Declaration of Robert Smith-Gillespie in Support of
Petition for *Inter Partes* Review of
U.S. Patent No. 9,173,322

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD AND SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners,

v.

MANUFACTURING RESOURCES INTERNATIONAL, INC.,
Patent Owner

IPR2023-00220

U.S. Patent No. 9,173,322

Issue Date: October 27, 2015

Title: CONSTRICTED CONVECTION COOLING SYSTEM FOR AN ELECTRONIC DISPLAY

DECLARATION OF ROBERT SMITH-GILLESPIE IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,173,322

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I, Robert Smith-Gillespie, declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

A. Introduction

1. I have been retained by Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, "Samsung" or "Petitioners") as a technical expert witness in connection with the petition for *inter partes* review of U.S. Patent No. 9,173,322 ("'322 patent"). The statements set forth in this declaration are based on my own personal knowledge. I am being compensated at my usual rate, which is $350 per hour, for the time spent preparing this declaration, and my compensation is not contingent on the outcome of any matter or any of the opinions provided below. I have no financial interest in this matter.

2. I understand that the '322 patent issued on October 27, 2015 from U.S. Application Serial No. 14/508,621, naming William Dunn as inventor. I have been advised and it is my understanding that the earliest provisional priority date of the '322 patent is March 3, 2008, the filing date of Provisional Application No. 61/033,064, to which the '322 patent claims priority. For purposes of my analysis herein, I have used this date as the relevant time period.

3. I have been asked by Petitioner to offer opinions regarding the state of the art in the field of cooling electronic display equipment prior to March 3, 2008. I

have been asked to provide my opinion concerning the question of whether the devices described in claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, and 16 of the '322 patent were novel and would have been unobvious to a person of ordinary skill in the art ("POSITA") by March 3, 2008.

4. In preparing this Declaration, I have reviewed the '322 patent, its prosecution history, and each of the documents I reference herein. In reaching my opinions, I have relied upon my experience in the field and have also considered the viewpoint of a person of ordinary skill in the art at the time of the '322 patent's priority date. As explained below, I am familiar with the level of skill of a person of ordinary skill in the art regarding the technology at issue as of that time frame.

5. I make this Declaration based upon my own personal knowledge, information, and belief, and I would and could competently testify to the matters set forth in this Declaration if called upon to do so. I do not have any personal or financial stake or interest in the outcome of the present proceeding, and the compensation is not dependent on the outcome of this IPR and in no way affects the substance of my statements in this declaration.

B. Qualifications and Experience

6. My background includes roughly 35 years of professional experience in the field of illuminated products including liquid crystal displays ("LCD") and

backlighting, LED illuminated consumer products, LED general lighting devices and large area LED display products. I am currently working in a consulting role as a manufacturing systems engineer for Alveo Technologies providing process development expertise for micro-fluidic diagnostic product manufacturing.

7. I received a B.A. in Physics in 1981 from the State University of New York, and a B.S. in Mechanical Engineering from Arizona State University in 1989. More recently, I received a Master of Systems Engineering degree from Embry-Riddle University (Oct. 2021). Additionally, I completed several continuing education courses related to optical illuminated systems. These include a UCLA Extension Short Course in 1993 or 1994 on Photometry and Colorimetry & Flat Panel Displays, Optical System Analysis with ASAP optical analysis software by Breault Research Organization in 1996, and a short course on LCD physics and material at the Kent State University in 1998.

8. My first role involving display products was as a Manufacturing Engineer for Sperry Aerospace Corporation from 1985 through 1989. Sperry was purchased by Honeywell Inc., and I continued at Honeywell's Air Transport Systems Division. In 1989, I moved into the Flight Deck Packaging group as a Sr. Project Engineer where I was responsible for illuminated controls (switches, lighted panels, LED annunciators and numeric LCD modules). I continued at Honeywell through

1997, working as a Principal Engineer where I was responsible for mechanical and optical designs of the primary displays on the Boeing 777 aircrafts.

9. From 1997 through 1999, I worked as Technical Specialist, Displays at Three-Five Systems, Inc., an original design manufacturer of handheld and small equipment LCD displays. My role focused on integrating LCD cells with backlights and mechanical structures for various custom LCDs into consumer products, and provided guidance for LED backlight design, materials and photometry and colorimetry. While there, I developed novel backlight designs and manufacturing process for both die-on-board and chip-on-board backlights.

10. From 1999 through 2002, I worked as Technical Staff Engineer at Rosen Products LLC, and I was responsible for management of LCD display technology, strategic planning and product benchmarking for automotive and aircraft entertainment systems.

11. After leaving Rosen Products LLC, I established and served as President of FPD Design & Consulting LLC, a display product design and development consulting company specializing in integration of ruggedized display components into customer specified products. I have worked at FPD Design & Consulting LLC from 2002 to the present. Projects I have worked on include direct-view backlight designs for aviation simulators, CCFL to LED backlight conversions,

commercial-off-the-shelf LCD display ruggedization and optical enhancement. During this time, I prepared a number of technical papers on display ruggedization, optical enhancement and backlight thermal design, the later as a "how-to" workshop for a local chapter of the Society for Information Display ("SID").

12. From 2011 to 2013, I was employed as the Chief Technologist by E3 Displays, LLC. My responsibilities included materials development and qualification (adhesives, EMI shielding, touch panels, LCD backlights & films), as well as supporting sales and design teams in developing technical solutions for display system's optical, mechanical, electrical, and lighting components, including enhanced LED backlight systems and night-vision compatible backlight designs. Key projects at E3 Displays include the development of an etched-nickel micro-mesh for EMI shielding of display screens, the optical design of light guides for high luminance backlights, and the complete re-packaging of a 19-inch monochrome LCD panel to meet military ground-vehicle mechanical, thermal, and optical requirements.

13. From 2012 to September 2018, I worked at Riverwood Solutions, Inc. ("RWS") as the Senior Technical Specialist. RWS provides electronic manufacturing services management for leading product development companies worldwide. As the Senior Technical Specialist, I provided technical expertise on

technology, materials, design, and manufacturability for product applications including medical products, solar powered devices, LED lamps, and LED illumination in electronic consumer products.

14. I received the Honeywell Technical Achievement Award in 1997. The award recognized my outstanding technical contribution in the field of flat panel display backlighting.

15. I have served on professional committees, groups, and organizations. Between 2001 and 2004, I was a member of the conference organizing committee of SID. My responsibilities focused on planning annual display symposia including technical paper review and selection and session chair.

16. I am an inventor of U.S. Patent No. 7,660,040, entitled "Diffuse reflective article."

17. I am the author or co-author of 16 scientific and engineering publications, including articles, conference presentations, technical and scientific reports and tutorials. These publications cover a wide variety of topics, including but not limited to flat panel display backlighting techniques, LED backlights, thermal design principles and analysis, design requirements for automotive entertainment displays, development of a high luminance, high contrast fixed format LCD and other areas.

18. A more detailed description of my educational and professional background is set forth in my curriculum vitae, attached hereto as Ex. 1003 to this Declaration.

C. Materials Considered

19. The analysis that I provide in this Declaration is based on my education and experience in the field of electronic display design and integration, as well as the documents I have considered, including the '322 patent (Ex. 1001) and its prosecution history (Ex. 1030). The '322 patent states on its face that it issued from U.S. Application Ser. No. 14/508,621, which was filed on October 7, 2014 and is a continuation-in-part of U.S. Application Ser. No. 12/234,307 filed on September 19, 2008 and a continuation of U.S. Application Ser. No. 12/411,925, which was filed on March 26, 2009 and itself was a Continuation-in-Part of each of the following U.S. Applications: (a) No. 12/234,360 filed on September 19, 2008; (b) No. 12/237,365 filed on September 24, 2008; and (c) No. 12/235,200 filed on September 22, 2008. The '322 patent also claims priority to ten (10) different provisional applications as part of its priority chain, the earliest of which is Provisional

Application No. 12/234,307, filed on March 3, 2008. (*See* Ex. 1001, 1:7-42).[1] For the purposes of this Declaration, I have assumed March 3, 2008 as the effective filing date for the '322 patent. I have cited to the following documents in my analysis below:

Exhibit No.	Description
Ex. 1001	U.S. Patent No. 8,854,322 ("the '322 Patent")
Ex. 1003	Curriculum Vitae of Robert Smith-Gillespie
Ex. 1004	U.S. Patent Application Publication No. 2006/0199514 to Kimura ("Kimura")
Ex. 1005	U.S. Patent No. 7,800,706 B2 to Kim, et al. ("Kim")
Ex. 1006	U.S. Patent Application Publication No. 2006/0132699 to Cho, et al. ("Cho")
Ex. 1007	Japanese Unexamined Patent Application Publication No. H11-68363 to Takahashi ("Takahashi")
Ex. 1008	Certified Translation of Japanese Unexamined Patent Application Publication No. H11-68363 to Takahashi ("Takahashi")
Ex. 1009	Korean Published Unexamined Patent Application No. 10-2006-0016469 to Na ("Na")
Ex. 1010	Certified Translation of Korean Published Unexamined Patent Application No. 10-2006-0016469 to Na ("Na")

[1] For purposes of this Declaration, citations to patents and patent applications, including the '322 patent, are in the form a:bb – c:dd, where "a" and "c" are column numbers, and "bb" and "dd" are line numbers.

Exhibit No.	Description
Ex. 1011	Claim Construction Order (D.I. 153) dated October 3, 2018 in *Manufacturing Resources Int'l, Inc. v. Civiq Smartscapes, LLC, et al.*, Civil Action No. 17-269-RGA (D. Del.)
Ex. 1012	Memorandum Opinion (D.I. 150) dated September 27, 2018 in *Manufacturing Resources Int'l, Inc. v. Civiq Smartscapes, LLC, et al.*, Civil Action No. 17-269-RGA (D. Del.)
Ex. 1013	U.S. Patent No. 6,825,828 B2 to Burke, et al. ("Burke")
Ex. 1014	E. Fred Schubert & Jong Kyu Kim, *Solid-State Light Sources Getting Smart*, 308 *Science* 1274 (2005) ("Schubert")
Ex. 1015	U.S. Patent Application Publication No. 2004/0223299 to Ghosh ("Ghosh")
Ex. 1016	Military Handbook: Reliability Prediction of Electronic Equipment, DEPARTMENT OF DEFENSE, MIL-HDBK-217F (1991) ("MIL-HDBK-217F")
Ex. 1017	Allan Webber, *Calculating Useful Lifetimes of Embedded Processors,* TEXAS INSTRUMENTS INCORPORATED, SPRABX4 (Nov. 2014) ("Webber")
Ex. 1018	LIAN-TUU YEH & RICHARD C. CHU, THERMAL MANAGEMENT OF MICROELECTRONIC EQUIPMENT: HEAT TRANSFER THEORY, ANALYSIS METHODS, AND DESIGN PRACTICES (Dereje Agonafer ed., 2002) ("Yeh & Chu")
Ex. 1019	ALLAN W. SCOTT, COOLING OF ELECTRONIC EQUIPMENT (John Wiley & Sons, 1974) ("Scott")
Ex. 1020	DAVE S. STEINBERG, COOLING TECHNIQUES FOR ELECTRONIC EQUIPMENT (John Wiley & Sons, 1980) ("Steinberg")
Ex. 1021	U.S. Patent No. 5,748,269 to Harris, et al. ("Harris")
Ex. 1022	U.S. Patent Application Publication No. 2002/0122134 to Kalua ("Kalua")
Ex. 1023	Custom Luxeon Design Guide, LUMILEDS FUTURE ELECTRONICS, Application Brief AB12 (Nov. 2004) ("Lumileds AB12")

Exhibit No.	Description
Ex. 1024	Thermal Design Using: Luxeon Power Light Sources, PHILLIPS LUMILEDS LIGHTING COMPANY, Application Brief AB05 (June 2006) ("Lumileds AB05")
Ex. 1025	Japanese Patent No. 2006-330196 to Tachikawa ("Tachikawa")
Ex. 1026	Certified Translation of Japanese Patent No. 2006-330196 to Tachikawa ("Tachikawa")
Ex. 1027	Japanese Unexamined Patent Application Publication No. 10-2003-162228 to Kochiyama("Kochiyama")
Ex. 1028	Certified Translation of Japanese Unexamined Patent Application Publication No. 10-2003-162228 to Kochiyama("Kochiyama")
Ex. 1029	U.S. Patent Application Publication No. 2007/0171353 A1 to Hong ("Hong")
Ex. 1030	PEM BULLETIN, PennEngineering (1997) ("PEM")
Ex. 1031	MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY (11th ed. 2007) ("Webster")
Ex. 1032	THE OXFORD ENGLISH DICTIONARY (J. A. Simpson & E. S. C. Weiner eds., 2d ed. 1989) ("Oxford")
Ex. 1033	RANDOM HOUSE WEBSTER'S COLLEGIATE DICTIONARY (2d ed. 2000) ("Random House")
Ex. 1034	File History for U.S. Application No. 12/411,925
Ex. 1035	U.S. Patent No. 8,854,595, to Dunn ("the '595 patent")
Ex. 1036	U.S. Patent Application Publication No. 2008/0218446 to Yamanaka ("Yamanaka")
Ex. 1037	U.S. Patent No. 7,753,567 to Kang, et al. "(Kang")
Ex. 1038	U.S. Patent Application Publication No. 2009/0154096 to Iyengar, et al. ("Iyengar")

II. LEGAL PRINCIPLES

20. I am not an attorney. For purposes of this declaration, I have been informed by counsel for Samsung Electronics Co., LTD, about certain aspects of the law that are relevant to my analysis and opinions, as set forth below.

A. Prior Art

21. I understand that the prior art to the '322 patent includes patents and printed publications in the relevant art that predate the '322 patent's priority date. As I explained previously, I have been instructed to assume for purposes of my analysis that March 3, 2008 is the relevant date for determining what is "prior art." In other words, I should consider as "prior art" anything publicly available prior to March 3, 2008. I further understand that, for purposes of this proceeding in the United States Patent Trial and Appeal Board, only patents and documents that have the legal status of a "printed publication" may be relied on as prior art.

B. Claim Construction

22. I understand that under the legal principles, claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application. I further understand that the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which a claim term appears,

but in the context of the entire patent, including the specification.

23. I am informed by counsel that the patent specification, under the legal principles, has been described as the single best guide to the meaning of a claim term, and is thus highly relevant to the interpretation of claim terms. I understand for terms that do not have a customary meaning within the art, the specification usually supplies the best context of understanding the meaning of those terms.

24. I am further informed by counsel that other claims of the patent in question, both asserted and unasserted, can be valuable sources of information as to the meaning of a claim term. Because the claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

25. I understand that the prosecution history can further inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. Extrinsic evidence may also be consulted in construing the claim terms, such as my expert testimony.

26. I have been informed by counsel that, in *inter partes* review ("IPR") proceedings, a claim of a patent shall be construed using the same claim construction

standard that would be used to construe the claim in a civil action filed in a U.S. district court (which I understand is called the "*Phillips*" claim construction standard), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

27. I have been instructed by counsel to apply the "*Phillips*" claim construction standard for purposes of interpreting the claims in this proceeding, to the extent they require an explicit construction. The description of the legal principles set forth above thus provides my understanding of the "*Phillips*" standard as provided to me by counsel.

28. I understand that some claims are independent, and that these claims are complete by themselves. Other claims refer to these independent claims and are "dependent" from those independent claims. The dependent claims include all of the limitations of the claims on which they depend.

C. Anticipation

29. I understand that a patent claim is anticipated if a single prior art document describes every element of the claim such that a POSITA could practice the claimed method without undue experimentation.

30. I understand that anticipation may be by express disclosure in the prior

art. I also understand that if the prior art reference does not expressly set forth a particular claim element, the prior art may still anticipate a patent claim if that element is "inherent" in its disclosure—that is, if it is necessarily found in the reference. A property is inherent even if a POSITA would not have appreciated that property as of the date of that prior art.

D. Obviousness

31. I understand that obviousness is a determination of law based on various underlying determinations of fact. In particular, these underlying factual determinations include (1) the scope and content of the prior art; (2) the level of ordinary skill in the art at the time the claimed invention was made; (3) the differences between the claimed invention and the prior art; and (4) the extent of any proffered objective indicia of non-obviousness. I understand that the objective indicia which may be considered in such an analysis include commercial success of the patented invention (including evidence of industry recognition or awards), whether the invention fills a long-felt but unsolved need in the field, the failure of others to arrive at the invention, industry acquiescence and recognition, initial skepticism of others in the field, whether the inventors proceeded in a direction contrary to the accepted wisdom of those of ordinary skill in the art, and the taking of licenses under the patent by others, among other factors.

32. To ascertain the scope and content of the prior art, it is necessary to first examine the field of the inventor's endeavor and the particular problem for which the invention was made. The relevant prior art includes prior art in the field of the invention, and also prior art from other fields that a person of ordinary skill in the art would look to when attempting to solve the problem.

33. I understand that a determination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention. Instead, it is my understanding that in order to render a patent claim invalid as being obvious from a combination of references, there must be some evidence within the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination in a way that would produce the patented invention.

34. I further understand that in an obviousness analysis, neither the motivation nor the purpose of the patentee dictates. Rather, any problem known in the field can provide a reason for combining the prior art in the manner claimed.

E. Mean Plus Function

35. I am informed and understand that certain claim elements may be understood as reciting a means-plus-function limitation. I am also informed and understand that the analysis of a claim element reciting a mean-plus-function

limitation may require the identification of a respective function recited in the claim element, and the identification of a respective structure that is disclosed in the specification or file history of the '322 patent, where the identified structure is linked to and performs the respective recited function. I am further informed and understand that to show that the prior art teaches the claim element, the prior art should disclose a structure that performs the function recited in the particular claim element, where the structure disclosed in the prior art is similar as or equivalent to the structure in the '322 patent that performs the recited function.

III. LEVEL OF ORDINARY SKILL IN THE ART

36. I understand that an assessment of claims of the '322 patent should be undertaken from the perspective of a person of ordinary skill in the art as of the earliest claimed priority date, which, as I explained above, I assumed to be March 3, 2008.

37. I understand that a POSITA is a hypothetical person who is presumed to be aware of all pertinent art, applies conventional wisdom in the art, and is a person of ordinary creativity. I have also been advised that to determine the appropriate level of a person having ordinary skill in the art, the following factors may be considered: (1) the types of problems encountered by those working in the field and prior art solutions thereto; (2) the sophistication of the technology in

question, and the rapidity with which innovations occur in the field; (3) the educational level of active workers in the field; and (4) the educational level of the inventor.

38. Applying these factors, as to the ’322 patent, a POSITA in March 2008 would have had a bachelor’s degree in a pertinent discipline, such as mechanical engineering, physics, product design, or a related field. Such a person would also have 2–4 years of experience in working with electronic displays and have an understanding of product design issues and failure modes associated with electronic displays. Alternatively, a POSITA would have had 5–7 years of experience in the field working with electronic displays and have a similar understanding of product design issues and failure modes associated with electronic displays. To the extent necessary, a POSITA may collaborate with one or more other persons of skill in another art (e.g., one of skill in the art of electrical engineering) for one or more aspects with which the other person may have expertise, experience, and/or knowledge that was obtained through her own education, industrial or academic experience.

39. Based on this definition, I am a person of ordinary skill in the art at least due to my extensive experience in the areas electronic displays including LCD module design, integration, and ruggedization, CCFL and LED backlight design and

thermal management, and materials development. I was also a person of ordinary skill in the art in the 2007–2008 timeframe relevant to this proceeding.

IV. KNOWLEDGE IN THE ART AT THE TIME OF THE ALLEGED INVENTION OF THE '322 PATENT

40. I understand that a skilled artisan is presumed to know and be familiar with all of the relevant art in the field at the time of the relevant invention.

41. The technology at issue in the challenged claims of the '322 patent relates to the cooling of electronic displays, including LCD displays with LED backlights. Such displays and their cooling systems have been known and used well-before March 2008.

42. Electronic displays are devices that visually present static or moving images. Electronic displays have been around since the early 1900s and were widely commercialized in the 1940s with the first monochrome television set.

43. A typical LCD display is comprised of three main components: an LCD panel, an electronic driver circuit, and a backlight. The LCD display panel comprises a thin layer of liquid crystal ("LC") material constrained between two sheets of glass, one of which includes a thin film transistor ("TFT") array and the other which includes a color filter ("CF") array. The glass/LC/TFT/CF stack is covered front and rear with a pair of linear polarizers. Electronic control circuits are attached to the LCD panel via flexible printed circuits and connect to row and

column lines on the TFT substrate glass. A lighting assembly (backlight unit or "BLU") is housed behind the LCD panel to provide a uniform source of light to the rear of the panel. The light from the BLU is modulated pixel-by-pixel in the LCD panel to provide a color image to the viewer.

44. By 2008, LED backlights had become the backlight of choice in LCD displays based on their longer service, better low temperature performance, increased ruggedness and packaging-friendly formats when compared to CCFL backlights. Eventually, LEDs would provide better color reproducibility and lower power dissipation than CCFLs, furthering their advantages and solidifying the dominance as the light source of choice.

45. In the early- to mid-2000s, as LCD panel size grew, their use in a variety of indoor and outdoor environments outside the home also grew. (*See, e.g.*, Exs. 1013, 1:15-30; 1014, pp.1274-78.) For example, LCDs began to be used in indoor environments such as commercial offices, in airplanes, airports and train stations, and for advertising displays such as in malls, as well as in outdoor applications such as in ATMs, information kiosks, bus shelters, billboards, and street level advertising.

46. The use of electronic displays in such applications yields a design consideration that was well-known to those skilled in the art in March, 2008: namely thermal stress. Thermal stress is a general term for both short- and long-term

performance reduction of electronic components subject to operation at elevated temperature. The phenomena of thermal stress has been well known for at least the last 50 years,[2] with initial research and requirements developed by and for military equipment electronics. Thermal stress may cause premature failure of components. Known wear-out mechanisms are accelerated by high-temperature operation of semiconductors include gate oxide integrity break-down, electro-migration, and time dependent dielectric break-down.[3] Thermal stress can also cause component performance to drift or decay temporarily (i.e. at elevated temperature). Thermal stress may be induced by: (i) self-heating of components due to high power dissipation; (ii) exposure to elevated ambient temperatures; and (iii) convective, conductive or radiative heating of the immediate environment by other equipment's heat dissipation or by external sources such as solar radiation. The latter of which is a significant factor for displays used in outdoor environments where the sun may

[2] MIL-HDBK-217A was issued in 1965 to address thermal stress failures in monolithic ICs and other components. In 1994, MIL-HDBK-217F (Ex. 1016) was the last revision of the document as new electronics devices and methods of reliability prediction took hold. The U.S. military discontinued maintenance of the document in 1995.

[3] For a background on failure modes and component reliability, *see* Webber (Ex. 1017).

impinge directly on the display.

47. Sensitive electronics in display systems include power supply components, microcontrollers, microprocessors, and other semiconductor components, as well as LEDs used in the backlight, whose performance degradation includes reduction of emitted flux and color shift with increased temperature. These performance concerns were well known at the time of the '322 patent filing. Thus, some cooling mechanism must be used to ensure the continued reliability of electronics, and ultimately, to prevent failure. (*See* Ex. 1018, p.2 ("[B]ased on a survey by the U.S. Air Force and indicating that more than 50% of all electronics failures are caused by shortcomings in temperature control . . .").)

48. As noted above, the need to control the thermal environment of electronic components is an old problem. Heat generated by the electronics must be efficiently and effectively removed from the components. This process is generally called "cooling." (Exs. 1019, p.1 ("All electronic equipment needs cooling."); 1020, p.1.) Cooling is accomplished by heat transfer, the movement of thermal energy from one body to another. The three primary modes of heat transfer used to cool electronic equipment are conduction, radiation, and convection. (Ex. 1020, p.2.)

49. Convective heat transfer is accomplished via the flowing of a fluid, either liquids or gases across a surface. In heat transfer from a surface, energy is

transferred to the fluid by conduction across a boundary layer of air at the surface. This energy is carried away by the now warmed bulk fluid. (*Id.*, p.3.) In "forced convection," the movement of the air is induced by a mechanical object, such as a fan. (*Id.*) Often, and as is the case in the '322 patent, air acts as the heat transfer fluid.

50. A plenum is a cavity through which a fluid, normally air, flows. The ductwork in a typical heating and air-conditioning system is an example of a plenum system which constrains air flows to and from various regions of a building. Here, the air is moved under the influence of a fan. The air intake system on a modern automobile utilizes a plenum formed by a series of connected tubes and housings. In this case, the air is moved by a combination of negative pressure at the intake manifold, and positive pressure upstream of the incoming air filter. In electronics cooling applications, the walls of the plenum may be formed of a thermally conductive material on at least the side in contact with the heat source. This encourages conductive heat transfer through the plenum wall and into the moving air stream. (*See, e.g.*, Ex. 1021, 5:18–23.)

51. Since electronic displays contain electronics which are impacted by operation at elevated temperature (*see, e.g.*, any of the Temperature Factor tables in MIL-HDBK-217 (Ex. 1016), an example of which is shown below), the thermal

design of displays is always a key consideration. Cooling designs incorporating convection have been incorporated in displays for decades. The following examples are offered to highlight the state of the art several years prior to the '322 filing wherein thermal considerations and countermeasures were taken by the inventors.

6.3 TRANSISTORS, LOW FREQUENCY, BIPOLAR

$\lambda_p = \lambda_b \pi_T \pi_A \pi_R \pi_S \pi_Q \pi_E$ Failures/10^6 Hours

Base Failure Rate - λ_b

Type	λ_b
NPN and PNP	.00074

Temperature Factor - π_T

T_J (°C)	π_T	T_J (°C)	π_T
25	1.0	105	4.5
30	1.1	110	4.8
35	1.3	115	5.2
40	1.4	120	5.6
45	1.6	125	5.9
50	1.7	130	6.3
55	1.9	135	6.8
60	2.1	140	7.2
65	2.3	145	7.7
70	2.5	150	8.1
75	2.8	155	8.6
80	3.0	160	9.1
85	3.3	165	9.7
90	3.6	170	10
95	3.9	175	11
100	4.2		

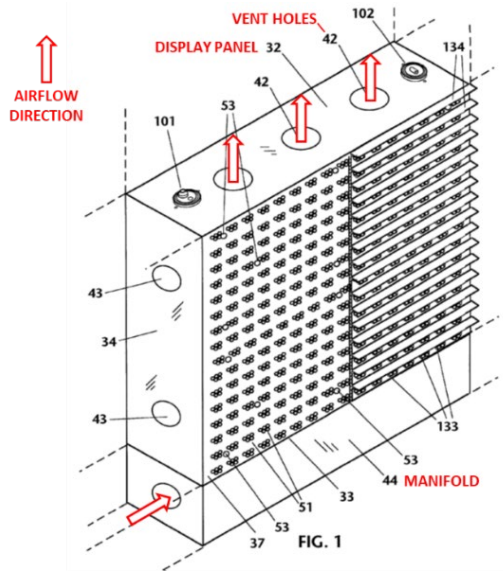
$$\pi_T = \exp\left(-2114\left(\frac{1}{T_J + 273} - \frac{1}{298}\right)\right)$$

T_J = Junction Temperature (°C)

(Ex. 1016, § 6.3.)

52. Kalua (Ex. 1022) addresses issues in direct-view LED displays related to thermal impact on LED lifetimes and the need for cooling systems. It further includes at least one embodiment of a forced air-cooling system in which the display housing acts as cascaded plenum units for constricting air flow in the LED panel

units to cool the displays, as reflected by Figure 1 (annotated):



(Ex. 1022, FIG. 1 (annotated).) Kalua explains:

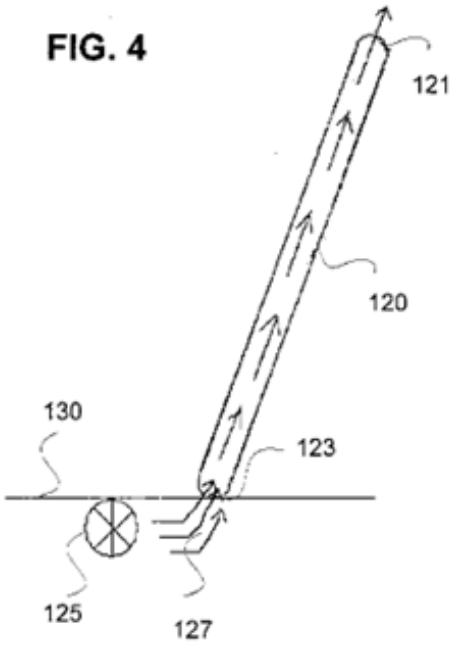
> Although LEDs have an extremely long mean time before failure (MTBF), they must be protected from damage due to particular operating conditions. For example, ***when LEDs overheat the life expectancy quickly may be shortened by factors of 10***. Heat buildup may be caused not only by the waste heat of the LEDs operating at high power, but also by external factors such as hot ambient air due to hot weather, high heat loads from direct sunlight, and the like. ***Generally speaking, some form of cooling system must be available to rid the LED systems of heat buildup to avoid diminishing the life of the LEDs***.

(*Id.*, ¶[0003] (emphasis added).) Kalua further explains:

> The image units are arrayed in columns and rows, and ***the bottom row is supported on a manifold that supplies cold air or other coolant through spaced holes in the manifold. [T]he top and bottom panels of each image unit includes [sic] at least one vent hole to promote the flow of coolant upwardly*** through the columns of image units. ***An exhaust manifold is secured to the top of the uppermost row of the array to carry away the coolant***, whereby substantial heat is removed from the video array.

(*Id.*, ¶[0013] (emphasis added).)

53. In an LCD panel related example, Figure 4 from Ghosh (Ex. 1015) illustrates a simple "forced convection" method for cooling a flat screen display in a laptop computer:



(Ex. 1015, FIG. 4.)

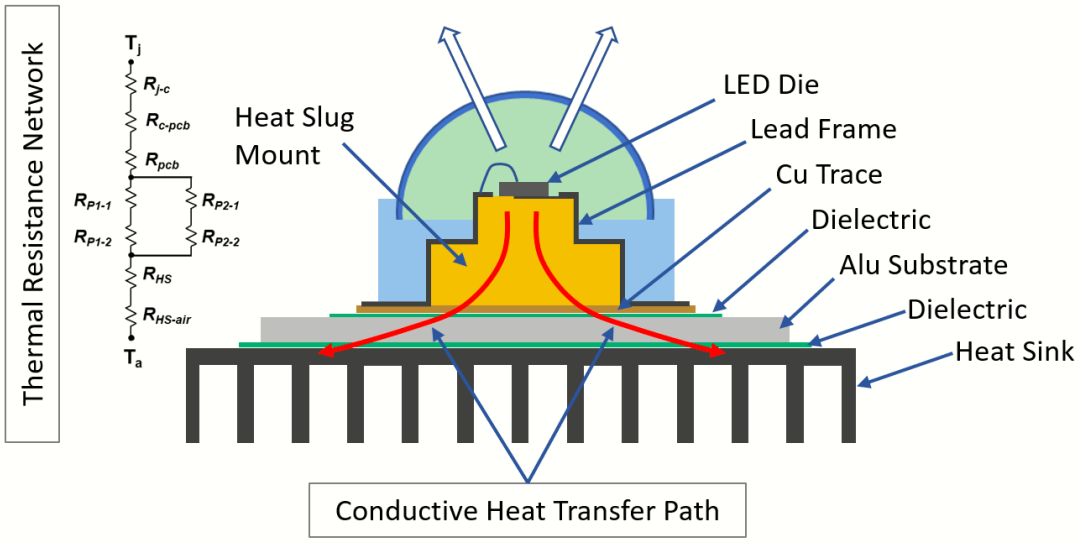
54. In this figure, display unit **120** comprises a display screen and other electronic components such as circuits, chips, batteries, etc. (Ex. 1015, ¶[0020].) These electronic components generate heat, and must be cooled to operate properly. Air can enter and exit through apertures **123** and **121**, respectively. (*Id.*) When operating, the air movement device **125**, such as a fan, moves cool air through aperture **123** and pushes it upwards through a cavity. (*Id.*, ¶¶[0021]-[0022].) As the air passes through display unit **120**, heat is transferred via convection from the electronic components of the display to the air stream, thereby cooling the display. (*Id.*) The heated air then exits through aperture **121**. (*Id.*, ¶[0022].)

55. Prior to the use of LEDs as LCDs backlight light sources, LCD

backlights depended predominantly on CCFL light sources. CCFL lamps comprise phosphor coated, tubular glass envelopes with electrodes placed at both ends. CCFLs emit light from the entire envelope but are limited in their luminous efficiency to around 65-70 lumens/watt, require very high voltages (typically >500V for a 300mm long lamp) and contain mercury, raising environmental concerns. As phosphor converted white LEDs started to reach roughly 50 lumen/watt efficiencies in the mid-2000s, their use in LCD backlights gained in popularity for several reasons. LEDs did not contain mercury, were driven at low voltages, did not suffer from cold-temperature operation (a big issue with CCFLs), and could withstand mechanical stress better than CCFLs. LEDs also promised the possibility of thinner LCD module packages with higher LCD color gamuts, and eventually higher luminous efficiencies than CCFL based products. However, LEDs are point sources and, as such, the heat generated in the LED package must be efficiently removed to prevent reduction in luminous efficiency and lifetime reduction.

56. LEDs dissipate electrical power as light, radiated heat ("IR radiation"), and conducted heat. The dominant pathway for heat dissipation in LEDs is via conduction from the LED die through both the lead frame and heat slug mount (if used) to the LED printed circuit board ("PCB"). The PCB should facilitate conduction to a heat sink while additionally spreading the heat over a large area to

reduce the junction temperature of the LED die. PCBs can be made of epoxy-fiberglass composite, such as FR-4, with single or multiple copper conductor layers, or using a metal core substrate with a single stack of circuit conductor and dielectric film.



57. Metal core printed circuit boards ("MCPCBs") are a special class of PCBs whose unique properties of high thermal conductivity both in-plane and cross-plane makes them attractive for medium- to high-power dissipation applications. Compared to typical composite circuit boards, an aluminum core circuit board can have several-times higher the thermal conductivity of that of an FR-4 (fiberglass-epoxy) circuit board (~3.0W/m-K vs. 0.3W/m-K, respectively). The higher thermal conductivity will allow roughly several-times higher power dissipation in a

component for the same rise in device junction, all other things being equal.

58. The use of MCPCBs dates to the 1970s for use in power electronics applications. (Ex. 1020, § 3.6, FIG. 3.5.) While FR-4 has been the de facto standard for medium- to low-power applications in standard environments (office, factory, home, etc.), as LEDs increased in power to hundreds of milliwatts and eventually more than a watt per package, more efficient thermal designs called for the use of metal core boards. For example, Lumileds AB12 instructed use of their 1-Watt LED products with MCPCBs stating "Luxeon Power Light Sources do require additional heat sinking to the aluminum-core PCB." (Ex. 1023, p.11; *see also* Ex. 1024, p.2 (noting all Level 2 Luxeon products are mounted on a MCPCB, which acts as a thermal heat sink interface).)[4]

V. THE '322 PATENT

A. Overview of the '322 Patent

59. The '322 patent, which is titled "Constricted convection cooling system for an electronic display," issued from U.S. Application Serial No. 14/508,621 filed

[4] Both of these Lumileds Design Guides (Exs. 1023 and 1024) are documents that I was familiar with as of the priority date of the '322 patent and both are documents of the type that a POSITA would rely upon in designing LED devices, and packaging and thermal protection solutions for LED devices.

on October 7, 2014. (Ex. 1001, face page.)

60. The '322 patent relates to cooling of electronic displays, including LCD displays using a fans to "propel or pull air" between a "constricted convection plate" and the rear surfaces of the electronic displays. (*Id.*, Abstract, 5:50-54.) The specification of the '322 patent identifies a few types of flat display systems, including "LCD (including TFT or STN type), light emitting diode (LED), organic light emitting diode (OLED), field emitting display (FED), cathode ray tube (CRT), and plasma displays." (*Id.*, 4:20-23.)

61. The specification discloses that "conductive and convective heat transfer systems for electronic displays are known," including systems that "have relied primarily on fans for moving air past the components to be cooled and out of the display." (*Id*., 1:52-58.) Figure 5B is an exemplary embodiment of the alleged invention set forth in the challenged claims and includes display **10** and fan **52** which "draw[s] ambient air between the posterior display surface **22** and the constricted convection plate **30**." (*Id.*, 6:1-5.) Figure 5C is another exemplary embodiment where "one or more fans **52** are used to force air ambient air between the posterior surface **22** and the constricted convection plate **30**." (*Id.*, 6:5-7.)

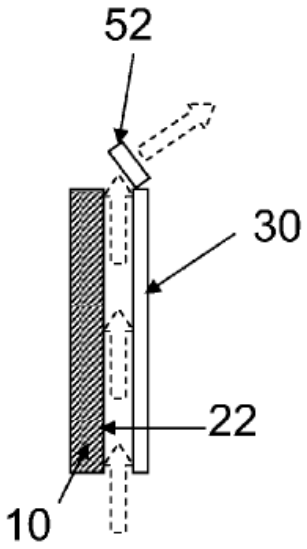


Fig. 5B

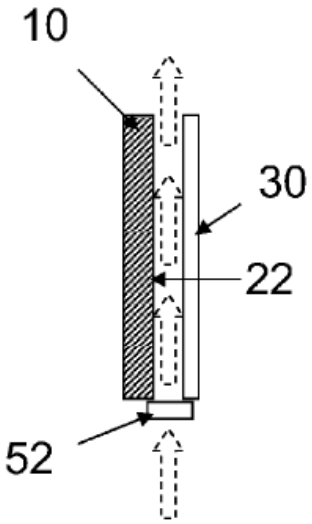
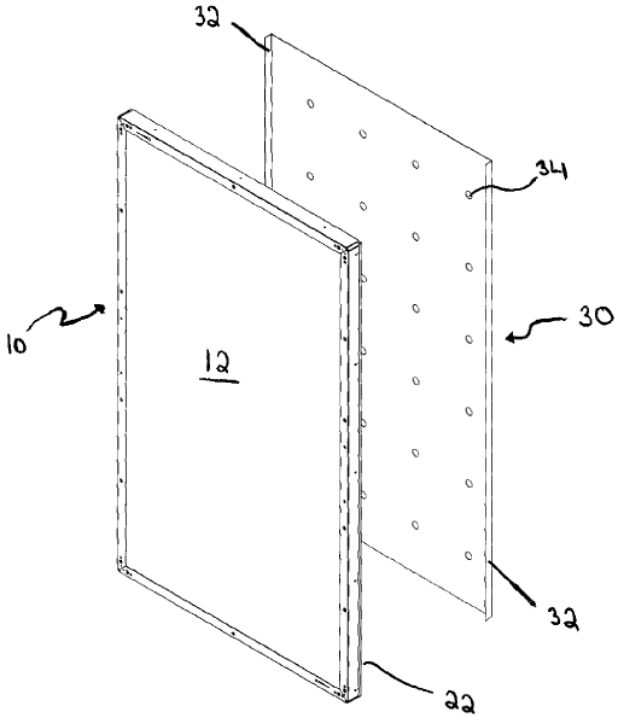


Fig. 5C

62. The constricted convection plate **30** may also include access apertures **34** that "allow access to hardware found on the display posterior **22**." (*Id*., 5:5-8.) Figure 4 is an exemplary embodiment showing side panels **32** and access apertures **34**:



(*Id.*, FIG. 4.)

63. The patent states that an LCD display has a backlight assembly which may be made of "a printed circuit board (PCB) with a plurality of LEDs mounted" to the front surface of the PCB. (*Id.*, 4:52-55.) Heat generated by LEDs and other electronic components must be dispersed to prevent overheating and malfunction. (*Id.*, 3:5-8.) The PCB may be made of metal, so that heat emitted by the LEDs can easily pass from the front side of the PCB to the rear, or posterior side of the LEDs. (*Id.*, 4:55-65.)

64. The patent specification discusses a few other features, some optional, that can be used along with the "constricted convection plate," such as an exterior

housing, (*Id.*, 2:45–46.) The patent also discusses that "mounting brackets **20** . . . may be used to secure the constricted convection plate **30**" to the rear of the display assembly. (*Id*., 5:34–37; *see also id.*, 6:50-55.) The specification states that the "present invention may use various shapes and numbers of mounting brackets **20**." (*Id*., 6:51-53.)

B. Prosecution History

65. I reviewed the history of the application as it was considered and then approved by the patent office, which I understand is called the "prosecution history" (Ex. 1030). I am aware the Patent and Trademark Office entered several office actions rejecting the claims based on a number of prior art references, relying primarily on: (a) Yamanaka (Ex. 1036); (b) Kang (Ex. 1037); and (c) Iyengar (Ex. 1038).

66. The Patent Owner made amendments to overcome the rejections based on this prior art and the claims were allowed in a Notice of Allowance dated September 15, 2015. (Ex. 1034, p.12.) The '322 patent issued on October 27, 2015.

67. Although Cho (Ex. 1006) was cited to the examiner on an Information Disclosure Sheet, it was not cited by the examiner in any rejections of record. (Ex. 1034, pp.79, 98.) None of the other references cited herein were considered by the examiner during prosecution of the '322 patent, nor are they cumulative of the

references the examiner did consider.

C. The Challenged Claims

68. This Declaration addresses claims 1-5, 7-13, and 16 of the ’322 patent. Claims 1, 4, and 9 are the independent claims.

69. Independent claim 1 recites:

1[pre]	A system for cooling an electronic display having a posterior display surface and contained within a housing, the system comprising:
1[a]	a constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface;
1[b]	at least one bracket which connects the posterior display surface with the constricted convection plate; and
1[c]	a fan placed to draw ambient air between the constricted convection plate and the rear posterior.

70. Independent claim 4 recites:

4[pre]	A liquid crystal display (LCD) comprising:
4[a]	a liquid crystal stack;
4[b]	a backlight assembly behind the liquid crystal stack and comprising:

4[b(i)]	a printed circuit board (PCB) having front and back sides;
4[b(ii)]	a plurality of LEDs mounted on the front side of the PCB;
4[b(iii)]	a posterior surface on the rear side of the PCB;
4[c]	a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and
4[d]	a fan positioned to draw air between the constricted convection plate and the posterior surface.

71. Independent claim 9 recites:

9[pre]	A system for cooling an electronic display comprising:
9[a]	an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display;
9[b]	a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface; and
9[c]	a means for forcing air between the constricted convection plate and the posterior surface of the electronic display.

72. I have added indices of the form 1[a], 1[b], 1[c], etc. to each of the claim

elements for ease of reference, and to match the indices used in the Petition.

D. Claim Construction

73. I understand that Patent Owner previously asserted the '322 patent against a third party, Civiq Smartscapes LLC, in patent litigation in the United States District Court for the District of Delaware captioned *Manufacturing Resources, Inc. v. Civiq Smartscapes, LLC*, No. 1:17-cv-00269 (D. Del.). I further understand that in that litigation, the District Court on October 3, 2018 issued a Claim Construction Order (Ex. 1011) where it construed two terms used in the challenged claims of the '322, which I discuss herein.

74. In particular, I understand that the Delaware District Court construed the term "**between**" as used in claim 4 of the '322 patent to mean "**in the space that separates**." (Ex. 1011, p.1.) I further understand that the Delaware District Court construed the term "**substantially parallel**" as it is used in claim 4 to mean "**approximately parallel**." (*Id*., p.2) I have applied these constructions in my analysis of the validity of claims 1-5, 7-13, and 16 of the '322 patent for the reasons provided by the District Court.

75. I believe that the term "**a fan [placed/positioned] to draw [ambient] air between the constricted convection plate and the [rear posterior/posterior surface]**" as used in claims 1 and 4 also requires construction for purposes of these

proceedings. It is my opinion that this term should be construed to mean "**a fan positioned to pull [ambient] air through and out of the space that separates the constricted convection plate and the [rear posterior/posterior surface]**." Such an interpretation is consistent with usage of the term "draw" in the specification of the '322 patent. For example, the specification explains that the claimed cooling system may include fans **52**, which "pull the air through the constricted convection channel **50**." (Ex. 1001, 5:45-58.) The specification further makes clear that the fans "draw ambient air" (i.e., air from outside the housing) through the constricted convection channel. (*Id.*, 5:65-67, 6:1-5, FIGs. 5B and 5D.) This construction is also consistent with the plain and ordinary meaning of "draw" as set forth in general purpose dictionary usage. (*See, e.g.*, Webster 2007 (Ex. 1031) at p.379 ("to pull up or out of a receptacle or place where seated or carried"); Oxford 1989 (Ex. 1032) ("To cause (anything) to move toward oneself by the application of force; to pull"); Random House 2000 (Ex. 1033) ("to cause to move in a particular direction by or as if by a pulling force; pull; drag").) Finally, this construction is also consistent with the District Court's construction of "between."

76. I am informed and understand that the term "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**" as used claims 9 and 13 may be understood as reciting a means-

plus-function limitation. I am also informed and understand that the analysis of this claim element may require the identification of a respective function recited in the claim element, and the identification of a respective structure that is disclosed in the specification or file history of the '322 patent, where the identified structure is linked to and performs the respective recited function. I am further informed and understand that to show that the prior art teaches the claim element, the prior art should disclose a structure that performs the function recited in the particular claim element, where the structure disclosed in the prior art is the same as or equivalent to the structure in the '322 patent that performs the recited function.

77. The recited function is "forcing air between the constricted convection plate and the posterior surface of the electronic display." The corresponding structure to perform this function as disclosed from the specification is one or more fans **52**, air conditioning unit **110**, and their equivalents. (*See* Ex. 1001, 6:60-67, 7:38-54; *see also id.,* 2:67-3:4, 5:50-52, 6:5-7, 6:9-12, 8:52-56.)

78. Otherwise, in my analysis of the validity of claims 1-5, 7-13, and 16 of the '322 patent, I have applied my understanding of what would be the plain and ordinary meaning to a POSITA of all other claim terms appearing in those claims.

VI. APPLICATION OF THE PRIOR ART TO ASSERTED CLAIMS

79. I have reviewed and analyzed the prior art references and materials

listed in Part I.C. above. In my opinion, the claims of the '322 patent are rendered unpatentable based on the following prior art:

Ground	**References**	**Claim(s)**
1	Kim [Ex. 1005] in view of Hong [Ex. 1029]	4, 7
2	Kim [Ex. 1005] in view of Hong [Ex. 1029] and Tachikawa [Ex. 1026]	5
3	Kim [Ex. 1005] in view of Hong [Ex. 1029] and Takahashi [Ex. 1008]	8
4	Kim [Ex. 1005] in view of Tachikawa [Ex. 1026]	1, 2, 3
5	Na [Ex. 1010]	4, 8, 9, 10, 16
6	Na [Ex. 1010] in view of Kim [Ex. 1005]	7, 12, 13
7	Na [Ex. 1010] in view of Tachikawa [Ex. 1026]	11
8	Kimura [Ex. 1004]	9, 12, 13, 16
9	Kimura [Ex. 1004] in view of Kochiyama [Ex. 1028]	1, 2, 3, 11
10	Kimura [Ex. 1004] in view of Hong [Ex. 1029]	4, 7

Ground	References	Claim(s)
11	Kimura [Ex. 1004] in view of Hong [Ex. 1029] and further in view of Kochiyama [Ex. 1028]	5
12	Cho [Ex. 1006]	4, 5, 9, 10, 11

80. I am informed by counsel that each reference listed above qualifies as prior art to the challenged claims because each reference was filed and/or published before the earliest claimed priority date of the ’322 patent. I reserve the right to respond in the future to any arguments or positions that the Patent Owner may raise, taking account of new information as it becomes available to me.

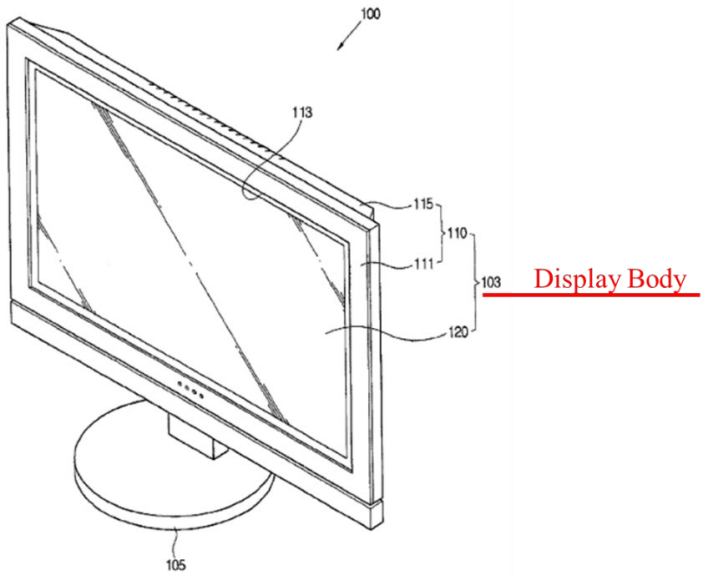
A. Brief Summary of Prior Art

1. Kim [Ex. 1005]

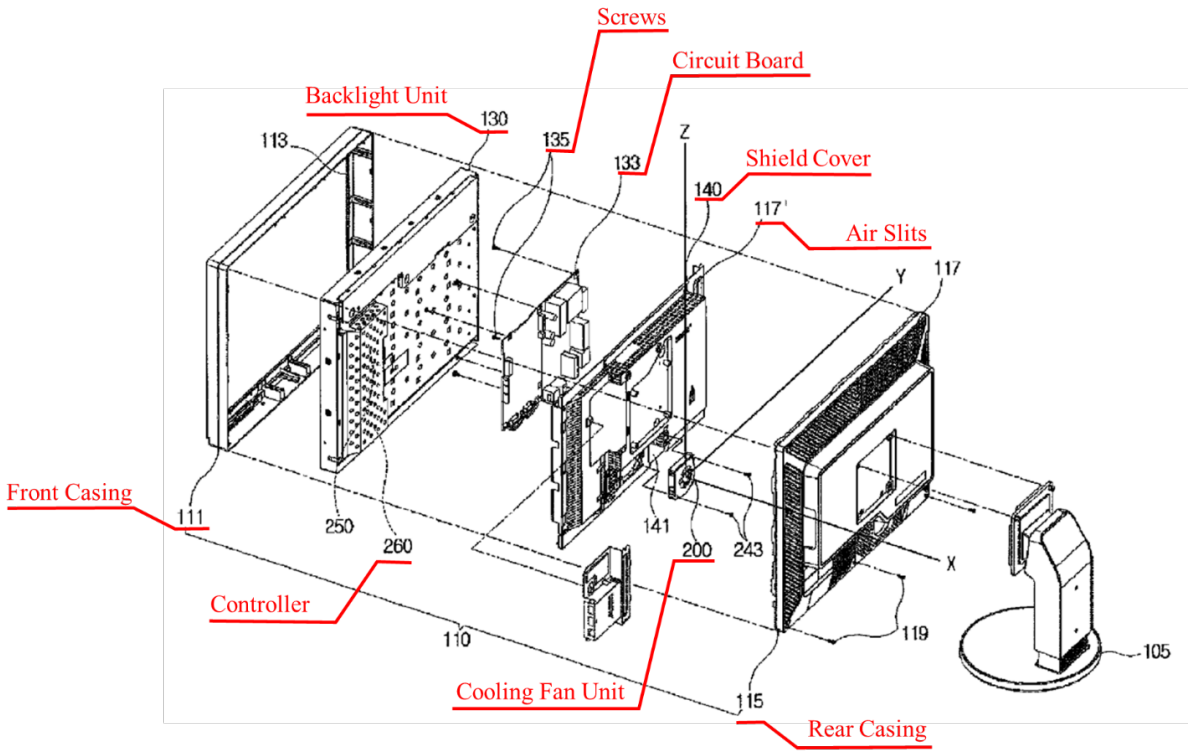
81. U.S. Patent No. 7,800,706 (“Kim”) (Ex. 1005), titled “Cooling Fan Unit and Display Apparatus Having the Same,” was issued on September 21, 2010 from Application No. 11/778,138, filed on July 16, 2007, which itself claims foreign priority to Korean Application No. 10-2006-0100537, filed on October 16, 2006. I am informed that Kim qualifies as prior art to the ’322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(e)(2) because it was described in a patent granted on a Korean application for a patent by another (i.e., Samsung) filed in the United States

before the invention of the '322 patent.

82. Kim is directed to "a cooling fan unit with improved cooling efficiency by efficiently cooling heat generated from a backlight unit, and a display apparatus having the same." (Ex. 1005, 1:46-49). As reflected by Figures 1 and 2, Kim's display apparatus **100** "generally comprises a display body **103** and a stand **105** that supports the display body **103**." (*Id.*, 4:1-4). The display apparatus further comprises "a casing **110**" with "a front casing **111** and a rear casing **115**" that accommodates and supports an LCD panel **120**, a backlight unit **130**, a shield cover **140**, and a cooling fan unit **200**. (*Id.*, 4:1-12.)



(*Id.*, FIG. 1 (annotated).)

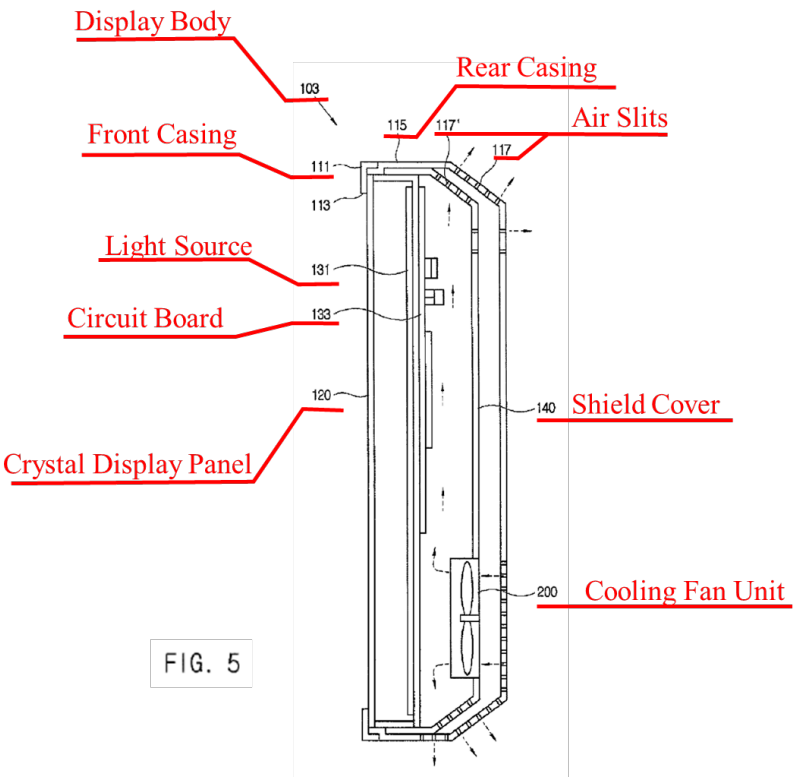


(*Id.*, FIG. 2 (annotated)). "The front casing **111** includes an opening part **113** and supports the LCD panel **120** on which an image is displayed." (*Id.*, 4:13-15).

83. Kim discloses that "[t]he backlight unit **130** comprises a plurality of light emitting diodes (LEDs) as a light source **131** that generates light." (*Id.*, 4:33-35). As shown in Figure 2, "a circuit board **133** that applies or controls power to the light source **131** . . . is combined to the rear side of the backlight unit **130** and is connected to the controller **260**." (*Id.*, 4:38-41; FIG. 2). Kim discloses that "[t]he circuit board **133** may be combined to a casing (not shown) of the backlight unit **130**" via screws **135**. (*Id.*, 4:41-43). The light source **131** "generates heat of high

temperature when the light source **131** emits light." (*Id.*, 4:43-46). The shield cover **140**, "which is provided in the rear side of the backlight unit **130**, is supported by at least one of the backlight unit **130** and the casing **110**, with a space formed between the shield cover **140** and the backlight unit **130**." (*Id.*, 4:52-55.) The shield cover **140** "may have a plurality of air slits **117′** through which flowing air produced by the cooling fan **210** comes in and out," and it "may be formed in diverse shapes such that the flowing air produced by the cooling fan **210** can be efficiently guided." (*Id.*, 4:59-63.)

84. To address the heat generation within the display apparatus, a "cooling fan unit **200** is combined to the shield cover **140** to cool the heat generating parts, such as the light source **131** and the circuit board **133** of the backlight unit **130**." (*Id.*, 5:16-18.) As shown in Figure 5, the cooling fan **200** may be disposed adjacent to the heat generating parts to improve the cooling effect. (*Id*., 5:26-28.)



(*Id.*, FIG. 5 (annotated)).

85. Likewise, the cooling fan unit **200** may be placed in a lower central portion of the shield cover **140**, or it may be placed in a central portion or an upper portion of the shield cover **140**, if necessary. (*Id.*, 5:38-42). The cooling air generated by the cooling fan **210** cools the light source **131** (which is widely distributed on the plane of the backlight unit **130**) and the circuit board **133**, by the cooling air flowing through the "space between the shield cover **140** and the backlight unit **130**." (*Id.*, 5:34-38; *see also id.*, 4:52-55). The cooling fan **210** "may either draw in the cooling air from the outside into the heat generating parts or

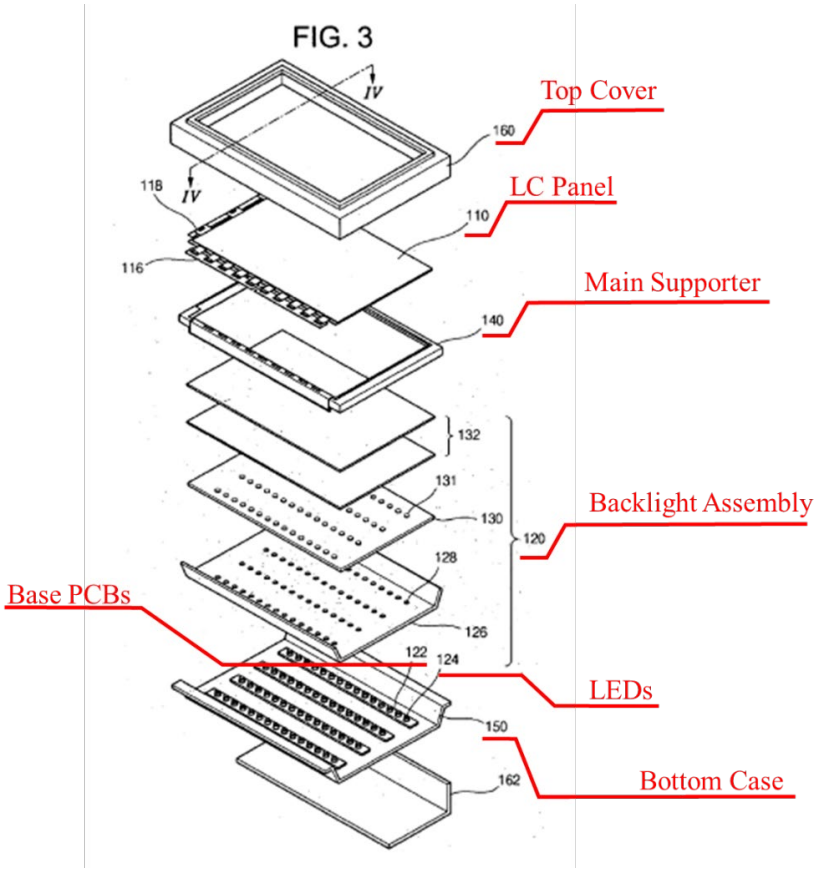
discharge the cooling air to the outside through the heat generating parts depending on its rotation direction." (*Id.*, 5:42-45).

2. Hong [Ex. 1029]

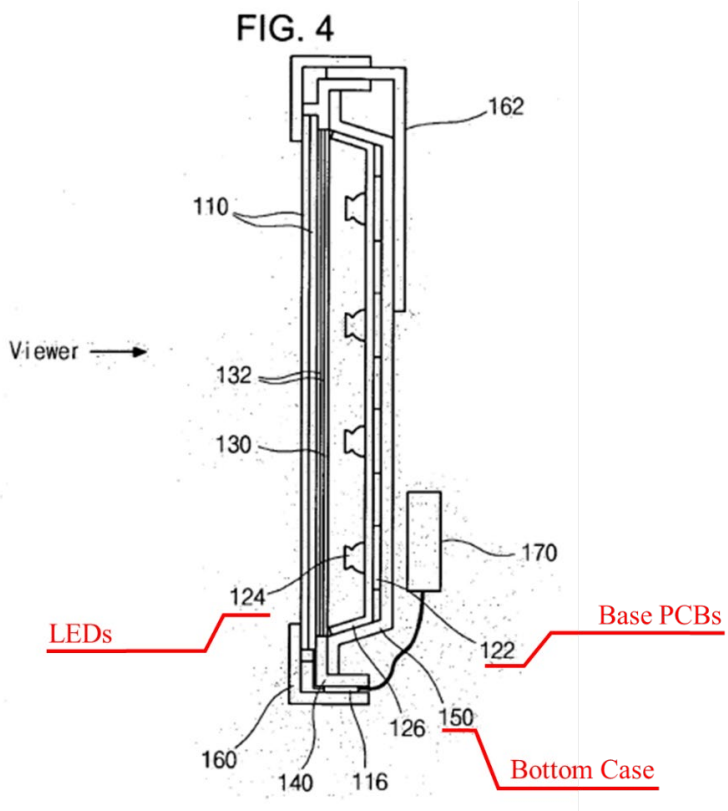
86. U.S. Patent Publication No. 2007/0171353A1 ("Hong") (Ex. 1029), titled "Liquid Crystal Display Device," was published on July 26, 2007, from Application No. 11/638,210, filed on December 13, 2006, which itself claims foreign priority to Korean Application No. 2006-006321, filed on January 21, 2006. I am informed that Hong qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(a) and (e)(1).

87. Hong discloses that its LCD device includes "a backlight assembly **120** and a liquid crystal panel **110** [which] may be disposed over an inner surface of a bottom case **150**." (Ex. 1029, ¶[0025].) Hong further discloses "[a] main supporter **140** has a rectangular frame shape and supports the backlight assembly **120** and the liquid crystal panel **110**." (*Id*., ¶[0026].) "A top cover **160** is disposed on a front surface of the LCD panel." (*Id*., ¶[0028].) As shown in annotated Figure 3 below, the backlight assembly **120** includes a base PCB **122**, which "is placed on an inner surface of the bottom case **150**[.]" (*Id*., ¶[0033].) "The peripheral portion of the liquid crystal panel **110** is placed on the main supporter **140**," and "[t]he top cover **160** surrounds the liquid crystal panel **110**." (*Id*.) A POSITA would have

understood this to disclose that the backlight assembly **120** is necessarily disposed behind the liquid crystal panel **110.**



(*Id.*, FIG. 3 (annotated).) As shown in Figure 4, "[t]he backlight assembly **120** includes a plurality of LEDs **124**," which "may be arranged on a plurality of base PCBs **122**." (*Id.*, ¶[0029].) "The base PCBs **122** are arranged in parallel on the bottom case **150**." (*Id.*)



(*Id.*, FIG. 4 (annotated).)

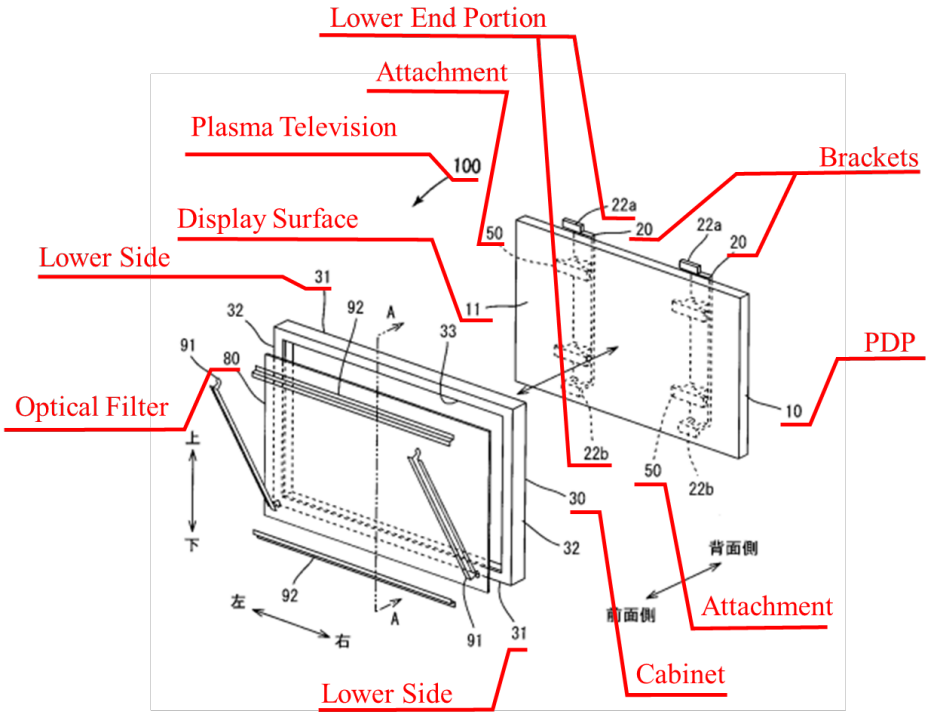
3. Tachikawa [Exs. 1025-1026]

88. Japanese Published Patent Application 2006-330196 ("Tachikawa") (Exs. 1025-1026), titled "Plasma Television and Image Display Device," was published on December 7, 2006 from Application No. 2005-151487, filed on May 24, 2004.[5] I am informed that Tachikawa qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its publication date of

[5] Unless otherwise stated, all citations are to the Certified Translation of Tachikawa (Ex. 1026).

December 7, 2006 predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

89. Tachikawa describes "a plasma television and an image display device having a structure wherein the inside of the housing is cooled." (Ex. 1026, ¶[0001].) As reflected by Figure 1, Tachikawa discloses that a plasma display panel ("PDP") is "housed in [a] cabinet **30** in a state of being supported by two brackets **20** on the rear side."[6] (*Id.*, ¶[0019].)



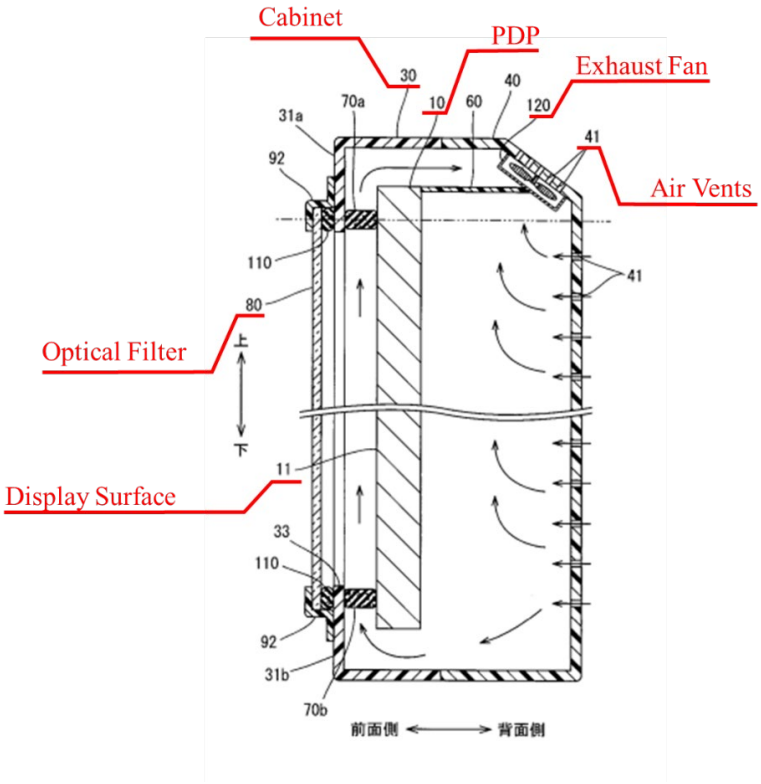
(*Id.*, FIG. 1 (annotated).) The attachment **50** "is fixed at four positions on the upper,

[6] References to numbers in Tachikawa's patent figures have been bolded.

lower, left, and right sides of the PDP **10**, and each set of the attachment **50** divided into two set of left and right is fixed to each one of the brackets **20**." (*Id*., ¶[0019].) Each of the two brackets **20** "is connected to a stand member (not shown) which stands substantially perpendicular from an installation surface of the plasma television **100**, thereby supporting substantially the entire plasma television **100** at a predetermined height." (*Id*.)

90. The front cabinet **30** "is also fixed to the bracket **20.**" (*Id*., ¶[0020].) When the bracket **20** is connected to the PDP **10** via the attachment **50**, "the upper and lower ends **22a** and **22b** of the bracket extend outward beyond the width of the PDP in the vertical direction." (*Id*.) The lower end portions **22a**, **22b** and the upper and lower sides **31** of the front cabinet **30** "are respectively fixed." (*Id*.) Further, "the rear cabinet **40** covering the rear side of the plasma television **100** is also fixed to the bracket **20**," such that "the front cabinet **30**, the PDP **10**, and the rear cabinet **40** are all fixed to the bracket **20**." (*Id*.)

91. In referring to Figure 2, a "predetermined gap is provided between the optical filter **80** and the display surface **11** with the opening **33** of the front cabinet **30** interposed therebetween." (*Id*., ¶[0023].)



(*Id*., FIG. 2 (annotated).) In the cabinet, the "air flowing in from each of the air vents **41** passes through not only through the space on the back side of the PDP **10** provided with the circuit, and the like, but also passes through the space, and is discharged to the outside of the cabinet by the exhaust fan **120**." (*Id*., ¶[0024].)

4. Takahashi [Exs. 1007-1008]

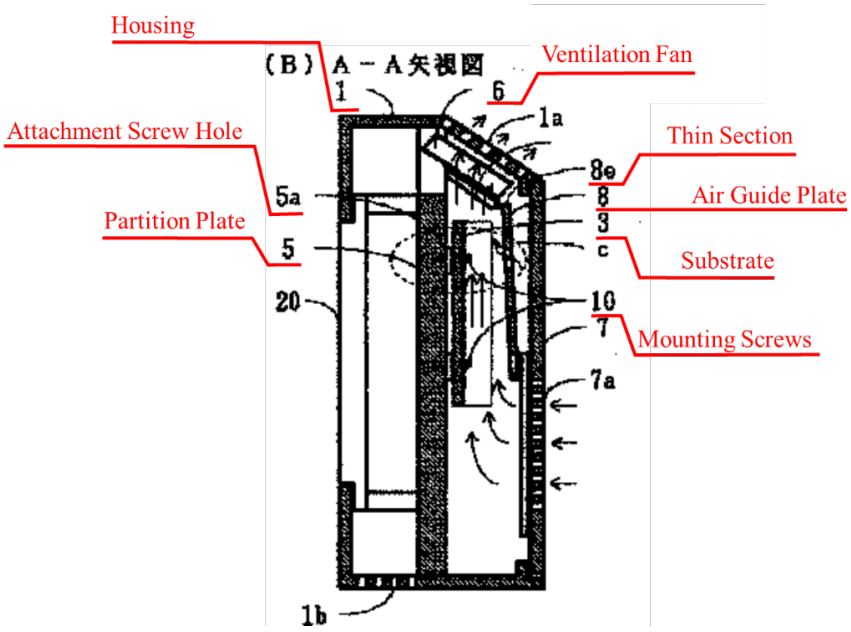
92. Japanese Unexamined Patent Publication No. H11-68363 ("Takahashi") (Exs. 1007-1008), titled "Heat Dissipation Structure for Electronics," was published on March 9, 1999 from Japanese Patent Application No. HN-223710,

filed August 20, 1997.[7] I am informed that Takahashi qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its publication date of March 9, 1999 predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

93. Takahashi discloses attachment members for heat dissipation structures in electronic devices, such as a plasma displays panels. According to Takashi, these attachment members connect two or more parts of the heat dissipation structure without interrupting the air circulation within in the heat dissipation structure. (*See* Ex. 1026, Abstract.)

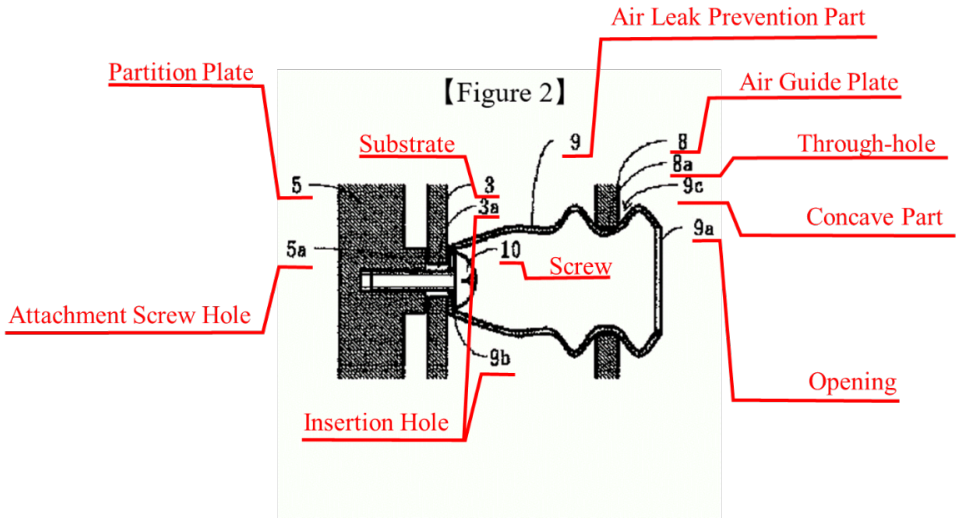
94. Takahashi is directed to the improvement of airflow control in "the heat dissipation structure of electronic devices such as PDP (plasma display [panel]) devices." (*Id.,* ¶[0002].) Such a device is shown in Figure B below.

[7] Unless otherwise stated, all citations are to the Certified Translation of Takahashi (Ex. 1008).



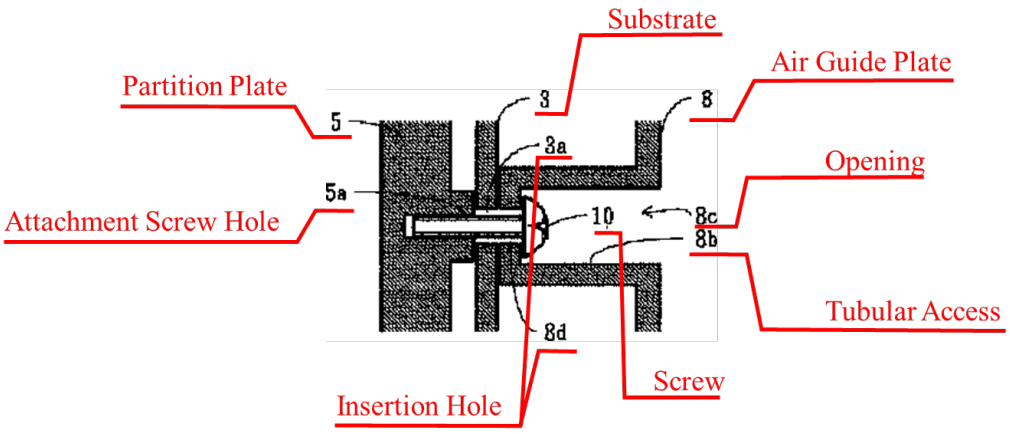
(*Id*., FIG. 1B (annotated).)

95. In particular, Takahashi discloses an "air leak prevention part [**9**] that is fitted to … through-hole **8a**, which is formed into a hollow body having, as shown in FIG. 2." (*Id*., ¶[0010].)



(*Id.*, FIG. 2 (annotated).) The air leak prevention part includes "an opening **9a** corresponding to the aforesaid through-hole **8a**; an insertion hole **9b** for insertion of the substrate attachment screw **10** formed in the base thereof; and a concave part **9c** that fits into the aforesaid through-hole **8a** formed at the peripheral edge of the opening **9a** thereof." (*Id.*) This concave part **9c** "is formed . . . to improve mating to the through-hole **8a** and to ensure that air leakage is prevented." (*Id.*, ¶[0010].) The "air leak prevention part **9** is fitted into the through-hole **8a** provided in the air guide plate 8, and the screw **10** is inserted through the opening **9a** in this air leak prevention part **9** and threaded through the attachment screw hole **5a** in the partition plate **5** via the insertion hole **9b** and the insertion hole **3a** in the substrate **3**, thereby fastening the substrate **3** to the partition plate 5." (*Id.,* ¶[0012].)

96. As reflected by Figure 3, Takahashi discloses that its "heat dissipation structure for electronics" also allows "the aforesaid air leak prevention part **9** [to be] integrally formed with the aforesaid air guide plate 8, and, as shown in the drawings, a tubular recess **8b** is formed in the air guide plate 8, thereby forming an opening **8c**, and an insertion hole **8d** is formed in the base of the same recess **8b**." (*Id.,* ¶[0011].)



(*Id.*, FIG. 3 (annotated).)

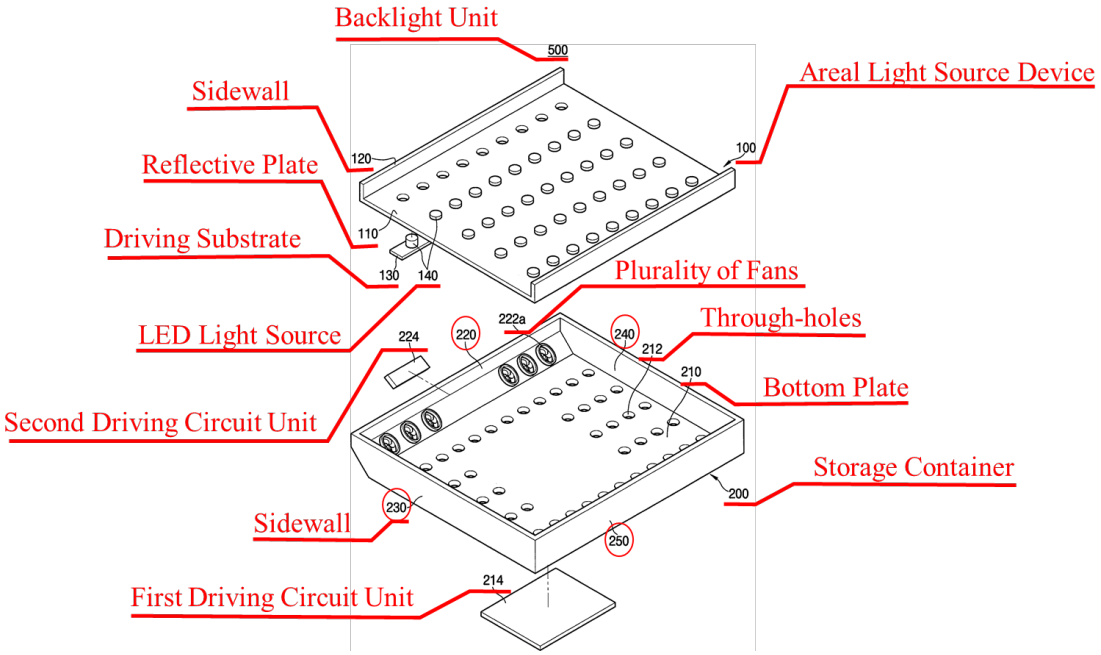
5. Na [Exs. 1009-1010]

97. Korean Patent Publication No. 10-2006-0016469 ("Na") (Exs. 1009-1010), titled "Backlight Unit and Liquid Crystal Device Including the Same," was published on February 26, 2006 from Korean Patent Application No. 10-2004-0064922, filed on August 18, 2004. I am informed that Na qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its publication date of February 26, 2006 predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

98. Na discloses a "backlight unit and a liquid crystal display [LCD] device including the same," in which the backlight unit "includes a light generator and a storage container." (Ex. 1010, Abstract.) The LCD device "uses the optical characteristics of liquid crystal to display an image," and "has the advantage of being

very small in volume and in weight" so as to be "widely used for portable computers, communication devices, liquid crystal TVs, etc." (*Id.*)

99. The light generator "generates light," while the storage container "accommodates the light generator, and an intake unit through which external air is sucked and an exhaust unit through which internal air is discharged are formed." (*Id.*) As shown in Figure 1, a backlight unit **500** includes "an areal light source device **100** and a storage container **200**." (*Id.*, p.4.)



(*Id.*, FIG. 1 (annotated).)

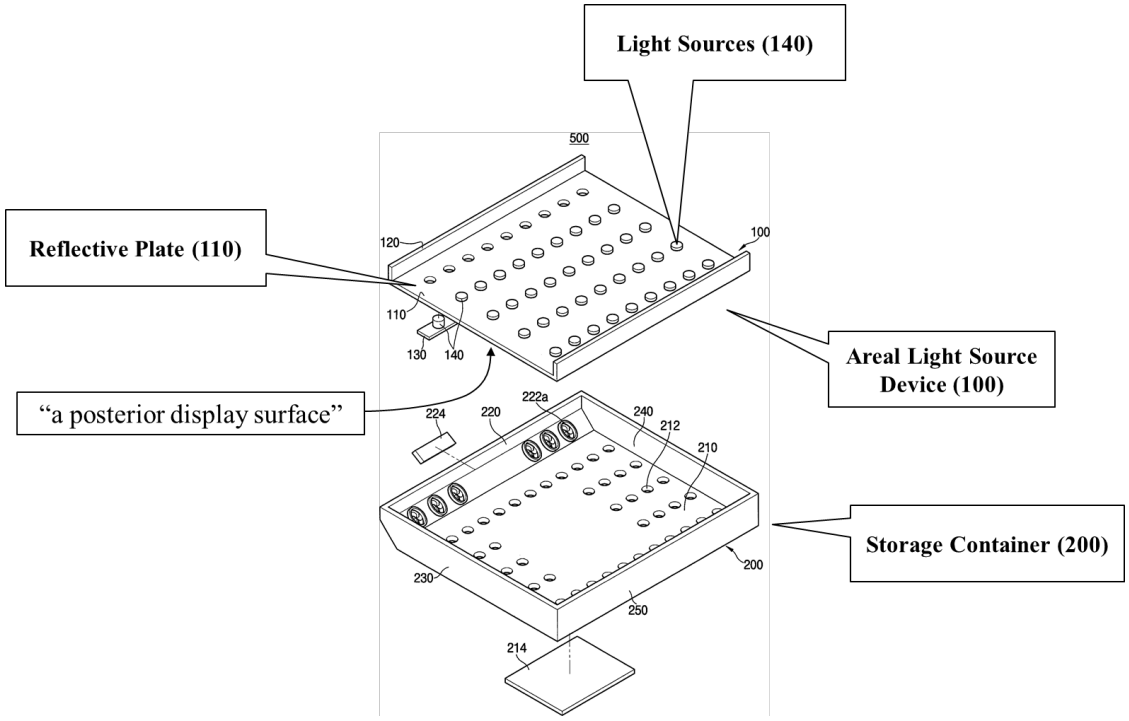
100. The "areal light source device **100**" includes "a reflective plate **110**, a sidewall **120**, a driving substrate **130**, and a plurality of light emitting diode [LED] light sources **140**." (*Id.*, p.4). The LED light sources **140** "are arranged in a line on

the driving substrate **130**, pass through the coupling holes **112** and are coupled to be positioned on the upper surface of the reflective plate **110**." (*Id.*) In addition to the embodiments disclosed in Figures 1–13, Na points out that it is possible to form through-holes in the side walls. Specifically, Na states: "In the present exemplary embodiment, although the through-holes are formed on the bottom plate, the through-holes may be further formed in the first to fourth sidewalls, or may be formed only in the first to fourth sidewalls." (*Id.*, p.4 at FIG. 3 discussion.)

101. The storage container **200** includes "a bottom plate **210**, a first sidewall **220**, a second sidewall **230**, a third sidewall **240**, and a fourth sidewall **250**." (*Id.*) As separately shown in Figure 13, the "edge portion" of a "color filter substrate **846** is surrounded by the chassis **860**, and a portion of the chassis **860** is coupled to a storage container **200**." (*Id.*, p.8.)

102. The bottom plate **210** "has a rectangular flat plate shape and includes a first driving circuit unit **214** and a plurality of through-holes **212**." (*Id.*, p.4) The "through-holes **212** are formed in portions except for the portion where the first driving circuit unit **214** is disposed, and are formed through the bottom plate **210**." Na discloses that "[a]ir may move through the through-holes **212**," and the through-holes **212** may "function as an intake unit through which external air is sucked." (*Id.*) A "plurality of fans **222a** are formed on the first sidewall **220**." (*Id.*) The fans

222a "are operated to flow air from the inner space to the outside." (*Id.*)



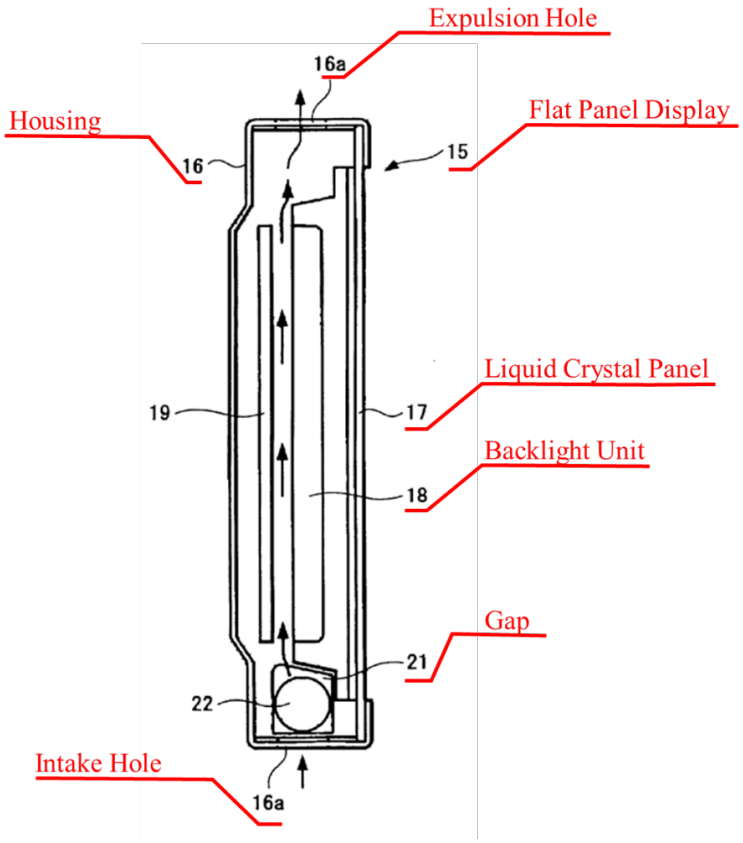
(*Id.*, Fig. 1 (annotated).)

6. Kimura [Ex. 1004]

103. U.S. Patent Application No. 2006/0199514 ("Kimura") (Ex. 1004), titled "Cooling fan and image display apparatus" was filed on Nov. 11, 2005 and published on September 7, 2006. I am informed that Kimura qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its publication date of September 7, 2006 predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

104. Kimura is directed to "A system for cooling an electronic display" in

the form of "a cooling fan that can be favorably used in a flat panel display apparatus such as a thin-screen television and to an image display apparatus." (Ex. 1004, ¶3.) The system of Kimura is captured in Figure 9 which shows "flat panel display whose overall structure is designated by reference numeral **15** has a liquid crystal panel **17** on a front surface of a display housing **16**." (*Id.*, ¶78.)

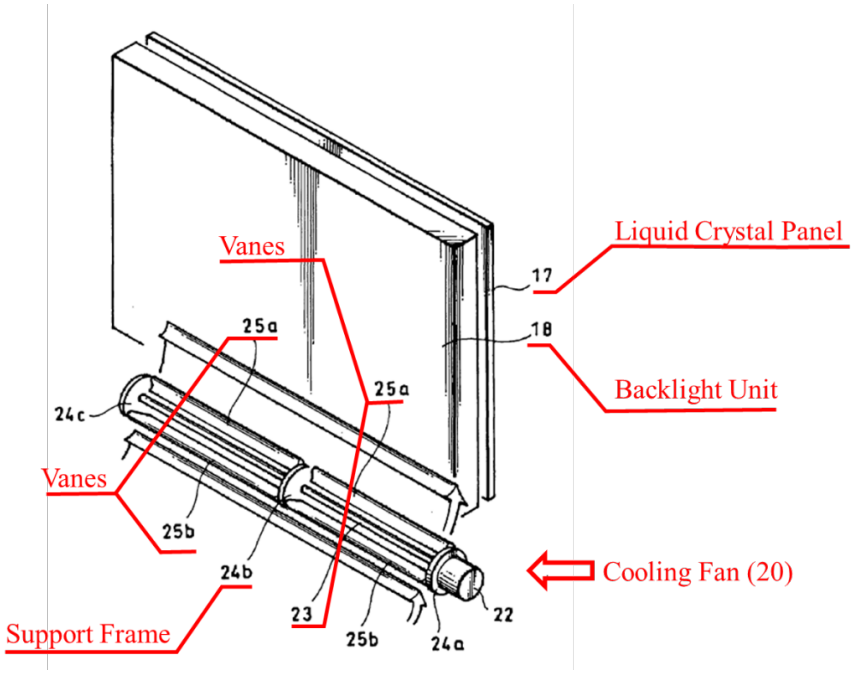


(*Id.*, FIG. 9 (annotated).) Kimura explains the function of its system as follows:

> A cooling fan **20** according to the present invention is installed inside a gap **21** . . . produced at a lower part of the panel due to the construction of the flat panel display. By circulating a wind generated by

> rotationally driving the cooling fan **20** in the form of a "film" to the rear surface of the backlight unit **18**, the entire backlight unit **18** is cooled uniformly. It should be noted that air is sucked into the cooling fan **20** from an air intake hole **16a** formed in a base surface of the display housing **16** and air supplied to cool the backlight unit **18** is expelled from an expulsion hole **16b**[8] formed in an upper surface of the display housing **16**.

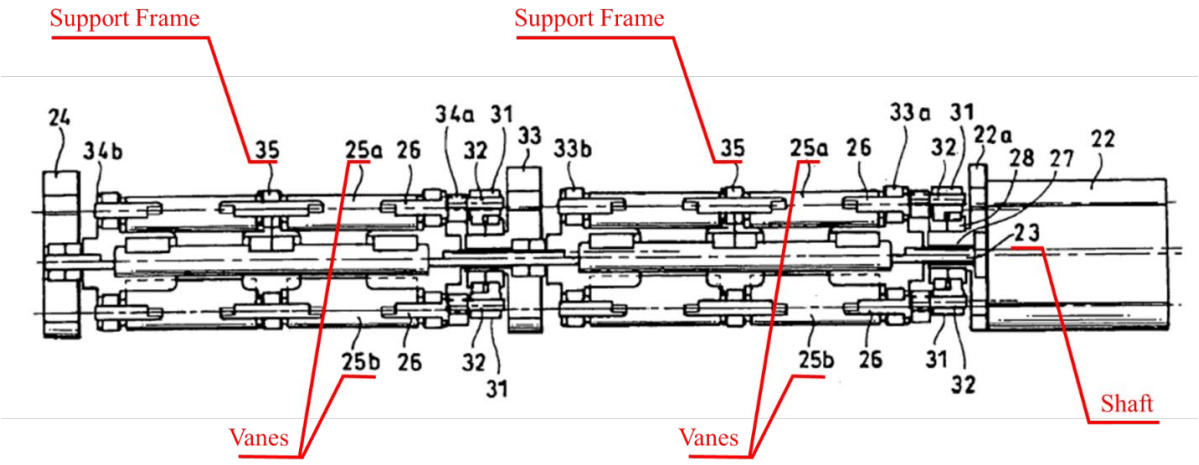
(*Id.*, ¶78.) "FIG. 10 is an external perspective view showing how the backlight of a liquid crystal display panel is cooled. In the illustrated example, the cooling fan has two vanes."



[8] Expulsion hole **16b** is mislabeled in Figure 9 of Kimura as **16a**.

(*Id.*, FIG. 10 (annotated).) In the example of Figure 10, the cooling fan has two sets of vanes **25a** and **25b** divided by support frame **24b**. (*Id.*, ¶80.)

105. In another aspect of cooling fan **20** shown in Figure 11, Kimura discloses that "the vanes that have been divided into two are further divided into two by the support frames **35**."



(*Id.*, FIG. 11 (annotated).) According to Kimura, this configuration protects the vanes from deformation when the cooling fan spins around its axis of rotation (e.g., shaft **23**). (*Id.*, ¶88.)

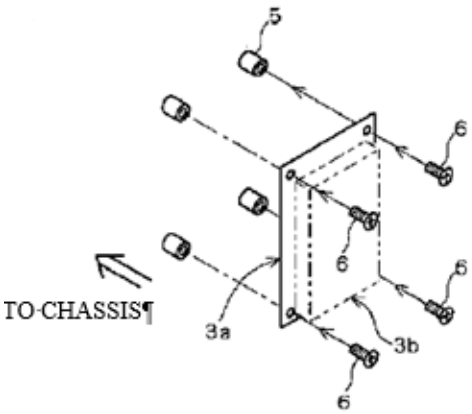
7. Kochiyama [Exs. 1027-1028]

106. Japanese Unexamined Patent Application Publication No. 2003-162228 ("Kochiyama") (Exs. 1027-1028), titled "Plasma Display Device," was published on June 6, 2003. I am informed that Kochiyama qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its

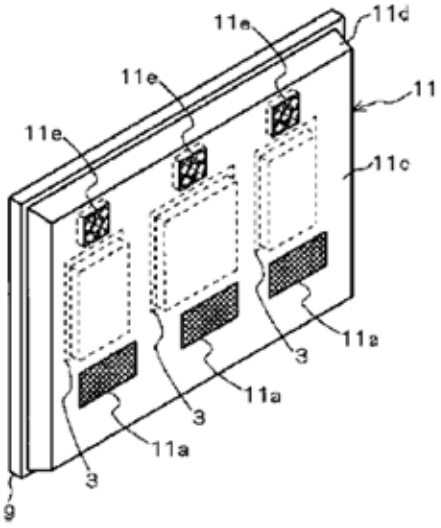
publication date predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

107. Kochiyama describes a plasma display device including "a chassis **2** having a heat radiating function [that] holds the PDP **1** on one main surface side and holds circuit boards **3** required to display a video image (drive-related boards, power supply boards, and the like) on the other main surface side." (Ex. 1028, ¶[0019].) Kochiyama explains that "as illustrated in FIG. 3, each circuit board **3** consists of a board body **3a** and a group of parts **3b** welded to the board body **3a**. The method of fixing the circuit board **3** to the chassis **2** is to fix the circuit board with screws **6** through a chassis support **5**, for example, so that there is a gap **4** between the chassis **2** and the board body **3a**." (*Id*.)

(FIG. 3)¶



(FIG. 7)¶



(*Id*., FIGs 3&7.)

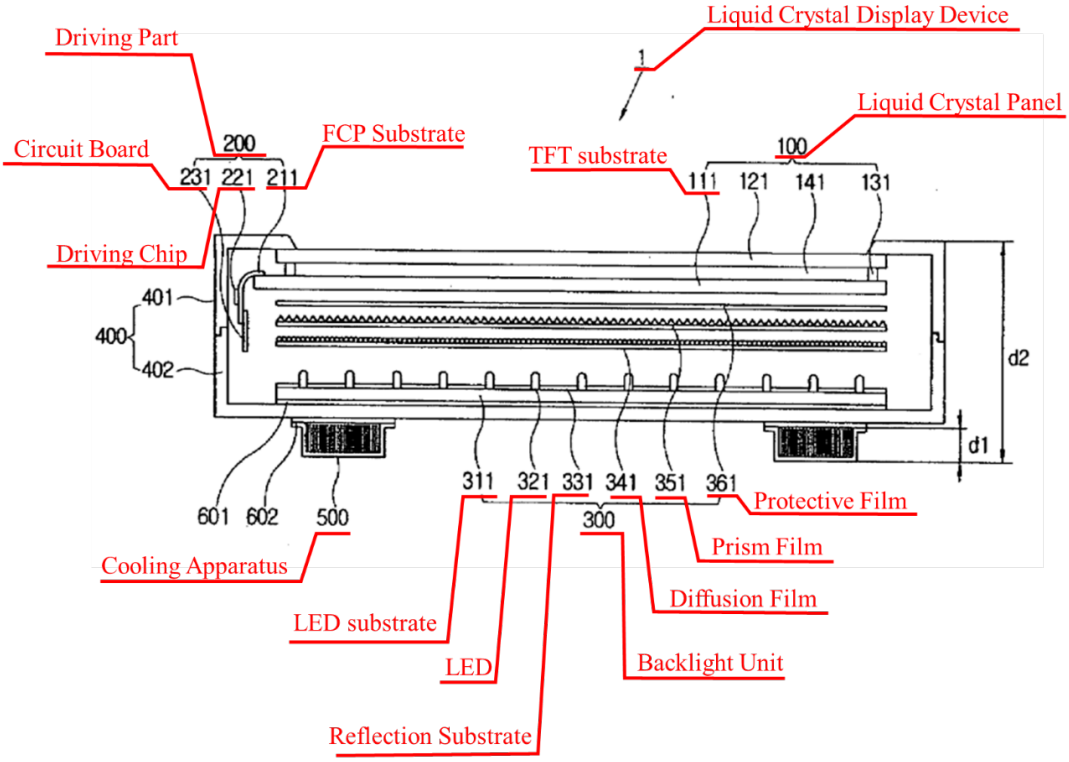
8. Cho [Ex. 1006]

108. U.S. Patent Publication No. 2006/0132699 ("Cho") (Ex. 1006) titled "Cooling Apparatus and Liquid Crystal Display Device Having the Same" was published on June 22, 2006 from an Application filed December 20, 2005, which was itself claim priority to Korean Patent Application No. 2004-0108831, filed December 20, 2004. I am informed that Cho qualifies as prior art to the '322 patent pursuant to at least pre-AIA 35 U.S.C. § 102(b) because its publication date of June 22, 2006 predates the earliest priority date of the '322 patent, which is March 3, 2008, by more than a year.

109. Cho describes a "cooling apparatus" that includes "a casing, a heat sink and a cooling fan." (Ex. 1006, Abstract.) The casing includes "a first opening and a second opening to provide an air path," and a "cooling fan is disposed in [a] recession part" of a the heat sink, which itself "is received in the casing." (*Id*., ¶[0015].)

110. Cho includes "a display device comprising a liquid crystal panel, a backlight unit, a chassis, and a cooling apparatus." (*Id*., ¶[0016].) The backlight unit "is disposed at a back surface of the liquid crystal panel and supplies light to the liquid crystal panel." (*Id*.) As shown in Figure 2, Cho's "display device" includes

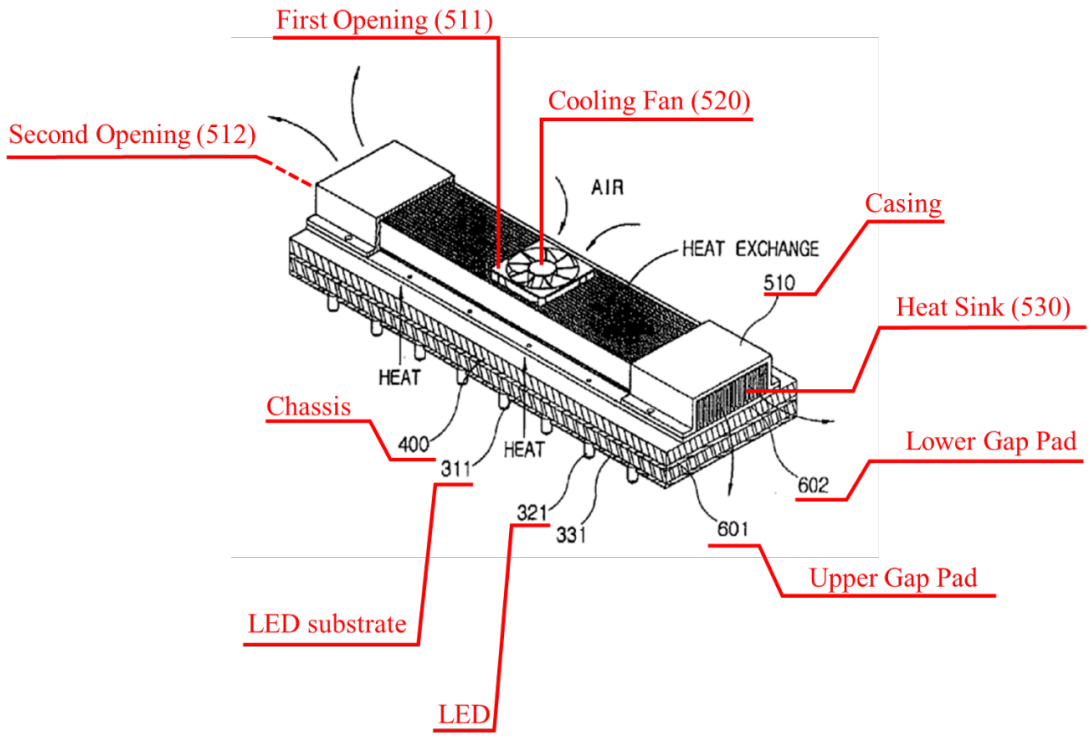
"driving part **200** [that] comprises a flexible print circuit (FPC) substrate **211** having a first side is connected with the thin film transistor substrate **111**, a driving chip **221** provided to the FPC substrate **211**, and a circuit board **231** connected with a second side of the FPC substrate **211**." (*Id.*, ¶[0033].)



(*Id.*, FIG. 2 (annotated).) The backlight unit **300** "is a direct type backlight unit and comprises an LED circuit substrate **311** disposed parallel to the liquid crystal panel **100**, an LED **321** coupled to the LED circuit substrate **311**, a reflection substrate **331** reflecting light from the LED **321** toward a direction of the liquid crystal panel **100**, a diffusion film **341** disposed between the LED **321** and the liquid crystal panel **100**,

a prism film **351**, and a protecting film **361**." (*Id*., ¶[0034].) The backlight unit **300** "may include an array of LEDs disposed on the LED circuit substrate **311**." (*Id*., ¶[0036].)

111. The LED circuit substrate **311** "drives the LED **321**, and at a same time, transfers heat generated by the LED **321** to the cooling apparatus **500**." (*Id*., ¶[0035].) As illustrated in the cutaway view in Figure 5, during operation of the liquid crystal display device 1, "heat is generated by the LED **321**" and "is transmitted to the heat transmission plate **531** [not shown in Figure 5] of the heat sink **530** [annotated in Figure 5] through the LED circuit substrate **321** [*sic*], the upper gap pad **601**, the chassis **400**, and the lower gap pad **602**." (*Id*., ¶¶[0053]-[0055].)



(*Id.*, FIG. 5 (annotated).) Kim's cooling fan **520** introduces "air … into the heat sink **530** [added in Figure 5] through the first opening **511** [added in Figure 5]." (*Id.*, ¶[0066].) The introduced air "flows along an air path formed by the casing **510** and the heat sink **530** [added in Figure 5] and discharges through the second opening **512** [added in Figure 5]." (*Id.*) Thus, "the air path may be formed from the second opening **512** to the first opening **511** in accordance with an operating direction of the cooling fan **520**." (*Id.*)

B. Ground 1: Claims 4 and 7 Are Obvious Over Kim In Combination with Hong

1. Independent Claim 4

112. It is my opinion that the combination of Kim and Hong renders obvious each and every limitation of independent claim 4 as discussed below.

a. "A liquid crystal display (LCD) comprising:" (Claim Element 4[pre])

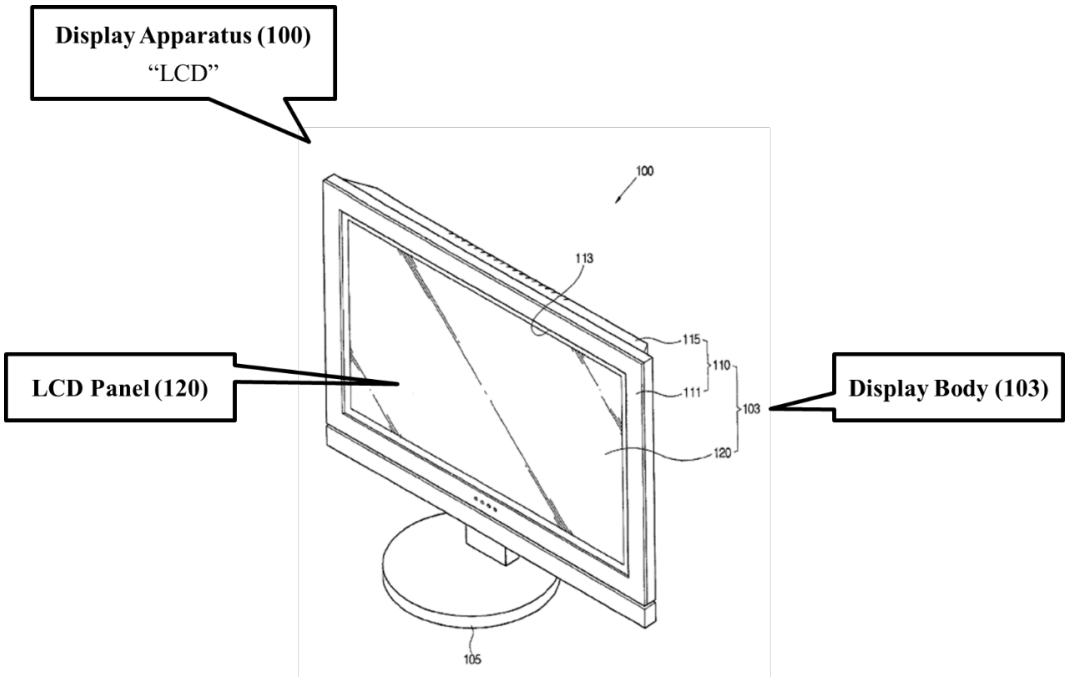
113. To the extent the preamble of claim 4 is limiting, rendered obvious by Kim in view of Hong. Kim discloses "**a liquid crystal display (LCD)**."

114. Kim discloses a display apparatus **100** which includes a display body **103** with a liquid crystal panel **120**:

> As shown in FIGS. 1 to 6, **a display apparatus 100** according to an exemplary embodiment of the present invention generally **comprises a display body 103** and a stand **105** that supports the display body **103**.
>
> The display body **103** comprises a liqu**id crystal display panel 120**, a backlight unit **130**, a shield cover **140**, and a cooling fan unit **200**.

(Ex. 1005, 4:1-6.)

115. Based on the above, a POSITA would have understood that **display apparatus 100** shown, for example, in Figure 1 is "**a liquid crystal display (LCD).**"



(*Id*., FIG. 1 (annotated).)

116. Accordingly, Kim in combination with Hong renders obvious the preamble of independent claim 4.

b. "a liquid crystal stack;" (Claim Element 4[a])

117. It is my opinion that Kim in combination with Hong discloses or renders obvious "**a liquid crystal stack**."

118. Kim discloses that "[t]he liquid crystal display panel **120** forms an image and displays the formed image through the opening part **113**." (Ex. 1005, 4:26-27; *see also id.*, Abstract, 1:57-67, 2:47-57, 7:10-15.) A POSITA would have

understood that a LCD display panel includes a liquid crystal stack.[9]

119. Kim discloses an LCD stack in an LCD panel (e.g., LCD panel **840**). (*Id.*, ¶161.) Further, if the term "**liquid crystal stack**" is intended to refer to the individual liquid crystal sub-layers (which, when stacked together, collectively form the liquid crystal layer of an LCD panel), a POSITA would know that these liquid crystal sub-layers are necessarily present in a liquid crystal layer of every LCD panel as part of its structure. (*Id.*) Therefore, Kim in combination with Hong discloses or renders obvious claim element 4[a].

c. "a backlight assembly behind the liquid crystal stack and comprising:" (Claim Element 4[b])

i. "a printed circuit board (PCB) having front and back sides;" (Claim Element 4[b(i)])

ii. "a plurality of LEDs mounted on the front side of the PCB;" (Claim Element 4[b(ii)])

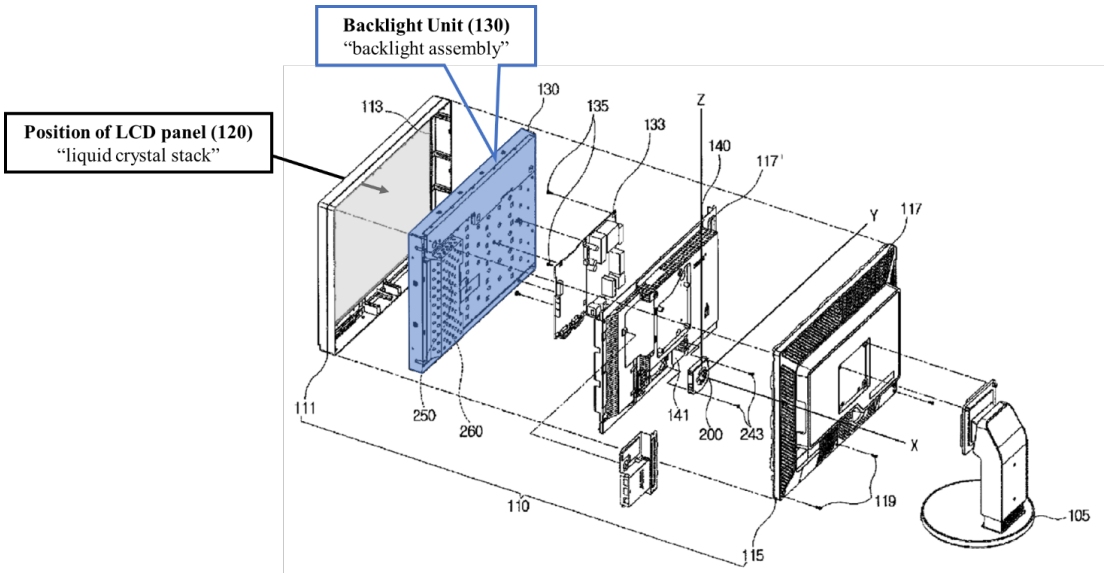
iii. "a posterior surface on the rear side of the PCB;" (Claim Element 4[b(iii)])

120. Kim in combination with Hong renders obvious claim element 4[b].

121. Kim discloses a backlight unit **130** ("a backlight **assembly**") that "is provided **behind** the liquid crystal display panel [**120**] and has a light source [**131**]

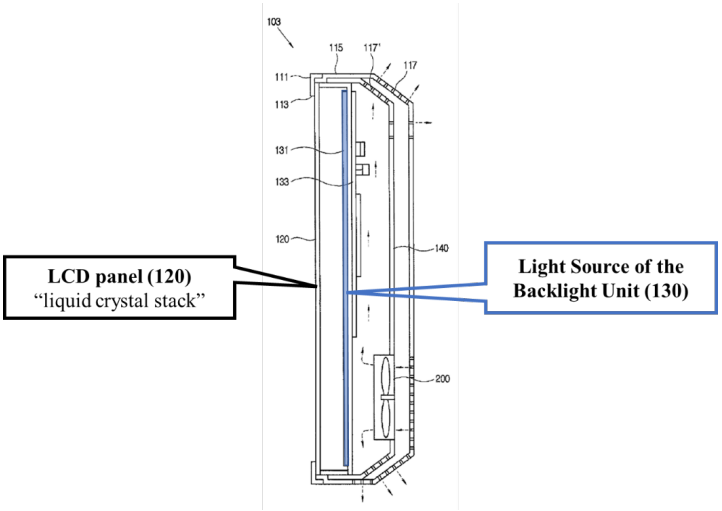
[9] Notably the specification of the '322 patent does not define the term "liquid crystal stack," but states the "display **10** may be the front glass plate of a liquid crystal display stack." (Ex. 1001, 9:19-21.)

that emits light[.]" (*See*, e.g., Ex. 1007 at 1:62-63, 2:51-54 (emphasis added[10]).) As seen in the annotated Figures 2 and 5 below, the backlight assembly is located **behind** the LCD panel **120** ("**the liquid crystal stack**"):



(*Id*., FIG. 2 (annotated).)

[10] In the citations below, emphasis is added unless indicated otherwise.



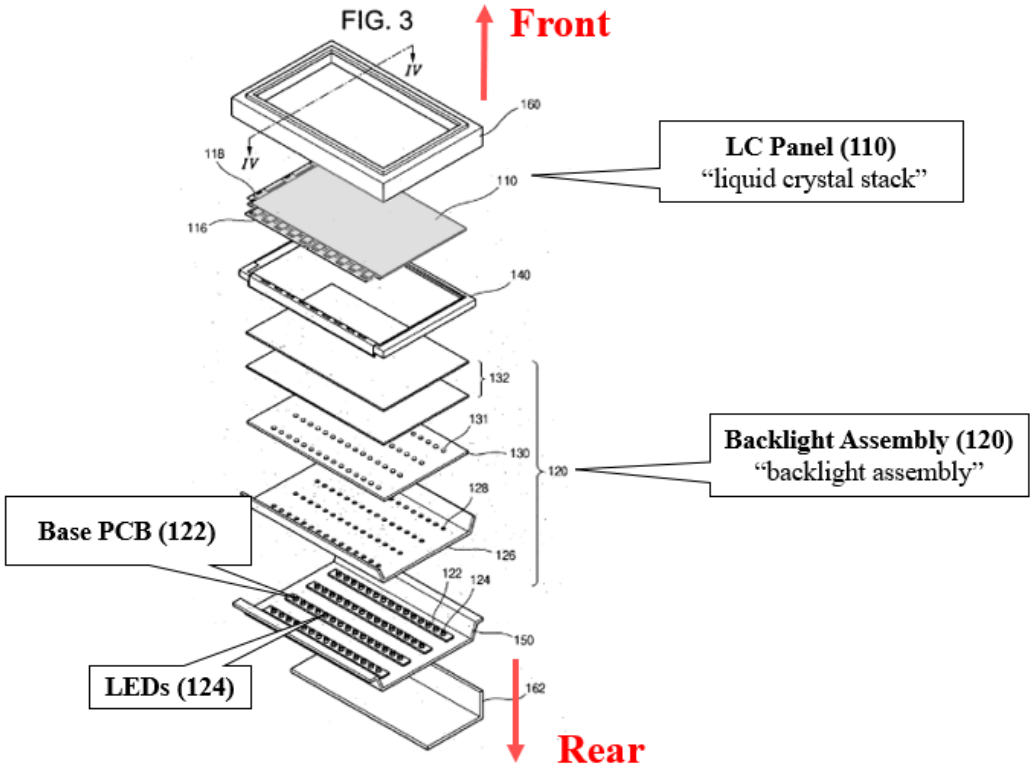
(*Id*., FIG. 5 (annotated).)

122. Kim discloses that "[t]he backlight unit **130** comprises a **plurality of light emitting diodes (LEDs)** as a light source **131** … that generates light" (*id*., 4:33-35) with "[t]he light source **131** of the backlight unit **130** [being] widely a**rranged on a plane** of the backlight unit **130**" (*id.*, 4:43-45). Kim further discloses that "**the backlight unit may further comprise** a diffusing sheet (not shown) that is provided above the LEDs in order to diffuse light emitted from the LEDs, an optical sheet (not shown), **or other known elements in the art**." (*Id*., 4:35-38.)

123. A POSITA would have known from his/her own knowledge, and from the prior art, that PCBs are an integral part of a backlight unit in an LCD device commonly used in the art to mechanically support and drive the LEDs of the backlight assembly. In other words, a POSITA would have known that Kim's LEDs need to be mounted on a first side of a PCB within backlight unit **130** in order to

operate as intended. A POSITA would also recognize that the LEDs mounted on a first side of a PCB are included as part of the backlight unit **130**, which would have "**front**" and "**back**" sides.

124. The prior art is full of examples of LCD backlight units comprising LEDs mounted on PCBs. Hong discloses an LCD device that includes "a backlight assembly **120** and a liquid crystal panel **110** [which] may be disposed over an inner surface of a bottom case **150**." (Ex. 1006, ¶[0025].) As shown in annotated Figure 3 below, the backlight assembly **120** includes a base PCB **122**, which "is placed on an inner surface of the bottom case **150**[.]" (*Id.*, ¶[0033].) "The peripheral portion of the liquid crystal panel **110** is placed on the main supporter **140**," and "[t]he top cover **160** surrounds the liquid crystal panel **110**." (*Id.*) A POSITA would have understood this disclosure to mean that the backlight assembly **120** is necessarily disposed behind the liquid crystal panel **110**.

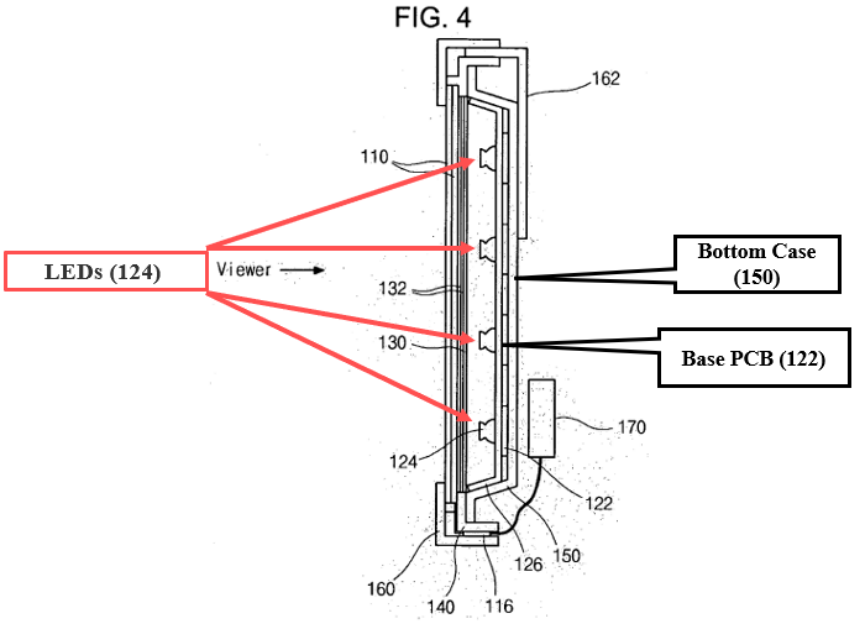


(Ex. 1006, ¶[0029]; FIG. 3 (annotated).) Therefore, Hong discloses a backlight assembly **120** that is "**behind the liquid crystal stack**."

125. Hong discloses in reference to Figure 3 that "[t]he backlight assembly **120** includes a plurality of LEDs **124**," which "may be arranged on a plurality of base PCBs **122**." (*Id.*, ¶[0029], FIG. 3.) Hong discloses that "the base PCB **122** is placed on an inner surface of the bottom case **150**, and the LEDs **124** are placed on the base PCB **122**." (*Id.*, ¶[0033].) Thus, Hong discloses a "**back side**" of the PCB, which faces the inner surface of the bottom case **150** and a "**front side**" of the PCB, on which a plurality of LEDs **124** are mounted. Accordingly, Hong discloses a

"**printed circuit board (PCB) having front and back sides**."

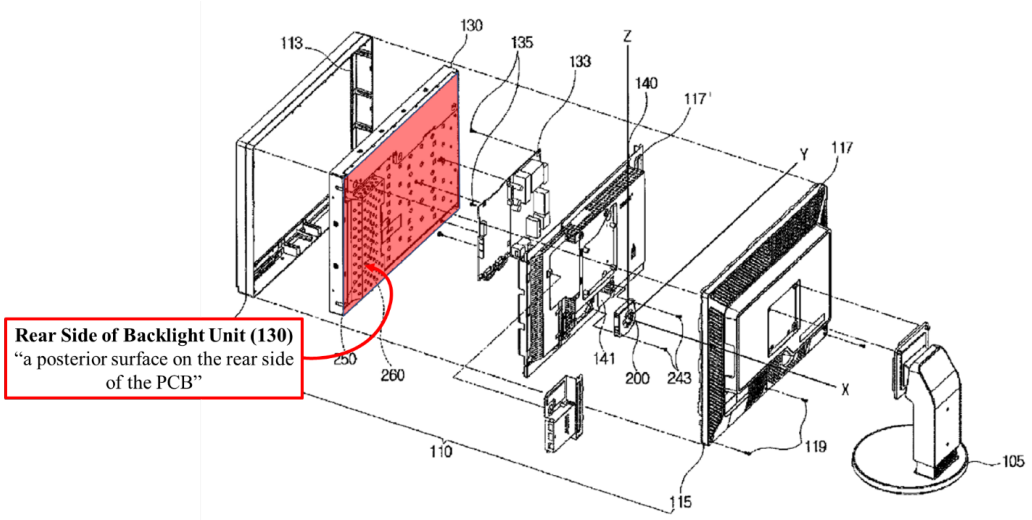
126. Hong likewise discloses "**a plurality of LEDs mounted on the front side of the PCB**." Hong discloses that "[t]he backlight assembly **120** includes a plurality of LEDs **124**" and that "[t]he LEDs **124** may be arranged on a plurality of base PCBs **122**." (*Id.*, ¶[0029.) Hong further discloses that "the base PCB **122** is placed on an inner surface of the bottom case **150**, and the LEDs **124** are placed on the base PCB **122**." (*Id.*, ¶[0033].) A POSITA would have understood this to mean that the LEDs **124** are mounted on the "**front side of the PCB**," as shown in annotated Figure 4:



(*Id.*, FIG. 4 (annotated).) Since Hong's "backlight assembly **120** includes a plurality of LEDs **124**" which "may be arranged on a plurality of base PCBs **122**," Hong

discloses "**a plurality of LEDs mounted on the front side of the PCB**." (*Id.*, ¶[0029].) Similarly, Hong's base PCB **122** has a "**back side**," which is the side of the PCB **122** which "is placed on an inner surface of the bottom case **150**" and a "**front side**," which is the surface of the PCB **122** on which the LEDs **124** are mounted, as shown in Figure 4. (*Id.*, ¶[0033].)

127. Finally, Kim discloses "**a posterior surface on the rear side of the PCB**." A POSITA would have understood the **rear side of backlight unit 130** is "a posterior surface on the rear side of the PCB" as shown in Figure 2 below (*see also* annotated Figure 5, *supra* ¶ 121).



(Ex. 1007, FIG. 2 (annotated).)

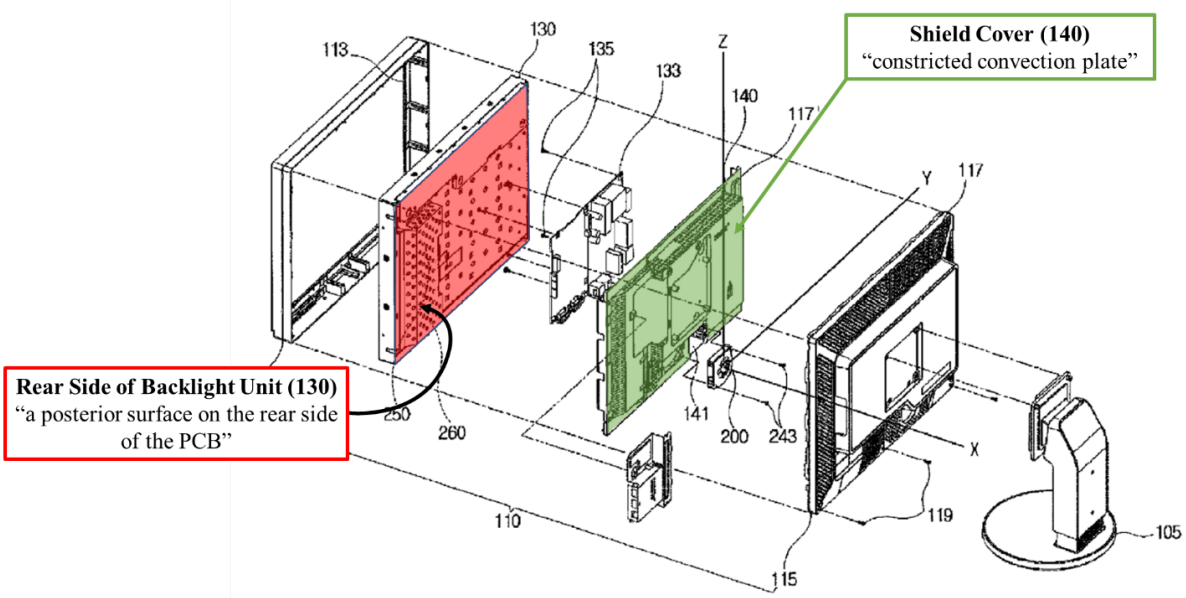
128. Accordingly, Kim in combination with Hong renders obvious claim element 4[b].

d. "a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and" (Claim Element 4[c])

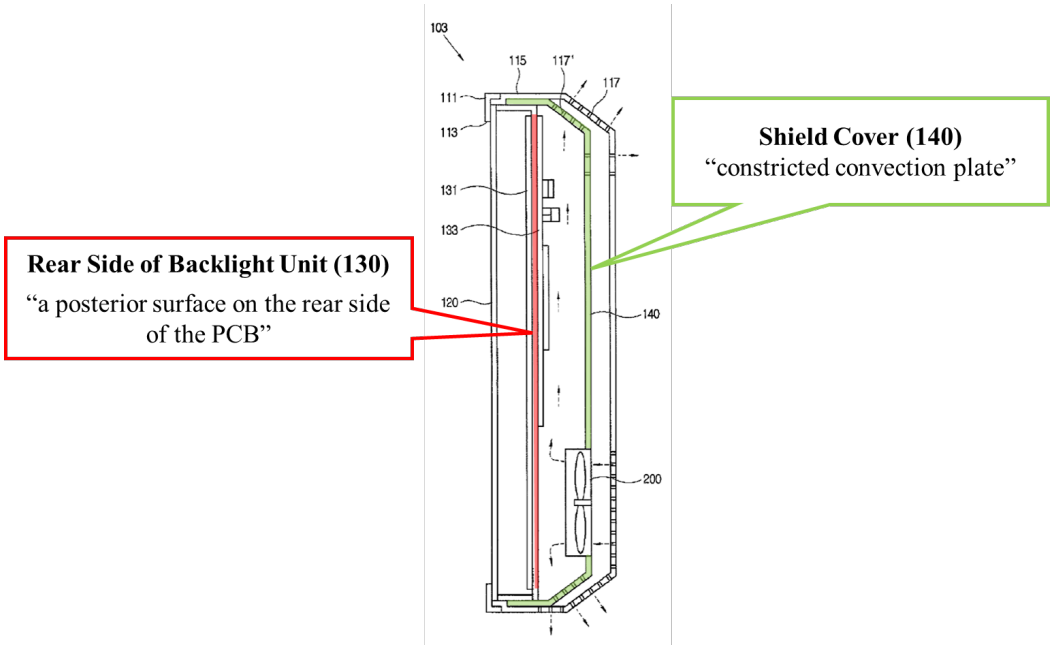
129. Kim in combination with Hong renders obvious "**a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB**."

130. Kim discloses a "**constricted convection plate**" in the form of "**shield cover 140**" that is "provided in the rear side of the backlight unit **130**," which "is supported by at least one of the backlight unit **130** and the casing **110**, with a space formed between the shield cover **140** and the backlight unit **130**." (Ex. 1005, 4:52-55; Figure 5.) Kim teaches that "cooling air flows through a space between the shield cover **140** and the backlight unit **130**." (*Id*., 5:37-38.)

131. As annotated Figures 2 and 5 reflect, the shield cover **140** "is provided in the rear side of the backlight unit **130**." (*Id*., 4:52-55.)



(*Id.*, FIG. 2 (annotated).)



(*Id.*, FIG. 5 (annotated); *see also* Ex. 1011, p.1; Ex. 1012, pp.6-8.) The "shield cover" combined with a cooling fan "supplies cooling air to the backlight unit." (Ex.

1005, Abstract). Kim discloses that shield cover **140** is configured to efficiently guide the airflow produced by the cooling fan **210**:

> The shield cover **140** may have a plurality of air slits **117'** through which flowing air produced by the cooling fan **210** comes in and out. The **shield cover 140** may be formed in diverse shapes such that the **flowing air produced by the cooling fan 210** can be efficient**ly guided**.

(*Id.*, 4:59-63.) Because Kim's "shield cover **140**" guides airflow to facilitate convective heat transfer from the backlight, it is my opinion that a POSITA would have understood that the "shield cover **140**" constricts air generated by the fan in order to achieve its purpose cooling the backlight. Kim achieves this constricted airflow effect by reducing the volume of the space behind the display panel using a shield cover which contains air slits **117** distal to the cooling fan **210** thereby causing air to flow across the backlight unit **130**. (Ex. 1005, 5:34-38.)

132. Additionally, shield cover **140** is "**placed behind and substantially parallel with the posterior surface of the PCB.**" As seen from Figures 2 and 5 above, shield **140** is "approximately parallel" to **the rear side of backlight unit 130**. And because the rear side of the backlight unit **130** ("the posterior surface on the rear side of the PCB") is facing shield cover **140** (see discussion in claim element 4[b(iii)]), the shield cover **140** is "**placed behind . . . the posterior surface of the PCB**."

133. Thus, Kim's shield cover **140**, not only functions as "a constricted convection plate," but is also in the same "posterior position" relative to the posterior surface of the backlight unit **130** as is the constricted convection plate **30** relative to the display posterior **22** shown in the Figures 3 and 5B-5F of the '322 patent. (Ex. 1001, 4:66-5:5; FIGs. 3, 5B-5F.)

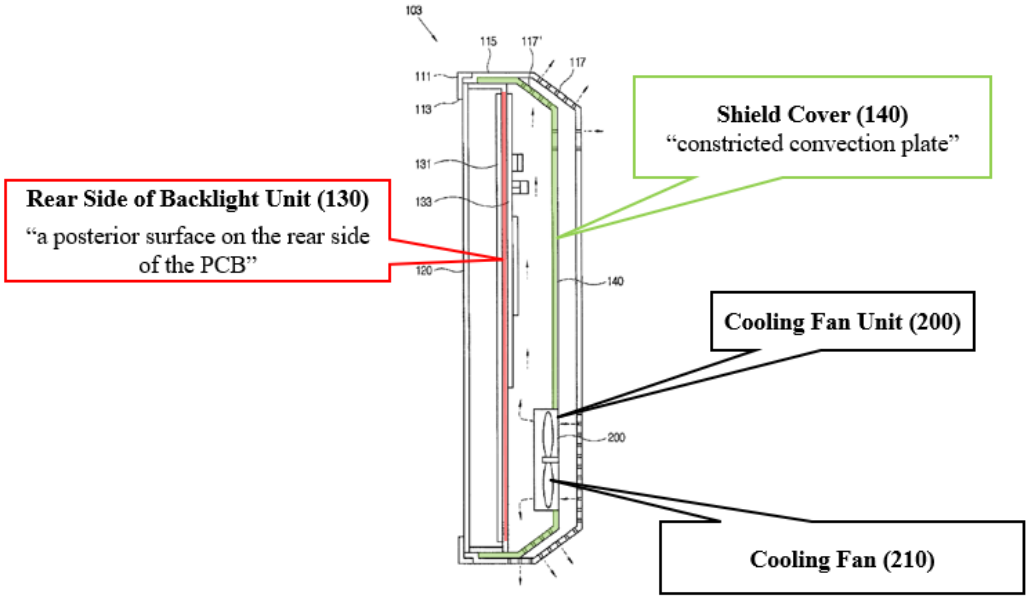
134. Accordingly, Kim's **shield cover 140** is the recited "**constricted convection plate**" which is "**placed behind and substantially parallel with the posterior surface of the PCB,**" as recited in claim element 4[c]. Therefore, Kim in combination with Hong discloses or renders obvious claim 4[c].

e. "a fan positioned to draw air between the constricted convection plate and the posterior surface. (Claim Element 4[d])

135. Kim in combination with Hong discloses or renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface**" as required by claim 4[d] of the '322 patent.

136. Kim discloses "cooling fan unit **200**" that is "combined to the shield cover **140** to cool the heat generating parts such as the light source **131** and the circuit board **133** of the backlight unit **130**." (Ex. 1005, 5:16-18 and FIG. 5). The "cooling fan unit **200** comprises the cooling fan **210** and a fan cover **220**." (*Id.*, 5:19-20.) While Kim explains that Figures 2 and 5 "show the cooling fan unit **200** placed in placed in a lower central portion of the shield cover **140**," as an alternative, "the

cooling fan may be placed in a central portion or an upper portion of the shield cover **140**, if necessary." (*Id.*, 5:40-42.)



(*Id.*, FIG. 5 (annotated).)

137. Kim teaches that "[t]he cooling fan **210** may draw in the **cooling air from the outside** into the heat generating parts or **discharge the cooling air to the outside** through the heat generating parts **depending on its rotation direction**." (*Id.*, 5:43-45.) Kim further teaches, "[t]he intake and discharge directions of the air through the cooling fan **210** may be changed in various ways according to the arrangement of the heat generating parts, the number of cooling fans **210**, etc." (*Id.*,

7:62-65; *see also id*., 5:4-6.) For example, "[t]he cooling fan **250**[11] [sic] of the display apparatus according to the exemplary embodiment may be provided to have a structure in which external air is discharged to the outside through the cooling fan **250** via the heat generating parts . . .." (*Id*., 8:16-20.) Accordingly, a POSITA would have understood Kim to disclose or render obvious a fan positioned to pull air from outside the housing and through and out of the space that separates the shield cover **140** ("the constricted convection plate") and the rear surface of backlight unit **130** ("the posterior surface").

138. Accordingly, Kim in combination with Hong discloses or renders obvious "**a fan placed to draw air between the constricted convection plate and the posterior surface**."

139. For these reasons, it is my opinion that Kim in combination with Hong renders obvious each and every limitation of Claim 4.

f. Motivation to Combine Kim and Hong

140. A POSITA as of March 3, 2008 would have been motivated to modify

[11] A POSITA would understand the reference to "cooling fan **250**" in column 8, lines 16-20 of Kim to be a typographical error. Earlier in its specification, Kim repeatedly uses reference number **250** to identify a "power supply." (*See* Ex. 1005, 6:64-7:7.) As such, a POSITA would understand Kim to be referring to "cooling fan **210**" in this passage.

Kim's backlight unit (Ex. 1005, 4:33-35, 4:40-46) to include with Hong's PCB with multiple LEDs mounted to its front side. (Ex. 1006, ¶¶[0029], [0033].) A POSITA would have known from his/her own knowledge, and from the prior art, that PCBs are an integral part of a backlight unit in an LCD device commonly used in the art to mechanically support and drive the LEDs of the backlight assembly. In other words, a POSITA would have known that Kim's LEDs need to be mounted on a first side of a PCB within backlight unit **131** in order to operate as intended and that Hong's PCB would have been suitable.

141. Hong discloses a typical LED backlight with a PCB for use in an LCD display. A POSITA would have immediately recognized the similarities between Hong's and Kim's backlight configurations and would have ascertained that Kim's LEDs (e.g., "[t]he light source **131** of the backlight unit **130** [which] is widely arranged **on a plane** of the backlight unit **130**" (*id*., 4:43-45)) are mounted on a PCB similar to Hong's base PCB **122**. A POSITA would also have recognized that the approach disclosed by Kim wherein the LEDs are "widely arranged on a plane of the backlight unit" suggests the use of a large area printed circuit board. Since the cost of circuit board is directly and positively related to the area of the circuit board, a POSITA, looking to reduce backlight unit costs, would have been motivated to reduce the total PCB area in the Kim design by using the approach disclosed in Hong,

wherein the LEDs are placed on a plurality of narrow circuit boards. This arrangement could reduce the circuit board area to ¼ of that in the Kim design and result in a significant cost savings. The combination would have amounted to no more than the use of a known technique (LEDs mounted on a PCB) to improve Kim's similar backlight to obtain predictable results. Accordingly, the POSITA would have had a reasonable expectation of success.

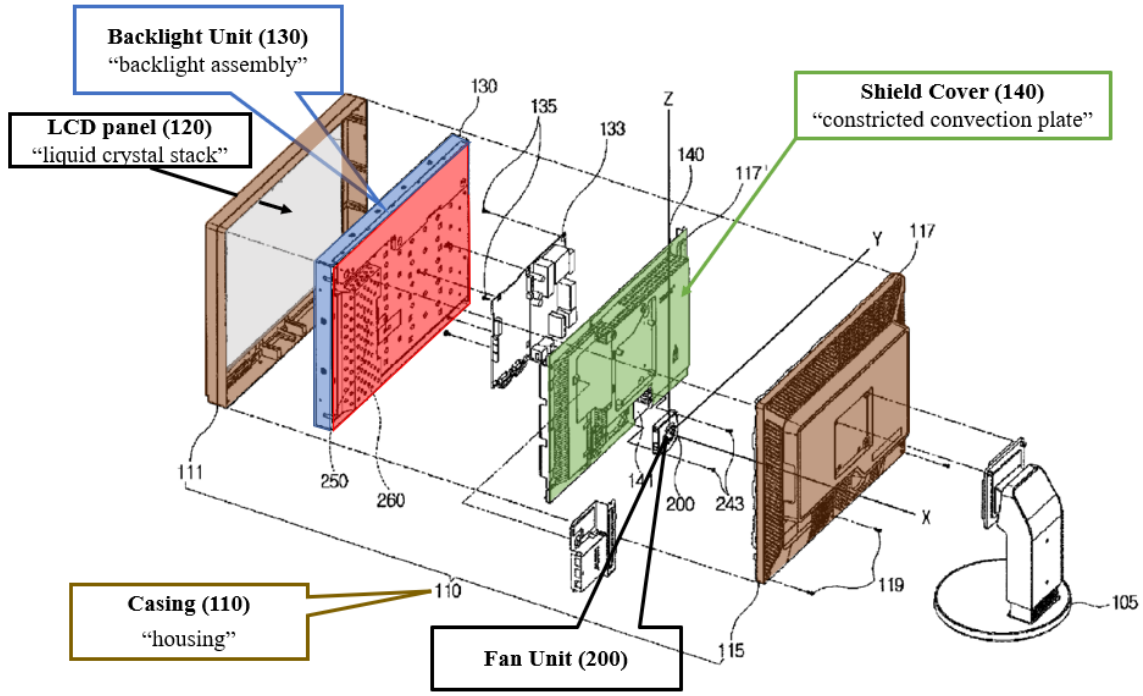
2. Claim 7: "The LCD from claim 4 further comprising:"

142. Kim in combination with Hong renders obvious claim 4 for the reasons provided above. Kim in combination with Hong further renders obvious claim 7.

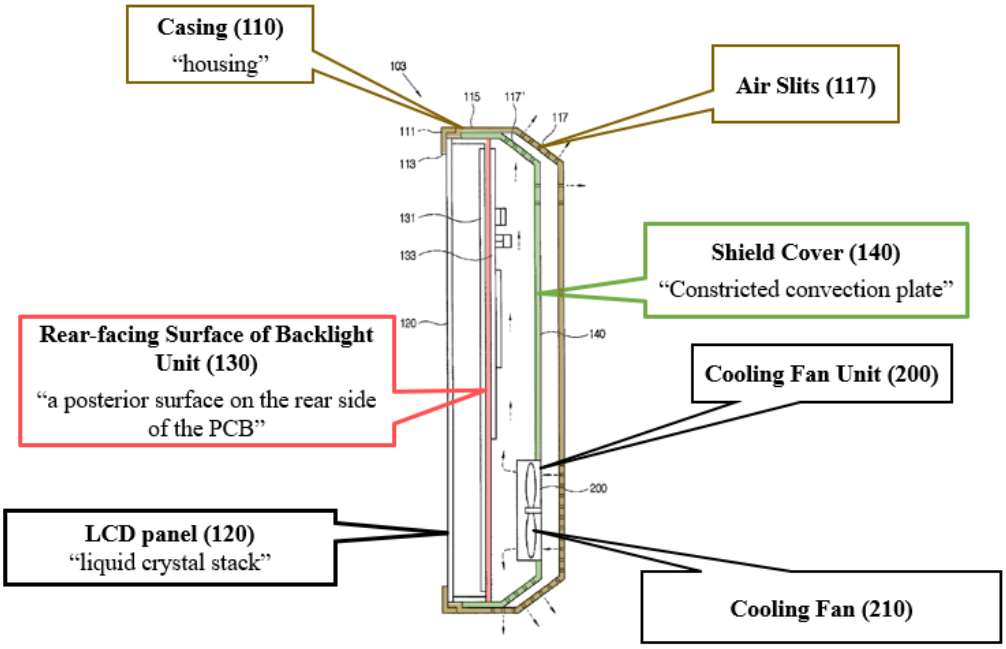
a. "a housing which contains the liquid crystal stack, backlight assembly, constricted convection plate, and fan; and" (Claim Element 7[a])

143. Kim in combination with Hong discloses or renders obvious "**a housing which contains the liquid crystal stack, backlight assembly, constricted convection plate, and fan"** as required by Claim 7[a].

144. Kim's display system shown in Figure 2 comprises a "**housing**" in the form of "a casing **110** that accommodates and supports the [LCD] display panel **120** and the backlight unit **130** to form an external shape, and comprises a front casing **111** and a rear casing **115**." (Ex. 1005, 4:8-12.)



(*Id*., FIG. 2 (annotated).) The front casing **111** "comprises an opening part **113** and supports the [LCD] display panel **120** on which an image is displayed." (*Id*., 4:13-15.) The rear casing **115** "is provided in the lateral and rear side of the liquid crystal display panel **120** and is combined with the front casing **111**." (*Id.*, 4:16-18.) As seen in Figure 2, the LCD display panel **120**, backlight unit **130**, shield cover **140** (i.e., "constricted convection plate") and fan unit **200** are all located within the front and rear casing (i.e., housing).



(*Id*., FIG. 5 (annotated).)

145. For these reasons, the combination of Kim and Hong renders obvious Claim 7[a].

b. "an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface of the PCB." (Claim Element 7[b])

146. Kim in combination with Hong discloses or renders obvious "**an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface of the PCB**," as required by claim 7[b].

147. Kim discloses that "[t]he rear casing **115** has a plurality of air slits **117**

through which air produced by a cooling fan **210** comes in and out." (*Id*., 4:20-24, *see also* 2:13-15, 3:9-12, claim 5.) As such, "air slits **117**" are "entrance a**pertures within the housing which permits external ambient air to enter the housing**."

Kim further discloses:

> The fan support **141** is spaced from the rear casing **115** and is formed through the shield cover **140** at a position which is adjacent to the backlight unit **130**. The fan support **141** may be formed at a central lower portion of the shield cover **140** such that **external air flows through the rear casing 115** and the **shield cover 140 from a lower side to an upper side of the backlight unit 130**.

(*Id*., 4:65-5:4.)

148. Accordingly, Kim in combination with Hong renders obvious "**an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface of the PCB**."

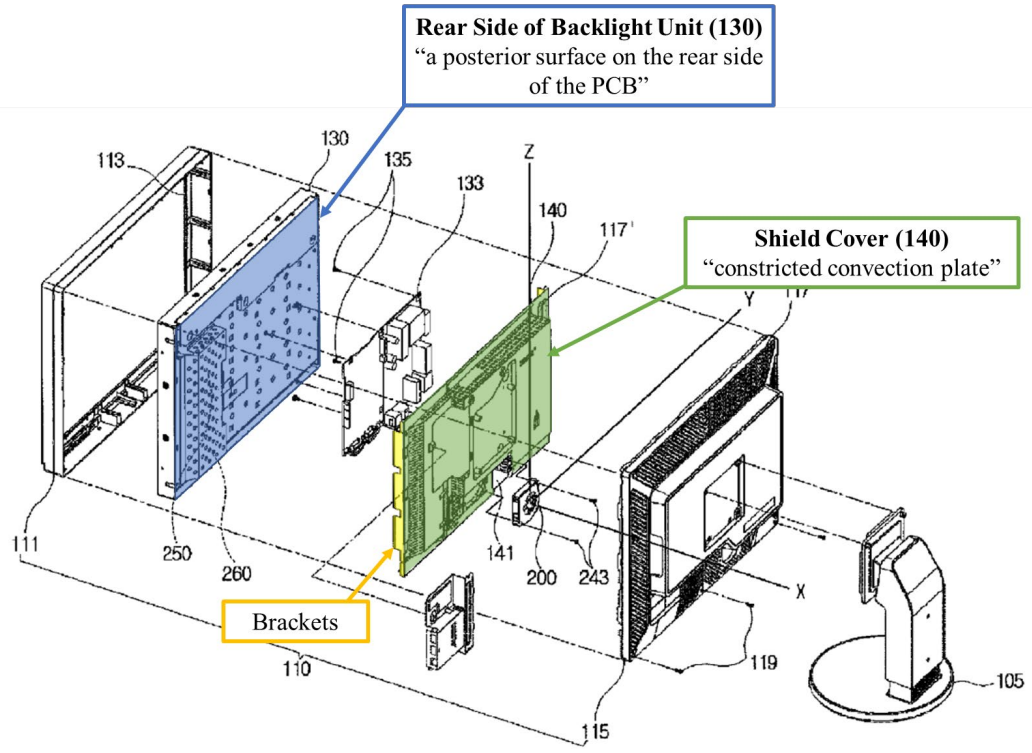
149. For these reasons, the combination of Kim and Hong renders obvious Claim 7.

C. Ground 2: The Combination of Kim, Hong and Tachikawa Renders Obvious Claim 5

1. Claim 5: "The LCD from claim 4 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate."

150. Kim in combination with Hong renders obvious the limitations of claim 4 for the reasons discussed above in Ground 1. The combination of Kim, Hong and Tachikawa discloses "**at least one bracket which connects the posterior surface with the constricted convection plate**," as required by claim 5 of the '322 patent.

151. As seen in annotated Figure 5, a POSITA would have understood that Kim's shield cover **140** (i.e., "**constricted convection plate**") is connected to the backlight unit **130** using brackets (colored yellow).

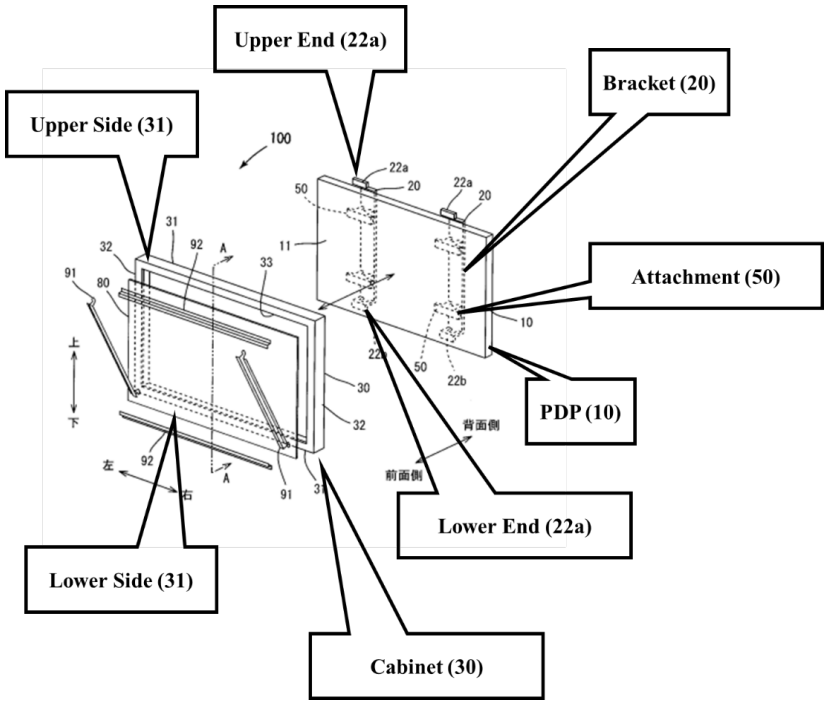


(Ex. 1005, FIG. 5 (annotated).) Kim teaches that the shield cover **140** "is supported by at least one of the backlight unit **130** and the casing **110**." (*Id.*, 4:52-55.)

152. Tachikawa presents a convective cooling system for a PDP and

addresses heat removal from the front of display surface **11** by drawing cooling air through a plenum formed by the display surface **11** and an optical filter **80** via a set of dust proof filters **70a** and **70b**. (Ex. 1026, FIGs. 1-2.)

153. In Figure 1, Tachikawa discloses a pair of brackets with attachments **50** (*see* FIG. 1) that allows PDP **10** to connect to front side cabinet **30**. Additionally, Tachikawa discloses that the rear side of the plasma television **100** (a rear cabinet **40** covering omitted in Figure 1 but shown in Figure 2) is also fixed to the bracket **20**.



(*Id.*, FIG. 1 (annotated).) Tachikawa explains:

> The PDP **10** is housed in the cabinet **30** in a state of being supported by two brackets **20** on the rear side. Specifically, the attachment **50** is fixed

> at four positions on the upper, lower, left, and right sides of the PDP **10**, and each set of the attachment **50** divided into two sets of left and right is fixed to each of the one brackets **20**. Each of the two brackets **20** is connected to a stand member (not shown) which stands substantially perpendicular from an installation surface of the plasma television, thereby supporting substantially the entire plasma television at the predetermined height.

(*Id*., ¶[0019].)

> The bracket **20** is designed such that when connected to the PDP **10** via the attachment **50**, the upper and lower ends **22a** and **22b** of the bracket extend outward beyond the width of the PDP **10** in the vertical direction, and the extended upper and lower ends **22a** and **22b** and the upper and lower sides **31** and **31** of the front cabinet **30** are respectively fixed. Further, although omitted in FIG. 1, the rear cabinet **40** covering the rear side of the plasma television **100** is also fixed to the bracket **20**.

(*Id*., ¶[0020].)

154. A POSITA would have understood that the posterior surface of PDP **10** in Tachikawa corresponds to the rear surface of backlight unit **130** of Kim, which is the recited "**posterior display surface**" as discussed above (*see also* claim element 4[b(iii)] in Ground 1). Therefore, the combination of Kim, Hong, and Tachikawa would result in a bracket used to "connect[] the posterior surface with the constricted convection plate" as recited in claim 5.

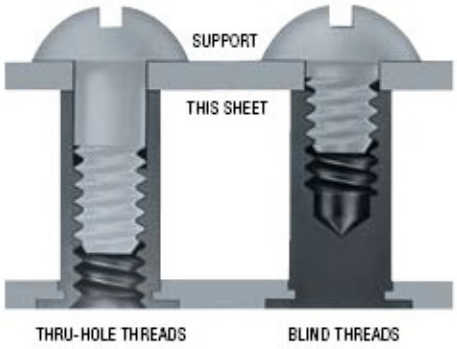
2. Motivation to Combine Kim, Hong, and Tachikawa

155. In my opinion, a POSITA would have been motivated to modify the display disclosed by the combination of Kim and Hong with the brackets disclosed by Tachikawa to improve on Kim's assembly serviceability and to improve structural strength of the display panel assembly, especially in larger size display applications.

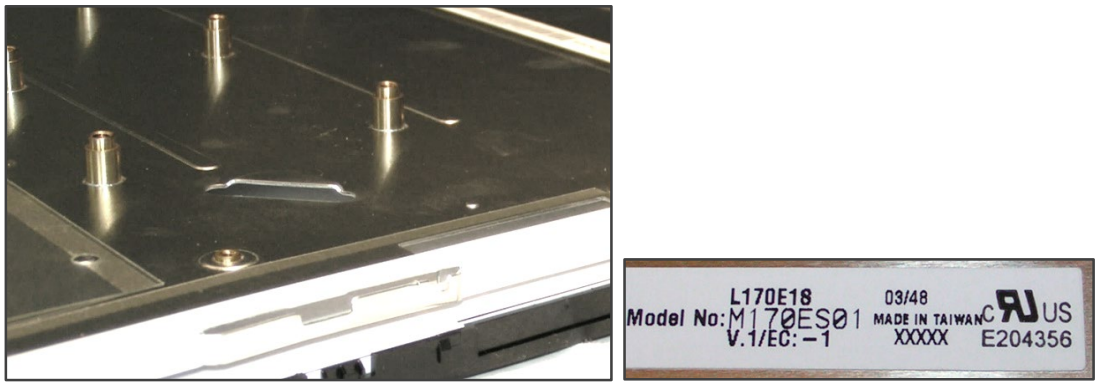
156. As discussed above, Kim's shield cover **140** (i.e., "constricted convection plate") is connected to the backlight unit **130** by a pair of brackets. However, Kim's approach may be less advantageous when it comes to accessing components, such circuit board **133** and the rear side of backlight unit **130**, from the rear of the assembly. For example, because Kim's brackets are obscured by casing **111** when assembled in the case, it would require additional effort to access and separate the shield cover **140** from the backlight assembly **130** (e.g., when servicing the backlight assembly). Additionally, as LCD panel sizes grow, additional structure is required beyond that of a typically molded plastic housing or thin sheet metal case. Accordingly, a POSITA would have been inclined to look for alternative bracket options to improve the connection between Kim's shield cover **140** and backlight **130**. In addition, Kim's stand **105** is only connected to the rear casing **115.**

157. To address these issues, a POSITA would have looked to alternative

bracket and support structures, the choices of which would have been well known to the POSITA at the time of the filing of the ’322 patent. These options include, but are not limited to: (i) a deep drawn bracket formed directly in either the posterior surface of the backlight unit case (rearward protrusion) or the shield cover (forward protrusion); (ii) install press fitted, self-clinching standoffs into the backlight unit case (examples of the part and its use in a 2003 LCD module shown below); or (iii) design and fit a custom bracket to the posterior surface of Kim’s backlight unit to which the shield cover would directly attach.



(Ex. 1030, p.2 (Image from 1997 PEM catalog showing SO-type self-clinching standoff).)



(Photograph of the rear plate of the backlight unit from a AUO L170E18 LCD module; ca. 2003 – date code 03/48 – yr/wk).)

158. All of these are "brackets" within the meaning of the '322 patent, which acknowledges that the brackets may be implemented **in various ways** and does not restrict the form of the claimed bracket. More specifically, the '322 patent specification states:

> In a typical display, the display posterior **22 may include four** mounting brackets **20**. **The four mounting brackets 20 are shown by way of example and not by way of limitation**, exemplary embodiments may be used with various numbers of mounting brackets **20**. The mounting brackets **20** serve to attach the constricted convection plate **30** (shown in FIG. 3) to the display posterior **22**. The height that the mounting brackets **20** extending from the display posterior **22** define the depth of the constricted convection cooling channel **50** (shown in FIG. 5). This may also be described as the gap distance between the display posterior **22** and the constricted convection plate.

(Ex. 1001, 4:40-52.)

159. Tachikawa provides an example of such a bracket structure that falls into category (iii). A POSITA looking to improve the serviceability and mechanical structure of Kim's display would have been motivated to look to other electronic displays that had addressed similar heat removal issues, including plasma display panels (PDPs). Knowledge of these displays would have been well within the scope and ability of the display practitioner especially since technical conferences and associated trade shows, such as the Society for Information Displays, included and addressed issues across all technologies in their journals and symposia.

160. A POSITA would have been motivated to look to this closely related sub-field of electronic displays to see how PDP devices, for example, incorporated convective cooling systems and would then also see structures implemented in the various cooling systems. The display panel portion of the PDP product, being much heavier than an LCD panel, would necessarily include structural members that were suitable for carrying the loads associated with the PDP element.

161. A POSITA would therefore understand from the above that the use of Tachikawa's brackets **20**, along with attachments **50**, allows the removal of rear cabinet **40** covering, which is positioned against the back surface of PDP **10**, with minimal effort since the rear cabinet **40** would be snapped on the PDP **10**, much like

front cabinet **30**. The bracket and attachment configuration proposed by Tachikawa would be applicable to Kim to take advantage of the benefits provided therefrom. For example, a POSITA would have envisioned, based on the teachings from Tachikawa, that the rear side surface of Kim's backlight unit **130** would be fitted with brackets via a set of attachments (e.g., like PDP **10** is fitted with brackets **20** via attachments **50** in Tachikawa) so that the shield cover **140** can be attached on the extended upper and lower ends (**22a** and **22b**) of the brackets.

162. The substitution of Kim's bracket arrangement with Tachikawa's would permit easy disassembly of Kim's display without compromising its cooling ability. This substitution and modification would merely involve the use of one known technique to improve similar devices in the same way, i.e., to connect Kim's shield cover **140** and backlight assembly **130**, which can be, at a later time, separated with minimal effort when servicing the display—and would produce predictable results because Tachikawa's bracket would advantageously and predictably allow access to Kim's backlight unit **130** beneath the shield cover **140** without interfering with Kim's cooling method. In addition, connecting Kim's rear casing, shield cover, stand, and brackets together would improve the stability of Kim's display system.

163. A POSITA would have a reasonable expectation of success from taking advantage not only of Kim's use of cooling system to discharge heat generated by

the backlight unit as modified by Hong, but also from Tachikawa's bracket arrangement for effortless display disassembly. A POSITA would combine each of these known approaches with no change in their respective functions, and the combination would yield predictable results.

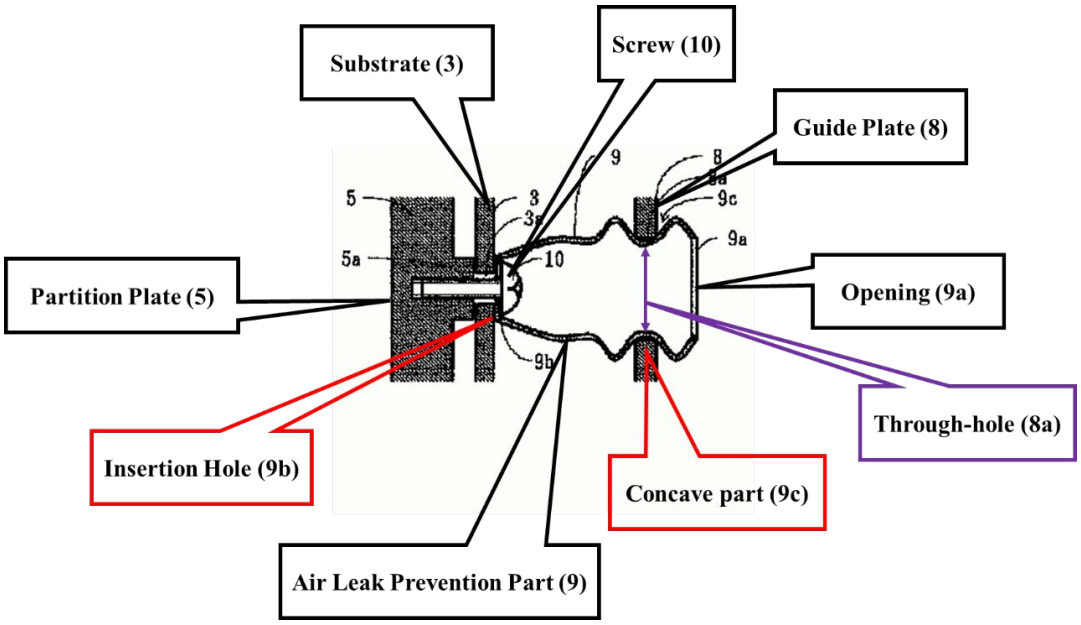
D. Ground 3: The Combination of Kim, Hong and Takahashi Renders Obvious Claim 8

1. Claim 8: "The LCD from claim 4 further comprising: a plurality of access apertures on the constricted convection plate."

164. Kim in combination with Hong renders obvious the limitations of claim 4 for the reasons discussed above. In my opinion, the combination of Kim, Hong and Takahashi discloses "**a plurality of access apertures through the constricted convection plate**," as required by claim 8 of the '322 patent.

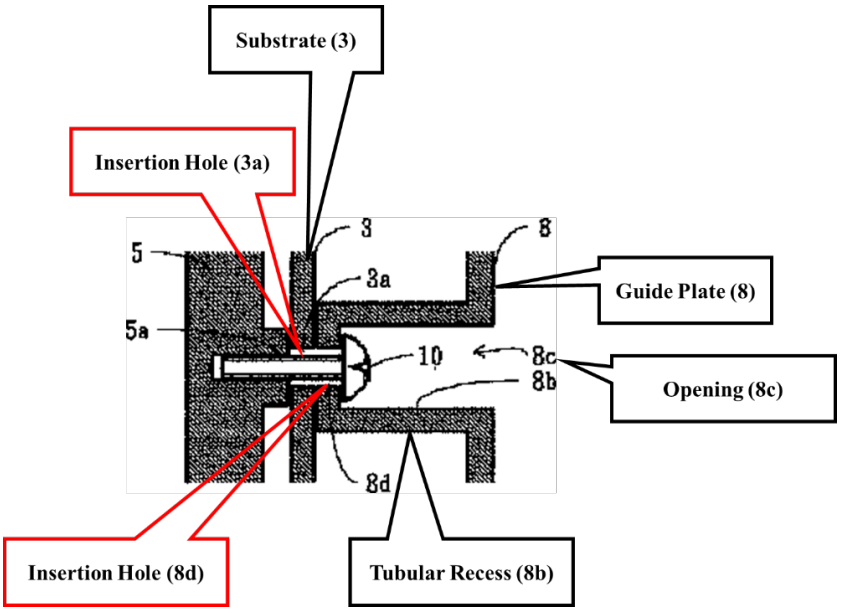
165. Kim discloses a **"constricted convection plate**" for the reasons discussed above with respect to claim element 4[c] in Ground 1. (*See supra* § VI.B.1.d.)

166. Takahashi further discloses as part of a "heat dissipation structure of electronic devices" such as "PDP (plasma display) devices" an "air leak prevention part [**9**] that is fitted to . . . through-hole **8a**, which is formed into a hollow body having, as shown in FIG. 2":



(*Id*., FIG. 2 (annotated).) Takahashi explains that the air leak prevention part includes "an opening **9a** corresponding to the aforesaid through-hole **8a**; an insertion hole **9b** for insertion of the substrate attachment screw **10** formed in the base thereof; and a concave part **9c** that fits into the aforesaid through-hole **8a** formed at the peripheral edge of the opening **9a** thereof." (*Id.*, ¶[0010].)

167. As further reflected by Figure 3, Takahashi discloses that its "heat dissipation structure for electronics" also allows "the aforesaid air leak prevention part **9** [to be] integrally formed with the aforesaid air guide plate 8, and, as shown in the drawings, a tubular recess **8b** is formed in the air guide plate 8, thereby forming an opening **8c**, and an insertion hole **8d** is formed in the base of the same recess **8b**." (*Id*., ¶[0011].)



(*Id.*, FIG. 3 (annotated).) The "thin section **8e** formed at the top of the air guide plate **8** is rotated, the air guide plate **8** is lifted up, and the substrate **3** is inserted to the designated position, after which the air guide plate **8** is placed on the substrate **3**, and the mounting screw **10** is inserted into the recess **8b** via the opening **8c**, whereupon it passes through the insertion hole **3a** in the substrate **3** via the insertion hole **8d** provided in the base of this recess **8b**, and is threaded into the attachment screw hole **5a** in the partition plate **5**, thereby fastening the substrate **3** to the partition plate **5**." (*Id.*, ¶[0012].)

168. It is my opinion that a POSITA would consider Takahashi's through-hole **8a**, and insertion holes **3a**, **8d** and **9b** to be "a plurality of **access apertures**," in that each hole allows "access" to screw 10. This allows an individual to service

or replace an electrical component (*e.g.*, substrate 3) associated with an electronic device such as a plasma display television or LCD, such as those disclosed by Kim and Hong. Takahashi further discloses that its "air leak prevention part **9** is fitted into the through-hole **8a** provided in the air guide plate **8**, and the screw **10** is inserted through the opening **9a** in this air leak prevention part **9** and threaded through the attachment screw hole **5a** in the partition plate **5** via the insertion hole **9b** and the insertion hole **3a** in the substrate **3**, thereby fastening the substrate **3** to the partition plate **5**." (*Id.*, ¶[0012].) Because Takahashi contemplates that a through-hole **8a** can be used to fasten a substrate **3** to a partition plate **5**, it would be obvious to a POSITA that these through-holes (i.e. a plurality of **access apertures**), formed from the combination of Kim and Hong, could be adjusted as needed for Kim's shield cover **140**, to gain access to and service electrical components associated with heat-generating parts such as the LED driver board **133** (which is between the shield cover **140** and the backlight **130** and otherwise obscured).

169. Accordingly, Kim and Hong combined with Takahashi renders obvious "**[t]he LCD from claim 4 further comprising: a plurality of access apertures through the constricted convection plate**" as required by claim 8.

2. Motivation to Combine Kim and Hong with Takahashi

170. It is my opinion that a POSITA would have been motivated to further

combine Kim and Hong with Takahashi for the following reasons.

171. In my opinion, a POSITA as of March 3, 2008 would have been motivated to use Kim's "cooling fan with improved cooling efficiency by efficiently cooling [*i.e.* removing] heat generated by a backlight unit" (Ex. 1005, 1:46-49), and would have been further motivated to use Takahashi's solution of using access apertures (i.e., through-holes) to gain access to hardware components associated with the backlight unit and/or LCD display. Indeed, Takahashi teaches that "in the event of maintenance or inspection, the substrate mounting screw can be removed from the opening in the air leak prevention park without needing to remove the air guide plate." (Ex. 1008, ¶[0014].)

172. The modification of Kim's "shield cover **140**" ("**constricted convection plate"**) with through-holes, like those disclosed by Takahashi, to permit servicing of the LED driver circuit board and backlight unit would have involved the use of one known technique to improve similar devices in the same way, and further would produce predictable results. Takahashi's through-holes would advantageously and predictably further allow access to the LED driver circuit board **133** beneath the shield cover **140** of Kim with no change to the function of the shield cover **140**, and while maintaining a leak-free cooling pathway, with a reasonable expectation of success.

173. The combination would have constituted the simple use of one known technique, the cooling of a posterior display surface by convection of air within a constricted convection channel, (as reflected by Kim), along with the known use of a PCB in an LED backlight, while further taking advantage of a known method of forming deep drawn through-holes in a plate to allow servicing electronic devices associated with display (as disclosed by Takahashi). A POSITA would have expected predictable results from the combination to achieve an LCD display that was more thermally efficient and more easily serviced. A POSITA would have a reasonable expectation of success that the combination of the three complimentary thermal efficiency and servicing techniques would work together as intended.

E. Ground 4: Claims 1-3 Are Obvious Over Kim and Tachikawa

1. Independent Claim 1

174. It is my opinion that Kim in combination with Tachikawa renders obvious each and every limitation of independent claim 1 as discussed below. A POSITA would have been motivated to combine Kim with Tachikawa for the same reasons as discussed above with respect to the combination of Kim, Hong, and Tachikawa. (*See supra* §VI.D.2.)

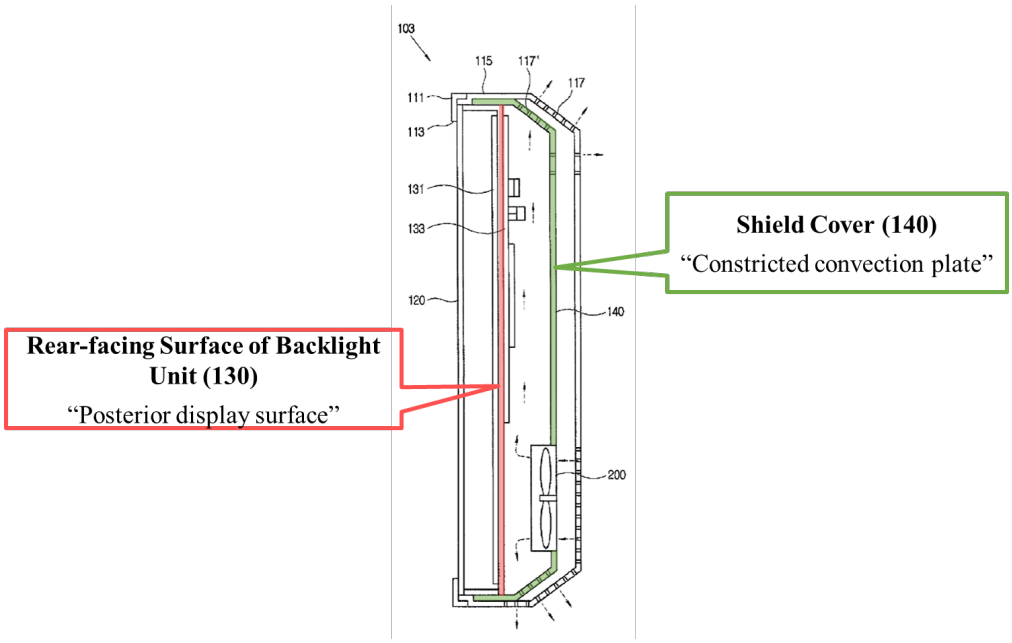
a. "A system for cooling an electronic display having a posterior display surface and contained within a housing, the system comprising:" (Claim Element 1[pre])

175. To the extent the preamble is limiting, Kim in combination with

Tachikawa renders obvious "**a system for cooling an electronic display having a posterior display surface and contained within a housing**."

176. Kim discloses "a cooling fan unit that cools a backlight unit of a display apparatus [an '**electronic display having a posterior surface**'] comprising a casing ['**a housing**'], the backlight unit that is supported by the casing and comprises light emitting diodes (LEDs), and a shield cover . . . ." (Ex. 1005, 3:21-30.) As discussed above with respect to claim 4[pre]-4[b], the electronic display is an LCD including a liquid crystal panel and backlight. (*See supra* §VI.B.1.a-c.)

177. A POSITA would have understood that **rear side of backlight unit 130** is "a posterior display" as shown in Figure 5 below:



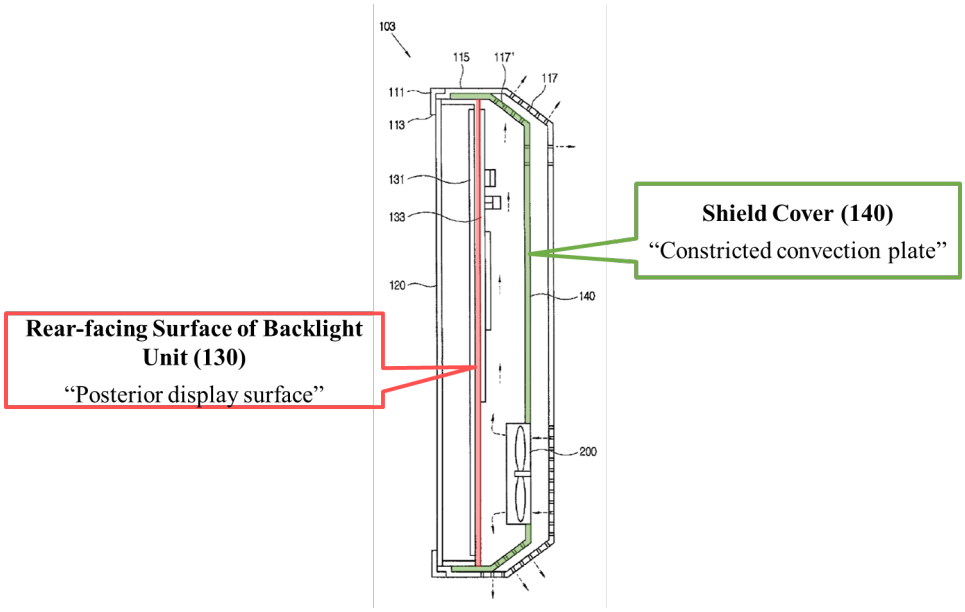
(Ex. 1007, FIG. 5 (annotated).)

178. Kim's display system comprises a "**housing"** in the form of "a **casing 110** as discussed in claim element 7[a] of Ground 1, the analysis of which is incorporated herein.

179. Accordingly, Kim in combination with Tachikawa renders obvious "**a system for cooling an electronic display having a posterior display surface and contained within a housing**."

b. "a constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface;" (Claim Element 1[a])

180. Kim in combination with Tachikawa renders obvious claim element 1[a]. For the reasons discussed above with respect to claim 4[c] in Ground 1, Kim discloses a "**constricted convection plate placed behind . . . the posterior surface of the PCB**." (*See supra* § IV.B.1.d.) Kim's "shield cover **140**" (i.e., "constricted convection plate") is also posterior to the rear-facing surface of backlight unit **130** (i.e., the "**posterior display surface**"). As shown in annotated Figure 2, Kim's shield cover **140**" (i.e., "constricted convection plate") covers the **majority** of the posterior display surface:



(*Id*., FIG. 5 (annotated).)

181. Therefore, Kim in combination with Tachikawa renders obvious claim 1[a].

c. "at least one bracket which connects the posterior display surface with the constricted convection plate; and" (Claim Element 1[b])

182. The combination of Kim and Tachikawa renders obvious "**at least one bracket which connects the posterior display surface with the constricted convection plate**." As discussed above with respect to claim 5 in Ground 2, the combination of Kim, Hong, and Tachikawa renders claim 5 obvious, which recites "**at least one bracket which connects the posterior surface with the constricted convection plate**." (*See supra* VI.C.1.) Claim 1[b] is obvious for these same reasons.

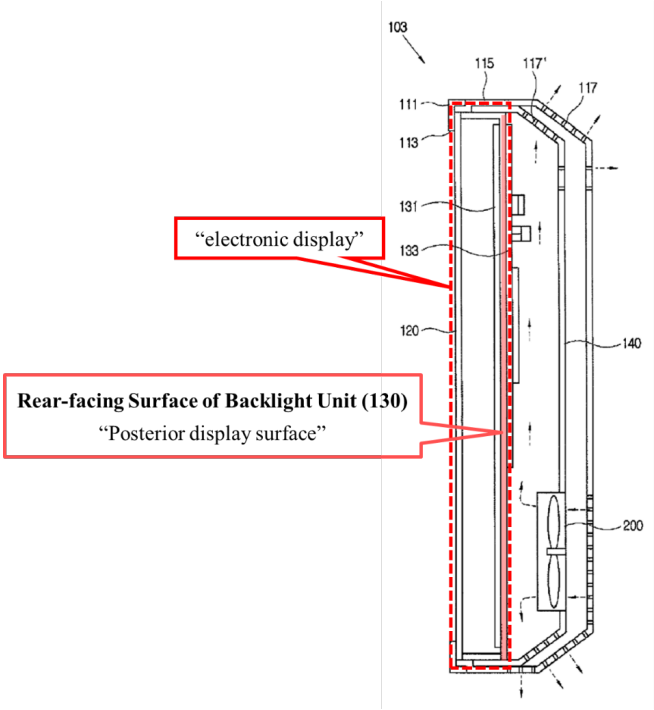
d. "a fan placed to draw ambient air between the constricted convection plate and the rear posterior." (Claim Element 1[c])

183. For the reasons discussed above with respect to claim 4[d] in Ground 1, Kim discloses or renders obvious "**a fan placed to draw air between the constricted convection plate and the rear posterior**." (*See supra* § VI.B.1.e.) Kim in combination with Tachikawa renders obvious claim 1[c] for these same reasons.

184. For these reasons, claim 1 is obvious over the combination of Kim and Tachikawa.

2. Claim 2: "The cooling system from claim 1 wherein: the posterior display surface comprises the rear surface of a backlight assembly."

185. Kim in combination with Tachikawa renders obvious claim 1 for the reasons described above. Kim in combination with Tachikawa renders obvious that "**the posterior display surface comprises the rear surface of a backlight assembly**" for the same reasons described above in claim element 1[pre] and with respect to claim 4[b] in Ground 1. (*See supra* §§ VI.B.1.c, VI.E.1.a.)



(Ex. 1005, FIG. 5 (annotated).)

186. Therefore, Kim in combination with Tachikawa renders obvious claim 2.

3. Claim 3: "The cooling system from claim 1 wherein: the constricted convection plate is substantially parallel to the posterior display surface."

187. Kim in combination with Tachikawa renders claim 1 for the reasons described above. Kim in combination with Tachikawa renders obvious that "**the constricted convection plate is substantially parallel to the posterior display surface**" for the same reasons described above with respect to claim 4[c] in Ground 1. (*See supra* § VI.B.1.d.) Therefore, claim 3 is obvious over Kim in view of

F. Ground 5: Na Renders Obvious Claims 4, 8, 9, 10, and 16

1. Independent Claim 4

188. It is my opinion that Na discloses or renders obvious each and every limitation of claim 4.

a. "A liquid crystal display (LCD) comprising:" (Claim Element 4[pre])

189. To the extent the preamble of claim 4 is limiting, it is disclosed or rendered obvious by Na.

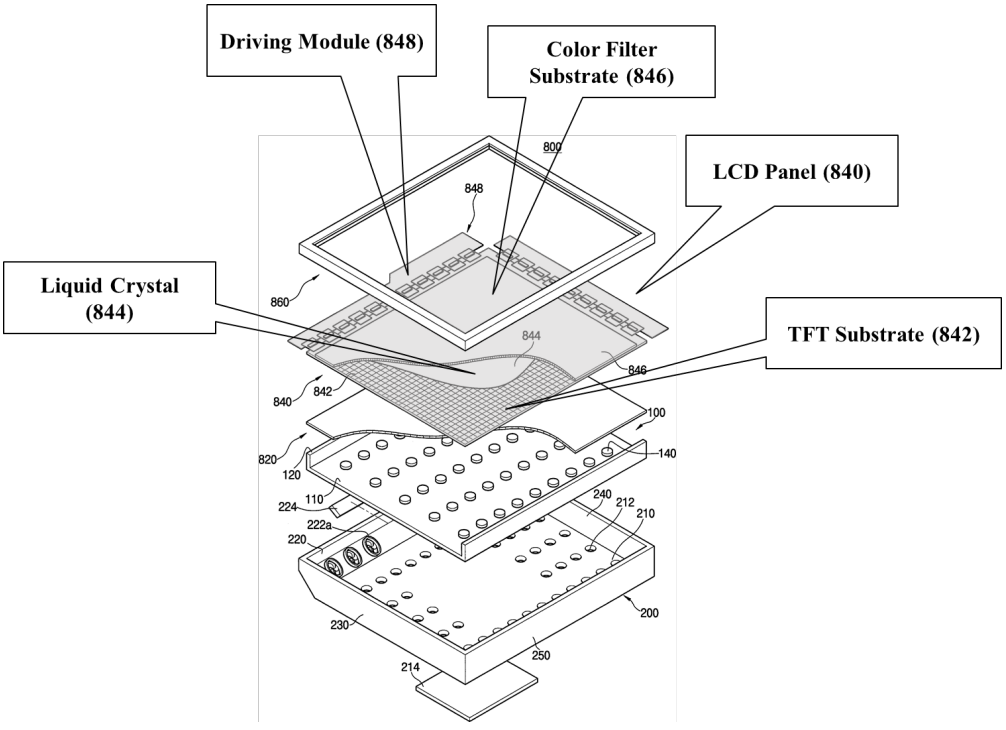
190. The title of Na is "Backlight Unit and Liquid Crystal Display Device Including the Same." (Ex. 1010, p.1.) Similarly, Na's Field of the Invention discloses "[t]he present invention relates to a backlight unit and **a liquid crystal display device** including the same, and more particularly, to a backlight unit capable of improving a cooling effect and **a liquid crystal display device** including the same." (*Id*., p.2.) Indeed, Na repeatedly and frequently discloses that its invention is directed to such an "**liquid crystal display (LCD)**," such as liquid crystal display device **800** shown in Figure 13. (*See,* e.g., *id*., pp.2-4, 6, 8-9, FIGs. 13-14.)

191. Accordingly, Na discloses or renders obvious "**a liquid crystal display (LCD)**" as required by the preamble of claim 4.

b. "a liquid crystal stack;" (Claim Element 4[a])

192. Na discloses or renders obvious "**a liquid crystal stack**" as required by claim element 4[a].

193. Na discloses "the present invention includes a backlight unit and a **liquid crystal display panel**." (Ex. 1010, p.3.) Na further discloses that "**[t]he liquid crystal display panel** uses the light emitted from the light generator to display an image." (*Id.*) Na's Figure **13** illustrates "the liquid crystal display panel **840**" (colored gray) as a "**stack**" that includes "thin film transistor (TFT) substrate **842**, a liquid crystal **844**, a color filter substrate **846**, and a driving module **848**."



(*Id*., p.8; FIG. 13 (annotated).) Accordingly, Na's liquid crystal display panel **840**

is a "**liquid crystal stack.**" [12]

194. Further, if the term "**liquid crystal stack**" is intended to refer to the individual liquid crystal sub-layers (which, when stacked together, collectively form the liquid crystal layer of an LCD panel), a POSITA would know that these liquid crystal sub-layers are necessarily present in a liquid crystal layer of every LCD panel as part of its structure.

195. Accordingly, Na discloses or renders obvious a "**liquid crystal stack**" as required by claim element 4[a].

c. "a backlight assembly behind the liquid crystal stack and comprising:" (Claim Element 4[b])

iv. "a printed circuit board (PCB) having front and back sides;" (Claim Element 4[b(i)])

v. "a plurality of LEDs mounted on the front side of the PCB;" (Claim Element 4[b(ii)])

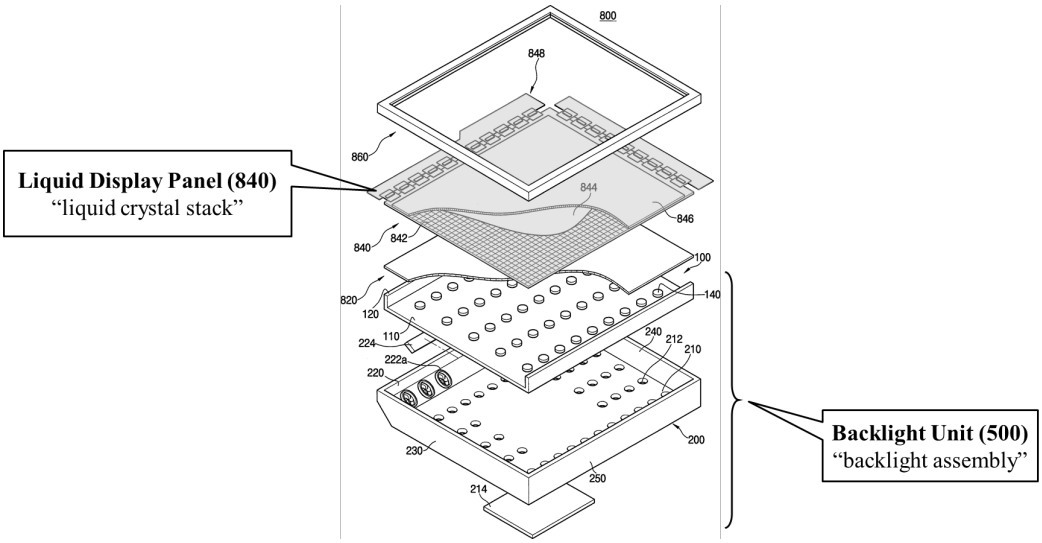
vi. "a posterior surface on the rear side of the PCB;" (Claim Element 4[b(iii)])

196. Na discloses or renders obvious the requirement of claim element 4[b] of "**a backlight assembly behind the liquid crystal stack and comprising: a printed circuit board (PCB) having front and back sides; a plurality of LEDs**

[12] Notably, the specification of the '322 patent does not define the term "liquid crystal stack," but states the "display 10 may be the front glass plate of a liquid crystal display stack." (Ex. 1001, 9:19-21.)

mounted on the front side of the PCB; a posterior surface on the rear side of the PCB."

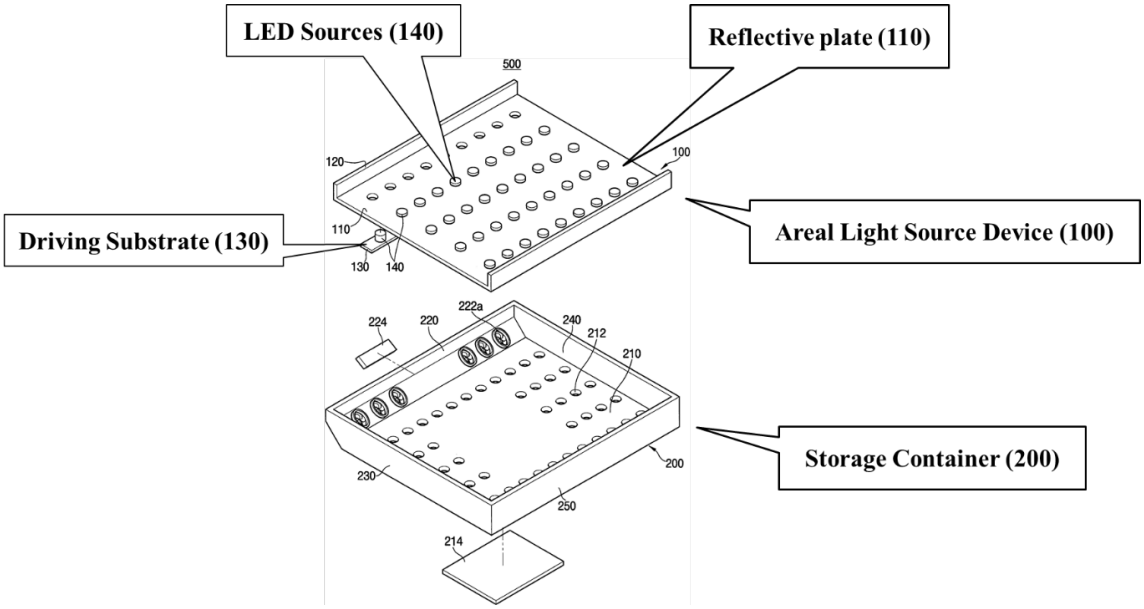
197. As discussed above, Na's liquid crystal display panel **840** is the recited "**liquid crystal stack**." Na discloses a "**a backlight assembly behind the liquid crystal stack**." Indeed, the title of Na is "**Backlight Unit** and Liquid Crystal Display Device Including the Same." (Ex. 1010, p.1.) Na discloses the backlight unit is part of the liquid crystal display device **800**. Specifically, Na discloses that a liquid crystal display device **800** "includes a backlight unit **500**, a liquid crystal display panel **840**, and a chassis **860**." (*Id.*, p.8.) The relative position of the aforementioned components of liquid crystal display device **800** is shown in Figure 13 below.



(*Id*., FIG. 13 (annotated).)

198. In referring to Figure 1, Na further discloses that "backlight unit **500**"

includes "an areal light source device **100** and a storage container **200**." (*Id*., p.4.)

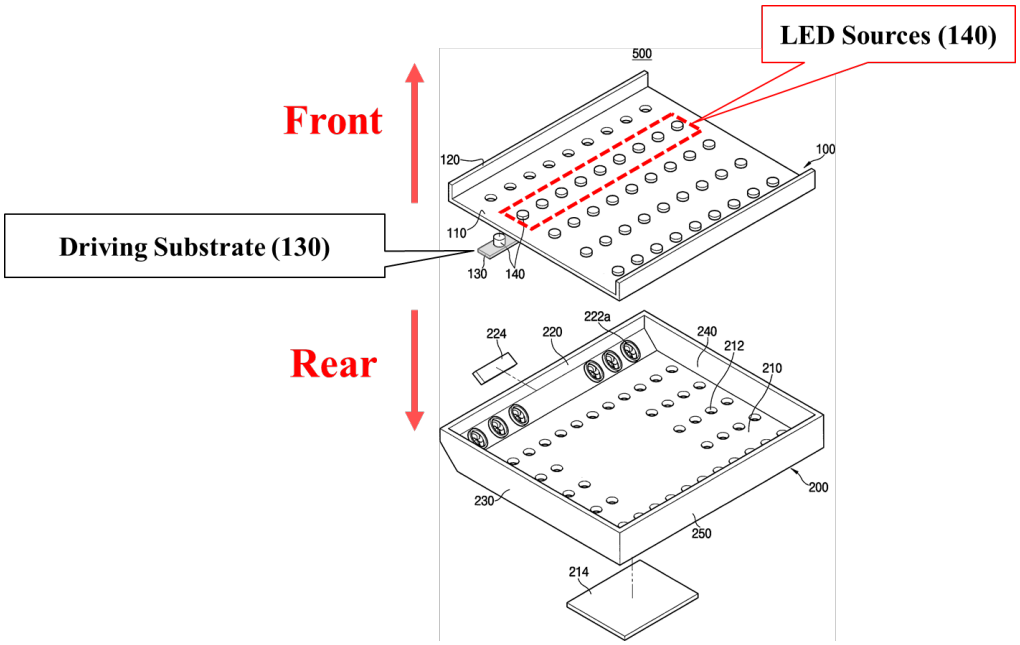


(*Id*., FIG. 1 (annotated).) The areal light source device **100** "includes a reflective plate **110**, a sidewall **120**, a driving substrate **130**, and a plurality of light emitting diode light sources **140**." (*Id.*) Accordingly, Na's "backlight unit" is the claimed "**backlight assembly**."

199. Na further discloses that its backlight unit is "**behind**" its liquid crystal display (i.e., "**liquid crystal stack**"). As shown in Figure 13, the "backlight assembly **500**" is located immediately beneath (i.e. "**behind**") the liquid display panel **840** (i.e. the "**liquid crystal stack**"). Accordingly, Na discloses a "**a backlight assembly behind the liquid crystal stack**."

200. Na discloses that "driving substrate **130** is arranged side by side at the

lower part of reflective plate **110**," and "[a] drive power source is applied to the driving substrate **130** to illuminate the light emitting diode light sources **140**." (*Id.*, p.4.) As reflected in Figure 1, "[t]he light emitting diode light sources **140** [i.e., a "**plurality of LEDs**"] are arranged in a line on driving substate **130**, pass through coupling holes **112** and are coupled to be positioned on the upper surface of reflective plate **110**." (*Id.*)



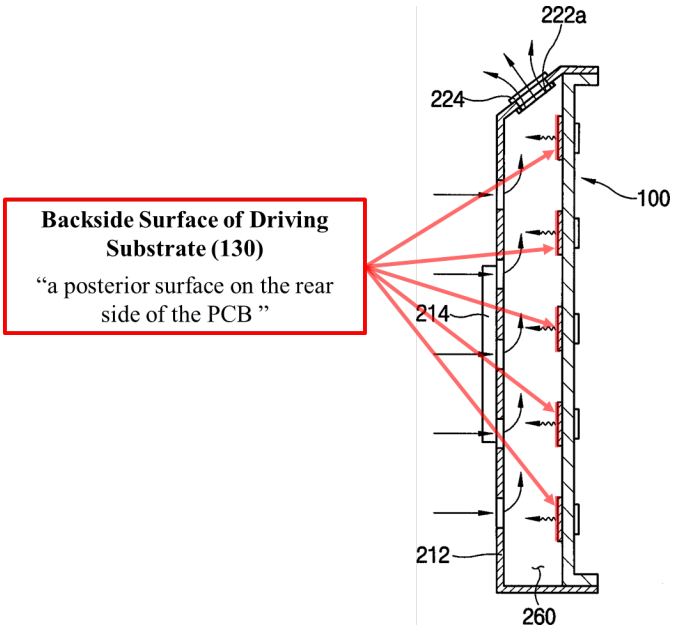
(*Id.*, FIG. 1 (annotated).) In being "arranged in a line on driving substrate **130**," and as clearly illustrated in Figure 1, the plurality of LEDs **140** necessarily are "**mounted**" on the "**front side**" of driving substrate **130** (the "**PCB**"). As illustrated in Figure 1, the driving substrate **130** has "**front and back sides**," with LED sources attached to the **front side** driving substrate **130** beneath (i.e. **behind**) the LCD panel

(the **LCD stack**). (*See id.*, FIG.13.)

201. Na teaches that the "driving substrate **130** of the areal light source device **100** is driven to generate heat." (*Id.*, p.7.) Because driving substrate **130** illuminates the LED sources **140** and generates heat, a POSITA would have understood Na's "driving substrate **130**" to be a circuit board. A POSITA would have known from his/her own knowledge that the term "driving substrate" is a "circuit board" because (i) the term "board" is a colloquial short-hand for "substrate" in that both the "board" and the "substrate" support multiple layers of conductor pathways (i.e., the "circuit") and dielectric layers, and (ii) that the "printed" descriptor is just a term of art describing a method of fabricating the circuit traces. Further, because Na's driving substrate **130** is a multifunctional component that performs a variety of tasks (e.g., powering the LEDs and connecting to other electronic components like driving circuit unit **224** (see *id*., p.4), a POSITA would have understood that driving substrate **130** is a **printed circuit board** ("PCB"). Accordingly, Na discloses "**a printed circuit board (PCB) having front and back sides**."

202. A POSITA would have understood that the "**posterior surface**" in Na corresponds to the outmost surface of the rear side of the portion of driving substrate **130** facing "the inner space **260**," which is illustrated in Figure 3 as the space located

between the reflective plate **110** of areal light source device **100** and the storage container **200** with its bottom plate **210**. (*Id*., p.5.)



(*Id.*, FIG. 3 (annotated)) **The posterior surface of the driving substrate 130** is thus "**a posterior surface on the rear side of the PCB**."

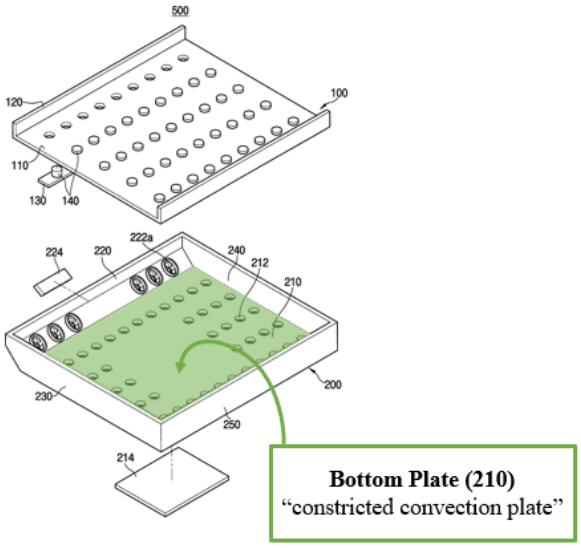
203. Therefore, Na discloses or renders obvious claim element 4[b].

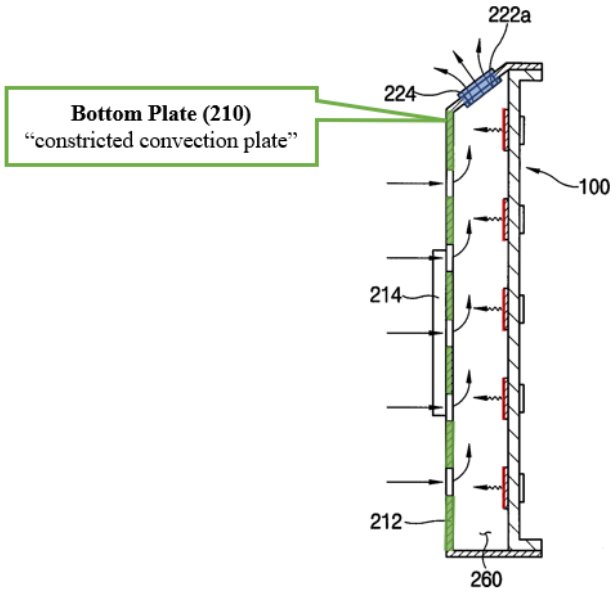
d. "a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and" (Claim Element 4[c])

204. Claim element 4[c] recites and Na discloses or renders obvious "**a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB**."

205. As shown in Figures 1 and 3, Na provides storage container **200** which

forms a cavity "inner space" **260** (shown in Figure 3) through which air is drawn to cool the backlight unit **500**. The bottom plate **210** of storage container **200** "has a rectangular flat plate shape" (*Id.*, p.4.) The "low-temperature air cooler than the high-temperature air in the inner space **260** is introduced from the outside of the backlight unit **500** through the through-holes **212**." (*Id*., p.5.) A plurality of fans **222a** "are formed on the first sidewall **220**." (*Id*., p.4.) These fans **222a** "are operated to flow air from the inner space to the outside." (*Id.*) Thus, "the heat generated by the areal light source device **100** is transferred from the inner space to the outside," and "the fans **222a** function as an exhaust unit for discharging internal air." (*Id.*) Na specifically teaches that "the cooling effect is increased by **a free convection phenomenon** or **a forced convection phenomenon** resulting from the operation of the components." (*Id*., p.9.) Therefore, it is my opinion that a POSITA would have understood that the bottom plate **210** constricts airflow in order to achieve the desired convective cooling effect as demonstrated in Figures 1 and 3.





(*Id*., FIGs. 1&3 (annotated).) Na discloses that it is possible to form holes in the side walls. Although the through-holes can be formed on the bottom plate, "the through-holes may be further formed in the first to fourth sidewalls, or may be formed only

in the first to fourth sidewalls." (*Id*., p.5.) A POSITA would have understood such an embodiment to look like the following modified versions of Figures 2 and 3:

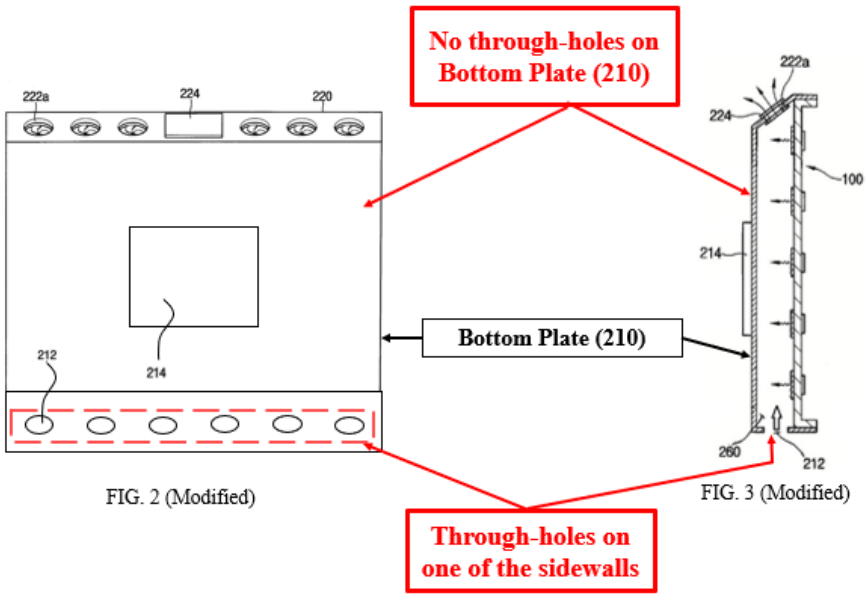


FIG. 2 (Modified)

FIG. 3 (Modified)

(*Id*., FIGs. 2 & 3 (modified and annotated).) Accordingly, the "rectangular flat plate shape[d]" bottom plate **210** of Na's storage container **200** is a "**constricted convection plate**"[13] that introduces and helps channel the air "in the inner space **260**" and which faces the rear-facing side of driving substate **130** ("**the posterior surface of the PCB**"), so as to be "**placed behind and substantially parallel**" as

[13] In my opinion, nothing in the claims or specification of the '322 patent suggests that the "**constrictive convection plate**" (e.g., storage container **200**) cannot also be a component of the "**backlight assembly.**"

required by claim 4[c]. Na's above noted configuration is also consistent with the Delaware District Court's construction for the term "**substantially parallel**" to mean "**approximately parallel**." For example, Na's bottom plate **210** is in a similar position relative to the posterior surface of driving substate **130** as is the constricted convection plate **30** shown relative to the display posterior **22** shown in the Figures 3 and 5B-5F of the '322 patent. (*See* Ex. 1001, at 4:66-5:5 and FIGs. 3, 5B-5F).

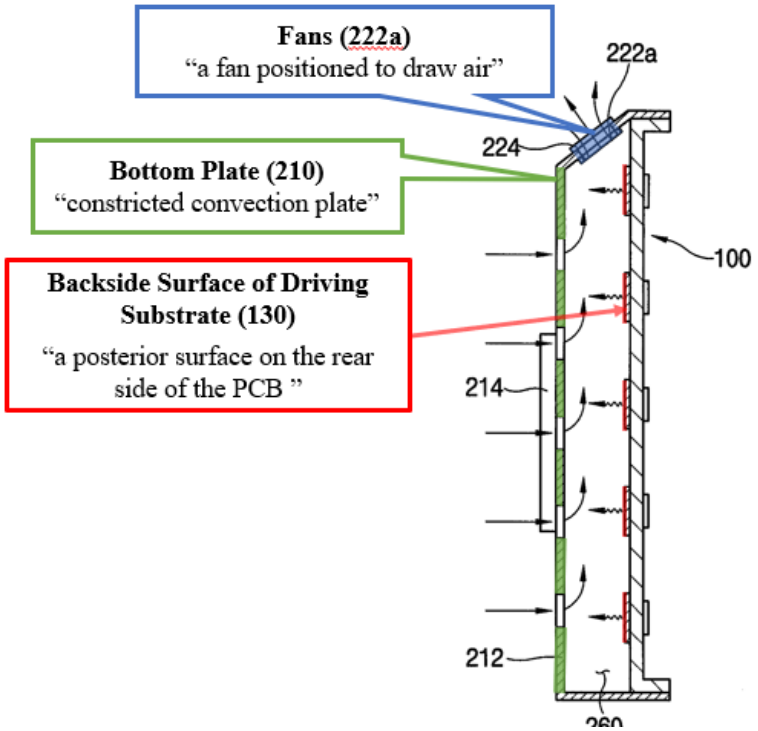
206. Accordingly, Na discloses or renders obvious "**a constricted convection plate placed posterior to the posterior display surface**."

e. "a fan positioned to draw air between the constricted convection plate and the posterior surface. (Claim Element 4[d])

207. Na discloses or renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface**."

208. As discussed above in connection with claim element 4[c], Na discloses a plurality of fans **222a** formed on the first sidewall **220**. Fans **222a** are shown, for example, in Figures 1-3 of Na. As further discussed in claim element 4[c], these "fans **222a** are operated to flow air from the inner space [in the space between the bottom plate **210** (e.g., "the constricted convection plate") and the backside surface of driving substrate **130** ("the posterior surface")] to the outside." (*Id.*, p.4.) According to Na, the fans also may "function as an intake unit for sucking [i.e. "**drawing"]** external air." (*Id.*, p.6.) Na's fans thus are positioned to pull air from

outside the display and through and out of the inner space **260** (i.e., the space that separates the "constricted convection plate" and "posterior surface") as shown schematically in the cross-sectional view of Figure 3.



(*Id*., FIG. 3 (annotated).) Thus, Na discloses or renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface**."

209. Accordingly, Na discloses or renders obvious each and every limitation of claim 4.

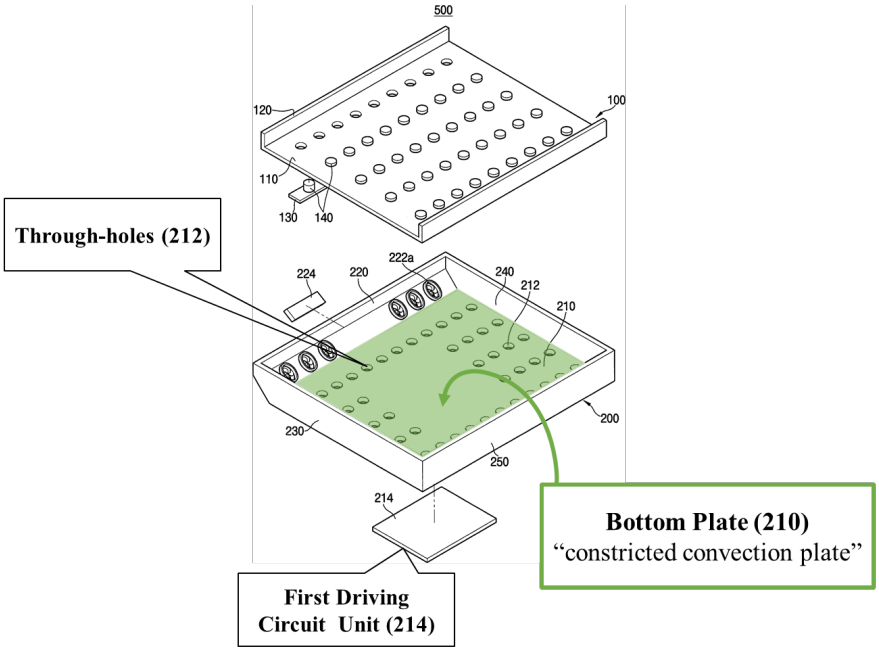
2. Claim 8: "The LCD from claim 4 further comprising: a plurality of access apertures on the constricted convection plate."

210. Claim 8 depends from claim 4. Na discloses or renders obvious the

elements of claim 4 for the reasons discussed above. Claim 8 recites and Na discloses or renders obvious "**a plurality of access apertures on the constricted convection plate**."

211. As discussed above in connection with claim element 4[c], Na discloses a "**constricted convection plate**" in the form of "bottom plate **210**." (*See supra* § VI.F.1.d.)

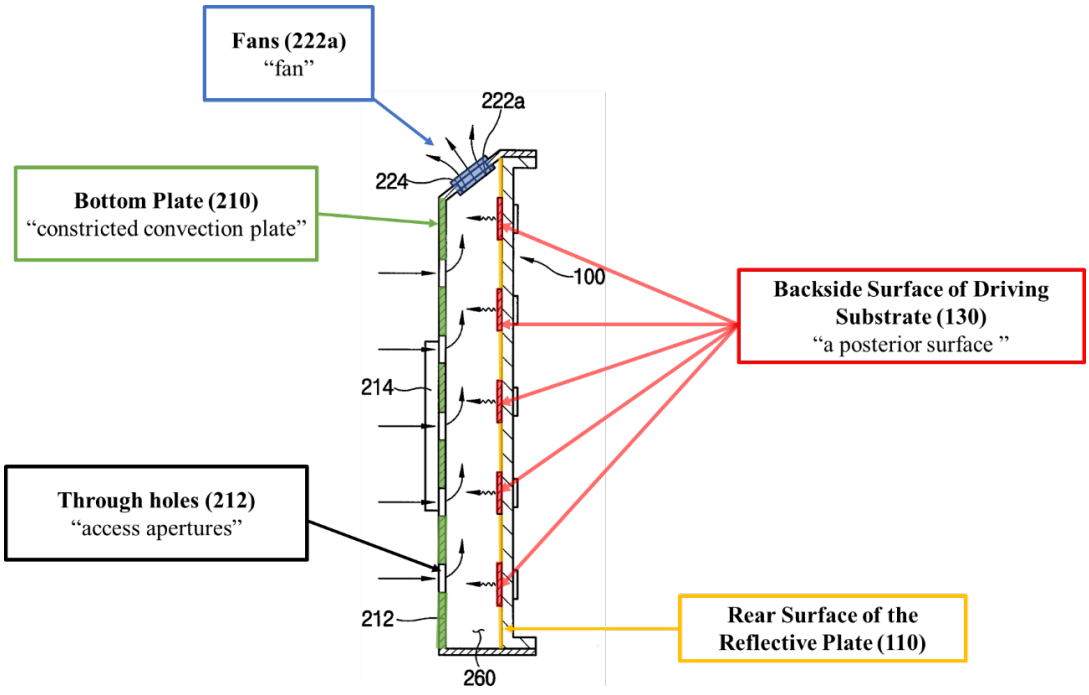
212. As shown in Figure 1, Na discloses that bottom plate **210** "includes a plurality of **through-holes 212**." (Ex. 1010, p.4.)



(*Id*., FIG. 1 (annotated).) Na explains that these "through-holes **212** are formed in portions except for the portion where the first driving circuit unit **214** is disposed, and are formed **through the bottom plate 210** [i.e. 'through t**he constricted**

convection plate']." (*Id.*) Na discloses that "[a]ir may move through the through-holes **212**," and the through-holes **212** may "function as an intake unit through which external air is sucked." (*Id.*)

213. Inasmuch as these through-holes provide "**access**" "**through the constricted convection plate**," they are to a POSITA "**access apertures**." Moreover, a POSITA would have been motivated to optimize these through holes by moving or expanding them to serve other purposes, such as servicing electrical components and hardware associated with the backlight unit and/or the LCD display like the internal parts of the fans **224**, the backlight driving substrate **130** (i.e., PCB), or a rear surface of the reflective plate **110** (colored orange). A POSITA would have had a reasonable expectation of success in such a modification.



(*Id*., FIG. 3 (annotated).)

214. Accordingly, Na discloses or renders obvious "**a plurality of access apertures on the constricted convection plate**" as required by claim 8.

3. Independent Claim 9

215. It is my opinion that Na disclosed each and every limitation of independent claim 9 for the reasons set forth below.

a. "A system for cooling an electronic display comprising:" (Claim Element 9[pre])

216. To the extent the preamble of claim 9 is limiting, it is disclosed or rendered obvious by Na.

217. Na discloses an "**electronic display**" in the form of a LCD for the

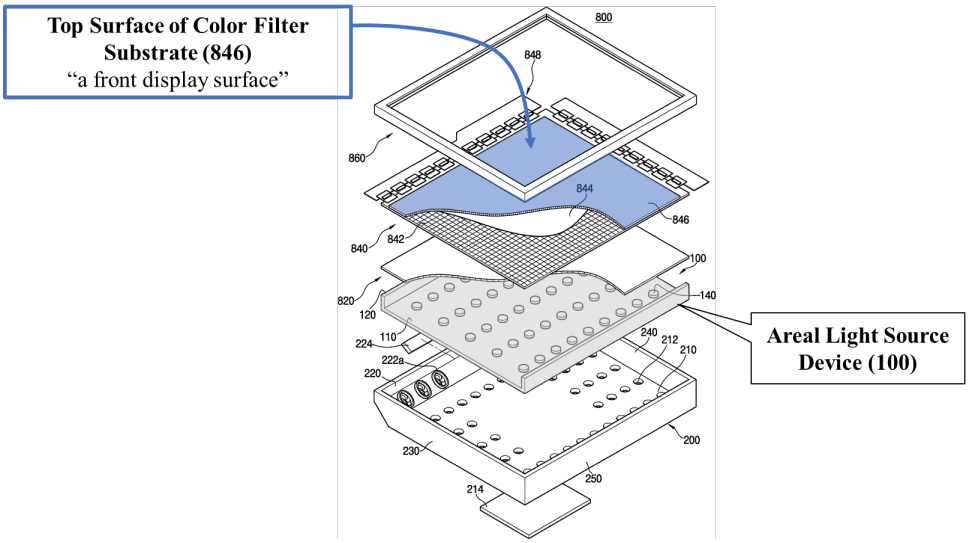
reasons discussed with respect to claim 4[pre]. (*See supra* §VI.F.1.a.) As discussed with respect to claim 4 (*supra* §VI.F.1), Na discloses an arrangement of components including storage container **200** with a plurality of fans **222a** on surfaces of sidewall **200** and through-holes **212** as shown in Figure 2. (*Id.*, pp.4-5; FIG. 2.) Together these elements comprise "**a system for cooling an electronic display.**"

218. Accordingly, Na discloses or renders obvious "**a system for cooling an electronic display**."

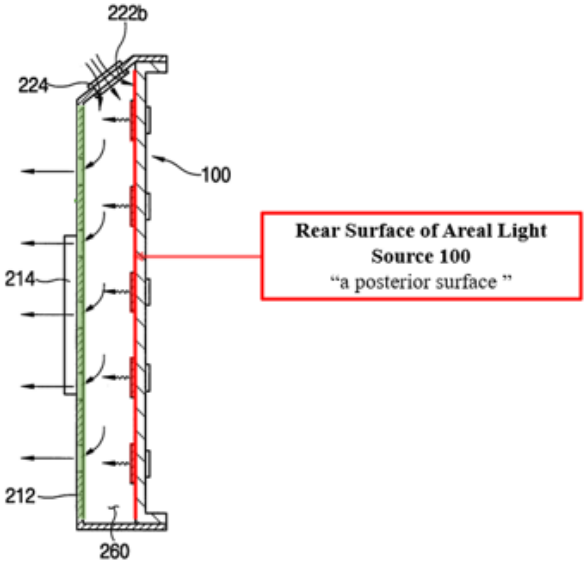
b. "an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display;" (Claim Element 9[a])

219. Na discloses or renders obvious "**an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display**."

220. As discussed above, Na's liquid crystal display device **800** is an "electronic display." The liquid crystal display device **800** comprises liquid display panel **840** and areal light source device **100**. (Ex. 1010.) As labeled in annotated Figure 13, below, **the upper most top surface** of the liquid display panel **840**, which is the **top surface** of color filter substrate **846** (colored blue), corresponds to the claimed "**front display surface**."



(*Id*., FIG. 13 (annotated).) The bottom most surface of the areal light source device **100** (colored red) in Figure 3, corresponds to the claimed "**posterior surface**" of the "**electronic display**."



(*Id*., FIG. 3 (annotated).)

221. Further, and as shown in Figure 3 above, "**no electronics are mounted to the posterior surface of the electronic display**." This would also be the understanding of a POSITA since Na's objective is to dissipate heat off the areal light source **100** via air convection; consequently, electronics mounted on the backside surface would negatively impact the efficiency of the cooling function. Indeed, additional electronic components, such as first and second driving circuit units **214** and **224**, are located outside inner space **260**.

222. Accordingly, Na discloses or renders obvious "**an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display**."

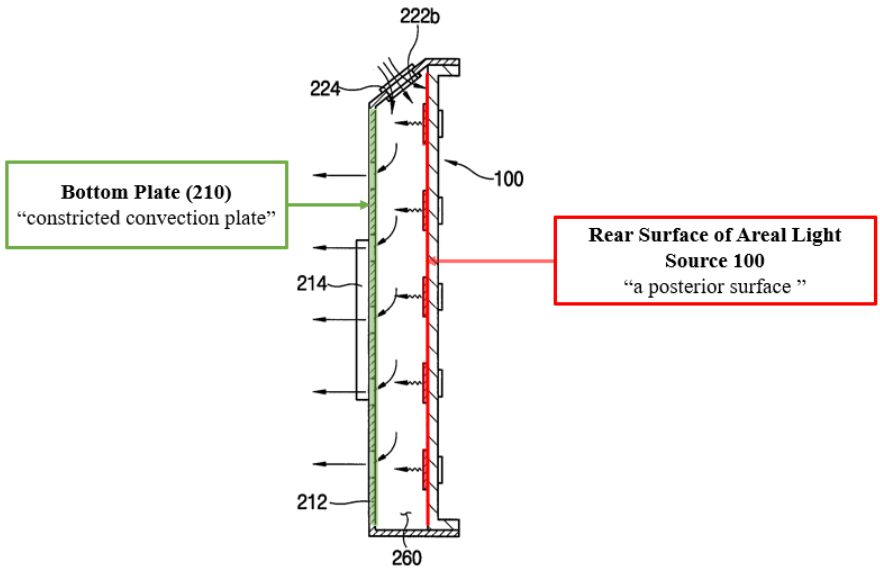
c. "a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface; and" (Claim Element 9[b])

223. Na discloses or renders obvious "**a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface**" as required by claim element 9[b].

224. Na discloses "**a constricted convection plate behind the posterior surface of the display**" for the reasons discussed above with respect to claim 4[c]. (*See supra* § VI.F.1.d.)

225. Further, and as shown in the cross-sectional view of Figure 9, Na's

bottom plate **210**[14] ("**constricted convection plate**"; colored green) is "**covering a majority of**" the rear-facing side of areal light source **100** ("**the posterior display surface**").



(*Id.*, FIG. 9 (annotated).)

226. Accordingly, Na discloses or renders obvious "**a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface**."

d. "a means for forcing air between the constricted convection plate and the posterior surface of the electronic display" (Claim Element 9[c])

[14] In Figure 3, the bottom plate **210** is not labeled while the label for through-holes **212** is misplaced and points to bottom plate **210**.

227. Na discloses or renders obvious "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**."

228. As discussed above, I am informed and understand that this is a means-plus-function limitation, in which "forcing air between the constricted convection plate and the posterior surface of the electronic display" is the required function, and in which one or more fans **52**, or refrigeration unit **110**, and their equivalents, is the corresponding structure. (*See supra* ¶¶76-77.)

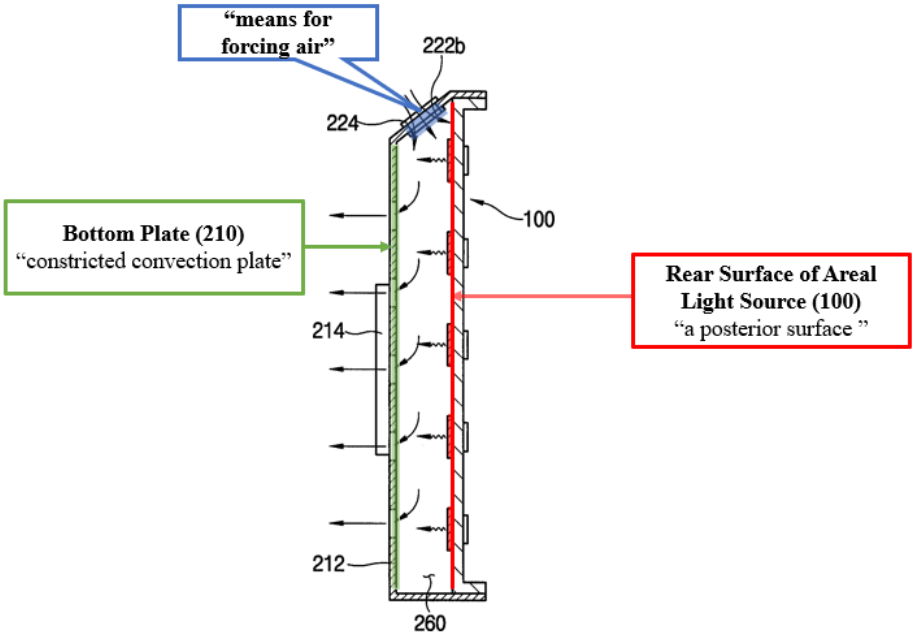
229. In its Exemplary Embodiment 3, Na discloses fans operating to force external air "in the space that separates" the "**constricted convection plate and the posterior surface of the electronic display**":

> Referring to FIG. 9, the driving substrate **130** of the areal light source device **100** is driven to generate heat. The temperature of the air remaining in the inner space **260** between the areal light source device **100** and the storage container **200** may be increased by the heat. Here, the fans **222b** inject low-temperature external air of the backlight unit **500** into the inner space **260** at high speed. The injected external air collides with a reflective plate **110** generating heat to cool the reflective plate **110**. In the meantime, since the external air is introduced into the inside by the fans **222b**, the internal pressure increases. Therefore, the air in the inner space **260** is discharged to the outside of the backlight unit **500** through the through-holes **212**. Accordingly, the processes of introducing the low-temperature external air and discharging the high-

> temperature internal air are continuously repeated, and as a result, the heat generated in the areal light source device **100** is cooled by the flow of air.

(Ex. 1010, p.6.)

230. Na further discloses that "the cooling process according to the present exemplary embodiment is mainly achieved by a forced convection phenomenon by of the fans **222b** functioning as the cooler." (*Id*.) In other words, the operation of fans disclosed by Na **force external air between** (in the space that separates) the bottom plate **210** of the storage container **200** ("**the constricted convection plate**") and the rear-facing side of areal light source **100** ("**the posterior surface of the electronic display**"). This is shown schematically in the cross-sectional views of annotated Figure 9:



(*Id*., FIG. 9 (annotated).)

231. Fans **222b** disclosed by Na ("Na's fans") are equivalent to fan **52** of the '322 patent because: (i) Na's fans and fan **52** are positioned in identical locations with respect to the air's entrance point location—e.g., near or at an opening; and (ii) both Na's fans and fan **52** force air "between" or "in the space that separates" the "constricted convection plate" and the "posterior surface of the electronic display" as indicated by respective arrows in Figures 9 and 13 of Na and Figure 5C of the '322 patent.

232. Accordingly, Na discloses or renders obvious "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**."

233. For the reasons set forth above, Na discloses or renders obvious independent claim 9.

4. Claim 10: "The cooling system from claim 9 further comprising: a plurality of apertures on the constricted convection plate."

234. Na discloses or renders obvious claim 9 for the reasons described above. For the reasons discussed above with respect to claim 8 in Ground 1, Na discloses "**a plurality of access apertures on the constricted convection plate**." (*See supra* §VI.F.2.) Na further discloses or renders obvious "**a plurality of apertures on the constricted convection plate**" for these same reasons.

5. Claim 16: "The cooling system from claim 9 wherein: the electronic display comprises an LED backlight LCD display where the posterior surface is the rear surface of a backlight assembly."

235. Claim 16 depends from claim 9, which Na discloses or renders obvious for the reasons discussed above. Na further discloses or renders obvious "**the electronic display comprises an LED backlight LCD display where the posterior surface is the rear surface of a backlight assembly**," as required by claim 16.

236. Na discloses that "**the electronic display comprises an LED backlight LCD display**" for the reasons discussed above in claim element with respect to claim elements 9[a], 4[pre] and 4[b]. (*See supra* §§ VI.F.1.a, VI.F.1.c,

VI.F.3.b.)

237. Further, and as discussed for claim element 9[a], the "**posterior surface**" of the "**electronic display**" is the "**rear surface of the backlight assembly**," namely the backside surface of areal light source 100. (*Supra* §VI.F.3.b.)

238. Accordingly, Na discloses or renders obvious claim 16.

G. Ground 6: The Combination of Na and Kim Renders Claims 7, 12 and 13 Obvious

1. Claim 7: "The LCD from claim 4 further comprising:"

239. Na discloses or renders obvious claim 4 for the reasons described above in Ground 5. (*See supra* § VI.F.1.) The combination of Na and Kim renders obvious claim 7.

a. "a housing which contains the liquid crystal stack, backlight assembly, constricted convection plate, and fan; and" (Claim Element 7[a])

b. "an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface of the PCB." (Claim Element 7[b])

240. Kim discloses the limitations of claim 7 for the reasons discussed above with respect to claim 7 in Ground 1. (*See supra* §VI.B.2.)

c. Motivation to combine Na and Kim

241. In my opinion, a POSITA as of March 3, 2008 would have been

motivated to improve Na's "backlight unit and a liquid crystal display [LCD] device" by adding an outer housing, as disclosed by Kim, to enclose Na's liquid crystal stack, backlight assembly, constricted convection plate and fan. (Ex. 1005, Abstract.)

242. Na, like Kim, contemplates an LCD device that "uses the optical characteristics of liquid crystal to display an image," and "has the advantage of being very small in volume and in weight" so as to be "widely used for portable computers, communication devices, liquid crystal TVs, etc." (*Id.*, p.2.) As such, Na already contemplates that its LCD display could fulfill various product embodiments each of which have unique product packaging which typically comprise front and rear housings and possibly a stand or mount. Therefore, it would have been obvious to a POSITA provide a housing external to the display assembly of Na with its cooling system to form and fully enclose Na's LCD electronic display using the teachings of Kim.

243. Both Na and Kim are concerned with efficient cooling of the posterior display surface of an LCD display, and both references use nearly identical cooling mechanisms employing fans, entrances and exits to a cooling channel. Further, Na's first and second driving circuits **214** and **224** are exposed to ambient air. It would have been obvious to add an external housing to protect these driving units. The

modification of Na's solution of cooling the rear-facing surface of an LCD display system by adding an external housing behind bottom plate **210** and enclosing the whole the display, that allows ambient air to enter and flow between the Na's bottom plate **210** and the posterior surface of driving circuit **130**, as contemplated by Kim's vented housing, would have involved the use of one known technique to improve similar devices in the same way.

244. A POSITA in March 2008 would have understood that an LCD device contained within a device like a liquid crystal TV needs to be contained within some kind of housing, and thus would have been motivated to employ Kim's solution because it yields predictable results. A POSITA would have a reasonable expectation of success from taking advantage not only of Na's cooling system design, but then extending those advantages via Kim's further protection and discharge of the heated air to outside the housing. In such a configuration, a POSITA would have understood that it would have been advantageous not only to convey cooling air through the "inner space **260**" (formed between the bottom plate **210** and the rear surface of Na's areal light source **100** (the "**posterior display surface**")) to outside of the sidewalls of the storage container **200**, but to also displace the heated air outside of the entire display encased by the external housing, as contemplated by Kim.

245. This combination of Na's and Kim's solutions would constitute the simple use of one known technique, the cooling of the posterior display surface of an LCD display by convection within a constricted convection channel (as reflected by Na) with the extension of that cooling technique to removing the heat to outside the housing (as reflected by Kim). Na's known technique as modified by Kim's would function in the same way as before, with predictable results. A POSITA would have a reasonable expectation of success in that the combination of the two complimentary cooling techniques would work as intended.

246. A POSITA would have been motivated to combine the advantages of Na's cooling system that efficiently displaces heat generated by the display assembly and discharges it outside the storage container with the advantages of Kim's solution which further discharges the unwanted heat outside the housing. To a POSITA, using the well-known cooling solutions via a constricted cooling channel of both Na and Kim with the further extension of an outer housing would simply require combination of one known element with another. And a POSITA would have a reasonable expectation of success from such a combination.

247. For these reasons, Na in combination with Kim's housing discloses "**a housing which contains the electronic display, constricted convection plate, and means for forcing air**" and "**an entrance aperture within the housing which**

permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface."

248. Accordingly, the combination of Na and Kim renders claim 7 obvious.

2. Claim 12: "The cooling system from claim 9 further comprising:"

a. "a housing which contains the electronic display, constricted convection plate, and means for forcing air; and" (Claim Element 12[a])

b. "an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface." (Claim Element 12[b])

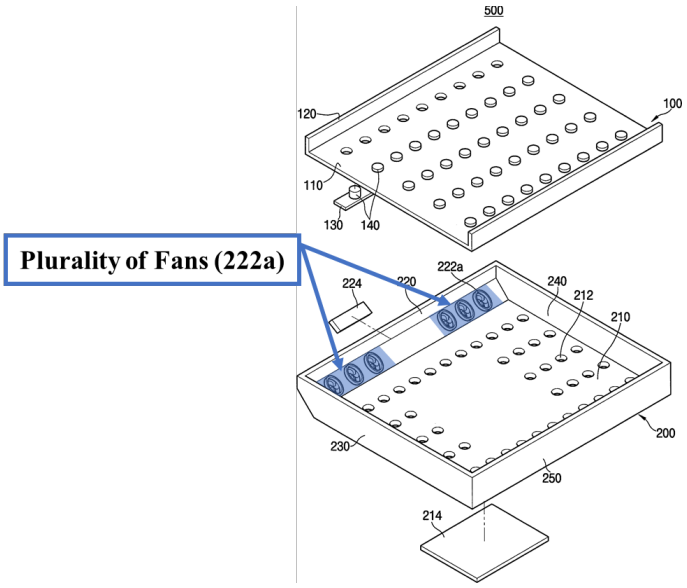
249. Na discloses or renders obvious claim 9 for the reasons described above in Ground 5. (*See supra* § VI.F.3.) The combination of Na and Kim renders obvious claim 12 for the same reasons as explained above with respect to nearly identical limitations of claim 7. (*See supra* § VI.G.1.)

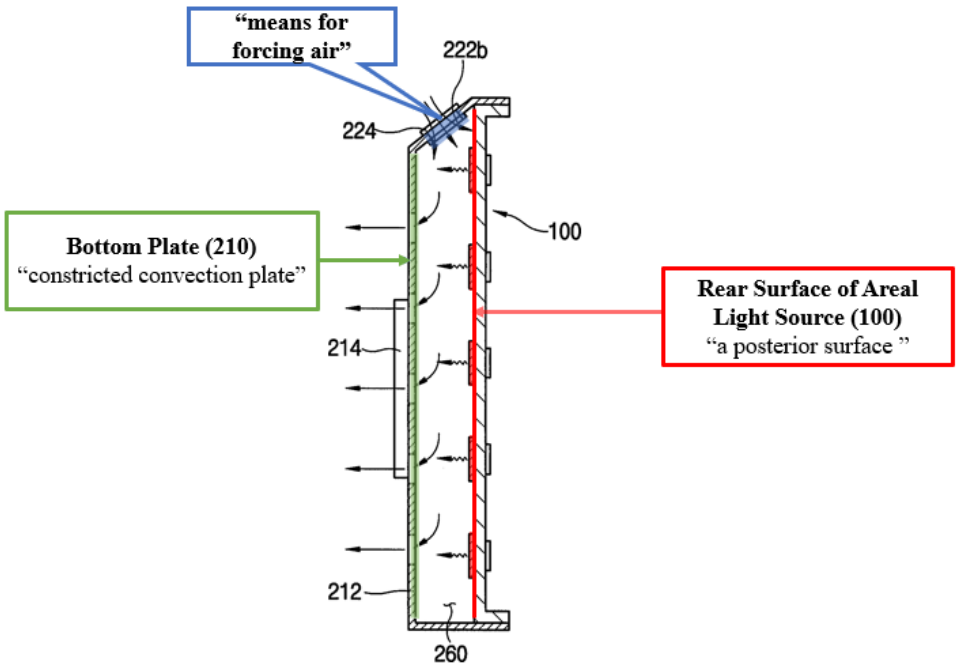
3. Claim 13: "The cooling system from claim 12 wherein: the means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture."

250. Claim 13 depends from claim 12, which is rendered obvious by the combination of Na and Kim for the reasons discussed above. It is my opinion that the combination of Na and Kim also renders obvious claim 13, which recites: "**the means for forcing air between the constricted convection plate and the posterior**

surface of the electronic display comprises a plurality of fans placed near the entrance aperture."

251. As discussed above with respect to claim element 9[c] of Ground 5, Na discloses a "**means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture**" in the form of "**plurality of fans 222b**." (*See supra* § VI.F.3.d.) This plurality of fans is shown in Figures 7 and 9 below.



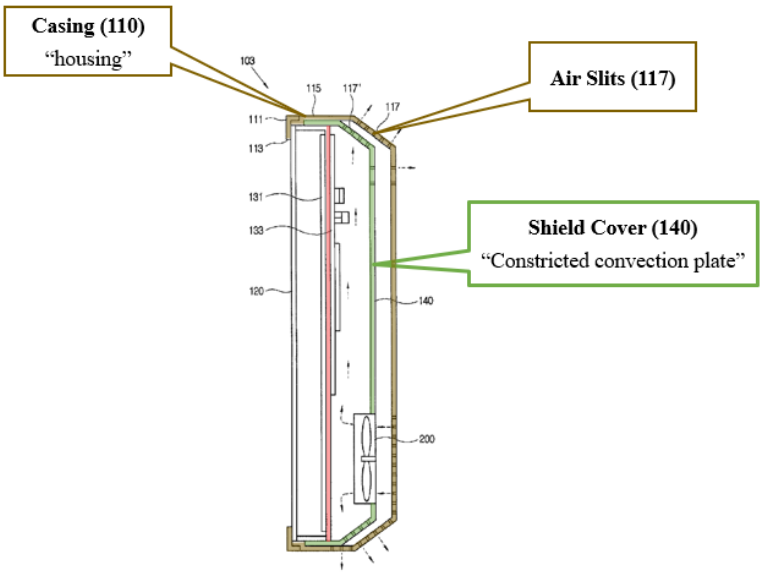


(Ex. 1010, FIGs. 7 & 9 (annotated).)

252. Kim discloses that "[t]he rear casing **115** has a plurality of air slits **117** through which air produced by a cooling fan **210** comes in and out." (Ex. 1005, 4:22-25.) As such, "air slits **117**" are "**entrance apertures within the housing which permits external ambient air to enter the housing**." Kim further discloses:

> The fan support **141** is spaced from the rear casing **115** and is formed through the shield cover **140** at a position which is adjacent to the backlight unit **130**. The fan support **141** may be formed at a central lower portion of the shield cover **140 such that external air flows through the rear casing 115** and the shield c**over 140** from a lower side **to an upper side of the backlight unit 130**.

(*Id.*, 4:65-5:4.)



(*Id*., FIG. 3 (annotated).)

253. As shown in Figure 5 of Kim, the air slits (entrance apertures) are located both in the top and bottom portion of the housing. Accordingly, in combination with Na, the entrance apertures would be located near Na's plurality of fans, which are located in the upper portion of the cooling channel in the embodiment of Figure 7 as shown above or on any of the sidewall surfaces of storage container **200**[15].

254. Accordingly, the combination of Na and Kim renders obvious "**the**

[15] "[T]he fans may be formed on a bottom plate and **any one or more of the first to fourth sidewalls**." (Ex. 1010, pp.6, 8.)

means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture."

H. Ground 7: Na in View of Tachikawa Renders Obvious Claim 11

1. Claim 11: "The cooling system from claim 9 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate."

255. Na discloses or renders obvious the limitations of claim 9 for the reasons discussed above in Ground 5. (*See supra* § VI.F.3.) The combination of Na and Tachikawa discloses "**at least one bracket which connects the posterior surface with the constricted convection plate**," as required by claim 5 of the '322 patent.

256. As discussed above in connection with the combination of Kim, Hong and Tachikawa with respect to claim 5 in Ground 2 (*supra* § VI.C.1), Tachikawa discloses a display "housed in the cabinet **30** in a state of being supported by two brackets **20** on the rear side." (Ex. 1026, ¶[0019].) "Each of the two brackets **20** is connected to a stand member (not shown) which stands substantially perpendicular from an installation surface of the plasma television, thereby supporting substantially the entire plasma television at the predetermined height." (*Id.*) As such, Tachikawa's brackets **20**, along with attachments **50** provide for enhanced

mounting stability.

a. Motivation to Combine Na and Tachikawa

257. A POSITA would have been motivated to combine Na with the brackets disclosed by Tachikawa to improve Na's display stability. A POSITA would have looked to Tachikawa for the same reasons discussed above with respect to the combination of Kim with Tachikawa in Ground 2. (*Supra* § VI.C.2.)

258. While Na discloses that "the areal light source device **100** is easily coupled to the storage container **200**," (Ex. 1010, p.4), Na does not disclose how its LCD is mounted for use. Na teaches that it "has the advantage of being very small in volume and in weight" so as to be "widely used for portable computers, communication devices, liquid crystal TVs, etc." (*Id.*, p.2.) Accordingly, a POSITA would have been motivated to add a stand to Na's device to support it for its intended use.

259. A POSITA looking to modify Na in this manner would have been motivated to look to other electronic displays that had addressed similar heat removal, including plasma display panels. Tachikawa provides an example of such a stand and bracket structure. Tachikawa teaches that its display is "housed in the cabinet **30** in a state of being supported by two brackets **20** on the rear side." (Ex. 1026, ¶[0019].) "Each of the two brackets **20** is connected to a stand member (not

shown) which stands substantially perpendicular from an installation surface of the plasma television, thereby supporting substantially the entire plasma television at the predetermined height." (*Id.*) As such, Tachikawa's brackets **20**, along with attachments **50**, allow removal of rear cabinet **40** with minimal effort, and provide for enhanced mounting stability. A POSITA would have envisioned, based on the teachings from Tachikawa, that the rear side surface of Na's areal light source **100** would be fitted with brackets via a set of attachments to bottom surface **210** and an installation surface.

260. This adaptation would amount to the use of a known technique to improve similar devices in the same way and would produce predictable results. The addition of Tachikawa's stand and bracket arrangement would provide support to Na's display without compromising its cooling ability. A POSITA would have been motivated to combine each of these known approaches with no change in their respective functions, and the combination would yield predictable results. Accordingly, the POSITA would have had a reasonable expectation of success.

I. Ground 8: Kimura Renders Obvious Claims 9, 12, 13, and 16

1. Independent Claim 9

261. It is my opinion that Kimura discloses or renders obvious each and every limitation of independent claim 9.

a. "A system for cooling an electronic display comprising:" (Claim Element 9[pre])

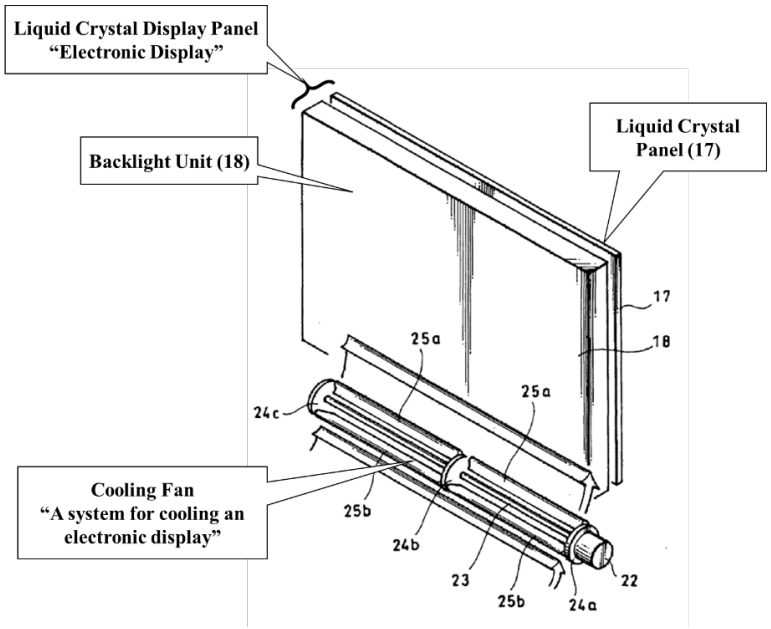
262. To the extent the preamble of claim 9 is limiting, it is disclosed or rendered obvious by Kimura.

263. Kimura discloses "**a system for cooling an electronic display**" in the form of "**a cooling fan** that can be favorably used in a **flat panel display apparatus** such as a thin-screen television and to an image display apparatus." (Ex. 1004, ¶ 3.) Specifically, Kimura discloses:

> **a cooling fan for cooling a backlight unit that is a high-temperature region in a flat panel display apparatus**, the cooling fan being especially capable of uniformly cooling the backlight unit of a large flat panel display apparatus with high efficiency and operating more quietly than conventional fans.

(*Id*., ¶ 3.)

264. Kimura discloses "**an electronic display**" (as a part of the flat panel display apparatus) in the form of **a liquid crystal display panel** shown in Figures 9 and 10. (*Id*., ¶ 77.)



(*Id*., FIG. 10 (annotated).)

265. Accordingly, Kimura discloses or renders obvious "**A system for cooling an electronic display**," as recited in claim 9.

b. "an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display;" (Claim Element 9[a])

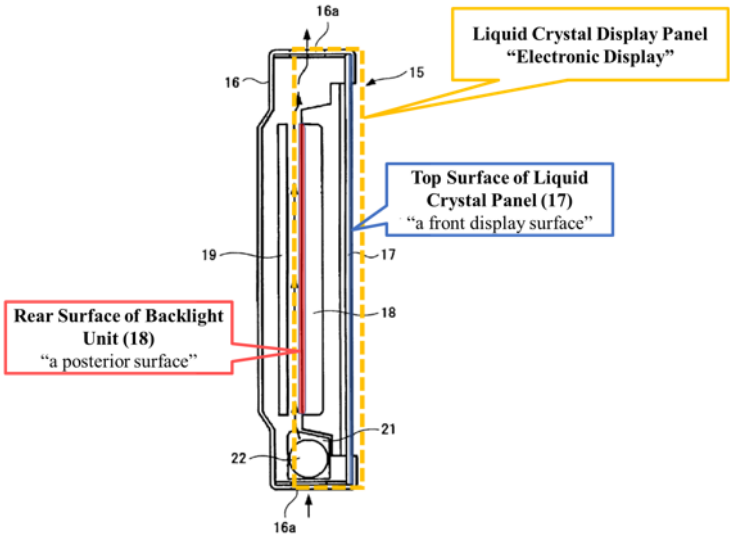
266. Kimura discloses or renders obvious "**an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display**."

267. As discussed above, Kimura discloses "**an electronic display**" as part of **a flat panel display apparatus** in the form of **a liquid crystal display panel**. (Ex. 1004, ¶¶ 3 and 77, FIGs. 9-10.) Kimura discloses:

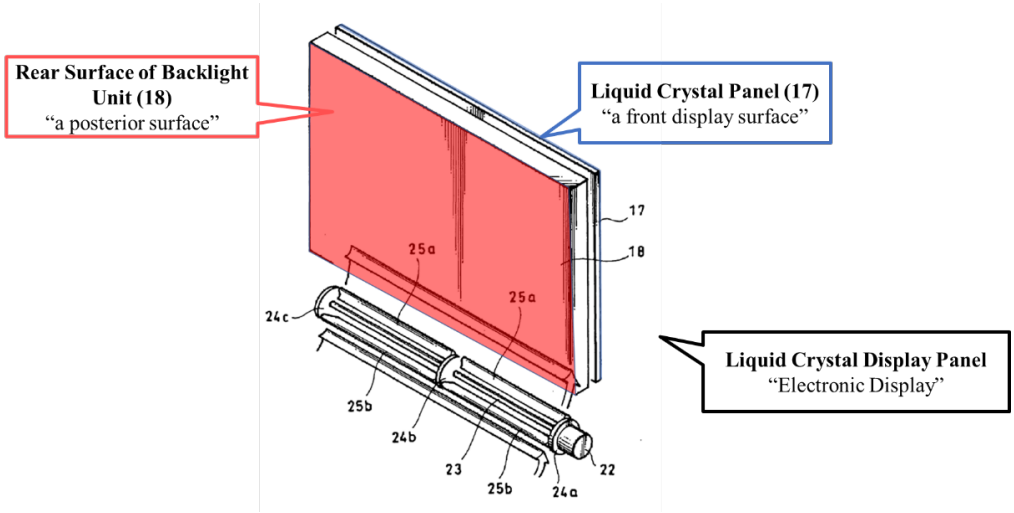
> In **FIG. 9**, the flat panel display [apparatus] whose overall structure is designated by reference numeral **15** has **a liquid crystal panel 17** on a front surface of a display housing **16**. **A backlight unit 18 that is a light source of the liquid crystal panel 17** and is composed of LEDs or the like is disposed behind the liquid crystal panel **17**.

(*Id.*, ¶78.)

268. As seen in annotated Figures 9 and 10 below, Kimura's LCD panel ("electronic display") includes "**a front display surface"** of the liquid crystal panel **17** (colored blue) and "**a posterior surface**" of the backlight unit **18** (colored light-red).



(*Id.*, FIG. 9 (annotated).)



(*Id.*, FIG. 10 (annotated).)

269. Additionally, and as shown in the cross-sectional view of Figure 9, "**no electronics are mounted to the posterior surface of the electronic display**"—e.g., on the posterior surface of backlight unit **18**.

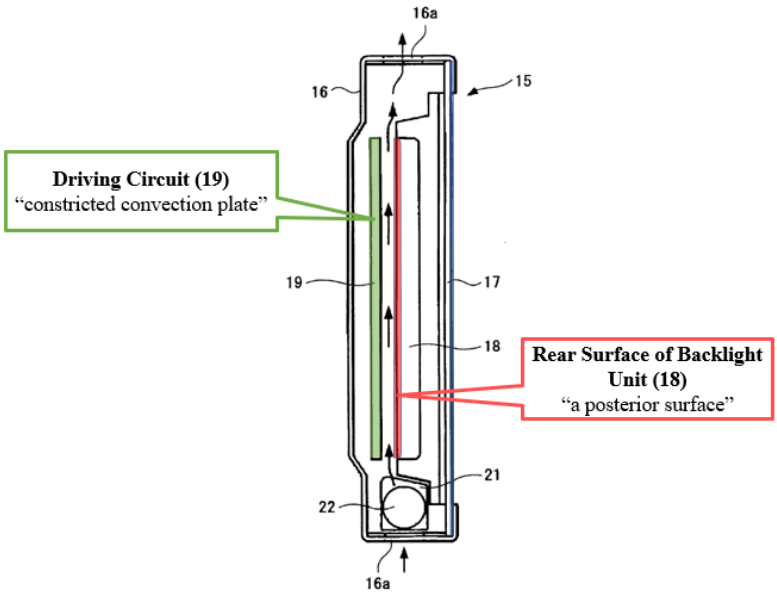
270. Accordingly, Kimura discloses or renders obvious "**an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display**," as recited in claim 9.

c. "a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface; and" (Claim Element 9[b])

271. Kimura discloses or renders obvious "**a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface**."

272. As discussed above, Kimura discloses a "**posterior surface of the display**" in the form of **the rear surface** of the backlight unit **18**.

273. Kimura's driving circuit **19**, which is shown in Figure 9 and is colored green, is positioned "**behind the posterior surface of the display**."



(Ex. 1004, FIG. 9 (annotated).) Indeed, Kimura discloses: "A **driving circuit 19** for the flat panel display **is disposed behind the backlight unit 18**." (*Id.*, ¶78.) Kimura further explains that "by circulating a wind generated by rotationally driving the cooling fan **20** in the form of a "**film**" to the rear surface of the backlight unit **18**, the **entire backlight is cooled uniformly**." (*Id.*) In other words, Kimura achieves the formation of a **uniform airflow film** by appropriately positioning the driving circuit **19** relative to the rear surface of the backlight unit **18** ("the posterior surface") so that the air-flow generated by cooling fan **20** is channeled therebetween. As such,

Kimura's driving circuit **19** doubles as a "**constricted convection plate**" that confines the air-flow within the space formed between the driving circuit **19** and the rear surface of the backlight unit **18**.

274. The air flow design of Kimura allows simultaneous cooling of the backlight unit **18** and the driving circuit **19**, which a POSITA would have understood to be the two primary heat generating elements in an LCD display. The length of cooling fan **20**, which runs across the entire width of the LCD panel, is indicative of the size of both the driving circuit **19** and the backlight unit **18**. Thus, a POSITA would have understood that Kimura's airflow design facilitates a driving circuit **19** that covers "**a majority of the posterior display surface**" without generating overheating issues for the display. In the alternative, a POSITA would have been inclined to optimize the display cooling capability by enlarging Kimura's **"driving circuit 19" to cover the entire rear surface of the display so that "the entire backlight is cooled uniformly."** (*Id*., ¶[0078].)

275. Accordingly, Kimura discloses or renders obvious "**a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface**," as recited in claim 9[b].

d. "a means for forcing air between the constricted convection plate and the posterior surface of the electronic display" (Claim Element 9[c])

276. Kimura discloses or renders obvious "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**."

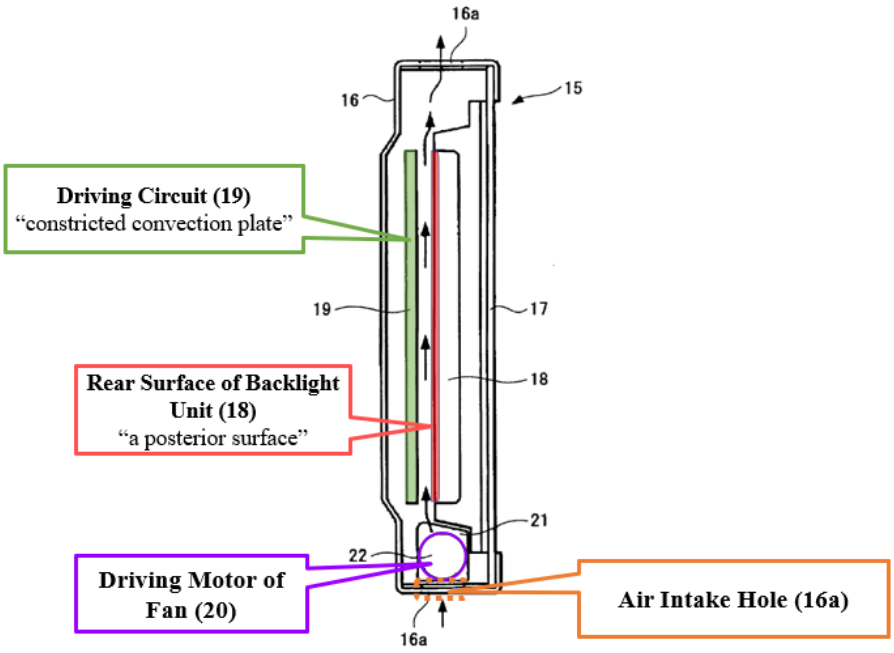
277. As discussed above, I am informed and understand that this is a means-plus-function limitation, in which "forcing air between the constricted convection plate and the posterior surface of the electronic display" is the required function, and in which one or more fans **52**, or refrigeration unit **110**, and their equivalents, is the corresponding structure. (*Supra* ¶ 76.)

278. As discussed above with respect to the preamble of claim 9, Kimura discloses "a cooling fan for cooling a backlight unit . . . in a flat panel display apparatus[.]" (*Supra* § VI.I.1.a; Ex. 1004, ¶3.) With respect to the location of the cooling fan, Kimura, in referring to Figure 9, discloses:

> A cooling fan **20** according to the present invention is installed inside a gap **21** that is around **20** mm square and **700** mm long that is produced at a lower part of the panel due to the construction of the flat panel display.

(*Id*., ¶[0078].) Figure 9 is reproduced and annotated below to indicate the placement of cooling fan **20** (not shown) in gap **21** (colored red) and in relation to driving

circuitry **19** ("constricted convection plate"; colored green) and the bottom surface of the blacklight unit **18** ("posterior surface of the electronic display"; colored light-red). The driving motor **22** of cooling fan **20** is colored purple for reference.



(*Id*., FIG. 9 (annotated). Note: Airflow pathway arrows are included in the original and are not part of my annotations.) Kimura teaches that "[b]y circulating a wind generated by rotationally driving the cooling fan **20** in the form of a 'film' to the rear surface of the backlight unit **18**, the entire backlight unit is cooled uniformly." (*Id*., ¶[0078].) Kimura discloses that "air is sucked into the cooling fan **20** from an air intake hole **16a** formed in a base surface of the display housing **16** and air supplied to cool the backlight unit **18** is expelled from an expulsion hole **16b** formed in an upper surface of the display housing **16**." (*Id*., ¶[0078].)

279. It is my opinion that cooling fan **20** is **equivalent to** fan **52** of the '322 patent because: (i) both cooling fan **20** and fan **52** are positioned in identical locations with respect to the recited "**constricted convection plate**" and the "**posterior surface of the electronic display**"—i.e., at a bottom portion of the display; and (ii) both cooling fan **20** and fan **52** force air "**between**" or "**in the space that separates**" the "**constricted convection plate**" and the "**posterior surface of the electronic display**" as indicated by respective arrows in Figure 9 of Kimura and Figure 5C of the '322 patent, respectively.

280. And because Kimura discloses cooling fan **20** as "means for forcing air" in the space that separates the driving circuitry **19** ("the constricted convection plate") and the rear surface of backlight unit **18** ("the posterior surface of the electronic display"), Kimura discloses or renders obvious "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**," as recited in claim element 9[c].

2. Claim 12: "The cooling system from claim 9 further comprising:

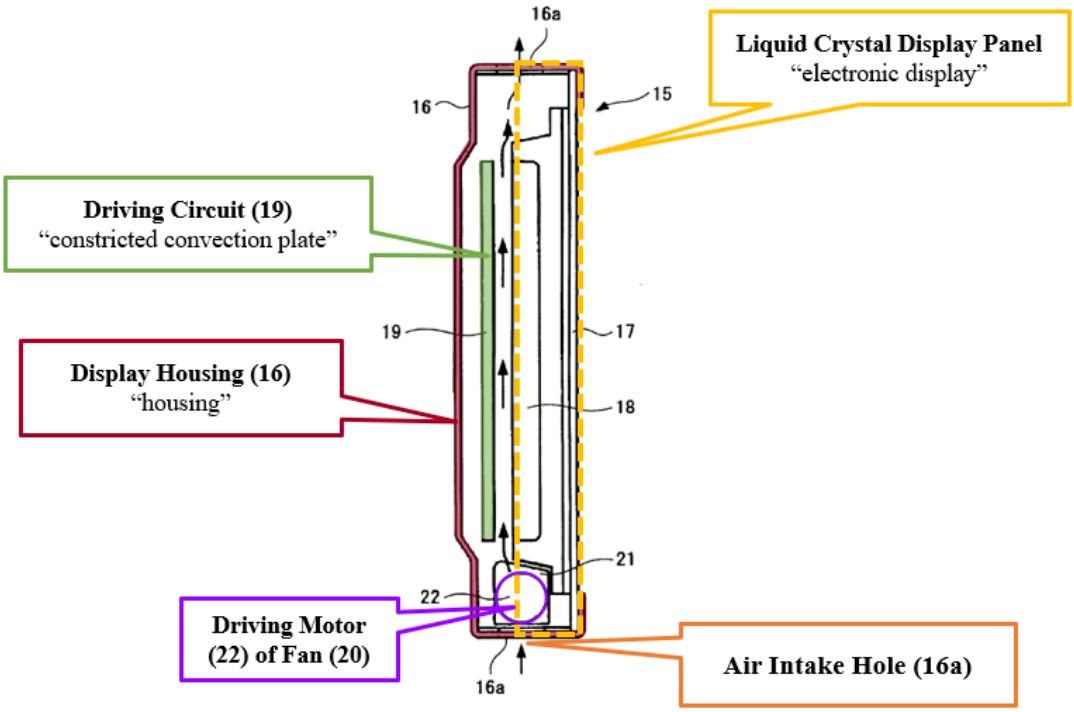
281. Claim 12 depends from independent claim 9, which Kimura renders obvious as discussed above. It is my opinion that Kimura discloses or renders obvious claim 12.

a. "a housing which contains the electronic display, constricted convection plate, and means for forcing air; and" (Claim Element 12[a])

282. Kimura discloses or renders obvious "**a housing which contains the electronic display, constricted convection plate, and means for forcing air**."

283. As discussed above in claim 9, Kimura discloses an "**electronic display,**" a "**constricted convection plate**," and "**means for forcing air**." (*Supra* §VI.I.1.)

284. Kimura discloses a display housing **16**, which, as reflected in Figure 9 below, **contains** the liquid crystal display panel (" **electronic display**"), the driving circuit **19** ("**constricted convection plate**"; colored green), and cooling fan **20** ("**means for forcing air**") as indicated by the cooling fan's driving motor **22** (colored purple).



(Ex. 1004, FIG. 9 (annotated).)

285. For these reasons, Kimura discloses or renders obvious "**a housing**" as recited in claim element 12[a].

b. "an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface." (Claim Element 12[b])

286. Kimura discloses or renders obvious "**an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface**."

287. As discussed above in claim element 9[c], Kimura discloses that cooling fan **22** forces the air "**between**" or "**in the space that separates**" the

"**constricted convection plate**" and the "**posterior surface of the electronic display**" as indicated by respective arrows in Figure 9. Therefore, Kimura discloses that the air directed via cooling fan **22** within display housing **16** "**flow[s] between the constricted convection plate and the posterior surface**."

288. In particular, and with respect to display housing **16** shown in Figure 9, Kimura discloses:

> **air is sucked into the cooling fan 20 from an air intake hole 16a formed in a base surface of the display housing 16** and air supplied to cool the backlight unit **18** is expelled from an expulsion hole **16b** formed in an upper surface of the display housing 16.

(*Id*., ¶[0078].) A POSITA would have understood from Kimura that the air is **external to the display housing 16**, and therefore, the incoming air is "**external ambient air**." And because air intake hole **16a** is located within display housing **16** (e.g., "**the housing**"), air intake hole **16a** is the recited "**entrance aperture within the housing which permits external ambient air to enter**" the display housing **16** "**and flow between**" driving circuitry **19** ("**the constricted convection plate**") and the rear surface of backlight unit **18** ("**the posterior surface**").[16] Accordingly, Kimura discloses "**an entrance aperture within the housing which permits**

[16] A POSITA would have understood that air expulsion hole **16b** is mislabeled as **16a** at the top of the electronic display.

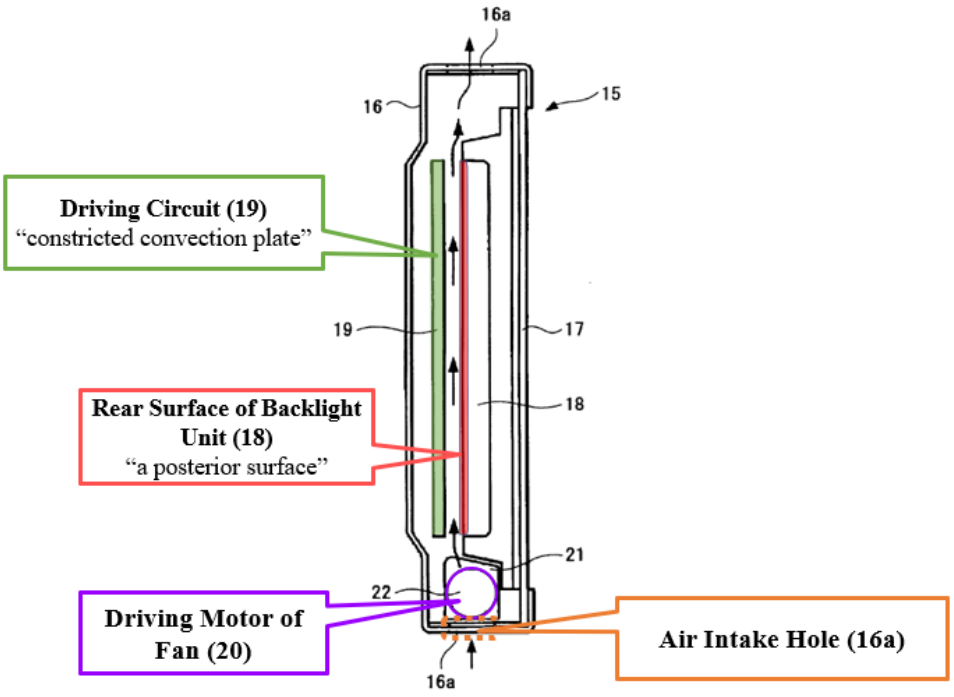
external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface."

289. For the reasons set forth above, Kimura discloses or renders obvious claim 12.

3. Claim 13: "The cooling system from claim 12 wherein: the means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture."

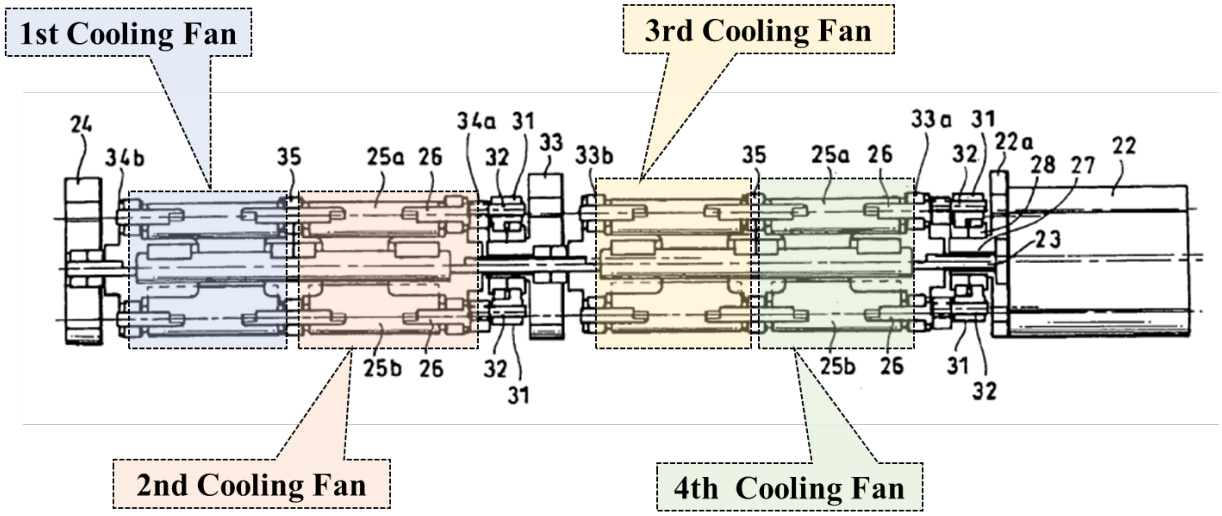
290. Kimura discloses or renders obvious claim 12 as discussed above. Claim 13 further recites and Kimura discloses or renders obvious "**the means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture**."

291. Kimura discloses "means for forcing air" in the form of fan **20** placed near entrance aperture **16a**.



(Ex, 1004, Fig. 9 (annotated).)

292. It would have been obvious to the POSITA to replace fan **20** with a plurality of fans. With reference to Figures 10 and 11, Kimura discloses that vanes **25a** and **25b** of cooling fan **20** can be replaced by **two or more shorter vanes** with the addition of support frames **33a**, **33b**, **34a**, **34b**, and **35**. (Ex. 1004, ¶88.) In other words, Kimura proposes **replacing a single long cooling fan with a plurality of shorter fans having shorter respective vanes**. These fans are separated by support frames **34b-35**, **35-34a**, **33b-35**, and **35-33a** as shown schematically in Figure 11.



(Ex. 1004, FIG. 11 (annotated).) According to Kimura, there are benefits in doing so. For example, short vanes, when subjected to centrifugal forces during operation, are more resilient to deformation compared to long vanes.

> Also, in the case of the cooling fan shown in FIG. 11, the vanes that have been divided into two are further divided into two by the support frames 35. **This is in response to deformation of the vanes due to centrifugal force calculated from the cross-sectional form of the vanes, material hardness, specific gravity, rotational speed, rotational radius, and the like**.

(*Id*., ¶88.) And because increasing the length of shaft **23** increases the wind-producing area (*see id*., ¶90 ("since it is possible to increase the wind-producing area by increasing the length")), a POSITA would have been motivated to use a plurality of shorter rotating fans for wide displays as opposed to a single long fan to: (i) "increase the wind-producing area," and (ii) to prevent vane deformation during

operation.

293. Because the functionality of the plurality of fans **is identical to that** of cooling fan **20** (e.g., they both force air "**between the constricted convection plate and the posterior surface of the electronic display")**, their placement is also identical (e.g., both are positioned near the air intake hole **16a** ("the entrance aperture"; *see* discussion in claim element 12[b]) as shown in Figure 9 below. Because Kimura recommends on the use of a plurality of fans to address the known recited deficiency with the use of long fan elements, a POSITA would have had a reasonable expectation of success in using a plurality of fans instead of a single one.

294. Accordingly, Kimura discloses or renders obvious "**the means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture**."

4. Claim 16: "The cooling system from claim 9 wherein: the electronic display comprises an LED backlight LCD display where the posterior surface is the rear surface of a backlight assembly."

295. Claim 16 depends from claim 9, which Kimura discloses or renders obvious for the reasons discussed above. Kimura also discloses or renders obvious the limitations of claim 16, which recites: "**the electronic display comprises an LED backlight LCD display where the posterior surface is the rear surface of a**

backlight assembly."

296. As discussed above with respect to claim 9 (*see*, e.g., discussions for claim elements 9[pre] and 9[a]), Kimura discloses that its liquid crystal panel ("**the electronic display**") includes the liquid crystal panel **17** and backlight unit **18**, which "is composed of LEDs." (*Supra* § VI.I.1; Ex. 1004, ¶ 78.) Accordingly, Kimura discloses "**the electronic display comprises an LED backlight LCD display**." Further, as discussed above with respect to claim 9, the "**posterior surface is the rear surface of a backlight assembly**."

297. Accordingly, Kimura discloses or renders obvious the elements of claim 16.

J. Ground 9: The Combination of Kimura and Kochiyama Renders Obvious Claims 1, 2, 3, and 11

1. Independent Claim 1

298. It is my opinion that the combination of Kimura and Kochiyama discloses or renders obvious each and every limitation of independent claim 1.

a. "A system for cooling an electronic display having a posterior display surface and contained within a housing, the system comprising:" (Claim Element 1[pre])

299. The combination of Kimura and Kochiyama disclose "**a system for cooling an electronic display having a posterior display surface and contained within a housing.**"

300. As explained with respect to claims 9[pre], 9[a] in Ground 8, Kimura discloses or renders obvious a "**a system for cooling an electronic display," "and electronic display . . . comprising a posterior surface,"** and a **"housing."** For these same reasons, Kimura discloses or renders obvious claim 1[pre].

b. "a constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface;" (Claim Element 1[a])

301. The combination of Kimura and Kochiyama disclose "**a constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface."**

302. Kimura discloses or renders obvious a "**constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface"** for the same reasons as discussed above with respect to claim 9[b] in Ground 8. Accordingly, Claim 1[a] is disclosed or rendered obvious by Kimura and Kochiyama for these same reasons.

c. "at least one bracket which connects the posterior display surface with the constricted convection plate; and" (Claim Element 1[b])

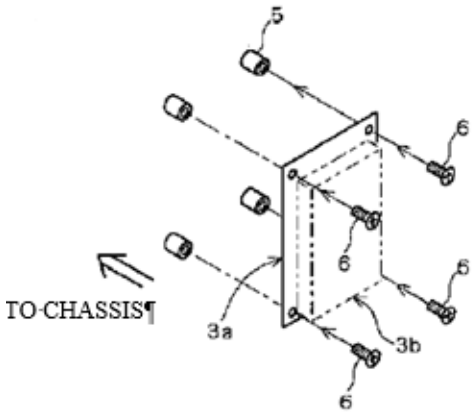
303. The combination of Kimura and Kochiyama render obvious "**at least one bracket which connects the posterior display surface with the constricted convection plate**."

304. Kimura does not expressly disclose how the "posterior display surface"

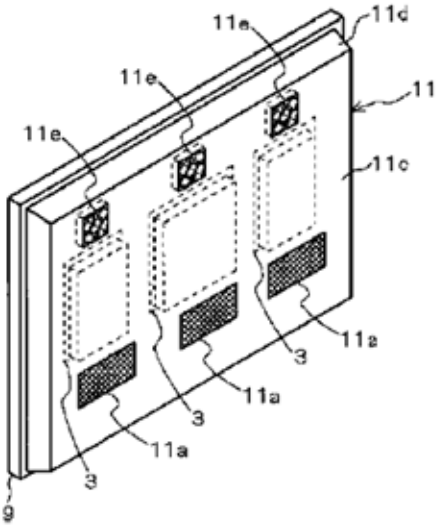
is connected to the "driving circuit **19**" ("**constricted convection plate**").

305. Kochiyama describes a plasma display device including "a chassis **2** having a heat radiating function [that] holds the PDP **1** on one main surface side and holds circuit boards **3** required to display a video image (drive-related boards, power supply boards, and the like) on the other main surface side." (Ex. 1028, ¶[0019].) Kochiyama explains that "as illustrated in FIG. 3, each circuit board **3** consists of a board body **3a** and a group of parts **3b** welded to the board body **3a**. The method of fixing the circuit board **3** to the chassis **2** is to fix the circuit board with screws **6** through a chassis support **5**, for example, so that there is a gap **4** between the chassis **2** and the board body **3a**." (*Id*.)

(FIG. 3)¶



(FIG. 7)¶



(*Id*., FIGs 3&7.)

306. A POSITA would have understood Kochiyama's screws and bosses to be the claimed "bracket" because they provide a connection (fixing of) two parts to one another. Indeed, the specification of the '322 patent discloses that "[t]he present invention may use various shapes and numbers of mounting brackets **20**. The mounting brackets **20** may serve to attach the constricted convection plate **30** (shown in FIG. 3) to the display posterior." (Ex. 1001, 6:50-55.)

d. "a fan placed to draw ambient air between the constricted convection plate and the rear posterior." (Claim Element 1[c])

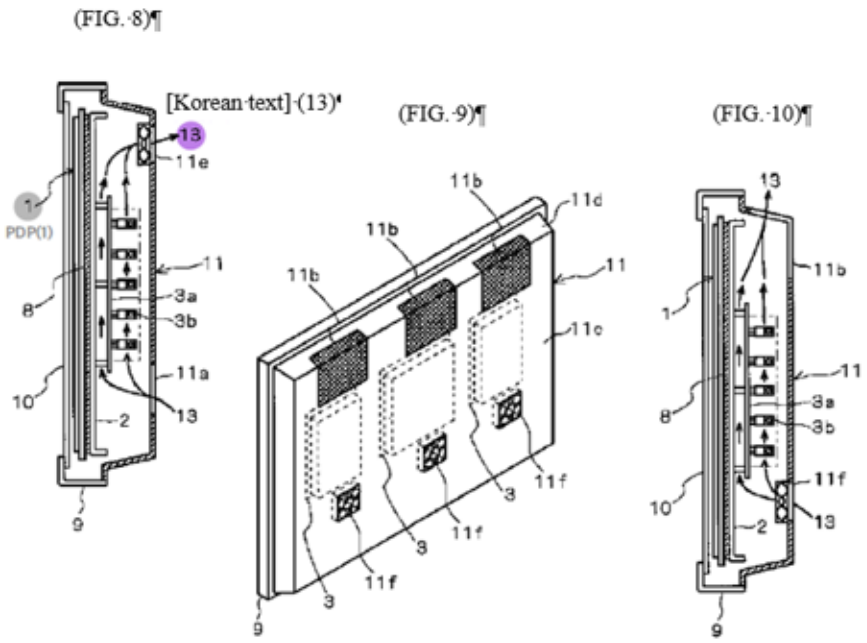
307. The combination of Kimura and Kochiyama render obvious "**a fan placed to draw ambient air between the constricted convection plate and the rear posterior**."

308. As discussed above in connection with claim 9[c] in Ground 8, Kimura discloses a "cooling fan **20**" that forces ambient air between the driving circuit 19 and the posterior surface of the display. (*Supra* § VI.I.1d; Ex. 1004, ¶[0078].)

309. Kimura teaches that while "it is assumed that the vanes are rotationally driven in the clockwise direction," they may also be driven in other directions. (*Id*., ¶[0055].) For example, Kimura further discloses that the cooling fan can alternatively be driven "to produce an air flow **expelled and blow out of the direction of the arrow A**" by changing the rotational angle of the vanes of the fan. (Ex. 1004, ¶[0055].) Accordingly, a POSITA would have understood that the

airflow in Kimura's embodiments **can be reversed** so as to be positioned to pull air through expulsion hole **16b** and out of the space that separates the driving circuit ("**constricted convection plate**") and the posterior surface with a reasonable expectation of success.

310. For example, Kochiyama teaches the use of cooling fans both to force air into, and draw air out of, a display. With respect to Figures 7 and 8, Kochiyama discloses "exhaust holes **11e** with fans" located in the upper part of back cover **3**. (*Id*. ¶¶[0028]-[0029].) These fans draw air out of the display. With respect to Figures 9 and 10, Kochiyama discloses "suction holes **11f** with fans" where the "suction holes **11f** are provided at the lower part of the back cover **11**." (Ex. 1028, ¶¶[0031]-[0032].) These fans force air into the display. Kochiyama teaches that these fans "further enhance[] the cooling effect because air can be blown directly onto the chassis **2** and the circuit boards **3**." (*Id*., ¶[0032].)



(*Id*., FIGs. 8-10.)

311. I understand that the term "**between**" has been construed by the Delaware District Court to mean "**in the space that separates**." (Ex. 1012, pp.9-10.) Consequently, claim element 4[d] requires "a fan positioned to draw air **in the space that separates** the constricted convection plate and the posterior surface." It is my opinion that the combination of Kim and Kochiyama discloses this arrangement.

e. Motivation to Combine Kimura and Kochiyama

312. A POSITA would have been motivated to improve Kimura's display by adding the brackets disclosed by Kochiyama to improve Kimura's device without impacting airflow. As discussed above, Kimura does not expressly disclose how the

"posterior display surface" is connected to the "driving circuit **19**" ("constricted convection plate"). A POSITA would have looked to improve the stability of Kimura's driving circuit by attaching it to the rear surface of the backlight through the use of standard connection options, such as brackets. The POSITA would have been motivated to look to other electronic displays that had addressed similar heat removal issues. (*Supra* ¶260.) In particular, the POSITA would have looked to displays using brackets to connect a PCB to another surface. (*Id.*) Indeed, commercial products designed for mounting circuit boards and other hardware to support plates were readily available for use by product integrators. (*Supra* ¶157.)

313. As discussed above, Kochiyama's mounting brackets serve to attach a circuit board to a chassis while maintaining a gap between the two, thereby allowing forced air to flow between. As such, the POSITA would have recognized the similarities between Kimura's LCD and Kochiyama's PDP cooling arrangements.

314. A POSITA would have been motivated to add Kochiyama's bracket to Kimura's display to connect the rear surface of the backlight and driving circuit. A POSITA would have understood this modification to improve the Kimura display's stability while permitting easy attachment and disassembly of Kimura's driving circuit. This addition and modification would merely involve the use of one well-known technique (Kochiyama's connection brackets) to improve Kimura's similar

device in the same way, and would produce predictable results because Kochiyama's bracket would advantageously and predictably improve stability of Kimura's driving circuit without interfering with its cooling method.

315. A POSITA would have expected predictable results from the combination to achieve an LCD display that was thermally efficient and more easily serviced. A POSITA would have a reasonable expectation of success that the combination of Kimura's LCD cooling system with Kochiyama's brackets would work together as intended.

316. Accordingly, claim 1 is obvious over the combination of Kimura and Kochiyama.

2. Claim 2: "The cooling system from claim 1 wherein: the posterior display surface comprises the rear surface of a backlight assembly."

317. The combination of Kimura and Kochiyama disclose that "**the posterior display surface comprises the rear surface of a backlight assembly**."

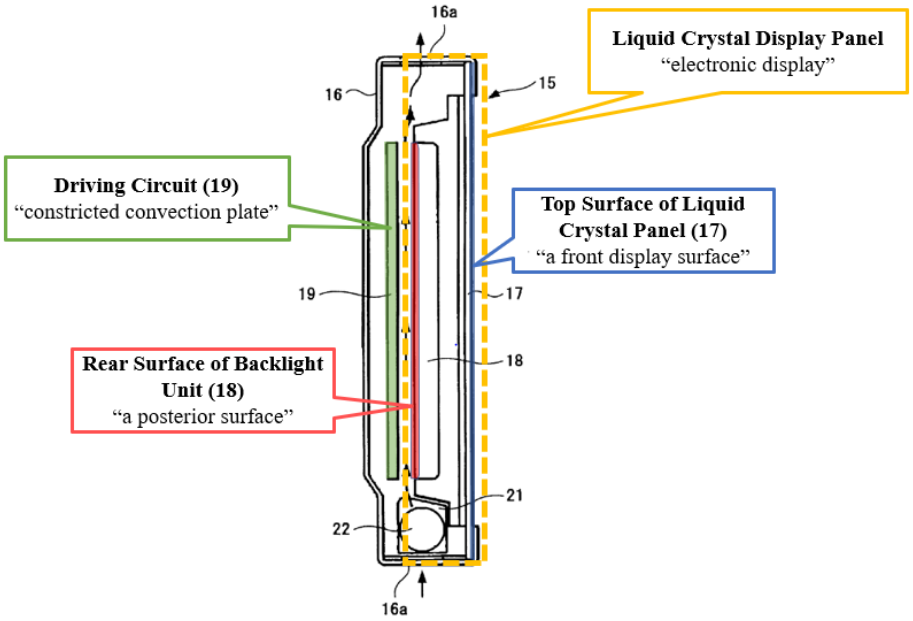
318. As discussed above with respect to claim 16, Kimura discloses that the "**posterior surface is the rear surface of the display assembly**." (*See supra* § VI.I.4.) Claim 2 is obvious over the combination of Kimura and Kochiyama for these same reasons.

319. Accordingly, claim 2 is obvious over Kimura and Kochiyama.

3. Claim 3: "The cooling system from claim 1 wherein: the constricted convection plate is substantially parallel to the posterior display surface."

320. Claim 1 is obvious over the combination of Kimura and Kochiyama for the reasons above. The combination of Kimura and Kochiyama further renders obvious that the "**constricted convection plate is substantially parallel to the posterior display surface**."

321. Kimura discloses a "constricted **convection plate**" for the reasons described above with respect to claim 1. As show in Figure 9, Kimura's driving circuit ("constricted convection plate") is "**substantially parallel**" or "**approximately parallel**" to the posterior display surface.



(Ex. 1004, FIG. 9 (annotated.))

322. Accordingly, claim 3 is obvious over Kimura and Kochiyama.

4. Claim 11: "The cooling system from claim 9 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate."

323. Claim 9 is obvious over Kimura for the reasons discussed above in Ground 8. (*See supra* § VI.I.1.) The combination of Kimura and Kochiyama render obvious "**at least one bracket which connects the posterior surface with the constricted convection plate"** as recited in claim 9 for the same reasons discussed with respect to nearly identical claim 1[b]. (*See supra* § VI.J.1.c.)

K. Ground 10: The Combination of Kimura and Hong Render Obvious Claims 4 and 7

1. Independent Claim 4

324. It is my opinion that the combination of Kimura and Hong render obvious claim 4.

a. "A liquid crystal display (LCD) comprising:" (Claim Element 4[pre])

325. To the extent the preamble of claim 4 is limiting, it is rendered obvious by the combination of Kimura and Hong.

326. As discussed in connection to claim element 9[pre] in Ground 8, Kimura discloses "**a liquid crystal display panel**" shown, for example, in Figure 10. (Ex. 1004, ¶[0077].)

327. Accordingly, the combination of Kimura and Hong renders obvious "**a**

liquid crystal display (LCD)" as required by the preamble of claim 4.

b. "a liquid crystal stack;" (Claim Element 4[a])

328. The combination of Kimura and Hong discloses or renders obvious "**a liquid crystal stack.**"

329. Kimura discloses "**liquid crystal panel 17**." (Ex. 1005, ¶[0078].) A POSITA would have understood that a liquid crystal panel inlcues a "liquid crystal stack."[17]

330. Further, if the term "**liquid crystal stack**" is intended to refer to the individual liquid crystal sub-layers (which, when stacked together, collectively form the liquid crystal layer of an LCD panel), a POSITA would know that these liquid crystal sub-layers are necessarily present in a liquid crystal layer of every LCD panel as part of its structure. (*Id.*) Therefore, Kimura discloses or renders obvious claim element 4[a].

331. Accordingly, the combination of Kimura and Hong renders obvious a "**liquid crystal stack**" as required by claim element 4[a].

c. "a backlight assembly behind the liquid crystal stack and comprising:" (Claim Element 4[b])

[17] Notably the specification of the '322 patent does not define the term "liquid crystal stack," but states the "display **10** may be the front glass plate of a liquid crystal display stack." (Ex. 1001, 9:19-21.)

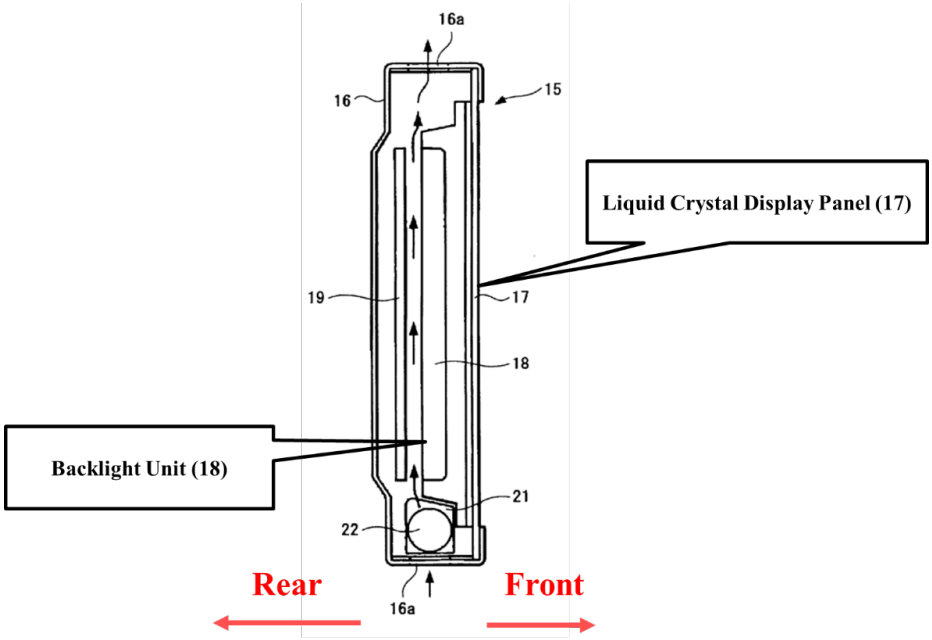
vii. **"a printed circuit board (PCB) having front and back sides;" (Claim Element 4[b(i)])**

viii. **"a plurality of LEDs mounted on the front side of the PCB;" (Claim Element 4[b(ii)])**

ix. **"a posterior surface on the rear side of the PCB;" (Claim Element 4[b(iii)])**

332. The combination of Kimura and Hong renders obvious renders obvious the requirement of claim element 4[b] of "**a backlight assembly behind the liquid crystal stack and comprising: a printed circuit board (PCB) having front and back sides; a plurality of LEDs mounted on the front side of the PCB; a posterior surface on the rear side of the PCB**."

333. Kimura discloses "[a] **backlight unit 18** that is a light source of the liquid crystal panel **17** and is **composed of LEDs** or the like is **disposed behind the liquid crystal display panel 17**." (Ex. 1004, ¶[0078].)



(*Id*., FIG. 9 (annotated).)

334. A POSITA would have known from his/her own knowledge, and from the prior art, that PCBs are an integral part of a backlight unit in an LCD device commonly used in the art to mechanically support and drive the LEDs of the backlight assembly. In other words, a POSITA would have known that Kimura's LEDs needs to be mounted on a first side of a PCB within backlight unit **18** in order to operate as intended.

335. The prior art is replete with examples of LCD backlight units comprising LEDs mounted on PCBs. Hong is an example of a typical LCD backlight structure. Hong discloses a "**printed circuit board (PCB) having front and back sides, a plurality of LEDs mounted on the front side of the PCB, a posterior**

surface on the rear side of the PCB," for the same reasons as discussed above with respect the combination of Kim and Hong in Ground 1. (*Supra* §VI.B.1.c.)

336. Therefore, the combination of Kimura and Hong renders obvious claim element 4[b].

d. "a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and" (Claim Element 4[c])

337. The combination of Kimura and Hong discloses or renders obvious "**a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB**."

338. Kimura discloses or renders obvious a "**constricted convection plate"** for the same reasons as discussed above with respect to claim 9[b] in Ground 8. (*See supra* § VI.I.1.c.) The "driving circuit **19**" ("constricted convection plate") is also "**placed behind and substantially parallel with the posterior surface of the backlight**," which includes a PCB as would have been understood by a POSITA in view of Hong. Kimura's configuration is also consistent with the Delaware District Court's construction for the term "**substantially parallel**" to mean "**approximately parallel**."

339. Accordingly, claim 4[c] is rendered obvious by the combination of Kimura and Hong.

e. "a fan positioned to draw air between the constricted convection plate and the posterior surface. (Claim Element 4[d])

340. The combination of Kimura and Hong renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface.**"

341. For the reasons explained above in Ground 1[c] of Ground 9, Kimura discloses or renders obvious "**a fan placed to draw ambient air between the constricted convection plate and the rear posterior**." (*See supra* § VI.J.1.d.) Kimura discloses or renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface"** for these same reasons.

342. Accordingly, the combination of Kim and Hong renders claim 4 obvious.

f. Motivation To Combine Kimura and Hong

343. A POSITA would have been motivated to incorporate Hong's PCB into Kimura's LED backlight for the same reasons as discussed above with respect to the combination of Kim and Hong as to claim 4 in Ground 1. (*Supra* §VI.B.1.) A POSITA would have known that PCBs are an integral and commonly used part of an LED backlight unit in an LCD device. In other words, a POSITA would have known that Kimura's LEDs need to be mounted on a first side of a PCB within backlight unit **18** in order to operate as intended.

344. Hong provides an example of a typical LED backlight. A POSITA would have been motivated to utilize a PCB such as that disclosed by Hong in Kimura's backlight so that Kimura's device can function. The combination would have amounted to no more than the use of a known technique (LEDs mounted on a PCB) to improve Kimura's similar backlight to obtain predictable results. Accordingly, the POSITA would have had a reasonable expectation of success.

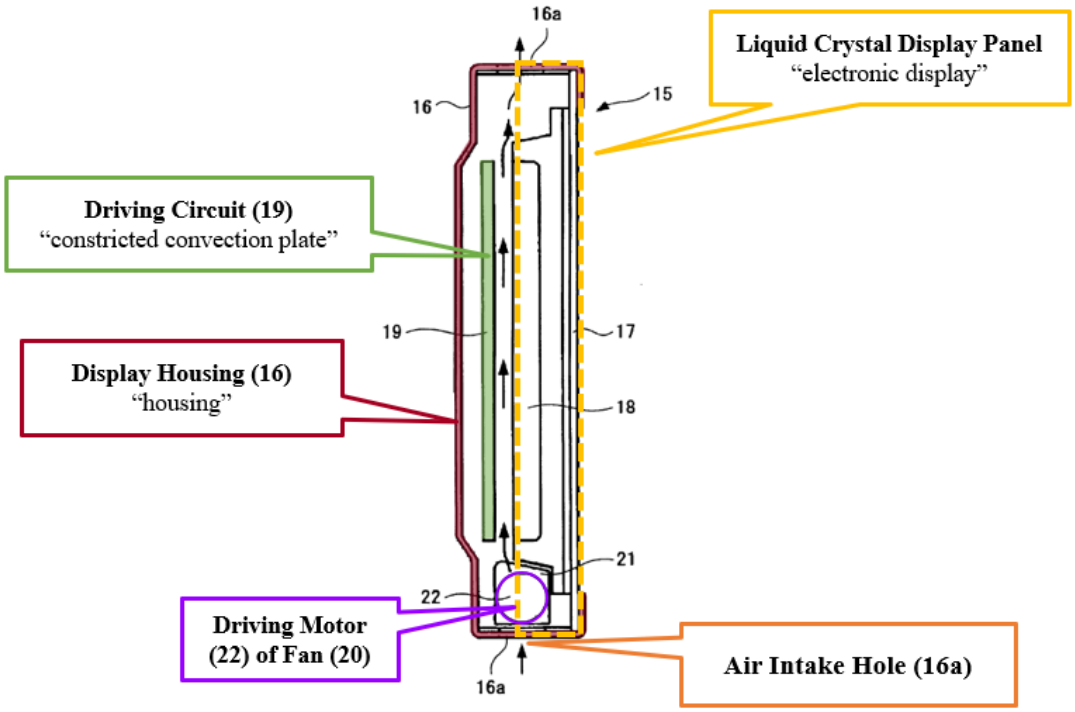
2. Claim 7: "The LCD from claim 4 further comprising:"

a. "a housing which contains the liquid crystal stack, backlight assembly, constricted convection plate, and fan; and" (Claim Element 7[a])

a. "an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface of the PCB." (Claim Element 7[b])

345. The combination of Kimura and Hong render claim 4 obvious. Kimura discloses or renders obvious claim 12, which recites **"a housing which contains the electronic display, constricted convection plate, and means for forcing air, and an entrance aperture within the housing which permits external ambient air to enter the housing and flow between the constricted convection plate and the posterior surface"** for the reasons described above in Ground 8. (*Supra* §VI.I.2.) The combination of Kimura and Hong renders obvious claim 7 for the same reasons as explained above with respect to the nearly identical limitations of claim 12.

Further, Kimura's housing contains the liquid crystal stack and backlight assembly that are part of the "electronic display" and in combination with Hong, the entrance aperture allows air to flow between the driving circuit ("constricted convection plate") and posterior surface of the PCB:



L. Ground 11: The Combination of Kimura, Hong, and Kochiyama Render Obvious Claim 5

1. Claim 5: "The LCD from claim 4 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate."

346. The combination of Kim and Hong render claim 4 obvious for the reasons described above in Ground 10. (*Supra* § VI.K.1.) The combination of Kim and Hong, and further in view of Kochiyama disclose "**at least one bracket which**

connects the posterior surface with the constricted convection plate."

347. As discussed above with respect to claim 1[b] in Ground 9, the combination of Kimura and Kochiyama render obvious "**at least one bracket which connects the posterior surface with the constricted convection plate.**" (*See supra* § VI.J.1.c.) Claim 5 is obvious over Kimura, Hong, and Kochiyama for these same reasons.

M. Ground 12: Cho Renders Obvious Claims 4, 5, 9, 10, and 11

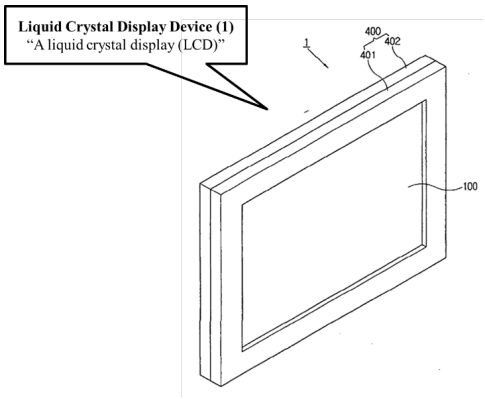
1. Independent Claim 4

348. It is my opinion that Cho renders obvious independent claim 4 as discussed below.

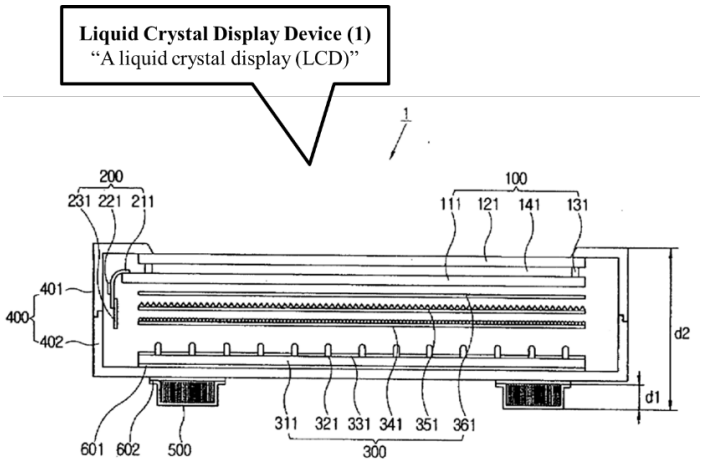
a. "A liquid crystal display (LCD) comprising:" (Claim Element 4[pre])

349. To the extent the preamble of claim 4 is limiting, it is disclosed or rendered obvious by Cho. Cho discloses "**a liquid crystal display (LCD)**."

350. Cho is titled "Cooling apparatus and **liquid crystal display device** having the same" and is directed to "**a liquid crystal display device** having an effectively cooled backlight unit." (Ex. 1006 in the Title and ¶[0011].) Figures 1A and 2 show, respectively, an isometric and a cross-sectional view of Cho's liquid crystal display device 1.



(*Id.*, FIG. 1A (annotated).)



(*Id.*, FIG. 2 (annotated).) With respect to liquid crystal display device 1, Cho discloses:

> **a liquid crystal display device 1** comprises a liquid crystal panel **100**, a driving part **200** applying a driving signal to the liquid crystal panel **100**, a backlight unit **300** supplying light to the liquid crystal panel **100**, a chassis **400** receiving the liquid crystal panel **100** and a cooling apparatus **500** disposed at an exterior surface of the chassis **400** and cooling the backlight unit **300**.

(*Id.*, ¶[0031].)

351. Therefore, Cho discloses or renders obvious a "**liquid crystal display (LCD)**."

b. "a liquid crystal stack;" (Claim Element 4[a])

352. Cho discloses or renders obvious a "**a liquid crystal stack.**"

353. Cho discloses an **LCD panel** as being **a stack** and comprising **a liquid crystal layer**:

> An LCD device comprises a liquid crystal panel having a thin film transistor board, a color filter board, and liquid crystal interposed between the thin film transistor board and the color filter board.

(Ex. 1006, ¶[0006].)

354. In particular and in reference to the liquid crystal panel **100**, Cho discloses:

> **The liquid crystal panel 100** comprises a thin film transistor substrate **111** having thin film transistors, a color filter substrate **121** facing the thin film transistor substrate **111**, a sealant **131** bonding edge portions of the color filter substrate **121** and the thin film transistor substrate **111**, and **a liquid crystal layer 141** disposed between the color filter substrate **121** and the thin film transistor substrate **111** in a space defined by the sealant **131**.

(*Id*., ¶[0032].)

355. Further, if the term "**liquid crystal stack**" is intended to refer to the individual liquid crystal sub-layers (which, when stacked together, collectively form the liquid crystal layer of an LCD panel), a POSITA would know that these liquid crystal sub-layers are necessarily present in a liquid crystal layer of every LCD panel as part of its structure.

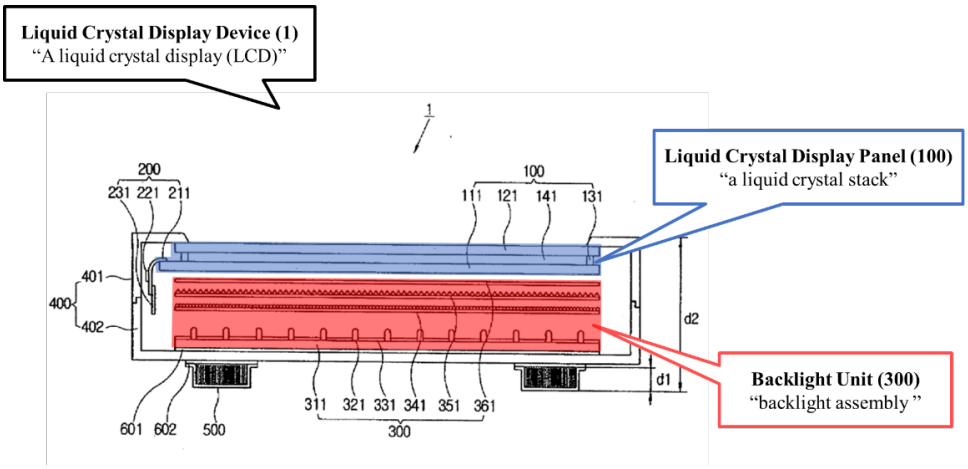
356. Accordingly, Cho discloses or renders obvious "**a liquid crystal stack**" consistent with the understanding of a POSITA, as discussed for claim element 4[a] in Ground 1. (*Supra* §VI.B.1.b.)

c. "a backlight assembly behind the liquid crystal stack and comprising:" (Claim Element 4[b])

357. Cho discloses or renders obvious "**a backlight assembly behind the liquid crystal stack**."

358. Cho discloses that "[s]ince the LCD device is a non-light emitting device, the LCD device needs a backlight unit disposed proximate to the liquid crystal panel to supply light to the liquid crystal panel." (Ex. 1006, ¶[0007].)

359. As shown from the cross-sectional view of Figure 2, Cho discloses backlight unit **300** placed **behind** the LCD panel **100** ("the liquid crystal stack") to supply light to the LCD panel **100**.



(*Id.*, FIG. 2 (annotated).) According to Cho, the backlight unit **300** is an assembly of elements:

> The **backlight unit 300** is a direct type backlight unit and comprises an LED circuit substrate **311 disposed parallel to the liquid crystal panel 100**, an LED **321** coupled to the LED circuit substrate **311**, a reflection substrate **331** reflecting light from the LED **321** toward a direction of the liquid crystal panel **100**, a diffusion film **341** disposed between the LED **321** and the liquid crystal panel **100**, a prism film **351**, and a protecting film **361**.

(*Id.*, ¶[0034].)

360. Therefore, Cho discloses or renders obvious "**a backlight assembly behind the liquid crystal stack.**"

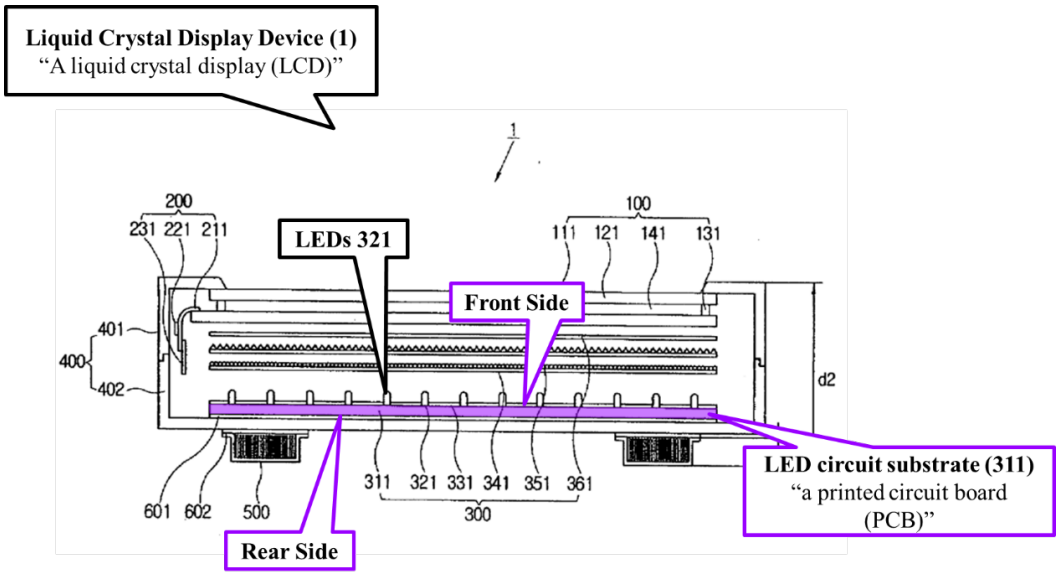
i. "a printed circuit board (PCB) having front and back sides;" (Claim Element 4[b(i)])

361. Cho discloses or renders obvious "**a printed circuit board (PCB)**

having front and back sides."

362. Cho discloses that "[t]he backlight unit **300** … comprises an LED circuit substrate **311** disposed parallel to the liquid crystal panel **100**." (Ex. 1006, ¶ [0034].) "The LED circuit substrate **311** drives the LED **321**, and at a same time, transfers heat generated by the LED **321** to the cooling apparatus **500**." (*Id*., ¶[0035].) A POSITA would have known from his/her own knowledge that the term "circuit substrate" is synonymous with the term "printed circuit board" because (i) both use the term circuit to describe the electrical circuits formed on the board, and (ii) that "board" is a colloquial short-hand for "substrate" in that both the "circuit board" and the "circuit substrate" support multiple layers of conductor pathways (i.e., the "circuit") and dielectric layers, and (iii) that the "printed" descriptor is just a term of art describing a method of fabricating the circuit traces.

363. Additionally, and as shown in Figure 2 below, LED circuit substrate **311** has a "**front side**" on which a plurality of LEDs **321** are mounted and a "**back side"** opposite to the "**front side**."



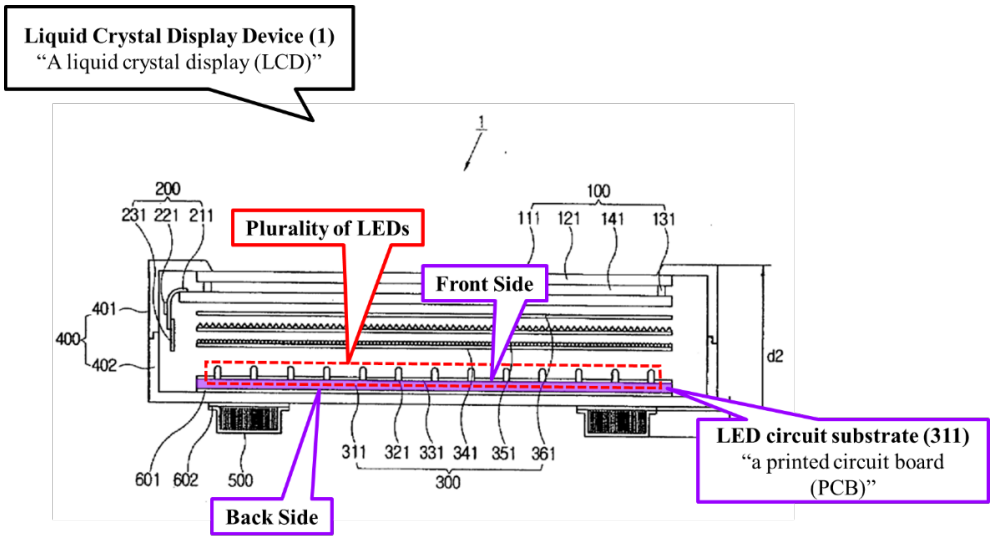
(Ex. 1006, FIG. 2 (annotated).)

364. Accordingly, Cho discloses or renders obvious "**a printed circuit board (PCB) having front and back sides**."

ii. "a plurality of LEDs mounted on the front side of the PCB;" (Claim Element 4[b(ii)])

365. Cho discloses or renders obvious "**a plurality of LEDs mounted on the front side of the PCB**."

366. Cho discloses that "[t]he backlight unit **300** may include **an array of LEDs** disposed on the LED circuit substrate **311** [i.e., the **PCB**]." (Ex. 1009, ¶[0036].) As shown in Figure 2, "**a plurality of LEDs** [are] **mounted on the front side of the PCB**."



(*Id.*, FIG. 2 (annotated).)

367. Accordingly, Cho discloses or renders obvious claim element 4[d].

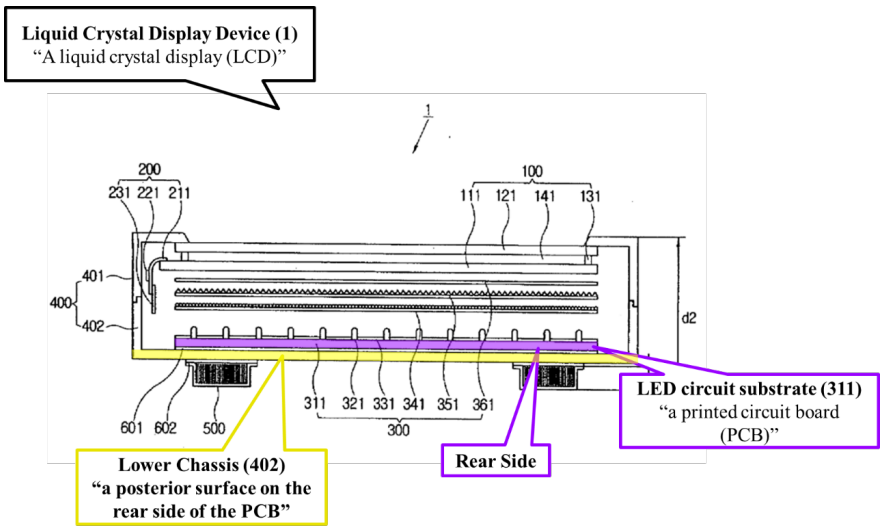
iii. "a posterior surface on the rear side of the PCB;" (Claim Element 4[b(iii)])

368. Cho discloses or renders obvious "**a posterior surface on the rear side of the PCB**."

369. As discussed above, Cho's LED circuit substrate **311** is the recited "**PCB having front and back sides**." A POSITA would have recognized that the "**the rear side of the PCB**" refers to the "**back side**" of the PCB. Based on this understanding, it is my opinion that Cho discloses "**a posterior surface on the rear side of the PCB**" in the form of **the rear surface of chassis 400**.

370. In referring to Figure 2, Cho discloses a lower chassis **402** (colored yellow) on the rear/back side of LED circuit substrate **311** (colored purple) to

improve heat dissipation from LEDs **321**.



(Ex. 1006, FIG. 2 (annotated).)

371. More specifically, Cho discloses:

> The LED circuit substrate **311** drives the LED **321**, and at the same time, transfers heat generated by the LED **321** to the cooling apparatus **500**. An upper gap pad **601** is disposed between the LED circuit substrate **311** and **the chassis 400**. The upper gap pad **601** prevents air from existing between the LED circuit substrate **311** and the chassis **400**. Air has a low heat transfer coefficient, thus if air exists between the LED circuit substrate **311** and the chassis **400**, the heat generated from the LED **321** is not effectively transferred to the cooling apparatus **500**. The upper gap pad **601** is a thin board comprising a material having a high heat transfer coefficient. **The LED circuit substrate 311**, the upper gap pad **601**, and the chassis **400** are closely adhe**red with each other**.

(*Id.*, ¶[0035].) Cho teaches that "[t]he chassis **400** includes an upper chassis **401** and a lower chassis **402**, and receives the liquid crystal panel **100** and the backlight unit **300**." (*Id.*, ¶[0042].)

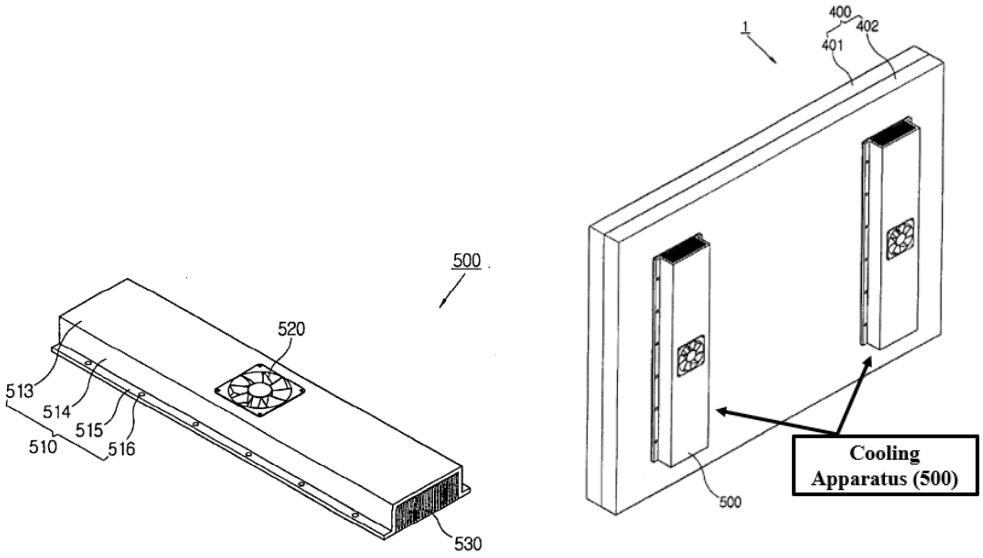
372. Because the lower chassis **402** is disposed on the back side of the LED circuit substrate **311**, the lower chassis **402** is disposed on "**the rear side**" of the LED circuit substrate **311**. Accordingly, the lower chassis **402** is "**a posterior surface on the rear side of the PCB**."

373. Therefore, Cho discloses or renders obvious claim element 4[b(iii)].

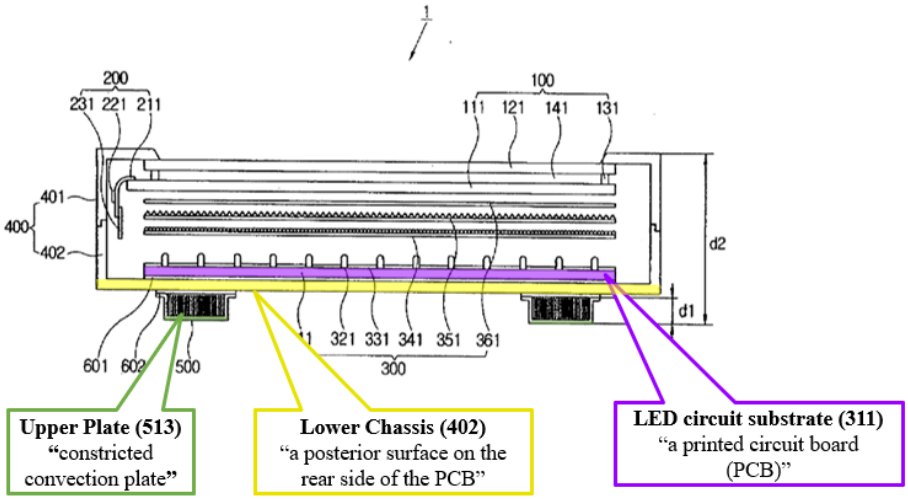
d. a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and" (Claim Element 4[c])

374. Cho discloses or renders obvious "**a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB**."

375. Cho discloses a cooling apparatus **500** depicted in Figures 3 and 4 which is "disposed at an exterior surface of the chassis **400**." (Ex. 1006, ¶[0031].)



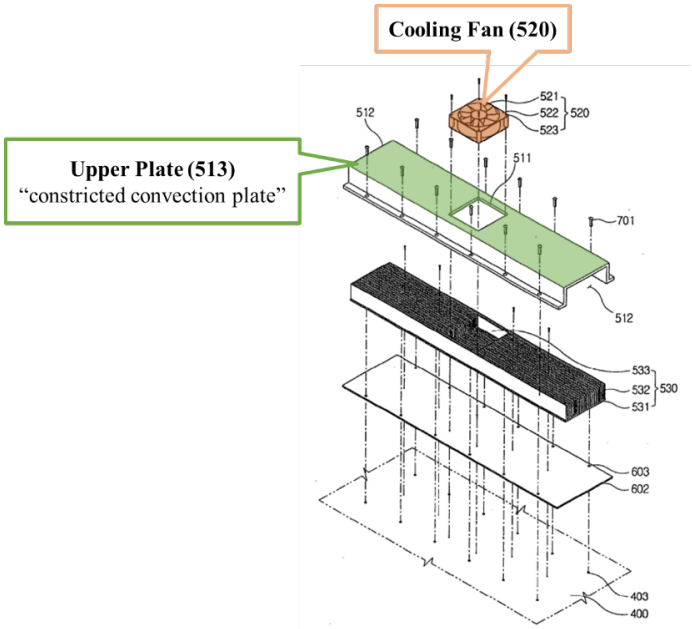
(*Id.*, FIGs. 3 (left) and 1B (right) (annotated).)

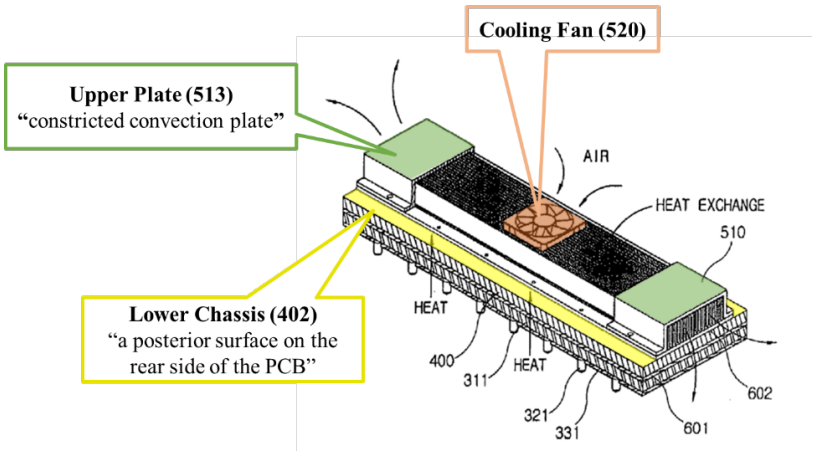


(*Id.*, FIG. 2 (annotated).)

376. The cooling apparatus **500** features an upper plate **513** (colored green) "**placed behind and substantially parallel with**" the lower chassis **402** ("the posterior surface of the PCB"; colored yellow), as shown in the annotated Figures 2

and 4 below.





(*Id.*, FIGs. 4 & 5 (annotated).)

377. Indeed, Cho teaches that "[t]he upper plate **513** is disposed parallel to the external surface of the lower chassis **402**." (Ex. 1006, ¶[0048].) The upper plate **513** along with side surface parts **514** (*see* Figure 3 above) form an enclosure in

which air can flow (e.g., a convection channel structure). Accordingly, upper plate **513** of cooling apparatus **500** is the recited "**constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB**."

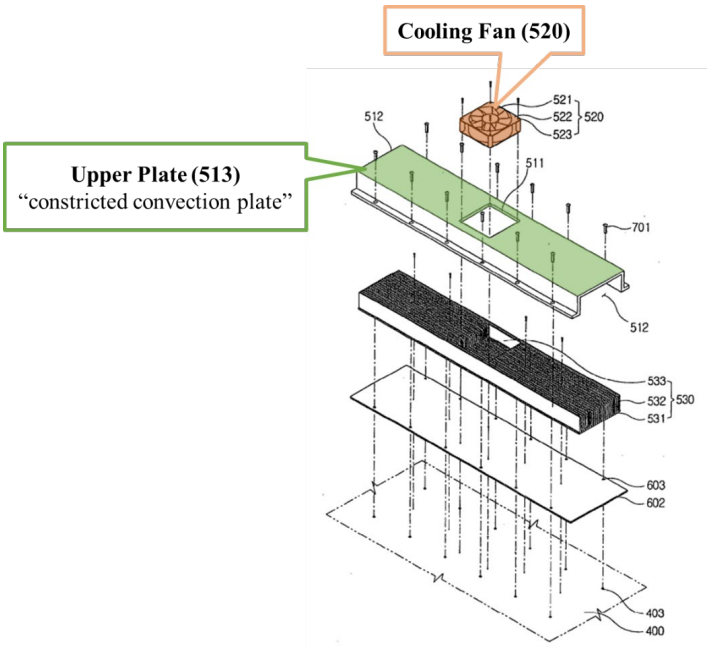
378. Therefore, Cho discloses or renders obvious claim element 4[c].

e. "a fan positioned to draw air between the constricted convection plate and the posterior surface. (Claim Element 4[d])

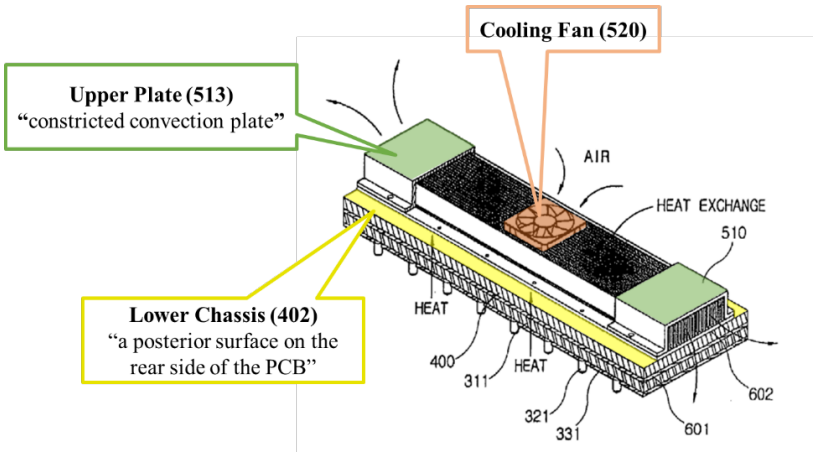
379. Cho discloses or renders obvious "**a fan positioned to draw air between the constricted convection plate and the posterior surface**."

380. As discussed above, upper plate **513** of cooling apparatus **500** is the claimed "**constricted convection plate**" and lower chassis **402** is the claimed "**posterior surface on the rear side of the PCB**."

381. In describing cooling apparatus **500**, Cho discloses a cooling fan **520** disposed in a first opening **511** of upper plate **513** as shown in the exploded view of Figure 4.



(Ex. 1009, FIG. 4 (annotated).) Cho explains that "[a]ir is **introduced** [e.g., forced] through the first opening **511** by operation of the cooling fan **520** and discharged **through the second opening 512**." (*Id.*, ¶[0050].) This means that "[t]he cooling fan **520** exhausts air **introduced** [e.g., forced] **from outside** the cooling apparatus **500** to a side direction through the heat sink **530**." (*Id.*) The cited "side direction" **being parallel to the longitudinal direction** of upper plate **513** and parallel to the lower chassis **402** ("**the posterior surface of the PCB**") as shown in Figure 2 (previously) and Figure 5 below.



(*Id*., FIG. 5 (annotated).)

382. Figure 5 shows the air flow produced by the cooling apparatus **500** during the operation of cooling fan **520** according to the description provided above. Cho also discloses that depending on the operating direction (e.g., the rotational direction) of cooling fan **520**, the air can be introduced **from the second opening 512 to the first opening 511**—e.g., opposite to the one shown above in Figure 5. "**Thus, the air path may be formed from the second opening 512** to the first **opening 511** in accordance **with an operating direction of the cooling fan 520**." (*Id*., ¶[0056].) This means that the operating direction of cooling fan **520** can be a adjusted so that cooling fan **520** forces air from the first opening **511** to second opening **512** or pulls air **through the channel from the second opening 512 to the first opening 511**.

383. Accordingly, a POSITA would have understood that Cho discloses a

cooling fan **520** positioned to positioned to pull air through and out of the space that separates upper plate **513** ("**the constricted convection plate**") and the external surface of lower chassis **402** ("**the posterior surface**").

384. For these reasons, Cho discloses or renders obvious each and every limitation of claim 4.

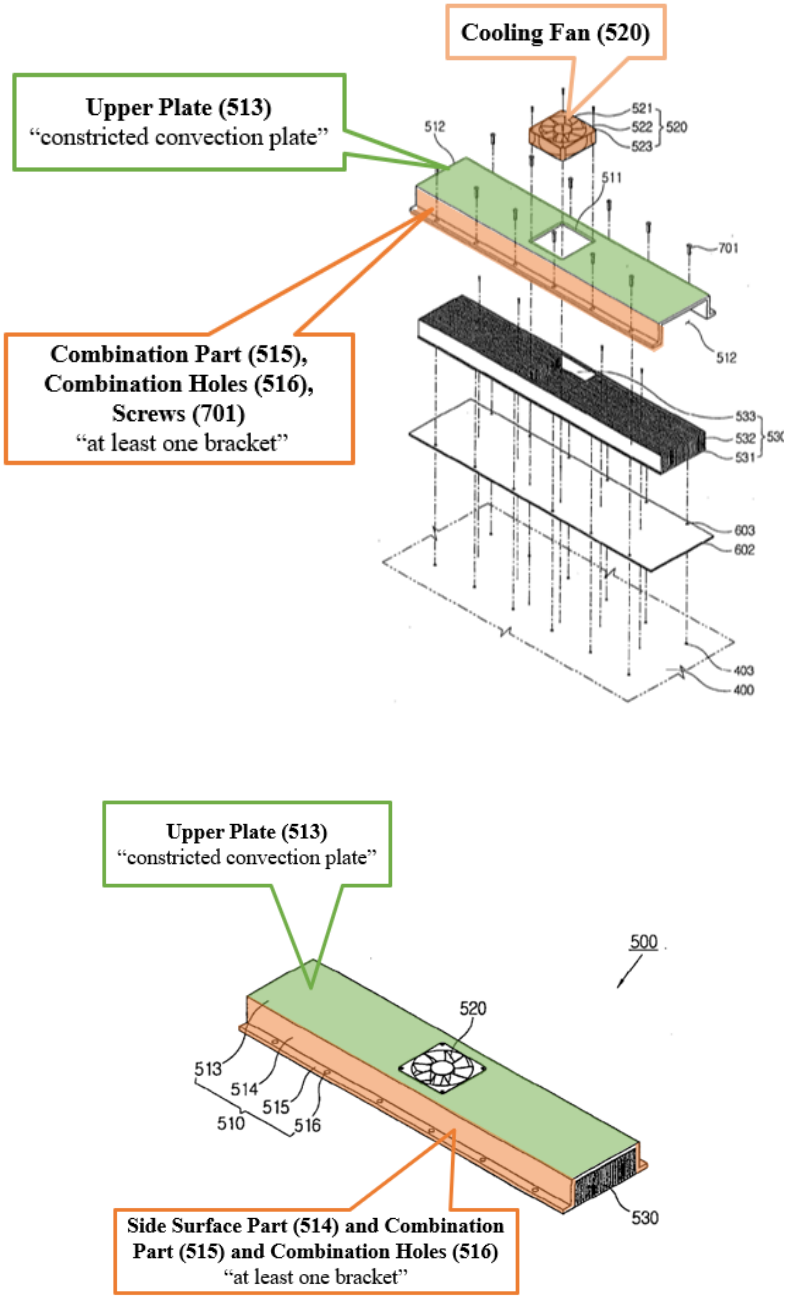
2. Claim 5: "The LCD from claim 4 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate."

385. Cho discloses or renders obvious the limitations of claim 4 for the reasons discussed above. Cho further discloses or renders obvious "**at least one bracket which connects the posterior surface with the constricted convection plate**," as required by claim 5 of the '322 patent.

386. Specifically, Cho discloses that combination part **515**, combination holes **516,** and combination screw **701** permit attachment of the upper plate **513** to the lower chassis **402**. Cho states:

> The combination part **515** includes combination holes **516** disposed at intervals along a longitudinal length of the combination part. **The combination holes 516** are aligned with **contact holes 403** of the lower chassis 402 to permit **attachment of the casing 510** to the lower cha**ssis 402** ["the posterior surface"] **via a combination screw 701**.

(*Id*., ¶[0048].) This is shown in annotated Figure 4 below.



(*Id.*, FIG. 4 (annotated).)

387. In other words, combination part **515**, combination holes **516,** and

screws **701** collectively form "**at least one bracket which connects the posterior surface with the constricted convection plate**."

388. Accordingly, Cho discloses or renders obvious the limitations of claim 5.

3. Independent Claim 9

389. It is my opinion that Cho renders obvious every limitation of independent claim 9.

a. "A system for cooling an electronic display comprising:" (Claim Element 9[pre])

390. To the extent the preamble of claim 9 is limiting, it is disclosed or rendered obvious by Cho.

391. Cho discloses an "**electronic display**" in the form of a LCD for the reasons discussed with respect to claim 4[pre]. (*Supra* §VI.M.1.a.) As discussed with respect to claim 4 (*supra* §VI.M.1), Cho discloses "cooling apparatus **500**." (Ex. 1006, pp.4-5; FIG. 2.) Together these elements comprise "**a system for cooling an electronic display.**"

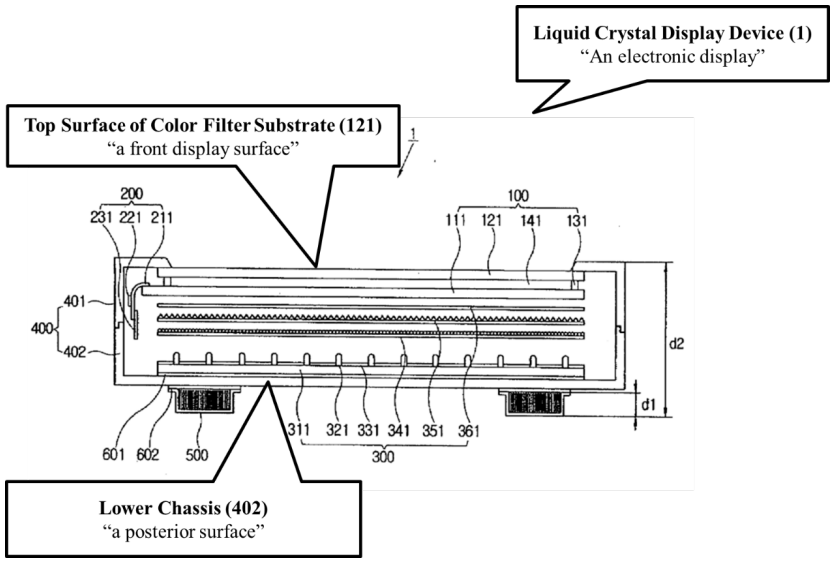
392. Therefore, Cho discloses or renders obvious "a system for cooling an electronic display."

b. "an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display;" (Claim Element 9[a])

393. Cho discloses or renders obvious "**an electronic display comprising a front display surface and a posterior surface where no electronics are mounted to the posterior surface of the electronic display**."

394. As discussed above, Cho's liquid crystal display (LCD) device **1** is "**an electronic display**." Cho's LCD device **1** includes: (i) the liquid crystal panel **100**, (ii) the backlight unit **300**, (iii) and the driving part **200**. (Ex. 1006, ¶[0031].) Accordingly, the top surface of the liquid crystal panel **100** (e.g., the top surface of the color filter substrate **121**) is "**a front display surface.**"

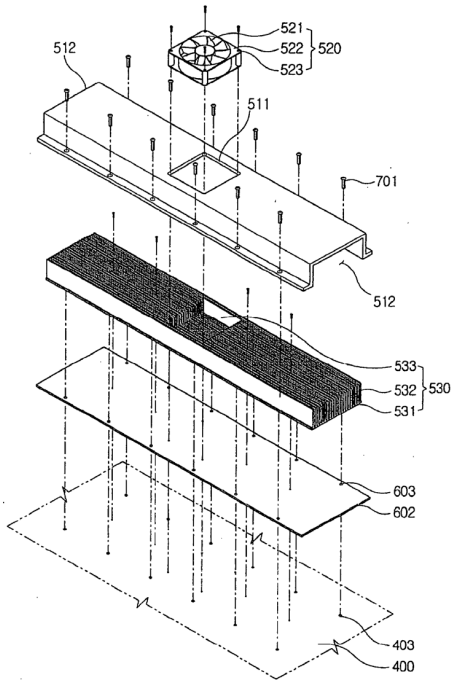
395. As explained above with respect to claim element 4[b(iii)], a POSITA would have understood that Cho's "**lower chassis 402**" is the claimed "**posterior surface on the rear side of the PCB,**" and therefore, "**a posterior surface**" of the LCD device **1** (the "electronic display"). (*See supra* § VI.M.1.c.iii.)



(*Id*., FIG. 2 (annotated).)

396. Cho discloses that "heat transmission plate **531**, the lower gap pad **602**, and the lower c**hassis 402** are closely adhered to each other." (*Id*., ¶[0052].) Accordingly, and as reflected in the cross-sectional view of Figure 4, there are **no electronics [] mounted** on the rear surface of lower chassis **402** ("the posterior **surface of the electronic display**").

FIG. 4



(*Id.*, FIG. 4.)

397. Therefore, Cho discloses or renders obvious claim 9[a].

c. "a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface; and" (Claim Element 9[b])

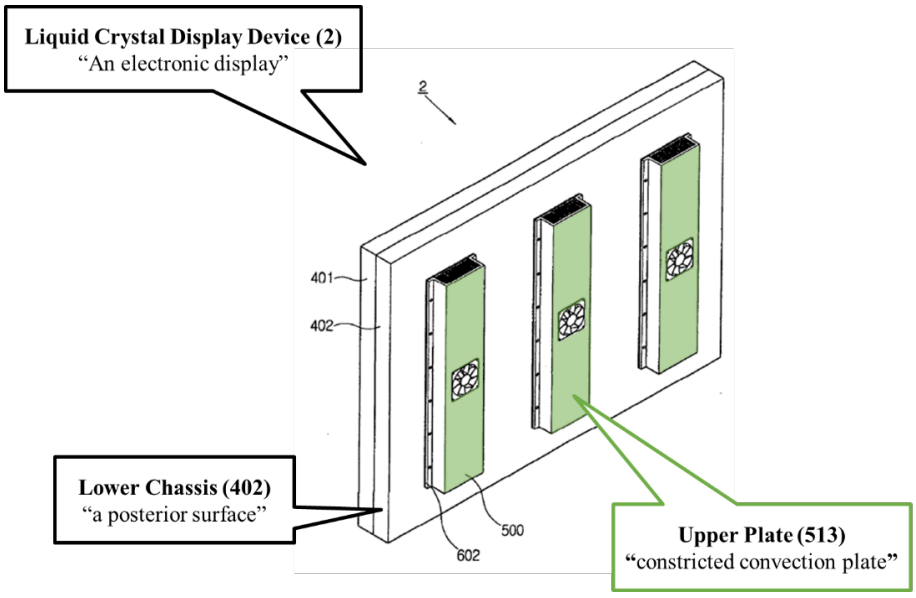
398. Claim element 9[b] requires and Cho renders obvious "**a constricted convection plate behind the posterior surface of the display covering a majority of the posterior display surface**" for the following reasons.

399. Cho discloses "**a constricted convection plate behind the posterior surface of"** the PCB for the reasons discussed above with respect to claim 4[c]. This constricted convection plate is also located behind the posterior surface of the display, namely lower chassis **402**.

400. Cho teaches that "any number of the cooling apparatuses **500** may be employed," such that "although FIGS 1B and 2 show two cooling apparatuses **500**, more or less may be employed." (*Id.*, ¶[0043].) For example, with respect to Figure 7A, Cho discloses that additional cooling apparatuses may be used for larger displays or depending on the amount of heat generated by the backlight unit **300**:

> A number and an installed position of the cooling apparatuses **500** is variable according to a size of the liquid crystal display device **2** and an amount of heat generated by the backlight unit **300**.

(*Id.*, ¶ 61.)



(*Id*., FIG. 7A (annotated).)

401. Therefore, a POSITA would have understood that the upper plates **513** of the additional cooling apparatuses **500** collectively form a "constricted convection plate" that covers a larger area of the lower chassis **402** (e.g., "**a majority of the posterior display surface**") so that the LCD device **2** is more efficiently cooled. Alternatively, as heat loads increased, a POSITA would have been motivated to incorporate additional cooling apparatuses **500** or combine several cooling apparatuses into a single larger cooling apparatus with a wider constricted convection plate that covers the majority of the posterior display surface in order to optimize cooling with a reasonable expectation of success since the primary function of the cooling apparatus will remain unchanged.

402. Accordingly, Cho renders obvious "a constricted convection plate

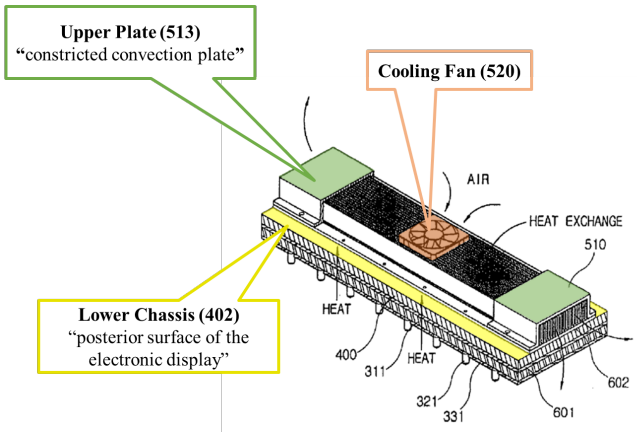
behind the posterior surface of the display covering a majority of the posterior display surface."

d. "a means for forcing air between the constricted convection plate and the posterior surface of the electronic display" (Claim Element 9[c])

403. Cho discloses or renders obvious "a **means for forcing air between the constricted convection plate and the posterior surface of the electronic display**."

404. As discussed above, I am informed and understand that this is a means-plus-function limitation, in which "forcing air between the constricted convection plate and the posterior surface of the electronic display" is the required function, and in which one or more fans **52**, or refrigeration unit **110**, and their equivalents, is the corresponding structure. (*Supra* ¶76.)

405. As discussed in claim element 4[d] above (*supra* §VI.M.1.e), Cho discloses a cooling fan **520** disposed in a first opening **511** of upper plate **513**. Cho explains that "[a]ir is **introduced** [e.g., forced] through the first opening **511** by operation of the cooling fan **520** and discharged **through the second opening 512**." (Ex. 1006, ¶[0050].) This means that "[t]he cooling fan **520** exhausts air **introduced** [e.g., forced] **from outside** the cooling apparatus **500** to **a side direction through the heat sink 530**." (*Id*.)



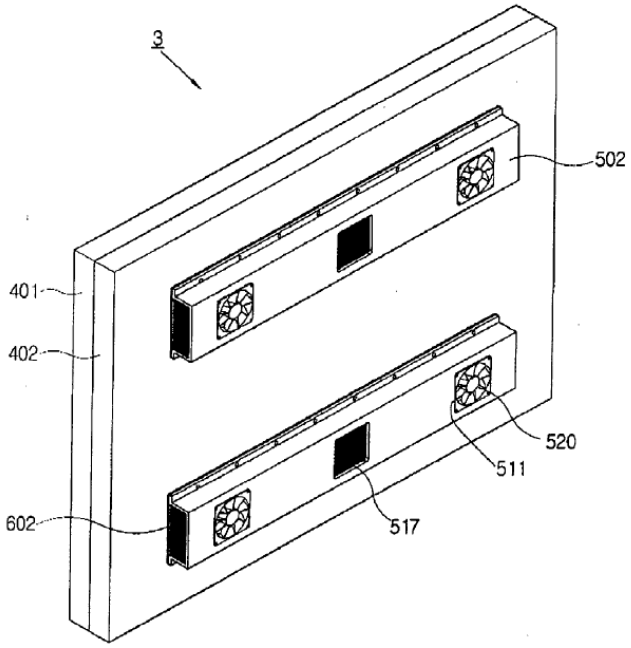
(*Id*., FIG. 5 (annotated).)

406. It is my opinion that cooling fan **520** is equivalent to fan **52** of the '322 patent because: (i) both cooling fan **520** and fan **52** are positioned in similar locations with respect to the air's entrance point location—e.g., near or at an opening; and (ii) both cooling fan **520** and fan **52** force air "between" or "in the space that separates" the "constricted convection plate" and the "posterior surface of the electronic display" as indicated by respective arrows in Figure 5 of Cho and Figure 5C of the '322 patent, respectively.

407. And because Cho discloses a cooling fan **520** as "means for forcing air" in the space that separates the upper plate **513** ("the constricted convection plate") and the lower chassis **402** ("the posterior surface of the electronic display"), Cho discloses or renders obvious "**a means for forcing air between the constricted convection plate and the posterior surface of the electronic display**," as recited in claim element 9[c].

4. Claim 10: "The cooling system from claim 9 further comprising: a plurality of apertures on the constricted convection plate."

408. Cho discloses or renders obvious claim 10. For example, with respect to Figure 7B, Cho discloses an embodiment including "two first openings **511** and two cooling fans **520**" and "[a] second opening **517** … disposed at the center of each of the cooling apparatuses **502** to exhaust air coming from both directions toward the second opening." (Ex. 1006, ¶[0062].) Openings **511** and **517** are "**apertures**." In optimizing the "**constricted convection plate**" as discussed above with respect to claim 9[b], and in view of these teachings, a POSITA would have been motivated to optimize the number and location of opening apertures with a reasonable expectation of success to enhance cooling.



(Ex. 1006, FIG. 7B.)

409. Accordingly, Claim 10 is disclosed or rendered obvious by Cho.

5. Claim 11: "The cooling system from claim 9 further comprising: at least one bracket which connects the posterior surface with the constricted convection plate.

410. Cho discloses or renders obvious the limitations of claim 9 for the reasons discussed above. Claim 11 is identical to claim 5, which is disclosed or obvious over Cho for the reasons discussed above. (*Supra* §VI.M.2.) Cho also discloses claim 11 for at least the same reasons.

VII. NO SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

411. I understand from counsel that the Patent Owner in the underlying district court litigation has not yet identified any evidence with respect to secondary considerations of non-obviousness.

412. To the extent the Patent Owner cites any evidence of sales or any praise or any industry recognition of products that the Patent Owner asserts to implement the claimed invention, I am not aware of any information demonstrating that any purported increased sales, commercial success, praise, or any other secondary factor (that the Patent Owner may assert) was a result of the particular features recited in the '322 patent's claims. Since the Patent Owner has not yet identified any evidence of secondary considerations, the Patent Owner cannot demonstrate that the

limitations of the claimed invention in particular, as opposed to other features of the products at issue, were the factors that caused any increased sales, praise, or any other asserted secondary considerations.

413. Thus, based on my review of the evidence to date, I can summarize my opinions regarding any alleged secondary considerations of non-obviousness relating to the ’322 patent, as follows:

414. *No commercial success of the claimed invention*. The Patent Owner has not cited any evidence of particular commercial success of products embodying the ’322 patent as opposed to products that do not embody the ’322 patent. The Patent Owner has not cited any evidence that any commercial success of any products is particularly a result of the claimed inventions recited in the ’322 patent’s claims and not due to any other facts.

415. *No long-felt but unsolved need*. The Patent Owner has not cited any evidence of any long-felt need that remained unsolved in the prior art before the ’322 patent. To the contrary, as discussed above, the prior art solved the problems that the ’322 patent purported to address.

416. *No failure of others*. The Patent Owner has not cited any evidence of anyone who tried, but failed, to solve the problems addressed by the ’322 patent. As shown by my analysis above, there existed prior art references that successfully

disclosed and rendered obvious the subject matter claimed by the ’322 patent.

417. *No copying of the claimed invention*. The Patent Owner has not cited any evidence that any other party (including Facebook or third parties) ever copied from the ’322 patent and its claimed invention.

418. *No unexpected results of the claimed invention*. The Patent Owner has not cited any evidence of unexpected results achieved by the ’322 patent’s claimed invention. To the contrary, the prior art disclosed the predictable, expected results that show why the ’322 patent’s claims are obvious as discussed in my Declaration.

419. *No praise for the claimed invention*. The Patent Owner has not cited any evidence of praise for the claimed invention recited in the ’322 patent.

420. *No surprise or skepticism at the claimed invention*. The Patent Owner has not cited any evidence that observers were surprised by, or skeptical of, the claimed invention recited in the ’322 patent.

421. *No departure from the wisdom of the prior art*. The Patent Owner has not cited any evidence that the claimed inventions of the ’322 patent departed from the wisdom of the prior art. The ’322 patent claims subject matter that was already present in the prior art, including in the references discussed in my analysis above.

422. Moreover, with respect to the considerations discussed above, I also refer to and incorporate my opinions stated throughout this Declaration, including

my analysis showing that the ’322 patent is directed to techniques known in the prior art and does not provide any inventive technology.

423. To the extent the Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to comment on it.

VIII. CONCLUSION

424. In my opinion, based on my review of the ’322 patent, the materials referenced herein, and my knowledge of what a person of ordinary skill in the art would have known at and before the ’322 patent’s priority date about the technology at issue, a POSITA would have understood all of the limitations of the challenged claims 1-5, 7-13, and 16 to be obvious over the prior art for the reasons described above.

425. Accordingly, it is my opinion that challenged claims 1-5, 7-13, and 16 should be found unpatentable.

426. Furthermore, I reserve the right to supplement my opinions in the future to respond to any arguments or positions that the Patent Owner may raise, taking account of new information as it becomes available to me.

427. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be

true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Declaration of Robert Smith-Gillespie in Support of
Petition for *Inter Partes* Review of
U.S. Patent No. 9,173,322

Respectfully submitted,

Dated: December 5, 2022

Robert Smith-Gillespie