



(51) International Patent Classification:  
**G06F 1/20** (2006.01) **G06F 1/16** (2006.01)  
**H05K 7/20** (2006.01)

(21) International Application Number:  
PCT/US2009/068663

(22) International Filing Date:  
25 January 2010 (25.01.2010)

(25) Filing Language: English

(26) Publication Language: English

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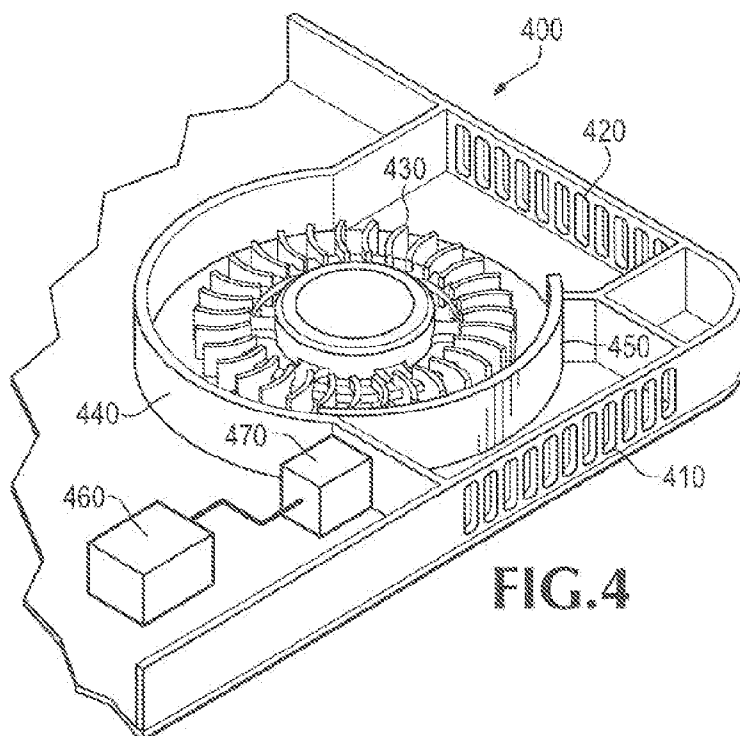
(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,  
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SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,  
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,  
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,  
TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: AUTOMATIC SHUTTER IN A MULTIPLE EXHAUST PORT DEVICE

(57) Abstract: A fan circulates air inside a device. A first exhaust port vents the circulated air out of the computing device. A second exhaust port also vents circulated air out of the computing device. A shutter automatically blocks one of the exhaust ports based on the physical orientation of the computing device.



**FIG. 4**



ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

— *as to applicant's entitlement to apply for and be granted  
a patent (Rule 4.17(ii))*

**Published:**

— *with international search report (Art. 21(3))*

**Declarations under Rule 4.17:**

— *as to the identity of the inventor (Rule 4.17(i))*

## AUTOMATIC SHUTTER IN A MULTIPLE EXHAUST PORT DEVICE

### BACKGROUND

[0001] Heated generated within a computing device is typically extracted via a heat exchanger and then vented out of a device exhaust port via a fan. A cool computing device typically runs more reliably and lasts longer than one that runs hot. Overheating of the internal components in a computing device can lead to data loss or even damage to the computing device itself.

### BRIEF DESCRIPTION OF DRAWINGS

[0002] The following description includes discussion of figures having illustrations given by way of example of implementations of embodiments of the invention.

[0003] **Figure 1** is a diagram illustrating a computing device according to various embodiments.

[0004] **Figure 2** is a sectional diagram illustrating an apparatus according to various embodiments.

[0005] **Figure 3** is a sectional diagram illustrating an apparatus according to various embodiments.

[0006] **Figure 4** is a sectional diagram illustrating an apparatus device according to various embodiments.

[0007] **Figure 5** is a flow diagram of operation in a system according to various embodiments.

[0008] **Figure 6** is a flow diagram of operation in a system according to various embodiments.

#### **DETAILED DESCRIPTION**

[0009] When a user holds a portable computing device (e.g., a tablet or slate style notebook), the user can position the device in many different physical orientations (e.g., landscape mode, portrait mode, etc.). Frequently, one side of the computing device rests against or is facing the user's body. Depending on the orientation of the device, the thermal exhaust port on the device may become blocked or it may direct exhaust directly towards the user. As mentioned above, overheating of the internal components in a computing device can lead to data loss or even damage to computing device itself.

[0010] In various embodiments described herein, a portable computing device is endowed with multiple thermal exhaust ports. A shutter included in the fan housing of the computing device automatically rotates to block one of the thermal exhaust ports based on the physical orientation of the device.

The shutter is designed to automatically block an exhaust port that is orientated downward (i.e., towards the ground). Indeed, an exhaust port on the downward-facing side of a computing device is prone to becoming blocked inasmuch as this side frequently rests against something (e.g., a user, furniture, etc.).

[0011] Coinciding with the blocking of one thermal exhaust port, the shutter opens a different thermal exhaust port (e.g., one that faces away from the user or object in contact with the computing device). Thus, for example, when the orientation of the computing device is changed (e.g., from portrait mode to landscape mode), the shutter automatically blocks the exhaust port facing the user while opening the exhaust port facing away from the user.

[0012] **Figure 1** is a block diagram illustrating a computing device according to various embodiments. Device 100 can be any type of computing device that is susceptible to changes in orientation and has components to vent heat out of the device. In various embodiments, device 100 could be a tablet or slate-style computer, a notebook computer, a handheld device, or other portable computing device. While it is readily understood that portable computing devices are susceptible to changes in orientation, other computing devices (e.g., desktops, workstations, etc.) could also be subjected to changes in orientation. For example, a desktop box might be configurable to sit upright or lay on its side. Thus, in certain embodiments, device 100 could be a desktop computer, a workstation or the like.

[0013] From the perspective of a user facing (e.g., while holding) the display screen 102 of device 100, **Figure 1** shows exhaust port 110 facing downward (i.e., towards the ground) while exhaust port 120 is facing sideways (i.e., to the right from the perspective of the user facing device 100). Thus, any heat vented out of exhaust port 120 would be directed substantially away from the user facing device 100. When device 100, as shown in a portrait orientation, is rotated to a landscape orientation (e.g., rotated 90 degrees clockwise), exhaust port 120 would then be facing downward (i.e., towards the ground) while exhaust port 110 is facing sideways (i.e., to the left from the perspective of the user facing device 100).

[0014] As described in more detail below, a shutter mechanism inside device 100 moves to block either exhaust port 110 or exhaust port 120 based on the orientation of device 100.

[0015] In the various embodiments described herein, the exhaust ports and/or outlets may be configured differently than shown in **Figs. 1-4**. For example, exhaust ports and/or outlets may have more slits, fewer slits, or other suitable openings that allow air to be exhausted and/or vented out of a computing device.

[0016] **Figure 2** illustrates a sectional view of computing device according to various embodiments. In particular, **Fig. 2** shows a computing device 200 similar to device 100 of **Fig. 1**, but with the front cover (including the display screen) of the device removed. Device 200 also includes multiple exhaust

ports (210, 220). Alternate embodiments may have a different number of exhaust ports.

[0017] In various embodiments, device 200 may include a heat exchanger 240 to transfer heat to the fan housing area of device 200. Fan 230 circulates air inside device 200. In many cases, including those where heat exchanger 240 is used, the air circulated by fan 230 may be heated air. Exhaust ports 210 and 220 vent the circulated air out of device 200. Thus, the combination of heat exchanger 240, fan 230 and exhaust ports 210 and 220 vent air (e.g., heated air) out of device 200.

[0018] In various embodiments, a gravity shutter 250 rotates around fan 210 using the same axis as fan 210. In alternate embodiments, gravity shutter 250 could rotate around a different axis than fan 210. As the name implies, gravity shutter 250 moves (e.g., rotates) based on gravity. Gravitational force pulls gravity shutter 250 downward in view of changing device orientation. For example, if exhaust port 210 is oriented downward (i.e., towards the ground), then gravity shutter 250 automatically rotates to block exhaust port 210. Concurrently, the blocking of exhaust port 210 causes exhaust port 220 to become unblocked. Thus, heat may be vented out of device 200 through exhaust port 220 when exhaust port is oriented downward and is blocked by shutter 250. Similarly, if a user is holding device 200 with exhaust port 220 oriented downward (e.g., towards the ground and/or against the user's lap), then gravity causes shutter 250 to

move such that it blocks exhaust port 220, which concurrently opens exhaust port 210, again allowing heat to be vented in a direction away from the user.

[0019] **Figure 3** illustrates a sectional view of another computer device according to various embodiments. In particular, the components of device 300 are similar to those of device 200 (**Fig. 2**) but with the addition of a spring mechanism 360. In various embodiments, gravity shutter may move in both directions based on gravity while spring mechanism 360 (e.g., whose force is smaller than the force of gravity on the shutter) pushes the shutter 350 in a particular direction when the gravity force is not being applied (e.g., when device 300 is laid on a flat surface such as a desk or table). In other embodiments, shutter 350 may move in a single direction based on the force of gravity while moving in the other direction based on the force of spring mechanism 360. While spring mechanism 360 is shown as a coil spring, other suitable types of springs and/or spring-like mechanism could be used in different embodiments.

[0020] **Figure 4** illustrates a sectional view of a computing device according to various embodiments. While the venting components are similar to those of **Figs. 2-3**, device 400 includes an accelerometer 460 and a switch 470. Accelerometer 460 detects magnitude and direction of acceleration of device 400 to sense (at least) orientation of device 400. Accelerometer sends signals to switch 470 based on the orientation of device 400 to cause

switch 470 to move shutter 450. Thus, based on the orientation of device 400, shutter 450 moves to block either exhaust port 410 or exhaust port 420.

[0021] In various embodiments, the shutter (e.g., shutter 450) may move in some manner other than by rotating around an axis. For example, a separate shutter could be placed between the fan and each exhaust port where the shutter is a hinged panel that flips up and down based on switch control, gravity, etc. Any other suitable shutter mechanism (or combination of shutter mechanisms) could be used to block exhaust ports based the orientation of the computing device.

[0022] **Figure 5** is a flow diagram of operation in a system according to various embodiments. Based on an orientation of a computing device, the device automatically closes 510 one of multiple heat exhaust outlets. For example, a computing device might have two heat exhaust outlets. Thus, depending on the orientation of the device, one of the two outlets is automatically closed. In various embodiments, at least one outlet remains open. The exhaust outlet may be automatically closed based on a gravitational or other force (e.g., spring force, etc.) applied to a shutter or other outlet-blocking mechanism. The device ventilates 520 heat through an open exhaust outlet. Heat may be ventilated, for example, via a fan or other suitable mechanism for moving air out of the device.

[0023] **Figure 6** is a flow diagram of operation in a system according to various embodiments. A computing device detects 610 a change in device

orientation. In certain embodiments, orientation is detected by an accelerometer (e.g., single-axis, multi-axis, etc.) or similar mechanism. Based on the detected change in device orientation, the computing device drives 620 a switch to close at least one exhaust outlet. In various embodiments, the computing device detects 630 another (i.e., second) change in device orientation that causes the device to drive 640 a switch to open the exhaust outlet that was previously closed by the switch. In certain embodiments, the closing of one exhaust outlet simultaneously opens a different exhaust outlet and vice-versa.

**CLAIMS**

1. An apparatus for venting air from a computing device, the apparatus comprising:
  - a fan to circulate air inside the computing device;
  - a first exhaust port to vent the circulated air out of the computing device;
  - a second exhaust port to vent the circulated air out of the computing device;
  - and
  - a shutter to automatically block one of the exhaust ports based on a physical orientation of the computing device.
2. The apparatus of claim 1, wherein the fan is rotatable around an axis and the shutter is independently rotatable around the axis.
3. The apparatus of claim 2, wherein the shutter is rotatable in a first direction around the axis by a gravitational force.
4. The apparatus of claim 3, further comprising:
  - a spring mechanism having a spring force to rotate the shutter in a second direction around the axis, wherein the spring force is less than the gravitational force.
5. The apparatus of claim 1, further comprising:
  - an accelerometer to detect a change in orientation of the computing device;
  - and

a switch to move the shutter to block one of the exhaust ports in response to a notification from the accelerometer of the change in orientation of the computing device.

6. A method, comprising:

automatically closing one of multiple heat exhaust outlets on a computing device based at least on an orientation of the computing device; and

ventilating heat out of the computing device through an open heat exhaust outlet.

7. The method of claim 6, wherein the automatic closing further comprises:

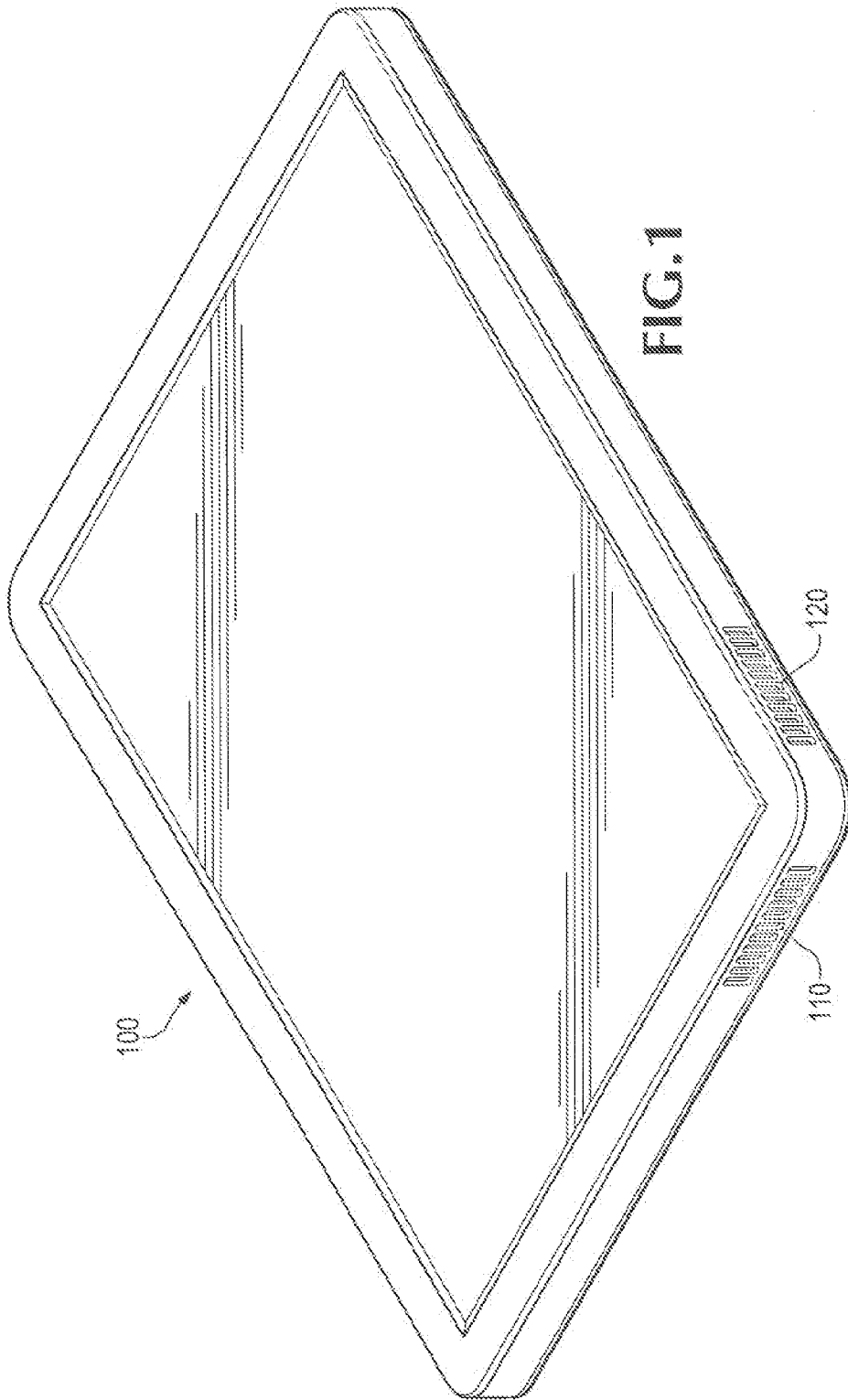
detecting, by a sensor, a first change in orientation of the computing device; and

driving a switch to close one of the multiple heat exhaust outlets in response to detecting the change in orientation.

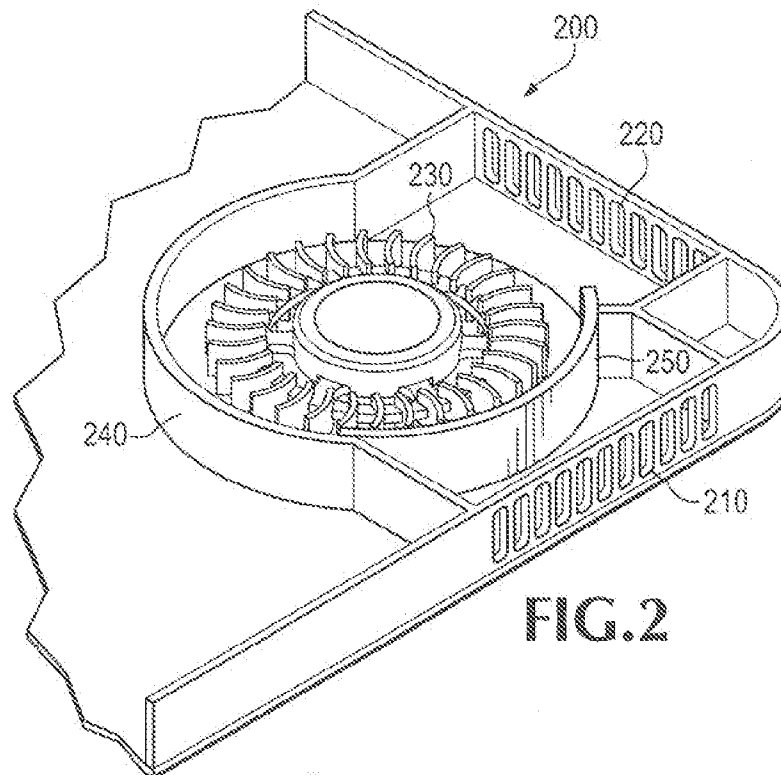
8. The method of claim 7, further comprising:

driving the switch to open a closed heat exhaust outlet in response to detecting a second change in orientation of the computing device.

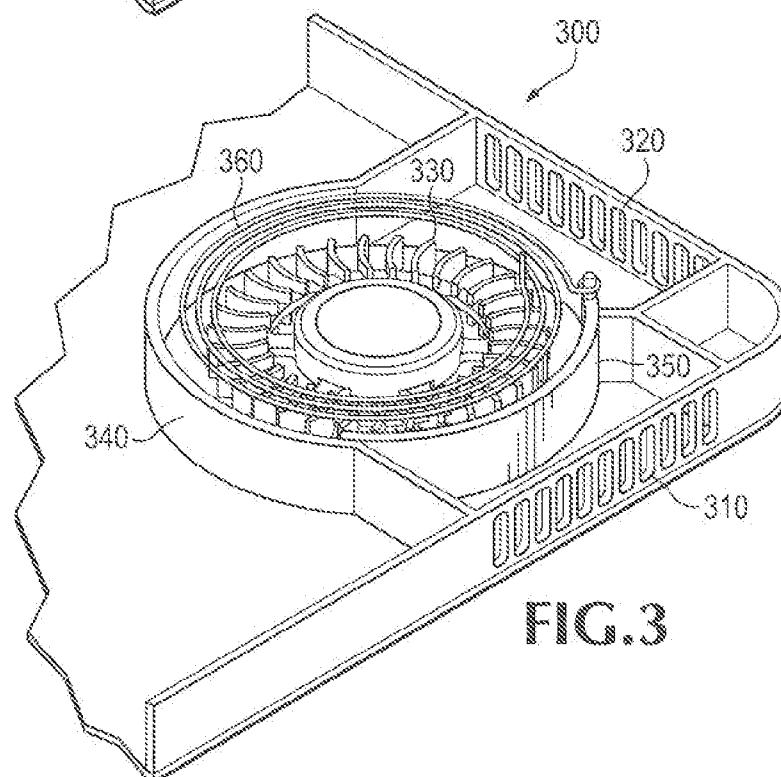
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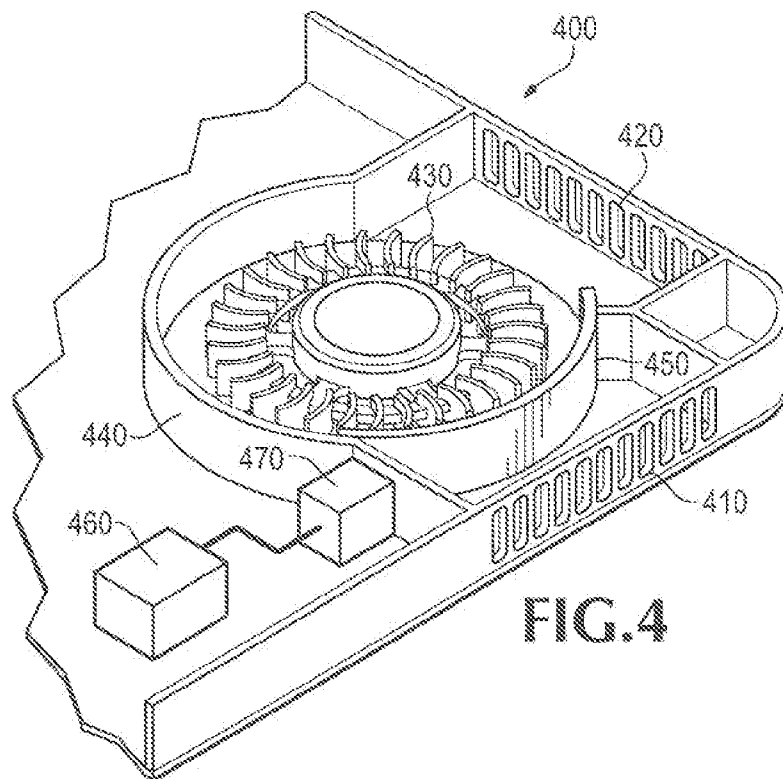


**FIG. 2**



**FIG. 3**

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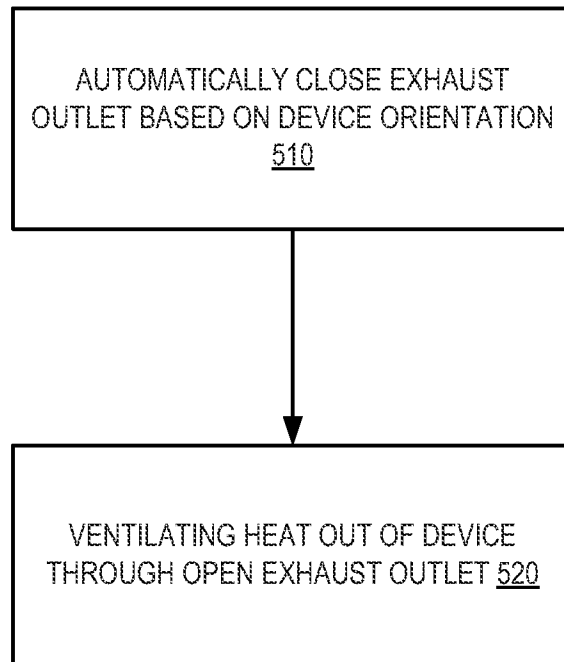


FIG. 5

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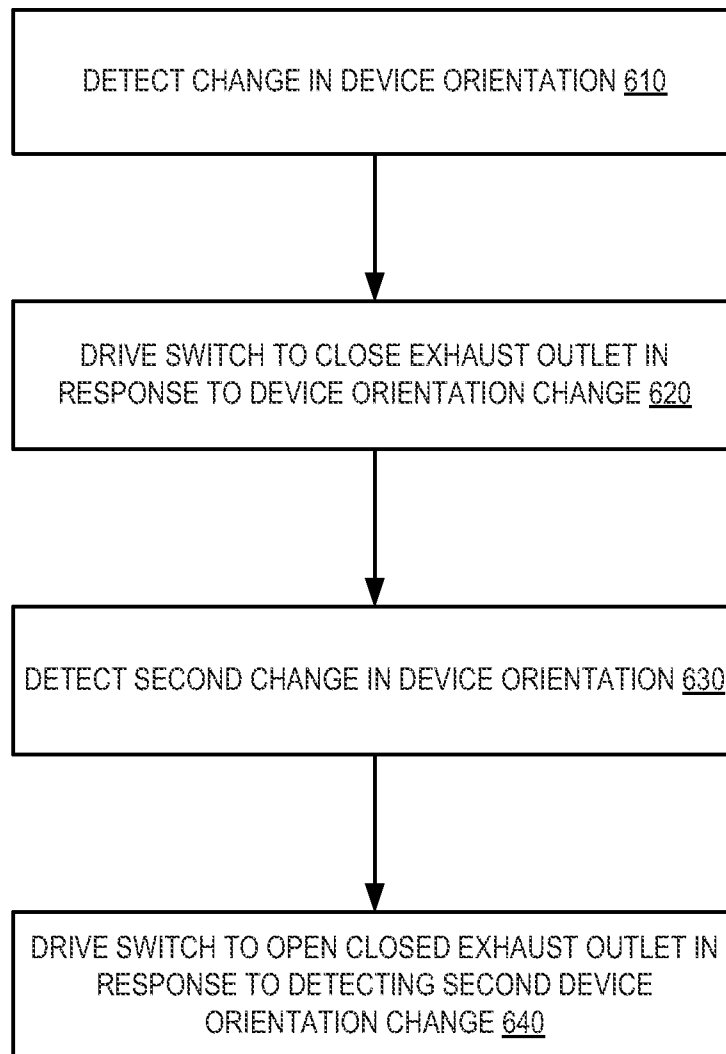


FIG. 6

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2009/068663****A. CLASSIFICATION OF SUBJECT MATTER****G06F 1/20(2006.01)i, H05K 7/20(2006.01)i, G06F 1/16(2006.01)i**

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

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

G06F 1/20; F25D 23/12

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: fan, cooling, vent, air, shutter, exhaust port

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                             | Relevant to claim No. |
|-----------|----------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | EP 0898220 A1 (HEWLETT-PACKARD COMPANY) 24 February 1999<br>See abstract, paragraphs [7]-[14], and claims 1-8. | 1-8                   |
| A         | US 20040109288 A1 (BEITELMAL, A. H. et al.) 10 June 2004<br>See abstract, figures 2A-3B, and claims 1-41.      | 1-8                   |
| A         | US 20040228085 A1 (CHEN, Y. et al.) 18 November 2004<br>See abstract, figures 3-5, and claims 1-6.             | 1-8                   |



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

15 OCTOBER 2010 (15.10.2010)

Date of mailing of the international search report

**20 OCTOBER 2010 (20.10.2010)**

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Facsimile No. 82-42-472-7140

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Telephone No. 82-42-481-8371



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2009/068663**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| EP 0898220 A1                             | 24.02.1999          | US 06088223A A             | 11.07.2000          |
| US 20040109288 A1                         | 10.06.2004          | None                       |                     |
| US 20040228085 A1                         | 18.11.2004          | GB 2402812 A               | 15.12.2004          |