

Patent No. 6,862,179
Petition for *Inter Partes* Review

Paper No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VERTIV CORPORATION

Petitioner

v.

VALTRUS INNOVATIONS LTD. and KEY PATENT INNOVATIONS LTD.

Patent Owners

Patent No. 6,862,179
Original Issue Date: March 1, 2005

Title: PARTITION FOR VARYING THE SUPPLY OF COOLING FLUID

Inter Partes Review No. Unassigned

PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. § § 311-319 AND 37 C.F.R. § 42.100 *ET. SEQ.*

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LISTING OF EXHIBITS

Exhibit No.	Description
Ex. 1001	U.S. Patent No. 6,862,179 (“the ’179 patent”)
Ex. 1002	Declaration of John P. Abraham
Ex. 1003	Prosecution History of the ’179 patent
Ex. 1004	Infringement Claim Chart for the ’179 Patent in <i>Valtrus Innovations Limited v. Digital Realty Trust, Inc. et al</i> , Case No. 2-24-cv-00139-JRG
Ex. 1005	U.S. Patent Publication No. 2004/0065097A1 (“Bash”)
Ex. 1006	U.S. Patent No. 6,574,104 B2 (“Patel”)
Ex. 1007	Infringement Claim Chart for the ’179 Patent in <i>Valtrus Innovations Ltd. and Key Patent Innovations Ltd. v. TierPiont, LLC</i> , Case No. 2-24-cv-00777-JRG
Ex. 1008	U.S. Patent Application Publication No. 2002/0149911 (“Bishop”)
Ex. 1009	U.S. Patent No. 6,188,189 (“Blake”)
Ex. 1010	[RESERVED]
Ex. 1011	U.S. Patent No. 5,979,167 (“Kochavi”)
Ex. 1012	Webster’s New Collegiate Dictionary (1979) (definition of “partition”)
Ex. 1013	U.S. Patent No. 5,467,609 (“Feeney”)

LISTING OF CHALLENGED CLAIMS

Claim 1	
1[pre]	A method of cooling a plurality of racks in a data center, said method comprising:
1[a]	activating a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of said data center, said zone including at least one associated rack of said plurality of racks;
1[b]	sensing the temperature of said at least one associated rack;
1[c]	determining whether said sensed temperature is within a predetermined temperature range; and
1[d]	manipulating said controllable partition to vary said supply of said cooling fluid to said zone in response to said sensed temperature being outside said predetermined temperature range.
Claim 2	
2[a]	The method according to claim 1, further comprising: determining whether the measured temperature of said at least one associated rack is below or equal to a predetermined minimum set point temperature; and
2[b]	decreasing the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that falls below or equal said predetermined minimum set point temperature.
Claim 3	
3[a]	The method according to claim 1, further comprising: sensing a pressure of a supply of said cooling fluid;
3[b]	determining whether said sensed pressure is within a predetermined pressure range; and

3[c]	varying an output of said cooling device in response to said sensed pressure falling outside of said predetermined pressure range.
Claim 4	
[4]	The method according to claim 2, further comprising: increasing the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature.
Claim 5	
[5]	The method according to claim 3, wherein said step of varying said cooling device output includes determining whether said measured pressure falls below or equals a predetermined minimum set point pressure.
Claim 6	
[6]	The method according to claim 4, further comprising: decreasing an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone exceeding said increase in cooling fluid supply to said zone.
Claim 7	
[7]	The method according to claim 4, further comprising: opening a plurality of vents, said vents being configured to supply cooling fluid to said racks; controlling one or more of said plurality vents to decrease the supply of said cooling fluid to said at least one associated rack having a measured temperature that fall below or equal said predetermined minimum set point temperature; and controlling said one or more vents to increase the supply of said cooling fluid to said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature.
Claim 8	

[8]	The method according to claim 4, further comprising: opening a plurality of returns, said returns being configured to remove cooling fluid from various locations of said data center; and controlling one or more of said plurality of returns to decrease the removal of said cooling fluid from around said at least one associated rack having a measured temperature that fall below or equal said predetermined minimum set point temperature; and controlling said one or more returns to increase the removal of said cooling fluid from around said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature.
Claim 9	
9[a]	The method according to claim 4, further comprising: receiving temperatures from a movable device configured to detect at least one environmental condition at various locations of said data center;
9[b]	determining whether at least one of said sensed temperatures and received temperatures are within a predetermined temperature range; and
9[c]	manipulating said controllable partition to vary said supply of said cooling fluid to said zone in response to at least one of said sensed and received temperatures being outside of said predetermined temperature range.
Claim 10	
[10]	The method according to claim 4, further comprising: performing a numerical modeling of a temperature distribution and flow characteristics of the data center; and manipulating said cooling device in response to said numerical modeling.
Claim 11	
[11]	The method according to claim 5, further comprising: increasing the output of said cooling device in response to said measured pressure falling below or equaling said predetermined minimum set point pressure.

Claim 12	
[12]	The method according to claim 5, further comprising: decreasing the output of said cooling device in response to said measured pressure exceeding said predetermined minimum set point pressure.
Claim 13	
[13]	The method according to claim 6, further comprising: increasing an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone falling below said increase in cooling fluid supply to said zone.
Claim 14	
[14]	The method according to claim 7, further comprising: determining whether said at least one associated rack having a measured temperature that exceeds said predetermined minimum set point temperature is relatively downstream of the supply of said cooling fluid from said at least one associated rack having a measured temperature that fall below or equal said predetermined minimum set point temperature; and controlling said one or more vents to decrease the supply of said cooling fluid to said at least one associated rack being relatively upstream of the supply of said cooling fluid and controlling said one or more vents to increase the supply of said cooling fluid to said at least one associated rack being relatively downstream of the supply of said cooling fluid in response to determining said at least one associated rack having a measured temperature that exceeds said predetermined minimum set point temperature is relatively downstream of the supply of said cooling fluid from said at least one associated rack having a measured temperature that fall below or equal said predetermined minimum set point temperature.
Claim 15	

[15]	15. The method according to claim 10, further comprising: implementing said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of at least one of said zone and said racks within said data center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said cooling device in response to said inferred thermal condition.
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I. INTRODUCTION

Vertiv Corporation (“Petitioner”) requests *inter partes* review of claims 1–15 (“Challenged Claims”) of U.S. Patent No. 6,862,179 (Ex. 1001, “the ’179 patent”). The ’179 patent is currently assigned to Valtrus Innovations Limited (“Valtrus”) and Key Patent Innovations Ltd. (“KPI”) (collectively, “Patent Owners”). The Challenged Claims relate to methods and systems of manipulating a controllable partition to vary the supply of cooling fluid in a zone of a data sensor based on detected temperatures. The prior art cited herein anticipates and renders obvious the Challenged Claims, and there is a reasonable likelihood that Petitioner will prevail. As such, Petitioner respectfully submits that the Board should institute review and cancel the Challenged Claims.

II. MANDATORY NOTICES

A. Real Party in Interest

Petitioner Vertiv Corporation is the real party in interest. No entity other than Vertiv Corporation is funding, controlling, or otherwise had an opportunity to provide input regarding this Petition; no entity other than Vertiv Corporation will fund, control, or otherwise have an opportunity to provide input regarding any resulting IPR trial; no entity other than Vertiv Corporation has reviewed this Petition.

B. Related Matters

The '179 patent is the subject of the following pending civil actions:

- *Valtrus Innovations Limited et al v. DataBank Holdings Ltd.*, Case No. 2-24-cv-00777-JRG (E.D. Texas) (“*DataBank*”);
- *Valtrus Innovations Limited et al v. TierPoint, LLC*, Case No. 2-24-cv-00776-JRG (E.D. Texas) (“*TierPoint*”);
- *Vertiv Corporation v. Valtrus Innovations Limited*, Case No. 2-24-cv-00907-JRG (E.D. Texas) (“*Vertiv Declaratory Judgment Action*”); and
- *Valtrus Innovations Limited v. NTT Data Services, LLC et al*, Case No. 2-24-cv-00361-JRG (“*Lead Case*”).

The *Vertiv Declaratory Judgment Action* has been consolidated for pre-trial purposes in the *Lead Case*.

In addition to the above actions, the '179 patent was the subject of the following civil actions, in which Petitioner had intervened, and which were dismissed by the parties:

- *Valtrus Innovations Limited v. Digital Realty Trust, Inc. et al*, Case No. 2-24-cv-00139-JRG (E.D. Texas) (“*Digital Realty I*”);
- *Valtrus Innovations Limited et al v. Digital Realty Trust, Inc. et al*, Case No. 2-24-cv-00535-JRG (E.D. Texas) (“*Digital Realty IP*”);

- *Valtrus Innovations Ltd. v. Dawn Acquisitions LLC (d/b/a Evoque Data Center Solutions)*, Case No. 2:2024-cv-00142-JRG (E.D. Texas); and
- *Valtrus Innovations Ltd. v. CyrusOne, LLC*, Case No. 2:2024-cv-00534-JRG (E.D. Texas).

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D. Notice of Service Information

Please address all correspondence to the lead counsel at the address shown above. Petitioner consents to service by email at the following email addresses:

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DLVertiv@nixonpeabody.com.

E. Payment of Fees

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 50-4181 (Customer ID No. 70001) for the fees required by 37 C.F.R. §42.15(a) for this Petition and authorizes the payment of any additional fees to be charged to this Deposit Account.

III. GROUNDS FOR STANDING

Petitioner certifies that the '179 patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR on the grounds identified herein.

IV. IDENTIFICATION OF CHALLENGE AND RELIEF REQUESTED

The '179 patent issued from U.S. Application No. 10/303,761, filed November 26, 2002. Ex. 1001, Cover. Thus, patentability is governed by pre-AIA 35 U.S.C. §§102/103.

Petitioner requests that the Challenged Claims of the '179 patent be cancelled based on the following grounds:

Ground	Claims	Description
1	1–15	Anticipated under §102(e) by Bash (Ex. 1005)
2	1–7, 10–15	Anticipated under §102(e) by Patel (Ex. 1006)
3	1–6, 11–13	Obvious under §103(a) over Bishop (Ex. 1008), Feeney (Ex. 1013), and Kochavi (Ex. 1011)

Bash published on April 8, 2004 from an application filed on October 3, 2002, prior to the November 26, 2002, filing date of the '179 Patent. Furthermore, Bash has two additional co-inventors not common to the '179 Patent—Cullen E. Bash and Ratnesh K. Sharma. *Compare* Exs. 1001 and 1005. Therefore, Bash and the '179 Patent have different inventive entities, and Bash is thus a publication of a patent application “by another” under 35 U.S.C. 102(e). *See* MPEP § 2136.04 (“‘Another’ means . . . a different inventive entity. The inventive entity is different if not all inventors are the same. The fact that the application and reference have one or more inventors in common is immaterial.”). Bash is therefore prior art to the '179 Patent under 35 U.S.C. § 102(e). Ex. 1002 ¶¶96–106.

Patel issued on June 3, 2003, from an application filed on October 5, 2001, prior to the November 26, 2002, filing date of the '179 Patent. Furthermore, Patel has one additional co-inventor not common to the '179 Patent—Cullen E. Bash. *Compare* Exs. 1001 and 1006. Therefore, Patel and the '179 Patent have different inventive entities, and Patel was thus granted on a patent application “by another” under 35 U.S.C. 102(e). *See* MPEP § 2136.04 (“‘Another’ means . . . a different inventive entity. The inventive entity is different if not all inventors are the same. The fact that the application and reference have one or more inventors in common is immaterial.”). Patel is therefore prior art to the '179 Patent under 35 U.S.C. § 102(e). Ex. 1002 ¶¶107–116.

Bishop was filed on April 12, 2001, and published on October 17, 2002, which were was less than one year before the November 26, 2002, priority date of the '179 patent. Ex. 1008, cover. Thus, Bishop qualifies as pre-AIA 35 U.S.C. §102(a) prior art. Ex. 1002 ¶¶117–137.

Kochavi issued on November 9, 1999, which was more than one year before the November 26, 2002, priority date of the '179 patent. Ex. 1011, cover. Thus, Kochavi was publicly available and qualifies as pre-AIA 35 U.S.C. §102(b) prior art. Ex. 1002 ¶¶138–152.

Feeney issued on November 21, 1995, which was more than one year before the November 26, 2002, priority date of the '179 patent. Ex. 1013, cover. Thus, Feeney was publicly available and qualifies as pre-AIA 35 U.S.C. §102(b) prior art. Ex. 1002 ¶¶153–159.

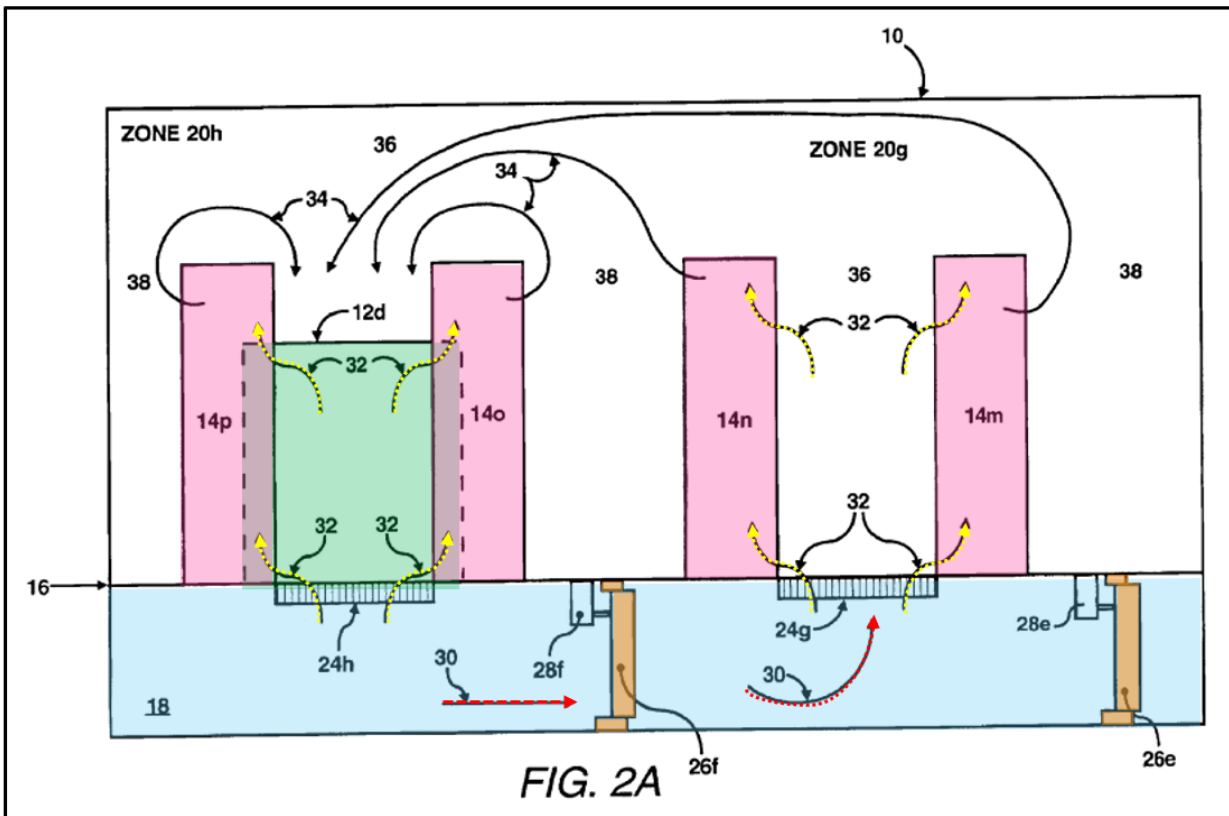
Petitioner's challenges are supported by the Declaration and testimony of John P. Abraham, Ph.D., an expert in design, development and evaluation of fluid flow and heat exchange systems for cooling electronics with more than 20 years of experience. Ex. 1002 ¶¶11–27.

V. THE '179 PATENT

A. Summary of Subject Matter

The '179 patent is directed to systems and methods of opening a controllable partition to vary the supply of cooling fluid to zones of a data center based on the sensed temperatures of each individual zone. The '179 patent contends that the disclosed systems and methods can cool data centers more efficiently by “increasing the cooling fluid flow to those racks dissipating greater amounts of heat and by [] decreasing the cooling fluid flow to . . . those racks dissipating lesser amounts of heat.” Ex. 1001, 3:6–11.

The '179 patent provides Figure 2A, reproduced and annotated below, as an exemplary system in a data center that purportedly is capable of strategic distribution of cooling fluid.

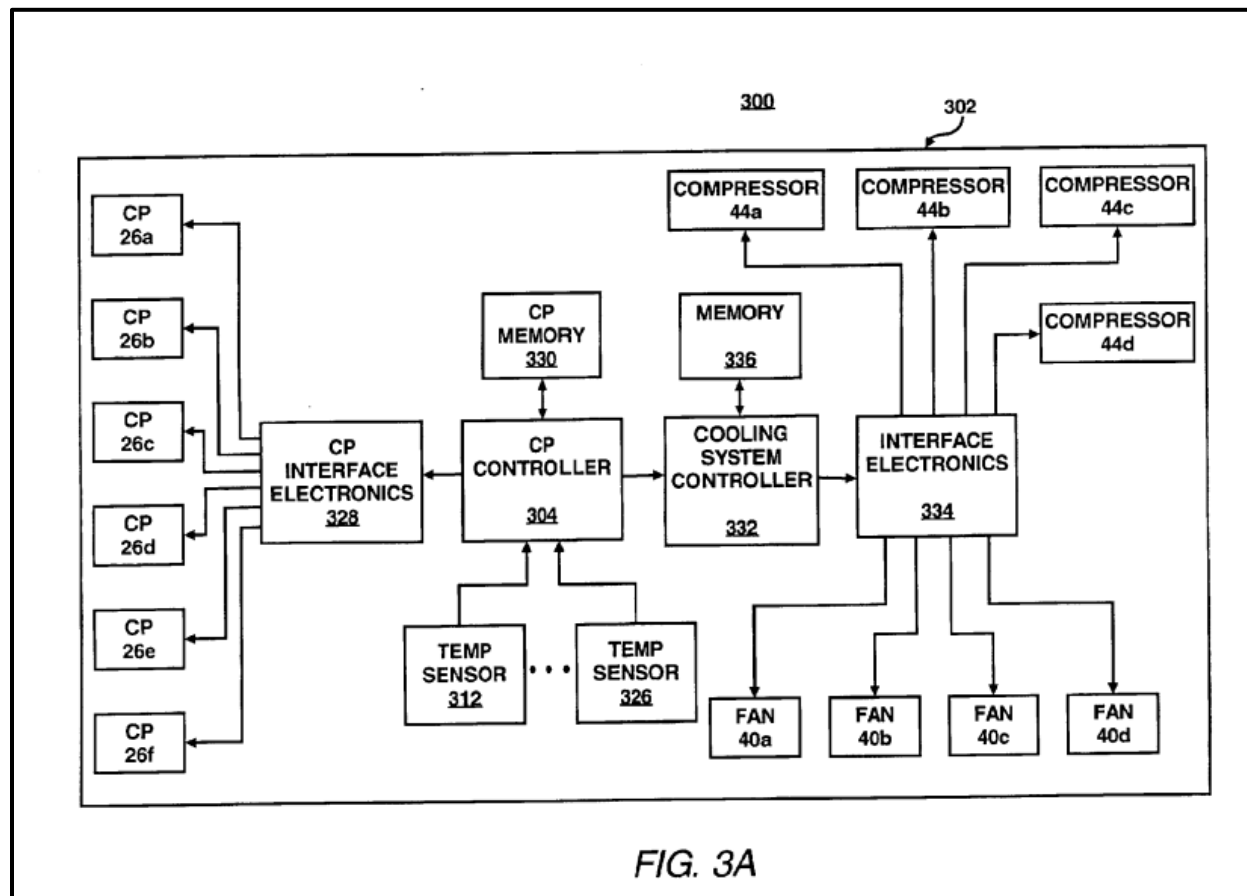


Ex. 1001, FIG. 2A (annotated).

As shown above, cooling fluid flows from the cooling system **12d** (green) into the pressurized enclosure **18** (blue) under the floor as indicated by the arrows **30** (red). Ex. 1001, 5:3–5. The cooling fluid travels from the pressurized enclosure **18** up through the vents **24h** and **24g** along arrows **32** (yellow) into two zones **20h** and **20g** that contain two racks each, **14p**, **14o**, and **14n**, **14m** (pink), respectively. Ex. 1001, 4:45–47; 5:8–20. After the cooling “fluid is heated by the heat dissipating components located within the racks **14m–14p**,” the returned cooling fluid reenters “the cooling system **12d**.” Ex. 1001, 4:55–60; 5:20–23.

“[T]he zones **20h** and **20g** may receive substantially individualized and localized amounts of cooling fluid according to the heat loads of the respective racks **14m–14p** within each zone **20h** and **20g**. For example, if the racks **14m** and **14n** in zone **20g** are generating relatively little heat load as compared to racks **14o** and **14p** in zone **20h**, the C[ontrollable] P[artition] **26f** (orange) may be controlled to reduce the velocity and/or volume flow rate of the cooling fluid being conveyed therethrough. In this manner, the volume flow rate of cooling fluid available to flow through the vents **24h** and **24g** may be modified.” Ex. 1001, 5:9–19.

The '179 patent also provides Figure 3A, reproduced below, which is a block diagram of a control scheme for a cooling system capable of providing localized cooling to racks in a data center. Ex. 1001, 2:45–47.



Ex. 1001, FIG. 3A.

As shown in Figure 3A, the '179 patent discloses using a controllable partition controller **304** “to control the operation of” multiple controllable partitions **26a–26f**. Ex. 1001, 8:33–34. The controllable partition controller **304** receives temperature measurements from temperature sensors **312–326**, which are positioned at various positions around the subsystems and/or the racks **14a–14p** and correspond to a respective zone (e.g., **20h** and **20g**) in the data center. Ex. 1001, 8:41–46. Based on the measured or anticipated temperatures of the racks (such as racks **14m–14p**) and/or zones (such as zones **20h** and **20g**), the controllable

partition controller **304** operates the controllable partitions **26a–26f** to vary the flow of cooling fluid therethrough to meet the cooling needs of each particular zone. Ex. 1001, 8:37–41.

The “temperature sensors [**312–326**] need not be stationary.” Ex. 1001, 9:6. For example, a mobile device can be used that “travel[s] around the racks” of the data center to measure temperature or other environmental conditions at various locations. Ex. 1001, 9:10–13.

If the measured temperature (T_C) of a rack or zone is below or equal to a minimum set point temperature ($T_{\min, \text{set}}$), the controllable partition controller **304** decreases the volume flow rate and/or the velocity of cooling fluid to those racks. Ex. 1001, FIG. 4A, 13:32–35. And if the measured temperature (T_C) of a rack or zone is above a maximum set point temperature ($T_{\min, \text{set}}$), the controllable partition controller **304** increases the volume flow rate and/or the velocity of cooling fluid to the rack. Ex. 1001, FIG. 4A, 13:47–50.

The cooling system controller **332** may also be in communication with pressure sensors that measure the pressure within chambers of the pressurized enclosure **18** shown in FIG. 2A. Ex. 1001, 10:52–58. The output of the fans **40a–40d** may be varied by the cooling system controller **332** based on the measured pressures to maintain the pressure of the cooling fluid in various chambers of the pressurized enclosure **18** at a substantially uniform level. Ex. 1001, 11:3–13.

If a measured pressure is below or equal to a minimum set point pressure ($P_{\min, \text{set}}$), “the cooling system controller may operate to increase the cooling fluid output, e.g., by increasing the appropriate fan output,” and “if the [measured pressure] is determined to exceed the $P_{\min, \text{set}}$, and thereby exceed the [maximum set point pressure] $P_{\max, \text{set}}$, the cooling system controller **332** may operate to decrease cooling fluid output, e.g., by decreasing the appropriate fan output.” Ex. 1001, FIG. 4B, 15:56–63.

The '179 patent further discloses implementing computational fluid dynamics (“CFD”) tools to continuously vary the operation of the cooling system to operate according to the actual or anticipated heat loads generated in the racks. Ex. 1001, 17:10–18. CFD tools may be used to create “a numerical model of the data center to [] determine an optimized cooling distribution within the data center.” Ex. 1001, 17:28–30. For example, a “correlation of one or more of the following properties: velocity of the cooling fluid flowing through various zones of the data center, distribution of temperature and pressure of the cooling fluid in the data center, and the power draw into the racks, may be created based on the numerical modeling.” Ex. 1001, 17:30–35.

B. Relevant Prosecution History

A Non-Final Rejection was issued by the Office on June 14, 2004, rejecting all forty-one claims that were pending at this time. Ex. 1003, 303–04. Claims 1–41

were rejected under the doctrine of obviousness-type double patenting over U.S. Patent No. 6,694,759 (the “’759 patent”). Ex. 1003, 305–06.

In a September 14, 2004 Response, the applicant, Hewlett-Packard Company (“Applicant”) did not amend any of the claims. Ex. 1003, 283–96. The Applicant argued that there are differences between the claims of the ’179 patent and the ’759 patent, namely, “Claim 1 of the present invention includes a controllable partition that is operated to vary the supply of cooling fluid to a zone in response to a sensed **temperature** being outside of a predetermined temperature range. Claim 1 of the ’759 patent includes a plurality of automatically adjustable vents that are automatically actuated in response to the **pressure** within the plenum being outside of a predetermined pressure range.” Ex. 1003, 299 (emphasis original). Applicant also argued that the claims differ because the ’179 patent “pertains to manipulation of a controllable partition” and the ’759 patent “pertains to actuation of an automatically adjustable vent.” Ex. 1003, 300–01.

C. Person of Ordinary Skill in the Art (“POSITA”)

A POSITA at the time of the alleged invention would have at least a bachelor’s degree in mechanical or chemical engineering or an equivalent discipline, together with four years of experience in the design and/or operations of atmospheric management systems for buildings or electronics or computer systems; or a master’s degree in mechanical or chemical engineering or an equivalent discipline, with two

years of experience in the design and/or operations of atmospheric management systems for buildings or electronics or computer systems. Ex. 1002 ¶¶31–35.

D. Claim Construction

Pursuant to 37 C.F.R. § 42.100(b), claims subject to IPR are construed according to their plain and ordinary meaning as understood by a POSITA. Petitioner is unaware of any prior claim construction determination related to the '179 patent.

Patent Owners have served infringement contentions in several Related Matters showing Patent Owners' expected claim interpretations for the '179 patent. *See generally* Ex. 1004 (*Digital Realty I*, '179 patent infringement contentions); Ex. 1007 (*TierPoint*, '179 patent infringement contentions). The infringement contentions comprise Patent Owners' positions in Related Matters in which Patent Owners set forth positions concerning the scope of the '179 patent claims and may be considered by the Board. 35 U.S.C. §§ 301(a)(2) and 301(d).

Petitioner's position is that the claim terms are understood pursuant to their plain and ordinary meaning as understood by a POSITA in light of the specification and file history. For comparison to Patent Owners' construction, Petition sets forth below that plain and ordinary meaning, as discussed by Dr. Abraham. Ex. 1002 ¶¶77–95.

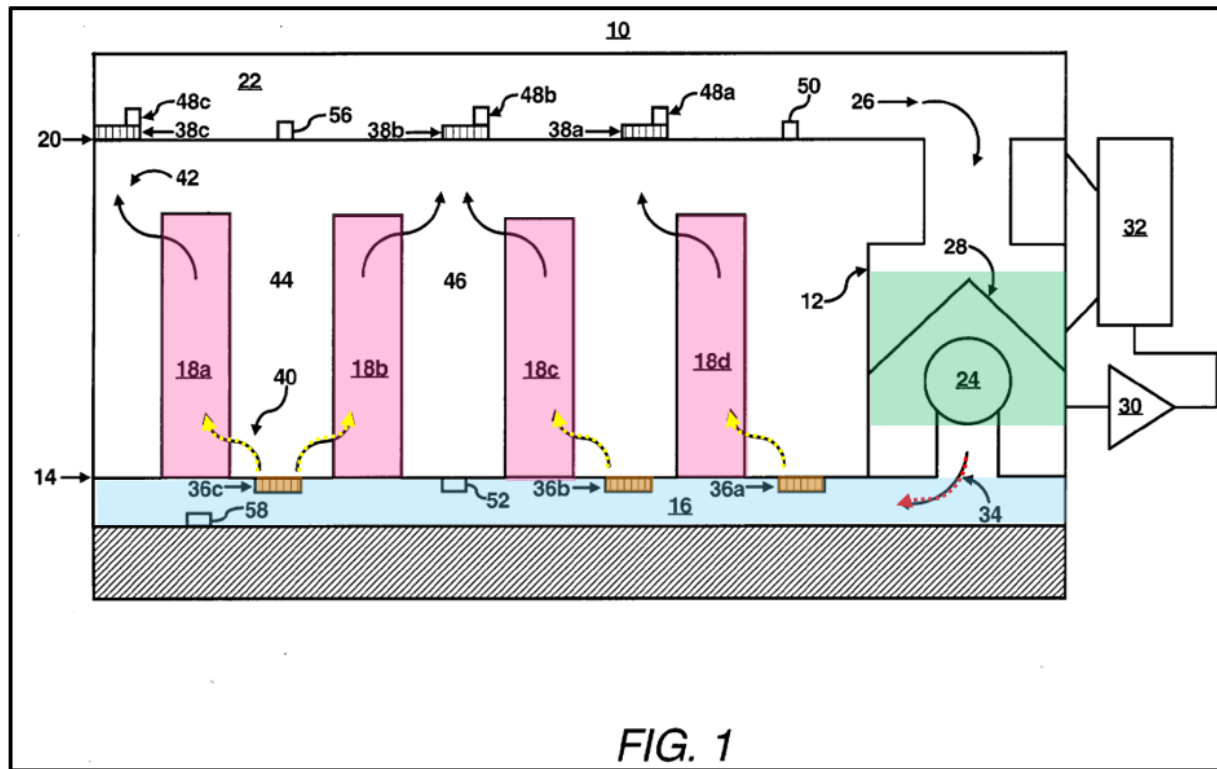
Claim Term	Petitioner's Construction	Patent Owners' Implied Construction
"partition" (claims 1–15)	"a barrier or wall that subdivides a space"	"a device capable of manipulating cooling fluid flow"

VI. THE PRIOR ART

A. Bash

Like the '179 patent, Bash was developed by the same applicant, Hewlett Packard Co., including some overlap of the inventive entity (not all of the inventors are the same between Bash and the '179 patent). Accordingly, Bash's disclosure is extremely similar to that of the '179 patent, including several highly similar Figures and descriptions of the disclosed technology. Like the '179 patent, Bash is directed to "a cooling system for cooling racks in a data center," and more specifically, to a cooling system "configured to adjust cooling fluid . . . flow to and/or from various racks located throughout a data center, . . . based upon the detected or anticipated temperatures at various locations throughout the data center." Ex. 1005, Abstract, [0011].

Bash discloses a schematic of a data center with an exemplary cooling system in Figure 1, an annotated version of which is provided below. Ex. 1005, [0007].



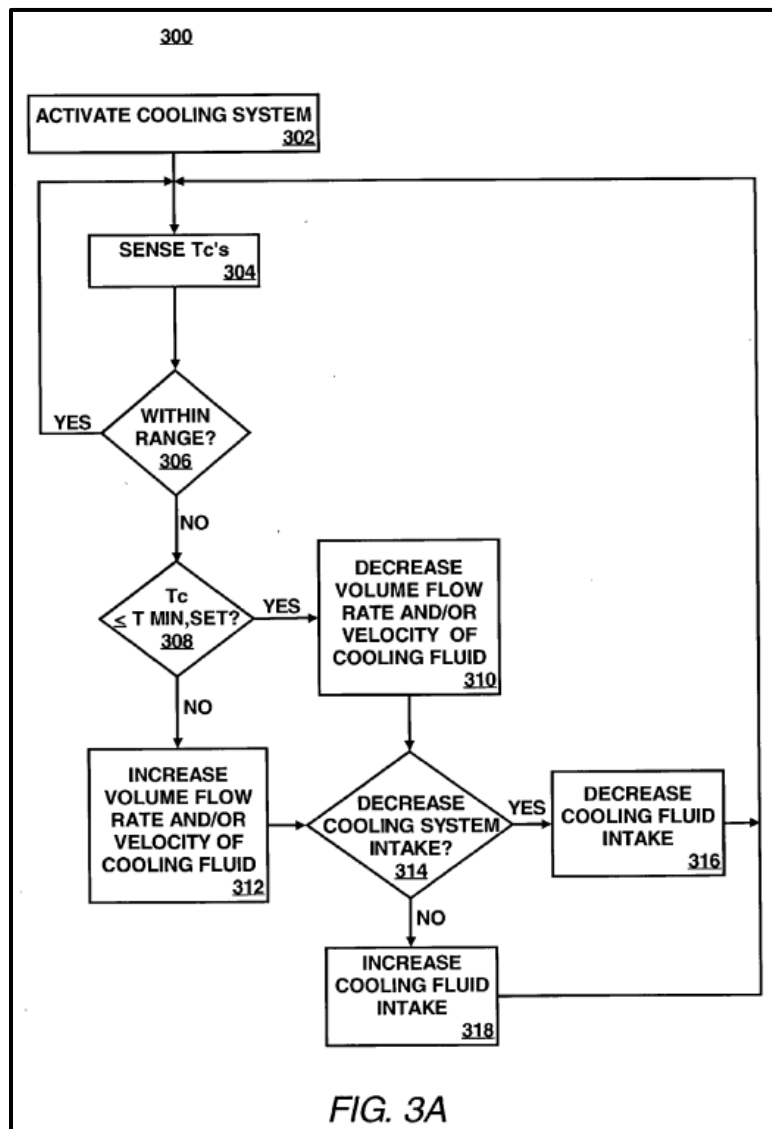
Ex. 1005, FIG. 1 (annotated).

As shown in Figure 1 of Bash, “cooling fluid flows out of the raised floor **14** through a plurality of dynamically controllable vents **36a-36c** [(orange)] that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough.” Ex. 1005, [0018]. The cooling fluid then “absorb[s] dissipated heat as it flows through the racks **18a-18d** [(pink)]. This heated cooling fluid may flow into the lowered ceiling through a plurality of dynamically controllable returns **38a-38c** that generally operate to control the velocity, direction, and the volume flow rate of the heated cooling fluid therethrough.” Ex. 1005, [0019]. Bash also teaches “varying the shape and/or opening size of the vents **36a-36c** and/or the

returns **38a-38c**” such that “the racks **18a-18d** may receive substantially individualized and localized amounts of cooling fluid according to their heat loads.”

Ex. 1005, [0019].

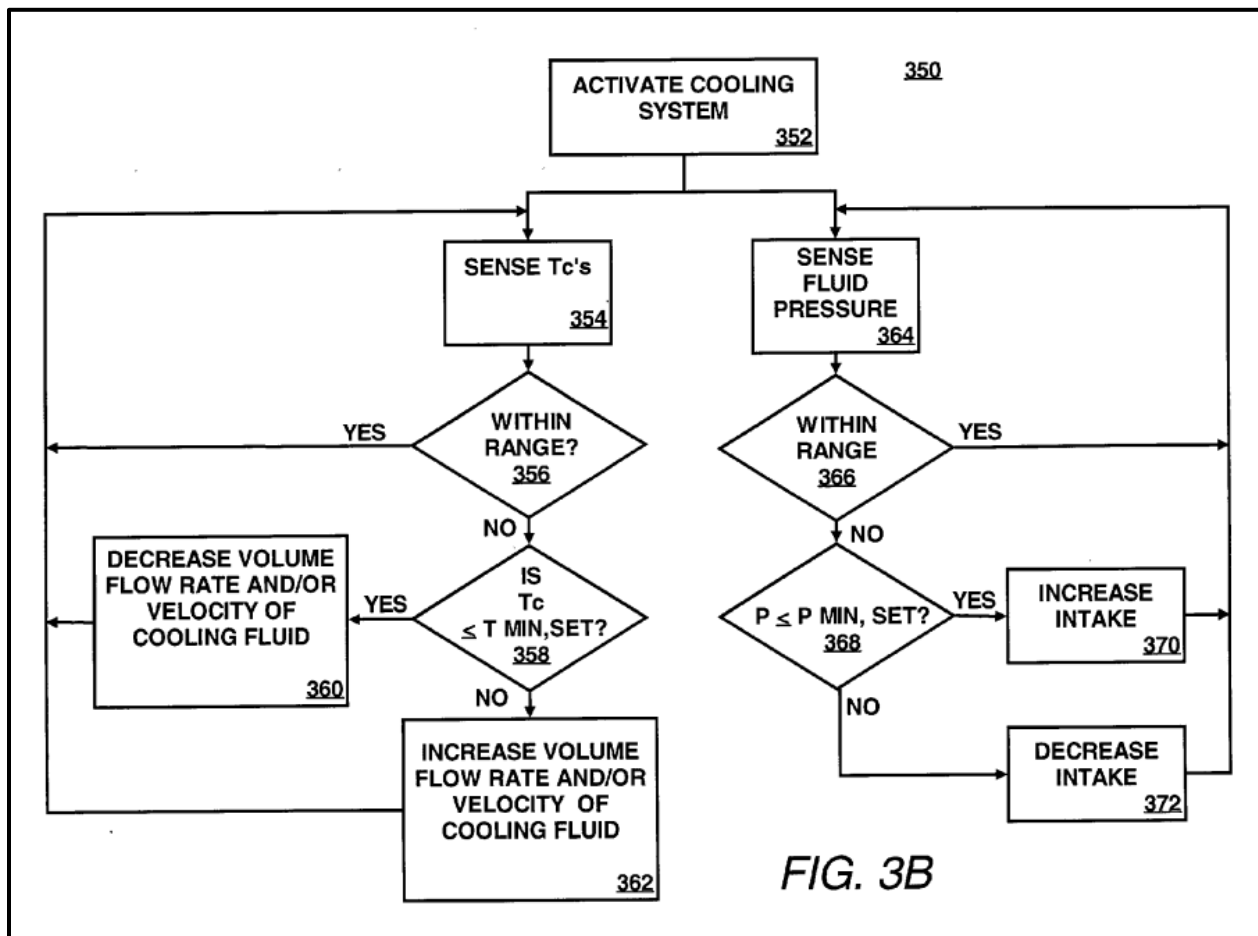
Figure 3A of Bash, reproduced below, provides further details regarding providing individualized and localized amounts of cooling air to racks in a data center based on measured temperatures.



Ex. 1005, FIG. 3A.

As shown in Figure 3A of Bash, Bash teaches measuring the temperatures (T_c) of individual components or locations **304** and then determining “whether each of the measured temperatures are individually within a predetermined range of operating temperatures” **306**. Ex. 1005, [0049]. “If the [measured temperatures] T_c ’s of some of the racks are below or equal to the [(minimum set point temperature)] $T_{\min, \text{set}}$, the return controller **210** and/or the vent controller **228** may operate to decrease the volume flow rate and/or the velocity of cooling fluid circulating about those racks at step **310**.” Ex. 1005, [0051]. Alternatively, “[i]f the T_c ’s of some of the racks exceed the $T_{\min, \text{set}}$ (i.e., also exceed the $T_{\max, \text{set}}$), the return controller **210** and/or the vent controller **228** may operate to increase the volume flow rate and/or the velocity of cooling fluid circulating about those racks at step **312**.” Ex. 1005, [0052].

Similar to Figure 3A, Figure 3B of Bash, reproduced below, provides further details regarding providing individualized and localized amounts of cooling air to racks in a data center based on measured temperatures and/or pressures.

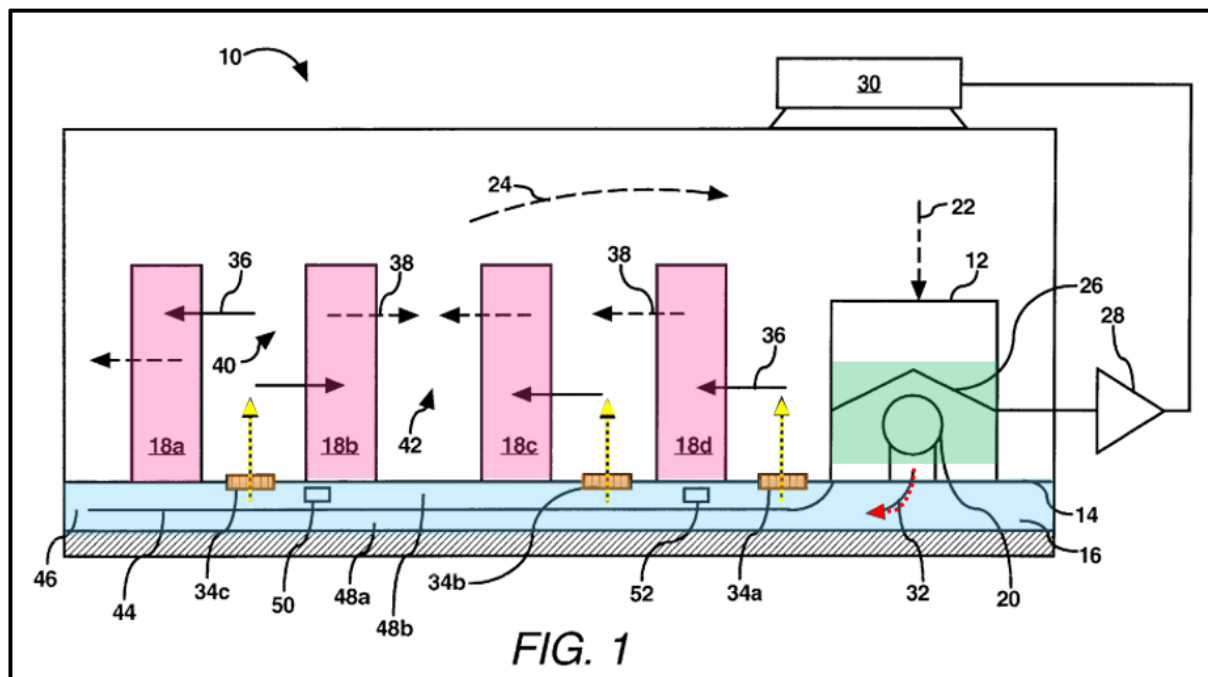


Ex. 1005, FIG. 3B.

B. Patel

Similarly, Patel (like Bash above) was developed by Hewlett Packard Co. and also includes overlapping—but not identical—inventorship. The specification and Figures of Patel are also very similar to the specification and Figures of both the '179 patent and Bash. The cooling systems and methods of Patel can be understood with reference to Figure 1 of Patel, an annotated version of which is provided below. Ex. 1006, 4:8–9. Patel teaches supplying a cooling fluid (air) from a cooling system **12** into a space (plenum) **16** (blue) below a raised floor **14** of a

data center. Ex. 1006, 4:11–15. The cooling fluid then “flows out of the raised floor 14 through a plurality of dynamically controllable vents 34a-34c that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough.” Ex. 1006, 5:8–11. “[T]he velocity and the volume flow rate of the cooling fluid may be regulated by varying the shape and/or opening size of the vents 34a-34c” (orange) so that “the racks 18a-18d [(pink)] may receive substantially individualized and localized amounts of cooling fluid according to their heat loads.” Ex. 1006, 5:11–17.



Ex. 1006, FIG. 1 (annotated).

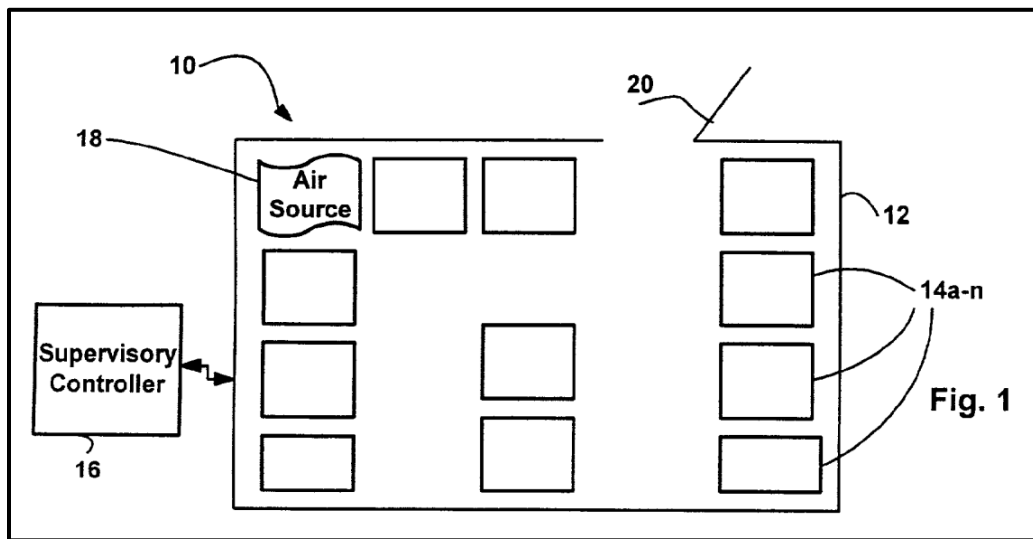
Patel also discloses increasing/decreasing cooling fluid flow rates and/or velocities based on sensed temperatures and pressures in a very similar manner to

the disclosure in Bash, including almost identical versions of Figs. 2 and 3 in both Patel and Bash. Ex. 1006, 10:16–28, 38–43. Ex. 1006, 11:6–23.

C. Bishop

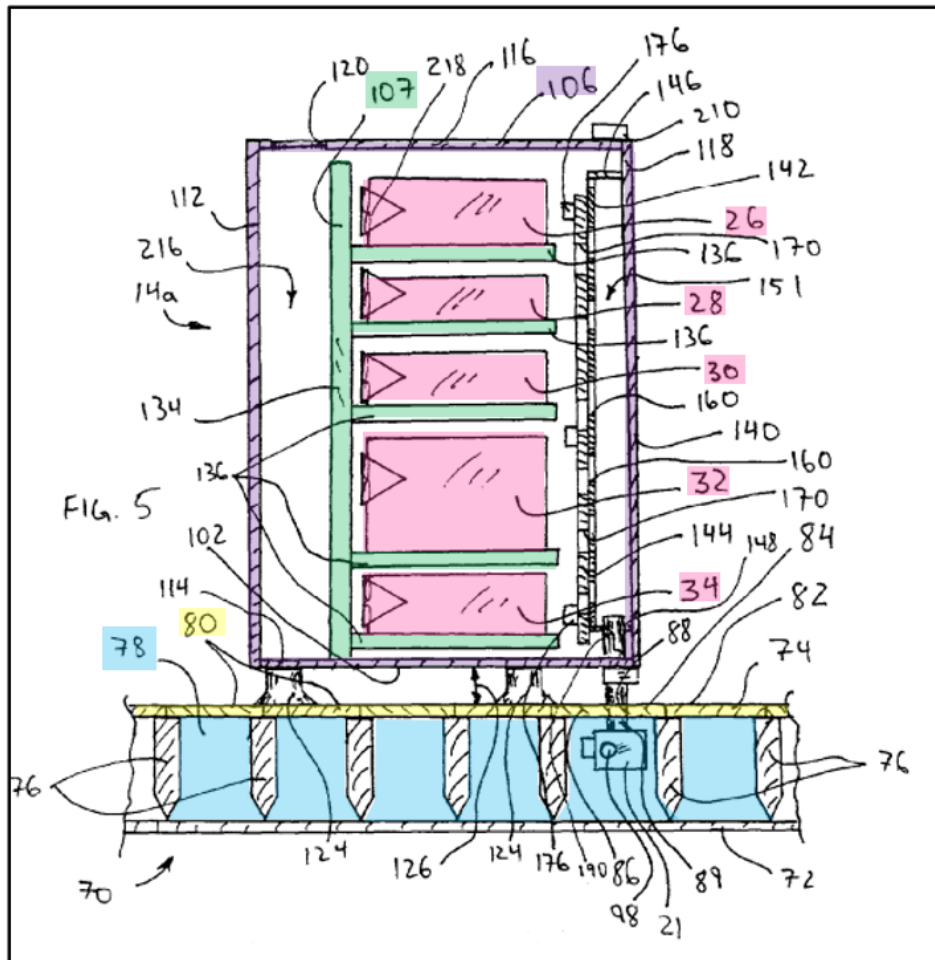
Bishop is directed to “air cooling systems for electronic equipment and more specifically to a plenum-based system for delivering cooling air to an electronic equipment cabinet.” Ex. 1008, [0003].

Bishop teaches cooling systems and methods for a critical environment room **10** (i.e., a data center) with “a plurality of electronic module cabinet assemblies **14a-n** [] arranged in a spaced format,” as shown in Figure 1 of Bishop, provided below. Ex. 1008, [0062]. “An air source **18** is located inside [the critical] environment **10** and provides cooling air.” Ex. 1008, [0062]. Additionally, “a supervising controller **16** is located outside environment **10** but links to various components within environment **10** via one or more data buses that enable supervising controller **16** to monitor and control environment characteristics.” Ex. 1008, [0062].



Ex. 1008, FIG. 1.

Bishop provides additional details on one of the cabinet assemblies **14a** in Figure 5, an annotated version of which is provided below. Ex. 1008, [0064]. Bishop discloses that the cabinet assembly **14a** includes a housing **106** (purple), a shelving unit **107** (green) and five electronic modules **26, 28, 30, 32** and **34** (pink). Ex. 1008, [0067].

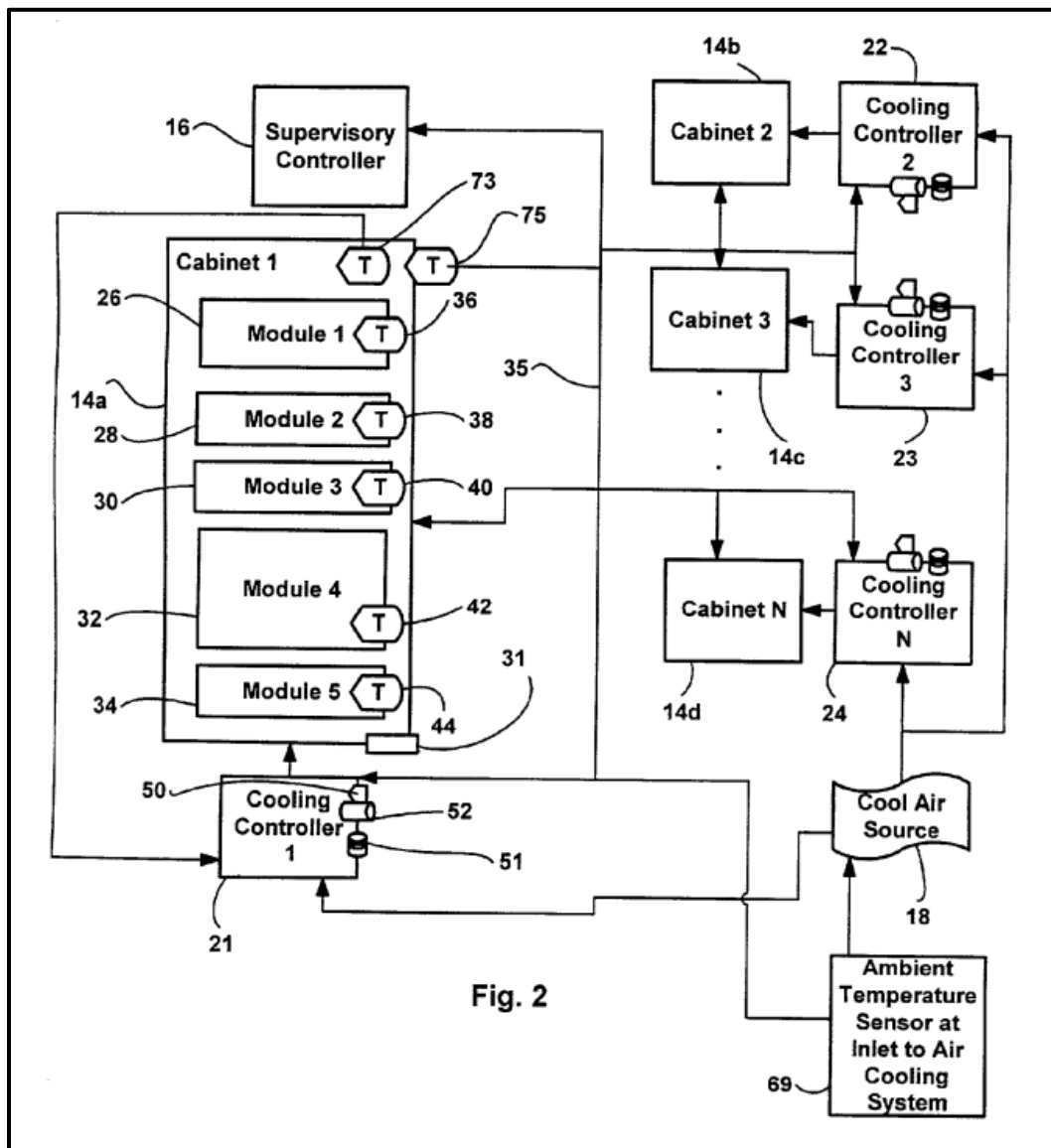


Ex. 1008, FIG. 5 (annotated).

Still referring to Figure 5 of Bishop, the cooling air source **18** provides cool air within space **78** (blue) below the support tiles **80** (yellow) that serve as a floor on which the cabinet assembly **14a** sits. Ex. 1008, [0063]. “Some of the tiles are . . . special control tiles (e.g., **84**)” that “facilitate delivery of cool air from space **78** directly into cabinet assemblies (e.g., **14a**) thereabove.” Ex. 1008, [0064]. The “control tile **84** also includes a cooling controller unit **21**” that “includes a damper and a processor (not separately illustrated).” Ex. 1008, [0065].

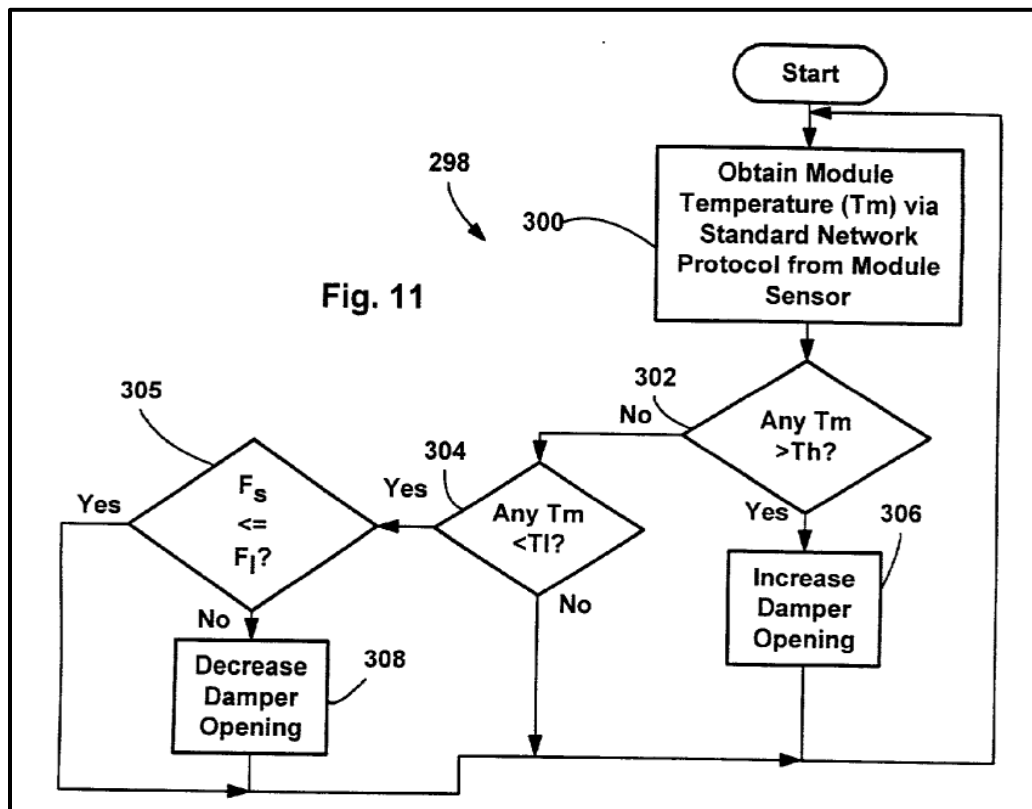
As one example of how Bishop varies the delivery of cool air to heat-generating electronic modules in a cabinet assembly (e.g., **14a**), Bishop discloses a method that utilizes the cooling controller **21**, which is best explained with reference to Figures 2 and 11 of Bishop.

Figure 2, provided below, provides a schematic diagram of many of the components of Figure 1—including the cooling controller **21** and a cabinet assembly (e.g., **14a**). Ex. 1008, [0046]. As shown in Figure 2, “the temperature sensors in [the electronic]modules **26, 28, 30, 32** and **34** are identified by numerals **36, 38, 40, 42** and **44**, respectively.” Ex. 1008, [0081]. Since each module has its own temperature sensor, “each module is capable of determining its own internal temperature and communicating that temperature to supervising controller **16**” so that the “supervisory controller **16** may control controller **21** based on the temperature.” Ex. 1008, [0081]–[0082].



Ex. 1008, FIG. 2.

As shown below in Figure 11, Bishop further discloses both increasing and decreasing the damper opening to adjust cooling air flow depending on the measured temperature. Ex. 1008, [0082]–[0085].



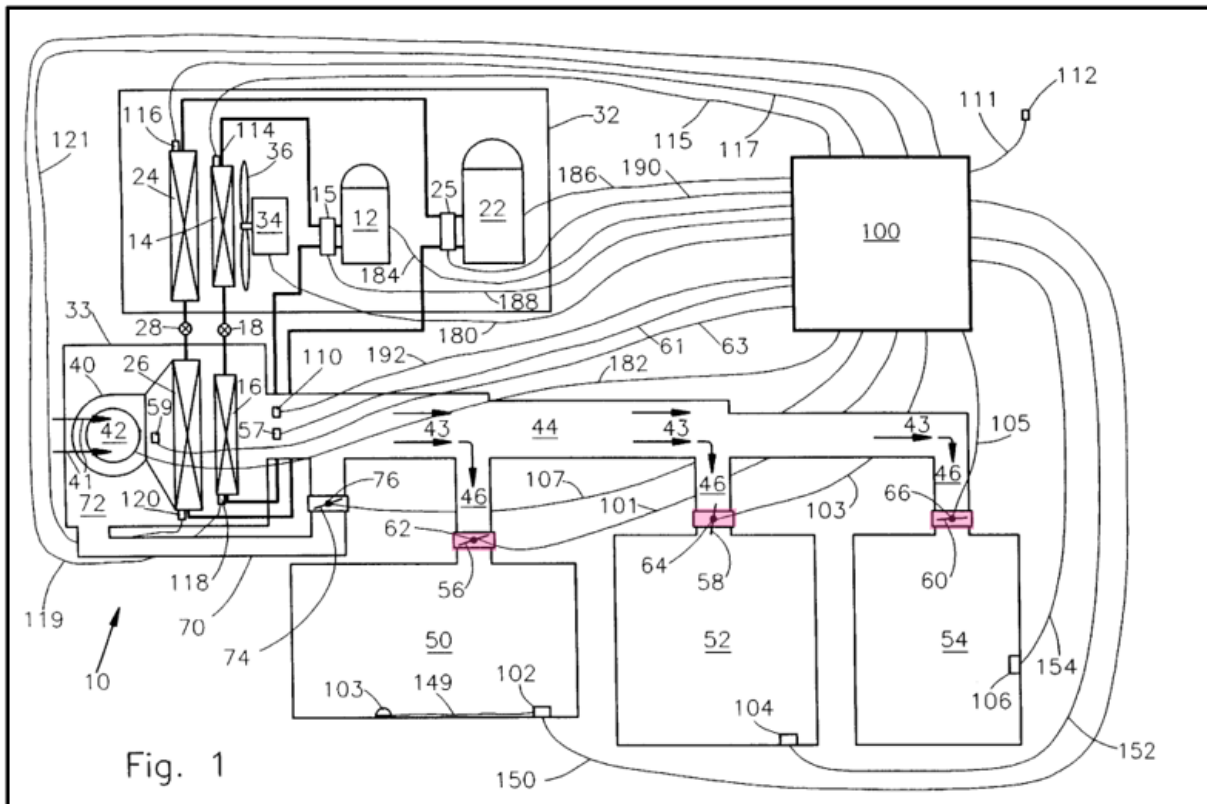
Ex. 1008, FIG. 11.

D. Kochavi

Kochavi is directed to an air conditioning system that is capable of heating and cooling multiple rooms simultaneously, where the rooms have different heating and cooling requirements.

As shown in the annotated version of Figure 1, provided below, Kochavi discloses an air conditioning system **10** including a first compressor **12**, a second compressor **22**, a blower **40**, a main duct **44**, and a control system **100**. Ex. 1011, 3:61–4:42; 4:64–67. The blower **40** directs a flow of air through heat exchangers **16**, **26** to condition the air, and then the conditioned air **43** flows through the main

duct **44** and “through a plurality of branch ducts **46** to a plurality of rooms **50**, **52** and **54** via variable dampers **56**, **58** and **60** [(pink)] respectively.” Ex. 1011, 4:38–47.



Ex. 1011, FIG. 1 (annotated).

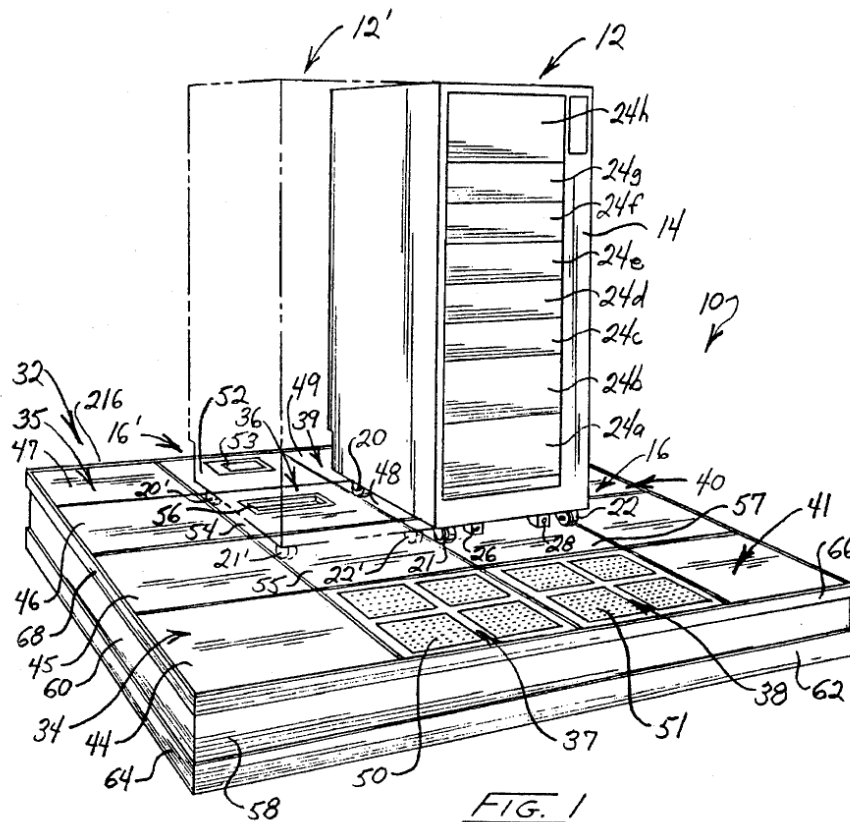
“The air conditioning system **10** also comprises an air flow pressure sensor **110** which may be located at the entrance to the main duct **44**. . . . [that] is operative to send a duct pressure signal to the control system **100** which is substantially proportional to the air pressure at the entrance to the main duct **44**.” Ex. 1011, 4:58–67.

Kochavi also discloses that the control system **100** communicates with various elements of the system, including controlling opening of dampers **56**, **58**, and **60**. Ex. 1011, 6:60–7:24; 7:50–62, 8:24–27, 13:21–27.

E. Feeney

Feeney discloses a raised floor system for supporting rack-mounted computer equipment in facilities such as data centers. Ex. 1013, 1:17–36, 2:27–31. The disclosed system is made up of connectable floor modules, including modules providing operational support for use by the computer components. For example, air cooling coils and associated motor driven blower fans are installed in some floor modules to provide cooling. Ex. 1013, 2:38–45. Other modules may house power supply devices or power distribution network components. Ex. 1013, 2:49–4:55.

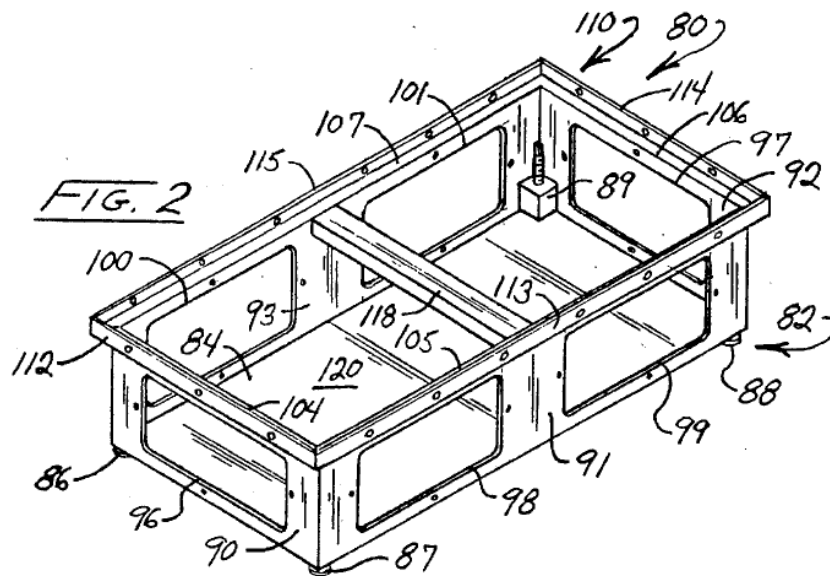
Feeney's disclosed raised floor system is illustrated in Figure 1, reproduced below.



Ex. 1013, FIG. 1. The floor system **10** is illustrated as having an elevated floor, formed of floor modules, supporting computer rack **12** and adjacently-positioned computer rack **12'** shown in phantom. Ex. 1013, 5:35–41, 53–65.

Certain modules, for example modules **37** and **38**, contain chilled water air conditioning coils and floor tiles **50** and **51** contain air entry holes for supplying air to the cooling coils. Ex. 1013, 5:56–60; 6:2–7. Floor module **38** also houses an air blower fan **148**. Ex. 1013, 8:1–3. Tile **54** within floor module **52** contains an air outlet **56** through which cooled air may flow into the base region of computer component **12'**. Ex. 1013, 6:16–19.

Figure 2 shows an individual floor module.



Ex. 1013, FIG. 2.

Feeney teaches that the user can define the paths for cooling air flow under the raised floor and through vented floor tiles by gasketing and selectively closing these air transfer openings. Ex. 1013, 10:20–22. For example, with reference to Figure 1 above, the air blower fan **148** in floor module **38** supplies cooling air through the system. By utilizing blocking panels and gasketing to block certain of the air transfer openings, an air flow path is established extending through the openings floor tile **51**, then through chilled water-cooling coil **124** to the input of the blower, and then from the blower output through the defined air flow path, and exiting through an opening **56** in floor tile 54. Ex. 1013, 8:1–17.

Feeney emphasizes the capability for reconfiguring the floor modules “depending upon changing processing requirements and/or changes in the geometry of the floor region available for the data center function” as being advantageous. Ex. 1013, 11:48–52, 13:53–15:10; FIG. 10.

VII. STATEMENT OF HOW EACH CLAIM IS UNPATENTABLE

A. Ground 1: Claims 1–15 are Anticipated by Bash

As set forth below, under Patent Owner’s own construction of “partition,” claims 1–15 are anticipated under §102(e) by Bash (Ex. 1005). Ex. 1002 ¶¶160–274.

Claim 1

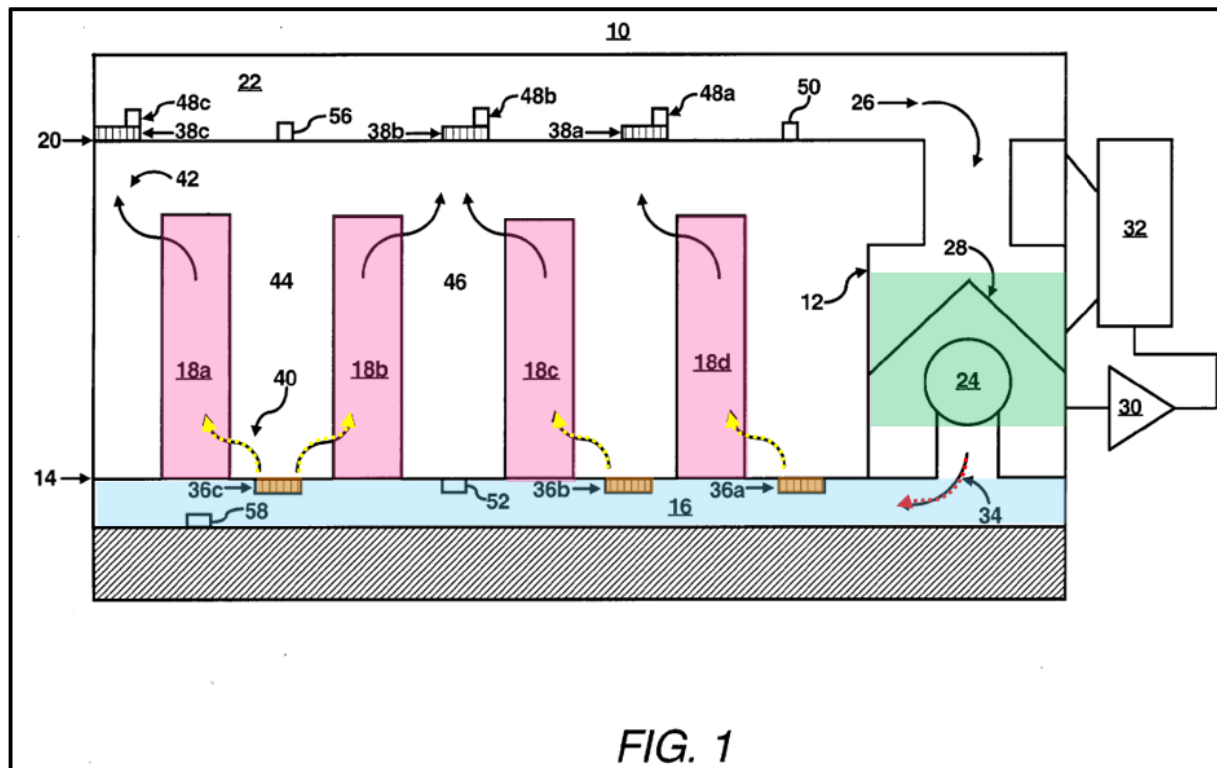
1[pre]

If the preamble is limiting, Bash discloses the preamble in relation to “[a] method of cooling a plurality of racks in a data center.” Ex. 1005, Claim 12; *see also* Ex. 1005, Abstract. Ex. 1002 ¶¶162–166.

1[a]

Bash discloses a data center **10** containing a cooling system **12**, a zone above a raised floor **14** with a plurality of racks **18a–18d** that house a plurality of electronic components, and a space **16** beneath a raised floor **14** that may function as a plenum to deliver cooling fluid (*e.g.*, air) from the cooling system **12** to the plurality of racks **18a–18d**. Ex. 1005, [0012]; Figure 1 (reproduced and annotated

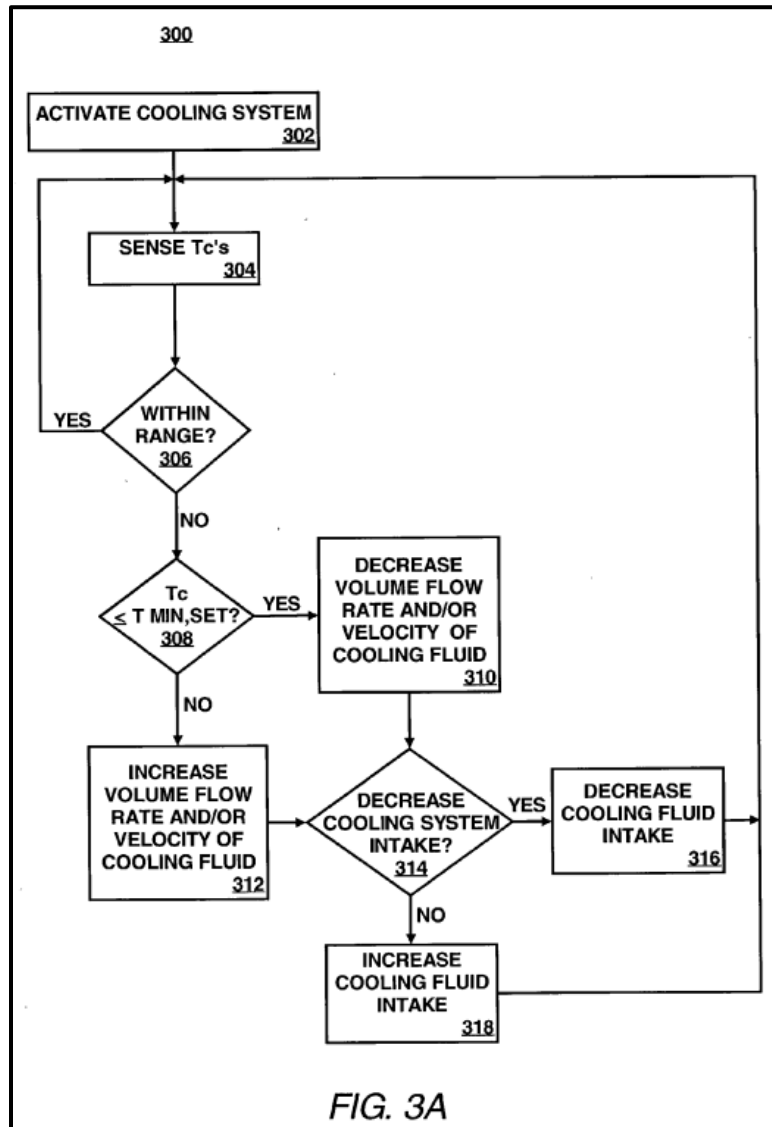
below). The cooling system **12** generally includes a “cooling device having a fan” **24** for circulating cooling fluid in the data center **10**. Ex. 1005, [0005]. Ex. 1002 ¶¶167–168.



Ex. 1005, FIG. 1 (annotated).

Bash further discloses the cooling fluid, *i.e.*, cooling air, being delivered to the plurality of racks **18a–18d** by “flow[ing] out of the raised floor **14** through a plurality of dynamically controllable vents **36a–36c** that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough” and into the zone above the raised floor **14** where the plurality of racks **18a–18d** are located. Ex. 1005, [0018]. Ex. 1002 ¶169.

Bash also teaches a method of operating the cooling system **202** in the flow diagram **300** of Figure 3A of Bash, provided below. In the first step **302** of this method, “the cooling system **202** is activated and the vents **36a-36c** . . . are opened.”
Ex. 1005, [0048]. Ex. 1002 ¶170.



Ex. 1005, FIG. 3A.

Since the cooling system of Bash includes a cooling device, a POSITA would understand that activating the cooling system also activates the cooling device.

Thus, Bash teaches activating a cooling device as recited in limitation 1[a]. Ex. 1002 ¶170.

Bash also discloses opening a controllable partition configured to vary a supply of cooling fluid within a zone of said data center as recited in limitation 1[a].

With regard to “cooling fluid,” Bash discloses supplying cooling fluid under Patent Owners’ expected construction, which includes cooling air. Bash teaches that “cooling fluid (e.g., *air*)” is delivered “from the cooling system **12** to a plurality of racks **18a-18d**.” Ex. 1005, [0012] (emphasis added). Ex. 1002 ¶¶171–173.

Bash also discloses the “controllable partition” recited in this claim limitation under Patent Owners’ expected construction of “partition.” Specifically, Patent Owners’ expected construction encompassing any device capable of manipulating the flow of cooling fluid includes the controllable vents **36a-36c** of Bash Ex. 1002 ¶174.

Bash teaches that “cooling fluid flows out of the raised floor **14** through a plurality of dynamically *controllable* vents **36a-36c** that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough.” Ex. 1005, [0018] (emphasis added). Since the vents of Bash are controllable and are capable of manipulating the flow (e.g., velocity and volume flow rate) of cooling fluid, the vents **36a-36c** of Bash disclose the controllable partition under Patent Owners’ expected construction of “partition.” Therefore, the vents **36a-36c** of Bash disclose

the controllable partition recited in claim 1 under Patent Owners’ expected construction of “partition.” Ex. 1002 ¶¶175–176.

Bash also discloses that the vents **36a-36c** are configured to vary a supply of cooling fluid within a zone of the data center: “[t]he cooling fluid flows out of the raised floor **14** through a plurality of dynamically controllable vents **36a-36c** that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough.” Ex. 1005, [0018]. Ex. 1002 ¶177.

Bash further discloses that the zone of said data center includes at least one associated rack of said plurality of racks. For example, Bash teaches that the “cool aisles **44** are those aisles that include the vents **36a-36c** and thus receive cooling fluid for delivery to the racks **18a-18d**.” Ex. 1005, [0020]. Ex. 1002 ¶¶178–179.

1[b]

Bash teaches detecting temperatures via “a plurality of temperature sensors **48a-48c**, e.g., thermocouples, [that] may be positioned at various positions around the subsystems and/or the racks **18a-18d**.” Ex. 1005, [0030]. All of the temperature sensors disclosed in Bash (e.g., **48a-48c**, **50**, **52**, **236-230**) may be employed to sense temperatures (T_C ’s) “in the general vicinity of the racks and/or sections of the racks.” Ex. 1005, [0048]. Ex. 1002 ¶¶180–182.

1[c]

As shown in the flow diagram **300** in Figure 3A of Bash, “[a]t step **304**, the temperatures of the components (T_C ’s) are individually sensed by the temperature sensors. . . . At step **306**, it is determined whether each of the measured temperatures are individually within a predetermined range of operating temperatures, e.g., between a maximum set point temperature ($T_{\max, \text{set}}$) and a minimum set point temperature ($T_{\min, \text{set}}$).” Ex. 1005, [0049], FIG. 3A; Ex. 1002 ¶¶183–185.

1[d]

Bash discloses that the “the shape and/or opening size of the vents **36a-36c**” are manipulable to vary the “velocity and the volume flow rate of the cooling fluid” that passes through the vents **36a-36c** from the plenum **16** below the raised floor **14** and into the zone where the racks **18a-18d** are located. Ex. 1005, [0019]. Bash also discloses that this manipulation of the vents is in response to said sensed temperature being outside said predetermined temperature range. Ex. 1002 ¶¶186–190.

Claim 2

a. 2[a]

As shown in Figure 3A, Bash further teaches that “[f]or those racks determined to have heat loads that do not fall within the predetermined temperature range, i.e., fall outside of $T_{\min, \text{set}}$ and $T_{\max, \text{set}}$, it is determined whether the sensed

temperature equals or falls below the $T_{\min, \text{set}}$ at step **308**.” Ex. 1005, [0050]. Bash also defines a “minimum set point temperature [as] ($T_{\min, \text{set}}$).” Ex. 1005, FIG 3A, [0049]. Ex. 1002 ¶¶194–195.

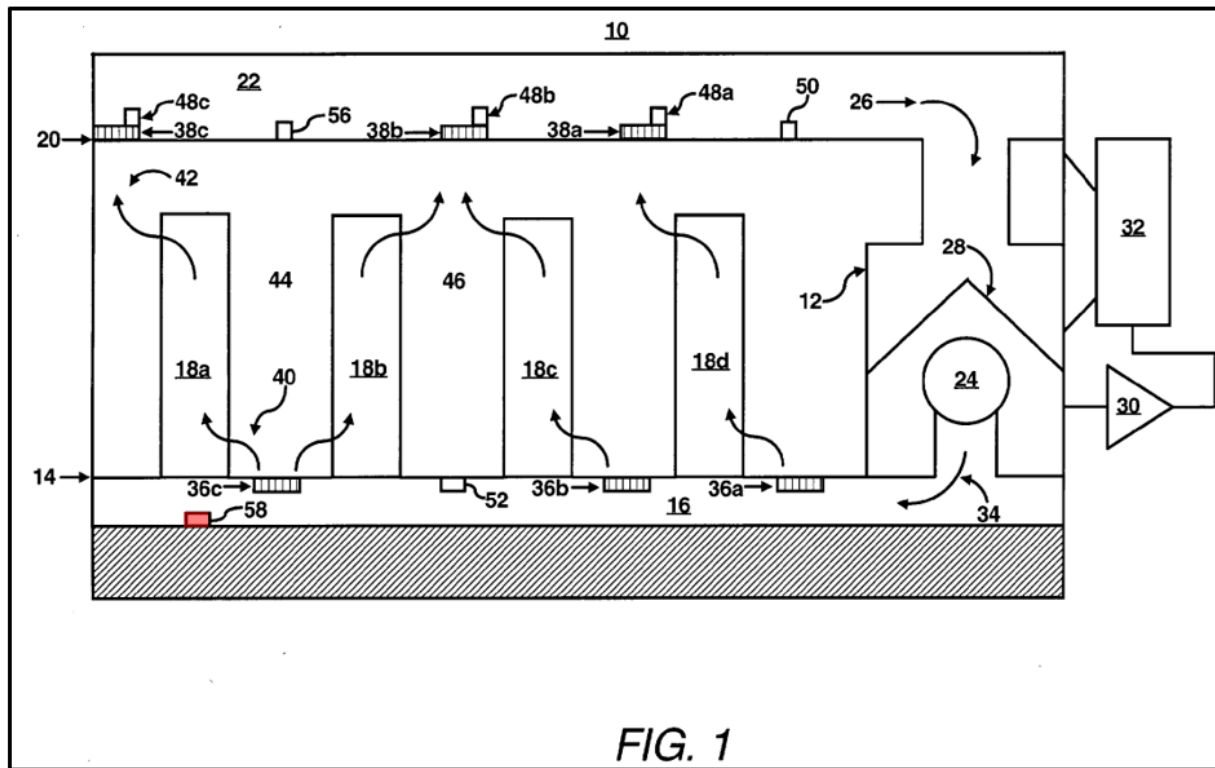
2[b]

Bash discloses that “[i]f the T_C ’s of some of the racks are below or equal to the $T_{\min, \text{set}}$, . . . the vent controller **228** may operate to decrease the volume flow rate and/or the velocity of cooling fluid circulating about those racks at step **310**.” Ex. 1005, FIG. 3A, [0051]. Ex. 1002 ¶¶196–198.

Claim 3

3[a]

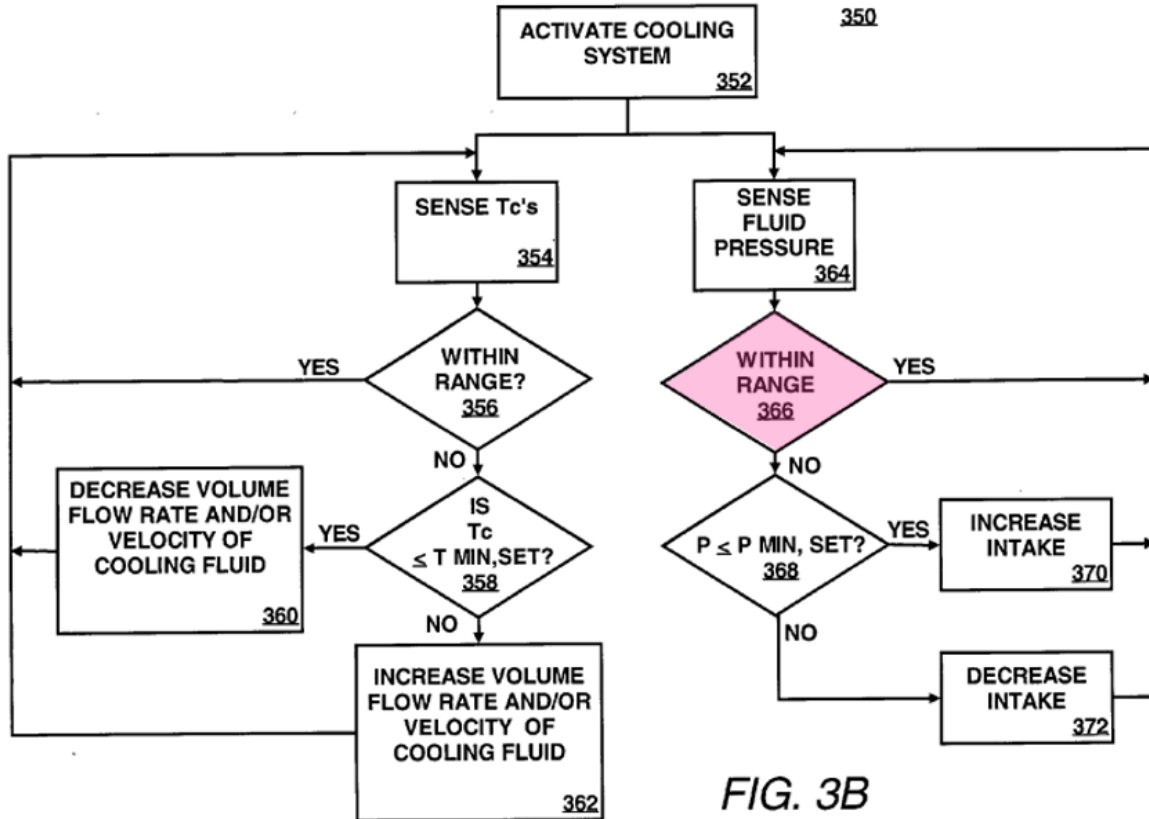
As further shown in Figure 1 of Bash, reproduced and annotated below, Bash further discloses “a pressure sensor **58** [(red)] may be configured to measure the pressure of the cooling fluid in the space **16**” below the floor from which cooling fluid is supplied. Ex. 1005, [0027]. Ex. 1002 ¶¶202–203.



Ex. 1005, FIG. 1 (annotated).

3[b]

As shown in Figure 3B of Bash, an annotated version of which is provided below, Bash teaches “determin[ing] whether the measured pressure is within a predetermined pressure range, e.g., a predetermined minimum set point pressure ($P_{\min, \text{set}}$) and a predetermined maximum set point pressure ($P_{\max, \text{set}}$), at step **366**” (pink). Ex. 1005, [0060]. Ex. 1002 ¶¶204–206.



Ex. 1006, FIG. 3B (annotated).

3[c]

Bash teaches establishing a “predetermined pressure range” of “threshold pressures to determine whether to increase or decrease the movement of cooling fluid, e.g., in the space 16.” Ex. 1005, [0061]. Ex. 1002 ¶¶207–208.

For example, as shown in Figure 3B of Bash, provided above, “[i]f the absolute value of the P[ressure] is determined to be below or equal to the $P_{\min, \text{set}}$, the cooling system controller 246 may operate to increase the cooling fluid intake, e.g., by increasing the speed of the fan 24 at step 370. Otherwise, if the absolute value

of the P_{ressure} is determined to exceed the $P_{\text{min,set}}$, and thereby exceed the $P_{\text{max,set}}$, the cooling system controller **246** may operate to decrease the intake of the cooling fluid, e.g., by decreasing the compressor capacity and/or the fan speed, at step **372**.” Ex. 1005, [0062]. Ex. 1002 ¶209.

And because the “cooling device ha[s] a fan,” a POSITA would readily understand that Bash discloses varying the speed of the fan varies the output of the cooling device. Ex. 1005, [0005]. Ex. 1002 ¶¶210–211.

Claim 4

Claim 4 requires decreasing the cooling fluid flow to a zone at one time and increasing the cooling fluid flow at another time. Ex. 1002 ¶¶212–213.

Bash’s system is capable of both decreasing and increasing the cooling fluid flow to a zone as the sensed temperature conditions dictate. Bash discloses that “[i]f the T_C ’s [(measured temperatures)] of some of the racks exceed the $T_{\text{min,set}}$ (i.e., also exceed the $T_{\text{max,set}}$), . . . the vent controller **228** may operate to increase the volume flow rate and/or the velocity of cooling fluid circulating about those racks at step **312**.” Ex. 1005, [0049]; [0052]. Ex. 1002 ¶¶214–215.

Claim 5

As explained above, Bash discloses the method of claim 3. Bash also expressly teaches “determin[ing] whether an absolute value of the measured

pressure (P) is below or equal to a minimum pressure set point ($P_{\min, \text{set}}$) at step **368**.”

Ex. 1005, FIG. 3B, [0061]. Ex. 1002 ¶¶216–219.

Claim 6

Claim 6 depends directly from claim 4 and indirectly from claim 2. A POSITA would understand that this claim requires decreasing the cooling fluid output from the cooling device in response to the decrease in cooling fluid to the zone (per claim 2) exceeding the increase in cooling fluid to the zone (per claim 4). Bash discloses that if the total amount of decreases in the volume flow rates of the cooling fluid exceeds the total amount of increases in the volume flow rates of the cooling fluid, the cooling system controller **246** may decrease the cooling fluid intake at step **316** by decreasing the speed of the fan **24**. Ex. 1005, [0054]. A POSITA understands that the intake and the output of cooling fluid by the cooling system of Bash are correlated. Decreasing the fan speed decreases the output of cooling fluid from the cooling device because the “cooling fluid is circulated in the data center by a cooling device having a fan.” Ex. 1005, FIG. 1, [0005]. Ex. 1002 ¶¶220–222.

Claim 7

As explained above, Bash discloses the methods of claims 2 and 4 if analyzed according to Patent Owner’s position that a “partition” can be any device capable of manipulating cooling fluid flow. That construction would essentially make claim

7 redundant to claims 2 and 4 since Patent Owner's construction would include a vent as one type of partition. Therefore, the discussions for claims 2 and 4 apply to claim 7. *See supra* § VII.A. (Claims 2 and 4); Ex. 1002 ¶¶223–226.

Claim 8

As explained above, Bash discloses the method of claim 4. Bash further discloses opening a plurality of returns **38a–38c** that are configured to remove cooling fluid from the vicinity of racks in a data center. Ex. 1005, [0048]; [0067]. Bash also discloses controlling the returns **38a–38c** to decrease the removal of cooling fluid from the vicinity of the racks having a measured temperature (T_C) that falls below or equal to a predetermined minimum set point temperature ($T_{\min, \text{set}}$); and to increase the removal of cooling fluid from the vicinity of the racks having a measured temperature (T_C) that exceeds the predetermined minimum set point temperature ($T_{\min, \text{set}}$). Ex. 1005, [0050]–[0052]. Ex. 1002 ¶¶227–230.

Claim 9

Each limitation of claim 9 is discussed below, in conjunction with the relevant disclosures of each claim limitation by Bash. Ex. 1002 ¶231.

9[a]

As explained above, Bash discloses the method of claim 4. Bash further discloses that “a mobile device” may be used “to gather or measure at least one local environmental condition (e.g., temperature, pressure, air flow, humidity, etc.)

in the data center **10**. More particularly, the mobile device is configured to travel around the racks to determine the one or more environmental conditions at various locations throughout the data center The information gathered by the mobile device may be transmitted to the cooling system **202**.” Ex. 1005, [0032]. Ex. 1002 ¶¶232–235.

9[b]

As shown in Figure 3A, provided below, Bash discloses determining whether each of the measured temperatures are within a predetermined range of operating temperatures. Ex. 1005, [0049]. Bash further discloses that the cooling system **202** that receives measured temperatures from the mobile device (Ex. 1005, [0032]) is capable of performing the method shown in the flow diagram **300** in Figure 3A of Bash (Ex. 1005, [0048]). Ex. 1002 ¶¶236–239.

9[c]

Bash discloses that the “the shape and/or opening size of the vents **36a-36c**” (i.e. controllable partitions under Patent Owners’ expected construction of “partition”) are manipulable to vary the “velocity and the volume flow rate of the cooling fluid” that passes through the vents and into the zone. Ex. 1005, [0019]. As discussed above, Bash also discloses manipulating the vents in response to sensed temperatures being outside of a predetermined temperature range. Ex. 1005, FIG. 3A, [0050]–[0052]. Ex. 1002 ¶¶240–243.

Claim 10

As explained above, Bash discloses the method of claim 4. Bash further discloses a “method . . . comprising: performing a numerical modeling of a temperature distribution and flow characteristics of the data center; and manipulating said cooling system in response to said numerical modeling.” Ex. 1005, Claim 20. Ex. 1002 ¶¶244–246.

Moreover, Bash discloses inputting velocity of the cooling fluid flowing through various sections of the data center and the distribution of temperature and pressure of the cooling fluid into a computational fluid dynamics (CFD) tool. Bash teaches using “a numerical model of the data center [produced by the CFD tool] to thus determine an optimized cooling distribution of the data center.” Ex. 1005, [0066]. Bash also teaches incorporating the numerical model into the control logic summarized in Figure 3A “to determine whether the cooling system intake should be decreased based upon the heat loads and the fluid flow throughout the data center.” Ex. 1005, [0067]. Thus, Bash teaches using CFD tools to generate a numerical model of cooling fluid flow, temperature, and/or pressure in a data center. Bash also teaches using that numerical model to manipulate the operation of the air conditioning units (i.e., cooling devices). Ex. 1002 ¶¶248–250.

Bash also discloses that the cooling system includes a “cooling device having a fan,” so a POSITA would understand that Bash’s disclosure referring to

manipulating the cooling system is synonymous with manipulating the cooling device. Ex. 1005, [0005]. Ex. 1002 ¶247.

Claim 11

As explained above, Bash discloses the method of claim 5. Bash further discloses that if the absolute value of the measured supply air pressure is “below or equal to the $P_{\min, \text{set}}$, the cooling system controller **246** may operate to increase the cooling fluid intake, e.g., by increasing the speed of the fan **24** at step **370**.” Ex. 1005, [0062]. Ex. 1002 ¶¶251–253.

And because Bash discloses that the “cooling fluid is circulated in the data center by a cooling device having a fan,” a POSITA would understand that increasing the speed of the fan **24** increases the output of cooling fluid from the cooling device. Ex. 1005, [0005]. Ex. 1002 ¶¶254–255.

Claim 12

As explained above, Bash discloses the method of claim 5. Bash further discloses that if the measured supply air pressure exceeds the $P_{\min, \text{set}}$, and thereby exceeds the $P_{\max, \text{set}}$, the cooling system controller **246** may decrease the intake of the cooling fluid by decreasing the fan speed. Ex. 1005, [0062]. Bash also explains that $P_{\min, \text{set}}$ is a minimum pressure set point of a predetermined pressure range. Ex. 1005, [0061]. Ex. 1002 ¶¶256–258.

And because Bash discloses that the “cooling fluid is circulated in the data center by a cooling device having a fan,” a POSITA would understand that decreasing the speed of the fan **24** decreases the output of cooling fluid from the cooling device. Ex. 1005, [0005]. Ex. 1002 ¶¶259–260.

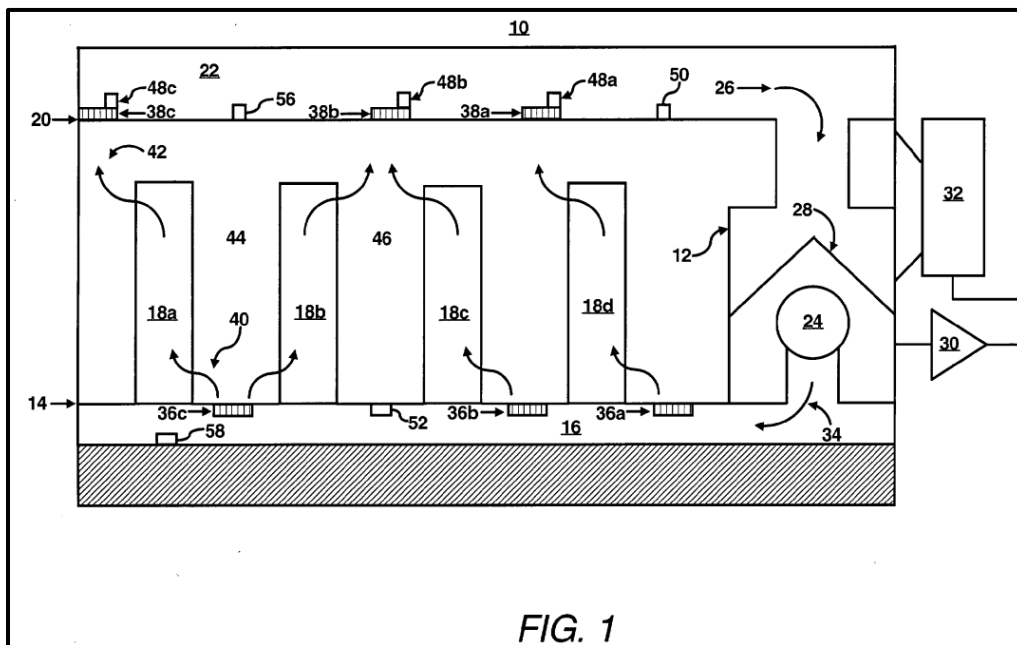
Claim 13

As explained above, Bash discloses the method of claim 6. Bash further discloses that “if the total amount of increases in the volume flow rates of the cooling fluid exceeds the total amount of decreases, the cooling system controller **246** may operate to increase the cooling system intake at step **318**.” Ex. 1005, [0054]. Bash explains that “increas[ing] the cooling fluid intake” may be accomplished “by increasing the speed of the fan **24**.” Ex. 1005, [0062]. As previously explained, the intake of cooling fluid by the cooling system of Bash correlates to the output of cooling fluid by the cooling system. And because Bash discloses that the “cooling fluid is circulated in the data center by a cooling device having a fan,” increasing the speed of the fan **24** increases the output of cooling fluid from the cooling device. Ex. 1005, FIG. 1, [0005]. Ex. 1002 ¶¶261–264.

Claim 14

As explained above, Bash discloses the method of claim 7. Bash further discloses controlling the vents **36a–36c** so as to selectively vary the supply of cooling fluid to data center zones based on sensed temperatures associated with the

racks in each zone. Bash's disclosed cooling system is adapted for a typical data center layout having racks arranged in cold aisles that include floor vents to supply cooling air and hot aisles having returns to remove air. Ex. 1005, FIG. 1, [0020]. Figure 1 illustrates this arrangement and shows cooling air supplied by fan **24** flowing under a raised floor plenum towards adjacent aisles (e.g. **44**, **46**) in the direction of arrow **34**. Ex. 1002 ¶¶265–267.



Ex. 1005, FIG. 1.

Racks **18a**, **18b** and associated vent **36c** are downstream of racks **18c**, **18d** and associated vents **36b**, **36a** relative to the location of the cooling air source. It follows directly from Bash's teachings that the controller is operable to increase cooling air flow through vent **36c** in response to a high temperature condition sensed at relatively downstream racks **18a** and/or **18b**, and to decrease cooling air flow

through vents **36a** and/or **36b** in response to a low temperature condition sensed at relatively upstream racks **18c** and/or **18d**. Ex. 1002 ¶¶268–269.

Claim 15

As explained above, Bash discloses the method of claim 10. Bash further discloses: “implementing said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of said racks within said data center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said cooling system in response to said inferred thermal condition.” Ex. 1005, Claim 21; *see also* Ex. 1005, [0066]–[0067]. Bash discloses that the cooling system includes a “cooling device having a fan,” so a POSITA would understand that manipulating the cooling system is synonymous with manipulating the cooling device. Ex. 1005, [0005]. Ex. 1002 ¶¶270–274.

B. Ground 2: Claims 1–7 and 10–15 are Anticipated by Patel

As set forth below, under the construction of “partition” reflected in Patent Owners’ infringement assertions, claims 1–7 and 10–15 are anticipated under §102(e) by Patel (Ex. 1006). Patel’s disclosure is very similar to that of Bash, including that the Applicant included “dynamically controllable vents” which meet the “controllable partition” limitation based on the Patent Owner’s construction of that term and as discussed below. Ex. 1002 ¶275.

Claim 1

Set forth below is a discussion of each limitation of claim 1, in conjunction with the relevant disclosures of each claim limitation by Patel. Ex. 1002 ¶276.

1[pre]

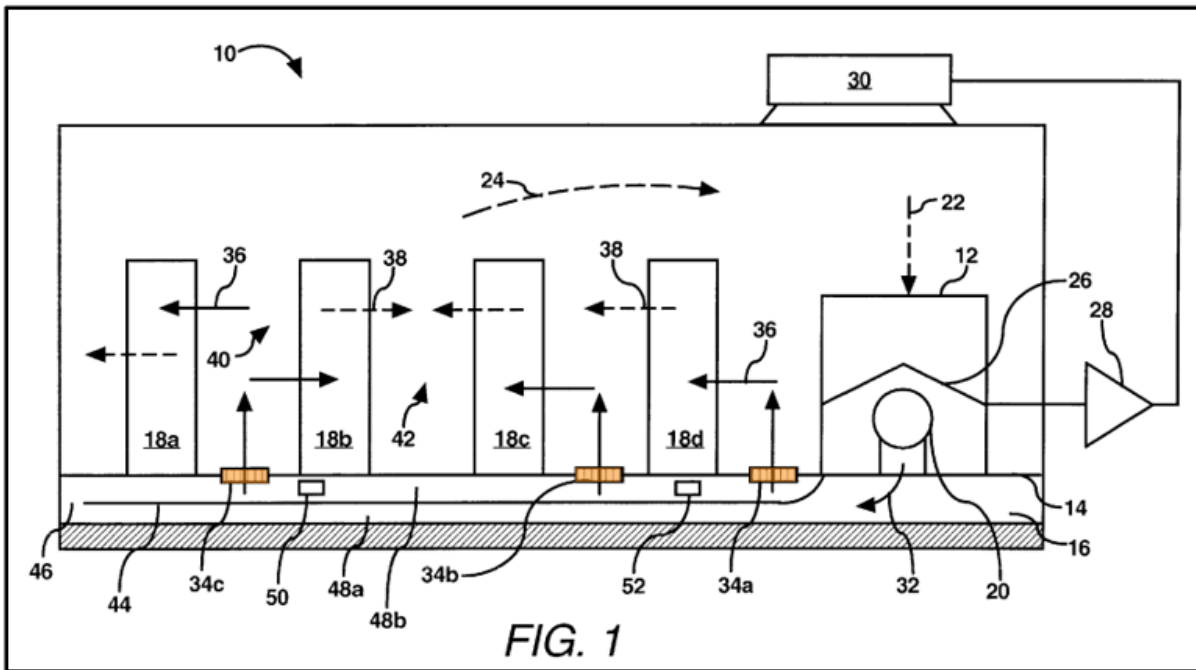
If the preamble is limiting, Patel discloses the preamble in relation to “a method of cooling a plurality of racks in a data center.” Ex. 1006, 2:27–29; Claim 14. Ex. 1002 ¶¶277–280.

1[a]

Patel discloses a data center **10** containing a cooling system **12**, a zone above a raised floor **14** with a plurality of racks **18a–18d** that house a plurality of electronic components, and a space **16** beneath the raised floor **14** that may function as a plenum to deliver cooling fluid (*e.g.*, air) from the cooling system **12** to the plurality of racks **18a–18d**. Ex. 1006, 3:48–54; 4:7–44; Figure 1 (reproduced and annotated below).¹ “The cooling system **12** generally includes a fan **20** for supplying cooling fluid into the space **16** (*e.g.*, plenum)” as indicated by arrow **32**. Ex. 1006, 4:44–45; Figure 1. “Air is supplied into the fan **20** from the heated air in the data center **10** as indicated by arrows **22** and **24**” that is cooled by the cooling

¹ Figure 1 of Patel, and the related disclosure, is nearly identical in relevant portions to Figure 1 of Bash and its related disclosure.

system **12** before being delivered into the space **16** (e.g., plenum). Ex. 1006, 4:45–52; 5:6–27. Ex. 1002 ¶¶281–282.

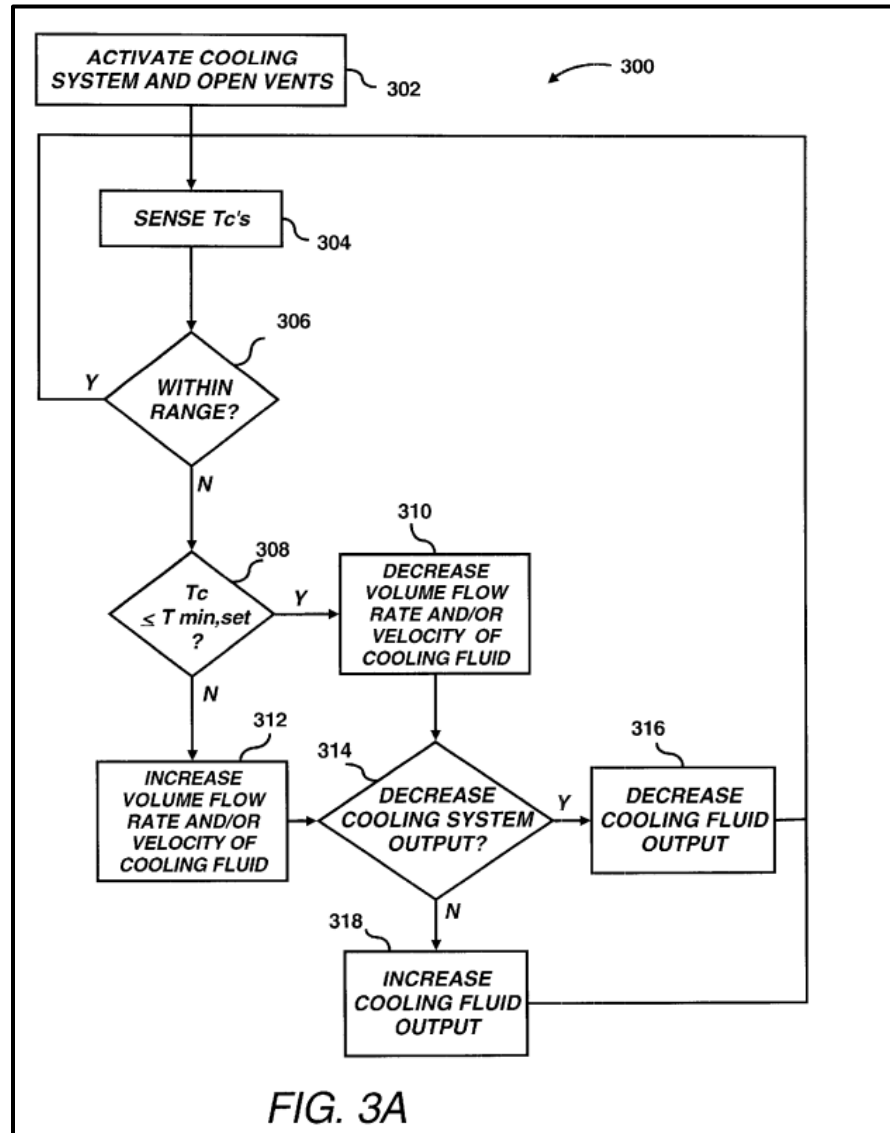


Ex. 1006, FIG. 1 (annotated).

Patel further discloses the cooling fluid being delivered to the plurality of racks **18a–18d** by “flow[ing] out of the raised floor **14** through a plurality of dynamically controllable vents **34a–34c** [(orange)] that generally operate to control the velocity and the volume flow rate of the cooling fluid therethrough” and into the zone above the raised floor **14** where the plurality of racks **18a–18d** are located. Ex. 1006, 5:6–28. Ex. 1002 ¶283.

Patel also teaches a method of operating the cooling system in the flow diagram **300** of Figure 3A of Patel, provided below. In the first step **302** of this

method, “the cooling system **202** is activated and the vents **206–210** . . . are opened.” Ex. 1006, 10:16–17. Ex. 1002 ¶284.



Ex. 1006, FIG. 3A.

Patel also discloses that the “smart cooling system for cooling racks in a data center . . . includes a cooling device for supplying cooling fluid to the racks. The

cooling device includes a variable output fan and a variable capacity compressor.”

Ex. 1006, 2:16–19. Ex. 1002 ¶285.

Patel discloses the cooling fluid of the ’179 patent under Patent Owners’ expected construction, which includes cooling air. For example, Patel teaches that “cooling fluid (e.g., *air*)” is delivered “to various areas of a data center” Ex. 1006, 1:6–8 (emphasis added). Ex. 1002 ¶286.

With regard to a “controllable partition,” Patel’s controllable vents (e.g., **34a-34c**) disclose the controllable partition under Patent Owners’ expected construction of “partition” to encompass any device capable of manipulating the flow of cooling fluid. As discussed above, the dynamically controllable vents **34a-34c** operate to control the velocity and the volume flow rate of the cooling air into aisles of the data center containing racks. Ex. 1006, 5:8–11. For example, Patel teaches that the “cool aisles **40** are those aisles that include the vents **3[4]a-3[4]c** and thus receive cooling fluid for delivery to the racks **18a-18d**.” Ex. 1006, 5:23–26. Ex. 1002 ¶¶287–288.

1[b]

Patel teaches detecting temperatures via “a plurality of temperature sensors **212-216**, e.g., thermocouples, [that] may be positioned at various positions around the subsystems and/or the racks **18a-18d**.” Ex. 1006, 7:16–19; 7:37–41. Ex. 1002 ¶¶289–291.

1[c]

Patel discloses that the temperatures of the components (T_C 's) are individually sensed by the temperature sensors and then it is determined whether each measured temperature is within a predetermined range of operating temperatures, e.g., between $T_{\max, \text{set}}$ and $T_{\min, \text{set}}$. Ex. 1006, 10:35–43. Ex. 1002 ¶¶292–294.

1[d]

As discussed above with respect to limitation 1[a], the vents of Patel disclose the controllable partition under Patent Owners' expected construction of "partition." Ex. 1002 ¶¶295–296.

Patel further discloses that the "the shape and/or opening size of the vents **34a-34c**" are manipulable to vary the "velocity and the volume flow rate of the cooling fluid" that passes through the vents and into the zone containing racks **18a-18d**. Ex. 1006, 5:7–17. Patel also discloses manipulating the vents in response to said sensed temperature being outside said predetermined temperature range. For example, "[i]f the T_C 's of some of the racks are below or equal to the $T_{\min, \text{set}}$, the vent controller **204** may operate to decrease the volume flow rate and/or the velocity of cooling fluid to those racks at step **310**." Ex. 1006, 11:6–20. Likewise, "[i]f the T_C 's of some of the racks exceed the $T_{\min, \text{set}}$ (i.e., also exceed the $T_{\max, \text{set}}$), the vent

controller **204** may operate to increase the volume flow rate and/or the velocity of cooling fluid to those racks at step **312**.” Ex. 1006, 11:20–23. Ex. 1002 ¶¶297–298.

Claim 2

Each limitation of claim 2 is discussed below, in conjunction with the relevant disclosures of each claim limitation by Patel. Ex. 1002 ¶299.

2[a]

As explained above, Patel discloses the method of claim 1 under Patent Owners’ expected construction of “partition.” And as explained in relation to claim 1, Patel’s vent controller determines whether sensed rack temperatures are below a preset temperature range. Ex. 1006, 10:38–43, 10:53–61. Ex. 1002 ¶¶300–303.

2[b]

Referring again to Figure 3A, shown above, Patel discloses that “[i]f the T_C ’s of some of the racks are below or equal to the $T_{\min, \text{set}}$, the vent controller **204** may operate to decrease the volume flow rate and/or the velocity of cooling fluid to those racks at step **310**.” Ex. 1006, 11:6–9. Ex. 1002 ¶¶304–306.

Claim 3

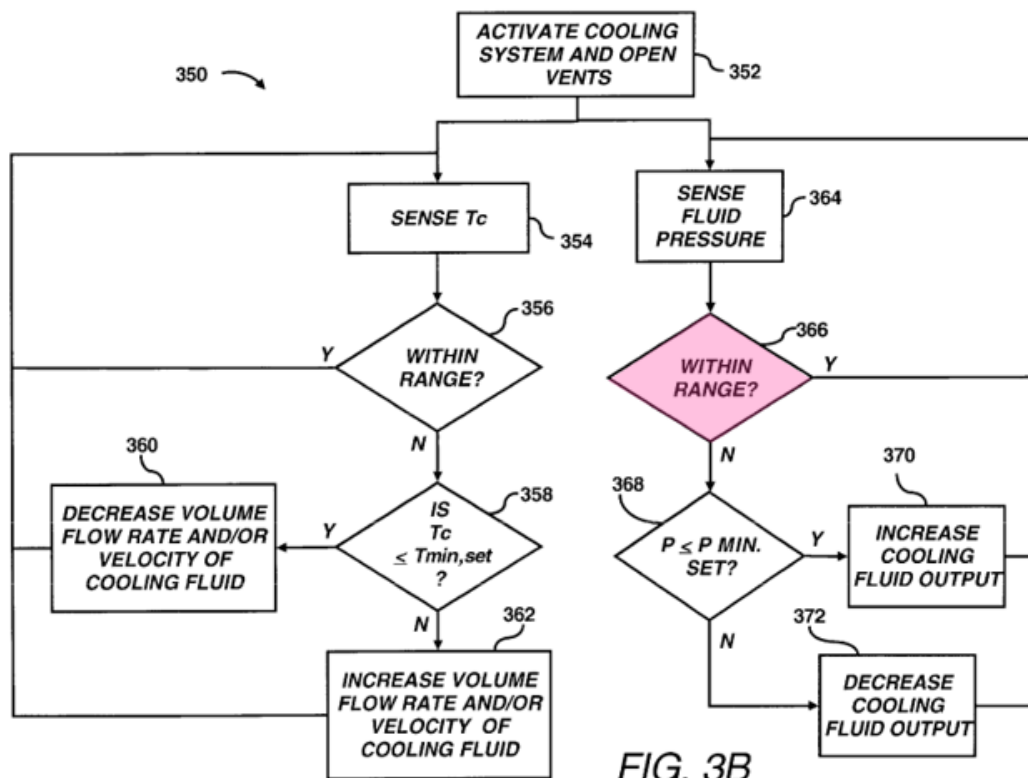
Each limitation of claim 3 is discussed below, in conjunction with the relevant disclosures of each claim limitation by Patel. Ex. 1002 ¶307.

3[a]

As explained above, Patel discloses the method of claim 1. Patel also teaches “the pressure of the cooling fluid supplying the vents **206-210** may be measured by a pressure sensor **232**.” Ex. 1006, 12:52–54. Ex. 1002 ¶¶308–311.

3[b]

As shown in Figure 3B of Patel, reproduced with annotations below, Patel teaches “determin[ing] whether the measured pressure is within a predetermined pressure range, e.g., a predetermined minimum set point pressure ($P_{\min, \text{set}}$) and a predetermined maximum set point pressure ($P_{\max, \text{set}}$), at step **366**” (pink). Ex. 1006, 12:56–60. Ex. 1002 ¶¶312–314.



Ex. 1006, FIG. 3B (annotated).

3[c]

Patel teaches that “the predetermined pressure range pertains to the threshold pressures to determine whether to increase or decrease the supply of fluid, e.g., in the second chamber **48b**” of the space (plenum) **16** below the raised floor **14** of the data center. Ex. 1006, 13:4–7. Ex. 1002 ¶¶315–316.

For example, as shown in Figure 3B of Patel, provided above, “[i]f the [measured] P[ressure] is determined to be below or equal to the $P_{\min, \text{set}}$, the cooling system controller **222** may operate to increase the cooling fluid output, e.g., by increasing the compressor capacity and/or the fan output, at step **370**. Otherwise, if the [measured] P[ressure] is determined to exceed the $P_{\min, \text{set}}$, and thereby exceed the $P_{\max, \text{set}}$, the cooling system controller **222** may operate to decrease cooling fluid output, e.g., by decreasing the compressor capacity and/or the fan output, at step **372**.” Ex. 1006, 13:13–20. Varying the fan output varies the cooling air output of the cooling device. Ex. 1002 ¶¶317–318.

Claim 4

Patel’s system is capable of both decreasing and increasing the cooling fluid flow to a zone at different times as the sensed temperature conditions dictate. For example, Patel teaches that “[i]f the T_C ’s [(measured temperatures)] of some of the racks exceed the $T_{\min, \text{set}}$ [(minimum set point temperature)] (i.e., also exceed the

$T_{\text{max,set}}$), the vent controller **204** may operate to increase the volume flow rate and/or the velocity of cooling fluid to those racks at step **312**.” Ex. 1006, 10:35–43; 11:20–23. Ex. 1002 ¶¶319–322.

Claim 5

Patel teaches “determin[ing] whether the measured pressure (P) is below or equal to a minimum pressure set point ($P_{\text{min,set}}$) at step **368**.” Ex. 1006, FIG. 3B, 13:2–4. Ex. 1002 ¶¶323–326.

Claim 6

Patel includes disclosure essentially verbatim of this claim language: “decreasing an output of said cooling fluid from said cooling system in response to said decrease in cooling fluid supply to said racks exceeding said increase in cooling fluid supply to said racks.” Ex. 1006, 11:51–61; *see also* Ex. 1006, 17:45–50. Ex. 1002 ¶¶327–331.

Claim 7

As explained above, claim 7 is redundant to claims 2 and 4 under Patent Owner’s construction of the term “partition,” which includes any device that can manipulate cooling fluid flow and therefore would treat a vent as a type of partition. Therefore, the above discussions for claims 2 and 4 also apply to claim 7. Ex. 1002 ¶¶332–336.

Claim 10

Patel's disclosure includes essentially verbatim language as the additional limitation of claim 10: "performing a numerical modeling of a temperature distribution and flow characteristics of the data center; and manipulating said cooling system in response to said numerical modeling." Ex. 1006, 18:4–9; *see also* Ex. 1006, 14:27–40; 14:52–62. Ex. 1002 ¶¶337–342.

Claim 11

As required by claim 11, Patel further discloses measuring the pressure of cooling air in the raised floor supply plenum, and "[i]f the P is determined to be below or equal to the $P_{\min, \text{set}}$, the cooling system controller **222** may operate to increase the cooling fluid output, e.g., by increasing the compressor capacity and/or the fan output" of the cooling device. Ex. 1006, 2:16–19; 13:13–16. Ex. 1002 ¶¶343–346.

Claim 12

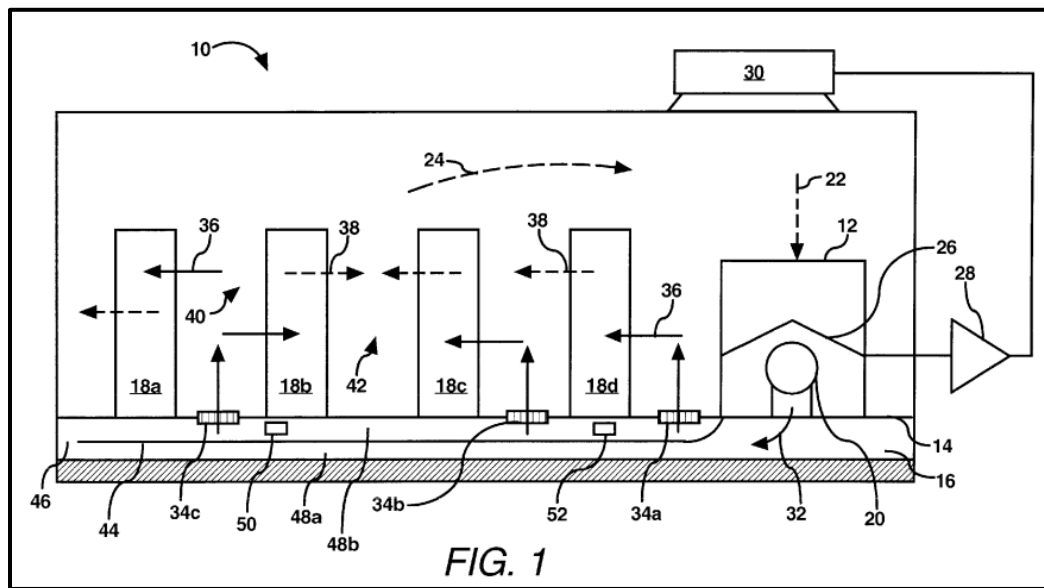
As required by claim 12, Patel further discloses "if the P[ressure] is determined to exceed the $P_{\min, \text{set}}$ [(predetermined minimum set point pressure)], and thereby exceed the $P_{\max, \text{set}}$, the cooling system controller **222** may operate to decrease cooling fluid output, e.g., by decreasing the compressor capacity and/or the fan output" of the cooling device. Ex. 1006, 2:17–19; 12:58; 13:13–20. Ex. 1002 ¶¶347–351.

Claim 13

Patel's disclosure is essentially identical to that of claim 11: discloses "increasing an output of said cooling fluid from said cooling system [and therefore from said cooling device] in response to said decrease in cooling fluid supply to said racks falling below said increase in cooling fluid supply to said racks." Ex. 1006, 11:51–65; 17:51–56; Ex. 1002 ¶¶352–356.

Claim 14

Patel further discloses controlling the vents **34a–34c** to selectively vary the supply of cooling fluid to data center zones based on sensed temperatures associated with the racks in each zone. Ex. 1006, 5:8–17. Patel's disclosed cooling system is adapted for a typical data center layout having racks arranged in cold aisles that include floor vents to supply cooling air and hot aisles that receive air heated by the computer equipment. Ex. 1006, FIG. 1, 5:21–28. Figure 1 illustrates this arrangement and shows cooling air supplied by fan **20** flowing under a raised floor plenum towards adjacent aisles (e.g. **40, 42**) in the direction of arrow **32**. Ex. 1002 ¶¶357–359.



Ex. 1006, FIG. 1.

Racks **18a**, **18b** and associated vent **34c** are downstream of racks **18c**, **18d** and associated vents **34b**, **34a** relative to the location of the cooling air source. It follows directly from Patel’s teachings that the controller is operable to increase cooling air flow through vent **34c** in response to a high temperature condition sensed at relatively downstream racks **18a** and/or **18b**, and to decrease cooling air flow through vents **34a** and/or **34b** in response to a low temperature condition sensed at relatively upstream racks **18c** and/or **18d**. Ex. 1002 ¶¶360–361.

Claim 15

Patel includes disclosure essentially verbatim of this claim language:
“implementing said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of said racks within said

data center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said cooling system in response to said inferred thermal condition.” Ex. 1006, 18:10–18; *see also* Ex. 1006, 14:40–56. Ex. 1002 ¶¶362–366.

C. Ground 3: Claims 1–6 and 11–13 are Obvious Over Bishop in View of Feeney and Kochavi

For the reasons set forth below, claims 1–6 and 11–13 of the ’179 patent are rendered obvious by Bishop in view of Feeney and Kochavi. Ex. 1002 ¶¶367–467.

Whereas Grounds 1 and 2 demonstrate that the claims are anticipated by Applicant’s own work (different inventive groups) using the Patent Owner’s own construction of the term “partition,” Ground 3 demonstrates that the above claims are obvious under the (i) plain and ordinary meaning of “partition” or (ii) Patent Owner’s broader definition, each as explained in the Abraham Declaration. Ex. 1002 ¶¶367–467.

In particular, the plain meaning of the term “partition” as used throughout the ’179 patent refers to “a barrier or wall that subdivides a space.” The only structures identified as being “partitions” are the vertical barriers **22a–22j** beneath the raised floor platform that subdivide the pressurized enclosure into zones. Ex. 1001, FIG. 1; 4:13–16. Some barriers are controllable by a motorized mechanism, such as

controllable partition 26f, which also divides the space into zones (i.e., zones **20g** and **20h**). Ex. 1001, FIG. 5, 16:9–10; 16:21–23. Ex. 1002 ¶368.

If independent claim 1 is interpreted such that the controllable partitions are barriers that subdivide the plenum space, a POSITA familiar with Bishop’s teachings and Feeney’s teachings would have been motivated to modify a preferred embodiment of Bishop by providing cooling air flow control dampers in the form of barriers that subdivide the space beneath Bishop’s raised floor platform. The same is true for the dependent claim limitations directed to pressure-sensing and related limitations as set forth in Kochavi (set forth beginning in claim 3 and in the Abraham Declaration at ¶¶438–444). Ex. 1002 ¶¶369; 438–444.

As explained by Prof. Abraham, it would have been obvious to a skilled artisan to modify the system and methods of Bishop based on Feeney in view of their collective teachings, and based on a POSITA’s knowledge of the art. Both Bishop and Feeney are directed to solving a similar problem, *i.e.*, to provide cooling air for varying heat loads generated by computer equipment to maintain the temperature distribution throughout the environment within an acceptable range. Both offer a similar solution: directing cooling air from a central source through a plenum beneath a raised floor platform to exit through specialized floor tiles near the heat-generating computer equipment positioned on the floor. Feeney directs the air flow by selectively opening or closing openings in vertically oriented side panels of

individual modules within the plenum space, and by providing vents in certain floor tiles through which the cooling air exits into the desired zones. Bishop accomplishes a similar result through use of controllable air flow dampers directing flow through a computer cabinet. Ex. 1002 ¶370.

Bishop does not expressly describe dampers or cooling air flow control devices that subdivide the space beneath its raised floor platform into zones. However, as explained by Prof. Abraham, a POSITA would look to modify Bishop based on Feeney, or combine the interrelated teachings of the two references to arrive at the claimed invention, and following the ordinary design process choosing from a finite number of predictable solutions, to modify the controllable damper mechanism described in Bishop so that it forms a controllable barrier that subdivides the under-floor plenum space into zones, in addition to allowing for controlling cooling air flow to desired zones, all with a reasonable expectation of success. Ex. 1002 ¶371.

Bishop's approach of providing a vertically oriented supply conduit and associated controllable damper for directing cooling airflow upwards to exit through select floor tiles represents one known way to accomplish this. Bishop's disclosed system automatically adjusts the damper position in response to air temperatures sensed near the equipment to optimize the cooling fluid distribution. However, continually adjusting the amount of cooling air flowing through individual

controllable dampers can cause the plenum air pressure to vary appreciably and create undesirable pressure imbalances. Bishop specifically acknowledges that disparate pressures in the space beneath the platform can cause operational challenges and should be avoided. Ex. 1008, [0088]. Ex. 1002 ¶372.

The '179 patent recognizes the benefits of subdividing the plenum of a pressurized raised floor enclosure into zones and controlling the flow of cooling air from one zone to another in order to better control the amount of cooling air delivered to the respective racks. Ex. 1001, 4:11–31. It further shows the flexibility of such a system when operating multiple cooling devices to provide cooling air to a large number of racks, such as the four cooling systems 12a–12d for cooling sixteen racks illustrated in Figure 1. Ex. 1001, FIG. 1, 3:41–56. However, a POSITA would have already appreciated these benefits from the teachings of Feeney, which similarly provide a subdivided pressurized plenum space to distribute cooling air output from multiple cooling devices (i.e. chilled water coils equipped with air blower fans) and teaches a POSITA to use adjustable vertical barriers to create subzones and flow paths within the plenum for directing sufficient cooling air to particular data center zones. Ex. 1002 ¶373.

Modifying Bishop's system to include controllable subdividing barriers in the plenum space to adjust air flow to different areas of the data center would have been exceedingly straightforward using the existing features of Bishop's system and the

capabilities of a POSITA. Bishop includes vertically-oriented beams 76 supporting the raised floor support assembly 74. Ex. 1008, FIG. 5. It would have been straightforward for a POSITA to insert panels spanning adjacent beams and mechanically connect them to the beams to subdivide the plenum space into zones. A POSITA would have also been able to readily integrate Bishop's controllable dampers into such vertically-oriented panels. Cooling air supplied through a damper into a zone would then flow upward through one or more of the existing openings in floor tile(s) of the zone. Ex. 1002 ¶¶374–375.

The '179 patent recognizes that cooling fluid flow through a vertically-oriented, subdividing partition can be regulated by varying the size of an opening in the partition (Ex. 1001, 5:5:3–8), which is the same basic function of Bishop's controllable dampers. Furthermore, this approach would have predictably resulted in a greater ability to direct cooling air flow within the plenum space while maintaining stable pressure equilibrium. It would also have provided a more flexible and customizable system by permitting the data center heat loads to be managed in sub-zones, including through the use of multiple cooling devices, each device responsible for supplying cooling air to one or more particular zones. Furthermore, this approach would have predictably resulted in more consistent and reliable control of cooling air flow to locations where it is needed, as well as more efficient operation of the entire cooling system. Ex. 1002 ¶376.

Thus, ample motivation existed for a POSITA to make the above modifications to Bishop's system and methodology based on Feeney's teachings in order to arrive at the methods of the Bishop/Feeney Combination. Ex. 1002 ¶¶377–379.

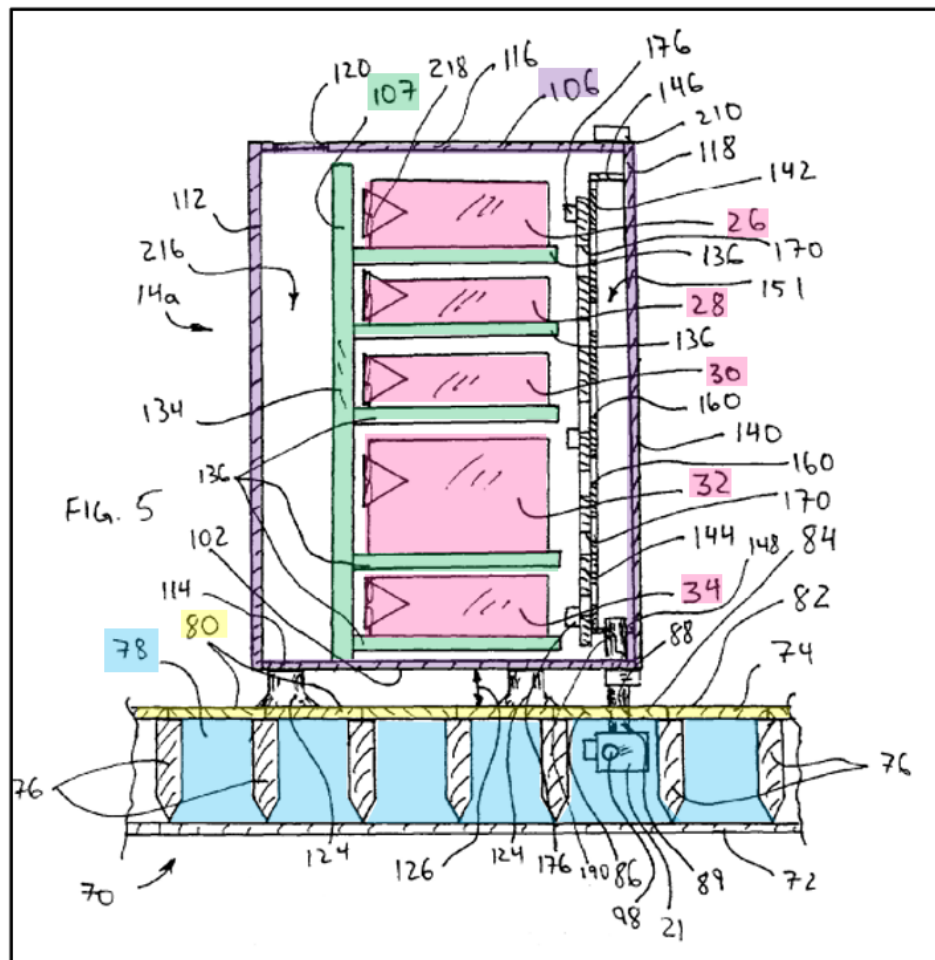
Claim 1

1[pre]

If the preamble is limiting, Bishop is directed to “cooling at least one electronic module inside a module cabinet.” Ex. 1008, [0043]. Bishop further discloses that each cabinet “is typically constructed about each rack” (Ex. 1008, [0007]), with each rack including “computer servers and other electronic modules” (Ex. 1008, [0005]). Ex. 1002 ¶¶380–381.

1[a]

Bishop provides further details regarding an exemplary cabinet assembly **14a** in Figure 5, provided below with annotations. Bishop discloses that the “cabinet assembly **14a** includes . . . five electronic modules **26, 28, 30, 32** and **34**” (pink). Ex. 1008, [0067]. Ex. 1002 ¶¶387–388.



Ex. 1008, FIG. 5 (annotated).

The “cooling air source **18** provides cool air within space **78**” below the support tiles **80** that serve as a floor on which the cabinet assembly **14a** sits. Ex. 1008, [0063]. “Some of the tiles are . . . special control tiles (e.g., **84**)” that “facilitate delivery of cool air from space **78** directly into cabinet assemblies (e.g., **14a**) thereabove.” Ex. 1008, [0064]. The “control tile **84** also includes a cooling controller unit **21**” that “includes a damper and a processor (not separately illustrated).” Ex. 1008, [0065]. Thus, Bishop discloses activating a cooling device

(i.e. cooling air source **18**) in order to provide cool air to the cabinet assemblies. Ex. 1002 ¶¶389–391.

With regard to the “controllable partition” in limitation 1[a], Bishop discloses controlling the damper of each cooling controller unit **21** to vary the supply of cooling fluid within zones of a data center containing computer racks (i.e. cabinet assemblies). Bishop’s system is operable to vary a supply of cooling fluid to the cabinet assemblies supported above special control tiles (such as tile **84**) that include a cooling controller unit **21**. Ex. 1008, [0064]–[0065]. Thus, Bishop discloses opening a controllable partition (i.e., damper) configured to vary a supply of cooling fluid within a zone of said data center containing a cabinet or rack. Ex. 1002 ¶392.

As discussed above in §VI.C. and shown in Figure 11, the cooling controller **21** may “decrease[] the damper opening to reduce cooling air flow to the corresponding cabinet” at block **308** and may “increase[] the damper opening to increase cooling air flow to the corresponding cabinet” at block **306**. Ex. 1008, FIG. 11; [0084]–[0085]. Ex. 1002 ¶393.

However, Bishop does not expressly describe dampers that are associated with barriers that subdivide the space **78** below the raised floor **74**. To the extent that limitation 1[a] is interpreted to require a controllable wall or barrier that subdivides the plenum space, this would have been obvious to a POSITA based on

the combined teachings of Bishop and Feeney and a POSITA's knowledge of conventional technologies, tools, and practices. Ex. 1002 ¶¶394–395.

As discussed above, Feeney describes a subdivided pressurized plenum space to distribute cooling air from multiple cooling devices. Feeney teaches that the user can define the paths for cooling air flow under the raised floor and through vented floor tiles by selective closure of air transfer openings in vertically oriented walls that subdivide the plenum space. Ex. 1013, 10:20–22. Feeney encourages the practice of reconfiguring the air flow paths “depending upon changing processing requirements and/or changes in the geometry of the floor region available for the data center function” as being advantageous. Ex. 1013, 11:48–52. Feeney teaches numerous exemplary arrangements of blocking panels to prevent or permit flow through the vertical subdividing walls so as to define airflow paths for targeting the supply of cooling air to the data center zones. Ex. 1002 ¶396.

It would have been obvious to a POSITA familiar with Bishop's system and Feeney's additional teachings to modify Bishop to provide controllable dampers within barriers that subdivide plenum space **78** into sections or zones. A POSITA would have recognized that breaking up the plenum space into smaller regions would help avoid undesirable pressure imbalances, a concern that Bishop specifically acknowledges. Ex. 1008, [0088]. A POSITA would further appreciate that this would provide other similar benefits to those stated in the '179 patent, such as

assuring that sufficient cooling air is distributed from one zone to another in order to better control the amount of cooling air delivered to the racks in each zone. Ex. 1001, 4:11–31. The additional benefits in terms of flexibility to adjust the system to accommodate operating multiple cooling systems to provide cooling air to a large number of racks, is also suggested by Feeney. The system of Feeney has a subdivided pressurized plenum space to distribute cooling air from multiple cooling devices along optimized plenum flow paths using partitions to properly balance the supply of cooling fluid between cooling devices and heat loads. Ex. 1002 ¶397.

Modifying Bishop's system to include subdividing barriers in the plenum space would improve both Bishop's and Feeney's systems because the vertical barriers would be controllable in response to changing temperature conditions. Bishop is already equipped with controller **21** and a control logic for automatically manipulating airflow dampers based on sensed temperature conditions associated with the computer racks. The modifications would require only routine implementation of mechanical components to add subdividing barriers having associated dampers and connect them to controllers **21**. The damper positions would then be automatically adjustable to vary cooling flow rates based on sensed temperature conditions. Ex. 1002 ¶398.

For these reasons and the additional reasons provided above, it would have been obvious to implement Bishop's air flow control dampers as controllable

partitions that subdivide the plenum space so as to provide greater control over the distribution of cooling air within the plenum space while maintaining stable pressure conditions regardless of the number of cooling devices deployed, the size of the data center, or the number of computer racks in the data center. Ex. 1002 ¶399.

Therefore, under the plain and ordinary meaning of “partition,” the Bishop/Feeney Combination discloses activating a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of a data center that includes at least one computer rack, as recited in limitation 1[a]. The same is true under Patent Owner’s broader interpretation. Ex. 1002 ¶¶400–401.

1[b]

Bishop discloses “temperature sensors in [or on the electronic]modules **26**, **28**, **30**, **32** and **34**” in each rack. Ex. 1008, [0081]; *see also* Ex. 1008, [0106]. Ex. 1002 ¶¶402–406.

1[c]

Bishop teaches “compar[ing] each module temperature T_m to a threshold temperature that is at the high end of an acceptable temperature range” (T_h). Ex. 1008, [0083]. “[W]here any module temperature [does not] exceed[] the threshold temperature T_h , control passes to block **304** where supervising controller **16** determines if any temperature is less than a low threshold temperature T_l .” Ex. 1008, FIG. 11, [0083]. The temperature sensor **73** inside each cabinet **14a** is also linked

to controller **21** and may be assessed against the acceptable temperature range as an alternative to the sensed module temperatures. Ex. 1008, [0105]. Ex. 1002 ¶¶407–409.

1[d]

Bishop discloses that if the sensed temperature is above the high threshold temperature, the controller increases the damper opening to increase cooling air flow to the corresponding cabinet. Ex. 1008, [0085]. If the sensed temperature is below the low threshold, the controller is operable to decrease the damper opening to reduce cooling air flow to the corresponding cabinet. Ex. 1008, [0084]. Ex. 1002 ¶¶410–412.

Claim 2

2[a]

As explained above, Bishop discloses determining whether sensed temperatures associated with the racks or the modules in the racks are below a minimum threshold temperature. Ex. 1002 ¶¶413–416.

2[b]

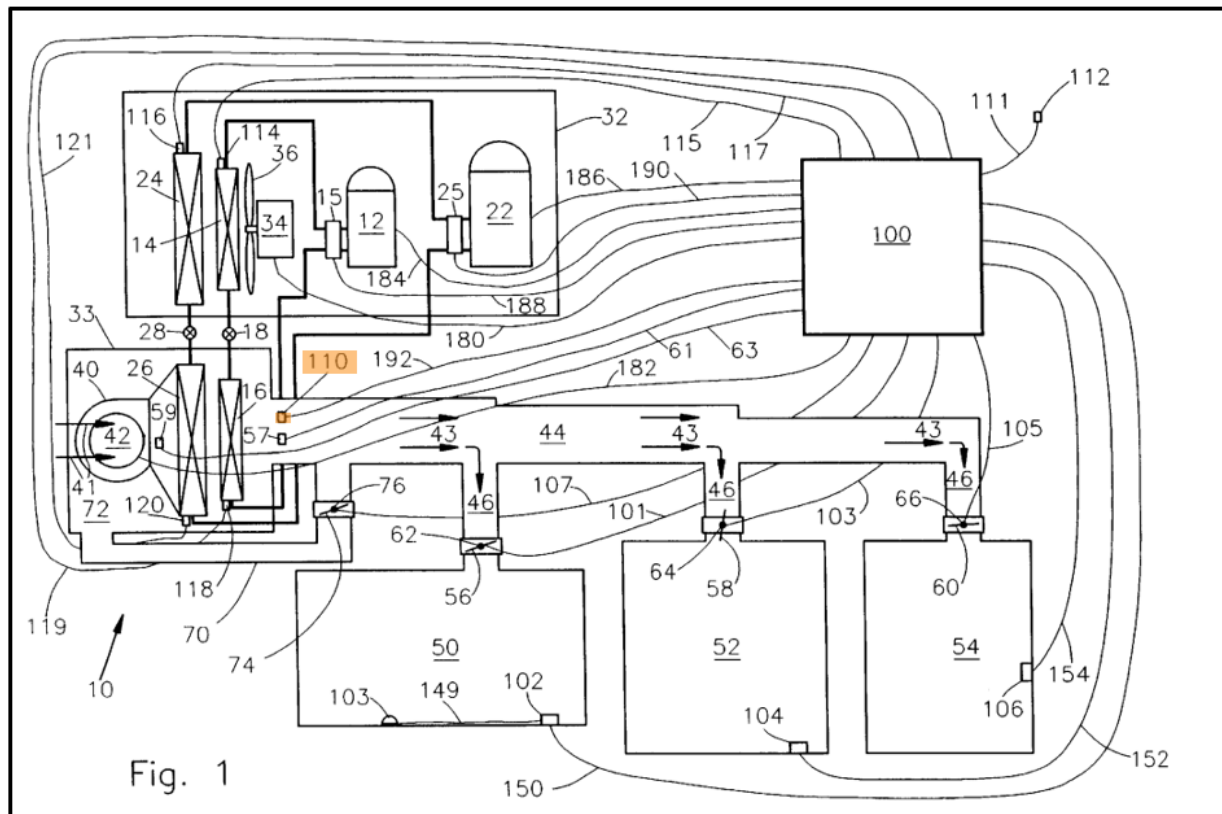
As discussed in relation to claim 1, Bishop discloses that the controller decreases the damper opening to reduce cooling air flow to the corresponding cabinet when the sensed temperature is below a minimum threshold. Ex. 1008, [0084]. Ex. 1002 ¶¶417–420.

Claim 3

3[a]

As explained above, Bishop discloses the method of claim 1. Bishop further discloses a pressure sensor sensing the static pressure within space **78** from which the cool air is supplied into cabinet assemblies. Ex. 1008, [0064], [0066]. Ex. 1002 ¶¶421–425.

And as shown in Figure 1 of Kochavi, reproduced with annotations below, “[t]he air conditioning system **10** [] comprises an air flow pressure sensor **110** [(annotated in orange)] which may be located at the entrance to the main duct **44** The air flow sensor **110** is operative to send a duct pressure signal to the control system **100** which is substantially proportional to the air pressure at the entrance to the main duct **44**.” Ex. 1011, 4:58–67. Ex. 1002 ¶426.



Ex. 1011, FIG. 1 (annotated). The air flow pressure sensor **110** of Kochavi senses a pressure of a supply of cool air. Therefore, both Bishop and Kochavi disclose sensing a pressure of a supply of said cooling fluid, as recited in limitation 3[a]. Ex. 1002 ¶¶426–428.

3[b]

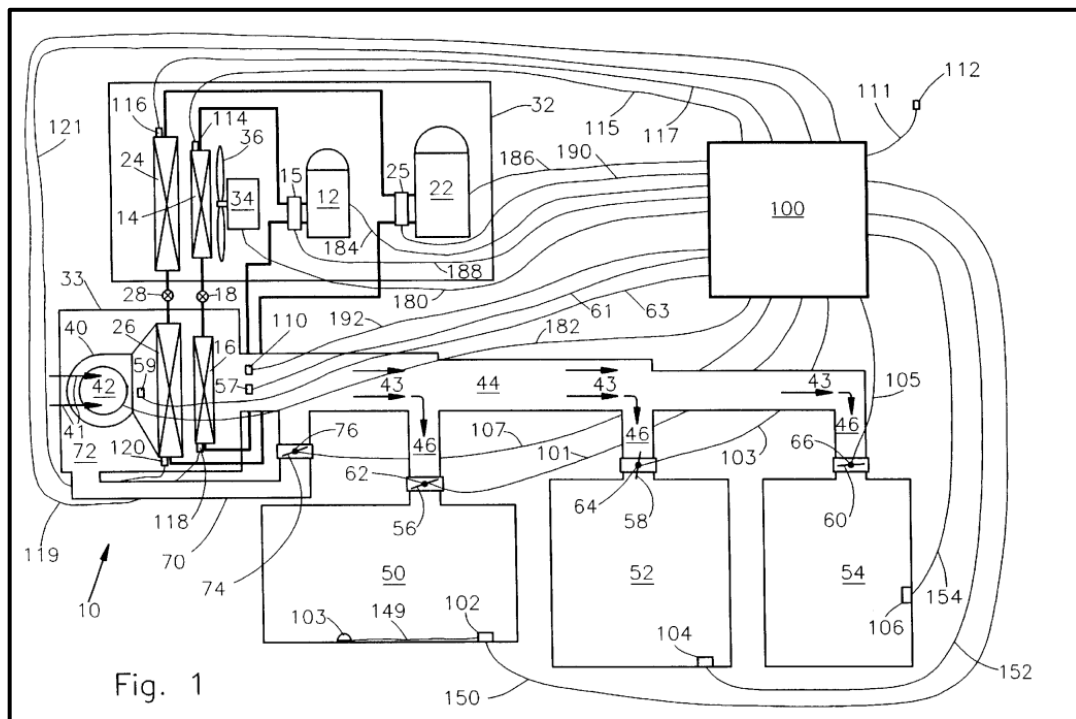
Kochavi discloses a bypass damper **74** in the bypass duct **70** that “is operative, in response to signals from the control system **100**, to return some or all of the conditioned air to the entrance region **72** if the pressure sensed by air flow pressure sensor **110** exceeds a value which may be in the region of 16 to 19 psi and is preferably about 17 psi.” Ex. 1011, 5:5–12. Thus, Kochavi teaches comparing a

sensed pressure to a predetermined pressure range (i.e., 16 to 19 psi). Ex. 1002 ¶¶429–431.

3[c]

In particular, Kochavi discloses a bypass damper **74** in the bypass duct **70** that “is operative, in response to signals from the control system **100**, to return some or all of the conditioned air to the entrance region **72** if the pressure sensed by air flow pressure sensor **110** exceeds a value which may be in the region of 16 to 19 psi and is preferably about 17 psi.” Ex. 1011, 5:5–12. Kochavi further discloses that depending on the pressure in the main duct **44** sensed by the air flow pressure sensor **110**, the system increases or decreases the fraction opening of the bypass damper **74** to maintain a substantially constant pressure in the main duct **44**. Ex. 1011, 15:61–65. Ex. 1002 ¶¶432–434.

Figure 1 below shows the position of the bypass damper **74** in the air duct system. Ex. 1002 ¶435.



Ex. 1011, FIG. 1.

A POSITA reviewing this diagram would understand that increasing/decreasing the opening of the bypass damper **74** based on pressure is below ranges leads to increased/decreased airflow to main duct **44** thereby increasing/decreasing the conditioned air pressure. Ex. 1002 ¶436.

It would have been obvious to a POSITA, to modify the Bishop/Feeney Combination by adding Kochavi's capability of adjusting the cooling device when the pressure of the cooling air supply to the zones is outside of a desired pressure range. Ex. 1002 ¶¶437.

For example, a POSITA would have been motivated to incorporate Kochavi's capability to vary the supply of cooled air when the air pressure falls outside of a predetermined range because Bishop teaches measuring the pressure of a supply of cool air and providing pressure measurements to a supervising controller **16** (Ex. 1008, [0066]) so that the supervising controller **16** can "diagnose problems such as . . . inefficient pressure generation" (Ex. 1008, [0088]). Bishop cautions that air pressure in raised floor plenums such as Bishop's space 78 "can vary appreciably despite the fact that equilibrium is ideal." Ex. 1008, [0087]. A POSITA desiring to use a system made in accordance with the Bishop/Feeney Combination would have been motivated to solve this problem and would have looked to an analogous reference such as Kochavi for a solution. Ex. 1002 ¶¶438–441.

Kochavi teaches varying the cooling device output as needed to return the supply air pressure to the desire range. It would have been a routine matter to modify Bishop's controller to include the capability to vary the cooling air output of the cooling device when the pressure is out of range. Kochavi offers another easily implementable approach of a bypass damper to adjust the cooling flow output from the cooling device. Ex. 1002 ¶442.

A POSITA would have had a reasonable expectation of success in implementing a suitable means for varying the supply of cool air in response to pressure fluctuations in the supply plenum. The results—improved pressure control

and more stable operations—were both beneficial and predictable. Ex. 1002 ¶¶443–444.

Claim 4

As previously discussed, Bishop’s system controller increases the damper opening to increase cooling air flow to the corresponding cabinet when the sensed temperature is above the desired range. Ex. 1008, FIG. 11, [0085]. Ex. 1002 ¶¶445–448.

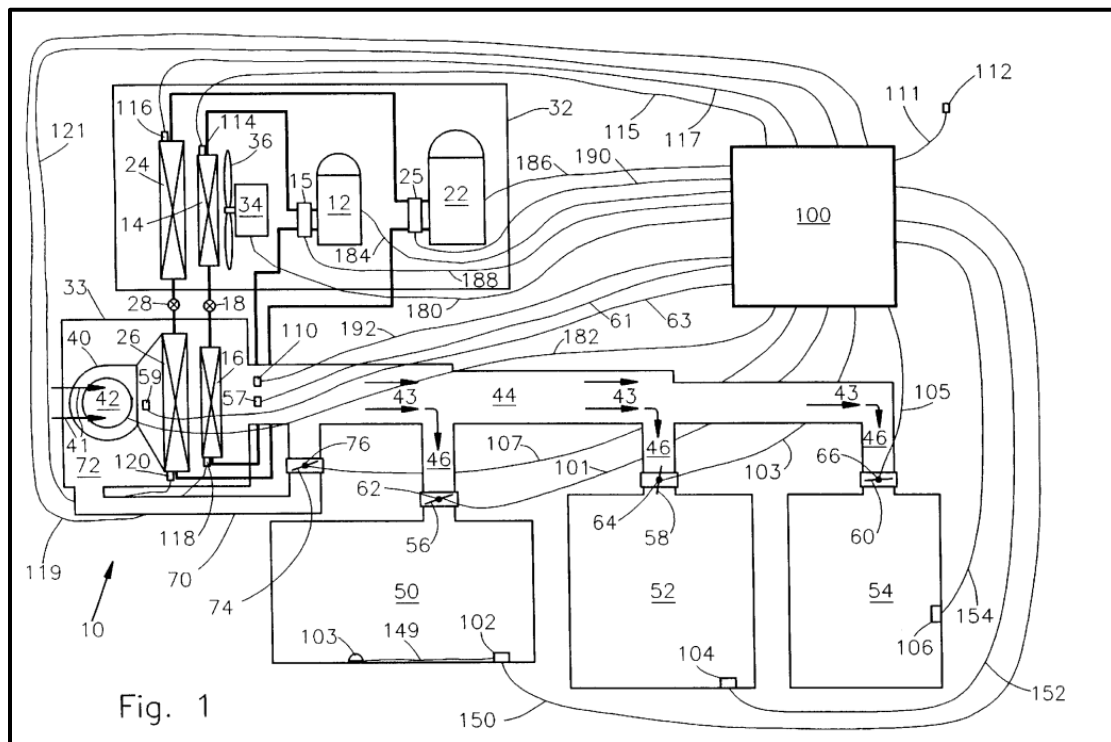
Claim 5

As discussed, Kochavi discloses increasing or decreasing the fraction opening of the bypass damper 74 to maintain a substantially constant pressure in the main duct 44. Ex. 1011, 15:61–65. Thus, Kochavi’s air supply pressure control necessarily involves determining whether the sensed pressure is within the predetermined pressure range because Kochavi discloses that the bypass damper 74 returns some or all of the conditioned air to the entrance region 72 based on the outcome of that determination. A POSITA would understand that this control strategy includes determining when the sensed pressure is below the predetermined range such that the airflow to main duct 44 should be increased. Ex. 1002 ¶¶449–452.

Claim 6

A POSITA would understand that this claim requires decreasing the cooling fluid output from the cooling device if the decrease in cooling fluid to the zone (per claim 2) exceeds the increase in cooling fluid to the zone (per claim 4). Ex. 1002 ¶¶453–454.

As discussed above, Kochavi's system allows for varying cooling air flow to individual rooms via controllable air dampers, as shown in Figure 1 below. Ex. 1002 ¶455.



Ex. 1011, FIG. 1.

Kochavi's Damper Control Procedure is operable to increase or decrease the fraction open for the dampers **56**, **58**, and **60** in each of the rooms, thereby increasing

or decreasing the flow of conditioned air. Ex. 1011, 15:55–60. As illustrated in Figure 1, middle damper **58** is fully open, left damper **56** is partially open, and right damper **60** is closed, which results in increased/decreased airflow to the accompanying rooms. Ex. 1002 ¶456.

This feature is provided by the same pressure regulation feature of Kochavi discussed above, and the Bishop/Feeney Combination as modified in view of Kochavi discloses claim 6. Ex. 1002 ¶¶457–458.

Claim 11

As explained with respect to claim 5, Kochavi teaches comparing a sensed pressure to a predetermined pressure range (i.e. 16 to 19 psi). Kochavi indicates that depending on the pressure in the main duct **44** sensed by the air flow pressure sensor **110**, Kochavi's system increases or decreases the fraction opening of the bypass damper **74** to maintain a substantially constant pressure in the main duct **44**. Ex. 1011, 15:61–65. Thus, Kochavi's pressure control necessarily involves increasing the cooling fluid output to the main duct **44** when the sensed pressure is below the predetermined pressure range. Ex. 1002 ¶¶459–461.

Claim 12

Kochavi discloses comparing a sensed pressure to a predetermined pressure range and decreasing the fraction opening of the bypass damper **74** to maintain a substantially constant pressure in the main duct **44**. Ex. 1011, 15:61–65. Thus,

Kochavi's pressure control necessarily involves decreasing the cooling fluid output to the main duct 44 when the sensed pressure exceeds the predetermined pressure range. Ex. 1002 ¶¶462–464.

Claim 13

This claim is analogous to claim 6, but is directed to the circumstance in which decreases in cooling fluid supplied to a zone are less than increases in cooling fluid supplied to the zone. Accordingly, the analysis above for claim 6 applies here. Ex. 1002 ¶¶465–467.

VIII. THE BOARD SHOULD NOT EXERCISE ITS DISCRETION UNDER SECTIONS 314(A) OR 325(D)

The Board should decline to exercise its discretion to not institute trial under Sections 314(a) or 325(d).

Section 314(a)

The parties are both involved in the *Vertiv Declaratory Judgment Action*, but that litigation is at an early stage. As explained below, the factors identified by the Board in *Fintiv* favor institution. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential).

Factor 1: This factor is neutral where no party has requested a stay. *See, e.g., Nokia of America Corporation f/k/a Alcatel-Lucent USA Inc. et al v. Wireless Alliance, LLC*, PTAB-IPR2024-00619, Paper 19 at 9 (PTAB Sept. 13, 2024) (granting institution); *Google LLC v. Flypsi, Inc.*, PTAB-IPR2023-00361, Paper 9

at 7–8 (PTAB July 31, 2023) (same).

Factor 2: Jury selection has been scheduled for April 6, 2026 in the *Lead Case*. *Lead Case*, Dkt. 60 at 2. Any final written decision would likely be due by August 26, 2026, making any final decision in this proceeding statutorily due less than four months after trial. Thus, factor 2 weighs against discretionary denial. *See, e.g., Ericsson Inc. et al v. XR Communications LLC d/b/a Vivato Technologies*, IPR2024-00868, Paper 8 at 29 (PTAB Dec. 13, 2024) (“[T]rial is currently scheduled less than five months before the Final Written Decision in this proceeding is due . . . We determine that the facts pertaining to this factor weigh against exercising our discretion to deny institution under § 314(a).”).

Factor 3: To date, the parties have invested little in the *Vertiv Declaratory Judgment Action*. Claim construction proceedings have not begun, there have been no depositions, and expert reports have not been exchanged. “Because of the significant investment that remains in the parallel district court proceeding, . . . factor 3 weighs against exercising discretion to deny institution.” *Hewlett Packard Enterprise Company et al v. Cobblestone Wireless, LLC*, IPR2024-00707, Paper 17 at 49 (PTAB Sept. 24, 2024).

Factor 4: If trial is instituted, Petitioner does not intend to assert in the *Vertiv Declaratory Judgment Action* that the claims of the ’179 patent are invalid on the same grounds raised during this proceeding. *Ericsson Inc. et al v. XR*

Communications LLC d/b/a Vivato Technologies, IPR2024-00868, Paper 8 at 30 (PTAB Dec. 13, 2024) (explaining that such a stipulation “mitigates to some degree the concerns of duplicative efforts between the district court and the Board, as well as concerns of potentially conflicting decisions.”). Additionally, Petitioner has not raised any issues of invalidity in the *Vertiv Declaratory Judgment Action* at this time.

Moreover, Petitioner, as an Intervenor, previously served invalidity contentions in the prior *Digital Realty* and *CyrusOne* actions that have since been dismissed. Those contentions were based on several prior art references not in the Petition, as well as invalidity based on non-patent/publication prior art. Accordingly, “there is not complete overlap in the issues. . . . [and thus,] this fourth factor does not favor discretionary denial.” *SAP America, Inc. v. Isix IP LLC*, IPR2024-00615, Paper 9 at 25 (PTAB Sept. 26, 2024).

Factor 5: The parties to this proceeding and the *Vertiv Declaratory Judgment Action* are the same. Valtrus/Patent Owner is a plaintiff in *TierPoint* and *DataBank* in which it asserts the ’179 patent against Vertiv’s customers, but Vertiv is not a party to those actions.

Factor 6: This Petition presents “compelling” arguments for unpatentability of the challenged claims for the reasons discussed above. *See* USPTO Memorandum, Interim Procedure for Discretionary Denials in AIA Post Grant Proceedings with Parallel District Court Litigation, 4–5 (June 21, 2022) (“the PTAB

will not deny institution based on *Fintiv* if there is compelling evidence of unpatentability”); *see also CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 23 at 3–5 (Feb. 27, 2023) (precedential) (evidence is compelling when it is “highly likely that the petitioner would prevail with respect to at least one challenged claim”). Thus, institution is consistent with the significant public interest against “leaving bad patents enforceable.” *Thryv, Inc v. Click-To-Call Techs., LP*, 140 S. Ct. 1367, 1374 (2020).

The balance of considerations under the *Fintiv* factors strongly favors institution of trial.

Section 325(d)

The prior art used in the Petition was not before the Examiner during examination, and no comparable art was considered. Consequently, no §325(d) factors favor denial.

IX. CONCLUSION

Petitioner respectfully requests institution of IPR.

Patent No. 6,862,179
Petition for *Inter Partes* Review

Respectfully submitted,

Dated: February 26, 2025

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CERTIFICATE OF COMPLIANCE

I hereby certify that this Petition complies with the word count limitation of 37 C.F.R. § 42.24(a)(1)(i) because the Petition contains approximately 13,815 words, excluding the parts of the Petition exempted by 37 C.F.R. § 42.24(a)(1), which is less than 14,000 words. Counsel relies on the word count of the computer program used to prepare the response on February 26, 2025.

Dated: February 26, 2025

By: /Timothy P. Maloney/
Lead Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition for *Inter Partes* Review together with all exhibits and other papers filed therewith was served on February 26, 2025, by placing a copy into FEDERAL EXPRESS directed to the attorney of record for the patent at the following address:

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A courtesy copy has also been provided to the following counsel of record for Patent Owners in *Vertiv Corporation v. Valtrus Innovations Limited*, Case No. 24-cv-00907-JRG (E.D. Tex.):

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