

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.

Patent No. 9,733,681 to Eriksen

IPR2024-01497

**PETITION FOR *INTER PARTES* REVIEW OF
CLAIMS 1-7 OF U.S. PATENT 9,733,681**

TABLE OF CONTENTS

TABLE OF EXHIBITS	iv
TABLE OF AUTHORITIES	v
I. Introduction.....	1
II. Initial Statement.....	1
III. Mandatory Notices Under 37 C.F.R. §42.8(A)(1)	4
A. Real Party-in-Interest Under 37 C.F.R. §42.8(b)(1)	4
B. Related Matters Under 37 C.F.R. §42.8(b)(2)	4
C. Lead and Back-up Counsel Under 37 C.F.R. §42.8(b)(3) and Service Information under 37 C.F.R. §42.8(b)(4).....	6
IV. Word Count	6
V. IPR Eligibility (37 C.F.R. §42.104)	7
VI. The '681 Patent.....	7
A. General Overview.....	7
B. Embodiments of the Challenged Claims.....	8
C. Effective Filing Date	12
D. Prosecution History and Prior IPR Outcome	12
1. Prosecution of the '681 patent.....	12
2. Outcome of the Prior IPR.....	14
E. The '764 patent IPR	14
F. Applicant Admitted Prior Art ("AAPA")	15
G. The Challenged Claims	17
VII. Person of Ordinary Skill in the Art ("POSITA")	17
VIII. Claim Construction.....	18
IX. Discretionary Denial is Unwarranted	18
A. 35 U.S.C. §314(a) Does Not Favor Denial	18
B. 35 U.S.C. §325(d) Does Not Favor Denial	18
X. Overview of the Prior Art.....	20

A.	Duan (Ex-1007; US2006/0185830)	20
B.	Duan-I (Ex-1008; US2006/0185829).....	20
C.	Shin (Ex-1009; JP2002-151638).....	21
D.	Nakano (Ex-1010; US6915653).....	21
XI.	GROUND 1: Duan in view of Duan-I, Shin and Nakano	21
A.	Scope, Content, and Rationale for Combining Prior Art	21
B.	Challenged Claims	29
	Claim 1	29
	1. The motivation to combine Nakano with Duan, Duan I and Shin.....	70
	Claim 2	84
	Claim 3	85
	Claim 4	90
	Claim 5	94
	Claim 6	95
	Claim 7	97
XII.	Conclusion	101
	CERTIFICATE OF SERVICE	1

TABLE OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,733,681 (the “’681 patent”)
1002	Final Written Decision in IPR2020-00524 re: the ’681 patent (“’681-IPR-FWD”)
1003	U.S. Patent No. 8,245,764, attached with its Inter Partes Reexamination Certificate (1409 th) (the “’764 patent”)
1004	Final Written Decision in IPR2023-00668 (IPR2022-01317) re: the ’764 patent (“’764-IPR-FWD”)
1005	Declaration of John Abraham, Ph.D. Regarding Invalidity of U.S. Patent No. 9,733,681 (“Abraham Dec.”)
1006	File history of the ’681 patent (“’681-FH”)
1007	U.S. Patent Publication No. 2006/0185830 (“Duan”)
1008	U.S. Patent Publication No. 2006/0185829 (“Duan-I”)
1009	Certified Translation of Japanese Unexamined Patent App. Pub. No. 2002-151638 to Takayuki Shin (“Shin”)
1010	U.S. Patent No. 6,915,653 to Nakano <i>et al.</i> (“Nakano”)
1011	File history of Reexamination Request 95/002,386, U.S. Patent No. 8,245,764 (“’764-Rexam-FH”)
1012	Final Written Decision in IPR2023-00667 (IPR2022-01316) re: U.S. Patent No. 8,240,362 (“’362-IPR-FWD”)
1013	Patent Owner Response in IPR2020-00524 re: the ’681 patent
1014	U.S. Patent No. 8,240,336 (the “’362 patent”)

TABLE OF AUTHORITIES

	Page(s)
Federal Cases	
<i>Advanced Bionics LLC v. Med-EL Elektromedizinische Geräte GMBH</i> , IPR2019-01469, Paper 6 (Feb. 13, 2020)	17
<i>Asetek Danmark A/S v. CoolIT Systems, Inc.</i> , 3-19-cv-00410 (N.D. Cal.).....	3
<i>B&B Hardware, Inc. v. Hargis Indus., Inc.</i> , 135 S.Ct. 1293 (2015), The ’764	14, 29, 45, 48, 50
<i>Becton Dickinson & Co. v. B. Braun Melsungen AG</i> , IPR2017-01586, Paper 8, 6-7 (Dec. 15, 2017)	18
<i>In re Cohen</i> , 767 Fed. Appx. 985 (Fed. Cir. 2019).....	14
<i>Constant v. Advanced Micro-Devices, Inc.</i> , 848 F.2d 1560 (Fed. Cir. 1988)	16
<i>Cooler Master Co., Ltd. v. Asetek Danmark A/S</i> , 4-21-cv-04627 (N.D. Cal.).....	3
<i>CoolIT Systems, Inc. v. Asetek Danmark A/S</i> , Case No. 2022-1086 (Fed. Cir.).....	4
<i>KSR Int’l Co. v. Teleflex, Inc.</i> , 550 U.S. 398 (2007).....	70
<i>PharmaStem Therapeutics, Inc. v. ViaCell, Inc.</i> , 491 F.3d 1342 (Fed. Cir. 2007)	14
<i>Qualcomm Inc. v. Apple Inc.</i> , 24 F.4th 1367 (Fed. Cir. 2022)	15
Federal Statutes	
35 U.S.C. 103(a)	11
35 U.S.C. § 102(a)	20
35 U.S.C. § 102(b)	20
35 U.S.C. § 102(e)	19, 20

35 U.S.C. § 312(a)	3
35 U.S.C. § 312(b)	3
35 U.S.C. § 325(d)	17, 19

Regulations

37 C.F.R. § 42.24(a)(1)(i)	6
----------------------------------	---

Other Authorities

CoolIT Systems, Inc. v. Asetek Danmark A/S, Inter Partes

Review No. IPR2020-00524	4, 7, 13, 16, 17, 18, 29, 38, 40, 93
U.S. Patent No. 6,915,653	20
U.S. Patent No. 7,325,591	19
U.S. Patent No. 8,245,764	2, 4, 13, 14, 19, 29, 45, 48, 50
U.S. Patent No. 9,733,681.. 1, 2, 3, 4, 6, 7, 11, 13, 14, 15, 16, 17, 19, 20, 27, 28, 30, 51, 54, 60, 63, 66, 100	
U.S. Patent No. 10,078,355	4
U.S. Patent No. 10,599,196	4

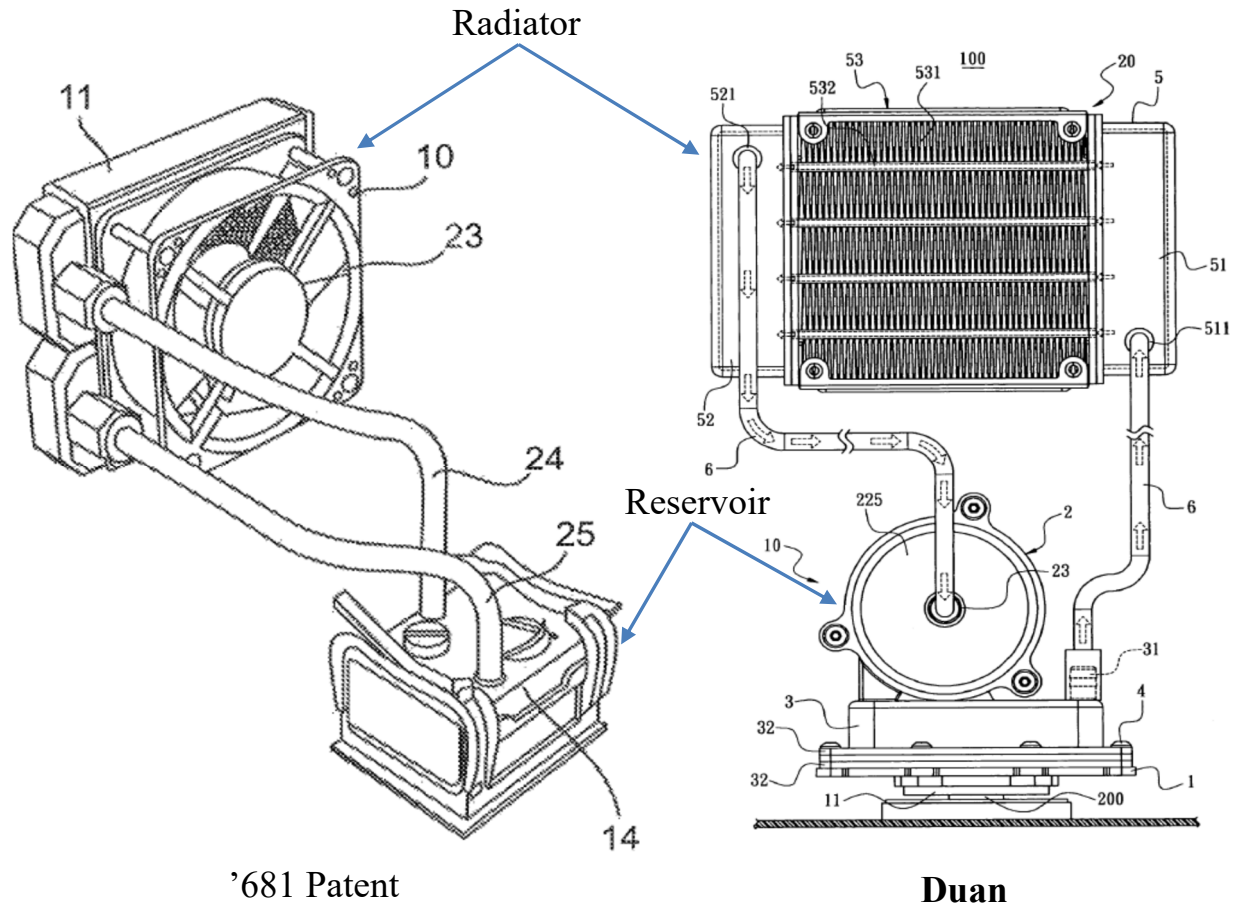
I. Introduction

Cooler Master Co., Ltd. (“Petitioner”) hereby seeks *inter partes* review of claims 1-7 (the “Challenged Claims”) of U.S. Patent No. 9,733,681 (Ex-1001, the “’681 patent”).¹

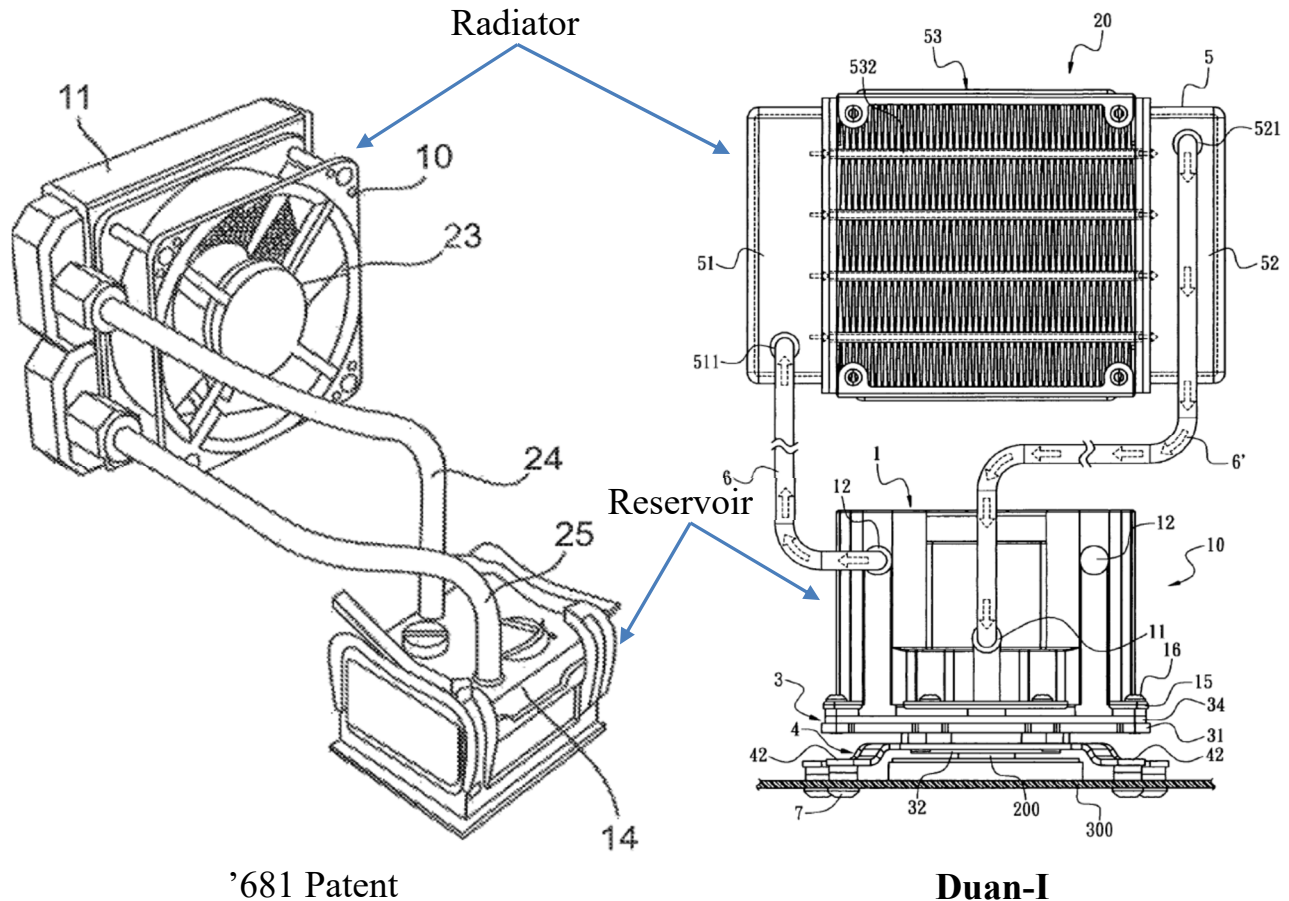
II. Initial Statement

The ’681 patent discloses a liquid cooling system used in computer systems. The use of liquid cooling with what is sometimes referred to as an “all-in-one” cooler (*i.e.*, a modular pumping mechanism) to cool semiconductor chips was known to skilled artisans before the ’681 patent. In particular, the use of a closed-liquid cooling loop connecting an all-in-one cooler and a radiator was generally known before the claimed priority date, as evidenced by the prior art cited herein, including the *two* prior-art references shown and discussed below (’681 patent vs. Duan (Ex-1007) (the first figure below); ’681 patent vs. Duan-I (Ex-1008) (the second figure below)):

¹ Claims 8-16 were disclaimed in a statutory disclaimer filed on November 30, 2020. (Ex-1006 (’681-FH) at 436.)



(Compare Ex-1001 at 8 with Ex-1007 (**Duan**) at 7; Ex-1005, ¶49.)



(Compare Ex-1001 at 8 with Ex-1008 (**Duan-I**) at 7; Ex-1005, ¶49.)

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. (See Ex-1004 ('764-IPR-FWD) at 18.) The claims of the '764 patent shares a number of similarities with the Challenged Claims of the '681 patent herein as shown herein.

III. Mandatory Notices Under 37 C.F.R. §42.8(A)(1)

A. Real Party-in-Interest Under 37 C.F.R. §42.8(b)(1)

Petitioner certifies that the real party-in-interest is Cooler Master Co., Ltd.

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

The '681 patent was the subject of the following terminated litigation:

- *Cooler Master Co., Ltd. v. Asetek Danmark A/S*, 4-21-cv-04627 (N.D. Cal.) (“the Litigation”).

The above Litigation filed by Petitioner was a Declaratory Judgment (D.J.) action asserting non-infringement of the '681 patent, among others. Petitioner did not challenge the validity of any claim of the '681 patent in its D.J. action above. Thus, the provisions of 35 U.S.C. §312(a) do not apply. Petitioner has also not been served with a complaint for patent infringement relative to the '681 patent.² Thus, the time limit of 35 U.S.C. §312(b) has not begun or expired.

The following terminated District Court case is also related to the '681 patent:

- *Asetek Danmark A/S v. CoolIT Systems, Inc.*, 3-19-cv-00410 (N.D. Cal.).

Petitioner is also aware of the following prior AIA trial, and the appeal thereof, involving the '681 patent:

² The Litigation has been dismissed without prejudice.

- *CoolIT Systems, Inc. v. Asetek Danmark A/S, Inter Partes* Review No. IPR2020-00524 (“the Prior IPR”).³
- *CoolIT Systems, Inc. v. Asetek Danmark A/S*, Case No. 2022-1086 (Fed. Cir.)

Petitioner is unaware of any other litigations, AIA trials, or appeals relating to the ’681 patent.

Petitioner notes that the following related family members have been subject to *inter partes* reviews:

- The ’764 patent—all claims (1-30) cancelled in IPR2022-01317 (“the ’764 patent IPR”);⁴
- U.S. Patent No. 10,078,355—claims 1, 2, 5, 6, 8, 10, 11, and 13 cancelled in IPR2020-00522 and claims 1, 2, 5, 6, and 8 cancelled in IPR2023-01318; claims 3, 4, 7, and 9-16 have been statutorily disclaimed; and
- U.S. Patent No. 10,599,196 challenged in IPR2021-01196 (terminated by settlement between the parties after institution).

³ Background on the Prior IPR is provided in Section VI.D.2.

⁴ Background on the ’764 patent IPR is provided in Section VI.E; IPR2023-00668 also relates to the ’764 patent through IPR2023-00668 (filed by Petitioner), which is a joinder to IPR2022-01371.

C. Lead and Back-up Counsel Under 37 C.F.R. §42.8(b)(3) and Service Information under 37 C.F.R. §42.8(b)(4)

Petitioner designates the following lead and backup counsel:

Lead Counsel	Back-up Counsel
Heath J. Briggs (Reg. No. 54,919) Greenberg Traurig, LLP 1144 15th St. Suite 3300 Denver, CO 80202 Telephone: 303-685-7418 Facsimile: 720-904-6118 BriggsH@gtlaw.com	James L. Ryerson (Reg. No. 64,617) GREENBERG TRAURIG, LLP 500 Campus Drive, Suite 400 Florham, NJ 07932 Telephone: 973-360-7900 Facsimile: 973-301-8410 ryersonj@gtlaw.com
Kyle Chen (Pro Hac Vice Forthcoming) GREENBERG TRAURIG, LLP 1900 University Avenue, 5th Floor East Palo Alto, CA 94303 Telephone: 650-328-8500 Facsimile: 650-328-8508 kchen@gtlaw.com	

Service on Petitioner may be made by mail or hand delivery to: Greenberg Traurig, LLP, 1144 15th St., Suite 3300, Denver, CO 80202. Petitioner also consents to and prefers electronic service by emailing CoolerMaster-IPRs@gtlaw.com and counsel of record.

IV. Word Count

Petitioner certifies this Petition is 11,830 words, as counted by the word-processing program (Microsoft Word for Office 365) used to generate this Petition (excluding the table of contents, table of authorities, mandatory notices, certificate

of service, and this certificate). This Petition complies with the 14,000 word limit (37 C.F.R. §42.24(a)(1)(i)).

V. IPR Eligibility (37 C.F.R. §42.104)

Petitioner certifies that the '681 patent is available for IPR and Petitioner is not barred or estopped from requesting cancellation of the Challenged Claims identified below.

Ground	'681 Patent Claim	Basis
Ground 1	1-7	Obvious in view of Duan (Ex-1007), Duan-I (Ex-1008), Shin (Ex-1009) and Nakano (Ex-1010)

VI. The '681 Patent

A. General Overview

The '681 patent relates to a liquid-cooling system for a computer system. The specification purports to disclose embodiments of a liquid-cooling system that is more efficient, easier to use, and more compact with integrated components than prior art cooling systems. (Ex. 1001 at 1:12-2:24.) The '681 patent explains that it provides an “integrate element” to limit the number of separate elements and provides an “entire pump [that] is a placed inside the reservoir” or placed “outside the reservoir in the immediate vicinity of the reservoir.” (*Id.* at 2:17-18 and 2:25-29.) The '681 patent further states (and subsequently claims) that these purported improvements may be achieved by having an integrated element comprising the heat

exchange interface, the reservoir of cooling liquid, and the pump for pumping the cooling liquid. (*Id.* at 1:53-2:36; claims 1-16.) As shown in detail in this Petition, however, the Challenged Claims of the '681 patent are not inventive.

B. Embodiments of the Challenged Claims

The figures discussed below capture the main characteristics of the purported invention claimed in the Challenged Claims. (*Id.* at ¶¶37-43.)

“FIG. 8 [which should have been FIG. 7,⁵ reproduced and annotated on the right] is a perspective view of the cooling system showing the reservoir housing 14 with the heat exchanging surface (not shown) and the pump (not shown) inside the reservoir. The tube inlet connection and the tube outlet

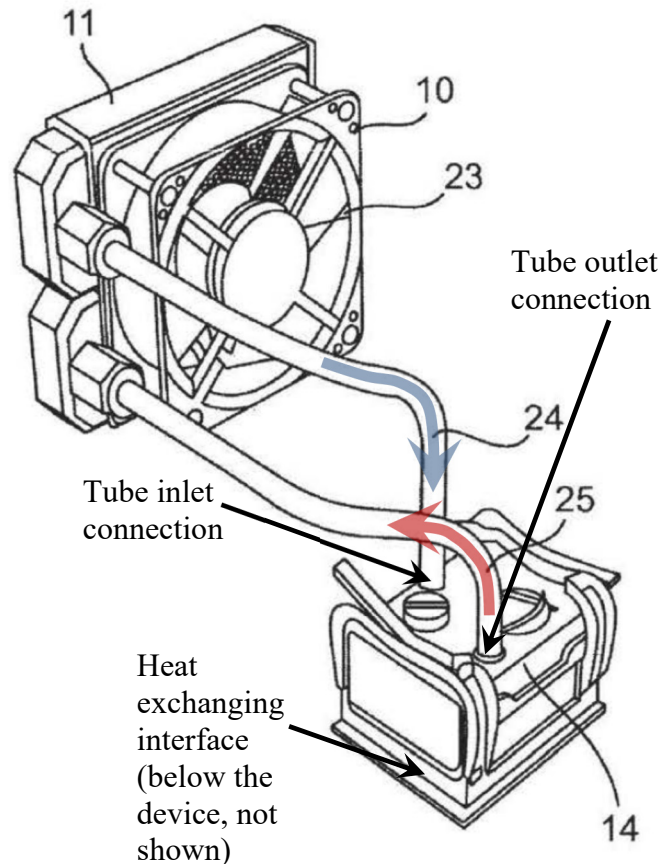


FIG. 7

⁵ As the Board recognized in the Prior IPR, the figure numbers of FIG. 7 and FIG. 8 in the patent's description are transposed. The description for FIG. 8 is actually for FIG. 7, and the description for FIG. 7 is actually for FIG. 8. (Ex-1002 at 5, n.5.)

connection are connected to a heat radiator by means of connecting tubes 24 and 25 through which the cooling liquid flows into and out of the reservoir and the heat radiator, respectively. Within the heat radiator 11, the cooling liquid passes a number of channels for conducting/convecting the heat, which has been dissipated into the cooling liquid inside the reservoir, and to the surroundings of the heat exchanger. The air fan 10 blows air past the channels of the heat radiator in order to cool the radiator and thereby cooling the cooling liquid flowing inside the channels through the heat radiator and back into the reservoir.” (Ex. 1001 at 16:16-30.)

The internal structures of the claimed reservoir 14 are depicted in FIGS. 17 and 20, reproduced below. “FIG. 17 shows a preferred possible embodiment of a reservoir according to the invention. The reservoir housing 14, as shown in FIGS. 17 and 20, is in the form of a double-sided chassis configured to mount an electrical motor.” (*Id.* at 21:48-52.) “The reservoir housing 14 may ... be provided with a[tube] inlet [connection] (not shown [in FIGS. 17 or 20]) and a[tube] outlet [connection] (not shown [in FIGS. 17 or 20]) for the cooling liquid. ... The [tube] inlet [connection] and the [tube] outlet [connection] lead to a radiator (not shown [in FIGS. 17 or 20]) intended for cooling the cooling liquid after having been heated by the processing unit via a heat exchanging surface[.]” (*Id.* at 22:31-38.) A POSITA would have understood that the tube “inlet” connection and the tube “outlet”

“The radiator may be placed nearby or distant from the reservoir housing 14,



10

incorporated in one unit” as shown in FIG. 20 (reproduced and annotated below).

(*Id.* at 22:39-48.)

“The reservoir housing 14 has a recess 40 in the centre on the upper side of the reservoir. The recess 40 is intended for accommodating a stator 37 of an electrical motor driving an impeller 33 of the pump, said impeller being attached to a shaft 38 of a rotor 39 of the electrical motor. The recess has an orifice 41, four sidewalls 42, a bottom 43 and a circular jacket 44 extending from the bottom 43 of the recess 40 and outwards towards the orifice 41 of the recess 40. The interior (see FIG. 20) of the jacket 44 is intended for encompassing the rotor 39 of the pump. As shown in FIG. 20, the impeller 33 is housed in a recess on the underside of the reservoir housing 14, the recess being an extension of the interior of the jacket 44.” (*Id.* at 21:58-22:9)

“Thereby, a liquid-proof division is made between the rotor 39 of the motor, said rotor 39 being placed inside the interior of the jacket 44 and being submerged in the cooling liquid, and the stator 37 of the

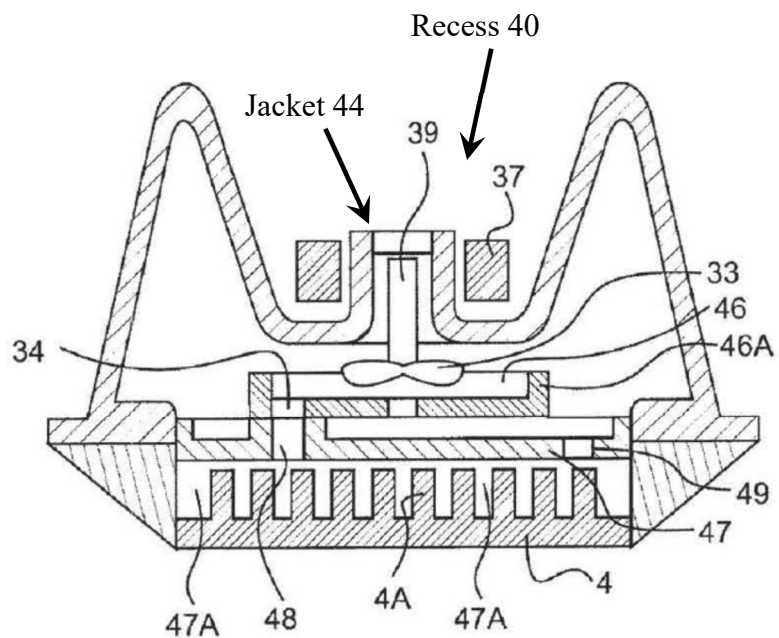


FIG. 20

pump, said stator 37 being positioned in the recess 40 and surrounding the exterior of the jacket 44. Accordingly, the stator 37 need not be sealed against the cooling liquid, because the recess 40 together with the jacket 44 ensures the stator staying dry from the cooling liquid, but the stator 37 still being capable of driving the rotor 39, when being supplied with electrical power from a power supply (not shown) of the computer system.” (*Id.* at 22:10-20.)

C. Effective Filing Date

The ’681 patent appears to have an effective filing date of May 6, 2005, based on its priority chain. Petitioner does not concede that the ’681 patent is entitled to this effective filing date, and reserves the right to contest the priority claim, but assumes that this date applies for purposes of this Petition.

D. Prosecution History and Prior IPR Outcome

1. Prosecution of the ’681 patent

Prosecution of the ’681 patent was minimal. A first non-final rejection of then-pending claims 1-7 under 35 U.S.C. 103(a) was issued over Batchelder (US6019165) in view of Lenehan (US7591302B1). (Ex-1006 (’681-FH) at 256-63.) After the Patent Owner responded without amendment, the Examiner issued a final rejection on the same grounds previously articulated. (*Id.* at 279-89 and 293-302.)

Next, Patent Owner filed remarks asking that claims 1-7 be placed in condition for allowance (*Id.* at 306-322.) Patent Owner also amended claim 1 and

added Claims 19-27, arguing that these amendments and new claims traversed the previous rejections:

“For example, Batchelder does not teach or suggest a first passage that ‘directs the cooling liquid into the thermal exchanger chamber *between a first end and a second end of the thermal exchanger chamber,*’ as claimed. Instead, Batchelder discloses, as shown in Fig. 8, the heat transfer fluid enters pocket 230 at either end of the pocket and flow inward through the fins 52. In another example, Batchelder does not teach or suggest ‘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,*’ as claimed. Instead, Batchelder discloses, as shown in Fig. 8, the exit slots 232 are positioned in the center of the fins 52 and pocket 230. And Lenehan does not cure these deficiencies of Batchelder.”⁶

(*Id.* at 330-49.) A Notice of Allowance followed, noting that “[t]he closest prior art of record Batchelder (as previously cited) teaches a pump chamber but fails to teach the recited first and second passages. There would be no motivation to modify the pump chamber of Batchelder.” (*Id.* at 370-77.)

⁶ Emphasis is added herein unless otherwise noted.

2. Outcome of the Prior IPR

In the Prior IPR, the petitioner challenged claims 1, 4, 8, 11, 15, and 16. After trial was instituted, Patent Owner statutorily disclaimed claims 8-16, leaving only claims 1 and 4 for analysis by the Board. (Ex-1002 at 1-2.)

As it related to claims 1 and 4, the prior petitioner sought invalidity based on the prior art of Duan (US2006/0185830), Shin (JP2002-151638), and Cheon (US5731954). Ultimately, the Board found that Duan alone failed to disclose both “an inlet positioned *below* the center of the impeller ...” and “a thermal exchange chamber formed *below* the pump chamber and *vertically* spaced apart from the pump chamber” (*Id.* at 29.) This is because “claim 1 requires a single frame of reference throughout the claim.” (*Id.*) However, as shown herein, a related patent filing by the same inventor Duan on the same date, February 18, 2005 (Ex-1008, “Duan-I”), demonstrates that it was obvious to a POSITA to include “an inlet positioned *below* the center of the impeller ...” and “a thermal exchange chamber formed *below* the pump chamber and *vertically* spaced apart from the pump chamber ...” as claimed in the ’681 patent.

E. The ’764 patent IPR

As noted above, several family members of the ’681 patent were subject to *inter partes* reviews resulting in the cancellation of claims. Of particular relevance, in IPR2023-00668 (filed by Petitioner), which is a joinder to IPR2022-01317, the

PTAB cancelled all claims of the '764 patent, many of which include identical or similar limitations to those challenged in this IPR (*e.g.*, claims 1-5 and 7 of the '764 patent) and based on the same prior art used in this IPR. Patent Owner did not appeal that decision, and thus the Board's decision on those issues has preclusive effect. *B&B Hardware, Inc. v. Hargis Indus., Inc.*, 135 S.Ct. 1293, 1310 (2015).⁷

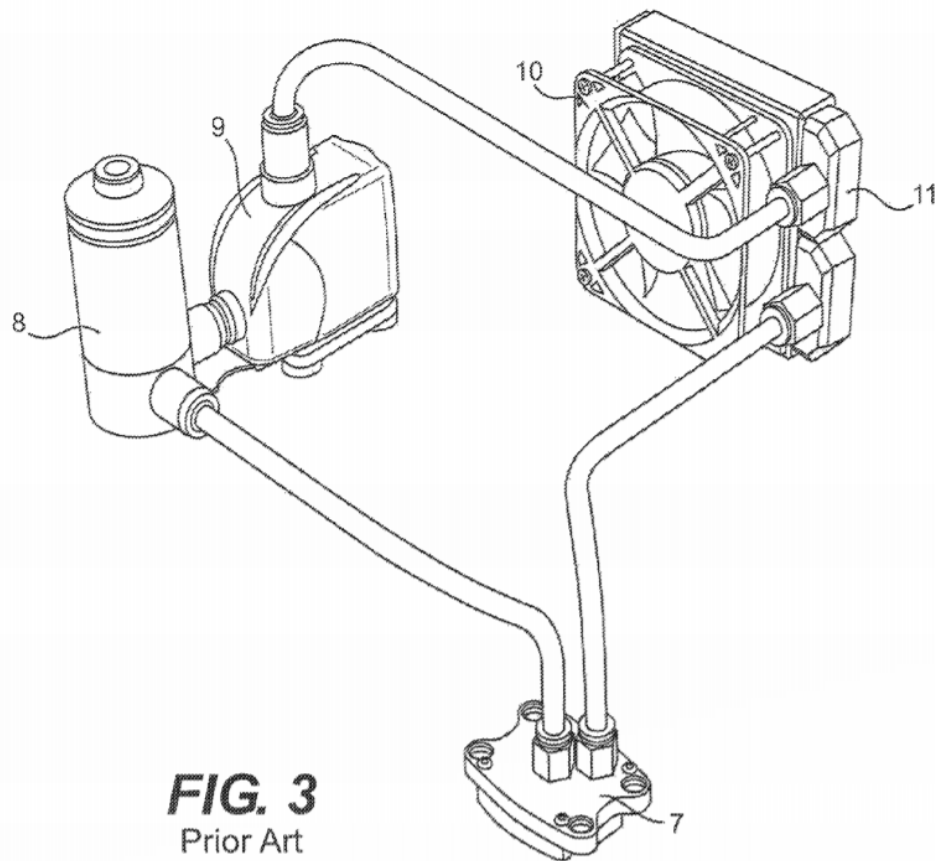
F. Applicant Admitted Prior Art (“AAPA”)

Prior art admissions made in the specification of a patent application are binding on a Patent Owner, and may be used as prior art against the patent. *PharmaStem Therapeutics, Inc. v. ViaCell, Inc.*, 491 F.3d 1342, 1362 (Fed. Cir. 2007) (“Admissions in the specification regarding the prior art are binding on the patentee for purposes of a later inquiry into obviousness.”) Patent Owner made such admissions here. FIGS. 1-2 of the '681 patent show a prior art embodiment of “the typical components in an air-cooling type CPU cooling arrangement”, and FIG. 3 shows an embodiment of “the typical components in a liquid-cooling type CPU cooling arrangement.” (Ex. 1001 at 9:40-48, 10:22-67; FIGS. 1-3.) *See In re Cohen*, 767 Fed. Appx. 985, 987-89 (Fed. Cir. 2019) (affirming an examiner's reliance on

⁷ The '764 patent was also subject to reexamination under Application No. 95/002,386, which preceded the '764 patent IPR.

the disclosure of a “typical” technique in the “Background” section of a patent as applicant-admitted prior art).

Patent Owner admits that both air-cooling systems and liquid-cooling systems in the prior art included “a prior art air fan” (Ex. 1001 at 10:22-67), and that in prior art liquid-cooling systems the air fan 10 is “provided together with the heat radiator” and “blow[s] air through the heat radiator” (*id.* at 10:50-67). FIG. 3 of the '681 patent, showing air fan 10, is reproduced below:



Accordingly, FIGS. 1-3 of the '681 patent and the descriptions thereof are available as prior art. *Qualcomm Inc. v. Apple Inc.*, 24 F.4th 1367, 1375 (Fed. Cir.

2022) (“[I]t is appropriate to rely on admissions in a patent’s specification when assessing whether that patent’s claims would have been obvious in an inter partes review proceeding.”); *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1570 (Fed. Cir. 1988) (“A statement in the patent that something is in the prior art is binding on the applicant and patentee for determinations of anticipation and obviousness.”)

G. The Challenged Claims

Petitioner challenges claims 1-7. Claim 1 is the only independent claim.

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

A POSITA in the field of the ’681 patent at the time of the effective filing date 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. 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. (Ex-1005, ¶42.) The Board adopted this POSITA definition in the Prior IPR. (Ex-1002 at 20-21.)

VIII. Claim Construction

In the prior IPR, the Board applied the plain and ordinary meaning (“plain meaning” to all claim terms. (Ex-1002 at 10-17.) In doing so, the Board extensively discussed the term “*an inlet positioned below the center of the impeller,*” and determined its plain meaning should apply. (*Id.*) The Board further held that “claim 1 does have a particular positional/directional frame of reference that is used throughout the claim.” (*Id.* at 17, 29.)

Here, Petitioner does not believe any specific terms require construction and applies the plain meaning of all claim terms herein. Petitioner reserves the right to challenge any constructions offered by Patent Owner. Petitioner also applies the “particular positional/directional frame of reference that is used throughout the claim[s].” (*See* Ex-1005, ¶27.)

IX. Discretionary Denial is Unwarranted

A. 35 U.S.C. §314(a) Does Not Favor Denial

As noted above, the previously co-pending litigation surrounding the ’681 patent was terminated. (*See* Section III.B.) Thus, the ’681 patent is not subject to any parallel district court litigation. Therefore, the *Fintiv* factors are inapplicable.

B. 35 U.S.C. §325(d) Does Not Favor Denial

Non-institution under §325(d) would be improper in view of the *Advanced Bionics* framework and the *Becton Dickinson* factors. *See Advanced Bionics LLC v. Med-EL Elektromedizinische Geräte GMBH*, IPR2019-01469, Paper 6, (Feb. 13,

2020) (precedential); *Becton Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8, 6-7 (Dec. 15, 2017).

As explained in Section VI.D.2, in the Prior IPR, claims 1 and 4 were not found unpatentable because the Board held that “claim 1 does have a particular positional/directional frame of reference that is used throughout the claim.” (Ex-1002 at 17, 29.) Based on this understanding, the Board found that Duan alone failed to disclose the “inlet” and “thermal exchange chamber” requirements of the claims. (*Id.* at 29.)

However, Duan is only one arrangement disclosed by the inventor Qiang-Fei Duan. Mr. Duan also filed a second patent application (2006/0185829; Ex-1008 or “Duan-I”), disclosing additional liquid cooling arrangements. Indeed, both Duan and Duan-I were filed on the same day, name the same inventor, and relate to alternative liquid-cooling heat dissipation apparatus arrangements that can be advantageously integrated into a casing to achieve compact space. These additional teachings of Duan-I (which were *not* presented in the Prior IPR) show that the “inlet” and “thermal exchange chamber” limitations that the Board believed to be missing from Duan were, in fact, known in the art and were obvious based on Duan in view of Duan-I, as explained herein. Thus, this Petition presents new, non-cumulative teachings not previously considered by the Office. Accordingly,

discretionary denial under 35 U.S.C. §325(d) would be improper.

Advanced Bionics, supra.

X. Overview of the Prior Art

A. Duan (Ex-1007; US2006/0185830)

Duan is U.S. Patent Application Publication No. 2006/0185830 to Qiang-Fei Duan et al. (Ex-1007.) Duan was filed on February 18, 2005 and published on August 24, 2006. Thus, Duan is entitled to an effective filing date of at least February 18, 2005, making it prior art to the '681 patent under at least pre-AIA 35 U.S.C. §102(e).

B. Duan-I (Ex-1008; US2006/0185829)

Duan-I is U.S. Patent Application Publication No. 2006/0185829 to Qiang-Fei Duan et al. (Ex-1008.) Duan-I was filed on February 18, 2005 and published on August 24, 2006. Thus, Duan-I is entitled to an effective filing date of at least February 18, 2005, making it prior art to the '681 patent under at least pre-AIA 35 U.S.C. §102(e). Duan-I was not cited during prosecution of the '681 patent. For purposes of completeness, Petitioner notes that the issued patent corresponding to Duan-I (U.S. Patent No. 7,325,591) was cited during Reexamination No. 95/002,386 of the related '764 patent, but not in the manner proposed in this Petition (as a secondary reference combined with Duan). (Ex-1011.)

C. Shin (Ex-1009; JP2002-151638)

Shin was filed as Japanese Patent Application 2000-345470 on November 8, 2000 and published on May 24, 2002 as Japanese Unexamined Patent Application Publication No. 2002-151638 to Takayuki Shin. (Ex. 1009 at (21), (22), (11), (43).) Thus, Shin is at least pre-AIA 35 U.S.C. §102(b) prior art.

D. Nakano (Ex-1010; US6915653)

Nakano is U.S. Patent No. 6,915,653, filed April 8, 2004. (Ex-1010, [10], [45].) Nakano also published on December 16, 2004 as U.S. Patent Publication No. 2004/0250558. Thus, Nakano is at least pre-AIA 35 U.S.C. §§ 102(a), (e) prior art. Nakano was not disclosed or cited during prosecution of the '681 patent. (*See generally* Ex-1006 ('681-FH).)

XI. GROUND 1: Duan in view of Duan-I, Shin and Nakano

A. Scope, Content, and Rationale for Combining Prior Art

Ground 1 relies on Duan and Duan-I, a combination already adopted by the Board in the '764-IPR-FWD. (*See* Ex-1004 at 13.) Duan discloses the majority of the limitations of the claims, but Duan does not specifically teach the “inlet” and “thermal exchange chamber” arrangements in the orientation under the same frame of reference as required by claim 1. As explained in detail below, however, Duan in view of Duan-I teaches the claimed arrangements.

Specifically, Duan teaches a double-sided chassis (accommodation chamber 21) adapted to mount a pump (liquid driving unit 22) configured to circulate a

cooling liquid, the pump comprising a stator (coil stage 221) and an impeller (impeller stage 223):

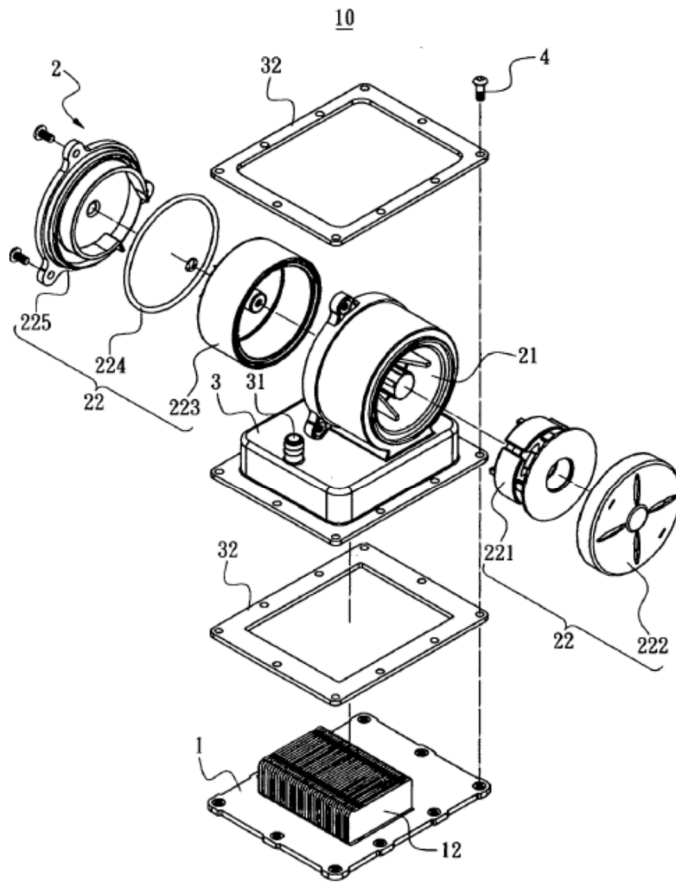


FIG. 2

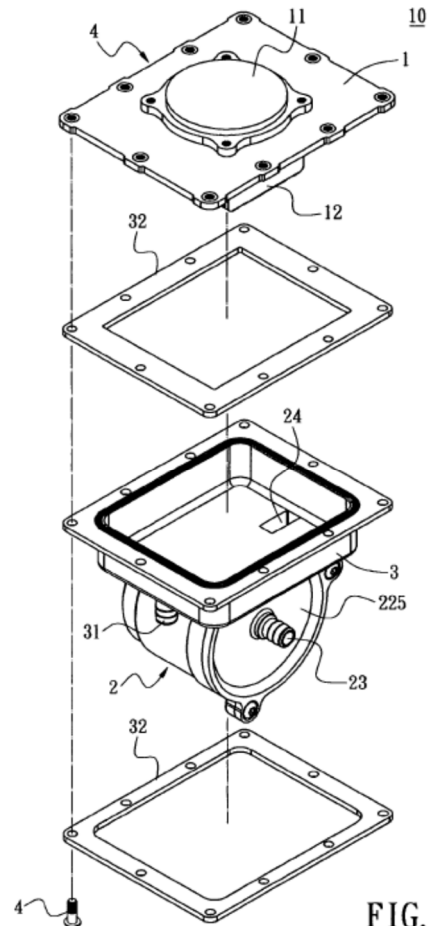
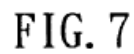


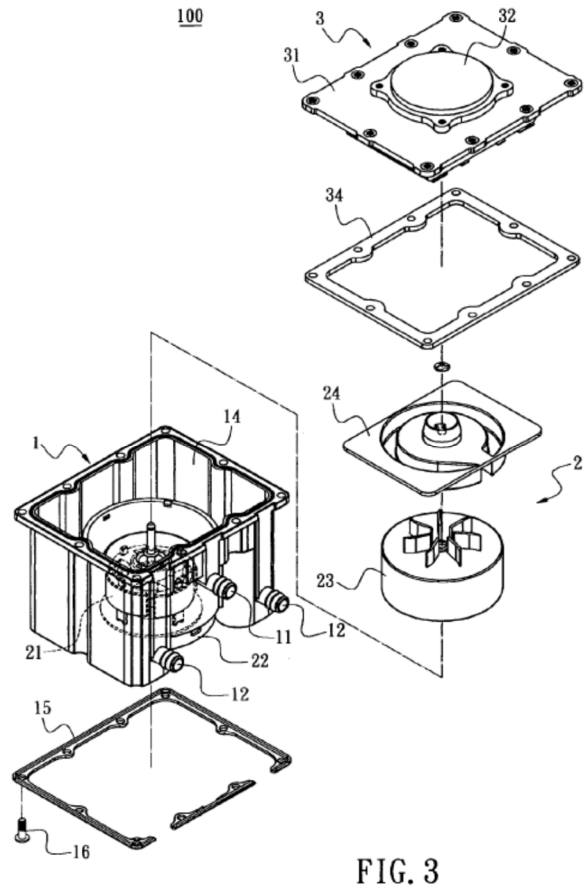
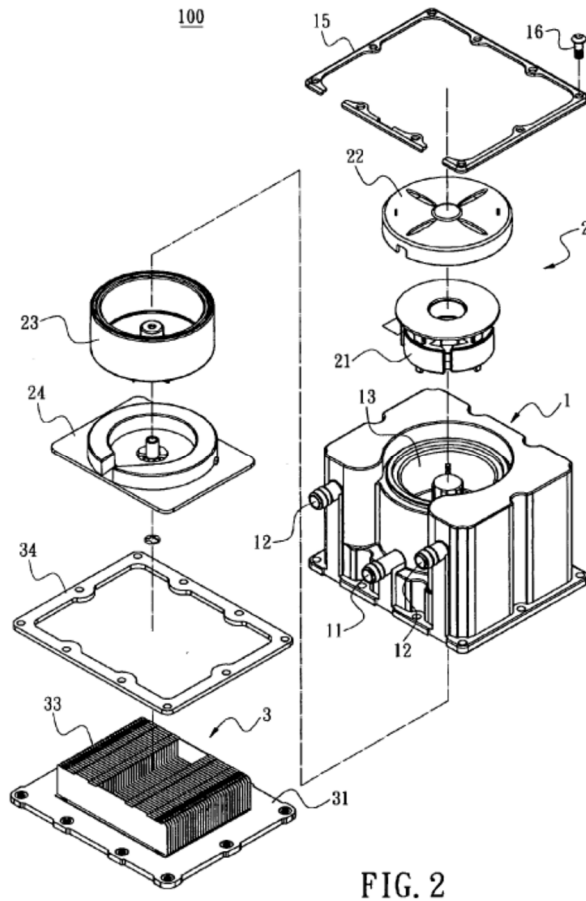
FIG. 4



Duan also teaches that the impeller (223) is positioned on the underside of the chassis (accommodation chamber 21) in contact the cooling liquid and the stator (221) positioned on the chassis' upper side isolated from the cooling liquid:



Similarly, Duan-I teaches a cooling system with the stator (coil stage 21) positioned on the upper side of the chassis (casing 1) isolated from the liquid and the impeller (23) positioned on the underside of the chassis (casing 1) contacting the liquid:



(Ex-1008, FIGS. 2-3; [0021].) As shown above, Duan's liquid driving unit 2 is oriented in a direction 90° from that of Duan-I's liquid driving unit 22. A POSITA would have recognized that Duan's liquid driving module 22 is oriented in a way such that the overall device is taller than Duan-I, as shown below:

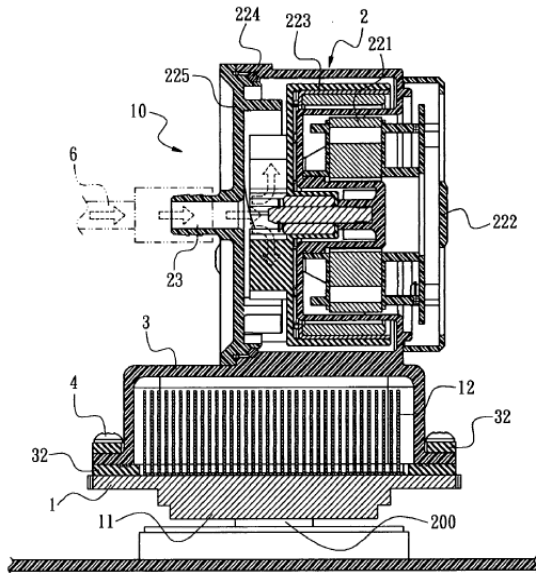


FIG. 7

Duan

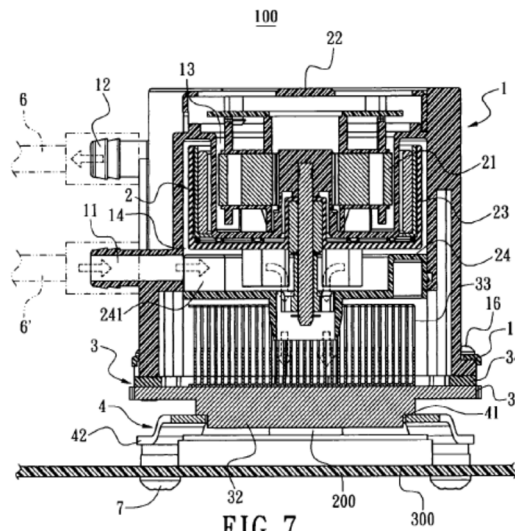


FIG. 7

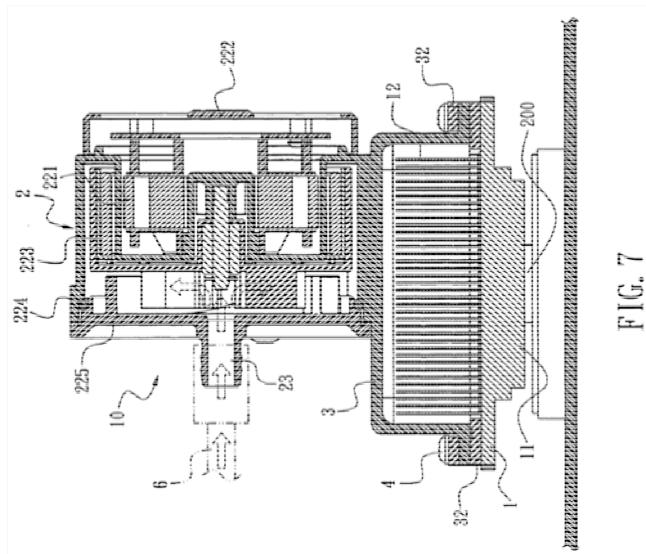
Duan-I

(Ex-1005, ¶56.)

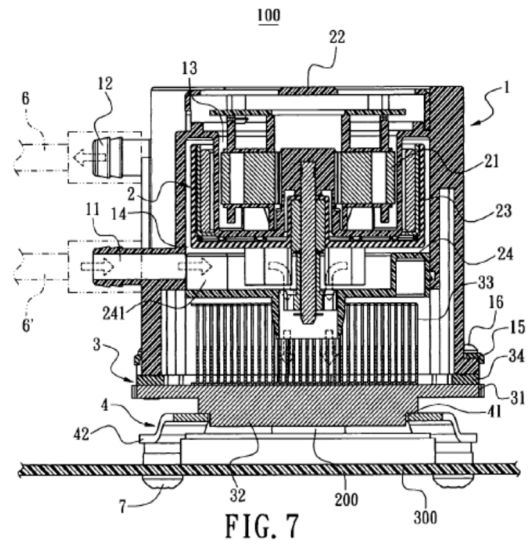
A POSITA would have been motivated to combine the teachings of Duan and Duan-I. Both references are by the same author (Duan) and are in the same field of endeavor. Indeed, given the known “compact trend of computer[s]” recognized by Duan [0006], a POSITA would have been motivated to rotate Duan’s liquid driving module 2 (pump) counterclockwise by 90 degrees in Figure 7 to reduce the system’s overall height, in view of Duan-I. (Ex-1005, ¶57.)

Although modifying Duan in this fashion would require some minor reconstruction, doing so would reasonably be expected to result in success. The modification is well within a POSITA’s technical grasp, and would have predictably resulted in a modified system like the one below (double-sided chassis outlined

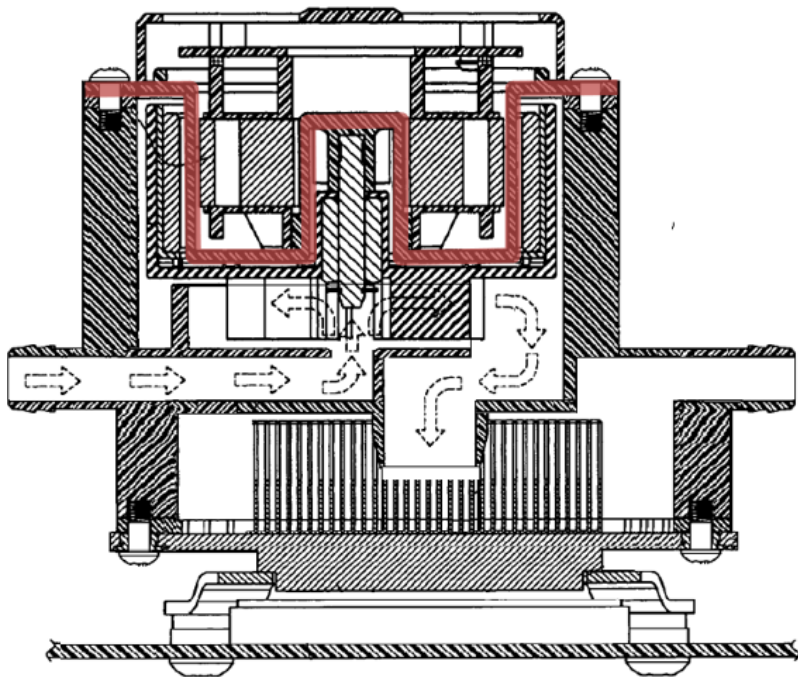
in red):



Duan (rotated 90° CCW)



Duan-I



Duan+Duan I

(Ex-1005, ¶58.)

Accordingly, Duan, as modified above in view of Duan-I, teaches a double-sided chassis (accommodation chamber 21) adapted to mount a pump (liquid driving unit 22) configured to circulate a cooling liquid, the pump comprising a stator (coil stage 221) and an impeller (impeller stage 223), the impeller being positioned on the underside of the chassis and the stator (221) being positioned on the upper side of the chassis and isolated from the cooling liquid. (Ex-1005, ¶59.)

As shown below, Duan+Duan-I discloses the majority of the limitations of the claims. Duan+Duan-I does not appear to specifically disclose “a control system configured to independently control a speed of the pump and a speed of the fan.” However, such control systems were well-known prior to the ’681 patent as evidenced by Shin and Nakano. As a matter of basic liquid-cooling design, a POSITA would have found it obvious based on Shin and/or Nakano to independently control a speed of the fan and a speed of the pump because this would allow for the individual operation of the fan and the pump, which is advantageous to independently regulate the airflow and the liquid flow to achieve an optimal efficiency of the system while reducing noise. (*Id.* at ¶60.) Moreover, a motor that drives an air fan is typically of a different construction than, and physically separate from, a motor that drives an impeller to move cooling liquid. Given that these motors are typically of different construction and physically separate from each other, it would have been obvious to a POSITA to independently control them. (*See id.*)

A POSITA would also have had a reasonable expectation of successfully applying the control system teachings of Shin and/or Nakano to the Duan references. A POSITA would merely need to implement straightforward hardware and/or software to ensure that both motors (air, liquid) were appropriately powered and controlled. (*See* Ex-1005, ¶61.)

B. Challenged Claims

As shown below, claims 1-7 are unpatentable for being obvious based on the prior art cited in Ground 1.

Claim 1

[1PRE] “A liquid cooling system for cooling a heat-generating component of a computer, comprising:” (*See* Ex-1005, ¶62.)

Duan discloses the preamble, regardless of whether it is a limitation. Duan “relates to a cooling plate module, and more particularly to a cooling plate module used for *heat emitting device such as a CPU*.” (Ex-1007 at [0002].) Duan further teaches that the disclosed cooling plate module “includes a cooling plate and a *liquid driving module*.” (*Id.* at Abstract; *see also* Ex-1005, ¶62.) Thus, Duan discloses the preamble.

[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;” (See Ex-1005, ¶¶63-87.)

This limitation is patentably indistinct from limitation [1a] of claim 1 of the ’764 patent, which was cancelled in the ’764 patent IPR, and is thus disclosed by the combination of Duan and Duan-I as a matter of law (*B&B Hardware, supra*):

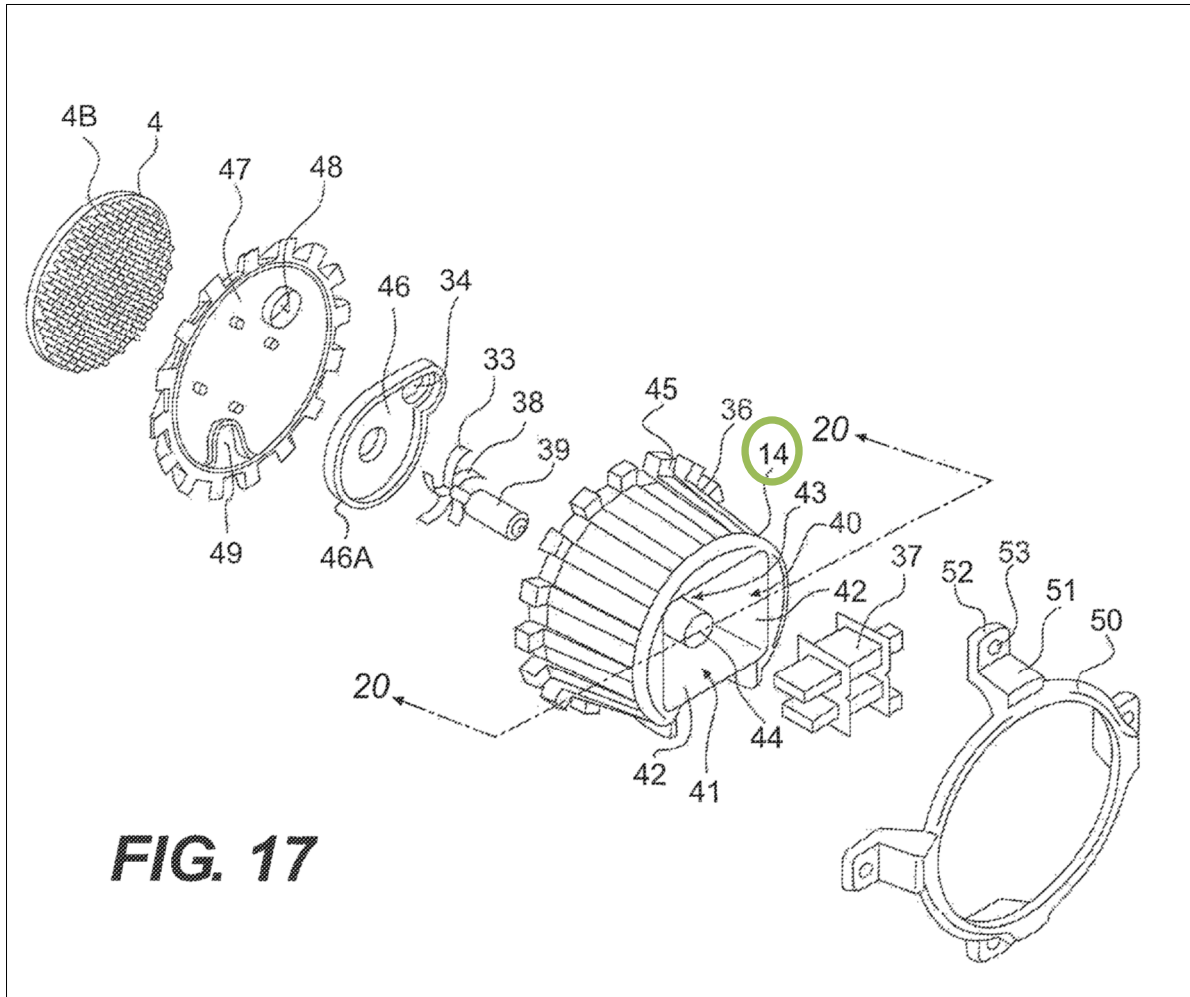
’681 limitation 1[a] of claim 1	’764 limitation 1[a] of claim 1
“a double-sided chassis adapted to mount a pump configured to circulate a cooling liquid, the pump comprising a motor with a stator and an impeller, the impeller being positioned on one side of the chassis and the stator being positioned on an opposite side of the chassis and isolated from the cooling liquid;”	“a double-sided chassis adapted to mount a pump configured to circulate a cooling liquid, the pump comprising a stator and an impeller, the impeller being positioned on the underside of the chassis and the stator being positioned on the upper side of the chassis and isolated from the cooling liquid;”

The highlighted text in the above comparison table shows the patentably indistinct portions between the ’681 limitation [1a] and the ’764 limitation [1a]. 64.

As an initial matter, a POSITA would have understood that most modern “pumps,” especially of the type described by Duan, would likely have included a

“motor.” This is because the presence of a rotor and a stator implies the presence of a motor. A stator is the stationary part of a motor; it remains fixed while the rotor or impeller rotates. The rotation is caused by the electromagnetic interaction between the stator and the impeller. These two parts, the stator and the rotating impeller/rotor, form a motor, as a POSITA would have understood. (Ex-1005, at ¶64.) Indeed, in the Prior IPR, Patent Owner never challenged that Duan discloses a motor in its pump. *See generally* Ex-1013 (Patent Owner Response in IPR2020-00524).

Nonetheless, with regards to this 1[a] limitation, the '681 patent explains an example of how its “reservoir housing” forms “a double-sided chassis configured to mount an electrical motor” in FIG. 17 (Ex. 1001 at FIG. 17; 21:47-56.):



As shown above, the “reservoir substantially has a conical, circular configuration.”
(*Id.*). FIG. 20 of the ’681 patent provides an example of a cross section view where
“the impeller 33 is housed in a recess on the underside of the reservoir housing 14”
(colored in green below):

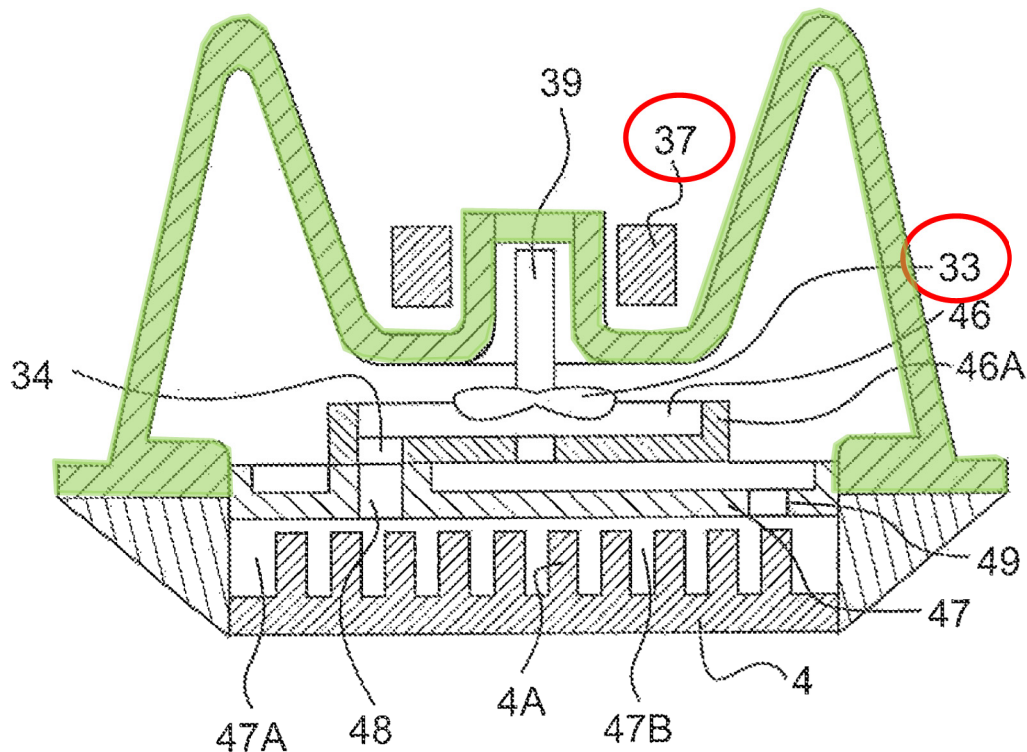


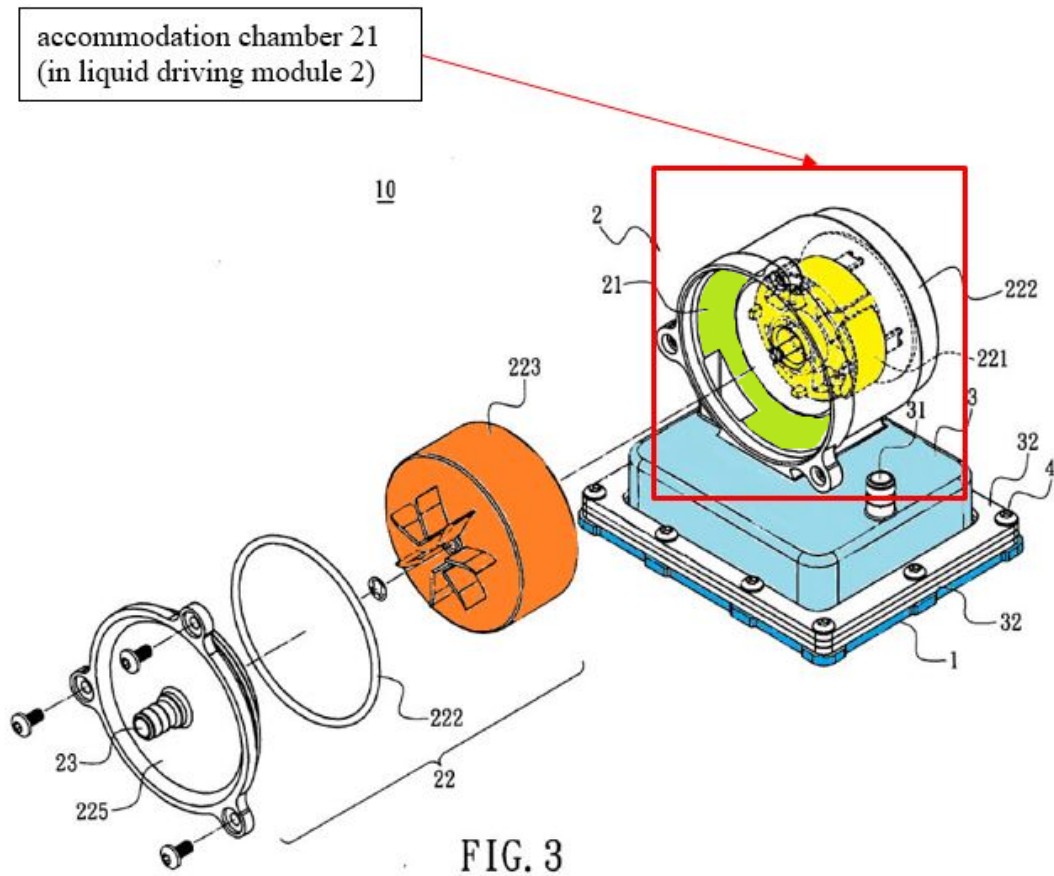
FIG. 20

(Ex. 1001 at 22:6-9 and FIG. 20.) Specifically, FIG. 20 depicts the impeller 33 on one side of the chassis and the stator 37 on the other side of the chassis. (See Ex-1005, ¶¶65-66.)

Duan describes virtually the same embodiment related to the claimed “double-sided chassis.” For example, Duan discloses a pump comprising a motor (e.g., liquid driving module 2) comprised of an impeller (e.g., the impeller stage 223) and a stator (e.g., the coil stage 221).

To illustrate, reproduced below are colored versions of FIGS. 2 and 3 of Duan that use the following color coding scheme:

Color	Duan Element
Yellow	coil stage 221
Orange	impeller stage 223
Light blue	cap 3
Dark blue	cooling plate 1
Lime green	accommodation chamber 21 (interior)



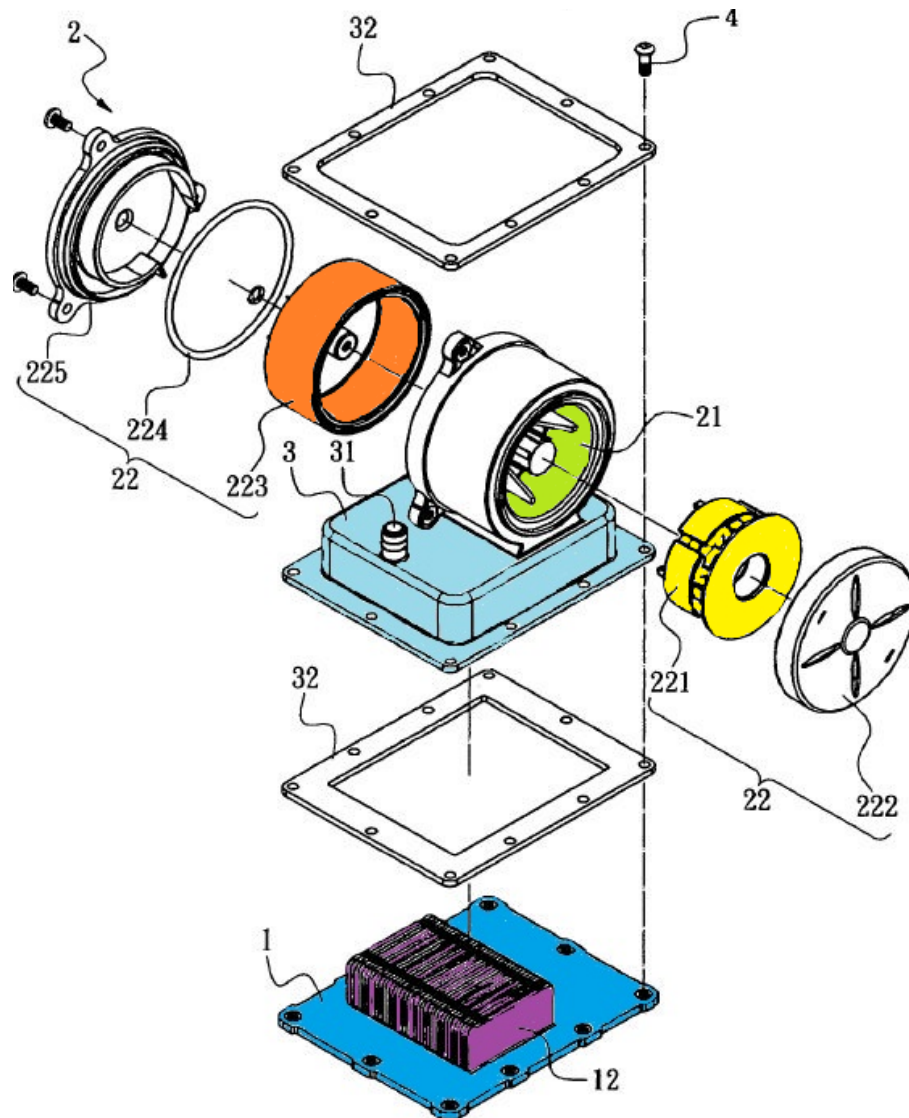


FIG. 2

As illustrated in the above figures, Duan discloses a double-sided chassis (e.g., accommodation chamber 21) adapted to mount a pump (e.g., liquid driving unit 22), which includes a motor, configured to circulate a cooling liquid. (See Ex. 1007 at [0023]). (See Ex-1005, ¶¶67-69.)

In addition, as shown above, FIGS. 2 and 3 further disclose the impeller (e.g., impeller of impeller stage 223) being positioned on one side of the chassis (e.g., accommodation chamber 21) and the stator (e.g., at least part of the coil stage 221) being positioned on the upper side of the chassis and isolated from the cooling liquid. (*Id.*; *see also* Ex. 1007 at [0026] (“In the present invention, during the assembling of the liquid cooling cyclic mechanism 100, the liquid inlet 23 of the cooling plate module 10 is communicated to the liquid outlet 521 of the liquid exit region 52 of the water tank 20 through duct 6”). A POSITA would have understood the coil stage 221 is a stator and the impeller stage 223 is a rotor, which together form a motor. (*See* Ex-1005, ¶70.)

A POSITA reading Duan would have understood that Duan’s coil stage 221 is part of an electric rotary motor’s stationary portion, i.e., a stator, which is a common structure of a rotary motor that includes the stationary functional parts of a motor during its operation. (Ex. 1001 at 2:40-42) Thus, Duan’s disclosure of a coil stage and impeller stage further discloses the presence of a stator needed to cause the impeller to rotate about an axis for purposes of providing a fluid pump. Petitioner notes that the impeller stage 223 of Duan includes blades of a fan. (Ex. 1007 at FIG. 3, item 223.) (*See* Ex-1005, ¶71.)

Duan further discloses that the impeller is “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,” as recited in claim 1. A POSITA reading Duan would have understood that the impeller of the impeller stage is in contact with the liquid for performing the liquid pump functionality provided by Duan’s liquid driving module. Specifically, Duan states that “[t]he lower cover 225 comprises a liquid inlet 23” which means that the impeller makes contact with liquid. (Ex. 1007 at [0023].) Duan also teaches the use of a “a sealing washer 224” to prevent liquid from escaping around the impeller. (*See* Ex-1005, ¶72.)

In addition, Duan’s coil stage (including the stator) is not in contact with fluid. This is shown in FIG. 2 of Duan where the impeller 223 is separated from the coil stage. In this respect, Duan protects its coil stage from the fluid that is being moved by the impeller stage. As a result, FIG. 2 of Duan shows separating the coil stage (which includes a stator) and the impeller (which is part of the impeller stage) such that the former is not submerged while the latter is submerged. By positioning Duan’s stator on the opposite side of the impeller stage, Duan discloses isolating the stator from the cooling liquid. (*See* Ex-1005, ¶73.)

FIG. 7 of Duan provides yet another view of a double-sided chassis that separates the impeller and stator on opposite sides of the chassis so that the stator is isolated from liquid. FIG. 7, below, shows the locations of the impeller (item 223) and the coil stage that includes a stator (item 221):

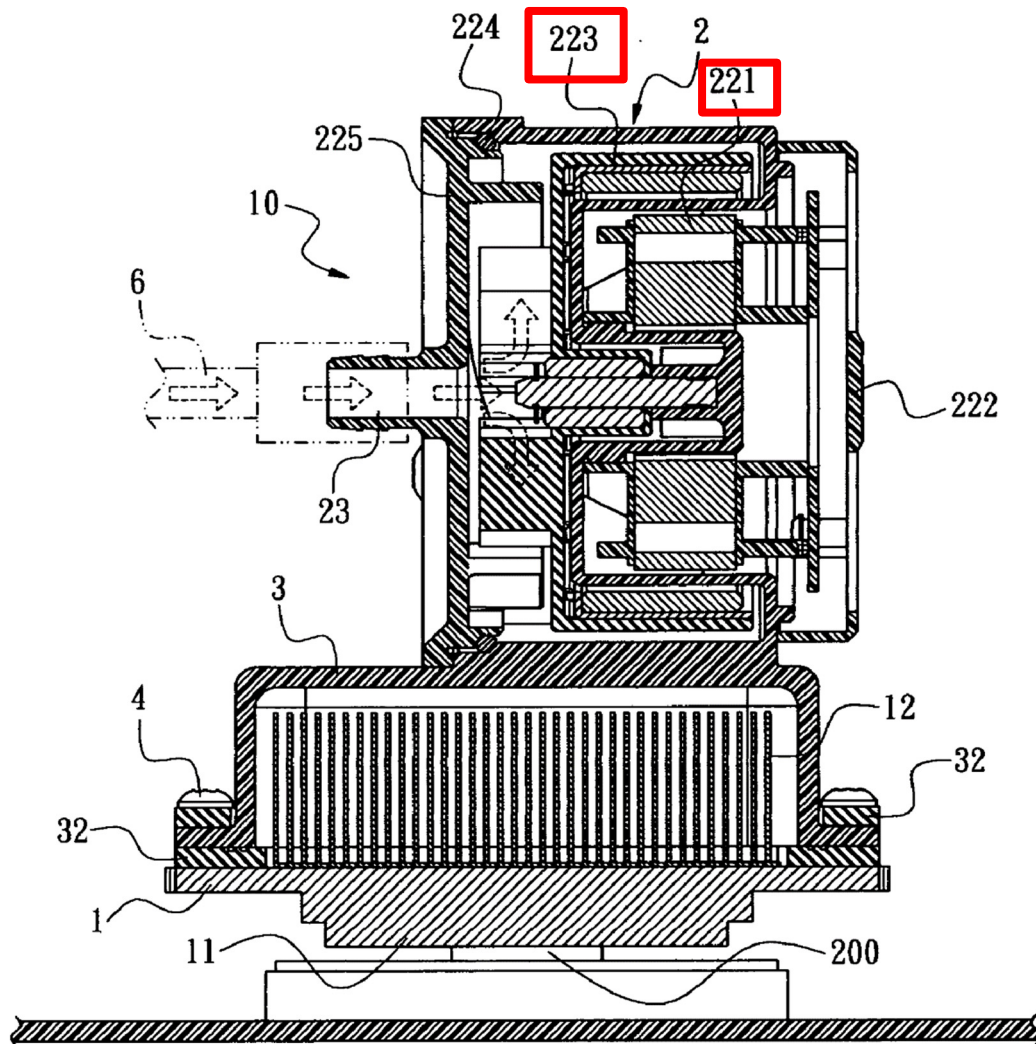


FIG. 7

(Ex. 1007 at FIG. 7 (emphasis added to show items 221 and 223).) In addition, a red line is added to FIG. 7 below to show a cross-section of the chassis as it separates items 221 and 223:

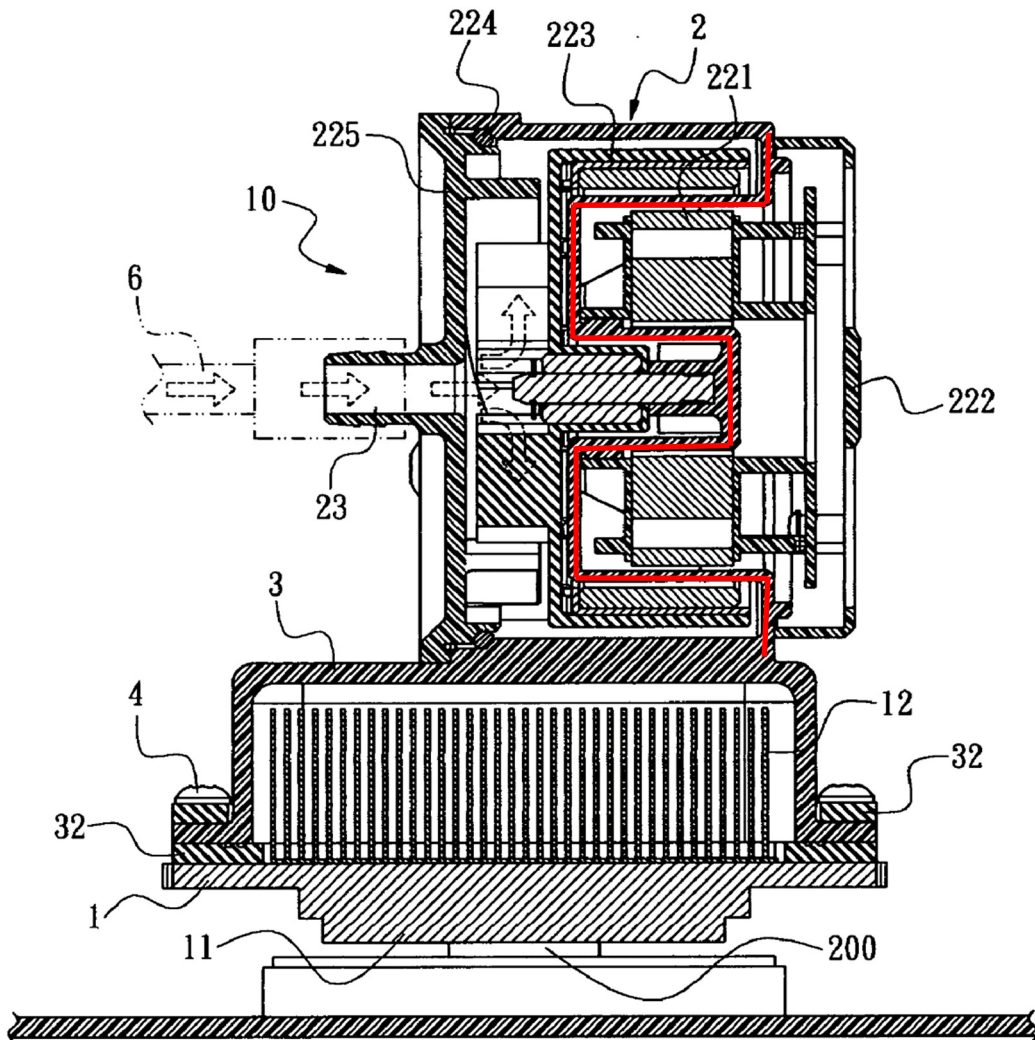


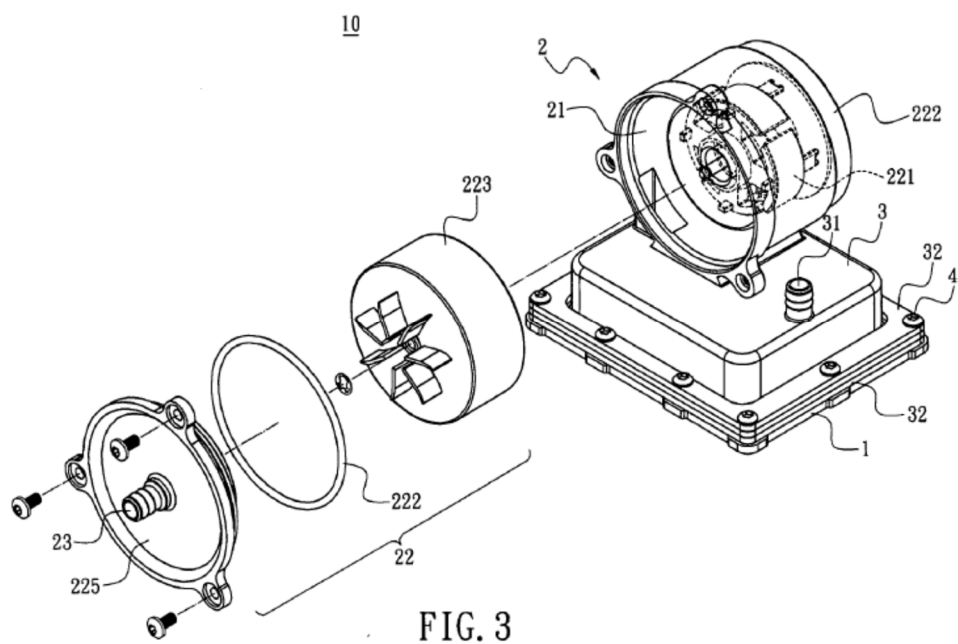
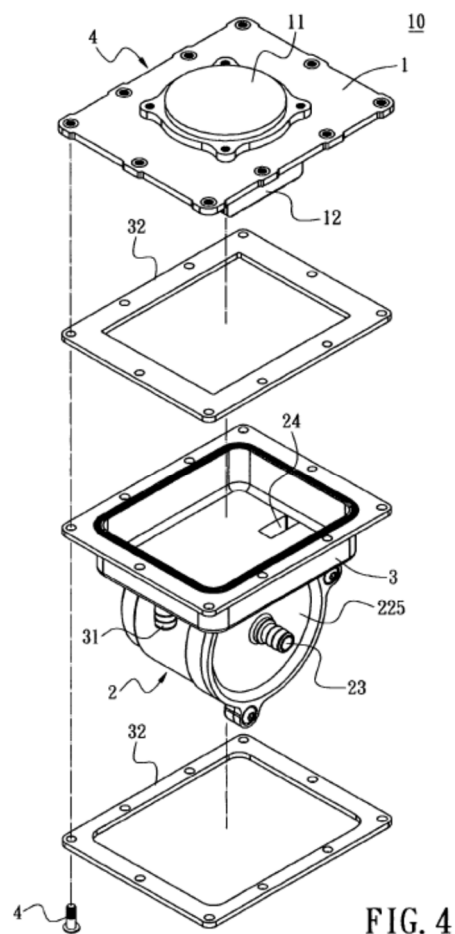
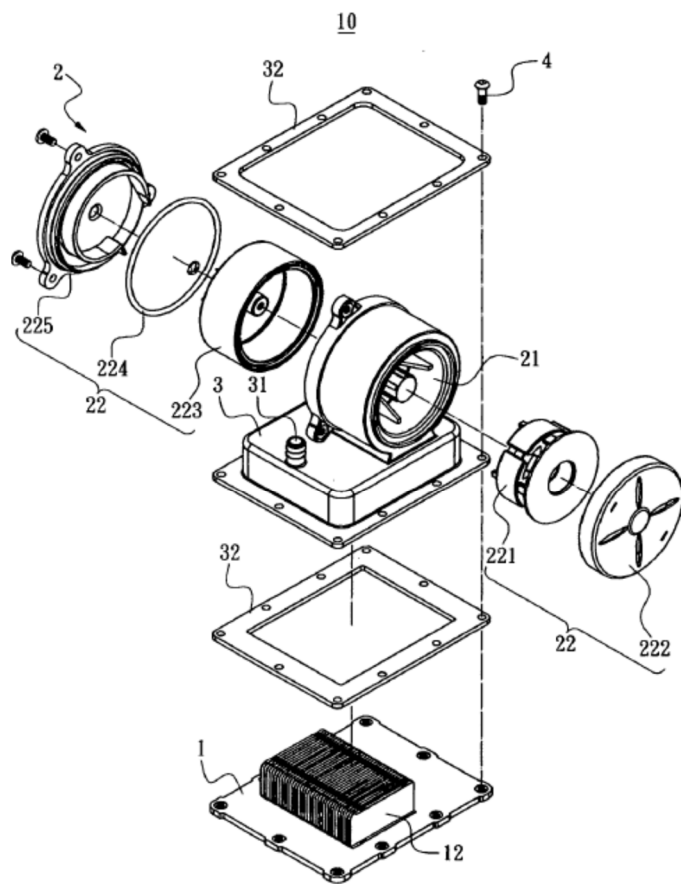
FIG. 7

(Ex. 1007 at FIG. 7 (emphasis added).) Thus, FIG. 7 of Duan further discloses an impeller being positioned on one side of the chassis (denoted partially by a red line along the cross section) and a stator of the pump positioned on an opposite side of the chassis so that the stator is isolated from the liquid. (See Ex-1005, ¶74.)

Next, the “one side” vs. “an opposite side” language in the ’681 limitation 1[a] corresponds to, and is broader than, “the underside” vs. “the upper side”

language in the '764 limitation 1[a]. Since the Board has already found the '764 limitation [1a] is disclosed or taught by Duan+Duan I, the '681 limitation [1a] is likewise disclosed or taught by Duan+Duan I. (*See generally* Ex-1004 ('764-IPR-FWD); *see also* Ex-1005, ¶75.).)

Nonetheless, both Duan and Duan in view of Duan-I teach limitation [1a] of the '681 patent. In the Prior IPR, Patent Owner did not dispute that Duan teaches a double-sided chassis (accommodation chamber 21) adapted to mount a pump (liquid driving unit 22) configured to circulate a cooling liquid, the pump comprising a motor and a stator (coil stage 221) and an impeller (impeller stage 223):



(Ex-1007, FIGS. 2-4; [0023] (“[T]he liquid driving module 2 comprises an accommodation chamber 21 and a **liquid driving unit 22 located in the accommodation chamber 21** and used to driv[e] the cool liquid. The liquid driving unit 22 comprises a **coil stage 221 ... an impeller stage 223**...[T]he liquid driving module 2 **can be reciprocating pump, centrifugal pump or axial-flow pump.**”); Ex-1005, ¶76.)

Similarly, in the Prior IPR, Patent Owner did not dispute that Duan also teaches that the impeller (223) is positioned on one side of the chassis (accommodation chamber 21) in contact the cooling liquid and the pump (liquid driving unit 22) includes a motor and a stator (221) positioned on the chassis’s “opposite side” isolated from the cooling liquid:

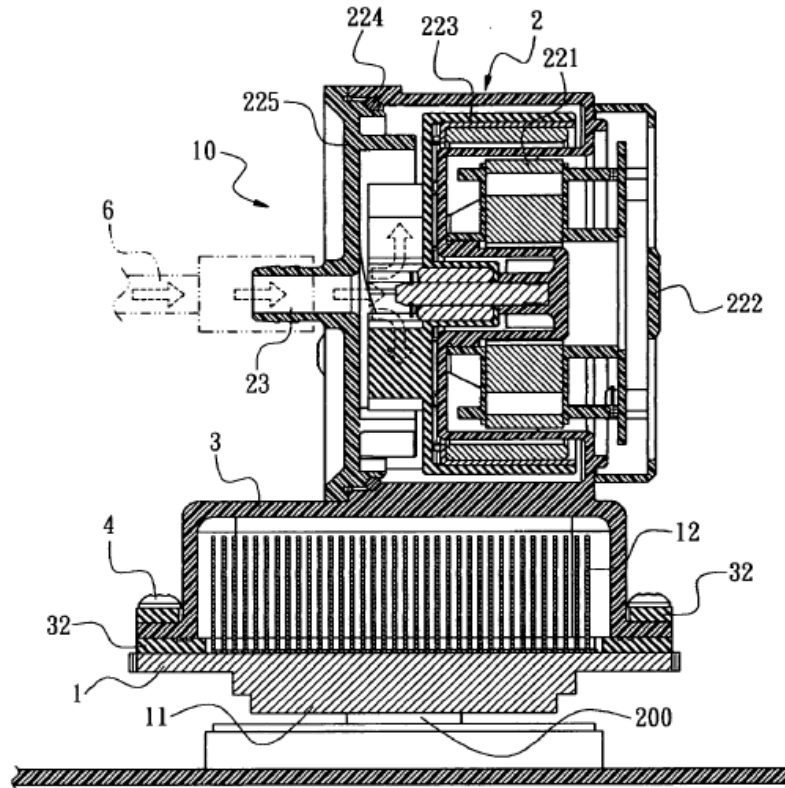
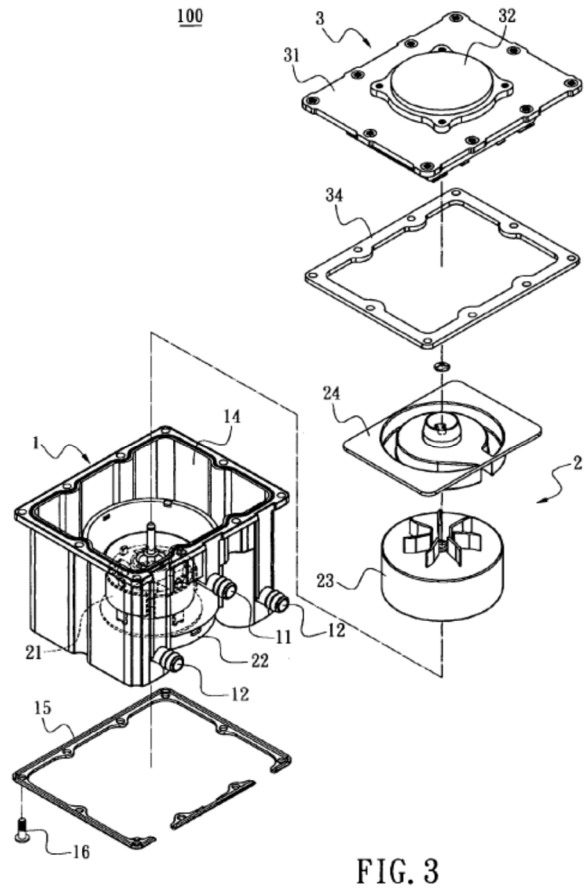
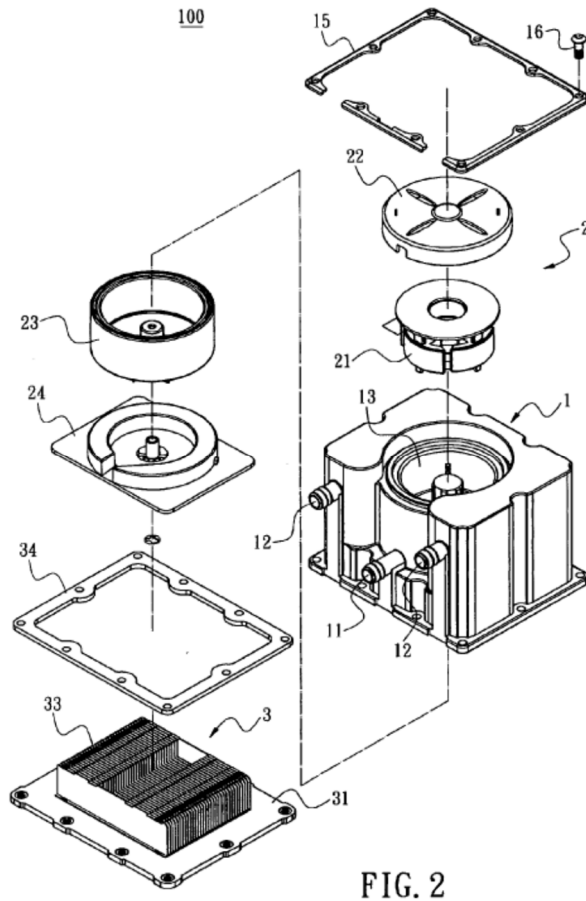


FIG. 7

(Ex-1007, FIG. 7; Ex-1005, ¶77.)

Duan in view of Duan-I also teaches limitation [1a] of the '681 patent. Duan-I teaches a cooling system with the impeller (23) positioned on the “one side” of the chassis (casing 1) contacting the liquid and a pump including a motor and a stator (coil stage 21) positioned on the “opposite side” of the chassis (casing 1) isolated from the liquid:



(Ex-1008, FIGS. 2-3; [0021].) As shown above, Duan's liquid driving unit 2 is oriented in a direction 90° from that of Duan-I's liquid driving unit 22. (See Ex-1005, ¶78.)

A POSITA would have recognized that Duan's liquid driving module 22 is oriented in a way such that the overall device is taller than Duan-I, as shown below:

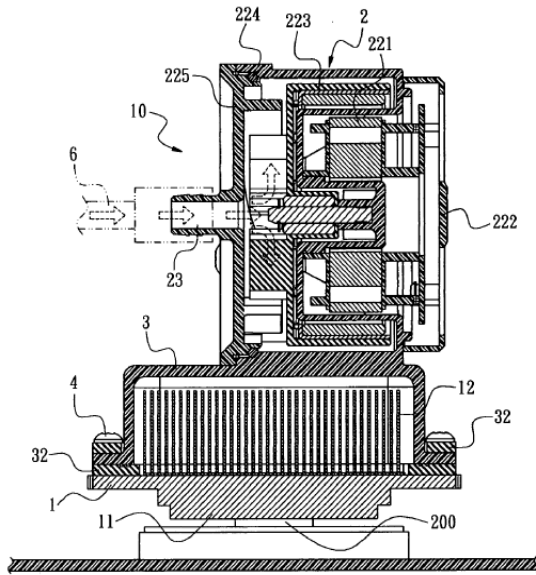


FIG. 7

Duan

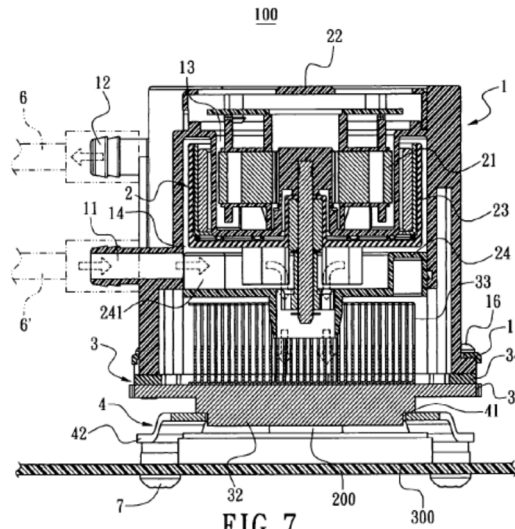
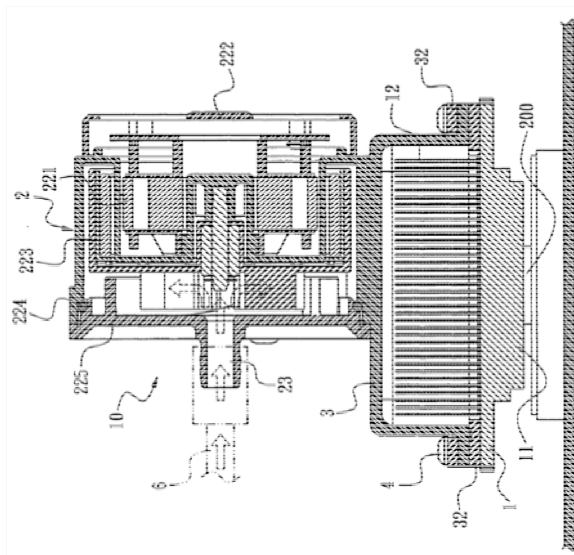


FIG. 7

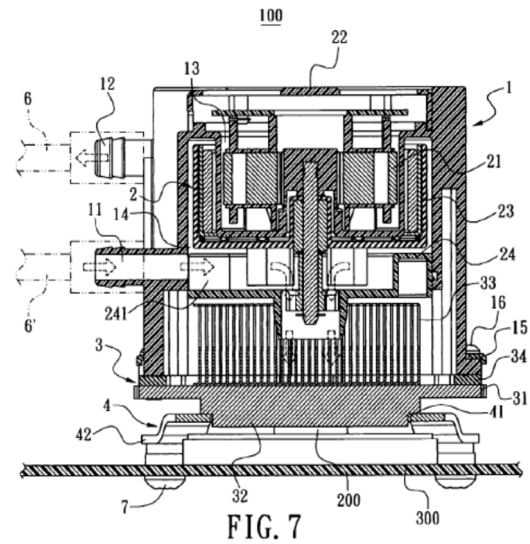
Duan-I

(Ex-1005, ¶79.)

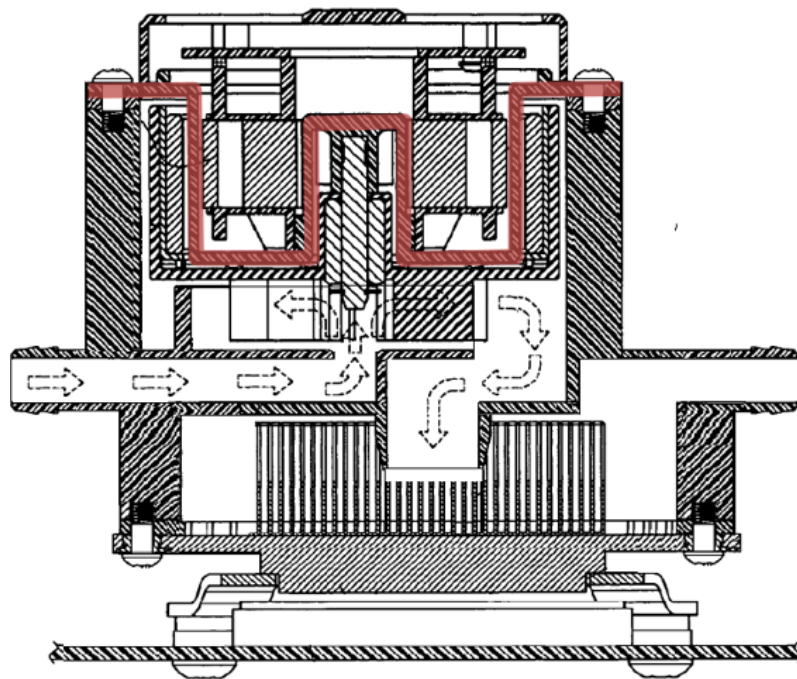
As explained previously, given the known “compact trend of computer[s]” recognized by Duan [0006], a POSITA would have been motivated to rotate Duan’s liquid driving module 2 (pump) counterclockwise by 90 degrees in Figure 7 to reduce the system’s overall height, in view of Duan-I. (Ex-1005, ¶80.) Although modifying Duan in this fashion would require some minor rearrangements, doing so would have been well within a POSITA’s technical grasp, and would have predictably resulted in a modified system like the one below (double-sided chassis outlined in red):



Duan (rotated 90° CCW)



Duan-I



Duan+Duan I

(Ex-1005, ¶80.)

Thus, Duan, as modified above in view of Duan-I, teaches a double-sided

chassis (accommodation chamber 21) adapted to mount a pump (liquid driving unit 22) configured to circulate a cooling liquid, the pump comprising a motor and a stator (coil stage 221) and an impeller (impeller stage 223), the impeller being positioned on the “one side” of the chassis and the motor and the stator (221) being positioned on the “opposite side” of the chassis and isolated from the cooling liquid. (Ex-1005, ¶81.)

[1b] “a reservoir adapted to pass the cooling liquid there-through, the reservoir including:” (See Ex-1005, ¶¶82-85.)

This limitation is identical to limitation [1b] of claim 1 of the ’764 patent, which was cancelled in the ’764 patent IPR, and is thus disclosed by the combination of Duan and Duan-I as a matter of law. *B&B Hardware, supra*.

Nonetheless, Duan discloses [1b]. Duan discloses a “liquid cooling cyclic mechanism 100...composed of the **cooling plate module 10** and a water tank module 20 connected with the cooling plate module 10 through ducts.” (Ex-1007, [0022], FIG. 6.) The structure of the cooling plate module 10 is illustrated below:

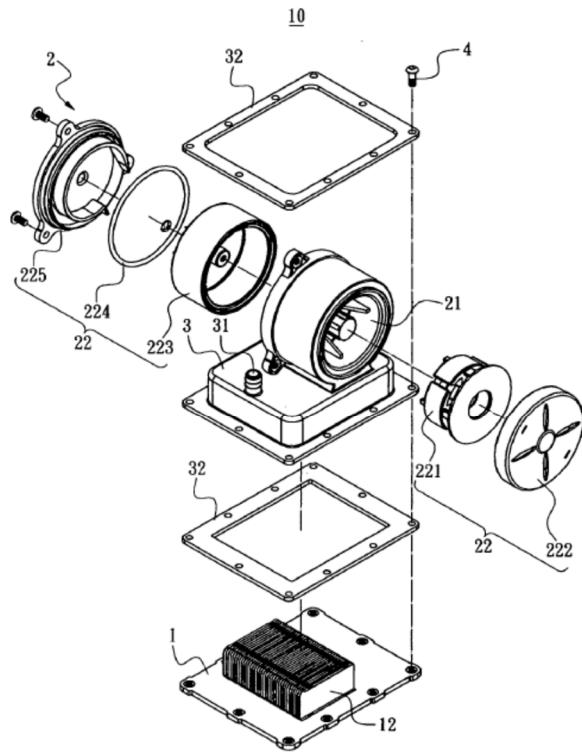


FIG. 2

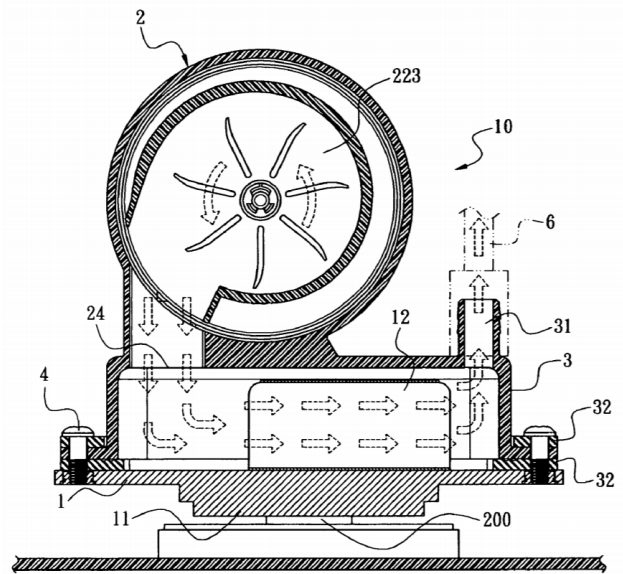


FIG. 8

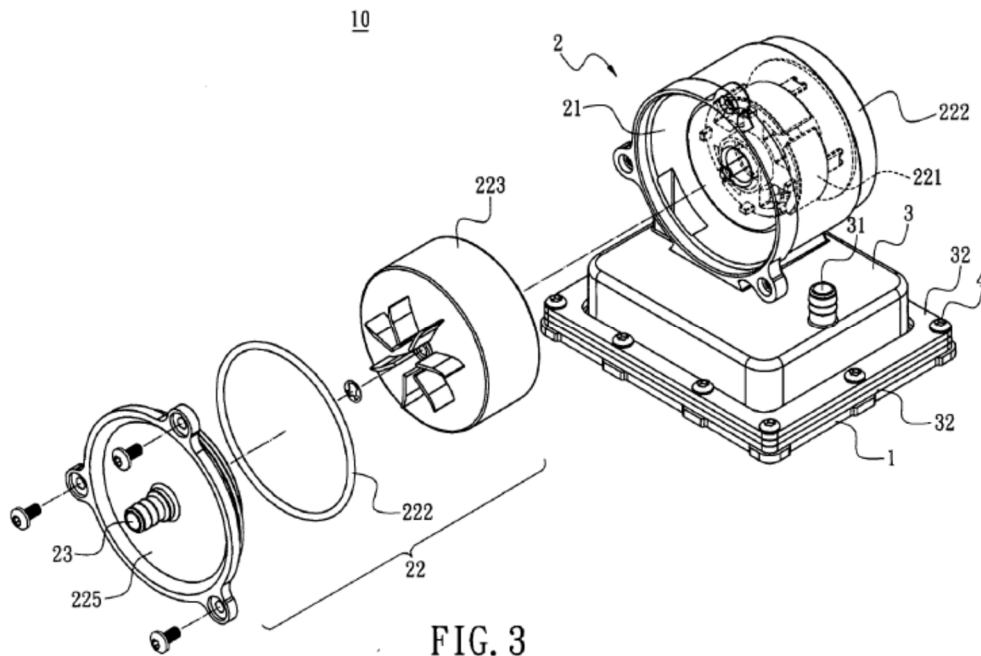
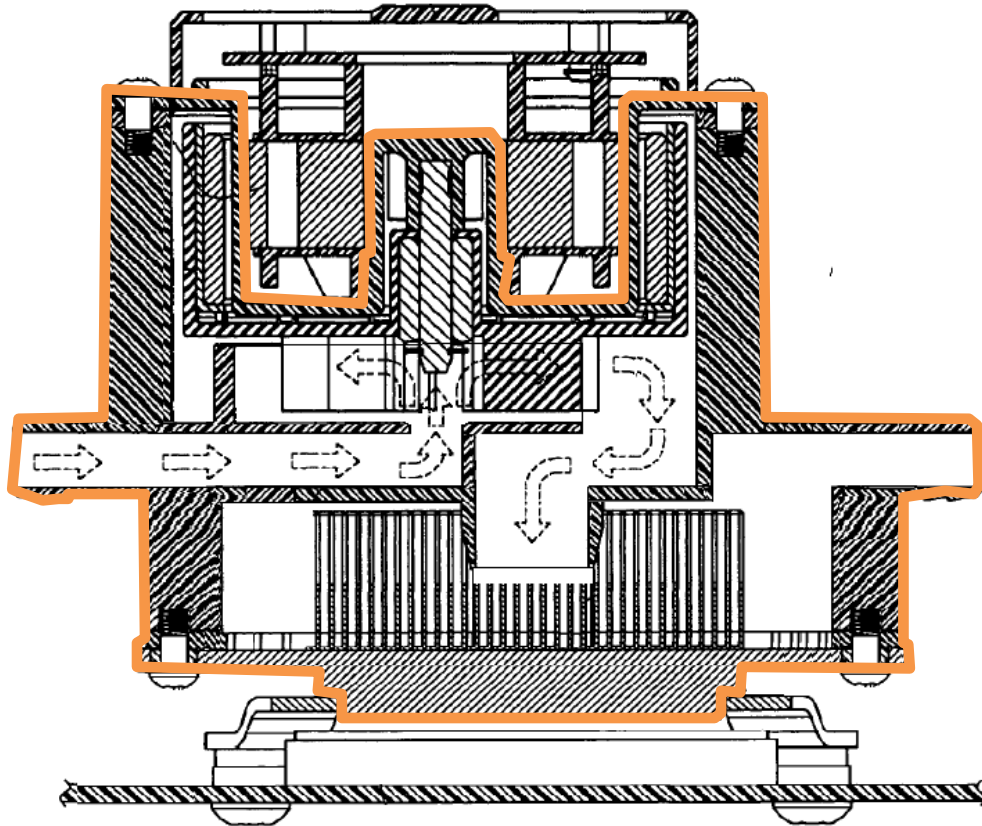


FIG. 3

Cooling plate module 10 includes a reservoir—i.e., a single receptacle defining a

fluid flow path—in which the cooling fluid enters accommodation chamber 21 of the module via inlet 23, flows through outlet 24 into the closed space defined by cap 3 and cooling plate 1, and exits at second liquid outlet 31. (Ex-1007, [0023] (“The lower cover 225 comprises a liquid inlet 23 communicated with the accommodation chamber 21. A first liquid outlet 24 is communicated to the bottom of the accommodation chamber 21 and is enclosed by a cap 3. A second liquid outlet 31 is defined on the cap 3. The cooling plate 1 is assembled with the cap 3 to define a closed space therein....”); [0024] (“[S]ealing pads 32 are provided between the cap 3 and the cooling plate 1 and provided atop the cap 3...The cooling plate 1 is fixed to bottom of the cap 3....”); [0025]; [0027] (“[T]he cool liquid in the water tank 20 is conveyed to the accommodation chamber 21 through...the liquid inlet 23 of the cooling plate module 10 and driven by the liquid driving unit 22. The cool liquid then flows to the cap 3 through the first liquid outlet 24 for heat dissipating the heat-dissipating plates 12 in the cap 3...The hot liquid then flows to the liquid entrance region 51 of the water tank 20 through the second liquid outlet 31....”).) Accordingly, Duan teaches a reservoir (accommodation chamber 21, cap 3, and cooling plate 1) adapted to pass the cooling liquid therethrough. (Ex-1005, ¶¶82-83.)

When Duan is modified in view of Duan-I by rotating the pump (*see* limitation [1a] above), the modified system also satisfies this limitation, as shown below (reservoir outlined in orange):



(Ex-1005, ¶84.) This combination was already previously adopted by the Board in the '764 patent IPR. (Ex-1004 at 13.)

Thus, Duan in view of Duan-I renders obvious limitation [1b]. (Ex-1005, ¶85.)

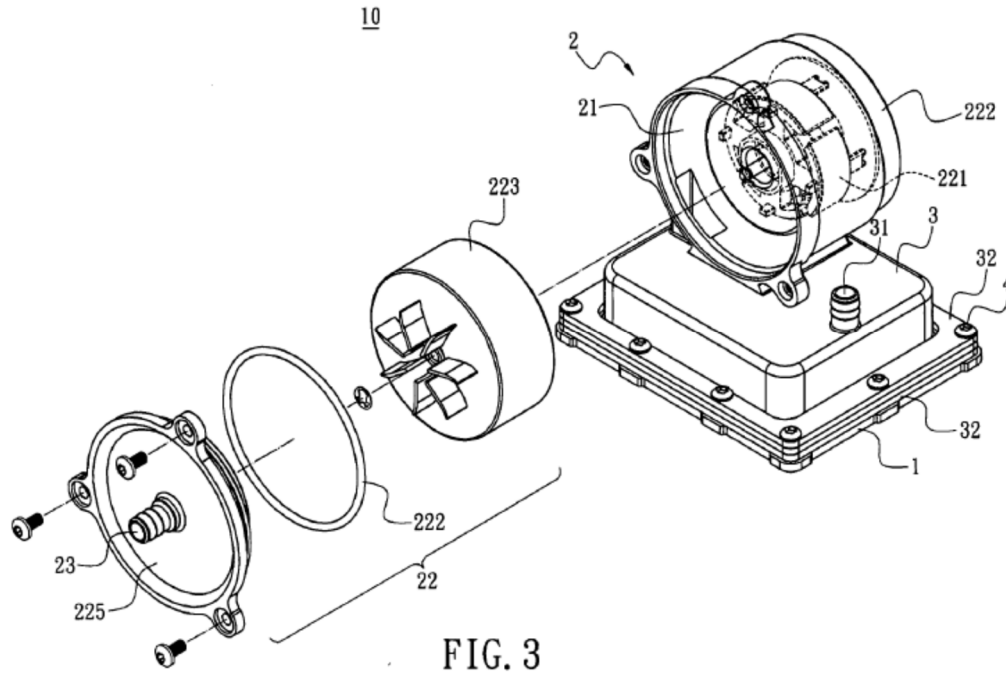
[1c] “a pump chamber including the impeller; and,” (See Ex-1005, ¶¶86-88.)

This limitation includes the same language as that in limitation [1c] of claim 1 of the '764 patent (“a pump chamber including the impeller ...”), which was cancelled in the '764 patent IPR, and is thus disclosed by the combination of Duan and Duan-I as a matter of law. *B&B Hardware, supra*.

Nonetheless, both Duan and Duan in view of Duan-I teach limitation [1c].

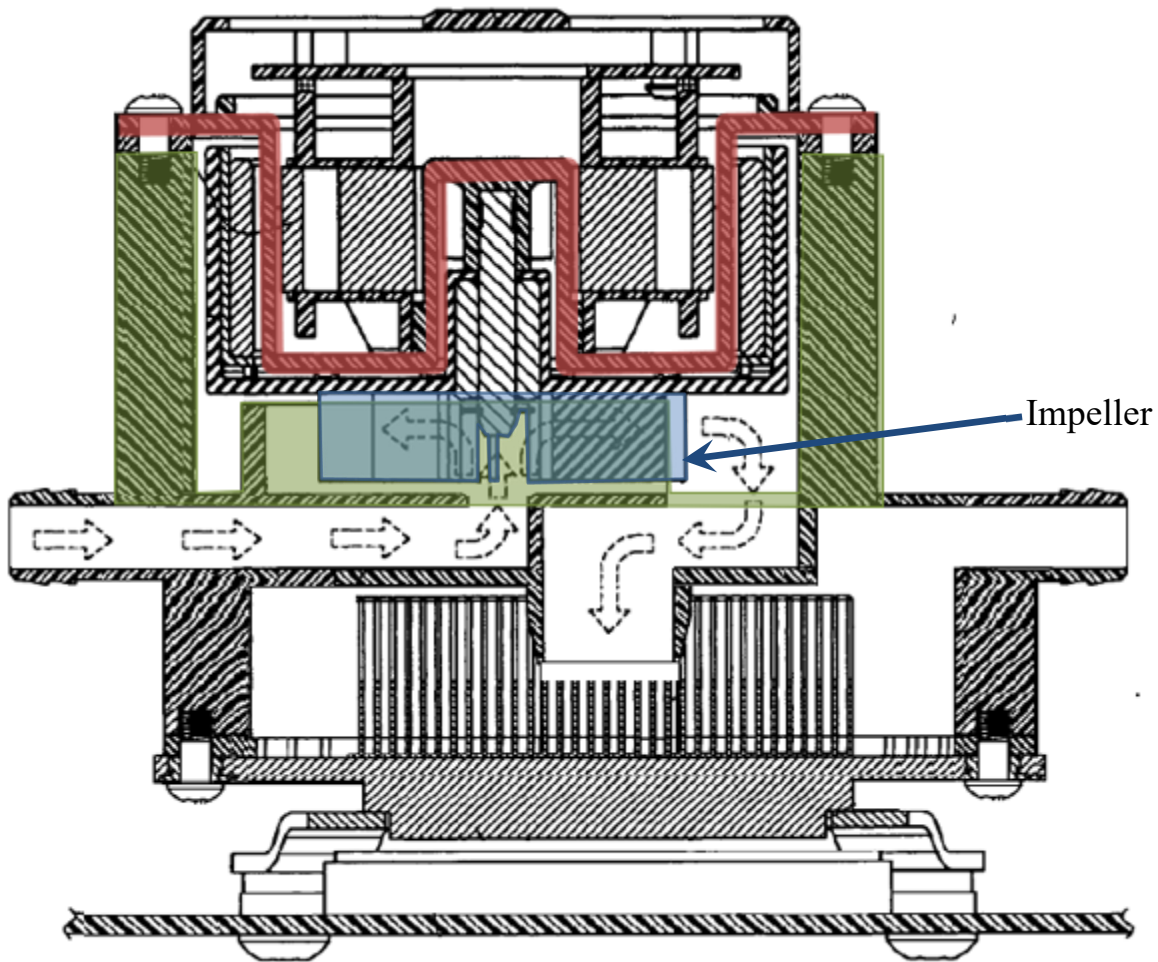
FIG. 3 of Duan illustrates a pump chamber (at the near end of accommodation

chamber 21 in FIG. 3) including an impeller (223). (Ex-1005, ¶86.)



(Ex-1007, FIG. 3.)

When Duan is modified in view of Duan-I by rotating the pump (*see* limitation [1a] above), this limitation is also satisfied, as shown below (with the chassis in red and impeller (in blue) within the pump chamber — i.e., the space surrounded by the impeller cover (green) and under the chassis (red)):



Thus, Duan in view of Duan-I renders obvious limitation [1c].

[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;” (See Ex-1005, ¶¶89-92.)

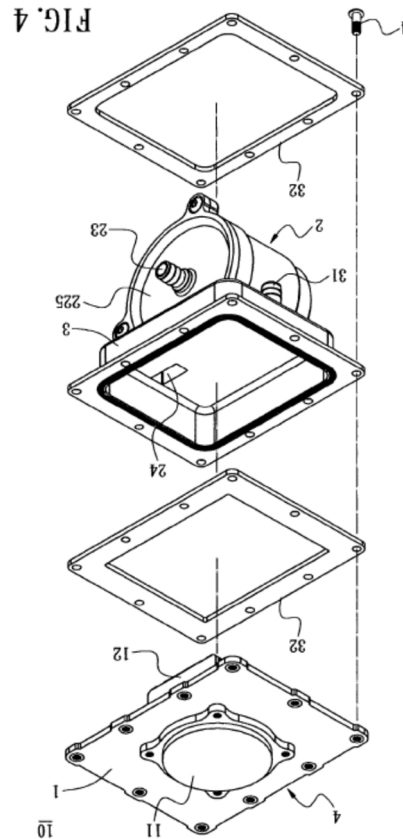
This limitation is patentably indistinct from limitation [1d] of claim 1 of the '764 patent, which was cancelled in the '764 patent IPR, and is thus disclosed by the combination of Duan and Duan-I as a matter of law. *B&B Hardware, supra*:

'681 limitation 1[d] of claim 1	'764 limitation 1[d] of claim 1
“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 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 chambers that are fluidly coupled;”

The highlighted text in the above comparison table shows the patentably indistinct portion between the '681 limitation [1d] and the '764 limitation [1d].

As an initial matter, a POSITA would have understood that both the pump and thermal exchange chambers are conventionally “enclosed” to contain the cooling liquid / prevent the cooling liquid from would leaking out. (Ex-1005, ¶89.) Indeed, in the Prior IPR involving the '681 patent, Patent Owner never challenged that Duan’s chambers are “enclosed.” *See generally* Ex-1013.

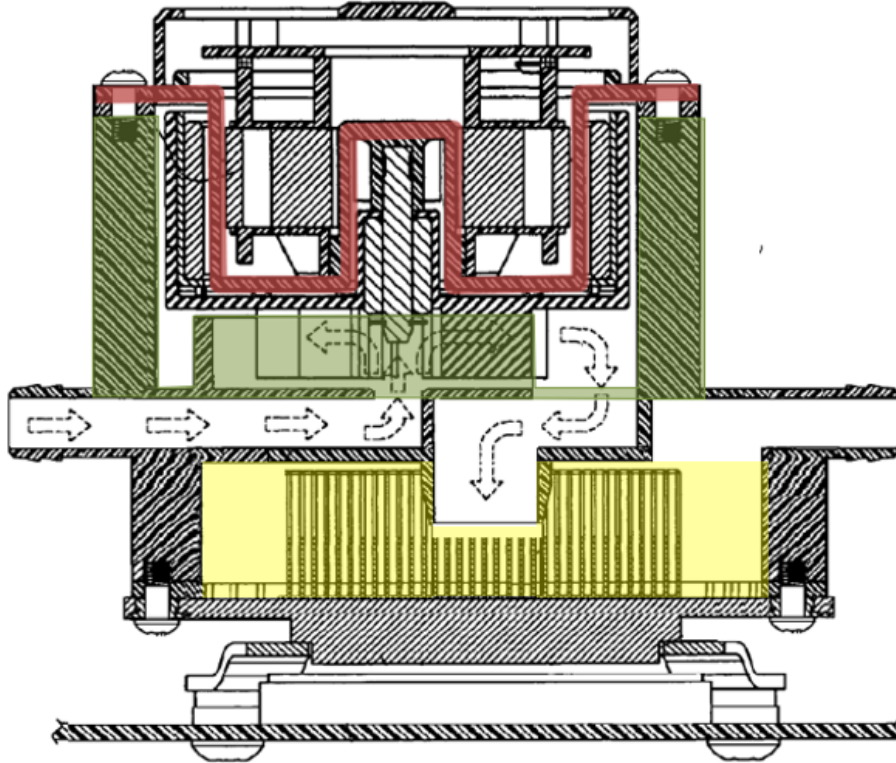
In any event, Duan in view of Duan-I teaches this limitation [1-d].



(Ex-1007, FIG. 4 (rotated upside-down).) As shown, Duan discloses a thermal exchange chamber (the space bounded by inside of cap 3 and top of cooling plate 1) formed below the pump chamber (accommodation chamber 21) and vertically spaced apart from the pump chamber (with reference to each other and the heat exchanging interface), the pump chamber and the thermal exchange chamber being separate enclosed chambers fluidly coupled together by the one or more passages (liquid inlet 24). (Ex-1005, ¶90.)

When Duan is modified in view of Duan-I by rotating the pump (*see* limitation [1-a] above), the modified system also satisfies this limitation, as shown below, with the thermal exchange chamber shaded yellow and formed below and vertically

spaced from the pump chamber — i.e., the space inside the impeller cover and under the chassis) — with both chambers being “enclosed”:



(Ex-1005, ¶91.)

Thus, Duan in view of Duan-I renders obvious limitation [1d].

[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;” (See Ex-1005, ¶¶93-97.)

A POSITA would have understood that Duan discloses a heat-exchanging interface (e.g., cooling plate 1) removably coupled (e.g., via bolt units 4) to the reservoir (e.g., accommodation chamber 21, cap 3, and cooling plate 1), the heat-exchanging interface forming a boundary wall of the thermal exchange chamber

(e.g., cap 3 and cooling plate 1) and configured to be placed in thermal contact (e.g., via heat-absorbing face 11) with a surface of the heat-generating component (e.g., CPU 200). For example, Duan teaches:

The cooling plate 1 comprises a heat absorbing face 11 on bottom thereof and being in contact with a heat source. A plurality of heat-dissipating plates 12 are formed on top face of the cooling plate 1 and can be arranged in longitudinal or transverse manner.

(Ex-1007 at [0022]; *see also id.* at [0024] and [0027].) Duan further states “sealing pads 32 are provided between the cap 3 and the cooling plate 1 and provided atop the cap 3, and are retained by bolt units 4.” (Ex-1007 at [0024].) A POSITA would have understood that the use of bolt units 4 to secure the cooling plate 1 indicates the cooling plate 1 is *removable* by unscrewing the bolts. Thus, the cooling plate 1 is removably coupled to the reservoir. (Ex-1005, ¶93.) FIGS. 7 and 8 are also illustrative:

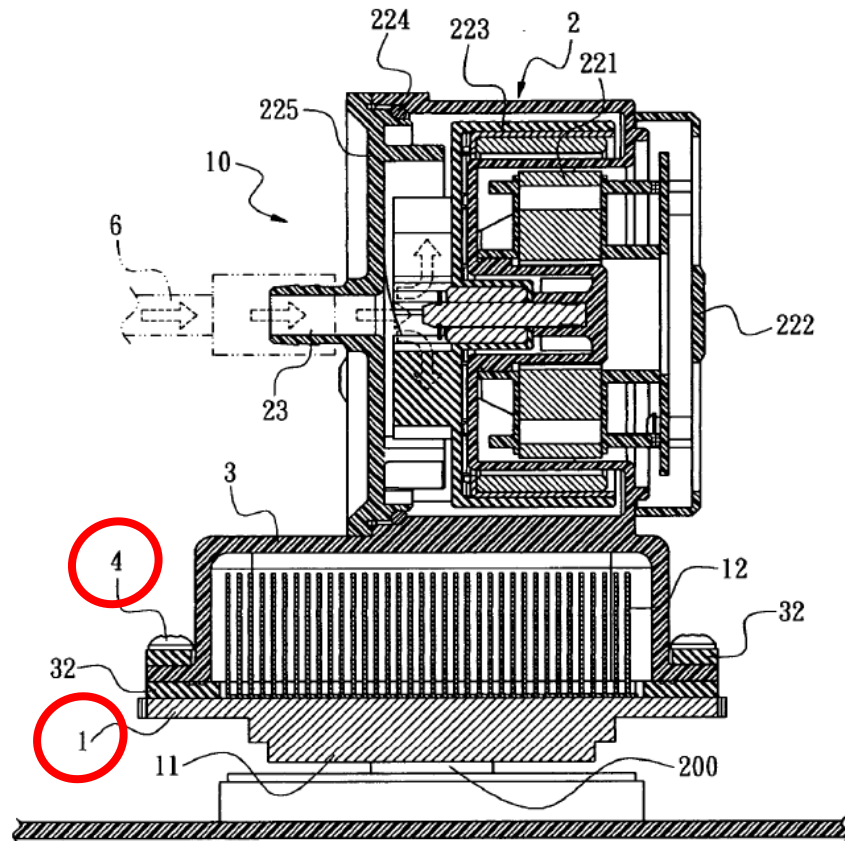
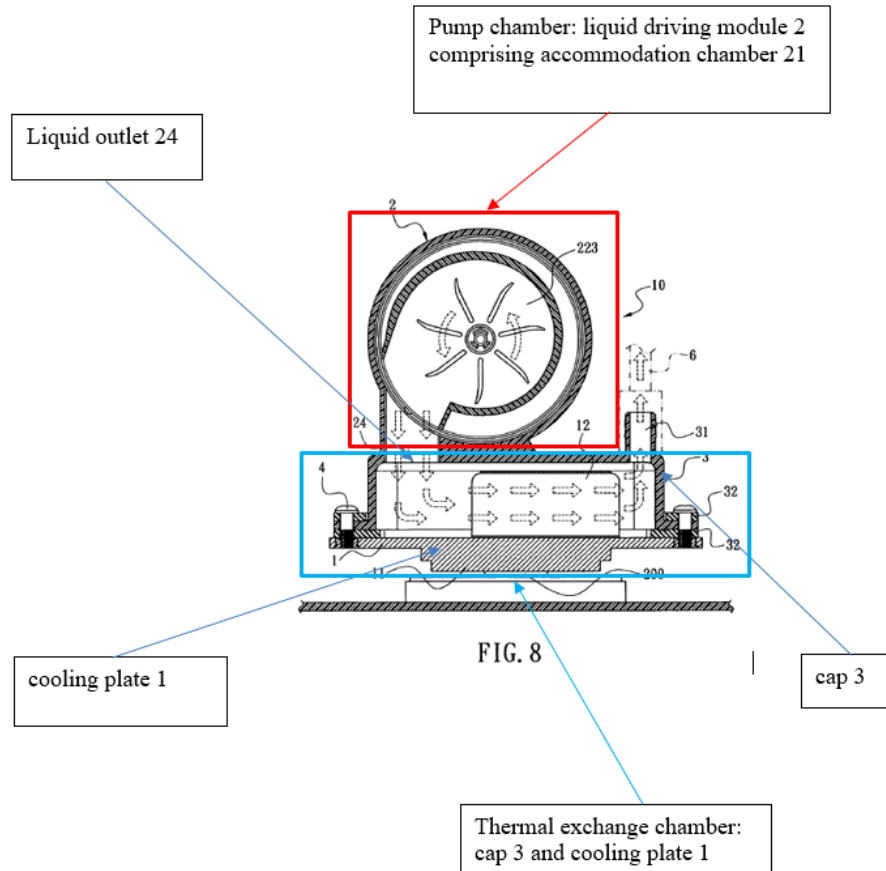


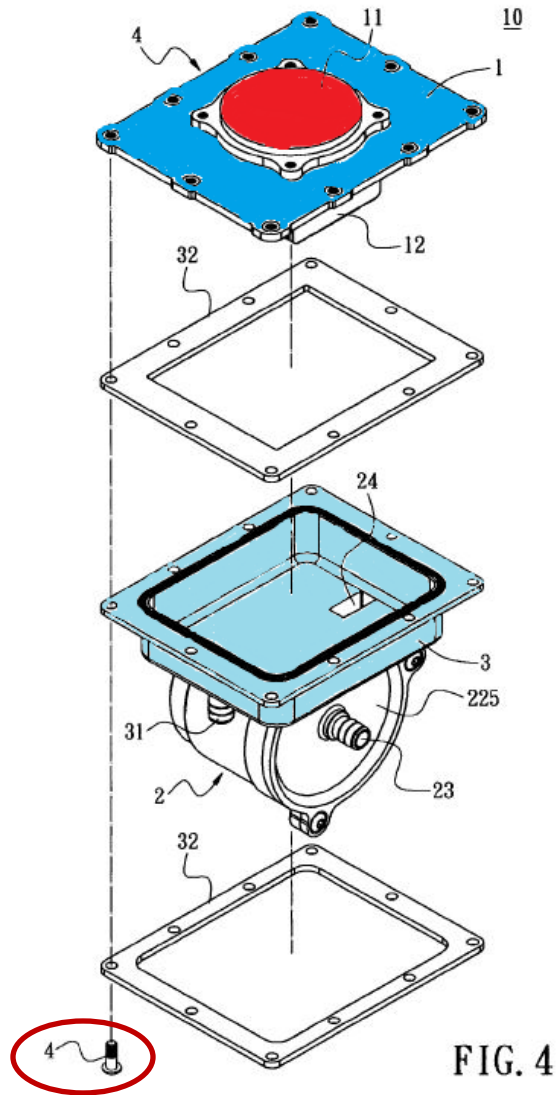
FIG. 7

FIG. 7 of Duan shows a heat-exchanging interface (e.g., cooling plate 1) removably coupled (e.g., via bolt units 4). This is also depicted below in FIG. 8:



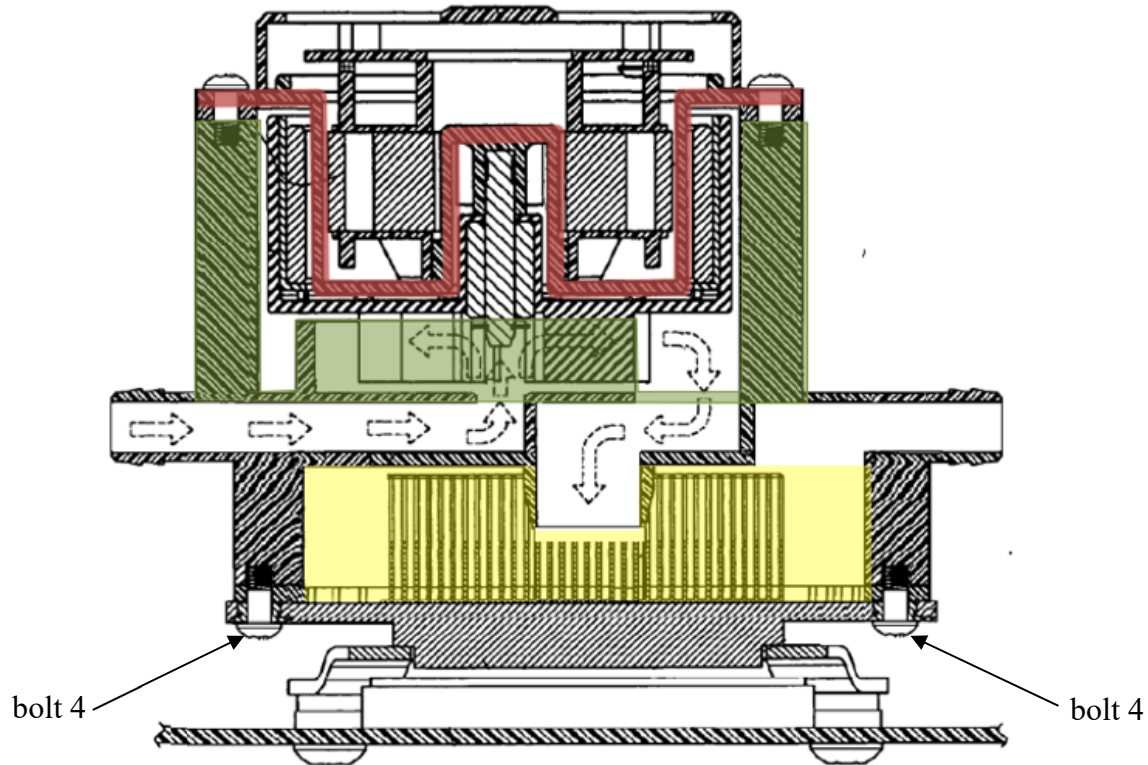
Reproduced below is a colored version of FIG. 4 of Duan that uses the following color coding scheme and illustrates the disclosure of this limitation. Again, the use of bolt 4 indicates the plate 1 is removably coupled:

Color	Duan Element
Red	Heat-absorbing face 11
Light blue	cap 3
Dark blue	cooling plate 1



(Ex-1005, ¶¶93-95.)

When combined with Duan-I, Duan's use of bolts to removably secure the heat-exchange interface does not change, as shown below:



Thus, Duan in view of Duan-I renders obvious this limitation.

[1f] “a heat radiator adapted to pass the cooling liquid there-through, 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;”
(See Ex-1005, ¶¶98-100.)

A POSITA would have understood that Duan discloses a heat radiator (e.g., cooling stage 53, heat-dissipating fins 531, and runners 532 which are components within box 5) adapted to pass the cooling liquid there-through (e.g., via ducts 6, liquid inlet 511, and liquid outlet 521), fluidly coupled to the reservoir (e.g.,

accommodation chamber 21, cap 3, and cooling plate 1) via conducts (e.g., ducts 6), and configured to dissipate heat from the cooling liquid (e.g., duct 6, liquid inlet 511, and liquid outlet 521). This is shown with respect to FIG. 6 of Duan, reproduced below:

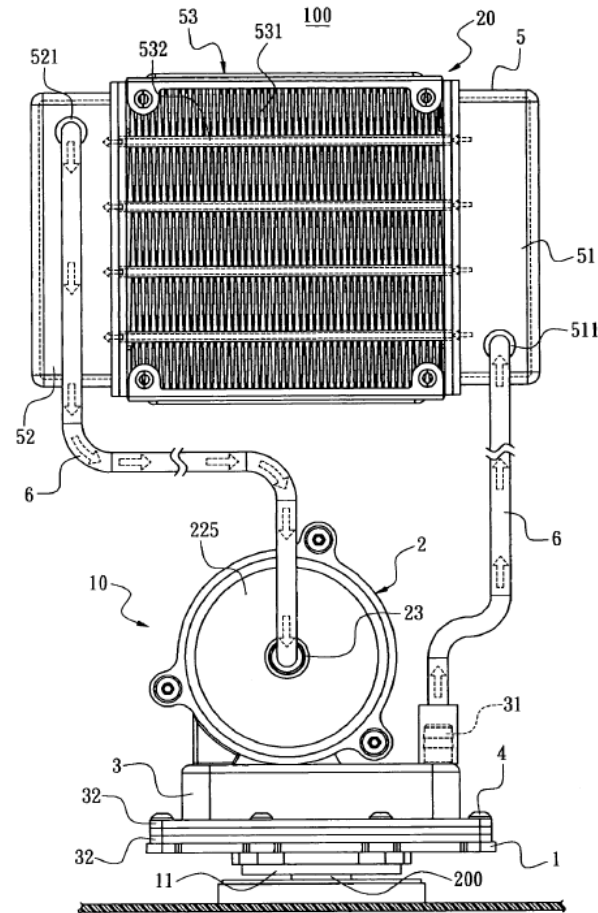


FIG. 6

With reference to Figure 6, Duan teaches:

As shown in FIG. 6, the water tank 20 of the liquid cooling cyclic mechanism 100 comprises a box 5 with a liquid entrance region 51 and a liquid exit region 52 provided on both sides of the water tank 20, respectively. The box 5 comprises a cooling stage 53 at center

thereof and composed of a plurality of stacked heat-dissipating fins
531 arranged in rows.

(Ex-1007 at ¶0025.) Based on these disclosures, a POSITA would further understand from the teachings of Duan that the heat radiator, which is to be mounted on the side of the computer case, is positioned at a location horizontally spaced apart by at least some distance from the heat-generating CPU. (*Id.*; see Ex-1007 at FIG. 6.) For example, FIG. 1 of Duan (reproduced and annotated below) shows arranging components along a horizontal plane such as a radiator (e.g., cooling stage 30a with heat dissipating fins 303a, which a POSITA would have understood is a radiator) and a heat-generating component (e.g., 200a).

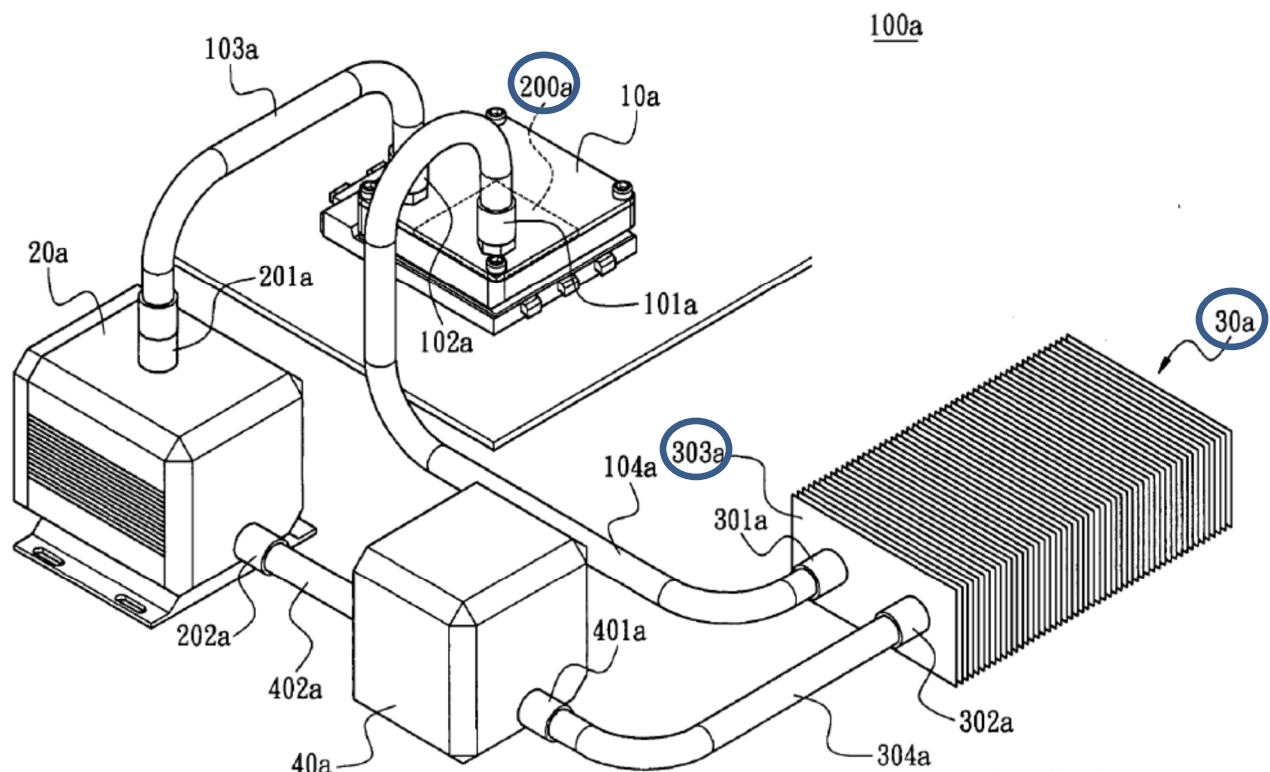
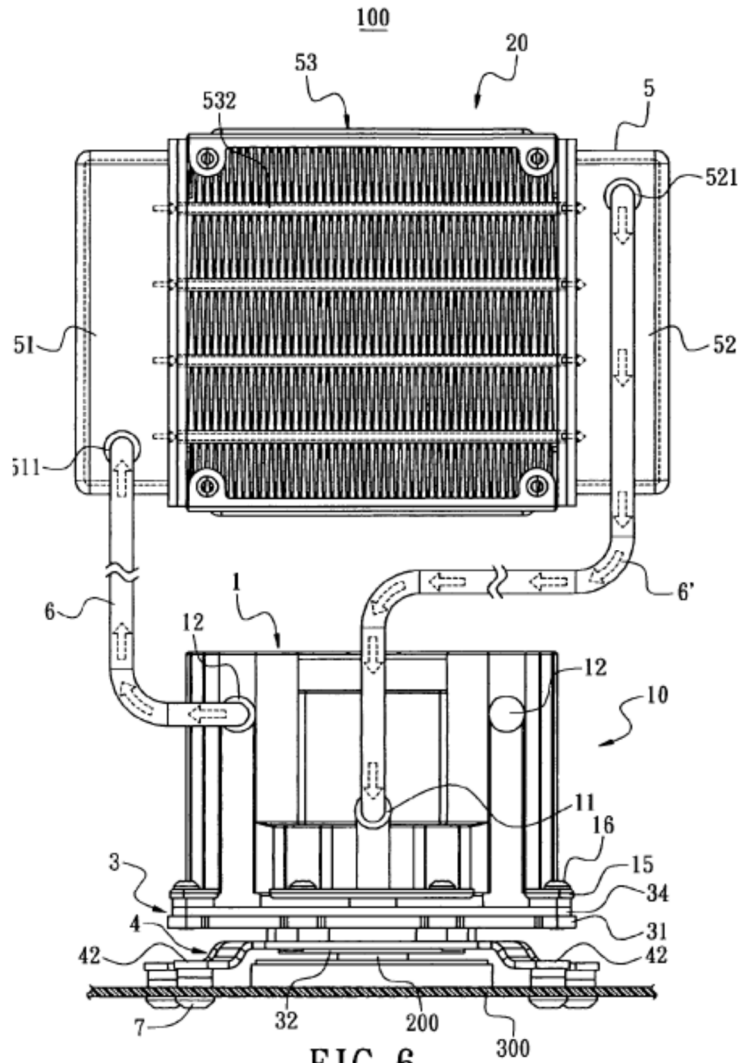


FIG. 1
PRIOR ART

Thus, Duan renders obvious this limitation. Duan-I similarly discloses a radiator, as shown below:



(Ex-1008 at 7.) Thus, the combination of Duan+Duan-I teaches this limitation.

[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”
(See Ex-1005, ¶¶101-104.)

The combination of Duan+Duan-I does not expressly teach this limitation, but Shin does. Thus, the Duan+Duan-I combination in view of Shin renders obvious this limitation.

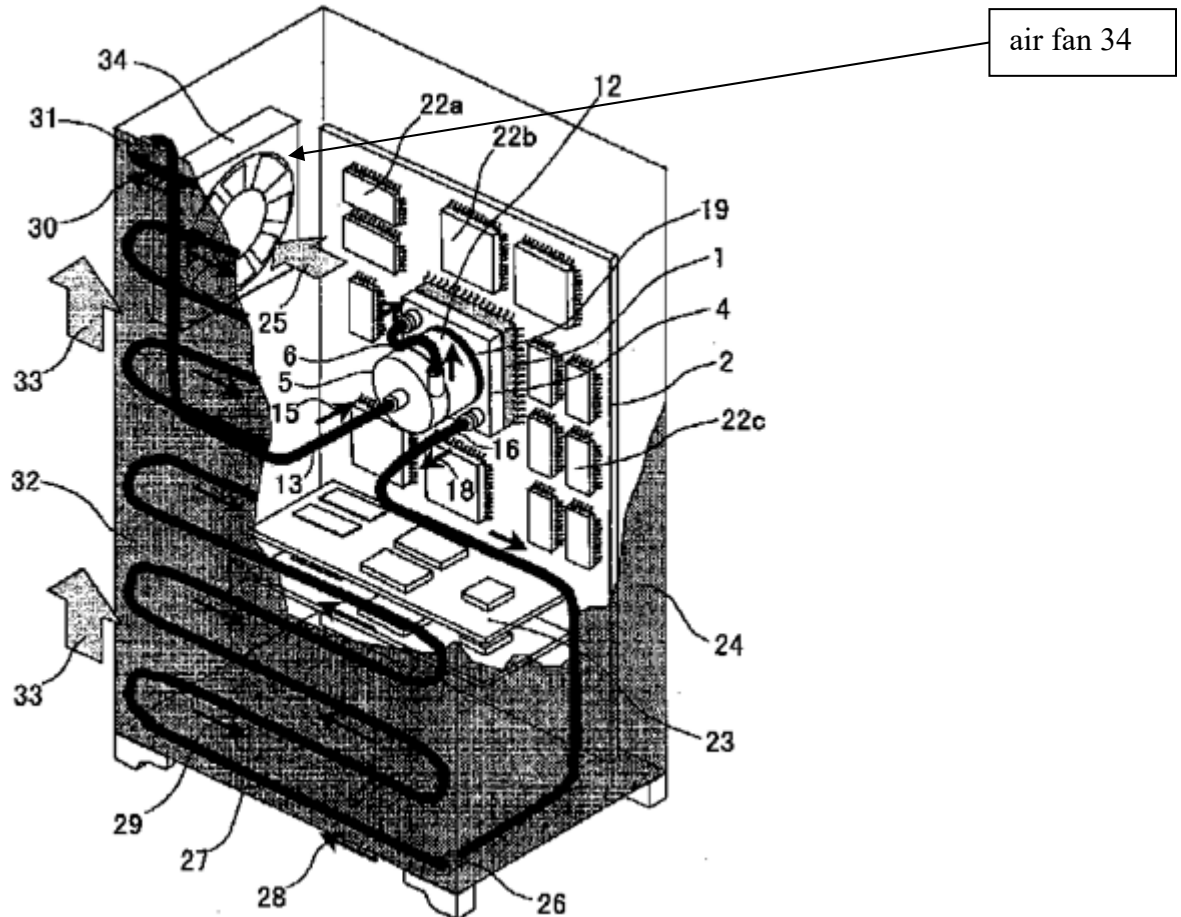
As discussed above, Duan discloses a radiator by describing a box 5 that includes a cooling stage 53, heat-dissipating fins 531, and runners 532. Duan’s radiator is separate from the motor of the pump (e.g., liquid driving unit 22). (See, e.g., Ex-1007 at FIG. 6.) A POSITA reading FIG. 6 of Duan would have understood that the heat-dissipating fins 531 release heat through air. In other words, the heat-dissipating fins heat up and release the heat to the surrounding air such that the air transfers heat away from the heat dissipating fins 531. (*Id.*)

Because stagnant air will continue to heat up, a POSITA was well-aware before the ’681 patent to use a fan to disperse stagnant hot air. For example, Shin documents the conventional practice of using a fan to disperse hot air accumulated at a radiator. For example, Shin teaches: “[u]sing a DC motor *allows the motor speed to be easily changed by changing the DC voltage, thus enabling control of cooling power.*” (Ex-1009 at [0019].) Shin also teaches with respect to the embodiment in FIG. 3:

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.* at [0023]-[0024].) These elements are also shown in FIG. 3:

FIG. 3



(*Id.* at FIG. 3.) Based on these teachings, a POSITA would have understood that Shin discloses or suggests an air fan (34) configured to direct air through a heat radiator, the fan being driven by a motor separate from the motor of the pump.⁸

⁸ The AAPA confirms the teachings of Shin in relation to the conventional use of a fan. (Ex-1001 at 10:50-65 & FIG. 3 (labeled as prior art; acknowledging that that it

Indeed, a POSITA would have found it obvious to add a fan to any liquid-cooling system to direct air through the heat radiator for breaking up stagnant hot air. A POSITA would have further found it obvious, as a matter of basic design of a liquid-cooling system, that such a prior art air fan would need to be driven by a motor separate from the motor of the pump because this would allow for the individual operation of the fan and the pump, which is advantageous to independently regulate the airflow and the liquid flow to achieve an optimal efficiency of the system while reducing noise. (Ex-1005, ¶¶101-104.) Also, as explained previously, a motor that drives an air fan is typically of a different construction than, and physically separate from, a motor that drives an impeller to move cooling liquid. Given that these motors are typically of different construction and physically separate from each other, it would have been obvious to a POSITA to independently control them. *Id.* at ¶60.)

Thus, Duan in view of Duan-I and Shin renders obvious this limitation.

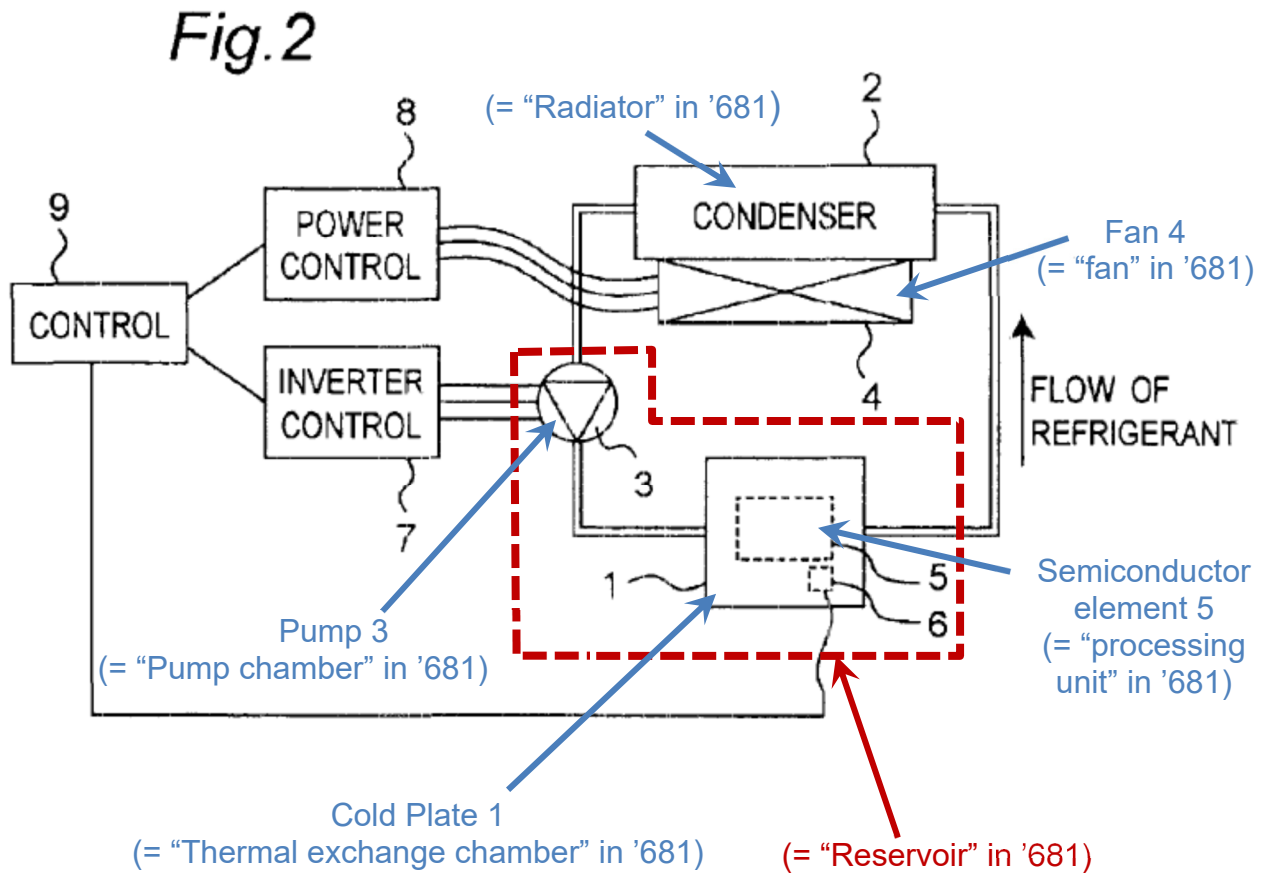
[1h] “a control system configured to independently control a speed of the pump and a speed of the fan;” (See Ex-1005, ¶¶105-108.)

The combination of Duan and Duan-I does not expressly disclose or teach this limitation, but Nakano does. Specifically, Nakano teaches “[t]he semiconductor

was already known to that liquid-cooling systems included an air fan “provided together with the heat radiator” and for “blowing air through the heat radiator.”)

cooling device shown in FIG. 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. A refrigerant is filled in this refrigerating cycle. The condenser 2 is adapted to be cooled by a fan 4.”
(Ex-1010, 2:38-45.)

A POSITA would have understood Nakano’s cooling system to be similar to that of the ’681 patent, as demonstrated by the followed annotated version of Nakano FIG. 2 (Ex-1010, FIG. 2; Ex-1005, ¶106):



Nakano also states that “the 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.” (Ex-1010, 2:57-60.) Nakano further states:

In accomplishing the above and other objectives, the semiconductor cooling device according to the present invention includes a cold plate for cooling a semiconductor element, a condenser, and an inverter-controlled refrigerant pump, all of which are fluid connected in series with each other to define a refrigerating cycle. The semiconductor cooling device also includes a fan for cooling the condenser, a temperature detector disposed in proximity to the semiconductor element, and a controller for controlling the refrigerant pump and the fan. **The controller controls the number of revolutions of the refrigerant pump and that of the fan depending on a value measured by the temperature detector.** The temperature detector may be accommodated in the semiconductor element.

(Ex-1010, 1:42-55.) Nakano also discloses or teaches “adjust[ing] the pump speed” as follows (Ex-1005, ¶107):

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.

The 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. **The controller 9 is designed so as to preferentially reduce, when the amount of heat emitted from the semiconductor element 5 is less than a predetermined level, the number of revolutions of the fan 4 before that of the refrigerant pump 3,** making it possible to provide a cooling device that is low in noise level.

(Ex-1010, 2:65-3:6; Ex-1005, ¶108.) As shown, Nakano teaches independent control of refrigerant pumps and air fans for purposes of proper temperature regulation and with the added benefit of reduced noise. Reading Nakano, a POSITA would have understood that the controller is capable of adjusting the speed of the pump independent of the fan speed. Nakano therefore discloses or teaches “a control system configured to independently control a speed of the pump and a speed of the fan.” (*Id.*, ¶111.) Thus, Duan+Duan I in view of Shin and further in view of Nakano⁹ renders this limitation obvious. (*Id.*)

⁹ Petitioner also notes that, in IPR2023-00667 filed by Petitioner (which is a joinder to IPR2022-01316), the Board (Ex-1012 at 19-20) found that Nakano teaches similar limitations of the '362 patent (Ex-1014): “a speed of the fan is configured to be

1. The motivation to combine Nakano with Duan, Duan I and Shin.

A POSITA would have been motivated to apply the controller teachings of Nakano to the system taught by Duan, Duan I and Shin. (Ex-1005, ¶¶109-110.) Shin recognized: “[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.*” (Ex-1009, [0019]; *see also id.* at [0006] (“It is an object of the present invention to *provide a cooling structure for electronic devices which* is compact, *has low noise, superior cooling performance* and high reliability.”).) Shin also teaches with respect to the embodiment in FIG. 3:

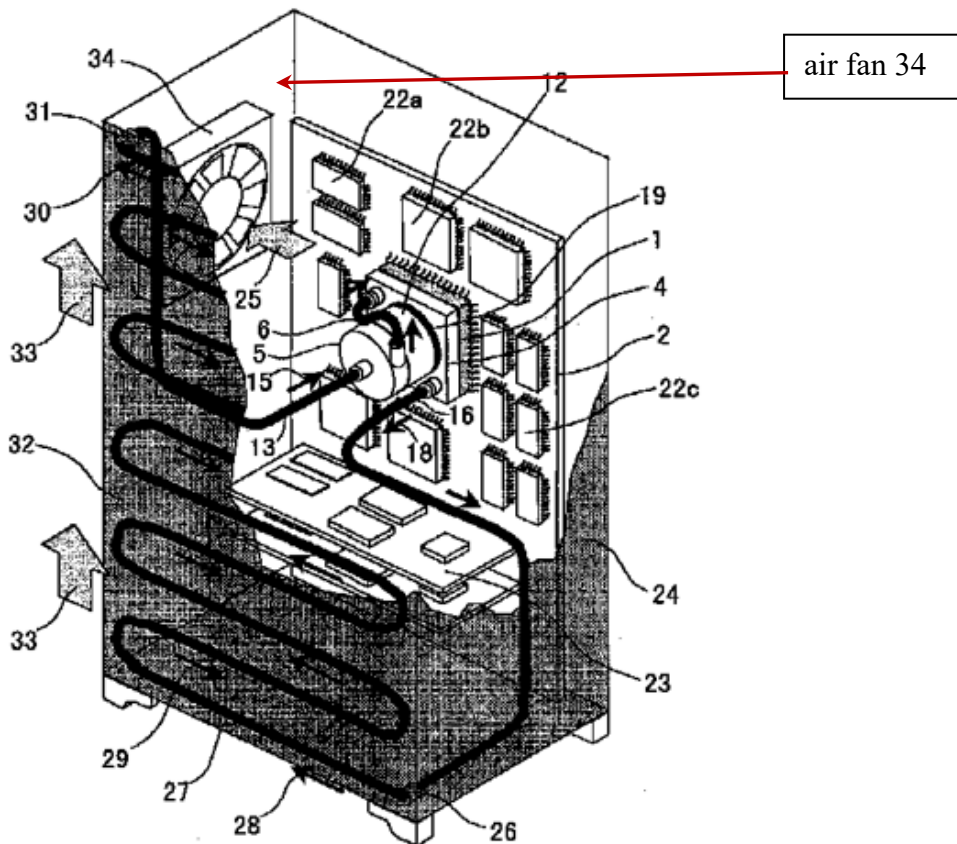
Besides the heat generating element 1, heat generating elements 22a, 22b, 22c, such as memory LSI and driver LSI chips, *which can be cooled by air cooling*, as well as an IO card, memory card, hard disk or other card mounting board 23 are also installed on the wiring board 2. The wiring board 2 is housed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

varied independent of a speed of the impeller of the pump” in claim 12, and “a speed of the impeller is configured to be varied independent of the speed of the fan” in claim 14. The ’362 patent and the ’681 patent significantly overlap (*e.g.*, they share the same Figures 1-16) and disclose similar systems. Compare Ex-1001 with Ex-1014.

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.* at [0024].) These elements are also shown in FIG. 3:

FIG. 3



(*Id.* at FIG. 3; *see also* Ex-1005, ¶109.) Nakano supplements the teachings of Shin by showing that independent control of refrigerant pumps and air fans can help improve temperature regulation while also reducing noise. Thus, a POSITA reading Duan, Duan I, Shin, and Nakano would have been motivated to incorporate Nakano's control system into the Duan, Duan I, Shin system in order to

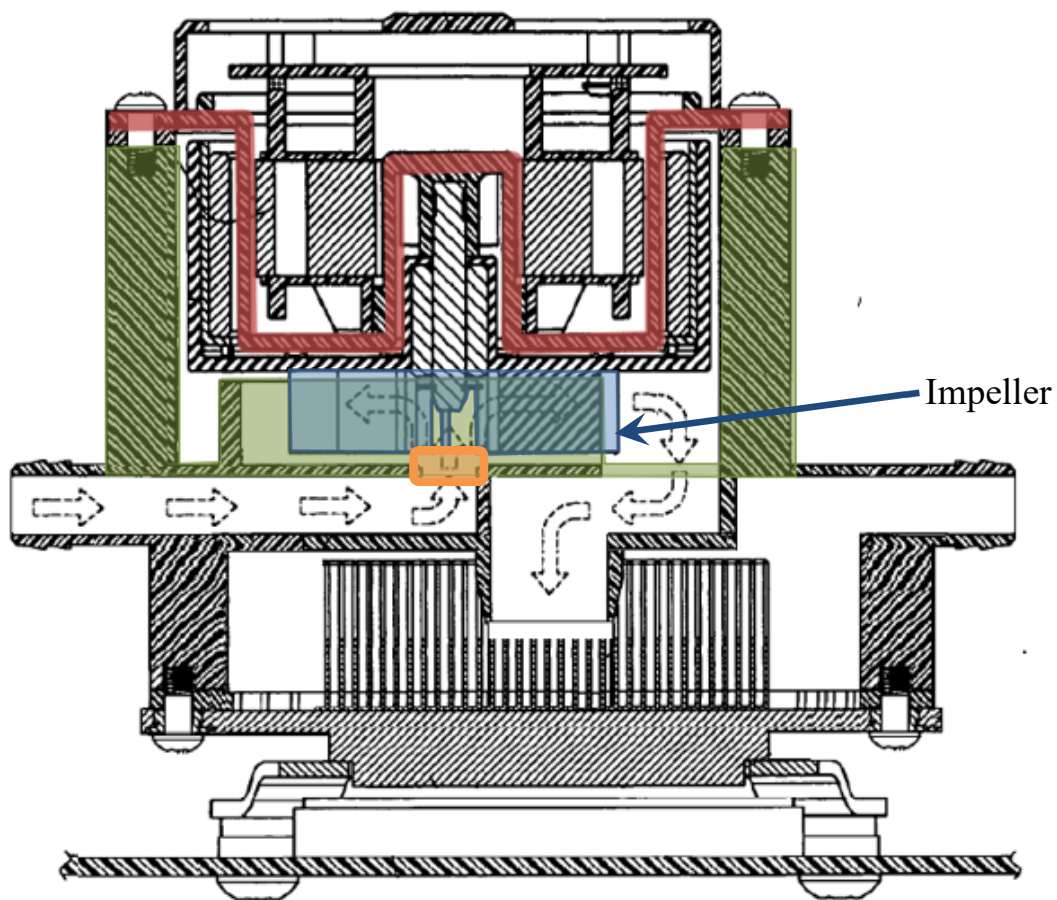
independently adjust the fan speed and the pump speed to meet the needed cooling capacity while also reducing noise. (Ex-1005, ¶110.) The POSITA would have had a reasonable expectation of success because a pump, a fan, and a control system are familiar elements in computer cooling and can be readily used in any suitable computer system with predictable results. (*Id.*); *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 401 (2007) (“a combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results”)

[1i] “wherein the pump chamber includes:” (See Ex-1005, ¶111.)

As discussed above, Duan discloses a pump chamber (e.g., accommodation chamber 21 and lower cover 225). (Ex-1007 at [0023].)

[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;”
(See Ex-1005, ¶¶112-113.)

Duan in view of Duan-I disclose this limitation. As shown below, in the combined Duan+Duan-I device, an inlet (orange) is positioned below the center of the impeller (blue) configured to enable the cooling liquid to flow into the center of the pump chamber:



Thus, Duan in view of Duan-I discloses this limitation.

[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;” (See Ex-1005, ¶¶114-118.)

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).

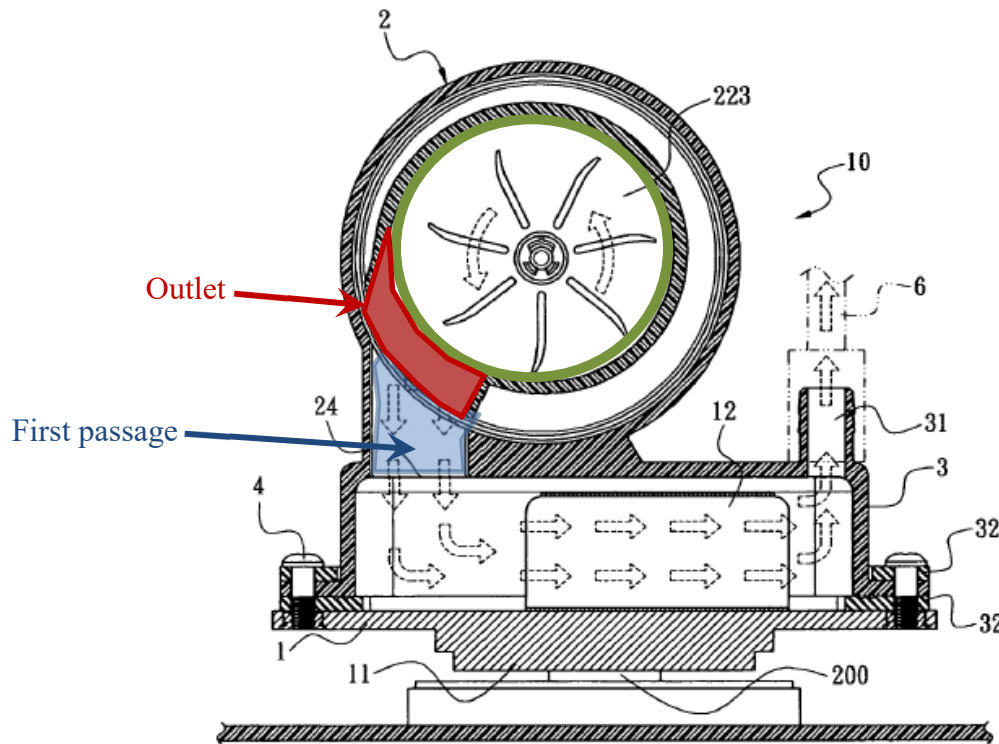


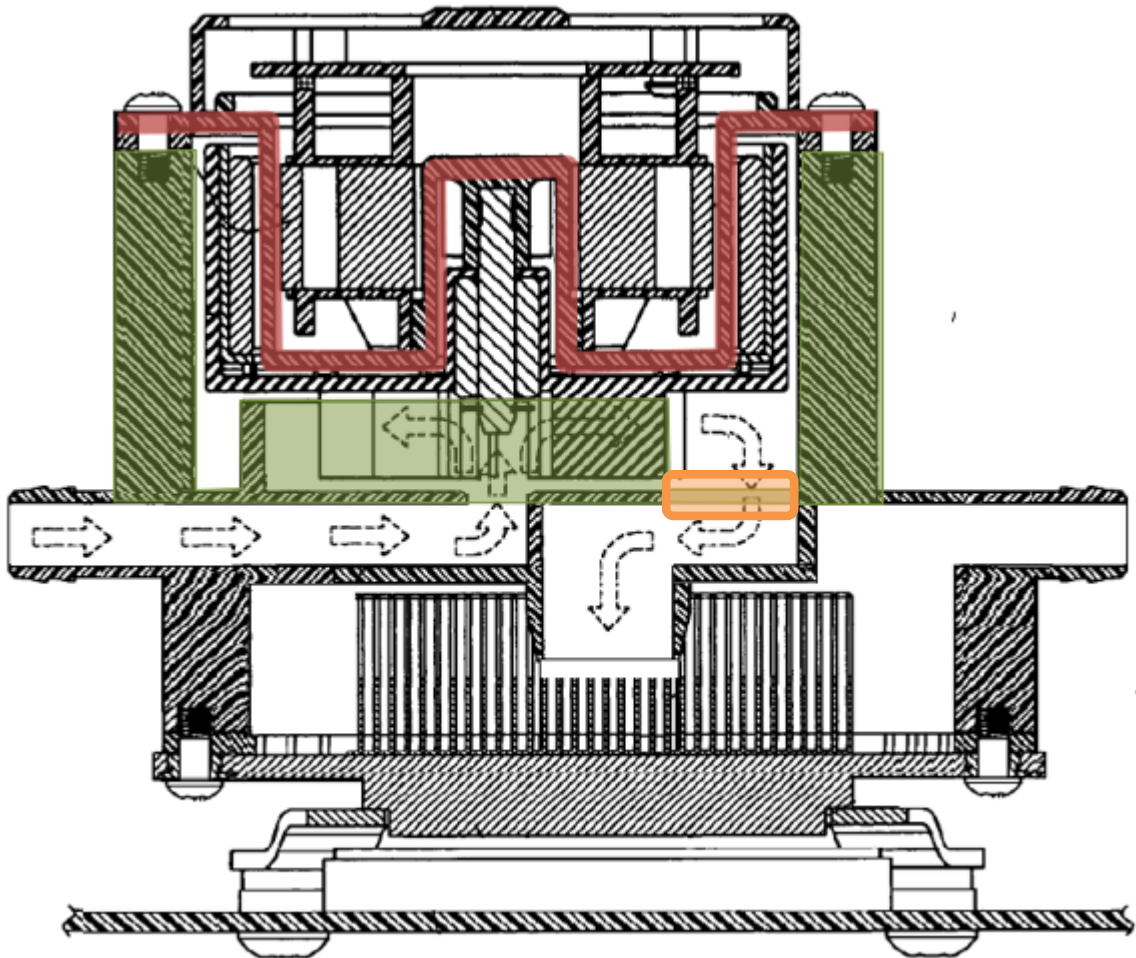
FIG. 8

Duan discloses that liquid outlet 24 is configured to direct the cooling liquid driven by the impeller through liquid outlet 24 to the thermal exchange chamber (cap 3 and cooling plate 1):

the liquid driving module 2 comprises an accommodation chamber 21 and a liquid driving unit 22 located in the accommodation chamber 21 and used to driving the cool liquid. The liquid driving unit 22 comprises ... *an impeller stage 223*...” [D]uring operation ... *the cool liquid ... is conveyed to the accommodation chamber 21* ... and driven by the liquid driving unit 22. *The cool liquid then flows to the cap 3 through the first liquid outlet 24 for heat dissipating...*

Thus, Duan alone discloses this limitation.

Duan in view of Duan-I also discloses this limitation. As shown below, 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, Duan in view of Duan-I discloses this limitation.

[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;” (See Ex-1005, ¶¶117-125.)

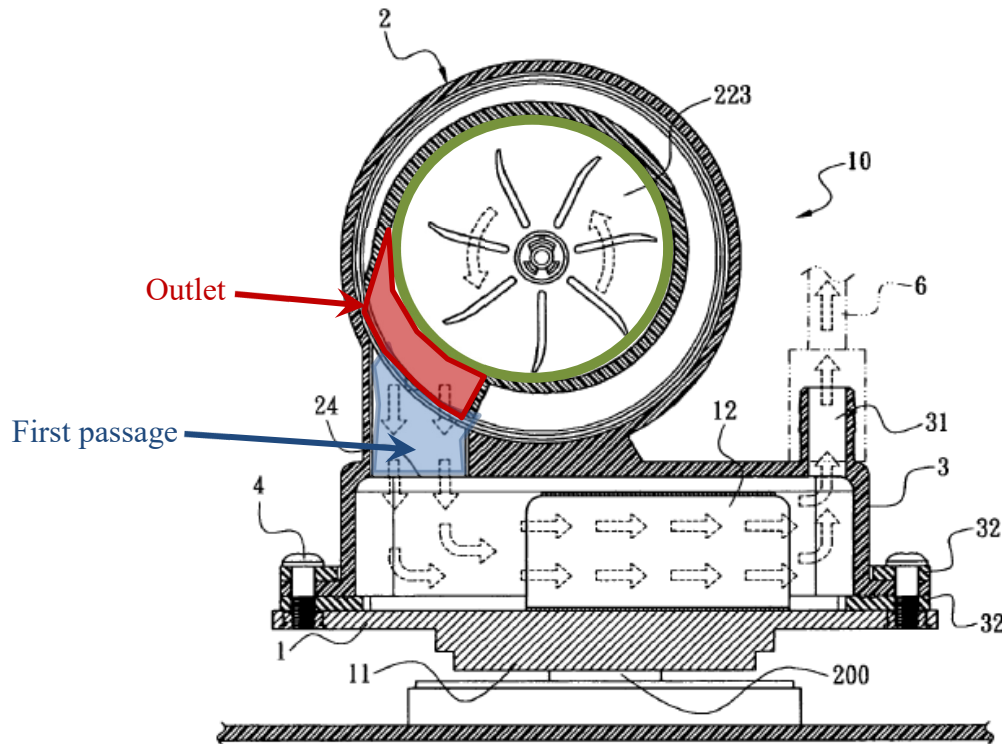
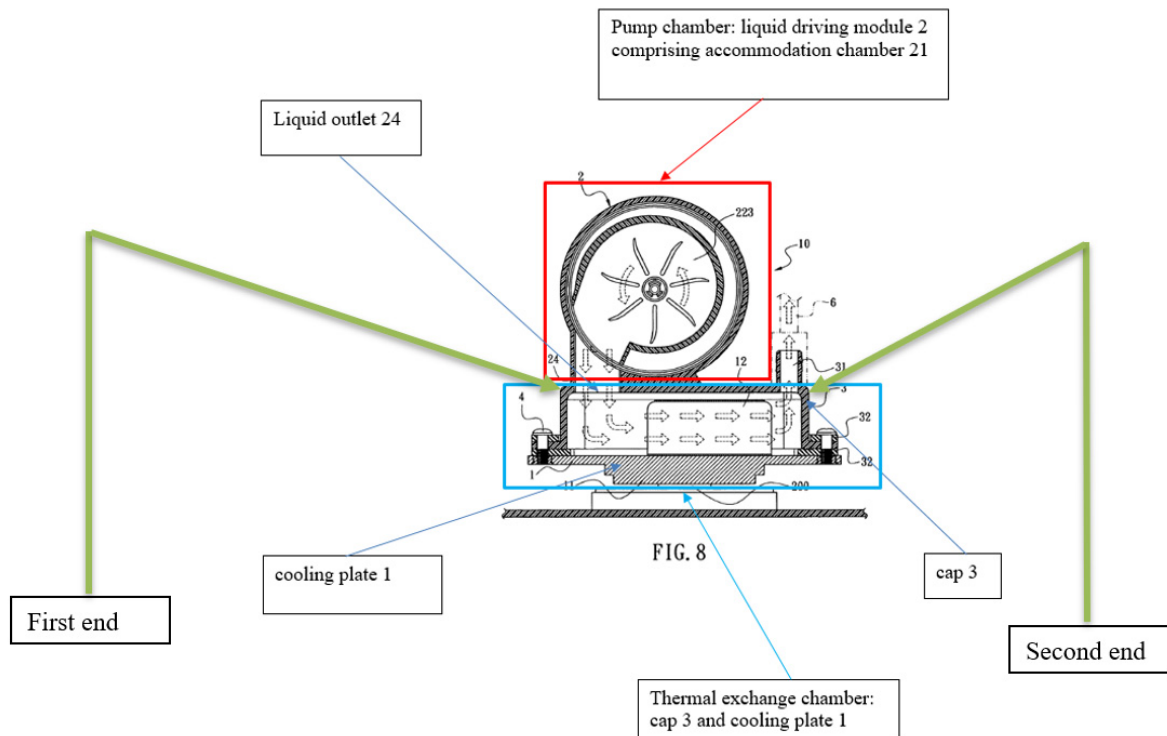


FIG. 8

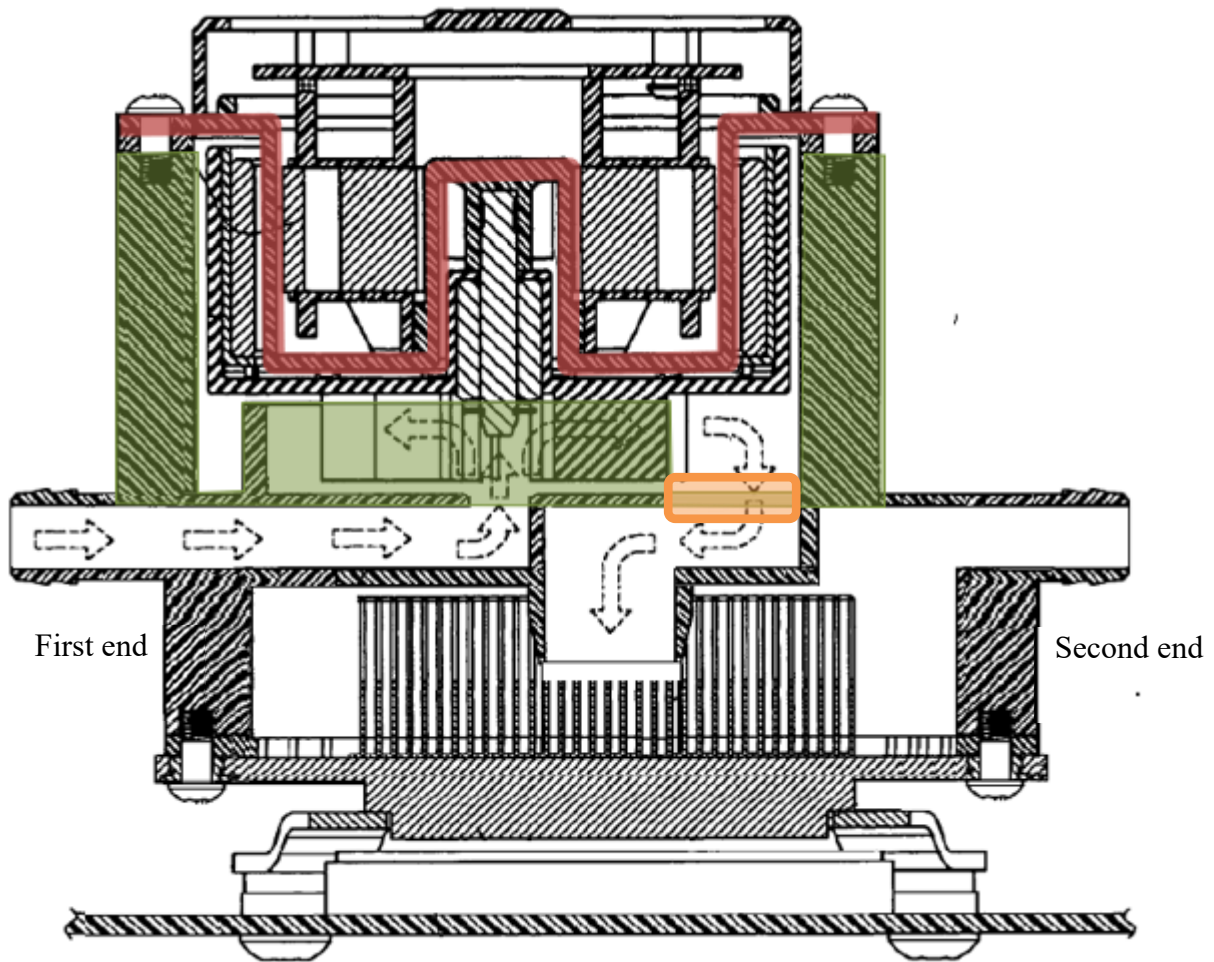
Duan’s FIG. 8 (above) discloses a first passage (e.g., part of the first liquid outlet 24, referring to also the FIG. 8 reproduced and annotated above, in which the first passage is colored in dark red) that directs the cooling liquid into the thermal exchange chamber (e.g., cap 3 and cooling plate 1) between a first end and a second end of the thermal exchange chamber (e.g., cap 3 and cooling plate 1), highlighted below with the green arrows:



(Ex-1007 at FIG. 8.)

Thus, Duan alone discloses this limitation.

Duan in view of Duan-I also discloses this limitation. As shown below, in Duan+Duan-I, the first passage (orange) directs the cooling liquid into the thermal exchange chamber between a first end and a second end of the thermal exchange chamber:



Thus, Duan in view of Duan-I discloses this limitation.

[Ii-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.” (See Ex-1005, ¶¶123-127.)

A POSITA would have understood that Duan discloses a thermal exchange chamber (e.g., cap 3 and cooling plate 1) that includes at least one second passage (e.g., second liquid outlet 31) configured to direct the cooling liquid out of the thermal exchange chamber, the at least one second passage being positioned at the

second end of the thermal exchange chamber (cap 3 and cooling plate 1).

Specifically, Duan teaches:

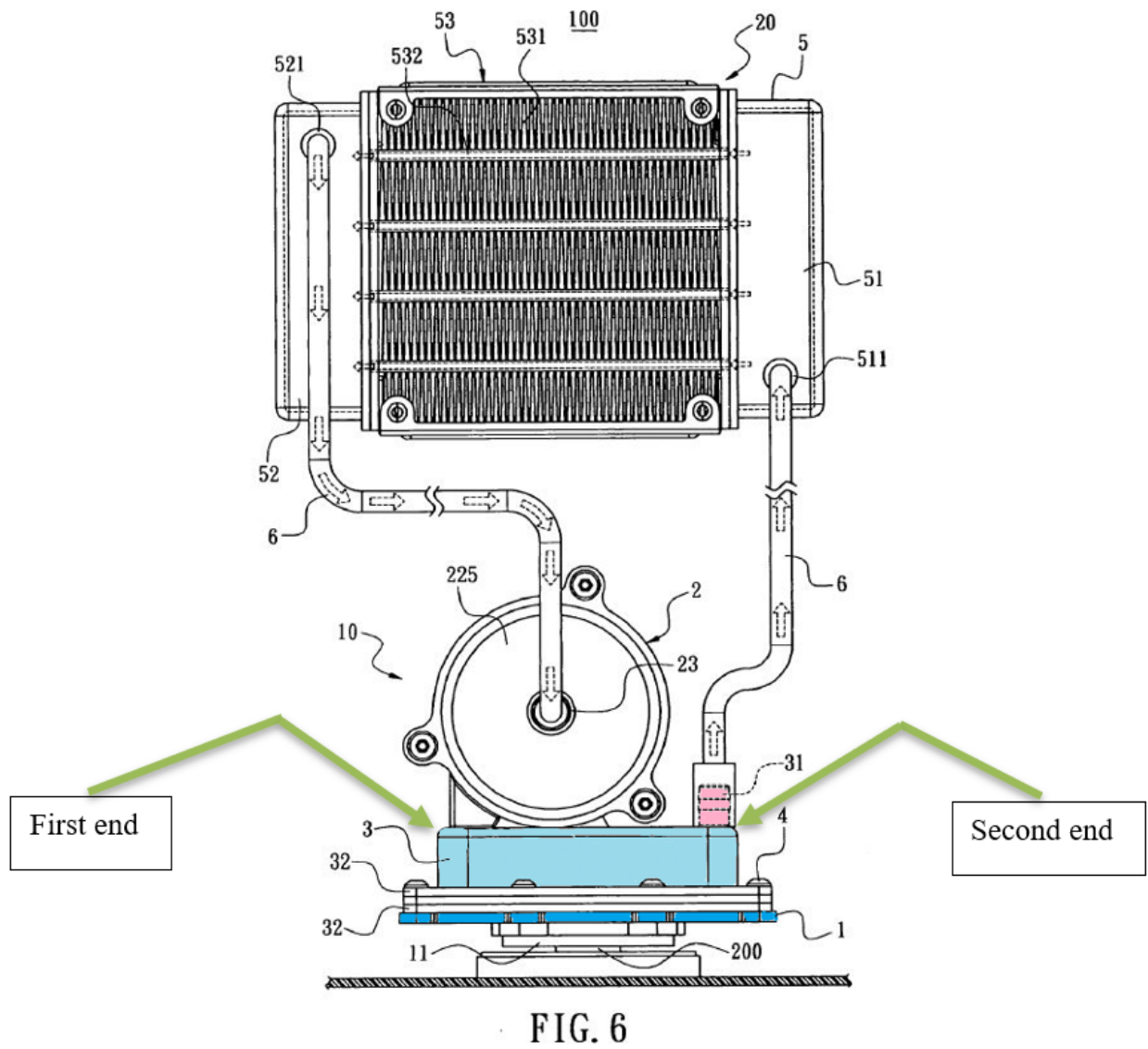
“In the present invention, during the assembling of the liquid cooling cycle mechanism 100, the liquid inlet 23 of the cooling plate module 10 is communicated to the liquid outlet 521 of the liquid exit region 52 of the water tank 20 through duct 6. ***Moreover, the second liquid outlet 31 of the cooling plate module 10 is communicated to the liquid inlet 511 of the liquid entrance region 51 of the water tank 120 through duct 6,*** thus forming the liquid cooling cycle mechanism 100 with continuous cycles. Thereafter, the liquid cooling cyclic mechanism 100 is assembled to the CPU 200 with the heat absorbing face 11 being in contact with the CPU 200 for heat dissipating the CPU 200.”

(Ex-1007 at [0026].) Duan further teaches:

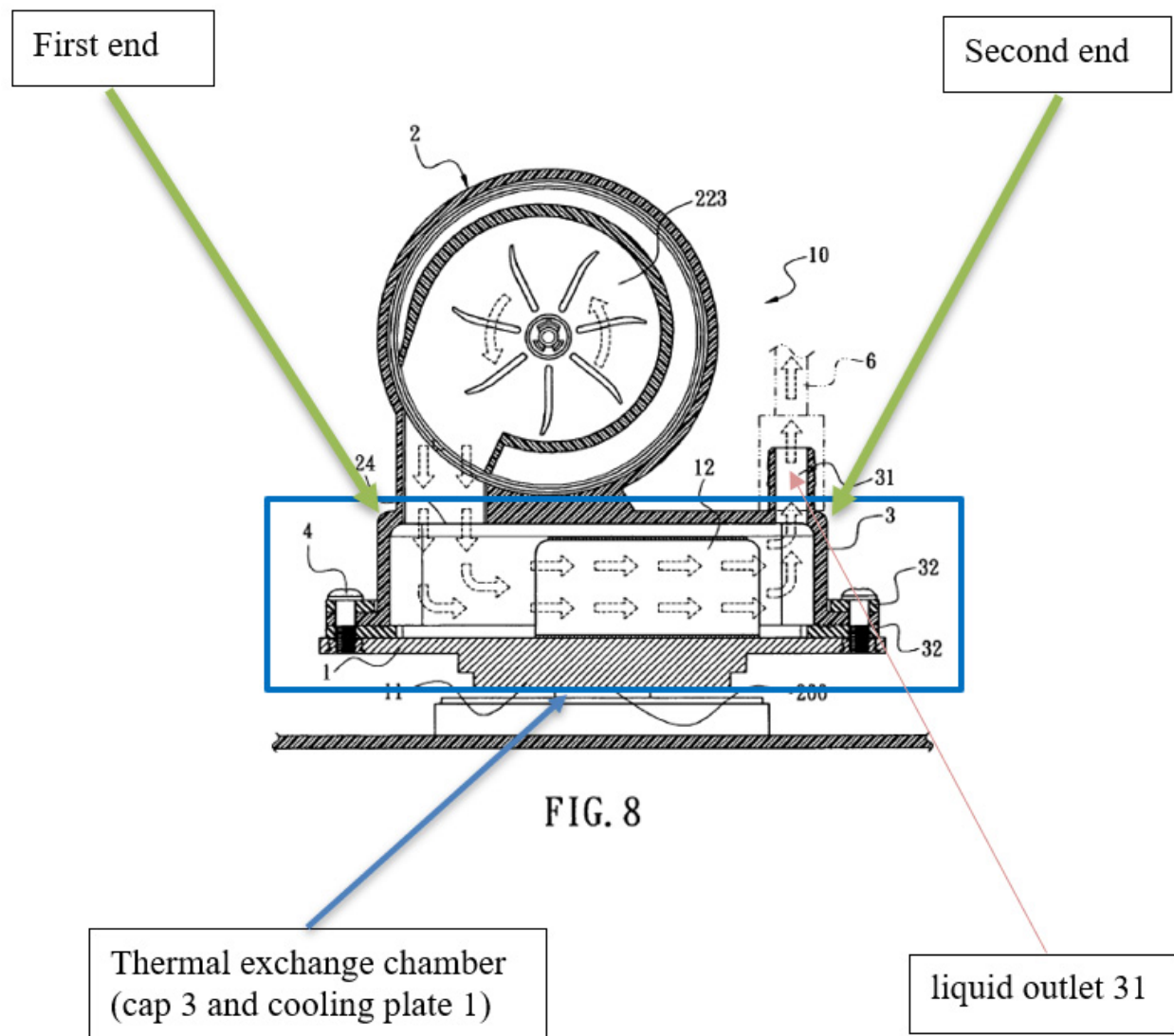
“More particularly, the cool liquid is heat exchanged with the heat-dissipating plates 12 into hot liquid. The hot liquid then flows to the liquid entrance region 51 of the water tank 20 through the second liquid outlet 31 of the cooling plate module 10 and another duct 6.”

(Ex-1007 at [0025].) These teachings are also illustrated in the following annotated version of FIG. 6 with the below color coding scheme:

Color	Duan Element
Pink	second liquid outlet 31
Light blue	cap 3
Dark blue	cooling plate 1



(Ex-1007 at FIG. 6.) These teachings are also shown in FIG. 8:

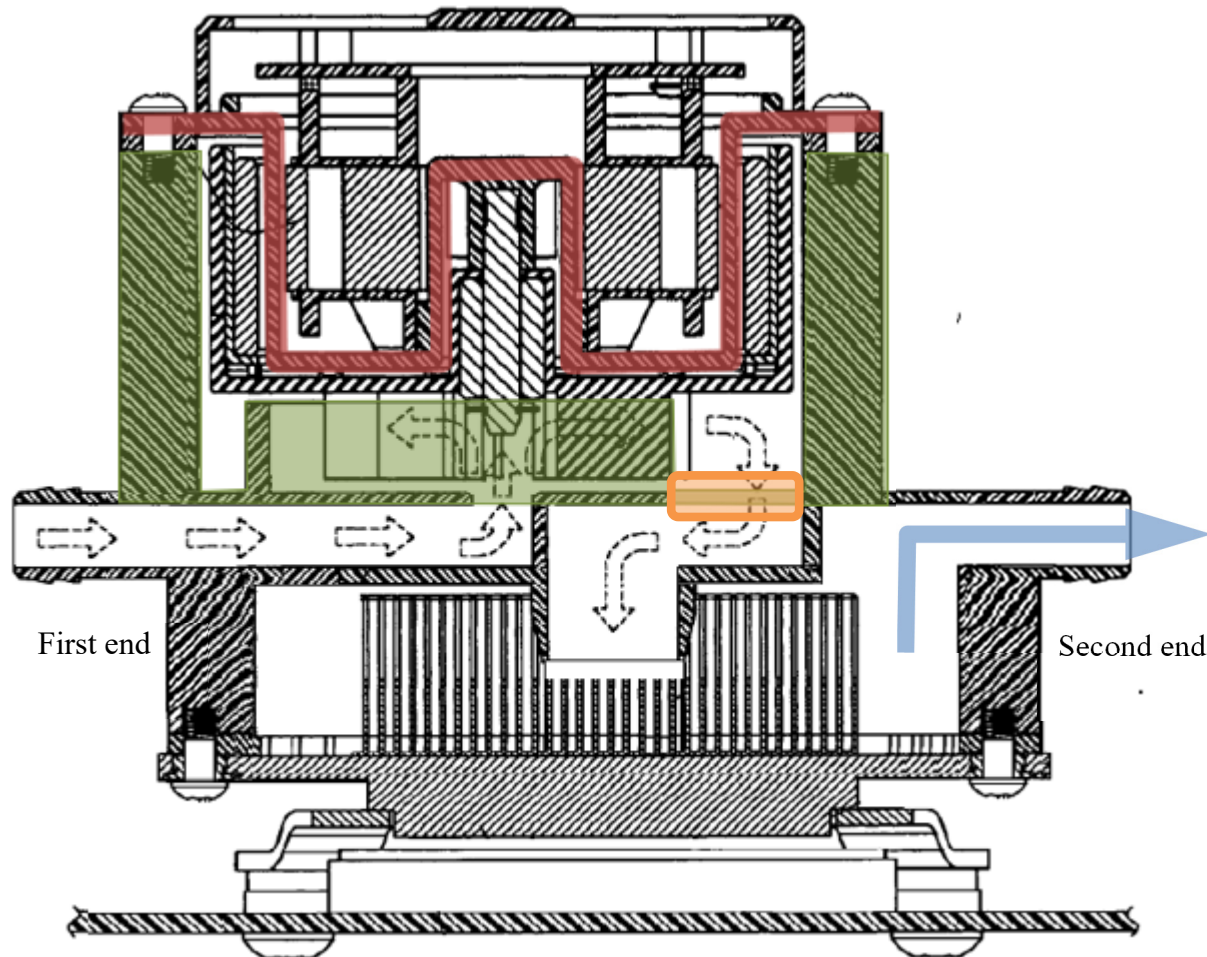


(Ex-1007 at FIG. 8.)

Thus, Duan alone discloses this limitation.

Duan in view of Duan-I also discloses this limitation. As shown below, in Duan+Duan-I, the thermal exchange chamber includes at least one second passage configured to direct the cooling liquid out of the thermal exchange chamber, and

the at least one second passage is positioned at the second end of the thermal exchange chamber:



Thus, Duan in view of Duan-I discloses this limitation.

For at least the above reasons, the Ground 1 prior art discloses all limitations of claim 1.

Claim 2

“2. The cooling system of claim 1, wherein the chassis shields the stator from the cooling liquid in the reservoir.” (See Ex-1005, ¶¶128-130.)

Duan teaches this limitation. As shown below, the double-sided chassis (accommodation chamber 21 - red) shields the stator (coil stage 221 - yellow) from the cooling liquid contained inside the pump chamber (at least partially defined) by impeller cover (lower cover 225 - green) and the double-sided chassis (accommodation chamber 21):

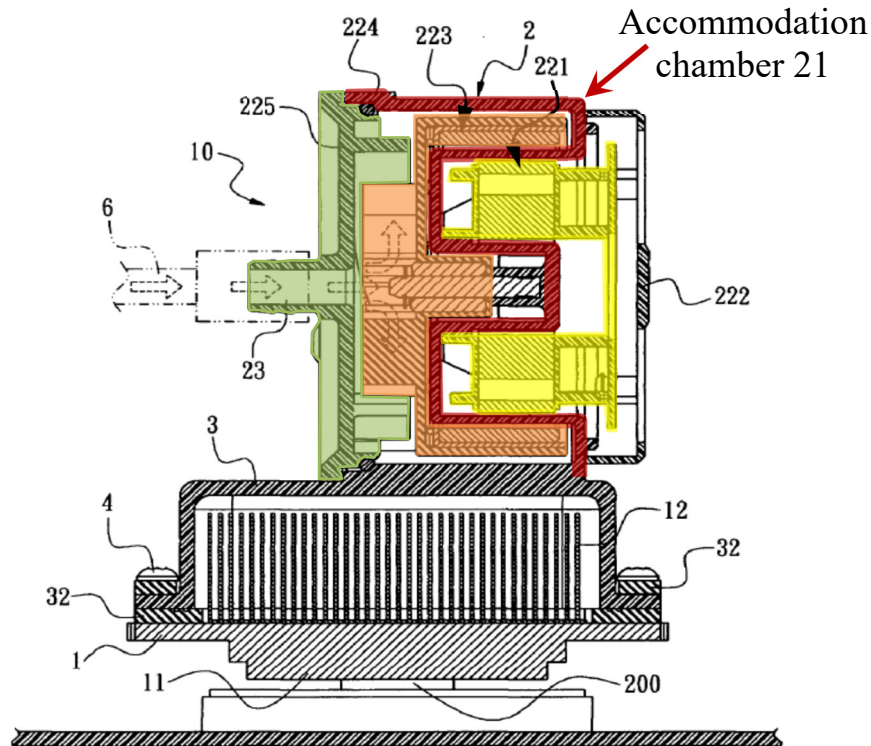
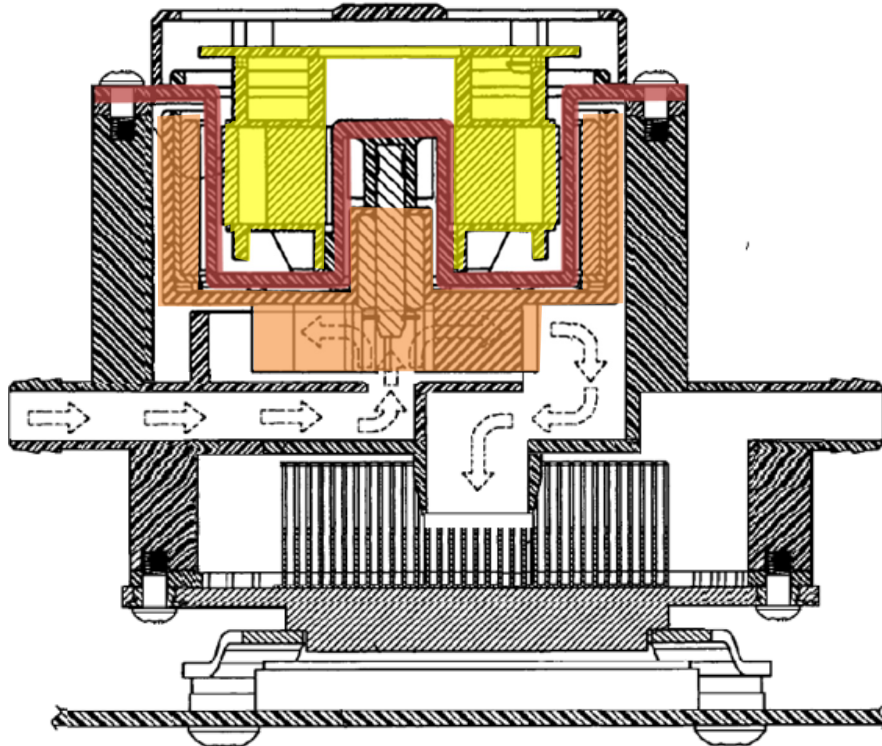


FIG. 7

(Ex-1005, ¶128.) Thus, Duan alone teaches this limitation.

Duan in view of Duan-I also discloses this limitation. In the modified system of Duan in view of Duan-I, the double-sided chassis (red) also shields the stator (yellow, located on the upper side of the chassis) from the cooling liquid (which, as shown by the arrows, circulates on the underside of the chassis):



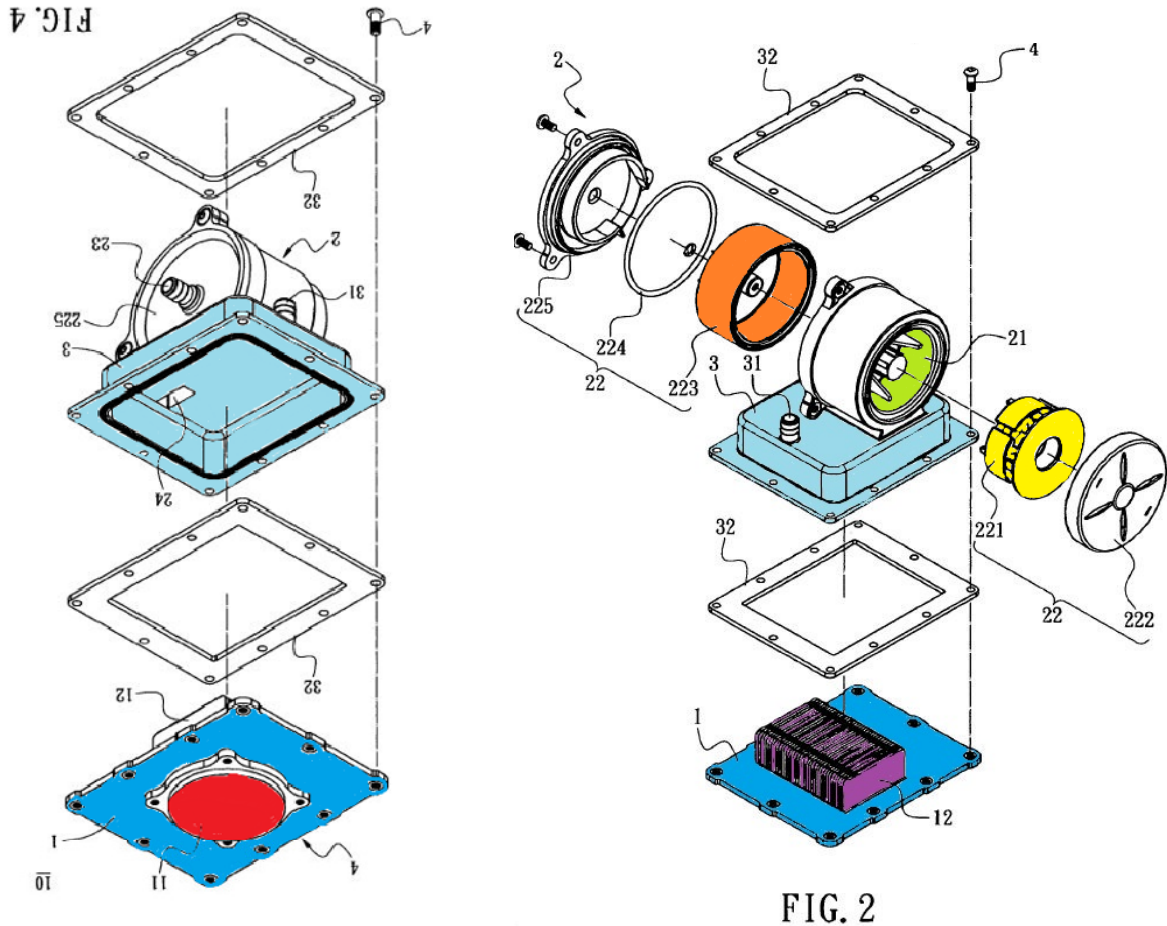
(Ex-1005, ¶129.) Thus, Duan+Duan-I teaches this limitation.

Claim 3

[3a] “The cooling system of claim 1, wherein the heat exchanging interface includes a first side and a second side opposite the first side, and”
(See Ex. 1005, ¶¶131-133.)

Duan discloses a heat-exchanging interface (e.g., cooling plate 1) that includes a first side (e.g., top surface of cooling plate 1) and a second side opposite the first side (e.g., heat absorbing face 11). (see Ex-1007 at [0022].) These elements are

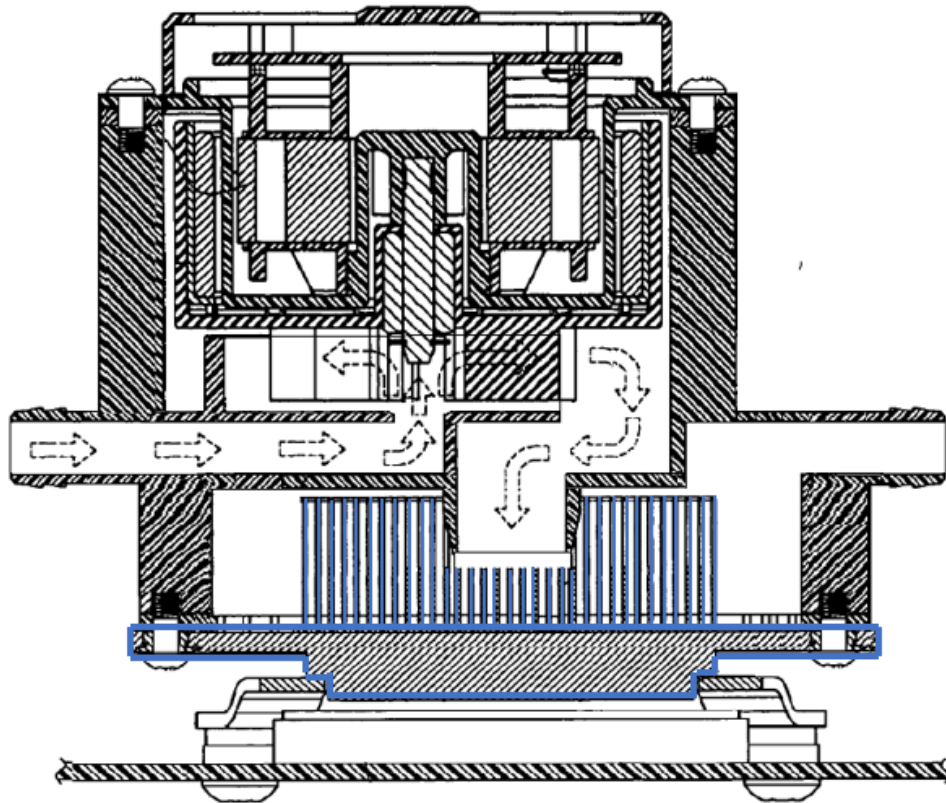
shown in FIGS. 4 (inverted) and 2, of Duan which depict these elements from opposite views revealing a first and second surface:



(*Id.* at FIGS. 4 (inverted), 2; *see also id.* at [0026] (stating “Thereafter, the liquid cooling cyclic mechanism 100 is assembled to the CPU 200 with the heat absorbing face 11 being in contact with the CPU 200 for heat dissipating the CPU 200”).)

Thus, Duan alone teaches this limitation. (Ex-1005, ¶131.)

Duan in view of Duan-I also discloses this limitation. The modified system of Duan in view of Duan-I has a heat-exchanging interface with the same features (outlined in blue), and therefore it also teaches the claim 3 limitation:



(Ex-1005, ¶¶131-132.)

Thus, Duan in view of Duan-I discloses this limitation.

[3b] “wherein the heat-exchanging interface contacts the cooling liquid in the thermal exchange chamber on the first side and the heat-exchanging interface is configured to be in thermal contact with the surface of the heat-generating component on the second side.” (See Ex. 1005, ¶¶134-137.)

Duan discloses a heat-exchanging interface that contacts the cooling liquid in the thermal exchange chamber (e.g., cap 3 and cooling plate 1) on the first side and where the heat-exchanging interface (e.g., cooling plate 1) is configured to be in thermal contact with the surface of the heat-generating component (e.g., CPU 200) on the second side (heat absorbing face 11). (Ex-1007 at [0031]; *see also* FIGS. 2

and 4 reproduced and annotated in Section [3a] above.) Specifically, Duan states that “the cool liquid can directly flush the heat-dissipating plates 12 for enhancing heat dissipation efficiency.” (*Id.* at [0031].)

Duan teaches this limitation. As discussed above and as shown below, Duan discloses a heat-exchanging interface (cooling plate 1 and heat absorbing face 11):

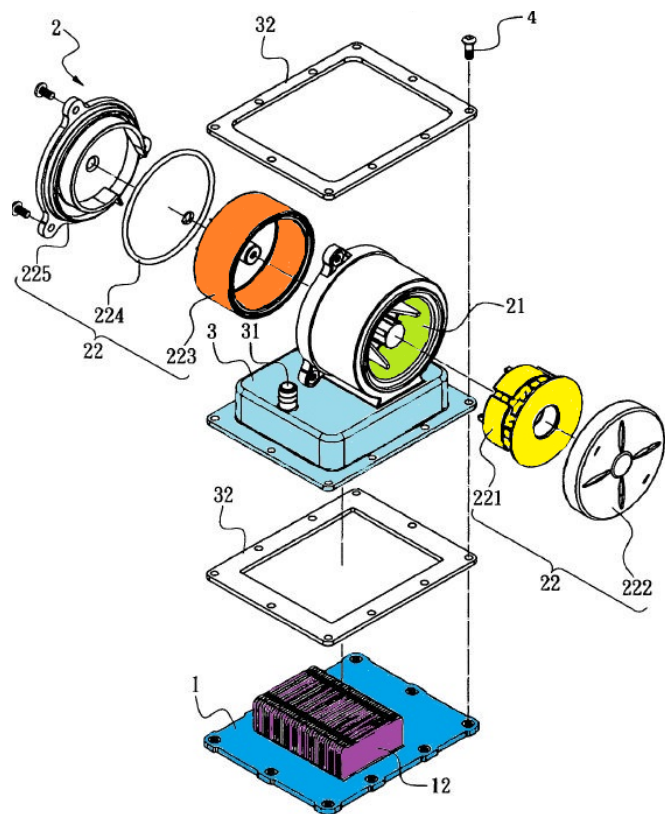
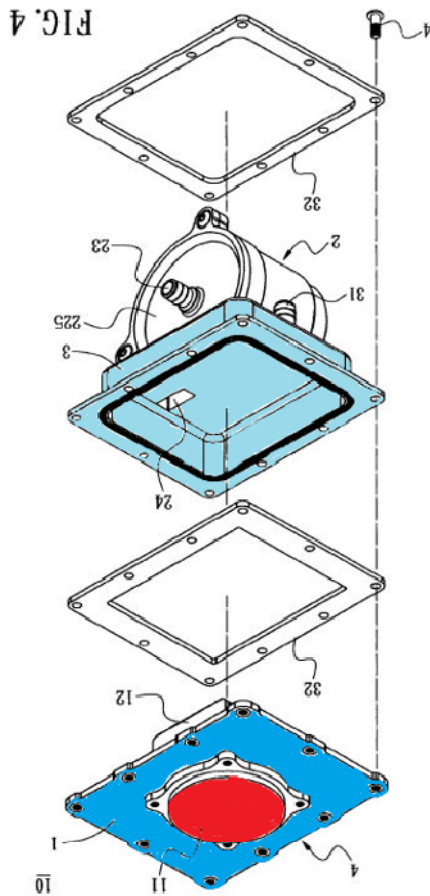
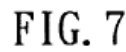


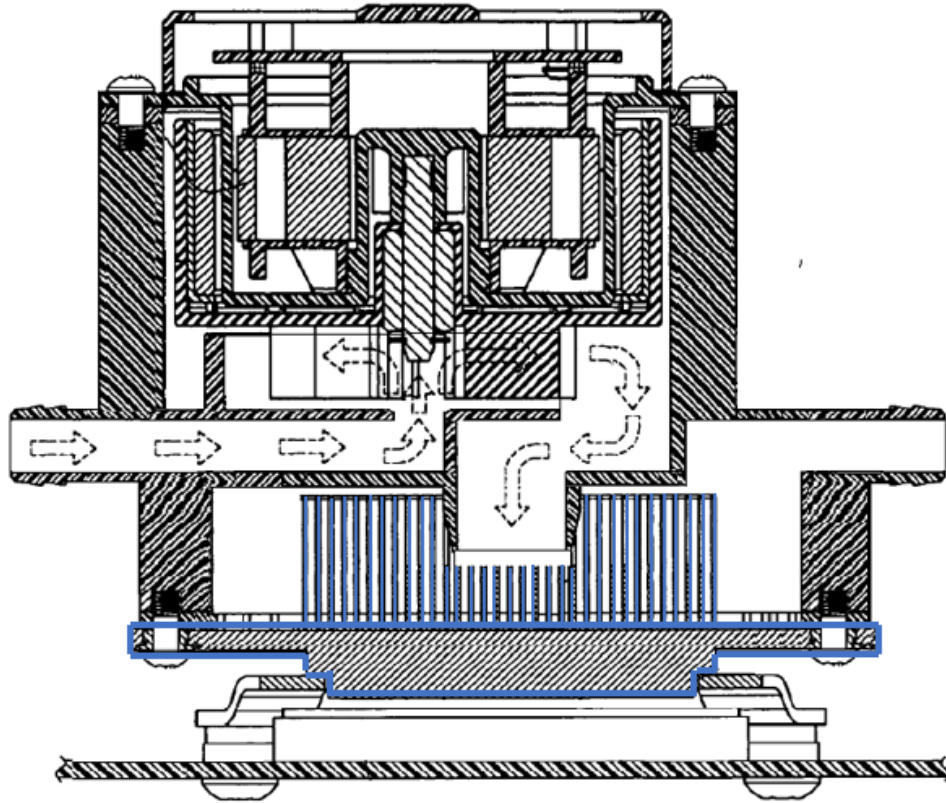
FIG. 2



Thus, Duan alone discloses this limitation. (Ex-1005, ¶¶134-135.)

89

of Duan in view of Duan-I, there is a heat-exchanging interface with the same features (outlined in blue), and therefore it also teaches the claim 3 limitation:



(Ex-1005, ¶136.) Thus, Duan in view of Duan-I discloses this limitation rendering claim 3 obvious.

Claim 4

“4. The cooling system of claim 3, wherein the first side of the heat-exchanging interface includes features that are adapted to increase heat transfer from the heat-exchanging interface to the cooling liquid in the thermal exchange chamber.” (See Ex-1005, ¶¶138-141.)

Duan teaches this limitation. Duan discloses a first side of the heat-exchanging interface (e.g., cooling plate 1) that includes features (e.g., heat-dissipating plates 12) that are adapted to increase heat transfer from the heat-

exchanging interface (e.g., cooling plate 1) to the cooling liquid in the thermal exchange chamber (e.g., cap 3 and cooling plate 1). (Ex-1005, ¶138.) For example, Duan discloses, “[a] plurality of heat-dissipating plates 12 are formed on top face of the cooling plate 1 and can be arranged in longitudinal or transverse manner.” (Ex-1007 at [0022]; *see also id.* at [0031] (“the cool liquid can directly flush the heat-dissipating plates 12 for enhanced heat dissipation efficiency.”).) The heat-dissipating plates 12 are colored in purple in the following reproduction of FIG. 2:

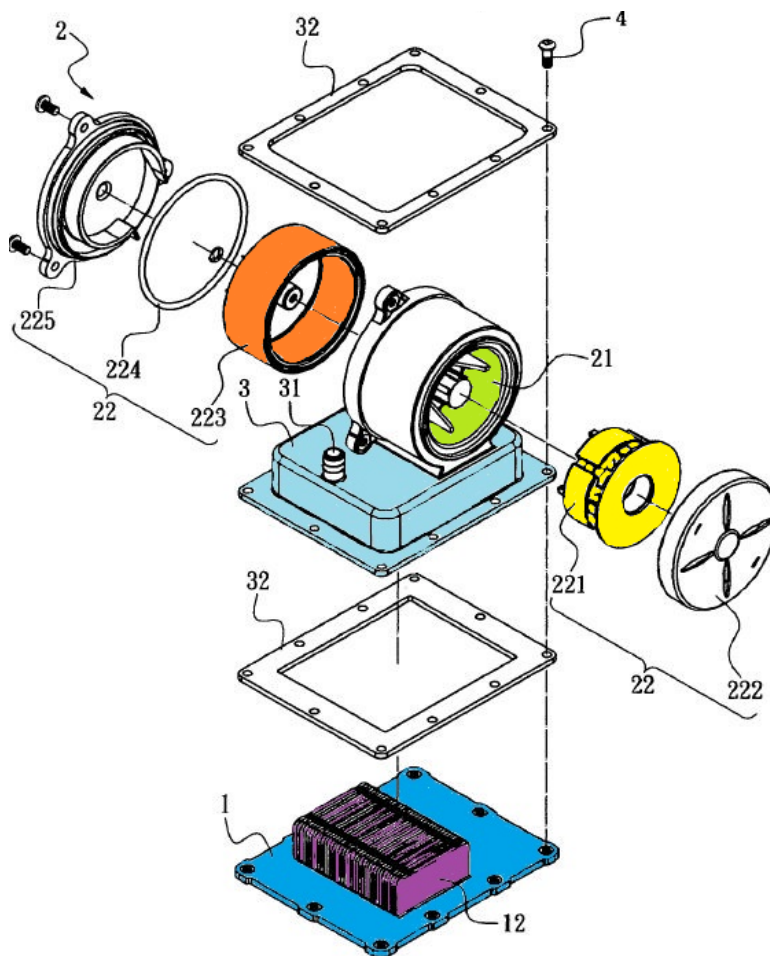


FIG. 2

(Ex-1007 at FIG. 2.) A POSITA would have understood that the shape and orientation of Duan's plates 12 increase heat transfer by increasing the surface area contact between the liquid and the plates. A larger surface area can draw away more heat from the liquid as it comes into contact with the plates 12. (*Id.*).

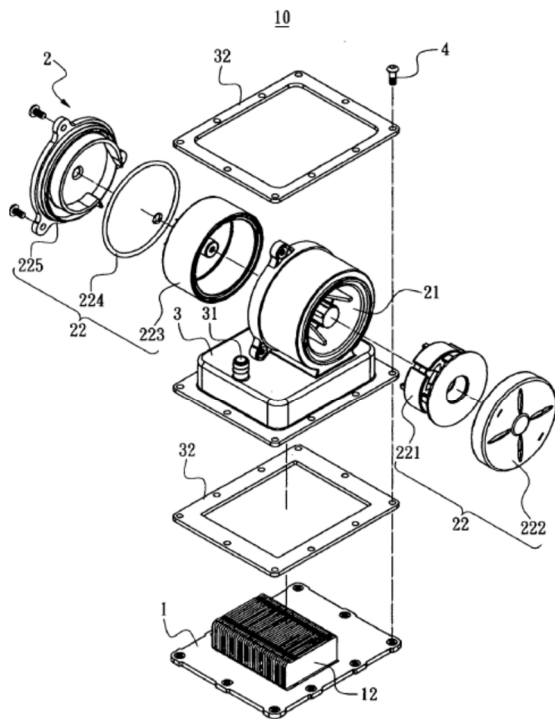


FIG. 2

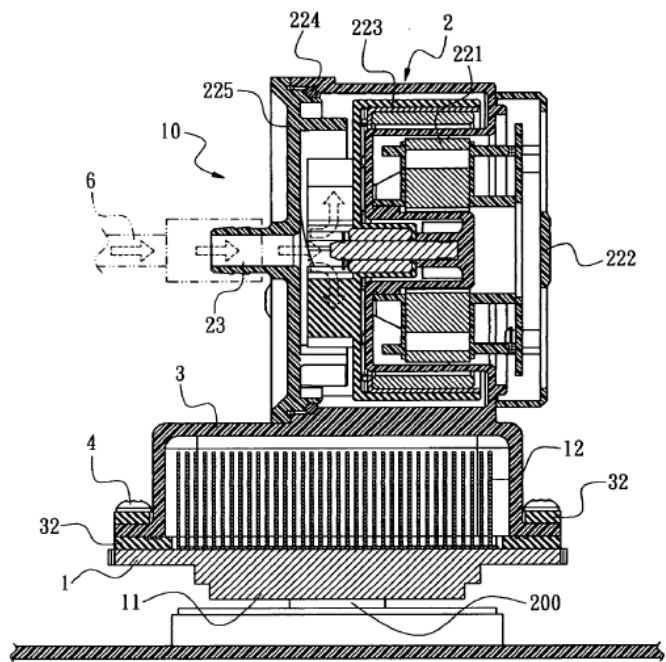
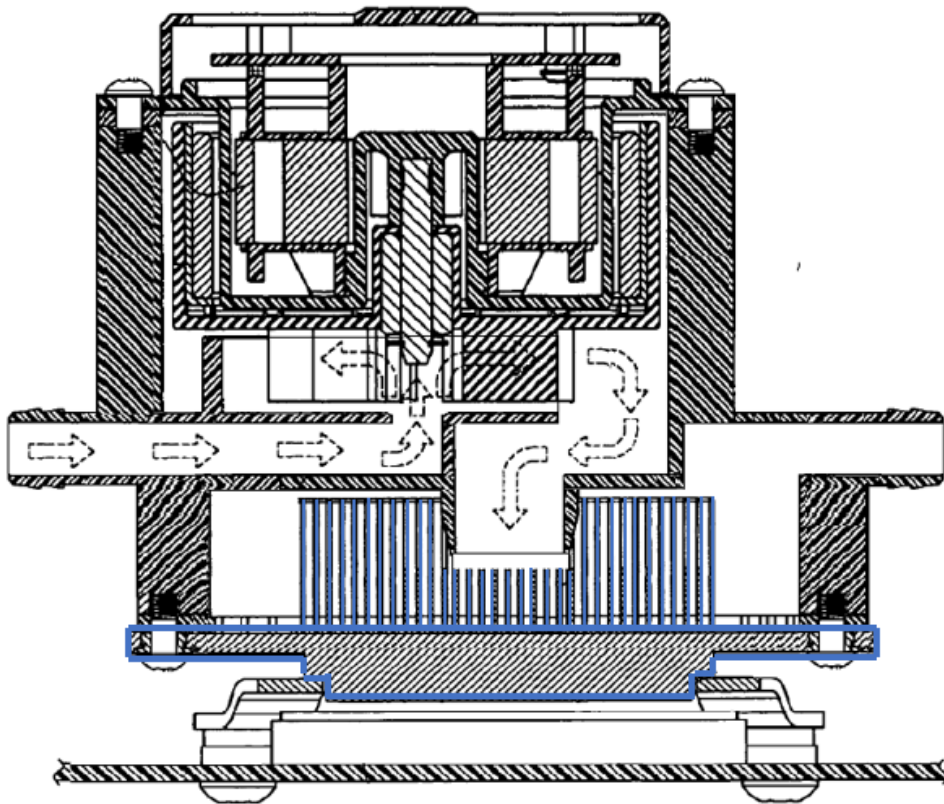


FIG. 7

Indeed, Duan teaches that “cool liquid can directly flush the heat-dissipating plates 12 **for enhancing heat dissipation efficiency.**” (Ex-1007, [0022], [0031].) Accordingly, Duan discloses a first side (top side of cooling plate 1) of the heat-exchanging interface that includes features (heat-dissipating plates 12) adapted to increase heat transfer from the heat-exchanging interface to the cooling liquid in the thermal exchange chamber (cap 3 and cooling plate 1). (Ex-1005, ¶¶138-139.)

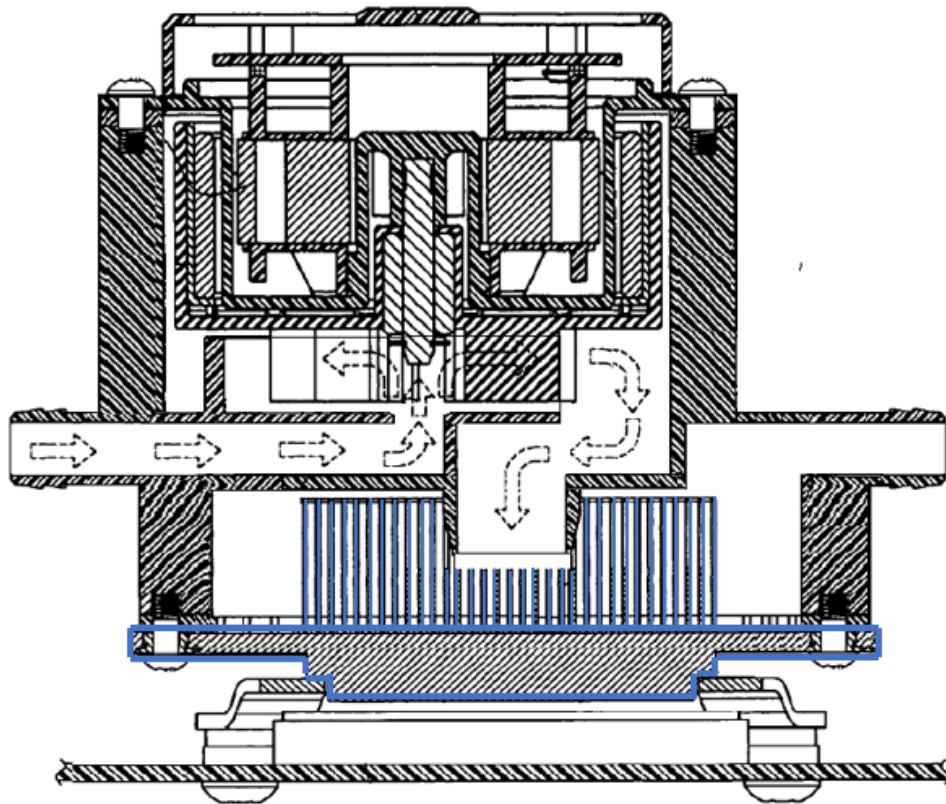
Duan in view of Duan-I also discloses this limitation. In the modified system of Duan in view of Duan-I, there is a heat-exchanging interface with the same features (outlined in blue) that are adapted to increase heat transfer from the heat-exchanging interface to the cooling liquid in the thermal exchange chamber, and thus it also teaches claim 4:



(Ex-1005, ¶140.) Thus, Duan in view of Duan-I discloses this limitation rendering claim 4 obvious.

single direction. (Ex-1005, ¶142.) Indeed, in the Prior IPR, the Patent Owner did not dispute Duan discloses this limitation. (*See generally* Ex-1013.)

Duan in view of Duan-I also discloses this limitation. The modified system of Duan in view of Duan-I also has a heat-exchanging interface (outlined in blue) with the same “pins or fins” features, and therefore it also teaches claim 5:

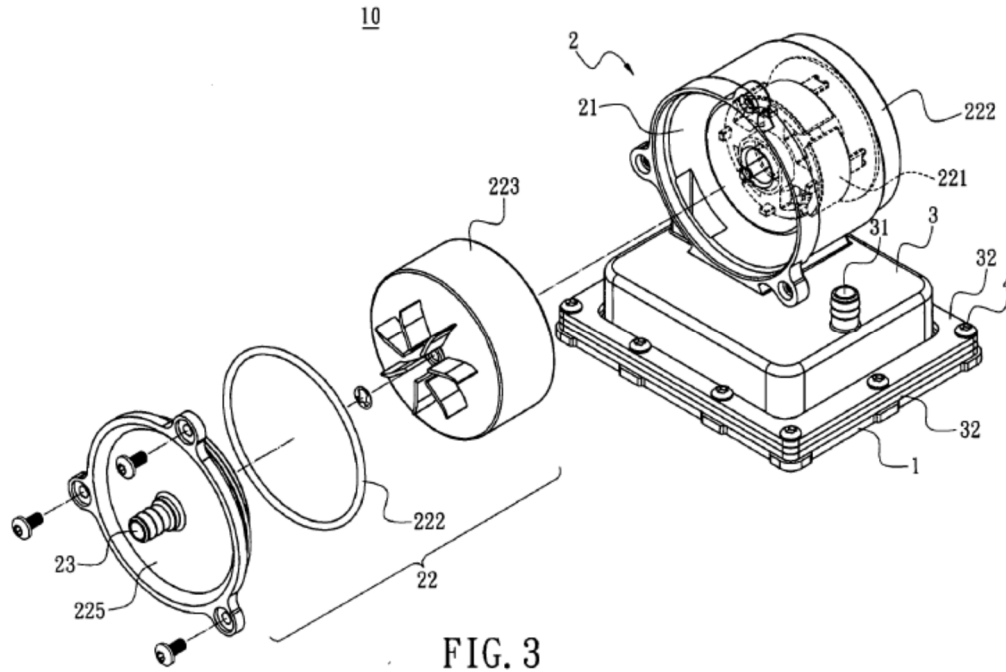


(Ex-1005, ¶143.) Thus, Duan+Duan-I teaches this limitation.

Claim 6

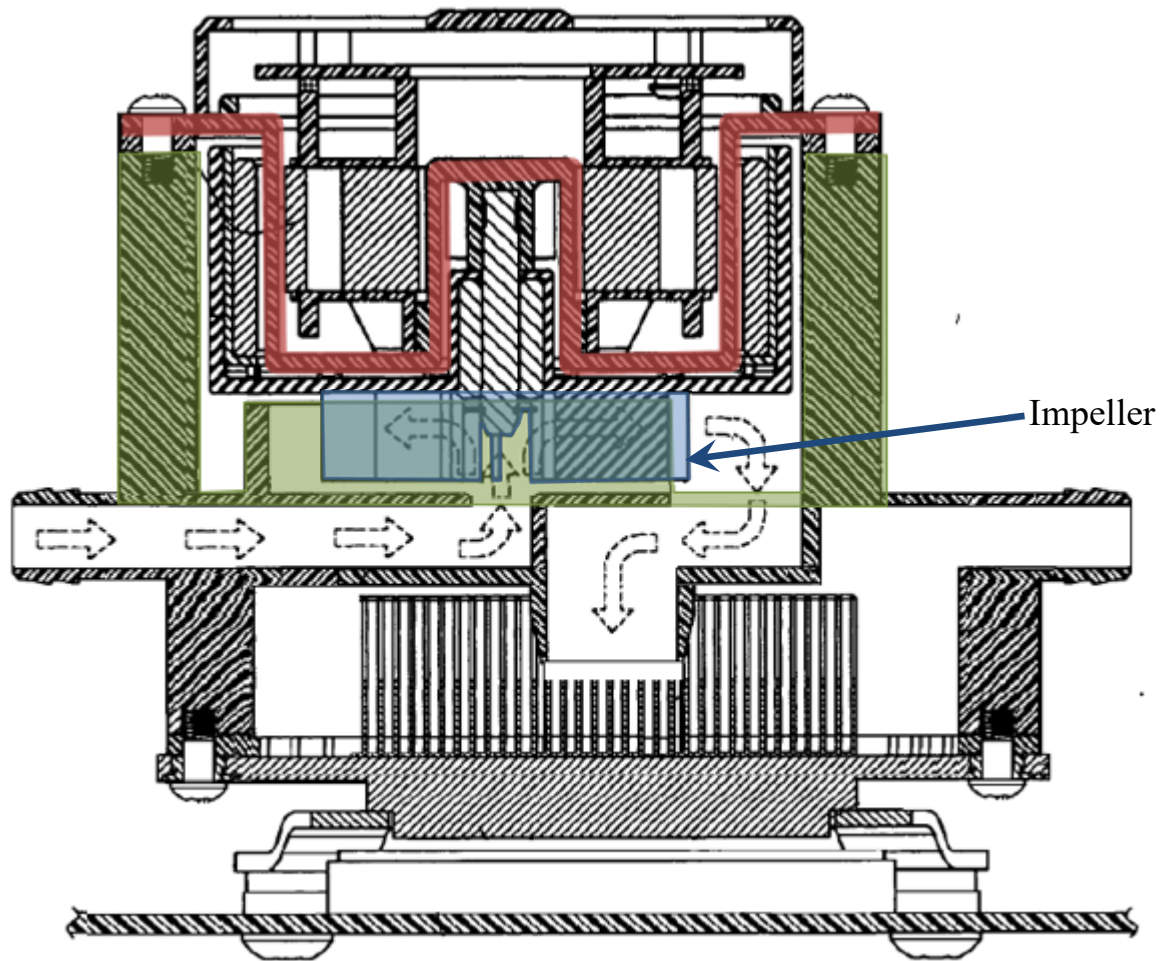
“6. The cooling system of claim 1, wherein the impeller is positioned in the pump chamber.” (*See* Ex-1005, ¶¶145-147.)

Duan teaches this limitation. As discussed above, Duan teaches limitation [1-c], which confirms that the impeller is position in the pump chamber:



(Ex-1007, FIG. 3.) As shown, Duan discloses a pump chamber (at the near end of accommodation chamber 21 in FIG. 3) including the impeller (223). (Ex-1005, ¶145.) That is, the impeller (223) is positioned in the pump chamber (accommodation chamber 21). Thus, Duan alone teaches this limitation.

When Duan is modified in view of Duan-I by rotating the pump (*see* limitation [1-c] above), this limitation is also satisfied, as shown below:

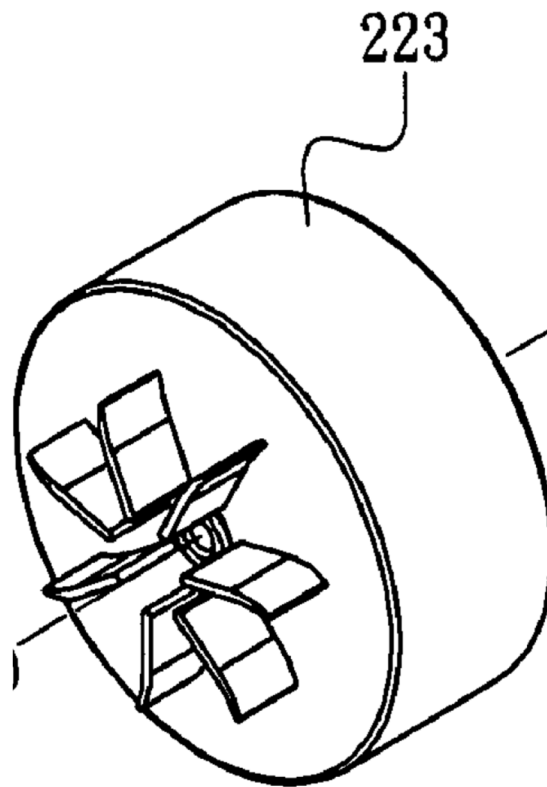
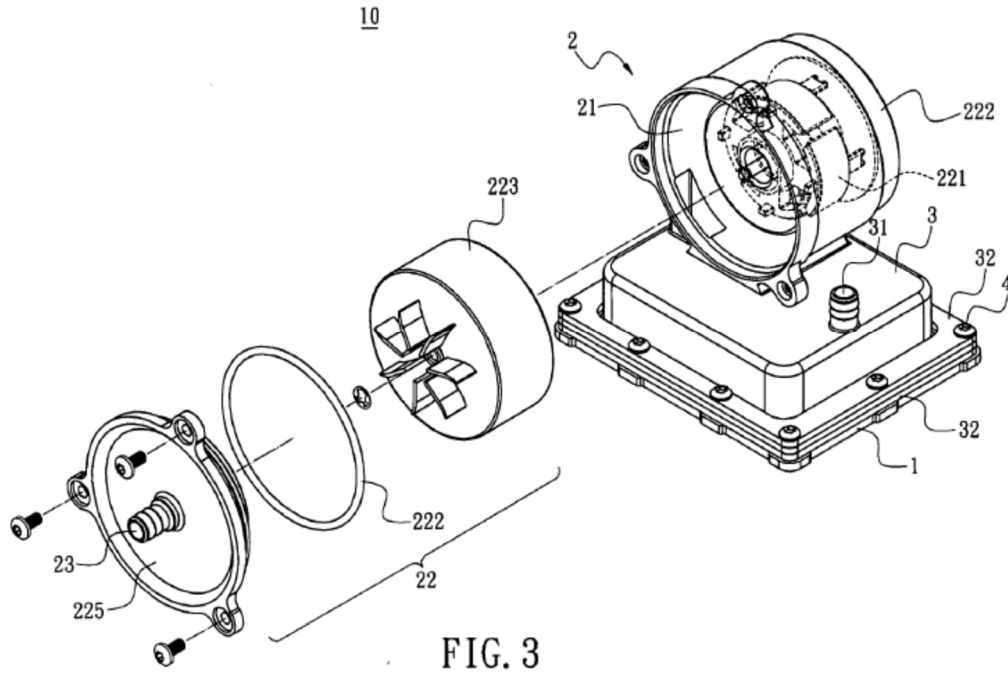


As can be seen above, the impeller (blue) in Duan+Duan-1 is included in the pump chamber (green). (Ex-1005, ¶¶146-147.) Thus, Duan in view of Duan-I discloses this limitation.

Claim 7

“The cooling system of claim 1, wherein the impeller includes a plurality of curved blades.” (See Ex-1005, ¶¶148-151.)

Duan teaches this limitation. For instance, various figures of Duan show impellers with curved blades:



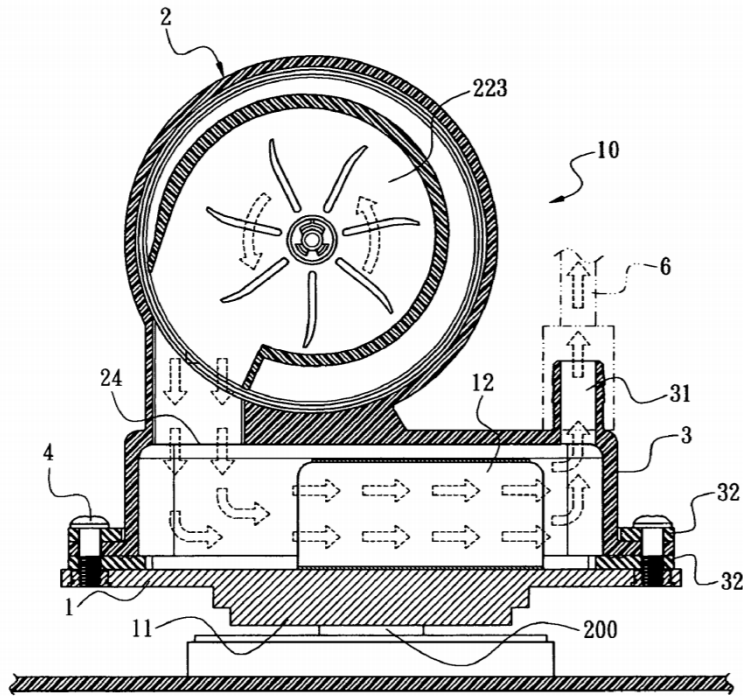
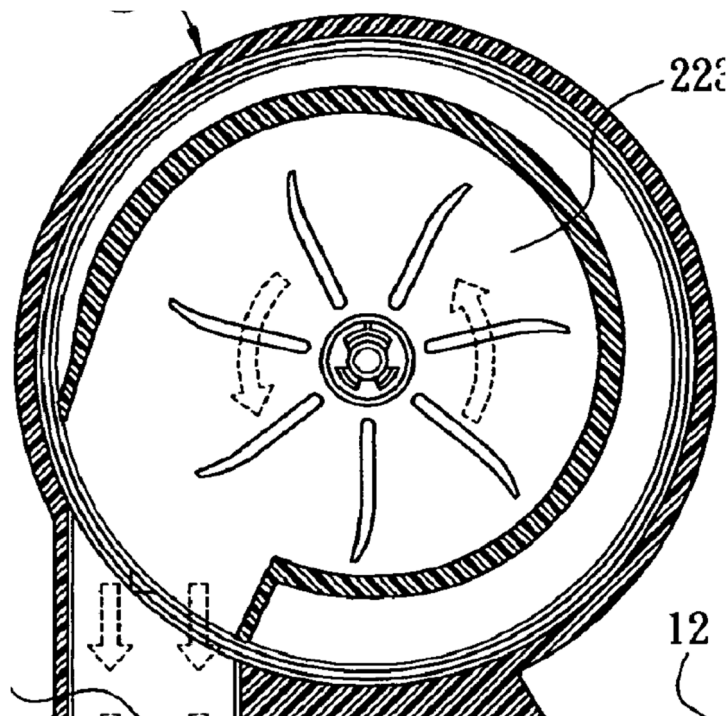
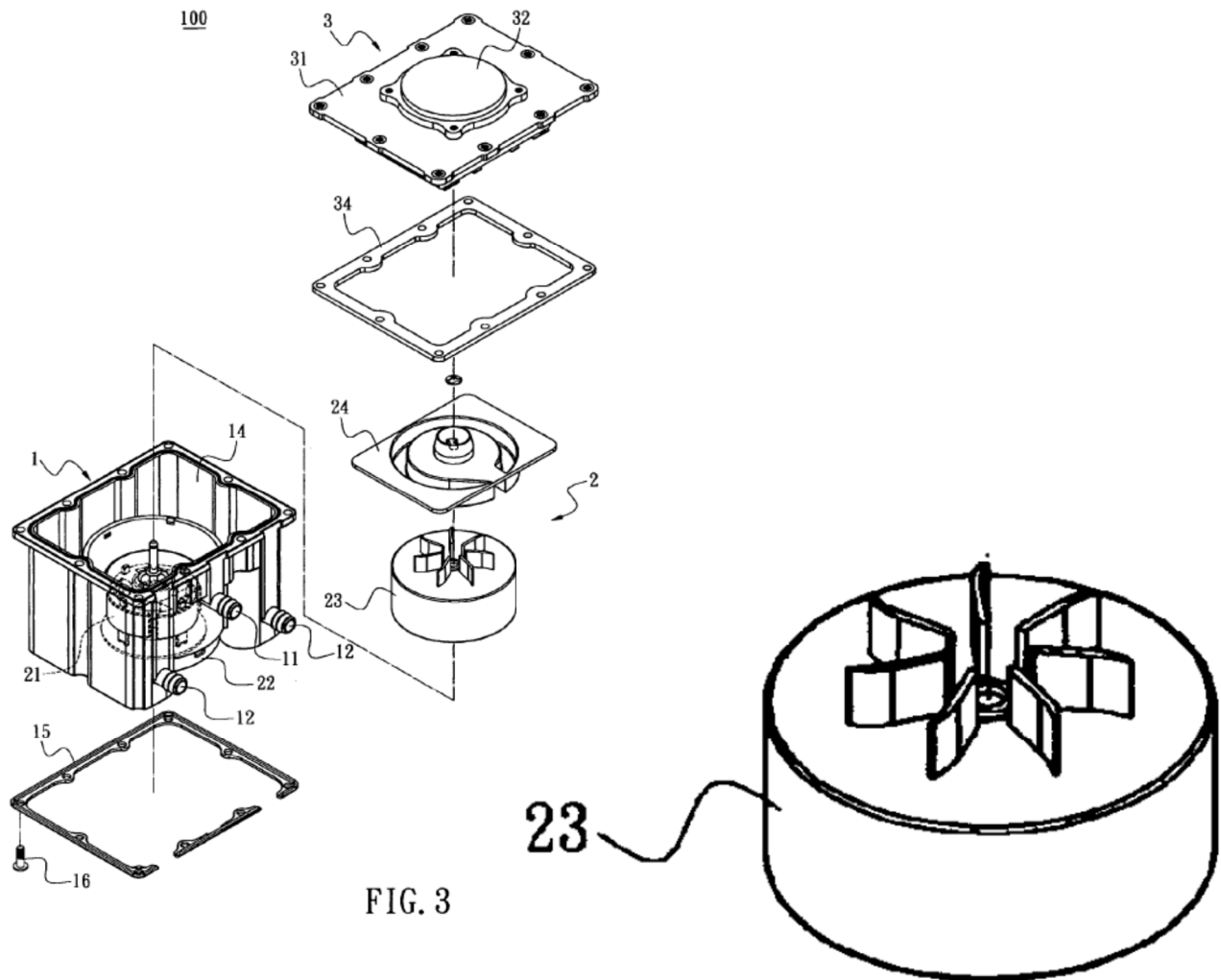


FIG. 8



(Ex-1007 at FIGS. 3, 8.) Thus, Duan alone teaches this limitation.

Similarly, the impeller blades of Duan-I also have curvature:



(Ex-1008 at FIG. 3). In the combination of Duan and Duan-I, it was obvious to a POSITA to use the already existing blades of Duan, which meet the requirement of “wherein the impeller includes a plurality of curved blades.” It was equally obvious

to use the curved impeller blades of Duan-I given they are indistinct from those of Duan. Thus, Duan in view of Duan-I teaches this limitation.

XII. Conclusion

For the foregoing reasons, Petitioner respectfully requests cancellation of claims 1-7 of the '681 patent.

Respectfully submitted,
GREENBERG TRAURIG, LLP

Date: September 30, 2024

By: /hjb/
Heath J. Briggs
1144 15th Street, Suite 3300
Denver, CO 80202
Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned certifies that a true and correct copy of the Petition together with all exhibits identified in the above Table of Exhibits and Petitioner's Power of Attorney, have been served on Patent Owner by mailing via Priority Mail Express or by means at least as fast and reliable as Priority Mail Express on September 30, 2024, at the following address:

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

Respectfully submitted,
GREENBERG TRAURIG, LLP

Date: September 30, 2024

By: /hjb/
Heath J. Briggs
1144 15th Street, Suite 3300
Denver, CO 80202