horizontally, when shown flowing horizontally may flow vertically, and the like.

[0074] It is contemplated that the assembly 10, or various components thereof, may be adapted for and/or used with any size side assemblies 14 in any application. For example, but not to serve as a limitation, the assembly 10, or various components thereof, may be adapted for and/or used with a vehicle topper unit such as is illustrated and

described in U.S. Patent Application Serial No.: 15/450,365 filed March 6, 2017, the disclosures of which are hereby incorporated by reference in their entirety.

[0075] **Figure 13** is a front perspective view of another exemplary assembly 100 also indicating Detail A. Figure 13 through figure 18B illustrate and describe an adaptation of the assembly 10 for use with a vehicle topper unit as previously mentioned. Similar features have been similarly numbered but increased by 100 (e.g., assembly 10 and assembly 100). The assembly 100 may comprise a frame 112 which may be rectangular in shape, though any shape is contemplated. The frame 112 may be covered by cladding that forms a housing. The cladding may provide an aesthetically pleasing appearance and may improve aerodynamics. The frame 112 may be adapted to be mounted to the roof of a vehicle, though such is not required. A first and second side assembly 114 may be attached to the frame 112, though any number of side assemblies 114 are contemplated. In exemplary embodiments, the first and second side assemblies 114 are placed back-to-back on either side of the frame 112. The assembly 100 may further comprise a pair of mounting devices 150. In exemplary embodiments, the mounting devices 150 may be located on the underside of the frame 112 and may be feet configured to permit the assembly 100 to be mounted to the roof of a vehicle, though any type of mounting device 150 is contemplated.

[0076] A fan 134 may be located on an aperture in the frame 112 and may be configured to permit the ingestion of ambient air 138. Once ingested, the ambient air 138 may travel horizontally through channels in the side assemblies 114 and exit through apertures on the other end of the frame 112. This may form an open loop. It is contemplated that the fan 134 may be located at any location along the path of the ambient air 138.

[0077] **Figure 14** is a front perspective view of the assembly 100 of figure 13 illustrated with one of the side assemblies 114 in the open position. The side assemblies 114 may be hingedly mounted to the frame 112 by way of a hinging device 122. The hinging device 122 may permit the side assemblies 114 to be moved between a closed position, wherein the respective side assembly 114 rests against or is located in close proximity with the frame 112 and/or where the front surface of the respective side assembly 114 is substantially perpendicular to the ground, and an open position wherein the respective side assembly 114 is rotated outwardly from the frame 112 and/or at least one edge of the side assembly 114 is moved away from the frame 112. A gasket 128 may extend around the perimeter of the surfaces of the frame 112 which contact the side

assemblies 114. The gaskets 128 may be configured to provide a substantially air tight seal in the electronics cavity 118 when the side assemblies 114 are located in the closed position.

[0078] An electronics cavity 118 may be located between the rear surfaces of the side assemblies 114. The electronics cavity 118 may comprise a plate 142 that is configured to receive a number of electronic components 130 or additional electronic components 144 which may be mounted thereto. In exemplary embodiments, the plate 142 may be mounted to the frame 112. In other exemplary embodiments, the plate 142 may be mounted to, or form a part of, one of the side assemblies 114. Various pass through devices 135 may be located in the walls defining the cavity 118 such that power lines, communication lines, and the like may be passed into the cavity 118 from outside. The pass through devices 135 may be configured to provide a substantially air and water tight seal or otherwise provide ingress and egress protection. This may help to reduce the number of pass through points in the assembly 100 and simplify the cabling. Additionally, the pass through devices 135 may provide a single or limited number of connection or disconnection points for removing the wiring for servicing the side assemblies 114. In exemplary embodiments, the electronics cavity 118 may provide a cooled, powered, connected, and/or sealed area for electronic components, such as but not limited to, the electronic components 130 and the additional electronic components 144.

[0079] When either or both the of side assemblies 114 are placed in the open position, the electronics cavity 118 may be exposed. This may allow access to the electronics cavity 118, the plate 142, and the electronic components 130 such that personnel may service the electronic components 130 located therein. In exemplary embodiments, the side assemblies 114 may be selectively locked to the frame 112 such that the respective side assembly 114 cannot normally be moved from the closed position unless unlocked. This may assist in restricting access to the electronics cavity 118 to authorized personnel.

[0080] The frame 112 may comprise interior and exterior surfaces. In exemplary embodiments, a lower gap 140 may be located in the space between the interior and exterior surfaces of the frame 112 along a lower portion thereof. Stated another way, the lower gap 140 may be located between the bottom of the electronics cavity 118 and the bottom of the frame 112.

[0081] **Figure 15** is a rear perspective view of the assembly 100 of figure 13 is illustrated with both of the side assemblies 114 in the open position and also indicating Detail B. A first and second strut 152 may extend between the frame 112 and each of the respective side assemblies 114. In other exemplary embodiments, a pair of struts 152 may be used for each respective side assembly 114. The strut 152 may be configured to temporarily secure the respective side assembly 114 in the opened position, although it is contemplated that the strut 152 may be configured to also temporarily secure the respective side assembly 114 in the closed position. Alternatively, any of the aid devices 20 may be utilized in conjunction with or in substitution of the struts 152.

[0082] In exemplary embodiments, the struts 152 may be mounted to each of the respective side assemblies 114 in a rotatable fashion. The struts 152 may be mounted in a rotatable fashion by way of a pin, bearing, hinge, fastener, or the like, though any device or mounting configuration is contemplated. Regardless, the struts 152 may be configured to be temporarily secured to each of the respective side assemblies 114 such that the respective side assembly 114 is propped or otherwise held in the open position. While the struts 152 are discussed as being mounted to each of the respective side assemblies 114 and temporarily secured to the frame 112, it is contemplated that the struts 152 may instead be mounted to frame 112 and temporarily secured to each of the respective side assemblies 114.

[0083] **Figure 16** is a front perspective view of the assembly 100 of figure 14 illustrated with one of the side assemblies 114 removed. Circulating gas 136 may travel vertically through the electronics cavity 118 where it is separated and passes through each respective side assembly 114. In exemplary embodiments, the circulating gas 136 flows through a channel between a cover glass and an electronic display in each of the respective side assemblies 114. The circulating gas 136 may then travel through the lower gap 140 and be returned to the electronics cavity 118 via apertures in the interior surfaces of the frame 112, thereby forming a closed loop. In exemplary embodiments, these apertures in the frame 112 may have fans 134 mounted thereto to move the circulating gas 136 through the closed loop, though it is contemplated that the fans 134 may be located anywhere along the path of the circulating gas 136.

[0084] U.S. Patent Application Serial No.: 15/450,365 filed March 6, 2017, the disclosures of which are hereby incorporated by reference in their entirety, describes an exemplary thermal management system for the assembly 100 including, but not limited to, open and closed loop pathways for ambient air and circulating gas.

[0085] It is contemplated that either or both of the side assemblies 114 may comprise an electronics display, a poster holder, or a cover. It is further contemplated that some or all of the electronic components 130 used to operate the side assemblies 114 may be located on the plate 142. It is also contemplated that the side assemblies 114 of the same type (*e.g.*, comprising an electronic display, poster holder, or cover) may be substantially identical, such that the side assemblies 114 located on the left or right side of the assembly 100 may be freely substituted.

[0086] **Figure 17** is a detailed top perspective view of Detail A of figure 13. The hinging device 122 may comprise a first and second display hinge plate 156, a first frame hinge plate 154, and a second frame hinge plate 158. Each of the first and second display hinge plates 156 may be substantially “L” shaped and may be configured to extend between a rear surface of the respective side assemblies 114 and the first frame hinge plate 154. The first frame hinge plate 154 may be mounted to either end of the frame 112. Optionally, a second frame hinge plate 158 may be located on the other side of the first and second display hinge plates 156 such that the first and second display hinge plates 156 are sandwiched between the first frame hinge plate 154 and the second frame hinge plate 158. It is contemplated that the second display hinge plate 156 may not be required, but may be used to provide added strength and stability. Additionally, the second hinge plate 158 may be configured to extend behind a portion of the side assemblies 114 so as to serve as a backstop.

[0087] A first fastener 127 may extend through the first frame hinge plate 154, the first display hinge plate 156, and the second frame hinge plate 158. Likewise, a second fastener 127 may extend through the first frame hinge plate 154, the second display hinge plate 156, and the second frame hinge plate 158. The fastener 127 may be a pin or another device permitting rotational movement of the first and second display hinge plates 156. In exemplary embodiments, the second frame hinge plate 158 may be selectively secured to the respective side assembly 114 such that the respective side assembly 114 may be temporarily secured in the closed position. The frame hinge plate 156, the display hinge plate 154, and the fasteners 127 may be configured to bear all or substantially all of the weight of the respective side assembly 114.

[0088] The design of the hinge device 122 may provide for easy removal of one or both of the side assemblies 114 when servicing the assembly 100. The fasteners 127 may be removed from either side of the respective side assembly 114 and the entire side assembly 114 may be removed. Additionally, the disconnection of wiring, along with

other steps, may be required. A replacement side assembly 114 may then be installed. Additionally, the connection of wiring, along with other steps, may be required. The side assembly 114 being serviced may then be returned to a service center for servicing. This may minimize downtime of the assembly 100.

[0089] **Figure 18A** is a detailed perspective view of Detail B of figure 15 also illustrating the otherwise hidden strut 152. **Figure 18B** is a top perspective view of the assembly 100 of figure 18A illustrated with the side assembly 114 in the open position. As can be seen, the strut 152 may be moved between a supporting and a stored position. The strut 152 may be rotated into the stored position such that the strut 152 is substantially aligned with the side assembly 114 when the side assembly 114 is in the closed position. In this way, the strut 152 is no longer bearing the weight of the side assembly 114 and may be stored within the respective side assembly 114 when the strut 152 is not being used to keep the side assembly 114 in the open position. The strut 152 may be rotated into the supporting position where the strut 152 is secured at an angle to the frame 112 such that the side assembly 114 may be propped or otherwise held in the open position. In exemplary embodiments, the strut 152 may comprise a notch 153 configured to be temporarily secured to a corresponding bracket or groove located on the frame 112 such that the strut 152 bears some or all of the weight of the side assembly 114 so as to prop or hold the respective side assembly 114 in the open position.

[0090] **Figure 19A** through **figure 20** illustrates another exemplary embodiment of the assembly 210. Similar features have been similarly numbered but increased by 100 (e.g., assembly 10 and 110 now assembly 210). The assembly 210 may comprise a second open loop channel 262 for ambient air. The second open loop channel 262 may be located in one or more of the side assemblies 214. In exemplary embodiments, the second open loop channel 262 is located in the side assembly or assemblies 214 comprising a cover or a poster holder, though it is contemplated that the second open loop channel 262 may be located in any side assembly 214, including those comprising digital displays. The second open loop channel 262 may be located behind an open loop channel cover 264. An open loop channel plate 266 may be located behind said open loop channel cover 264. In exemplary embodiments, the open loop channel plate 266 is spaced apart from, and located substantially parallel to, the open loop channel cover 264. The open loop channel cover 264 may have substantially the same surface area as the open loop channel plate 266, though such is not required. In exemplary embodiments, the open loop channel cover 264 may be the outermost surface of the respective side of

the assembly 210 and/or of the respective side assembly 214 such as is illustrated in figure 19B. However, in other exemplary embodiments, an outer cover 268 may be located above the open loop channel cover 264, such as is illustrated in figure 19A. In such embodiments, the outer cover 268 may be positioned substantially parallel with, spaced apart from, and cover the entirety of the open loop channel cover 264, though such is not required.

[0091] Regardless, the second open loop channel 262 may be defined by the space between the open loop channel cover 264 and the open loop channel plate 266. The second open loop channel 262 may further comprise one or more side panels 270 configured to extend between the open loop channel cover 264 and the open loop channel plate 266 to further define the second open loop channel 262.

[0092] Any number of electronic components or equipment 244 or 230 may be located in or near the second open loop channel 262, such as but not limited to, being mounted to the open loop channel cover 264 or the open loop channel plate 266. Such electronic components or equipment 244 or 230 may include a power supply or module, though any electronic component or equipment is contemplated. The second open loop channel 262 may be configured to transfer heat from the side assemblies 214, the electronic components or equipment 244 or 230, other components of the assembly 210 to the ambient air passing through the second open loop channel 262. The second open loop channel 262 may comprise surface features, materials, or components configured to facilitate the transfer of heat, though such is not required. These may include, without limitation, fins, thermally conductive materials, heat exchangers, or the like. In exemplary embodiments, the open loop channel 262 may comprise a corrugated layer 246. It is contemplated that any number of fans 234 may be placed at any location near or along the second open loop channel 262 to force or encourage the flow of ambient air through the second open loop channel 262.

[0093] In exemplary embodiments, the ambient air 238 may enter the assembly 210 at or near the top of the assembly 210 or the respective side assembly 214. Similarly, in exemplary embodiments, the ambient air 238 may be exhausted at or near the bottom of the assembly 210 or the respective side assembly 214 such that the ambient air 238 flows vertically downwards through the second open loop channel 262. In other exemplary embodiments, the ambient air 238 may enter the assembly 210 or the respective side assembly 214 at or near the bottom of the assembly 210 or the respective side assembly 214 and ambient air 238 may exhaust the assembly 210 at or near the top

of the assembly 210 or the respective side assembly 214 such that ambient air flows vertically upwards through the second open loop channel 262. The second open loop channel 262 may share the intake 241 and the exhaust 209 such that ambient air enters via the common intake 241 and is separated into flow paths which travel into the two side assemblies 214. In other exemplary embodiments, the second open loop channel 262 may have a separate intake and exhaust.

[0094] The oppositely facing side assembly 214 may comprise an electronic display 211 located in front of a backlight 221. Circulating gas 236 may pass through the first channel 225 defined by the space between the electronic display 211 and a cover panel 217. The circulating gas 236 may pass into a cavity 218 located between the side assemblies 214. The cavity 218 may contain one or more fans 234 for moving the circulating gas through the closed loop pathway. The cavity 218 may also comprise electronic components 230 or 244 and an electronics plate 242 for mounting the same. The cavity 218 may comprise one or more heat transfer devices 282, though such is not required. In such embodiments, ambient air 238 may also be passed through the heat transfer device 282, though such is not required.

[0095] The side assembly 214 embodiment illustrated and described in figure 19A through figure 20 may be the same as, or contain the features illustrated or described with respect to, other side assemblies 14 and 114 embodiments illustrated or described herein, though such is not required. Any of the illustrated or described embodiments, or features thereof, may be utilized with any of the other embodiments illustrated or described herein.

[0096] In exemplary embodiments, the assembly 210 may be mounted in an elevated position at a downward angle. In exemplary embodiments, the assembly 210 may be mounted to a sign, pole, street lamp, street fixture, sidewalk fixture, building, structure, ground, or the like, though mounting to any surface is contemplated. The assembly 210 may be positioned at a downward angle, such that the side assembly 214 facing the ground may be viewed by those traveling underneath. The downward angle may be substantially 50 degrees, though any angle is contemplated.

[0097] In such embodiments, the second open loop channel 262 may be placed on the side assembly 214 which would normally receive the greatest solar load. For example, without limitation, the second open loop channel 262 may be placed on the side assembly 214 which would normally face upwards when mounted, though it is contemplated that the second open loop channel 262 may be located in either or both of the side assemblies 214. Such an embodiment may be used in conjunction with, but is not limited to, the

exemplary assemblies 210 mounted in an elevated position at a downward angle, because the solar loading may primarily be experienced on the upward facing side assembly 214. In this way, the second open loop channel 262 may be configured to remove some or all of the solar loading experienced on the upward facing side assembly 214. In such embodiments, the upward facing side assembly 214 may comprise the second open loop channel 262 and a cover and the downward facing side assembly 214 may comprise an electronic display or static backlit poster, though any combination of side assemblies 214 is contemplated.

[0098] Any embodiment of the present invention may include any of the optional or preferred features of the other embodiments of the present invention. The exemplary embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The exemplary embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described exemplary embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS**WHAT IS CLAIMED IS:**

1. A field serviceable assembly for displaying images comprising:
 - a frame;
 - a first and second side assembly, each having a rear surface and hingedly mounted to the frame in a back to back arrangement, wherein at least one of the side assemblies comprises:
 - a cover panel,
 - an electronic display located behind the cover panel,
 - a backlight located behind the electronics display,
 - a first channel configured to receive circulating gas, and
 - a second channel configured to receive ambient air;
 - a cavity located in the space between the rear surfaces of the first and second side assemblies and the frame;
 - an electronics plate positioned within the cavity and configured to receive a plurality of electronic components;
 - a closed loop pathway comprising said cavity and said first channel; and
 - an open loop pathway comprising said second channel.
2. The field serviceable assembly of claim 1 further comprising:
 - a first and second frame hinge plate located on the frame; and
 - a first and second display hinge plate located on each of the first and second side assemblies;wherein the first and second frame hinge plates are configured to interact with the first and second display hinge plates so as to permit the first and second side assemblies to rotate outward.
3. The field serviceable assembly of claim 2 further comprising:
 - a plurality of fasteners; and
 - a plurality of apertures or notches located in the first and second frame hinge plates and the first and second display hinge plates, wherein the apertures or notches are so located such that a single fastener may be extended through the first or second frame hinge plate and into the first or second display hinge plate so as to mount the respective side assembly to the frame.
4. The field serviceable assembly of claim 3 wherein:
 - the plurality of fasteners are pins; and

- the pins are configured to bear substantially the entire weight of the display assembly for which the pins are used.
5. The field serviceable assembly of claim 1 wherein:
the first channel is located between the cover panel and the electronic display.
 6. The field serviceable assembly of claim 5 wherein:
the second channel is located behind the backlight.
 7. The field serviceable assembly of claim 1 wherein:
the frame is configured to be mounted to the ground.
 8. The field serviceable assembly of claim 1 wherein:
the frame is configured to be mounted to the roof of vehicle.
 9. The field serviceable assembly of claim 1 further comprising:
a connector configured to be placed in electrical connection with an external power source and a communications network.
 10. The field serviceable assembly of any of claims 1-9 wherein:
each of the first and second side assemblies comprises:
a cover panel,
an electronic display located behind the cover panel,
a backlight located behind the electronics display,
a first channel configured to receive circulating gas, and
a second channel configured to receive ambient air.
 11. The field serviceable assembly of claim 1 wherein:
at least one of the side assemblies is configured to accommodate a static poster.
 12. The field serviceable assembly of claim 1 wherein:
at least one of the side assemblies comprises a cover comprised of sheet metal or black glass.
 13. The field serviceable assembly of claim 1 wherein:
the first and second side assemblies are configured to be rotated between an open position and a closed position by way of a first and second aid device configured to assist in moving the first and second side assemblies, respectively, between the open and the closed positions; and
the cavity is configured to remain substantially air tight while the first and second side assemblies are located in the closed position.
 14. The field serviceable assembly of claim 1 wherein:
said electronics plate comprises a server rack.

15. The field serviceable assembly of claim 1 further comprising:
one or more pass through devices located on the frame and configured to permit cabling to pass into the cavity.
16. A field serviceable assembly for displaying images comprising:
a frame which is substantially rectangular in shape and comprises a first and second frame hinge plate;
a first and second side assembly mounted to the frame in a back to back arrangement, wherein each of the first and second side assemblies comprises:
an electronic display,
a backlight located behind the electronic display,
a first channel configured to receive circulating gas,
a first and second display hinge plate, and
a second channel configured to receive ambient air,
a cavity located in the space between the first and second side assemblies and the frame, wherein said cavity is configured to receive the circulating gas;
an electronics plate positioned within the cavity between, spaced apart from, and substantially parallel to the rear surfaces of the side assemblies, wherein said electronics plate is configured to receive a plurality of electronic components;
wherein said first and second frame hinge plates are hingedly mounted to said first and second display hinge plates such that the first and second electronic side assemblies are capable of being rotated outwardly;
wherein the electronics plate is configured to remain fixed when the first and second side assemblies are rotated.
17. The field serviceable assembly of claim 16 wherein:
said electronics plate comprises a 1U server rack.
18. The field serviceable assembly of claim 16 wherein:
the first and second frame hinge plates are located on opposing sides of said frame; and
the first and second display hinge plates are located along an upper edge of said side assemblies such that said side assemblies are configured to rotate about a substantially horizontal axis.

19. The field serviceable assembly of any of claims 16-18 wherein:
the first and second frame hinge plates are located on the same side of said frame;
and
the first and second display hinge plates are located along the same side of said side assemblies such that said side assemblies are configured to rotate about a substantially vertical axis.
20. A field serviceable assembly for displaying images comprising:
a frame having a substantially rectangular shape and comprising a first and second frame hinge plate located on opposing sides of said frame;
a first and second side assembly hingedly mounted to the frame in a back to back arrangement such that each of the first and second side assemblies may be rotated outwardly along a substantially horizontal axis, wherein each of said first and second side assemblies comprises:
a transparent layer,
an electronic display located behind the transparent layer,
a backlight located behind the electronic display,
a corrugation layer located between the backlight and the rear surface of the side assembly, wherein the corrugation layer is configured to receive ambient air, and
a channel located between the transparent layer and the electronic display, wherein the first channel is configured to receive circulating gas,
a cavity defined by the space between the rear surfaces of the first and second side assemblies and the frame;
a server rack positioned within the cavity configured to receive a plurality of electronic components, wherein said server rack is configured to remain stationary when said first and second side assemblies are rotated;
a substantially sealed closed loop pathway comprising said cavity and said channel; and
an open loop pathway comprising said corrugation layer.

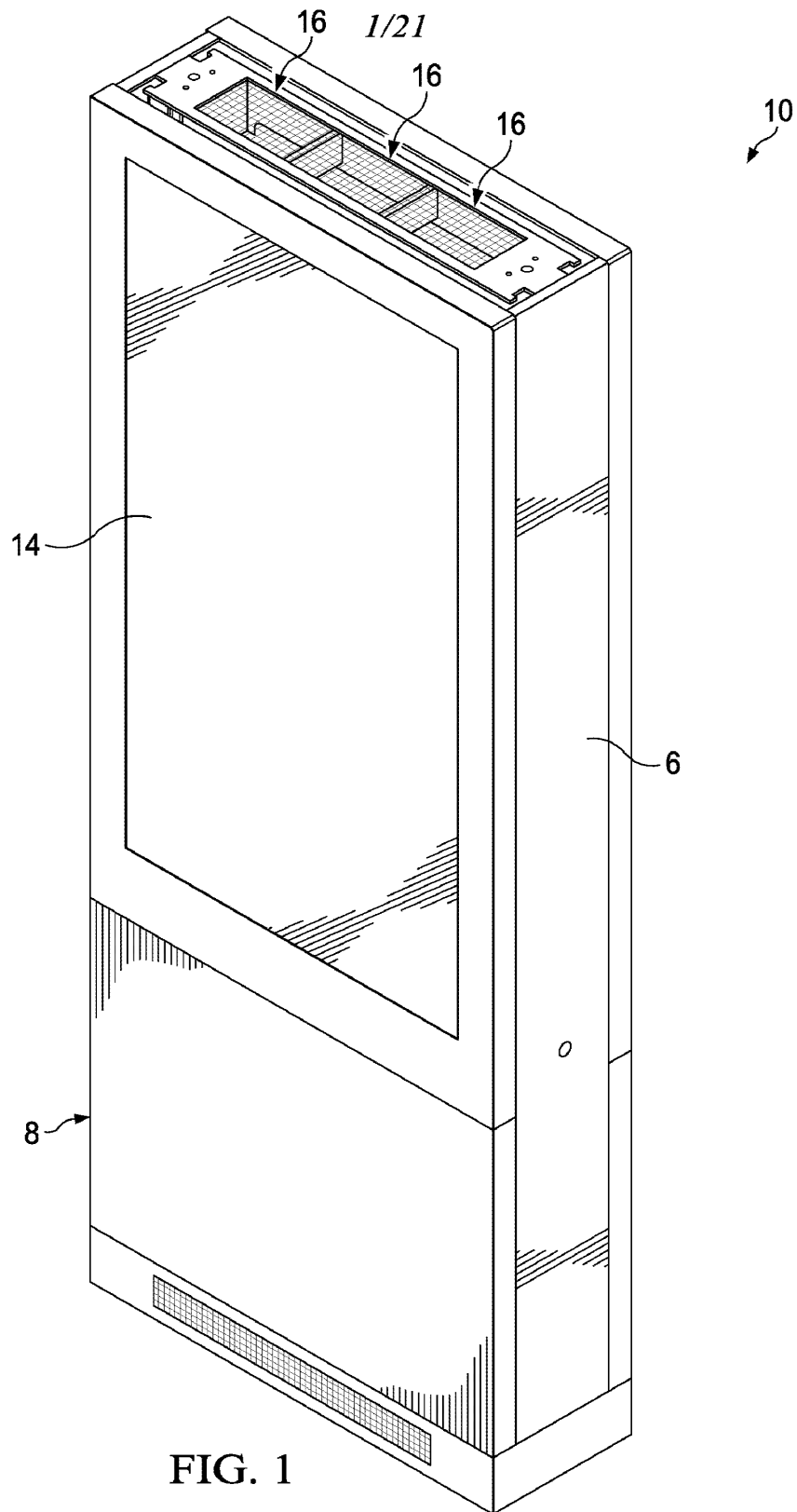
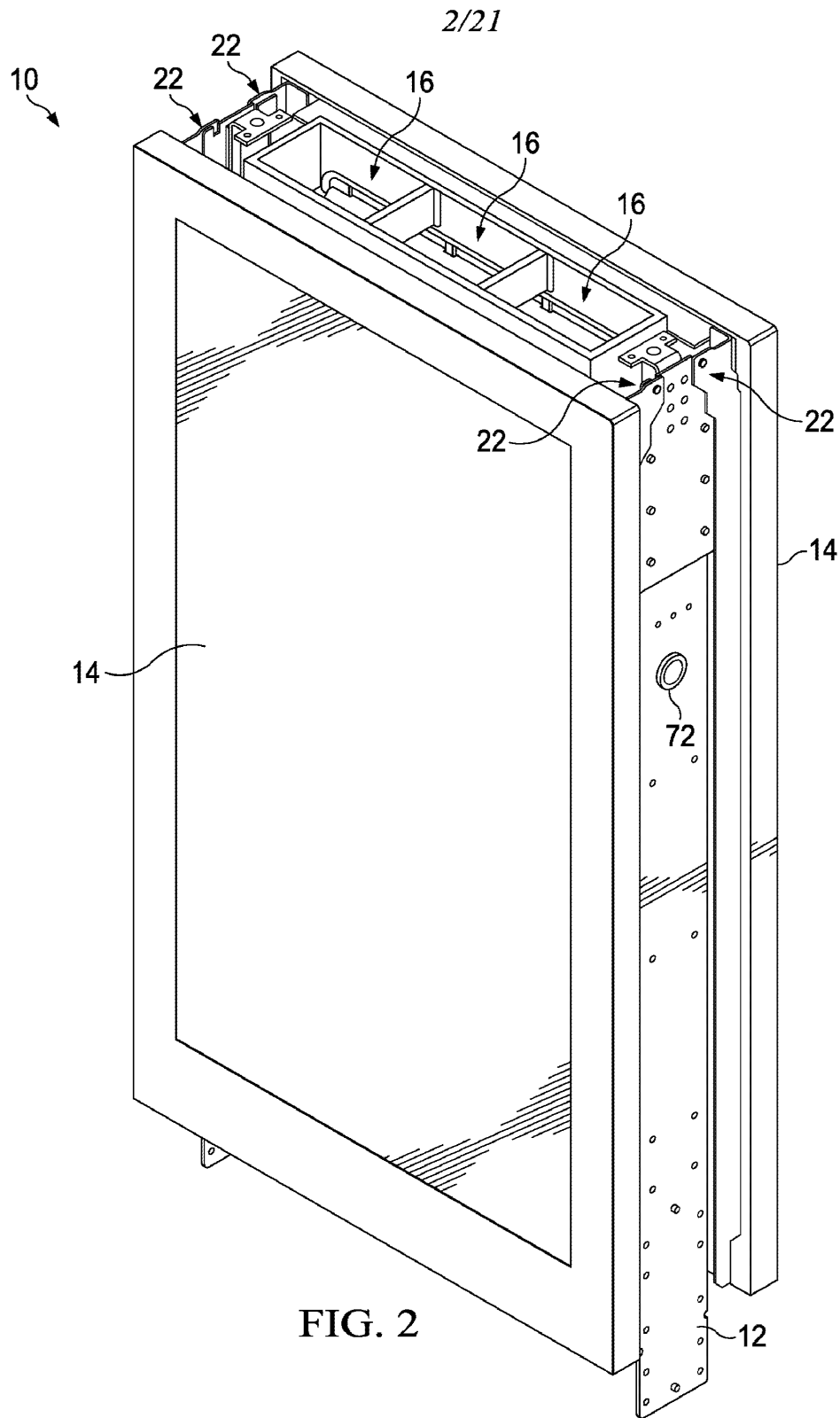


FIG. 1

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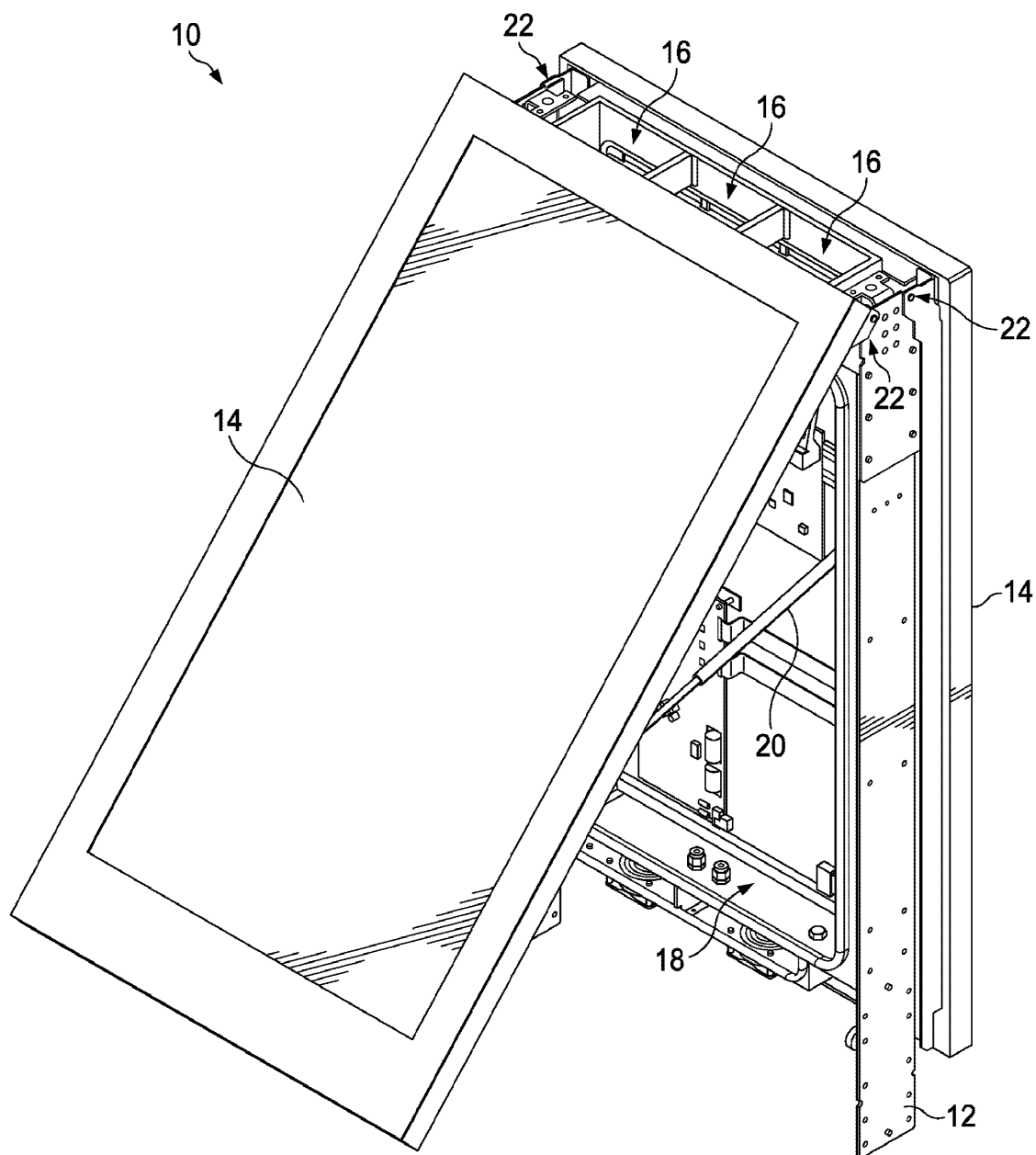
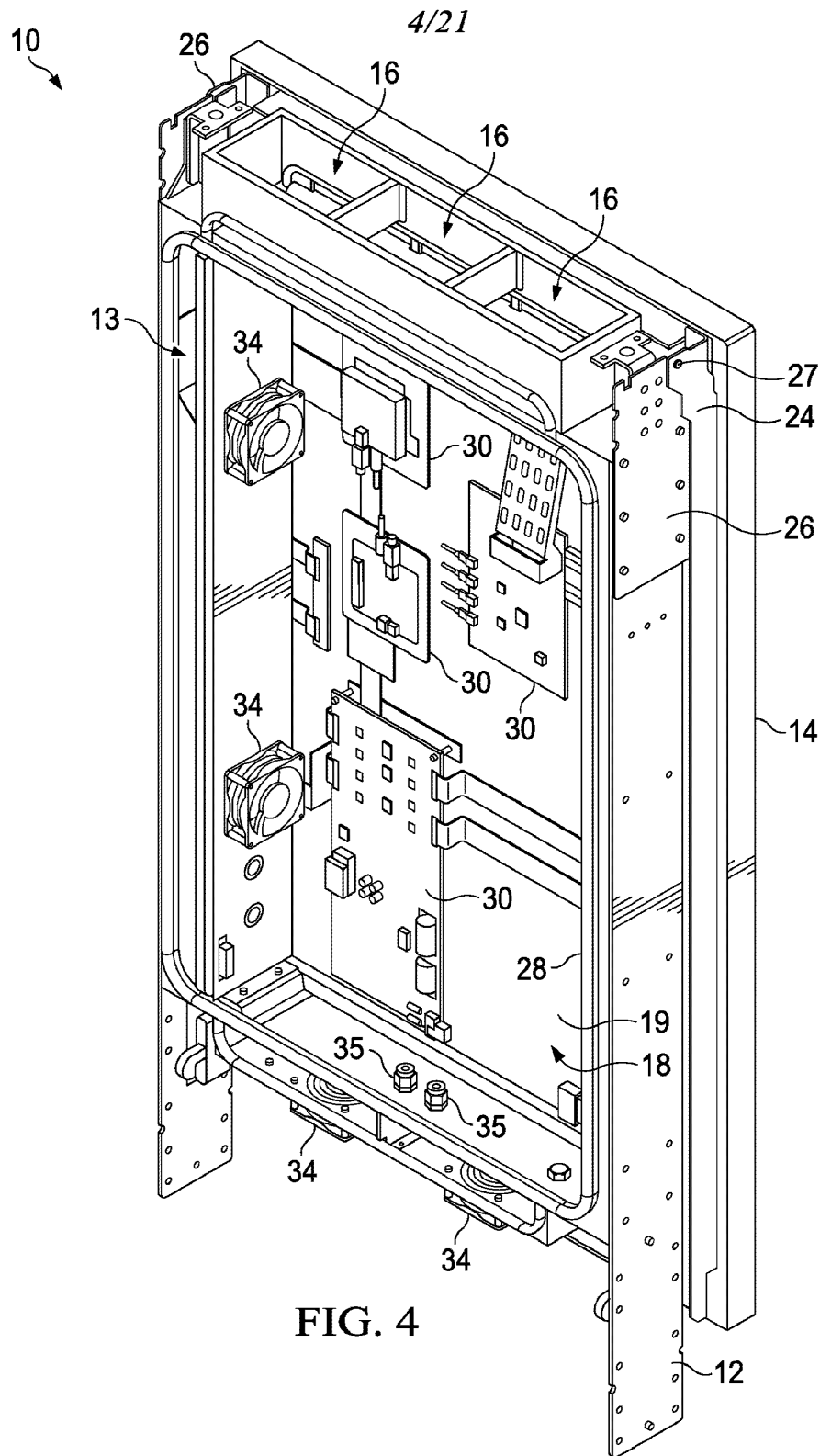
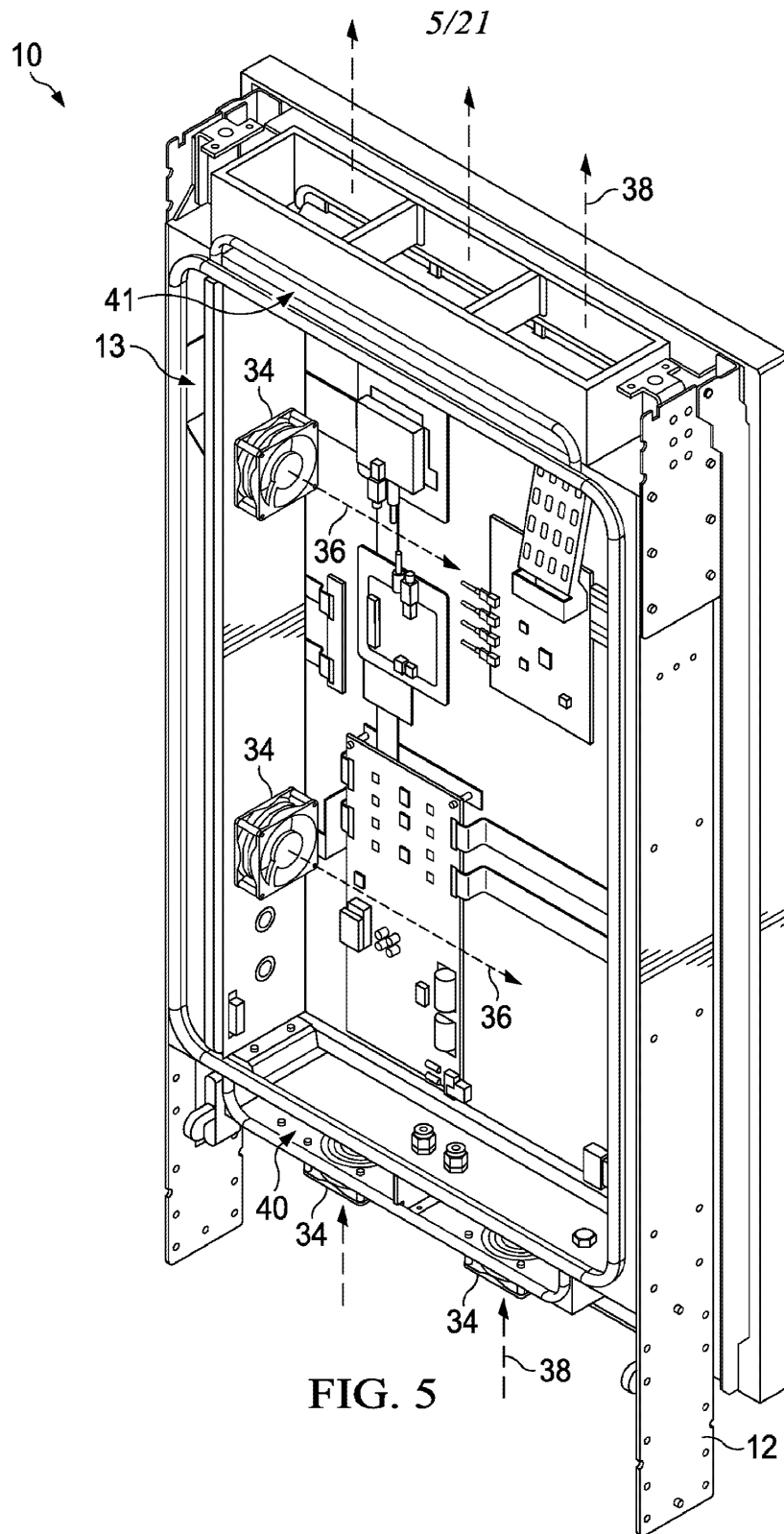


FIG. 3

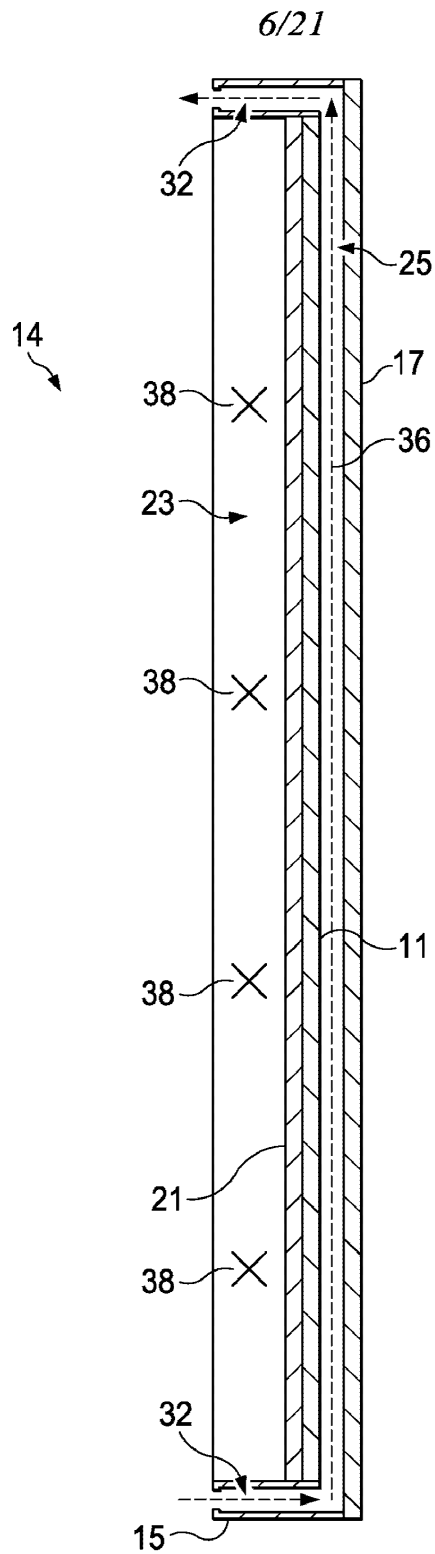
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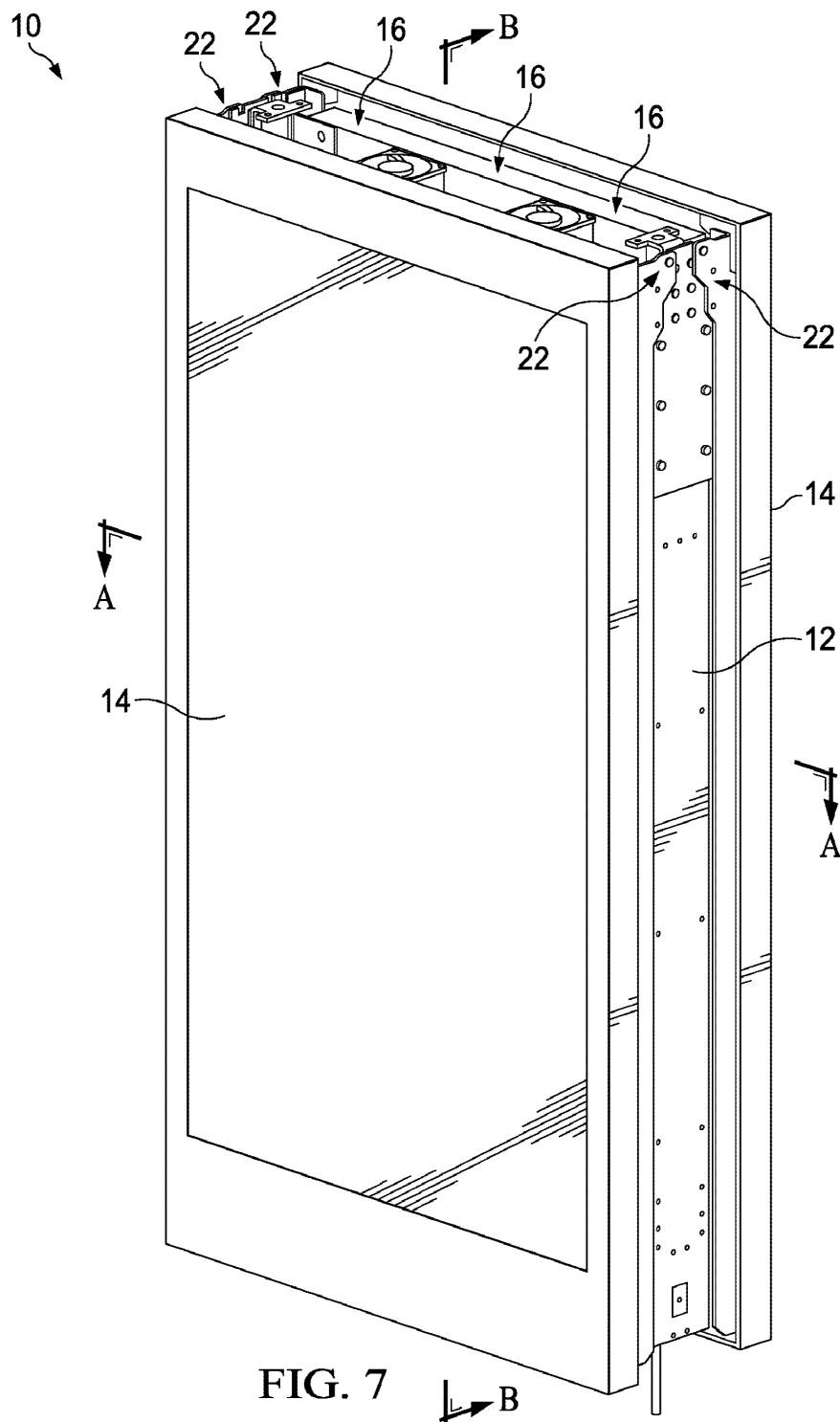


FIG. 7

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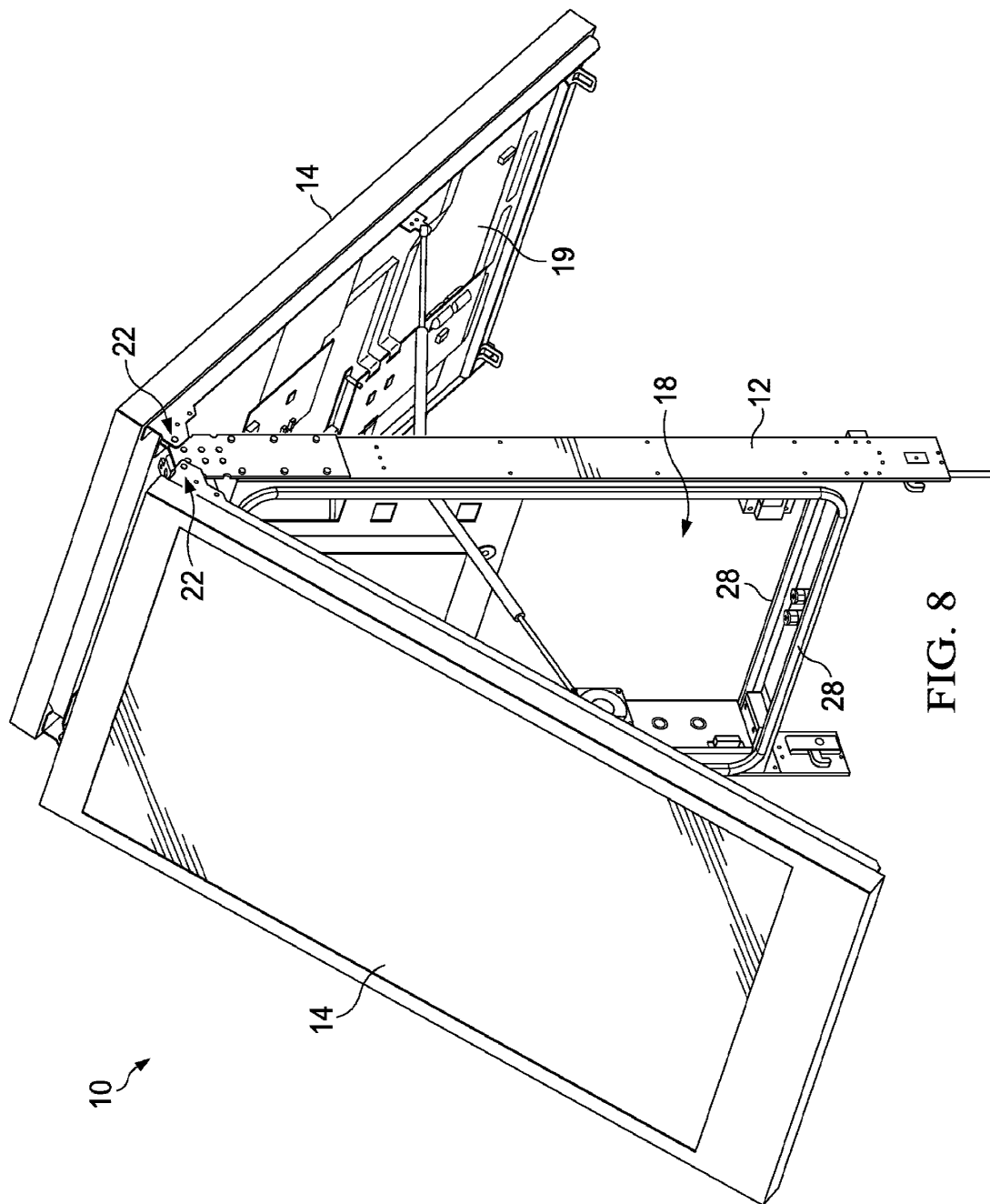
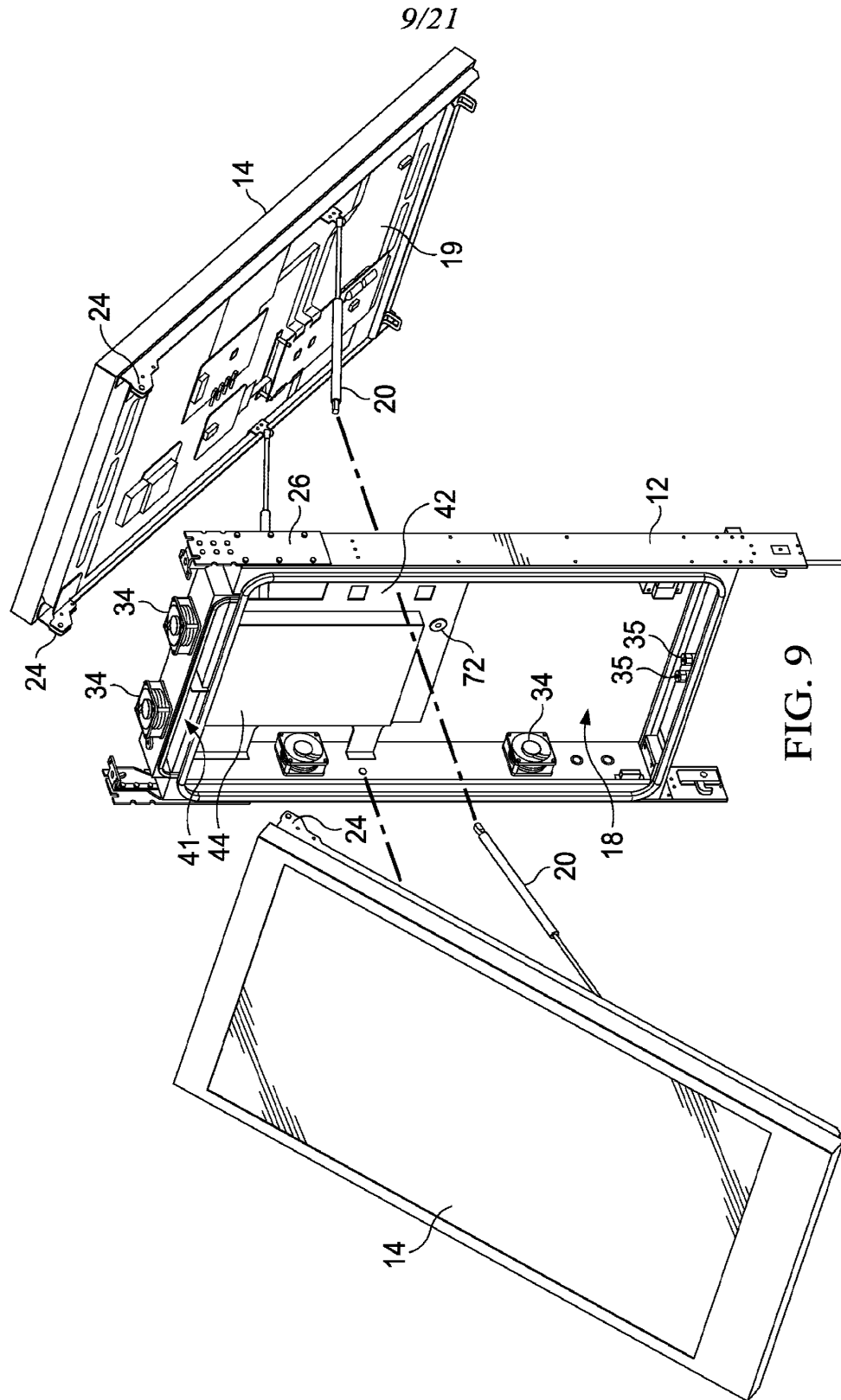
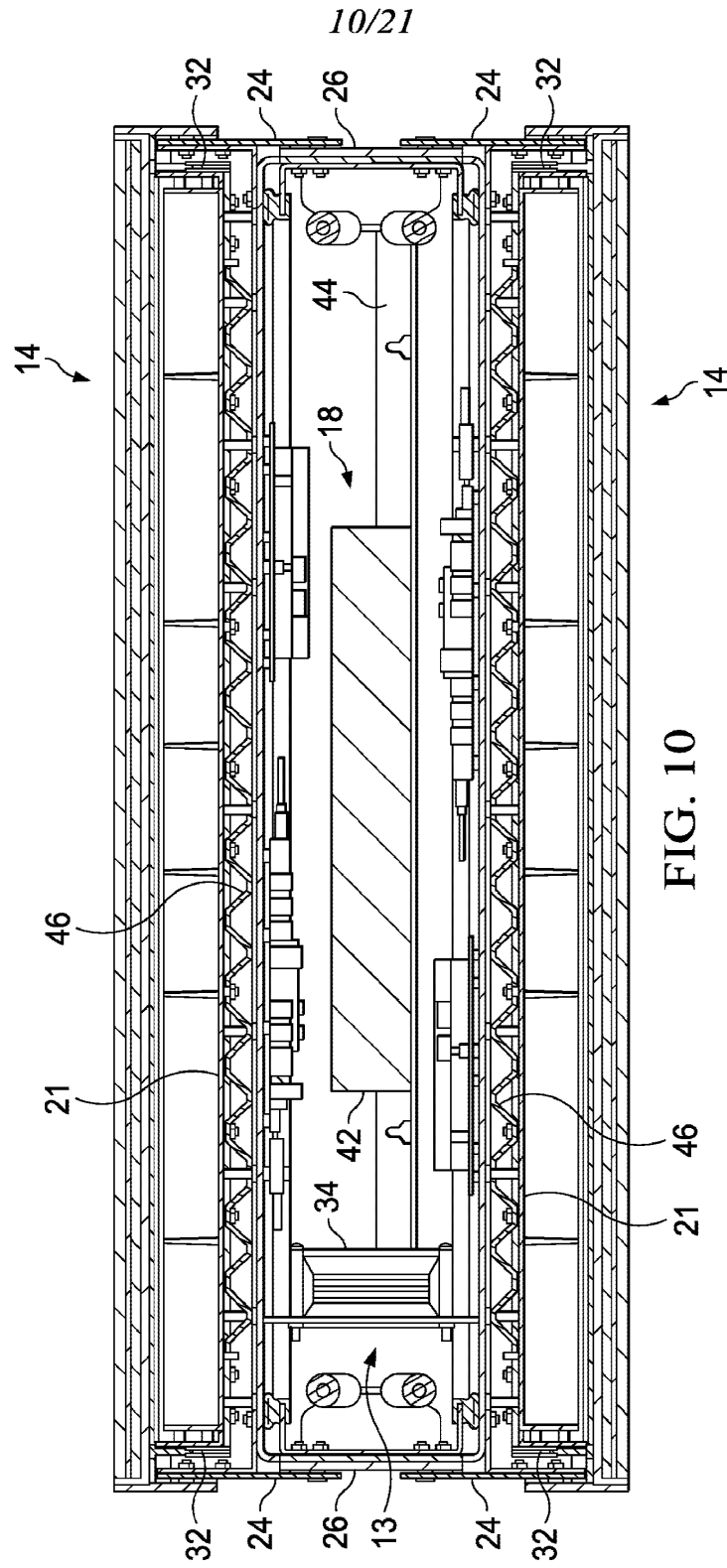


FIG. 8

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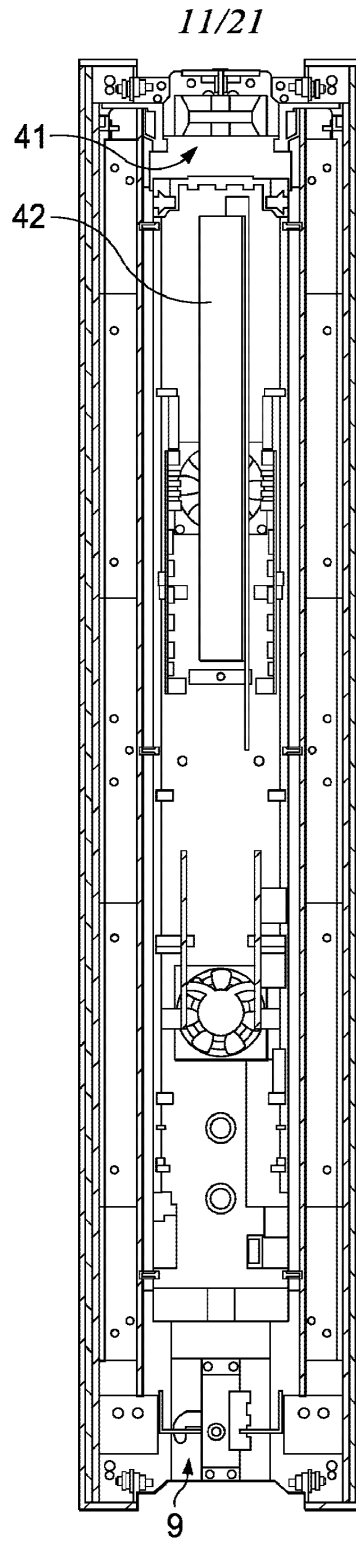


FIG. 11

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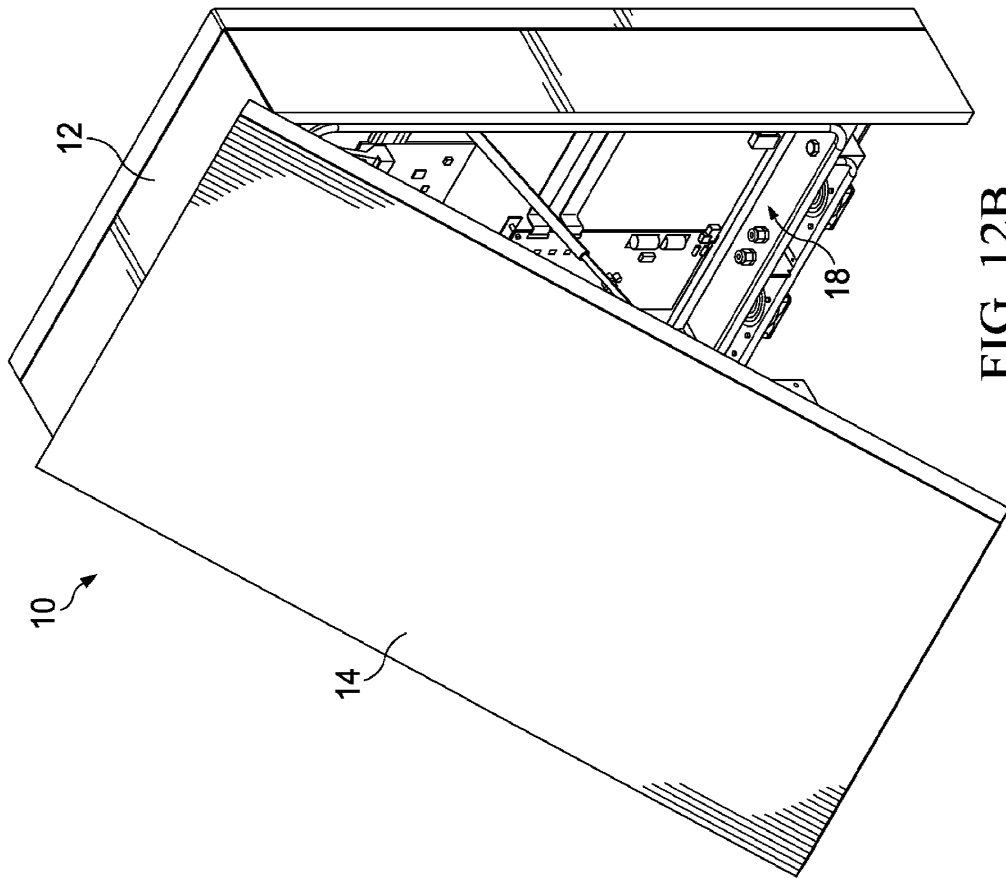


FIG. 12B

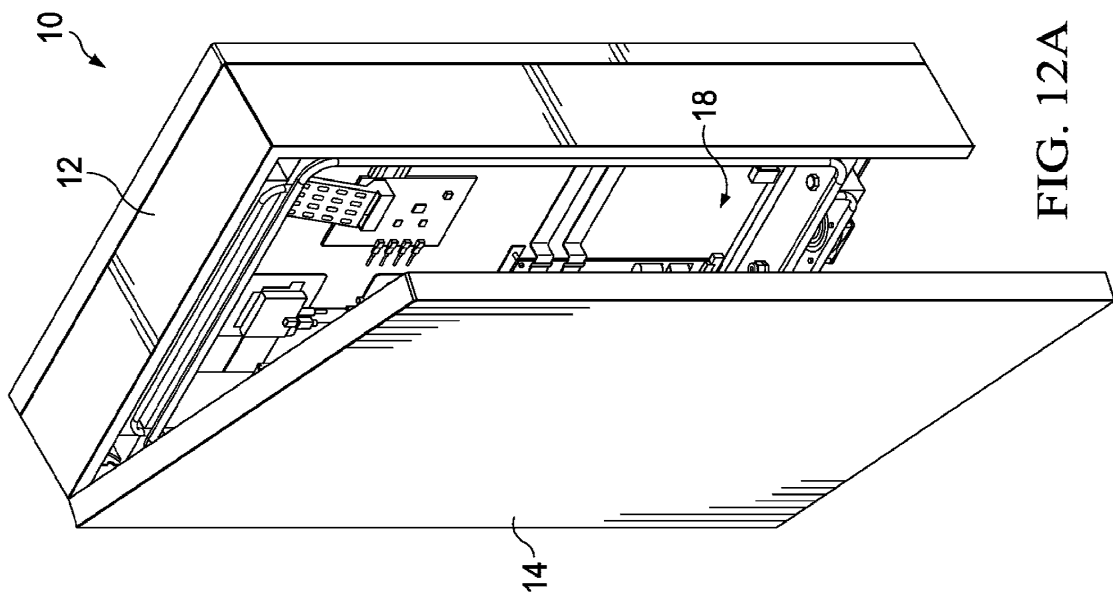
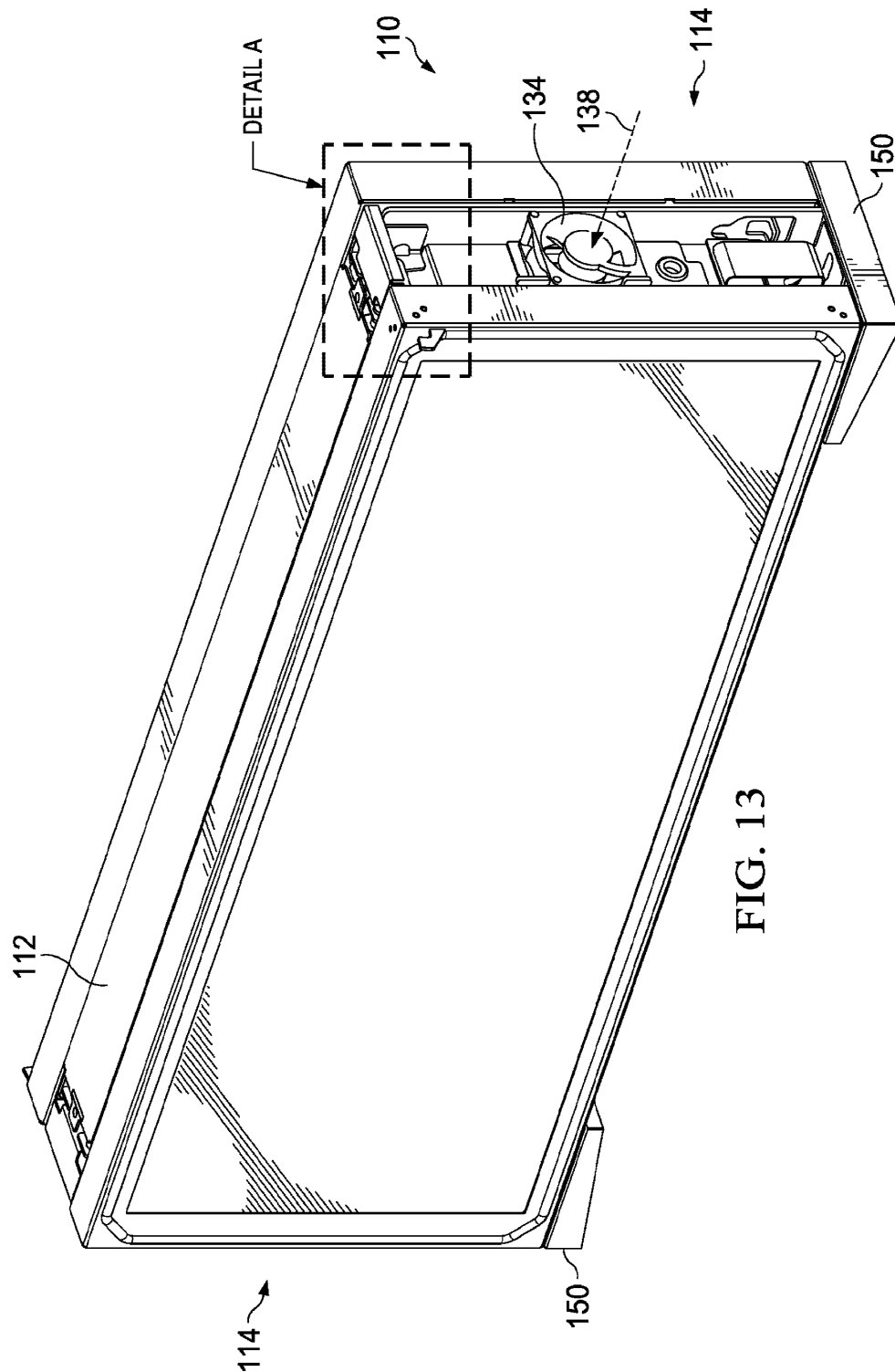


FIG. 12A

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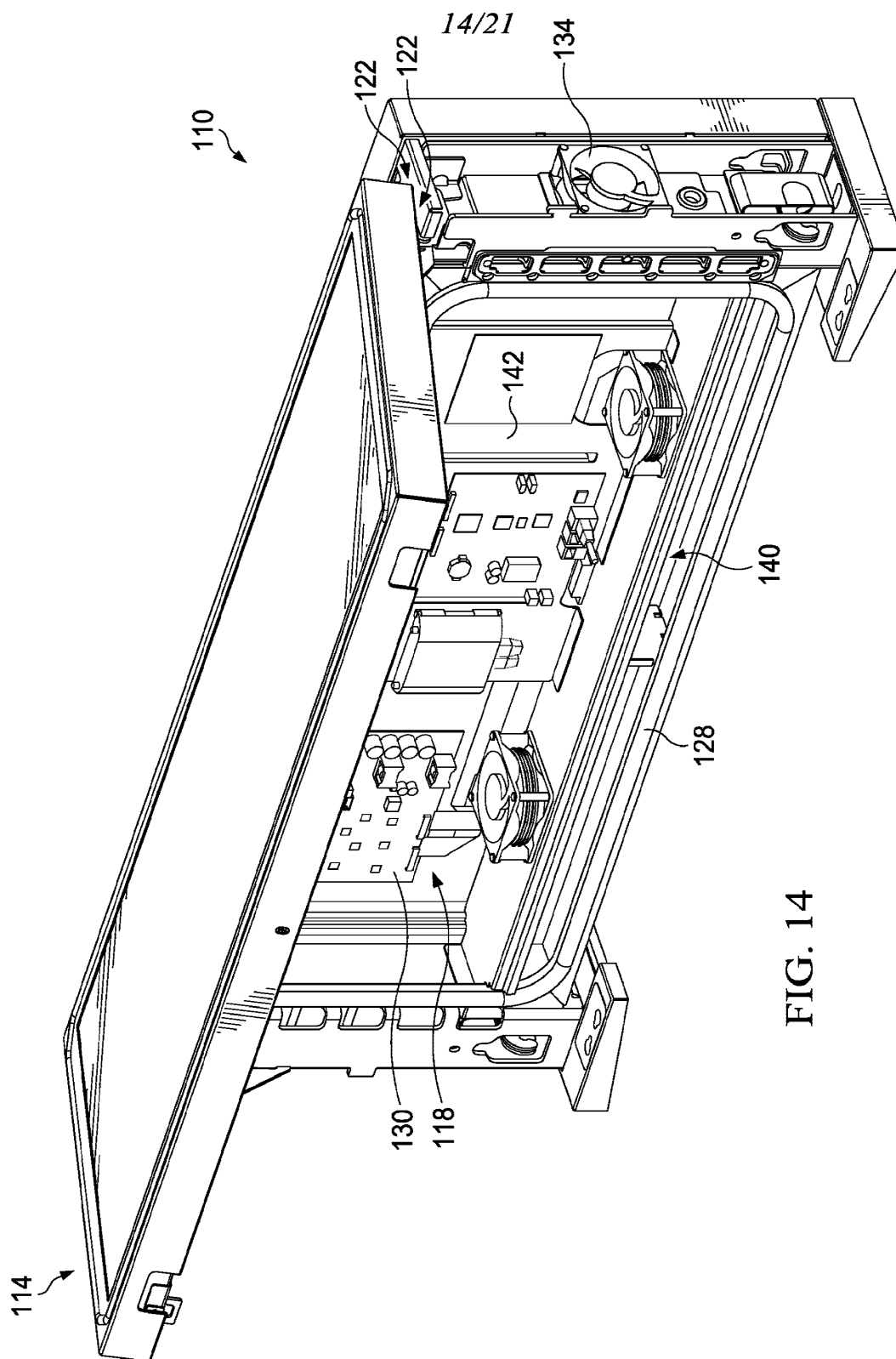
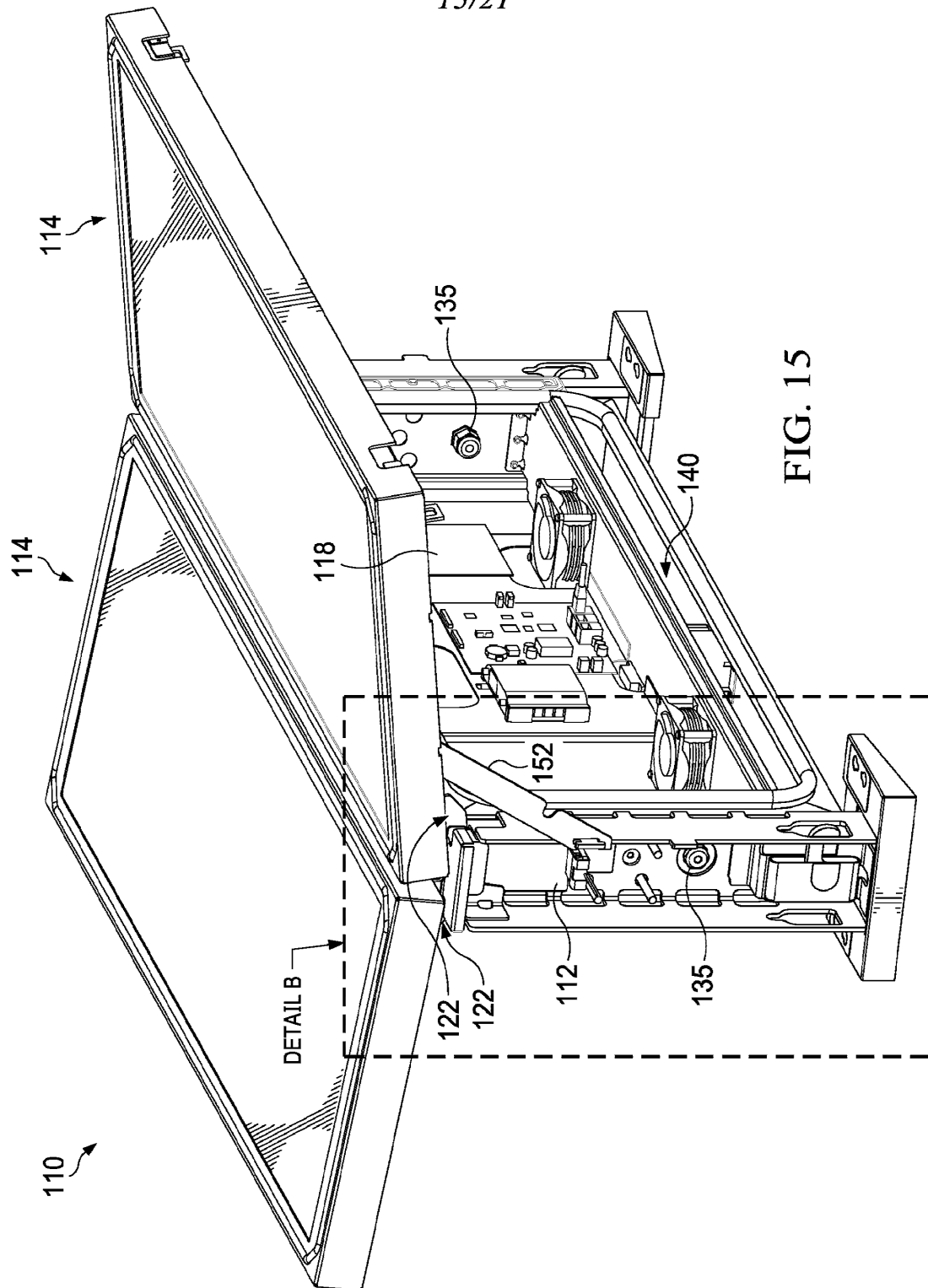


FIG. 14

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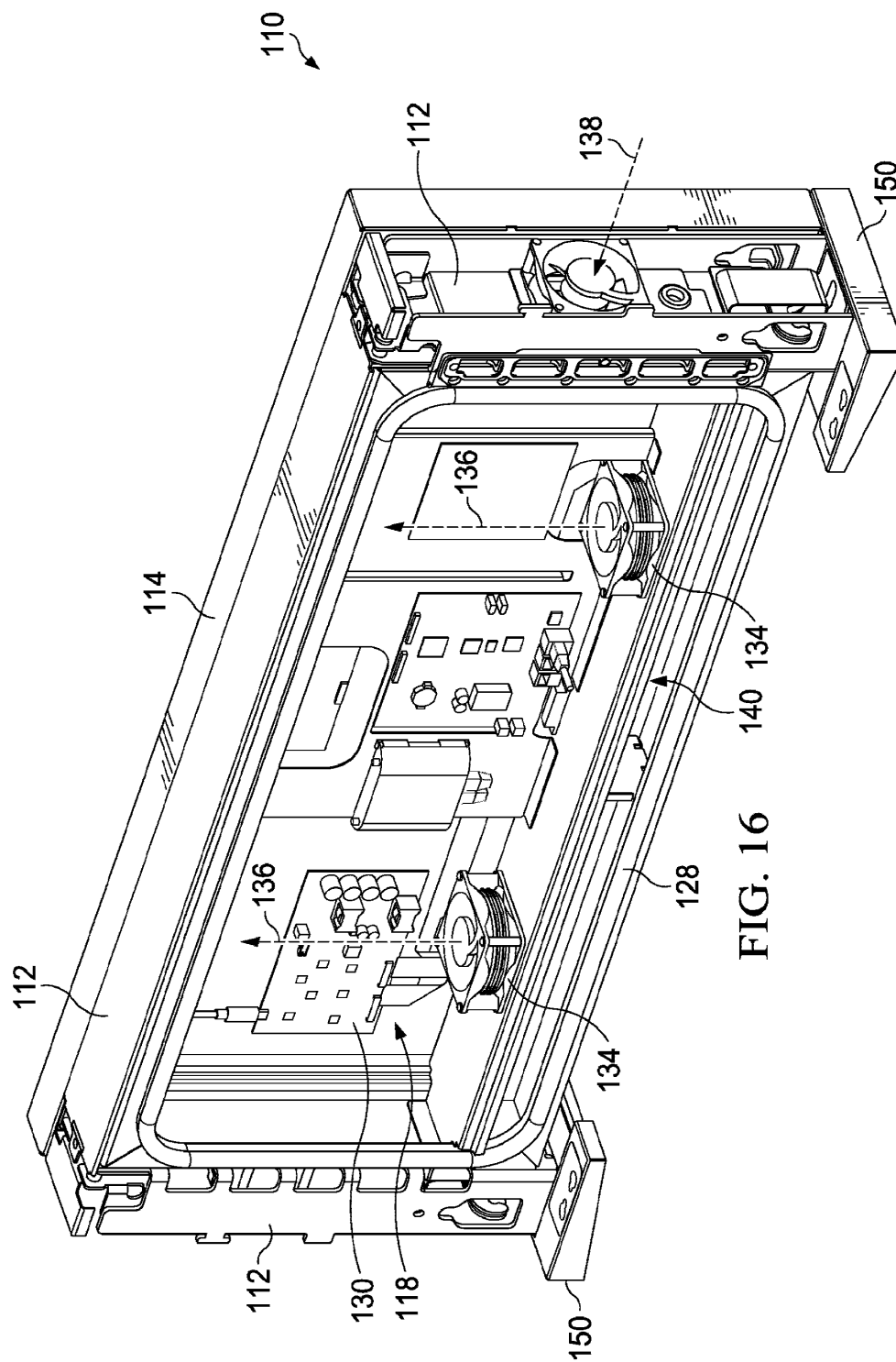
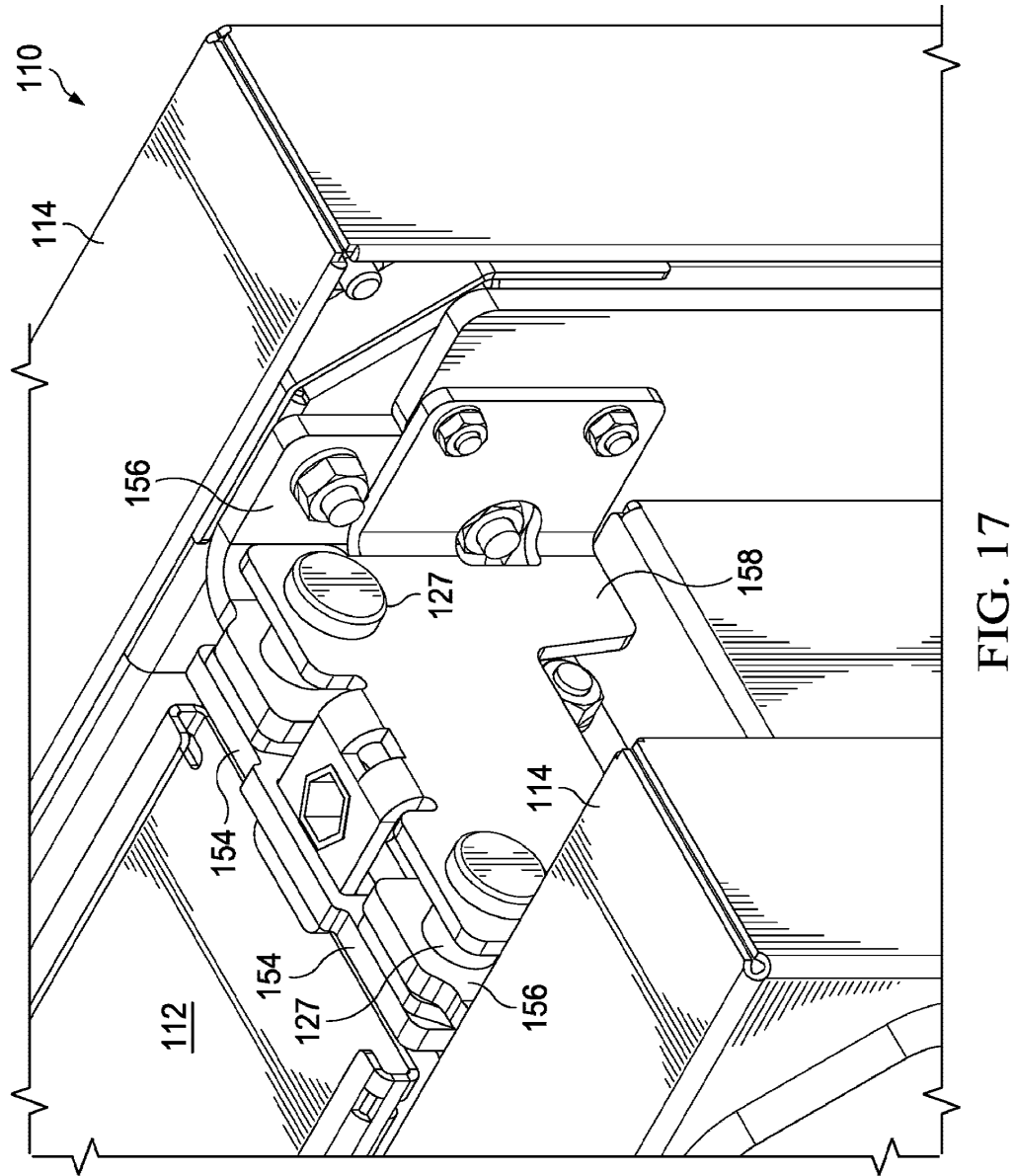


FIG. 16

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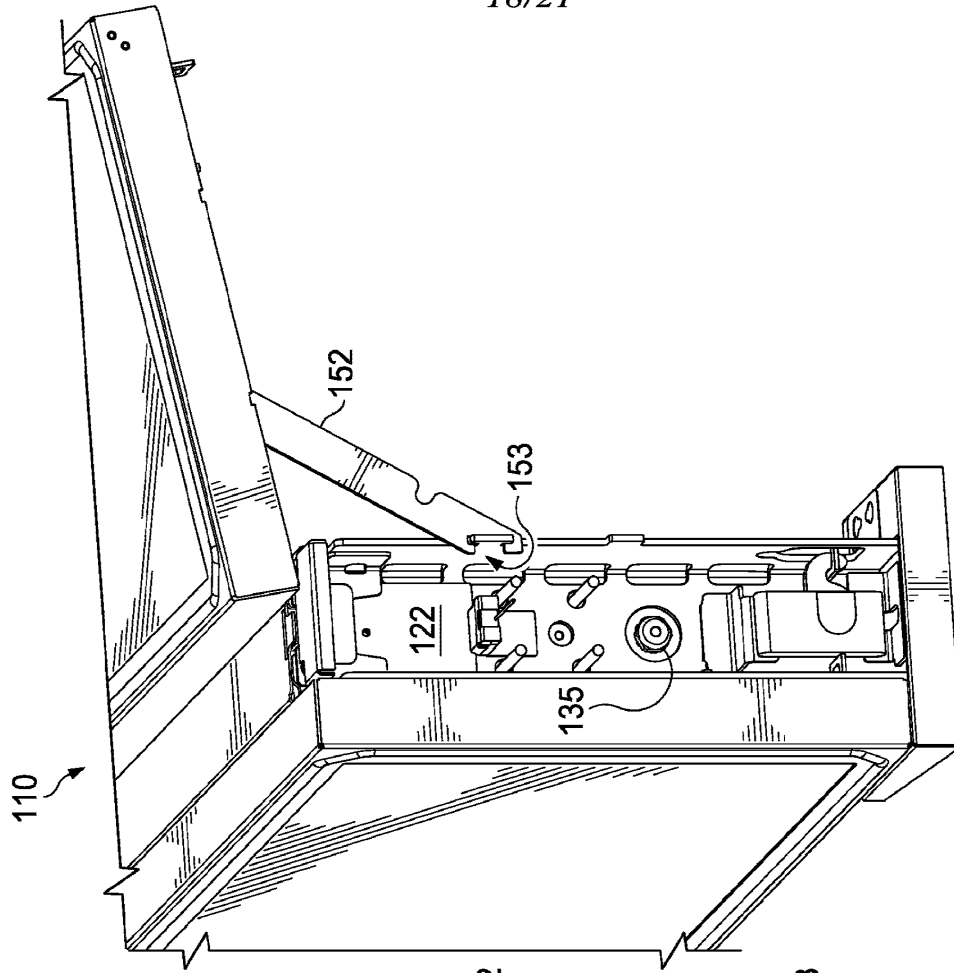


FIG. 18B

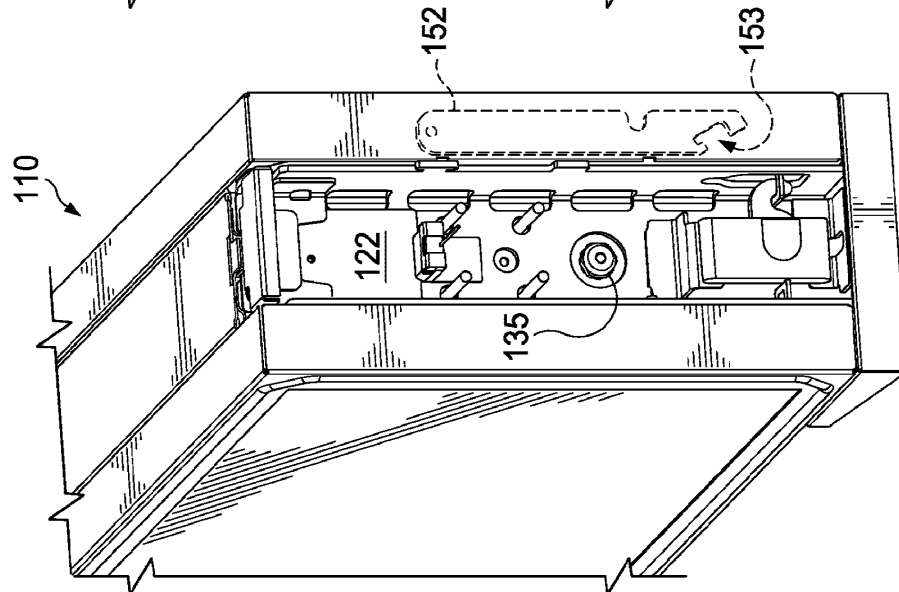


FIG. 18A

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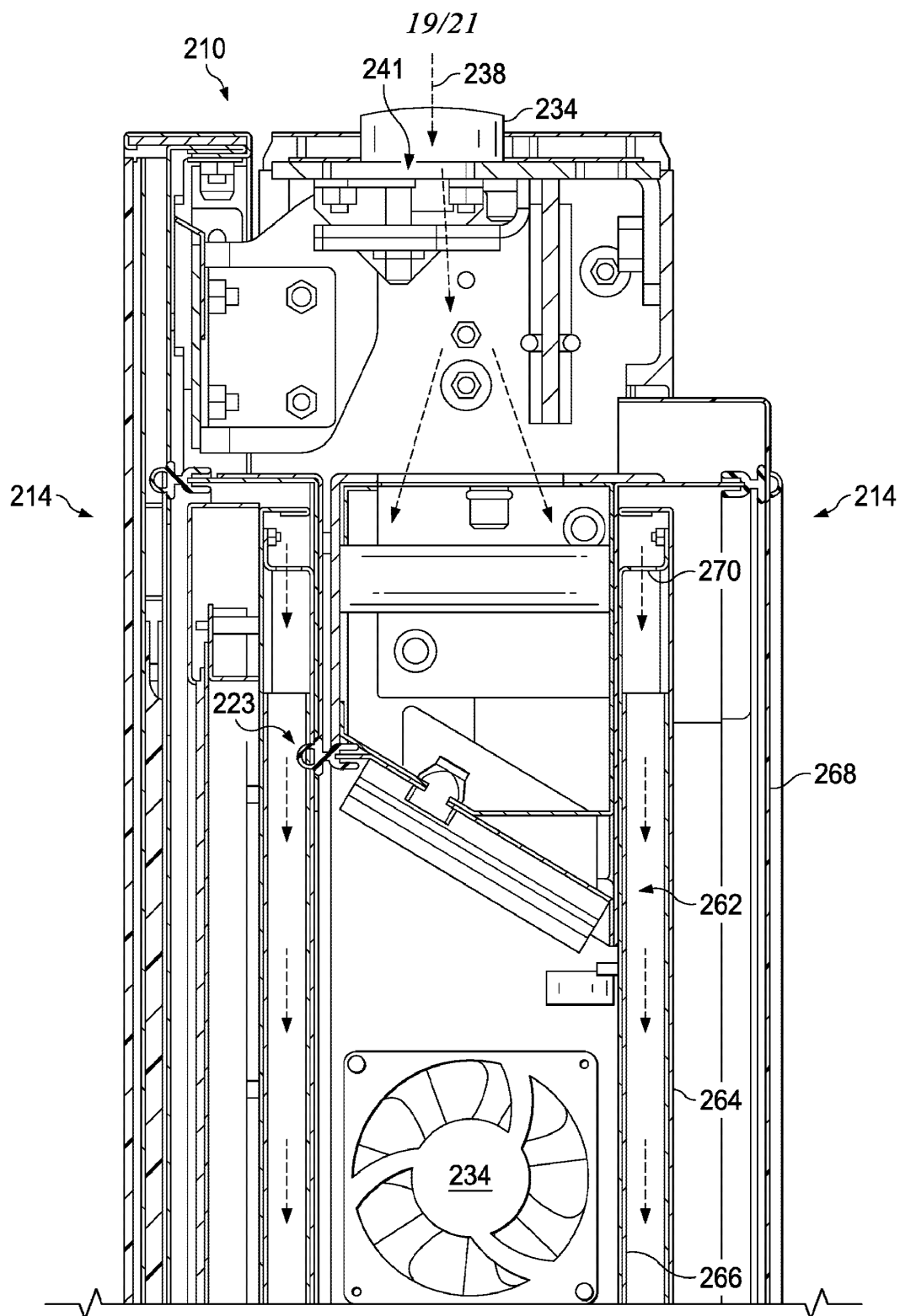


FIG. 19A

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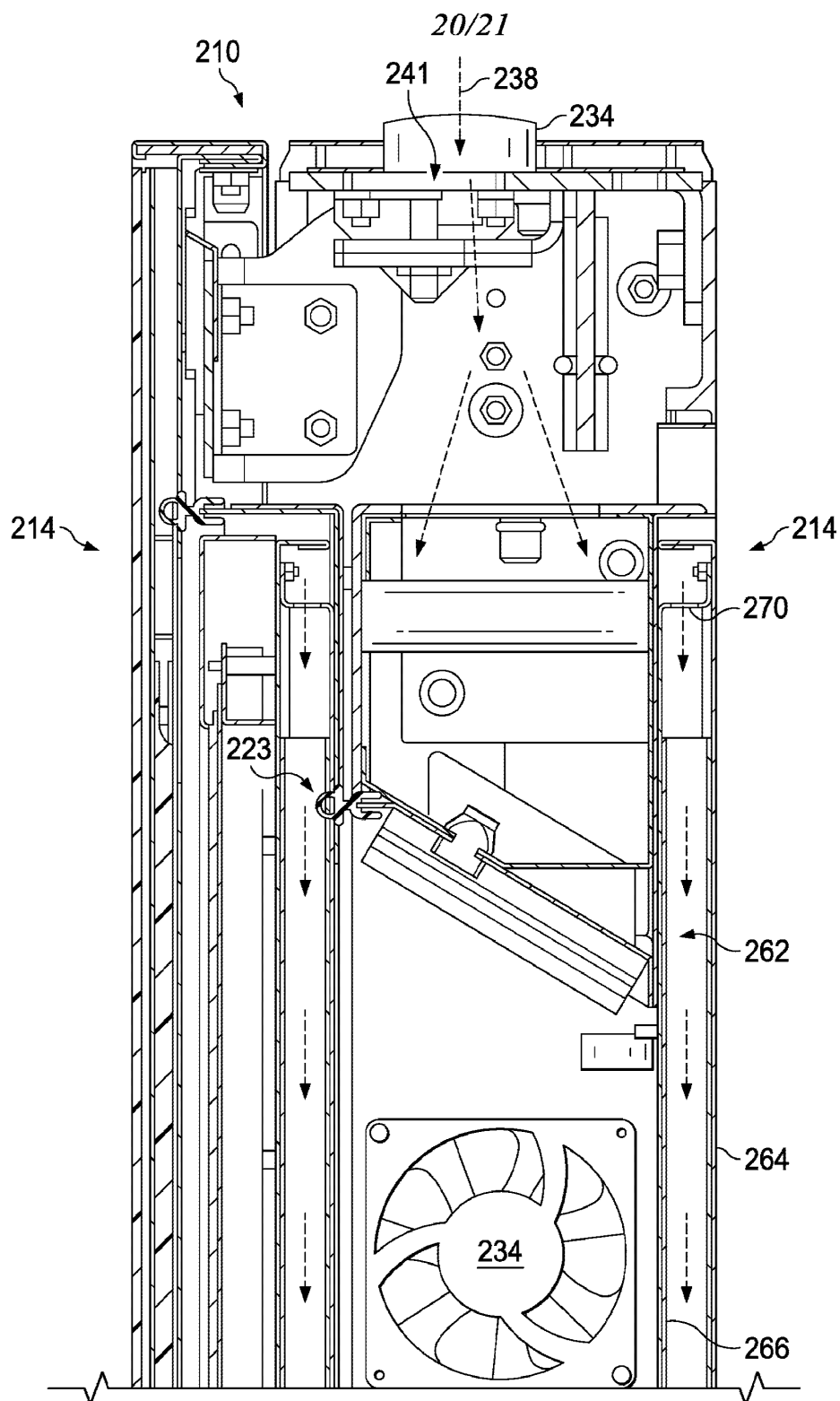


FIG. 19B

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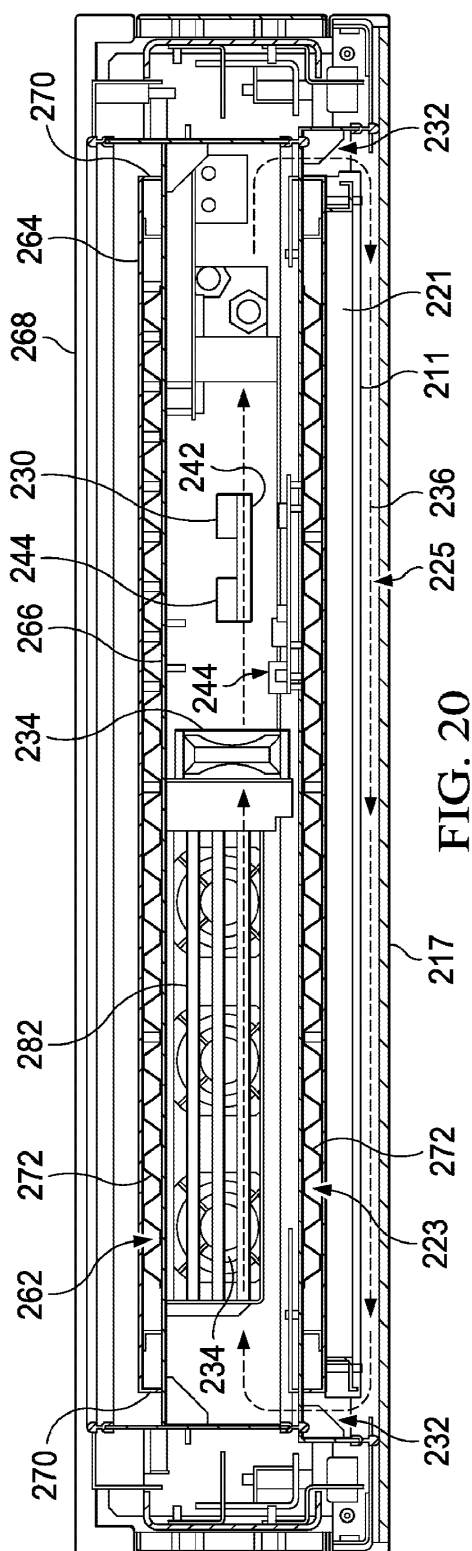


FIG. 20

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/27970

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - G02B 26/00, G06F 1/16, G09G 3/34, H01J 7/24, H04N 5/64, H05K 5/00, H05K 7/20 (2018.01) CPC - G02B 26/00, G02F 1/03, G06F 1/16, G09G 3/34, H01J 7/00, H01J 7/24, H01J 9/185, H01J 29/006, H01J 2201/3165, H01J 2217/4025, H01J 2217/49271, H01J 2329/00, H01J 2329/18, H01J 2329/8625, H05K 3/4697, H05K 5/0004, H05K 5/0017, H05K 5/0204, H05K 5/0226, H05K 5/0221, H05K 5/06, H05K 7/1438, H05K 7/20009, H05K 7/202, H05K 7/20709, H05K 7/20954, H05K 7/20972, H04N 5/64, Y10T 29/4973 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
See Search History Document		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
See Search History Document		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
See Search History Document		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2016/127613 A1 (HUAWEI TECHNOLOGIES CO., LTD.) 18 August 2016 (18.08.2016), English Abstract; Figs. 3, 4	1-20
A	US 2015/0366101 A1 (MANUFACTURING RESOURCES INTERNATIONAL, INC.) 17 December 2015 (17.12.2015), Fig. 2A, 2B; para [0017], [0023]-[0026], [0032]	1-20
A	US 2011/0019363 A1 (VAHLSING et al.) 27 January 2011 (27.01.2011), Figs. 8, 8A; para [0009], [0030], [0065]	1-20
A	US 2004/0035032 A1 (MILLIKEN) 26 February 2004 (26.02.2004), Figs. 3, 4; para [0022], [0024]	1-20
A	US 6,125,565 A (HILLSTROM) 03 October 2000 (03.10.2000), Figs. 34-36; col 2, ln 33-47; col 14, ln 3-24	1-20
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
07 June 2018		10 JUL 2018
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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- (71) **Applicant:** MANUFACTURING RESOURCES INTERNATIONAL, INC. [US/US]; 6415 Shiloh Road East, Alpharetta, GA 30005 (US).
- (72) **Inventors:** DUNN, William; 6415 Shiloh Road East, Alpharetta, GA 30005 (US). LINCOLN, Andrew; 6415 Shiloh Road East, Alpharetta, GA 30005 (US). BROWN, Mike; 6415 Shiloh Road East, Alpharetta, GA 30005 (US). DIAZ, Marcos; 6415 Shiloh Road East, Alpharetta, GA 30005 (US).
- (74) **Agent:** SMITH, Adam, J. et al.; Standley Law Group LLP, 6300 Riverside Drive, Dublin, OH 43017 (US).

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(54) **Title:** SYSTEM AND METHOD FOR PREVENTING DISPLAY BOWING

(57) **Abstract:** An apparatus for preventing bowing of an electronic display (14) includes a housing (16) and a cover panel (12). The electronic display (14) is located behind said cover panel (12), and a backlight (30) is located behind said electronic display (14). A closed loop pathway for circulating gas (24) includes a first gas pathway (22) located between said cover panel (12) and the electronic display (14), a backlight cavity (36) located between the electronic display (14) and the backlight (30), and a second gas pathway (26) located behind the backlight (30).

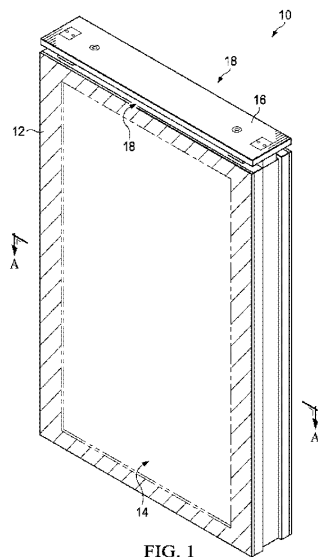


FIG. 1

WO 2018/200905 A1

SYSTEM AND METHOD FOR PREVENTING DISPLAY BOWING

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. provisional patent application serial no. 62/491,123 filed April 27, 2017, which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] Exemplary embodiments of the present invention relate generally to assemblies for electronic displays.

BACKGROUND AND SUMMARY OF THE INVENTION

[0003] Electronic displays have grown in popularity not only for indoor use, but also for outdoor use. One exemplary application, without limitation, is the digital out of home market where the electronic displays are increasingly replacing the use of static posters. The use of electronic displays is advantageous because they allow images to be changed quickly as well as permit the use videos and interactive displays, among other benefits. Such displays may be used for advertisements, public announcements, information, wayfinding, and the like.

[0004] Such outdoor, and some indoor, displays are sometimes encased in a housing to protect them from environmental conditions. The housing may be designed to resist, mitigate, manage, control, or prevent water, precipitation, dust, and air contaminant intrusion, vandalism, tampering, wind, temperature changes, solar loading, extreme temperatures, and the like. Oftentimes, these displays are placed outdoors where they are subject to extreme temperatures, drastic temperature changes, and significant solar loading. If the temperature inside the housing gets too high or too low the electronic displays and related components may be damaged. As such, the temperature inside the housing must be maintained at acceptable levels. In order to maintain the temperature inside the housings at acceptable levels, a number of gas pathways are generally placed through the housing. Sometimes, a combination of open loops carrying ambient air and closed loops carrying circulating gas are used.

[0005] Over time, the market has demanded increasingly larger displays. These larger displays have correspondingly larger surface areas and often require correspondingly larger, in size or number, gas pathways to maintain the temperature in the housing. As the dimensions of these displays and corresponding gas pathways have increased, the potential for the displays to bow outwardly has increased. This is because,

typically, the displays are mostly unsupported. The displays are generally mounted along their perimeter so illumination from the backlight is permitted to reach the entirety of the display, among other considerations. Thus, a large section of the display is not directly mounted to a housing or other stabilizing or supporting structure, which may allow bowing of the display. Additionally, the asymmetrical temperature loading of various layers and components of the display may contribute to such display bowing. Further still, some displays have a gap between the electronic display itself and a cover panel located in front of the electronic display. As the electronic display bows towards the cover panel, the gap between the cover panel and the display may be narrowed and a resulting venturi effect may be created. The venturi effect may increase the bowing forces.

[0006] Such bowing can cause damage to the display, distortion of the displayed image, and may disrupt airflow through the open and closed loops. In some cases, the electronic display may bow outwardly enough that it contacts the cover panel. This may not only interrupt normal thermal management but may also result in significant heat transfer from the solar loaded cover panel to the electronic display. This may rapidly cause permanent damage to the display. Therefore, what is needed is a system and method for preventing an electronic display from bowing.

[0007] Additionally, display assemblies comprising a backlight sometimes have a sealed cavity for the backlight. As the illumination devices and other components of the backlight generate heat, heat can become trapped in this cavity. Because the cavity may be completely or partially sealed, the heat may build up and cause damage to components of the assembly. Therefore, what is needed is a system and method for removing heat from the backlight cavity.

[0008] The present invention is a system and method for preventing an electronic display from bowing. The present invention is also a system and method for removing heat from the backlight cavity. The present invention provides a first gas pathway through first gas pathways between a cover panel and an electronic display and an additional flow path through a backlight cavity located in the space between the electronic display and a backlight. The flow of air through the backlight cavity removes heat from the backlight cavity generated by the illumination devices or other components.

[0009] The amount or speed of airflow through the first gas pathway and the backlight cavity may be controlled so as to create a pressure drop in the backlight cavity as compared to the first gas pathway. This pressure drop may result in forces which tend to pull the electronic display away from the cover panel, thereby reducing or eliminating

the bowing. In particular, a support or a bracket may be used to create an entrance gap and exit gap into and out of the backlight cavity. In this way the amount or speed of airflow through the backlight cavity may be controlled. The entrance gap may be smaller than the exit gap. In exemplary embodiments, an angled section may extend from the distal end of the bracket located near the exit gap. The angled section may extend towards the side of the housing to restrict the flow of air from the first gas pathway into a second gas pathway located behind the backlight. The constriction of this air may create a venturi effect, creating a low-pressure zone near the angled section to pull circulating gas through the backlight cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In addition to the features mentioned above, other aspects of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments, wherein like reference numerals across the several views refer to identical or equivalent features, and wherein:

[0011] **Figure 1** is a perspective view of an exemplary display assembly in accordance with the present invention also indicating section lines A-A;

[0012] **Figure 2** is a top sectional view of an exemplary display assembly embodiment taken along section line A-A of figure 1;

[0013] **Figure 3** is a top sectional view of another exemplary display assembly embodiment taken along section line A-A of figure 1;

[0014] **Figure 4** is a top section view similar to figure 2 illustrating an exemplary pressure analysis where the display bowing is reduced or eliminated;

[0015] **Figure 5** is a top section view similar to figure 3 illustrating another exemplary pressure analysis where the display bowing is reduced or eliminated;

[0016] **Figure 6** is an exemplary graphical representation of another exemplary pressure analysis;

[0017] **Figure 7A** is a side view of another exemplary display assembly in accordance with the present invention;

[0018] **Figure 7B** is a front view of the display assembly of figure 7A also indicating section line B-B;

[0019] **Figure 8** is a top sectional view taken along section line B-B of figure 7B also indicating detail A;

[0020] **Figure 9** is a detailed top sectional view of Detail A of figure 8;

[0021] **Figure 10** is a front perspective view of another exemplary display assembly in accordance with the present invention also indicating section line C-C;

[0022] **Figure 11** is a top perspective sectional view taken along section line C-C of figure 10 also indicating Detail B and Detail C;

[0023] **Figure 12** is a detailed top sectional perspective view of Detail B of figure 11;

[0024] **Figure 13** provides another angle of Detail B of figures 11-12;

[0025] **Figure 14** is a detailed top perspective sectional view of Detail C of figure 11;

[0026] **Figure 15** is a detailed top perspective sectional view similar to figure 14 illustrated in greater detail and from a different angle;

[0027] **Figure 16** is another exemplary pressure analysis similar to figure 6;

[0028] **Figure 17** is a top sectional view similar to figure 11 showing an exemplary air flow velocity analysis also indicating Detail D and Detail E;

[0029] **Figure 18** is a detailed top sectional view of Detail D of figure 17; and

[0030] **Figure 19** is a detailed top sectional view of Detail E of figure 17.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

[0031] Various embodiments of the present invention will now be described in detail with reference to the accompanying drawings. In the following description, specific details such as detailed configuration and components are merely provided to assist the overall understanding of these embodiments of the present invention. Therefore, it should be apparent to those skilled in the art that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the present invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

[0032] **Figure 1** is a perspective view of an exemplary display assembly 10 in accordance with the present invention also indicating section line A-A. The display assembly 10 may comprise an electronic display 14 located in a housing 16. In exemplary embodiments, the electronic display 14 is a liquid crystal display (LCD). However, any type of electronic display 14 may be used, such as but not limited to, a LCD, light emitting diode (LED) display, organic LED display, plasma display, or the like. The electronic display 14 may optionally comprise one or more diffuser sheets or optical films. A cover panel 12 may be located in front of the electronic display 14. The cover panel 12 may be located substantially parallel to, spaced apart from, and in front of the electronic display

14. The cover panel 12 may form the front surface of the housing 16. The cover panel 12 may be comprised of a transparent or translucent material such as, but not limited to, a glass or acrylic. The cover panel 12 may be comprised of multiple layers. As will be shown and described in greater detail herein, one or more electronic displays 14 and corresponding components may be used, including but not limited to, a pair of electronic displays 14 placed back to back within the housing 16. Regardless, an intake 18 may extend along either side or the upper portion of the housing 16, though any location is contemplated. As will be shown and described in greater detail herein, an exhaust 20 may be located along the lower edge of the display assembly 10, though any location is contemplated.

[0033] **Figure 2** is a top section view taken along section line A-A of figure 1 illustrating an exemplary display assembly 10 using a single electronic display 14. A backlight 30 may be located behind the electronic display. The backlight 30 may be located behind, substantially parallel to, and spaced apart from, the electronic display 14. The backlight 30 may comprise a number of illumination devices, such as but not limited to light emitting diodes (LEDs), located on a pan. In exemplary embodiments, the backlight 30 may comprise a number of illumination devices arranged in a spaced pattern to provide a directly backlit arrangement. In other exemplary embodiments, the backlight 30 may comprise a number of illumination devices arranged in a line along one or more sides of the electronic display 14 in an edge lit arrangement. In still other exemplary embodiments, the backlight 30 may form a part of the electronic display 14, such as without limitation with an organic LED display. In such embodiments, a backlight pan may be located behind the electronic display 14. The backlight pan may be a metal sheet or the like.

[0034] Regardless, a rear plate 32 may be located behind the backlight 30. The rear plate 32 may be located behind, spaced apart from, and substantially parallel to the backlight 30. A first gas pathway 22 may be located in the space between the rear surface of the cover panel 12 and the front surface of the electronic display 14. This space may also be referred to as the LCD cavity herein. The first gas pathway 22 may be configured to receive circulating gas 24. The circulating gas 24 may travel through the first gas pathway 22 and into a second gas pathway 26 located behind the backlight 30.

[0035] The second gas pathway 26 may be located in the space between the rear plate 32 and the rear of the housing 16. The second gas pathway 26 may comprise a heat exchanger 28 and an electronics cavity 30, though such is not required. The heat

exchanger 28 may be any type of heat exchanger 28. The heat exchanger 28 may be mounted to the rear plate 32, though any location is contemplated. In exemplary embodiments, the heat exchanger 28 occupies a first portion of the second gas pathway 26 and the electronics cavity 34 occupies a second portion where various electronic components may be located. The heat exchanger 28 may also be part of a second open loop pathway. These various electronic components may be used to operate the display assembly 10. After traveling through the second gas pathway 26, the circulating gas 24 may return to the first gas pathway 22, thus creating a closed loop. Stated another way, the closed loop may encircle the electronic display 14. One or more closed loop fans 35 may be placed along the closed loop so as to control the speed and amount of circulating gas 24 pass through the closed loop, or through the first gas pathway 22 or the second gas pathway 26. In exemplary embodiments, the closed loop fan 35 may be located between the heat exchanger 28 and the electronics cavity 34, though any location is contemplated.

[0036] In exemplary embodiments, a corrugation layer 38 may be located between the rear surface of the backlight 30 and the front surface of the rear plate 32. The corrugation layer 38 may be configured to receive ambient air 44. The space between the rear plate 32 and the backlight 30 may define a first open loop channel 37. The ambient air 44 may also flow through the heat exchanger 28 (the second open loop pathway). Ambient air 44 may enter the assembly 10, pass through the first or second open loop pathways and then exit the assembly 10, thus creating an open loop. One or more open loop fans 33 may be placed along the open loop to control the amount or speed of ambient air 44 flowing through the open loop, or through the corrugation layer 38 or the heat exchanger 28.

[0037] A backlight cavity 36 may be located in the space between the rear surface of the electronic display 14 and the front surface of the backlight 30. A portion of the circulating gas 24 may be separated from the remainder of the circulating gas 24 and travel into or through the backlight cavity 36. This portion of the circulating gas 24 may also be referred to herein as the backlight cavity gas 25. The backlight cavity gas 25 that exits the backlight cavity 36 may be rejoined with the circulating gas 24. The backlight cavity 36 may be framed on the sides, at least in part, by supports 47. In exemplary embodiments, a first supports 47 is located on the side of the backlight cavity 36 which receives the backlight cavity gas 25 and a second support 47 is located on the side of the backlight cavity 36 where the backlight cavity gas 25 exits the backlight cavity 36.

[0038] The supports 47 may extend from the rear surface of the electronic display 14 to support various components, such as but not limited to, a diffuser, optical films, a transparent sheet, or the like, located between the electronic display 14 and the backlight 30. The supports 47 may be spaced apart from the backlight 30 or the electronic display 14 at one or more locations to define an entrance gap and an exit gap for the backlight cavity gas 25 to enter or exit the backlight cavity 36, respectively. In other exemplary embodiments, the supports 47 may comprise a number of aperture which define the entrance gap and the exit gap. As will be explained in greater detail herein, the backlight cavity gas 25 may be maintained at a lower pressure relative to the circulating gas 24 traveling through the first gas pathway 22, though such is not required.

[0039] In exemplary embodiments, the pressure of the backlight cavity gas 25 may be kept relatively low by controlling the amount or speed of the backlight cavity gas 25 permitted to enter and exit the backlight cavity 36. The amount or speed of the backlight cavity gas 25 may be controlled, at least in part, by the dimensions and/or shape of the backlight cavity 36. In exemplary embodiments, the gap between the supports 47 and the front surface of the backlight 30 may be sized and configured to control the amount or speed of the backlight cavity gas 25 allowed to enter and exit the backlight cavity 36. In exemplary embodiments, the gap between the support 47 located at the entrance to the backlight cavity 36 may be smaller than the gap between the support 47 located at the exit of the backlight cavity 36 to reduce the pressure of the backlight cavity gas 25.

[0040] Alternatively, or in addition, the amount or speed of air permitted to enter and exit the backlight cavity 36 may be controlled by brackets 48. In exemplary embodiments, a first bracket 48 is located on the side of the backlight cavity 36 which receives the backlight cavity gas 25 and a second bracket 48 is located on the side of the backlight cavity 36 where the backlight cavity gas 25 exits the backlight cavity 36. The brackets 48 may be substantially shaped as an upside-down “L” and may extend from either edge of the electronic display 14 so as to also frame the backlight cavity 36. The gap between the bracket 48 and the surrounding structure, including but not limited to, the backlight 30 and the corrugation layer 38, may be sized and configured to control the amount or speed of the backlight cavity gas 25 allowed to enter and exit the backlight cavity 36. In exemplary embodiments, the gap between the bracket 48 located at the entrance to the backlight cavity 36 may be smaller than the gap between the bracket 48 located at the exit of the backlight cavity 36 to reduce the pressure of the backlight cavity gas 25.

[0041] In exemplary embodiments, some or all of the brackets 48 may comprise an angled section 49 extending from an end thereof. This angled section 49 may be angled, oriented, sized, shaped, and otherwise configured to likewise to control the amount or speed of the backlight cavity gas 25 allowed to enter and exit the backlight cavity 36. In exemplary embodiments, the angled section 49 may only be located on the exit of the backlight cavity 36 to assist in reducing the pressure of the backlight cavity gas 25.

[0042] In exemplary embodiments, the angled section 49 may extend towards the side of the housing. The angled section 49 may extend into the flow of circulating gas 24 passing from the first gas pathway 22 into the second gas pathway 26. The angled section 49 may disrupt a portion of such flow and instead permit said backlight cavity gas 25 to rejoin the remainder of the circulating gas 26. As the angled section 49 may restrict the flow of circulating gas 24 passing from the first gas pathway 22 into the second gas pathway 26, the angled section 49 may create a venturi effect and result in a lower pressure area near the exit of the backlight cavity 36. This lower pressure area may force or encourage the backlight cavity gas 25 to enter, flow through, and exit the backlight cavity 36. This may affect the relative pressure of the backlight cavity gas 25 and the resulting forces on the electronic display 14. The angle of the angled section 49 may be engineered and adjusted to provide a desirable flow through the backlight cavity 36 and resulting force on the electronic display 14.

[0043] The amount or speed of the circulating gas 24 permitted to enter and exit the backlight cavity 38 (the backlight cavity gas 25) may be predetermined to account for anticipated bowing of the electronic display 14. Indeed, the amount or speed of the backlight cavity gas 25 may determine the pressure of the backlight cavity gas 25, and thus the resulting force on the electronic display 14. For example, without limitation, enough resulting force may be desirable to substantially cancel out the bowing of the electronic display 14. However, too much resulting force may compress the electronic display 14, resulting in image distortion and/or damage to the electronic display 14. In exemplary embodiments, a pressure difference between 0-0.5 psi between the circulating gas 24 flowing through the first gas pathway 22 and the backlight cavity gas 25 may be desirable, though any relative pressures are contemplated. For example, without limitation, the supports 47, the brackets 48, and the angled section 49 may be sized to create a predetermined relative pressure drop. Similarly, the angle of the angled section 49 may be selected to create a predetermined relative pressure drop. It is contemplated that other control devices may be used to control the amount or speed of the backlight

cavity gas 25 such as, without limitation, fans, structural obstructions, diffusers, filters, throttles, valves, flow splitters, or the like.

[0044] **Figure 3** is a top sectional view of another exemplary display assembly 10 embodiment taken along section line A-A of figure 1. The display assembly 10 illustrated and described with respect to figure 3 is similar to the display assembly 10 illustrated with respect to figure 2 with the addition of a second electronic display 14 placed back to back with the first electronic display 14. Related components for the second electronic display, such as but not limited to, a second cover panel 12, a second backlight cavity 36, may likewise be placed back to back with the first electronic display 14. In this embodiment, the circulating gas 24 may separate after traveling through the second gas pathway 26 such that a portion flows in front of each electronic display 14. Similarly, a portion of the circulating gas 24 may be separated and may flow as backlight cavity gas 25 through each respective backlight cavity 36. The circulating gas 24 flowing in front of each of the respective electronic display 14 may be rejoined at the other end of the first gas pathway 22 and flow through the second gas pathway 26. In such embodiments, the second gas pathway 26 may share a common heat exchanger 28, electronics, electronics cavity 34, and other related components, though such is not required. It is contemplated that separate closed loop pathways may instead be utilized. It is further contemplated that additional electronic displays 14 in various locations are contemplated.

[0045] **Figure 4** is a top sectional view similar to figure 2 illustrating an exemplary pressure analysis for the display assembly 10. Similarly, **figure 5** is a top sectional view similar to figure 3 illustrating an exemplary pressure analysis for the display assembly 10. Figures 4 and 5 demonstrate how bowing of the electronic display 14 may be reduced or eliminated. These analyses are merely exemplary and are not intended to be limiting. Any dimensions, temperatures, pressures, and the like are contemplated.

[0046] As can be seen in both figure 4 and figure 5, the pressure of the backlight cavity gas 25 located in the backlight cavity 38 is relatively low as compared to the pressure of the circulating gas 24 located in the first gas pathway 22 along the entirety of the first gas pathway 22. For example, but not to serve as a limitation, the pressure of the backlight cavity gas 25 is illustrated as green, thereby indicating a lower pressure, as compared to the pressure of the circulating gas 24 in the first gas pathway 22 which is illustrated yellow to indicate a higher pressure. The indicated pressure drop may create forces which counteract the bowing of the electronic display 14 that may otherwise occur, leading to decreased or eliminated bowing of the electronic display 14 as shown.

[0047] **Figure 6** is an exemplary graphical representation of another exemplary pressure analysis illustrating differential pressure between the first gas pathway 22 (also referred to as the LCD cavity, the front glass air gap, or the LCD-front glass air gap herein) and the backlight cavity 36 (also referred to as the LED cavity herein). This analysis and the results are merely exemplary and are not intended to be limiting. Any dimensions, temperatures, pressures, and the like are contemplated. The detailed data used to produce the graphical representation shown in figure 6 is as follows:

LCD-FRONT GLASS AIR GAP DATA				
X [in]	Y [in]	Z [in]	Abs Pressure [lbf/in ²]	Temperature (Fluid) [°C]
28	-14	4.25	15.64857752	80.1480277
14	-14	4.25	15.64646607	79.09110465
0	-14	4.25	15.6454628	75.28046445
-14	-14	4.25	15.6448872	75.11193992
-28	-14	4.25	15.64592538	73.22106961
28	0	4.25	15.65053391	76.47154539
14	0	4.25	15.64905628	76.15458164
0	0	4.25	15.64821219	72.39194399
-14	0	4.25	15.64801795	71.92009026
-28	0	4.25	15.64829522	69.78575356
28	14	4.25	15.65330566	72.50363672
14	14	4.25	15.65321209	71.96269658
0	14	4.25	15.65307815	67.82091386
-14	14	4.25	15.65242712	67.46451856
-28	14	4.25	15.65168999	65.76823918

Table 1

LED CAVITY (ABS PRESSURE PSI) DATA				
X [in]	Y [in]	Z [in]	Abs Pressure [lbf/in ²]	Temperature (Fluid) [°C]
28	-14	3.37	15.64622021	87.70353149
14	-14	3.37	15.64566772	87.96110944
0	-14	3.37	15.64512518	91.58209795
-14	-14	3.37	15.644584	79.94765992
-28	-14	3.37	15.64401504	79.7297815

28	0	3.37	15.64615716	88.11894204
14	0	3.37	15.64556531	86.24853469
0	0	3.37	15.64509058	77.61667113
-14	0	3.37	15.64448586	75.67236919
-28	0	3.37	15.64400603	74.72774976
28	14	3.37	15.64606925	89.41494757
14	14	3.37	15.64557001	82.3178322
0	14	3.37	15.6449758	83.04160394
-14	14	3.37	15.64443134	76.65225751
-28	14	3.37	15.64397409	71.0659114

Table 2

DIFFERENTIAL PRESSURE (LCD-LSD) (PSI)
0.002357311
0.000798346
0.000337611
0.000303201
0.001910336
0.004376755
0.003490969
0.003121612
0.003532089
0.004289189
0.007236418
0.007642077
0.008102352
0.007995777
0.0077159

Table 3

CHART DATA			
	-14	0	14
28	0.002357	0.004377	0.007236
14	0.000798	0.003491	0.007642
0	0.000338	0.003122	0.008102
-14	0.000303	0.003532	0.007996
-28	0.00191	0.004289	0.007716

Table 4

[0048] As can be seen, the pressure of the backlight cavity gas 25 located in the backlight cavity 38 is relatively low as compared to the pressure of the circulating gas 24

located in the first gas pathway 22 along the entirety of the first gas pathway 22. The resulting pressure drop may create forces which counteract the bowing of the electronic display 14 that may otherwise occur, leading to decreased or eliminated bowing as shown in this figure. It is notable that while the pressure differential (here, a relative pressure drop) between the data points in the backlight cavity 36 and the corresponding data points in the first gas pathway 22 may be relatively small, when multiplied by the number of square inches in the corresponding electronic display 14, the resulting forces can be significant.

[0049] **Figure 7A** and **Figure 7B** illustrate another exemplary display assembly 10 in accordance with the present invention. Ambient air 44 may be ingested into the top of the display assembly 10 and exhausted from the bottom of the display assembly 10, thus creating an open loop.

[0050] **Figure 8** and **figure 9** illustrate another exemplary embodiment of the display assembly 10. As illustrated, circulating gas 24 may flow through the electronics cavity 34. A first portion of the circulating gas 24 may enter the first gas pathway 22, and a second portion of the circulating gas 24 may enter the backlight cavity 36 (i.e., the backlight cavity gas 25). The circulating gas 24 be rejoined when exiting the first gas pathway 22 and the backlight cavity 36 and returning to the electronics cavity 34, thus creating a closed loop. The electronics cavity 34 may comprise one or more heat exchangers 28, though such is not required. In exemplary embodiments, the heat exchanger 28 may comprise one or more closed loop channels 29 for the circulating gas 24. Ambient air 44 may travel through one or more of the first open loop channels 37. The ambient air 44 may also travel through one or more open loop channels 27 in the heat exchanger 28.

[0051] **Figure 10** through **figure 15** illustrate another exemplary embodiment of the display assembly 10. This embodiment may likewise comprise supports 47, brackets 48, and an angled section 49 similar to those described herein. Multiple angled sections 49 may extend from the brackets 48.

[0052] A first exit gap 45 may be located between the support 47 and the rear plate 32. In exemplary embodiments, the second exit gap 43 may be located between a distal end of the support 47 and the front surface of the rear plate 32. A second exit gap 43 may be located between the bracket 48 and the housing 16. Alternatively, or in addition the second exit gap 43 may be located between the angled section 49 and the housing 16. In exemplary embodiments the portion of the housing 16 defining the second exit gap

43 may be a sidewall of the housing 16 which also defines a portion of the electronics cavity 34. The first exit gap 45 and the second exit gap 43 may permit the backlight cavity gas 25 to escape the backlight cavity 36 and rejoin the remainder of the circulating gas 24.

[0053] A second entrance gap 41 may be located between the support 47 and the rear plate 32. In exemplary embodiments, the second entrance gap 41 may be located between a distal end of the support 47 and the front surface of the rear plate 32. A first entrance gap 39 may be located between the brackets 48 and the housing 16. In exemplary embodiments the portion of the housing 16 defining the first entrance gap 39 may be a sidewall of the housing 16 which also defines a portion of the electronics cavity 34. The second entrance gap 41 and the first entrance gap 39 may permit a portion of the circulating gas 24 (i.e., the backlight cavity gas 25) to separate from the remainder of the circulating gas 24 and enter the backlight cavity 36.

[0054] As previously described, in exemplary embodiments the first entrance gap 39 is smaller than the second exit gap 43. In exemplary embodiments the second entrance gap 41 is smaller than the first exit gap 45. However, any size first entrance gap 39, second exit gap 43, second entrance gap 41, and first exit gap 41 is contemplated.

[0055] **Figure 16** is another exemplary pressure analysis and data output similar to figure 6. The detailed data used to produce the graphical representation shown in figure 16 is as follows:

Medium - Fluid, Iteration = 376					
X [in]	Y [in]	Z [in]	Pressure [lbf/in ²]	Temperature [Fluid] [°C]	
-13	-27	3.41	15.95534032	82.80915223	
-13	0	3.41	15.95415027	78.80780428	
-13	27	3.41	15.95314981	76.73172097	
0	-27	3.41	15.95525719	89.47604249	
0	0	3.41	15.95417125	89.52926056	
0	27	3.41	15.95312927	82.66170811	
13	-27	3.41	15.95527029	92.04619987	
13	0	3.41	15.95415218	97.38758681	
13	27	3.41	15.95312114	87.79855441	

X [in]	Y [in]	Z [in]	Pressure [lbf/in ²]	Temperature [Fluid] [°C]	
-13	-27	4.3	15.96063588	79.33436377	
-13	0	4.3	15.95969667	76.02973785	
-13	27	4.3	15.96581331	74.39993587	
0	-27	4.3	15.96603453	80.51190665	
0	0	4.3	15.95935343	80.63542739	
0	27	4.3	15.96185612	75.60167989	
13	-27	4.3	15.96510689	83.28837491	
13	0	4.3	15.95824758	80.84146671	
13	27	4.3	15.96025992	77.61727691	

Table 5

[0056] Figure 17 through figure 19 illustrate an exemplary air flow velocity analysis for the display assembly 10. As can be seen in these figures, a portion of the circulating gas 24 (i.e., the backlight cavity gas 25) may enter the backlight cavity 36 and travel therethrough at generally a relatively lower velocity as compared to the circulating gas 24 traveling through the first gas pathway 22. Also, the angled sections 49 may create an eddy of circulating gas 24 in an area 51 around the angled sections 49 resulting in slowed circulating gas 24 exiting the area 51. Regardless, this area 51 may comprise circulating gas at a relatively low pressure as compared to the circulating gas 24 in the surrounding area. The illustrated analysis is merely exemplary and is not intended to be limiting.

[0057] Although the flow of the ambient air 44 and the circulating gas 24 may be shown and described herein with respect to particular directions and orientations, it is contemplated that the ambient air 44 and the circulating gas 24 may flow in other directions. For example, without limitation, ambient air 44 and circulating gas 24 shown as flowing clockwise may flow counter-clockwise, when shown flowing vertically from top to bottom may flow from bottom to top, when shown flowing horizontally from right to left may flow from left to right, when shown flowing vertically may flow horizontally, when shown flowing horizontally may flow vertically, and the like.

[0058] Any embodiment of the present invention may include any of the optional or preferred features of the other embodiments of the present invention. The exemplary embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The exemplary embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described exemplary embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS**WHAT IS CLAIMED IS:**

1. An apparatus for preventing bowing of an electronic display comprising:
 - a housing;
 - a cover panel, wherein the electronic display is located behind said cover panel;
 - a backlight located behind said electronic display; and
 - a closed loop pathway for circulating gas comprising:
 - a first gas pathway located between said cover panel and the electronic display,
 - a backlight cavity located between the electronic display and the backlight,
 - and
 - a second gas pathway located behind the backlight.
2. The apparatus of claim 1 further comprising:
 - an open loop pathway for ambient air located behind said backlight.
3. The apparatus of claim 2 further comprising:
 - a rear plate located behind said backlight;
 - a corrugated layer extending between said rear plate and said backlight; and
 - a first open loop pathway located between said backlight and said rear plate.
4. The apparatus of claim 3 further comprising:
 - a heat exchanger located within the second gas pathway; and
 - a second open loop pathway comprising said heat exchanger.
5. The apparatus of any of claims 1-4 further comprising:
 - a second cover panel;
 - a second electronic display located behind said second cover panel; and
 - a second backlight located behind said second electronic display;wherein the closed loop pathway for circulating gas further comprises:
 - a third gas pathway located between said second cover panel and the second electronic display, and
 - a second backlight cavity located between the second electronic display and the second backlight,wherein the second gas pathway is located between the backlight and the second backlight.
6. The apparatus of claim 5 wherein:
 - the second cover panel, the second display assembly, and the second backlight

are located in a back to back arrangement with the cover panel, the display assembly, and the backlight, respectively.

7. The apparatus of claims 1 further comprising:
a first and second support located at an entrance and an exit, respectively, of the backlight cavity, wherein said first and second supports define an entrance gap and an exit gap, respectively, for the circulating gas to enter or exit the backlight cavity.
8. The apparatus of claim 7 wherein:
the entrance gap is smaller than the exit gap.
9. The apparatus of claim 1 further comprising:
a first and second bracket located at an entrance and an exit, respectively, of the backlight cavity, wherein said first and second brackets define an entrance gap and an exit gap, respectively, for the circulating gas to enter or exit the backlight cavity.
10. The apparatus of claim 9 wherein:
the entrance gap is smaller than the exit gap.
11. The apparatus of claims 9 wherein:
the second bracket comprises an angled section located on a distal end of said bracket and extending towards the side of said housing.
12. The apparatus of claim 11 wherein:
the angled section is configured to create a venturi effect on circulating gas passing from the first gas pathway to the second gas pathway.
13. The apparatus of claim 1 wherein:
the closed loop pathway is configured such that the pressure of the circulating gas passing through the backlight cavity is lower than the circulating gas passing through the first gas pathway.
14. The apparatus of claim 13 wherein:
the pressure of the circulating gas passing through the backlight cavity is between 0 and .5 psi lower than the circulating gas passing through the first gas pathway.
15. The apparatus of claim 2 further comprising:
at least one circulating gas fan located within the second gas pathway for moving the circulating gas through the closed loop pathway; and
at least one ambient air fan located within the open loop pathway for moving

the ambient air through the open loop pathway.

16. An apparatus for preventing bowing of an electronic display comprising:
- a housing;
 - a cover panel, wherein the electronic display is located behind, spaced apart from, and substantially parallel to said cover panel;
 - a backlight located behind, spaced apart from, and substantially parallel to said electronic display, wherein the space between the backlight and the electronic display defines a backlight cavity;
 - a closed loop pathway for circulating gas encircling the electronic display and comprising the space between said cover panel and said electronic display, the backlight cavity, and a space between said housing and said backlight; and
 - an open loop pathway located in the space between said housing and said backlight.
17. The apparatus of claim 16 further comprising:
- a first and second bracket located at an entrance and an exit, respectively, of the backlight cavity, wherein said first and second brackets define an entrance gap and an exit gap, respectively, for the circulating gas to enter or exit the backlight cavity, wherein the entrance gap is smaller than the exit gap;
 - an angled section located on a distal end of the second bracket and extending towards the side of said housing; and
 - a first and second support located at the entrance and the exit, respectively, of the backlight cavity, wherein said first and second supports define a second entrance gap and a second exit gap, respectively, for the circulating gas to enter or exit the backlight cavity, wherein the second entrance gap is smaller than the second exit gap.
18. The apparatus of claim 17 wherein:
- the first and second brackets comprise a first set of apertures which define the entrance gap and the exit gap; and
 - the first and second supports comprise a second set of apertures which define the second entrance gap and the second exit gap.
19. The apparatus of any of claims 16-18 wherein:
- the electronic display comprises liquid crystals; and
 - the backlight comprises light emitting diodes.

20. An apparatus for preventing bowing of an electronic display comprising:
- a housing;
 - a cover panel, wherein the electronic display is located behind said cover panel;
 - a backlight located behind said electronic display and comprising a number of light emitting diodes;
 - a closed loop pathway for circulating gas comprising:
 - a first gas pathway located between said cover panel and the electronic display,
 - a backlight cavity located between the electronic display and the backlight having an entrance and an exit, and
 - a second gas pathway located behind the backlight and comprising a heat exchanger;
 - a rear plate located behind said backlight;
 - an open loop pathway comprising:
 - a first open loop pathway located in the space between said rear plate and said backlight, and
 - a second open loop pathway comprising said heat exchanger;
 - a first and second bracket located at the entrance and the exit, respectively, of the backlight cavity, wherein said first and second brackets comprise a first number of apertures defining an entrance gap and an exit gap, respectively, for the circulating gas to enter or exit the backlight cavity, wherein the entrance gap is smaller than the exit gap;
 - an angled section located on a distal end of said second bracket and extending towards the side of said housing; and
 - a first and second support located at the entrance and the exit, respectively, of the backlight cavity, wherein said first and second supports comprise a second number of apertures defining a second entrance gap and a second exit gap, respectively, for the circulating gas to enter or exit the backlight cavity, wherein the second entrance gap is smaller than the second exit gap.

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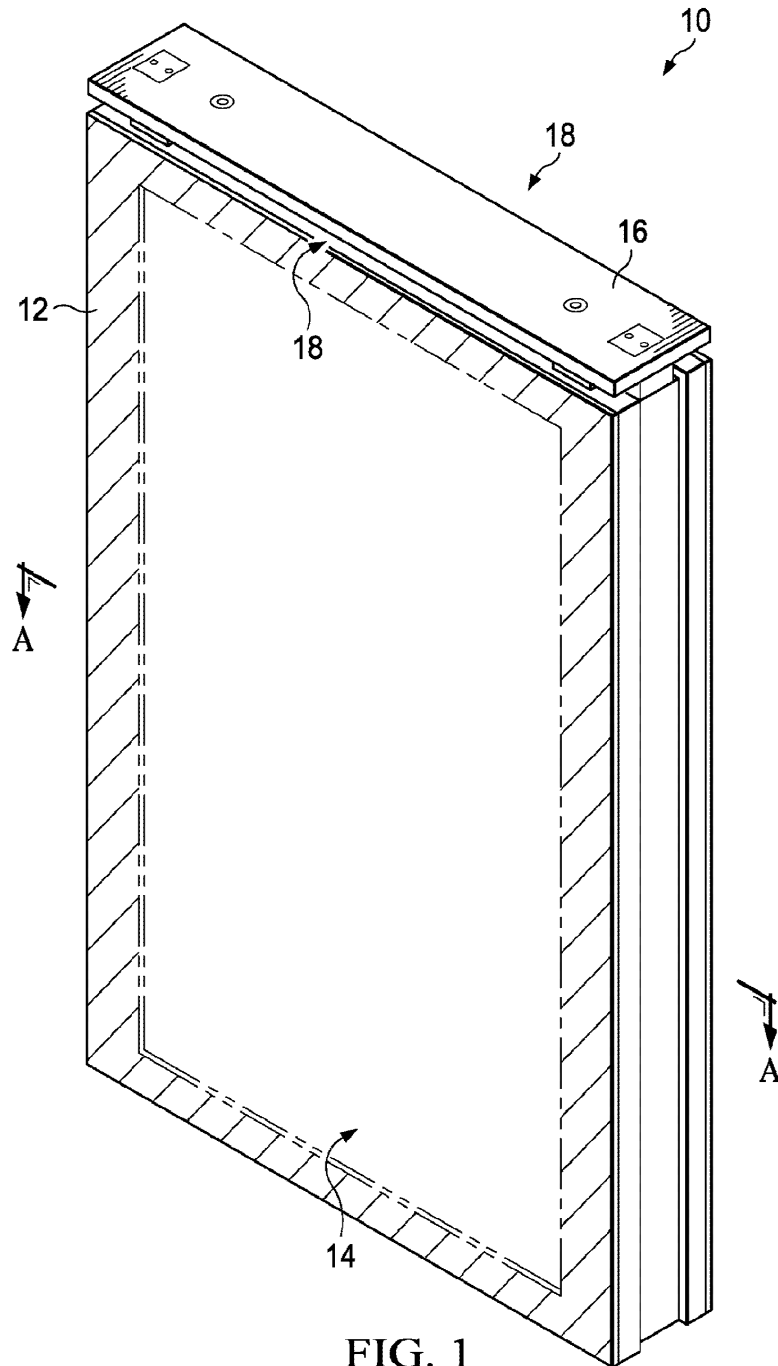


FIG. 1

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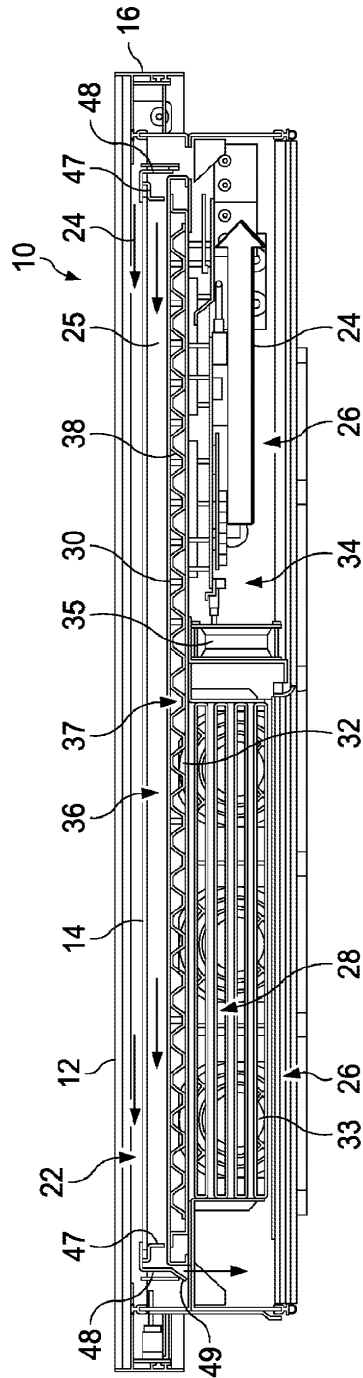


FIG. 2

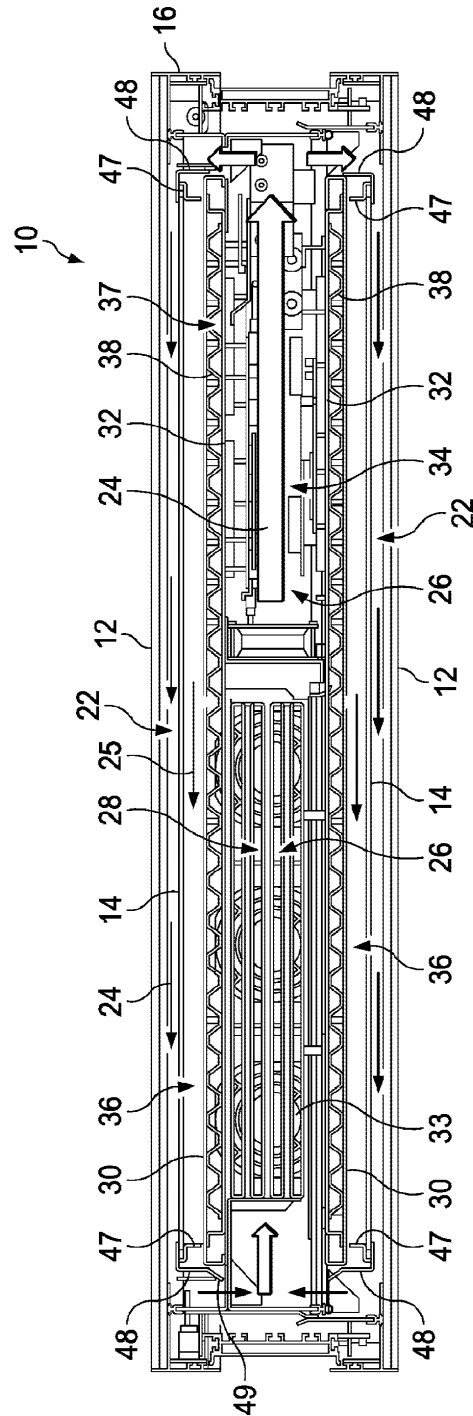
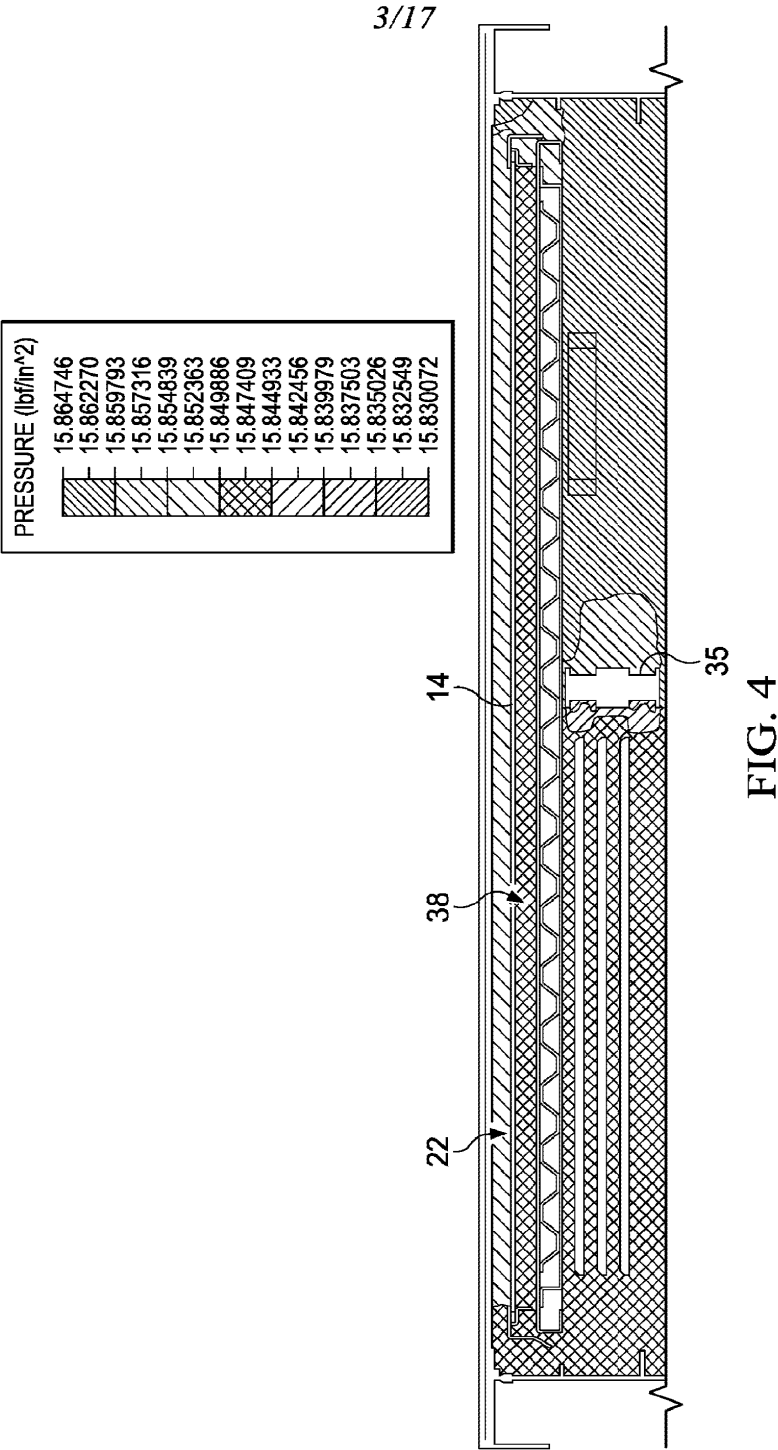
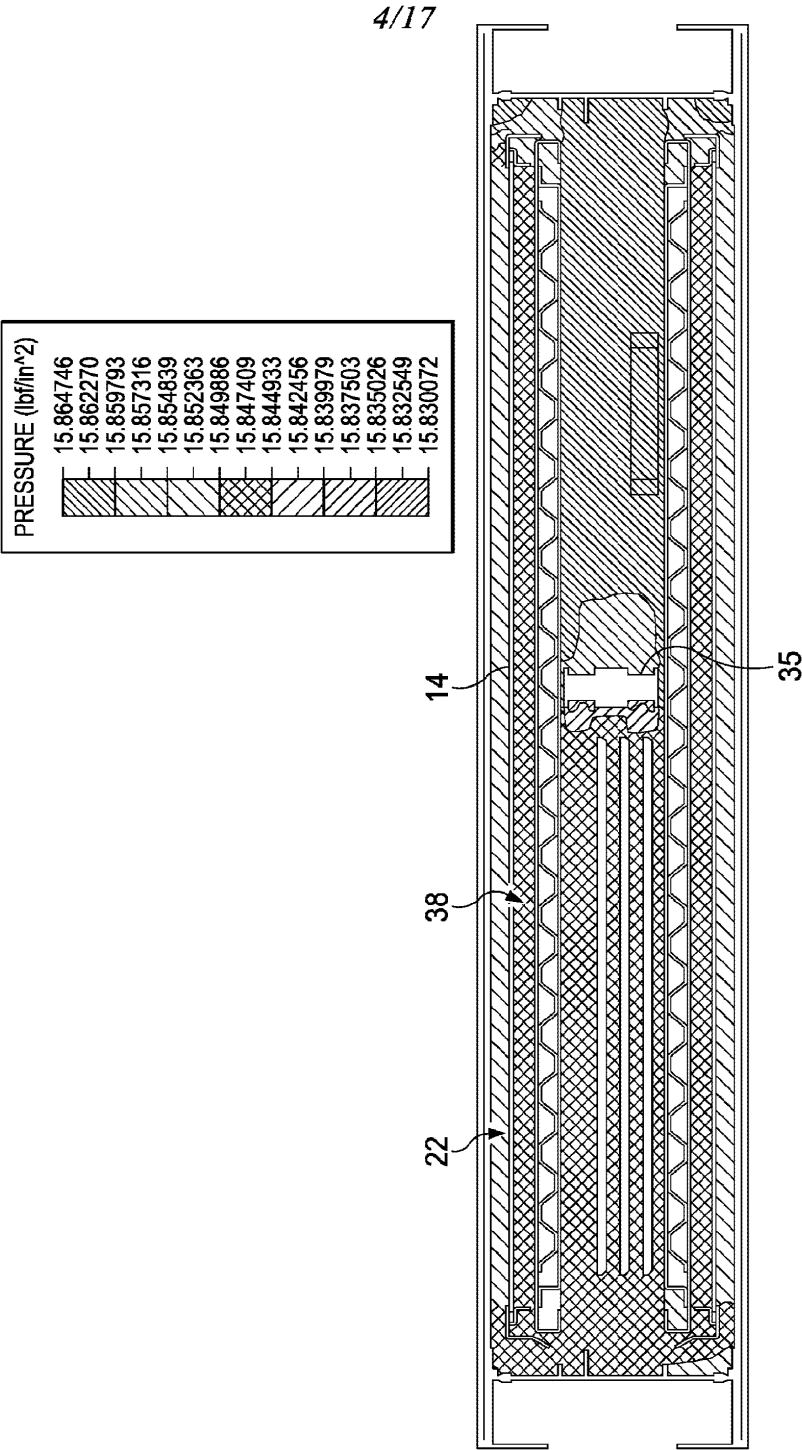


FIG. 3

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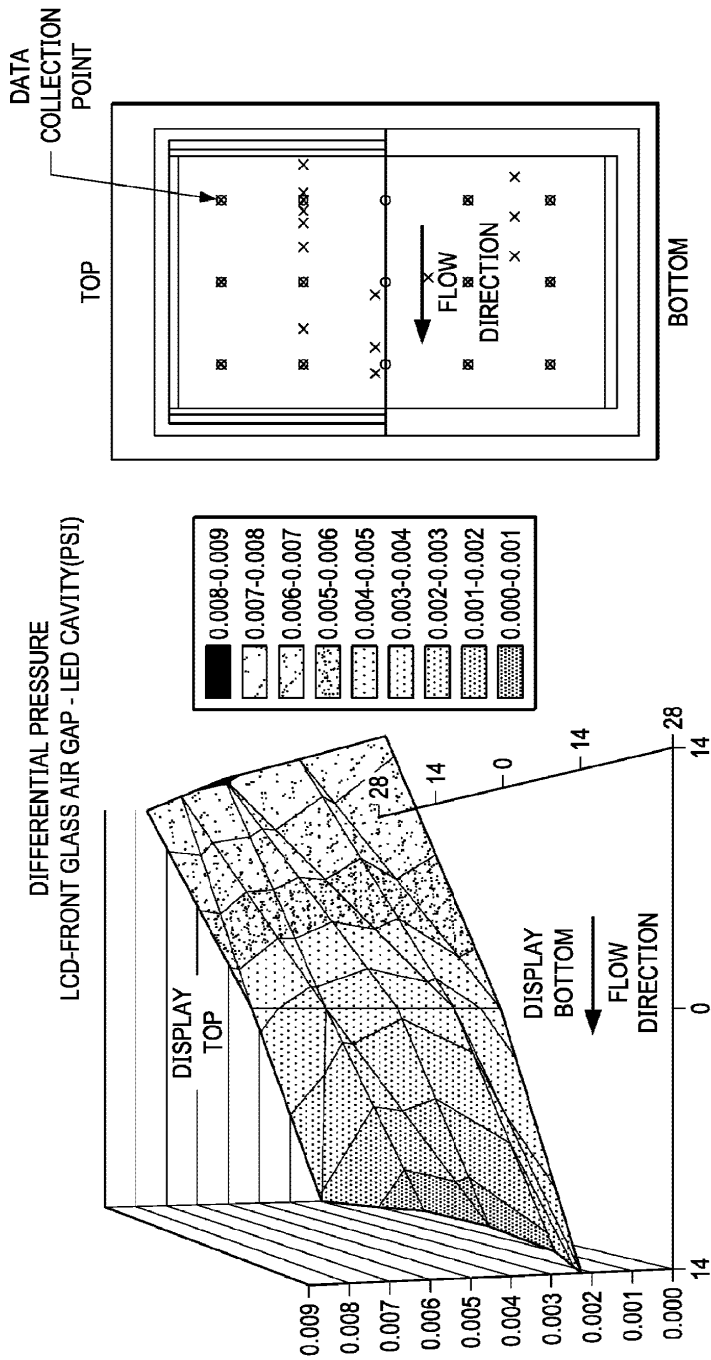
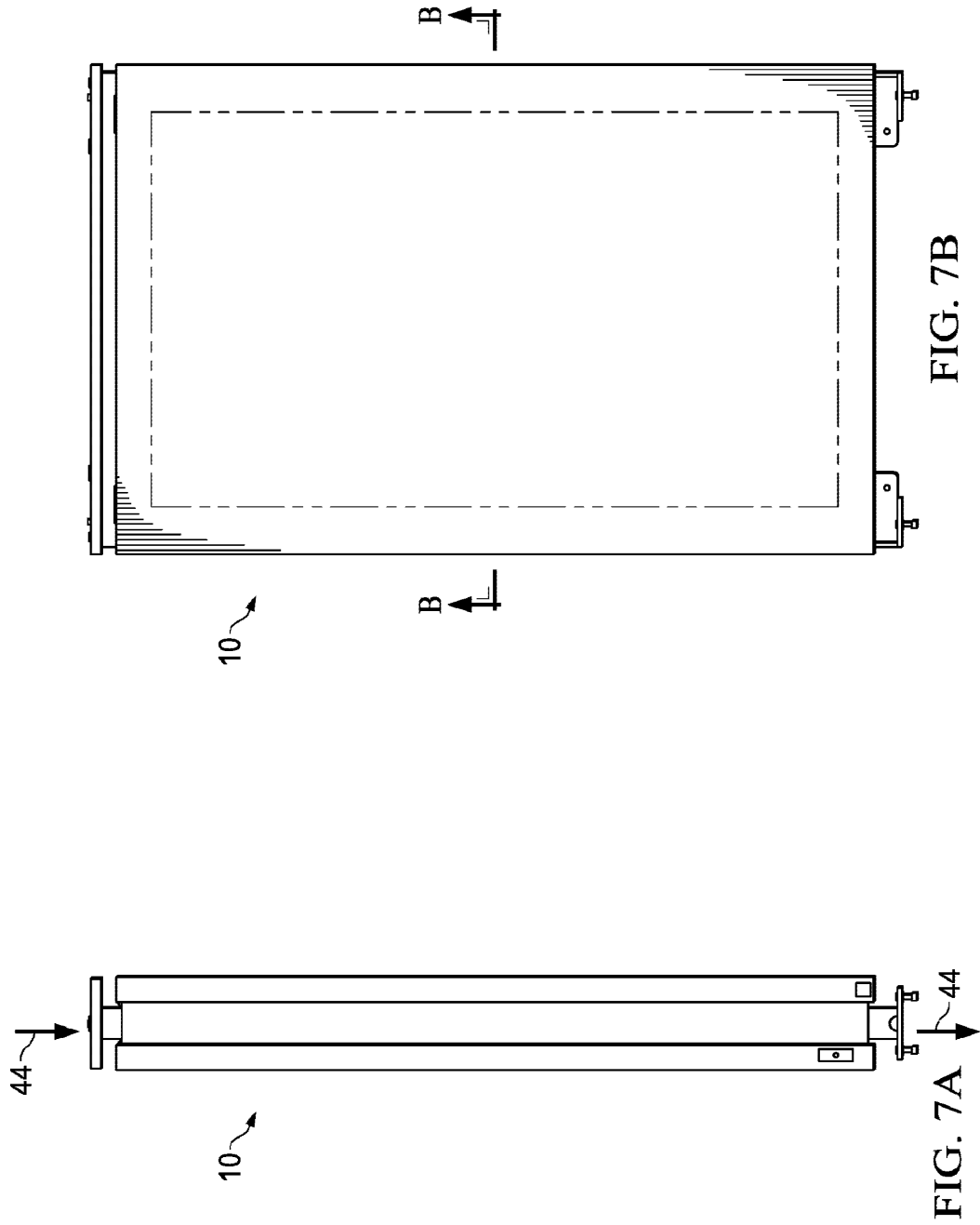


FIG. 6

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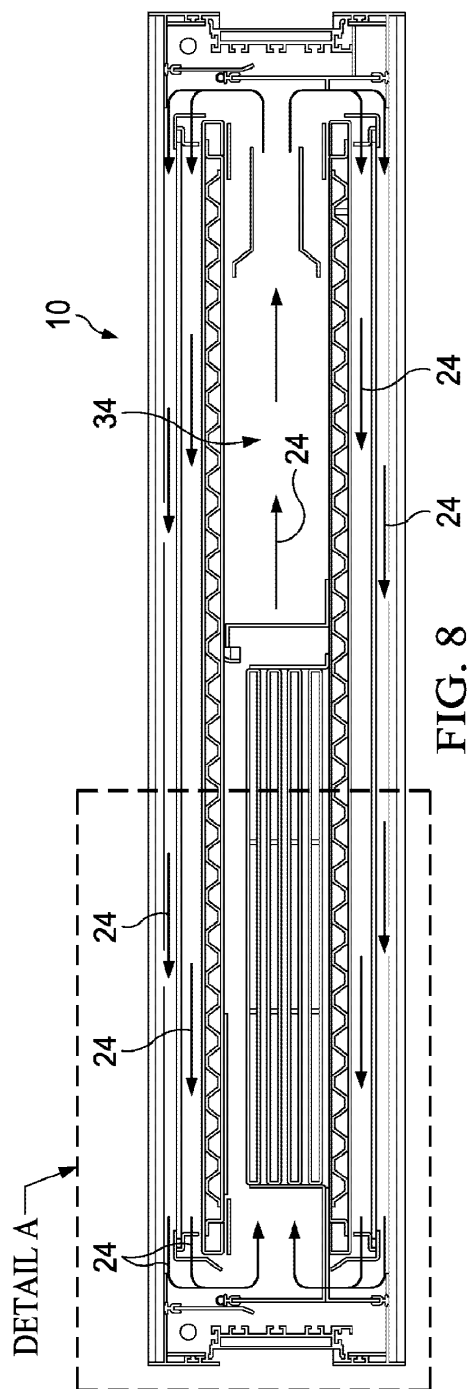


FIG. 8

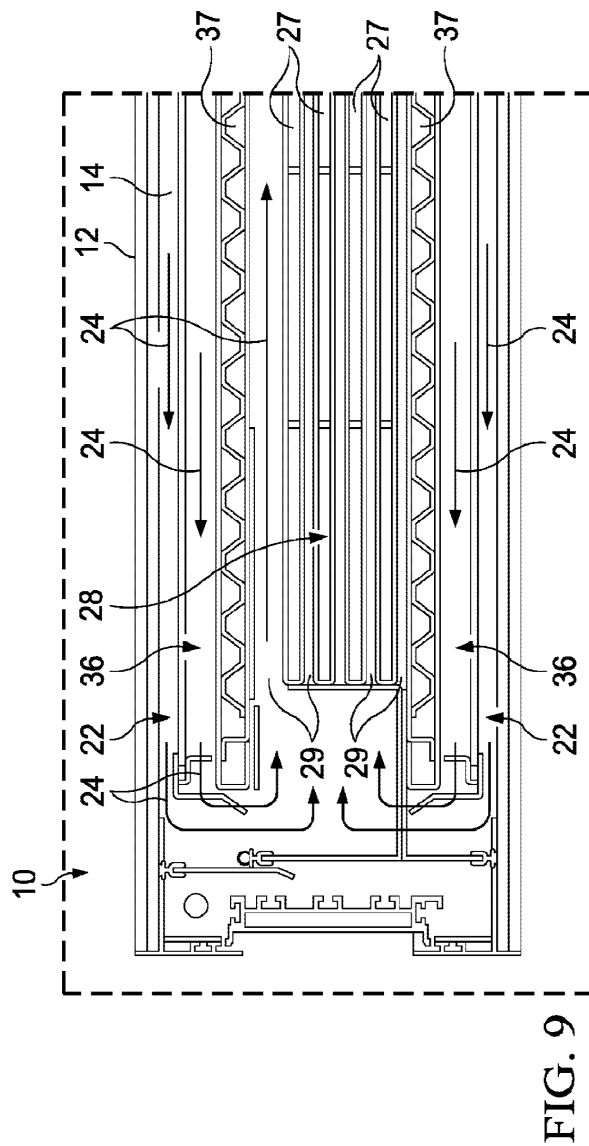


FIG. 9

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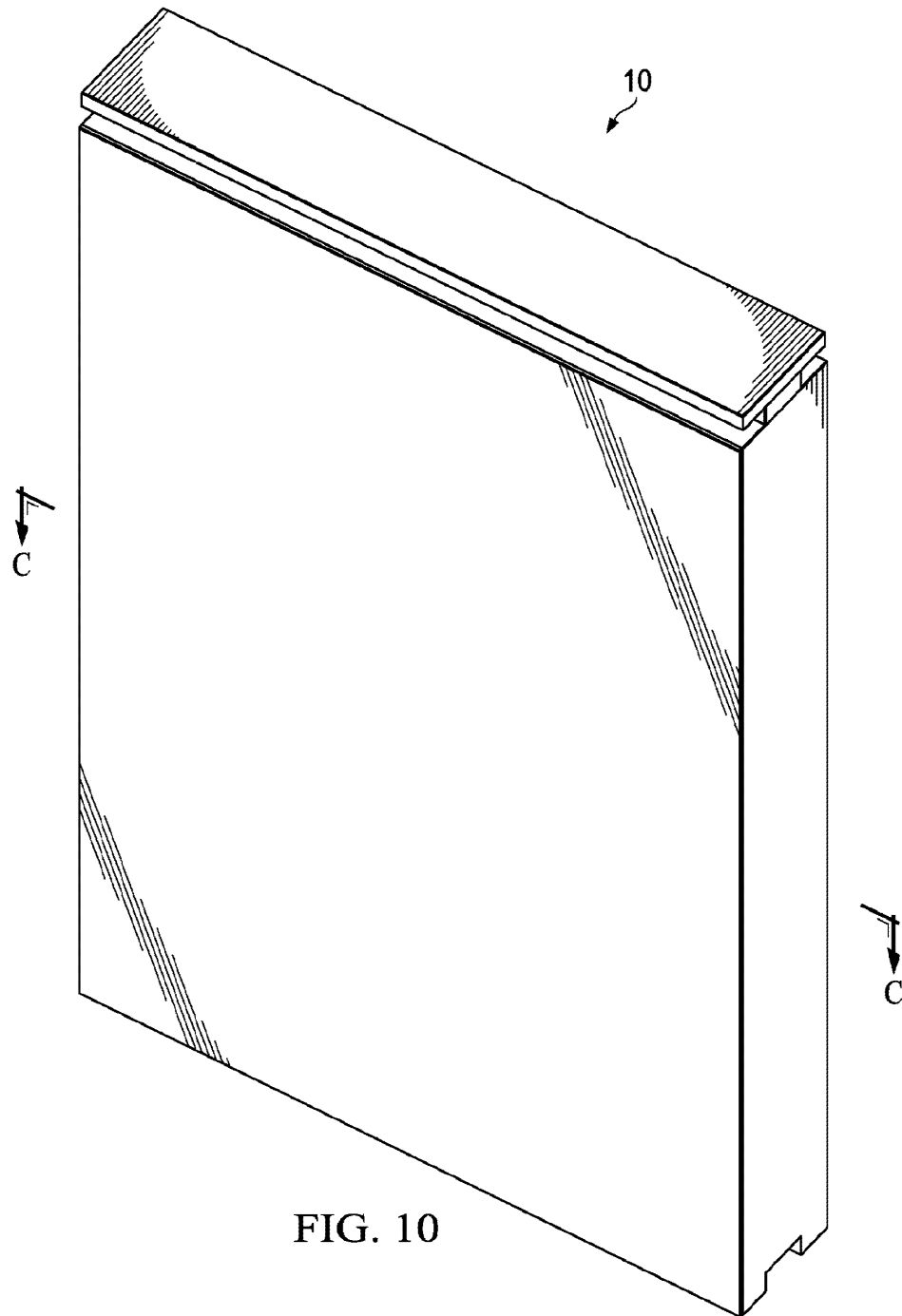


FIG. 10

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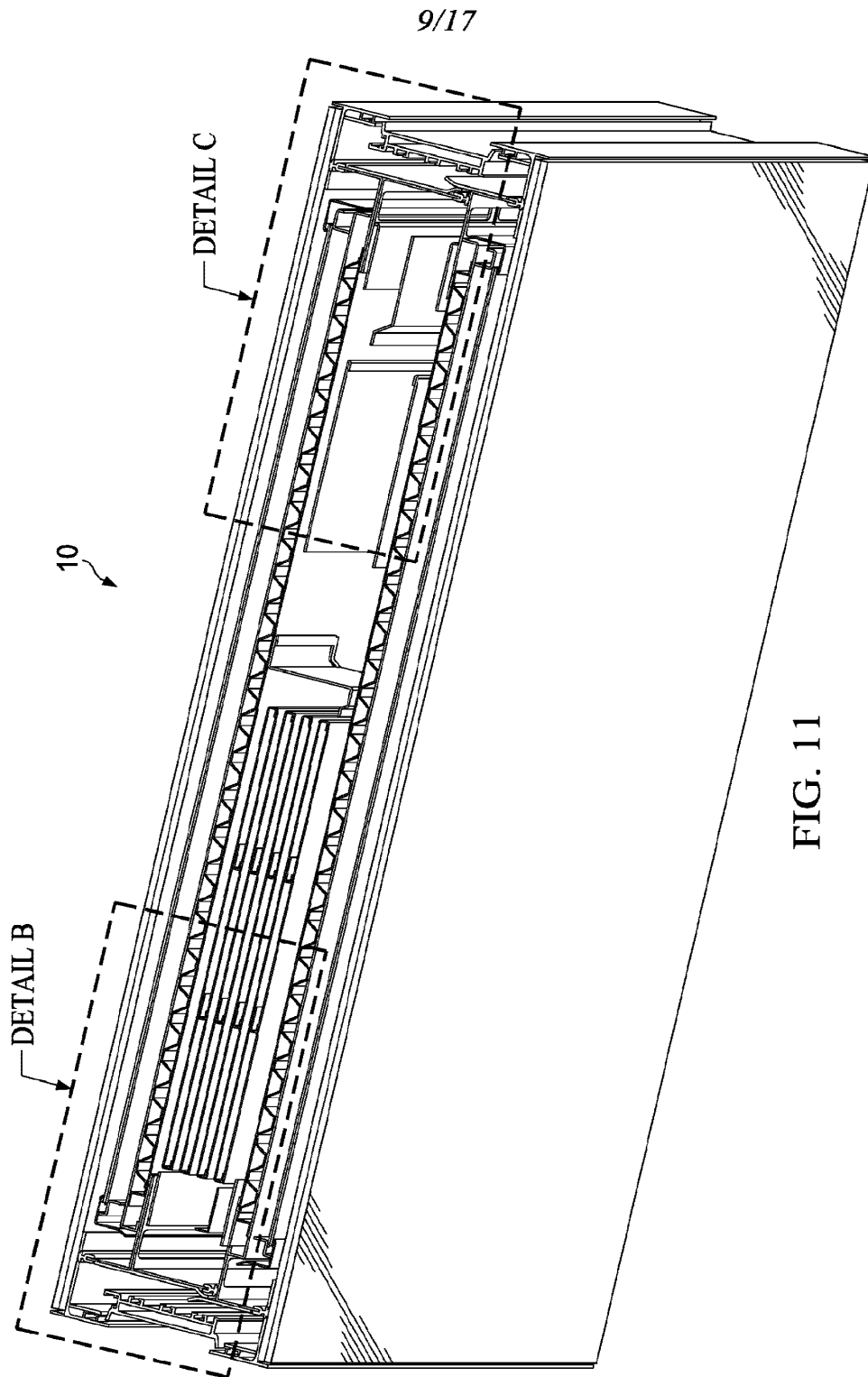
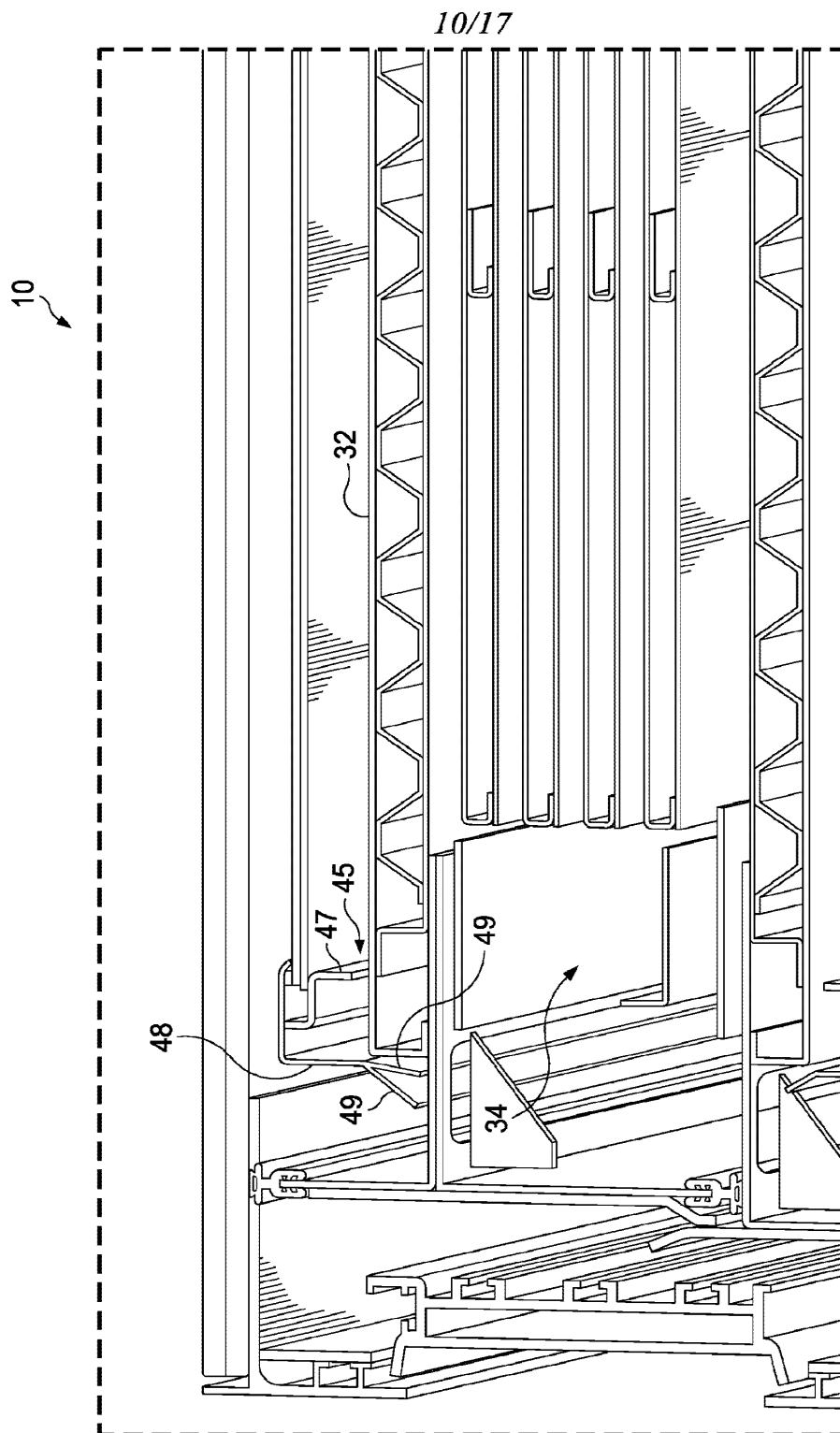


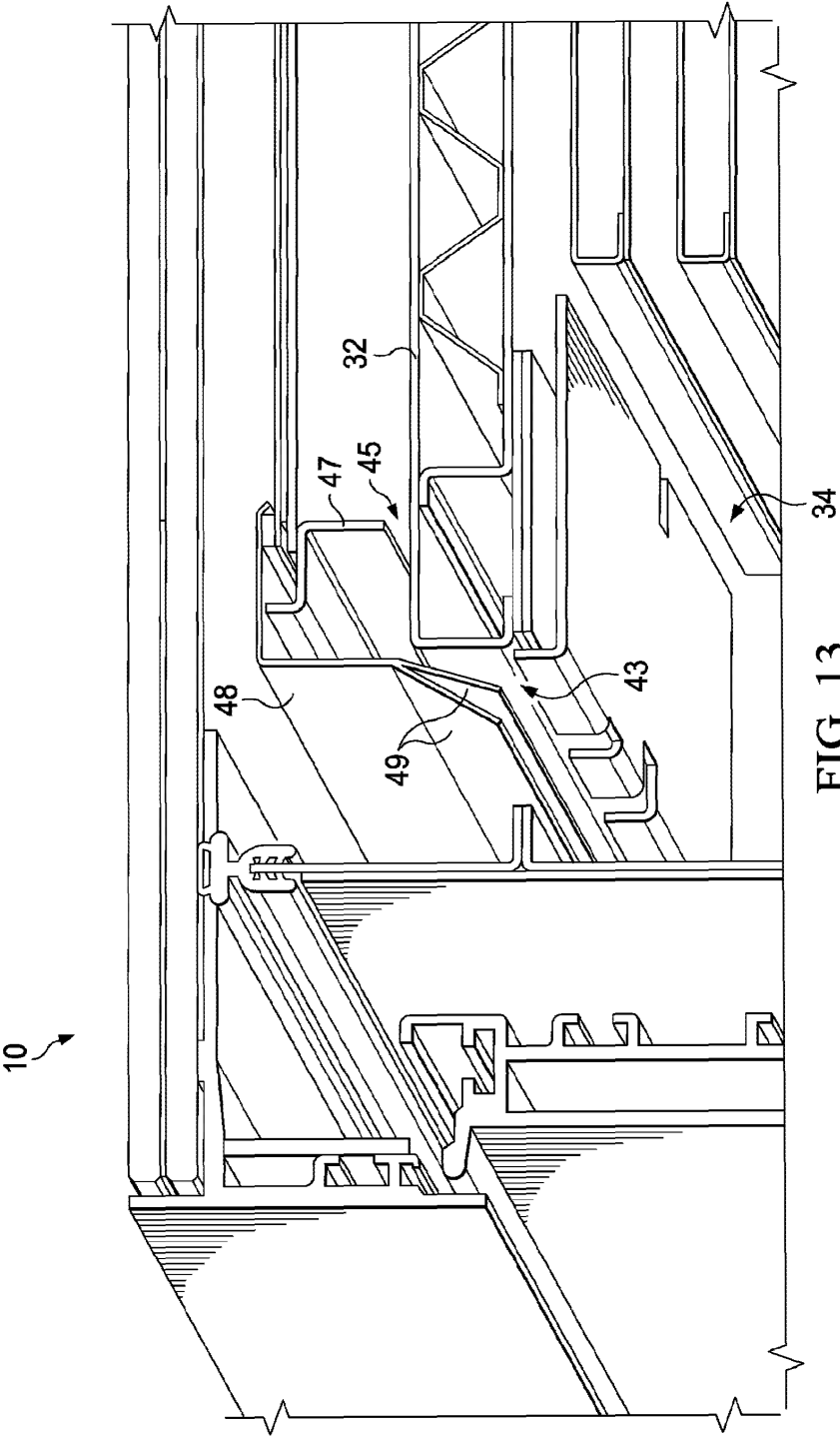
FIG. 11

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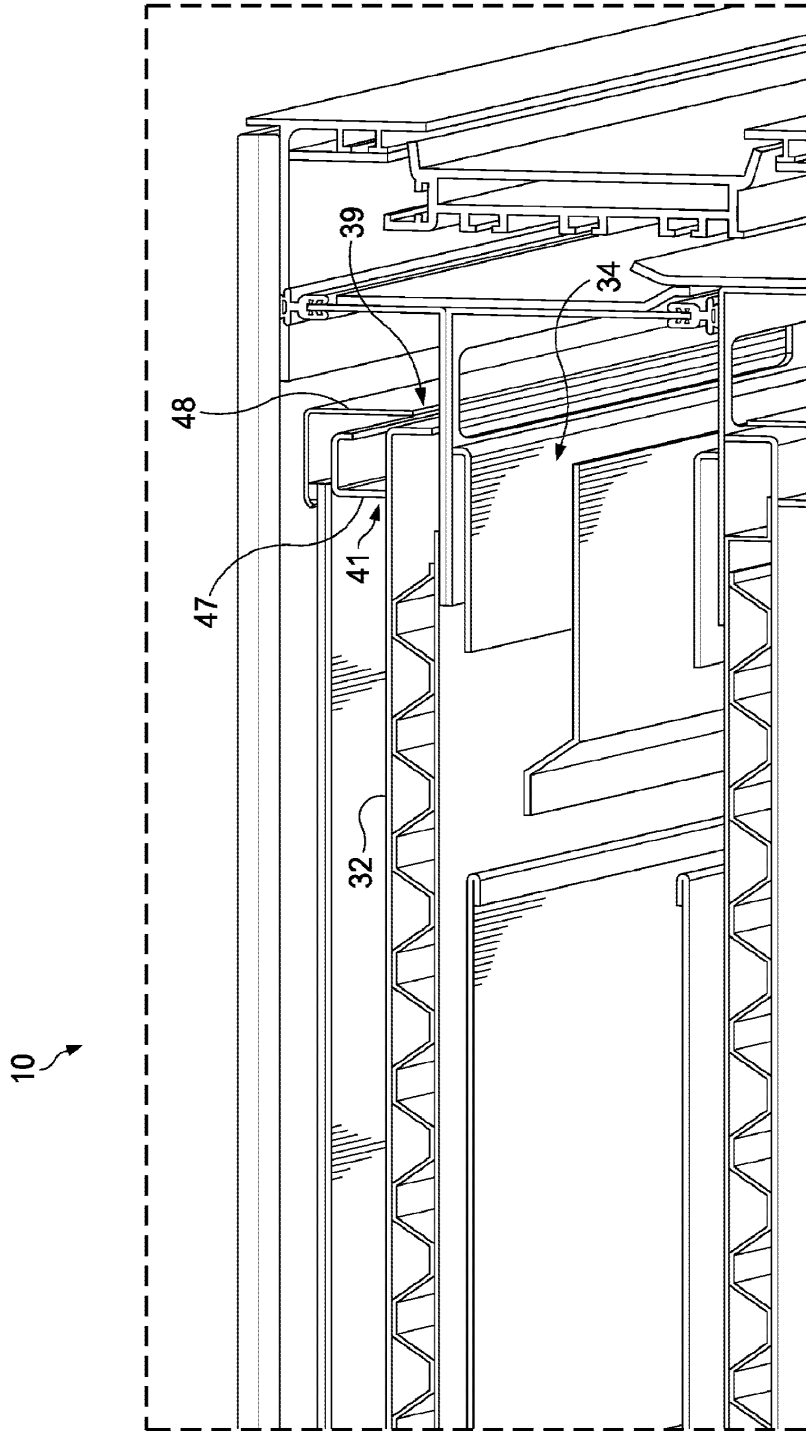


FIG. 14

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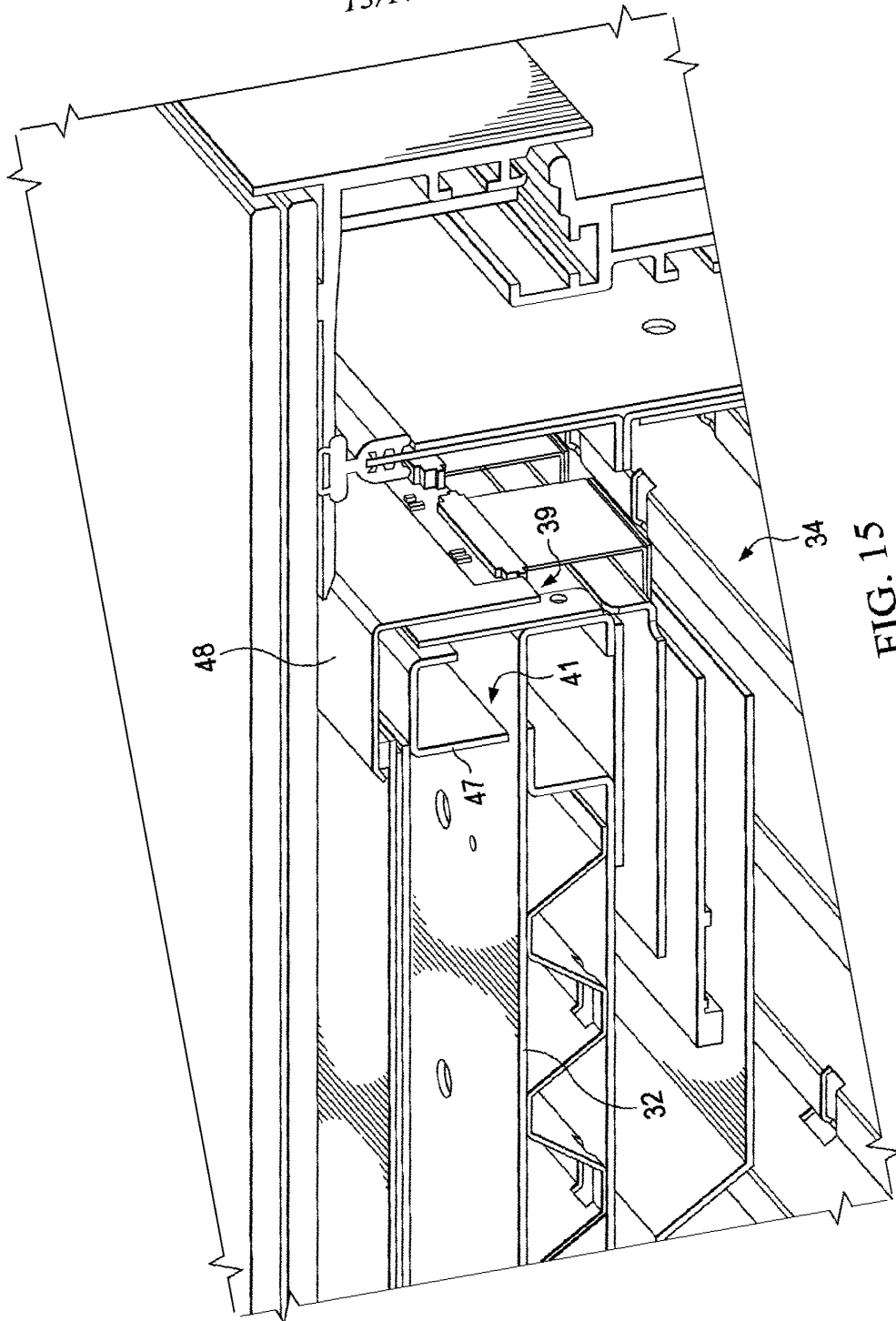


FIG. 15

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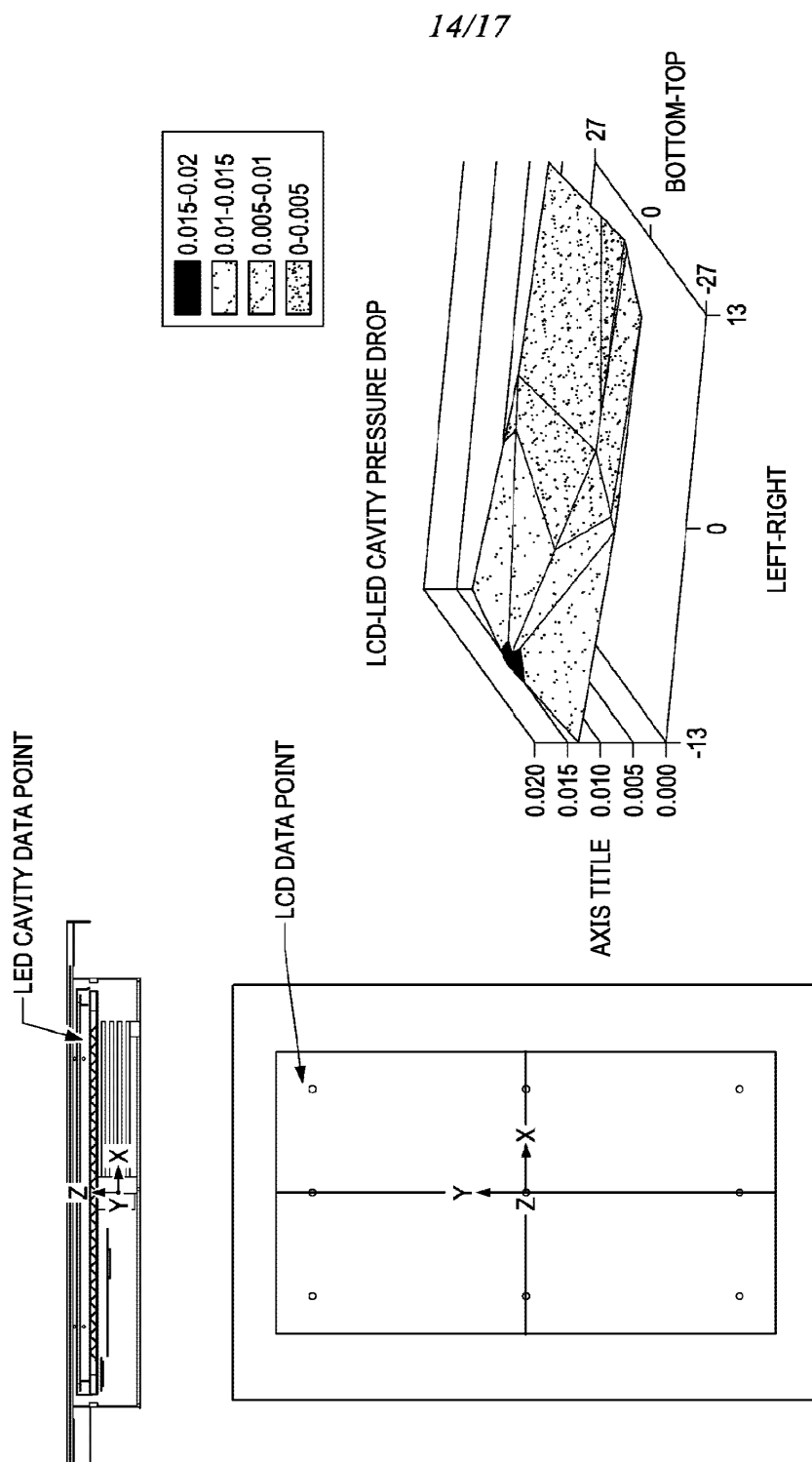


FIG. 16

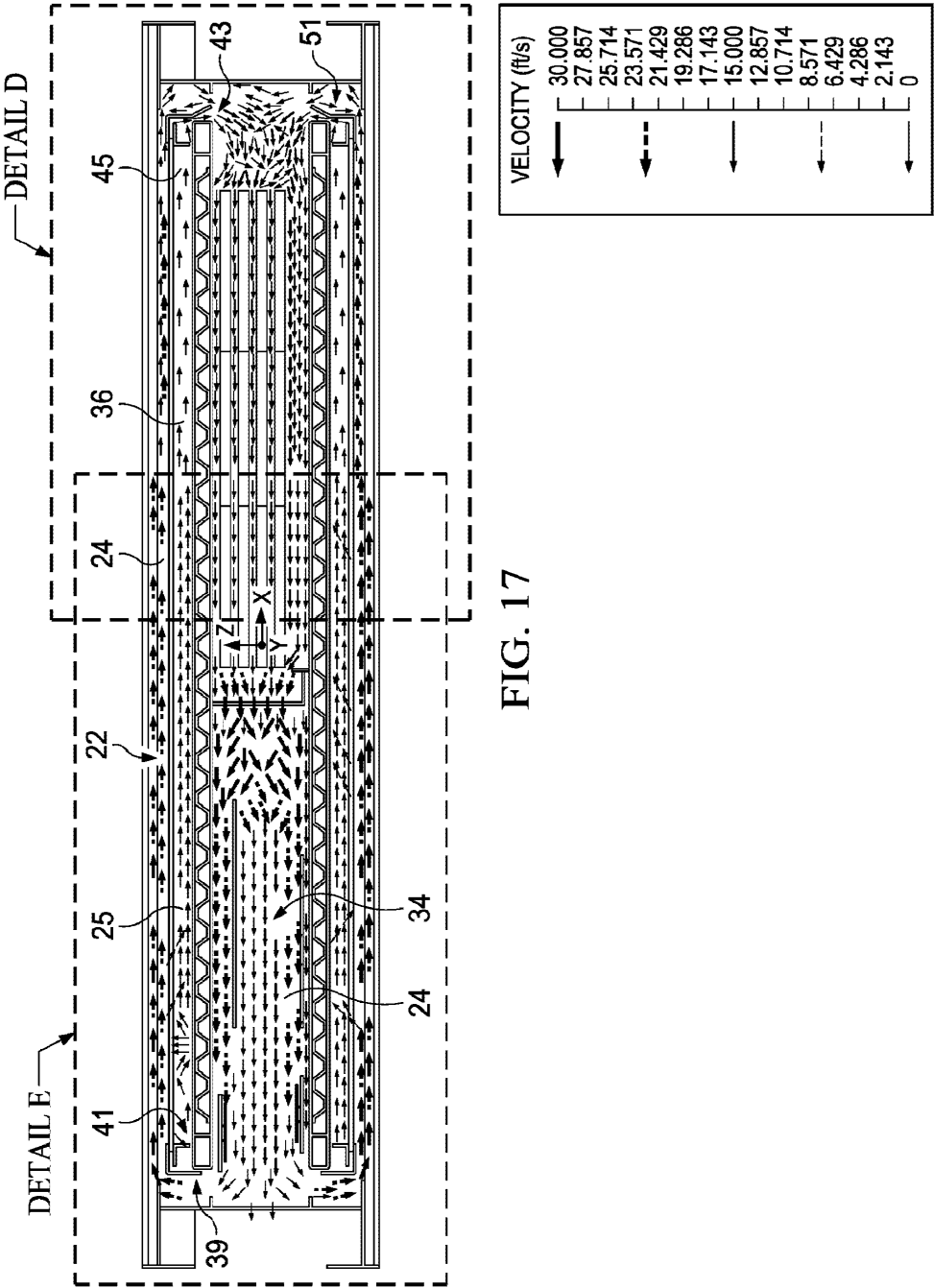


FIG. 17

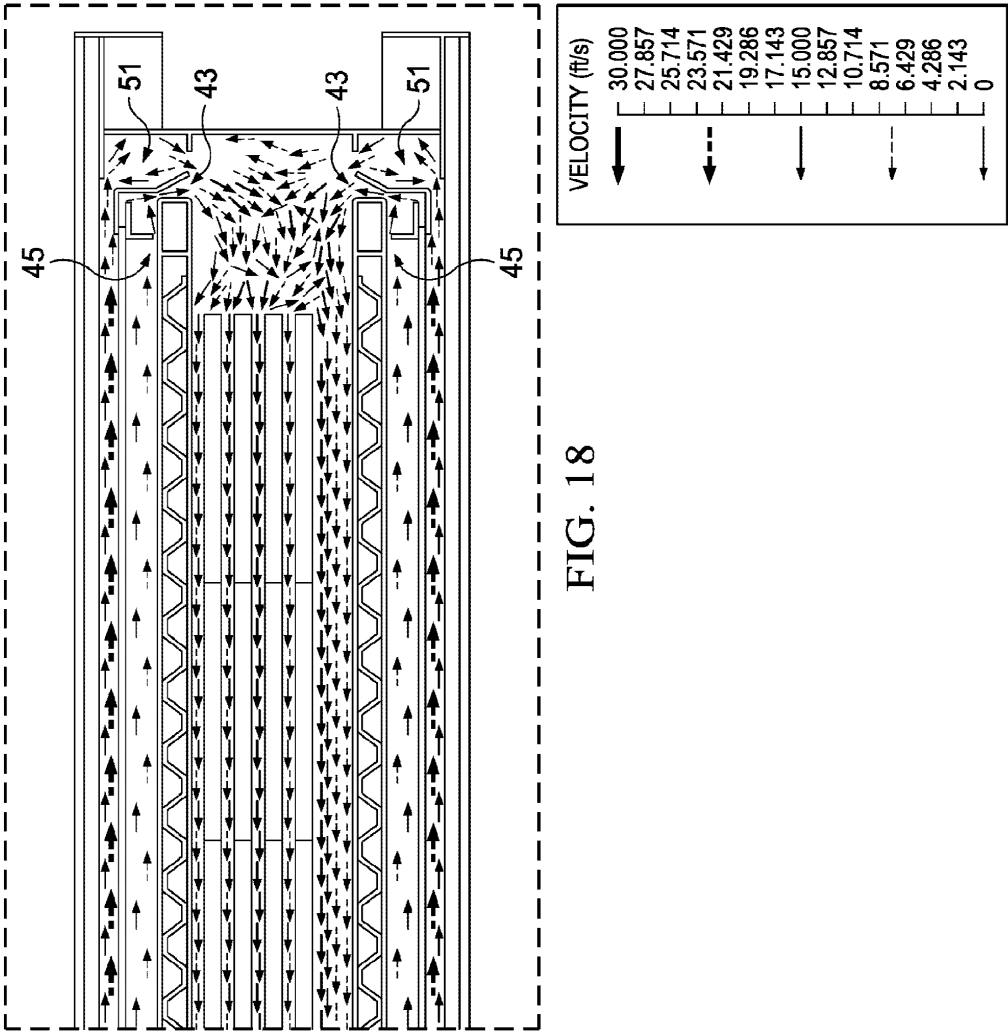


FIG. 18

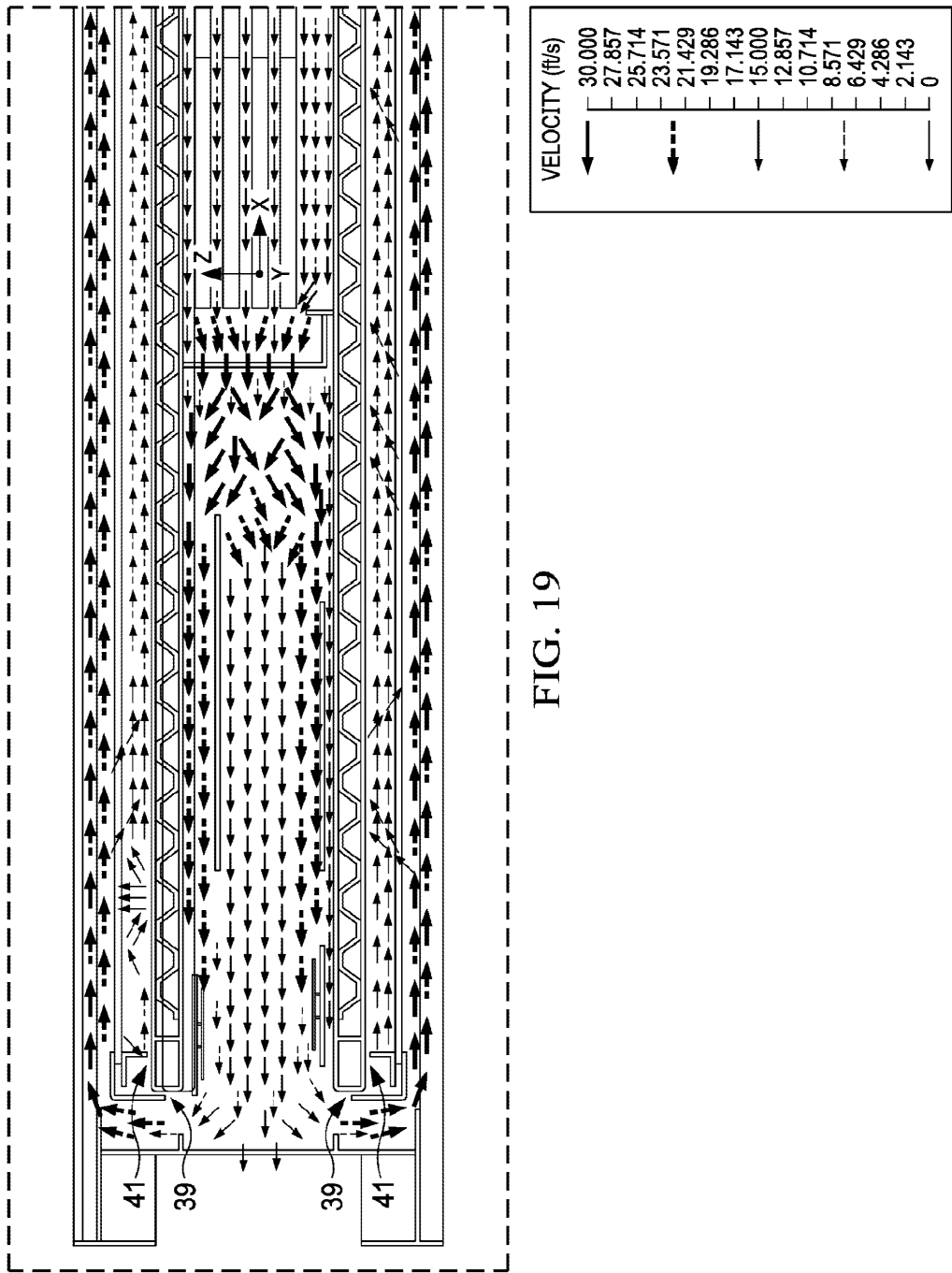


FIG. 19

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US18/29707

A. CLASSIFICATION OF SUBJECT MATTER IPC - H05K 7/20; F28D 15/00; G02F 1/13357 (2018.01) CPC - H05K 7/20972, 7/202, 7/20145, 7/20172; F28D 15/00; G02F 1/133603		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) See Search History document		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched See Search History document		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) See Search History document		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y --- A	US 2012/0012300 A1 (DUNN, W et al.) 19 January 2012; abstract, figures 1a, 4, 7, 8-9, 11, paragraphs [0008]-[0009], [0011], [0027], [0029], [0037]-[0039], [0040], [0043]-[0046], [0050], [0054]	1-4, 7, 9, 11, 15-16, & 19/16 --- 8, 10, 12-13, 17-18, 19/17, 19/18, & 20 --- 5/1, 5/2, 5/3, 5/4, 6, & 14
X	WO 2013/182733 A1 (MITRON OY) 12 December 2013; entire document	1 & 16
Y	US 2013/0176517 A1 (SAMSUNG ELECTRONICS CO., LTD) 11 July 2013; figures 2-3, paragraphs [0058]-[0062], [0067], [0072]	8, 10, 17-18, 19/17, 19/18, & 20
Y --- A	US 2002/0050793 A1 (CULL, B et al.) 02 May 2002; figure 8, paragraphs [0042]-[0043]	12-13 --- 14
A	US 2010/0226091 A1 (DUNN, W) 09 September 2010; figures 1-2, paragraphs [0023]-[0027]	1-20
A	US 2012/188481 A1 (KANG, C et al.) 26 July 2012; figures 1-5, paragraphs [0020]-[0025]	1-20
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 22 June 2018 (22.06.2018)		Date of mailing of the international search report 07 SEP 2018
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300		Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

SEC et al. v. MRI
 SEC Exhibit 1022.5583
 IPR2023-00221



Espacenet

Bibliographic data: CN108700739 (A) — 2018-10-23

COOLING SYSTEM FOR DOUBLE SIDED DISPLAY ASSEMBLY

Inventor(s): 马科斯·迪亚兹

Applicant(s): 制造资源国际公司

Classification: - international: G02B27/00; G02B27/02; H05K7/06; H05K7/20
 - cooperative: B60R11/0229; H05K7/20145; H05K7/20154;
H05K7/20972; B60R2011/004

Application number: CN20178013974 20170306 Global Dossier

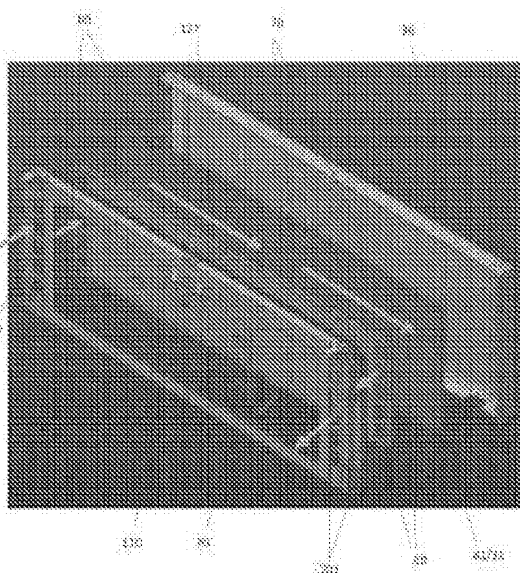
Priority number (s): US201662303806P 20160304 ; WO2017US20884 20170306

Also published as: AU2017228430 (A1) CA3015365 (A1) US2017257978 (A1) WO2017152166 (A1)

Abstract not available for CN108700739 (A)

Abstract of corresponding document: US2017257978 (A1)

A pair of electronic displays are placed back to back and are configured for mounting to a vehicle. A pair of thermal plates are located behind the electronic displays and a pair of transparent plates are located in front of the electronic displays. A closed loop of air travels vertically through the space between the electronic displays and transparent panels and through a closed loop plenum. An open loop of air travels horizontally through the space between thermal plates and the rear surface of the electronic displays.



(19)中华人民共和国国家知识产权局



(12)发明专利申请



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(71)申请人 制造资源国际公司

地址 美国佐治亚州

(72)发明人 马科斯·迪亚兹

(74)专利代理机构 北京思格颂知识产权代理有限公司 11635

代理人 王申

(51)Int.Cl.

G02B 27/00(2006.01)

G02B 27/02(2006.01)

H05K 7/06(2006.01)

H05K 7/20(2006.01)

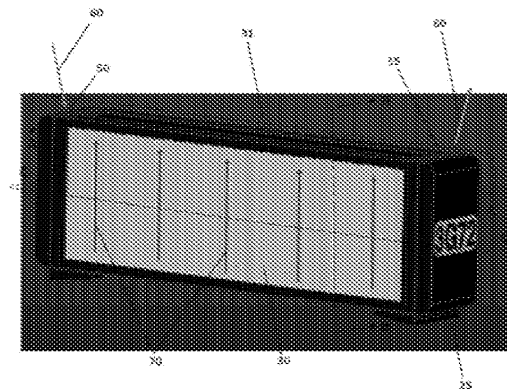
权利要求书2页 说明书4页 附图6页

(54)发明名称

一种用于双侧显示组件的冷却系统

(57)摘要

一对电子显示器(30和31)背对背放置并用于安装到车辆上,一对隔热板(126和127)位于电子显示器的后面,一对透明板(35和36)位于电子显示器的前面。闭环的空气垂直穿过电子显示器与透明面板之间的空间并通过闭环气室。开环的空气水平地穿过隔热板与电子显示器的后表面之间的空间。



CN 108700739 A

1. 一种安装在车辆上的显示组件,包括:
背靠背放置的第一电子显示器和第二电子显示器;
第一透明面板和第二透明面板,均位于所述第一电子显示器和第二电子显示器其中之一的前面;
开环路径,位于所述第一电子显示器和第二电子显示器之间,用于接收环境空气;
闭环路径,用于接收循环气体,并且包括:
分别由所述第一透明面板和第二透明面板与所述第一电子显示器和第二电子显示器形成的第一通道和第二通道,
位于所述第一电子显示器和第二电子显示器之间并与所述通道气体连通的气室,和
适于安装到车辆顶部的壳体,其中,所述壳体与所述第一透明面板和第二透明面板形成基本上围绕所述第一电子显示器和第二电子显示器、所述开环路径和所述闭环路径的外壳;
其中,所述闭环路径和所述开环路径用于将热能从循环气体传递到环境空气,同时不允许所述循环气体与所述环境空气以任何实质方式混合。
2. 如权利要求1所述的显示组件,还包括:
第一隔热板和第二隔热板,均被放置在所述电子显示器第一和第二电子显示器看之一的后表面的后面。
3. 如权利要求2所述的显示组件,其中还包括:多个电子部件,安装在至少一个所述隔热板的后表面上。
4. 如权利要求2所述的显示组件,其中还包括:
第一开环通道和第二开环通道,分别由所述第一隔热板和第二隔热板与所述第一电子显示器和第二电子显示器的后表面形成。
5. 如权利要求4所述的显示组件,其中:所述开环路径包括所述第一开环通道和第二开环通道。
6. 如权利要求5所述的显示组件,其中:所述开环路径使得环境空气水平地通过所述第一开环通道和第二开环通道。
7. 如权利要求1所述的显示组件,其中:所述闭环路径使得闭环空气垂直地通过所述第一通道和第二通道以及所述气室。
8. 如权利要求1所述的显示组件,其中,所述开环路径还包括:
位于所述壳体内部的进气孔,用于吸入环境空气;和
位于所述壳体内部的排气孔,用于排出环境空气。
9. 如权利要求8所述的显示组件,其中,所述开环路径还包括:
多个入口孔,与所述进气孔以及所述第一开环通道和第二开环通道气体连通,和
多个出口孔,与所述第一开环通道和第二开环通道以及所述排气孔气体连通。
10. 如权利要求5所述的显示组件,其中:所述闭环路径包括第一流径和第二流径,其中,所述第一流径和第二流径分别垂直环绕所述第一电子显示器和第二电子显示器。
11. 如权利要求10所述的显示组件,其中:所述第一开环通道和第二开环通道从所述第一流径和第二流径的中间穿过。
12. 如权利要求1所述的显示组件,还包括:至少一个被放置在所述开环路径内的开环

风扇,用于推动环境空气通过所述开环路径。

13.如权利要求1所述的显示组件,还包括:至少一个与所述闭环路径放置在一起的闭环风扇,用于推动循环气体通过所述闭环路径。

14.一种安装在车辆上的显示组件,包括:

一对背靠背放置并具有前表面和后表面的电子显示器;

一对透明面板,均位于一个所述电子显示器的前表面的前面;

一对闭环通道,均位于一个所述透明面板与一个所述电子显示器之间;

一对隔热板,均位于一个所述电子显示器的后表面的后面;

一对开环通道,均位于一个所述隔热板与所述一个电子显示器的后表面之间,其中,所述开环通道用于允许环境空气水平地通过;和

由所述一对隔热板形成的闭环气室,其中,所述闭环气室与所述一对闭环通道气体连通;

其中,所述闭环通道和所述闭环气室用于允许循环气体垂直通过。

15.如权利要求14所述的显示组件,还包括:安装在至少一个所述隔热板的后表面上的多个电子部件。

16.如权利要求14所述的显示组件,还包括:空间上分离的一对闭环风扇,用于推动循环气体通过所述闭环气室和所述闭环通道。

17.如权利要求14所述的显示组件,还包括:开环风扇,用于推动环境空气通过所述开环通道。

18.如权利要求14所述的显示组件,还包括:适于安装在车辆顶部的壳体。

19.一种用于安装在车辆上的显示组件,包括:

一对背靠背放置的电子显示器,所述电子显示器之间的空间形成间隙;

壳体,用于包围所述电子显示器并安装到所述车辆的车顶;

闭环路径,围绕每个所述电子显示器并穿过所述间隙;和

一对开环路径,穿过所述间隙;

其中,所述开环路径和所述闭环路径不相交。

20.如权利要求19所述的显示组件,还包括:一对隔热板,位于所述电子显示器之间,将所述开环路径与所述闭环路径相隔离。

一种用于双侧显示组件的冷却系统

交叉引用的相关申请

[0001] 本申请要求在2016年3月4日提交的美国临时专利申请No. 62/303,806的权益,特此合并于此作为整体参考。

技术领域

[0002] 本发明的实施例通常涉及用于电子显示器的冷却系统。

背景技术

[0003] 电子显示器有时用于室外环境,或其他周围温度可能较高的区域,或者可能存在其他热源的区域,例如太阳能负载,从而导致显示器内部温度升高。然而,显示器的某些部分是难以冷却的,因为简单地将环境空气吸入显示器的某些部分会将灰尘和污染物带入到显示器的敏感部分,这会导致显示器过早的发生故障。

发明内容

[0004] 示例性实施例可包括多个单独的用于使流体(例如空气)通过电子显示器壳体的流动路径。至少一个路径是闭环,而其他几个路径可以提供开环。优选地,闭环路径通过密封电子舱循环,并且从电子显示器与前透明面板之间通过。环境空气的第一开环可以从第一电子显示器后面通过,而环境空气的第二路径可以从第二电子显示器的后面通过。在一些实施例中,开环空气还能移除具有电子部件的隔热板的热量,并且在一些实施例中,开环空气也能移除LED背光(或LED显示器)的热量。通过定位风扇的位置,可以精确地控制通过每条路径的流体量。

附图说明

[0005] 除了上述特征之外,还将通过对以下附图和示例性实施例的描述对本发明的其他方面做详细说明,其中,几个视图中相同的参考数字表示相同或等同的特征,其中:

[0006] 图1所示的是双侧显示组件的一个示例性实施例的前剖视图,以及剖面线A-A,B-B和C-C的位置。

[0007] 图2所示的是沿着图1所示实施例中的剖面线A-A截取得到的侧剖视图。

[0008] 图3所示的是沿着图1所示实施例的剖面线B-B截取得到的前剖视图。

[0009] 图4所示的是沿着图1所示实施例的剖面线C-C截取得到顶剖视图,并指出细部A的位置。

[0010] 图5所示的是细部A的详细截面视图。

[0011] 图6所示的是图1所示实施例的局部爆炸图。

具体实施方式

[0012] 下文将参照附图所展示的本发明的示例性实施例对本发明进行更完整地描述。

然而,本发明可以多种不同形式体现,且不应被解释为仅限于本发明所述的示例性实施例。相反,提供这些实施例的目的是将本发明彻底和完整的公开,并将本发明的范围完全传达给本领域的技术人员。在附图中,为了清楚起见,图层和区域的大小和相对大小可以被放大。

[0013] 这里使用的术语仅用于描述特定实施例,并不用于限制本发明。如这里所使用的,单数形式“一”、“一个”和“该”也旨在包括复数形式,除非上下文另有明确指示。当在本说明书中使用术语“包括”和/或“包含”时,需要进一步理解为,指定所声明的特征、整数、步骤、操作、元素和/或组件的存在。但不排除存在或添加一个或多个其他特征、整数、步骤、操作、元素、组件和/或组件。

[0014] 在此将参考本发明的理想化实施例(和中间结构)的示意图的图示来描述本发明的实施例。因此,可以预料到图示的形状可能会发生变化,例如由于制造技术和/或公差导致的变化。因此,本发明的实施例不应被解释为仅限于本文所示区域的特定形状,而应包括形状上的偏差,例如来自制造的偏差。

[0015] 除非另外定义,本发明使用的所有术语(包括技术和科学术语)具有与本发明所属领域的普通技术人员通常理解的含义相同的含义。需要进一步理解的是,诸如在常用词典中定义的那些术语应当被解释为具有与其在相关领域的上下文中的含义一致的含义。除非明确定义,否则不会以理想化或过于正式的方式解释。

[0016] 图1所示的是双侧显示组件的一个示例性实施例的前剖视图,以及剖面线A-A,B-B和C-C的位置。一般而言,示例性实施例包括两个背对背放置于壳体25内的显示器30和31。环境空气60从进气孔50流入,穿过壳体25。环境空气60优选地通过排气孔55排出壳体25。循环气体70也在壳体25内闭环流动,但是优选的不与环境空气60的流动有任何实质方式的混合。

[0017] 如本文所用,术语环境空气60仅指为组件提供周围环境的普通大气。已知该环境空气60含有不同类型的气态元素以及灰尘、污垢、花粉、水蒸气和其他颗粒的混合物。同样如本文所用,术语循环气体70可以指任何气态物质,其可以是不同类型气体的混合物或可以是纯气态物质。优选地,循环气体70不含有大量的灰尘、污垢、花粉或其他类型的颗粒。

[0018] 本发明的示例性实施例可以用于安装到车辆上,优选地安装在车顶。壳体25的尺寸和构造可以设定成适于安装在车顶上。此外,壳体25的尺寸可以设定成适于使空气动力学阻力最小化。壳体25可包括一对支脚26,用于将壳体25安装到车辆上。支脚26的尺寸和构造可以设定成能被固定到车辆的车顶,或者固定到放置在车辆上或位于车辆内的内部支撑件。在这样的实施例中,壳体25优选地要薄,并且包括圆角和其他使空气动力学阻力最小化的特征。壳体25可包括各种提供结构刚度和强度的加强构件,以承受由移动的车辆引起的力。同样地,显示组件的各种部件可以由足够刚性的材料构成或包括足够刚性的材料,以便承受由移动的车辆引起的力。此外,显示组件的壳体和各种部件可以承受力、振动和安装在车辆上的其他严格要求。例如,但不作为一种限制,支脚26和显示组件的其他部件可包括橡胶垫或其他减震装置。

[0019] 如图所示,剖面线A-A水平地位于组件中心的下方,并垂直地穿过组件。截面线B-B是垂直方向的,并且水平地穿过组件。最后,剖面线C-C是水平方向的,并且也水平地穿过组件。图1中的剖面线箭头表示为获得剖面视图而假想的切割方向。

[0020] 图2所示的是沿着图1所示实施例的剖面线A-A截取得到的侧剖视图。环境空气60可以通过进气孔50进入壳体25,然后它可以被导向一个入口气室中,并且穿过与开环通道(下面进一步描述)连接的多个入口孔200中的一个。环境空气60优选地由一个或多个风扇100牵引,但是风扇100也可以被定位用来推动环境空气60,或者几个风扇用于推动/牵引的组合。在该特定实施例中,风扇100位于出口气室附近,环境空气60穿过多个出口孔201中的一个从开环通道被收集到出口气室内,并且通过排气孔55被引导出壳体25。

[0021] 如下面将进一步描述的,入口孔200和出口孔201与在电子显示器31后面行进的第一开环通道气体连通。优选地,在组件相对侧上具有另一组入口孔和出口孔(在该视图中未示出),与在电子显示器30后面行进的第二开环通道连通。优选地,孔200和201以彼此基本等距的方式分布在电子显示器30/31的宽度上。孔200/201允许环境空气60的流穿过壳体25和开环通道,并且基本上不与循环气体70混合或进入密封电子舱125。

[0022] 多个电子部件110,优选地,放置在密封电子舱125内,该密封电子舱125构成了循环气体70闭环的一部分。电子部件110可以包括一个或多个下列部件:电源模块、视频播放器、电子数据存储、微处理器、卫星/无线接收器/发射器以及定时和控制板。电子部件110中的至少一些部件可以与显示器30和31电连接。

[0023] 一个或多个风扇90可以将循环气体70的闭环施加在电子部件110上。虽然图示中有两个风扇90,但这不是必需的。另外,虽然示出了将循环气体70推送到电子元件110上,但这不是必需的,因为风扇90也可以定位成拉动循环气体70,或者多个风扇90可以用于组合推/拉循环气体70。

[0024] 图3所示的是沿着图1所示实施例的剖面线B-B截取得到的前剖视图。这里,可以清楚地示出循环气体70的闭环。如上所述,循环气体70,优选地,在密封电子舱125内流过电子部件110,然后分开,分别环绕显示器30和31。关于第一显示器30,优选地,将透明面板35放置在显示器30的前面,在显示器30与透明面板35之间限定了用于接收循环气体70的闭环通道。一旦循环气体70穿过显示器30,它就被引回到密封电子舱125中再次开始封闭循环。

[0025] 类似地,关于第二显示器31,透明面板36,优选地,放置在显示器31的前面,在显示器31与透明面板36之间限定了用于接收循环气体70的闭环通道。一旦循环气体70穿过显示器31上,它就被引回到密封电子舱125中再次开始封闭循环。

[0026] 如图所示,环境空气60的气流,优选地,分成至少两个通道,其中,一个开环通道在每个显示器后面行进。关于显示器30,环境空气60的路径优选地从显示器30的后表面与密封电子舱125的隔热板126之间经过。当使用直接LED背光LCD作为显示器30时,虽然不是必需的,环境空气60优选地从LED背光40的后表面与隔热板126之间经过。如上所示,多个电子部件110优选地连接到一个或两个隔热板126和127上(或在它们附近)。这样,来自电子部件110的热量可以被传递(优选地通过传导,但是也可能发生一些对流和辐射)到隔热板126和127并且通过环境空气60的流动被移除。

[0027] 类似地,关于显示器31,环境空气60的路径优选地从显示器31的后表面与密封电子舱125的隔热板127之间行进。当使用直接LED背光LCD作为显示器31时,虽然不是必需的,环境空气60优选地从LED背光41的后表面与隔热板127之间经过。应该明确指出,尽管在这些实施例中示出了直接LED背光LCD,但是这种类型的显示器及其相关的背光对每个实施例并不是必需的。显示器30和31可以是以下任何一种:等离子、OLED、LCD(直接点亮或边缘点

亮)、LED和任何类型的电致发光聚合物显示器。

[0028] 图4所示的是沿着图1所示实施例的剖面线C-C截取得到顶剖视图,并指出细部A的位置。在该图中,可以看到在每个显示器30和31的后面有两个环境空气60的通道。同样,优选地,环境空气60的两个通道可以移除来自电子显示器30和31以及电子部件110的热量(通过隔热板126和127)。

[0029] 图5所示的是细部A的详细截面视图。一旦环境空气60穿过每个开环通道,它就被出口气室收集,并被风扇100排到显示器壳体25之外。

[0030] 图6所示的是图1所示实施例的局部爆炸图。该图示出了组件一侧的元件的层叠结构,即电子显示器31周围的部件。环境空气60优选地被引导通过入口孔200,使其可以从隔热板127与电子显示器31的后部之间通过(在该实施例中,是LED背光41的后表面)。一旦通过了开环通道,环境空气60优选地被引导出出口孔201,使得它可以被收集到出口气室中并从显示器外壳排出。循环气体70通常环绕具有环境空气60的开环通道。换句话说,开环的环境空气60通过循环气体70的闭环的中心。

[0031] 如上所述,循环气体70优选地经过电子部件110,离开密封电子舱125,从前透明板36与电子显示器31的前部之间经过,最终返回到密封电子舱125。再次应该注意的是,在该局部爆炸图中仅示出了该实施例的一半。通常,如上所示和所述,将存在围绕相对的显示器30行进的循环气体70的第二个闭环和用于使环境空气60通过显示器30后面的第二开环通道。

[0032] 还应注意的是,图中所示的各种打开和闭合的冷却回路可以以水平或垂直布置示出,但是,显然,这可以根据具体实施例逆转或改变。因此,闭环可以水平或垂直地,并且沿顺时针或逆时针方向行进。此外,开环也可以是水平的或垂直的,并且可以从左到右、从右到左、从上到下或从下到上地行进。

[0033] 展示并描述了本发明的优选实施例后,本领域技术人员将认识到,在发明要求保护的范围内仍然可以进行许多影响所描述发明的变化和修改。另外,上面指出的许多元件可以由不同的元件改变或替换,这些元件将提供相同的结果,并且符合所述发明的构思。因此,其意图是仅根据权利要求书的范围来限制本发明。

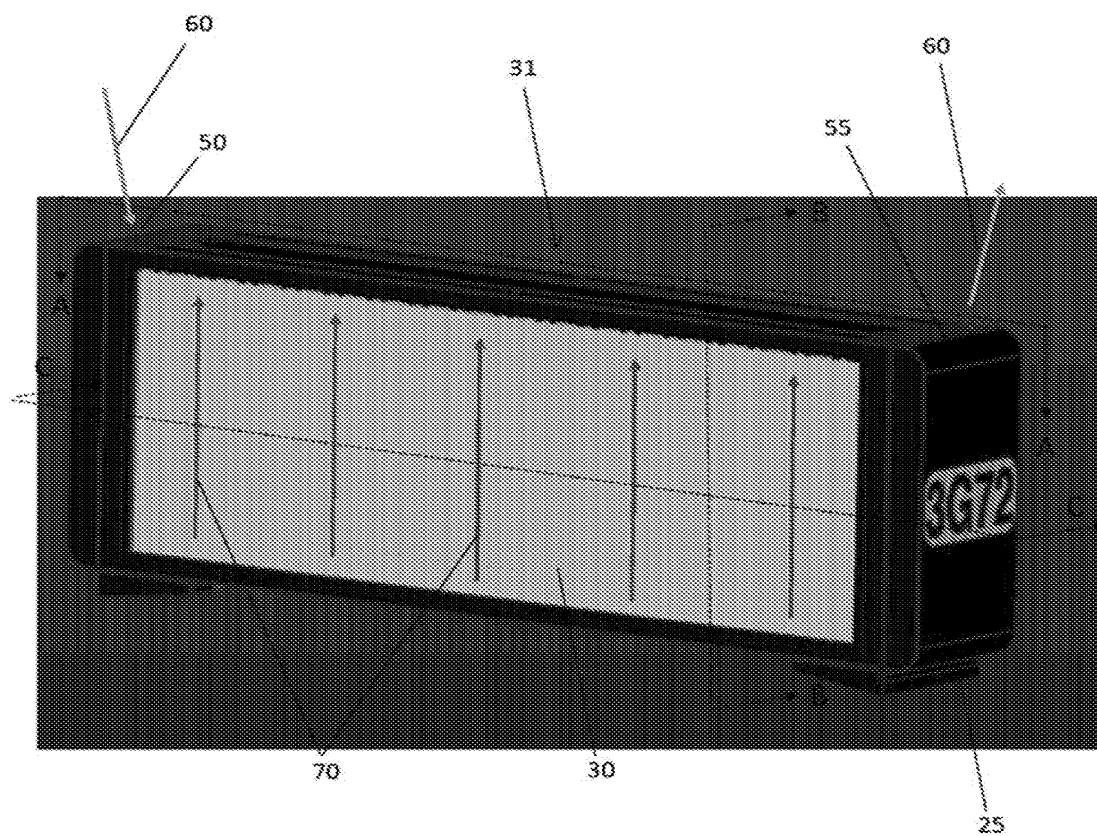


图1

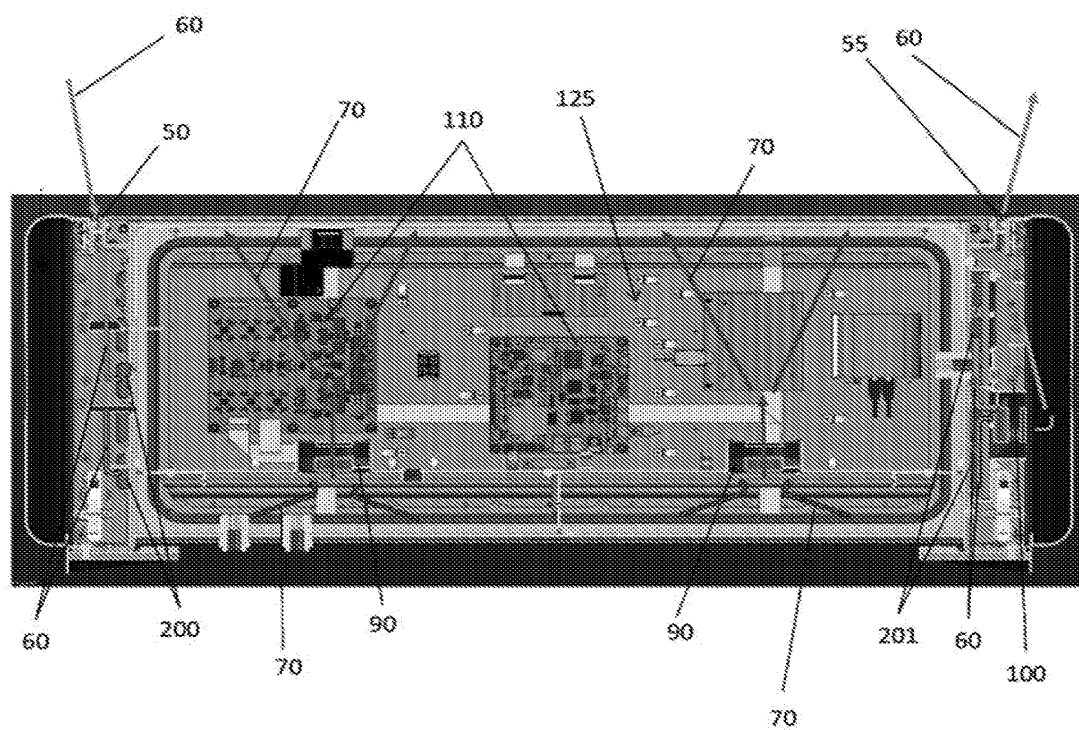


图2

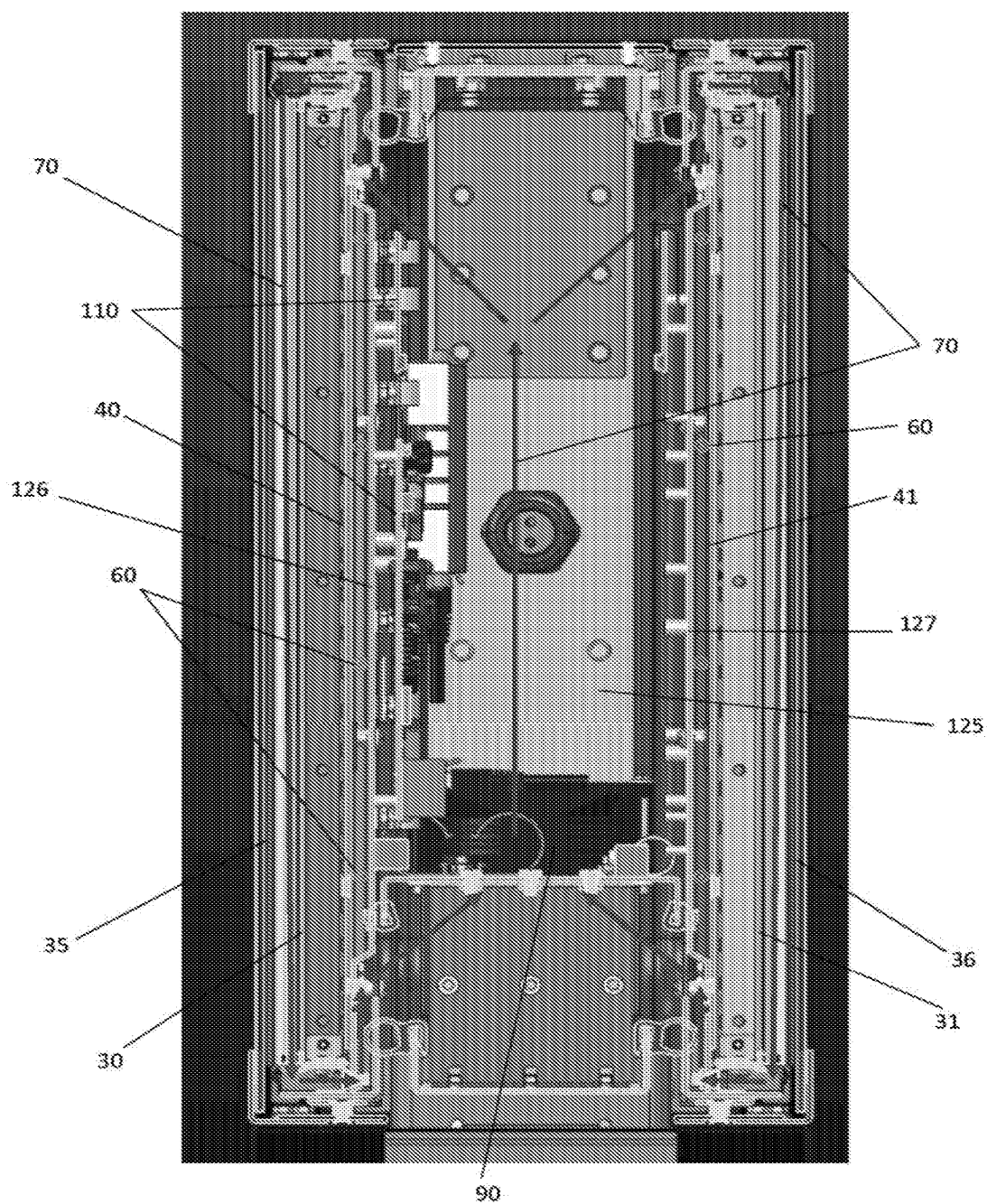


图3

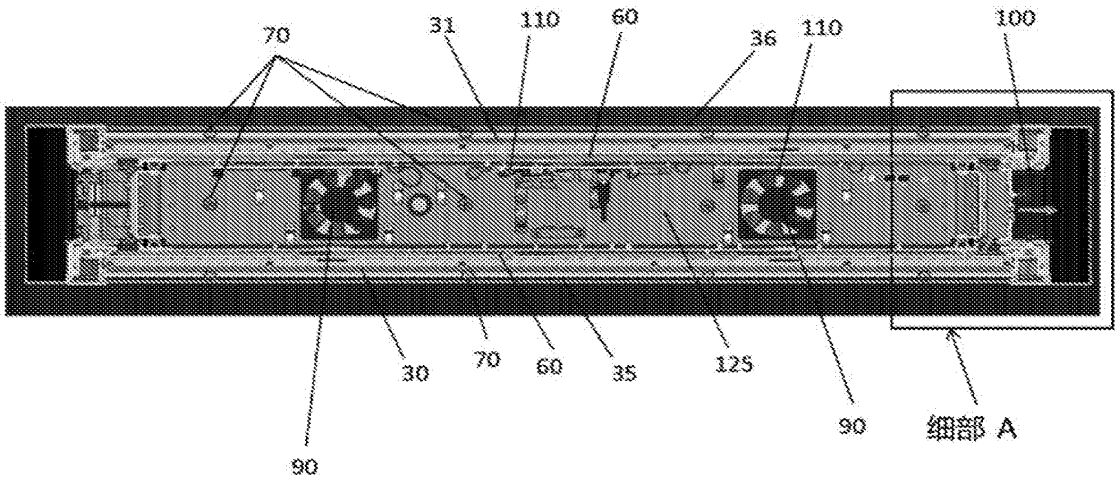


图4

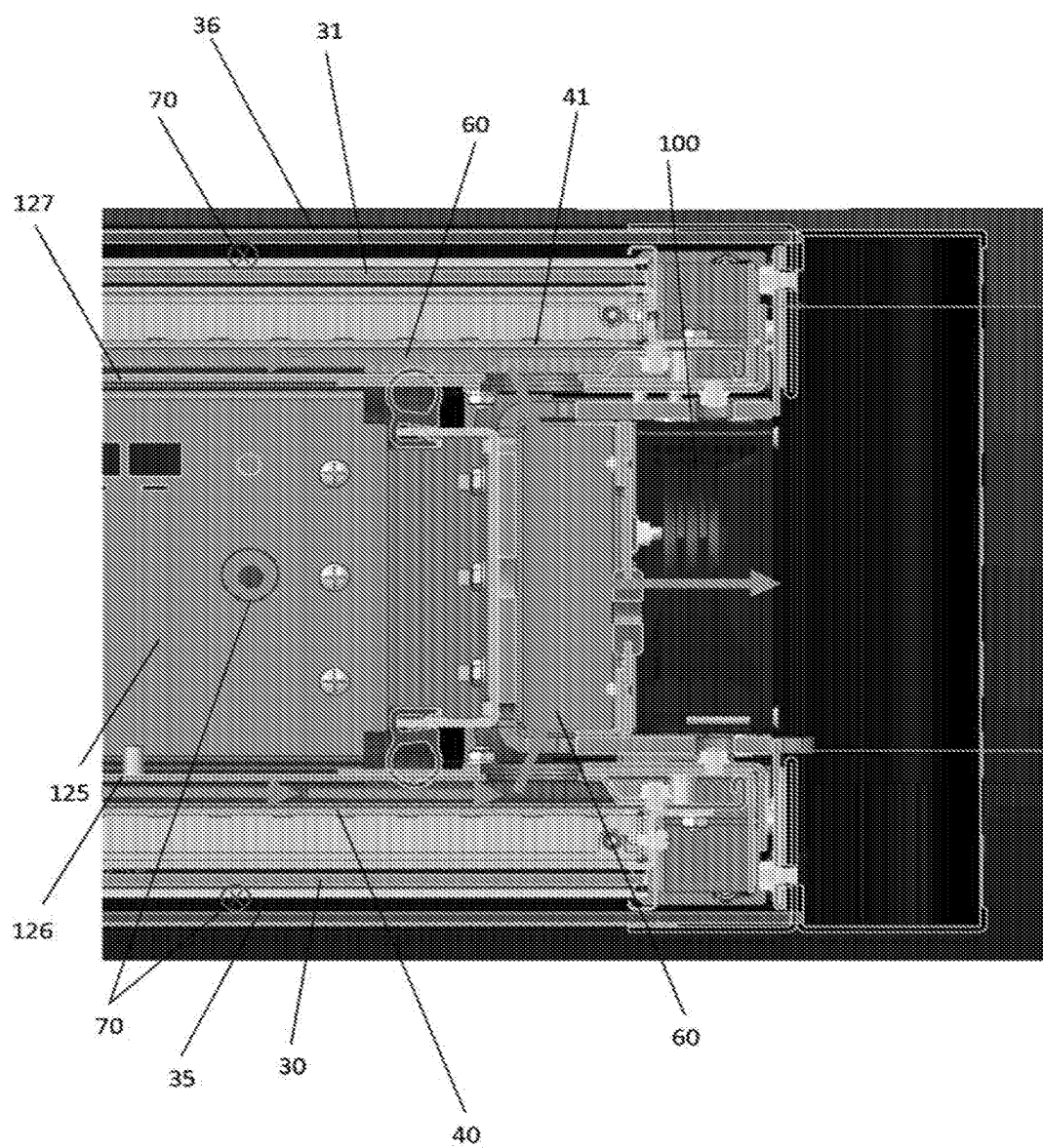


图5

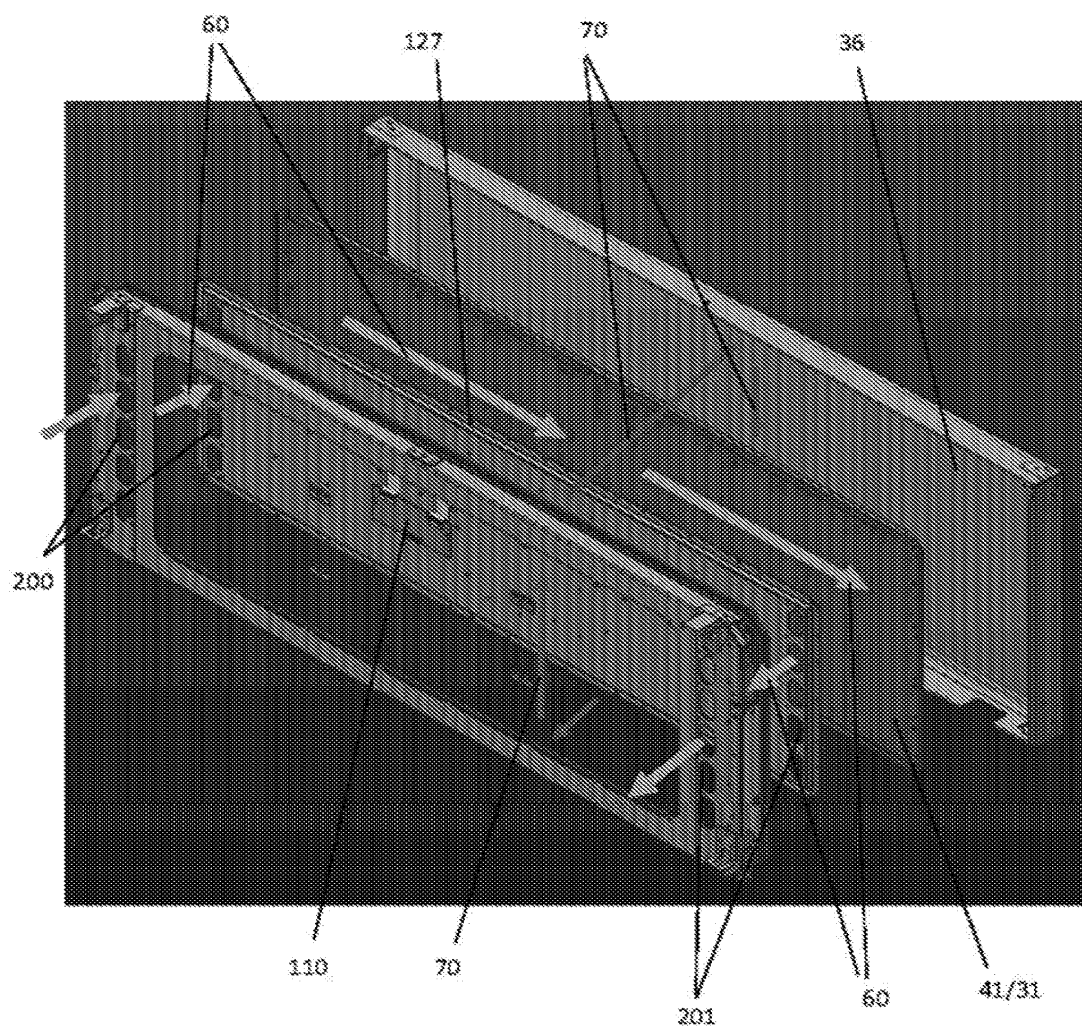


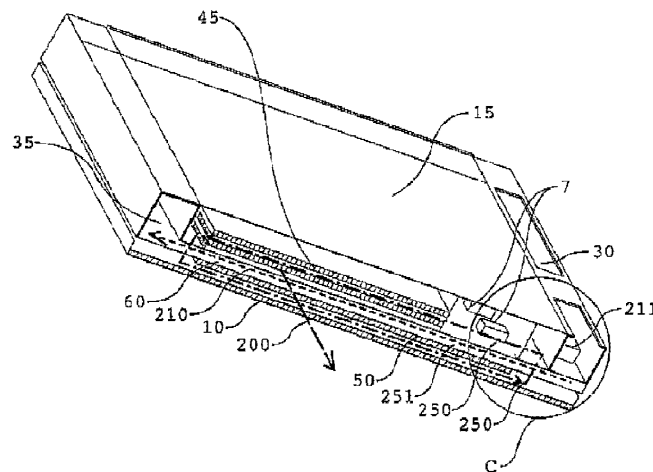
图6



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(72) Inventeurs/Inventors:
DUNN, WILLIAM R., US;
HUBBARD, TIM, US;
BEDELL, WARE, US
(73) Propriétaire/Owner:
MANUFACTURING RESOURCES INTERNATIONAL,
INC., US
(74) Agent: GASTLE AND ASSOCIATES

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ELECTRONIQUE PRESENTANT DES EMISSIONS DE BRUIT REDUITES
(54) Title: SYSTEM FOR THERMALLY CONTROLLING AN ELECTRONIC DISPLAY WITH REDUCED NOISE
EMISSIONS



(57) Abrégé/Abstract:

An assembly for cooling an electronic image assembly having a rear channel placed behind the image assembly and a heat exchanger for accepting ambient air. The system contains a first fan placed within the heat exchanger to force ambient air through the heat exchanger and the rear channel. A second fan may be used to force circulating gas through an interior portion of the display housing and through the heat exchanger in order to transfer heat to the ingested ambient air.

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- (71) Applicant (for all designated States except US): **MANUFACTURING RESOURCES INTERNATIONAL, INC.**
[US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US).
- (72) Inventors; and
(75) Inventors/Applicants (for US only): **DUNN, William, R.** [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US). **HUBBARD, Tim** [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US). **BEDELL, Ware** [US/US]; 1600 Union Hill Road, Alpharetta, GA 30005 (US).
- (74) Agents: **DUNHAM, Tyler** et al.; Standley Law Group LLP, 6300 Riverside Drive, Dublin, OH 43017 (US).
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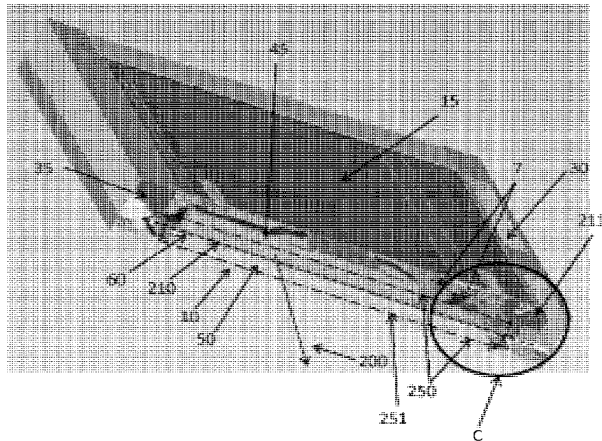


FIG - 4

(57) Abstract: An assembly for cooling an electronic image assembly having a rear channel placed behind the image assembly and a heat exchanger for accepting ambient air. The system contains a first fan placed within the heat exchanger to force ambient air through the heat exchanger and the rear channel. A second fan may be used to force circulating gas through an interior portion of the display housing and through the heat exchanger in order to transfer heat to the ingested ambient air.

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SYSTEM FOR THERMALLY CONTROLLING AN ELECTRONIC DISPLAY WITH REDUCED NOISE EMISSIONS

Inventors: William Dunn, Tim Hubbard, and Ware Bedell

Technical Field

[0001] Exemplary embodiments generally relate to cooling systems and in particular to cooling systems for electronic displays.

Background of the Art

[0002] Improvements to electronic displays now allow them to be used in outdoor environments for informational, advertising, or entertainment purposes. While displays of the past were primarily designed for operation near room temperature, it is now desirable to have displays which are capable of withstanding large surrounding environmental temperature variations. For example, some displays are capable of operating at temperatures as low as -22F and as high as 113 F or higher. When surrounding temperatures rise, the cooling of the internal display components can become even more difficult.

[0003] Additionally, modern displays have become extremely bright, with some backlights producing 1,000-2,000 nits or more. Sometimes, these illumination levels are necessary because the display is being used outdoors, or in other relatively bright areas where the display illumination must compete with other ambient light. In order to produce this level of brightness, illumination devices and electronic displays may produce a relatively large amount of heat.

[0004] Still further, in some situations radiative heat transfer from the sun through a front display surface can also become a source of heat. In some locations 800-1400 Watts/m² or more through such a front display surface is common. Furthermore, the market is demanding larger screen sizes for displays. With increased electronic display screen size and corresponding front display surfaces, more heat will be generated and more heat will be transmitted into the displays.

[0005] Exemplary modern displays have found some effective means for cooling the displays including circulating a closed loop of gas around the display and drawing ambient gas through the display so that the closed loop of gas may be cooled (as well as portions of the electronic display). Various thermal communications have been discovered which can transfer heat away from the sensitive electronic components and out of the display. Heat exchangers were found to produce an excellent means for transferring heat between the closed loop of gas and the ambient gas. However, previous designs for moving the gas through the display have been found to generate an undesirable amount of noise emission from the display as well as thermal gradients where portions of the display were cooled but others remained warm.

[0006] When using LCD displays, it was found that backlights were often a source of heat and it was desirable to move gas across the rear surface of the backlight in order to cool it. While desirable, it was thought that the front surface of the backlight could not be cooled for fear that the backlight cavity would become contaminated with dust, dirt, or other particulate.

Summary of the Exemplary Embodiments

[0007] In an aspect, there is provided an assembly for cooling an electronic image assembly within a housing having an inlet aperture for ambient gas, exit aperture for ambient gas, and internal cavity for circulating gas. The assembly comprises a first portion of a heat exchanger which accepts ambient gas from the inlet aperture. A second portion of a heat exchanger accepts ambient gas from the first portion. A channel is placed behind the electronic image assembly and in gaseous communication with the inlet and exit apertures. A first fan is positioned between the first and second portions which forces ambient gas through the first portion, second portion, and the channel. A second fan forces circulating gas through the internal cavity and at least one of the heat exchanger portions.

[0008] In another aspect, there is provided an electronic display assembly comprising a housing having an inlet aperture and exit aperture for ambient gas. An electronic image assembly is within the housing. A transparent front plate is in front of the electronic image assembly, and the space between the transparent front plate and the electronic image assembly defines a front channel. A rear plate is placed behind the

electronic image assembly, and the space between the rear plate and the electronic image assembly defines a rear channel. A heat exchanger is in gaseous communication with the front channel. The heat exchanger comprises two portions, each portion having first and second gas pathways, where the first gas pathways are in gaseous communication with the inlet and exit apertures and the second gas pathways are in gaseous communication with the front channel. An ambient gas fan assembly is placed between the two portions of the heat exchanger to force ambient gas through the first gas pathways and through the rear channel; and a circulating gas fan assembly is positioned to force circulating gas through the front channel and the second gas pathways.

[0009] In another aspect, there is provided a thermally-controlled liquid crystal display (LCD) assembly comprising a housing having an inlet aperture and exit aperture for ambient gas. A LED backlight has a rear surface and placed within the housing. A liquid crystal display (LCD) has a front surface and placed in front of the LED backlight and within the housing. A transparent front plate is in front of the LCD, and the space between the transparent front plate and the LCD defines a front channel. A rear plate is placed behind the rear surface of the LED backlight. A plurality of ribs is placed between the rear plate and LED backlight, and the space between the rear plate, LED backlight, and ribs defines a plurality of rear channels. A heat exchanger has a first gas pathway in gaseous communication with the front channel, and a second gas pathway is in gaseous communication with the inlet and exit apertures. An ambient gas fan assembly is placed within the heat exchanger to force ambient gas into the inlet aperture, through the second gas pathway and the rear channels, and out of the exit aperture. A circulating gas fan assembly is positioned to force circulating gas through the front channel and the first gas pathways.

[0010] Exemplary embodiments may use a combination of circulating gas and ambient gas in order to adequately cool an electronic display. Circulating gas may be used to remove heat from the front of the image assembly. Circulating gas may also be used to remove heat from internal electronic assemblies. When using a LCD as the electronic image assembly, circulating gas may also be used to remove heat from the backlight cavity of the LCD. Because the gas is only circulating within the display, it can remain free of particulate and contaminants and will not harm the display.

[0011] Ambient gas may be ingested into the display in order to cool the circulating gas. The ambient gas and the circulating gas may be drawn through a heat exchanger which will allow the heat to transfer from the circulating gas to the ambient gas, preferably without letting the ambient and circulating gases mix with one another. An exemplary embodiment would use a cross-flow heat exchanger. An additional flow of ambient gas can be drawn across the rear surface of the image assembly to remove heat from the rear portion of the image assembly. When using a LCD as the electronic image assembly, this additional flow of ambient gas can be used to remove heat from the rear portion of the backlight for the LCD.

[0012] In order to reduce noise emissions, the fans which drive the ambient and/or circulating gas through the heat exchanger may be placed within the heat exchanger (or between two separate heat exchangers), which can then act as a muffler and reduce the noise emitted by the fans. Further, if using the additional ambient gas pathway behind the electronic image assembly, a manifold may be used to collect the ambient gas along an edge of the display and distribute this into a number of smaller flows. The fans for driving this additional ambient gas pathway can be placed within the manifold in order to reduce the noise emitted by the fans and provide an even distribution of ambient gas across the display. In an exemplary embodiment, a single fan assembly can be used to drive the ambient gas through both the heat exchanger(s) and behind the electronic image assembly.

[0013] It has been found that ingesting ambient gas from the top or bottom edge of the display is preferable as these edges are not typically observable to the viewer. However, when ingesting ambient gas from the top or bottom of a portrait-oriented display, it has been found that as the cool ambient gas travels across the rear portion of the electronic image assembly and accepts heat it increases in temperature. Once the cooling air reaches the opposite edge (either top or bottom), it may have increased in temperature substantially and may no longer provide adequate cooling to the opposing portion of the display. Thus, the manifolds herein allow for cool ambient air to adequately cool the entire electronic image assembly in an even manner and reduce any 'hot spots' within the electronic image assembly.

[0014] The foregoing and other features and advantages will be apparent from the following more detailed description of the particular embodiments of the invention, as illustrated in the accompanying drawings.

Brief Description of the Drawings

[0015] A better understanding of an exemplary embodiment will be obtained from a reading of the following detailed description and the accompanying drawings wherein identical reference characters refer to identical parts and in which:

[0016] **FIGURE 1A** provides a front perspective view of an exemplary embodiment of the electronic display.

[0017] **FIGURE 1B** provides a rear perspective view of an exemplary embodiment of the electronic display.

[0018] **FIGURE 2** provides a rear perspective view similar to that shown in Figure 1B where the rear cover has been removed.

[0019] **FIGURE 3** provides a perspective sectional view along the A-A section line shown in Figure 1B.

[0020] **FIGURE 4** provides a perspective sectional view along the B-B section line shown in Figure 1B.

[0021] **FIGURE 5** provides a perspective sectional view of insert C shown in Figure 4.

[0022] **FIGURE 6** provides a perspective sectional view of one embodiment of the cross through plate.

[0023] **FIGURE 7** provides an exploded perspective view of one embodiment of the heat exchanger.

[0024] **FIGURE 8** provides a perspective sectional view of another embodiment which uses a flow of circulating gas through the backlight cavity of a liquid crystal display (LCD).

FIGURE 9 provides a perspective sectional view of an exemplary embodiment which uses a flow of circulating gas through the backlight cavity in addition to the flow of circulating gas between the LCD and front plate.

[0025] FIGURE 10 provides a rear perspective view of an embodiment using a single fan assembly to control the flow of ambient gas, the embodiment shown with the rear cover removed.

[0026] FIGURE 11A provides a perspective sectional view of the embodiment from Figure 10 based on section line 11A-11A shown in Figure 10.

[0027] FIGURE 11B provides a perspective sectional view of insert B from Figure 11A.

Detailed Description

[0028] The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0029] It will be understood that when an element or layer is referred to as being "on" another element or layer, the element or layer can be directly on another element or layer or intervening elements or layers. In contrast, when an element is referred to as being "directly on" another element or layer, there are no intervening elements or layers present. Like numbers refer to like elements throughout. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0030] It will be understood that, although the terms first, second, third, etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer or section from another region, layer or section. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the present invention.

[0031] Spatially relative terms, such as "lower", "upper" and the like, may be used herein for ease of description to describe the relationship of one element or feature to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "lower" relative to other elements or features would then be oriented "upper" relative the other elements or features. Thus, the exemplary term "lower" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0032] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0033] Embodiments of the invention are described herein with reference to cross-section illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0034] For example, an implanted region illustrated as a rectangle will, typically, have rounded or curved features and/or a gradient of implant concentration at its edges rather than a binary change from implanted to non-implanted region. Likewise, a buried region formed by implantation may result in some implantation in the region between the buried region and the surface through which the implantation takes place. Thus, the regions illustrated in the figures are schematic in nature and their shapes are not

intended to illustrate the actual shape of a region of a device and are not intended to limit the scope of the invention.

[0035] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0036] **FIGURE 1A** provides a front perspective view of an exemplary embodiment of the electronic display 100. A transparent front plate 10 is placed on the front portion of the display to protect the internal components and allow the images produced by the display 100 to be seen. Some embodiments may use glass as the transparent front plate 10. Exemplary embodiments may use two pieces of glass laminated with index-matching optical adhesive. Some front plates 10 may provide other utility such as anti-reflection or polarizing functions. An inlet aperture 24 and exit aperture 25 may be provided in the housing so that the display 100 can accept ambient gas for cooling the display 100.

[0037] **FIGURE 1B** provides a rear perspective view of an exemplary embodiment of the electronic display 100. A rear cover 15 may be used to provide access to the internal components of the display 100.

[0038] **FIGURE 2** provides a rear perspective view similar to that shown in Figure 1B where the rear cover 15 has been removed. Ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. An exemplary placement for the heat exchanger fan assembly 46 is discussed further below, but in many embodiments the fan assembly 46 can be placed near the inlet aperture 24 and/or exit aperture 25 and may or may not be placed within the heat exchanger 45 (as shown in Figure 2).

[0039] Optionally, ambient gas 210 may also be ingested into the display through inlet aperture 24. Ambient gas 210 may then be directed through a first manifold 30 which

travels along the edge of the display. The first manifold 30 accepts the single larger inlet flow of ambient gas 210 and distributes it into a plurality of smaller flows across the display. A second manifold 35 may be placed along the opposite edge of the display as the first manifold 30. The second manifold 35 accepts the plurality of smaller flows and combines them into a single flow and exhausts it out of the exit aperture 25. In this embodiment, a manifold fan assembly 211 is used to draw the ambient gas 210 into the inlet aperture 24 and force the ambient gas 210 across the display. For this particular embodiment, the manifold fan assembly 211 is placed within the first manifold 30 and is used to draw the ambient gas 210 into the display as well as distribute the single flow into a plurality of smaller flows. This is not required however, as some embodiments may place the manifold fan assembly 211 in the second manifold 35, or within both the first and second manifolds 30 and 35.

[0040] While both flows of ambient gas may be used in an exemplary embodiment, there is no requirement that they are both used. Some embodiments may use only ambient gas 200 or ambient gas 210. Also, if using both flows of ambient gas 200 and ambient gas 210 there is no requirement that they share the same inlet and exit apertures. Thus, there may be separate inlet and exit apertures for the two flows of ambient gas.

[0041] FIGURE 3 provides a perspective sectional view along the A-A section line shown in Figure 1B. Again, ambient gas 200 may be ingested into the display through the inlet aperture 24 and pass through a heat exchanger 45 and exit the display through the exit aperture 25. The ambient gas 200 may be drawn into the display and forced through the heat exchanger 45 using heat exchanger fan assembly 46. Obviously, the inlet aperture 24 may contain a filter or other coverings so that contaminants, insects, garbage, and/or water/fluids cannot easily be ingested into the display. However, an exemplary embodiment would not be damaged if the ambient gas 200 contained contaminants as they would only pass through the heat exchanger 45 which may not be susceptible to damage from particulate or contaminants. Exit aperture 25 may also contain some type of covering to ensure that contaminants and/or insects could not enter the display.

[0042] An electronic image assembly 50 may be placed behind the front plate 10. A plurality of channels 60 may be placed behind (preferably immediately behind) the

electronic image assembly 50. Ambient gas 210 may be forced through the channels 60 after travelling through the first manifold 30 (not shown here). The flow of ambient gas 210 immediately behind the electronic image assembly 50 may be used to remove any buildup of heat from the rear portion of the electronic image assembly 50. It may be preferable to have a thermally conductive surface on the rear portion of the electronic image assembly 50 so that heat can easily transfer to this plate and be removed by the ambient gas 210.

[0043] The channels 60 can take on any number of forms. Although shown in this embodiment with a square cross-section this is not required. Other embodiments may contain channels 60 with I-beam cross-sections, hollow square cross-sections, hollow rectangular cross-section, solid rectangular or solid square cross-sections, 'T' cross-sections, 'Z' cross-sections, a honeycomb cross-section, or any combination or mixture of these. The channels 60 are preferably thermally conductive and also preferably in thermal communication with the electronic image assembly 50. Thus, in a preferred embodiment, heat which accumulates on the rear portion of the electronic image assembly 50 may be transferred throughout the channels 60 and removed by ambient gas 210.

[0044] FIGURE 4 provides a perspective sectional view along the B-B section line shown in Figure 1B. In this view, the path of the circulating gas 250 can also be observed. The space between the front plate 10 and the electronic image assembly 50 may define a front channel 251, through which the circulating gas 250 may travel in order to remove any accumulation of heat on the front surface of the electronic image assembly 50. The circulating gas 250 is preferably then directed into the heat exchanger 45 where heat may be transferred from the circulating gas 250 to the ambient gas 200. Upon exiting the heat exchanger 45, the circulating gas 250 may be

re-directed into the front channel 251. The circulating gas 250 may also be directed over various electronic components 7 so that heat may be transferred from the electronic components 7 to the circulating gas 250. The electronic components 7 could be any one of the following but not limited to: power modules, heat sinks, capacitors, motors, microprocessors, hard drives, AC/DC converters, transformers, or printed circuit boards.

[0045] Also shown in this sectional view is the path of the ambient gas 210 travelling down one of the channels 60 directly behind the electronic image assembly 50. In this embodiment, the ambient gas 210 is forced out of the first manifold 30, across the channels 60, and into the second manifold 35 by manifold fan assembly 211. As shown in this Figure, the paths of the ambient gas 210 and the circulating gas 250 will likely cross, but it is preferable to keep the two gases from mixing (as the ambient gas 210 may contain particulate or contaminants while the circulating gas 250 can remain substantially free of particulate and contaminants). It may be preferable to keep the circulating gas 250 from having particulate or contaminants because it travels in front of the electronic image assembly 50. Thus, to keep the image quality from being impaired, it may be desirable to keep the circulating gas 250 clean and prevent it from mixing with the ambient gas 210.

[0046] FIGURE 5 provides a perspective sectional view of insert C shown in Figure 4. As noted above, if practicing an embodiment which uses ambient gas 210 as well as the circulating gas 250, the pathways of the two gases may need to cross over one another and it may be desirable to prohibit them from mixing to prevent contamination of sensitive portions of the display. Here, cross through plate 500 allows the pathways of the two gases to cross over one another without letting them mix together. The cross through plate 500 in this embodiment contains a series of voids which pass through the plate. A first series of voids 550 passes through the cross through plate 500 and allows ambient gas 210 to travel from the first manifold 30 into the channels 60 which run behind the electronic image assembly 50. A second series of voids 525 pass through the cross through plate 500 in a direction substantially perpendicular to that of the first series of voids 550. The second series of voids 525 allows the circulating gas to exit the front channel 251, cross over the ambient gas 210, and continue towards the heat exchanger 45. In this embodiment, a circulating gas fan assembly 255 is used to draw

the circulating gas 250 through the front channel 251 and through the heat exchanger 45. Much like the other fan assemblies shown and described here, the circulating gas fan assembly 255 could be placed anywhere within the display, including but not limited to the entrance/exit of the heat exchanger 45 or the entrance/exit of the front channel 251.

[0047] FIGURE 6 provides a perspective sectional view of one embodiment of the cross through plate 500. In this embodiment, the cross through plate 500 is comprised of a plurality of hollow blocks 503 sandwiched between a top plate 501 and bottom plate 502 with sections of the plates 501 and 502 removed to correspond with the hollow sections of the blocks 503. A portion of the top plate 501 has been removed to show the detail of the hollow blocks 503, first series of voids 550, and second series of voids 525. The cross through plate 500 could take on any number of forms and could be constructed in a number of ways. Some other embodiments may use a solid plate where the first and second series of voids 550 and 525 are cut out of the solid plate. Other embodiments could use two sets of hollow blocks where the hollow sections are perpendicular to each other and the blocks are fastened together. Still other embodiments could use a design similar to those that are taught below for the heat exchanger 45, for example any type of cross-flow heat exchanger design could be used.

[0048] FIGURE 7 provides an exploded perspective view of one embodiment of the heat exchanger 45. In this view, the heat exchanger fan assembly 46 is shown removed from its mounted position within the heat exchanger 45. In this embodiment, the heat exchanger 45 is divided into two portions 47 and 48 where the fan assembly 46 is placed between the two portions 47 and 48. While the fan assembly 46 can be placed anywhere so that it draws ambient gas 200 through the heat exchanger 45, it has been found that placing the fan assembly 46 between the two portions of the heat exchanger can provide a number of benefits. First, the volumetric flow rate of the ambient gas 200 through the heat exchanger is high, which results in better cooling capabilities for the heat exchanger 45. Second, the noise produced by the fan assembly 46 can be drastically reduced because the surrounding portions 47 and 48 of

the heat exchanger 45 essentially act as a muffler for the fan assembly 46. In this embodiment, portion 48 is thinner and longer than portion 47. This was done in order to free up more space within the housing so that additional electronic components could fit within the housing (adjacent to portion 48). This design may be preferable when it is desirable to create the largest possible heat exchanger 45 (for maximum cooling abilities). This is of course not required, and other embodiments may have portions which are of equal width and length. Also, although this embodiment uses the fan assembly 46 to drive the ambient gas 200, other embodiments could use a fan assembly placed within the heat exchanger to drive the circulating gas 250 instead and drive the ambient gas 200 with another fan assembly (possibly placed within the heat exchanger or located at the entrance/exit of the heat exchanger).

[0049] The ambient gas 200 travels through a first pathway (or plurality of pathways) of the heat exchanger 45 while the circulating gas 250 travels through a second pathway (or plurality of pathways) of the heat exchanger 45. Although not required, it is preferable that the circulating gas 250 and ambient gas 200 do not mix. This may prevent any contaminants and/or particulate that is present within the ambient gas 200 from harming the interior of the display. In a preferred embodiment, the heat exchanger 45 would be a cross-flow heat exchanger. However, many types of heat exchangers are known and can be used with any of the embodiments herein. The heat exchanger 45 may be a cross-flow, parallel flow, or counter-flow heat exchanger. In an exemplary embodiment, the heat exchanger 45 would be comprised of a plurality of stacked layers of thin plates. The plates may have a corrugated, honeycomb, or tubular design, where a plurality of channels/pathways/tubes travel down the plate length-wise. The plates may be stacked such that the directions of the pathways are alternated with each adjacent plate, so that each plate's pathways are substantially perpendicular to the pathways of the adjacent plates. Thus, ambient gas or circulating gas may enter an exemplary heat exchanger only through plates whose channels or pathways travel parallel to the path of the gas. Because the plates are alternated, the circulating gas and ambient gas may travel in plates which are adjacent to one another and heat may be transferred between the two gases without mixing the gases themselves (if the heat exchanger is adequately sealed, which is preferable but not required). In other words,

an exemplary heat exchanger would have at least a first gas pathway for ambient gas and at least a second gas pathway for circulating gas, where the two pathways are substantially perpendicular and adjacent to each other and do not allow the ambient gas and circulating gas to mix.

[0050] In an alternative design for a heat exchanger, an open channel may be placed in between a pair of corrugated, honeycomb, or tubular plates. The open channel may travel in a direction which is perpendicular to the pathways of the adjacent plates. This open channel may be created by running two strips of material or tape (esp. very high bond (VHB) tape) between two opposite edges of the plates in a direction that is perpendicular to the direction of the pathways in the adjacent plates. Thus, gas entering the heat exchanger in a first direction may travel through the open channel (parallel to the strips or tape). Gas which is entering in a second direction (substantially perpendicular to the first direction) would travel through the pathways of the adjacent plates).

[0051] Other types of cross-flow heat exchangers could include a plurality of tubes which contain the first gas and travel perpendicular to the path of the second gas. As the second gas flows over the tubes containing the first gas, heat is exchanged between the two gases. Obviously, there are many types of cross-flow heat exchangers and any type would work with the embodiments herein.

[0052] An exemplary heat exchanger may have plates where the sidewalls have a relatively low thermal resistance so that heat can easily be exchanged between the two gases. A number of materials can be used to create the heat exchanger. Preferably, the material used should be corrosion resistant, rot resistant, light weight, and inexpensive. Metals are typically used for heat exchangers because of their high thermal conductivity and would work with these embodiments. However, it has been discovered that plastics and composites can also satisfy the thermal conditions for electronic displays. An exemplary embodiment would utilize polypropylene as the material for constructing the plates for the heat exchanger. It has been found that although polypropylene may seem like a poor thermal conductor, the large amount of surface area relative to a small sidewall thickness, results in an overall thermal resistance that is low. Thus, an exemplary heat exchanger would be made of plastic

and would thus produce a display assembly that is thin and lightweight. Specifically, corrugated plastic may be used for each plate layer where they are stacked together in alternating fashion (i.e. each adjacent plate has channels which travel in a direction perpendicular to the surrounding plates).

[0053] FIGURE 8 provides a perspective sectional view of another embodiment which uses a flow of circulating gas 350 through the backlight cavity of a liquid crystal display (LCD) 300. In this embodiment, a LCD 300 and an associated backlight 320 are used as the electronic image assembly. A backlight wall 330 may be placed between the LCD 300 and the backlight 320 in order to enclose the area and create a backlight cavity. Typically, the backlight cavity is closed to prevent contaminants/particulate from entering the backlight cavity and disrupting the optical/electrical functions of the backlight 320. However, as discussed above the exemplary embodiments may use a clean gaseous matter for the circulating gases which could now be used to ventilate the backlight cavity in order to cool the backlight 320 and even the rear portion of the LCD 300. An opening 340 can be placed in the backlight wall 330 to allow circulating gas 350 to flow through the backlight cavity. A fan assembly 360 may be used to draw the circulating gas 350 through the backlight cavity. In an exemplary embodiment there would be an opening on the opposing backlight wall (on the opposite side of the display as shown in this figure) so that circulating gas 350 could easily flow through the backlight cavity.

[0054] FIGURE 9 provides a perspective sectional view of an exemplary embodiment which uses a flow of circulating gas 350 through the backlight cavity in addition to the flow of circulating gas 250 between the LCD 300 and front plate 10. Circulating gas fan assembly 255 may be placed so that it can draw circulating gas 350 through the backlight cavity as well as circulating gas 250 between the LCD 300 and the front plate 10. As discussed above, the circulating gases 250 and 350 are preferably forced through the heat exchanger 45 (not shown in this figure) so that they may be cooled by the ambient gas 200 (also not shown in this figure).

[0055] Also shown in Figure 9 is the optional additional flow of ambient gas 210 which may travel immediately behind the backlight 320. Once travelling through the first manifold 30, the ambient gas 210 may pass through the channels 60 in order to

remove heat from the backlight 320 and even the channels 60 themselves (if they are thermally conductive). The manifold fan assembly 211 may be used to draw the ambient gas 210 into the first manifold 30 and through the channels 60. Again, the cross through plate 500 may be used to allow the circulating gases 350 and 250 to cross paths with the ambient gas 210 without letting the two gases mix.

[0056] In an exemplary embodiment, the backlight 320 would contain a plurality of LEDs mounted on a thermally conductive substrate (preferably a metal core PCB). On the surface of the thermally conductive substrate which faces the channels 60 there may be a thermally conductive front plate which may be in thermal communication with the channels 60. In an exemplary embodiment, the thermally conductive plate would be metallic and more preferably aluminum.

[0057] FIGURE 10 provides a rear perspective view of an embodiment 1000 using a single fan assembly 1050 to control the flow of ambient gas. The embodiment 1000 is shown here with the rear cover removed. In this figure, the main display assembly is still within the exterior display housing 1001. Similar to some of the embodiments describe above, a circulating gas fan assembly 1105 may be used to draw circulating gas 1106 into and through the heat exchanger 1100. Further, another circulating gas fan assembly 1205 may be used to draw circulating gas 1106 through heat exchanger 1200. The circulating gas 1106 may also be used to extract heat from various electrical components 1109.

[0058] An ambient gas fan assembly 1050 may be used to draw ambient gas into the inlet aperture 1009 and exhaust the ambient gas out of an exit aperture 1010. The ambient gas preferably travels through the heat exchangers 1200 and 1100 as well as the channel behind the electronic image assembly (if used). The section line 11A-11A is shown cutting horizontally through the display embodiment 1000.

[0059] FIGURE 11A provides a perspective sectional view of the embodiment from Figure 10 based on section line 11A-11A shown in Figure 10. For clarity, the exterior housing 1001 has been removed. Once the circulating gas 1106 has traveled through the heat exchangers 1200 and 1100, it may then be directed between the front transparent plate 1500 and the electronic image assembly 1600. After passing between the front transparent plate 1500 and the electronic image assembly 1600, the

circulating gas 1106 may then return to the heat exchangers 1200 and 1100. In this embodiment, fan assembly 1050 is used to control the flow of ambient gas 1055 and 1056. Ambient gas 1055 is directed through the heat exchangers 1200 and 1100 while ambient gas 1056 is directed behind the electronic image assembly 1600.

[0060] FIGURE 11B provides a perspective sectional view of insert B from Figure 11A. The channel 1700 may be defined by the space between the rear surface or portion of the electronic image assembly 1600 and a plate which is substantially parallel to the rear surface or portion of the electronic image assembly 1600. The channel 1700 may also contain ribs which are also thermally conductive and preferably in thermal communication with the electronic image assembly 1600. By placing the fan assembly 1050 so as to direct the ambient gas within the channel 1700 and the heat exchangers 1200 and 1100 simultaneously, several improvements can be achieved, including but not limited to: increased air flow, less fan noise, and a less expensive/lighter assembly. In this embodiment, the paths for ambient gas 1055 and ambient gas 1056 are substantially parallel to one another.

[0061] As noted above, many electronic image assemblies (especially LEDs, LCDs, and OLEDs) may have performance properties which vary depending on temperature. When 'hot spots' are present within an image assembly, these hot spots can result in irregularities in the resulting image which might be visible to the end user. Thus, with the embodiments described herein, the heat which may be generated by the image assembly (sometimes containing a backlight assembly) can be distributed (somewhat evenly) throughout the channels 60 and thermally-conductive surfaces to remove hot spots and cool the backlight and/or electronic image assembly.

[0062] The circulating gases and ambient gases can be any number of gaseous matters. In some embodiments, air may be used as the gas for all. Preferably, because the circulating gases may travel in front of the image assembly and/or within the backlight cavity, they should be substantially clear, so that they will not affect the appearance of the image to a viewer. The circulating gases should also preferably be substantially free of contaminants and/or particulate (ex. dust, dirt, pollen, water vapor, smoke, etc.) in order to prevent an adverse effect on the image quality and/or damage to the internal electronic components. It may sometimes be preferable to keep ambient

gases from having contaminants as well. Filters may be used to help reduce the particulate within ambient gases. Filters could be placed near the inlet apertures so that ambient gases could be drawn through the filter. However, in an exemplary embodiment the display may be designed so that contaminants could be present within the ambient gases but this will not harm the display. In these embodiments, the heat exchanger, manifolds, channels, and any other pathway for ambient or circulating gas should be properly sealed so that any contaminants in the ambient gas would not enter sensitive portions of the display. Thus, in these exemplary embodiments, ingesting ambient air for the ambient gases, even if the ambient air contains contaminants, will not harm the display. This can be particularly beneficial when the display is used in outdoor environments or indoor environments where contaminants are present in the ambient air.

[0063] The cooling system may run continuously. However, if desired, temperature sensing devices (not shown) may be incorporated within the electronic display to detect when temperatures have reached a predetermined threshold value. In such a case, the various cooling fans may be selectively engaged when the temperature in the display reaches a predetermined value. Predetermined thresholds may be selected and the system may be configured to advantageously keep the display within an acceptable temperature range. Typical thermostat assemblies can be used to accomplish this task. Thermocouples may be used as the temperature sensing devices.

[0064] It is to be understood that the spirit and scope of the disclosed embodiments provides for the cooling of many types of displays. By way of example and not by way of limitation, embodiments may be used in conjunction with any of the following electronic image assemblies: LCD (all types), light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), light emitting polymer (LEP), organic electro luminescence (OEL), plasma displays, and any other thin panel electronic image assembly. Furthermore, embodiments may be used with displays of other types including those not yet discovered. In particular, it is contemplated that the system may be well suited for use with full color, flat panel OLED displays. Exemplary embodiments may also utilize large (55 inches or more) LED backlit, high definition liquid crystal displays (LCD). While the embodiments described

herein are well suited for outdoor environments, they may also be appropriate for indoor applications (e.g., factory/industrial environments, spas, locker rooms) where thermal stability of the display may be at risk.

[0065] As is well known in the art, electronic displays can be oriented in a portrait manner or landscape manner and either can be used with the embodiments herein. Although circulating gas may be shown traveling clockwise or counterclockwise, either orientation may be used with any of the embodiments herein. Similarly, although ambient gas may be shown travelling from top-bottom, bottom-top, left-right, or right-left, any arrangement can be used. Further, it should be understood that the figures herein are not necessarily drawn to scale, and some components may be enlarged for clarity and explanatory purposes.

[0066] Having shown and described preferred embodiments, those skilled in the art will realize that many variations and modifications may be made to affect the described embodiments and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS

1. An assembly for cooling an electronic image assembly within a housing having an inlet aperture for ambient gas, exit aperture for ambient gas, and internal cavity for circulating gas, the assembly comprising:
 - a first portion of a heat exchanger which accepts ambient gas from the inlet aperture;
 - a second portion of a heat exchanger which accepts ambient gas from the first portion;
 - a channel placed behind the electronic image assembly and in gaseous communication with the inlet and exit apertures;
 - a first fan positioned between the first and second portions which forces ambient gas through the first portion, second portion, and the channel; and
 - a second fan which forces circulating gas through the internal cavity and at least one of the heat exchanger portions.
2. The cooling assembly of claim 1 wherein:
 - the first fan also draws ambient gas through the inlet aperture.
3. The cooling assembly of claim 2 wherein:
 - the first fan also pushes ambient gas through the exit aperture.
4. The cooling assembly of claim 1 further comprising:
 - an electronic component placed within the path of the circulating gas.
5. The cooling assembly of claim 4 wherein:
 - the electronic component is a power module.
6. The cooling assembly of claim 1 wherein:
 - the heat exchanger portions are comprised of corrugated layers.
7. The cooling assembly of claim 1 wherein:

the heat exchanger portions are cross-flow heat exchanger portions.

8. An electronic display assembly comprising:
 - a housing having an inlet aperture and exit aperture for ambient gas;
 - an electronic image assembly within the housing;
 - a transparent front plate in front of the electronic image assembly, the space between the transparent front plate and the electronic image assembly defining a front channel;
 - a rear plate placed behind the electronic image assembly, the space between the rear plate and the electronic image assembly defining a rear channel;
 - a heat exchanger in gaseous communication with the front channel, the heat exchanger comprising two portions, each portion having first and second gas pathways, where the first gas pathways are in gaseous communication with the inlet and exit apertures and the second gas pathways are in gaseous communication with the front channel;
 - an ambient gas fan assembly placed between the two portions of the heat exchanger to force ambient gas through the first gas pathways and through the rear channel; and
 - a circulating gas fan assembly positioned to force circulating gas through the front channel and the second gas pathways.
9. The electronic display assembly of claim 8 further comprising:
 - a power module placed within the path of the circulating gas.
10. The electronic display assembly of claim 8 wherein:
 - the electronic image assembly is a liquid crystal display.
11. The electronic display assembly of claim 8 wherein:
 - the electronic image assembly is an OLED display.
12. The electronic display assembly of claim 8 wherein:

the heat exchanger is a cross-flow heat exchanger comprised of corrugated layers.

13. The electronic display assembly of claim 8 further comprising:

a plurality of ribs placed within the rear channel and in thermal communication with the electronic image assembly.

14. The electronic display assembly of claim 13 wherein:

the ribs are metallic.

15. The electronic display assembly of claim 13 wherein:

the ribs are placed in conductive thermal communication with the electronic image assembly.

16. The electronic display assembly of claim 13 wherein:

the ribs have a rectangular cross-section.

17. A thermally-controlled liquid crystal display (LCD) assembly comprising:

a housing having an inlet aperture and exit aperture for ambient gas;

a LED backlight having a rear surface and placed within the housing;

a liquid crystal display (LCD) having a front surface and placed in front of the LED backlight and within the housing;

a transparent front plate in front of the LCD, the space between the transparent front plate and the LCD defining a front channel;

a rear plate placed behind the rear surface of the LED backlight;

a plurality of ribs placed between the rear plate and LED backlight, the space between the rear plate, LED backlight, and ribs defining a plurality of rear channels;

a heat exchanger having a first gas pathway in gaseous communication with the front channel, and a second gas pathway in gaseous communication with the inlet and exit apertures;

an ambient gas fan assembly placed within the heat exchanger to force ambient gas into the inlet aperture, through the second gas pathway and the rear channels, and out of the exit aperture; and
a circulating gas fan assembly positioned to force circulating gas through the front channel and the first gas pathways.

18. The LCD assembly of claim 17 further comprising:

a power module placed within the path of the circulating gas.

19. The LCD assembly of claim 17 wherein:

the heat exchanger is a cross-flow heat exchanger comprised of corrugated layers.

20. The LCD assembly of claim 17 wherein:

the ribs are metallic.

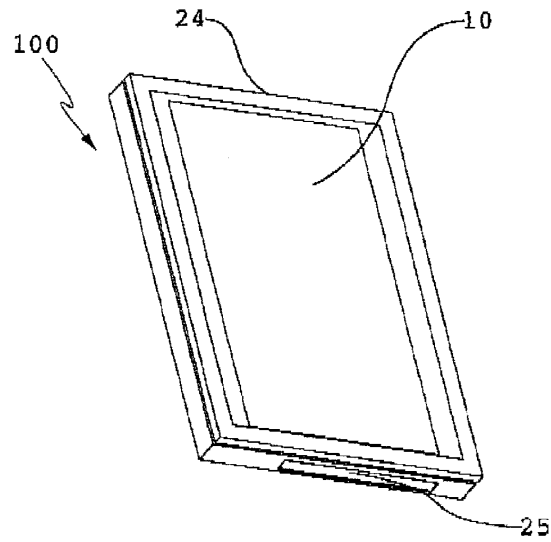


FIG - 1A

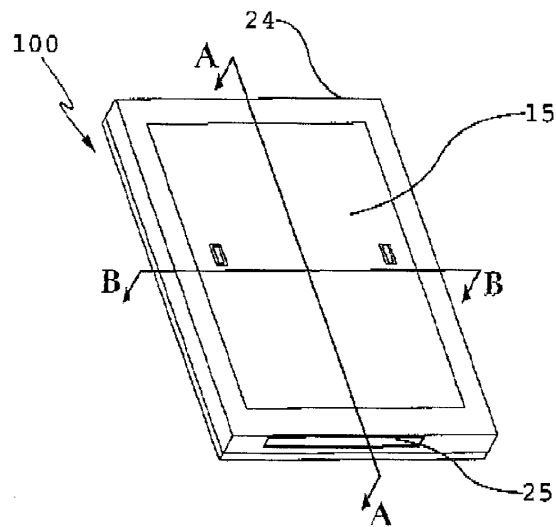


FIG - 1B

STL-TON/PCT-CDA

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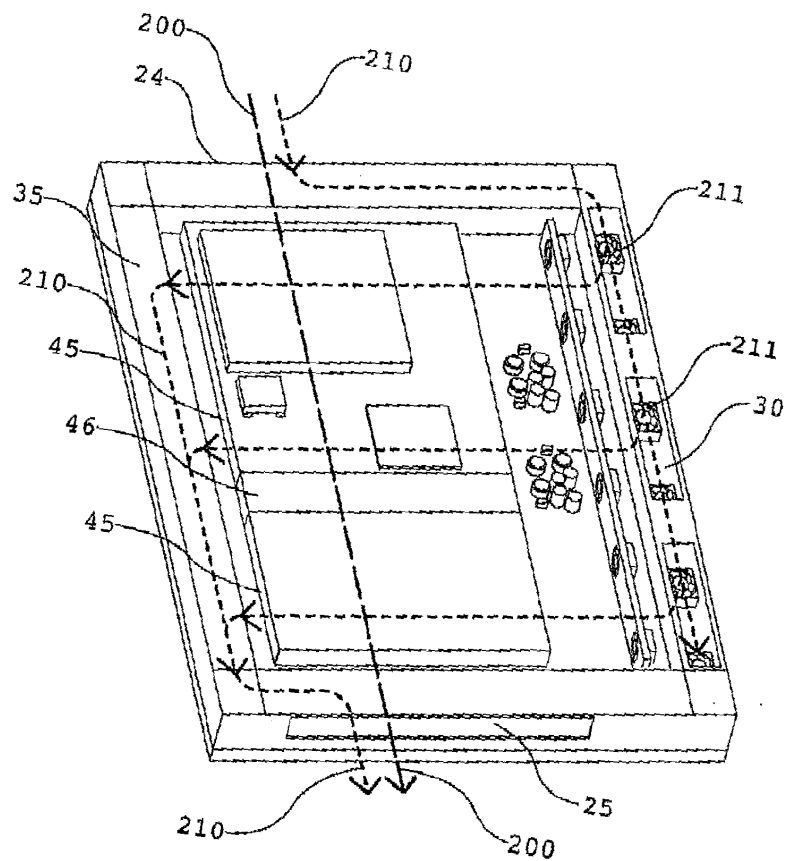


FIG - 2

STL-TCN/PCT-GDA

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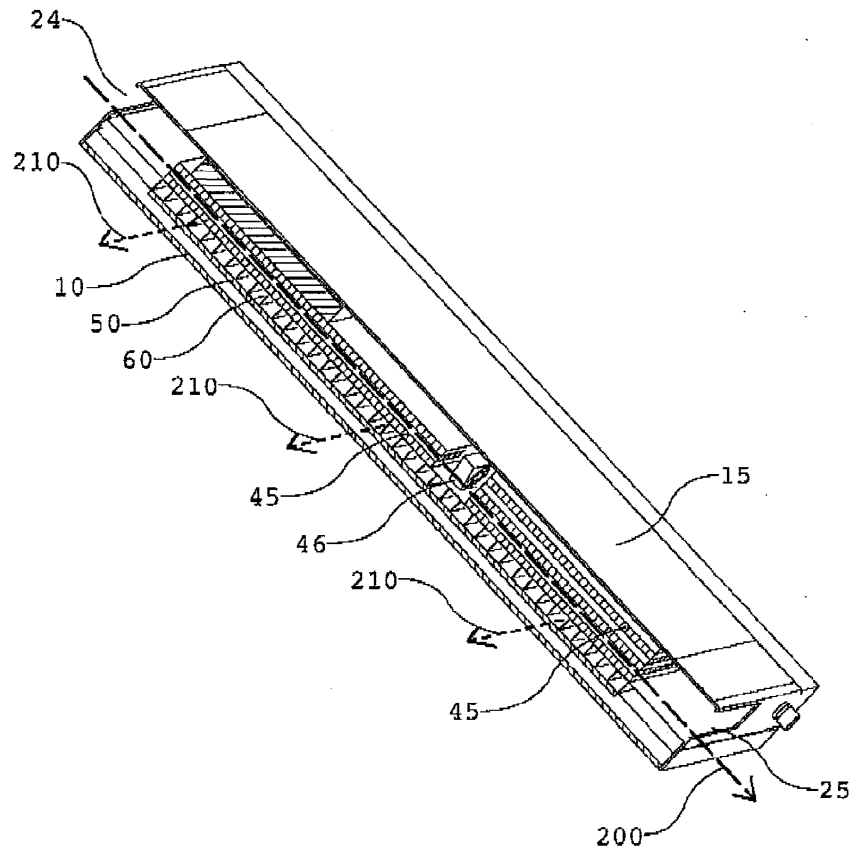


FIG - 3

STL-TCN/PCT-CDA

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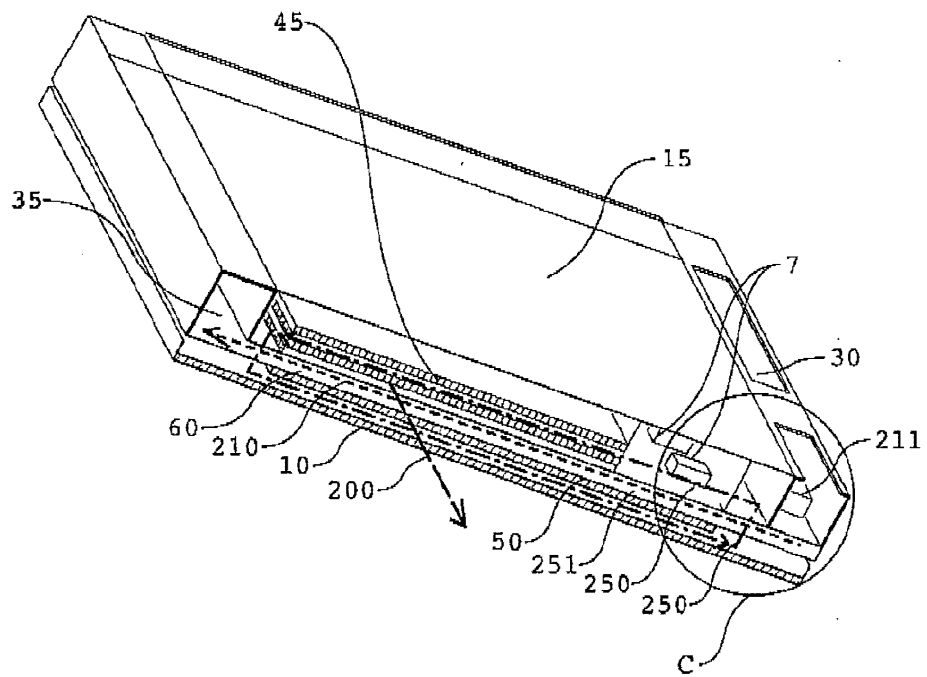


FIG - 4

STL-TCNPCT-CDA

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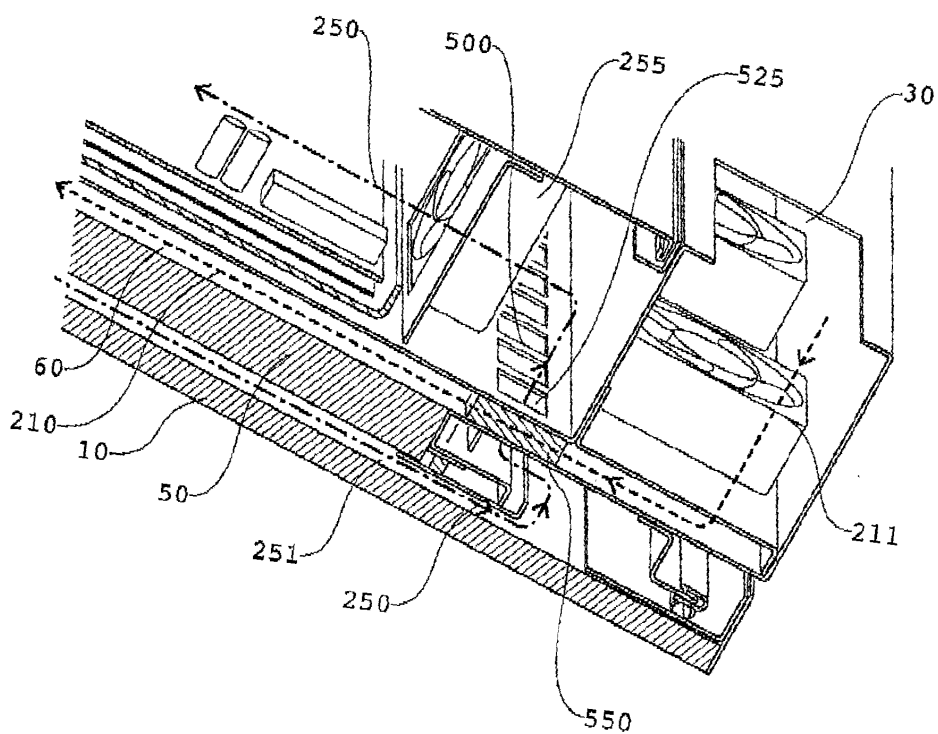


FIG - 5

811-YCN/PCT-GDA

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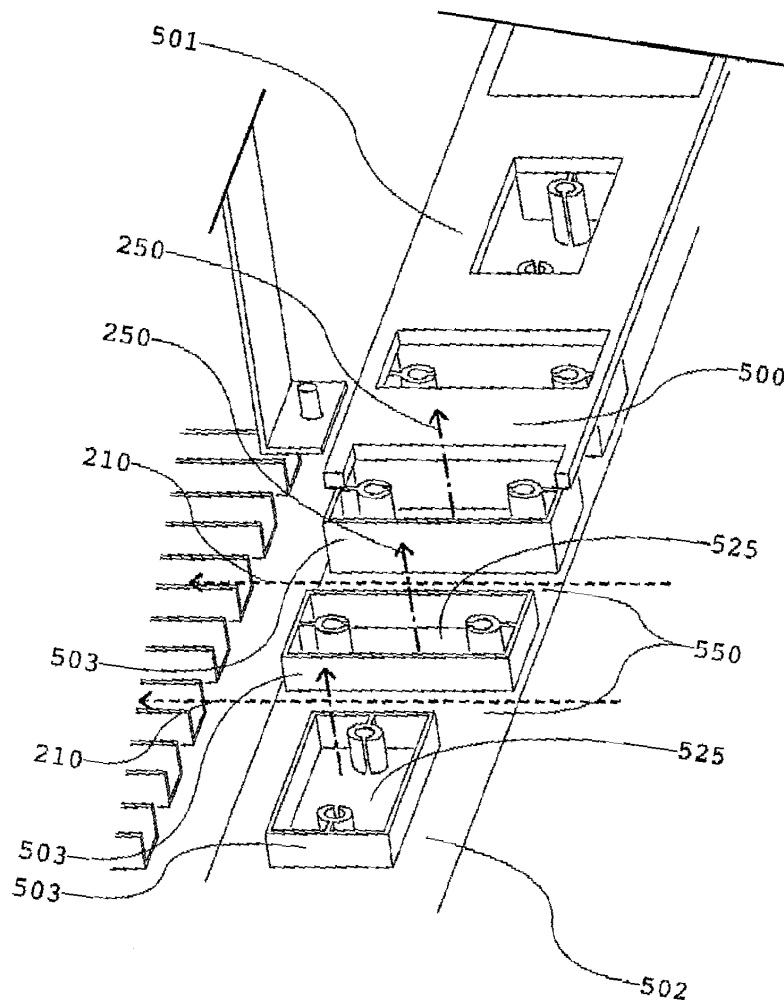


FIG - 6

STL-TCN/PCT-CDA

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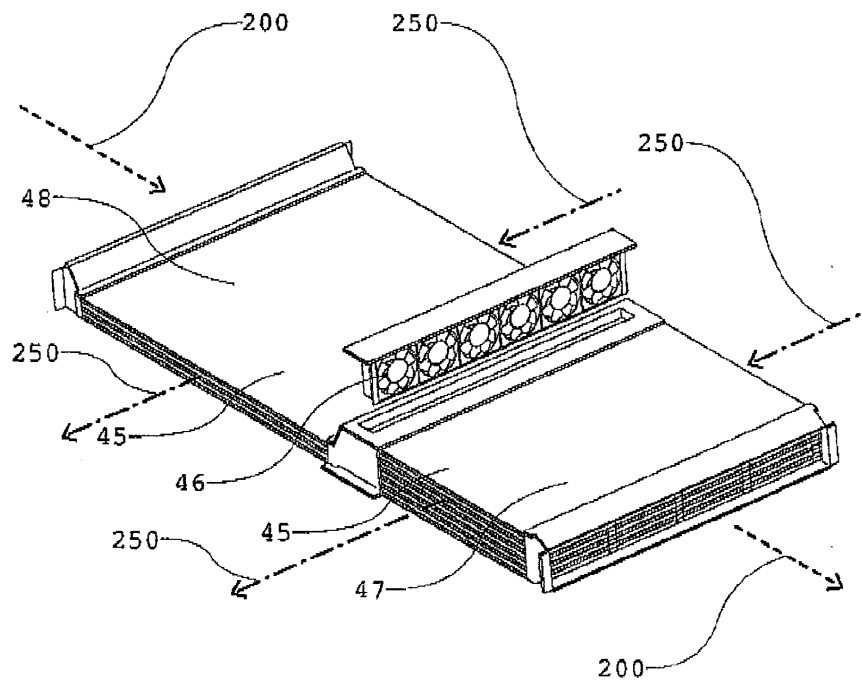


FIG - 7

STL-TCH/PCT-CDA

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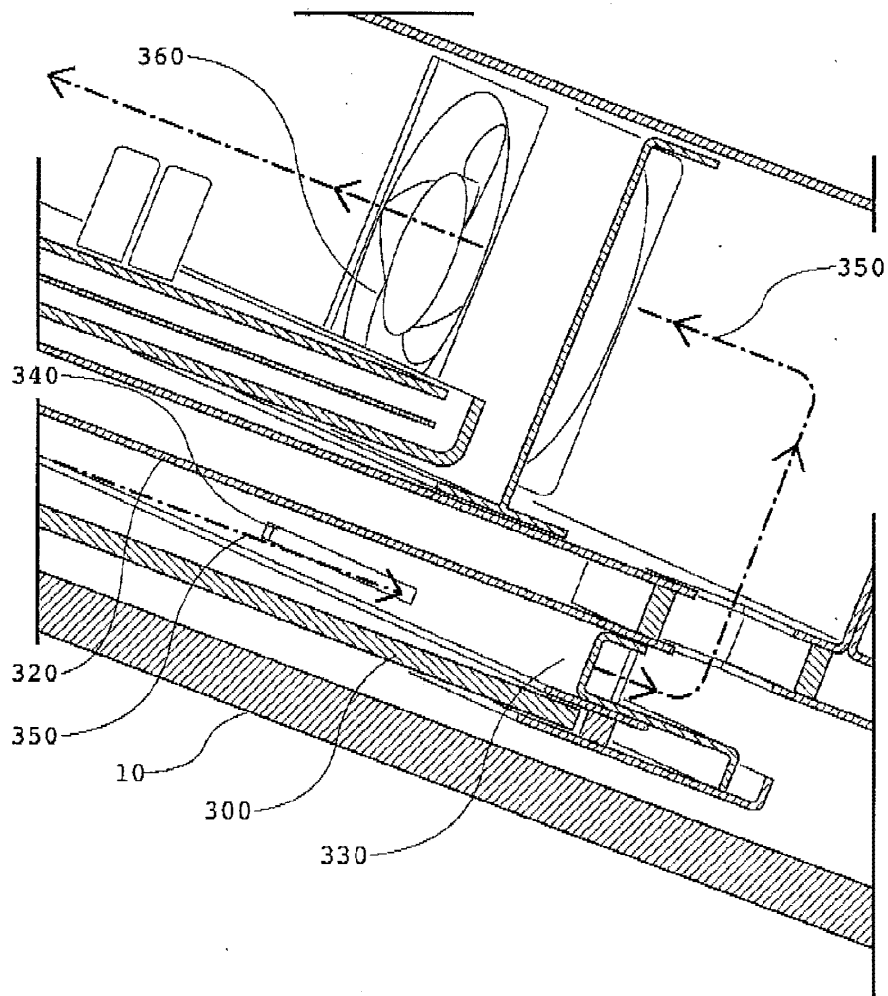


FIG - 8

STL-TQM/PCT-CDA

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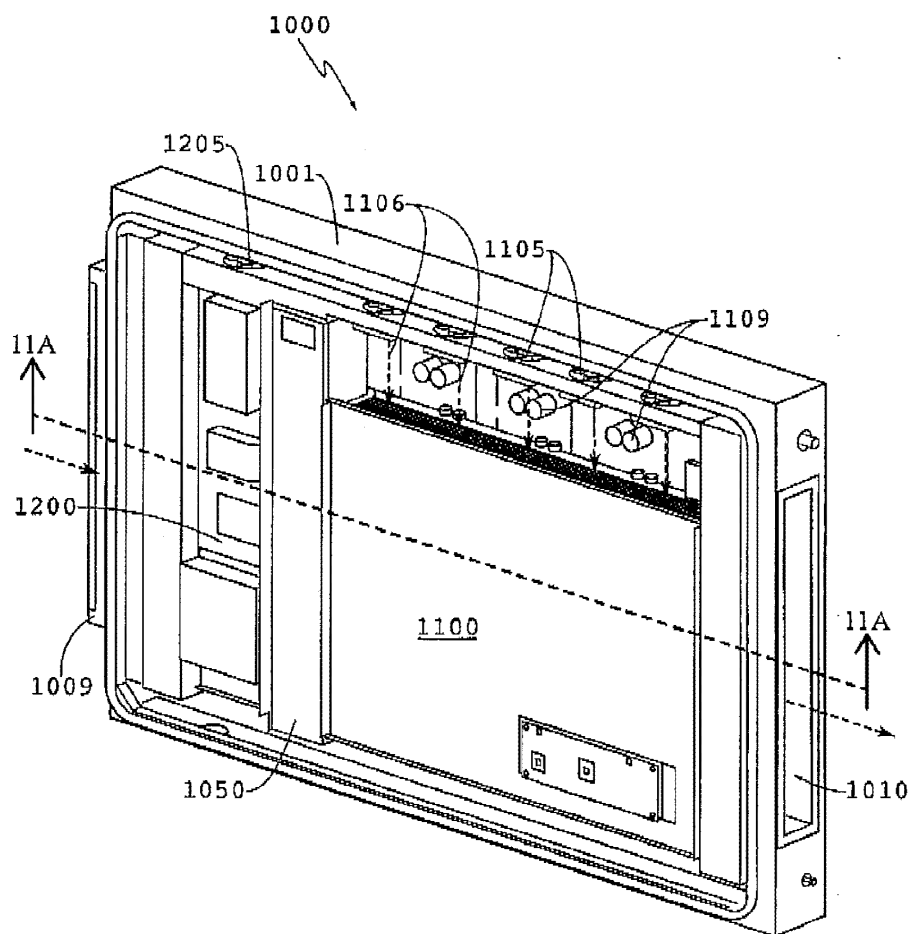
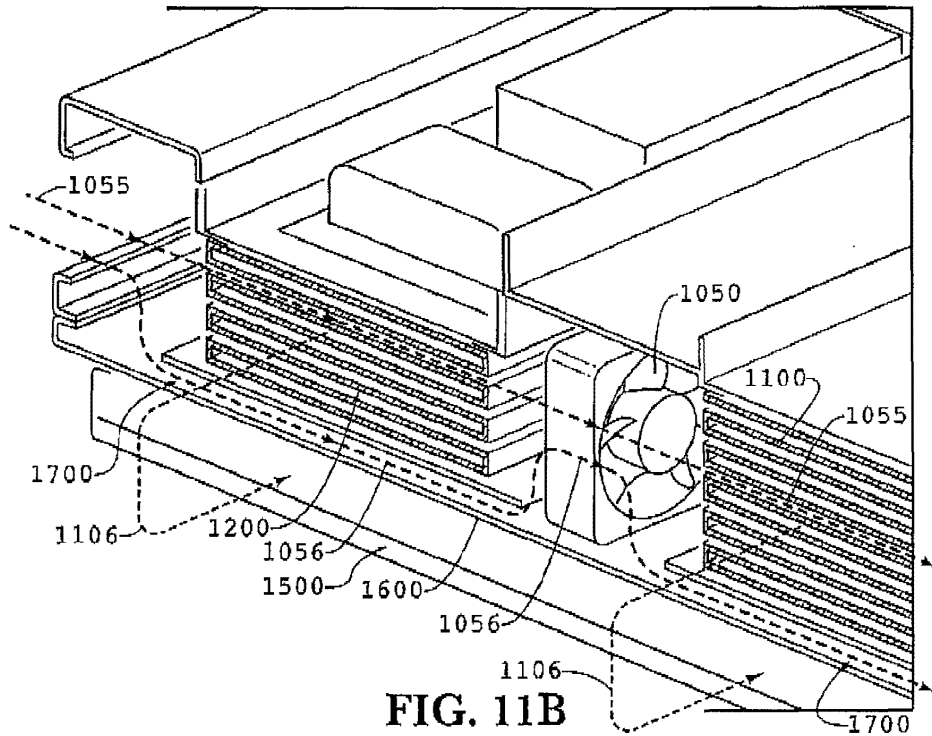
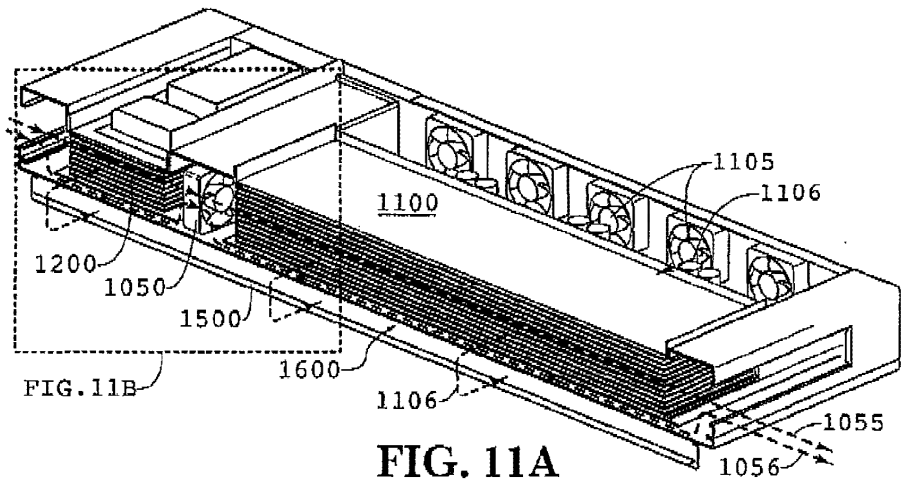


FIG. 10

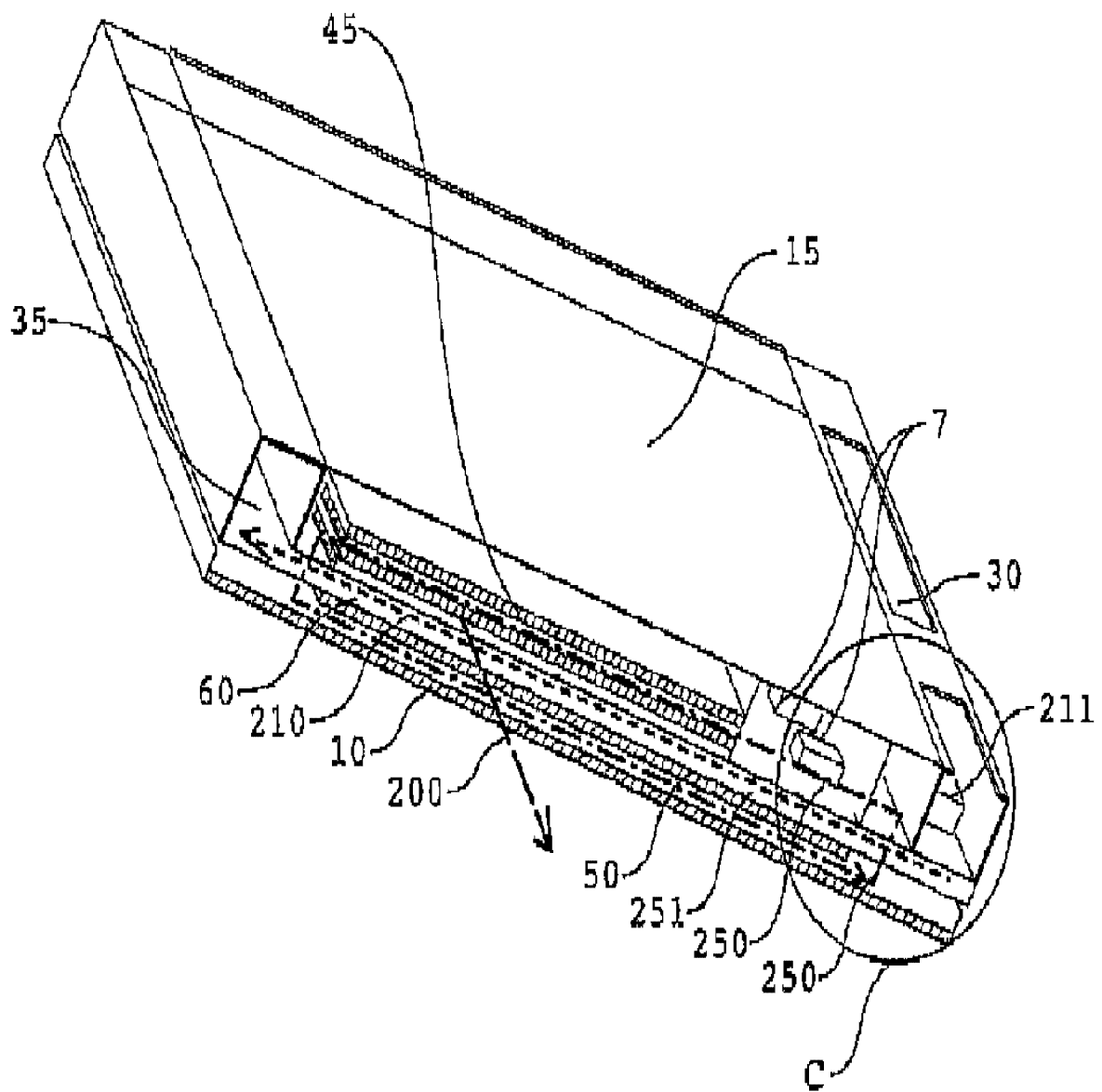
STL-TQNPCT.CDA

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6TL-TCNPCT-CDA

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Dustproof housing heat radiating mechanism of plasma display panel display panel device

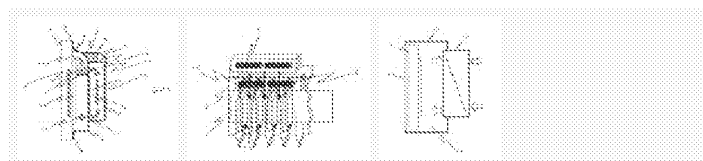
Abstract

PROBLEM TO BE SOLVED: To efficiently deter the dustproof housing of a plasma display panel (PDP) display device from rising in temperature and to make the device thin.

SOLUTION: The dustproof housing heat radiating mechanism of the plasma display panel display device is equipped with a dustproof cover 2 which is fitted to the back of the PDP display device 1 to cover a discharge opening 1b and an air intake 1c provided on the back side of the PDP display device 1, heat radiation fins 3 which are provided to the back side of the dustproof cover 2, an internal fan 6 which sends hot air, discharged from the discharge opening 1b to inside the dustproof cover 2, out to the heat radiation fins 3, and an external fan 7 which cools the heat radiation fins 3; and the hot air generated by the PDP display device 1 are cooled by the heat radiation fins 3 and external fan 7 and then the cooled air which is discharged from in the heat radiation fins 3 to inside the dustproof cover 2 is introduced in the PDP display device 1 from the air intake 1c.

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Images (3)



JP2004286940A

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Other languages: Japanese

Inventor: Yoshinori Goto, Masamoto Kobayashi, Toshihisa Kumazaki, 正岡 小祐, 高野 俊孝, 久米 隆昭

Original Assignee: Hitachi Systems Co Ltd, 株式会社日立アイ・システムズ

Priority date: 2003-03-20

Family: JP (1)

Date	Appl/Pub Number	Status
2003-03-20	JP2003077130A	Withdrawn
2004-10-14	JP2004286940A	Application

Info: Cited by (4), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Claims (5)

Translated from Japanese

1. A dust cover mounted on the back of the plasma display panel display device so as to cover the exhaust port provided on the rear side of the plasma display panel display device and the intake port, the heat radiation fins provided on the back side of the dust-proof cover 1f, comprising an internal fan for feeding the hot air is discharged to the dust-proof cover from the exhaust port to the radiation fins, and an external fan for cooling the radiation fin, and, Wherein the rear side above the dust-proof cover, the heat radiation fins inlet for feeding hot air to the radiating fins inside from the dustproof the cover is provided by the internal fan, and on the back side under the dust-proof cover, the heat radiation fins radiating fins outlet for discharging the inner with cooled air from the heat radiating fins into the dustproof cover is provided.
After cooling the hot air from the plasma display panel display device by the heat radiation fins and the external fan, air after cooling were drained to dust cover from the heat radiating fins it is introduced into the interior of the plasma display panel display device from the intake port dustproof casing heat radiation mechanism in the plasma display panel display device, characterized in that the so that configuration.
2. The dust proof cover, the partition wall for blocking said exhaust port and the intake port, dustproof housing heat radiation mechanism of the plasma display panel display device according to claim 1, characterized in that it comprises inside of the dust cover.
3. The heat dissipating fan, flow-through dustproof casing heat radiation mechanism of the plasma display panel display device according to claim 1 or 2, characterized in that a fan.
4. The radiating fins, dustproof housing heat radiation mechanism of the plasma display panel display device according to claim 1, 2 or 3, characterized in that it comprises a bag-shaped slit.
5. Said external fan, the and the fan cover to the opening for maintenance provided on the back of the dust proof cover is hinged, by removing the fan cover, the replacement of the internal fan of the dust-proof in the cover dustproof casing heat radiation mechanism of the plasma display panel display device of claim 1, 2, 3 or 4, characterized in that a readily frangible.

Description

Translated from Japanese

[0001]

BACKGROUND OF THE INVENTION

The present invention, the temperature rise resulting in a plasma display panel display device upon a dust-proof structure, it relates to dust-proof housing heat radiation mechanism of suppressing the plasma display panel display device by the radiation.

[0002]

BACKGROUND OF THE INVENTION

Conventionally, a plasma display panel display device 1 of the dust-proof structure (hereinafter, referred to as PDP display device) in, by a as shown in FIG. 3 constituting the PDP display device, it has been subjected to internal heat dissipation of the display device 1. Specifically, a dust-proof structure over the entire PDP display device 1 in

a front panel 12 and the housing 13, and the rear surface heat exchanger (front panel surface facing the at the housing 13) of the housing 13 14 by placing, it was configured so as to emit heat in the housing 13 to the outside. Then, the configuration described above, have enabled the dustproof and heat dissipation of the PDP display device 1.

[0003]

[Problems that the invention is to Solve]

However, screen size is large a screen and device itself thin PDP display device, prone to local temperature rise. In such a case, in order to entirely cool the inside of the display device using a conventional heat dissipation system as described above, it is necessary to secure enough number of the first device inside the spatial volume 15. Further, since the efficiency becomes worse in the heat exchanger 14, the heat exchanger 14, the heating value or more cooling capacity is required. In view of the above, in the prior art, it can not be efficiently radiated PDP display device of the dustproof structure, also has a problem that it can also be a display device itself to be thin.

[0004]

Accordingly, an object of the present invention is to solve the above problems, dust proofing box also can be efficiently radiating, moreover PDP display device capable of reducing the thickness of the entire device in the case of the PDP display apparatus has a dust-proof structure It is to provide the body heat dissipation mechanism.

[0005]

In order to solve the problems]

To achieve the above object, the dust-proof housing heat radiation mechanism in the plasma display panel display device of the present invention, the plasma display panel so as to cover the exhaust port provided on the rear side of the plasma display panel display device and the intake port a dust cover mounted on the back surface of the display device, the heat radiating fins provided on the back side of the dust-proof dust cover, and an internal fan for feeding the hot air is discharged to the dust-proof cover from the exhaust port to the radiation fins, wherein radiating fins and an external fan for cooling, wherein the back side above the dust-proof cover, the heat radiation fins inlet for feeding hot air to the radiating fins inside from the dustproof the cover is provided by the internal fan, and the dust-proof on the rear side lower cover, the heat radiation dustproof inside cover the cooled air from the heat radiating fins in fin Radiating fins exhaust port is provided for discharging the hot air generated from the plasma display panel display device, after cooling by the heat radiating fins and the external fan, after cooling which is drained into the dust-proof cover from the heat radiating fins air There has been configured to be introduced into the plasma display panel display device from the intake port.

[0006]

Further, in the dustproof casing heat radiation mechanism in the plasma display panel display device of the present invention, the dust-proof cover, the partition wall for blocking said exhaust port and the intake port, by including the inside of the dust cover, the object It is achieved.

[0007]

Further, in the dustproof casing heat radiation mechanism in the plasma display panel display device of the present invention, the cooling fan is the object by a flow-through fan is achieved and the heat radiation fins, be provided with a bag-shaped slit But the above-described object can be attained.

[0008]

Further, in the dustproof casing heat radiation mechanism in the plasma display panel display device of the present invention, and the external fan, the fan cover to the opening for maintenance provided on the back of the dust-proof cover is Kutsugae設, for the fan by removing the cover, the replacement of internal fans may be configured so as to easily practice of the dust-proof cover.

[0009]

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, the dust-proof housing heat radiation mechanism of the PDP display apparatus according to an embodiment of the present invention will be described in detail with reference to FIGS. Figure 1 is a side cross-sectional view showing the configuration of a dust-proof housing heat radiation mechanism of the PDP display apparatus according to an embodiment of the present invention, FIG. 2 is an enlarged view according to A arrow view of FIG. 1. Arrows in FIG. 1 indicate the flow of the device inside the air.

[0010]

[Configuration of the dust-proof housing heat dissipation mechanism]

Dustproof casing heat radiation mechanism of the PDP display apparatus according to the present embodiment, as shown in FIG. 1, a dust cover 2 is attached through the spacer 9 on the back of the PDP display apparatus 1 further to the dustproof cover 2 the plurality of heat radiation fins 3 with a bag-shaped slit as shown in FIG. 2 is mounted on the inner surface. With the configuration described above, the PDP apparatus 1 becomes being blocked from the outside air, dust-proof structure of a PDP display device 1 is realized.

[0011]

Further, the inner space of the dust cover 2 that exists between the back cover 1a provided on the back side of the PDP display apparatus 1 and the dust cover 2, the partition wall 5 provided in the substantially horizontal direction, back cover 1a an upper space 2a of the PDP display device exhaust port 1b side provided above the, is divided into a lower space 2b of the PDP display device inlet 1c side which is provided below the rear cover 1a. Thus, dust-proof housing heat dissipation mechanism according to the present embodiment has a configuration in which isolation from the inlet 1c and the exhaust port 1b of the PDP display device 1.

[0012]

Further, in the above upper space 2a, the rear side radiating fin inlet 10 is provided in, and more the upper surface of the partition wall 5, the heat radiation fins introducing sucked and the hot air of the hot air discharged from the PDP display device outlet 1b internal cross-flow fan 6 flows through the (cross-flow) type having a role of feeding the mouth 10 to the radiating fins 3 inside it is mounted.

[0013]

Further, in the lower space 2b, the back side is provided with radiating fins outlet 11, air which has been cooled in the heat radiation fins 3 as described later, the heat radiation fins through the heat radiating fins outlet 11 It is configured to be discharged into the dust-proof cover 2 from the inside 3.

[0014]

Further, the upper surface of the heat radiating fins 3, as a fan for cooling the radiation fin 3, cross-flow external cross-flow fan 7 (cross flow) type are mounted. Moreover, the fan cover 8 is attached to the external cross-flow fan 7 top.

[0015]

In the present embodiment, the inside of the heat radiation fins 3, the hot air fed from the inside of the dust cover 2 is a sheet for to flow within the heat radiating fin slit as shown by the broken line arrows in FIG. 2 4 which it is attached. Although this embodiment uses a sheet 4, the hot air fed from the inside of the dust cover 2 is means to flow inside the heat radiating fin slit is not limited to the sheet 4.

[0016]

Further, in the present embodiment, the rear surface of the dust cover 2, and the maintenance opening for exchanging maintenance inside the dust cover 2, inspection and internal cross-flow fan 6 (not shown) is provided, wherein the fan cover 8, is provided so as to block the maintenance opening. With the above configuration, an operator who performs maintenance and inspection by removing the fan cover 8, it becomes possible to easily perform the exchange of the dust cover 2 inside the inner cross-flow fan 6.

[0017]

[Heat release process in the dust-proof housing heat dissipation mechanism]

Next, the heat release process by the dust-proof casing heat radiation mechanism of the PDP display device configured as described above will be explained with reference to FIGS.

[0018]

11/30/2018

JP2004286940A - Dustproof housing heat radiating mechanism of plasma display panel display panel device - Google Patents

First, the hot air has been sucked out of the PDP device outlet 1b, as shown in FIG. 2, the internal cross-flow fan 6 is discharged from the dust cover inside 2 to the radiating fins 3, it is guided to the heat radiation fin inlet 10. Then, hot air guided to the radiating fin inlet 10, as described above, flows inside the heat radiating fin slit by a sheet 4 as shown by the broken line arrow in FIG.

[0019]

Here, when flowing inside the heat radiating fin slit hot air as described above, the hot air is cooled by heat conduction to the heat radiation fins 3, and when the external cross-flow fan 7 is outside air temperature lower than the temperature in the apparatus by flowing in the direction of the solid arrow in FIG. 2, the heat radiation fins 3 warmed by heat conduction as described above it is also cooled.

[0020]

Air cooled as described above, it is discharged from the heat radiating fins outlet 11 into the dust cover 2. Then, after being discharged into the dust cover 2, it is introduced from the PDP display device inlet 1c inside the PDP display device 1.

[0021]

Thus, the hot air has been sucked out of the PDP device outlet 1b, by going through each process of the above, the temperature of the air introduced from the PDP display device inlet 1c inside the PDP display apparatus 1 is reduced. Therefore, as a result, the temperature rise inside the PDP display device 1, and thus are effectively suppressed.

[0022]

[Effect of the invention]

As described above, according to the dust-proof casing heat radiation mechanism of the present invention, it is possible to dustproof the PDP display apparatus, hot air generated from the PDP display device exhaust port through the radiation fin in the interior of the PDP display device until being introduced, the heat radiation temperature can be lowered by the fins and the external cross-flow fan, it is possible to efficiently increase in temperature of the suppression. Further, according to the dust-proof casing heat radiation mechanism of the present invention, it is not necessary to secure enough number space volume of the apparatus can be realized even in the thickness of the entire device.

[0023]

Further, an opening for maintenance on the back of the dust-proof cover is provided, and by the fan cover to be Kutsugae outside the cross-flow fan provided so as to close the maintenance opening, an operator who performs maintenance and inspection, by removing the fan cover, the exchange of internal cross-flow fan of internal dust-proof cover can be easily carried out, maintenance and inspection work is eliminated can become complicated.

BRIEF DESCRIPTION OF THE DRAWINGS

1 is a side cross-sectional view showing the configuration of a dust-proof housing heat radiation mechanism of the PDP display apparatus according to an embodiment of the present invention.

In dustproof casing heat radiation mechanism of the PDP display apparatus of FIG. 1, FIG is a main part configuration enlarged view according to A arrow view for explaining the configuration of a main part.

3 is a side cross-sectional view showing a dustproof heat radiation mechanism of the conventional PDP display device.

DESCRIPTION OF SYMBOLS

1 ... plasma display panel display device (PDP display device), 1a ... rear cover, 1b ... PDP display device outlet, 1c ... PDP display device inlet, 2 ... dust cover, 2a ... upper space, 2b ... lower space, 3 ... radiation fins 4 ... sheet, 5 ... bulkhead 6 ... internal cross-flow fan, 7 ... external cross-flow fan, 8 ... fan cover, 9 ... spacer 10 ... radiator fin inlet, 11 ... radiator fins outlet, 12 ... front panel, 13 ... housing, 14 ... heat exchanger, 15 ... space.

Cited By (4)

Publication number	Priority date	Publication date	Assignee	Title
JP2007250105A *	2006-04-26	2007-11-08	Sony Corp	Image display device
JP2011000925A *	2009-09-09	2011-03-24	Panasonic Corp	Cooling device and electronic apparatus mounted with the same
KR101035282B1	2008-12-15	2011-05-18	자열시스템주식회사	Standing signboard for flat display
KR101053046B1	2010-05-14	2011-08-01	(주)한국컴퓨터전자	Digital information display
Family To Family Citations:				

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Similar Documents

Publication	Publication date	Title
JP4081809B4	1996-07-16	Cooling device of electronic equipment
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Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
JP2003077135A	2003-03-20	2003-03-20	Dustproof housing heat radiating mechanism of plasma display panel display panel device

Applications Claiming Priority (1)

Application	Filing date	Title
JP2003077135A	2003-03-20	Dustproof housing heat radiating mechanism of plasma display panel display panel device

Legal Events

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2006-06-06	A300	Withdrawal of application because of no request for examination	Free format text: JAPANESE INTERMEDIATE CODE: A300 Effective date: 20060606

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(71) 出願人 000150497
株式会社日立アイーシステム
愛知県稲沢市幸町120番地の1
(74) 代理人 110000073
特許業務法人プロテック
(72) 発明者 熊崎 寿久
愛知県稲沢市幸町120番地の1 株式会
社日立アイーシステム内
(72) 発明者 小林 正朋
愛知県稲沢市幸町120番地の1 株式会
社日立アイーシステム内
(72) 発明者 後藤 嘉範
愛知県稲沢市幸町120番地の1 株式会
社日立アイーシステム内
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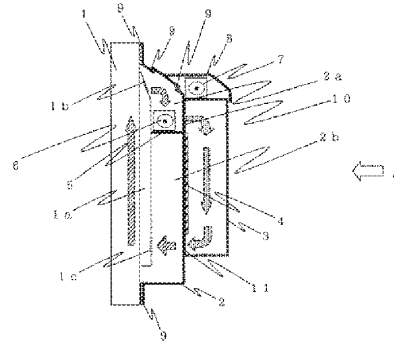
(54) 【発明の名称】 プラズマディスプレイパネル表示装置の防塵筐体放熱機構

(57) 【要約】

【課題】プラズマディスプレイパネル(PDP)表示装置の防塵筐体における温度上昇を効率良く抑制し且つ装置の薄型を実現する。

【解決手段】PDP表示装置1の背面側に設けられた排気口1bと吸気口1cとを覆うように当該PDP表示装置1の背面に取り付けられた防塵カバー2と、該防塵カバー2の背面側に設けられた放熱フィン3と、前記排気口1bから前記防塵カバー2内へ排出される熱気を前記放熱フィン3へ送り出す内部ファン6と、前記放熱フィン3を冷却する外部ファン7とを具備し、PDP表示装置1から生じた熱気を、前記放熱フィン3及び前記外部ファン7により冷却後、放熱フィン3内から防塵カバー2内へ排出させられた冷却後の空気が前記吸気口1cからPDP表示装置1の内部に導入されるよう構成されている。

【選択図】 図1



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【特許請求の範囲】

【請求項1】

プラズマディスプレイパネル表示装置の背面側に設けられた排気口と吸気口とを覆うように当該プラズマディスプレイパネル表示装置の背面に取り付けられた防塵カバーと、該防塵カバーの背面側に設けられた放熱フィンと、前記排気口から前記防塵カバー内へ排出される熱気を前記放熱フィンへ送り出す内部ファンと、前記放熱フィンを冷却する外部ファンと、を具備し、

前記防塵カバーの背面側上方には、前記内部ファンにより当該防塵カバー内から放熱フィン内部へ熱気を送り込むための放熱フィン導入口が設けられ、かつ前記防塵カバーの背面側下方には、前記放熱フィン内で冷却された空気を放熱フィン内から防塵カバー内へ排出させるための放熱フィン排気口が設けられ、

プラズマディスプレイパネル表示装置からの熱気を前記放熱フィン及び前記外部ファンにより冷却後、前記放熱フィンから防塵カバーへ排出させられた冷却後の空気が前記吸気口からプラズマディスプレイパネル表示装置の内部に導入されるよう構成したことを特徴とするプラズマディスプレイパネル表示装置における防塵筐体放熱機構。

【請求項2】

前記防塵カバーは、前記排気口と前記吸気口とを遮断する隔壁を、当該防塵カバーの内部に具備することを特徴とする請求項1に記載のプラズマディスプレイパネル表示装置の防塵筐体放熱機構。

【請求項3】

前記放熱ファンは、貫流型のファンであることを特徴とする請求項1又は2に記載のプラズマディスプレイパネル表示装置の防塵筐体放熱機構。

【請求項4】

前記放熱フィンは、袋状のスリットを備えて成ることを特徴とする請求項1、2又は3に記載のプラズマディスプレイパネル表示装置の防塵筐体放熱機構。

【請求項5】

前記外部ファンと、前記防塵カバーの背面に設けられた保守用の開口部とにファン用カバーが覆設されており、前記ファン用カバーを取り外すことにより、前記防塵カバー内の内部ファンの交換を容易に実施可能とすることを特徴とする請求項1、2、3又は4に記載のプラズマディスプレイパネル表示装置の防塵筐体放熱機構。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】

本発明は、プラズマディスプレイパネル表示装置を防塵構造とした際に生じる温度上昇を、放熱により抑制するプラズマディスプレイパネル表示装置の防塵筐体放熱機構に関するものである。

【0002】

【従来の技術】

従来、防塵構造のプラズマディスプレイパネル表示装置1（以下、PDP表示装置という）において、PDP表示装置を図3に示すような構成とすることにより、表示装置1の内部の放熱を行っていた。具体的には、PDP表示装置1の全体を前面パネル12と筐体13とで覆って防塵構造とし、且つ筐体13の後面（筐体13において前面パネルと対向する面）に熱交換器14を配置することにより、筐体13内の熱を外部に放出するような構成としていた。そして、以上のような構成により、PDP表示装置1の防塵および放熱が可能となっていた。

【0003】

【発明が解決しようとする課題】

ところで、画面サイズが大画面であり且つ装置自体が薄型のPDP表示装置では、局所的な温度上昇が起こりやすい。このような場合、上述のような従来の放熱方式を用いて表示装置内部を全体的に冷却するためには、まず装置内部の空間体積15を十分多く確保する

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必要がある。また、熱交換器 1 4 においても効率が悪くなるため、熱交換器 1 4 には、発熱量以上の冷却能力が要求される。以上の点を考慮すると、従来技術では、防塵構造の PDP 表示装置を効率良く放熱することはできず、また表示装置自体を薄型にすることもできないという問題点があった。

【0004】

そこで本発明の目的は、上記問題点を解決し、PDP 表示装置を防塵構造とした場合においても効率良く放熱することができ、しかも装置全体の薄型化を図ることのできる PDP 表示装置の防塵筐体放熱機構を提供することにある。

【0005】

【課題を解決するための手段】

上記目的を達成するために、本発明のプラズマディスプレイパネル表示装置における防塵筐体放熱機構は、プラズマディスプレイパネル表示装置の背面側に設けられた排気口と吸気口とを覆うように当該プラズマディスプレイパネル表示装置の背面に取り付けられた防塵カバーと、該防塵カバーの背面側に設けられた放熱フィンと、前記排気口から前記防塵カバー内へ排出される熱気を前記放熱フィンへ送り出す内部ファンと、前記放熱フィンを冷却する外部ファンと、を具備し、前記防塵カバーの背面側上方には、前記内部ファンにより当該防塵カバー内から放熱フィン内部へ熱気を送り込むための放熱フィン導入口が設けられ、かつ前記防塵カバーの背面側下方には、前記放熱フィン内で冷却された空気を放熱フィン内から防塵カバー内へ排出させるための放熱フィン排気口が設けられ、プラズマディスプレイパネル表示装置から生じた熱気を、前記放熱フィン及び前記外部ファンにより冷却後、放熱フィン内から防塵カバー内へ排出させられた冷却後の空気が前記吸気口からプラズマディスプレイパネル表示装置の内部に導入されるように構成されている。

【0006】

また、本発明のプラズマディスプレイパネル表示装置における防塵筐体放熱機構において、前記防塵カバーが、前記排気口と前記吸気口とを遮断する隔壁を、当該防塵カバーの内部に具備することで、上記目的は達成される。

【0007】

さらに、本発明のプラズマディスプレイパネル表示装置における防塵筐体放熱機構において、前記放熱ファンが、貫流型のファンであることで上記目的は達成され、また前記放熱フィンは、袋状のスリットを備えることで上記目的は達成される。

【0008】

また、本発明のプラズマディスプレイパネル表示装置における防塵筐体放熱機構において、前記外部ファンと、前記防塵カバーの背面に設けられた保守用の開口部とにファン用カバーが覆設され、前記ファン用カバーを取り外すことにより、前記防塵カバー内の内部ファンの交換を容易に実施可能とするように構成されていてもよい。

【0009】

【発明の実施の形態】

以下、本発明の一実施形態に係る PDP 表示装置の防塵筐体放熱機構について、図 1 及び図 2 を参照して詳細に説明する。図 1 は本発明の一実施形態に係る PDP 表示装置の防塵筐体放熱機構の構成を示す要部側断面図であり、図 2 は図 1 の A 矢視による要部拡大図である。尚、図 1 中の矢印は、装置内部の空気の流れを示している。

【0010】

〔防塵筐体放熱機構の構成〕

本実施形態に係る PDP 表示装置の防塵筐体放熱機構は、図 1 に示すように、PDP 表示装置 1 の背面にスペーサ 9 を介して防塵カバー 2 が取付けられており、さらにこの防塵カバー 2 には、内面に図 2 のような複数個の袋状のスリットを備えた放熱フィン 3 が搭載されている。以上のような構成により、PDP 表示装置 1 は外気と遮断されることとなり、PDP 表示装置 1 の防塵構造が実現されている。

【0011】

また、PDP 表示装置 1 の背面側に設けられた背面カバー 1 a と前記防塵カバー 2 との間

に存在する前記防塵カバー2の内部空間は、略水平方向に設けられた隔壁5によって、背面カバー1aの上方に設けられたPDP表示装置排気口1b側の上側空間2aと、背面カバー1aの下方に設けられたPDP表示装置吸気口1c側の下側空間2bとに分割されている。これにより、本実施形態に係る防塵筐体放熱機構は、PDP表示装置1の排気口1bと吸気口1cとを遮断した構成となっている。

【0012】

また、前記上側空間2a内において、背面側には放熱フィン導入口10が設けられ、さらに隔壁5の上面には、PDP表示装置排気口1bから排出される熱気を吸い出し且つこの熱気を放熱フィン導入口10から放熱フィン3内部へ送り込む役目を有する貫流（クロスフロー）型の内部貫流ファン6が搭載されている。

【0013】

また、前記下側空間2b内において、背面側には放熱フィン排気口11が設けられており、後述の如く放熱フィン3内で冷却された空気が、この放熱フィン排気口11を通して放熱フィン3内から防塵カバー2内へ排出されるように構成されている。

【0014】

また、前記放熱フィン3の上面には、放熱フィン3を冷却するためのファンとして、貫流（クロスフロー）型の外部貫流ファン7が搭載されている。また、この外部貫流ファン7上部にはファン用カバー8が取り付けられている。

【0015】

ここで、本実施形態において、前記放熱フィン3の内部には、防塵カバー2の内部から送り込まれた熱気が、放熱フィンスリットの内部を図2の破線矢印のように流れるようにするためのシート4が取り付けられている。尚、本実施形態ではシート4を用いているが、防塵カバー2の内部から送り込まれた熱気が、放熱フィンスリットの内部を流れるようにするための手段は前記シート4に限定されるものではない。

【0016】

また、本実施形態において、防塵カバー2の背面には、防塵カバー2の内部の保守・点検や内部貫流ファン6の交換を行うための保守用開口部（図示せず）を設けており、前記ファン用カバー8を、その保守用開口部を塞ぐように設けている。以上のような構成により、保守・点検を行う作業者は、ファン用カバー8を取り外すことにより、防塵カバー2内部の内部貫流ファン6の交換を容易に実施することができることとなる。

【0017】

〔防塵筐体放熱機構における放熱過程〕

次に、上記構成のPDP表示装置の防塵筐体放熱機構による放熱過程について、図1及び図2を参照して以下説明する。

【0018】

まず、PDP表示装置排気口1bから吸い出された熱気は、図2のように、内部貫流ファン6により防塵カバー2内から放熱フィン3へ吐出され、放熱フィン導入口10に導かれる。続いて、放熱フィン導入口10に導かれた熱気は、上述の如く、シート4により放熱フィンスリット内部を図2中の破線矢印のように流れる。

【0019】

ここで、上述のように熱気が放熱フィンスリット内部を流れる際に、この熱気は放熱フィン3への熱伝導により冷却され、またこの時、外部貫流ファン7が装置内部の温度より低温の外気を図2中の実線矢印の方向に流すことによって、上述のような熱伝導によって暖められた放熱フィン3も冷却される。

【0020】

以上のようにして冷却された空気は、放熱フィン排気口11より防塵カバー2内へ排出される。そして、防塵カバー2内へ排出された後、PDP表示装置吸気口1cからPDP表示装置1の内部に導入される。

【0021】

このように、PDP表示装置排気口1bから吸い出された熱気は、上記の各過程を経るこ

とによって、PDP表示装置吸気口1 cからPDP表示装置1の内部に導入される空気の温度は低下するため、結果的に、PDP表示装置1の内部の温度上昇は、効率良く抑制されることとなる。

【0022】

【発明の効果】

以上述べたように、本発明の防塵筐体放熱機構によれば、PDP表示装置の防塵を図ることができると共に、PDP表示装置排気口から発生する熱気が放熱フィンを経てPDP表示装置の内部に導入されるまでの間に、放熱フィンおよび外部貫流ファンによって温度を低下させることができ、効率の良い温度上昇の抑制が可能となる。また、本発明の防塵筐体放熱機構によれば、装置内部の空間体積を十分多く確保する必要がないため、装置全体の薄型化をも実現することができる。

【0023】

さらに、防塵カバーの背面に保守用の開口部を設け、且つ外部貫流ファンに覆設されるファン用カバーを当該保守用開口部を塞ぐように設けることによって、保守・点検を行う作業者は、このファン用カバーを取り外すことにより、防塵カバー内部の内部貫流ファンの交換を容易に実施することができ、保守・点検作業が煩雑になることがなくなる。

【図面の簡単な説明】

【図1】本発明の一実施形態に係るPDP表示装置の防塵筐体放熱機構の構成を示す要部側断面図である。

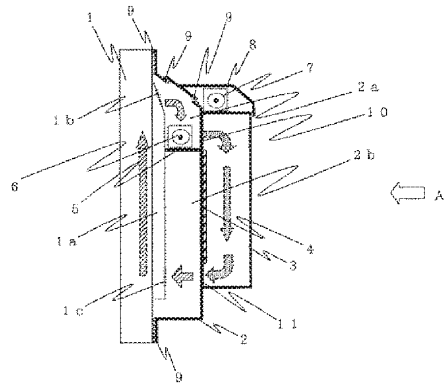
【図2】図1のPDP表示装置の防塵筐体放熱機構において、要部の構成を説明するためのA矢視による要部構成拡大図である。

【図3】従来のPDP表示装置の防塵放熱機構を示す要部側断面図である。

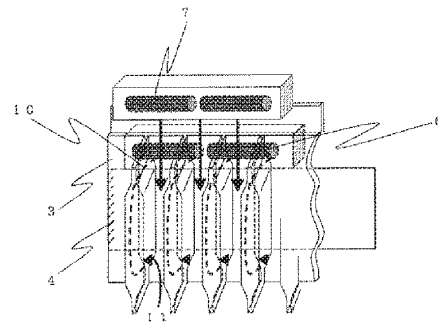
【符号の説明】

1…プラズマディスプレイパネル表示装置（PDP表示装置）、1 a…背面カバー、1 b…PDP表示装置排気口、1 c…PDP表示装置吸気口、2…防塵カバー、2 a…上側空間、2 b…下側空間、3…放熱フィン、4…シート、5…隔壁、6…内部貫流ファン、7…外部貫流ファン、8…ファン用カバー、9…スパーサ、10…放熱フィン導入口、11…放熱フィン排気口、12…前面パネル、13…筐体、14…熱交換器、15…空間。

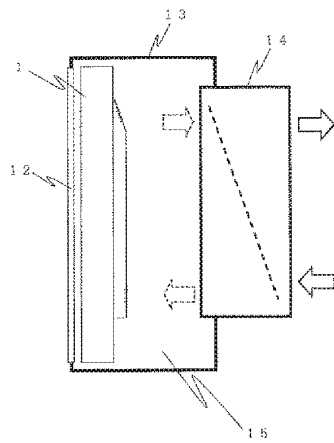
【図1】



【図2】



【図3】



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(71) Applicant: **MANUFACTURING RESOURCES INTERNATIONAL, INC.** [US/US]; 6415 Shiloh Road East, Alpharetta, GA 30005 (US).

(72) Inventor: **DIAZ, Marcos**; 6415 Shiloh Road East, Alpharetta, GA 30005 (US).

(74) Agent: **SMITH, Adam, J.**; Standley Law Group LLP, 6300 Riverside Drive, Dublin, OH 43017 (US).

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[Continued on next page]

(54) Title: COOLING SYSTEM FOR DOUBLE SIDED DISPLAY ASSEMBLY

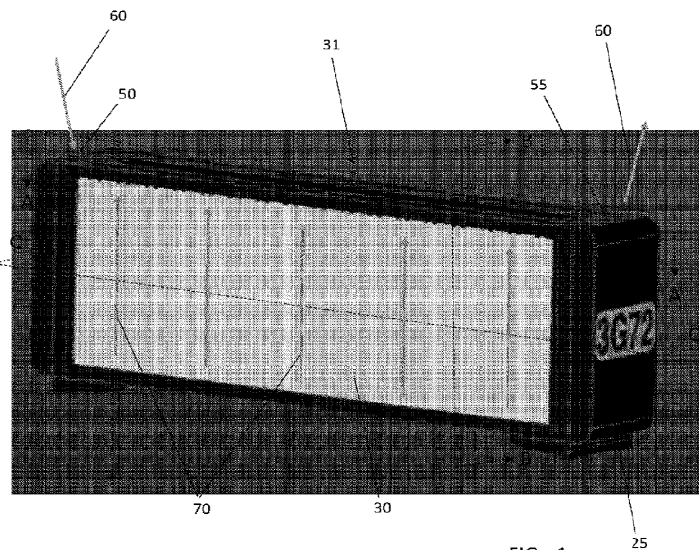


FIG - 1

(57) Abstract: A pair of electronic displays (30 and 31) are placed back to back and are configured for mounting to a vehicle. A pair of thermal plates (126 and 127) are located behind the electronic displays and a pair of transparent plates (35 and 36) are located in front of the electronic displays. A closed loop of air travels vertically through the space between the electronic displays and transparent panels and through a closed loop plenum. An open loop of air travels horizontally through the space between thermal plates and the rear surface of the electronic displays.

WO 2017/152166 A1



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- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

COOLING SYSTEM FOR DOUBLE SIDED DISPLAY ASSEMBLY

Inventor(s): Marcos Diaz

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The application claims the benefit of US Provisional Patent Application No. 62/303,806 filed on March 4, 2016, which is hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of the present invention generally relate to cooling systems for electronic displays.

BACKGROUND

[0003] Electronic displays are sometimes used in outdoor environments or other areas where the surrounding temperatures may be high or there may be other sources of heat such as solar loading causing the temperatures within the display to rise. However, some portions of the display can be difficult to cool as simply ingesting ambient air into some portions of the display can introduce dust and contaminants into sensitive portions of the display, which can lead to premature failures.

SUMMARY OF THE INVENTIVE CONCEPT

[0004] Exemplary embodiments may comprise multiple separate flow paths for a fluid, such as air, through an electronic display housing. At least one path may be a closed loop and several other paths may provide open loops. The closed loop path preferably circulates through a sealed electronics compartment as well as pass between the electronic display(s) and a front transparent panel. A first open loop of ambient air may pass behind the first electronic display while a second path of ambient air may pass behind the second electronic display. In some embodiments the open loop air also removes heat from a thermal plate having electronic

components and in some embodiments the open loop air also removes heat from an LED backlight (or LED display). The fans can be positioned so as to precisely control the amount of fluid travelling through each path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] In addition to the features mentioned above, other aspects of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments, wherein like reference numerals across the several views refer to identical or equivalent features, and wherein:

[0006] FIGURE 1 is a front perspective view showing an exemplary embodiment of the double sided display assembly, as well as the location for section lines A-A, B-B, and C-C.

[0007] FIGURE 2 is a side section view of the embodiment shown in Figure 1, taken along the section line A-A.

[0008] FIGURE 3 is a front section view of the embodiment shown in Figure 1, taken along the section line B-B.

[0009] FIGURE 4 is a top section view of the embodiment shown in Figure 1, taken along the section line C-C and indicating the location for Detail A.

[0010] FIGURE 5 is a detailed section view of Detail A.

[0011] FIGURE 6 is a partial exploded view of the embodiment shown in Figure 1.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

[0012] The invention is described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the exemplary embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and

complete, and will fully convey the scope of the invention to those skilled in the art. In the drawings, the size and relative sizes of layers and regions may be exaggerated for clarity.

[0013] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/ or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0014] Embodiments of the invention are described herein with reference to illustrations that are schematic illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0015] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0016] FIGURE 1 is a front perspective view showing an exemplary embodiment of the double sided display assembly, as well as the location for section lines A-A, B-B, and C-C. Generally speaking, an exemplary embodiment includes two displays 30 and 31 positioned back to back and placed within a housing 25. An inlet aperture 50 accepts a flow of ambient air 60 into and through the housing 25. The ambient air 60 is preferably exhausted out of the housing 25 through the exhaust aperture 55. A closed loop flow of circulating gas 70 travels within the housing 25 as well, but preferably does not mix with the flow of ambient air 60 in any substantial manner.

[0017] As used herein, the term ambient air 60 simply refers to common atmospheric air that would provide the surrounding environment for the assembly. This ambient air 60 is known to contain a mixture of different types of gaseous elements, as well as dust, dirt, pollen, water vapor, and other particulate. Also as used herein, the term circulating gas 70 can refer to any gaseous matter, which might be a mixture of different types of gases or could be a pure gaseous matter. Preferably, the circulating gas 70 does not contain substantial amounts of dust, dirt, pollen, or other types of particulate.

[0018] Exemplary embodiments of the present invention may be configured for mounting to a vehicle, preferably to the roof. The housing 25 may be sized and configured for fitting atop a vehicle roof. Further, the housing 25 may be sized and adapted to minimize aerodynamic drag. The housing 25 may comprise a pair of feet 26 for mounting the housing 25 to the vehicle. The feet 26 may be sized and configured to be secured to a vehicle's roof, or to be secured to internal supports placed on or within the vehicle. In such embodiments, the housing 25 is preferably thin and comprises rounded corners and other features to minimize aerodynamic drag. The housing 25 may comprise a variety of stiffening members to provide

structural rigidity and strength to accommodate the forces caused by a moving vehicle. Likewise, the various components of the display assembly may be configured or comprised of a sufficiently rigid material so as to accommodate the forces caused by a moving vehicle. Furthermore, the housing and various components of the display assembly may be configured to withstand the forces, vibrations, and other rigors of being mounted to a vehicle. For example, but not to serve as a limitation, the feet 26 and other components of the display assembly may comprise rubber pads or other vibration and shock absorption devices.

[0019] As indicated in the figure, section line A-A is positioned horizontally down the center of the assembly and cuts through the assembly vertically. Section line B-B is oriented vertically and cuts through the assembly horizontally. Finally, section line C-C is oriented horizontally and cuts through the assembly horizontally as well. The section line arrows in figure 1 indicate the direction of hypothetical cut to obtain the section view.

[0020] FIGURE 2 is a side section view of the embodiment shown in Figure 1, taken along the section line A-A. The ambient air 60 may enter the housing 25 through the inlet aperture 50, where it may then be directed into an entrance plenum, and pass through one of a plurality of entrance apertures 200 which connect with the open loop channels (described further below). The ambient air 60 is preferably pulled by one or more fans 100, but the fans 100 could also be positioned to push the ambient air 60, or several fans could be used for a combination of push/pull. In this particular embodiment, the fan 100 is located near an exit plenum, where the ambient air 60 is collected from the open loop channels by travelling through one of a plurality of exit aperture 201, collected within the exit plenum, and directed out of the housing 25 through the exhaust aperture 55.

[0021] As will be described further below, the entrance apertures 200 and exit apertures 201 are in gaseous communication with a first open loop channel running behind the electronic display 31. There is preferably another set of entrance apertures and exit apertures on the opposite side of the assembly (not shown in this view), which communicate with a second open loop channel running behind the electronic display 30. The apertures 200 and 201 are preferably distributed across the width of the electronic display 30/31 in a substantially equidistant manner from one another. The apertures 200/201 allow the flow of ambient air 60 to pass through the housing 25 and the open loop channels without substantially mixing with the circulating gas 70 or entering the sealed electronics compartment 125.

[0022] A plurality of electronic components 110 are preferably placed within a sealed electronics compartment 125 which forms a part of the closed loop for the circulating gas 70. The electronic components 110 may comprise one or more of the following: power modules, video player, electronic data storage, microprocessor, satellite/wireless receiver/transmitter, and timing and control board. At least some of the electronic components 110 may be in electrical connection with the displays 30 and 31.

[0023] One or more fans 90 may force the closed loop of circulating gas 70 over the electronic components 110. While shown with two fans 90, this is not required. Additionally, while shown pushing the circulating gas 70 over the electronic components 110, this is not required as the fans 90 could also be positioned to pull the circulating gas 70, or several fans 90 could be used in a combination push/pull of the circulating gas 70.

[0024] **FIGURE 3** is a front section view of the embodiment shown in Figure 1, taken along the section line B-B. Here, the closed loop of circulating gas 70 can be clearly

shown. As mentioned above, the circulating gas 70 preferably travels over the electronic components 110 within the sealed electronics compartment 125 and then splits to wrap around each of the displays 30 and 31. Regarding the first display 30, a transparent panel 35 is preferably placed in front of the display 30 to define a closed loop channel between the display 30 and the transparent panel 35 for accepting circulating gas 70. Once the circulating gas 70 has travelled across the display 30, it is directed back in to the sealed electronics compartment 125 to begin the closed loop again.

[0025] Similarly, regarding the second display 31, a transparent panel 36 is preferably placed in front of the display 31 to define a closed loop channel between the display 31 and the transparent panel 36 for accepting circulating gas 70. Once the circulating gas 70 has travelled across the display 31, it is directed back in to the sealed electronics compartment 125 to begin the closed loop again.

[0026] As shown, the flow of ambient air 60 is preferably split into at least two channels, with one open loop channel travelling behind each display. Regarding display 30, a path of ambient air 60 preferably travels between the rear surface of the display 30 and a thermal wall 126 of the sealed electronics compartment 125. Although not required, when using a direct LED backlit LCD as the display 30, the ambient air 60 preferably travels between the rear surface of the LED backlight 40 and the thermal wall 126. As shown above, a plurality of electronic components 110 are preferably attached to (or near) one or both thermal walls 126 and 127. In this way, heat from the electronic components 110 may be transferred (preferably through conduction but some convection and radiation may occur as well) to the walls 126 and 127 and removed by the flow of ambient air 60.

[0027] Similarly regarding display 31, a path of ambient air 60 preferably travels between the rear surface of the display 31 and a thermal wall 127 of the sealed electronics compartment 125. Although not required, when using a direct LED backlit LCD as the display 31, the ambient air 60 preferably travels between the rear surface of the LED backlight 41 and the thermal wall 127. It should be expressly noted that although a direct LED backlit LCD is shown in these embodiments, this type of display and its associated backlight is not necessary for every embodiment. The displays 30 and 31 could be any one of the following: plasma, OLED, LCD (direct lit or edge lit), LED, and any type of electroluminescent polymer display.

[0028] FIGURE 4 is a top section view of the embodiment shown in Figure 1, taken along the section line C-C and indicating the location for Detail A. In this figure, the two channels for ambient air 60 behind each of the displays 30 and 31 can be seen. Again, preferably the two paths of ambient air 60 can remove heat from the electronic displays 30 and 31 as well as the electronics 110 (through the thermal walls 126 and 127).

[0029] FIGURE 5 is a detailed section view of Detail A. Once the ambient air 60 has travelled through each of the open loop channels, it can be gathered by the exit plenum and forced out of the display housing 25 by the fan 100.

[0030] FIGURE 6 is a partial exploded view of the embodiment shown in Figure 1. This shows the stacking of the elements for one side of the assembly, i.e. the components surrounding electronic display 31. The ambient air 60 is preferably directed through the entrance apertures 200 so that it may pass between the thermal plate 127 and the rear of the electronic display 31 (in this embodiment, the rear surface of the LED backlight 41). Once passing through the open loop channel, the ambient air 60 is preferably directed out of an exit aperture 201 so that it can be

collected in the exit plenum and exhausted out of the display housing. The circulating gas 70 generally encircles the open loop channel(s) having the ambient air 60. In other words, the open loop ambient air 60 passes through the center of the closed loop of circulating gas 70.

[0031] As noted above, the circulating gas 70 preferably passes over electronic components 110, exits the sealed electronics compartment 125, travels between the front transparent plate 36 and the front of the electronic display 31, eventually returning to the sealed electronics compartment 125. Again it should be noted that only one half of the embodiment is shown in this partial exploded view. Generally, there would be a second closed loop of circulating gas 70 travelling around the opposing display 30 and a second open loop channel for ambient air 60 passing behind the display 30, as shown and described above.

[0032] It should also be noted that the variety of open and closed cooling loops that are shown in the figures may be shown in a horizontal or vertical arrangement but it is clearly contemplated that this can be reversed or changed depending on the particular embodiment. Thus, the closed loop may run horizontally or vertically and in a clockwise or counter-clockwise direction. Further, the open loop may also be horizontal or vertical and can run left to right, right to left, and top to bottom, or bottom to top.

[0033] Having shown and described a preferred embodiment of the invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention and still be within the scope of the claimed invention. Additionally, many of the elements indicated above may be altered or replaced by different elements which will provide the same result and fall within the spirit of the

claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

CLAIMS

WHAT IS CLAIMED IS:

1. A display assembly for mounting on a vehicle comprising:
 - a first and second electronic display positioned back to back;
 - a first and second transparent panel, each positioned in front of one of the first and second electronic displays;
 - an open loop pathway located between the first and second electronic displays and configured to receive ambient air;
 - a closed loop pathway configured to receive circulating gas and comprising:
 - a first and second channel defined by the first and second transparent panels and the first and second electronic displays, respectively,
 - and
 - a plenum located between the first and second electronic displays and in gaseous communication with the channels; and
 - a housing adapted to be mounted to the roof of a vehicle, wherein the housing and the first and second transparent panels create an enclosure substantially surrounding the first and second electronic displays, the open loop pathway, and the closed loop pathway;
 - wherein the closed loop pathway and the open loop pathway are configured to transfer thermal energy from the circulating gas to the ambient air while not allow the circulating gas and the ambient air to mix in any substantial manner.
2. The display assembly of claim 1, further comprising:
 - a first and second thermal plate, each placed behind a rear surface of one of the first and second electronic displays.

3. The display assembly of claim 2, further comprising:
a number of electronic components mounted to a rear surface of at least one
of the thermal plates.
4. The display assembly of claim 2, further comprising:
a first and second open loop channel, each defined by the first and second
thermal plates and the rear surface of the first and second electronic
displays, respectively.
5. The display assembly of claim 4, wherein:
the open loop pathway comprises the first and second open loop channels.
6. The display assembly of claim 5, wherein:
the open loop pathway is configured such that ambient air travels horizontally
through the first and second open loop channels.
7. The display assembly of claim 1, wherein:
the closed loop pathway is configured such that closed loop air travels
vertically through the first and second channels and the plenum.
8. The display assembly of claim 1, wherein:
the open loop pathway further comprises:
an inlet aperture located in the housing for ingesting ambient air, and
an exhaust aperture located in the housing for exhausting ambient air.
9. The display assembly of claim 8, wherein:
the open loop pathway further comprises:
a number of entrance apertures in gaseous communication with the
inlet aperture and the first and second open loop channels, and
a number of exit apertures in gaseous communication with the first and
second open loop channels and the exhaust aperture.

10. The display assembly of claim 5, wherein:
the closed loop pathway comprises a first and second flow wherein the first
and second flows vertically encircle the first and second electronic
display, respectively.
11. The display assembly of claim 10, wherein:
the first and second open loop channels pass through the middle of the first
and second flows.
12. The display assembly of claim 1, further comprising:
at least one open loop fan placed within the open loop pathway and
configured to propel ambient air through the open loop pathway.
13. The display assembly of claim 1, further comprising:
at least one closed loop fan placed with the closed loop pathway and
configured to propel circulating gas through the closed loop pathway.
14. A display assembly for mounting on a vehicle comprising:
a pair of electronic displays placed back to back and having a front and a rear
surface;
a pair of transparent panels, each positioned in front of the front surface of
one the electronic displays;
a pair of closed loop channels, each located between one of the transparent
panels and one of the electronic displays;
a pair of thermal plates, each positioned behind the rear surface of one of the
electronic displays;
a pair of open loop channels, each located between one of the thermal plates

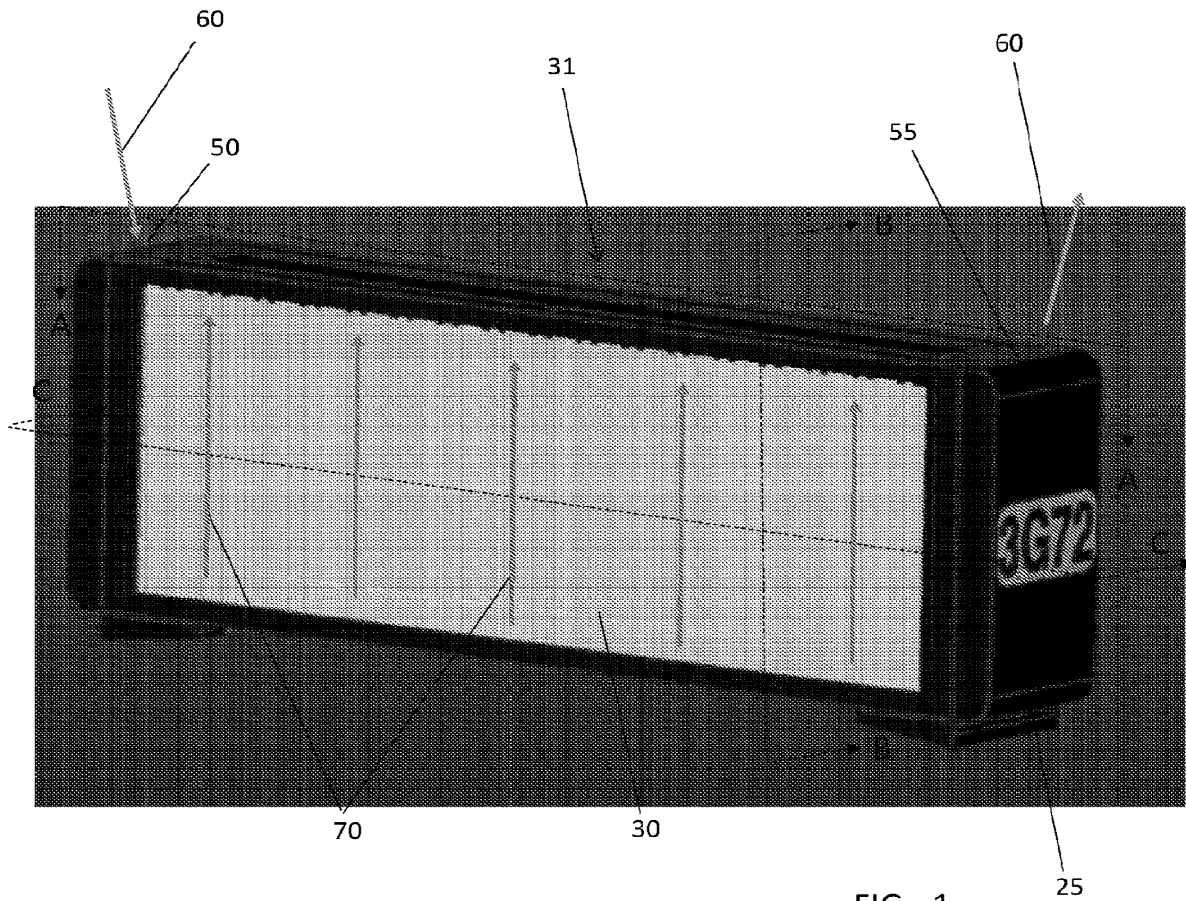
- and the rear surface of one of the electronic displays, wherein the open loop channels are configured to allow ambient air to pass horizontally therethrough; and
- a closed loop plenum defined by the pair of thermal plates, wherein the closed loop plenum is in gaseous communication with the pair of closed loop channels;
- wherein the closed loop channels and the closed loop plenum are configured to allow circulating gas to pass vertically therethrough.
15. The display assembly of claim 14, further comprising:
- a number of electronic components mounted to a rear surface of at least one of the thermal plates.
16. The display assembly of claim 14, further comprising:
- a pair of closed loop fans spaced apart and configured to propel circulating gas through the closed loop plenum and the closed loop channels.
17. The display assembly of claim 14, further comprising:
- an open loop fan positioned to propel ambient air through the open loop channels.
18. The display assembly of claim 14, further comprising:
- a housing adapted to be mounted to the roof of a vehicle.
19. A display assembly for mounting on a vehicle comprising:
- a pair of electronic displays placed back to back, the space between the electronic displays defining a gap;
- a housing configured to surround the electronic displays and be mounted to the roof of the vehicle;

a closed loop pathway that surrounds each of said electronic displays and
travels through the gap; and
a pair of open loop pathways that travel through the gap;
wherein the open loop pathways and the closed loop pathway do not
intersect.

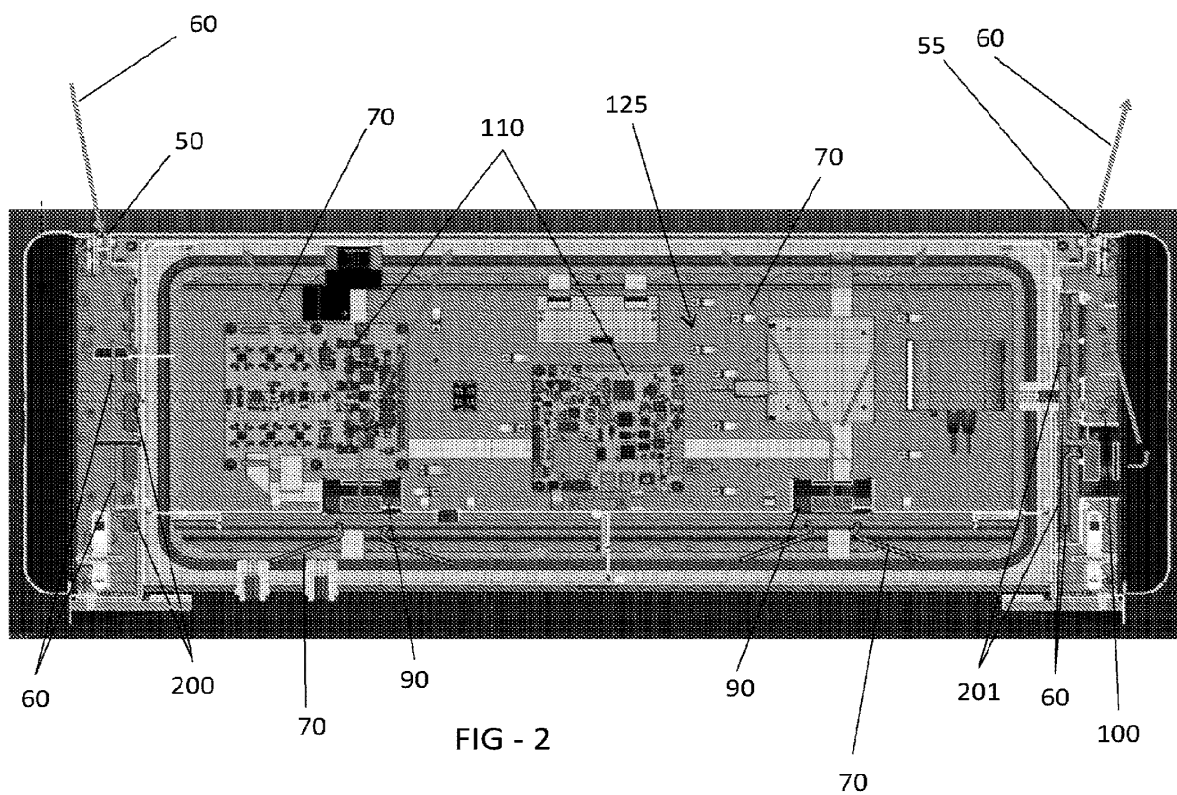
20. The display assembly of claim 19, further comprising:

a pair of thermal plates located between the electronic displays and
separating the open loop pathways from the closed loop pathway.

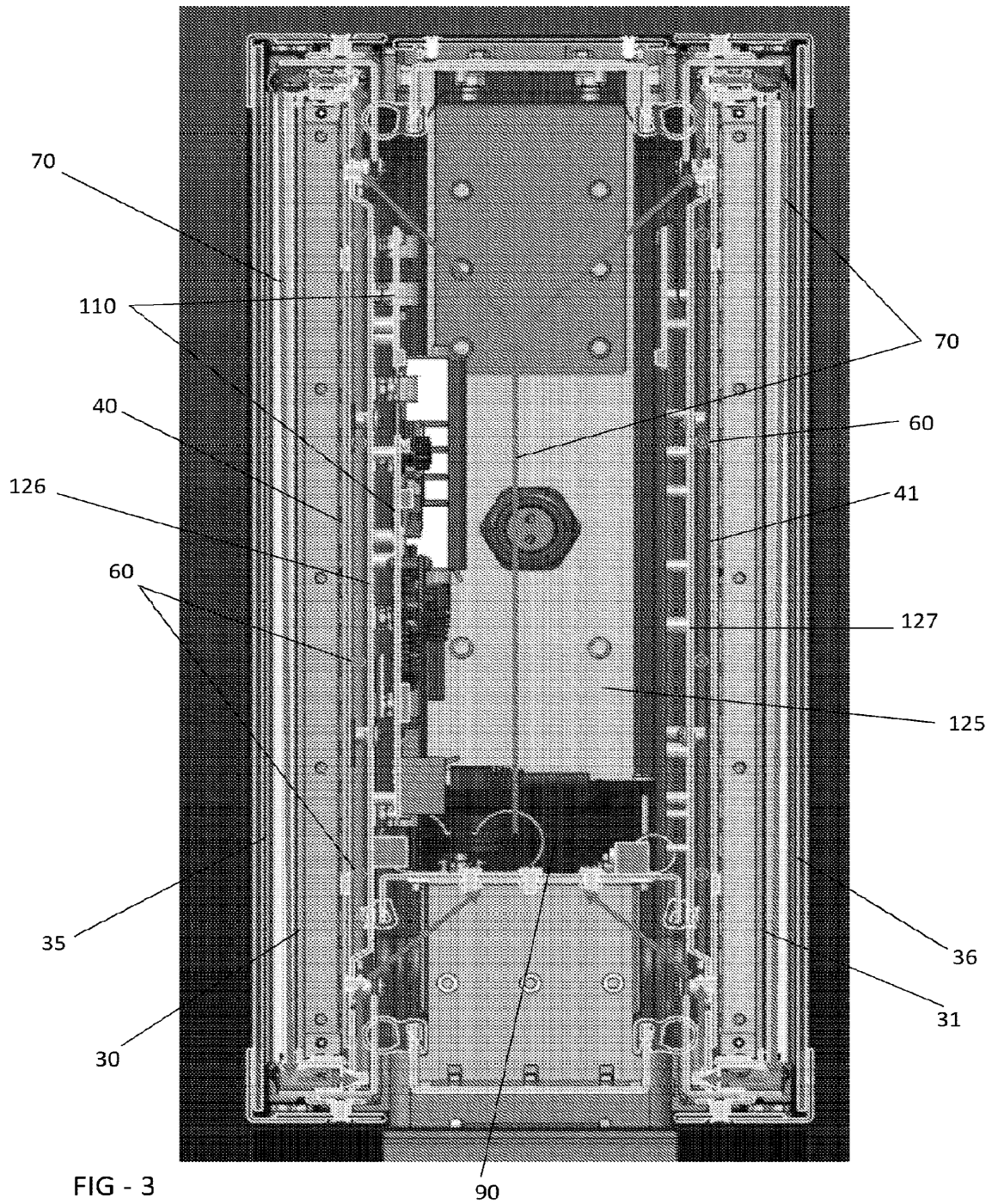
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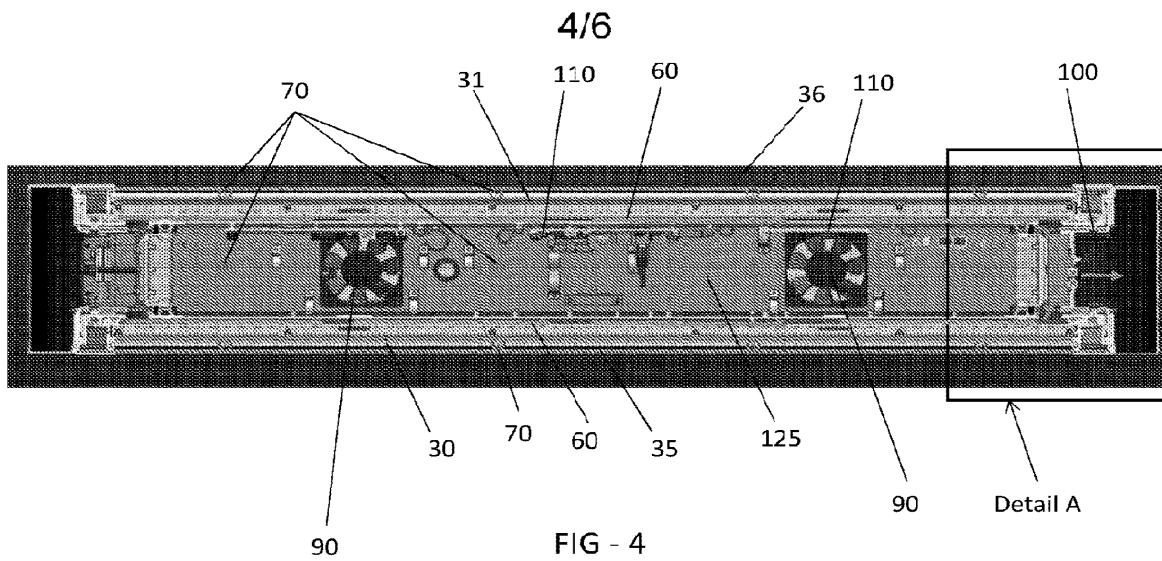


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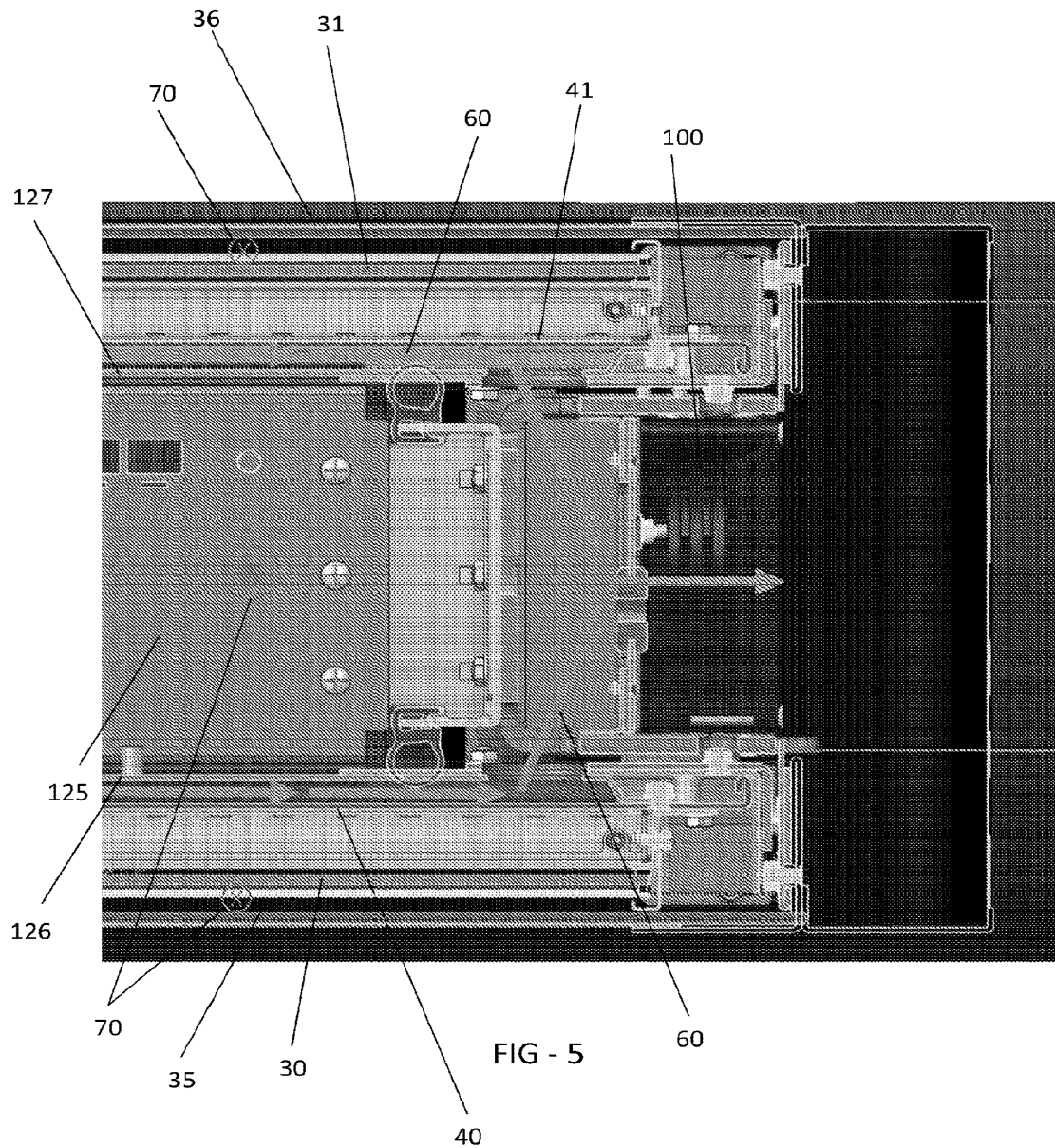


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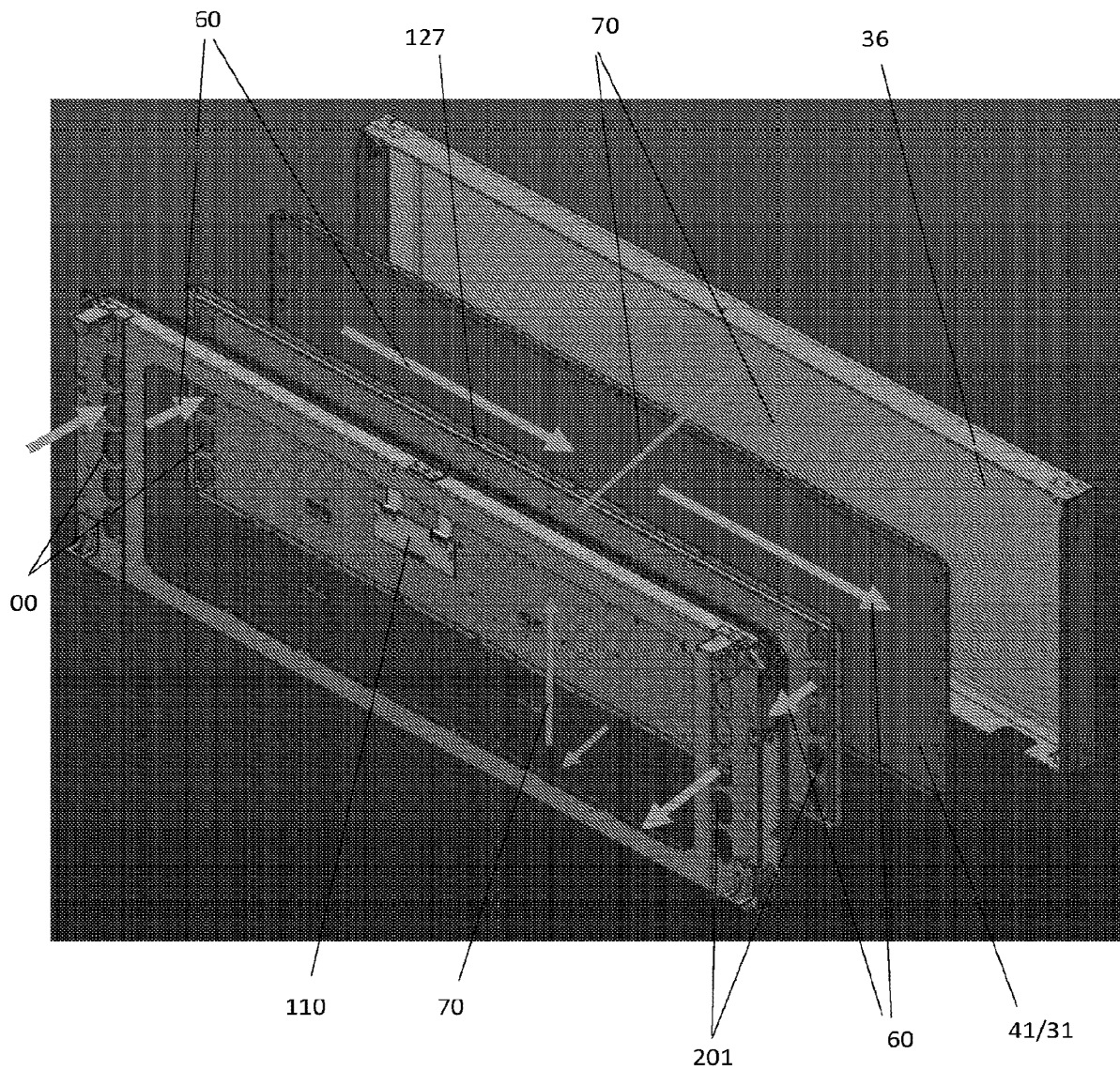


FIG - 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US17/20884

A. CLASSIFICATION OF SUBJECT MATTER

IPC - G02B 27/00, 27/02; H05K 7/06, 7/20 (2017.01)

CPC - H05K 7/20, 7/20009, 7/20127, 7/20954, 7/20136, 7/20145, 7/20154, 7/202

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

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

See Search History document

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2011/0085301 A1 (DUNN, W) April 14, 2011; figures 1, 2B, 3C, paragraphs [0017]-[0018], [0020], [0023], [0026], [0034], [0037], [0041]	1-9, 12-13 & 19-20
Y	US 2005/0253699 A1 (MADONIA, J) November 17, 2005; abstract, figures 1 & 5, paragraphs [0016] & [0019]	1-9, 12-13 & 19-20
Y	US 2014/0134767 A1 (HITACHI HIGH-TECHNOLOGIES CORPORATION); May 15, 2014; figure 4, paragraph [0067]	3
Y --- A	US 2015/0366101 A1 (MANUFACTURING RESOURCES INTERNATIONAL, INC.) December 17, 2015; abstract, paragraph [0037], claim 1	6 --- 1-5, 7-13 & 19-20

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

* Special categories of cited documents:

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

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

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search

21 June 2017 (21.06.2017)

Date of mailing of the international search report

Name and mailing address of the ISA/

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P.O. Box 1450, Alexandria, Virginia 22313-1450

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Shane Thomas

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PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US17/20884

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: Claims 1-13, 19, & 20: Group II: Claims 14-18

Continued within extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-13 & 19-20

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US17/20884

----Continued from Box No. III - Observations where unity of invention is lacking----

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-13, 19, & 20 appear to be directed towards at least a housing for an electronic display.

Group II: Claims 14-18 appear to be directed towards a pair of thermal plates.

The inventions listed as Groups I & II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features.

The special technical features of Group I are at least a housing adapted to be mounted to the roof of a vehicle, wherein the housing and the first and second transparent panels create an enclosure substantially surrounding the first and second electronic displays, the open loop pathway, and the closed loop pathway; wherein the closed loop pathway and the open loop pathway are configured to transfer thermal energy from the circulating gas to the ambient air while not allow the circulating gas and the ambient air to mix in any substantial manner, which are not present in Group II.

The special technical features of Group II are at least a pair of thermal plates, each positioned behind the rear surface of one of the electronic displays; a pair of open loop channels, each located between one of the thermal plates and the rear surface of one of the electronic displays, wherein the open loop channels are configured to allow ambient air to pass horizontally therethrough; and a closed loop plenum defined by the pair of thermal plates, wherein the closed loop plenum is in gaseous communication with the pair of closed loop channels; wherein the closed loop channels and the closed loop plenum are configured to allow circulating gas to pass vertically therethrough, which are not present in Group I.

The common technical features of Groups I and II are a first and second electronic display positioned back to back; a first and second transparent panel, each positioned in front of one of the first and second electronic displays; an open loop pathway located between the first and second electronic displays and configured to receive ambient air; a closed loop pathway configured to receive circulating gas and comprising: a first and second channel defined by the first and second transparent panels and the first and second electronic displays, respectively, and a plenum located between the first and second electronic displays and in gaseous communication with the channels

US 2011/0085301 A1 (DUNN) discloses a first and second electronic display positioned back to back (dual electronic image assembly that are back to back; title, abstract); a first and second transparent panel, each positioned in front of one of the first and second electronic displays (illustrated figure 2A); an open loop pathway located between the first and second electronic displays and configured to receive ambient air (illustrated figure 2B); a closed loop pathway configured to receive circulating gas and comprising: a first and second channel defined by the first and second transparent panels and the first and second electronic displays (closed loop pathway configured to receive circulating gas and comprises left and right channels defined by the panels; figure 3C), respectively, and a plenum located between the first and second electronic displays and in gaseous communication with the channels (illustrated at 300 in figure 3C).

Since the common technical features were previously disclosed by DUNN, they are not special and groups I & II lack unity.

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(71) Applicant SAMSUNG ELECTRONICS CO., LTD.

416, Maetan 3-dong, Paldal-gu, Suwon, Gyeonggi-do

(72) The inventor Seo Youngbae

Suwon, Gyeonggi-do, Korea

Young Jin Jang

342-46 Gil-dong, Gangdong-gu, Seoul

Kim Young-ho

108-4 Gil 2-dong, Gangdong-gu, Seoul

Regular meeting

Seoul, Korea

Ahn Sang Sang

41-5, Gumi-dong, Bundang-gu, Seongnam-si,

(74) Agent Kim Sung Soo

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(54) Radiators and heaters for telecommunication equipment enclosures

summary

A heat dissipating and heating device for a communication equipment enclosure is disclosed. This heat dissipating device has a plurality of PCBs and devices A communication equipment enclosure comprising: left and right side walls of a three-piece housing; outer air cylinders An inner air passage formed in each of the right and left side walls, an outer air passage extending from the lower end of the enclosure through an outer air passage, And the air inside the enclosure flows from the top to the bottom of the enclosure through the inner air passage And a system shelf top fan that only operates to flow. In this heat generating device, the left and right side walls

1. A communication equipment enclosure made of triple and having a plurality of PCBs and devices mounted thereon, the enclosure comprising a system shelf, At the lower end of the heat exchange plate and heat exchange plate which are spaced apart at regular intervals, And a heat generator.

Representative figure

3

Specification

Brief Description of Drawings

1 is a front view of a conventional communication equipment enclosure.

2 is a right side view of another conventional communication equipment enclosure.

3 is a right side view of a conventional large-capacity communication equipment enclosure.

4 is a front view of a communication equipment enclosure according to the present invention.

5 is a right side view of the communication equipment enclosure according to the present invention.

Description of the Related Art

10: cooling air flow passage

20: air suction part

30:	40: External blower
50: Hull roof	60: Internal blower
70: Top shelf	80: Lower Shelf

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100: Housing roof	110: cooling device
120: blower	130: Heat pipe
140: Back door	150: enclosure
160: Support	170: Front door
180: Lower shelf	190: PCB, device
200: PCB, device	210: suspended shelf
220: Top shelf	230: Top cooling system
240: Hull roof	310: Enclosure lid
320: Rubber for leakage prevention, silicone	330: Blower for shelf exhaust
340: blower for outer outlet	360: Waterproof rubber, silicone
370: Roof enclosure	390: Rubber for leakage prevention, silicone
400: internal air passage	410: Outside air passage
420: Heat exchange plate	430: Heater
440: separating wall	450: enclosure
460: PCB, Device	470: Support
480: Lower shelf	490: System shelf
500: Heat exchange plate	510: Outside air passage
520: internal air passage	530: Rubber for leakage prevention, silicone
540:	550: Chinchilla chin
560: Chin for the room	570:
580: Back door	590: Blower
600: Front door	

Detailed description of the design

Purpose of Design

The technology to which the invention belongs and the prior art in the field

The present invention relates to a heat dissipating and heating device for a communication equipment enclosure. In particular, Using a new heat sink convection structure using only the wall of the enclosure itself and a fan, Concerning a communication equipment enclosure having a triple-wall cooling device capable of stable heat dissipation in a consuming system (system) to be.

1 is a front view of a conventional communication equipment enclosure. The enclosure includes a top shelf 10 and a bottom shelf 80, and is provided with a PCB (PCBs) and units are mounted, An internal blower (Fan) 60 for convection of the heated air in the shelf, A cooling air flow passage 10 through which the air for cooling flows, An air intake part (20), a cooling fan for cooling the cooling air, and a cooling fan An air discharge unit 30, an external blower 40 for rapidly moving the warmed air, And an enclosure roof (50) called as a roof.

Referring to FIG. 1, the cooling process of the enclosure will be described with reference to various PCBs mounted on the upper and lower shelves 70 and 80, Air is convected by the internal blower 60 existing inside the enclosure. The convective further The heated air is cooled through the heat exchange plate between the shelves 70, 80 and the airflow passage 10. At this time, Air is supplied from the outside through the air suction unit 20 existing at the lower end of the housing.

When the hot air of the shelf and the cold air of the outside are exchanged through the heat exchange plate, By the convection, the air of the shelf goes down and the outside air goes up. At this time, When blowers 60, 40 are placed on the roof, rapid cooling and convection take place.

FIG. 2 is a right side view of another conventional communication equipment enclosure, and FIG. 3 is a right side view of a large capacity communication equipment

3, a large-capacity enclosure applied to a system having a large power consumption is provided on a roof 240 of a general enclosure

A heat radiating pipe 130 constituting a cooling device 110 for cooling the warmed air, warmed air from the device
A rear door 140 for drawing cold air outside through the heat radiating pipe 130, a support 160 for supporting the housing,
And a housing roof (100) for protecting the front door (170) and the housing from snow and rain.

3, a large-capacity enclosure applied to a system having a large power consumption is provided on a roof 240 of a general enclosure

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A separate upper cooling device 230 is attached, and the heat dissipation principle of the cooling device is used for a general enclosure
The same as the principle of the cooling device.

Referring to FIG. 2, the enclosure 150 includes a plurality of

There are shelves 220, 210 and 180 where PCBs and devices 190 and 200 are mounted side by side in this shelf,

All. The cooling device 110 is mounted on the rear door 140 of the enclosure to form an air flow inside the enclosure

Heat is transferred to the outside of the enclosure.

The air flow and the heat dissipating structure are formed by a heat dissipating pipe 130 assembled inside the cooling device 110,
Heat generated in each PCB and devices 190 and 200 is transferred to the cooling device 110

The flow blown by the blower 120 and moving in the direction of the arrow proceeds. A room inside the cooling device (110)

The heat passing through the heat pipe 130 is cooled by the external cold air flow and continues to move to the bottom of the enclosure

do. The airflow is continuously blown by the blower 120 inside the cooling device 110,

So that heat exchange with the outside of the housing is made.

However, the enclosure uses a cooling device or an air conditioner or a heat exchanger

Air conditioners have problems with reliability and durability, and the air conditioner itself is likely to be heavy and expensive.

The complexity and complexity of after-service (After-Service) costs a lot. The heat exchanger is reliable and

The configuration is somewhat improved compared to the air conditioner, but it is still heavy, the structure is complicated, and it is expensive.

Technological challenge to be devised

Therefore, in order to solve the above-mentioned problems, the present invention has been made to solve the above-mentioned problems in view of the reliability, d

Equipped with a triple-walled cooling system that enhances the weight of each unit and ease of after-sales service,

And a heat generating device.

Another objective of the present invention is to use only the wall and blower of the enclosure in which the PCB and the device requiring the cooling device are mou

In the system which realizes a new radiating convection structure and consumes a relatively low power, a triple wall

And to provide a communication equipment enclosure having a cooling device.

Other objects and advantages of the present invention will become apparent from the following detailed description of the invention when read in conjunction with t
It will lose.

Composition and action of design

According to another aspect of the present invention, there is provided a heat dissipating device for a communication equipment enclosure,

1. A communication equipment enclosure in which a plurality of PCBs and devices are mounted,

Left and right side walls of the case made of triple;

An outer air passage formed in the left and right side walls, respectively;

An inner air passage formed in the left and right side walls, respectively;

An upper fan operated so that outside air flows only from the lower end to the upper end of the housing through the outer air passage;

And

The air inside the enclosure is operated to flow from the upper end to the lower end of the enclosure through the inner air passage

And a stem shelf upper fan.

In this embodiment, sealing between the housing, the enclosure loop and the outer top plate to prevent air leakage

Lt; / RTI & gt;

The system shelves being spaced apart at regular intervals to cool the air exiting the shelf outlet

Exchange plate;

An outer air passage through which the air for cooling the heat exchange plate flows from bottom to top;

An outer discharge unit for discharging air warmed up through the outer air passage; And

And a roof for discharging the air from the outer outlet,

The heat exchange plate is preferably shielded from the outside in order to protect the PCB and the devices from external environment,

Preferably, the shelf outlet includes a blower for the rapid flow of air,

The outside air is preferably introduced into the outside air passage,

Preferably, the outer outlet includes a blower for rapid air flow,

The roof is provided with front and rear surfaces of the housing so that the air escapes and water can not enter the roof

Lt; / RTI &

The roof is sealed to the right and left sides of the housing with a sealing material such as rubber or silicone to prevent water leakage. Directly,

A bottom shelf that houses PCBs and devices that consume high power and have a strong structure in the outside environment;

An air inflow part for introducing outside air into the lower end shelf; And

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And an air discharge unit for discharging the introduced air to the outside,

The lower shelf has a separating wall at the top of the lower shelf to prevent heat from being transferred to the system shelf

Lt; / RTI & gt;

Preferably, the air inlet includes a blower for the rapid flow of air.

According to another aspect of the present invention, there is provided a heating device for a communication equipment enclosure, In a telecommunication equipment enclosure in which a right side wall is made of triple and a plurality of PCBs and devices are mounted, System shelf;

A heat exchange plate surrounding the system shelves at regular intervals; And

At the lower end of the heat exchange plate, there is provided a heater for protecting the PCB and the devices during a cold weather.

In the present embodiment, the heat radiator has a plate-like shape in order to increase the heating area and minimize the installation height

In the following description, a communication equipment enclosure equipped with a triple-wall cooling device according to a preferred embodiment of the present i Many specific details, such as the structure and function of triple walls, provide a better overall understanding of the proposed design Respectively. However, for those skilled in the art,

It will be apparent that the invention may be practiced without departing from the spirit and scope of the present invention.

In addition, the features and functions of well-known communication equipment enclosures are described in detail to avoid obscuring the present invention , And for the same terms, English initials or Korean language interpretation terms shall be used for convenience of explanation and understanding.

Fig. 4 is a front view of the communication equipment enclosure according to the present invention, and Fig. 5 is a right side view thereof. Referring to the drawing The construction of the present invention will be described. In a communication equipment housing 450 equipped with a three-walled cooling device according to lt

A system shelf (490) for mounting PCBs and devices sensitive to external environments, a system shelf

To the shelf outlet

A blower (Fan) 330 for the shelf discharge unit for blowing air,

In order to cool the hot air in the passages 400 and 520, the system shelf 490 is heat-

Plates 420 and 500, external air passages 410 and 510 through which outside air passes to cool the hot air,

(Plinth: 470) equipped with a passage through which outside air flows, and a heat exchanger

A ventilator (340) for the outer discharge unit for blowing the air on the roof; And discharging the warmed outside air to the outside

An outer case discharging unit 540 and 570, a case cover 310 covering the upper end of the case 450,

A housing roof 370, a lid 370 for preventing intrusion of snow and rain leaking into the housing roof,

Jaws 550 and 560, a sealing material 320, 360, 390, and 530 such as rubber and silicone sealing the jaws for the room,

A heater (430) for protecting the PCB / devices, and a PCB / device (460) resistant to the external environment

A lower end shelf 480, an enclosure for receiving external air for cooling the PCB devices mounted on the lower end shelf

A rear door 580, an air blower 590 for increasing the cooling efficiency by speeding up the flow of the outside air,

The front side door 600 where the air cooled the shelf 480 is discharged, the heat exchange between the lower side shelf 480 and the system shelf

And a separating wall (440) for blocking the separating wall (440).

Referring to FIGS. 4 and 5, the operation of the communication equipment enclosure having the triple wall cooling device according to the present invention will be The enclosure is constructed by three walls of the left and right sides of the housing, and two air flow passages (400, 410, 510, 520)

. Here, the external air passages (410, 510) are arranged such that the external air is blown by the blower (340)

And the inner air passages 400 and 520 pass through only the top of the system shelf 490,

The air inside the enclosure is designed to flow from the upper end of the enclosure to the lower end by the ventilator (330). With this design,

The heat exchange efficiency in the heat exchange plates 420 and 500 at the left and right sides of the housing can be increased.

In addition, a triple-wall structure and a completely enclosed roof 370, a housing 450 and a ceiling 550,

And sealed with a sealing material such as a cone to have external air flow passages 410 and 510 and a sealing structure. In addition,

In order to prevent the water from flowing into the inside of the roof through the outer discharge portions 540,

The jaws 550 and 560 are provided on the front and rear surfaces of the housing and sealed.

In addition, the heat generator 430 is installed below the internal air inflow portion at the lower end of the system shelf 490,

In case you need heat. At this time, the heating unit has a large heating area and minimizes installation height

A plate-like heat generator 430 is used.

5, the external air introduced from the base of the housing is guided along the left and right passages 410 and 510,

And is discharged through the outer discharge units 540 and 570.

In addition, a partition wall 440 is provided under the plate-type heat generator 430 so that heat is transferred to the lower shelf under the housing, I will.

Here, the PCB device mounted on the lower shelf consumes high power and has a strong structure in the external environment

The outside air is directly blown from the rear door 580 to the front door 600 through the blower installed in the lower shelf,

Devices 460 are directly cooled.

While the present invention has been described and illustrated by way of example and with reference to the drawings, Various changes and modifications can be made within the scope of the technical idea of the present invention. This will be obvious. For example, instead of using a flat surface as a heat exchange plate, It is also possible to increase the rate.

Therefore, it should be understood that the present invention is not limited to the particular form set forth in the specification, The claimed invention is intended to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention defined by the .

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It is to be understood that the invention includes equivalents and alternatives.

Effect of design

The present invention operates as described above, in which the air flow in the inside and the outside is opposite to each other in the left and right sides of the housing. The heat exchange efficiency is high in the heat exchange plate because the heat exchange is performed in the thin heat exchange plate.

Another effect of the present invention is that only the internal and external blowers are used to cool the enclosure, The reliability of the cooling of the furnace is enhanced, the after-service is easy, and a separate heat exchanger is not attached, The cost of the apparatus can be reduced, and the cooling apparatus can be lightened.

Another effect of the present invention is that the air flow passage in the inside and the outside is sealed by a triple wall structure, It is possible to maximize the efficiency of use of the machine, and even if snow or rain, it is possible to perform excellent rain.

Another effect according to the present invention is that a plate heater is adopted for keeping the system warm, Less resistance to airflow, and less risk of fire or burns than coil-type heaters.

(57) Claims

Claim 1

1. A communication equipment enclosure in which a plurality of PCBs and devices are mounted,

Left and right side walls of the case made of triple;

An outer air passage formed in the left and right side walls, respectively;

An inner air passage formed in the left and right side walls, respectively;

An upper fan operated so that outside air flows only from the lower end to the upper end of the housing through the outer air passage; And

The air inside the enclosure is operated to flow from the upper end to the lower end of the enclosure through the inner air passage And a stem shelf upper fan.

Claim 2

2. The airbag device according to claim 1, wherein the airbag is sealed between the enclosure, the enclosure loop, Heat dissipation device for enclosure.

Claim 3

The method according to claim 1,

A shelf outlet for discharging hot air of the system shelves upward;

The system shelves being spaced apart at regular intervals to cool the air exiting the shelf outlet Exchange plate;

An outer air passage through which the air for cooling the heat exchange plate flows from bottom to top;

An outer discharge unit for discharging air warmed up through the outer air passage; And

Further comprising a roof through which the air of the outer outlet portion escapes.

Claim 4

The heat exchanger according to claim 3, wherein the heat exchange plate is made of a material that is shielded from the outside to protect the PCB and the devices Heat dissipation device for communication equipment enclosure.

Claim 5

4. The apparatus of claim 3, wherein the shelf ejector comprises a blower for rapid airflow, Heat sink.

Claim 6

The heat dissipating device for a communication equipment enclosure according to claim 1, wherein the outside air flows into the outside air passage.

Claim 7

[5] The apparatus as claimed in claim 3, wherein the outer casing has a blower for rapid air flow,
Heat sink for communication equipment enclosure.

Claim 8

[4] The air conditioner according to claim 3, wherein the roof is provided with an air conditioner jaw so that air can escape and water can not enter,
Installed heat sink for communication equipment enclosure.

Claim 9

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The roof according to claim 8, wherein the roof is formed of a sealing material such as rubber or silicone on the right and left sides of the housing for preventing wa  
Heat sink for communication equipment enclosure.

Claim 10

The method according to claim 1,

A bottom shelf that houses PCBs and devices that consume high power and have a strong structure in the outside environment;

An air inflow part for introducing outside air into the lower end shelf; And

And an air discharging portion for discharging the introduced air to the outside.

Chi.

Claim 11

11. The system of claim 10, wherein the lower shelf comprises a lower shelf to prevent heat from being transferred to the system shelf,  
A heat dissipation device for a communication equipment enclosure, provided at the top of the shelf.

Claim 12

11. The apparatus of claim 10, wherein the air inlet comprises a triple-walled cooling device with an air blower for rapid airflow,  
. Heat dissipation device for communication equipment enclosure.

Claim 13

1. A communication equipment enclosure in which right and left side walls are made of triple and in which a plurality of PCBs and devices are mounted,  
System shelf;

A heat exchange plate surrounding the system shelves at regular intervals; And

And a heater for protecting the PCB and the devices at the time of the cold in the lower end of the heat exchange plate.  
Thermal device.

Claim 14

[14] The apparatus of claim 13, wherein the heat radiator has a plate-like shape to widen the heating area and minimize the installation height  
A heating device for a communication equipment enclosure.

drawing

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(19) 대한민국특허청(KR)  
(12) 공개실용신안공보(U)

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(71) 출원인 삼성전자 주식회사 윤종웅  
경기도 수원시 팔달구 매탄3동 416  
(72) 고안자 서영배  
경기도 수원시 장안구 조원동 761-5 화성아파트 101-306  
장영진  
서울특별시 강동구 길동 342-46 송림파크빌라 102호  
김영후  
서울특별시 강동구 길2동 108-4  
정희정  
서울특별시 동작구 흑석2동 40-11  
안웅상  
경기도 성남시 분당구 구미동 41-5  
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특허청구 : 없음

(54) 통신장비 함체용 방열 및 발열 장치

요약

통신 장비 함체용 방열 및 발열장치에 대해 개시한다. 본 방열 장치는, 다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서, 3중으로 제작된 함체의 좌우측벽, 좌우측벽내에 각각 형성된 바깥쪽 공기통로, 좌우측벽내에 각각 형성된 안쪽 공기통로, 외부공기가 바깥쪽 공기통로를 통해 함체 하단에서 상단으로만 흐르도록 작동하는 상단부판 및 함체 내부공기가 안쪽 공기통로를 통해 함체 상단에서 하단으로만 흐르도록 작동하는 시스템 쉘프 상단부판을 구비하여 이루어진다. 그리고 본 발열장치는, 좌우측벽이 3중으로 제작되고, 다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서, 시스템 쉘프, 시스템 쉘프를 일정한 간격을 두고 둘러싼 열교환 판 및 열교환 판 하단에, 흡열기때 PCB와 장치들을 보호하기 위한 발열기를 구비하여 이루어진다.

도면

도1

도2

도면의 간단한 설명

도 1 은 종래의 통신 장비 함체 정면도이다.

도 2 는 종래의 다른 통신 장비 함체 우측면도이다.

도 3 은 종래의 대용량 통신 장비 함체 우측면도이다.

도 4 는 본 고안에 의한 통신 장비 함체의 정면도이다.

도 5 는 본 고안에 의한 통신 장비 함체의 우측면도이다.

<도면의 주요 부분에 대한 부호의 설명>

10 : 냉각용 공기 흐름 통로 20 : 공기 흡입부  
30 : 공기 배출부 40 : 외부 송풍기  
50 : 함체 지붕 60 : 내부 송풍기  
70 : 상단 쉘프 80 : 하단 쉘프

|                      |                      |
|----------------------|----------------------|
| 100 : 함체 지붕          | 110 : 냉각 장치          |
| 120 : 송풍기            | 130 : 방열 파이프         |
| 140 : 뒤틀문            | 150 : 함체             |
| 160 : 받침             | 170 : 앞 문            |
| 180 : 하단 쉘프          | 190 : PCB, 장치        |
| 200 : PCB, 장치        | 210 : 중단 쉘프          |
| 220 : 상단 쉘프          | 230 : 상단 냉각 장치       |
| 240 : 함체 지붕          | 310 : 함체 뚜껑          |
| 320 : 누수 방지용 고무, 실리콘 | 330 : 쉘프 배출부용 송풍기    |
| 340 : 외곽 배출부용 송풍기    | 360 : 누수 방지용 고무, 실리콘 |
| 370 : 함체 지붕          | 390 : 누수 방지용 고무, 실리콘 |
| 400 : 내부 공기 통로       | 410 : 외부 공기 통로       |
| 420 : 열교환 판          | 430 : 발열기            |
| 440 : 분리벽            | 450 : 함체             |
| 460 : PCB, 장치        | 470 : 받침             |
| 480 : 하단부 쉘프         | 490 : 시스템 쉘프         |
| 500 : 열교환 판          | 510 : 외부 공기 통로       |
| 520 : 내부 공기 통로       | 530 : 누수 방지용 고무, 실리콘 |
| 540 : 외곽 배출부         | 550 : 방우용 턱          |
| 560 : 방우용 턱          | 570 : 외곽 배출부         |
| 580 : 뒤틀문            | 590 : 송풍기            |
| 600 : 앞문             |                      |

#### 고안의 상세한 설명

##### 고안의 목적

##### 고안이 속하는 기술 및 그 분야의 종래기술

본 고안은 통신 장비 함체용 방열 및 발열장치에 관한 것이다. 특히 냉각 장치가 필요한 회로소자가 실장 되는 함체 자체의 벽과 송풍기(Fan)만을 이용한 새로운 방열 대류 구조를 사용하여 비교적 저전력을 소모하는 시스템(System)에서 안정적인 방열을 하는 3중벽 냉각 장치를 갖춘 통신 장비 함체에 관한 것이다.

도 1 은 종래의 통신 장비 함체의 정면도이다. 이를 참고로 종래의 통신 장비 함체를 설명하면, 종래의 함체는 각종 PCB(Printed Circuit Board), 장치(Unit)들이 실장 되는 상단 쉘프(70)와 하단 쉘프(80), 상기 쉘프에서 가열된 공기를 대류 시키기 위한 내부 송풍기(Fan : 60), 상기 가열된 공기를 냉각시키기 위한 공기가 흐르는 냉각용 공기 흐름 통로(10), 상기 냉각용 공기가 들어가는 함체 받침 쪽에 위치한 공기 흡입부(20), 상기 냉각용 공기가 냉각한 후 더워진 공기를 외부로 배출하기 위한 함체 지붕에 위치한 공기 배출부(30), 상기 더워진 공기를 신속히 움직이게 하는 외부 송풍기(40)와 함체를 비로부터 보호하는 함체 지붕(50)을 구비하여 이루어진다.

상기 함체의 냉각 과정을 도 1 을 참고로 설명하면, 상단·하단 쉘프(70, 80)에 실장된 각종 PCB와 장치들에 의해 더워진 공기는 함체 내부에 존재하는 내부 송풍기(60)에 의해 대류 한다. 상기 대류 하는 더워진 공기는 쉘프(70, 80)와 공기 흐름 통로(10) 사이의 열교환 판을 통해 냉각된다. 이때 더워진 공기를 냉각시키는 공기는 함체 하단에 존재하는 공기 흡입부(20)를 통해 외부에서 공급된다.

이처럼 쉘프의 더운 공기와 외부의 찬 공기가 열교환 판을 통해 열교환이 이루어지면, 송풍기로 인한 강제 대류 현상에 의해 쉘프의 공기는 아래로 내려가고, 외부 공기는 위로 올라간다. 이때, 쉘프와 함체 지붕에 송풍기(60, 40)를 달면, 빠른 냉각과 대류가 일어난다.

도 2 는 다른 종래의 통신 장비 함체 우측면도이고, 도 3 은 대용량 통신 장비 함체의 우측면도이다. 이를 참고로 종래의 다른 함체의 구성을 설명하면, 종래 함체(150)는, 상·중·하단 쉘프(200, 210, 180)에 실장되는 각종 통신용 PCB·장치(190,200), 상기 장치에서 나오는 더워진 공기를 냉각 장치(110)로 끌어들이는 송풍기(120), 상기 더워진 공기를 냉각하는 냉각 장치(110)를 구성하는 방열 파이프(130), 상기 방열 파이프(130)로 외부의 찬 공기를 끌어들이는 뒤틀문(140), 상기 함체를 받치는 받침(160), 앞문(170)과 함체를 눈·비로부터 보호하는 함체 지붕(100)을 구비하여 이루어진다.

그리고, 도 3 의 경우처럼 전력 소모가 큰 시스템에 적용하는 대용량 함체는 일반 함체의 지붕(240)에

별도의 상단 냉각 장치(230)를 하나 더 부착한 것으로, 냉각 장치의 방열 원리는 일반 함체에 사용되는 냉각 장치의 원리와 동일하다.

상기 함체를 도 2를 참고로 설명하면, 밀폐된 함체(150) 내부에는 상하로 연속적으로 실장되는 다수의 쉘프(220, 210, 180)가 있는데 PCB 및 장치(190, 200)들은 이 쉘프 속에 좌우로 나란히 다수개가 실장된다. 그리고 냉각 장치(110)는 함체의 뒷면(140)에 장착되어 도 2에 나타난 공기 흐름처럼 함체 내부의 열이 함체 외부로 전달되게 된다.

상기 공기 흐름과 방열 구조는 냉각 장치(110) 내부에 조립된 방열 파이프(130)에 의하여 함체 내·외부의 열교환이 이루어지는데 각 PCB와 장치(190, 200)에서 발생한 열은 냉각 장치(110)에 부착된 송풍기(120)에 의하여 송풍되어 화살표 방향으로 이동하는 흐름이 진행된다. 냉각 장치(110) 내부의 방열 파이프(130)를 통과하는 열은 외부의 저온 공기 흐름에 의해 냉각되고 함체 하단부로 계속 이동하게 된다. 그리고 이와 같은 공기 흐름은 냉각 장치(110) 내부의 송풍기(120)에 의해 송풍이 계속되면서 순환하게 되고 따라서 함체 외부와 열교환이 이루어지게 되는 것이다.

그러나, 상기 함체는 냉각 장치를 보통 에어컨디셔너(Airconditioner)나 열교환기를 사용하게 되는데 에어컨디셔너의 경우 신뢰성과 내구성에 문제가 있고, 에어컨디셔너 자체가 무겁고 고가가 되기 쉬우며 구조가 복잡하고 애프터서비스(After-Service) 측면에서도 많은 비용이 발생한다. 열교환기는 신뢰성과 내구성은 에어컨디셔너에 비해 다소 향상되나 여전히 무겁고 구조가 복잡하며 고가가 되는 문제점이 있다.

#### 고안이 이루고자하는 기술적 과제

따라서 본 고안은 상기와 같은 문제점을 해결하기 위하여, 냉각 장치의 신뢰성, 내구성, 제조 비용, 냉각 장치의 자체 무게, 애프터서비스의 용이성을 높인 3중벽 냉각 장치를 갖춘, 통신 장비 함체용 방열 및 발열장치를 제공하는 것을 목적으로 한다.

본 고안의 다른 목적은 냉각 장치가 필요한 PCB와 장치가 실장되는 함체 자체의 벽과 송풍기만을 이용한 새로운 방열 대류 구조를 실현하여 비교적 저전력을 소모하는 시스템에서 안정적인 방열을 하는 3중벽 냉각 장치를 갖춘 통신 장비 함체를 제공하는 것이다.

본 고안의 다른 목적과 장점은 아래의 고안의 상세한 설명을 읽고 아래의 도면을 참조하면 보다 명백해질 것이다.

#### 고안의 구성 및 작용

상기와 같은 목적을 달성하기 위하여 본 고안에 따른 통신 장비 함체용 방열장치의 바람직한 실시예는, 다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서,

3중으로 제작된 상기 함체의 좌우측벽;

상기 좌우측벽내에 각각 형성된 바깥쪽 공기통로;

상기 좌우측벽내에 각각 형성된 안쪽 공기통로;

외부공기가 상기 바깥쪽 공기통로를 통해 상기 함체 하단에서 상단으로만 흐르도록 작동하는 상단부팬; 및

상기 함체 내부공기가 상기 안쪽 공기통로를 통해 상기 함체 상단에서 하단으로만 흐르도록 작동하는 시스템 쉘프 상단부팬을 구비하여 이루어진다.

본 실시예에 있어서, 공기 누수를 막기위해 상기 함체, 함체 루프 및 외부상판 사이를 밀봉처리하는 것이 바람직하며,

상기 쉘프 배출부를 통해 나온 공기를 냉각하기 위해 상기 시스템 쉘프를 일정한 간격을 두고 둘러싼 열교환 판;

상기 열교환 판을 냉각하기 위한 공기가 아래로부터 위로 흐르는, 외곽 공기 통로;

상기 외곽 공기 통로를 통해 더워진 공기를 위로 배출하는 외곽 배출부; 및

상기 외곽 배출부의 공기가 빠져나가는 지붕을 더 구비하는 것이 바람직하며,

상기 열교환 판은, PCB와 장치들을 외부 환경으로부터 보호하기 위해 외부와 차단되는 것이 바람직하며,

상기 쉘프 배출부는, 공기의 신속한 흐름을 위해 송풍기를 구비하는 것이 바람직하며,

외부공기는 상기 바깥쪽 공기 통로로 유입되는 것이 바람직하며,

상기 외곽 배출부는 공기의 신속한 흐름을 위해 송풍기를 구비하는 것이 바람직하며,

상기 지붕에는 공기는 빠져나가고 물은 들어올 수 없도록 방우용 턱이 함체의 전후면에 설치되는 것이 바람직하며,

상기 지붕은 누수 방지를 위해 함체 좌우측에 고무나 실리콘 등의 밀봉재로 밀봉처리가 되는 것이 바람직하며,

고전력을 소모하면서 외부환경에는 강한 구조를 가지고 있는 PCB와 장치들을 장착하는 하단부 쉘프;

상기 하단부 쉘프로 외부의 공기를 유입하는 공기 유입부; 및

상기 유입된 공기를 외부로 배출하는 공기 배출부를 더 구비하는 것이 바람직하며,

상기 하단부 쉘프는, 시스템 쉘프로 열이 전달되는 것을 막기 위해 분리벽을 하단부 쉘프의 상단에 구비하는 것이 바람직하며,

상기 공기 유입부는, 공기의 신속한 흐름을 위해 송풍기를 구비하는 것이 바람직하다.

상기한 다른 목적을 달성하기 위한 본 고안에 따른 통신 장비 함체용 발열장치의 바람직한 실시예는, 좌우측벽이 3층으로 제작되고, 다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서,

시스템 쉘프;

상기 시스템 쉘프를 일정한 간격을 두고 둘러싼 열교환 판; 및

상기 열교환 판 하단에, 축전기때 PCB와 장치들을 보호하기 위한 발열기를 구비한다.

본 실시예에 있어서, 상기 발열기는, 발열 면적을 넓게 하고 설치 높이를 최소화하기 위해 판 모양으로 이루어지는 것이 바람직하다.

하기 설명에서 본 고안의 바람직한 실시예에 따른 3중벽 냉각 장치를 갖춘 통신 장비 함체가 첨부된 도면을 참조로, 3중벽의 구조와 기능 등과 같은 많은 특정 상세들이 본 고안의 보다 전반적인 이해를 제공하기 위해 나타나 있다. 그러나, 당해 기술분야에 숙련된 자들에게 있어서는 본 고안이 이러한 상세한 항목들이 없어도 상기한 본 고안의 기술적 사상에 의해 충분히 실시될 수 있다는 것이 명백한 것이다.

또한, 잘 알려진 통신 장비 함체의 특징 및 기능들은 본 고안을 모호하지 않게 하기 위해 상세히 설명하지 않으며, 동일 용어에 대해서는 설명 및 이해의 편의상 영문 이니셜 또는 국어 해석용어를 병용한다.

도 4 는 본 고안에 의한 통신 장비 함체의 정면도이고, 도 5 는 그 우측면도이다. 상기 도면을 참고로 본 고안의 구성을 설명하면, 본 고안에 의한 3중벽 냉각 장치를 갖춘 통신 장비 함체(450)는,

외부 환경에 민감한 PCB와 장치들을 실장하는 시스템 쉘프(System Shelf : 490), 상기 시스템 쉘프에서 나오는 더운 공기를 쉘프 배출부로 송풍시키는 쉘프 배출부용 송풍기(Fan : 330), 상기 내부 공기 통로(400, 520)의 더운 공기를 냉각시키기 위해 시스템 쉘프(490)를 일정한 간격을 두고 둘러싼 열교환 판(420, 500), 상기 더운 공기를 냉각시키기 위한 외부 공기가 지나가는 외부 공기 통로(410, 510), 상기 외부 공기가 유입되는 통로가 구비된 함체 받침(Plinth : 470), 내부 공기와의 열교환으로 더워진 외부 공기를 지붕위로 송풍시키는 외곽 배출부용 환풍기(340); 상기 더워진 외부 공기를 외부로 배출하는 외곽 배출부(540, 570), 함체(450)의 상단을 덮는 함체 뚜껑(310), 상기 함체를 눈·비로부터 보호하는 함체 지붕(370), 상기 함체 지붕으로 누수 되는 눈·비의 침입을 막는 뚜껑(370)내에 존재하는 방우용 턱(550, 560), 상기 방우용 턱을 밀봉하는 고무·실리콘 등의 밀봉재(320, 360, 390, 530), 축전기 때의 PCB·장치들을 보호하기 위한 발열기(430), 외부 환경에 대한 내성이 강한 PCB·장치(460)들을 실장하는 하단부 쉘프(480), 상기 하단부 쉘프에 실장된 PCB·장치들을 냉각하기 위한 외부 공기가 들어오는 함체 뒷문(580), 상기 외부 공기의 흐름을 빨리 하여 냉각 효율을 높이는 송풍기(590), 상기 하단부 쉘프(480)를 냉각시킨 공기가 나가는 함체 앞 문(600)과 상기 하단부 쉘프(480)와 시스템 쉘프의 열교환을 막는 분리벽(440)을 구비하여 이루어진다.

본 고안에 의한 3중벽 냉각 장치를 갖춘 통신 장비 함체의 동작을 도 4 와 도 5 를 참고로 설명하면, 본 함체는 함체 좌우측의 벽을 3층으로 제작하여 공기 흐름 통로 2개(400, 410, 510, 520)를 좌우측에 각각 형성한다. 여기서 외부 공기 통로(410, 510)는 외부공기가 외곽 배출부용 송풍기(340)에 의해 함체 하단에서 상단으로만 흐르며 내부 공기 통로(400, 520)는 시스템 쉘프(490) 바로 위에 장착된 쉘프 배출부용 환풍기(330)에 의해 함체 내부 공기가 함체 상단에서 하단 방향으로 흐르게 설계된다. 이처럼 설계하면, 함체 좌우측의 열교환 판(420, 500)에서의 열교환 효율을 크게 할 수 있다.

또한 3중벽 구조이면서도 완벽하게 함체 지붕(370)과 함체(450) 및 방우용 턱(550, 560)을 고무나 실리콘 등의 밀봉재로 밀봉 처리하여 외부 공기 흐름 통로(410, 510)와 밀봉 구조를 갖춘다. 또한 방우 기능을 강화하기 위하여 외곽 배출부(540, 570)를 통해 물이 지붕 안쪽으로 유입되는 것을 막기 위해 방우용 턱(550, 560)을 함체의 전후면에 설치하고 밀봉한다.

그리고, 발열기(430)를 시스템 쉘프(490) 하단부의 내부 공기 유입부 아래에 설치하여 축전시에 시스템에 열이 필요한 경우를 대비한다. 이때의 발열기는 발열 면적을 넓게 하고, 설치높이는 최소화하기 위해 판 모양의 발열기(430)를 사용한다.

도 5 에 나타난 바와 같이 함체의 받침에서 유입된 외부 공기는 좌우통로(410, 510)를 따라 지붕(370)의 외곽 배출부(540, 570)를 거쳐 배출된다.

또한 판형 발열기(430) 아래에는 분리벽(440)이 있어 함체 아래의 하단부 쉘프에 열이 전달되는 것을 차단한다.

여기서 하단부 쉘프에 실장되는 PCB·장치는 고전력을 소모하면서 외부 환경에는 강한 구조를 가진 것으로 하단부 쉘프에 장착된 송풍기를 통해 뒷문(580)에서 앞 문(600)으로 외부 공기를 직접 송풍하여 발열 장치(460)들이 직접 냉각한다.

상기의 설명에서 본 고안을 도면을 중심으로 예를 들어 설명하고 한정하였지만, 본 분야의 통상의 지식을 가진 자에게는 본 고안의 기술적 사상을 벗어나지 않는 범위 내에서 여러 가지 변화와 변형이 가능함이 명백한 것이다. 예를 들어 열교환 판을 평평한 면으로 하지 않고 주름을 주어 접촉면을 높여 냉각 효율을 높이는 것도 가능한 것이다.

따라서, 본 고안은 명세서에서 언급된 특별한 형태로 한정되는 것이 아닌 것으로 이해되어야 하며, 오히려 본 고안은 첨부된 청구범위에 의해 정의된, 본 고안의 기술적 사상과 범위 내에 있는 모든 변형물,

균등을 및 대체물을 포함하는 것으로 이해되어야 한다.

#### 고안의 효과

상기와 바와 같이 동작하는 본 고안은, 내·외부의 공기 흐름이 함체 좌·우측에서 서로 반대 방향으로 흐르면서 두께가 얇은 열교환 판에서 열교환이 이루어지므로 열교환 판에서의 열교환 효율이 높다.

본 고안에 의한 다른 효과는, 내·외부 송풍기만을 사용하여 함체를 냉각시키므로 단순한 냉각 장치 구조로 냉각의 신뢰성이 높아지고, 애프터서비스가 용이하고, 별도의 열교환 장치를 부착하지 않아 냉각 장치 원가가 절감되고, 냉각 장치의 경량화가 가능하다.

본 고안에 의한 또 다른 효과는, 3중벽 구조이면서도 내·외부의 공기 흐름 통로를 밀봉 처리하여 송풍기의 사용효율을 극대화할 수 있고, 눈·비가 오더라도 우수한 방우가 가능하다.

본 고안에 의한 또 다른 효과는, 시스템 보온을 위하여 판형 발열기를 채택하여 함체 높이를 크게 높이지 않아도 되고, 공기 흐름상의 저항이 적고, 코일형 발열기에 비해 화재나 화상의 위험이 적다.

#### (57) 청구의 범위

##### 청구항 1

다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서,

3중으로 제작된 상기 함체의 좌우측벽;

상기 좌우측벽내에 각각 형성된 바깥쪽 공기통로;

상기 좌우측벽내에 각각 형성된 안쪽 공기통로;

외부공기가 상기 바깥쪽 공기통로를 통해 상기 함체 하단에서 상단으로만 흐로도록 작동하는 상단부팬; 및

상기 함체 내부공기가 상기 안쪽 공기통로를 통해 상기 함체 상단에서 하단으로만 흐로도록 작동하는 시스템 쉘프 상단부팬을 구비하는, 통신 장비 함체용 방열장치.

##### 청구항 2

제 1 항에 있어서, 공기 누수를 막기위해 상기 함체, 함체 루프 및 외부상판 사이를 밀봉처리한, 통신 장비 함체용 방열장치.

##### 청구항 3

제 1 항에 있어서,

상기 시스템 쉘프의 더운 공기를 위로 배출하는 쉘프 배출부;

상기 쉘프 배출부를 통해 나온 공기를 냉각하기 위해 상기 시스템 쉘프를 일정한 간격을 두고 둘러싼 열교환 판;

상기 열교환 판을 냉각하기 위한 공기가 아래로부터 위로 흐르는, 외곽 공기 통로;

상기 외곽 공기 통로를 통해 더워진 공기를 위로 배출하는 외곽 배출부; 및

상기 외곽 배출부의 공기가 빠져나가는 지붕을 더 구비하는, 통신 장비 함체용 방열장치.

##### 청구항 4

제 3 항에 있어서, 상기 열교환 판은, PCB와 장치들을 외부 환경으로부터 보호하기 위해 외부와 차단된, 통신 장비 함체용 방열장치.

##### 청구항 5

제 3 항에 있어서, 상기 쉘프 배출부는, 공기의 신속한 흐름을 위해 송풍기를 구비한, 통신 장비 함체용 방열장치.

##### 청구항 6

제 1 항에 있어서, 외부공기는 상기 바깥쪽 공기 통로로 유입되는, 통신 장비 함체용 방열장치.

##### 청구항 7

제 3 항에 있어서, 상기 외곽 배출부는 공기의 신속한 흐름을 위해 송풍기를 구비한, 통신 장비 함체용 방열장치.

##### 청구항 8

제 3 항에 있어서, 상기 지붕에는 공기는 빠져나가고 물은 들어올 수 없도록 방우용 턱이 함체 전후면에 설치된, 통신 장비 함체용 방열장치.

##### 청구항 9

제 8 항에 있어서, 상기 지붕은 누수 방지를 위해 함체의 좌우측에 고무나 실리콘 등의 밀봉재로 밀봉처리가 된, 통신 장비 함체용 방열장치.

**청구항 10**

제 1 항에 있어서,

고전력을 소모하면서 외부환경에는 강한 구조를 가지고 있는 PCB와 장치들을 장착하는 하단부 셸프;

상기 하단부 셸프로 외부의 공기를 유입하는 공기 유입부; 및

상기 유입된 공기를 외부로 배출하는 공기 배출부를 더 구비하여 이루어지는, 통신 장비 함체용 방열장치.

**청구항 11**

제 10 항에 있어서, 상기 하단부 셸프는, 시스템 셸프로 열이 전달되는 것을 막기 위해 분리벽을 하단부 셸프의 상단에 구비한, 통신 장비 함체용 방열장치.

**청구항 12**

제 10 항에 있어서, 상기 공기 유입부는, 공기의 신속한 흐름을 위해 송풍기를 구비한, 3중벽 냉각 장치를 갖춘 통신 장비 함체. 통신 장비 함체용 방열장치.

**청구항 13**

좌우측벽이 3중으로 제작되고, 다수의 PCB와 장치가 장착되는 통신 장비 함체에 있어서,

시스템 셸프;

상기 시스템 셸프를 일정한 간격을 두고 둘러싼 열교환 판; 및

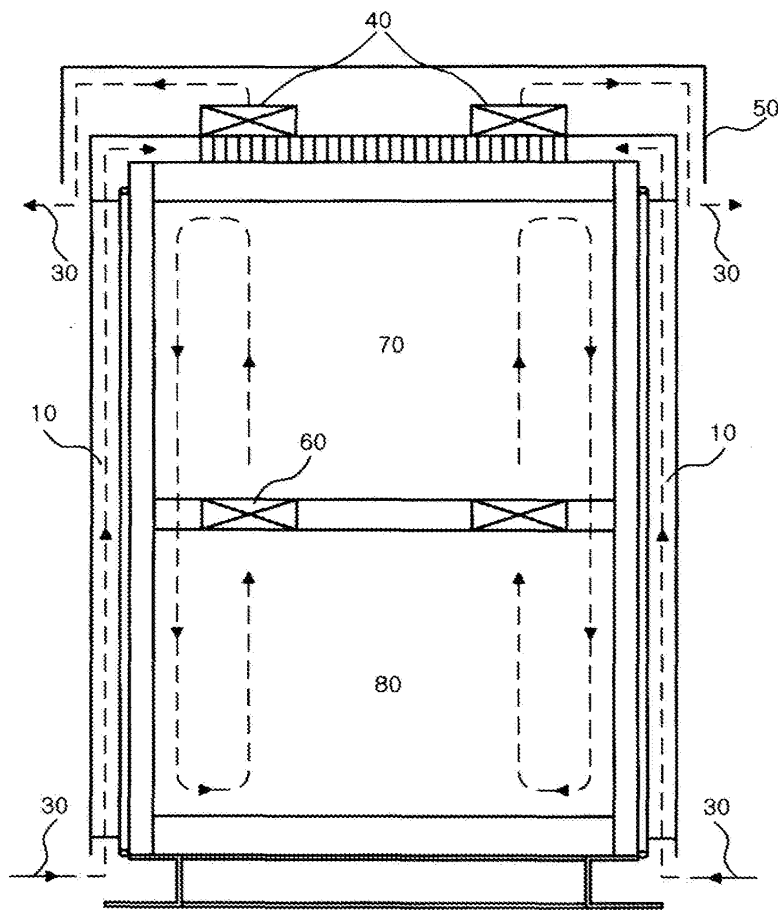
상기 열교환 판 하단에, 축전기때 PCB와 장치들을 보호하기 위한 발열기를 구비한, 통신 장비 함체용 방열장치.

**청구항 14**

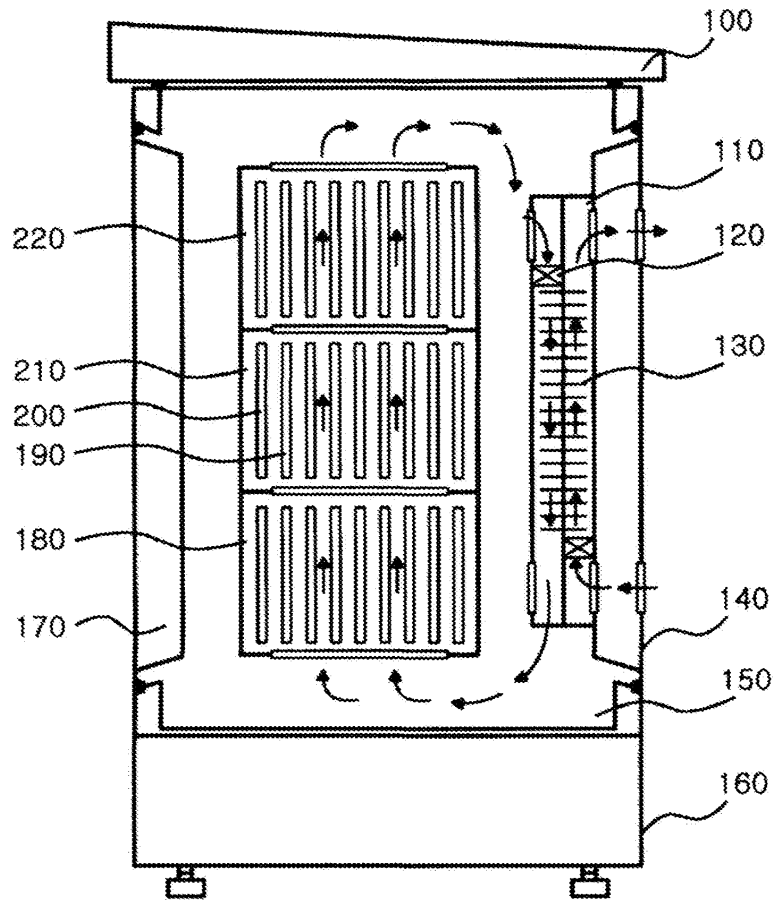
제 13 항에 있어서, 상기 발열기는, 발열 면적을 넓게 하고 설치 높이를 최소화하기 위해 판 모양으로 이루어진, 통신 장비 함체용 방열장치.

도면

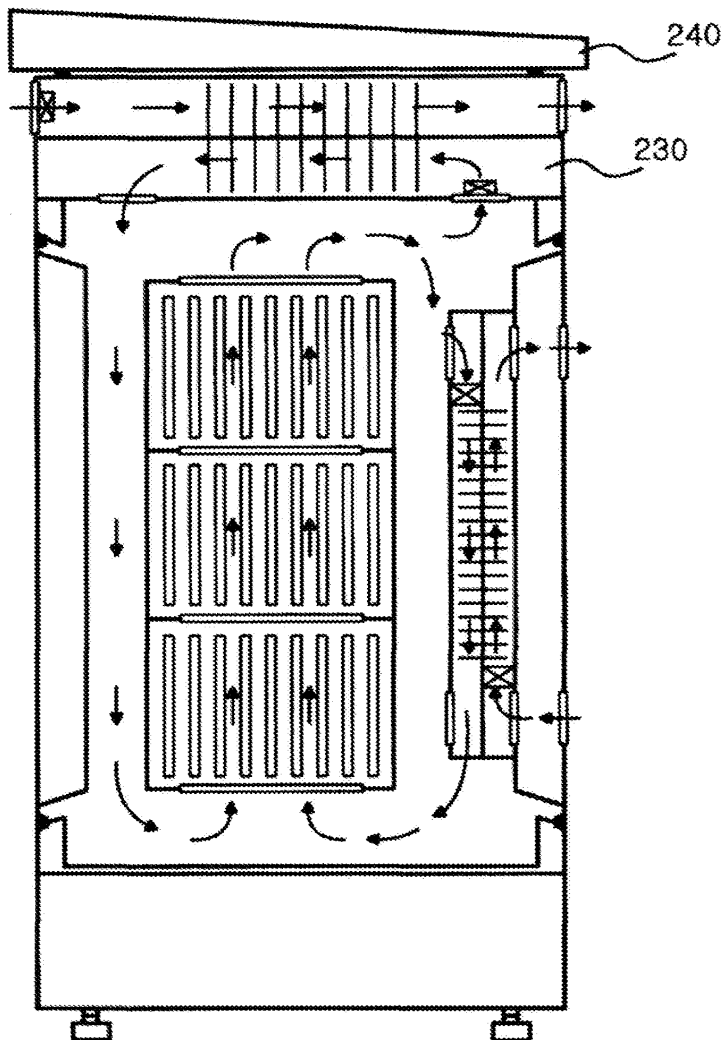
도면1



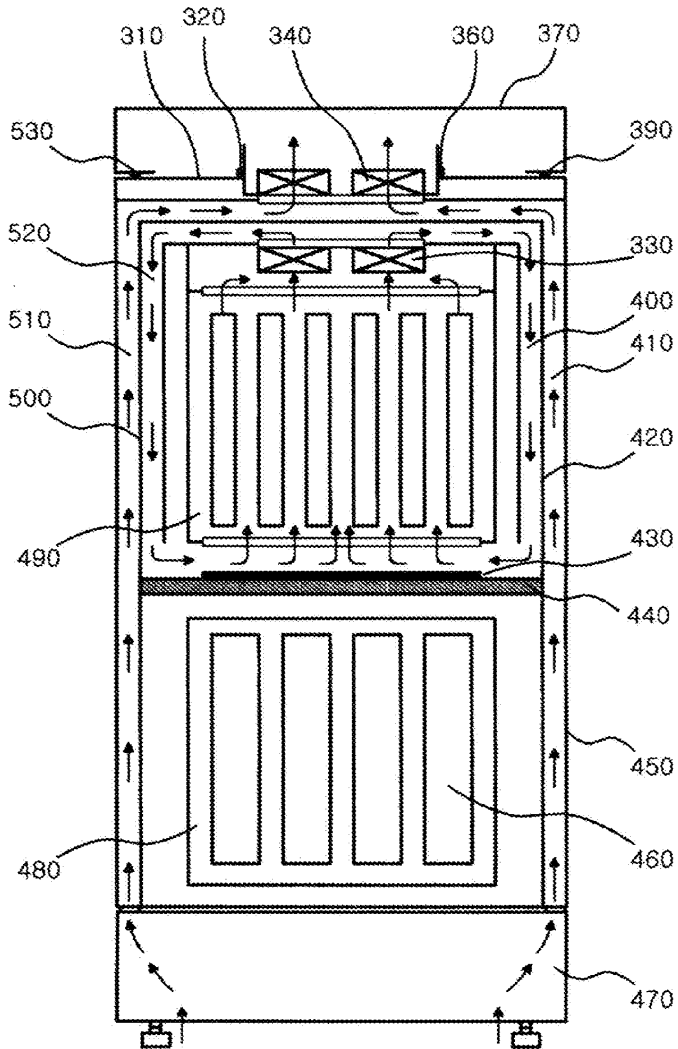
도 2

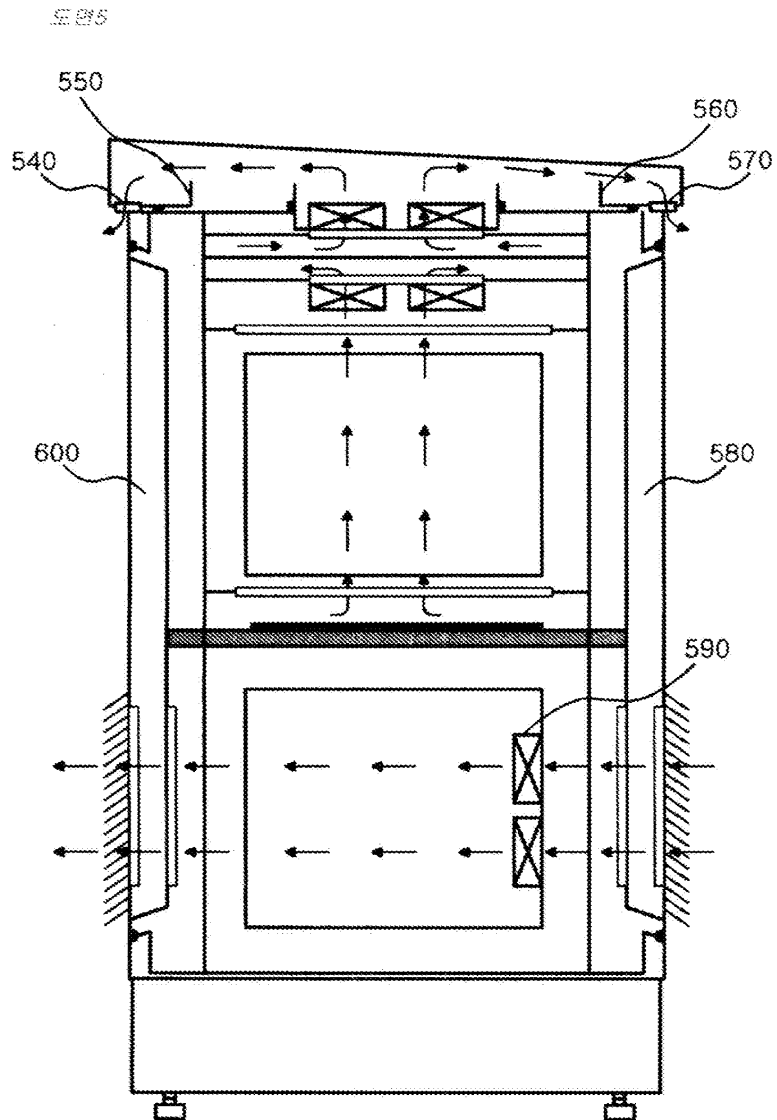


도 80



도 84







Espacenet

## Bibliographic data: KR200000047899 (A) — 2000-07-25

### COOLING DEVICE, COOLING METHOD AND ELECTRONIC APPARATUS

**Inventor(s):** MIZOGUCHI MOTOSHI [JP]; HOKAO SHIGEYUKI [JP]; NAKAI YASUHIRO [JP]; OZAKI YUZO [JP]; SONEHARA TAKASHI [JP] ± (MIZOGUCHI MOTOSHI, ; HOKAO SHIGEYUKI, ; NAKAI YASUHIRO, ; OZAKI YUZO, ; SONEHARA TAKASHI)

**Applicant(s):** SONY CORP ± (SONY CORPORATION)

**Classification:** - **international:** G06F1/20; (IPC1-7): G06F1/20  
- **cooperative:** G06F1/203

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EP1006426 (A2) EP1006426 (A3) EP1006426 (B1)  
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US6437978 (B1) US6599090 (B2) less

### Abstract of KR200000047899 (A)

**PURPOSE:** A cooling device, a cooling method and an electronic apparatus are provided to be capable of easily discharging air in a main body of an electronic apparatus of even a miniature type in which a gap between an air inlet of the cooling device and the inner wall of the main body is narrow, a cooling method therefor, and an electronic apparatus having a main body to be cooled by the cooling device, and discharging air even in a space, opposite to an air inlet of the cooling device, in a main body of an electronic apparatus. **CONSTITUTION:** An electronic apparatus includes a main body having a movable bottom surface portion and a display unit openable/closeable relative to the main body. In one arrangement the cooling device includes means for transmitting an opening/closing angle of the display unit, and means for driving the movable bottom surface portion in accordance with the opening/closing angle of the display unit transmitted by the transmission means, to enlarge the inner space of the main body, thereby cooling the interior of the main body. In another arrangement the cooling device includes means for sucking a first gas, means for discharging the first gas sucked by the sucking means, and means for sucking and discharging a second gas by the action of the first gas discharged by the discharging means.

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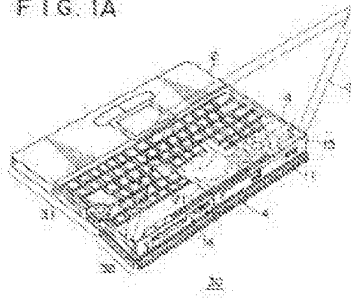


FIG. 18

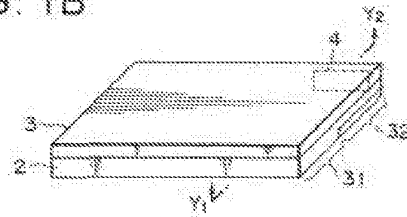
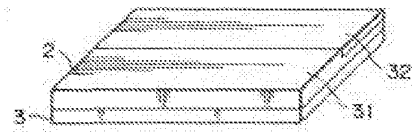


FIG. 1C



30

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| (72) 발명자   | 일본국 도쿄도 시나가와쿠 키타시나가와 6초메 7반 35고<br>오자키유조<br>일본도쿄도시나가와쿠키타시나가와6초메7반35고소니가부시키가이사내<br>니카이하스히로<br>일본아이치켄누카타군오아자사카자키아자스즈메가이리1소니코다가부시키가이사내<br>소네하라타카시<br>일본나가노켄아즈미군토요시나쵸오아자토요시나5432소니디지털프로덕츠가부<br>시키가이사내<br>호카오시게유키<br>일본도쿄도시나가와쿠키타시나가와6초메7반35고소니가부시키가이사내<br>미조구치모토시<br>일본도쿄도시나가와쿠키타시나가와6초메7반35고소니가부시키가이사내 |
| (74) 대리인   | 이병호                                                                                                                                                                                                                                                                                                 |

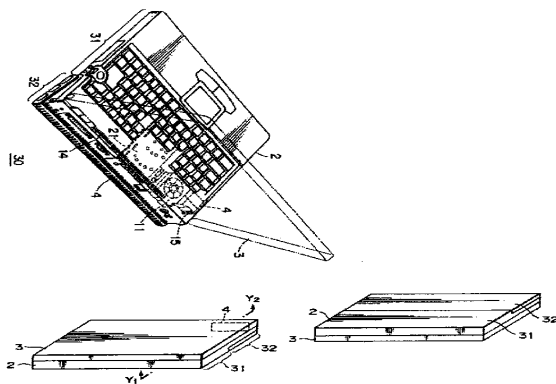
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(54) 냉각 장치, 냉각 방법 및, 전자 기기

요약

전자 기기의 본체 내부를 냉각시키기 위한 냉각 장치를 제공한다. 전자 기기는 가동 바닥면부를 갖는 본체와 이 본체에 대해 개폐될수 있는 디스플레이 유닛을 구비한다. 상기 냉각 장치는 디스플레이 유닛의 개폐 각도를 전송하기 위한 수단과, 전송 수단에 의해 전송된 상기 디스플레이 유닛의 개폐 각도에 따라 가동 바닥면부를 구동시켜 본체의 내부 공간을 확장시키고 그로 인해 본체의 내부를 냉각시키는 구동 수단을 포함하는 것을 특징으로 한다. 제 1 가스를 흡입하는 흡입 수단과, 상기 흡입 수단으로부터 흡입된 제 1 가스를 방출하는 방출 수단 및, 상기 방출 수단에 의해 방출된 제 1 가스의 작용에 의해 제 2 가스를 흡입 및 방출하는 수단을 포함하는 다른 냉각 장치도 개시되어 있다.

도면



# 개요

가동 바닥면부, 본체, 디스플레이 유닛, 개폐 각도, 전송 수단

## 본체

### 본체 상면

도 1a 는 본 발명이 적용되는 개인용 컴퓨터의 외관을 도시하는 사시도로서, 상기 개인용 컴퓨터로부터 디스플레이 유닛이 제거되어 있는 상태의 도면이고, 도 1b 와 도 1c 는 본체상에서 디스플레이 유닛이 폐쇄된 상태를 도시하는 개인용 컴퓨터의 외관을 도시하는 사시도.

도 2a 는 도 1b 의  $Y_1 - Y_2$  선상에서 취한 단면도이며, 도 2b 는 냉각 유닛의 장착 상태를 도시하는 도면.

도 3a 는 디스플레이가 본체로부터 개방되어 있고 개방가능한 바닥면부가 개방되어 있는 상태에서의 개인용 컴퓨터의 외관을 도시하는 사시도이며, 도 3b 내지 도 3d 는 개방가능한 바닥면부의 작용을 도시하는 도면.

도 4 는 개방가능한 바닥면부가 개방된 상태로 개인용 컴퓨터가 사용자의 무릎위에 놓여있는 상태를 도시하는 도면.

도 5a 는 도 3b 의  $P_1 - P_2$  선상에서 취한 단면도이고, 도 5b 와 도 5c 는 본체의 내부를 냉각시키는 작용을 도시하는 도면.

도 6 은 본체상으로 디스플레이가 폐쇄된 상태를 도시하는 개인용 컴퓨터의 우측면도.

도 7 은 도 6 에 도시된 범위 A의 확대 도시도.

도 8 은 디스플레이 유닛이 대략  $15^\circ$  각도로 개방되는 상태를 도시하는 개인용 컴퓨터의 다른 우측면도.

도 9 는 도 8 에 도시된 범위 A의 확대 도시도.

도 10 은 디스플레이 유닛이 대략  $90^\circ$  각도로 개방되는 상태를 도시하는 개인용 컴퓨터의 또 다른 우측면도.

도 11 은 도 10 에 도시된 범위 A의 확대 도시도.

도 12 는 릴리스 버튼이 사용자에게 의해 안쪽으로 눌러진 상태를 도시하는 개인용 컴퓨터의 또 다른 우측면도.

도 13 은 개방가능한 바닥면부가 상향 이동된 상태를 도시하는 개인용 컴퓨터의 또 다른 우측면도.

도 14 는 개방가능한 바닥면부가 폐쇄된 상태를 도시하는 개인용 컴퓨터의 또 다른 우측면도.

도 15 는 냉각 기구를 갖는 도킹 스테이션의 도시도.

도 16a 및 도 16b 는 냉각 기구를 갖는 다른 도킹 스테이션의 도시도.

도 17a 및 도 17b 는 본 발명이 적용되는 냉각 유닛의 외관을 도시하는 도면.

도 18 은 개인용 컴퓨터의 본체에 장착되는, 도 17a 와 도 17b 에 도시된 냉각 유닛의 단면도.

도 19 는 본체내에 공기 유입구가 제공된 개인용 컴퓨터의 도시도.

도 20 은 도 19 에 도시된 개인용 컴퓨터의 본체에 장착되는, 도 17a 와 도 17b 에 도시된 냉각 유닛의 단면도.

도 21 은 편평 핀이 장착되는 도 17a 및 도 17b 에 도시된 냉각 유닛의 도시도.

도 22 는 공기 유입구가 측면에 제공되어 있는, 도 17a 및 도 17b 에 도시된 냉각 유닛의 도시도.

도 23 은 종래의 개인용 컴퓨터의 외관을 도시하는 도면.

도 24 는 종래의 냉각 유닛의 외관을 도시하는 도면.

도 25a 및 도 25b 는 각각 도 24 에 도시된 냉각 유닛의 정면도 및 배면도.

도 26 은 도 23 에 도시된 개인용 컴퓨터의  $X_1 - X_2$  선상에서 취한 단면도.

★ 도면의 주요 부분에 대한 부호의 설명 ★

2 : 본체    3 : 디스플레이 유닛

11 : 냉각 유닛    30 : 개인용 컴퓨터

31, 32 : 바닥면부    62 : 챔

### 본체 하면

## 발명의 효과

### 발명이 속하는 기술분야 및 그 분야의 종래기술

본 발명은 냉각 장치와, 이 냉각 장치를 냉각하는 방법 및, 상기 냉각 장치에 의해 냉각될 전자 기기에 관한 것으로, 특히 전자 기기의 본체 내부 전체를 냉각하기 위한 냉각 장치와, 이를 냉각하기 위한 방법 및, 상기 냉각장치에 의해 냉각될 본체를 갖는 전자 기기에 관한 것이다.

도 23 은 본체(2)와 디스플레이 유닛(3)을 구비한 종래의 개인용 컴퓨터(personal computer:PC)(1)를 도시한다. 상기 본체(2)는 예를 들어 CPU 및 비디오칩과 같이 보드상에 장착되어 그 작동중에 열을 발생시키는 디바이스들을 구비한다. 전체 본체(2)의 온도 상승을 억제하기 위하여 본체(2)는 일반적으로 본체(2)의 윗면에 배치되는 공기 유출구(4)를 구비하며, 또한 도 24 에 도시된 냉각 유닛(11)을 포함한다. 상기 디바이스에서 발생된 열에 의해 뜨거워지는 본체(2)내의 공기는 냉각 유닛(11)에 의해 공기 유출구(4)를 통하여 외부로 배출된다.

도 24에 도시된 냉각 유닛(11)은 팬(13)이 내장되는 하우징(12)을 구비한다. 하우징(12)의 윗면에는 팬(13)의 회전에 의해 외부 공기를 흡입하는 공기 유입구(14)가 제공되고, 하우징(12)의 한 측면에는 공기 유입구(14)로부터 흡입된 공기가 배출되는 공기 유출구(15)가 제공된다.

도 25a 와 25b 는 냉각 유닛(11)의 정면도 및 배면도이다.

도 26 은 도 23 에 도시된 개인용 컴퓨터(1)의  $X_1 - X_2$  선상에서 취한 단면도이다. 도 26 과 관련하여 냉각 유닛(11)의 하우징(12)은 열 파이프와 같은 열 전도체(22)를 통하여, CPU 및 비디오 칩과 같은 디바이스가 장착되는 보드(21)에 연결된다. 상기 냉각 유닛(11)은 공기 유출구(15)가 본체(2)의 공기 유출구(4)에 정렬되는 방식으로 장착된다.

냉각 유닛(11)의 제 1 냉각 작용을 후술한다. 상기 디바이스들로부터 발생된 열은 하우징(12)내의 공기를 뜨겁게 하기 위해 보드(21) 및 열 전도체(22)를 통하여 냉각 유닛(11)의 하우징(12)에 전달된다. 냉각 유닛(11)의 팬(13)이 회전하여 공기 유입구(14)로부터 외부 공기를 흡입하고 이를 공기 유출구(15)를 통하여 배출하므로, 하우징(12) 내에서 더워진 공기는 냉각 유닛(11)의 공기 유출구(15) 및 본체(2)의 공기 유출구(4)를 통하여 외부로 배출된다. 이런 식으로, 열 소스와 같은 디바이스 또는 이들 디바이스가 장착되는 보드(21)는, 보드(21)및 열 전도체(22)를 통해 전달된 열에 의해 더워진 하우징(12)내 공기를 배출함으로써 냉각된다.

냉각 유닛(11)의 제 2 냉각 작용에 대해 후술한다. 디바이스 또는 보드로부터의 열은 또한 공간(F)내의 공기를 뜨겁게 하여 공간(F)내의 공기 온도를 증대시킨다. 공간(F)내의 뜨거워진 공기는 공기 유입구(14)로부터 냉각 유닛(11)에 흡입되고, 냉각 유닛(11)의 팬(13)의 회전에 의해 냉각 유닛(11)으로부터 외부로 공기 유출구(15,4)를 통해 배출된다. 이런 식으로, 공간(F)은 공간(F)내의 뜨거워진 공기를 배출함으로써 냉각된다. 냉각 유닛(11)의 공기 유입구(14)와 본체(2)의 내벽 사이의 갭이 넓어지면, 공간(G)이 제 2 냉각 작용에 따라 유사하게 냉각된다.

### 발명이 이루고자 하는 기술적 과제

전체 본체(2)의 온도 상승은 전술했듯이 본체(2)내의 각 부분을 냉각시키므로써 억제된다.

그러나, 개인용 컴퓨터(1)의 소형화와 더불어 본체(2)는 점점 두께가 얇아지고 있고 보다 정확히 말하면 본체(2)의 높이가 점점 낮아지고 있다. 따라서, 냉각 유닛(11)의 공기 유입구(14)와 본체(2)의 내벽 사이의 갭이 점점 좁아지고 있다. 이에 따르면, 갭 또는 공기 유동 통로의 공기 저항이 높아져서 공기가 갭 내를 원활하게 유동하지 못하게 되고 결과적으로 공기 유입구(14)로부터 냉각 유닛(11)의 공기를 흡입하는 것으로는 본체(2)의 온도 상승을 충분히 억제하기에 불충분하다는 문제를 야기한다.

본체(2)내의 공기가 높은 공기 저항을 갖는 공기 유동 통로를 통하여 공기 유입구(14)로부터 냉각 유닛(11)내로 흡입될수 있도록 하려면, 냉각 유닛(11)의 크기를 크게 할 필요가 있다. 이에 따르면 본체(2)의 크기를 소형화하기가 곤란하다는 문제가 생긴다.

종래의 냉각 유닛(11)에 따르면, 디바이스로부터 발생된 열에 의해 뜨거워지는 공기 유입구(24)와 대향하는 공간(G)내의 공기는 공기 유입구(24)로부터 냉각 유닛(11)내로 덜 흡입되고, 따라서 공간(G)내의 뜨거워진 공기는 외부로 충분히 배출될 수 없다. 따라서, 전체 본체(2)의 온도 상승을 충분히 억제하기 곤란하다는 문제가 떠오른다.

## 발명의 구성

본 발명의 제 1 목적은 냉각 장치의 공기 유입구와 본체의 내벽 사이의 갭이 좁은 소형 타입의 전자 기기의 본체 내의 공기를 쉽게 배출할수 있는 냉각 장치와, 이를 위한 냉각 방법 및, 상기 냉각 장치에 의해 냉각될 본체를 갖는 전자 기기를 제공하는 것이다.

본 발명의 제 2 목적은, 전자 기기의 본체내에서 그 공기 유입구와 대향하는 공간내의 공기를 배출할수 있는 냉각 장치와, 이를 위한 냉각 방법 및, 상기 냉각 장치에 의해 냉각될 본체를 갖는 전자 기기를 제공하는 것이다.

상기 제 1 목적을 달성하기 위하여, 본 발명에 따르면, 가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐 가능한 디스플레이 유닛을 구비한 전자 기기의 본체의 내부를 냉각하기 위한 냉각 장치로서, 상기 디스플레이 유닛의 개폐 각도를 전술하기 위한 전술 수단과, 상기 전술 수단에 의해 전술된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 상기 본체의 내부를 냉각하는 수단을 포함하는 냉각 장치가 제공된다.

상기 제 1 목적을 달성하기 위하여, 본 발명에 따르면, 가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐가능한 디스플레이 유닛을 구비하는 전자 기기의 본체의 내부를 냉각하기 위한 냉각 방법으로서, 상기 디스플레이 유닛의 개폐 각도를 전송하는 단계와, 상기 전송 단계에서 전송된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 본체의 내부를 냉각하는 단계를 포함하는 냉각 방법이 제공된다.

상기 제 1 목적을 달성하기 위하여, 본 발명에 따르면, 가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐 가능한 디스플레이 유닛을 구비한 전자 기기로서, 상기 디스플레이 유닛의 개폐 각도를 전송하기 위한 전송 수단과, 상기 전송 수단에 의해 전송된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 상기 본체의 내부를 냉각하는 수단을 포함하는 전자 기기가 제공된다.

상기 형태의 냉각 장치와 냉각 방법에 의하면, 가동 바닥면부가 상기 디스플레이 유닛의 전송된 개폐 각도에 따라 본체의 내부 공간을 확장하도록 구동되므로, 본체의 내부를 충분히 냉각할 수 있다.

상기 형태의 전자 기기에 의하면, 가동 바닥면부가 디스플레이 유닛의 전송된 개폐 각도에 따라 본체의 내부 공간을 확장하도록 구동되어 본체의 내부를 냉각하므로, 본체의 내부 공간을 효율적으로 이용할 수 있다.

상기 제 2 목적을 달성하기 위하여, 본 발명에 따르면, 제 1 가스를 흡입하기 위한 수단과, 상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하기 위한 배출 수단 및, 상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의해 제 2 가스를 흡입 및 배출하기 위한 수단을 포함하는 냉각 장치가 제공된다.

상기 제 2 목적을 달성하기 위하여, 본 발명에 따르면, 제 1 가스를 흡입하는 단계와, 상기 흡입 단계에서 흡입된 제 1 가스를 배출하는 단계와, 상기 배출 단계에서 배출된 제 1 가스의 작용에 의해 제 2 가스를 흡입 및 배출하는 단계를 포함하는 냉각 방법이 제공된다.

상기 제 2 목적을 달성하기 위하여, 본 발명에 따르면, 제 1 가스를 흡입하는 수단과, 상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하는 수단 및, 상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의해서 제 2 가스를 흡입 및 배출하기 위한 수단을 포함하는 전자 기기가 제공된다.

상기 형태의 냉각 장치 및 냉각 방법에 의하면, 제 1 가스가 흡입 및 배출되고 제 2 가스가 배출된 제 1 가스의 작용에 의해서 흡입되므로, 냉각 장치 주위의 전체 공간을 냉각시킬 수 있다.

상기 형태의 전자 기기에 의하면, 제 1 가스가 흡입 수단에 의해서 흡입되어 배출 수단에 의해서 배출되고 제 2 가스가 상기 배출된 제 1 가스의 작용을 이용하는 흡입 및 배출 수단에 의해서 흡입되므로, 전자 기기의 전체 내부를 냉각시킬 수 있다.

본 발명의 실시예를 기술하기 이전에, 실시예에 나타나는 부분들과 청구범위에 기술된 발명의 수단 사이의 대응을 명료히 하기 위하여, 수단 위에 괄호로 표시된 수단에 대응하는 부분으로 본 발명의 특징을 기술하기로 한다. 그러나, 이렇게 괄호로 표기한 부분의 기재는 단지 예시적인 것이며, 본 발명의 수단이 괄호로 표기한 부분에 제한되지는 않는 것이다.

청구항 1 에 기재된 냉각 장치는 디스플레이 유닛의 개폐 각도를 전송하기 위한 전송 수단(예를 들어, 도 9 에 도시된 램(62))과, 상기 전송 수단에 의해 전송된 디스플레이 유닛의 개폐 각도에 따라 본체의 내부 공간이 확장되도록 가동 바닥면부(예를 들어 도 3a 에 도시된 개방가능한 바닥면부(32))를 구동하여 본체의 내부를 냉각하기 위한 수단(예를 들어 도 9 에 도시된 힌지(63))를 포함한다.

청구항 3 에 기재된 전자 기기는 디스플레이 유닛의 개폐 각도를 전송하기 위한 수단(예를 들어 도 9 에 도시된 램(62))과, 상기 전송 수단에 의해 전송된 디스플레이 유닛의 개폐 각도에 따라 본체의 내부 공간이 확장되도록 가동 바닥면부(예를 들어 도 3a 에 도시된 개방가능한 바닥면부(32))를 구동하여 본체의 내부를 냉각하기 위한 수단(예를 들어 도 9 에 도시된 힌지(63))를 구비한다.

청구항 4 에 기재된 냉각 장치는 제 1 가스를 흡입하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유입구(24))와, 상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유출구(25)) 및, 상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의해서 제 2 가스를 흡입 및 배출하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유입구(43))를 구비한다.

청구항 6 에 기재된 전자 기기는 제 1 가스를 흡입하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유입구(24))와, 상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유출구(25)) 및, 상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의해서 제 2 가스를 흡입 및 배출하기 위한 수단(예를 들어 도 17a 와 도 17b 에 도시된 공기 유입구(43))를 구비한다.

#### 제 1 실시예

도 1a 내지 1c 는 본 발명이 적용되는 개인용 컴퓨터(30)의 외관을 위에서 비스듬히 연장되는 방향을 따라 바라보아서 도시한 사시도로서, 도 1a 는 개인용 컴퓨터(30)로부터 디스플레이 유닛(3)이 제거된 상태를, 도 1b 는 디스플레이 유닛(3)이 본체(2) 상으로 폐쇄된 상태를, 도 1c 는 디스플레이 유닛(3)이 본체(2)상으로 폐쇄된 상태를 각각 도시하고 있다. 이들 도면에서, 도 23 에 대응하는 부분들은 동일한 문자로 표시되고 중복되는 설명은 생략한다.

도 1a 내지 1c 에 있어서, 본체(2)의 바닥면부는 고정 바닥면부(31) 및, 디스플레이 유닛(3)의 개폐에 따라 개폐되는 개방가능한 바닥면부(32)로 나뉘어진다. 디스플레이 유닛(3)이 본체(2) 상으로 폐쇄된 상태에서 개방가능한 바닥면부(32)는 폐쇄된다.

도 2a 는 도 1b 의  $Y_1 - Y_2$  선상에서 취한 단면도이다. 도 24 에 도시된 것과 동일한 냉각 유닛(11)이 도

2a 에 도시된 바와 같이 본체(2)내에 장착된다. 냉각 유닛(11)의 장착 상태는 또한 도 2b 에도 도시되어 있다. 보다 자세히 말하면, 냉각 유닛(11)은 공기 유출구(15)가 본체(2)의 공기 유출구(4)와 정렬되고 공기 유출구(14)가 개방가능한 바닥면부(32)에 하향 정렬되도록 장착된다. 도면부호 33 은 공기는 통과할 수 있지만 외부 찌꺼기는 통과할 수 없는 망(net)을 지칭한다.

도 3a 는 디스플레이(3)가 본체(2)로부터 개방되고 개방가능한 바닥면부(32)가 개방되어 있는 상태에서의 개인용 컴퓨터(30)의 외관을 도시하는 사시도이며, 도 3b 내지 3d 는 개방가능한 바닥면부의 작용을 도시하는 도면이다. 도 3a에서, 본체(2)의 윗면에는 마우스 커서를 이동시키도록 작동되는 트랙 패드(35)와 문자 및 기호를 입력하기 위한 키보드(14)가 제공된다.

도 4 에 도시되어 있듯이, 개인용 컴퓨터(30)는 개방가능한 바닥면부(32)가 개방된 상태에서 사용자의 무릎에 놓인다.

도 5a 는 도 3a 의  $P_2 - P_1$  선상에서 취한 단면도이다. 도 5a 에 있어서, 작동가능한 바닥면부(32)가 개방되었을 때는, 냉각 유닛(11)의 공기 유입구(14)와 개방가능한 바닥면부(32) 사이에 넓은 공간(P)이 형성된다. 개방가능한 바닥면부(32)의 개폐 기구는 후술될 것이다.

도 5a 에 도시된 상태에서의 본체(2)의 내부를 냉각하는 작용은 도 5b 및 도 5c를 참조하여 설명될 것이다. 전술했듯이, 디스플레이(3)가 개방되었을 때, 개방가능한 바닥면부(32)는 공기 저항이 적은 공기 통로로서의 넓은 공간(P)을 얻기 위하여 공기 유입구(14)의 본체(2) 측부 상에서 개방가능한 바닥면부(32)가 개방된다. 그 결과, 공기는 공기 유입구(14)로부터 냉각 유닛(11)내에 충분히 흡입될 수 있으며, 또한, 디바이스 등에서 발생된 열은 공간(P) 내에서 자연스럽게 방출될 수 있다.

이런 식으로, 전체 본체(2)의 온도 상승은 바닥면, 즉 본체(2)의 개방가능한 바닥면부(32)의 개방부에 의해 충분히 억제될 수 있다.

개방가능한 바닥면부(32)는 다른 장점을 갖는데, 말하자면 개방가능한 바닥면부(32)가 개방되므로써 냉각 유닛(11)의 공기 유입구(14)와 본체(2) 사이의 공간, 예를 들어 도 2a 에 도시된 높이(H)를 갖는 공간을 확보할 필요가 없어지고, 그로 인해 본체(2)내의 공간이 효과적으로 이용될 수 있다.

개방가능한 바닥면부(32)의 또 다른 장점은 사용자가 개인용 컴퓨터(30)를 조작할 때 개방가능한 바닥면부의 일부만이 사용자의 무릎과 접촉되어, 즉 본체(2)의 전체 바닥면부가 사용자의 무릎과 접촉되지 않게 되어서, 본체의 온도 상승으로 인한 사용자의 불편함이 감소될 수 있다는 것이다. 또한, 사용자가 개인용 컴퓨터(30)를 조작할 때 개방가능한 바닥면부(32)가 개방되므로, 본체(2)가 전방으로 경사지고 따라서 키보드(34)의 작동성이 향상된다.

개방가능한 바닥면부(32)를 개방하는 메카니즘에 대해서는 후술한다. 도 6 은 디스플레이 유닛(3)이 본체(2) 상으로 폐쇄되는 상태를 도시하는 우측면도이고, 도 7 은 도 6 에 도시된 범위(A)의 확대 도시도이다. 도 7 에서는 디스플레이 유닛(3)의 개폐에 따라 회전 샤프트(61)에 랙(62)이 장착된다. 돌출부(63A)가 형성되는 힌지(63)의 일단부는 단부 회전 샤프트(64)에 연결되고, 힌지(63)의 다른 단부는 개방가능한 바닥면부(32)에 연결된다. 돌출부(65A)가 형성되는 레버(65)의 일단부는 단부 회전 샤프트(64)에 연결되고, 키이부(65B) 형상을 하는 레버(65)의 다른 단부는 로크부(66)에 의해 래칭된다. 본체(2) 상에는 망(33)의 윗면에 배치된 상태에서 릴리스 버튼(67)이 포함된다.

상기 디스플레이 유닛(3)이 도 8 에 도시된 범위 A 의 확대도인 도 9 에 도시되어 있듯이 도 6 에 도시된 상태에서부터 도 8 에 도시된 상태로 대략  $15^\circ$  개방되면 랙(62)은 화살표 A 로 도시된 방향으로 회전된다. 이 때, 레버(65)의 돌출부(65A)는 화살표 B 방향으로 구동되고 키이부(65B)는 분리되어 로크부(66)로부터 언래칭되며, 동시에 힌지(63)의 돌출부(63A)는 화살표 C 방향으로 구동되고 따라서 힌지 샤프트(63B)는 화살표 D 방향으로 이동된다.

디스플레이 유닛(3)이 도 10 에 도시된 범위 A 의 확대 도시도인 도 11 에 도시되어 있듯이, 도 6 에 도시된 상태에서부터 도 10 에 도시된 상태로 대략  $90^\circ$  개방되면, 힌지(63)는 수직 방향으로 완전히 연장된다. 이때, 본체(2)에 포함된 릴리스 버튼(67)은 힌지 샤프트(63B)에 의해 본체(2) 밖으로 밀려나간다.

개방가능한 바닥면부(32)가 힌지(63)가 일단 완전히 연장된 상태로 되고 나면, 힌지(63)의 돌출부(63A)는 어떤 방향으로도 구동되지 않는다. 예를 들어, 디스플레이 유닛(3)이  $90^\circ$  이상의 각도로 개방될 때에도 개방가능한 바닥면부(32)가 도 10 및 도 11 에 도시된 바와 같이 개방된 상태는 유지된다. 또한, 디스플레이 유닛(3)이 힌지(63)가 완전히 연장된 상태에서 도 12 에 도시된 상태로 폐쇄될 때에도, 개방가능한 바닥면부(32)는 도 10 및 도 11 과 관련하여 기술된 위의 경우와 마찬가지로 개방 상태를 유지한다.

개방가능한 바닥면부(32)의 폐쇄 메카니즘을 후술한다. 디스플레이 유닛(3)이 도 12 에 도시되듯이 폐쇄되는 상태에서 사용자에 의해 릴리스된 버튼(67)이 내측으로 눌리면, 도 13 에 도시되어 있듯이 힌지 샤프트(63)는 화살표 E 방향으로 이동되고 그로 인해 개방가능한 바닥면부(32)는 상향으로 이동된다. 그 결과, 도 14 에 도시되어 있듯이, 개방가능한 바닥면부(32)가 폐쇄 상태로 복귀된다. 이 때, 레버(65)의 키이부(65B)는 로크부(66)에 의해 래칭된다.

이러한 메카니즘에 의하면, 디스플레이 유닛(3)이 일단  $90^\circ$  이상의 각도로 개방되고 개방가능한 바닥면부(32)가 도 10 에 도시되듯이 완전히 개방되면, 디스플레이 유닛(3)의 개폐 각도가 변화하더라도 개방가능한 바닥면부(32)의 개방된 상태는 변하지 않는다. 그 결과, 디스플레이 유닛(2)의 개폐 각도가 변화하더라도, 도 5a 에 도시된 공간(P)이 확보될 수 있고, 그로 인해 전체 본체(2)의 온도 상승을 충분히 억제할 수 있다.

다음으로, 냉각 기구를 갖는 도킹 스테이션을 사용할 경우에 대해 도 15를 참조로 하여 설명하기로 한다. 도 15 에 도시된 도킹 스테이션(81)은 팬(82), 공기 유입구(83), 공기 유출구(84)를 구비한다. 공기 유입구(83)로부터 도킹 스테이션(81)내에 흡입된 외부 공기는 팬(82)의 회전에 의해 공기 유출구(84)를 통해 개방가능한 바닥면부(32)의 개방부로 이송된다. 이러한 메카니즘에 의하면, 다량의 공기가 공기 유입구

(14)로부터 냉각 유닛(11)에 흡입된다.

도 16a 및 도 16b 에 도시된 본체(2)는 냉각 유닛(11) 대신에 열전도체 (22) 상에 장착된 열 전도체(91)를 구비한다. 도 16a 및 도 16b 에 도시된 도킹 스테이션(101)은 열 싱크(102)와 공기 유출구(103)를 구비한다. 디바이스로부터 발생된 열은 보드(21) 및 열 전도체(22)를 통하여 도킹 스테이션(101)의 열 싱크(102)로 전달된다. 이렇게 열 싱크(102)로 전달된 열은 도킹 스테이션(101) 내의공기를 통해 공기 유출구(103)로부터 배출된다.

이런 식으로, 도킹 스테이션(81 또는 101)을 본 발명이 적용되는 개인용 컴퓨터(30)와 조합함으로써, 본체(2)의 내부를 보다 효과적으로 냉각하고 전체 본체(2)의 온도 상승을 억제할수 있다.

## 제 2 실시예

도 17a 와 도 17b 는 본 발명이 적용되는 냉각 유닛(41)의 외관을 도시하는 도면이다. 도 24 에 도시된 것과 동일한 부분들은 동일한 도면부호로 지칭되고 중복되는 설명은 생략된다. 이 실시예에서는, 냉각 유닛(41)의 저면도인 도 17b 에 도시되듯이, 하우징(42)의 바닥면부에 있어서 공기 유출구(25) 측부상의 위치에 공기 유입구(43)가 제공된다.

도 18 은 개인용 컴퓨터(30)의 본체(2)에 장착된 냉각 유닛(41)의 단면도이다. 냉각 유닛(41)의 냉각 작용은 도 18을 참조하여 설명될 것이다.

냉각 유닛(41)에 있어서, 보드(31)와 공간(F)은 종래의 냉각 유닛(11)과 동일한 제 1 및 제 2 냉각 작용에 따라 냉각되며 그 중복되는 설명은 생략된다.

다음으로, 공간(G)에 대한 제 3 냉각 작용을 설명한다. 냉각 유닛(41)의 판(22)이 회전되면, 냉각 유닛(41)의 공기 유입구(24) 위 공간(공간 F 를 포함)으로부터의 공기는 우선 공기 유입구(24)를 통하여 냉각 유닛(41)내로 흡입되고, 도 18에서 화살표 A 로 도시되듯이 본체(2)의 공기 유출구(4)와 냉각 유닛(41)의 공기 유출구(25)를 통하여 배출된다.

유동 A 가 발생되면, 통상 공기 유입구(43) 부근에서의 하우징(42)내 압력은 통상 보드(31) 아래의 공간(공간 G를 포함)내의 공기가 공기 유입구(43)로부터 냉각 유닛(41)내로 흡입되도록 베르누이 정리에 기초하여 강압된다. 이렇게 흡입된 공기는 도 18 에 도시된 유동 B 에 의해 도시된 바와같이, 공기 유출구(25)를 통하여 배출된다. 이런 식으로, 공간(G)이 냉각된다.

냉각 유닛(41)에서는, 제 1 및 제 2 냉각 작용에 더하여 제 3 냉각 작용에 의하여, 본체(2)의 내부가 냉각되고 이에 따라 전체 본체(2)의 온도 상승이 충분히 억제된다.

상기 실시예에서, 본 발명은 단지 공기 유출구(4)만 제공되고 일체의 공기 유입구는 제공되지 않은 개인용 컴퓨터(1)에 대해 적용되었으나, 본 발명은 또한 공기 유입구(51)가 본체(52)에 제공되어 있는 도 19 에 도시된 개인용 컴퓨터(53)에도 적용될 수 있다.

도 20 은 개인용 컴퓨터(53)의 본체(52)내에 장착된 냉각 유닛(41)의 단면도이다. 이 경우, 유동 A 및 유동 B 에 더하여, 공기 유입구(51)를 통해 본체(52)에 흡입된 공기가 냉각 유닛(41)의 공기 유입구(24) 및 공기 유출구(25)와 본체(52)의 공기 유출구(4)를 통하여 배출된다.

도 21 에 도시되어 있듯이, 평평 판이 장착되는 하우징(42)을 구비한 냉각 유닛(41)이 개인용 컴퓨터(1 또는 53)에 장착될 수도 있다.

전술한 내용에서는 공기 유입구(43)가 냉각 유닛(41)의 하우징(42)의 바닥면에 제공되어 있으나, 본 발명은 이에 한정되지 않으며 도 22 에 도시되어 있듯이 공기 유입구(43)는 하우징(42)의 측면에 장착될 수도 있다.

상기 실시예에서, 냉각 유닛(41)은 열 전도체(32)에 장착되어 있지만, 디바이스상에 직접 장착될 수도 있다. 또한, 공기 유출구(4)는 본체(2 또는 52)의 뒷면에만 아니라 본체(2 또는 52)의 우측면이나 좌측면에 도 장착될수 있다.

## 발명의 효과

본 발명의 양호한 실시예들을 특정 용어를 사용하여 기술하였으나, 이러한 기재 내용은 단지 예시적일 뿐이며 청구범위의 취지 및 범주를 벗어나지 않는 범위내에서의 다양한 수정 및 변경이 가능할수 있음에 유의해야 한다.

## (57) 청구의 범위

### 청구항 1

가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐 가능한 디스플레이 유닛을 구비한 전자 기기의 본체의 내부를 냉각하기 위한 냉각 장치로서,

상기 디스플레이 유닛의 개폐 각도를 전송하기 위한 전송 수단과,

상기 전송 수단에 의해 전송된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 상기 본체의 내부를 냉각하는 수단을 포함하는 냉각 장치.

### 청구항 2

가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐가능한 디스플레이 유닛을 구비하는 전자 기기의 본

체의 내부를 냉각하기 위한 냉각 방법으로서,

상기 디스플레이 유닛의 개폐 각도를 전송하는 단계와,

상기 전송 단계에서 전송된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 본체의 내부를 냉각하는 단계를 포함하는 냉각 방법.

#### 청구항 3

가동 바닥면부를 갖는 본체와 이 본체에 대하여 개폐 가능한 디스플레이 유닛을 구비한 전자 기기로서,

상기 디스플레이 유닛의 개폐 각도를 전송하기 위한 전송 수단과,

상기 전송 수단에 의해 전송된 디스플레이 유닛의 개폐 각도에 따라 상기 본체의 내부 공간이 확장되도록 상기 가동 바닥면부를 구동하여 상기 본체의 내부를 냉각하는 수단을 포함하는 전자 기기.

#### 청구항 4

냉각 장치로서,

제 1 가스를 흡입하기 위한 수단과,

상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하기 위한 배출 수단 및,

상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의해 제 2 가스를 흡입 및 배출하기 위한 수단을 포함하는 냉각 장치.

#### 청구항 5

냉각 방법으로서,

제 1 가스를 흡입하는 단계와,

상기 흡입 단계에서 흡입된 제 1 가스를 배출하는 단계와,

상기 배출 단계에서 배출된 제 1 가스의 작용에 의해 제 2 가스를 흡입 및 배출하는 단계를 포함하는 냉각 방법.

#### 청구항 6

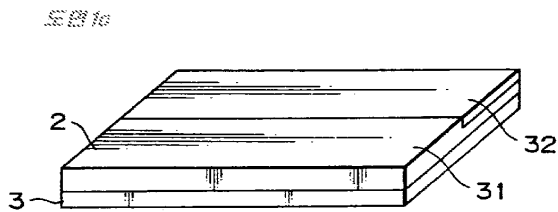
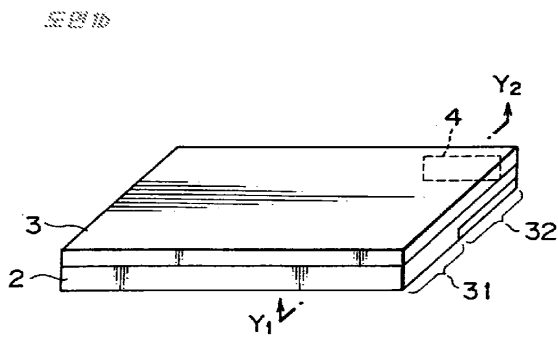
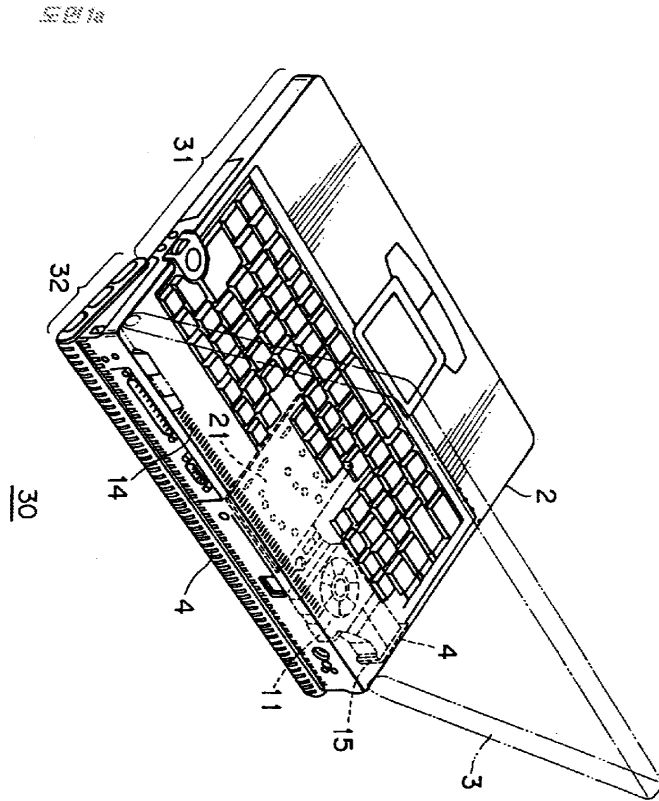
전자 기기로서,

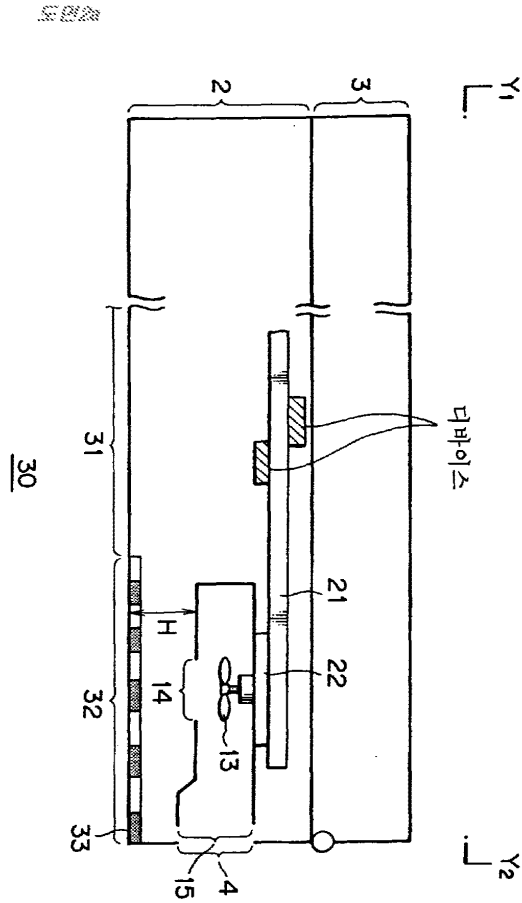
제 1 가스를 흡입하는 수단과,

상기 흡입 수단에 의해 흡입된 제 1 가스를 배출하는 수단 및,

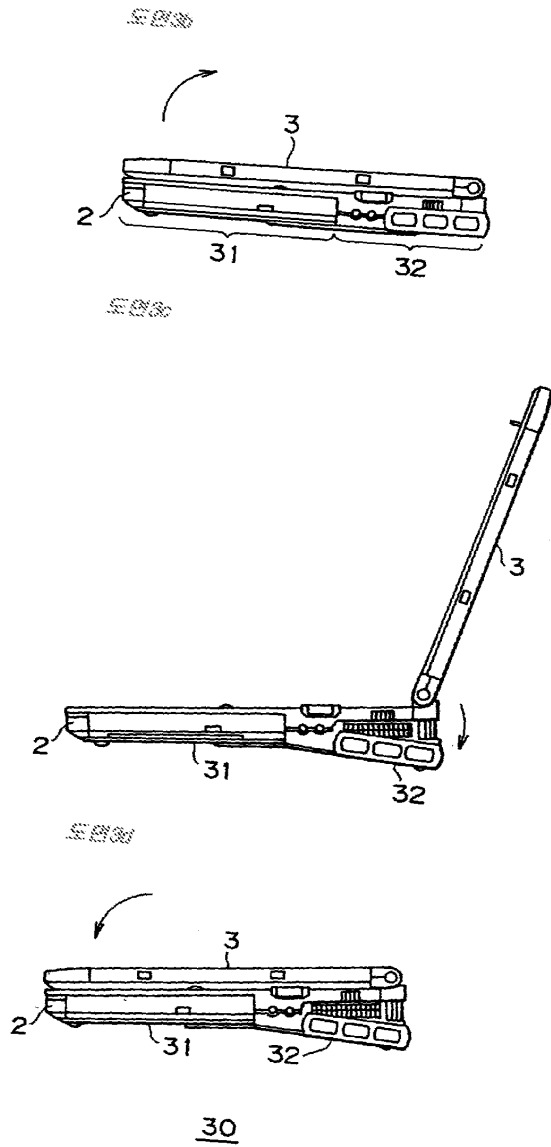
상기 배출 수단에 의해 배출된 제 1 가스의 작용에 의하여 제 2 가스를 흡입 및 배출하기 위한 수단을 포함하는 전자 기기.

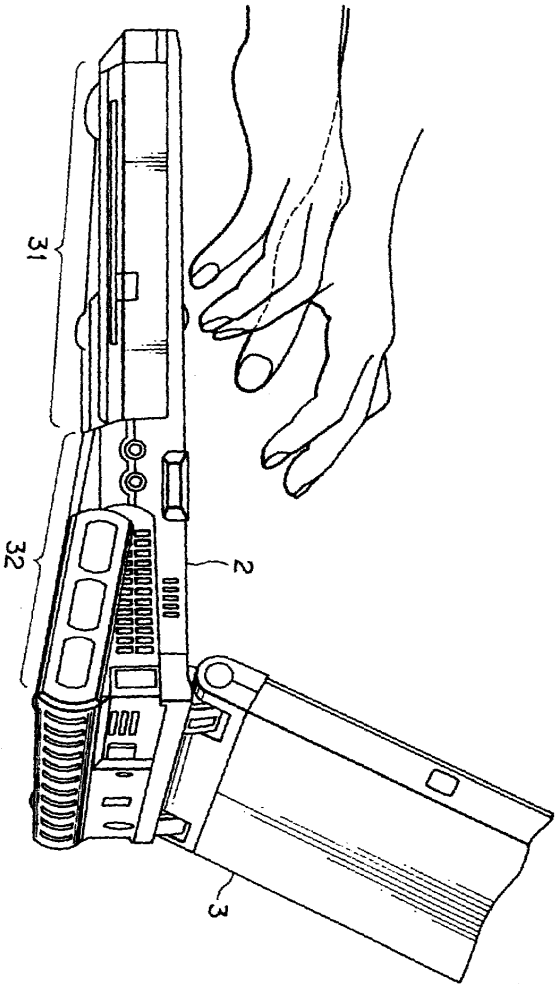
도면



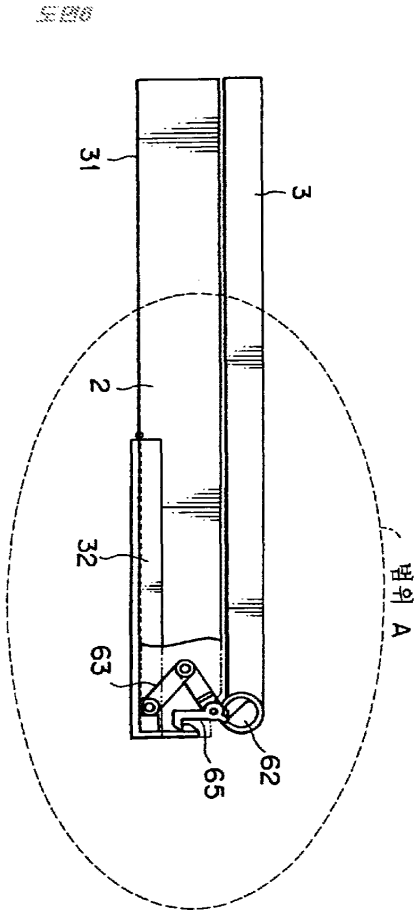
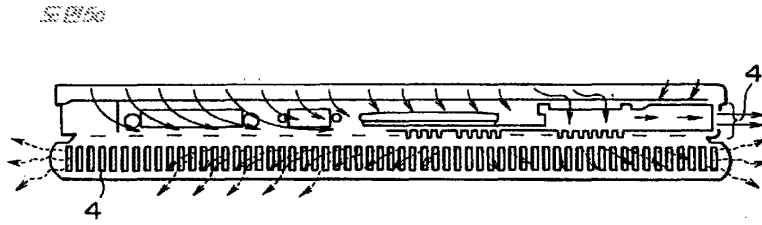


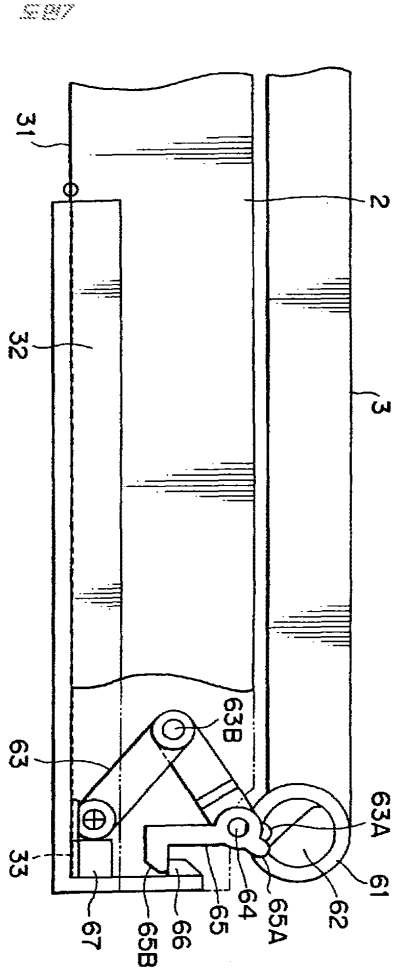


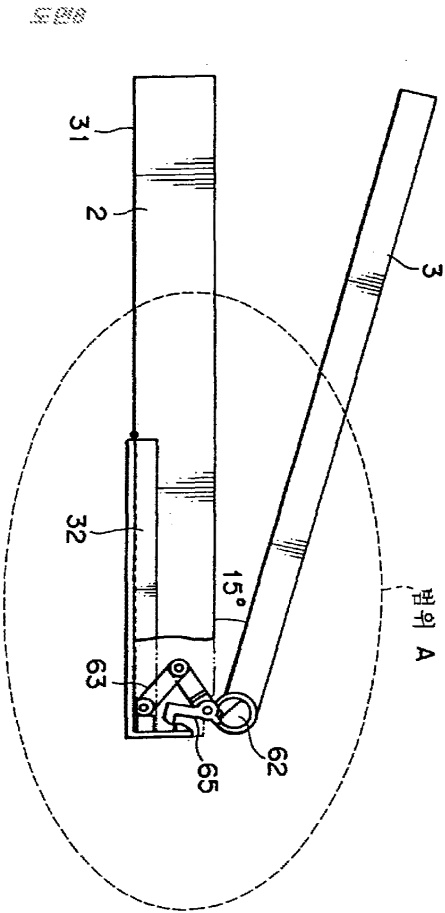


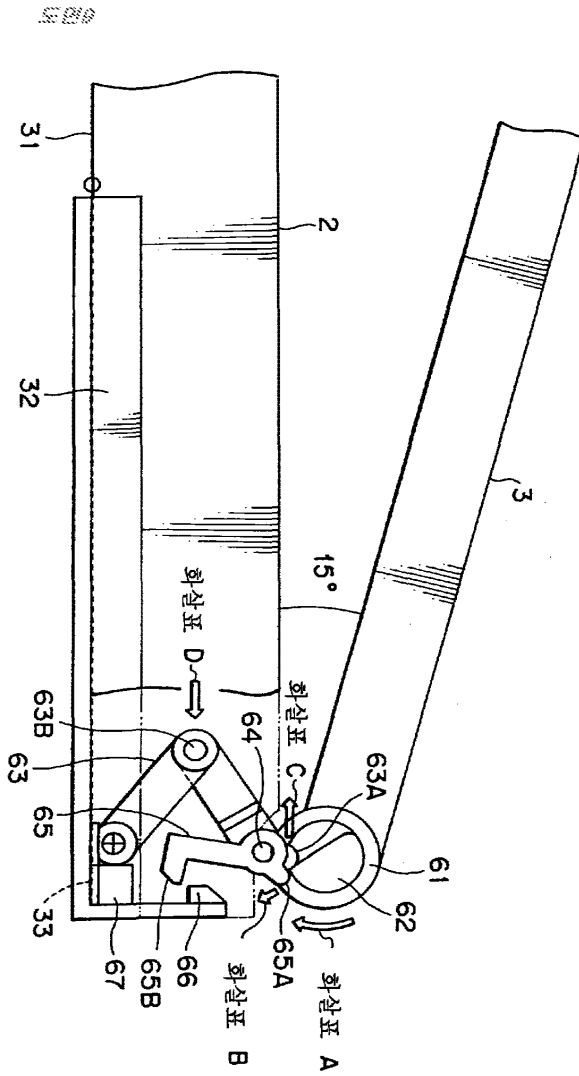


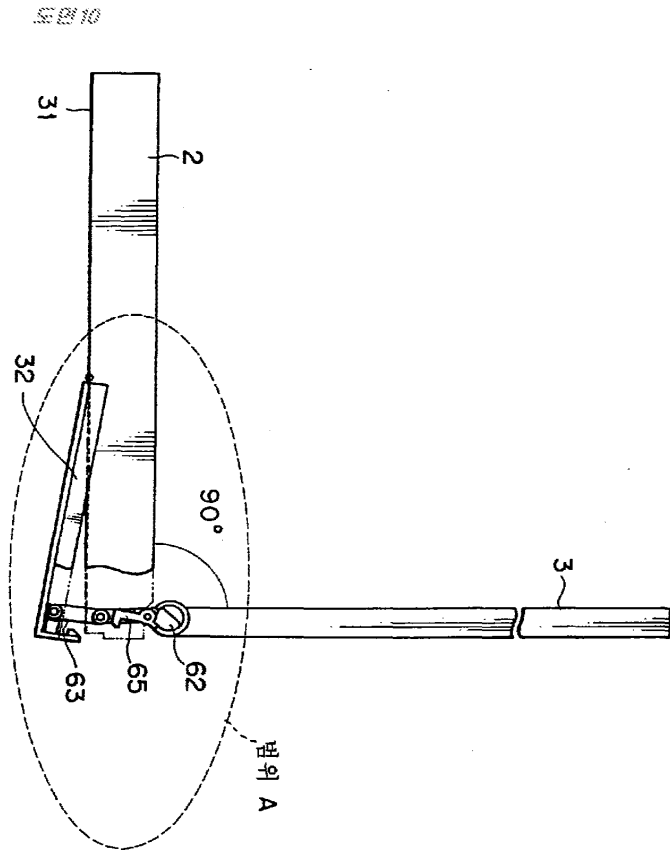


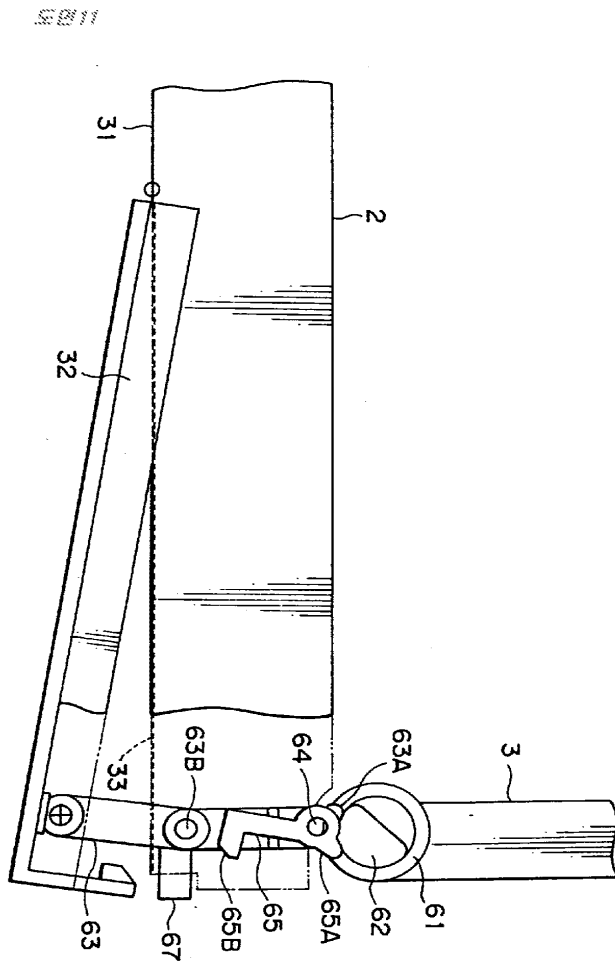


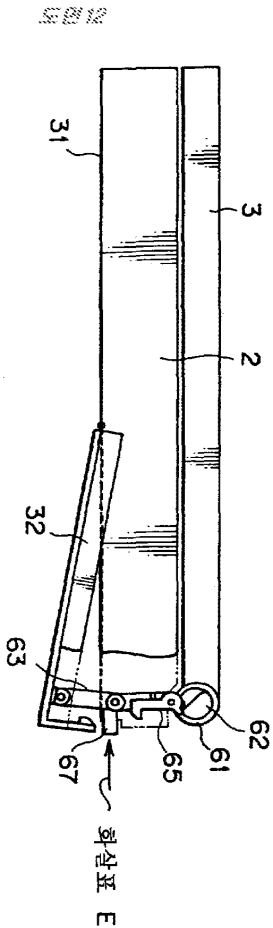


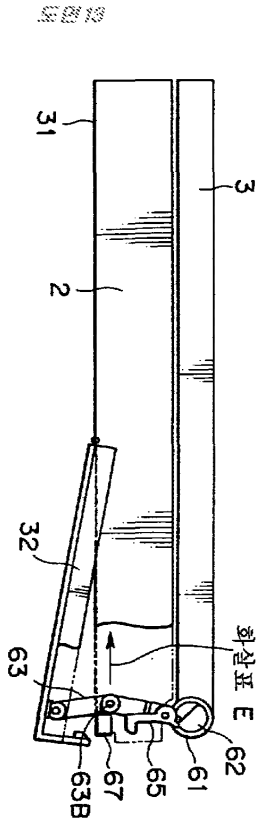


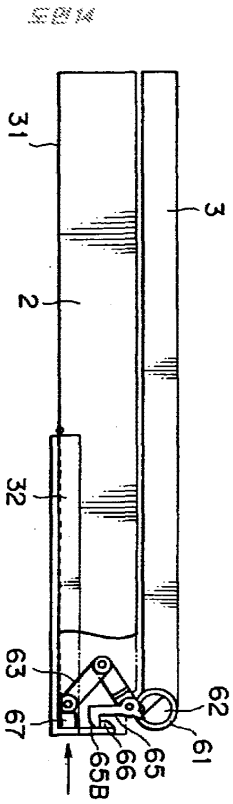


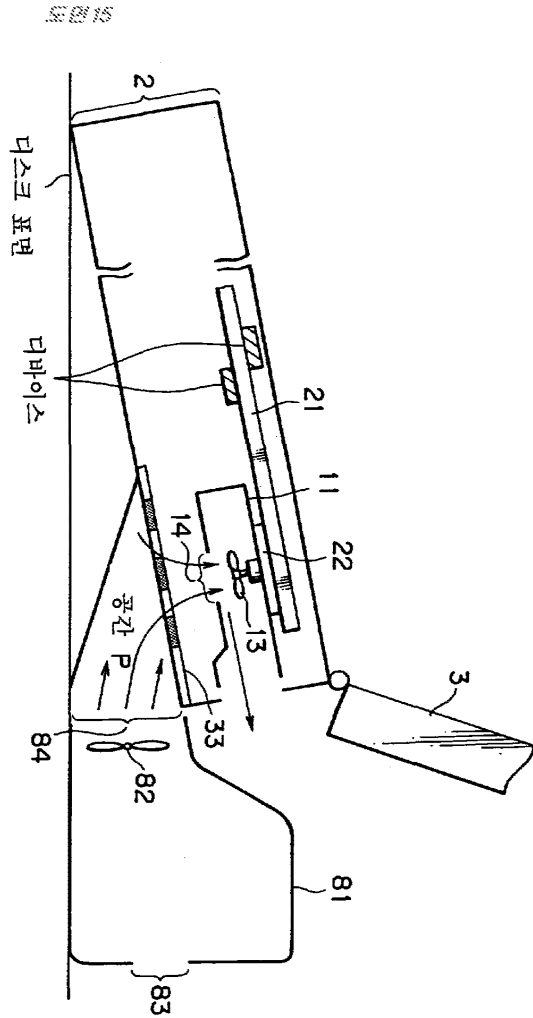


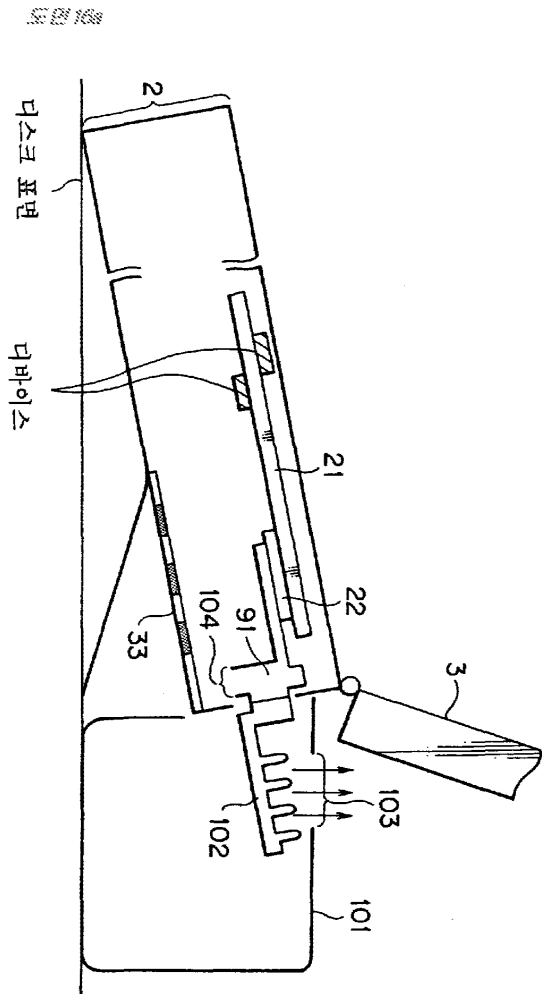


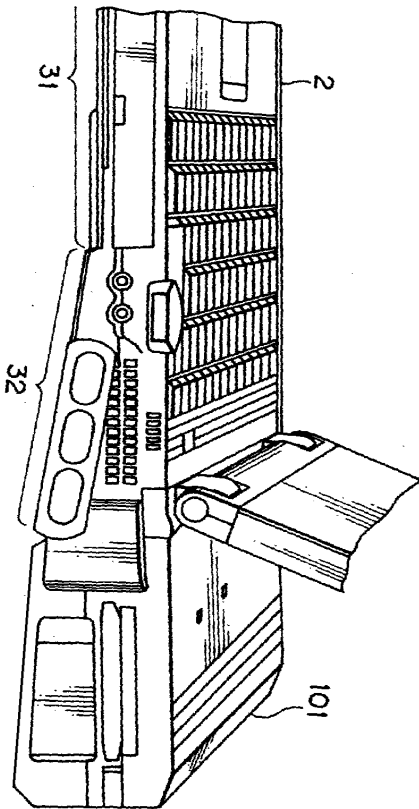


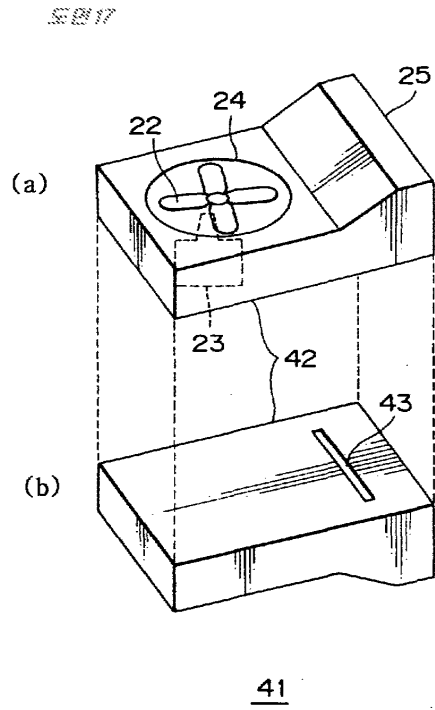


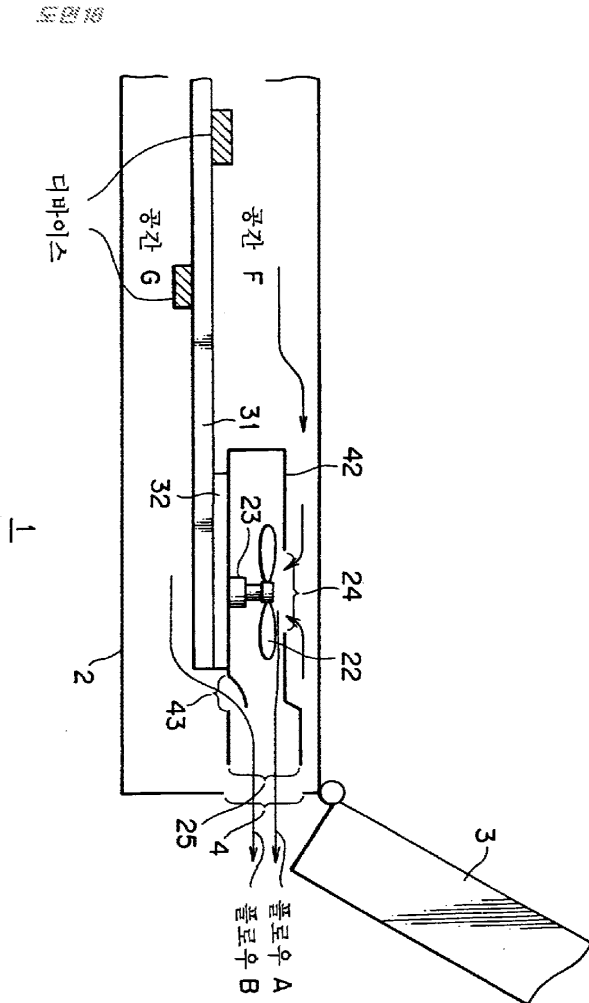


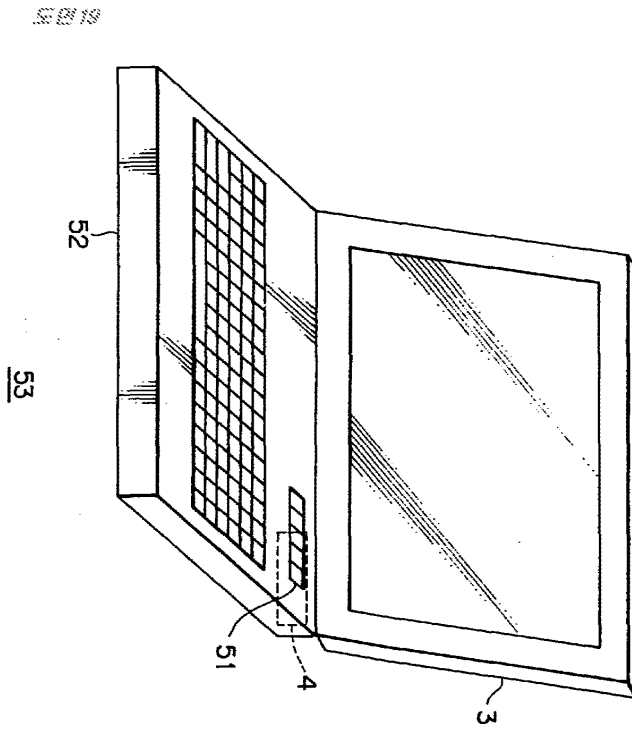


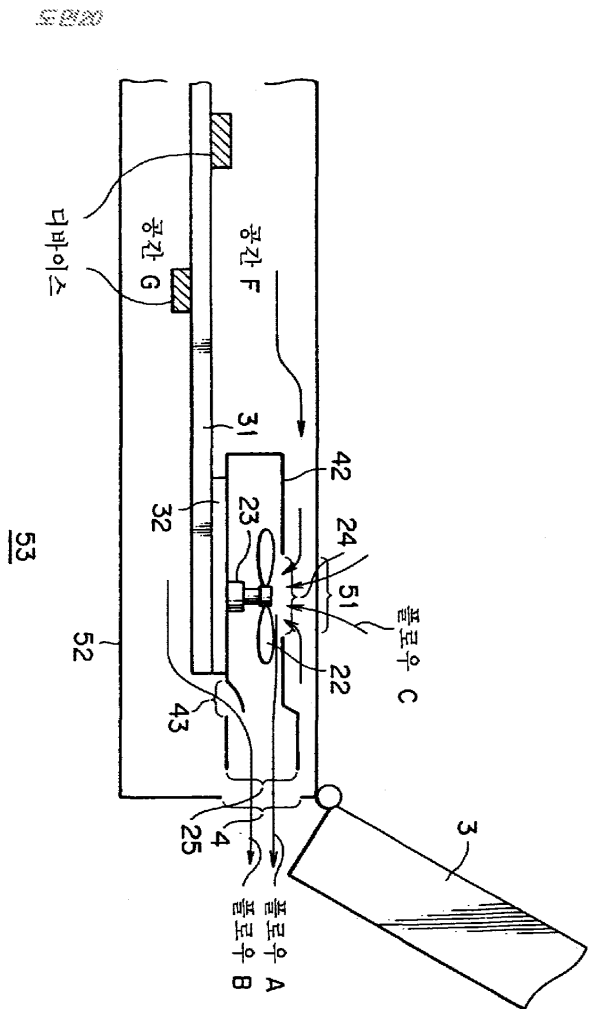




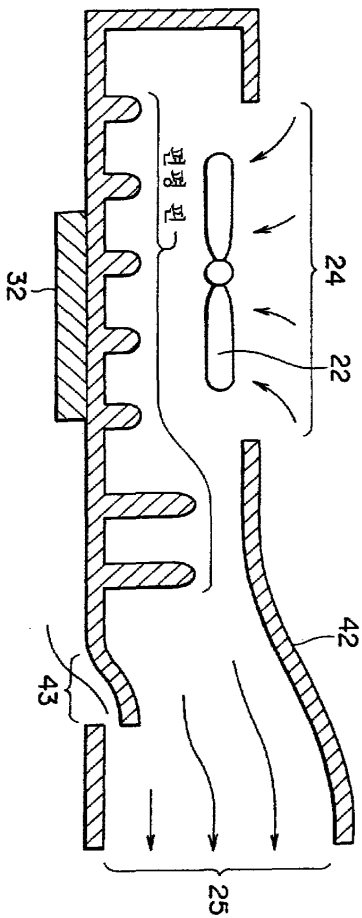




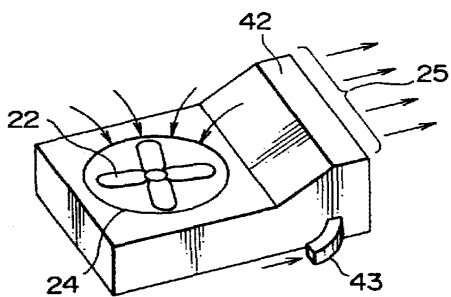


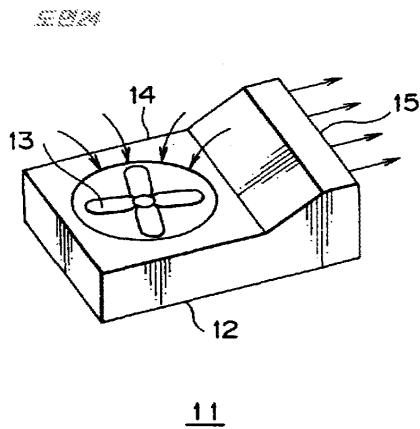
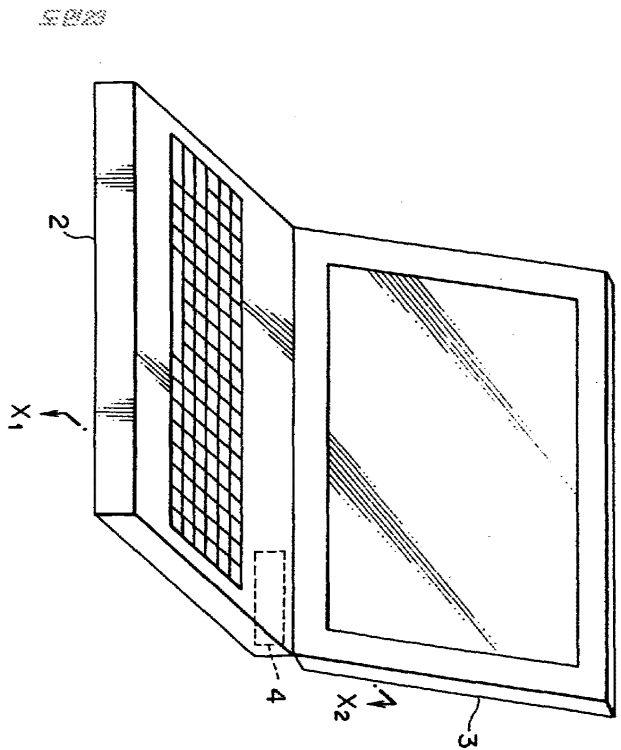


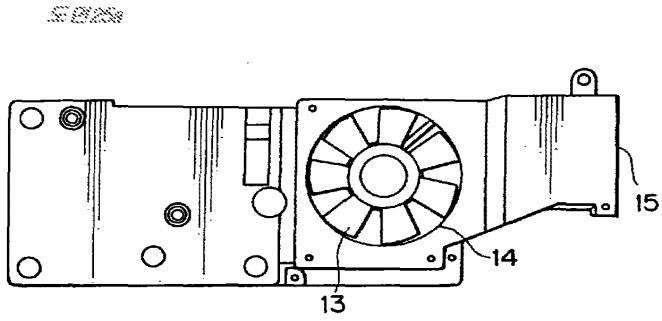
도 22



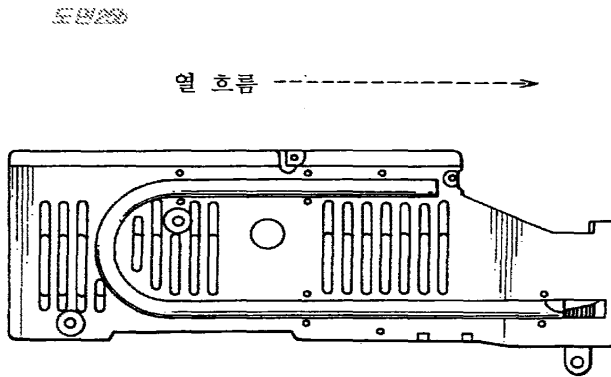
도 23





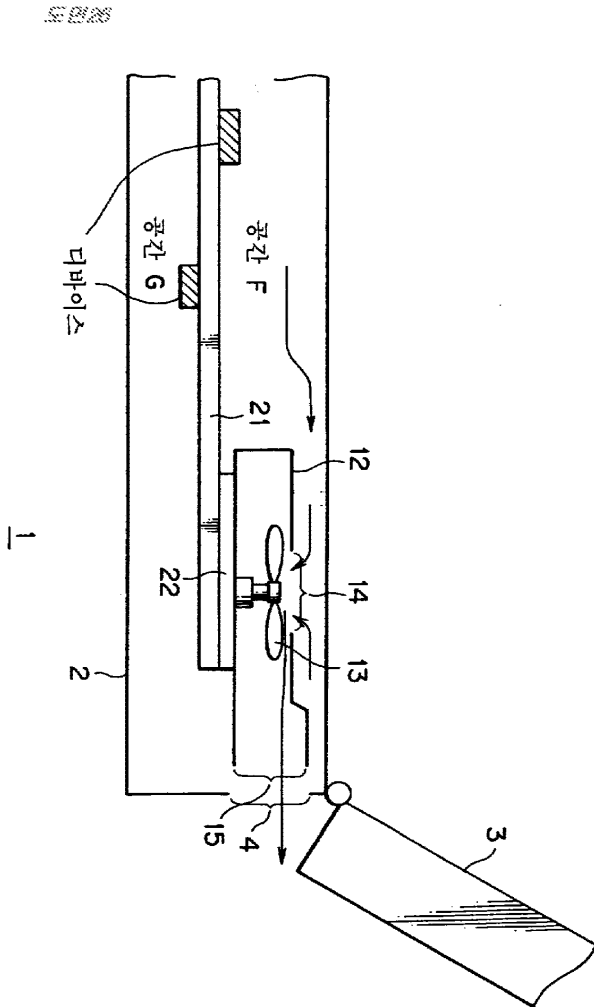


11 (정면)



열 흐름 →

11 (배면)





Espacenet

## Bibliographic data: KR20040067701 (A) — 2004-07-30

### HYBRID COOLING DEVICE

**Inventor(s):** PARK JI HWANG ± (PARK, JI HWANG)

**Applicant(s):** ICURIE LAB HOLDINGS LTD ± (ICURIE LAB HOLDINGS LIMITED)

**Classification:** - international: F28D15/02; F28D15/04; F28D20/02; H01L23/427; (IPC1-7): F28D20/02  
 - cooperative: F28D15/0233; F28D15/0266; F28D15/046; H01L23/427; F28F2210/02; F28F2245/02; H01L2924/0002 more

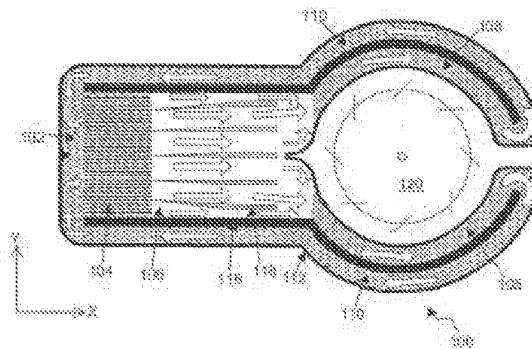
**Application number:** KR20030004932 20030124 Global Dossier

**Priority number(s):** KR20030004932 20030124

**Also published as:** AU2003273116 (A1) CN100419355 (C) CN1759284 (A) EP1595099 (A1) EP1595099 (A4) JP2006513577 (A) KR100505554 (B1) RU2005126722 (A) US2006266499 (A1) US7249627 (B2) WO2004065866 (A1) less

### Abstract of KR20040067701 (A)

**PURPOSE:** A hybrid cooling device is provided to perform cooling operations by latent heat in a phase change and by ventilation and convection and to improve cooling efficiency by minimizing the loss of conduction heat transfer through fins by installing the cooling device between the fins. **CONSTITUTION:** A hybrid cooling device(100) for cooling heat from an external heat source is composed of a phase change cooler(112) having a phase-changeable circulating loop of refrigerants formed therein and a branch portion formed at the side of the loop and a fan(120) installed to the branch portion of the phase change cooler. The phase change cooler comprises an evaporating unit(104) formed at one end and filled with liquid refrigerant in at least a portion by a capillary phenomenon to vaporize the liquid refrigerant by heat transmitted from an external heat source; a vaporized refrigerant moving unit(106) adjacent to the evaporating unit and



flowing the vaporized refrigerant toward the branch portion; a condensing unit(108) adjacent to the vaporizing refrigerant moving unit as at least a region of the branch portion and branched off into at least two parts to condense the vaporizing refrigerant into liquid; a liquid refrigerant moving unit(102) adjacent to the condensing unit as at least a region of the branch portion, insulating heat from the evaporating unit, and flowing the refrigerant condensed into liquid toward the evaporating unit; and a heat insulating unit for heat-insulating at least a portion of the liquid refrigerant moving unit and the evaporating unit.

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(71) 출원인 (주)아이큐리랩  
서울특별시 송파구 석촌동 23-1, 3층

(72) 발명자 박지황  
서울특별시 영등포구 양평동 3가 79-4 현대2차아파트 201-1305

(74) 대리인 오병석

심사청구 : 있음

(54) 하이브리드형 냉각 장치

요약

본 발명에 의하면, 상변화에 의한 냉각과 송풍 및 대류에 의한 냉각이 모두 가능한 하이브리드형 냉각 장치가 제공된다.

대표도

도 2

색인어

상변화, 송풍, 냉각

명세서

도면의 간단한 설명

도 1은 통상적인 히트 파이프형 냉각 장치의 일예를 개략적으로 도시한 도면.

도 2는 본 발명의 제1 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 3은 도 2의 하이브리드형 냉각 장치의 분해 사시도.

도 4a는 본 발명의 제2 실시예에 의한 하이브리드형 냉각 장치의 사시도.

도 4b는 도 4a의 하이브리드형 냉각 장치의 응축부 부분의 확대 사시도.

도 5a는 본 발명의 제3 실시예에 의한 하이브리드형 냉각 장치의 사시도.

도 5b는 도 5a의 하이브리드형 냉각 장치의 측면도.

도 6a는 본 발명의 제4 실시예에 의한 하이브리드형 냉각 장치의 사시도.

도 6b는 도 6a의 하이브리드형 냉각 장치의 측면도.

도 7은 본 발명의 제5 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 8은 본 발명의 제6 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 9는 본 발명의 제7 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 10은 본 발명의 제8 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 11은 본 발명의 제9 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 12a 및 도 12b는 본 발명의 제10 및 제11 실시예에 의한 하이브리드형 냉각 장치의 평단면도.

도 13a 내지 도 13f는 본 발명의 하이브리드형 냉각 장치의 또 다른 실시예들을 도시한 평면도.

## 발명의 상세한 설명

### 발명의 목적

#### 발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 반도체 집적회로 장치 등의 열을 냉각하기 위한 냉각 장치에 관한 것으로서, 특히 작동유체의 상변화에 의한 냉각 방식과 핀(fin) 및/또는 팬(fan)에 의한 냉각 방식을 병용하는 하이브리드형(또는 혼합형) 냉각 장치에 관한 것이다.

반도체소자의 고집적화 추세에 따라 디자인룰(design rule)이 감소하고, 그에 따라 반도체소자를 구성하는 전자 회로의 선폭(line width)이 작아짐에 따라 단위 면적당의 트랜지스터 수가 증가하여 전자 장비의 소형화, 고성능화를 달성하였으나, 그에 수반하여 반도체 소자의 단위 면적당 열발산율이 더욱 증가하게 되었다. 이러한 열발산율의 증가는 반도체 소자의 성능을 저하시키고 수명을 단축시키며, 궁극적으로 반도체 소자를 채용한 시스템의 신뢰도를 저하시키게 된다. 특히, 반도체소자에 있어서는 그 동작온도에 따라 각종 파라미터 값이 예민하게 변화되어 집적회로의 특성을 더욱 열화시키게 된다.

이러한 열발산율의 증가에 대응하여, 이를 냉각하기 위한 냉각기술도 발전하여 왔는데, 이미 알려진 통상적인 냉각기술로서는, 핀-팬(fin-fan) 냉각방식, 열전소자(Peltier) 냉각방식, 액체분사(water-jet) 냉각방식, 잠수(immersion) 냉각방식, 히트파이프(heat pipe) 냉각방식 등이 있다.

상기 핀-팬 냉각방식은 핀 및/또는 팬을 이용하여 강제 냉각시키는 방법으로써 수십 년 동안 많이 이용되어 왔으나, 소음, 진동 및 큰 제적에 비하여 냉각효율이 낮다는 문제점이 있다. 또한, 상기 열전소자 냉각방식은 소음, 진동은 없으나 큰 구동전원이 요구되어 에너지 보존법칙에 의해 고열측(hot junction)에서 필요 이상의 과다한 열소산 장치가 요구된다는 문제점이 있다. 또한, 상기 액체분사 냉각방식은 그 효율성이 우수하여 냉각기 연구의 주류를 이루고 있으나, 외부 전원을 이용하는 박막펌프 등을 사용하여 그 구조가 복잡하고 중력의 영향을 많이 받으며, 개인 휴대 전자장비에 적용할 경우 강건 설계(robust design)가 곤란하다는 문제가 있다.

상기와 같은 문제점들로 인하여 최근에는, 히트파이프 냉각방식이 구조가 간단하고 제작이 용이하다는 장점으로 인하여 상기 핀-팬 냉각 장치와 함께 소형 냉각 장치로서 다양한 형상으로 널리 적용되고 있다. 즉, 도 1에 도시된 바와 같이, 통상적인 히트파이프와 핀-팬을 결합한 냉각 장치 10은, 그 일단이 열원 20과 접촉된 히트파이프 12와, 상기 히트파이프 12의 타단에 설치된 복수의 핀 14와, 상기 핀 14의 근방에 설치된 팬 16을 구비하여, 열원 20으로부터 흡수된 열을 상기 핀 14에 의하여 방출하는 구조를 취한다.

그러나, 상기와 같은 히트파이프를 사용하는 냉각 장치 10에서는, 기체와 액체의 유동 방향이 서로 상반되기 때문에, 높은 열량이 히트파이프에 인가될 경우, 발생하는 기체의 빠른 유속으로 인하여 응축부에서 증발부로 귀환하는 액체가 기체유동부로 다시 빨려들어가 결국 증발부까지 귀환하지 못하게 되어 이로 인해 드라이아웃이 발생한다. 또한,

내부 파이프 내부에서 기화된 냉매는 부력과 압력차에 의존하여 이동하게 되며, 히트파이프 내부에서는 액화된 냉매가 귀환부 매질의 구조 및 크기로 인해 중력에 의존하기 때문에 설치할 수 있는 위치에 많은 제한이 따른다는 문제점이 있다.

나아가, 최근의 중앙처리장치와 같은 고집적화된 반도체 소자는 그 발열량이 종래의 냉각 장치로서는 감당하기 어려운 정도의 많은 양으로서, 상기 히트파이프와 핀-팬을 결합한 구조의 냉각 장치 10에 있어서도, 세 개 또는 네 개에 달하는 히트파이프 12와 두 개 또는 그 이상의 팬 16을 구비하여야만 냉각이 가능한 실정이다. 이렇게 구성 요소들의 개수가 증가하게 되면, 그 크기가 지나치게 비대하게 될 뿐만 아니라, 여러 개의 팬 16에 의한 소음과 전력 소모도 비약적으로 증가하게 되어, 결국 실용성을 잃게 되는 문제점이 있다. 이와 같은 기존 히트파이프 냉각 모듈의 단점은 유체의 상변화를 이용한다고 하더라도 결국은 넓은 면적의 핀을 통해 열을 전도 시켜야 하기에, 핀 자체에서의 열전달 손실이 히트파이프의 상변화 매질에서의 열전달에 비해서 급격히 떨어지기 때문이다.

#### 발명이 이루고자 하는 기술적 과제

본 발명은 상기의 문제점들을 해결하기 위하여 안출된 것으로서, 본 발명의 목적은, 상변화시의 잠열에 의한 냉각과 송풍 및 대류에 의한 냉각을 병행하는 소형의 하이브리드형 냉각 장치를 제공하는 것이다.

또한, 본 발명의 다른 목적은 핀과 핀사이에 하이브리드형 냉각장치를 배치하여 핀을 통한 전도 열전달의 손실을 최소화하여 냉각성능을 향상 시킨 소형의 하이브리드 냉각장치를 제공하는 것이다.

또한, 본 발명의 다른 목적은, 중력의 영향에 무관하게 냉각 성능을 발휘할 수 있는 소형의 하이브리드형 냉각 장치를 제공하는 것이다.

또한, 본 발명의 또 다른 목적은, 설치 위치나 장소에 실질적인 제한이 없는 소형의 하이브리드형 냉각 장치를 제공하는 것이다.

#### 발명의 구성 및 작용

상기 목적들을 달성하기 위하여, 본 발명은 외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서, 내부에 상변화하는 냉매의 순환루프가 형성되되 그 일측에 분기 부분을 구비하는 상변화 냉각기; 및 상기 상변화 냉각기의 분기 부분에 설치된 팬을 포함하되, 상기 상변화 냉각기는, 그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부; 상기 증발부와 인접하여 형성되되, 기화된 냉매가 상기 분기 부분을 향하여 이동하는 기상 냉매 이동부; 상기 분기 부분의 적어도 일부의 영역으로서 상기 기상 냉매 이동부와 인접한 영역에 형성되되 적어도 두 갈래로 분기되며, 상기 기상의 냉매가 액상으로 응축되는 응축부; 상기 분기 부분의 적어도 일부의 영역으로서 상기 응축부에 인접한 영역에 형성되되 상기 증발부와 단열되며, 액상으로 응축된 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부; 및 상기 증발부와 상기 액상 냉매 이동부의 적어도 일부를 단열시키는 단열부를 포함하는 하이브리드형 냉각 장치를 제공한다.

이하, 첨부 도면을 참조하여 본 발명의 바람직한 실시예에 관하여 상세히 설명한다.

먼저, 도 2를 참조하면, 도 2는 본 발명의 제1 실시예에 의한 하이브리드형 냉각 장치의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 하이브리드형 냉각 장치 100은, 그 내부에 상변화하는 냉매의 순환루프가 형성되되 그 순환루프의 적어도 일부는 중공의 고리 형상으로 분기된 부분(이하, 분기 부분)으로 구성되는 상변화 냉각기 112와, 상기 상변화 냉각기의 분기 부분의 중공에 설치된 팬 120을 포함한다.

상기 상변화 냉각기 112의 하우징은, 실리콘이나 갈륨과 같은 반도체물질, 자체 결집 단층막(Self Assembled Monolayer ; SAM)과 같은 신소재 적층물질, 열전도율이 우수한 구리 또는 알루미늄과 같은 금속물질 및/또는 이들의 합금물질, 세라믹물질, 플라스틱과 같은 고분자 물질이나 다이아몬드와 같은 결정질 재료 등의 다양한 소재로 제조될 수 있다. 특히, 외부 열원이 반도체 칩인 경우 외부 열원의 표면 물질과 동일한 물질로 형성하여 접촉 열저항을 최소화할 수 있다. 또한, 상기 상변화 냉각기 112가 반도체 물질로 제조될 경우에는, 반도체 칩의 제조공정에서, 상기 외부 열원의 표면 물질과 일체가 되도록 형성할 수도 있다.

다음으로, 상기 상변화 냉각기 112 내에 주입되는 냉매는, 외부의 열에 의해 액상 및 기상 간의 상변화를 일으킬 수 있는 것으로부터 선택될 수 있다. 본 실시예에 의하면, 상기 냉매로서, 잠열과 표면장력이 큰 물을 사용하는 것이 바람직하나, 이는 환경오염을 고려하여 프레온(CFC) 계열의 냉매를 사용하지 않는 것이 바람직하기 때문이다.

또한, 상기 상변화 냉각기 112의 재질에 따라 그 내벽과 냉매 사이의 표면장력의 크기가 달라지므로, 본 발명의 실시예에 있어서는 이에 적합한 냉매를 선택하여야 한다. 예컨대, 물 이외에도, 메탄올 또는 에탄올 등의 알코올계 냉매를 사용할 수도 있다. 상기와 같은 물이나 알코올계 냉매의 경우 열용량이 크며, 반도체물질 내벽과의 표면장력에 의한 접촉각이 작아, 냉매의 유속이 커지게 되어 많은 열량을 전달하기에 유리한 장점을 갖는다. 또한, 물이나 알코올계 냉매의 경우에는, 프레온계 냉매와 달리, 어떤 이유에 의하여 상기 상변화 냉각기 112로부터 누출되더라도 환경오염의 문제가 발생하지 않는다.

이러한 냉매의 선택은 본 발명의 실시를 위한 단순한 설계적 선택사항에 불과하므로 본 발명의 기술적 범위를 한정하는 것은 아니다.

도시된 바와 같이, 상기 상변화 냉각기 112는, 그 내부의 일단에 형성되며, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원(도시되지 않음)으로부터 전달된 열에 의하여 기화되는 증발부 104와, 상기 증발부 104와 인접하여 형성되며, 기화된 냉매가 그 압력차에 의하여 소정 방향으로 이동하는 기상 냉매 이동부 106과, 상기 기상 냉매 이동부 106과 인접하여 형성되며 두 갈래로 분기되며, 상기 기상의 냉매가 액상으로 응축되는 응축부 108과, 상기 응축부 108에 인접하여 형성되며 상기 증발부 104와 단열되며, 액상으로 응축된 냉매가 상기 증발부 104를 향하여 이동하는 액상 냉매 이동부 102 및 110를 포함한다. 본 실시예에서는 상기 응축부 108과 액상 냉매 이동부 110이 상기 분기 부분을 구성한다.

상기 상변화 냉각기 112 내에서 상기 냉매는, 도면의 화살표 방향을 따라 순환루프를 형성한다. 즉, 상기 증발부 104, 상기 기상 냉매 이동부 106, 상기 응축부 108, 상기 응축부측 액상 냉매 이동부 110 및 상기 증발부측 액상 냉매 이동부 102를 차례로 거쳐 순환되도록 구성되어 있다.

본 발명의 실시예에 따라서는, 상기 액상 냉매 이동부 102 및 110의 소정 영역에 일정량의 액상의 냉매가 저장될 수 있도록 적당한 체적을 가지는 냉매 저장부(도시되지 않음)를 더 포함할 수 있다. 예를 들어, 상기 증발부측 액상 냉매 이동부 102의 영역이 냉매 저장부로서 형성되어 사용될 수 있다.

상기 증발부측 액상 냉매 이동부 102의 일단(출구측)에는 상기 증발부 104가 인접하여 형성되며, 상기 증발부 104는 복수개의 미세채널이 형성되어, 모세관 현상에 의하여 상기 미세채널의 적어도 일부 또는 전부에 상기 증발부측 액상 냉매 이동부 102에 저장된 냉매가 충전된다. 또한, 상기 증발부 104는 외부의 열원(도시되지 않음)에 인접하도록 설치되는데, 그에 따라 상기 열원으로부터 전달된 열에 의하여 상기 미세채널에 충전된 액상의 냉매가 기화되어 기상의 냉매로 상변화를 일으키게 된다. 따라서, 상기 열원으로부터의 열은 상기 냉매의 상변화에 의한 잠열만큼 상기 냉매에 흡수되고, 후술하는 바와 같이 기상의 냉매를 다시 응축시킴으로써 상기 열원의 열을 제거하게 된다.

상기 미세채널 내에서의 표면장력은 중력보다 크도록 형성되는 것이 바람직하다. 상기 미세채널에 충전된 액상인 냉매의 매니스커스(meniscus)의 접촉각은 작을 수록 바람직하며, 이를 위하여는 상기 미세채널의 내벽을 친수성을 갖는 물질로 형성하거나 친수성 처리를 하는 것이 바람직하다. 이러한 친수성 처리의 예를 들면, 도금처리, 도장처리, 코팅처리, 착색처리, 아노다이징처리, 플라즈마처리, 레이저처리 등이 되어 있다. 또한, 그 열전달율을 향상시킬 수 있도록 상기 미세채널의 내벽의 표면거칠기를 조절할 수 있는데, 약 1Å 내지 약 100 $\mu$ m범위의 표면거칠기를 갖는 것이 바람직하다.

나아가, 상기 미세채널의 단면은 사각형 이외에도, 원형, 타원형, 직사각형, 정사각형, 다각형 등 다양한 형태를 갖도록 형성할 수도 있다. 특히, 상기 미세채널의 길이 방향(즉, X축 방향)을 따라 단면적을 증가 또는 감소시킴으로써 냉매와의 표면장력의 크기를 제어할 수 있으며, 그 내벽에 다수의 그루브 또는 노드를 설치하여 냉매의 이동 방향을 결정하거나 냉매의 이동 속도를 제어할 수도 있다.

다음으로, 상기 증발부 104에서 기화된 냉매는 상기 증발부측 액상 냉매 이동부 102의 반대 방향으로 이동하게 되는데, 이렇게 기상의 냉매가 이동할 수 있는 통로의 역할을 하는 기상 냉매 이동부 106을 상기 증발부 104에 인접하여 형성한다. 도시된 바와 같이, 상기 기상 냉매 이동부 106은, 기화된 냉매가 소정의 방향(즉, 상기 냉매 저장부 102의 반대 방향)으로 이동할 수 있도록 다수의 가이드 118들을 포함할 수 있다. 상기 가이드 118들은 상기 상변화 냉각기 112의 기계적인 강도를 증가시키는 기능도 갖는다. 따라서, 기계적인 강도에 문제가 없는 경우에는 상기 가이드 118은 포함되지 않을 수도 있다.

다음으로, 상기 응축부 108은, 상기 기상 냉매 이동부 106을 통하여 이동해 온 기상의 냉매가 다시 응축되어 액화되는 영역이다. 본 실시예에 의하면, 상기 응축부 108은, 상기 증발부 104와 동일한 평면상에서 소정 거리만큼 이격된 위치에 두 갈래로 분기된 고리 형상으로 형성되어 있다. 도시된 바와 같이, 상기 응축부 108을 상기 분기 부분에 배치하여 두 갈래로 분기시킴으로써, 그 사이에 팬 120을 설치할 수 있게 된다. 설치된 상기 팬 120을 회전시켜 상기 응축부 108 외부의 공기를 소정 방향으로 송풍시키면 상기 응축부 108에 도달한 기상의 냉매가 갖는 열을 용이하게 외부로 방출시킬 수 있게 되고, 따라서 냉매는 응축되어 액화된다.

본 실시예에서는 상기 응축부 108이 형성된 영역을 두 갈래로 분기시켜 전체적으로 고리 형상으로 형성하였으나, 분기 부분의 각각을 직선형상으로 형성하거나 “ $\gamma$ ”자 형상으로 형성하여 전체적으로 마름모꼴로 형성할 수도 있다(도 13 참조). 이렇게 형성된 분기 부분들의 사이에 상기 팬 120을 설치함으로써, 열방출 효율을 증대시킬 수 있는 구조를 달성할 수 있게 된다.

한편, 상기 응축부 108은, 상기 증발부 104에 형성된 미세채널과 유사한 복수개의 미세채널(도시되지 않음)을 포함할 수 있다. 이러한 응축부 108의 미세채널은, 후술하는 바와 같이, 상기 액상 냉매 이동부 110에도 연장되어 형성될 수 있으며, 나아가 상기 증발부측 액상 냉매 이동부 102에도 연장되어 형성될 수 있다. 이러한 응축부 108의 미세채널은, 기상 냉매의 응축을 더욱 용이하게 하며, 응축된 액상의 냉매가 상기 증발부측 액상 냉매 이동부 102의 방향으로 이동하게 하는 표면장력을 제공함으로써 냉매 순환 루프의 완성을 촉진한다.

상기 응축부 108의 미세채널의 깊이는 상기 증발부 104의 미세채널의 깊이 보다 깊게 형성되는 것이 바람직하나, 이에 한정되는 것은 아니다. 그 밖에도, 단면의 형상이나, 단면적의 변화, 그루브나 노드의 형성 등에 관하여 상기 증발부 104의 미세채널에 관한 모든 사항이 상기 응축부 108의 미세채널에도 동일하게 적용될 수 있으므로, 그 상세를 생략한다.

또한, 열방출의 효과를 더욱 향상시키기 위하여, 상기 응축부 108 외부의 상변화 냉각기 112에 다수의 핀을 형성할 수도 있다(도 4 내지 도 6 참조). 상기 핀은, 상기 응축부 108의 외부에 방사상으로 형성되거나, 기타 소정의 형상으로 형성될 수 있다. 이러한 핀들 사이 사이에 상기 팬 120에 의하여 송풍되는 주위의 공기가 접촉함으로써 방열 효과를 극대화할 수 있게 된다. 또한, 후술하는 바와 같이, 본 발명의 실시예에 따라서는, 복수개의 상변화 냉각기 112를 적층하여 사용할 수도 있는데, 이 경우에는 적층된 상변화 냉각기 112들 사이에 핀을 배치하여, 핀 내부에서의 온도 분포를 균일하게 함으로써, 냉각성능을 더욱 향상시킬 수 있다.

나아가, 상기 핀이 마이크로 액츄에이터를 포함하도록 형성되는 경우에는, 상기 응축부 108에서 외부로 방출되는 열을 재활용하여 주위의 공기를 순환시키도록 구동시킬 수도 있다. 또한, 상기 핀이 열전소자를 포함하는 미세 구조로 형성된 경우에는, 상기 응축부 108에서 방출되는 열을 전기적 에너지로 변환시켜 미세 구동을 위한 에너지로 사용할 수도 있다.

더욱이, 상기 응축부 108의 체적을 상기 증발부 104의 체적보다 크게 형성함으로써, 넓어지는 표면적에 의한 추가적 응축 효과를 달성할 수도 있다.

다음으로, 상기 액상 냉매 이동부 110은, 상기 응축부 108의 외주측에 형성되어, 상기 응축부 108에서 응축된 액상의 냉매가 상기 증발부측 액상 냉매 이동부 102로 이동하는 통로를 형성한다. 도시된 바와 같이, 상기 액상 냉매 이동부 110은, 상기 단열부 116에 의하여 상기 기상 냉매 이동부 106, 상기 응축부 108 및 증발부 104로부터 단열되어 구분된다.

상기 단열부 116은, 상기 상변화 냉각기 112내의 소정 위치에 형성된 내부 간막이의 형태로 구성하거나, 상기 상변화 냉각기 112내의 소정 위치에 밀봉된 별도의 내부 공간의 형태 또는 상기 상변화 냉각기 112의 상하를 관통하도록 개방되어 있는 형태로 구성할 수 있다. 상기 상변화 냉각기 112내에 밀봉된 내부 공간의 형태로 형성되는 경우, 상기 단열부 116은 진공상태를 유지하거나 공기 등의 단열물질로 채워질 수도 있다.

도시된 바와 같이, 상기 액상 냉매 이동부 110은, 상기 상변화 냉각기 112의 양측 외주를 따라 대칭되도록 형성하는 것이 바람직하다. 이러한 상변화 냉각기 112의 외주를 따라 대칭적으로 형성되는 냉매 순환 루프는, 막판의 형태, 즉 단면의 중형비가 클 경우 주위로의 열방출에 매우 유리한 구조로서, 열원으로부터 전달된 열을 방사방향으로 확산시킴으로써 넓은 면적을 활용하여 주위로 방출시킬 수 있다.

또한, 이러한 양방향의 냉매 순환 루프는, 상기 냉각 장치 100의 설치 위치에 따라 중력의 영향을 받아 어느 한쪽의 액상 냉매 이동부 110에서의 냉매 순환이 원활하지 않은 경우에도, 다른 쪽 액상 냉매 이동부 110을 통하여 냉매를 순환시킬 수 있다는 장점을 갖는다.

물론, 상기한 바와 같이, 상기 액상 냉매 이동부 110도 또한, 중력의 영향을 거의 받지 않도록 하기 위한 미세채널을 포함할 수 있으며, 그 미세채널 내에는 상기 냉매 저장부 102를 향하는 방향으로 복수개의 그루브(도시안됨)를 형성하는 등의 방법을 사용할 수 있다.

한편, 상기 증발부측 액상 냉매 이동부 102와 상기 액상 냉매 이동부 110의 경계부분 및 상기 응축부 108과 상기 액상 냉매 이동부 110의 경계부분에, 액상 냉매의 이동 방향을 규정하기 위한 복수개의 가이드(도시되지 않음)를 형성하여, 냉매의 유로가 급격히 전회함으로써 발생하는 냉매 순환의 저항을 감소시킬 수도 있다.

이제, 도 3을 참조하면, 도 3은 도 2의 하이브리드형 냉각 장치 100의 분해 사시도이다. 도시된 바와 같이, 상기 상변화 냉각기 112는 기관 112a 및 상판 112b를 포함한다. 상기 기관 112a 상에, 도 2를 참조하여 상기한 구조를 후술하는 방법으로 형성하고, 외형이 동일하게 형성된 상판 112b를 접착시키는 것이 바람직하다. 실시예에 따라서는 상판 112b의 내부에도 상기 기관 112a와 동일한 구조를 형성할 수도 있음은 물론이다.

이제 도 4 내지 도 6을 참조하여 본 발명의 다른 실시예에 관하여 상세히 설명한다.

먼저, 도 4a는 본 발명의 제2 실시예에 의한 하이브리드형 냉각 장치 200의 사시도이며, 도 4b는 도 4a의 하이브리드형 냉각 장치 200의 응축부 부분의 확대 사시도이다. 도시된 바와 같이, 본 실시예에서는 복수 개의 상변화 냉각기 100a, 100b 및 100c가 상하 복층으로 배열된다. 외부의 열원으로부터의 열은, 예컨대 도면의 붉은 화살표의 방향으로 각각의 상변화 냉각기 100a, 100b 및 100c의 증발부에 해당하는 영역으로 전달된다. 이를 위하여 상기 상변화 냉각기 100a, 100b 및 100c의 사이 사이에 열전달 물질을 충전시킬 수도 있다.

또한, 본 실시예에서는 각 상변화 냉각기 100a, 100b 및 100c의 응축부에 대응되는 외곽에 방사상으로 복수개의 핀 202를 형성하였으며, 그 중앙 공간에 팬 120이 배치된다. 이로 인해 기존의 히트파이프 모듈과는 달리 핀내부에서의 온도 분포를 균일하게 유지하여 냉각성능을 극대화 할 수 있다. 이러한 복층 구조의 하이브리드형 냉각 장치 200에 의하여 외부 열원의 냉각 효율을 비약적으로 증가시킬 수 있다.

다음으로, 도 5a는 본 발명의 제3 실시예에 의한 하이브리드형 냉각 장치 220의 사시도이며, 도 5b는 도 5a의 하이브리드형 냉각 장치 220의 측면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 220은, 도 4a에 도시된 실시예의 상변화 냉각기 100a, 100b 및 100c들의 냉매 저장부 및 증발부를 포함하는 부분을 상호간에 접합시켜 형성한 것이다. 응축부를 포함하는 부분은 팬 120에 의한 송풍의 효과를 극대화하기 위하여 접합하지 않고 분리시켰으며, 최하층과 중층의 상변화 냉각기들의 측면 구조는 그에 따라 다소 변형되었다.

한편, 본 실시예에 있어서, 상기 세 층의 상변화 냉각기의 각각에 속하는 증발부측 액상 냉매 이동부와 증발부가 상호간에 독립적으로 형성되는 대신에, 상호간에 공유될 수도 있다. 이 경우에는 증발부 또는 기상 냉매 이동부의 소정 위치로부터 상하로 분기가 형성되는 구조로 형성된다. 증발부가 공유 되는 경우, 증발부와 기체이동부 사이에 각층의 상변화 냉각기로 통하는 유로(도시되지 않음)가 형성되어 증발부에서 기화된 기체가 각층으로 분기되어 이동하게 된다.

다음으로, 도 6a는 본 발명의 제4 실시예에 의한 하이브리드형 냉각 장치 230의 사시도이며, 도 6b는 도 6a의 하이브리드형 냉각 장치 230의 측면도이다. 본 실시예에서는, 도 5a에 도시된 실시예에서의 핀의 크기를 최상층 및 최하층의 상변화 냉각기의 외곽을 벗어나지 않도록 조정하였다. 이렇게 함으로써 냉각 장치 230의 설치가 용이해 진다.

이상에서 설명한 본 발명의 각 실시예의 하이브리드형 냉각 장치를 제작하는 방법은 현재 널리 알려진 여러가지 방법에 의해 제작될 수 있으며, 예를 들어, 이미 알려져 있는 MIM(Metal Injection Molding) 방법이나, 반도체소자 제조 공정을 응용한 MEMS(Micro Electro Mechanical System) 방법이나, SAM(Self Assembled Monolayer) 방법을 응용하여 제작할 수 있다.

상기 MIM 방법에 의하여 제작하는 경우에는, 먼저 상기 상변화 냉각기 112 형상의 움푹형태의 상하 몰드를 만들고, 이 몰드에 각각 바인더(binder)로서 풀리머 등과 금속분말이 섞인 용융체를 틀에 주입하여 성형하고, 성형물을 몰드로부터 떼어낸 후, 용제 및 열처리로 바인더를 제거하여, 최종적으로 상하판을 브레이징 등의 금속접합기술을 사용하여 접합한다.

또는, 도 2 및 도 3을 참조하여 반도체 물질로 제조 할 경우의 구체적인 제작방법의 예를 간단히 설명하면, 먼저 상변화 냉각기 112의 기관 112a의 표면을 식각하여 증발부 104 및 그 미세채널, 기상 냉매 이동부 106, 응축부 108 및 액상 냉매 이동부 102 및 110 등을 형성한다. 그 다음에, 상기 기관 112a에 대응하여 일정한 패턴의 형상이 형성된 상판 112b를 형성하여, 이들을 서로 접착한다. 이들의 접착 방법의 예로서는, 양자를 상호 접촉시킨 후, 양자에 전압을 인가하여 아노딕 본딩(anodic bonding)을 수행할 수 있다. 다음으로, 상기 증발부측 액상 냉매 이동부 102에 인접된 상변화 냉각기 112의 소정 위치에 형성된 냉매 주입홀(도시되지 않음)을 통하여, 진공상태에서 소정량의 냉매를 주입하고, 상기 냉매 주입홀을 밀봉한다.

다음으로, 도 7을 참조하면, 도 7은 본 발명의 제5 실시예에 의한 하이브리드형 냉각 장치 700의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 700의 상변화 냉각기 712는, 그 분기 부분의 종단(점선으로 표시된 부분)이 상호간에 연결되어 전체적으로 하나의 폐고리 형상으로 형성되어 있다. 이 경우에도 상기 냉매의 순환 루프는 도 2를 참조하여 상기한 바와 같으며, 그 냉각 원리 및 효과도 또한 동일하다. 따라서, 이들의 상세에 관하여는 이를 생략한다.

도 7에서는, 본 실시예의 상변화 냉각기 712가, 상기 제1 실시예에 의한 상변화 냉각기 112에 포함된 가이드 118을 포함하지 않는 것으로 도시되었으나, 상기 가이드 118은 그 설계상의 선택에 따라 포함될 수도 있고 포함되지 않을 수도 있는 것임은 상기한 바와 같다.

다음으로 도 8을 참조하면, 도 8은 본 발명의 제6 실시예에 의한 하이브리드형 냉각 장치 800의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 800에 있어서, 외부 열원(도시되지 않음)으로부터의 열을 흡수하여 액상의 냉매를 기화시키는 증발부 104가 상변화 냉각기 812의 중앙부근에 형성되어 분기 부분에 인접하게 배치되어 있다.

본 실시예에 의하면, 기상의 냉매를 응축시켜 액화시키는 응축부 108과 응축되어 액화된 냉매가 다시 상기 증발부 104를 향하여 이동하는 액상 냉매 이동부 110가, 상기 분기 부분을 구성한다. 그리하여, 상기 증발부 104가 상기 기상 냉매 이동부 106과 상기 분기 부분의 사이에 배치된다. 이러한 구조에 의하여 상기 증발부 104로부터 기화된 냉매는 상기 분기 부분의 반대편으로 이동하게 되고, 계속하여 하우징의 외주를 따라 상기 분기 부분까지 도달한다. 상기 분기 부분의 중공에는 팬 120이 설치되어 주위의 공기를 순환시키고, 따라서 분기 부분에 도달한 기상의 냉매는 응축되어 액화된다. 따라서 본 실시예에서는, 도시된 바와 같이, 기상 냉매가 응축되는 응축부 108이 상기 분기 부분의 외주측으로 형성된다.

특히, 도시된 바와 같이, 본 실시예에 있어서는, 상기 증발부 104와 상기 액상 냉매 이동부 110를 단열시키는 단열부를 별도로 형성하지 않아도 냉매의 순환에 문제가 없다. 즉, 상기 기상 냉매 이동부 106으로부터 유출된 기상의 냉매는 결국 분기 부분의 분기 부분에 도달하게 되고, 여기에서 상기 팬 120에 의하여 순환되는 공기에 의하여 열을 빼앗겨 응축된다.

액화된 냉매는 계속하여 상기 분기 부분의 외주에 형성된 응축부 108 및 그 내주에 형성된 액상 냉매 이동부 110를 따라 이동하여 다시 상기 증발부 104로 귀환한다. 상기 응축부 108 및 액상 냉매 이동부 110는 간막이 810에 의하여 구분되어 있다. 상기 간막이 810은, 설계상의 선택에 따라 단열부의 역할도 가미될 수 있다.

상기 증발부 104의 분기 부분 측에는 상기 팬 120에 의하여 순환되는 주위의 공기가 지속적으로 접촉되므로, 외부의 열원 자체를 직접 냉각시키는 효과도 또한 달성된다.

본 실시예에 있어서도, 상기 분기 부분의 종단을 상호간에 연결하는 구조를 취할 수도 있음은 물론이다. 또한, 본 실시예의 상변화 냉각기 812에도, 상기 제1 실시예에 의한 상변화 냉각기 112의 기상 냉매 이동부 106에 포함된 가이드 118이 포함되지 않는 것으로 도시되었으나, 그 설계상의 선택에 따라 상기 가이드 118을 포함할 수도 있고 포함하지 않을 수도 있다.

다음으로, 도 9를 참조하면, 도 9는 본 발명의 제7 실시예에 의한 하이브리드형 냉각 장치의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 900의 상변화 냉각기 912는, 분기 부분이 폐쇄된 고리 형상으로 형성되는데, 그 내부의 냉매가 대칭으로 형성된 순환루프를 순환하는 대신에, 비대칭적으로 하나의 방향으로만 순환하는 구조를 갖는다.

즉, 상기 상변화 냉각기 912는, 그 내부의 일단에 형성된 증발부 104와, 상기 증발부 104에서 기화된 냉매가 소정 방향으로 이동하는 기상 냉매 이동부 106과, 상기 기상의 냉매가 일측으로 유입되어 응축되며, 응축된 액상의 냉매가 소정 방향으로 이동하여 타단으로 유출되는 부분으로서 중앙에 공간을 갖는 고리 형상의 분기 부분 108과, 상기 분기 부분 108의 타단과 인접하여 형성되며 상기 액상의 냉매가 계속하여 상기 증발부 104를 향하여 이동하는 액상 냉매 이동부 102를 포함한다. 상기 증발부 104와 기상 냉매 이동부 106은, 간막이 116에 의하여 상기 액상 냉매 이동부 102로부터 분리되어 있다. 상기 간막이 116은 단열 기능을 갖는 단열부로서 형성하여도 좋다.

본 실시예에 의하면, 상기 냉매의 순환루프가 비대칭형이라는 점과 외부 열원으로부터의 열이 상기 증발부 104의 영역으로 흡수되도록 하기 위하여, 상기 열원이 하우징의 중심부로부터 다소 벗어나서 증발부의 하부에 배치된다는 점을 제외하고는, 상기 제1 실시예의 냉각 장치 100에 관하여 상기한 모든 설명이 동일하게 적용될 수 있으므로 그 상세를 생략한다.

다음으로, 도 10을 참조하면, 도 10은 본 발명의 제8 실시예에 의한 하이브리드형 냉각 장치의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 1000의 상변화 냉각기 1012는, 제7 실시예에 의한 상변화 냉각기 912의 냉매 순환루프와 반대 방향의 냉매 순환루프를 갖는다.

즉, 냉매를 기화시키는 증발부 104를 분기 부분에 인접한 영역에 형성하고, 기화된 냉매가 상기 분기 부분 108의 반대 방향으로 이동하도록 형성함으로써, 기화된 냉매는 기상 냉매 이동부 106을 거쳐 상기 분기 부분 108의 일측으로 유입된다. 유입된 냉매는 상기 분기 부분 108의 중공에 형성된 팬 120에 의한 공기의 순환으로 인하여 응축되어 액화된다. 액화된 냉매는 상기 분기 부분 108을 거쳐 다시 상기 증발부 104로 유입된다.

본 실시예의 경우에도, 도 8을 참조하여 상기한 바와 같이, 상기 증발부 104가 상기 팬 120에 가까이 배치되므로, 상기 팬 120에 의하여 순환되는 주변 공기가 외부 열원 자체를 냉각시키는 효과도 또한 달성할 수 있다. 또한, 상기 외부 열원은 상기 증발부 104의 하부에 배치되는 것이 바람직하다.

다음으로, 도 11을 참조하면, 도 11은 본 발명의 제9 실시예에 의한 하이브리드형 냉각 장치의 평단면도이다. 도시된 바와 같이, 본 실시예에 의한 냉각 장치 1100은, 각각의 일단이 소정의 각도로 구부러지게 형성되어 중공의 분기 부분의 적어도 일부분을 구성하도록 형성된 한 쌍의 상변화 냉각기 1112a 및 1112b를 포함한다. 본 실시예에 의하면, 상기 한 쌍의 상변화 냉각기 1112a 및 1112b의 구부러진 부분들이 설치시에 분기 부분을 형성하게 된다. 이렇게 형성된 분기 부분의 중공에 역시 상기 팬 120이 설치된다.

도시된 바와 같이, 본 실시예에 의한 상변화 냉각기 1112a 및 1112b의 각각은 히트 파이프일 수 있다. 이 경우, 한 쌍의 히트 파이프 1112a 및 1112b의 각각은 그 자체가 상변화에 의한 냉각 기능을 보유하고 있으므로, 외부 열원으로 부터의 열을 흡수하여 이를 방열할 수 있다. 그러나, 본 발명에 의하면, 그 일부분, 즉 응축이 일어나는 부분(점선 108로 표시된 부분)을 소정 각도로 구부러 고리 형상으로 성형하고, 그 중앙의 공간에 팬 120을 설치하여 주위의 공기를 순환시킴으로써, 종래의 히트 파이프 각각이 갖고 있는 방열 용량을 훨씬 초과하는 방열 용량을 구현할 수 있다.

물론, 상기 한 쌍의 상변화 냉각기 1112a 및 1112b의 각각은, 반드시 히트 파이프일 필요는 없다. 이러한 실시예가 도 12a에 도시되어 있다. 도 12a는 본 발명의 제10 실시예에 의한 하이브리드형 냉각 장치 1200의 평단면도이다. 본 실시예에 의한 냉각 장치 1200도 역시 설치시 중앙에 공간을 갖는 분기 부분을 구성하는 한 쌍의 상변화 냉각기 1212a 및 1212b와, 상기 한 쌍의 상변화 냉각기 1212a 및 1212b가 구성하는 분기 부분의 중앙 공간에 설치된 팬 120을 포함한다. 그러나, 본 실시예에 의한 상기 상변화 냉각기 1212a 및 1212b의 각각은, 그 일측 단부의 소정 영역(본 명세서에서, "일단"이라 함) 108 및 110이 소정 각도로 구부러지도록 성형되며, 그 내부에 상변화하는 냉매의 순환루프가 형성되며, 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 외부의 열원(도시되지 않음)으로부터 전달된 열에 의하여 충전된 액상의 냉매가 기화되는 증발부 104와, 상기 증발부 104와 인접하여 형성되며, 기화된 냉매가 상기 일단 108 및 110을 향하여 이동하는 기상 냉매 이동부 106과, 적어도 상기 기상 냉매 이동부 106과 인접하여 형성되며 상기 일단의 적어도 일부를 형성하도록 성형되며, 상기 기상의 냉매가 일측으로 유입되어 응축되는 응축부 108과, 상기 응축부 108과 인접하여 형성되며 상기 일단의 적어도 일부를 형성하도록 성형되며, 상기 액상의 냉매가 상기 증발부 104를 향하여 이동하는 액상 냉매 이동부 110 및 상기 증발부 104와 상기 액상 냉매 이동부 110의 적어도 일부를 단열시키는 단열부 106을 포함하는 구조를 취한다.

한편, 도 12b를 참조하면, 도 12b는 본 발명의 제11 실시예에 의한 하이브리드형 냉각 장치 1200'의 평단면도이다. 본 실시예에서는 도 7에 도시된 제5 실시예의 경우와 같이, 분기 부분의 중단이 상호간에 연결되어 있다. 이 실시예의 경우에도 냉매의 순환은 상기한 제10 실시예의 경우와 동일하다.

따라서, 본 실시예들에 의한 냉각 장치 1200 및 1200'는, 도 2 및 도 9에 도시된 실시예들에 의한 냉각 장치들의 장점을 주로 보유한다. 나아가 본 실시예들에 의하면, 증발부가 상하 두 군데에 나누어 형성됨으로써 이격되어 설치된 복수의 열원으로부터 전달되는 열도 방열시킬 수 있는 장점을 갖는다. 또한, 상기 제10 및 제11 실시예에 의한 상변화 냉각기들 각각의 증발부를 상호간에 인접한 위치에 형성시킴으로써 보다 넓은 면적의 열원을 방열시킬 수도 있다. 물론 이 경우에는 증발부의 위치 변화에 따라 다른 내부 구조의 배치도 대칭적으로 변화하게 된다.

한편, 상기 제10 및 제11 실시예에서의 증발부 104를 상기 분기 부분 측으로 형성함으로써 도 8에 도시된 바와 같은 상변화 냉각기 800에서의 효과를 달성하게 할 수도 있다. 다시 말하면, 이 경우의 냉각 장치(도시되지 않음)도 역시 설치시 중앙에 공간을 갖는 분기 부분을 구성하는 한 쌍의 상변화 냉각기와, 상기 한 쌍의 상변화 냉각기가 구성하는 분기 부분의 중앙 공간에 설치된 팬을 포함한다. 그러나, 이 실시예에 의한 상기 상변화 냉각기의 각각은, 그 일단이 소정 각도로 구부러지도록 성형되며, 그 내부에 상변화하는 냉매의 순환루프가 형성되며, 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부와, 상기 증발부와 인접하여 형성되며, 기화된 냉매가 상기 구부러진 일단의 반대 방향을 향하여 이동하는 기상 냉매 이동부와, 상기 구부러진 일단에 인접한 영역에 형성되며, 상기 구부러진 일단의 적어도 일부를 형성하도록 성형되며, 상기 기상의 냉매가 일측으로 유입되어 응축되는 응축부와, 상기 응축부와 인접하여 형성되며 상기 구부러진 일단의 적어도 일부를 형성하도록 성형되며, 상기 액상의 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부를 포함한다.

본 실시예에 의하면 도 2 및 도 10에 도시된 실시예들에 의한 냉각 장치들의 장점을 주로 보유한다. 나아가 본 실시예들에 의하면, 증발부가 상하 두 군데에 나누어 형성됨으로써 이격되어 설치된 복수의 열원으로부터 전달되는 열도 방열시킬 수 있는 장점을 갖는다. 또한, 상기 실시예에 의한 상변화 냉각기들 각각의 증발부를 상호간에 인접한 위치에 형성시킴으로써 보다 넓은 면적의 열원을 방열시킬 수도 있다. 물론 이 경우에는 증발부의 위치 변화에 따라 다른 내부 구조의 배치도 대칭적으로 변화하게 된다.

상기 도 7 내지 도 12에 의한 냉각 장치들도, 도 2를 참조하여 상기한 냉각 장치 100과 마찬가지로, 복수의 상변화 냉각기들을 적층한 구조로 형성될 수 있음은 물론이다. 나아가 상기 분기 부분에는 소정의 형상을 갖는 복수의 핀을 설치하여 냉각 효율을 증대시킬 수 있다는 점도 마찬가지이다.

또한, 상기 상변화 냉각기에 포함된 응축부나 액상 냉매 이동부에는, 기상의 냉매가 버블(bubble)의 형태로 포함되어 있을 수도 있다. 이러한 버블은 당연히 응축부의 영역에 보다 많이 포함될 수 있으며, 도면에서는 이것을 일응 구별하기 위하여 빗금 영역과 물결 영역으로 구분하여 도시하였으나, 그 영역상 구분이 도시된 바에 한정되는 것이 아님은 물론이다.

또한, 상기 응축부나 액상 냉매 이동부에는 상기 증발부에 형성된 것과 유사한 미세채널들을 형성하여 응축된 액상 냉매의 이동을 보다 용이하게 할 수도 있다.

다음으로, 도 13a 내지 도 13f를 참조하면, 본 발명에 의한 냉각 장치의 또 다른 실시예들이 도시되어 있다. 도시된 바와 같이, 본 발명에 의한 냉각 장치들의 분기 부분은 반드시 원형의 고리 형상이어야 하는 것은 아니며, 직선형(도 13a 또는 도 13d 참조), 종단이 개방되거나 폐쇄된 막름모형(도 13b, 도 13c, 도 13e 및 도 13f 참조) 등으로 형성될 수도 있다. 따라서, 이러한 다양한 분기 부분의 형상은 그 설계적 선택 사항에 불과한 것이므로, 본 발명의 기술적 사상이 분기 부분의 특정 형상에 한정되는 것이 아님은 당연하다.

본 발명은 이상의 실시예에 대하여 상세히 설명하였지만, 이에 한정되는 것은 아니고 당해 기술분야에서 통상의 지식을 가진 자에 의해 다양하게 변형 실시할 수 있음은 물론이다. 예를 들어, 상기 미세채널을 직선형으로 형성하는 실시예를 설명하였지만, 이를 곡선형으로 형성할 수 있음은 물론이며, 상기 단열부 116의 형상도 다양하게 만들 수 있을 뿐만 아니라, 그 치수나 형상도 적절히 디자인하여 사용할 수 있음은 물론이다.

#### 발명의 효과

본 발명에 의하면, 상변화시의 잠열에 의한 냉각과 송풍 및 대류에 의한 냉각을 병행할 수 있다.

또한, 본 발명에 의하면 각층의 핀과 핀 사이에 복수의 상변화 냉각기를 적층되도록 배치하여 핀의 냉각효율을 극대화시켜 기존의 방식에 비해 같은 면적의 핀을 사용하더라도 냉각성능을 크게 향상시킬 수 있다.

또한, 본 발명에 의하면, 중력의 영향에 무관하게 냉각 성능을 발휘할 수 있는 소형의 하이브리드형 냉각 장치를 제공할 수 있다.

또한, 본 발명에 의하면, 설치 위치나 장소에 실질적인 제한이 없는 소형의 하이브리드형 냉각 장치를 제공할 수 있다.

또한, 본 발명에 의하면, 증발부 및 응축부의 미세채널들이 그 내부에서의 표면장력이 중력보다 크게 하면, 중력의 영향을 거의 받지 않고 냉매를 자연순환시킬 수 있기 때문에 설치위치 및 설치방법에 제한을 받지 않는다.

또한, 본 발명에 의하면, 단열부에 의해 액상의 냉매 이동부와 기상의 냉매 이동부를 열적 및 물리적으로 분리시킴으로써 냉매 유동의 안정성을 꾀하고, 혼입 한계를 억제시킴으로써 냉매의 질량유량을 증가시켜 냉각효율을 향상시켰다.

또한, 본 발명에 의하면, 액상 냉매 이동부를 냉각 장치의 양쪽 외곽을 따라 배치하고, 양 방향의 순환루프로 구성함에 따라 냉매의 과냉효과를 증가시키고, 중력수두에 의해 한쪽의 액상 냉매 이동부로 냉매 순환이 되지 않는 경우 반대쪽의 액상 냉매 이동부를 냉매의 유동을 원활히 하여 냉각효율이 향상되었다.

#### (57) 청구의 범위

##### 청구항 1.

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

내부에 상변화하는 냉매의 순환루프가 형성되고 그 일측에 분기 부분을 구비하는 상변화 냉각기; 및

상기 상변화 냉각기의 분기 부분에 설치된 핀을 포함하되,

상기 상변화 냉각기는,

그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

상기 증발부와 인접하여 형성되되, 기화된 냉매가 상기 분기 부분을 향하여 이동하는 기상 냉매 이동부;

상기 분기 부분의 적어도 일부의 영역으로서 상기 기상 냉매 이동부와 인접한 영역에 형성되되 적어도 두 갈래로 분기되며, 상기 기상의 냉매가 액상으로 응축되는 응축부;

상기 분기 부분의 적어도 일부의 영역으로서 상기 응축부에 인접한 영역에 형성되되 상기 증발부와 단열되며, 액상으로 응축된 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부; 및

상기 증발부와 상기 액상 냉매 이동부의 적어도 일부를 단열시키는 단열부를 포함하는 하이브리드형 냉각 장치.

## 청구항 2.

제1항에 있어서,

상기 액상 냉매 이동부의 적어도 일부분은 상기 액상의 냉매가 저장되는 냉매저장부인 하이브리드형 냉각 장치.

## 청구항 3.

제1항에 있어서,

상기 기상 냉매 이동부와 상기 액상 냉매 이동부는 상기 단열부에 의해 서로 분리된 하이브리드형 냉각 장치.

## 청구항 4.

제1항에 있어서,

상기 액상 냉매 이동부는 액상의 냉매와 상기 액상 냉매 이동부의 내벽과의 표면장력이 중력보다 크도록 설정된 적어도 하나의 미세채널을 포함하는 하이브리드형 냉각 장치.

## 청구항 5.

제1항에 있어서,

상기 기상 냉매 이동부에는 기상의 냉매를 상기 응축부로 이동시키기 위한 복수개의 가이드를 포함하는 하이브리드형 냉각 장치.

## 청구항 6.

제1항에 있어서,

상기 상변화 냉각기의 외측에 있어서 상기 응축부에 대응되는 영역에 형성된 복수개의 핀을 더 포함하는 하이브리드형 냉각 장치.

## 청구항 7.

제6항에 있어서,

상기 복수개의 핀 중 적어도 일부는 X-Y 평면에서의 단면이 곡선 형태로 형성된 하이브리드형 냉각장치.

## 청구항 8.

제1항에 있어서,

적어도 하나의 상기 상변화 냉각기를 더 포함하되, 상기 상변화 냉각기들 상호간에 적어도 상기 증발부를 공유하는 하이브리드형 냉각 장치.

## 청구항 9.

제8항에 있어서,

상기 증발부의 소정 위치로부터 상하로 분기가 형성되어, 상기 공유된 증발부에서 기화된 기체가 상기 복수의 상변화 냉각기 각각으로 분기되어 이동할 수 있는 냉매 유로를 더 포함하는 하이브리드형 냉각장치.

**청구항 10**

제8항에 있어서,

상기 기상 냉매 이동부의 소정 위치로부터 상하로 분기가 형성되어, 상기 공유된 증발부에서 기화된 기체가 상기 복수의 상변화 냉각기 각각으로 분기되어 이동할 수 있는 냉매 유로를 더 포함하는 하이브리드형 냉각장치.

**청구항 11.**

제1항에 있어서,

적어도 하나의 상기 상변화 냉각기를 더 포함하되, 상기 상변화 냉각기들 각각의 증발부가 열적으로 접촉된 하이브리드형 냉각 장치.

**청구항 12**

제1항에 있어서,

상기 분기 부분의 종단은 상호간에 연결되어 하나의 폐고리를 형성하는 하이브리드형 냉각 장치.

**청구항 13**

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

내부에 상변화하는 냉매의 순환루프가 형성되되 그 일측에 적어도 두 갈래의 분기 부분이 형성된 상변화 냉각기; 및

상기 상변화 냉각기의 분기 부분에 설치된 팬을 포함하되,

상기 상변화 냉각기는,

그 내부의 상기 분기 부분에 인접한 영역에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

상기 증발부와 인접하여 형성되되, 기화된 냉매가 상기 분기 부분의 반대 방향을 향하여 이동하는 기상 냉매 이동부;

상기 분기 부분에 형성되되, 상기 기상의 냉매가 유입되어 액상으로 응축되는 응축부; 및

상기 응축부에 인접하여 형성되되, 상기 액상으로 응축된 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부를 포함하는 하이브리드형 냉각 장치.

**청구항 14**

제13항에 있어서,

상기 액상 냉매 이동부의 적어도 일부분은 상기 액상의 냉매가 저장되는 냉매저장부인 하이브리드형 냉각 장치.

**청구항 15**

제13항에 있어서,

상기 액상 냉매 이동부는 액상의 냉매와 상기 액상 냉매 이동부의 내벽과의 표면장력이 중력보다 크도록 설정된 적어도 하나의 미세채널을 포함하는 하이브리드형 냉각 장치.

**청구항 16**

제13항에 있어서,

상기 기상 냉매 이동부에는 기상의 냉매를 상기 응축부로 이동시키기 위한 복수개의 가이드를 포함하는 하이브리드형 냉각 장치.

**청구항 17.**

제13항에 있어서,

상기 상변화 냉각기의 외측에 있어서 상기 응축부에 대응되는 영역에 형성된 복수개의 핀을 더 포함하는 하이브리드형 냉각 장치.

#### 청구항 18.

제17항에 있어서,

상기 복수개의 핀 중 적어도 일부는 X-Y 평면에서의 단면이 곡선 형태로 형성된 하이브리드형 냉각장치.

#### 청구항 19.

제13항에 있어서,

적어도 하나의 상기 상변화 냉각기를 더 포함하되, 상기 상변화 냉각기들 상호간에 적어도 상기 증발부를 공유하는 하이브리드형 냉각 장치.

#### 청구항 20.

제19항에 있어서,

상기 증발부의 소정 위치로부터 상하로 분기가 형성되어, 상기 공유된 증발부에서 기화된 기체가 상기 복수의 상변화 냉각기 각각으로 분기되어 이동할 수 있는 냉매 유로를 더 포함하는 하이브리드형 냉각장치.

#### 청구항 21.

제19항에 있어서,

상기 기상 냉매 이동부의 소정 위치로부터 상하로 분기가 형성되어, 상기 공유된 증발부에서 기화된 기체가 상기 복수의 상변화 냉각기 각각으로 분기되어 이동할 수 있는 냉매 유로를 더 포함하는 하이브리드형 냉각장치.

#### 청구항 22.

제13항에 있어서,

적어도 하나의 상기 상변화 냉각기를 더 포함하되, 상기 상변화 냉각기들 각각의 증발부가 열적으로 접촉된 하이브리드형 냉각 장치.

#### 청구항 23.

제13항에 있어서,

상기 분기 부분의 종단은 상호간에 연결되어 하나의 폐고리를 형성하는 하이브리드형 냉각 장치.

#### 청구항 24.

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

(가) 내부에 상변화하는 냉매의 순환루프가 형성되되,

가-1) 그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

가-2) 상기 증발부와 인접하여 형성되되, 기화된 냉매가 그 압력차에 의하여 소정 방향으로 이동하는 기상 냉매 이동부;

가-3) 적어도 상기 기상 냉매 이동부와 인접한 영역으로서 상기 증발부의 맞은 편에 형성되되, 상기 기상의 냉매가 일측으로 유입되어 응축되며, 응축된 액상의 냉매가 소정 방향으로 이동하여 타단으로 유출되며 중앙에 공간을 갖도록 성형된 분기 부분;

가-4) 상기 분기 부분의 타단과 인접하여 형성되되, 상기 액상의 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부; 및

가-5) 상기 증발부와 상기 액상 냉매 이동부의 적어도 일부를 단열시키는 단열부

를 포함하는 상변화 냉각기; 및

(나) 상기 상변화 냉각기의 상기 분기 부분의 중앙 공간에 설치된 팬

을 포함하는 하이브리드형 냉각장치.

**청구항 25.**

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

(가) 내부에 상변화하는 냉매의 순환루프가 형성되되,

가-1) 그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

가-2) 상기 증발부와 인접하여 형성되되, 기화된 냉매가 그 압력차에 의하여 소정 방향으로 이동하는 기상 냉매 이동부; 및

가-3) 상기 증발부와 인접한 영역으로서 상기 기상 냉매 이동부의 맞은 편에 형성되되, 상기 기상의 냉매가 일측으로 유입되어 응축되며, 응축된 액상의 냉매가 소정 방향으로 이동하여 상기 증발부로 유출되며 중앙에 공간을 갖는 분기 부분

을 포함하는 상변화 냉각기; 및

(나) 상기 상변화 냉각기의 상기 분기 부분의 중공에 설치된 팬

을 포함하는 하이브리드형 냉각장치.

**청구항 26.**

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

각각의 일단이 소정 각도로 구부러지도록 성형되어 설치시 중앙에 공간을 갖는 분기 부분을 구성하는 한 쌍의 히트 파이프; 및

상기 한 쌍의 히트 파이프의 구부러진 부분들이 형성하는 분기 부분의 중앙 공간에 설치된 팬을 포함하는 하이브리드형 냉각장치.

**청구항 27.**

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

각각의 일단이 소정 각도로 구부러지도록 성형되어 설치시 중앙에 공간을 갖는 분기 부분을 구성하는 한 쌍의 상변화 냉각기; 및

상기 한 쌍의 상변화 냉각기가 구성하는 분기 부분의 중앙 공간에 설치된 팬을 포함하되,

상기 한 쌍의 상변화 냉각기의 각각은,

그 내부에 상변화하는 냉매의 순환루프가 형성되되,

가-1) 그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

가-2) 상기 증발부와 인접하여 형성되되, 기화된 냉매가 상기 분기 부분을 향하여 이동하는 기상 냉매 이동부;

가-3) 적어도 상기 기상 냉매 이동부와 인접하여 형성되되 상기 분기 부분의 적어도 일부를 형성하도록 성형되며, 상기 기상의 냉매가 일측으로 유입되어 응축되는 응축부;

가-4) 상기 응축부와 인접하여 형성되되 상기 분기 부분의 적어도 일부를 형성하도록 성형되며, 상기 액상의 냉매가

상기 증발부를 향하여 이동하는 액상 냉매 이동부; 및

가-5) 상기 증발부와 상기 액상 냉매 이동부의 적어도 일부를 단열시키는 단열부를 포함하는 하이브리드형 냉각 장치.

# **청구항 28**

외부의 열원으로부터의 열을 냉각시키기 위한 하이브리드형 냉각 장치에 있어서,

각각의 일단이 소정 각도로 구부러지도록 성형되어 설치시 중앙에 공간을 갖는 분기 부분을 구성하는 한 쌍의 상변화 냉각기; 및

상기 한 쌍의 상변화 냉각기가 구성하는 분기 부분의 중앙 공간에 설치된 팬을 포함하되,

상기 한 쌍의 상변화 냉각기의 각각은,

그 내부에 상변화하는 냉매의 순환루프가 형성되되,

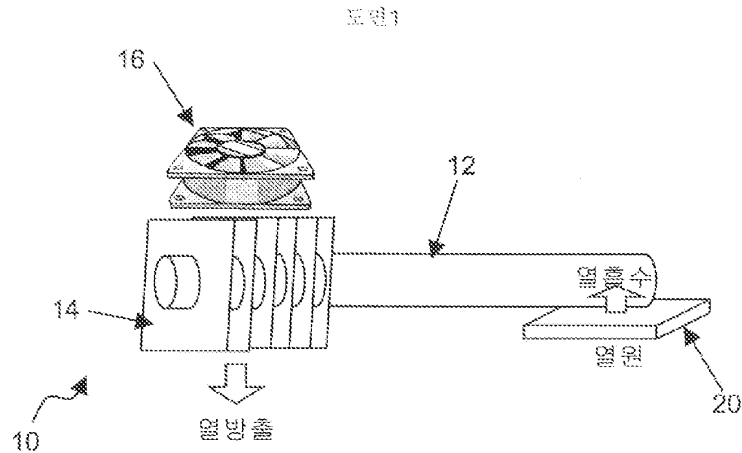
가-1) 그 내부의 일단에 형성되되, 상기 액상의 냉매가 모세관 현상에 의하여 적어도 일부에 충전되며, 충전된 액상의 냉매가 외부의 열원으로부터 전달된 열에 의하여 기화되는 증발부;

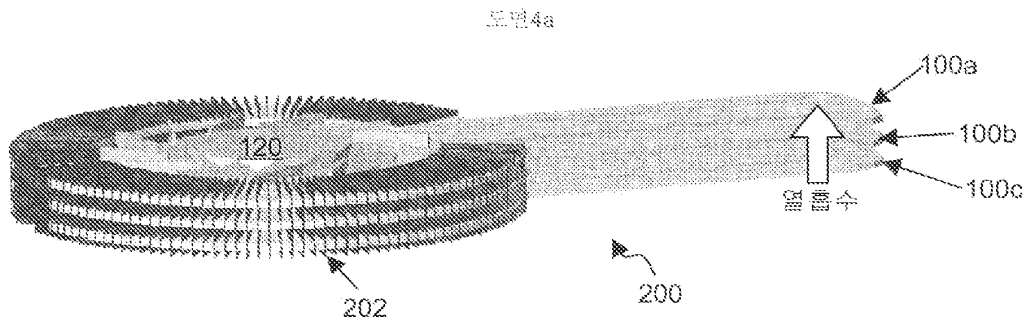
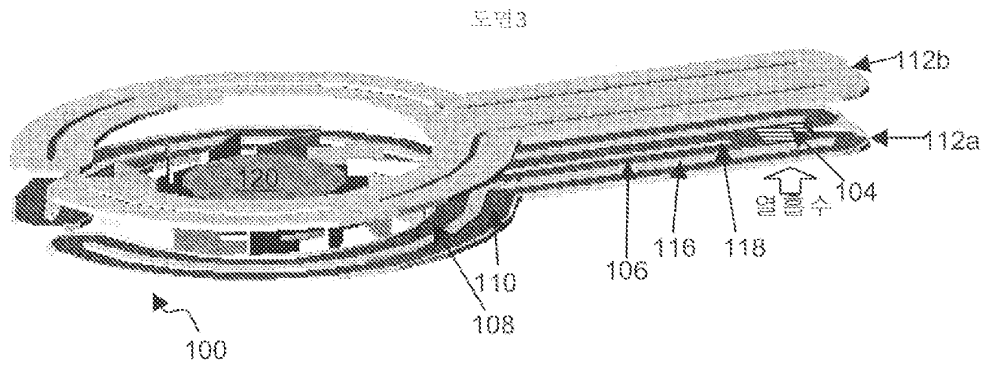
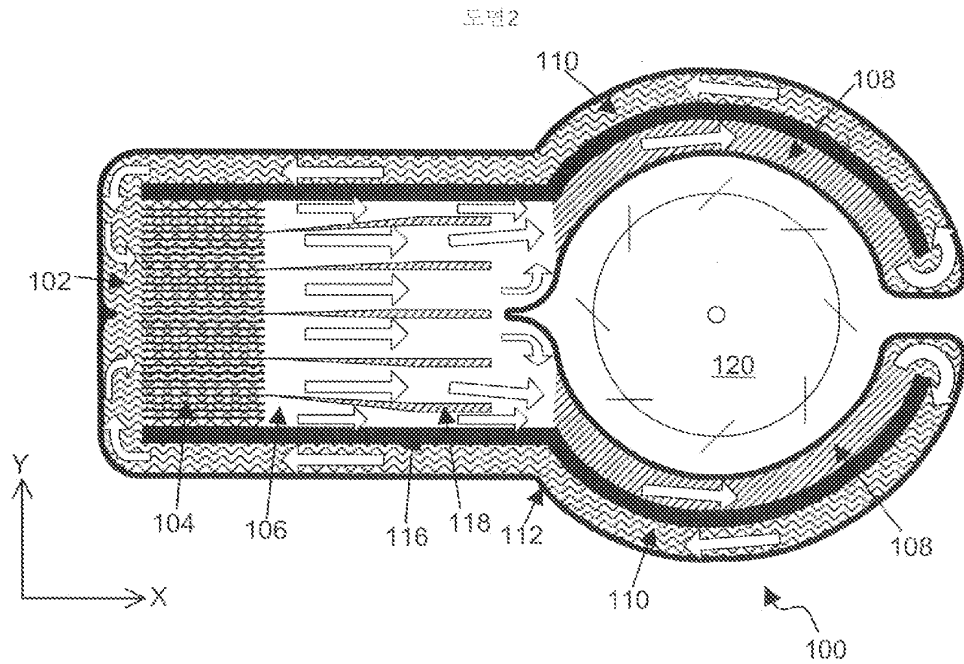
가-2) 상기 증발부와 인접하여 형성되되, 기화된 냉매가 상기 분기 부분의 반대 방향을 향하여 이동하는 기상 냉매 이동부;

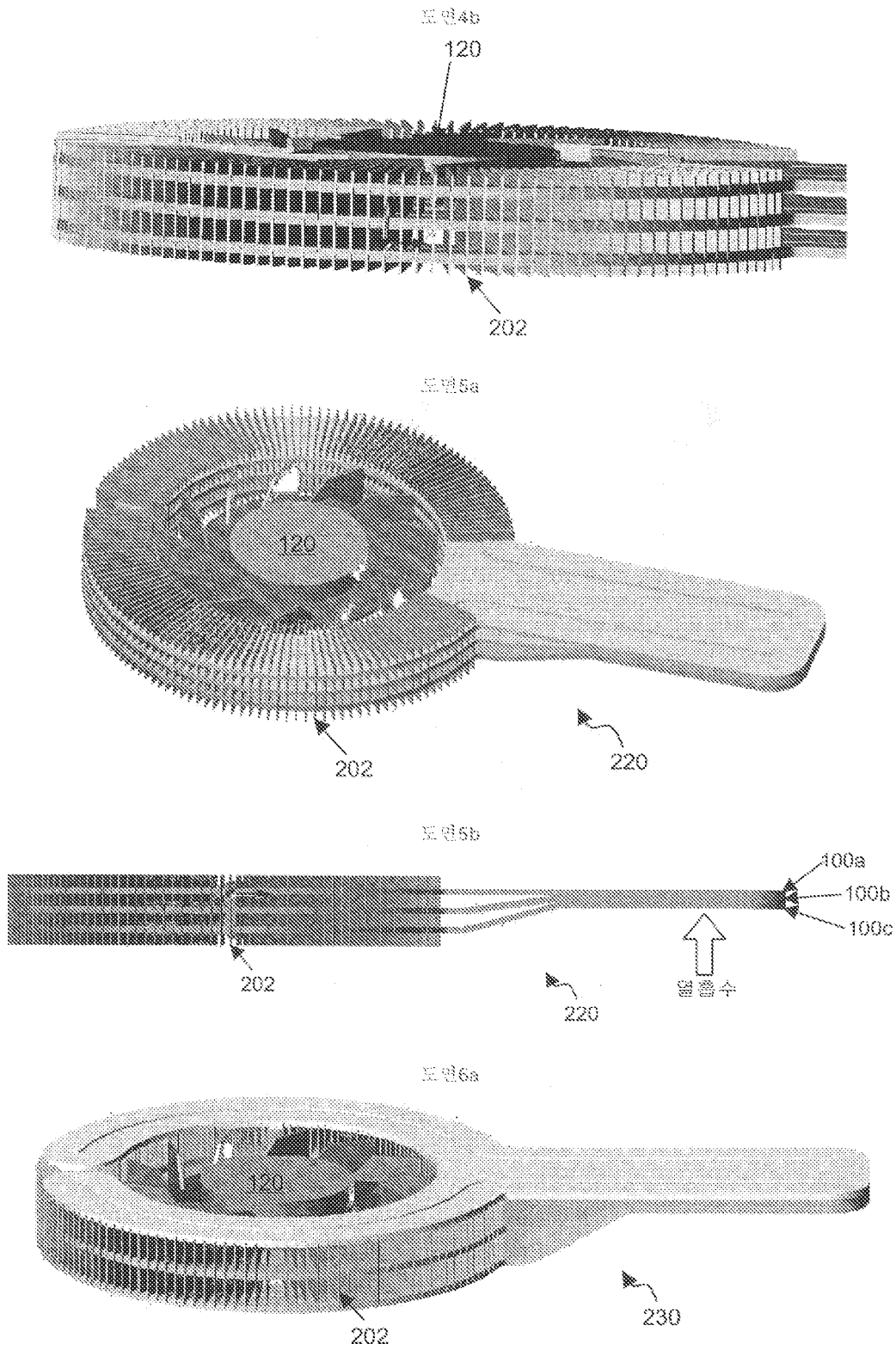
가-3) 상기 분기 부분에 인접한 영역에 형성되되, 상기 분기 부분의 적어도 일부를 형성하도록 성형되며, 상기 기상의 냉매가 일측으로 유입되어 응축되는 응축부; 및

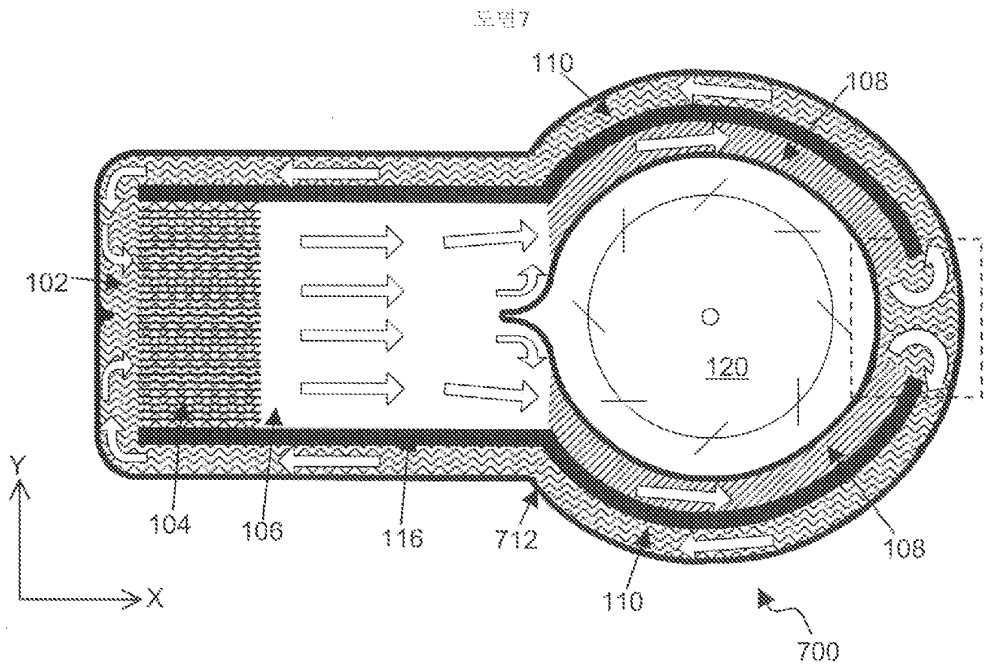
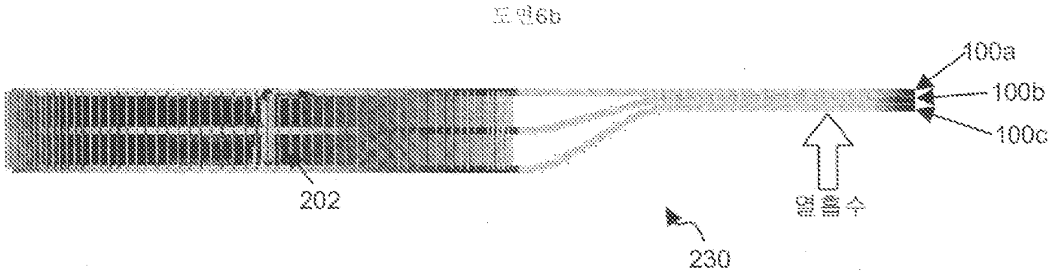
가-4) 상기 응축부와 인접하여 형성되되 상기 분기 부분의 적어도 일부를 형성하도록 성형되며, 상기 액상의 냉매가 상기 증발부를 향하여 이동하는 액상 냉매 이동부를 포함하는 하이브리드형 냉각 장치.

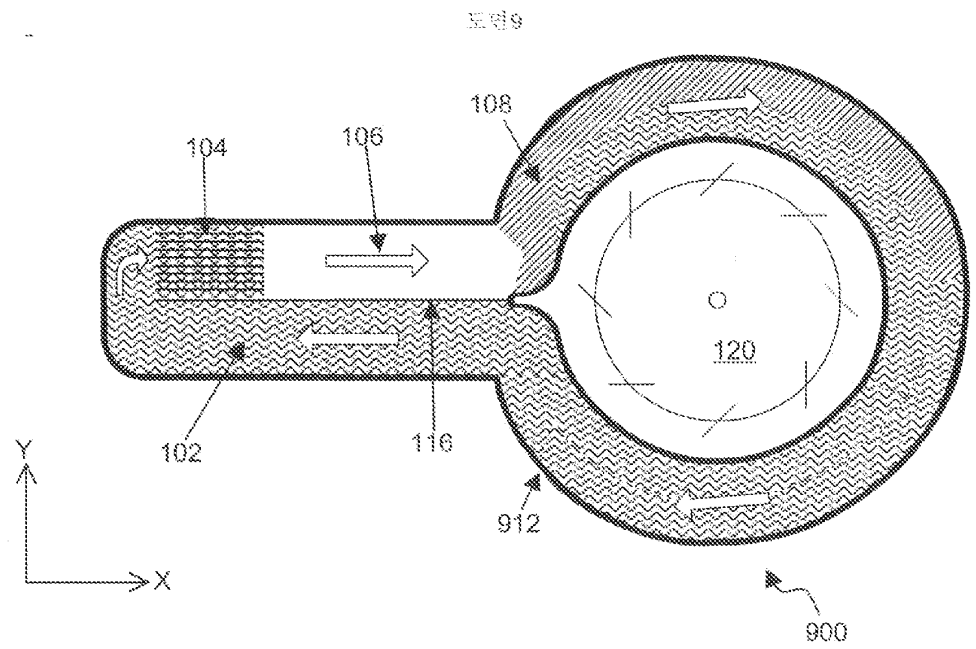
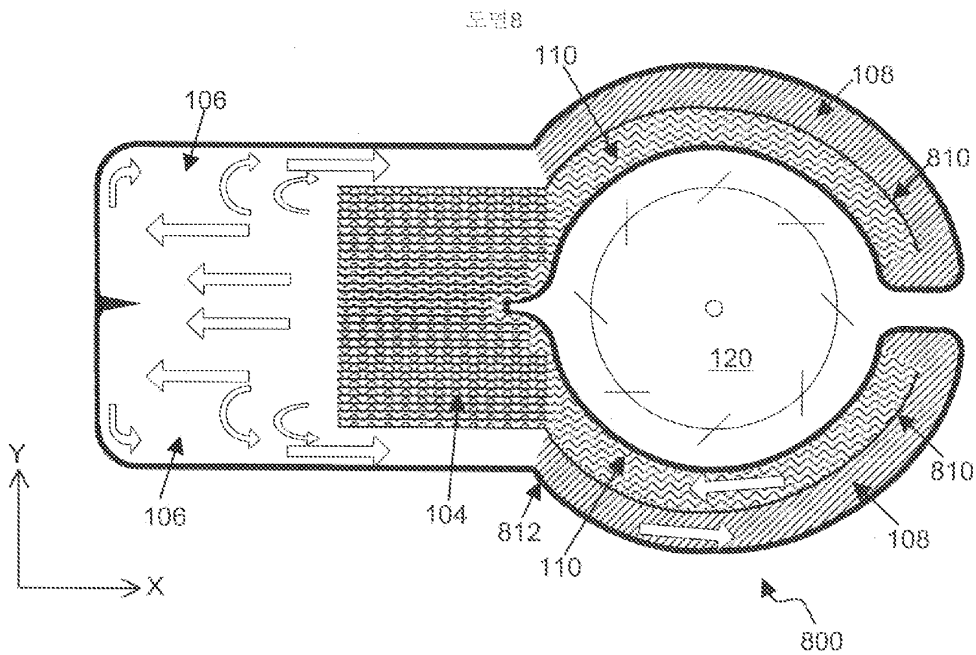
도면



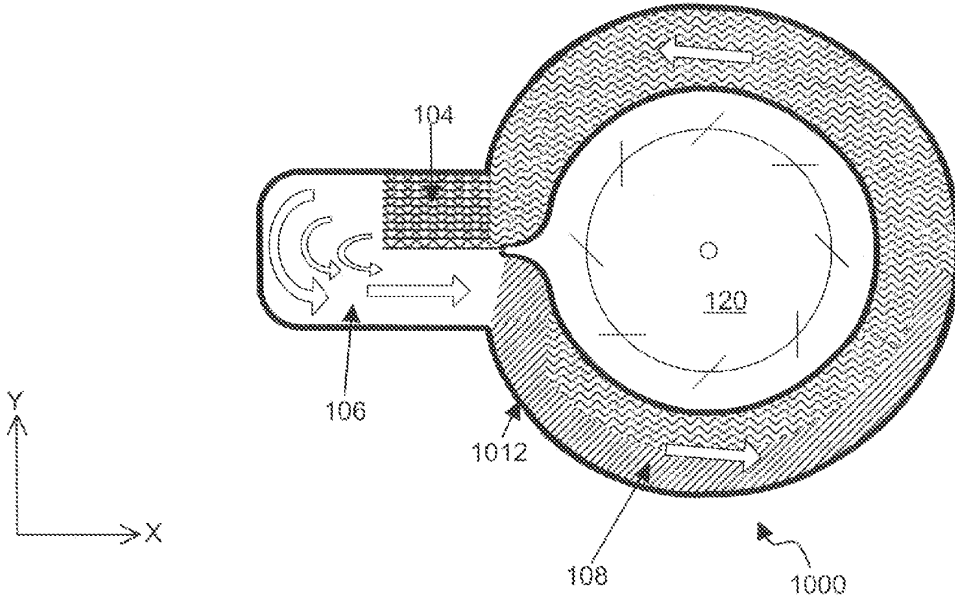




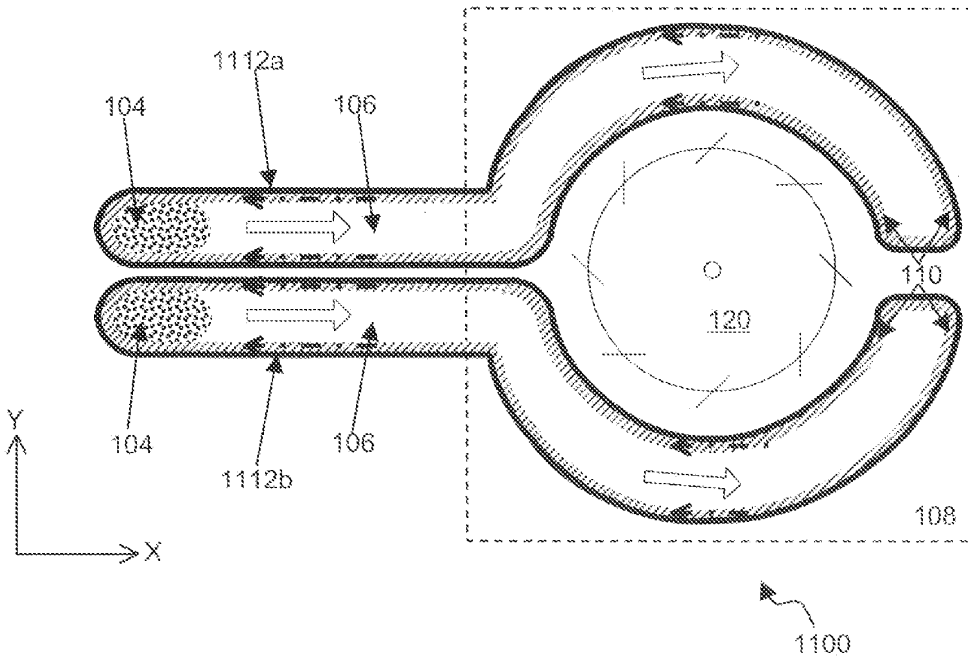


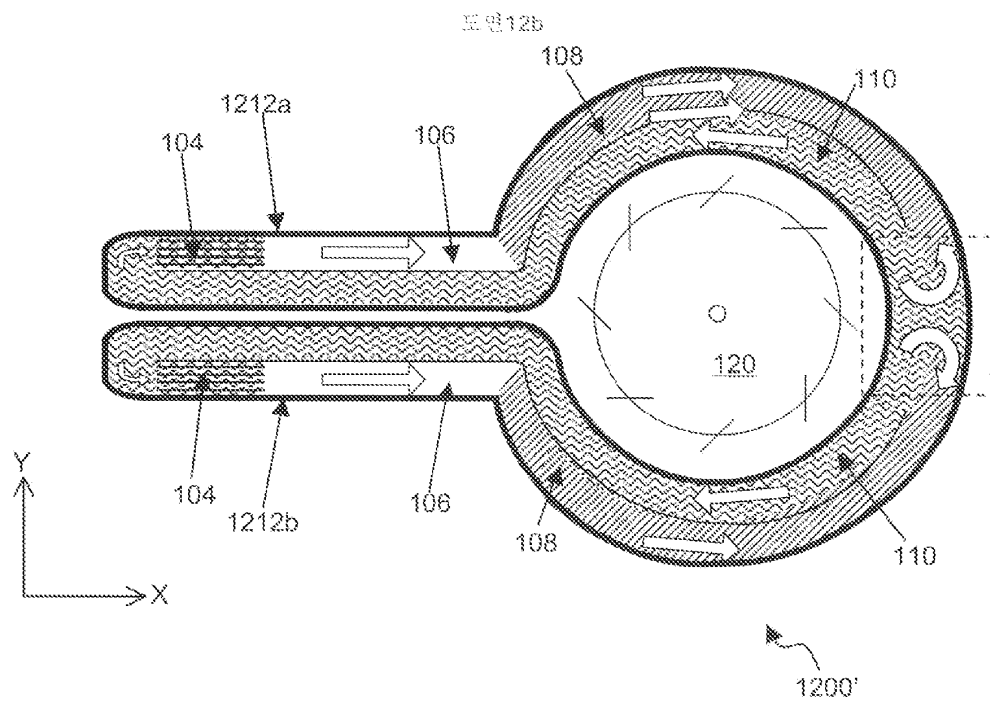
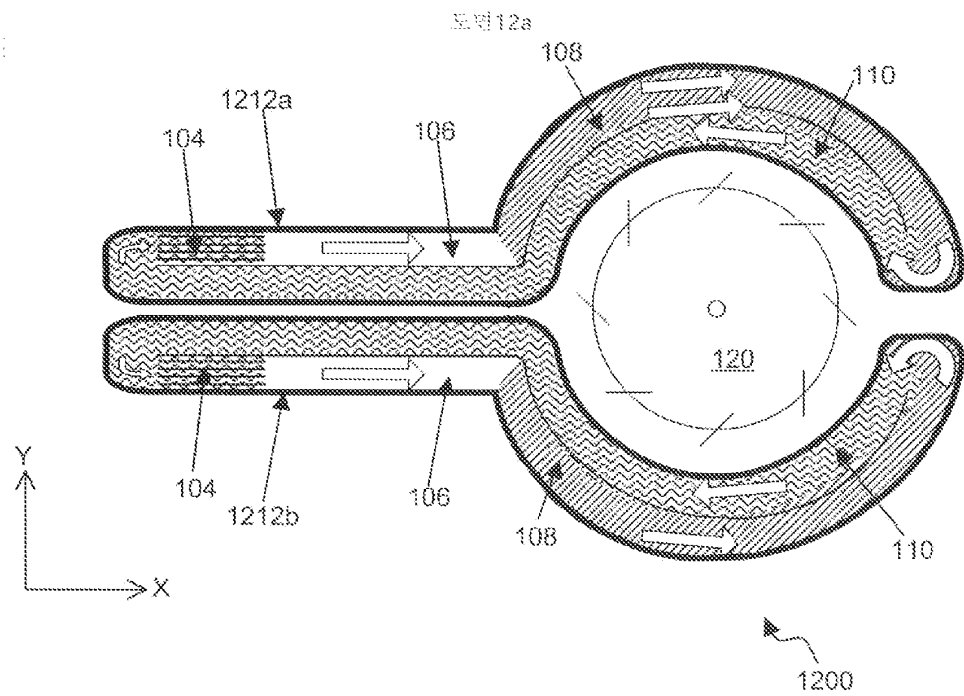


도면10

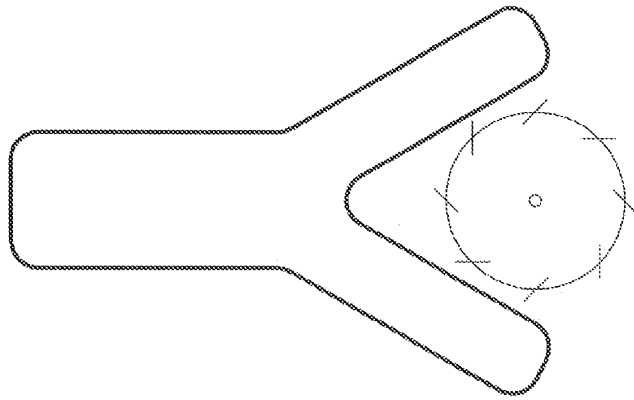


도면11

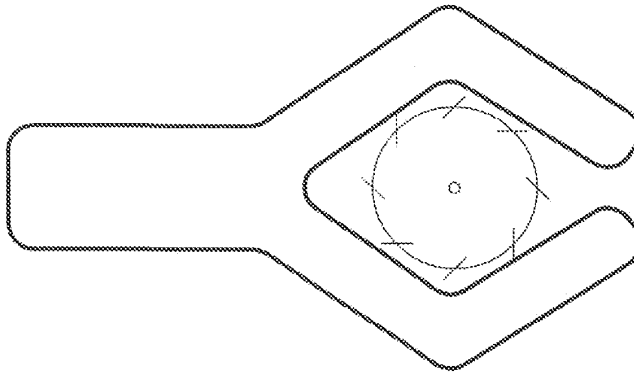




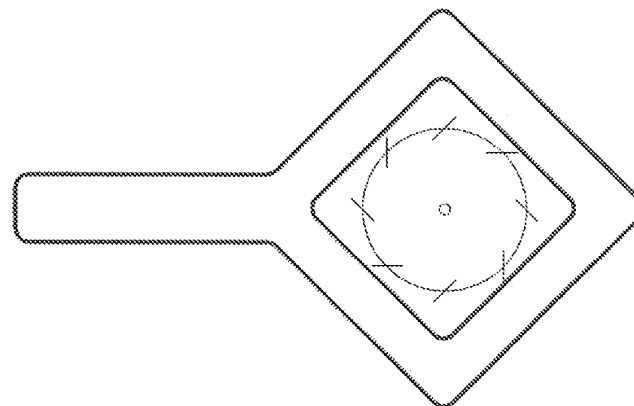
도면13a



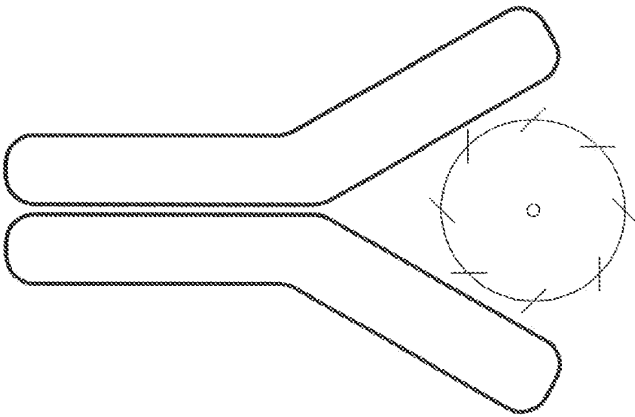
도면13b



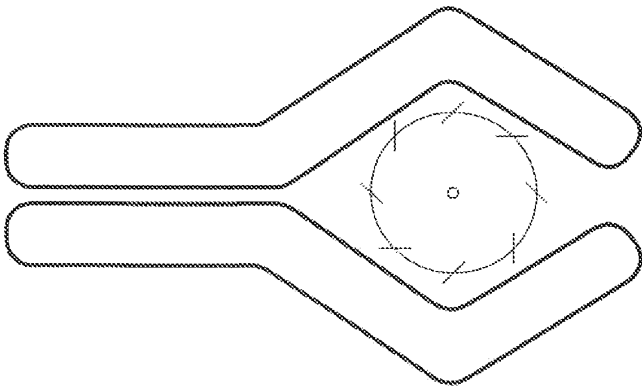
도면13c



도면13d



도면13e



도면13f

