

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COOLIT SYSTEMS, INC.,
Petitioner,

v.

ASETEK DANMARK A/S,
Patent Owner.

IPR2020-00524
Patent 9,733,681 B2

Before MICHAEL P. TIERNEY, *Vice Chief Administrative Patent Judge*,
KEVIN W. CHERRY, and JASON W. MELVIN,
Administrative Patent Judges.

CHERRY, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. BACKGROUND

CoolIT Systems, Inc. (“Petitioner”) filed a petition (Paper 2, “Pet.”) to institute an *inter partes* review of claims 1, 4, 8, 11, 15, and 16 of U.S. Patent No. 9,733,681 B2 (Ex. 1001, “the ’681 patent”). *See* 35 U.S.C.

§ 311. Asetek Danmark A/S (“Patent Owner”) timely filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). We also authorized Petitioner to file a Reply (Paper 8). Paper 7 (Order Authorizing Reply).

On August 24, 2020, based on the record before us at the time, we instituted an *inter partes* review of all challenged claims on all grounds alleged. Paper 9 (“Institution Decision” or “Dec.”). After we instituted this review, Patent Owner filed a statutory disclaimer disclaiming claims 8–16 (Ex. 2015, “Statutory Disclaimer”). Thus, the only claims and ground remaining in this proceeding are indicated in the table below.

Claim(s) challenged	35 U.S.C. §	Reference(s)
1, 4	103(a) ¹	Duan, ² Shin, ³ Cheon ⁴

Petitioner supports its Petition with a Declaration by Marc Hodes, Ph.D., dated February 7, 2020. Ex. 1003.

Patent Owner filed a Response in opposition to the Petition (Paper 21, “PO Resp.”). Patent Owner supported its Patent Owner Response with the Declaration of Donald E. Tilton, Ph.D., dated November 30, 2020

¹ Because the claims at issue have an effective filing date prior to March 16, 2013, the effective date of the applicable provisions of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), we apply the pre-AIA versions of 35 U.S.C. §§ 102 and 103 in this Decision.

² U.S. Patent Application Publication No. 2006/0185830, filed Feb. 18, 2005, published Aug. 24, 2006 (Ex. 1005, “Duan”).

³ Japanese Published Patent Application 2002-151638, published May 24, 2002 (Ex. 1006, “Shin”). The record includes a certified English translation of Shin. All citations will be to the certified English translation.

⁴ U.S. Patent No. 5,731,954, issued Mar. 24, 1998 (Ex. 1007, “Cheon”).

(Ex. 2018). Petitioner filed a Reply in support of the Petition (Paper 25, “Reply”). Petitioner supports the Reply with the Supplemental Declaration of Marc Hodes, Ph.D. (Ex. 1013). Patent Owner filed a Sur-reply responding to the Reply (Paper 28, “Sur-Reply”). Patent Owner did not move to amend any claim of the ’681 patent.

Both parties requested an oral hearing. *See* Paper 31. A transcript of the oral hearing is entered in the record. Paper 33 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. The evidentiary standard is a preponderance of the evidence. *See* 35 U.S.C. § 316(e) (2018); 37 C.F.R. § 42.1(d) (2019). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons expressed below, we conclude that Petitioner has *not* demonstrated by a preponderance of evidence that claims 1 and 4 (“the remaining challenged claims”) are unpatentable.

B. RELATED PROCEEDINGS

The parties identify *Asetek Danmark A/S v. CoolIT Systems, Inc.*, Case No. 3:19-cv-00410-EMC (N.D. Cal.) (complaint served on February 7, 2019, currently pending) as a related co-pending district court litigation. Pet. 1; Paper 4, 1. The parties also identify the following pending proceedings for *inter partes* review involving patents that are related to the ’681 patent: IPR2020-00522; IPR2020-00523. Pet. 1; Paper 4, 1.

C. THE ’681 PATENT

The ’681 patent is titled “Cooling System for a Computer System.” Ex. 1001, at [54]. The ’681 patent issued from Application Serial No. 13/861,593, filed April 12, 2013. *Id.* at [21], [22]. The ’593 application is a continuation of Application Serial No. 11/919,974, filed on January 6, 2009,

which is a U.S. national phase application of PCT/DK2005/00310, filed May 6, 2005. *Id.* at [63].

The '681 patent relates to a liquid-cooling system for a computer system. *Id.* at [57]. The Specification explains that, at the time of the invention, air cooling arrangements were the most-used cooling system for cooling central processing units (CPUs) in computer systems. *Id.* at 1:17–33. An alternative design known at the time of the invention was to use a cooling liquid circulating inside a closed system by means of a pumping unit with a heat exchanger past which the cooling liquid circulates. *Id.* at 1:34–38. The Specification contends that liquid cooling is generally more efficient and quieter than air cooling, but that a liquid cooling design consists of “many components,” which increases the total installation time, size, and risk of leakage of the cooling liquid from the system. *Id.* at 1:39–49. Thus, it is one object of the invention to provide a small and compact liquid-cooling solution, which is more efficient than existing air-cooling arrangements, can be produced at low cost enabling high production volumes, is easy to use and implement, can be used with existing CPU types and computer systems, and requires a low level of maintenance or no maintenance at all. *Id.* at 1:53–63.

An illustrative embodiment of such a system is depicted in Figures 7 and 8, reproduced below.

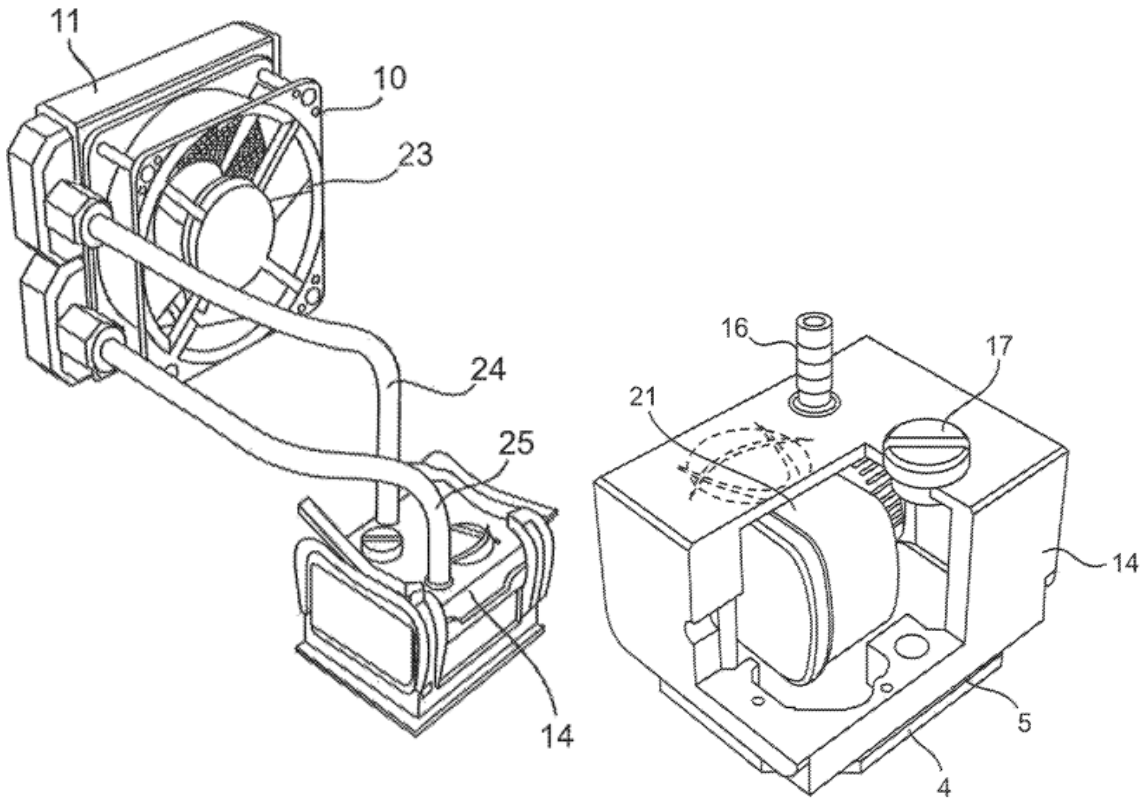


FIG. 7

FIG. 8

Figure 7⁵ is a perspective view of the cooling system showing reservoir housing 14 with heat exchanging surface 5 (shown in Figure 8) and pump 21 (shown in Figure 8) inside the reservoir. *Id.* at 16:16–19. Figure 8 is a cut-out view into reservoir housing 14, when the reservoir, pump 21, and heat exchanging surface 4 are situated inside the reservoir. *Id.* at 15:49–51. The reservoir has tube inlet connection 15 (not shown in Figure 8) through which the cooling liquid enters the reservoir. *Id.* at 15:51–53. From the tube

⁵ We agree with Petitioner that it appears that the Specification transposes the description of Figure 7 with that of Figure 8. Pet. 5 n.1. We refer to the description of “Figure 8” in the Specification in our discussion of Figure 7, and we refer to the Specification’s discussion of “Figure 7” in our discussion of Figure 8.

inlet connection, the cooling liquid flows through the reservoir passing heat exchanging surface 4 and enters the inlet of the pump. *Id.* at 15:54–56.

After the cooling liquid flows through the pump, the cooling liquid passes out of the outlet of the pump and further out through tube outlet connection 16. *Id.* at 15:56–58. As shown in Figure 7, tube inlet connection 15 and tube outlet connection 16 are connected to heat radiator 11 by means of connecting tubes 24 and 25. *Id.* at 16:19–21. Cooling liquid flows into and out of the reservoir and the heat radiator through connecting tubes 24 and 25, respectively. *Id.* at 16:21–23. The reservoir may be provided with channels or segments for establishing a certain flow-path for the cooling liquid through the reservoir to prevent the cooling liquid from passing the reservoir too quickly to take up a sufficient amount of heat from the heat exchanging surface. *Id.* at 16:51–62.

Within heat radiator 11 (shown in Figure 7), the cooling liquid passes a number of channels for radiating the heat carried in the cooling fluid from heat exchanging surface 4 (shown in Figure 8). *Id.* at 16:23–26. Air fan 10 (with propeller 23) of Figure 7 blows air past the channels of the heat radiator in order to cool the radiator and thereby cool the cooling liquid flowing inside the channels through the heat radiator and back into the reservoir. *Id.* at 16:26–30.

Figures 17 and 20 show the internal structures of a preferred embodiment of the reservoir according to the invention and are reproduced below. *Id.* at 21:48–50.

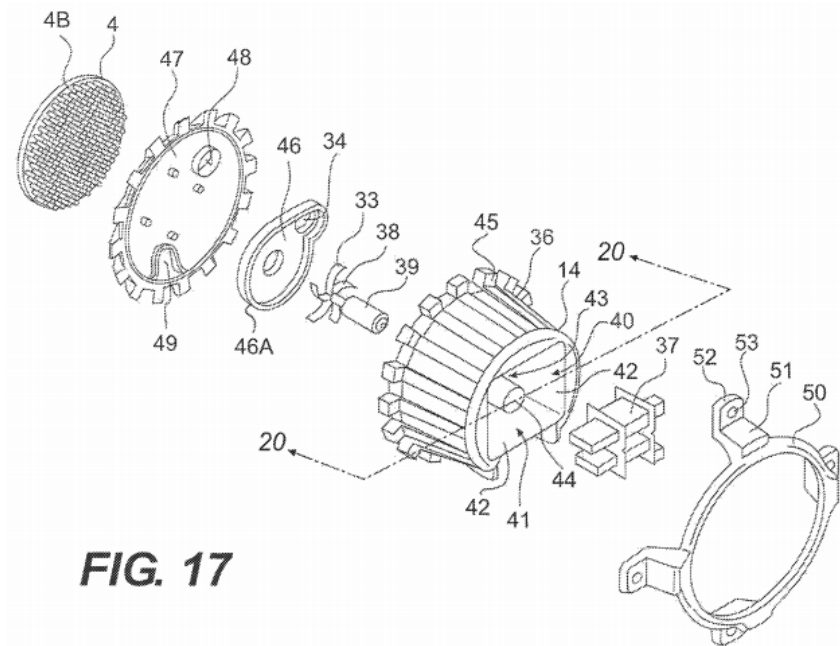


FIG. 17

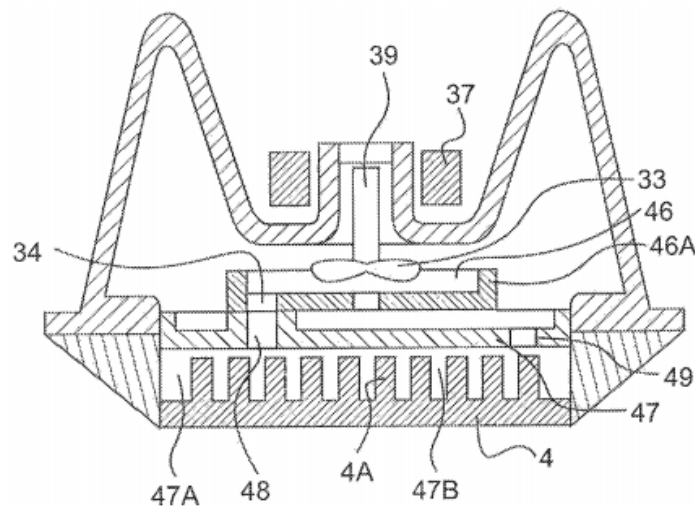


FIG. 20

Figure 17 is an exploded perspective view of a preferred embodiment of a reservoir, pump, and heat exchanging surface. *Id.* at 10:7–9. Figure 20 is a simplified schematic showing a cross-sectional view of the reservoir along plane 20-20 of Figure 17. *Id.* at 10:16–17. Reservoir housing 14, as shown in Figures 17 and 20, is in the form of a double-sided chassis having a substantially conical, circular configuration with stiffening ribs 36

extending axially along the exterior of the reservoir housing and configured to mount an electrical motor. *Id.* at 21:49–57. Reservoir housing 14 has recess 40 intended for accommodating stator 37 of electrical motor driving impellor 33 of the pump, which is attached to shaft 38 of rotor 39 of the electric motor. *Id.* at 21:58–22:1. The Specification explains that “a liquid-proof division” is made between rotor 39 of the motor, which is submerged in the cooling liquid, and stator 37 of the pump. *Id.* at 22:1–22:6.

The enclosed space between impeller 33 and heating exchanging interface 4 is divided into two separate chambers by impeller cover 46A and intermediate member 47, as shown in Figure 20. The chamber formed by impeller 33 and impeller cover 46A is described as “pump chamber 46” and has outlet 34. *Id.* at 22:64–67. A second chamber termed “thermal exchange chamber 47A” is formed by intermediate member 47 and heat exchanging interface 4. *Id.* at 23:5–11. Intermediate member 47 has two passages through it—first passage 48 and second passage 49. *Id.* at 23:7–15. First passage 48 connects to outlet 34 and provides a passage for the cooling liquid to flow from pump chamber 46 to thermal exchange chamber 47A. *Id.* Second passage 49 leads cooling liquid from thermal exchange chamber 47A to the interior of reservoir housing 14 allowing for the circulation of the liquid out of reservoir housing 14 to heat radiator 11. *Id.* at 23:11–19.

Claim 1 is the sole independent claim among the remaining challenged claims. Claim 4 depends from claim 1. Independent claim 1, which is illustrative, recites:

1. A liquid cooling system for cooling a heat-generating component of a computer, comprising:
a double-sided chassis adapted to mount a pump configured to circulate a cooling liquid, the pump comprising a motor

with a stator and an impeller, the impeller being positioned on one side of the chassis and the stator being positioned on an opposite side of the chassis and isolated from the cooling liquid;

a reservoir adapted to pass the cooling liquid therethrough, the reservoir including:

a pump chamber including the impeller; and

a thermal exchange chamber formed below the pump chamber and vertically spaced apart from the pump chamber, the pump chamber and the thermal exchange chamber being separate enclosed chambers that are fluidly coupled;

a heat-exchanging interface removably coupled to the reservoir, the heat-exchanging interface forming a boundary wall of the thermal exchange chamber and configured to be placed in thermal contact with a surface of the heat-generating component;

a heat radiator adapted to pass the cooling liquid therethrough, the heat radiator being fluidly coupled to the reservoir and positioned at a location horizontally spaced apart from the heat-generating component, the heat radiator being configured to dissipate heat from the cooling liquid;

a fan configured to direct air through the heat radiator, the fan being driven by a motor separate from the motor of the pump; and

a control system configured to independently control a speed of the pump and a speed of the fan;

wherein the pump chamber includes:

an inlet positioned below the center of the impeller configured to enable the cooling liquid to flow into the center of the pump chamber;

an outlet that fluidly couples the pump chamber to the thermal exchange chamber via a first

passage, the outlet is positioned along an outer circumference of the pump chamber and is configured to direct the cooling liquid driven by the impeller through the first passage to the thermal exchange chamber;

wherein the first passage directs the cooling liquid into the thermal exchange chamber between a first end and a second end of the thermal exchange chamber;

wherein the thermal exchange chamber includes at least one second passage configured to direct the cooling liquid out of the thermal exchange chamber, the at least one second passage is positioned at either the first end or the second end of the thermal exchange chamber.

Ex. 1001, 28:18–67.

II. ANALYSIS

A. CLAIM INTERPRETATION

We interpret claims in the same manner used in a civil action under 35 U.S.C. § 282(b), “including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2019).⁶ When applying that standard, we interpret

⁶ On October 11, 2018, the USPTO revised its rules to harmonize the Board’s claim construction standard with that used in federal district court. Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). This rule change applies to petitions filed on or after November 13, 2018. *Id.*

the claim language as it would be understood by one of ordinary skill in the art in light of the specification. *In re Suitco Surface, Inc.*, 603 F.3d 1255, 1260 (Fed. Cir. 2010). Thus, we give claim terms their ordinary and customary meaning as they would be understood by an ordinarily skilled artisan. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (“The ordinary and customary meaning ‘is the meaning that the term would have to a person of ordinary skill in the art in question.’” (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005))). Only terms that are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

In the Petition, Petitioner identifies “reservoir,” “chamber,” “impeller,” “stator,” “heat radiator,” “an inlet positioned below the center of the impeller,” and “intermediate member” as needing construction. Pet. 14–20. Petitioner submits that the other terms do not require construction. *Id.* at 20. In its Preliminary Response, Patent Owner agreed with Petitioner’s proposed constructions for “reservoir,” “chamber,” “impeller,” and “heat radiator.” Prelim. Resp. 21. Patent Owner disagreed with Petitioner’s constructions of “stator,” “intermediate member,” “an inlet positioned below the center of the impeller,” “double-sided chassis,” and “a first end or a second end of the thermal exchange chamber.” *Id.* at 21. In addition, Patent Owner proposed a construction for “the pump chamber defined by an intermediate and double-sided chassis housing.” *Id.* Patent Owner submitted that, although it disputes Petitioner’s constructions of “stator,” “intermediate member,” “double-sided chassis,” and “a first end or a second end of the thermal exchange chamber,” no construction of these terms was

necessary. *Id.* Patent Owner further submitted that resolving the parties’ conflicting constructions of the terms “an inlet positioned below the center of the impeller” and “the pump chamber defined by an intermediate member and a double-sided chassis housing” would aid our institution decision. *Id.*

In our Institution Decision, we agreed with Patent Owner that no construction was necessary of “reservoir,” “chamber,” “impeller,” “heat radiator,” “stator,” “intermediate member,” “double-sided chassis,” and “a first end or a second end of the thermal exchange chamber” for our determination of whether to institute *inter partes* review. Dec. 13. We also agreed with the parties that resolving the constructions of “an inlet positioned below the center of the impeller” and “the pump chamber defined by an intermediate member and a double-sided chassis housing” would be helpful for the Institution Decision. *Id.* at 13–14.

At this stage of the proceeding, the parties’ sole remaining claim construction dispute centers on the claim phrase “an inlet positioned below the center of the impeller,” which we consider below.

1. “*an inlet positioned below the center of the impeller*”

In the Petition, Petitioner submitted that the phrase “an inlet positioned below the center of the impeller” should be construed as including an “opening for fluid near the center of the impeller along the axis around which the impeller rotates.” Pet. 16. In its Patent Owner Response, Patent Owner argues that the phrase should be given its plain and ordinary meaning. PO Resp. 8. In its Reply, Petitioner offers a new construction (“New Construction”), and argues that we should instead construe the term to mean “on the ‘cooling liquid’ side of the impeller’s center.” Reply 1–2. In its Sur-Reply, Patent Owner argues that we should reject this new

construction because it is untimely and incorrect. Sur-Reply 1–9. We agree with Patent Owner that this phrase should receive its plain and ordinary meaning.⁷

We begin with the claim language. The full limitation in claim 1 states “an inlet positioned below the center of the impeller configured to enable the cooling liquid to flow into the center of the pump chamber.” Ex. 1001, 28:50–53. Petitioner argues that the end portion of this limitation—“configured to enable the cooling liquid to flow into the center of the pump chamber”—supports its new construction that “below,” recited earlier in the limitation, refers not to a direction, but instead to the cooling liquid side of the apparatus. Reply 1–3. However, we agree with Patent Owner that rather than support Petitioner’s construction, this language suggests that Petitioner’s construction is not correct. Sur-Reply 4–5. As Patent Owner explains, the claim already recites the functional relationship between the inlet and the coolant; namely, the inlet is “configured to enable the cooling liquid to flow into the center of the pump chamber.” *Id.* Furthermore, the claim uses the word “below” in another limitation—“a thermal exchange chamber formed below the pump chamber and vertically spaced apart from the pump chamber.” Petitioner’s new construction would require us to construe the term “below” differently in different limitations. Moreover, consistent with Petitioner’s initial construction, we agree with Patent Owner that the claim consistently uses “below” in a directional, not functional sense. Thus, we agree with Patent Owner that the claim language

⁷ We also agree with Patent Owner’s argument that Petitioner’s new claim construction is untimely. However, given that the issue is fully briefed and discussed, we will consider it.

does not support Petitioner’s new construction. *See Epcon Gas Sys., Inc. v. Bauer Compressors, Inc.*, 279 F.3d 1022, 1030–31 (Fed. Cir. 2002) (“A word or phrase used consistently throughout a claim should be interpreted consistently.” (quoting *Phonometrics, Inc. v. Northern Telecom Inc.*, 133 F.3d 1459, 1465 (Fed. Cir. 1998))).

The written description does not compel departing from the ordinary understanding of the word “below” as indicating a direction. As Patent Owner explains, nothing in the written description supports reading “below” as only describing a relationship with the cooling fluid side of the system. Sur-Reply 6. Thus, the written description does not weigh in favor of the construction.

Finally, Petitioner points to the testimony of Patent Owner’s expert agreeing that the inlet is on the coolant liquid side of the apparatus. *See Reply 6* (citing Ex. 1012, 34:16–35:17). The fact that Petitioner’s new construction is not inconsistent with the preferred embodiment does not mean that this construction is correct. Instead, we find the claim language to be clear on this point. Thus, we do not find the extrinsic evidence to compel a particular construction. *See Seabed Geosolutions (US) Inc. v. Magseis FF LLC*, --- F.4th ---, 2021 WL 3520472, at *3 (Fed. Cir. Aug. 11, 2021) (“Given the clarity of the intrinsic evidence, resort to extrinsic evidence is unnecessary.”)

In sum, we determine that the claim language is clear. The claim already explicitly recites the functional relationship that with its new construction Petitioner seeks to construe into the word “below.” We find the better reading of claim 1’s usage of the term “below” to be in its ordinary directional sense—as Petitioner originally proposed. Thus, we decline to

adopt Petitioner's new construction of "below," and instead give this limitation its plain and ordinary meaning.

We note, however, that Patent Owner additionally contends that "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." PO Resp. 19. We begin again with the language of claim 1. Claim 1 recites that the "thermal exchange chamber" is "formed below the pump chamber and vertically spaced apart from the pump chamber," and that the "heat radiator" is "positioned at a location horizontally spaced apart from the heat generating component." Thus, claim 1 contains "vertical" or "horizontal" references in addition to a requirement that the "thermal exchange chamber" be "below" the "pump chamber." We find that the combination of this language suggests a specific frame of reference for the components of the claimed system.⁸

Petitioner argues that Patent Owner is attempting to read the limitation "vertically" into the term "below," and that this would render claim 1's recitation of "vertically spaced apart" superfluous. Reply 9. However, we agree with Patent Owner that it is not seeking to read the limitation

⁸ The language of disclaimed claim 8, in contrast to the language of claim 1, does not impose any specific particular positional/directional frame of reference on the entire claimed cooling device, which indicates that Patent Owner knew how to claim a device with multiple frames of reference. *See Intellectual Ventures I LLC v. T-Mobile USA, Inc.*, 902 F.3d 1372, 1379 (Fed. Cir. 2018) ("This shows that the patentee knew how to restrict the resource allocator to using information obtained from layer 7. If the patentee had intended to similarly restrict the resource allocator in claim 1, it could have done so using the language of claim 19, but did not.").

“vertically” into term “below.” The frame of reference of the claims comes from the other limitations in claim 1, which directionally orient the thermal exchange chamber, pump chamber, and heat exchanger. Sur-Reply 9–10. We agree with Patent Owner that its arguments arise not from importing a limitation into “below,” but instead from applying the ordinary meaning of “below” once that positional frame of reference in the claim is established. *See id.*

On this point of whether Patent Owner is reading limitations into “below,” Petitioner relies heavily on testimony of Patent Owner’s expert, Dr. Tilton, where Dr. Tilton characterizes “vertically spaced apart” as seeming “superfluous” to him. Reply 10–11 (citing Ex. 1012, 27:19–28:1, 34:16–35:17). However, we agree with Patent Owner that when this testimony is read in context, Dr. Tilton clarifies that “vertically spaced apart” is not “completely redundant,” Ex. 1012, 28:24–29:9, because two things “could also be below and horizontally spaced apart, . . . meaning it would be below it, but off to the side,” *id.* at 27:6–11. Thus, when read in context, we do not agree with Petitioner’s characterization of Dr. Tilton’s overall testimony as reading a limitation into “below.” Moreover, given the clear and simple claim language, we do not find either parties’ extrinsic evidence to be helpful in resolving this dispute.

We further note that the Specification is consistent with this construction. Figures 17 and 20 and the supporting discussion are consistent with understanding the claim language as imposing an express limitation of the positional/directional frame in claim 1. The embodiment shown in Figures 17 and 20 of the ’681 patent shows a device with an inlet “below” the center of the impeller and a consistent positional frame of reference for

the entire device. “[W]hile it is of course improper to limit the claims to the particular preferred embodiments described in the specification, the patentee’s choice of preferred embodiments can shed light on the intended scope of the claims.” *Astrazeneca AB v. Mut. Pharm. Co.*, 384 F.3d 1333, 1340 (Fed. Cir. 2004).

Accordingly, we determine that “an inlet positioned below the center of the impeller” should be given its plain and ordinary meaning. We further determine that Patent Owner is correct that claim 1 does have a particular positional/directional frame of reference that is used throughout the claim.

2. Other Claim Terms

We discern no other terms in need of express interpretation. Accordingly, we apply the legal standards set forth above when reading the claims.

B. THE PARTIES’ POST-INSTITUTION ARGUMENTS

In our Institution Decision, we concluded that the argument and evidence adduced by Petitioner demonstrated a reasonable likelihood that claims 8, 11, 15, and 16, which have now been disclaimed, were unpatentable. Dec. 31–32. We noted that Petitioner had not shown a reasonable likelihood that claims 1 and 4 were unpatentable (*id.*), but we instituted on those claims under governing precedent and guidance. *See SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1354, 1359–60 (2018); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”); Consolidated Trial Practice Guide 64 (Nov. 2019), <https://www.uspto.gov/TrialPractice>

GuideConsolidated (“Consolidated TPG”) (“The Board will not institute on fewer than all claims or all challenges in a petition.”).

We must now determine whether Petitioner has established by a preponderance of the evidence that the remaining challenged claims are unpatentable over the cited prior art. 35 U.S.C. § 316(e) (2018). We previously instructed Patent Owner that “any arguments not raised in the [Patent Owner Response] may be deemed waived.” Paper 10, 8; *see also In re NuVasive, Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016) (holding that patent owner’s failure to proffer argument at trial as instructed in scheduling order constitutes waiver). Additionally, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.”

Consolidated TPG at 66.

C. LEGAL STANDARDS

Petitioner challenges the patentability of claims 1 and 4 on the ground that the claims are unpatentable as obvious over Duan, Shin, and Cheon. To prevail in its challenge to the patentability of the claims, Petitioner must establish unpatentability by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d) (2019). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing*

Corp. v. Videotek, Inc., 545 F.3d 1316, 1326–27 (Fed. Cir. 2008))
(discussing the burdens of proof in *inter partes* review).

The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), reaffirmed the framework for determining obviousness as set forth in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). The *KSR* Court summarized the four factual inquiries set forth in *Graham* that we apply in determining whether a claim is unpatentable as obvious under 35 U.S.C. § 103(a) as follows: (1) determining the scope and content of the prior art, (2) ascertaining the differences between the prior art and the claims at issue, (3) resolving the level of ordinary skill in the pertinent art, and (4) when in evidence, considering objective evidence indicating obviousness or nonobviousness. *KSR*, 550 U.S. at 406 (citing *Graham*, 383 U.S. at 17–18). In an *inter partes* review, Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable. An obviousness analysis “need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR*, 550 U.S. at 418; *accord Translogic*, 504 F.3d at 1259. Petitioner also must articulate a reason why a person of ordinary skill in the art would have combined the prior art references. *NuVasive*, 842 F.3d at 1382.

At this final stage of the proceeding, we determine whether a preponderance of the evidence of record shows that the remaining challenged claims would have been rendered obvious in view of the asserted

prior art. We analyze the asserted ground of unpatentability in accordance with these principles.

D. LEVEL OF ORDINARY SKILL

We review the grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the time of the invention. *Graham*, 383 U.S. at 17. Petitioner proposes that a person of ordinary skill

would have been knowledgeable regarding liquid cooling systems for computer systems, would have earned at least a bachelor's degree, such as an B.S. (bachelor of science), or equivalent thereof, in electrical or mechanical engineering or a closely-related field, and would have possessed at least two or three years of experience in liquid cooling systems for computer systems, or in similar systems.

Pet. 4 (citing Ex. 1003 ¶¶ 25–30). Patent Owner does not dispute this definition of a person of ordinary skill. *See generally* PO Resp. Patent Owner's expert, Dr. Tilton, however, testifies that

A person having ordinary skill in the field of liquid cooling systems at that time (i.e., in May 2005) would have (i) completed college level course work in thermodynamics, fluid mechanics, and heat transfer, and (ii) attained two or more years of experience in designing liquid cooling systems for computers, servers, or other electronic devices, or very similar technology. Alternatively, a person with a more advanced degree in the above fields may have had less practical experience and be a person of ordinary skill in the art.

Ex. 2018 ¶ 23.

We see no meaningful distinction between these definitions relevant to the particular issues necessary to decide this case. We adopt Petitioner's proposed level of ordinary skill, as it appears to be consistent with the level of skill reflected by the Specification and in the asserted prior art references.

See Okajima v. Bourdeau, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art itself can reflect the appropriate level of ordinary skill in the art).

E. CLAIMS 1, 4:

OBVIOUSNESS BASED ON DUAN, SHIN, CHEON

Petitioner argues that the combination of Duan, Shin, and Cheon renders claims 1 and 4 unpatentable as obvious. Pet. 26–68. Claim 1 is independent and claim 4 depends from claim 1. Ex. 1001, 28:18–67, 29:10–14. Patent Owner argues that, given the positional frame of reference of the claim, Petitioner’s challenge to claims 1 and 4 fails. *See* PO Resp. 15–21. We have agreed with Patent Owner’s proposed construction and agree with its effect on Petitioner’s challenge. Accordingly, as explained below, we determine that Petitioner *has not proven* by a preponderance of evidence that the combination of Duan, Shin, and Cheon renders claims 1 and 4 unpatentable as obvious.

1. Independent Claim 1

We first consider Petitioner’s argument that the combination of Duan, Shin, and Cheon renders obvious claim 1. Pet. 26–64.

a. Duan

Duan is titled “Cooling Plate Module.” Ex. 1005, at [54]. Duan discloses a cooling plate module for cooling a CPU. *Id.* ¶ 2. Duan’s system includes a cooling plate module with a cooling plate integrally formed with a liquid driving module such that the layout of the cooling plate module can be minimized to reduce space. *Id.* ¶ 7. Figure 6, reproduced below, is a view of the liquid cooling cyclic mechanism of Duan. *Id.* ¶ 17.

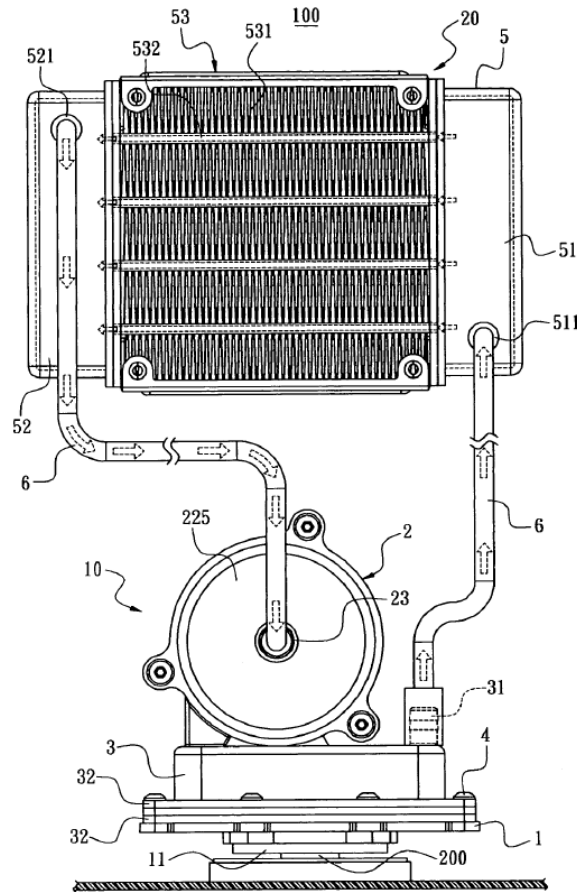


FIG. 6

Figure 6, reproduced above, shows liquid cooling cyclic mechanism 100 for cooling CPU 200. *Id.* ¶ 22. Liquid cooling cyclic mechanism 100 consists of cooling module 10 and water tank module 20, which is connected with cooling plate module 10 through ducts. *Id.* Cooling plate module 10 includes cooling plate 1, liquid driving module 2, and heat absorbing interface 11. *Id.* Heat absorbing face 11 is in contact with CPU 200 for dissipating heat generated by CPU 200. *Id.* ¶ 26.

Water tank 20 includes box 5, with liquid entrance region 51 and liquid exit region 52 on either side of box 5 and cooling stage 53 in the center of box 5. *Id.* ¶ 25. Cooling stage 53 has a plurality of heat-dissipating fins 531 arranged in rows with runners 532 defined between rows

of heat dissipating fins 531. *Id.* When hot liquid in liquid entrance region 51 flows to liquid exit region 52, heat from the hot liquid dissipates through heat-dissipating fins 531 and the resulting cool liquid flows to liquid exit region 52. *Id.*

Liquid inlet 23 of cooling plate module 10 is connected to liquid outlet 521 of liquid exit region 52 of water tank 20 through duct 6. *Id.* Second liquid outlet 31 of cooling plate module 10 is connected to liquid inlet 511 of liquid entrance region 51 of water tank 20 through duct 6, which allows hot liquid from cooling plate module 10 to be cooled and cycled back to cooling plate module 10. *Id.*

Figure 2, reproduced below, is an exploded view of cooling plate module 10 of Duan. *Id.* ¶ 13.

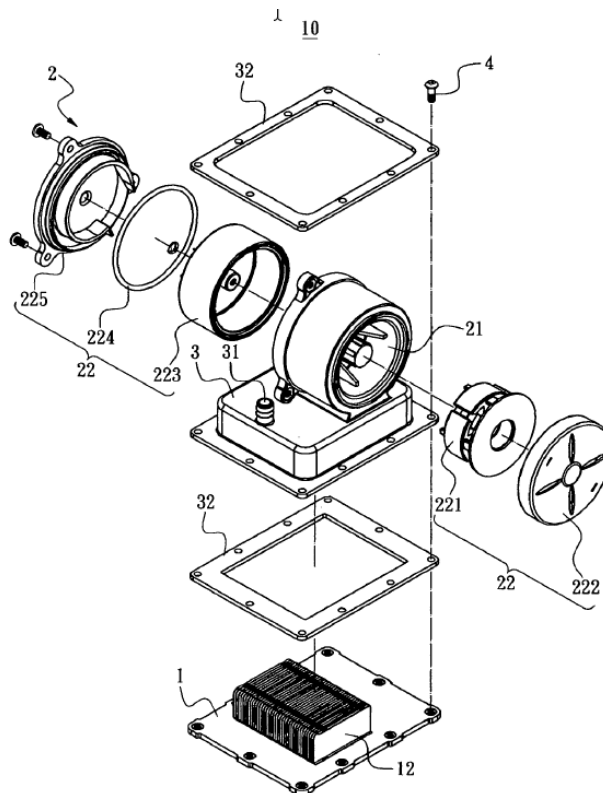


FIG. 2

Figure 2, reproduced above, shows a detailed exploded view of cooling plate module 10. Liquid driving module 2 of cooling plate module 10 includes accommodation chamber 21 and liquid driving unit 22 located in accommodation chamber 21 to drive the cool liquid. *Id.* ¶ 23. Liquid driving unit 22 includes coil stage 221, upper cover 222, impeller stage 223, sealing washer 224, and lower cover 225. *Id.* Lower cover 225 includes liquid inlet 23 connected with accommodation chamber 21. *Id.* First liquid outlet 24 connects to the bottom of accommodation chamber 21 and is enclosed by cap 3. *Id.* Cap 3 includes second liquid outlet 31, cooling plate 1 is assembled with cap 3 to define a closed space therein, and first liquid outlet 24 is corresponding to heat-dissipating plates 12. *Id.* Duan explains that liquid driving module 2 can be a reciprocating pump, centrifugal pump, or axial-flow pump. *Id.*

Figure 7 of Duan, reproduced below, is a sectional view of the cooling plate module. *Id.* ¶ 18.

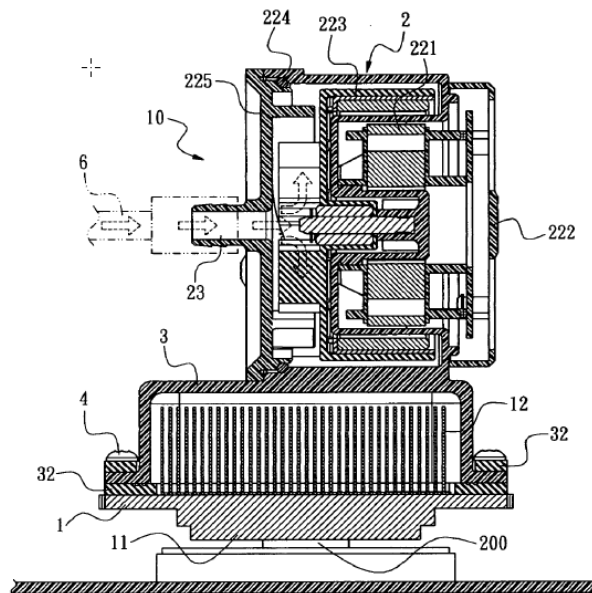


FIG. 7

Figure 7, reproduced above, is a sectional view of the cooling plate module of Duan. As shown in Figure 7, the cool liquid in water tank 20 flows to accommodation chamber 21 through duct 6 and liquid inlet 23 of cooling plate module 10 and is driven by liquid driving unit 22. *Id.* ¶ 27. The cool liquid then flows to cap 3 through first liquid outlet 24 for heat dissipating heat-dissipating plates 12 in cap 3. *Id.* The cool liquid is then heat exchanged with heat-dissipating plates 12 into hot liquid. *Id.* The hot liquid then flows to liquid entrance region 51 of water tank 20 through second liquid outlet 31 of cooling plate module 10 and another duct 6.

b. Shin

Shin is titled “Cooling device for electronic equipment.” Ex. 1006, at [54]. Shin discloses “a cooling structure for liquid cooling of heat generating electronic circuit components such as LSI chips installed on a wiring board, relating in particular to a cooling structure for compactly mounting a liquid cooled heat sink and pump.” *Id.* ¶ 1. Shin teaches that “[u]sing a DC motor allows the motor speed to be easily changed by changing the DC voltage, thus enabling control of cooling power. Moreover, making the motor into a DC brushless motor makes it possible to implement a pump of low noise and long service life.” *Id.* ¶ 19. Shin also teaches the following:

Besides the heat generating element 1, heat generating elements 22a, 22b, 22c, such as memory LSI and driver LSI chips, which can be cooled by air cooling, as well as an IO card, memory card, hard disk or other card mounting board 23 are also installed on the wiring board 2. The wiring board 2 is housed inside case 24, which is an electronic equipment case. An air cooling fan 34 is installed in the case 24, and the aforementioned multiple air cooled components are air-cooled by cooling air 25.

Id. ¶¶ 23, 24.

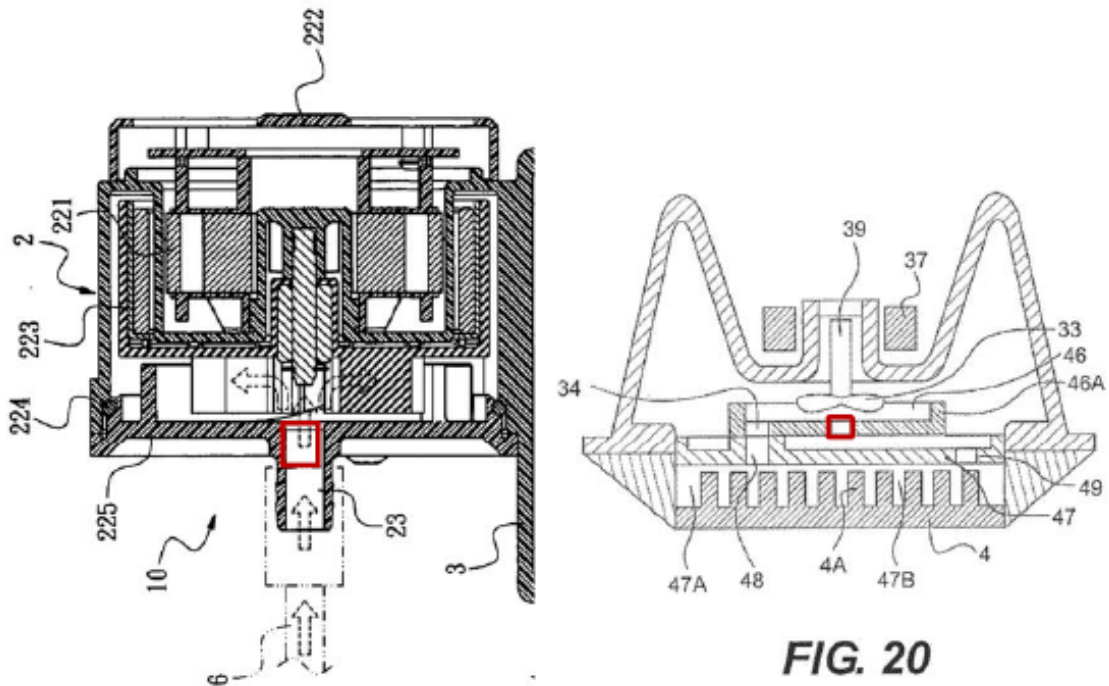
c. Cheon

Cheon is titled “Cooling System for Computer.” Ex. 1007, at [54]. Cheon discloses a cooling system for a computer having a heat transfer device contacting a computer component and communicating with a liquid coolant reservoir via first and second conduits, a radiator mounted on the outside of the computer housing and in heat exchanging contact with the reservoir, and a pump and brushless motor therefor mounted on the reservoir casing. *Id.* at 1:5–12. Specifically, Cheon discloses such a cooling system that has a control circuit that controls circulation of coolant based on feedback from one or more sensors indicating the temperatures of the components attached to the heat transfer device. *Id.* at 5:66–6:16.

d. Analysis

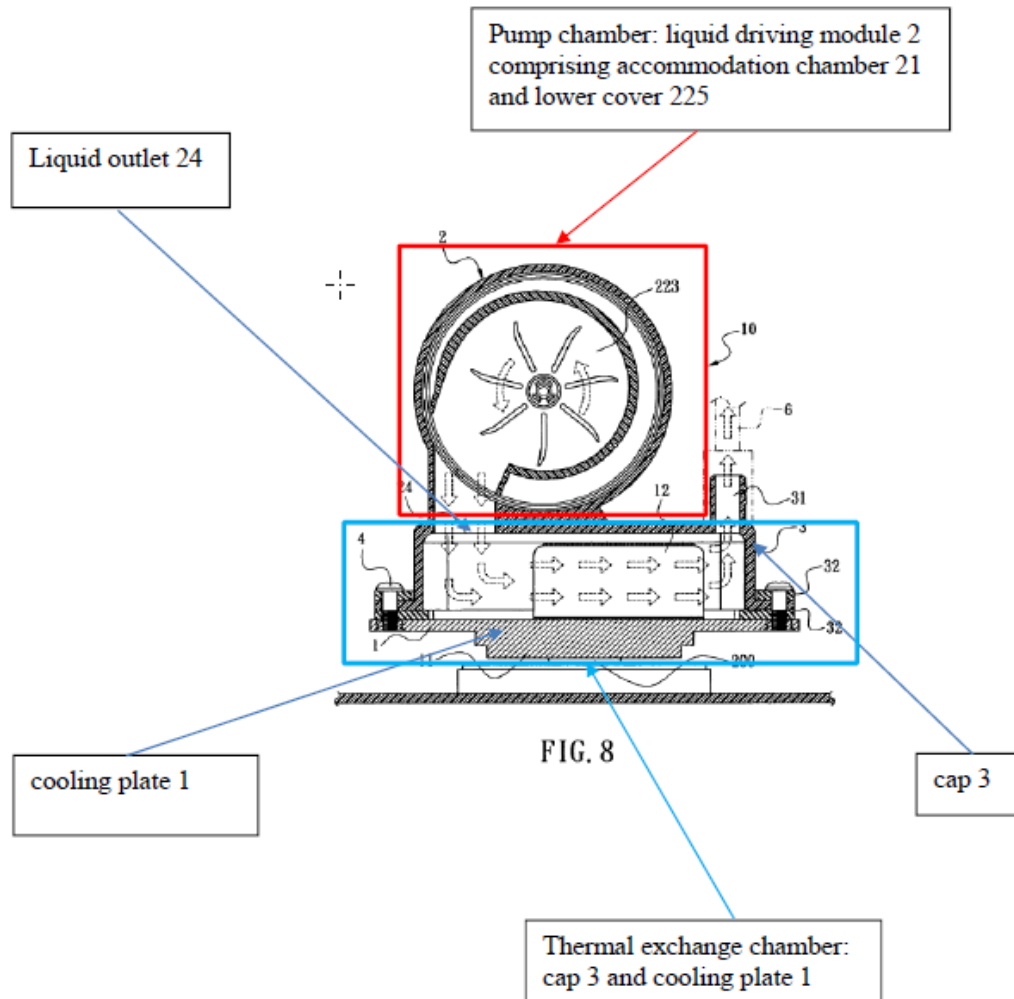
Patent Owner argues that Petitioner fails to prove the unpatentability of claim 1 because Duan fails to disclose both an “inlet” and a “thermal exchange chamber” that are positioned below the “pump chamber.” PO Resp. 1. We agree.

In the Petition, Petitioner argues that Duan accounts for the limitation “an inlet positioned below the center of the impeller configured to enable the cooling liquid to flow into the center of the pump chamber.” *See* Pet. 51–53. Petitioner submits that “Duan discloses an inlet (e.g., an opening below the impeller that receives liquid from liquid inlet 23) positioned below the center of the impeller (e.g., impeller stage 223) configured to enable the cooling liquid to flow into the center of the pump chamber (e.g., accommodation chamber 21 and lower cover 225).” *Id.* at 51. Petitioner provides a side-by-side annotated comparison of Figure 7 of Duan and Figure 20 of the ’681 patent, which is reproduced below.



Petitioner's illustration is an annotated side-by-side comparison of Figure 7 of Duan and Figure 20 of the '681 patent with a red box identifying the portion of each device, which Petitioner identifies as the "inlet below the center of the impeller." Pet. 52.

With respect to the limitation of claim 1 of "a thermal exchange chamber formed below the pump chamber and vertically spaced apart from the pump chamber, the pump chamber and the thermal exchange chamber being separate enclosed chambers that are fluidly coupled," Petitioner relies exclusively on Duan and offers the following annotated version of Figure 8 of Duan to support its analysis.



Petitioner's illustration shows Figure 8 of Duan, as annotated by Petitioner showing a red box around the upper part of the device, which Petitioner identifies as the "pump chamber" and a blue box around the bottom portion of the device, which Petitioner identifies as the "thermal exchange chamber." Pet. 35. Petitioner submits that the thermal exchange chamber is shown in the blue box of this annotated version of Figure 8 and the pump chamber is shown in the red box. *Id.* Petitioner further submits that the chamber is vertically spaced apart as required by the claim. *Id.* at 35–36.

As explained above in the claim construction section, claim 1 requires a single frame of reference throughout the claim. *See supra* II.A.1. Given this requirement, we determine that Petitioner has failed to establish by a preponderance of the evidence that Duan accounts for both “an inlet positioned below the center of the impeller configured to enable the cooling liquid to flow into the center of the pump chamber” and “a thermal exchange chamber formed below the pump chamber and vertically spaced apart from the pump chamber, the pump chamber and the thermal exchange chamber being separate enclosed chambers that are fluidly coupled.” Patent Owner’s expert and Petitioner’s expert both agree that when a consistent frame of reference is applied, Duan cannot teach both of these limitations. *See* Ex. 2018 ¶ 40; *see also* Ex. 2016, 40:3–44:2, 47:6–49:14 (Petitioner’s expert agreeing 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). Accordingly, we agree with the expert’s testimony and determine that Duan does not account for the limitations of claim 1, as properly construed.

e. Conclusion

Based on our review of Petitioner’s argument and evidence of record, and for all the reasons expressed above, we conclude that Petitioner has *not* established by a preponderance of evidence that claim 1 is unpatentable as obvious over Duan, Shin, and Cheon.

2. *Dependent Claim 4*

Claim 4 depends from claim 1. Petitioner provides no additional evidence or argument as to why claim 4 should be treated differently than

claim 1 regarding the directional limitations in claim 1. Because we have determined that Petitioner has failed to show by a preponderance of the evidence that claim 1 is unpatentable as obvious over Duan, Shin, and Cheon, we also determine that Petitioner has failed to show by a preponderance of the evidence that claim 4 is unpatentable over Duan, Shin, and Cheon.

3. Summary

For all the reasons expressed above, we conclude that Petitioner has failed to establish by a preponderance of evidence that the combination of Duan, Shin, and Cheon renders claims 1 and 4 unpatentable as obvious under § 103(a).

III. CONCLUSION

In summary,

Claim(s)	35 U.S.C. §	Reference(s)	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1, 4	103	Duan, Shin, Cheon		1, 4
Overall Outcome				1, 4

IV. ORDER

For the reasons given, it is:

ORDERED that Petitioner *has not shown* based on a preponderance of evidence that claims 1 and 4 of U.S. Patent No. 9,399,531 B2 are unpatentable; and

FURTHER ORDERED because this is a final written decision, the parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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