

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COOLER MASTER CO., LTD.,
Petitioner,

v.

ASETEK DANMARK A/S,
Patent Owner.

IPR2024-01497
Patent 9,733,681 B2

Before WILLIAM V. SAINDON, KEVIN W. CHERRY, and
JASON W. MELVIN, *Administrative Patent Judges*.

CHERRY, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Cooler Master Co., Ltd. (“Petitioner”) filed a petition to institute *inter partes* review of claims 1–7 of U.S. Patent No. 9,911,681 B2 (Ex. 1001, “the ’681 patent”). Paper 1 (“Pet.”). Asetek Danmark A/S (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”).

We have authority under 35 U.S.C. § 314 to determine whether to institute an *inter partes* review. The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” The Supreme Court has held that the Board, in a decision to institute under 35 U.S.C. § 314(b), may not institute review on less than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1355–56 (2018). Moreover, in accordance with our rules, “[w]hen instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.” 37 C.F.R. § 42.108(a) (2020); *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”).

Applying those standards, and upon considering the Petition, the Preliminary Response, and the evidence of record, we determine the information presented fails to show a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the challenged claims of the ’681 patent. Accordingly, we decline to institute an *inter partes* review.

II. BACKGROUND

A. Related Matters

The parties identify the following terminated district-court proceedings between the parties concerning the '681 patent: *Cooler Master Co., Ltd. v. Asetek Danmark A/S*, 4-21-cv-04627 (N.D. Cal.); *Asetek Danmark A/S v. CoolIT Systems, Inc.*, Case No. 3:19-cv-00410-EMC (N.D. Cal.). Pet. 4; Paper 3, 1 (Patent Owner's Mandatory Notices). Patent Owner further identifies an additional terminated district-court proceeding concerning the '681 patent: *Shenzhen Apaltek Co., Ltd. v. Asetek Danmark A/S*, Case No. 3:23-cv-01079-WHO (N.D. Cal.). Paper 3, 1. The parties also identify a terminated *inter partes* review, and terminated subsequent appeal from that case, directed to the '681 patent: *CoolIT Systems, Inc. v. Asetek Danmark A/S*, Case No. IPR2020-00524 (PTAB); *CoolIT Systems, Inc. v. Asetek Danmark A/S*, Case No. 2022-1086 (Fed. Cir.). Pet. 4; Paper 3, 1.

Petitioner also initially states:

The '681 patent is a continuation of Application No. 11/919,947 ("the '974 application"). *All claims* of a closely related patent, the '764 patent (Ex-1003), which is a continuation of the same '974 application, were invalidated *in their entirety* in IPR2023-00668 (filed by Petitioner), which is a joinder to IPR2022-01317.

Pet. 3 (citing Ex. 1004, 18).

B. Real Parties in Interest

Petitioner identifies its real party in interest as Cooler Master Co., Ltd. Pet. 4.

Patent Owner identifies Asetek Danmark A/S, Asetek USA, Inc., Asetek A/S, and Asetek Holdings, Inc. as its real parties in interest. Paper 3, 1.

A. The '681 Patent

The '681 patent is titled “Cooling System for a Computer System.” Ex. 1001, code (54). The '681 patent issued from Application Serial No. 13/861,593, filed April 12, 2013. *Id.* at code (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 code (63).

The '681 patent relates to a liquid-cooling system for a computer system. *Id.* at code (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.

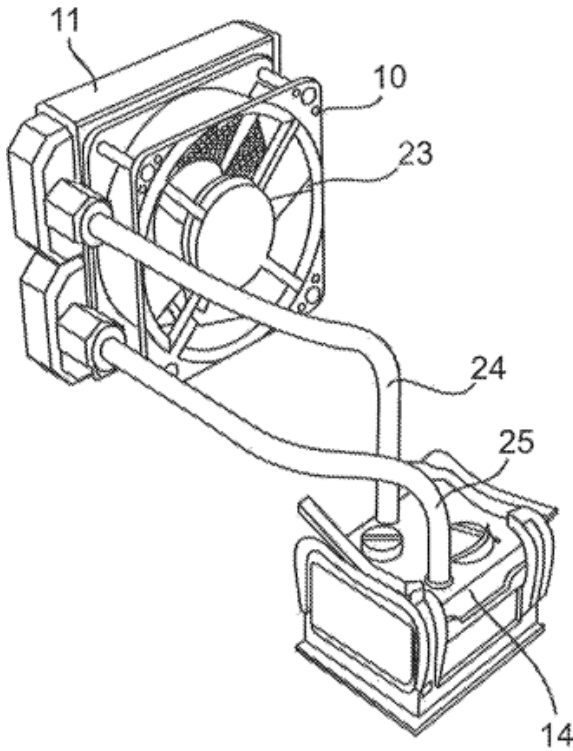


FIG. 7

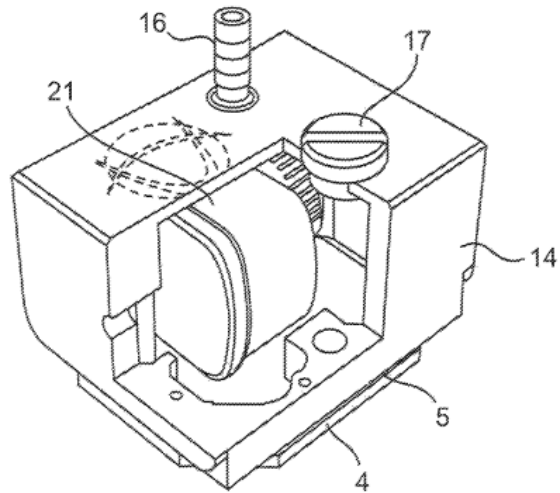


FIG. 8

Figure 7¹ 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

¹ We agree with Petitioner that it appears that the Specification transposes the description of Figure 7 with that of Figure 8. Pet. 8 n.5. 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.

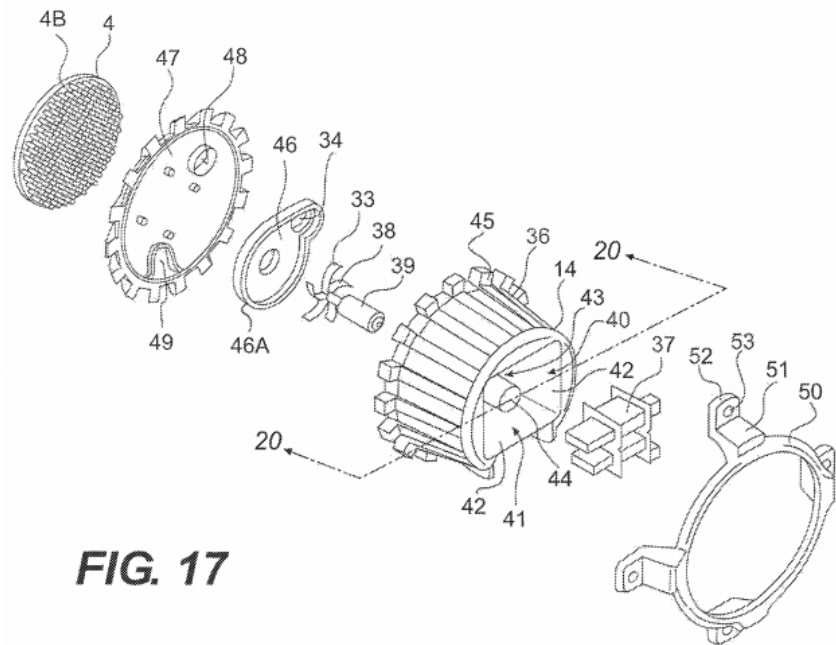


FIG. 17

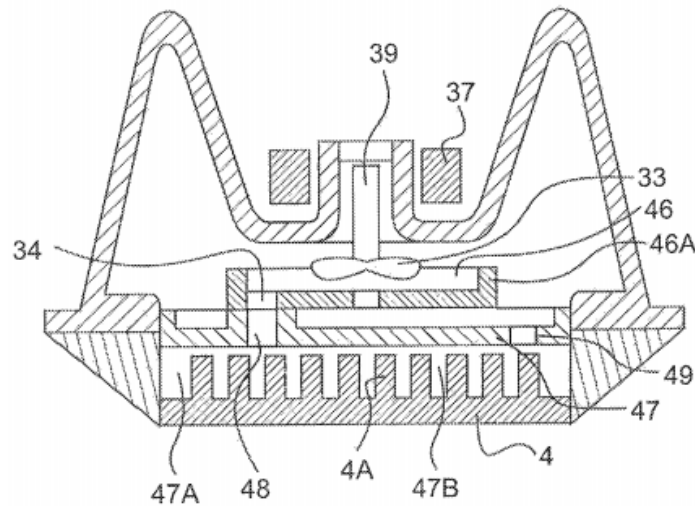


FIG. 20

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 impeller 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 22:1–22:12.

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.

C. The Challenged Claims

Petitioner challenges claims 1–7 of the ’681 patent. Pet. 1. Of the challenged claims, only claim 1 is independent, and is reproduced below with Petitioner’s identifiers for the claim limitations, as illustrative of the subject matter recited in the challenged claims.

[1Pre] A liquid cooling system for cooling a heat-generating component of a computer, comprising:

- [1a]** 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;
- [1b]** a reservoir adapted to pass the cooling liquid therethrough, the reservoir including:
- [1c]** a pump chamber including the impeller; and
- [1d]** 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;
- [1e]** 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;
- [1f]** 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;
- [1g]** 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
- [1h]** a control system configured to independently control a speed of the pump and a speed of the fan;
- [1i]** wherein the pump chamber includes:
 - [1i-i]** an inlet positioned below the center of the impeller configured to enable the cooling liquid to flow into the center of the pump chamber;

- [1i-ii] 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;
- [1i-iii] 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;
- [1i-iv] 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.

D. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Declaration of John Abraham, Ph.D.	1005
Duan, US 2006/0185830 A1 (published Aug. 24, 2006, filed Feb. 18, 2005) (“Duan”)	1007
Duan, US 2006/0185829 A1 (published Aug. 24, 2006, filed Feb. 18, 2005) (“Duan-I”)	1008
Shin, JP P2002–151638A (published May 24, 2002, filed Nov. 8, 2000) (“Shin”)	1009
Nakano, US 6,915,653 B2 (issued July 12, 2005, filed Apr. 8, 2004) (“Nakano”)	1010

E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–7	103(a) ²	Duan, Duan-I, Shin, Nakano

Pet. 7.

III. PATENTABILITY ANALYSIS

Petitioner contends that claims 1–7 of the ’681 patent are unpatentable under 35 U.S.C. § 103(a) over Duan, Duan-I, Shin, and Nakano. Pet. 7.

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103. The ’681 patent claims benefit of a May 6, 2005, filing date, which is before the effective date of the applicable AIA amendments. Ex. 1001, Code [63].

³ Patent Owner does not present arguments or evidence of secondary considerations in its Preliminary Response. Therefore, secondary considerations do not constitute part of our analysis herein.

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 of persuasion never shifts to Patent Owner. See *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

We organize our patentability analysis into four sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. Third, we provide an overview of the asserted references. And fourth, taking account of the information presented, we consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

A. Level of Ordinary Skill in the Art

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art. In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). “[O]ne or more factors may predominate.” *Id.*

Relying on the declaration testimony of Dr. Abraham, Petitioner contends that an ordinarily skilled artisan for the ’681 patent “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. 17. Petitioner additionally contends a “person with less education but more relevant practical experience, depending on the nature of that experience and degree of exposure to liquid cooling systems for computer systems, could also qualify as a POSITA in the field of the ’681 patent.” *Id.* (citing Ex. 1005 ¶ 42).

Patent Owner does not address the level of skill of the ordinary artisan. *See generally* Prelim. Resp.

Based on this record, we adopt Petitioner’s articulation of the level of ordinary skill in the art, which is consistent with the ’681 patent and the asserted prior art, and we apply it in our obviousness evaluations below. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art, itself, can reflect appropriate level of ordinary skill in art).

B. Claim Construction

Next, we turn to claim construction. In interpreting the claims of the ’681 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” *See* 37 C.F.R. § 42.100(b) (2020). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner “does not believe any specific terms require construction and applies the plain meaning of all claim terms herein.” Pet. 18. Patent Owner does not address claim construction. *See generally* Prelim. Resp.

Having considered the record, we determine that no express claim construction is necessary for any claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (holding that only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. The Prior Art

Before turning to Petitioner’s asserted grounds of unpatentability, we provide brief summaries of the asserted references.

1. Duan (Ex. 1007)

Duan is titled “Cooling Plate Module.” Ex. 1007, code (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.

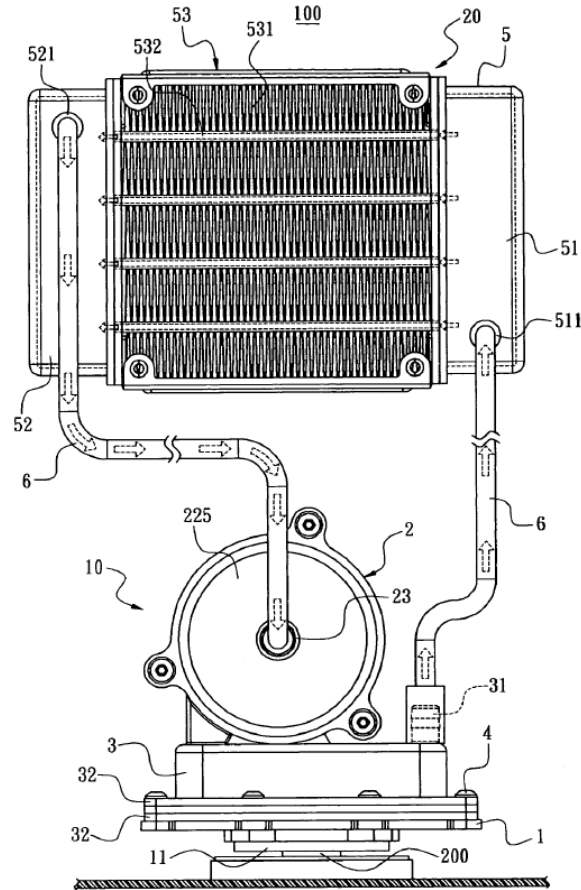


FIG. 6

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.

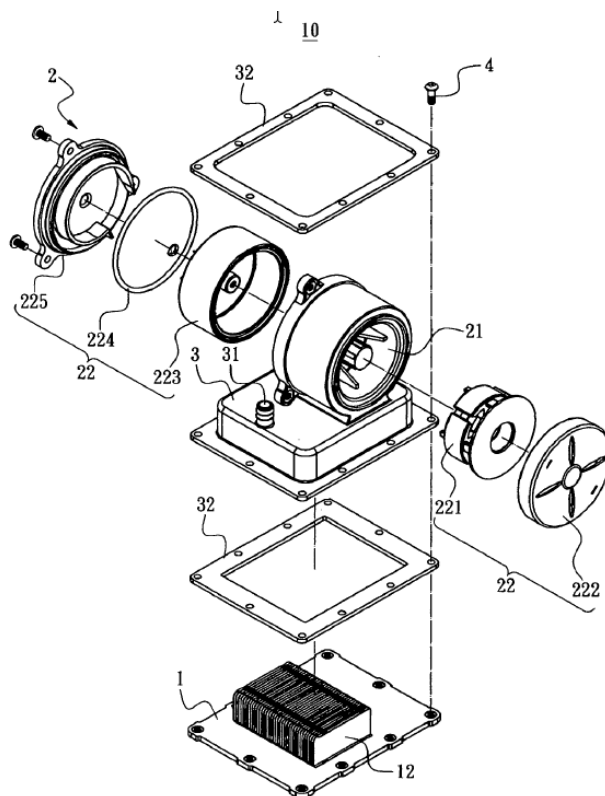


FIG. 2

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.

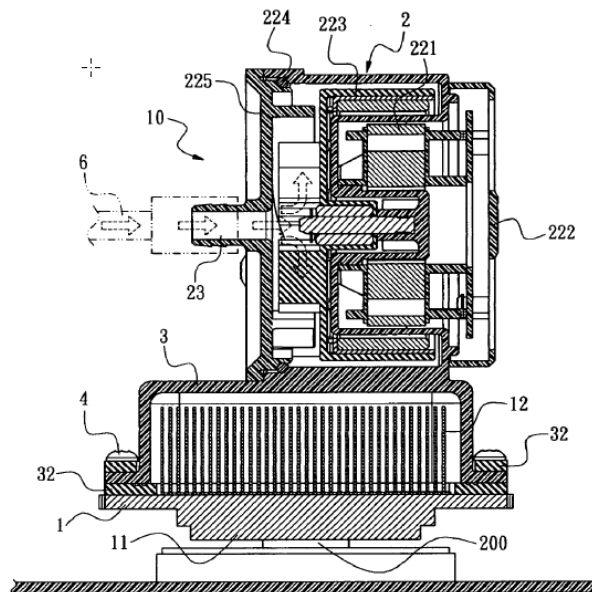


FIG. 7

Figure 7, reproduced above, is a sectional view of the cooling plate module of Duan. According to Duan, in cooling plate module 10, the cool liquid in water tank 20 flows to accommodation chamber 21 through duct 6 and liquid inlet 23 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.

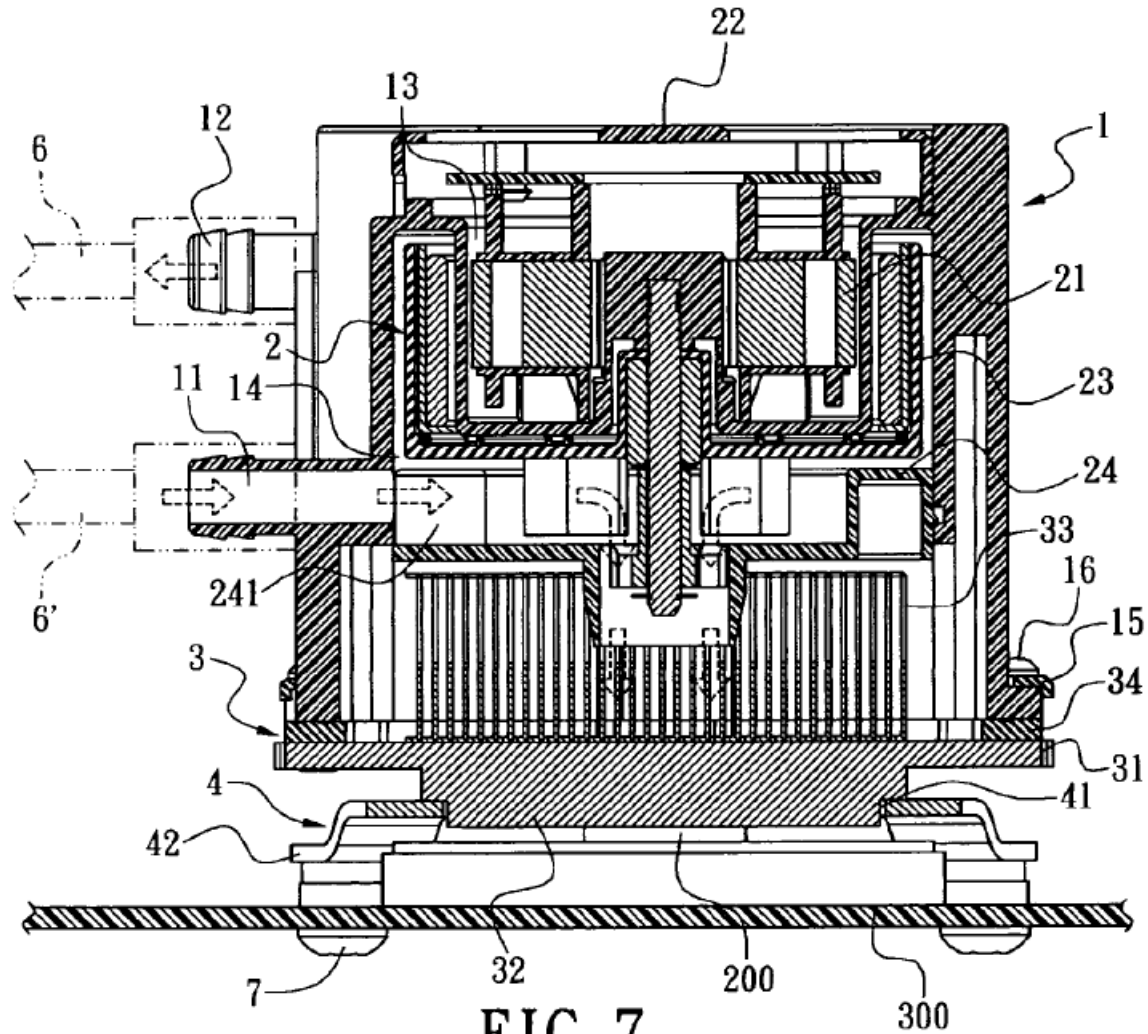
2. *Duan-I (Ex. 1008)*

Duan-I is entitled “Liquid-Cooling Heat Dissipation Apparatus.” Ex. 1008, code (54). Duan-I relates “to a liquid cooling heat dissipation apparatus used for heat emitting device such as a CPU.” *Id.* ¶ 2. Duan-I describes that prior-art cooling systems are “bulky and hard to assemble.” *Id.* ¶ 6.

Duan-I “provides a liquid-cooling heat dissipation apparatus with such mechanical design that the liquid driving unit and the cooling plate module can be advantageously integrated into the casing while the duct is reduced to achieve compact space.” *Id.* ¶ 7. Duan-I discloses

a casing comprising a first compartment, a liquid driving unit placed in the first compartment, a cooling plate module on bottom of the casing, a second compartment defined between an inner space of the casing and the cooling plate module and containing a cooling liquid, at least one liquid inlet and liquid outlet being defined on the casing and communicated through the second compartment.

Id. ¶ 9. Figure 7, reproduced below, depicts a sectional view of the liquid-cooling heat dissipation apparatus of Duan-I.



Duan-I's Figure 7 depicts liquid-cooling heat dissipation apparatus 100 comprising liquid driving unit 2 located on top of cooling plate module 3 with impeller stage 23 having a rotational axis normal to the surface of CPU 200 being cooled. Ex. 1008 ¶¶ 20–22, 28

3. *Shin* (Ex. 1009)

Shin is titled “Cooling device for electronic equipment.” Ex. 1009, code (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:

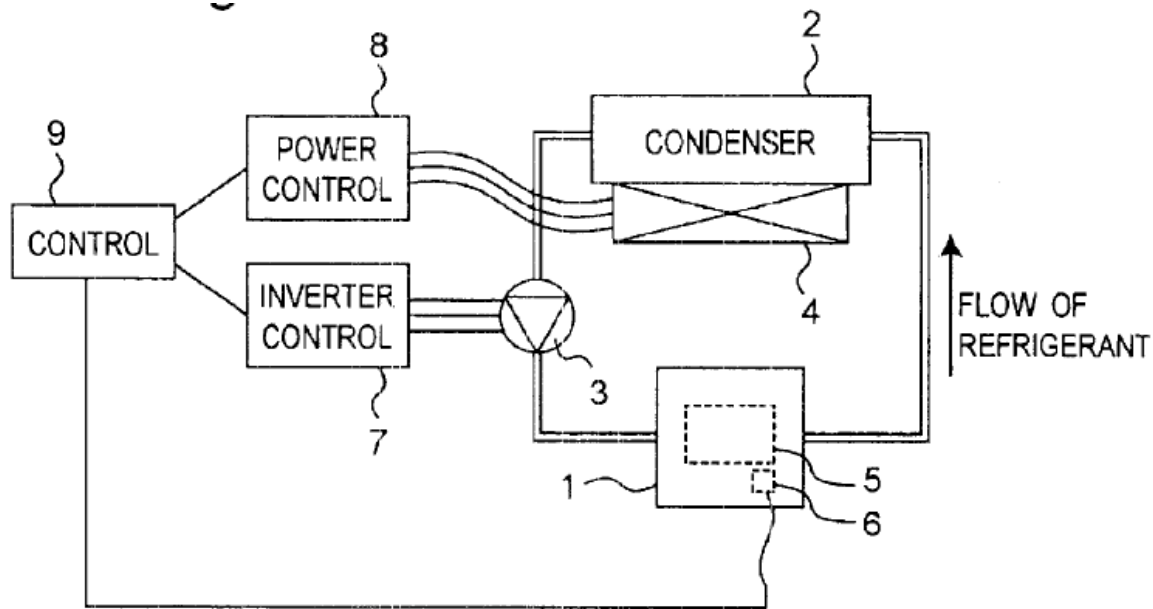
Besides the heat generating element 1, heat generating elements 22a, 22b, 22c, such as memory LSI and driver LSI chips, which can be cooled by air cooling, as well as an IO card, memory card, hard disk or other card mounting board 23 are also installed on the wiring board 2. The wiring board 2 is housed 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.

4. *Nakano (Ex. 1010)*

Nakano is entitled “Semiconductor Cooling Device.” Ex. 1010, code (54). Nakano relates “to a compact, easy-to-handle and efficient cooling device for cooling such a semiconductor element by utilization of a change in phase between a liquid phase and a vapor phase of a refrigerant.” *Id.* at 1:6–12. Nakano seeks “to provide a highly reliable semiconductor cooling device that is low in noise level and can conduct an appropriate control by changing the amount of circulation of refrigerant depending on the amount of heat generated by a semiconductor element.” *Id.* at 1:35–40.

A refrigerating cycle of a semiconductor cooling device of Nakano is depicted in Figure 2 of Nakano, reproduced below.



Nakano discloses the cooling device shown in Figure 2 “includes a cold plate 1 for cooling a highly exothermic semiconductor element 5 that tends to emit a substantial amount of heat when in operation, a condenser 2, and an inverter-controlled refrigerant pump 3, all connected in series with each other to define a refrigerating cycle.” *Id.* at 2:37–42. In Figure 2, “condenser 2 is adapted to be cooled by a fan 4.” *Id.* at 2:43–44. Nakano further discloses “cold plate 1 is provided with a temperature sensor 6 mounted thereon in proximity to the semiconductor element 5, and the temperature sensor 6 is electrically connected to a controller 9.” *Id.* at 2:56–59. According to Nakano, “controller 9 appropriately controls the number of revolutions of the refrigerant pump 3 and that of the fan 4 based on a value measured by the temperature sensor 6.” *Id.* at 2:65–67.

According to Nakano:

When the value measured by the temperature sensor 6 increases more than a predetermined value within a predetermined period of time, the controller 9 first maximizes the number of revolutions of the fan 4 and then increases the number of revolutions of the refrigerant pump 3 step by step while

comparing the measured value by the temperature sensor 6 with a value set in the controller 9.

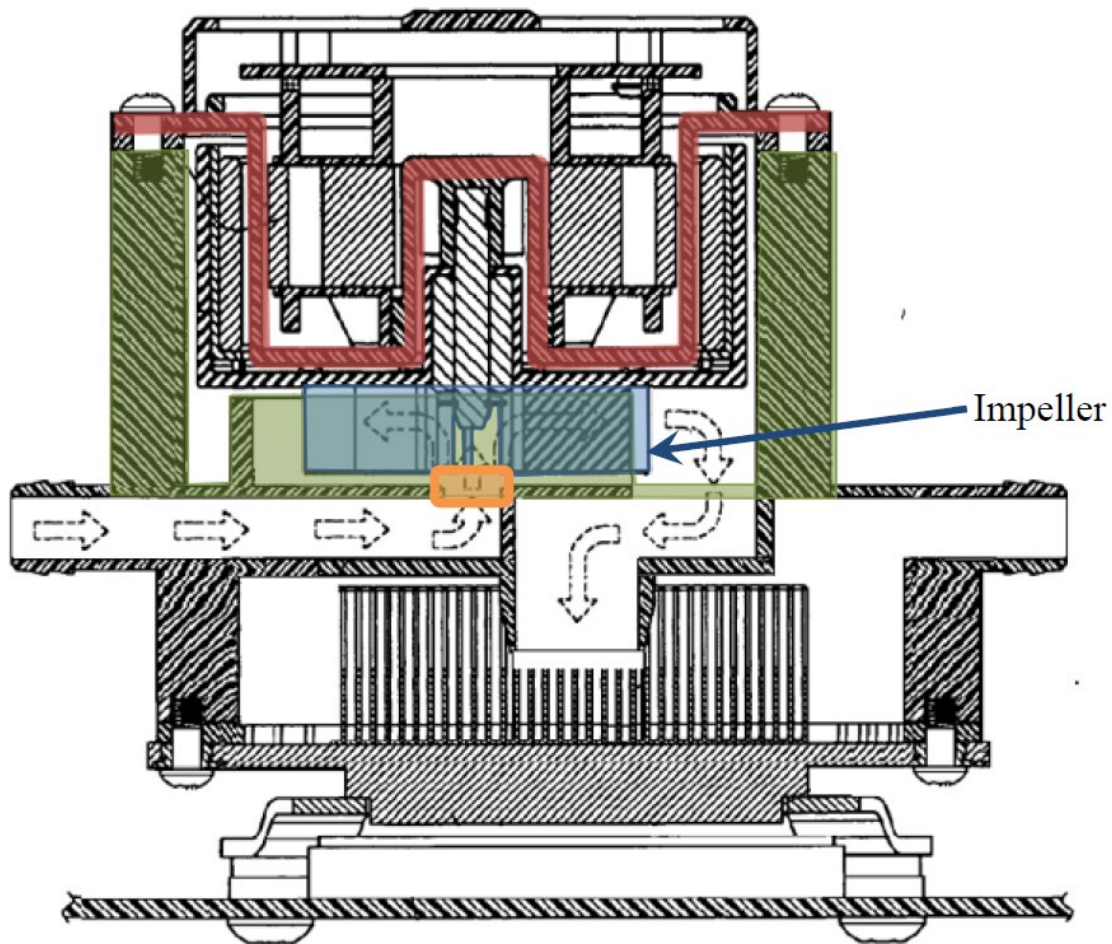
Id. at 3:7–13.

D. Alleged Ground of Unpatentability Over Duan, Duan-I, Shin, and Nakano

Petitioner contends that claims 1–7 of the ’681 patent are unpatentable under 35 U.S.C. § 103(a) as obvious over Duan, Duan-I, Shin, and Nakano. Pet. 21–101. Patent Owner offers counterarguments. Prelim. Resp. 16–19. Having considered the arguments and evidence before us, we determine that Petitioner has failed to show a reasonable likelihood that it would prevail on this asserted ground of unpatentability. We focus our analysis on claim limitations [1i-i] and [1i-ii].

Limitations [1i-i] and [1i-ii] require that the “pump chamber” include “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 “an outlet that fluidly couples the pump chamber to the thermal exchange 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.” Ex. 1001, 28:51–59.

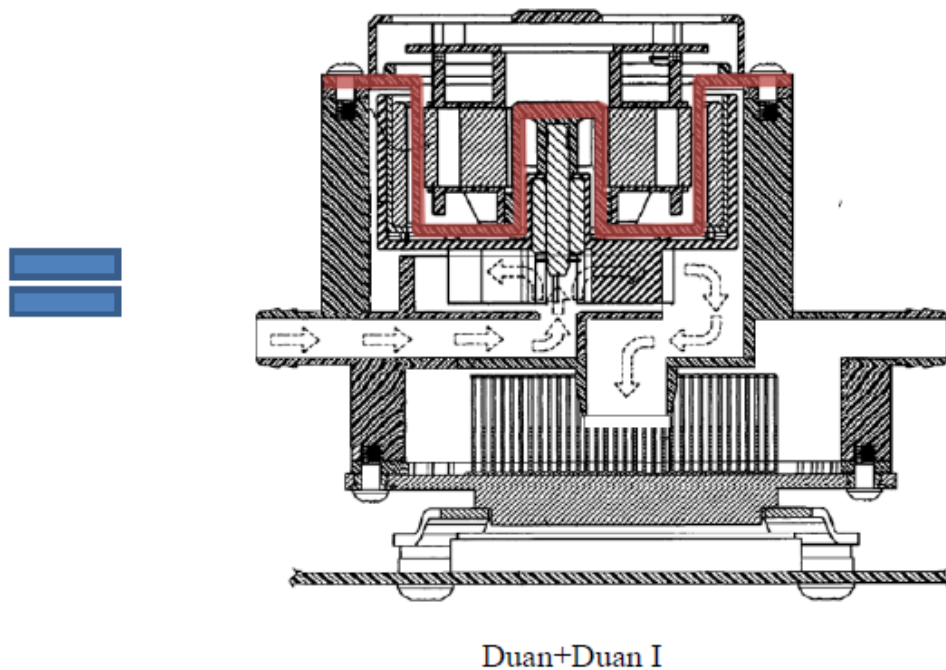
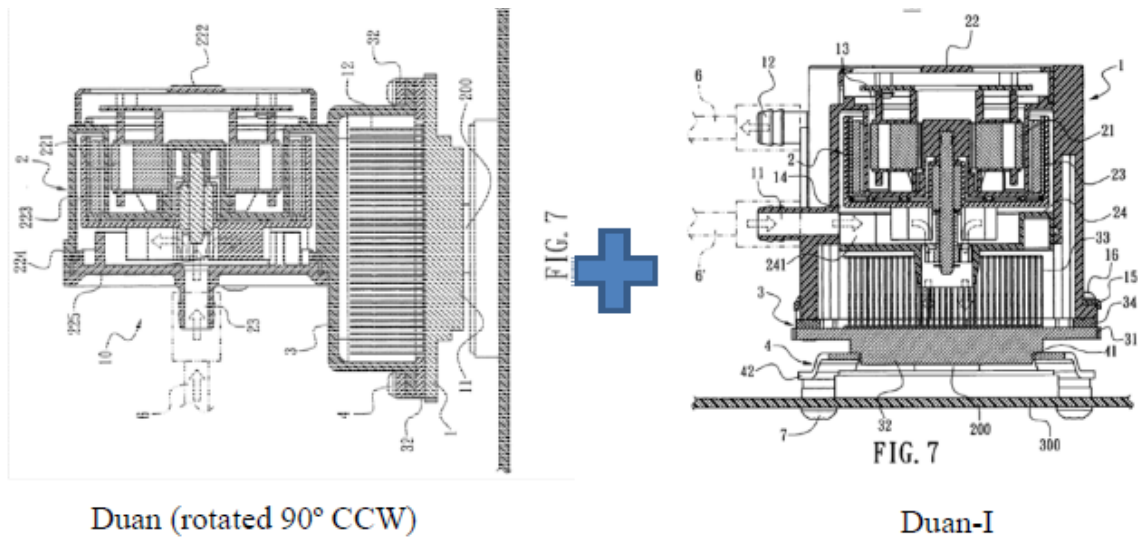
Petitioner argues that the combination of Duan and Duan-I accounts for limitation [1i-i]. Pet. 73. In particular, Petitioner provides an annotated figure, reproduced below, showing what Petitioner purports would be the combined device of Duan and Duan-I, with the “inlet positioned below the center of the impeller” shown in orange.



Pet. 73. An annotated figure provided by Petitioner, based on the figures of Duan and Duan-I and purporting to show the device resulting from the combination with the claimed “inlet” highlighted in orange.

To explain why a person of ordinary skill in the art would have been motivated to combine Duan and Duan-I in this manner, Petitioner argues that “given the known ‘compact trend of computer[s]’ recognized by Duan [], a POSITA would have been motivated to rotate Duan’s liquid driving module 2 (pump) counterclockwise by 90 degrees in Figure 7 to reduce the systems overall height in view of Duan-I.” Pet. 26 (citing Ex. 1007 ¶ 6; Ex. 1005 ¶ 57). Petitioner asserts that “[a]lthough modifying Duan in this fashion would require some minor reconstruction, doing so would

reasonably be expected to result in success.” *Id.* Petitioner contends that “[t]he modification is well within a POSITA’s technical grasp, and would have predictably resulted in a modified system like the one [reproduced] below (double-sided chassis outlined in red).” *Id.* at 26–27. Petitioner provides the following graphical explanation, reproduced below, of how it arrives at this modified figure.



Pet. 27 (citing Ex. 1005 ¶ 58). An annotated figure provided by Petitioner showing Figure 7 of Duan, rotated 90 degrees counter clockwise, and Figure 7 of Duan-I, along with a proposed configuration of the device resulting from combining the teachings of these two figures.

With respect to limitation [1i-ii], Petitioner argues that both Duan alone and Duan combined with Duan-I accounts for this limitation.

Petitioner contends that Duan that

As shown its FIG. 8 (reproduced and annotated below), Duan discloses an outlet (e.g., part of the first liquid outlet 24 (colored in dark red below)) that fluidly couples the pump chamber (e.g., accommodation chamber 21 and lower cover 225) to the thermal exchange chamber (e.g., cap 3 and cooling plate 1) via a first passage (part of the first liquid outlet 24, colored in dark blue below), the outlet (part of the first liquid outlet 24, colored in dark red) is positioned along an outer circumference of the pump chamber (e.g., accommodation chamber 21, of which the outer circumference is colored in green), and lower cover 225) and is configured to direct the cooling liquid driven by the impeller (e.g., the impeller stage 223) through the first passage (colored in dark blue) to the thermal exchange chamber (e.g., cap 3 and cooling plate 1).

Pet. 74. The annotated version of Figure 8 of Duan referred to above is reproduced below.

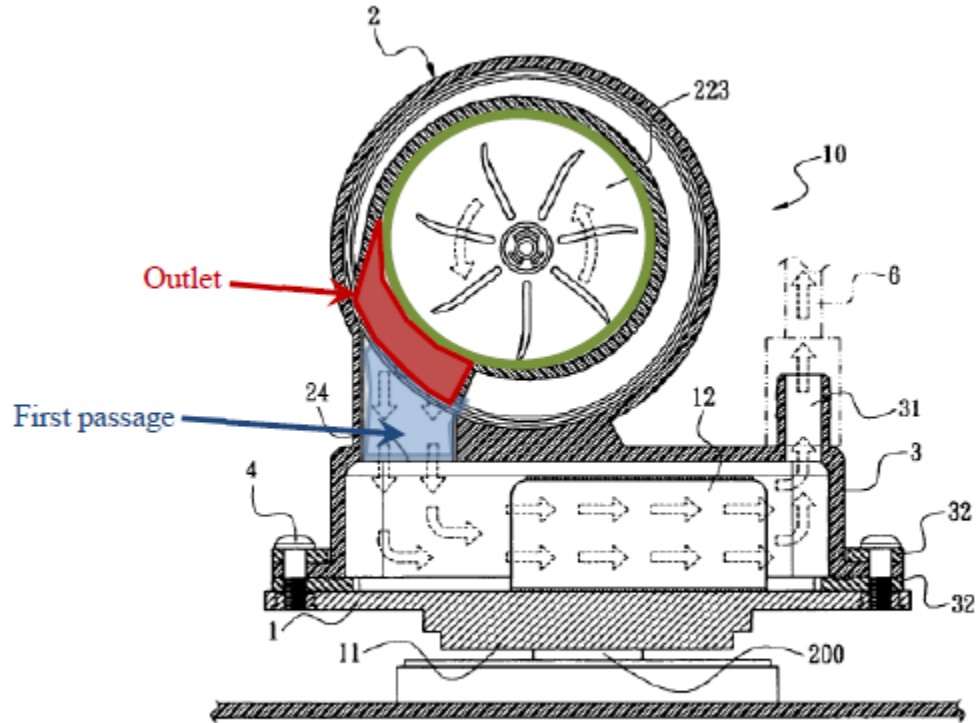
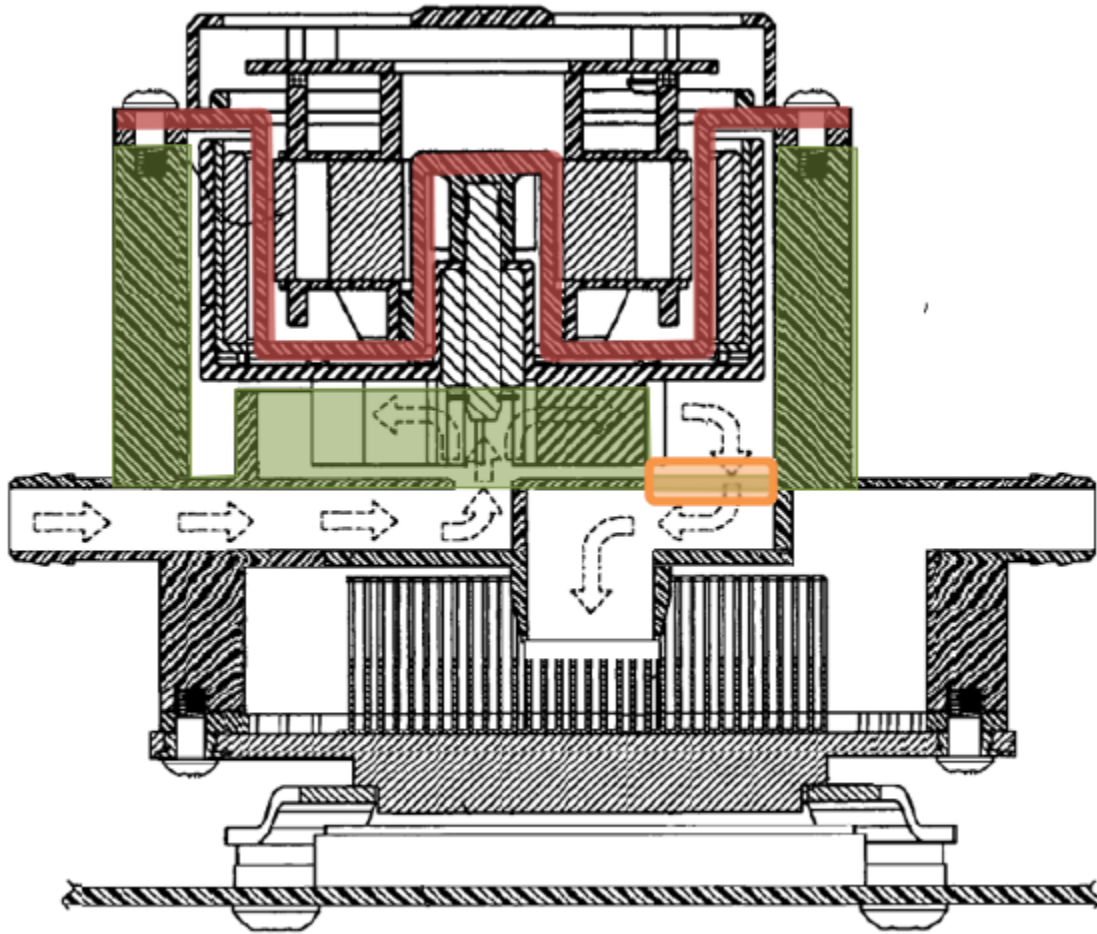


FIG. 8

Pet. 75. An annotated version of Figure 8 is reproduced above purporting to show the claimed “outlet” (in red) and “first passage” (in blue) of limitation [1i-ii].

Petitioner also argues that Duan in combination with Duan-I accounts for limitation [1i-ii]. Pet. 76. Petitioner provides an annotated version of its combination of the figures from Duan and Duan-I explained above with regard to limitation [1i-i], which we reproduce below.

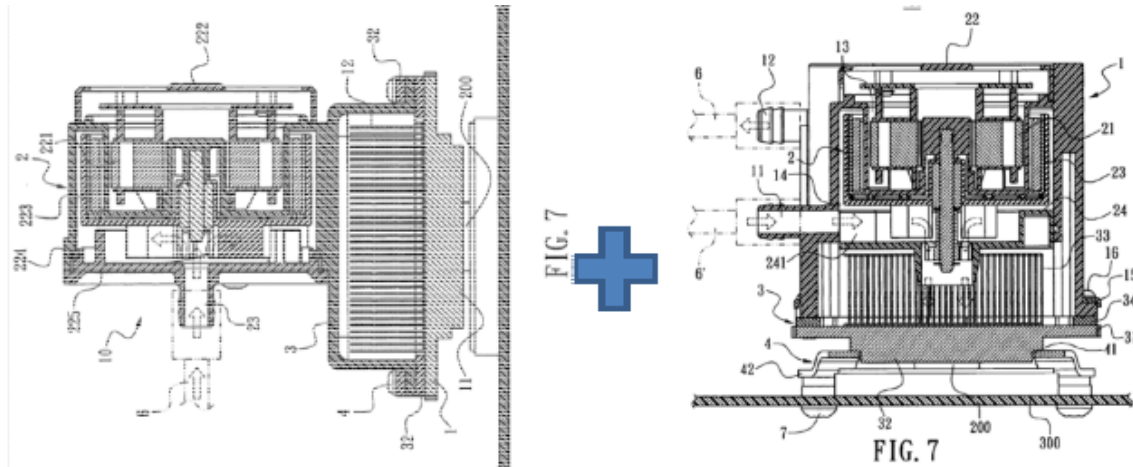


An annotated version of Petitioner’s combination of Figure 7 from Duan with Figure 7 from Duan-I. Pet. 76. Petitioner argues that, as shown in the annotated figure above, “in Duan+Duan-I, an outlet (orange) fluidly couples the pump chamber to the thermal exchange chamber via a first passage, and the 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.” Thus, Petitioner concludes that the combination of Duan and Duan-I teaches limitation [1i-ii].

We consider these limitations together because they illustrate several problems with the Petition’s analysis. To begin with, Petitioner proposes

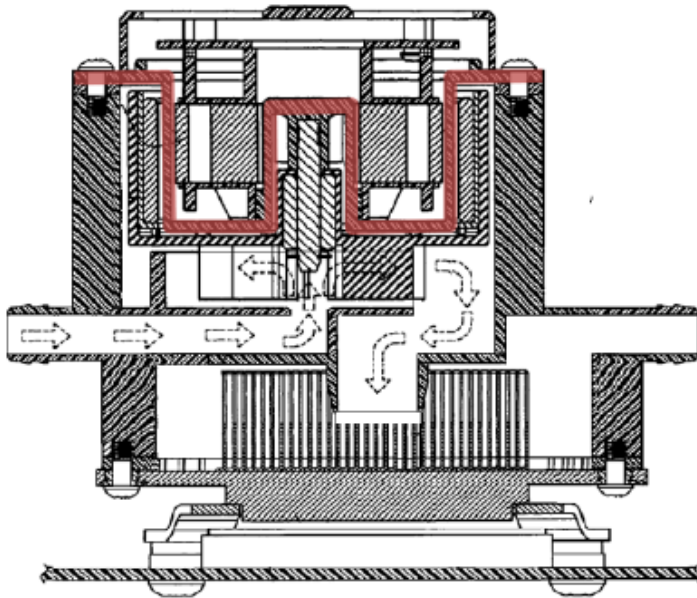
combining Duan and Duan-I, along with some significant modifications to the location of inlets and outlets to account for the claimed “inlet positioned below the center of the impeller” of limitation [1i-i], but then relies on the unmodified version of Figure 8 of Duan to account, in the alternative, for the claimed “first passage” of limitation [1i-ii]. *Compare* Pet. 73 *with id.* at 75. However, it appears that the structure in Duan identified by Petitioner as the “first passage” of limitation [1i-ii] is either eliminated or, at a minimum modified, in the proposed combination to account for limitation [1i-i]. Given the changes to Duan required to account for limitation [1i-i], we disagree with Petitioner that it can rely on the unmodified version of Duan to account for limitation [1i-ii]. Thus, we focus our attention on the proposed combination of Duan and Duan-I to account for both of these limitations.

As we explained above, Petitioner contends that the combination of Duan and Duan-I “would have predictably resulted in a modified system” for which it provides the following exemplary drawing, which we reproduce again for convenience.



Duan (rotated 90° CCW)

Duan-I



Duan+Duan I

Pet. 27 (citing Ex. 1005 ¶ 58). An annotated figure provided by Petitioner showing Figure 7 of Duan, rotated 90 degrees counter clockwise, and Figure 7 of Duan-I, along with a proposed configuration of the device resulting from combining the teachings of these two figures.

We agree with Patent Owner that, in this combined figure, “Petitioner inserts and rearranges passages not disclosed by either reference without

proper rationale or explanation.” Prelim. Resp. 17. Petitioner’s only acknowledgement of the rearranging and modifications it performs on the combined figure is that “modifying Duan in this fashion would require some minor reconstruction.” Pet. 26. However, “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). As Patent Owner argues, and we agree, “Petitioner has not provided any meaningful justification for modifying Duan and Duan-I to direct cooling liquid into the pump chamber at the center of the impeller through a made-up passage wedged in between Duan’s pump chamber and Duan-I’s thermal exchange chamber, which neither reference teaches.” See Prelim. Resp. 17. Patent Owner also persuasively argues that “Petitioner has also not provided any explanation for allowing cooling liquid to exit the pump chamber at the outer circumference of the pump chamber and to enter the thermal exchange chamber through a fabricated side passage (instead of entering the thermal exchange chamber through an opening at the center of impeller, as taught by Duan-I).” *Id.* We note that these rearrangements are not simply minor changes, but necessary for the combination to account for the particular limitations of the claim. Thus, we agree with Patent Owner Petitioner has failed to show sufficiently that the combination of Duan and Duan-I accounts for limitations [1i-i] and [1i-ii].

Accordingly, we find that Petitioner has failed to show a reasonable likelihood of prevailing in showing that claim 1 would have been obvious over the combination of Duan and Duan-I.

Claims 2–7 all depend from claim 1 and rely on the same reasoning above to account for limitations [1i-i] and [1i-ii]. Thus, we also find that Petitioner also has failed to show a reasonable likelihood of prevailing on claims 2–7.

IV. CONCLUSION

After considering the arguments presented in the Petition, the Preliminary Response, and the evidence of record, we determine that Petitioner has failed to demonstrate at least a reasonable likelihood of success in proving that at least one claim of the '681 patent is unpatentable. Thus, we decline to institute an *inter partes* review of all challenged claims (i.e., claims 1–7).

V. ORDER

In consideration of the foregoing, it is hereby:
ORDERED that the Petition is *denied*.

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Patent 9,733,681 B2

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