

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COOLIT SYSTEMS, INC.,
Petitioner,

v.

ASETEK DANMARK A/S,
Patent Owner.

Case No. IPR2020-00524
U.S. Patent No. 9,733,681

PATENT OWNER'S RESPONSE

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I. Preliminary Statement

For more than a decade, Patent Owner Asetek Danmark A/S (“Asetek” or “Patent Owner”) has developed and commercialized liquid cooling devices for desktop computers, servers, and datacenters. Asetek’s pioneering liquid cooling technology created the thriving market for liquid cooling devices and has been used in millions of computers worldwide. Asetek’s U.S. Patent 9,733,681 (“the ’681 patent”) discloses many of Asetek’s technological advances in the art of computer liquid cooling.

In particular, claim 1 of the ’681 patent recites a very specific and detailed arrangement for a liquid cooling system that requires a “reservoir including: a pump chamber . . . and a thermal exchanger chamber formed below the pump chamber and vertically displaced from the pump chamber,” and “an inlet positioned below the center of the impeller [included in the pump chamber].” This novel and innovative configuration, among other features of the patented invention, improves efficiency and compactness of liquid cooling devices. Ex. 2018, ¶¶28, 29. The prior art Duan reference relied on by Petitioner fails to disclose the configuration recited in claim 1. Specifically, Duan fails to disclose both an “inlet” and a “thermal exchange chamber” that are positioned below the “pump chamber.” *Id.* at ¶¶41, 42. Therefore, the Board properly concluded that “Petitioner has not shown sufficiently that Duan teaches or suggests a device where both the claimed ‘inlet’ is ‘positioned below the

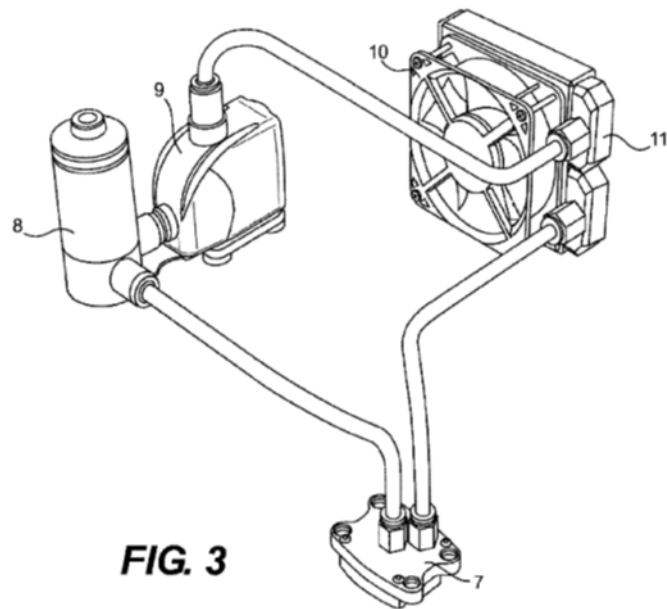
center of the impellor’ and the ‘thermal exchange chamber’ is ‘formed below the pump chamber and vertically spaced apart from the pump chamber.’” DI, 31-32. The Board also correctly determined that the other asserted prior art references, Shin and Cheon, do not overcome this fundamental deficiency of Duan, and therefore, “Petitioner has not shown a reasonable likelihood of prevailing in showing that claim 1 would have obvious over Duan, Shin, and Cheon.” *Id.* The Petition also does not show that Duan, Shin, and Cheon, alone or in combination, disclose “a control system configured to independently control a speed of the pump and a speed of the fan” as required by claim 1. Nothing in Petitioner’s reply can change or correct the technical flaws in Petitioner’s obviousness arguments against claims 1 and 4 of the ’681 patent. These claims should therefore be found patentable.

Patent Owner disagrees with Petitioner’s unpatentability grounds for challenged claims 8, 11, 15, and 16, but these claims are no longer asserted in the co-pending litigation due to a court-imposed narrowing of the asserted claims. Therefore, on November 30, 2020, Patent Owner disclaimed claims 8-16 of the ’681 patent, thereby removing challenged claims 8, 11, 15, and 16 from this proceeding. A copy of the as-filed Disclaimer, along with the automatically generated Acknowledgement Receipt showing payment of the fee required under 37 C.F.R. § 1.20(d), is included as Exhibit 2015. The disclaimer is not an admission that claims 8-16 are anticipated or rendered obvious by any of the asserted references. Claims

1-7 remain in the '681 patent, of which claims 1 and 4 are challenged in this IPR proceeding.

II. The '681 patent

Computers (and particularly their central processing units, or “CPUs”) generate heat during operation, which must be dissipated efficiently and effectively for computers to operate reliably. Ex. 2018, ¶26. As technology advances and computers become faster and more powerful, they generate increasing amounts of heat that must be managed. *Id.* Various heat dissipation methods, including air cooling and liquid cooling, are used to manage heat in computer systems. *Id.* at ¶27. While air cooling systems are cheaper and easier to install, they are not as efficient as liquid cooling systems at heat removal. *Id.* Prior art liquid cooling systems were bulky and posed significant risk of leakage from having several components (such as a heat exchanger, a liquid reservoir, a pump, and a heat radiator) coupled together using tubes. *Id.* Such a configuration is illustrated in prior Art Figure 3 of the '681 patent (depicted below), showing a prior art heat exchanger 7, a prior art liquid reservoir 8, a prior art pump 9, and a prior art heat radiator 11 connected in a closed loop using tubes.



Ex. 1001, Figure 3.

The liquid cooling technology described and claimed in the Asetek patents, including the '681 patent, addressed this leakage problem, among others, and resulted in a highly efficient yet compact (narrow profile) liquid cooling device that has been widely accepted by the industry (and copied by competitors like CoolIT). *See id.* at ¶¶28, 30. Among other things, Asetek's patented technology is a significant advancement from the modular approach of prior art liquid cooling devices. *Id.* at ¶28. Figures 17 and 20 of the '681 patent represent embodiments of the claimed invention. As evident from these figures and the patent claims, Asetek's invention has, among other features, a pump unit that combines a pump, a dual-chambered "reservoir," and a "heat-exchanging interface" (i.e., a cold plate) into a single component. *Id.* The "reservoir" in Asetek's patented design is divided into two

chambers, referred to as the “pump chamber” and “thermal exchange chamber” in the ’681 patent claims. *See, e.g.*, Ex. 1001, claim 1. The dual chambers are vertically spaced apart and fluidly coupled together to allow for heat dissipation from the CPU via the “heat-exchanging interface,” i.e., the boundary wall of the “thermal exchange chamber” which is placed in thermal contact with the CPU. *Id.* This configuration, among other features of the patented inventions, enables separate and independent optimization of the pumping function in the “pump chamber” and the heat transfer function in the “thermal exchange chamber.” *Id.* The unique dual-chambered “reservoir” concept also made manufacturing of liquid cooling products simpler and less costly, and has also made installation of liquid cooling products by users easier as compared to installation of the kit-based modular liquid cooling components (shown in prior art Figure 3 of the ’681 patent). Ex. 2018, ¶29.

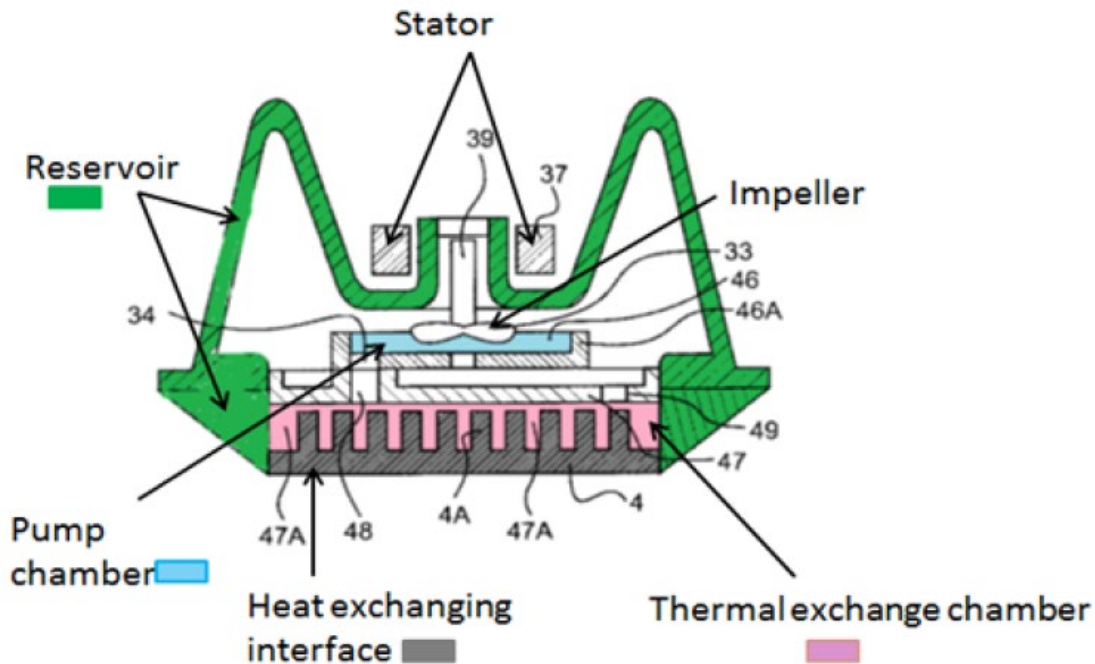
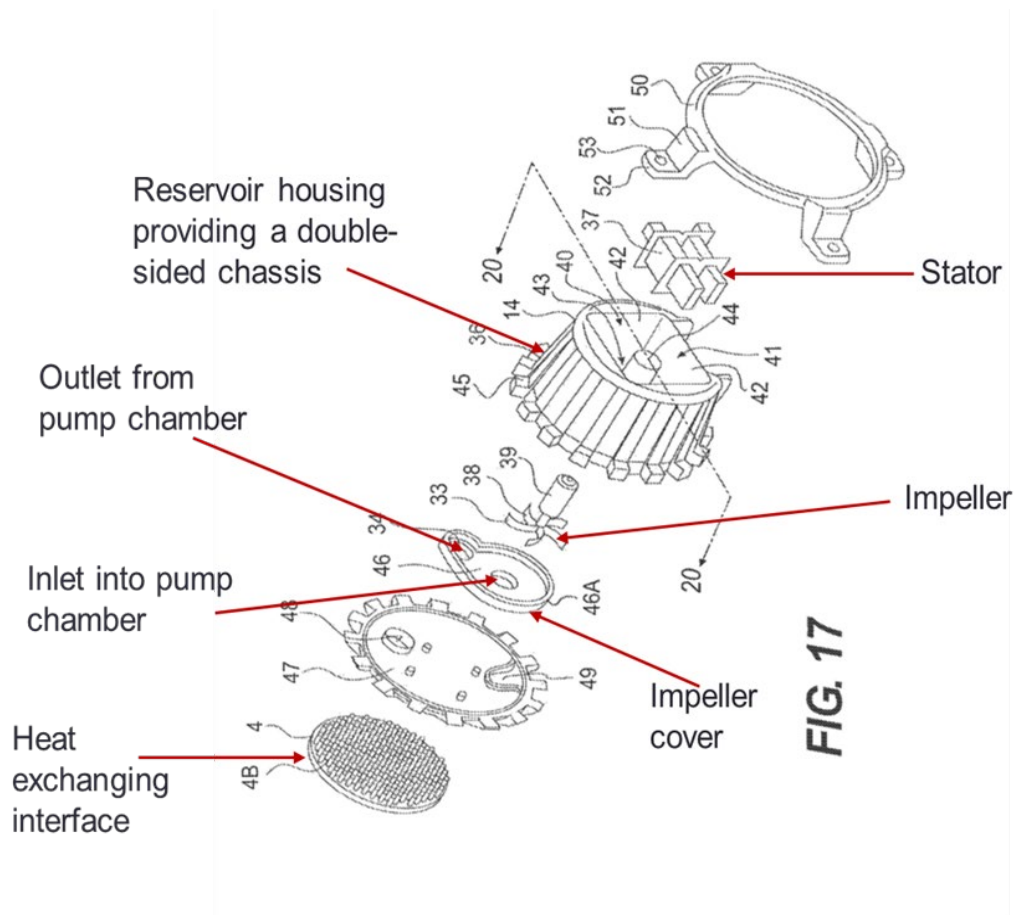


Figure 20

Ex. 1001, Figure 20 (annotations added); Ex. 2018, ¶28

The '681 patent further describes and claims a very specific configuration for the dual-chambered “reservoir,” where cooling liquid enters the “pump chamber” through an opening positioned below the center of an impeller housed in the “pump chamber.” Ex. 2018, ¶28; Ex. 1001, claim 1. For example, in the embodiment shown in Figure 17 (annotated below) and Figure 20 (annotated above), cooling liquid enters pump chamber 46 through an inlet in impeller cover 46A, the inlet being located below the rotational center of an impeller 33 housed in pump chamber 46. *See* Ex. 1001, 22:64-23:5, Figs. 17 and 20; Ex. 2018, ¶28. Cooling liquid exits pump

chamber 46 through an outlet 34 provided in impeller cover 46A, the outlet being positioned tangential to the circumference of impeller 33. *See* Ex. 1001, 22:64-23:5, Figs. 17 and 20; Ex. 2018, ¶28. Thermal exchange chamber 47A is defined between pump chamber 46 and heat exchanging interface 4 in such a way that thermal exchange chamber 47A is positioned below pump chamber 46 and the center of impeller 33. Ex. 1001, Figs. 17 and 20; Ex. 2018, ¶28.



Ex. 1001, Figure 17 (annotation added); Ex. 2018, ¶28.

III. Claim Construction

In the Institution Decision, the Board found no claim terms needed express construction. DI at 13-18. Asetek agrees that no claim construction is required to resolve the dispute between the parties in this IPR proceeding. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need to be construed that are in controversy, and only to the extent necessary to resolve the controversy.”). Therefore, Asetek has applied the plain and ordinary meaning for all relevant claim terms in this Response.

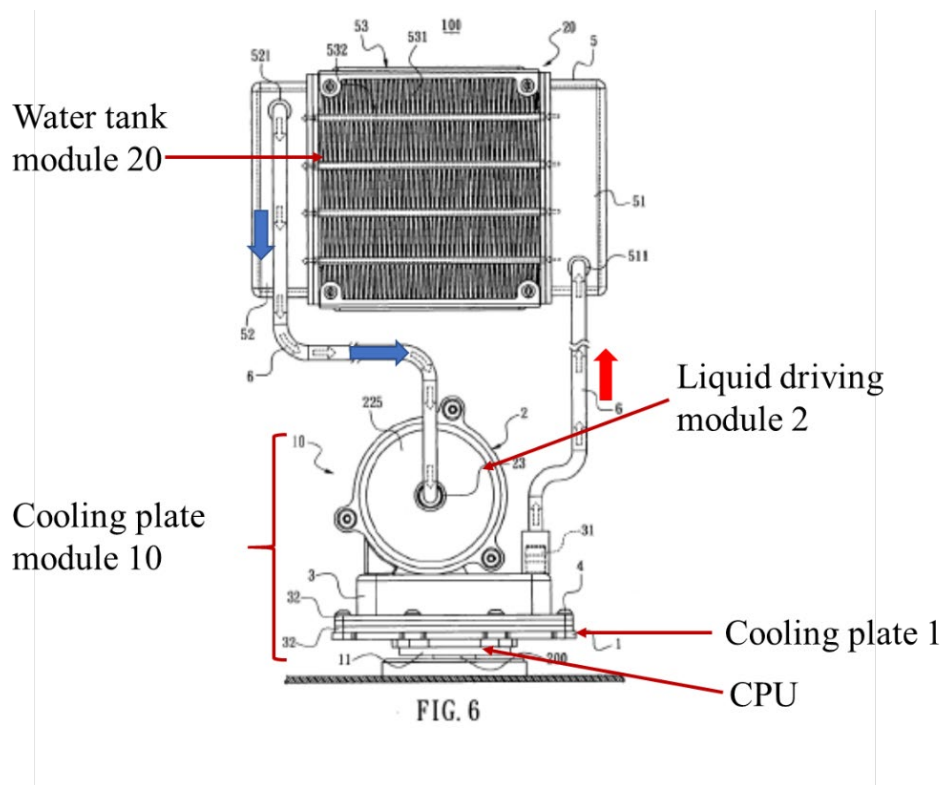
IV. Petition Prior Art

A. Duan

Duan discloses a cooling plate module for cooling a central processing unit (CPU). Ex. 1005, ¶[0002]. Duan’s cooling plate module includes a cooling plate and a liquid driving module. *Id.* ¶[0007]; Ex. 2018, ¶30. The liquid driving module in turn includes an accommodation chamber and a liquid driving unit. Ex. 1005, ¶[0009]; Ex. 2018, ¶30. The liquid driving unit drives the coolant through a cooling loop comprising the cooling plate module and a water tank module that cools heated coolant. Ex. 1005, ¶¶[0009], [0010]; Ex. 2018, ¶30.

Figure 6 of Duan, annotated below, shows an exemplary cooling plate module 10 in communication with water tank module 20 through ducts. Ex. 1005, ¶[0022]. Cooling plate module 10 includes a cooling plate 1 and a liquid driving module 2,

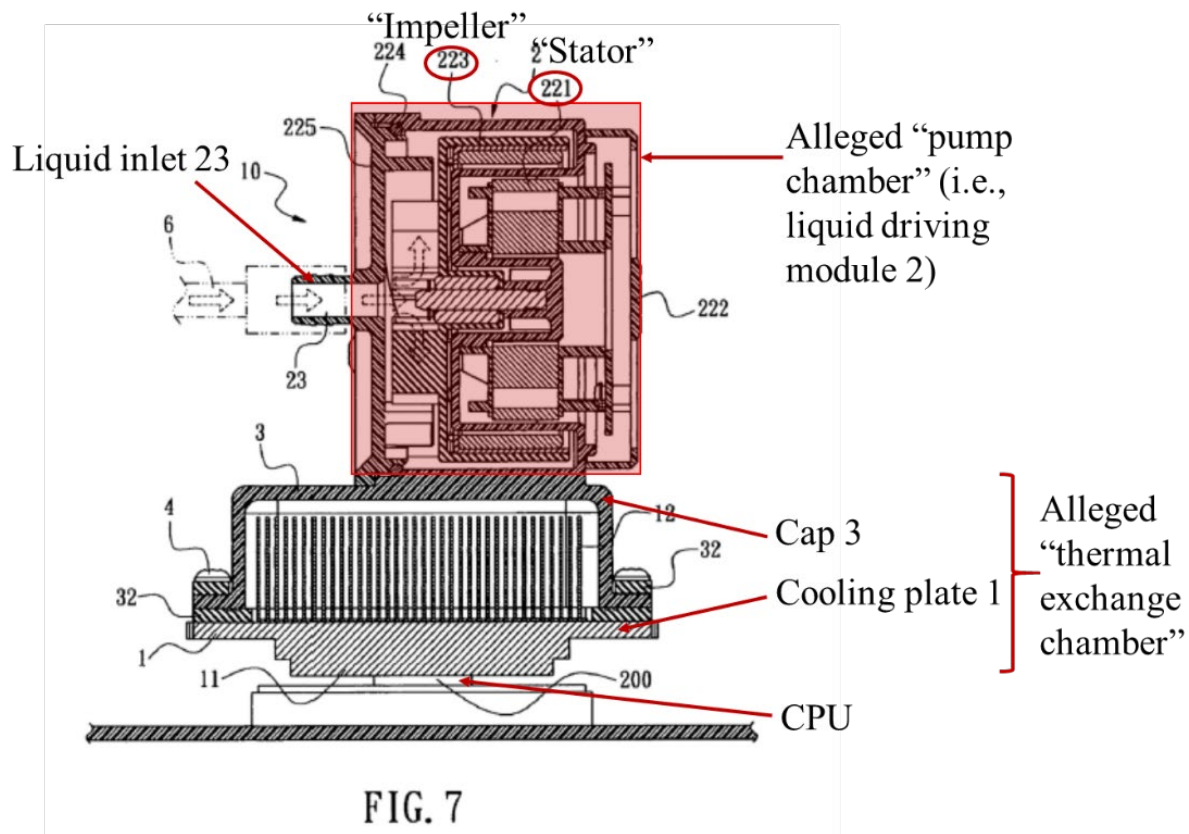
which comprises an accommodation chamber 21 and a liquid driving unit 22 located in accommodation chamber 21 and configured to drive the coolant. *Id.* at ¶¶[0022], [0023], Fig. 6 (accommodation chamber 21 and liquid driving unit 22 are not annotated in Figure 6 below but are included in liquid driving module 2); Ex. 2018, ¶31. The coolant collects heat from CPU 200 at cooling plate 1, the heated coolant flows to water tank module 20 where the coolant is cooled, and the cooled coolant flows back to liquid driving module 2 and then to cooling plate 1, thus forming a closed loop cooling circuit. Ex. 1005, Fig. 6, ¶¶[0021], [0022], [0027]; Ex. 2018, ¶31.



Ex. 1005, Figure 6 (annotation added); Ex. 2018, ¶31.

Duan's Figure 7, annotated below, shows a detailed view of cooling plate module 10. According to Petitioner's expert, Dr. Hodes, cooling plate 1 and cap 3 together define a "thermal exchange chamber," and liquid driving module 2 (which includes accommodation chamber 21) forms a "pump chamber." Ex. 1005, ¶[0023]; Ex. 2018, ¶32; Ex. 1003, pp. 52, 58. Dr. Hodes further testified that the combination of accommodation chamber 21, cap 3, and cooling plate 1 forms the claimed "reservoir." Ex. 1003, ¶¶97, 98, 99.

Lower cover 225 of liquid driving module 2 includes a liquid inlet 23 through which cooled coolant from the water tank module 20 enters accommodation chamber 21. Ex. 1005, ¶¶[0023], [0027]; Ex. 2018, ¶33. Coolant in accommodation chamber 21 flows to cap 3 through first liquid outlet 24. Ex. 1005, Fig. 8, ¶[0027]; Ex. 2018, ¶33. The coolant collects heat from heat-dissipating plates 12 in cap 3. Ex. 1005, ¶[0027]; Ex. 2018, ¶33. Cap 3 includes a second liquid outlet 31 through which heated coolant exits and flows to water tank module 20. Ex. 1005, Figs. 6 and 8.

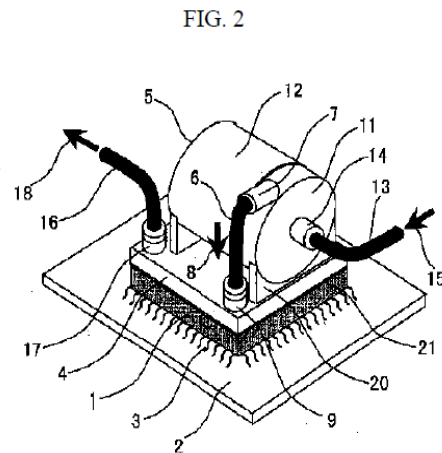
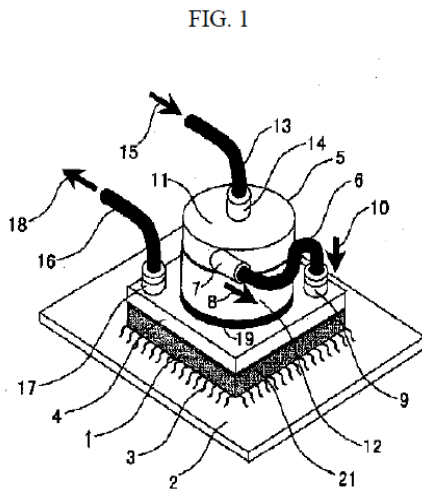


Ex. 1005, Fig. 7 (annotations added); Ex. 2018, ¶33.

B. Shin

Shin discloses a cooling device comprising a pump 5 and a heat sink 4, which are installed as an “integral structure” on an electronic heat generating element 1 to remove heat from that element. Ex. 1006, Abstract, Figs. 1 and 2 (reproduced below); Ex. 2018, ¶34. Pump 5 comprises an impeller case 11 and a motor 12. Ex. 1006, ¶[0018]; Ex. 2018, ¶34. A hose 6 connects impeller case 11 to heat sink 4. Ex. 1006, ¶[0013], Figs. 1 and 3; Ex. 2018, ¶34. In the embodiment shown in Figure 1, a vibration absorbing member 19 is positioned between pump 5 and heat sink 4 so

that vibration of the pump does not affect the functioning of the electronic component. Ex. 1006, ¶[0013]; Ex. 2018, ¶34.



Ex. 1006, Figs. 1 and 2.

Coolant entering heat sink 4 is “split into a plurality of channels formed inside the heat sink and flows in snaking fashion, absorbing the heat of the heat generating element 1,” and then exits heat sink 4 through hose 16 and flows into a heat exchanger 27 that cools the coolant. Ex. 1006, ¶¶[0013], [0025]; Ex. 2018, ¶35. Cooled coolant from heat exchanger 27 is returned to pump 5 by hose 13, is pressurized again by the pump, and then supplied to heat sink 4. Ex. 1006, ¶¶[0013], [0025]; Ex. 2018, ¶35.

Shin also teaches that the speed of pump motor 12 can be changed by changing the DC voltage supplied to the motor, thus enabling control of cooling power. Ex. 1006, ¶[0019]; Ex. 2018, ¶36. Moreover, “making the motor into a DC brushless

motor makes it possible to implement a pump of low noise and long service life.”
Ex. 1006, ¶[0019]; Ex. 2018, ¶36.

C. Cheon

Cheon discloses a cooling system for a computer that comprises one or more passive cold plates 12, 30, which are referred to as a “heat transfer devices.” Ex. 1007, Abstract, Figs. 1 and 2 (Figure 1 reproduced below); Ex. 2018, ¶37. The “heat transfer devices” are placed in thermal contact with heat-generating computer components. Ex. 1007, Figs. 1 and 2; Ex. 2018, ¶37. Coolant is circulated through conduits from a reservoir 48 to the “heat transfer devices” where the coolant collects heat from the computer components, and the heated coolant then flows back to reservoir 48 where it is cooled by radiator 42. Ex. 2018, ¶37. Radiator 42 is mounted on the outside of the computer housing and is placed in thermal contact with reservoir 48 via a Peltier effect cooling module 46. Ex. 1007, Figs. 1 and 2, 4:49-55; Ex. 2018, ¶37. A pump (P) having a brushless electric motor is mounted in the reservoir casing 50 to circulate the coolant between the reservoir and the “heat transfer devices.” Ex. 1007, Abstract, Figs. 1 and 2; Ex. 2018, ¶37.



Ex. 1007, Fig. 1.

Cheon discloses that its cooling system has a control circuit that controls circulation of coolant based on feedback from sensors indicating the temperatures of the electronic components to which the “heat transfer devices” are attached. Ex. 1007, 5:66–6:16; Ex. 2018, ¶38.

V. Ground 1 of the Petition Does Not Establish Obviousness of Claims 1 and 4 Based on Duan, Shin, and Cheon

In Ground 1, the Petition alleges that claims 1 and 4 are rendered obvious by the combination of Duan, Shin, and Cheon. But as discussed below, Duan, Shin, and Cheon, alone or in combination, do not disclose “an inlet positioned below the center of the impeller” and “a control system configured to independently control a speed of the pump and a speed of the fan,” as required by independent claim 1.

A. Duan, Shin, and Cheon do not disclose “an inlet positioned below the center of the impeller”

Claim 1 recites a “thermal exchange chamber” that is “formed *below* [a] pump chamber and vertically spaced apart from the pump chamber,” and also “an inlet positioned *below* the center of the impeller [included in the pump chamber].” Ex. 1001, 28:19-33. Because the “center of the impeller” is inside the “pump chamber,” the plain language of claim 1 requires the “inlet” to be positioned below the “pump chamber.” Ex. 2018, ¶39; Ex. 2016, 30:22-33:9 (Petitioner’s expert agreeing that “the center of the impeller is inside the pump chamber”). Thus, claim 1 by its terms requires both the “thermal exchange chamber” and the “inlet” to be positioned below the “pump chamber.” Ex. 2018, ¶39. This claimed configuration is fully supported by the embodiment shown in Figures 17 and 20 of the ’681 patent, which covers the claimed invention. As shown in the annotated Figure 20 below, the inlet into pump chamber 46 as well as thermal exchange chamber 47A are both located below pump chamber 46. Ex. 2018, ¶42. Even Petitioner’s expert, Dr. Hodes, agreed in his deposition that when a consistent frame of reference is applied to all the features in the embodiment shown in Figure 20 of the ’681 patent, the inlet through which cooling liquid enters pump chamber 46 is below the center of impeller 33 and thermal exchange chamber 47A is also below pump chamber 46. Ex. 2016, 45:18-46:9.

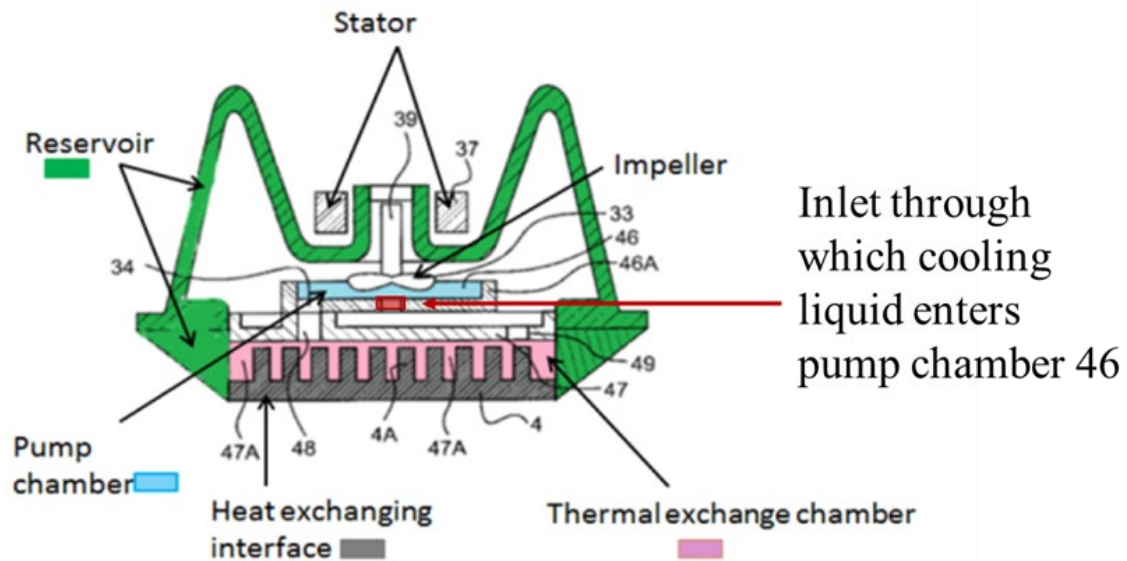
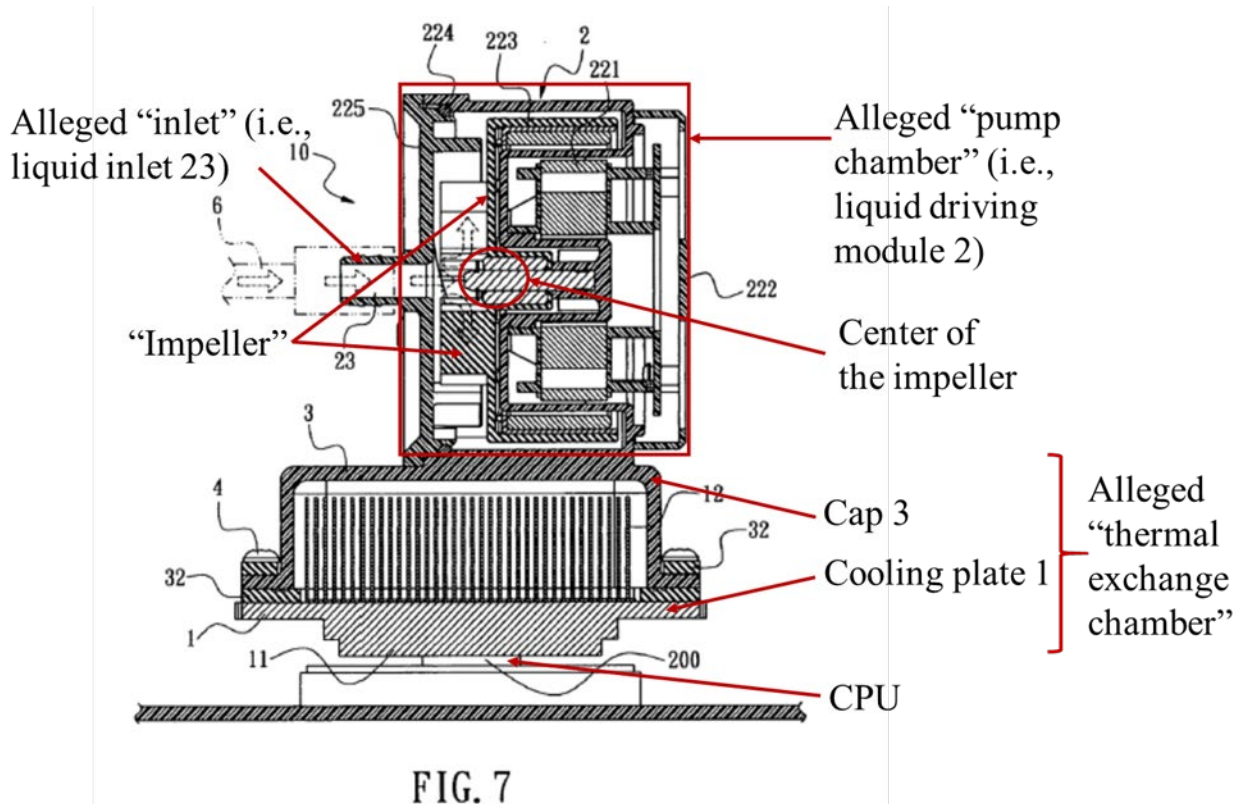


Figure 20

Ex. 1001, Fig. 20 (annotations added); Ex. 2018, ¶42.

The Petition relies on Duan to meet the limitations “a thermal exchange chamber formed below the pump chamber . . .” and “an inlet positioned below the center of the impeller.” Pet., 34-37, 51-53; DI, 30. But in Duan, when the “thermal exchange chamber” (the space between cap 3 and cooling plate 1) is below the pump chamber (liquid driving module 2), the inlet into the pump chamber (liquid inlet 23) is **not** positioned below the center of the impeller, but is instead positioned horizontally to the side of the impeller. Ex. 2018, ¶¶40, 41; Ex. 1005, Fig. 7 (annotated below). Put another way, if Duan’s thermal exchange chamber is considered to be below the pump chamber, then the inlet into the pump chamber cannot also be below the center of the impeller/pump chamber but must be on its

side, and vice versa. Ex. 2018, ¶42. As a result, Duan cannot simultaneously satisfy both the limitations “a thermal exchange chamber formed below the pump chamber” and “an inlet positioned below the center of the impeller.”



Ex. 1005, Fig. 7 (annotations added); Ex. 2018, ¶40.

Petitioner’s expert, Dr. Hodes, tried to remedy this critical shortcoming in Duan and in his Declaration by arguing in his deposition that “the relative positions of the inlet to the pump chamber and the impeller” is “distinct from” and not related to the position of “the pump chamber being above the thermal exchange chamber.” Ex. 2016, 31:22-33:11. As Dr. Hodes additionally explained, he considered “below” to be “a relative term between two objects.” *Id.* at 29:19-30:21. He “associated the

word ‘below’ with *either* the inlet to the impeller and the impeller *or* the thermal exchange chamber and the pump chamber. *[He] never considered relating all three with the same word,*” *id.*, and he “didn’t apply any frame of reference when [he] was discussing the relative location of the inlet to the impeller[,]” *id.* at 44:3-44:19. (Emphases added).

Dr. Hodes’s understanding of the two limitations — “a thermal exchange chamber formed below the pump chamber” and “an inlet positioned below the center of the impeller” — as separate and unrelated is incorrect both legally and technically. It is well established that a claim must be read and interpreted as a whole. *See Hockerson-Halberstadt, Inc. v. Converse Inc.*, 183 F.3d 1369, 1374 (Fed. Cir. 1999) (“proper claim construction . . . demands interpretation of the entire claim in context, not a single element in isolation.”). Moreover, “the same terms appearing in different portions of the claims should be given the same meaning unless it is clear from the specification and prosecution history that the terms have different meanings at different portions of the claims.” *Fin Control Sys. Pty, Ltd. v. OAM, Inc.*, 265 F.3d 1311, 1318 (Fed. Cir. 2001) (giving the term “lateral” the same meaning throughout the claim). Here, contrary to Dr. Hodes’s explanation, nothing in the intrinsic record of the ’681 patent claim suggests that claim 1 can be dissected into distinct and unrelated requirements, so that the word “below” in different portions of the claim

can have different meanings and different positional/directional frames of reference. Instead, “below” must be read consistently in all elements of the claim. *See id.*

Put another way, the two limitations “a thermal exchange chamber formed below the pump chamber” and “an inlet positioned below the center of the impeller” together impose a positional requirement for the term “below” which must be applied consistently to both limitations. Ex. 2018, ¶¶39, 40. Moreover, as the Board correctly found in the Institution Decision, claim 1’s recitation of a “thermal exchange chamber formed below the pump chamber and vertically spaced apart from the pump chamber” and a “heat radiator . . . positioned at a location horizontally spaced apart from the heat generating component” together provide a positional frame of reference for all the features in the claimed cooling device. DI, 14-15.

Contrary to the Petition, when the same directional frame of reference for above/below is applied consistently to all features in Duan’s liquid cooling device, Duan’s thermal exchange chamber is at the base/bottom of the device when installed on a CPU, and thus “below” the pump chamber, but the inlet to the pump chamber is positioned horizontally to the side of the impeller. Ex. 2018, ¶40; Ex. 1005, Fig. 7 (annotated above). The Board therefore correctly determined that “Petitioner has not shown sufficiently that Duan teaches or suggests a device where both the claimed ‘inlet’ is ‘positioned below the center of the impellor’ and the ‘thermal exchange chamber’ is ‘formed below the pump chamber and vertically spaced apart from the

pump chamber.” DI, 30-31. In fact, Petitioner’s expert, Dr. Hodes, agreed that if a single directional frame of reference is applied to all features in Duan’s cooling device, then Duan does not teach both these limitations:

Q Applying the same directional frame of reference to the entirety of the cooling plate module 10 of Duan, if Duan’s thermal exchange chamber is below the pump chamber, then Duan’s inlet 23 is not below the center of the impeller, correct?

...

A In that hypothetical situation, yes.

See Ex. 2016, 47:6-49:14; *see also id.* at 40:3-44:2.

In sum, the language of claim 1 imposes a single positional/directional frame of reference for above/below (or up/down) to all claimed features of the liquid cooling system. When this single frame of reference is applied to Duan, and its thermal exchange chamber is below the pump chamber, then the inlet into the pump chamber is not below the pump chamber or the center of the impeller. Claim 1 thus cannot be met by Duan.

Moreover, Petitioner’s reliance on Shin and Cheon for their discussions of “fan” and “control system” do not overcome Duan’s deficiencies with respect to the above limitations of claim 1. Ex. 2018, ¶43; DI, 30-31. Accordingly, claim 1 and

claim 4 (depending from claim 1) are not rendered obvious by Duan in view of Cheon and Shin in Ground 1. The Board therefore correctly concluded that “Petitioner has not shown a reasonable likelihood of prevailing in showing that claim 1 would have been obvious over Duan, Shin, and Cheon.” DI, 31.

B. Duan, Shin, and Cheon do not disclose “a control system configured to independently control a speed of the pump and a speed of the fan”

Petitioner relies on Shin and Cheon to meet the limitation “a control system configured to independently control a speed of the pump and a speed of the fan.” Pet., 47-51; Ex. 2016, 49:15-22 (Petitioner’s expert, Dr. Hodes, admitting that Duan does not disclose a control system for controlling pump and fan speeds). But neither Shin nor Cheon discloses controlling fan speed, or using a single control system to control both fan and pump speeds.

Shin discloses controlling a speed of the pump motor by changing the DC voltage. Ex. 1006, ¶[0019]; Ex. 2018, ¶45. But Shin does not disclose controlling a speed of a fan. Contrary to Petitioner and Dr. Hodes’s assertion, although Shin discloses a fan 34 for air-cooling the heat-generating elements 22a, 22b, 22c, and for cooling the heated coolant in heat exchanger 27, *see* Ex. 1006, ¶¶[0024], [0025], Shin does not disclose controlling the speed of fan 34. Petitioner’s expert Dr. Hodes admitted this in his deposition:

Q Shin does not disclose controlling
speed of a fan, correct?

...

*A Shin does not disclose directly
controlling speed of fan.*

However, Shin is focused on integrated
liquid cooling technology under discussion and
proposes controlling the speed of the pump.

It would be obvious to POSITA to also
control the speed of the fan for the same reasons;
noise, reliability, performance, et cetera.

Ex. 2016, 53:3-14 (emphasis added).

Likewise, Cheon also discloses controlling the circulation of coolant by
turning a pump motor on/off based on sensed temperatures of the heat-generating
electronic components. Ex. 1007, 6:3-16; Ex. 2018, ¶45. But Cheon does not
disclose a fan for cooling the electronic components, or for cooling radiator 42, and
so Cheon also does not disclose controlling speed of a fan. Ex. 2018, ¶46; Ex. 2016,
50:22-52:9 (Petitioner's expert, Dr. Hodes, agreeing that Cheon by itself does not
disclose a fan or controlling speed of a fan).

Thus, the limitation "a control system configured to independently control . .
. a speed of a fan" is completely missing from Duan, Shin, and Cheon.

Even if Dr. Hodes's assertion that a skilled artisan would have been motivated to control fan speed to reduce noise or improve cooling performance is accepted at face value, Dr. Hodes still fails to provide a rationale or motivation for "a" (one) control system to control both the fan and the pump speeds. Ex. 2018, ¶47. In fact, given that fan 34 and pump 5 in Shin are driven by separate motors, the obvious configuration would have been to use two separate control systems (not "a" system) to control the fan speed and the pump speed individually. *Id.* Therefore, even if Dr. Hodes's asserted motivation to control fan speed is accepted, the limitation "a control system configured to independently control a speed of a pump and a speed of a fan" is still completely missing from Duan, Shin, and Cheon.

To the extent Petitioner argues that "a" can mean one or more control systems, that interpretation is belied by the specification of the '681 patent. *Harari v. Lee*, 656 F.3d 1331, 1341 (Fed. Cir. 2011) (explaining there is not "a hard and fast rule that 'a' always means one or more than one," but that the limitation must be read "in light of the claim and specification to discern its meaning," and "[w]hen the claim language and specification indicate that 'a' means one and only one, it is appropriate to construe it as such even in the context of an open-ended 'comprising' claim."). Unlike Shin, the '681 patent explicitly discloses a *single* control system with a feedback loop to regulate both the rotational speed of the pump motor and the rotational speed of the fan motor, so that the regulation and feedback mechanisms

take into account both the cooling capacity and “which of the two cooling means, i.e., the pump and the air fan, is generating the most noise.” Ex. 1001, 14:59-61. “Thus, if the air fan generally is generating more noise than the pump, then the regulation will reduce the rotational speed of the air fan before reducing the rotational speed of the pump, whenever a lower cooling capacity is needed.” *Id.* at 14:61-65. In other words, the ’681 patent teaches a single control system for the air fan and the pump, even when they are operated independently by separate motors, so that regulation of fan speed and pump speed can take into account the overall noise generation. Ex. 2018, ¶48. There is no such teaching of a single control system in Shin. *Id.* In fact, the obvious configuration would have been to have two separate control systems in Shin to control the fan and pump speeds separately. Ex. 2018, ¶47.

Accordingly, Duan, Shin, and Cheon, alone or in combination, do not disclose or suggest 1) controlling the speed of a fan, or 2) providing “a” (i.e., a single) control system to control both pump speed and fan speed. Ex. 2018, ¶49. Even though Dr. Hodes tried to fill the gap in the prior art disclosures through unsupported assertions about motivation to control fan speed, he failed to provide any motivation or rationale for using “a” control system to control both the fan and the pump speeds. *Id.*

VI. Conclusion

Because the limitations “an inlet positioned below the center of the impeller” and “a control system configured to independently control a speed of the pump and a speed of the fan” of independent claim 1 are not disclosed or suggested by Duan, Shin, and Cheon, alone or in combination, claim 1 and claim 4 (which depends from claim 1) are not obvious in view of these prior art references. Claims 1 and 4 of the ’681 should therefore be confirmed as patentable.

Dated: November 30, 2020

By: /Arpita Bhattacharyya/
Arpita Bhattacharyya
Backup Counsel for Patent Owner
Reg. No. 63,681

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I, Arpita Bhattacharyya, certify that **PATENT OWNER'S RESPONSE** contains 4,646 words, excluding those portions identified in 37 C.F.R. § 42.24(b), as measured by the word-processing system used to prepare this paper.

Dated: November 30, 2020

By: /Arpita Bhattacharyya /
Arpita Bhattacharyya
Reg. No. 63,681

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I, William Esper, certify that on November 30, 2020, a copy of **PATENT OWNER'S RESPONSE and EXHIBITS 2015, 2016, and 2018** were served upon the below-listed counsel by electronic mail:

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Petitioner has consented to service by electronic mail.

Dated: November 30, 2020

By: /William Esper/
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Legal Assistant
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