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(54) **OFFSET WINDOW MOUNT EVAPORATIVE COOLER**

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(52) **U.S. Cl.**

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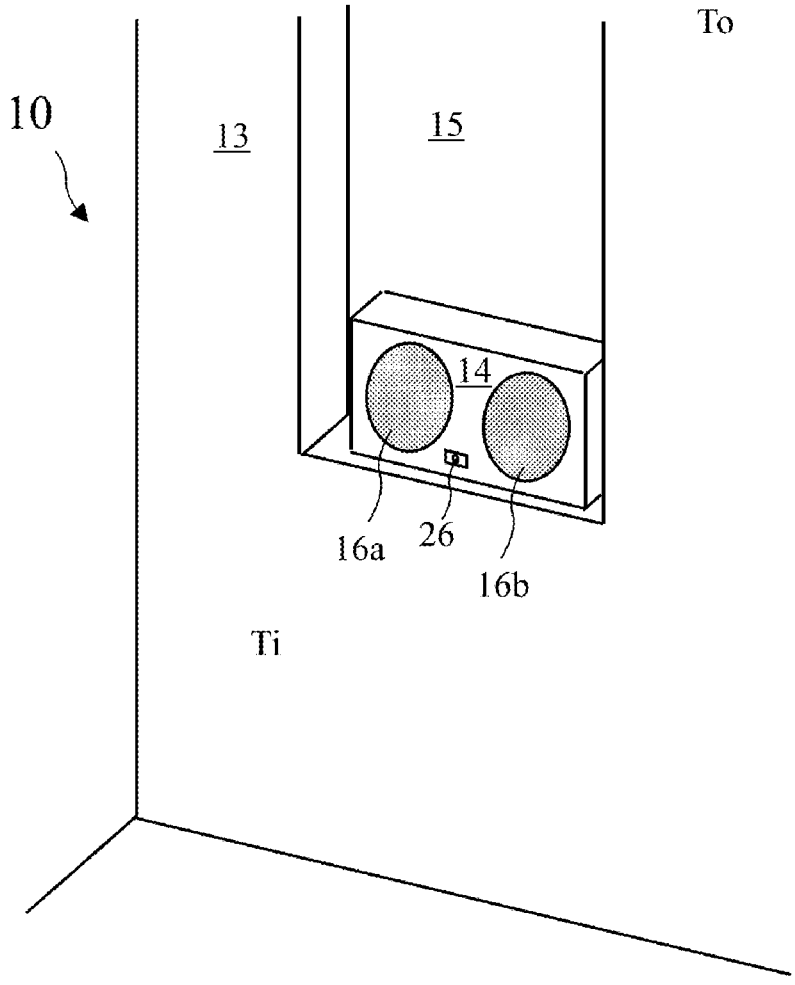
(57) **ABSTRACT**

An offset window mount fan unit includes two or more independently controlled fans controllable to move air in the same direction or in opposite directions. A housing substantially offsets the fans from a direct passage of air into the room. In one embodiment, the fans are mounted in a housing perpendicular to the window, air traveling through the fans turning 90 degrees to pass through the plane of the window and 90 degrees down into the room. Each fan includes a temperature sensor to measure temperature of air moving through each fan. The fans are energized periodically for a short time period to make accurate temperature measurements. When the combined temperature measurements indicate an advantage from fan operation, the fans are activated. An evaporative cooling section may be attached to an outside portion of the unit to provide additional cooling.



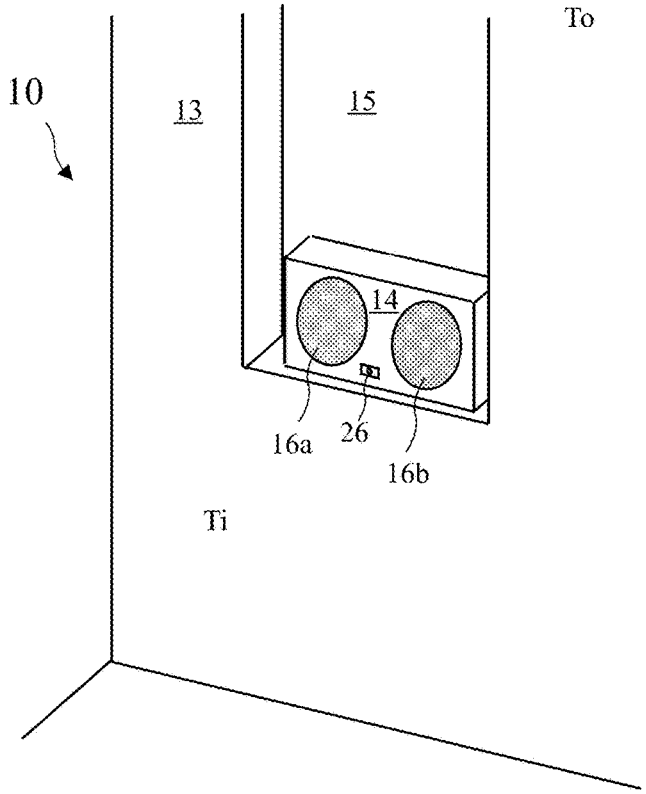


FIG. 1A

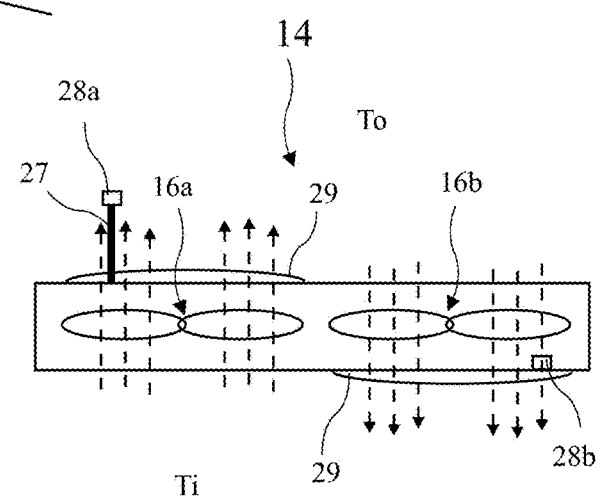


FIG. 1B

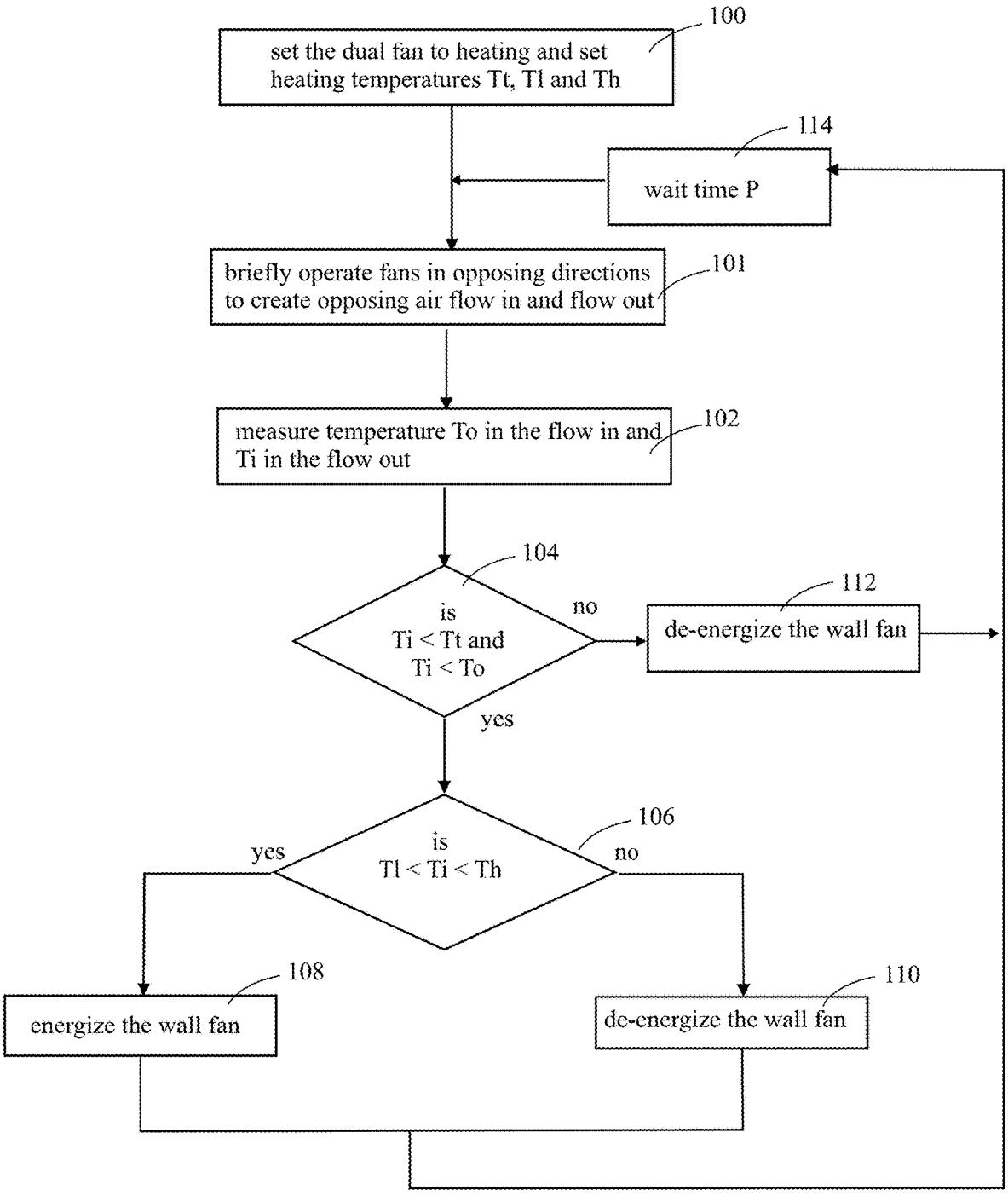

100
set the dual fan to heating and set heating temperatures Tt, Tl and Th
114
wait time P
101
briefly operate fans in opposing directions to create opposing air flow in and flow out
102
measure temperature To in the flow in and Ti in the flow out
104
is Ti < Tt and Ti < To
no
112
de-energize the wall fan
yes
106
is Tl < Ti < Th
yes
no
108
energize the wall fan
110
de-energize the wall fan

FIG. 2

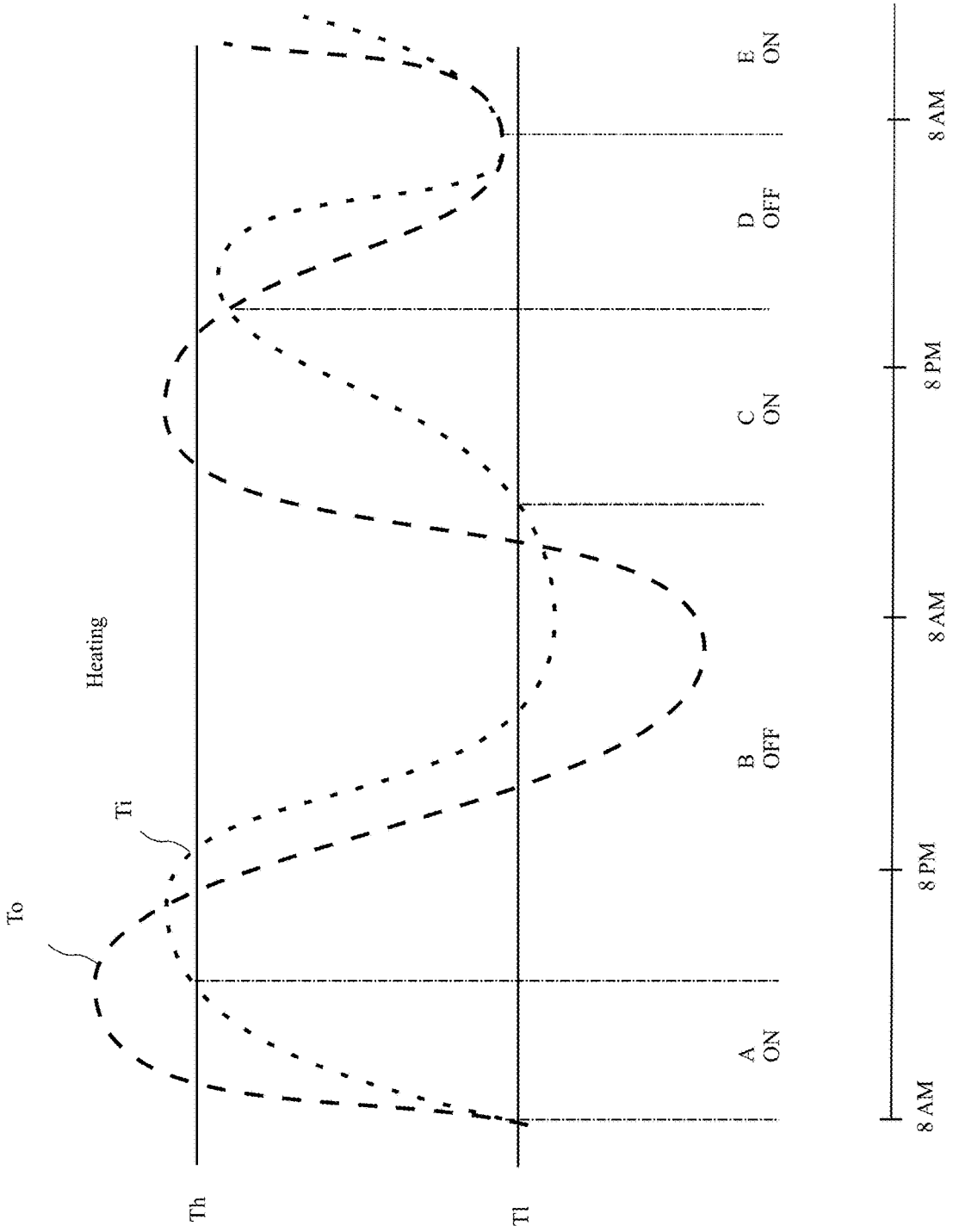


FIG. 3

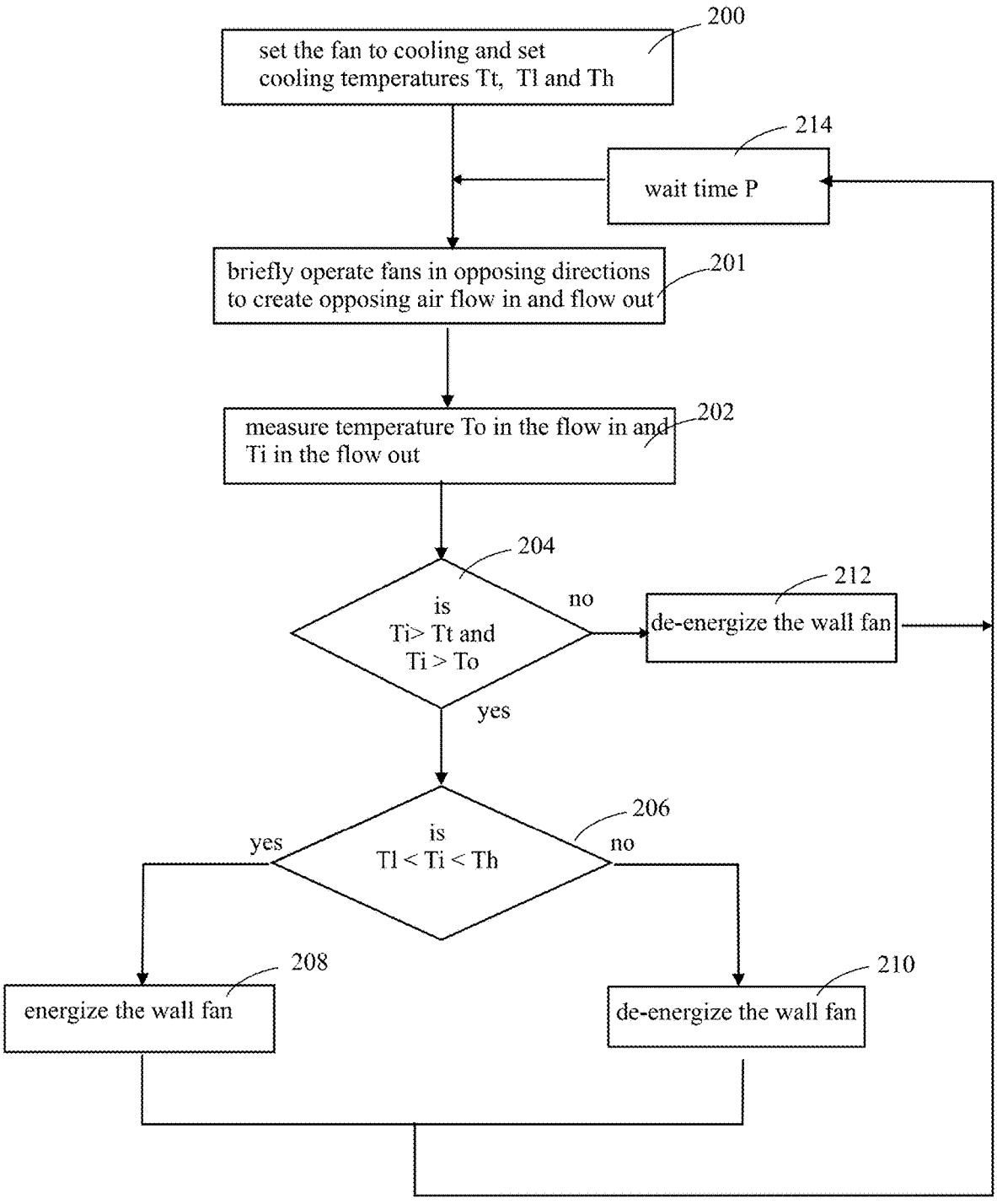

200
set the fan to cooling and set cooling temperatures Tt, Tl and Th
214
wait time P
201
briefly operate fans in opposing directions to create opposing air flow in and flow out
202
measure temperature To in the flow in and Ti in the flow out
204
is Ti> Tt and Ti > To
no
212
de-energize the wall fan
yes
206
is Tl < Ti < Th
yes
no
208
energize the wall fan
210
de-energize the wall fan

FIG. 4

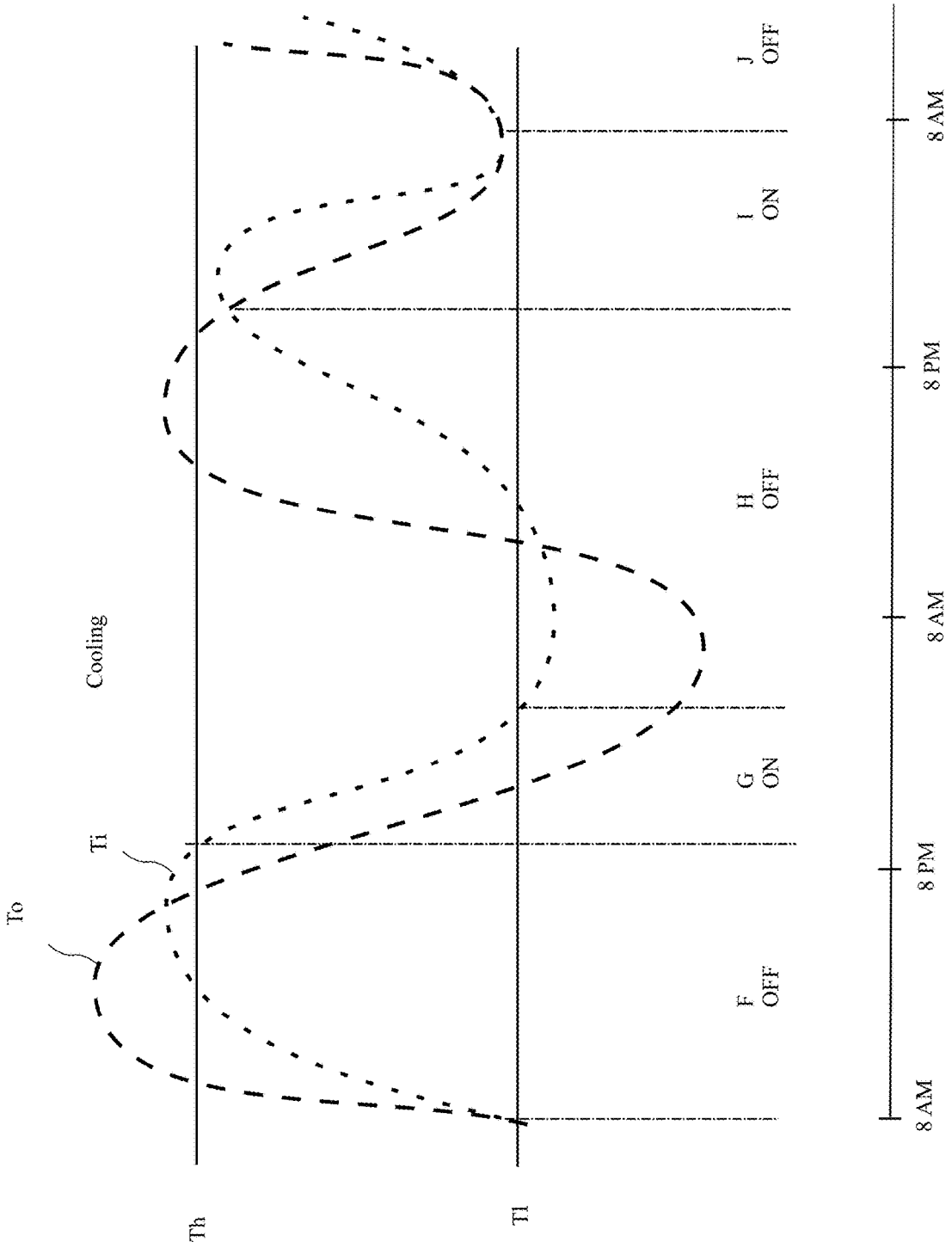


FIG. 5

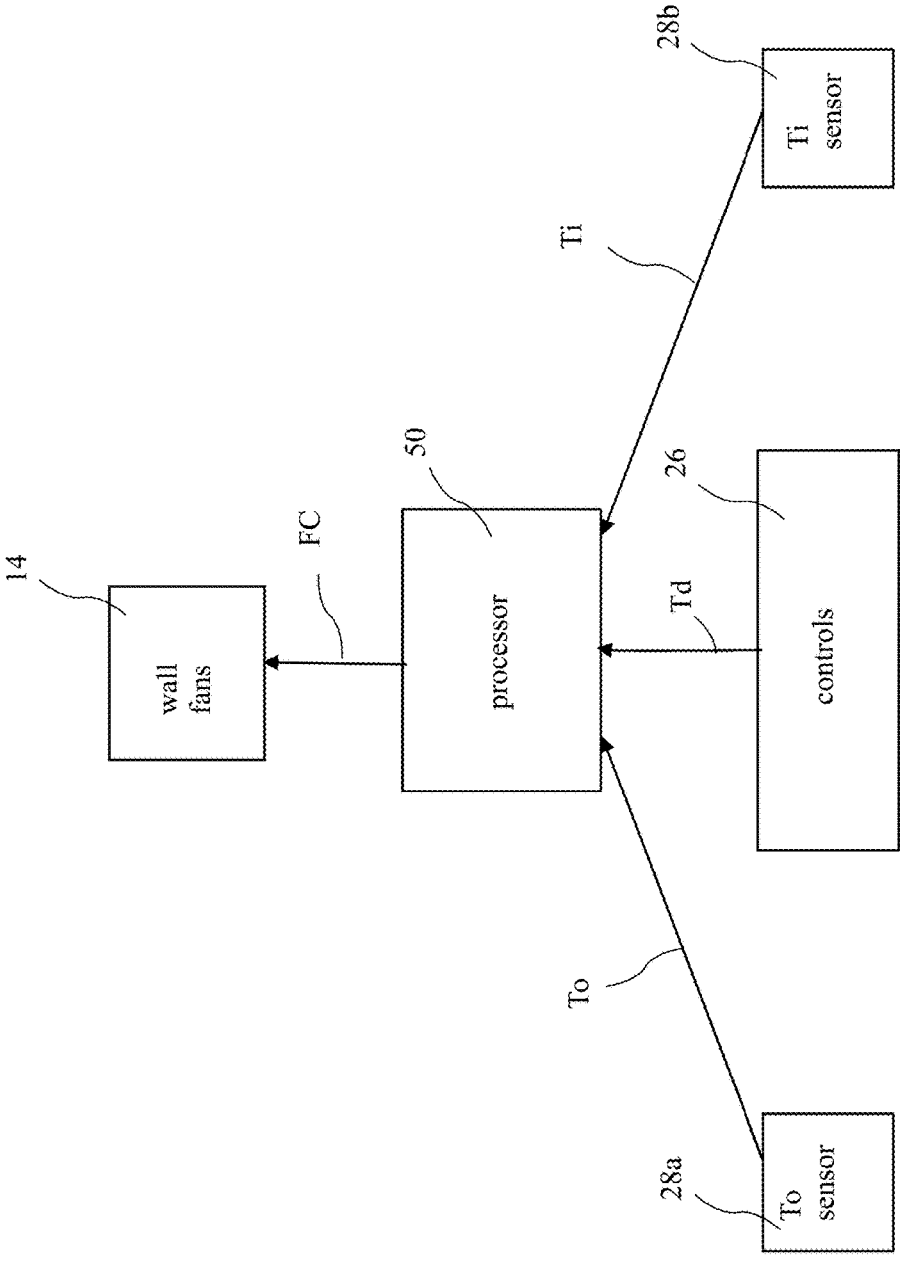

14
wall fans
FC
50
processor
Ti
28b
Ti sensor
26
controls
Td
To
28a
To sensor

FIG. 6

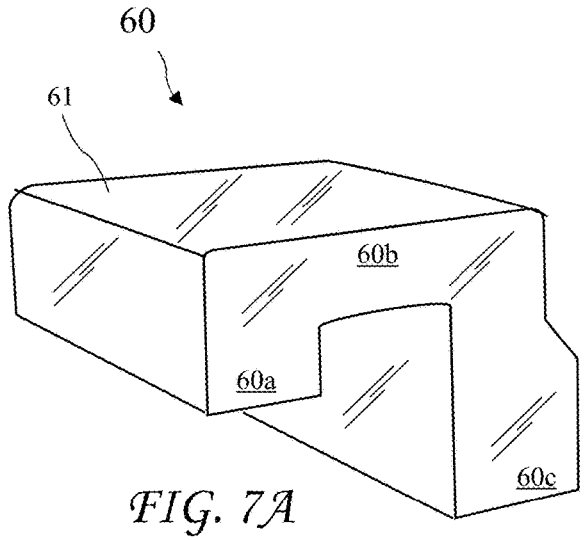


FIG. 7A

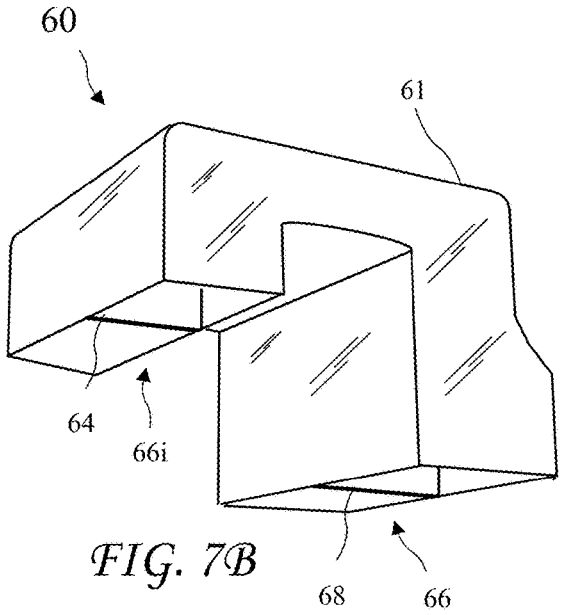


FIG. 7B

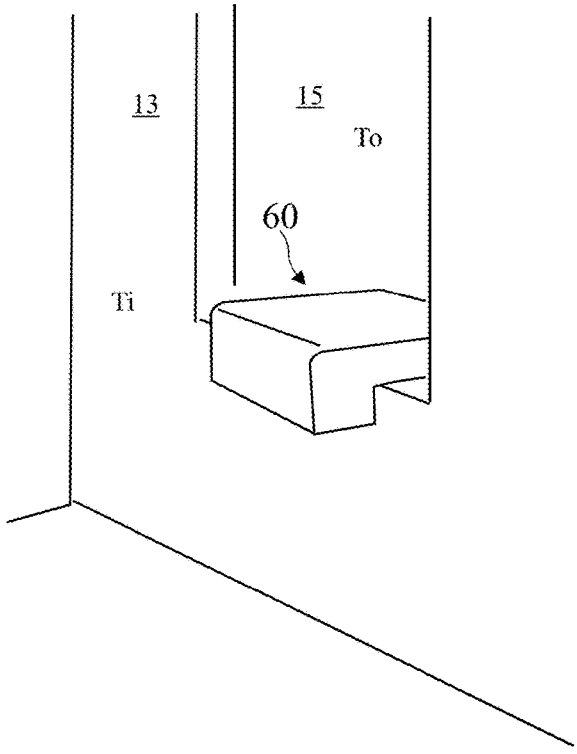


FIG. 8

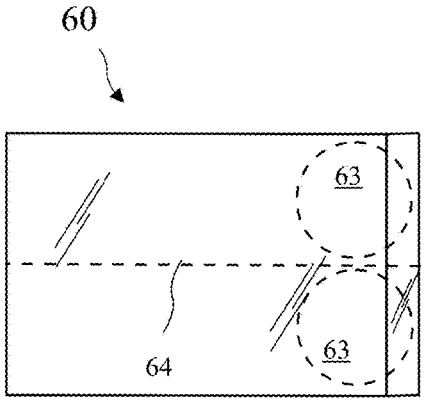


FIG. 9B

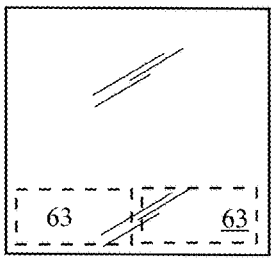


FIG. 9D

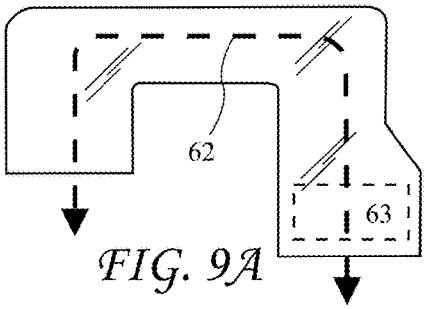


FIG. 9A

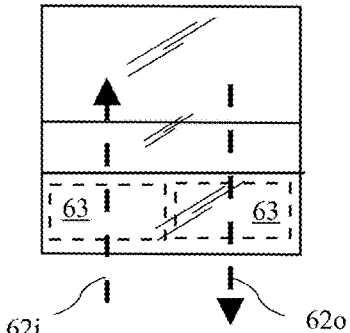


FIG. 9E

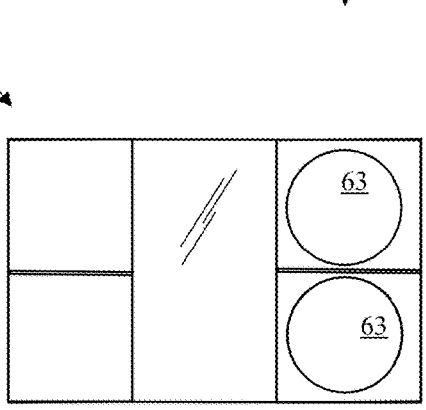


FIG. 9C

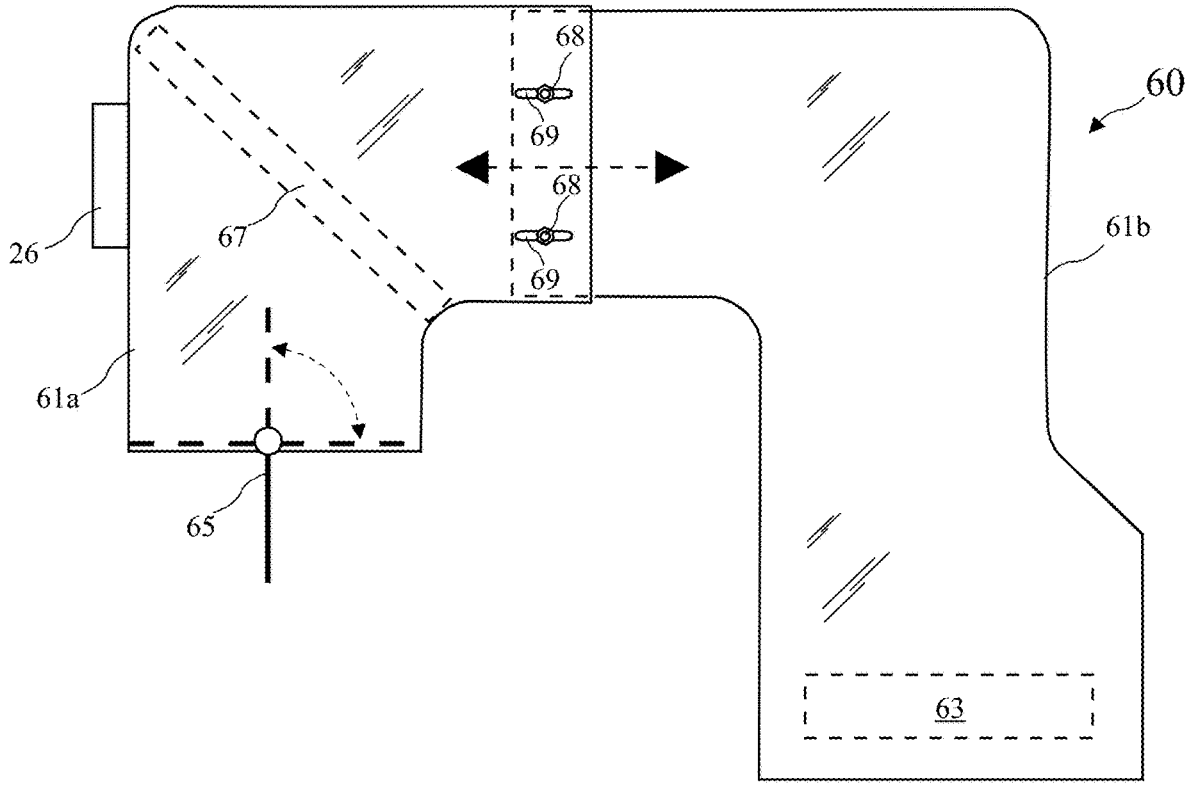


FIG. 10

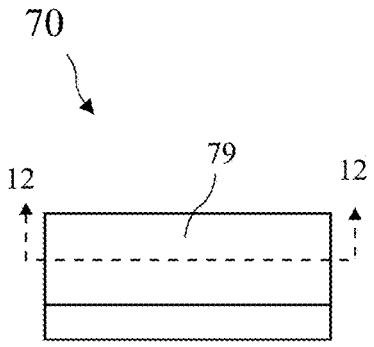


FIG. 11B

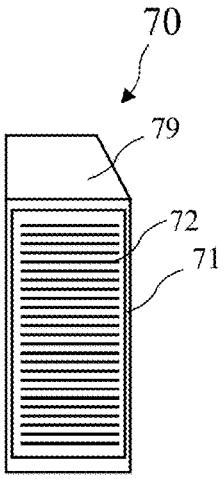


FIG. 11D

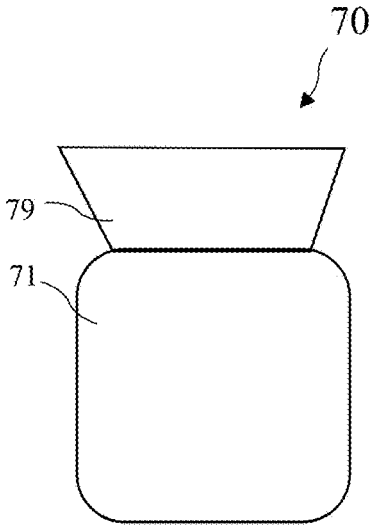


FIG. 11A

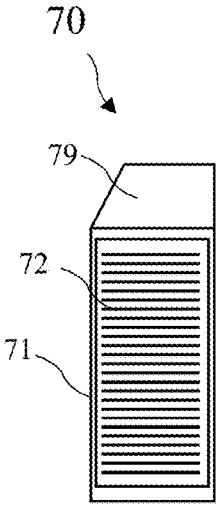


FIG. 11E

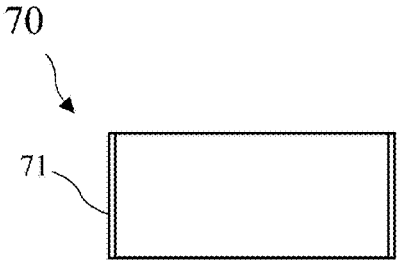


FIG. 11C

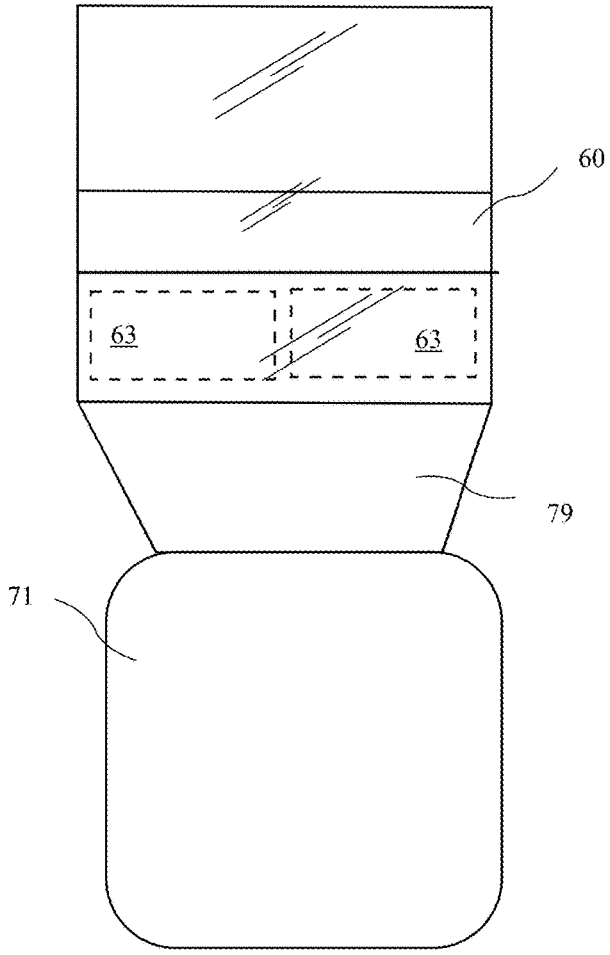


FIG. 12A

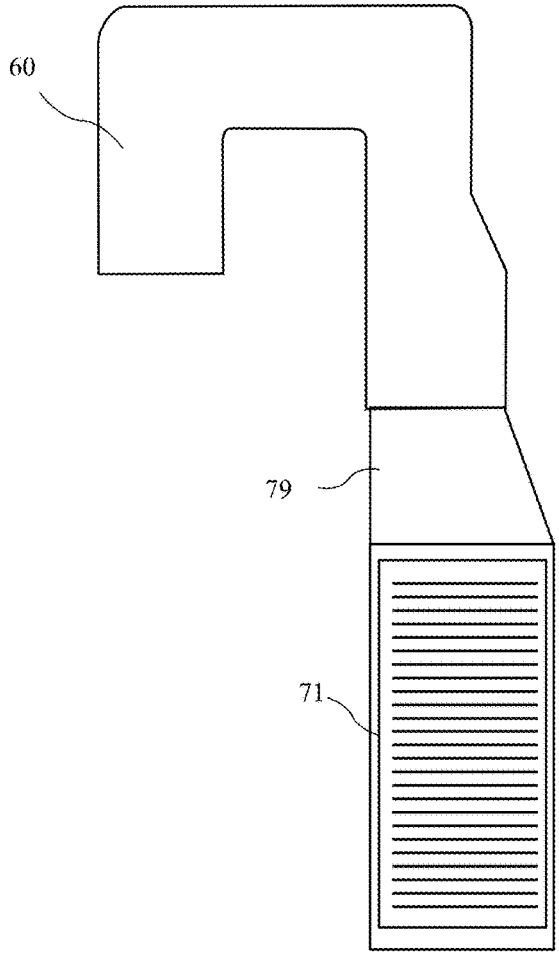


FIG. 12B

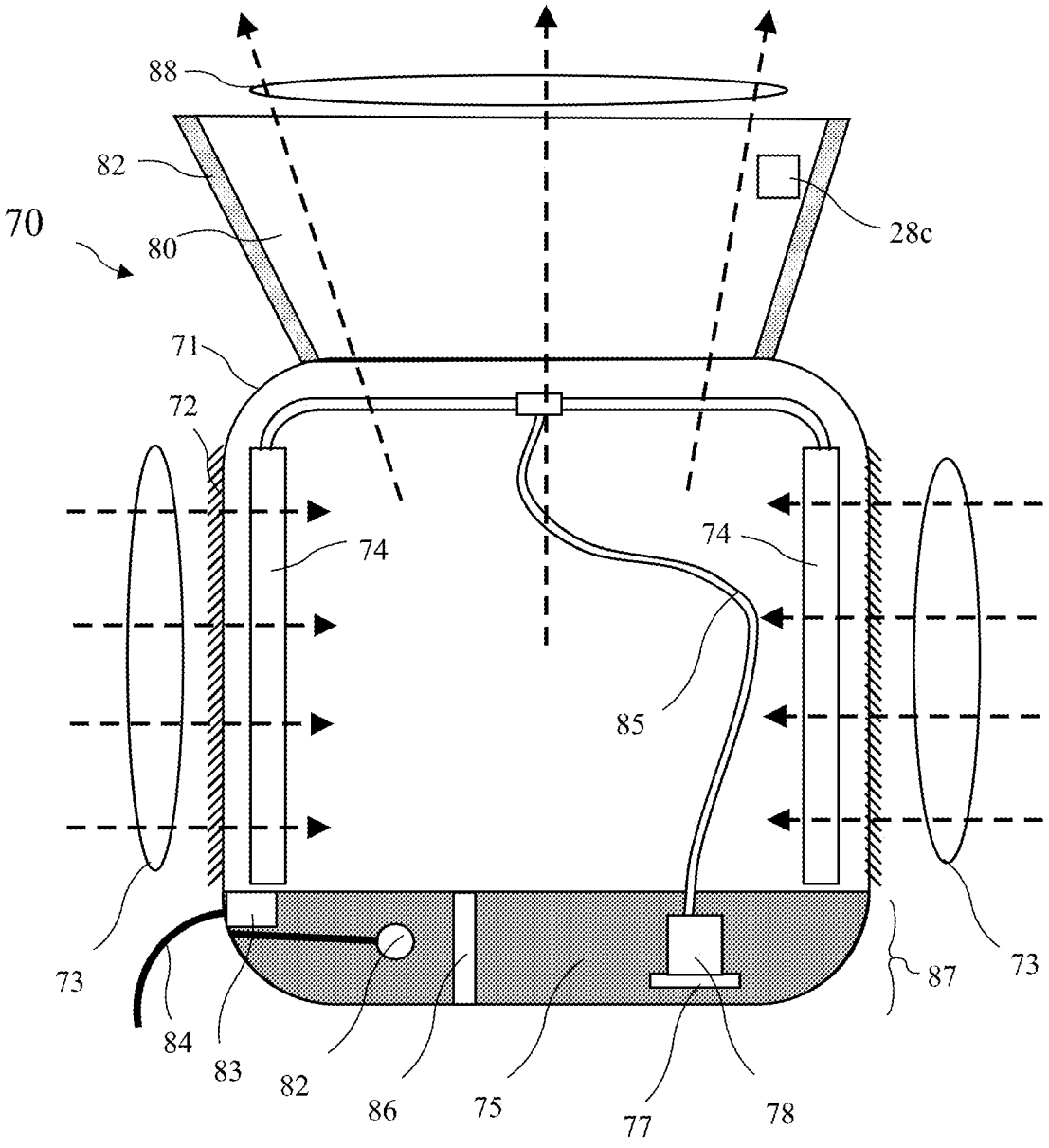


FIG. 13

OFFSET WINDOW MOUNT EVAPORATIVE COOLER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation In Part of U.S. patent application Ser. No. 16/036,266 filed Jul. 16, 2018, and a Continuation In Part of U.S. patent application Ser. No. 16/0417,122 filed May 20, 2019 which applications are incorporated in their entirety herein by reference.

BACKGROUND OF THE INVENTION

[0002] The present invention relates to room temperature control and in particular to wall mounted fans.

[0003] Wall mounted fans are often used to provide cool outside air to a room when cooling is desired, or warm outside air to a room when heating is desired. The fans generally compare room temperature to a temperature setting, and activate the fan when the room temperature exceeds the setting for cooling and activate the fan when room temperature is less than the setting for heating. In many instances, the fan is operated when outside air is above the inside air temperature when cooling is desired or below the inside air temperature when heating is desired, providing an undesirable result.

[0004] Further, window fans are generally thin and have very little resistance to air passing through the fan when the fan is not on. On a windy day, either hot or cold outside air may enter the room creating an undesired result. The known fans also block a large portion of the window at least as large and the area of the fan.

[0005] U.S. patent application Ser. No. 16/036,266 filed Jul. 16, 2018, and U.S. patent application Ser. No. 16/0417,122 filed May 20, 2019 disclose an improved window fan to circulate outside air into a room, but do not provide cooling for the outside air. In some instances, merely circulating outside air does little to improve comfort inside a room.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention addresses the above and other needs by providing an offset window mount fan unit including two or more independently controlled fans controllable to move air in the same direction or in opposite directions. A housing substantially offsets the fans from a direct passage of air into the room. In one embodiment, the fans are mounted in a housing perpendicular to the window, air traveling through the fans turning 90 degrees to pass through the plane of the window and 90 degrees down into the room. Each fan includes a temperature sensor to measure temperature of air moving through each fan. The fans are energized periodically for a short time period to make accurate temperature measurements. When the combined temperature measurements indicate an advantage from fan operation, the fans are activated. An evaporative cooling section may be attached to an outside portion of the unit to provide additional cooling.

[0007] In accordance with one aspect of the invention, there is provided an offset window fan housing having an outside portion containing at least one fan. The housing positions the partially, or totally offset from the window. In one embodiment, a housing has a narrow horizontal waist portion resting on a window sill, an exterior portion outside the window turning down, and an interior portion inside the room and turning down. At least one fan is in the exterior portion and has a fan axis (the direction air flows) perpendicular to the window. The thin waist portion minimizes the window area blocked by the fan and the downward interior and exterior portions prevent or reduce air flow due to wind.

[0008] In accordance with another aspect of the invention, there is provided a method for controlling a dual fan for heating a room. The method includes setting the dual fan to heating. Selecting a desired heating temperature setting. Briefly operating fans in opposing directions to create opposing air flow in and flow out. Measuring the temperature To in the flow in and Ti in the flow out. If the room temperature is below the heating temperature setting, and To is greater than Ti, operating the dual fan to bring in outside air.

[0009] In accordance with yet another aspect of the invention, there is provided a method for controlling a dual fan for cooling a room. The method includes setting the dual fan to cooling. Selecting a desired cooling temperature setting. Briefly operating fans in opposing directions to create opposing air flow in and flow out. Measuring the temperature To in the flow in and Ti in the flow out. If the room temperature is above the cooling temperature setting, and To is less than Ti, operating the dual fan to bring in outside air.

[0010] In accordance with another aspect of the invention, there is provided an offset window mount fan unit including an evaporative cooling attachment. The evaporative cooling attachment provides additional cooling with the advantages of the offset window mount fan unit. The evaporative cooling attachment may be combined with any or all of the functionality of the offset window mount fan unit, or may merely be attached to a basic offset window mount fan unit providing manually controlled cooling.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0011] The above and other aspects, features and advantages of the present invention will be more apparent from the following more particular description thereof, presented in conjunction with the following drawings wherein:

[0012] FIG. **1**A shows rooms including a dual wall fan according to the present invention.

[0013] FIG. **1**B shows a top view of the dual wall fan according to the present invention.

[0014] FIG. **2** shows a heating method according to the present invention.

[0015] FIG. **3** shows the operation of the heating method according to the present invention in operation.

[0016] FIG. **4** shows a cooling method according to the present invention

[0017] FIG. **5** shows the operation of the cooling method according to the present invention.

[0018] FIG. **6** shows a circuit according to the present invention.

[0019] FIG. **7**A is a perspective top, side, interior view of an offset window fan according to the present invention.

[0020] FIG. **7**B is a perspective bottom, side, interior view of the offset window fan according to the present invention.

[0021] FIG. **8** shows the offset window fan according to the present invention mounted in a window.

[0022] FIG. **9**A is a side view of the offset window fan according to the present invention.

[0023] FIG. **9**B is a top view of the offset window fan according to the present invention.

[0024] FIG. **9**C is a bottom view of the offset window fan according to the present invention.

[0025] FIG. **9**D is an interior view of the offset window fan according to the present invention.

[0026] FIG. **9**E is an exterior view of the offset window fan according to the present invention.

[0027] FIG. **10** is a cross-section of an offset window fan according to the present invention.

[0028] FIG. **11**A is a front view of an evaporative cooling attachment according to the present invention.

[0029] FIG. **11**B is a top view of the evaporative cooling attachment according to the present invention.

[0030] FIG. **11**C is a bottom view of the evaporative cooling attachment according to the present invention.

[0031] FIG. **11**D is a right side view of the evaporative cooling attachment according to the present invention.

[0032] FIG. **11**E is a left side view of the evaporative cooling attachment according to the present invention.

[0033] FIG. **12**A is a front view of the evaporative cooling attachment according to the present invention attached to the offset window fan.

[0034] FIG. **12**B is a side view of the evaporative cooling attachment according to the present invention attached to the offset window fan.

[0035] FIG. **13** is a cross-sectional view of the evaporative cooling attachment according to the present invention taken along line **13-13** of FIG. **11**B.

[0036] Corresponding reference characters indicate corresponding components throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0037] The following description is of the best mode presently contemplated for carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of describing one or more preferred embodiments of the invention. The scope of the invention should be determined with reference to the claims.

[0038] Where the terms "about" or "generally" are associated with an element of the invention, it is intended to describe a feature's appearance to the human eye or human perception, and not a precise measurement.

[0039] A temperature controlled area **10** including a dual wall fan (for example a window fan) unit **14** according to the present invention are shown in FIG. **1**A and a top view of the dual wall fan unit **14** in operation is shown in FIG. **1**B. The dual wall fan unit **14** is mounted to an external wall **13**, preferably in windows **15**. The dual wall fan unit **14** includes controls **26**, preferably as part of dual wall fan unit **14** (but may be wired or wireless remote controls), electrically connected (wired or wirelessly) to a processor **50** (see FIG. **6**). The controls **26** allow a user to select heating or cooling and a temperature target Tt determining if and when the wall fan unit **14** will be utilized. Further, in one embodiment, the user sets a lower temperature Tl and a higher temperature Th further determining if and when the wall fan unit **14** will be utilized.

[0040] The fans **16***a* and **16***b* are operated periodically in opposite directions and an outdoor temperature sensor **28***a* measures outdoor temperature To in an air flow out of the room due to one of the fans **16***a* or **16***b*, and in indoor temperature sensor **28***b* measures an indoor temperature Ti in an air flow into the room due to the other one of the fans **16***a* or **16***b*. The sensors **28***a* and **28***b* may be inside the dual wall fan unit **14**, on grills **29** of the dual wall fan unit **14**, or extended on rods **27** reaching into and out of the room **13**. The temperatures Tt, Tl and Th, To, and Ti are all provided to a processor **50** (see FIG. **6**).

[0041] The processor **50** determines if the wall fan unit **14** should be energized or de-energized, based on the method of FIGS. **2-5**. The sensors **28***a* and **28***b* are electrically connected to the controls **26**. The controls **26** controls power provided to the dual wall fan unit **14**.

[0042] FIG. **2** shows a heating method according to the present invention. The method includes: setting heating mode, a target temperature Tt, a low temperature Tl, and a high temperature Th at step **100**; briefly, for a sample period of time (for example, for five seconds), operate fans in opposing directions to create opposing air flow in and flow out at step **101**; measuring an outdoor temperature To and an indoor temperature Ti at step **102**; comparing Ti to Tt, and To and Ti at step **104**; If Ti is not less than Tt, or To is not greater than Ti at step **104**, de-energize the wall fan at step **112**, waiting a period of time P at step **114**, and then repeating measuring the outdoor temperature To and the indoor temperature Ti, otherwise, if Ti is less than Tt (heating is desired) and To is greater than Ti (i.e., can use outdoor air to heat the room), then if Tl is less than Ti and Ti is less than Th at step **106**, energizing the wall fan at step **108** or alternatively de-energizing the wall fan at step **110**, and after the period of time P at step **114**, again briefly operating the fans and measuring the outdoor temperature To and the indoor temperature Ti and repeating steps **104** through **110**. The temperature Tl is a lower preferred indoor temperature and the temperature Th is a higher preferred indoor temperature. The sample period of time is preferably between three and ten seconds, and is more preferably five seconds. The waiting time P is preferably between 15 and 30 minutes, and more preferably 20 minutes.

[0043] FIG. **3** shows the method of FIG. **2** controlling a wall fan in heating mode when heating desired. In interval A Ti is between Tl and Th, and To is greater than Ti, so the wall fan is energized to take advantage of the outdoor air to heat the room. During interval B Ti is greater than Th, or To is less than Ti and the wall fan is de-energize. During interval C Ti remains between Tl and Th and To is greater than Ti, so the wall fan is energized to take advantage of the outdoor air to heat the room. During interval D To is less than Ti and the wall fan is de-energized. During interval E, Ti remains between Tl and Th and To is greater than Ti, so the wall fan is energized to take advantage of the outdoor air to heat the room.

[0044] FIG. **4** shows a cooling method according to the present invention. The method includes: setting cooling mode, a target temperature Tt, the lower temperature Tl, and the higher temperature at step **200**; briefly, for the sample period of time, operating fans in opposing directions to create opposing air flow in and flow out at step **201**; measuring an outdoor temperature To and an indoor temperature Ti at step **202**; comparing Ti to Tt and Ti and To at step **204**; If Ti is not greater than Tt or Ti is not greater than To at step **204**, de-energize the wall fan at step **212**, waiting a period of time P at step **214**, and then repeating measuring the outdoor temperature To and the indoor temperature Ti, otherwise, if Ti is greater than Tt (cooling is desired), and Ti is greater than To (i.e., can use outdoor to cool the room), if Tl is less than Ti and Ti is less than Th at step **206**, energize

the dual wall fan at step **208** or alternatively de-energize the dual wall fan at step **210**, and after the period of time P at step **214**, again briefly operating fans and measuring the outdoor temperature To and the indoor temperature Ti and repeating steps **204** through **210**.

[0045] FIG. **5** shows the method of FIG. **4** controlling a wall fan in cooling mode when cooling is desired and cool outside air is available. In interval F, either To is greater than Ti or Ti is greater than Th, so the wall fan is de-energized. During interval G, Ti is between Tl and Th, and To is less than Ti so the wall fan is energized to take advantage of cooler outdoor air. During interval H, either Ti is less than Tl or To is greater than Ti, so the wall fan is de-energized. During interval I, Ti is between Tl and Th, and To is less than Ti so the wall fan is energized to take advantage of cooler outdoor air. During interval J, To is greater than Ti, so the wall fan is de-energized.

[0046] A circuit according to the present invention for controlling the dual wall fan unit **14** is shown in FIG. **6**. The controls **26**, sensors **28***a* and **28***b*, and dual wall fan unit **14** may be connected by wires or be wireless, for example BLUETOOTH®, wireless communications.

[0047] A perspective top, side, interior view of an offset window fan **60** is shown in FIG. **7**A and a perspective bottom, side, interior view of the offset window fan **60** is shown in FIG. **7**B. The offset window fan **60** includes a housing **61** having a thin waist portion **60***b* which minimizes the window **15** (see FIG. **8**) area blocked by the offset window fan **60**, a downward reaching interior portion **60***a* inside the room, and a downward reaching exterior portion **60***c*. The three portions of the offset window fan **60** prevent or reduce air flow through the offset window fan **60** due to wind. The offset window fan **60** may include only one fan, but in some embodiments includes two or more fans and the interior of the offset window fan **60** may include one or more dividers **64** separating air flows through the offset window fan **60**.

[0048] While the offset window fan **60** has been described as having the downward reaching interior and exterior portions **60***a* and **60***c*, in other embodiments the interior and exterior portions may simply be offset to some degree from the center portion to reduce overlap between the window **15** and the interior and exterior portions. For example, an air flow through the offset window fan **60** may be entirely horizontal.

[0049] FIG. **8** shows the offset window fan **60** mounted in the window **15**.

[0050] A side view of the offset window fan **60** is shown in FIG. **9**A, a top view of the offset window fan **60** is shown in FIG. **9**B, a bottom view of the offset window fan **60** is shown in FIG. **9**C, an interior view of the offset window fan **60** is shown in FIG. **9**D, and an exterior view of the offset window fan **60** is shown in FIG. **9**E, showing an embodiment having two fans **63**. The offset window fan **60** is separated to have two air flows, for example an inward airflow **62***i* and an outward air flow **62***o*. The fans are controllable to provide the airflows **62** in either directions a desired and discussed above. The offset window fan **60** further includes the sensors and controls described above for the dual wall fan unit **14** based on indoor temperature ti and outdoor temperature to (see FIG. **8**).

[0051] A cross-section of an offset window fan **60** is shown in FIG. **10**. The window fan **60** includes a two part telescoping housings **61***a* and **61***b* allowing the housing to the adjusted to fit an opening the window **15** is installed in. The housings **61***a* and **61***b* may be held in position by fasteners **68** cooperating with slots **69**. A filter **67** resides inside either the housing **61***a* or **61***b* and is preferably angled to allow the largest filter size. A damper **65** may be opened when the window fan **60** is operating or closed when the window fan **60** is off.

[0052] A control panel and/or circuit **26** is shown on the housing **61***a* for control of the fan **63**. The control panel **26** may include wireless communication with a Heating, Ventilation and Air Conditioning (HVAC) thermostat (for example a thermostat sold under the trademark Nest, Ecobee, or Honeywell) and with a local area network to remotely control the window fan **60**, for example over the Internet using a smart phone. Examples of the wireless communication are WI-Fi®, a BLUETOOTH®, or other wireless communication. The operation of the window fan **60** and HVAC may be coordinated so they do not operate at the same time, or to coordinate their operation to maximum cooling, maximum heating, or more efficient operation. The window fan **60** may operate with the outdoor temperature sensor **28***a* eliminated by using Internet of Things (IoT) to obtain nearby weather station temperature.

[0053] A front view of an evaporative cooling attachment **70** is shown in FIG. **11**A, a top view of the evaporative cooling attachment **70** is shown in FIG. **11**B, a bottom view of the evaporative cooling attachment **70** is shown in FIG. **11**C, a right side view of the evaporative cooling attachment **70** is shown in FIG. **11**D, and a left side view of the evaporative cooling attachment **70** is shown in FIG. **11**E. The evaporative cooling attachment **70** includes vents **72** on both sides of a housing **71** to allow an ambient air flow **73** (see FIG. **13**) into the housing **71**. An adapter **79** allows connection the evaporative cooling attachment **70** to the offset window fan **60**.

[0054] A front view of the evaporative cooling attachment **70** attached to the offset window fan **60** is shown in FIG. **12**A and a side view of the evaporative cooling attachment **70** attached to the offset window fan **60** is shown in FIG. **12**B. Air is drawn into the evaporative cooling attachment **70** by fans **63** in the offset window fan **60**.

[0055] FIG. **13** is a cross-sectional view of the evaporative cooling attachment **70** taken along line **13**-**13** of FIG. **11**B. The evaporative cooling attachment **70** includes the vents **72** allowing the ambient air flow **73** into the housing **71**. The housing **71** contains pads **74** in the path of the ambient air flows **73**. Water **75** is held in a reservoir **87** in the bottom of the housing **71** ans is supplied by a water source **84** through a valve **83**. The valve **83** may include float **82** to control the level of the water **75**. An overflow **86** releases water if the water level becomes too high. A pump **78** receives water through a filter or strainer **77** and pumps the water through a water line **85** to the top of the housing **71** and splits into right and left lines carrying the water to release into the pads **74**. The water moistens the pads **74** which cools the ambient air **73** to provide the cool air flow **88** into the offset window fan **60**.

[0056] The evaporative cooling attachment **70** may be attached to an offset window fan **60** including all of the features described in FIGS. **1**A-**10**, or into a simplified offset window fan **60** including the housing **61** and fans **63** with a manual control, or some but not all the features described in FIGS. **1**A-**10**.

[0057] The evaporative cooling attachment **70** may further include a third temperature sensor **28***c* in the cooled air flow **88**. Cooled air temperature Tc may be compared to indoor temperature Ti, and if the cooled air temperature Tc is greater than the indoor temperature Ti, the fans **63** may be deactivated.

[0058] While the invention herein disclosed has been described by means of specific embodiments and applications thereof, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope of the invention set forth in the claims.

I claim:

1. An offset window mount evaporative cooler comprising:
- an offset fan housing;
- an interior portion in fluid communication with a room interior;
- an exterior portion in fluid communication with a room exterior;
- a center portion configured to reside in a window opening and between the interior portion and the exterior portion and in fluid communication with both the interior portion and the exterior portion;
- at least one fan in either the interior portion or the exterior portion of the offset fan housing;
- an evaporative cooler housing extending down from the exterior portion of the offset fan housing and in fluid communication with the offset fan housing;
- vents allowing ambient to enter the evaporative cooler housing;
- pads in the path of the ambient air into the evaporative cooler housing;
- a water supply in fluid communication with the pads; and
- an air path through the vents, through the pads, and into the offset fan housing.

2. The offset window mount evaporative cooler of claim **1**, wherein the center portion of the offset fan housing has a smaller cross-section than either the interior portion or the exterior portion, reducing an amount of window area blocked by the offset window fan.

3. The offset window mount evaporative cooler of claim **1**, wherein:
- the exterior portion turns downward; and
- the fan resides in the exterior portion.

4. The offset window mount evaporative cooler of claim **1**, wherein the water supply comprises a reservoir in the bottom of the evaporative cooler housing.

5. The offset window mount evaporative cooler of claim **4**, wherein a water source fills the reservoir through a valve responsive to a water level in the reservoir.

6. The offset window mount evaporative cooler of claim **5**, wherein the valve is closed by a float residing in the water in the reservoir.

7. The offset window mount evaporative cooler of claim **5**, wherein an overflow releases water from the reservoir if the water level rises above the overflow.

8. The offset window mount evaporative cooler of claim **4**, further including a pump in fluid communication with the water.

9. The offset window mount evaporative cooler of claim **8**, wherein the pump is in fluid communication with the water through a strainer or a filter.

10. The offset window mount evaporative cooler of claim **8**, wherein the pump advanced water through a water hose to a position above the pads and releases the water into the pads.

11. The offset window mount evaporative cooler of claim **1**, wherein an insulated adapter connects the evaporative cooler housing to the offset fan housing.

12. The offset window mount evaporative cooler of claim **1**, wherein the fan housing is a telescoping two piece housing having the interior portion and the exterior portion adjustable to sandwich a room exterior wall containing the offset window fan.

13. An offset window mount evaporative cooler comprising:
- an offset fan housing;
- an interior portion in fluid communication with a room interior;
- an exterior portion in fluid communication with a room exterior;
- a center portion configured to reside in a window opening and between the interior portion and the exterior portion and in fluid communication with both the interior portion and the exterior portion, the center portion having a smaller cross-section than either the interior portion or the exterior portion, the interior and exterior portion turning downward from the center portion;
- at least one fan in the exterior portion of the offset fan housing;
- an evaporative cooler housing extending down from the exterior portion of the offset fan housing and in fluid communication with the offset fan housing;
- vents allowing ambient to enter the evaporative cooler housing;
- pads in the path of the ambient air into the evaporative cooler housing;
- a reservoir in the bottom of the evaporative cooler housing;
- the reservoir configured to connect to a water source through a valve responsive to a water level in the reservoir;
- the reservoir in fluid communication with the pads through a pump in fluid communication with the reservoir through a strainer or filter; and
- an air path through the vents, through the pads, and into the offset fan housing.

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