

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MANUFACTURING RESOURCES INTERNATIONAL, INC.,

Petitioner

v.

SAMSUNG ELECTRONICS CO., LTD.,

Patent Owner

U.S. Patent No. RE45,117
Filing Date: February 23, 2012
Issue Date: September 9, 2014

Title: Panel Type Display Device

DECLARATION OF DR. CARL D. MEINHART

IN SUPPORT OF

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. RE45,117**

Case No.: IPR2023-01201

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I, Carl D. Meinhart, Ph.D., declare as follows:

I. Introduction.

1. My name is Carl Meinhart. I am a Professor of Mechanical Engineering at the University of California – Santa Barbara (“UCSB”) and have been employed there as a professor, associate professor, or assistant professor since 1996. Among other things, I have been teaching undergraduate courses on fluid mechanics and thermodynamics as well as graduate courses on microscale flow transport phenomena. I have served as an advisor to dozens of graduate and post-doctoral students from the late-1990s through today.

A. Engagement

2. I have been retained by Petitioner Manufacturing Resources International, Inc. (“MRI” or “Petitioner”) to provide my expert opinions in this declaration with respect to the *inter partes* review (“IPR”) that will be filed before the United States Patent and Trademark Office (“USPTO”). My declaration sets forth my expert opinions based on my expert knowledge related to the technology of U.S. Patent No. RE45,117 (the “’117 Patent”), which is titled “Panel Type Display Device,” and its technical field.

3. Petitioner has asked me to provide my independent analysis and assessment of the validity of the ’117 Patent.

4. Patent Owner is paying a rate of \$825 per hour for my consulting services, with a small portion of that amount paid to the search service I am contracted to, including for my work in the preparation of this Declaration. I have no stake in either of the parties or in the outcome of this matter.

5. In forming my opinions, I have relied on my knowledge and experience in the design of electronic cooling systems using knowledge in the fields of fluid mechanics and heat transfer. For purposes of my analysis, I considered the validity based upon the knowledge of a person of ordinary skill in the art as I discuss below. My educational background, career history, publications, and other relevant qualifications are set forth in my curriculum vitae, appended as Exhibit 1004 hereto.

6. In addition to my academic appointments, I served as a Summer Faculty Fellow for NASA Johnson Space Center and previously was a research scientist at Ford Motor Company. I served as the Chief Technology Officer at SpectraFluidics Inc., and was a Co-Founder of Pi-MEMS, Inc. and a Founder of Ti-MEMS, Inc. I currently serve as the Chief Executive Officer of Numerical Design, Inc. I have also previously served as an industry consultant and expert witness, including on the subjects of fluid diagnostic instrumentation, heat transfer, microfluidic designs, DNA sequencing, medical devices, and MEMS-based oscillators. In addition, I also have 23 years of experience in using COMSOL

Multiphysics simulations, and for the past 11 years, I have been a COMSOL Certified Consultant.

7. My research interests include micro-resolution particle image velocimetry for micro-scale flow, enhancing immunoassays and stem cell culturing techniques, Ti-based thermal ground planes for cooling IC chips, and developing free surface fluidics using surface-enhanced Raman spectroscopy for trace chemical detection.

8. My graduate education includes an M.S. in Theoretical and Applied Mechanics, and Ph.D. in Theoretical and Applied Mechanics from the University of Illinois at Urbana-Champaign in 1991 and 1994.

9. Over the years I have been an invited or keynote speaker or seminar presenter at many national and international conferences, including on the topics of microfluidic devices, flow, imaging, velocimetry, BioMEMS & biomedical Nanotech, Nanomedicine, Biological Diagnostics, Micro and NanoTechnology, miniaturization of analytical instruments and micro-systems, Lab on a Chip.

10. I am listed as an inventor or co-inventor on more than 18 issued United States patents and I am the author or co-author of well over 150 scientific publications and conference papers. My work has been published in many journals, including The Proceedings of the National Academy of Sciences; The Journal of Biomedical Microdevices; Biomicrofluidics; Lab on a Chip; Micro and

Nanofluidics; The Journal of Physical Chemistry, Analytical Chemistry; Nanomedicine: Nanotechnology, Biology and Medicine; Nanoscale; Journal of Colloid and Interfacial Science; Analyst; Electrochimica Acta; ACS Applied Material Interfaces; Material Research Letters; Physics Review of Fluids; Journal of Fluid Mechanics; Journal of Fluids Engineering; ACS Nano; Physics of Fluids; Journal of Chromatography A; Langmuir; Journal of Nanophotonics; Journal of Heat Transfer; Journal of Physics; Annual Review of Fluid Mechanics; and Experiments in Fluids.

11. I have served as a reviewer and/or referee for many publications, including The Proceedings of the National Academy of Science, The Journal of Fluid Mechanics, Experiments in Fluids, ASME Journal of Fluids Engineering, among others. I am currently a founding associate editor of the journal FLOW.

12. I have worked in the field fluid mechanics and transport for over 33 years, including conducting research and authoring numerous publications.

II. Materials Considered

13. In preparing this declaration, I reviewed the materials listed in the table below, which I used in conjunction with my experience and qualifications to analyze the various grounds of invalidity presented in the Petition and form my opinions on the matters set forth below.

Exhibit or Paper No.	Document Description
1001	U.S. Patent No. RE45,117
1002	Prosecution History of U.S. Patent No. RE45,117 and U.S. Pat. No. 7,667,964
1005	U.S. Pat. No. 6,198,222 to Chang
1006	U.S. Patent No. 6,104,451 to Matsuoka
1007	U.S. Pat. No. 4,980,848 to Griffin
1008	US Pat. No. 7,164,586 to Lin
1009	WO 2007/116116 to Karppanen
1010	JP 2003075858 to Takahashi
1011	Certified English Translation of JP 2003075858 to Takahashi
1012	JP 2006-163217A to Nagayama
1013	Certified English Translation of JP 2006-163217A to Nagayama
1014	US Pub. No. 2002/0014840 to Kaneko

III. Applicable Legal Standards

A. A Person of Ordinary Skill in the Art

14. I am informed and understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person presumed to have known the relevant art at the time of the alleged invention. I am informed and understand that factors that may be considered in determining the level of ordinary skill in the art may include: (A) the type of problems encountered in the art; (B) prior art solutions to those problems; (C) the rapidity with which innovations are made; (D) the sophistication of the technology; and (E) the educational level of active workers in the field.

15. Upon consideration, in my opinion, a person of ordinary skill in the art is someone with at least Bachelor of Science degree in mechanical engineering, electrical engineering, or a similar degree with one or two years of graduate school

training or one to two years of industry experience in the fields of mechanical design, fluid mechanics, heat transfer, or electronics cooling.

16. Lack of work experience could have been remedied by additional education, and vice versa. Such academic and industry experience would be necessary to appreciate what was obvious and/or anticipated in the industry and what a POSITA would have thought and understood at the time.

17. The earliest priority date given on the face of the '117 Patent is October 15, 2007, the filing date of the U.S. application. Even if a foreign filing date for the Korean priority application applied (January 8, 2007), the references relied upon herein are prior art.

18. As of the relevant time frame for the '117 Patent, I possessed at least such experience and knowledge of a POSITA; hence, I am qualified to opine as to the validity of the '117 Patent.

B. Prior Art

19. It is my understanding that each of the references cited in the Petition qualify as prior art to the '117 Patent.

20. I have been informed and understand that a claim is obvious in light of the prior art if the difference or differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in

the art. I have been informed and understand that the Supreme Court provided an outline for analyzing obviousness in which it rejected an earlier test in favor of an “expansive and flexible approach” using “common sense.” I have also been informed and understand that the Supreme Court explained that under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. I have also been informed and understand that the Supreme Court explained that “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” I further have been informed and understand that the Court pointed to other factors that may show obviousness. These factors include the following principles:

- a. combination that unites that unites old elements with no change in their respective functions is unpatentable. As a result, the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results,
- b. a predictable variation of a work in the same or a different field of endeavor is likely obvious if a person of ordinary skill would be able to implement the variation,

- c. an invention is obvious if it is the use of a known technique to improve a similar device in the same way, unless the actual application of the technique would have been beyond the skill of the person of ordinary skill in the art. In this case, a key inquiry is whether the improvement is more than the predictable use of prior art elements according to their established functions,
- d. an invention is obvious if there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims,
- e. inventions that were "obvious to try" — chosen from a finite number of identified, predictable solutions, with a reasonable expectation of success — are likely obvious,
- f. known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art, and
- g. an explicit teaching, suggestion, or motivation in the art to combine references, while not a requirement for a finding of obviousness, remains "a helpful insight" upon which a finding of obviousness may be based.

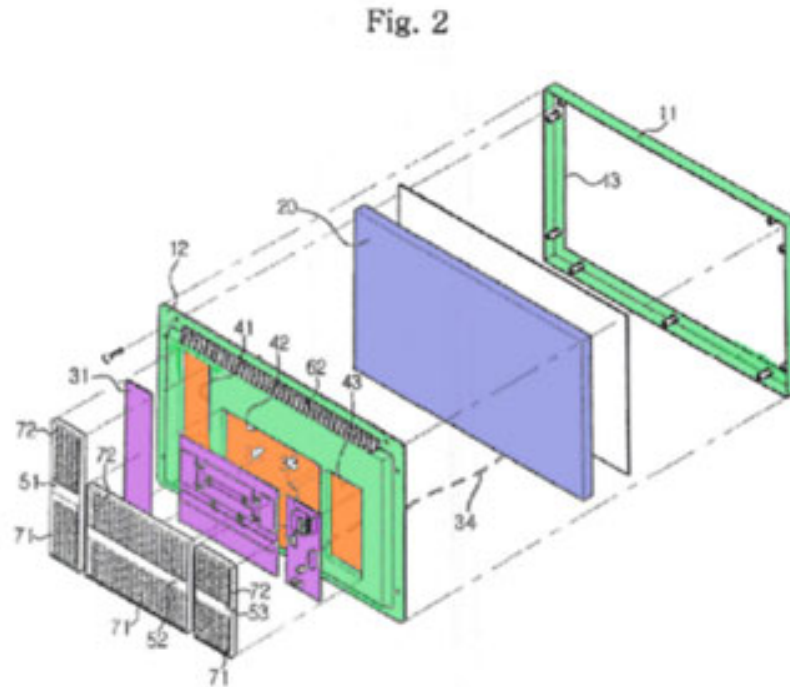
IV. Overview of the '117 Patent

21. The '117 Patent is generally directed to “a panel type display device” with a case, a display panel mounted in the interior of the case, a circuit board mounted on the rear surface of the case that controls the display panel, and two cooling paths—one for cooling the display panel and one for cooling the circuit board. Ex. 1001, 1:60–66. According to the specification, the disclosed panel type display device is “capable of minimizing temperature increase in the interior of a case and a display panel.” *Id.* at 1:58–59.

22. The '117 Patent concedes electronic display devices were known in the art, and such display devices included “a flat type panel on which images are displayed” and one or more circuit boards for controlling the display panel mounted in a case. *Id.* at 1:26–36. Such known devices also typically included air inlets and outlets so air could flow in and out of the case to cool the display panel and circuit boards. *Id.* at 1:26–51. However, the '117 Patent contends that, in such known devices, the display panel and circuit boards “are mounted in the same space,” and thus “the internal temperature of the case is increased due to inter-heating between the display panel and the circuit boards,” which can lead to deterioration of the display panel. *See Id.*

23. As illustrated in Figure 2 (reproduced with annotations below), the '117 Patent purports to solve this problem by placing a “**display panel 20**” in the

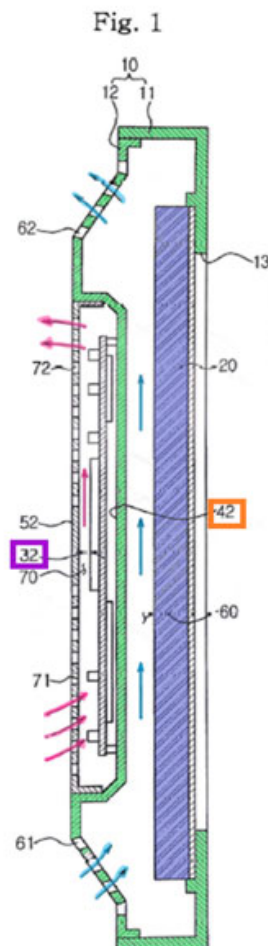
front interior of a “**case 10**” and mounting one or more circuit boards (e.g., “**circuit boards 31, 32, 33**”), which are electrically connected to the display panel 20 to control the display, on the rear surface of the case (or the “rear case 12”) via “**circuit board mounting parts 41, 42, 43.**” *Id.* at 2:53–57, 3:3–5, 3:10–12.



Id. Fig. 2.

24. As shown in Figure 1 of the '117 Patent (reproduced with annotations below), the **case 10** also includes “air inlets 61” at a lower portion of the case through which air for cooling the **display panel 20** can flow into the interior of the case, and “air outlets 62” at an upper portion of the case through which the air in the interior of the case can be exhausted. Ex. 1001, 3:13-18. “Air flow holes 71 and 72” are provided on covers 51, 52, 53 of **circuit board mounting parts 41, 42, 43**

so “air can flow in internal spaces of the circuit board mounting parts 41, 42, and 43.” *Id.* at 3:18–21. As shown in Figure 1, this arrangement creates two separate cooling paths: a “**first cooling fluid path 60**” to cool the display panel 20 and a “**second cooling fluid path 70**” to cool “**circuit boards 31, 32, 33.**” *Id.* at 3:25–27.



Id. Fig. 1.

25. More specifically, “the first cooling fluid path 60 is formed by a space between a rear surface of the display panel 20 and an inner surface of the rear case

12, and the second cooling fluid paths 70 are respectively formed by internal spaces of the circuit board mounting parts 41, 42 and 43 of the rear case 12.” *Id.* at 3:27–32. The ’117 Patent contends that this precise structure provides smooth cooling of both the display panel and circuit boards and minimizes temperature increase in the interior case because “heat produced from the circuit boards 31, 32 and 33 can be discharged through the second cooling fluid paths 70 without influencing the display panel 20, and heat produced from the display panel can also be discharged through the first cooling fluid path 60 without influencing the circuit boards 31, 32 and 33.” *Id.* at 3:47–55.

26. The ’117 Patent includes three independent claims and 23 total claims. Independent Claim 1, challenged in the Petition, recites:

[pre] 1. A panel display device comprising:

- [a]** a case;
- [b]** a display panel mounted in an interior of the case;
- [c]** at least one circuit board which controls the display panel;
- [d]** a first cooling fluid path which cools the display panel; and
- [e]** a second cooling fluid path which cools the circuit board,
- [f]** wherein the first and second cooling fluid paths are separated from each other, and

[g] wherein the case includes a circuit board mounting part provided on a rear surface of the case and partitioned from a space in which the display panel is mounted such that the circuit board is received in the circuit board mounting part, [h] the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the case, and [i] the second cooling fluid path includes an internal space of the circuit board mounting part.

Id. at 4:34-50.

27. Challenged dependent claims 2 and 5 recite aspects of the device, e.g., claim 2 recites that the case includes front and rear cases coupled to each other and that the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part; and claim 5, which depends from claim 2, recites that the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the rear case, with the second cooling fluid path including an internal space of the circuit board mounting part. *Id.* at 4:51-55, 5:1-5.

V. Claim Construction

28. I have been informed and understand that in an *inter partes* review claim terms are construed according to their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the specification and the

prosecution history of the patent. I have also been informed that in a co-pending ITC case, the following claim constructions have been proposed:

29. Counsel for Petitioner has explained to me that during an IPR, claims are construed under the *Phillips* standard in which claim terms are given their ordinary and customary meaning as understood by a POSITA in view of the patent specification and prosecution history.

30. I further understand that there is a copending International Trade Commission (“ITC”) proceeding in which claim constructions have been advanced by Petitioner and Patent Owner. As I explain below, I understand these constructions but do not find them determinative for my analysis of the Karppanen, Takahashi, Nagayama, and Kaneko references. Nevertheless, I have included the constructions provided to me by Counsel for Petitioner below and agree with the constructions advanced by Petitioner. I have included a table summarizing the constructions and have describe herein how the cited art teaches the limitations under both constructions.

Claim Term	MRI Construction	Samsung Construction
Display panel	A flat type screen on which images are displayed, such as a liquid crystal display or plasma display panel	No construction necessary; alternatively plain and ordinary meaning, which is: “flat type electronic display for displaying images”
Circuit board mounting part	Subject to 35 U.S.C. § 112, ¶6 <i>Function</i> : to receive and	No construction necessary; alternatively, plain and ordinary

	mount the circuit board <i>Structure:</i> the specific structure recited in Column 3, lines 3–12 and 60–65 and illustrated in Figures 1–2	meaning, which is: part for attaching a circuit board or, if 35 U.S.C. § 112, ¶6 applies: <i>Function:</i> to provide an area for mounting the circuit board <i>Structure:</i> the structure recited in Column 3, lines 3-12 and lines 60-65, and/or the structures illustrated in Figures 1–
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VI. Prosecution History

31. I have reviewed the prosecution history of the '117 Patent. The application leading to the '117 Patent, U.S. Application 11/872,057, was filed on October 15, 2007 with 11 claims, including independent claims 1 and 9. The application claimed priority to foreign application KR 10-2007-0002081, filed January 8, 2007.

32. The '117 Patent was filed as a reissue of U.S. Pat. No. 7,667,964 on February 23, 2012 and issued on September 9, 2014. Ex. 1002. There was no substantive examination of or amendment to claims 1, 2, and 5 during the prosecution leading to U.S. Pat. No. RE45,117. Ex. 1002, 110, 117, and 120-121. There was substantive examination and amendment of claim 1 during prosecution

leading to U.S. Pat. No. 7,667,964. Claim 9 was also discussed. That prosecution of U.S. Pat. No. 7,667,964 is discussed below.

33. Claim 1, as initially filed in the US on October 15, 2007, recited:

1. A panel display device comprising:
 - a case;
 - a display panel mounted in an interior of the case;
 - at least one circuit board which controls the display panel;
 - a first cooling fluid path which cools the display panel; and
 - a second cooling fluid path which cools the circuit board,

wherein the first and second cooling fluid paths are separated from each other.

Ex. 1002, 225.

34. On January 29, 2009, the USPTO issued a non-final office action rejecting claims 1, 2, 9, and 10 as anticipated by Chang (U.S. Pat. No. 6,198,222) (Ex. 1005), claims 1 and 9-11 as anticipated by Matsuoka et al (U.S. Pat. No. 6,104,451)(Ex. 1006), claims 1 and 9-11 as anticipated by Griffin et al (U.S. Pat. No. 4,980,848)(Ex. 1007), and claims 1, 2, and 9-11 as anticipated by Lin (US Pat. No. 7,164,586)(Ex. 1008). Ex. 1002, 192-194. The USPTO indicated that claims 3-8 were objected to as being dependent on a rejected base claim. *Id.* at 194-195. Rather than argue against the rejection of claim 1, Applicant amended claims 1 and

9 to include claim 8, resulting in the allowance of all pending claims. Ex. 1002, 169, 181-184. Applicant did not dispute that each of Chang, Matsuoka, Griffin, and Lin explicitly disclosed each feature of claim 1, including the first and second cooling fluid paths being separated from each other. *Id.* at 184.

35. For completeness, I have included additional context to understand the USPTO's rejection of original claim 1.

36. The USPTO cited to Figs. 1-4 of Chang for teaching a panel display device 10, a case 14, 16, a display panel 12 mounted in an interior of the case, at least one circuit board 36 which controls the display panel 12, a first cooling fluid path which cools the display panel 12, and a second cooling fluid path which cools the circuit board 36. Ex. 1002, 192. The USPTO further explained that front 14 and rear 15 cases are coupled to each other, that circuit board mounting part 26 is provided on the outer surface of the rear case, and that partition plate 44 divides the interior of the case into first and second cooling fluid paths. *Id.* Fig. 4 of Chang is included below:

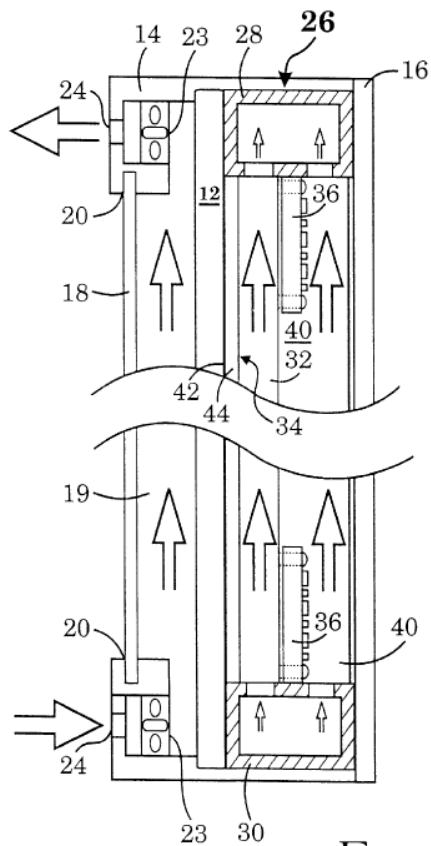


Fig. 4

Ex. 1005, Fig. 4.

37. From my review of Chang, the design and set-up are substantially different than that of Karppanen, Takahashi, Nagayama, and Kaneko, cited below. Accordingly, it is my opinion that Karppanen, Takahashi, Nagayama, and Kaneko are not substantially the same as Chang.

38. The USPTO cited to Figs. 1-14 of Matsuoka for teaching each element of claim 1, citing substantially the same text as from Chang, and adding a citation to the plurality of air flow holes 1040, 1041, and 1042. *Id.* at 193. From my review of Matsuoka, the USPTO appears to have made a copy and paste error from

the Chang rejection, as none of the element numbers cited correspond to that disclosed in Matsuoka. Fig. 1 of Matsuoka is shown below to provide an illustration of the set-up of its display unit.

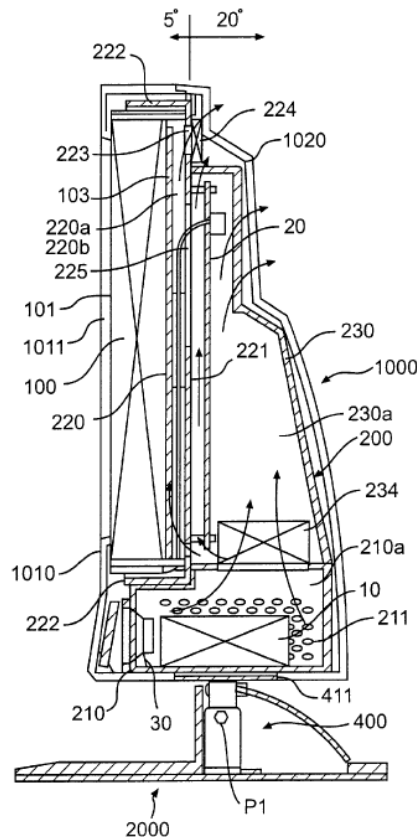
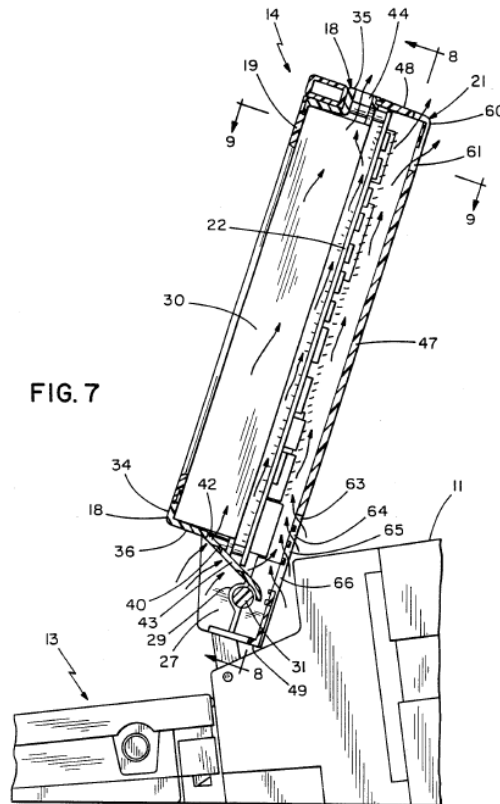


FIG. 1

Ex. 1006, Fig. 1, Abstract.

39. From my review of Matsuoka, the design and set-up are substantially different than that of Karppanen, Takahashi, Nagayama, and Kaneko, cited below. Accordingly, it is my opinion that Karppanen, Takahashi, Nagayama, and Kaneko are not substantially the same as Matsuoka.

40. The USPTO also cited Griffin but did not include any analysis. Griffin is directed to a portable computer. Ex. 1007, Title. Exemplary Fig. 7 is shown below.

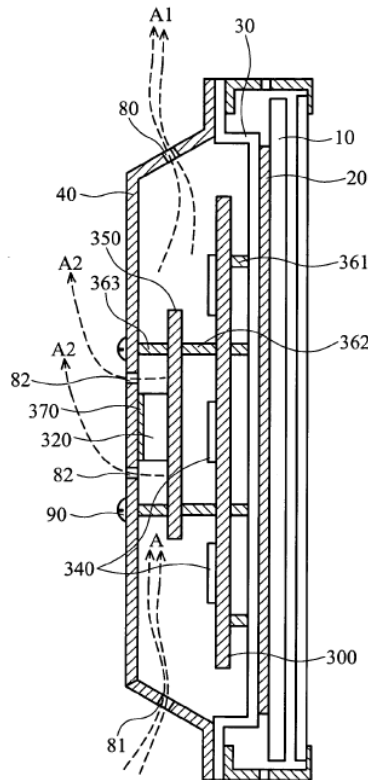


Ex. 1007, Fig. 7.

41. From my review of Griffin, the design and set-up are substantially different than that of Karppanen, Takahashi, Nagayama, and Kaneko, cited below. Accordingly, it is my opinion that Karppanen, Takahashi, Nagayama, and Kaneko are not substantially the same as Griffin.

42. The USPTO finally cited to Lin and stated that although Lin did not discuss an air path cooling a display, the vents at the top and bottom sides of the

case would inherently provide the air path cooling the display panel 10. *Id.* at 193-194. Fig. 3 of Lin is provided below as an illustrative of the alleged invention of Lin.



Ex. 1008, Fig. 3.

43. From my review of Lin, the design and set-up are substantially different than that of Karppanen, Takahashi, Nagayama, and Kaneko, cited below. Accordingly, it is my opinion that Karppanen, Takahashi, Nagayama, and Kaneko are not substantially the same as Lin.

44. For claim 9, applicant argued none of the applied references show a case which has a partition plate, which divides the case into separate spaces in

which the display panel and the circuit board are mounted. Applicant also asserted that the applied references do not teach a first cooling path which "comprises the space between a rear surface of the display panel and an inner surface of the case" and a second cooling path which "comprises the space in which the circuit board is mounted" as claimed. *Id.* at 185.

45. Claims 1-7 and 9-11 were subsequently allowed, and the Examiner provided the following reasons for allowance: "Claims 1-7: Allowable subject matter was indicated in the previous office action and successfully included in the amended claims. Claims 9-11 are allowable for at least the reason that the prior art fails to teach or suggest a panel display device comprising: a case; a partition plate for dividing an interior of the case into first and second cooling fluid paths; a display panel mounted between the partition plate and a front surface of the case to be cooled by air flowing in the first cooling fluid path; and at least one circuit board mounted between the partition plate and a rear surface of the case to be cooled by air flowing in the second cooling fluid path, wherein the partition plate divides the case into a first space in which the display panel is mounted and a separate second space in which the circuit board is mounted, and wherein the first cooling path comprises the space between a rear surface of the display panel and an inner surface of the case and the second cooling path comprises the space in which the circuit board is mounted." Ex. 1002, 169.

46. After the Notice of Allowance, applicant filed a supplemental Information Disclosure Statement to disclose a Chinese patent office communication and prior art cited by the Chinese patent office during prosecution of a counterpart application. *Id.* at 163-164.

47. The Examiner and applicant had an interview during which “[i]t was agreed to amend claim 9 with additional limitation regarding to the way it is mounted to a rear surface of the case.” *Id.* at 145.

48. A Supplemental Notice of Allowability was issued, which amended claim 9 to recite “wherein at least one circuit board is mounted to a circuit board mounting part provided on a rear surface of the case.” *Id.* at 147.

49. The application issued as U.S. Patent 7,687,964 on February 23, 2010. *Id.* at 131.

50. Two years later, on February 23, 2012, applicant filed a reissue application, seeking to add a new independent claim 11 and new dependent claims 12-22. *Id.* at 128.

51. The claims were ultimately allowed on April 29, 2014 and the ’117 Patent issued on September 9, 2014. *Id.* at 1, 3.

VII. Overview of Certain Prior Art References

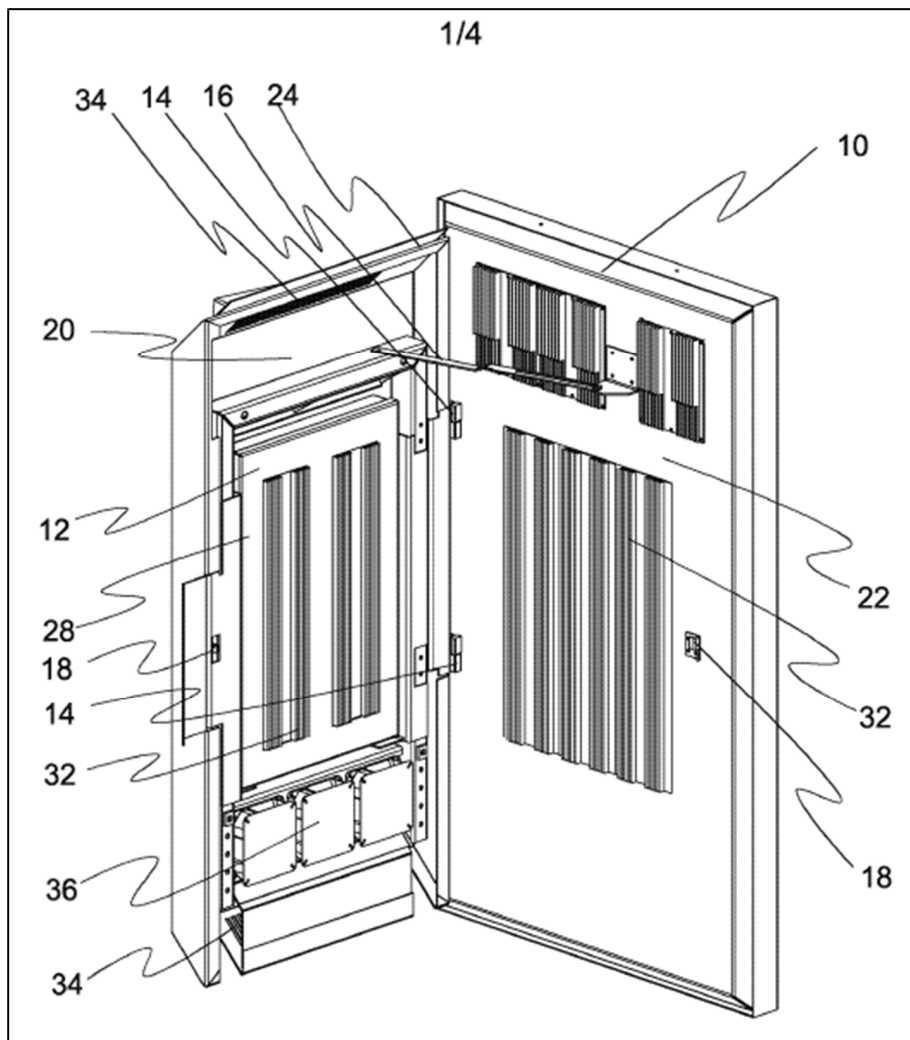
52. In preparing my declaration in support of the Petition, I have reviewed each of the prior art references cited above in the references considered. I include

here a brief overview of each of the Karppanen, Takahashi, Nagayama, and Kaneko references before proceeding with my opinions as to why claims 1, 2, and 5 are each invalid in view of the prior art.

A. Karppanen – WO 2007/116116 (Exhibit 1009)

53. International Patent Publication No. 2007/116116A1 (“Karppanen”), entitled “Electronic Information Board,” was filed as a PCT Application on April 11, 2006, and published on October 18, 2007, and is thus prior art to the ’117 Patent. Citations to Karppanen are to the page and line numbers as internally numbered.

54. Karppanen “relates to an electronic information board comprising a frame (40), a flat display element (26), such as a TFT LCD display or plasma display for presenting information, and electronic equipment for controlling the display element.” Ex. 1009, Abstract. Each of these elements are shown in Figure 1 below:



Id. at Fig. 1

55. Karppanen further discloses that “[i]n the back wall 22 of the display casing and the back cover 28 of the device casing there are cooling elements 32, by which heat is transferred from the inside of the device casing and the display casing to the cooling air in the cooling space 20.” *Id.* at 7:11-14. Further, “[i]n the cover 24 there are cooling fans 36, by which the circulation of air through the cooling space is regulated. The temperature and speed of flow of the air in the

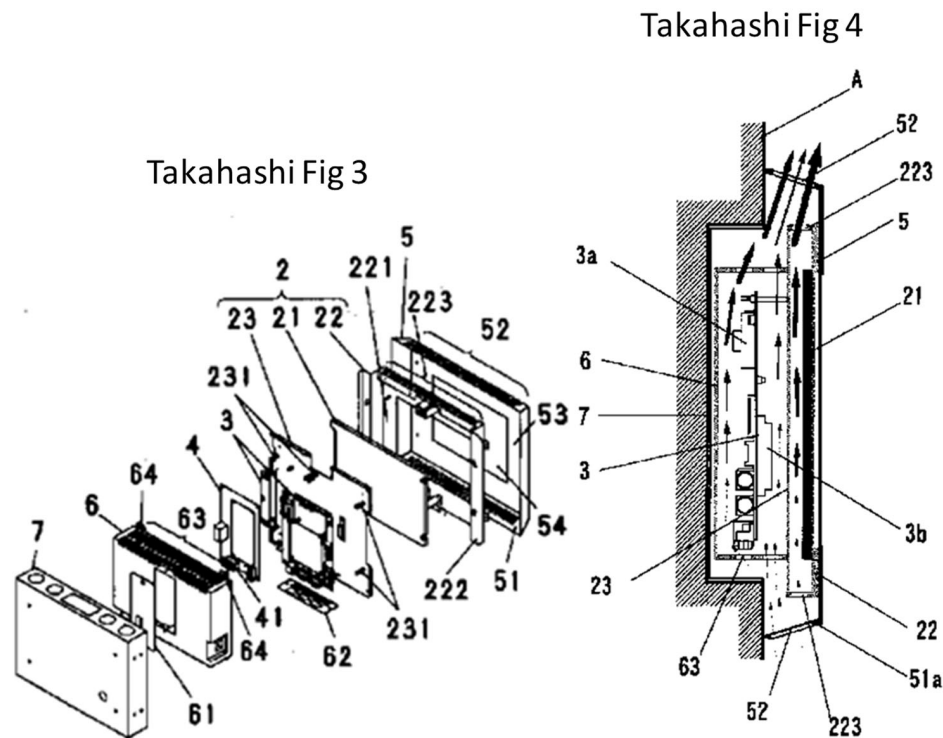
cooling space and thereby the transfer of heat from the cooling elements to the air is thus regulated with an air flow achieved by means of cooling fans.” Ex. 1009, 7:21-25.

56. Karppanen also discloses a “control system can be made for controlling the temperatures of the device casing individually, or it can be integrated as a part of the temperature control system of the display casing.” Ex. 1009, 10:28-30. In the “temperature control system” of Karppanen, the “temperature of the display casing is measured by temperature sensors (not shown), and the measurement data is transmitted to a control unit located in the device casing. On the basis of the measurement results, the control unit regulates, according to need, the operation of the cooling fans 68 and the fans 64 in the display casing as well as the operation of the cooling fans 36 in the cooling space for achieving a suitable operating temperature in the display casing.” Ex. 1009, 9:30-36.

**B. Takahashi – Japanese Patent Publication JP2003-075858
(Exhibits 1010-1011)**

57. Takahashi, entitled “Heat dissipation structure of wall embedded liquid crystal panel unit,” published on March 12, 2003, and is thus prior art to the ’117 Patent.

58. Takahashi relates to a heat dissipation structure of a wall embedded liquid crystal panel unit containing a liquid crystal panel together with a drive circuit, etc. Ex. 1011, Summary. Takahashi, Figs. 3 and 4 are shown below:



Ex. 1011, Figs. 3-4.

59. As shown above, the liquid crystal panel body 21 and the electronics 3, are contained within rear cover 6 and front cover 5. The front liquid crystal panel cover is 22 and the rear liquid crystal panel cover is 23. The printed circuit board is mounted on the rear surface of rear liquid crystal panel cover 23 using spacers 231 (as seen in Ex. 1011, Fig 3). Rear cover 6 covers the printed circuit board section of rear panel cover 23. Ex. 1011, [0016]-[0018].

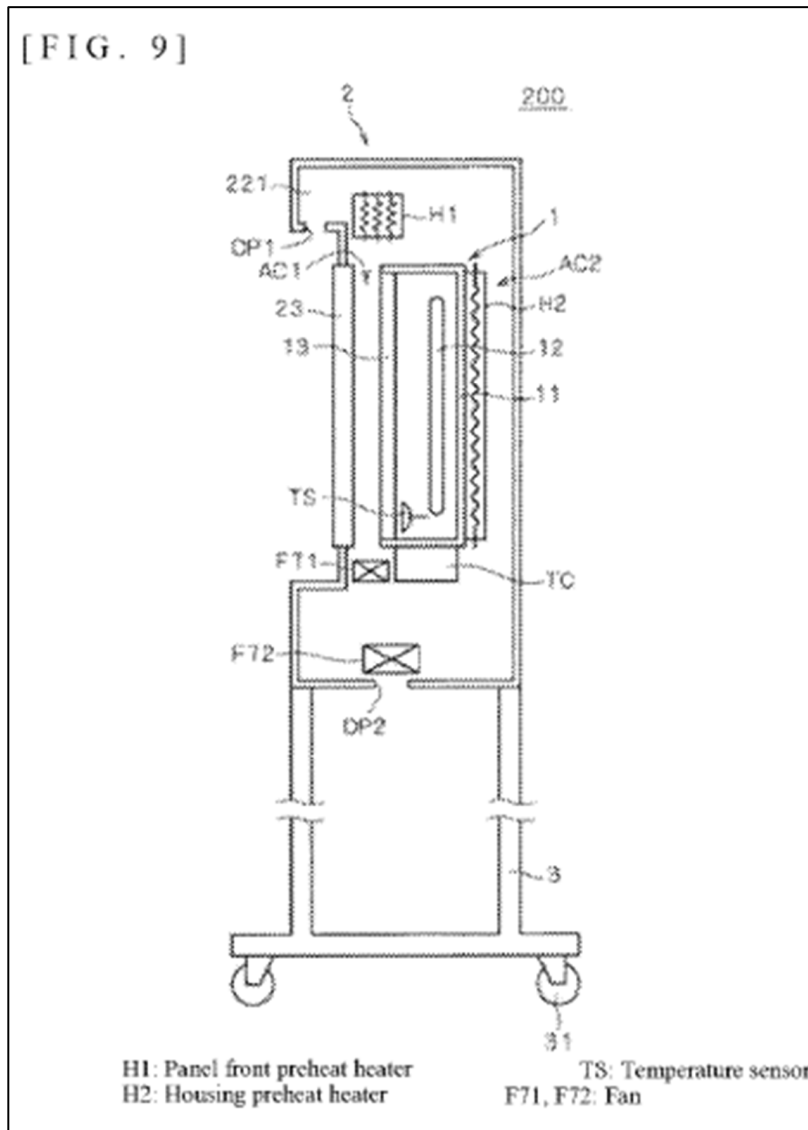
60. Takahashi discloses two separate cooling air flow paths. The first is between the LC panel body 21 and the rear LC panel cover 23 to cool the LC panel. The second is in the cavity created by LC panel cover 23 and rear cover 6 to cool the printed circuit board electronics. Ex. 1011, Fig. 3.

C. Nagayama – Japanese Patent Publication JP2006-163217A (Exhibits 1012-1013)

61. Japanese Patent Publication No. 2006-163217A (“Nagayama”), entitled “Outdoor Display Device,” published on June 22, 2006, and is thus prior art to the ’117 Patent.

62. Nagayama relates to “an outdoor display device” “that can efficiently dissipate heat generated from a flat panel type display device.” Ex. 1013, Abstract, [0001].

63. The “outdoor display device” of Nagayama has a flat panel display 13, a box (case) 2, an airflow generating means, F11, F12, and multiple airflow paths AC1, AC2 to dissipate heat. *See Id.* at Abstract, [0009], [0010]. The “outdoor display device” of Nagayama is shown below in Figure 9:



Ex. 1013, Fig. 9.

64. Nagayama further discloses that “[i]n the outdoor display 200 shown in Fig. 9, a liquid crystal panel front preheating heater H1 is arranged in the vicinity of the opening on the upper side of the front air passage AC1, and a housing preheating heater H2 is arranged on the back of the liquid crystal display 1. A temperature sensor TS (temperature measurement means) is attached to the

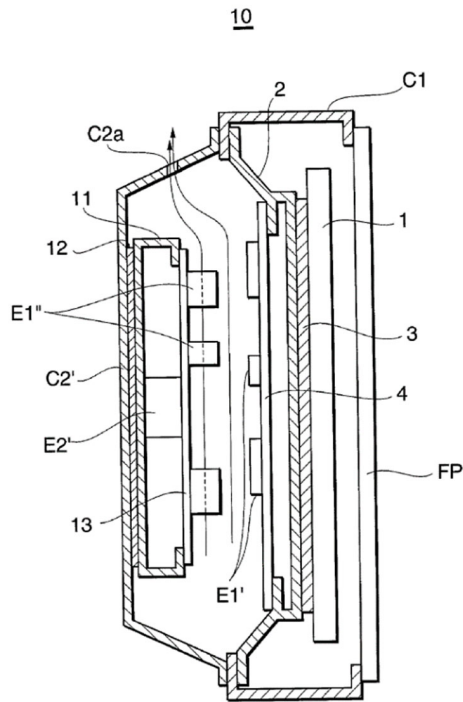
back surface of the liquid crystal panel 13.” Ex. 1013, [0071]. “In addition, a fan F71 is arranged in the vicinity of the opening on the lower side of the front air passage AC1 and a fan F72 is arranged in the vicinity of the opening OP2 on the bottom side of the device box 2.” *Id.* at [0072]. Moreover, Nagayama explains that the “liquid crystal panel front surface preheating heater H1, housing preheating heater H2, temperature sensor TS, and fans F71 and F72 are controlled by the liquid crystal panel temperature control board TC.” *Id.* at [0073].

D. Kaneko – US 2002/0014840 (Exhibit 1014)

65. U.S. Patent Application Publication No. 2002/0014840 A1 (“Kaneko”), entitled “Heat Dissipation Structure of Plasma Display Panel Device,” published on February 7, 2002, and is thus prior art to the ’117 Patent.

66. Kaneko relates to a structure for dissipating heat generated in a drive unit of a plasma display panel in a plasma display panel device. Kaneko, Fig 1 is shown below:

FIG.1



Ex. 1014, Fig. 1.

67. Plasma panel 1 and circuit board 4 are enclosed in a case comprising front panel FP, side case C1 and rear case C2'. Ex. 1014, [0052]. Circuit board 4 is mounted on the rear surface of chassis 2. *Id.* at [0053]. A cooling airflow path within the cavity formed by the rear surface of chassis 2 and the rear case C2' provides cooling for the electronics E1' and circuit board 4. Ex. 1014, [0051]-[0058].

68. Kaneko also teaches that an additional heat dissipative chassis 11 may be mounted to the rear case 2 and that circuit board 13 may be mounted to chassis 11. *Id.* at [0052], [0056]. The aforementioned cooling airflow also cools circuit board 13 and associated electronics.

69. I note that the references cited above use the term “dissipation” to describe a heat “removal” structure of a plasma display panel device. Therefore, for the purposes here, I will use the terms “heat dissipation” and “heat removal” interchangeably.

E. Motivations to Combine

70. As discussed in further detail below and in the next section, a POSITA would have been motivated to combine each of the above identified prior art references with one or more other prior art references. As described in the background section of the ’117 Patent, and demonstrated by the prior art, a POSITA at the time of the alleged invention would have been familiar with various display devices and their components—*e.g.*, a display panel, circuit board, and case—and techniques for heat dissipation and cooling of display devices. *See* ’117 Patent, at 1:32–51. Thus, the heat dissipation method and design claimed in the ’117 Patent simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

71. Further, a POSITA would have been motivated to consider and combine these prior art references because they are in the same field of electronic displays and techniques and designs, they were directed to solving the same problems that the ’117 Patent purports to address—temperature increase in the interior of the case due to heat produced by the display panel and circuit board

housed therein, which can lead to degradation of the display panel (*see* '117 Patent, at 1:43–51)—and were implementing similar techniques to address the problems. *See, e.g.*, Ex. 1009, 3:21–26 (“The invention relates to an electronic information board comprising a frame, a flat display element, such as a TFT LCD display or plasma display for displaying information, and electronic equipment for controlling the display element. The basic idea of the invention is that the display element and the electronics required for controlling the display are located separately from each other for facilitating the arrangements for temperature control and cooling of the information board.”); Ex. 1011, Summary (“A heat dissipation structure of a wall-embedded liquid crystal panel unit in which the panel unit body is housed in a front cover 5, which is fixed such that the liquid crystal panel 2 is exposed from the front surface, is attached to a mounting surface such as a wall surface. The front face of the front cover 5 is mounted protruding from the mounting surface A and a plurality of vent openings 52 are provided at the perimeter wall 51 of the projection to vent and dissipate heat generated from the mounting parts of the printed circuit board inside the panel unit body via the vent openings 52.”); Ex. 1013, Summary (“A display device is provided that can efficiently dissipate heat generated from a flat panel type display device.”); Ex. 1014, [0002] (“The invention relates to a structure for dissipating heat generated in

a drive unit of a plasma display panel in a plasma display panel device.”) and [0014].

72. Further, a POSITA would have been motivated to combine these references as they sought to solve the same problems associated with temperature increase inside a display device casing on the components of the device, such as degradation of the display, and aim to provide systems for managing the temperature within the device while still providing large screens, high resolution graphics, and displays that are protected from the environment. *See, e.g.*, Ex. 1009, 1:25-30 (“The problem is that when used in environments having high temperatures, the temperatures of the display devices easily rise too high. On the other hand, in cold environments there is the danger that the temperatures of the display devices fall too low. In both operation situations it is important that the temperatures at different points inside the display device can be kept as constant as possible.”); Ex 1011, Summary (“Provide a heat dissipation structure for wall embedded liquid crystal panel units.”); Ex. 1013, Summary (“A display device is provided that can efficiently dissipate heat generated from a flat panel type display device.”); Ex. 1014, [0006], [0018].

73. As another example, the references (with exemplary citations) solve one or more of the same problems of the ’117 Patent, including, increased temperature in the display device casing due to heat generating components, for

example, by separating the heat-generating components so that they may be individually cooled: Ex. 1009, 6:16-31 (“...The separation of the display element and control electronics from each other and placing them in their own casings makes it easier to control the temperature of the information board and to arrange the cooling thereof. In this way, the structure of the information board also becomes modular, which makes the manufacture of the device simpler and faster and facilitates the performance of maintenance and updating.”); Ex. 1013, Summary (“In the device box 2, the liquid crystal display device 1 is arranged such that the liquid crystal panel 13 of the liquid crystal display device 1 and the transparent plate 23 do not adhere, and there is a gap (front air passage AC1) between the two. In addition, the liquid crystal display 1 is arranged such that a gap exists between the back side of the liquid crystal panel 13 of the liquid crystal display 1 and the wall surface of the device box 2 facing it (back air passage AC2), and a fan F1, which is a means of generating air flow in the front air passage AC1, is arranged near the opening on the lower side of the front air passage AC1, and it is configured to pump air from the lower side into the front air passage AC1.”); Ex. 1011, [0015]; Ex. 1014, [0017] (“According to the first aspect, therefore, the heat dissipating path for creating an air flow in order to dissipate the heat, generated from the heat-generating electronic components, from the plasma

display panel device into the atmosphere, can be provided sufficiently between the heat-generating electronic components, resulting in efficient heat dissipation.”).

74. Further, known design incentives and market forces would have motivated one of ordinary skill to combine these references and utilize any of these systems, for example, to provide a display device that separates heat generating components (e.g., a circuit board and display panel) and cools the components independently via independent cooling paths, to achieve an efficient, thermally manageable device with the desired size and technical specifications. One of skill in the art would understand that these limitations were standard implementations and obvious design choices for thermal management in display devices. Such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

75. It would have been obvious to combine Karppanen, which discloses an electronic information board where “[t]he information board has its own display casing for the display element and a device casing for the electronic equipment needed for controlling the display element” (Ex. 1009, 3:21-30) with the objective of improving temperature control of the device (*Id.* at 3:23-26, 6:26-29) and cooling the information board in a cost-efficient manner (*Id.* at 5:6-7) using a structure that “makes the manufacture of the device simpler and faster and facilitates the performance of maintenance and updating” (*Id.* at 6:29-31), with

Takahashi, which discloses efficient heat dissipation structures for electronic displays.

76. It also would have been obvious to combine Nagayama, which discloses a display device capable of efficiently dissipating heat generated from a flat panel display device (Ex. 1013, [0010]), with Kaneko, which is related to thermal management structures in electronic display housings, *See, e.g.*, Ex. 1014, [0017] (“According to the first aspect, therefore, the heat dissipating path for creating an air flow in order to dissipate the heat, generated from the heat-generating electronic components, from the plasma display panel device into the atmosphere, can be provided sufficiently between the heat-generating electronic components, resulting in efficient heat dissipation.”). Further, a POSITA would have been motivated to separate heat producing components and include separate cooling paths in Nagayama’s device to efficiently cool the heat producing components in Nagayama’s device without unnecessary size increase, and would have had a reasonable expectation of success in doing so as such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

VIII. Ground 1: Claims 1, 2 and 5 are invalid as obvious over Karppanen in view of Takahashi

77. In the following sections, I set forth my analysis and conclusions as to the validity of claims 1, 2, 5 of the '117 Patent based on Karppanen as the primary reference.

78. Motivations to make the asserted combinations are discussed below, but also include known market forces and recognition in the art of the predictable and known uses of these systems and components. I understand predictability of results is an important obviousness consideration. The substantial overlaps I have identified between the various references confirm that the proposed combinations would have been obvious because each combination led to predictable, well-understood results. None of the combinations I have proposed involves references “teaching away” from the combination, or would involve modifying references to be inconsistent with their purpose.

79. In 2006, a POSITA would have been aware of and familiar with various display devices and their components—e.g., a display panel, circuit board, and case— and techniques for heat dissipation and cooling of display devices. *See* Ex. 1001, 1:32–51. While some of the display and cooling technologies have evolved, the components for providing an electronic display and the principles of heat dissipation have not changed since before Karppanen, so a POSITA would have been motivated to look to Karppanen in combination with other prior art

references such as Takahashi when designing an electronic display device. Like the '117 Patent, Karppanen and Takahashi are directed to techniques and designs for minimizing temperature increase in the interior of the case due to heat produced by the display panel and circuit board housed therein, which can lead to degradation of the display panel. *See, e.g.*, Ex. 1009, 3:21–26 (“The invention relates to an electronic information board comprising a frame, a flat display element, such as a TFT LCD display or plasma display for displaying information, and electronic equipment for controlling the display element. The basic idea of the invention is that the display element and the electronics required for controlling the display are located separately from each other for facilitating the arrangements for temperature control and cooling of the information board.”); Ex. 1011, Summary (“A heat dissipation structure of a wall-embedded liquid crystal panel unit in which the panel unit body is housed in a front cover 5, which is fixed such that the liquid crystal panel 2 is exposed from the front surface, is attached to a mounting surface such as a wall surface. The front face of the front cover 5 is mounted protruding from the mounting surface A and a plurality of vent openings 52 are provided at the perimeter wall 51 of the projection to vent and dissipate heat generated from the mounting parts of the printed circuit board inside the panel unit body via the vent openings 52.”). One of skill in the art would have considered Karppanen’s teachings about heat dissipation and considered different, available cooling

methods and arrangements of components to produce the desired electronic display device.

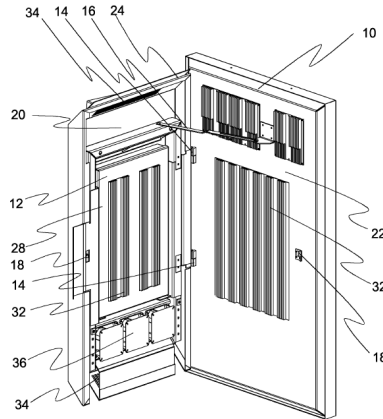
A. Claim 1

80. Element [1pre]: “A panel display device comprising:”

81. I understand the preamble is not a limitation. Nevertheless, Karppanen discloses a panel display device. Ex. 1009, Abstract, 1:3-5, 3:8-15, 3:21-34, claim 1, Figs. 1-4.

82. For example, Karppanen discloses “an electronic information board comprising a frame (40), a flat display element (26), such as a TFT LCD display or plasma display for presenting information, and electronic equipment for controlling the display element.” *Id.* at Abstract. Karppanen also discloses “[t]he invention relates to an electronic information board comprising a frame, a flat display element for presenting information and electronic equipment for controlling the display element” (*Id.* at 1:3-5) and “an electronic information board comprising a frame, a flat display element, such as a TFT LCD display or plasma display for displaying information, and electronic equipment for controlling the display element” where “the display element and the electronics required for controlling the display are located separately from each other for facilitating the arrangements for temperature control and cooling of the information board.” *Id.* at 3:21-26. In addition, “the information board has a modular structure, which also

facilitates the maintenance and updating of the device” and “[t]he information board has its own display casing for the display element and a device casing for the electronic equipment needed for controlling the display element.” *Id.* at 3:27-30.



Id. at Fig. 1.

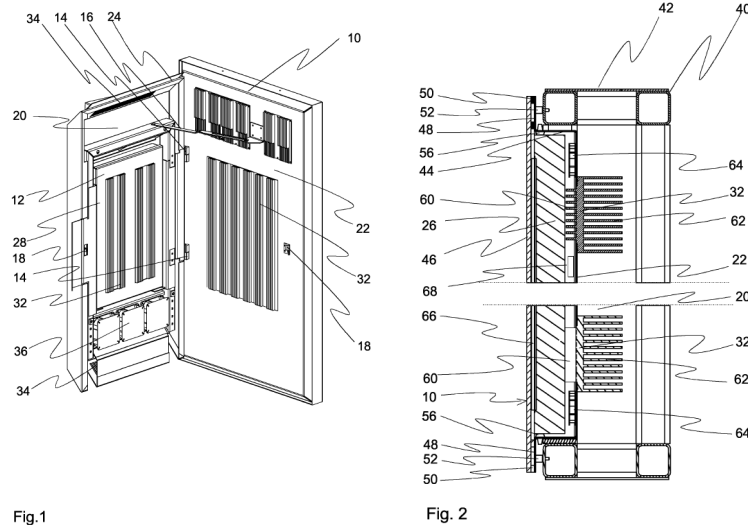
83. Therefore, it is my opinion that Karppanen discloses Element [1pre].

84. **Element [1a]: “a case”**

85. Karppanen discloses this a panel display device with a case. Ex. 1009, Abstract, 3:21-32, 6:16-31, 7:7-25, claim 1, Figs. 1-2.

86. For example, Karppanen discloses “[t]he information board has a weatherproof display casing (10) for the display element and a weatherproof device casing (12) for the electronic equipment needed for controlling the display element.” Ex. 1009, Abstract. The ’117 Patent similarly discloses a front and rear case. Ex. 1001, 2:53-57. Further, Karppanen describes “[t]he information board has a closed display casing 10, to the back wall 22 of which a cover 24 opening on

hinges 14 has been connected” and “[t]he display element 26 of the information board (Fig. 2) has been placed inside the display casing, and the electronic equipment needed in the control of the display element have been placed inside the device casing.” *Id.* at 6:16-24. In addition, Karppanen states “[i]n normal use, the display casing and the device casing are turned against each other to a closed position and locked to each other by locking means 18 on one side of the casings.” *Id.* at 7:7-25.



Id. at Figs. 1, 2.

87. As shown in these Figures, Karppanen disclose two cases: the display case 10 containing the flat display panel, and the device case 12 containing the electronics for controlling the display. *Id.*

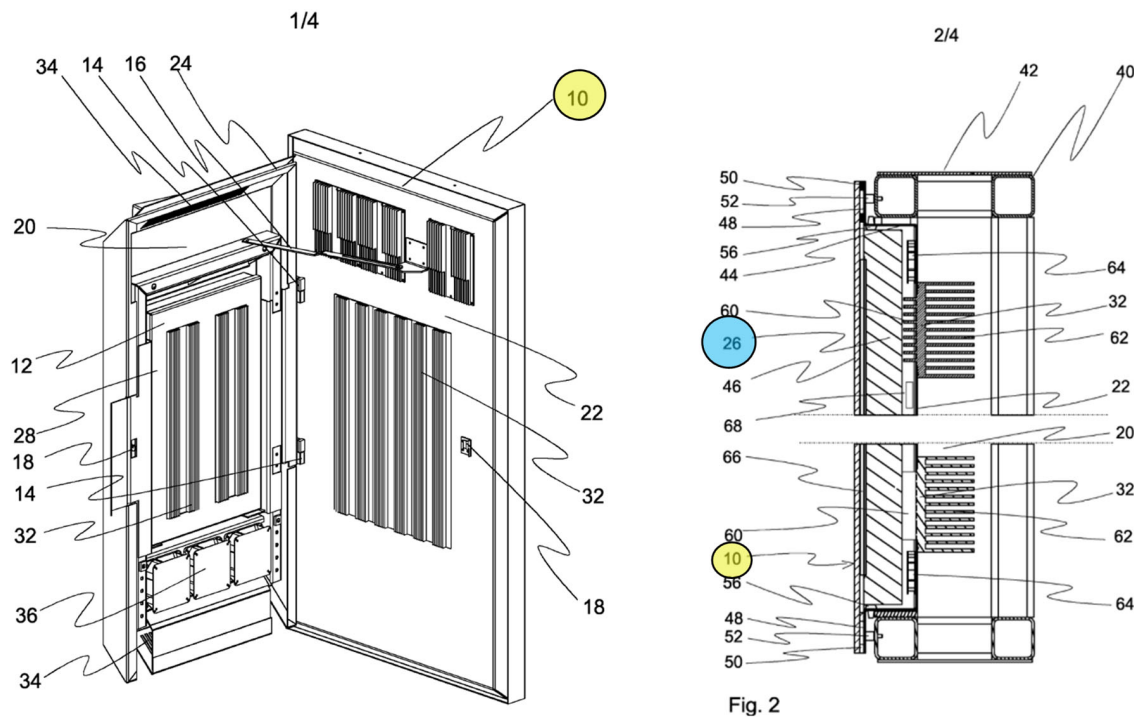
88. Therefore, it is my opinion that Karppanen discloses Element [1a].

89. **Element [1b]: “a display panel mounted in an interior of the case”**

90. Karppanen discloses a display panel mounted in an interior of the case. *See, e.g.*, Ex. 1009, Abstract, 1:16-22, 3:21-34, 6:16-31, 7:7-25, 7:31-32, 8:4-11, claim 1, Figs. 1, 2.

91. For example, Karppanen describes “display element 26 of the information board (Fig. 2) has been placed inside the display casing” (*Id.* at 6:16-31) and the display element 26 “is supported at its edges by support elements 56 to the edge part of the display casing in a way that there remains a gap enabling the circulation of air between the walls of the display casing and the outer surface of the display element” and “is preferably a TFT LCD display, which withstands static information significantly better than other display techniques,” but “can also be some other suitable, flat electronic display element, such as a plasma display, a LED display or an organic LED display.” *Id.* at 8:4-11.

92. Annotated Figures 1 and 2 below show the display panel 26 (blue) in the interior of the display case 10 (yellow). The front plate 46 and the back wall 22 are parts of the display case 10. *Id.* at 7:31-32 (“A display casing 10 comprising a back wall 22, a transparent front plate 46”).



Id. at Figs. 1-2.

93. Moreover, Karppanen explains this limitation was known and disclosed in the prior art: “The display of an electronic information board can be implemented by using any prior art display device technology. For the present, the most advantageous display technology for display devices of a few square metres and less is the TFT LCD technology, which provides the advantages of a large viewing angle, a short 20 response time, good contrast and reliability of the display. In addition to TFT LCD displays, other electronic display solutions, such as plasma displays, can be used in information boards.” Ex. 1009, 1:16-22.

94. Petitioner’s construction of “display panel” is “a flat type screen on which images are displayed, such as a Liquid Crystal Display or Plasma Display

Panel”. Karppanen teaches both a Liquid Crystal Display (“LCD”) and a plasma display. *Id.* at 1:16-22. Samsung’s construction is “flat-type electronic display for displaying images. Karppanen teaches this as well, disclosing a flat electronic display element. *Id.* at 8:4-11. Karppanen therefore discloses “a display panel” under either party’s construction.

95. Therefore, it is my opinion that Karppanen discloses Element [1b].

96. **Element [1c]: “at least one circuit board which controls the display panel”**

97. Karppanen discloses at least one circuit board which controls the display panel. Ex. 1009, Abstract, 1:3-5, 2:1-5, 3:21-34, 3:60-65, 6:16-31, claim 1, Figs. 1-4.

98. For example, Karppanen discloses “electronic equipment” that is “needed in the control of the display element” and “includes a programmable control unit with its power supply for controlling the display, and the power supplies of the background light of the display.” *Id.* at 6:16-31. At the relevant time, it is my opinion that it was widespread common knowledge (and a POSITA would know) that electronic equipment for controlling the displays described in Karppanen invariably comprises one or more circuit boards.

99. It is therefore my opinion that Karppanen discloses Element [1c].

100. Element [1d]: “a first cooling fluid path which cools the display panel”

101. Karppanen discloses a first cooling fluid path which cools the display panel. Ex. 1009, Abstract, 2:21-3:6, 3:8-15, 3:21-34, 4:29-36, 8:4-11, 9:3-13, 9:34-36, 10:6-18, claim 1, Figs. 1-4.

102. For example, Karppanen discloses “the display element is supported at its edges to the edge part of the display casing by support elements so as to form a gap enabling the circulation of air between the walls of the display casing and the outer surface of the display element,” which is a first cooling fluid path which cools the display panel. *Id.* at 4:29-32.

103. In addition, Karppanen states “[p]referably, there are fans inside the display casing for circulating air in the space between the walls of the display element and the display casing, and ducting has been arranged between the walls of the casing and the display element for directing the circulation of air around the display element.” *Id.* at 4:32-36; *see also* Ex. 1009, 8:4-11 (“Inside the display casing there is a display element 26, which is supported at its edges by support elements 56 to the edge part of the display casing in a way that there remains a gap enabling the circulation of air between the walls of the display casing and the outer surface of the display element. The display element is preferably a TFT LCD display, which withstands static information significantly better than other display

techniques. However, the display element can also be some other suitable, flat electronic display element, such as a plasma display, a LED display or an organic LED display.”). *Id.* at 10:6-18.

104. Further, Karppanen states “Inside the display casing on the back wall 22 there are fans 64, which circulate air in the space between the display element and the walls of the display casing. Suitable ducting 66 has been arranged between the display casing and the display element so that an air flow circulating the display element and equalizing the temperatures can be arranged by means of the fans. The fans 64 force the air of the inner casing to flow past the front plate 46 of the device. In cool conditions, the temperature of the front plate is naturally low. When the thermal conductivity of the front plate is selected suitably, the cool surface of the front plate cools the air flowing between the front plate and the display element. The fans circulating the air inside the display casing can be fastened so that when required, they can be easily changed in connection with the maintenance measures.” Ex. 1009, 9:3-13.

105. The first cooling fluid path for cooling the display panel described in Karppanen is shown in annotated Figure 2 below:

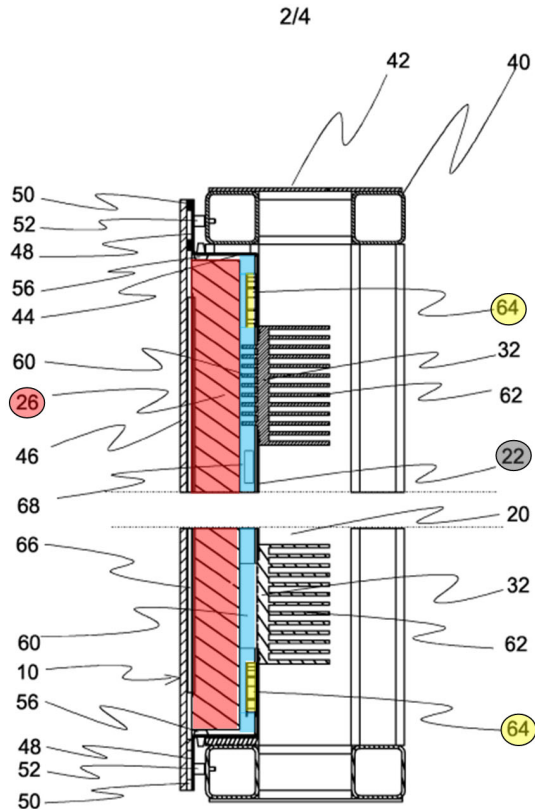


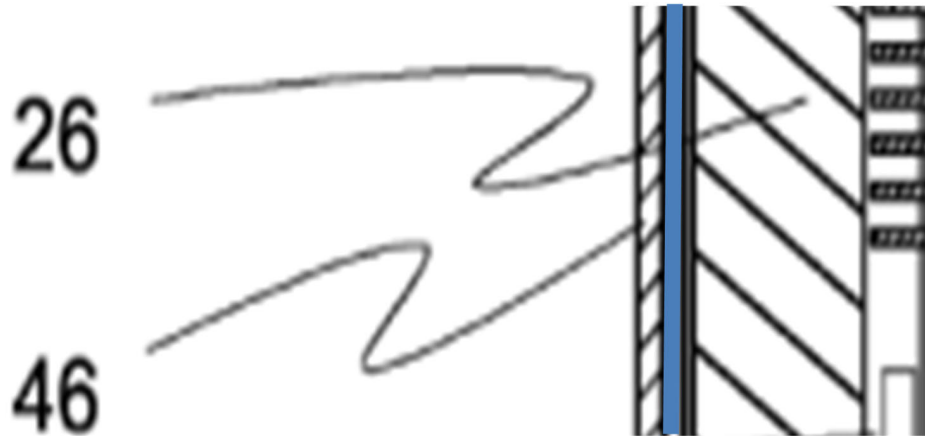
Fig. 2

Id. at Fig. 2.

106. Elements 64 (yellow) are the fans. Elements 60 and 62 are heat transfer parts. Element 22 is the back wall of the display casing 10. The blue area is a first cooling fluid path which cools the display. There is a secondary airflow in the display case 10 between the front plate 46 and the display element 26. Therefore, it is my opinion that each of these (primary and secondary) airflows independently constitute the claimed “first cooling fluid path.”

107. Thus, the gap or air channel between the display 26 and front plate 46 constitutes an additional cooling airflow path in the display case 10 which cools

the display. The blue area is the additional cooling airflow path in display case 10 as seen in the expanded annotated view of Fig 2 below:



Ex. 1009, Fig. 2.

108. Karppanen also describes the use of fans to specifically cool the display panel: “the control unit regulates, according to need, the operation of the cooling fans 68 and the fans 64 in the display casing as well as the operation of the cooling fans 36 in the cooling space for achieving a suitable operating temperature in the display casing.” Ex. 1009, 9:33-36.

109. It is therefore my opinion that Karppanen discloses Element [1d].

110. **Element [1e]: “a second cooling fluid path which cools the circuit board”**

111. Karppanen discloses a second cooling fluid path which cools the circuit board. Ex. 1009, Abstract, 3:21-23, 7:21-25, 8:4-11, 9:3-13, 10:6-18, 10:20-23, claim 1, Figs. 1-4.

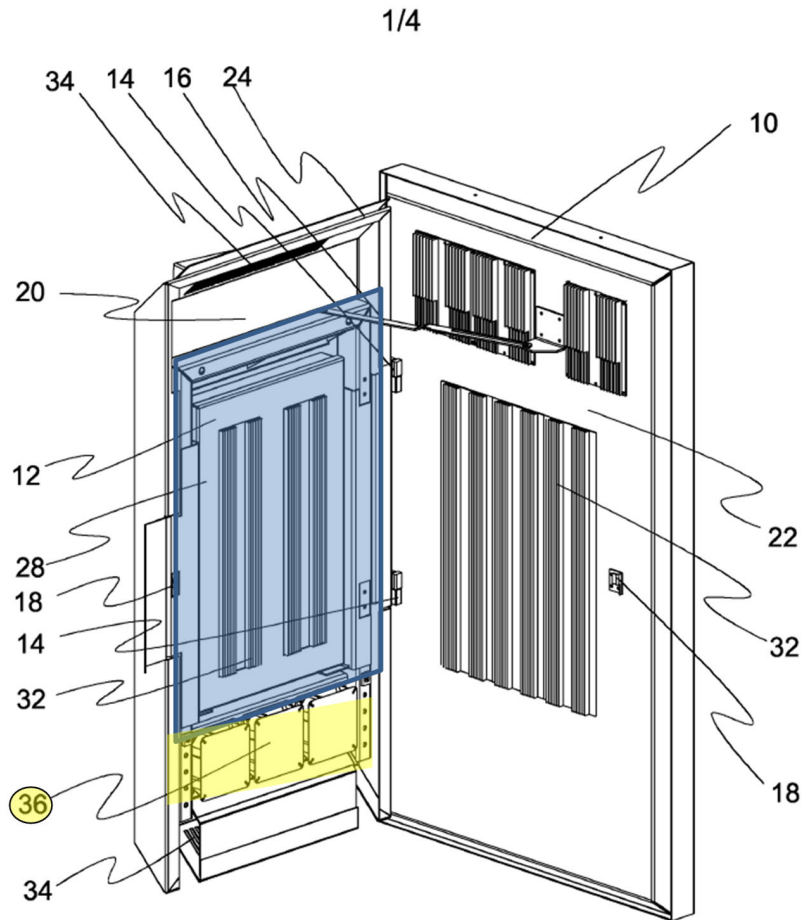
112. For example, Karppanen discloses “the device casing has a back cover bordered to the cooling space, having cooling elements for transferring heat from the device casing to the cooling space,” which is a second cooling fluid path which cools the circuit board. *Id.* at Abstract. Further, Karppanen states “[t]he basic idea of the invention is that the display element and the electronics required for controlling the display are located separately from each other for facilitating the arrangements for temperature control and cooling of the information board.” *Id.* at 3:23-26. In addition, “the device casing contains at least the control unit of the information board, the power supply of the control unit and the power supply of the background light of the display.” *Id.* at 3:28-34.

113. Karppanen also describes “cooling of components in the device casing 12 can be implemented by a corresponding cooling solution as described above in connection with the display casing.” *Id.* at 10:20-23.

114. There is a second cooling fluid path for cooling the circuit board in Karppanen’s device (electronics) casing 12. Karppanen teaches that “device casing (12) for the electronic equipment needed for controlling the display element.” *Id.* at Abstract. At the relevant time, it was widespread common knowledge (and a POSITA would know) that electronic equipment invariably comprises circuit boards.

115. Karppanen also explains that the device case 12 cooling is achieved in a similar way to the display case 10 cooling: “The warming and cooling of components in the device casing 12 can be implemented by a corresponding cooling solution as described above in connection with the display casing. Then the cooling or warming air flow circulates as forced past all the components becoming warmed.” Ex. 1009, 10:20-23. And, Karppanen teaches that cooling fans 36 are mounted in the cover 24 of the device case 12. *Id.* at 7:21.

116. Thus, as shown in annotated Figure 1 below, fans 36 (yellow) are located on the cover 24 and the blue area is the second cooling path inside device case 12 under back cover 28 of the device casing 12 (that is between the cover 24 and the back cover 28).



Id. at Fig. 1.

117. It is therefore my opinion that Karppanen discloses Element [1e].

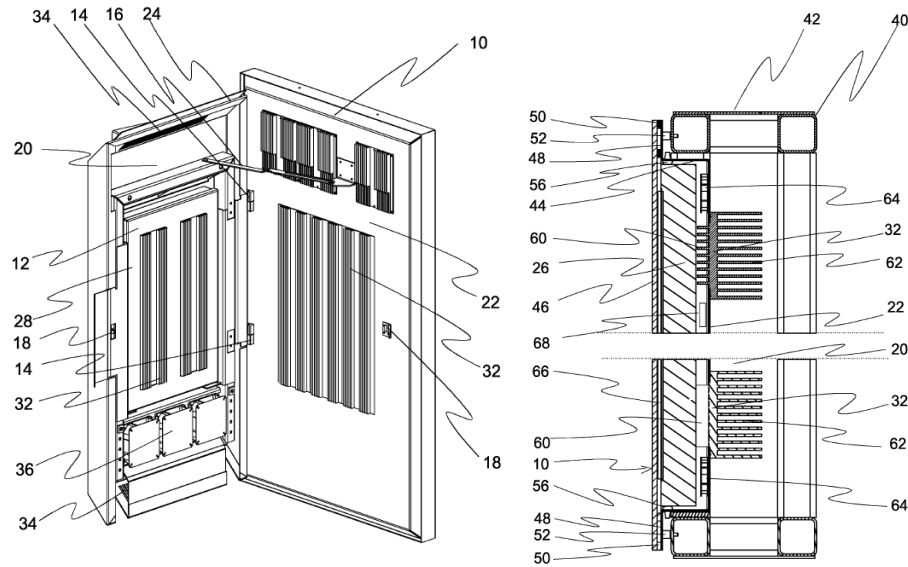
118. **Element [1f]: “wherein the first and second cooling fluid paths are separated from each other”**

119. Karppanen discloses the first and second cooling fluid paths are separated from each other. Ex. 1009, Abstract, 1:24-32, 2:18-29, 2:21-36, 3:8-15, 3:21-34, 3:38-4:3, 8:4-11, 9:3-13, 10:20-23, claim 1, Figs. 1-4.

120. For example, Karppanen discloses “[t]he information board has a weatherproof display casing (10) for the display element and a weatherproof

device casing (12) for the electronic equipment needed for controlling the display element,” “[t]he display casing has a back wall (22) bordered to the cooling space, having cooling elements for transferring heat from the display casing to the cooling space,” and “the device casing has a back cover bordered to the cooling space, having cooling elements for transferring heat from the device casing to the cooling space.” *Id.* at Abstract.

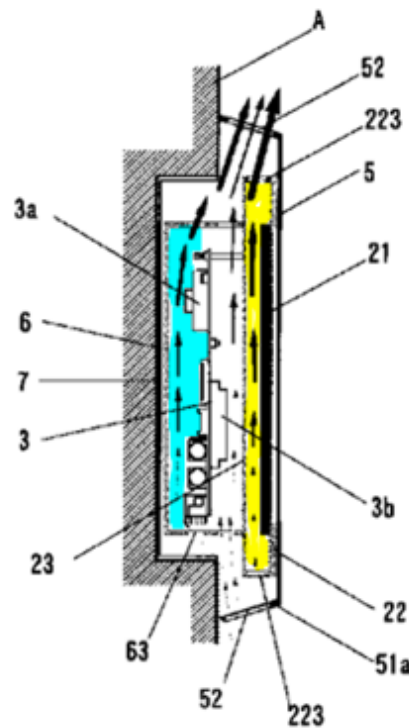
121. As set forth above in elements [1d] and [1e], Karppanen discloses a cooling fluid path for cooling the display element and a cooling fluid path for cooling the circuit board and that the display element and circuit board are separated from each other. Thus, Karppanen discloses the two cooling fluid paths are separate air flow paths. Further, as shown below in Figure 1 of Karppanen, the display case 10 and the device case 12 are separate where device case 12 is attached to the back of display case 10 by hinges 14 and locking means 18. *See Id.* at 7:9-11 (“In the closed position, there remains a cooling space 20 between the display casing and the device casing, delimited by the cover 24 and the display casing (Fig. 2).”).



Ex. 1009, Figs. 1-2.

122. Karppanen does not, however, expressly state that the paths are separate. Takahashi cures this deficiency.

123. Takahashi discloses element 1f, illustrating distinct air flow (cooling fluid) paths. As shown in the below annotated Figure, the flow paths shown by the arrows in Takahashi are separated by circuit board 3 (and elements 3a and 3b), as well as by a third path (the arrows left uncolored that are between the yellow and blue sections). Ex. 1011, Abstract.



124. Additionally, Takahashi discloses “the wall embedded liquid crystal panel unit 1 is divided into two space front and back by the rear surface liquid crystal panel cover 23, and a portion of the rear space is divided into almost two central and rear by the driving printed circuit board 3, forming three large spaces forward, central, and rear.” Ex. 1011, [0026]. Accordingly, it is my opinion that POSITA would understand that the fluid cooling paths of Takahashi are separated by at least rear surface liquid crystal panel cover 23.

125. From my review of the claim limitation, the Figures of the references cited in prosecution, and my knowledge of a POSITA, it is my opinion the paths in Takahashi are separated. The claims do not require a separated inlet and outlet from the ambient air. In other words, the claims require that the first cooling fluid

path and the second cooling fluid path are separated *in the device*. The ‘117 Patent clearly supports this, explaining that the paths are separate to keep the heat from one path from influencing the heat from the other path. *See* Ex. 1001, 3:47-55.

126. A POSITA would have been motivated to combine Karppanen with Takahashi as they sought to solve the same problems associated with temperature increase inside a display device casing on the components of the device, such as degradation of the display, and aim to provide systems for managing the temperature within the device while still providing large screens, high resolution graphics, and displays that are protected from the environment. A POSITA would have been motivated to include separate cooling paths in Karppanen’s device, such as those described in Takahashi, to efficiently cool the heat producing components, and would have had a reasonable expectation of success in doing so as such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

127. Therefore, it is my opinion that Karppanen in combination with Takahashi discloses element [1f].

128. **Claim 1g – wherein the case includes a circuit board mounting part provided on a rear surface of the case and partitioned from a space in which the display panel is mounted such that the circuit board is received in the circuit board mounting part,**

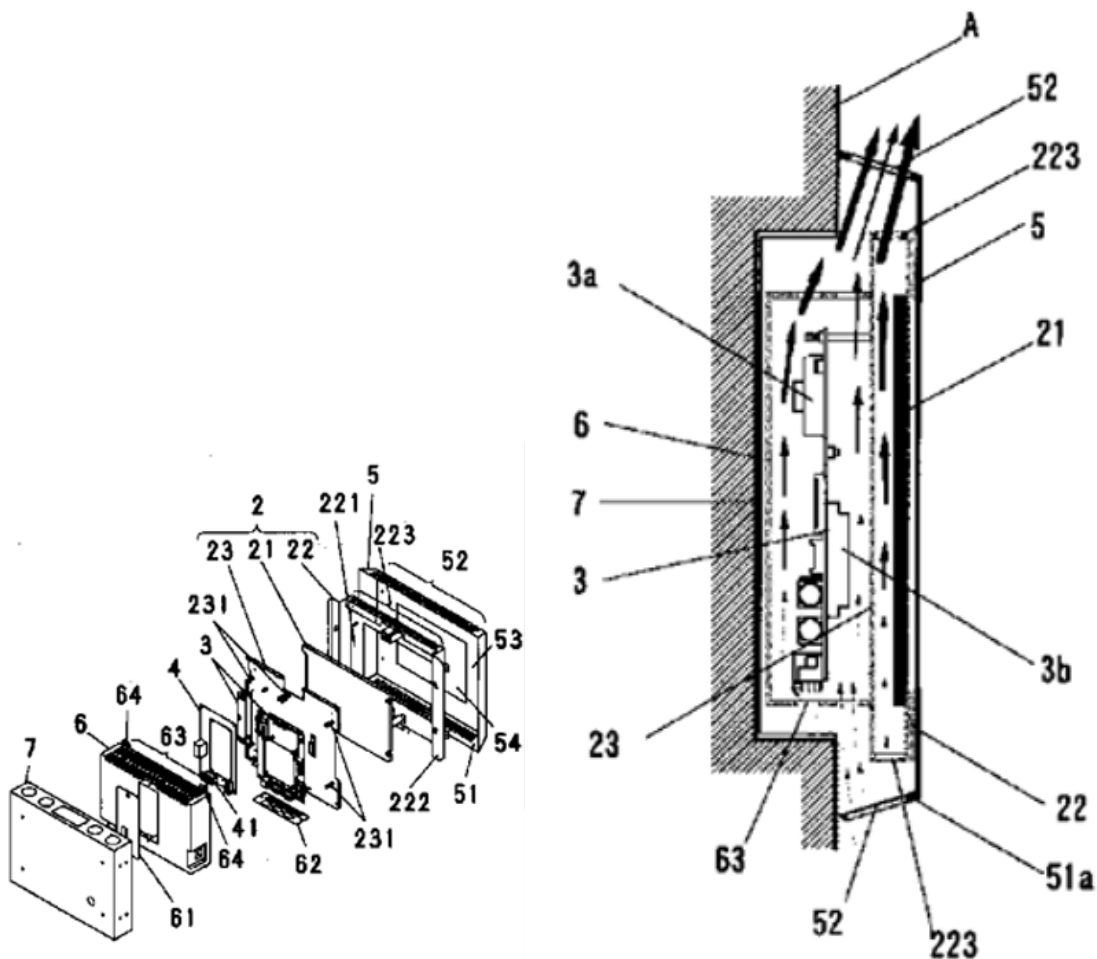
129. Karppanen illustrates the limitations in this claim element. Ex. 1009, Abstract, 3:21-34, 6:21-24, 8:4-11, 10:6-18, 10:20-23, claim 1, Figs. 1-2.

130. Karppanen discloses “a device casing for the electronic equipment needed for controlling the display element” (Ex. 1009, 3:21-34), which is attached to back wall 22 (the rear surface) of display case 10 using hinges 14 and locking means 18 (*Id.* at 6:17-18). Further, “closed device casing 12 has been fastened to the bottom of the cover” and “the electronic equipment needed in the control of the display element have been placed inside the device casing.” *Id.* at 6:21-24. Karppanen’s device case 12 corresponds to the ’117 Patent’s circuit board mounting part. Device case 12 is attached to the rear surface (back wall 22) of display case 10 using hinges 14 and locking means 18. *Id.*

131. Further, Karppanen’s circuit board mounting part (device case 12) is partitioned from the “display casing” in which the display panel is mounted (interior of display case 10). Ex. 1009, 3:21-34, 6:21-24. The display case back wall 22 completely seals off the interior of the display case 10 from the device case 12. The display is inside the display casing 10 and the display casing is sealed. The device case 12 contains the display control electronics: “The information board has a weatherproof display casing (10) for the display element and a weatherproof device casing (12) for the electronic equipment needed for controlling the display element.” *Id.* at Abstract.

132. Under MRI's construction, "circuit board mounting part" is subject to 35 U.S.C. § 112, ¶ 6, with the function being to receive and mount the circuit board and structure being the specific structure recited in column 3, lines 3-65 and illustrated in Figures 1-2 of the '117 Patent. Karppanen does not explicitly teach this limitation. Takahashi cures this deficiency.

133. For example, Takahashi discloses a circuit board mounting part recessed from rear to front of the rear case. As shown in Figures 3 and 4 below, the circuit board mounting part in Takahashi is recessed from rear to front of the rear case and provides a space in which the circuit board is mounted, as described for Figures 1 and 2 in the '117 Patent:



Takahashi, Figs. 3-4; *see also Id.* at [0018], explaining that the “partition within the panel unit body [that] separates the front side arranged by the liquid crystal panel body 21 and the two spaces arranged by the driving printed circuit board 3, preventing the distribution of heat between each space.”

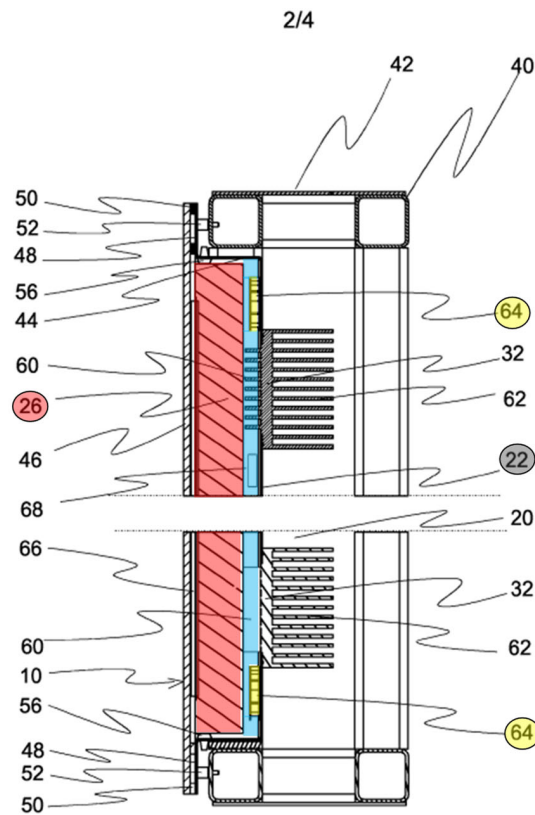
134. A POSITA would have been motivated to use the circuit board mounting part disclosed in Takahashi in Karppanen’s device to save space while maintaining separation of heat generating components for efficient cooling. This

would have been an obvious design choice and one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

135. Therefore, it is my opinion that the combination of Karppanen and Takahashi teach element [1g].

136. **Claim 1h – the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the case, and**

137. As explained in [1d] above, Karppanen describes a “first cooling fluid path” that cools the display panel. *See* Ex. 1009, Fig. 2(annotated):



138. More specifically, the first cooling path is between the rear surface of the display panel and the inner surface of the back wall 22 of the display casing.

139. Therefore, it is my opinion that Karppanen teaches element [1h].

140. **Claim 1i – the second cooling fluid path includes an internal space of the circuit board mounting part.**

141. As explained in [1e] above, the second cooling path is in the internal space of the device casing 12 (the corresponding structure of the '117 Patent's "circuit board mounting part"). For example, Karppanen states: "The warming and cooling of components in the device casing 12 can be implemented by a corresponding cooling solution as described above in connection with the display casing. Then the cooling or warming air flow circulates as forced past all the components becoming warmed." Ex. 1009, 10:20-23.

142. Thus, it is my opinion that Karppanen discloses element [1i].

143. Accordingly, based on the above, it is my opinion that the combination of Karppanen and Takahashi teaches each element of claim 1.

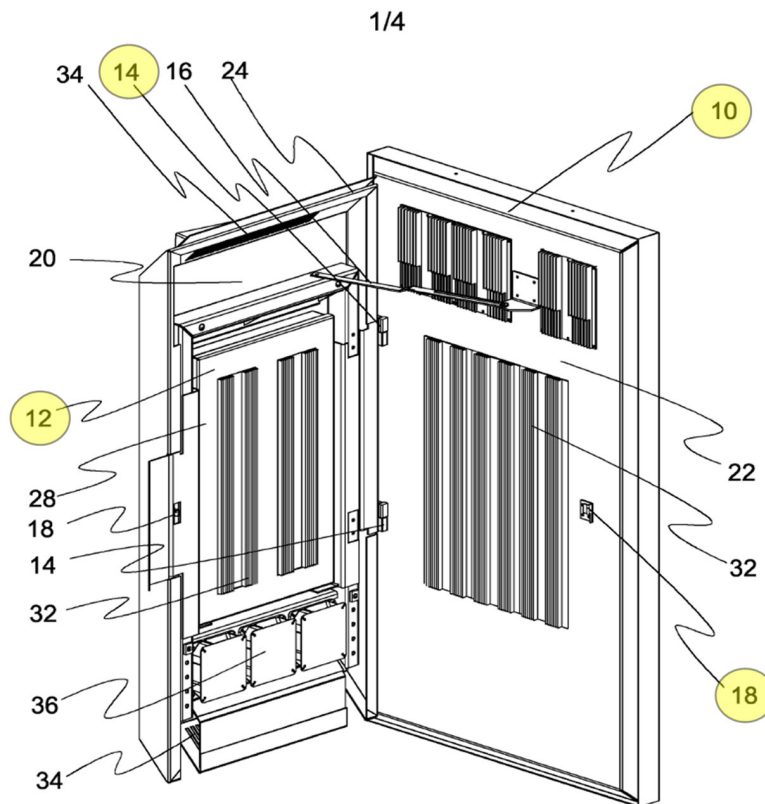
B. Dependent claim 2 – The panel display device as claimed in claim 1, wherein the case includes front and rear cases coupled to each other, and the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part.

144. Karppanen discloses the limitations in this claim. Ex. 1009, Abstract, 3:21-24, 6:16-31, 7:7-11, claim 4.

“wherein the case includes front and rear cases coupled to each other”

145. Karppanen’s case includes a front display casing 10 and a rear device casing 12 coupled to each other. For example, Karppanen discloses “display casing for the display element and a device casing for the electronic equipment needed for controlling the display element” (3:28-34) and “[i]n normal use, the display casing and the device casing are turned against each other to a closed position and locked to each other by locking means 18 on one side of the casings” (*Id.* at 7:7-9).

146. The device case 12 is attached to display case 10 using hinges 14 and locking means 18. Ex. 1009, Fig. 1 (annotated).



147. Karppanen therefore teaches this limitation of claim 2.

148. ***“the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part”***

149. Karppanen also discloses the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part. For example, Karppanen states “[t]he information board has a weatherproof display casing (10) for the display element and a weatherproof device casing (12) for the electronic equipment needed for controlling the display element” and “the device casing has a back cover bordered to the cooling space, having cooling elements for transferring heat from the device casing to the cooling space.” Ex. 1009, Abstract.

150. Karppanen further describes device case 12 is covered by cover 24. *Id.* at claim 4. As explained, cover 24 is not part of the device case, but is a separate cover for it, akin to the outer covers described for the circuit boards in the ’117 Patent. In contrast, back cover 28 is part of the device case 12 and constitutes an “outer surface of the rear case.” *Id.* at 7:9-11. A POSITA would understand the surface of the back cover 28 that faces away from the display case is the outer surface of the rear case.

151. Further, because Karppanen discloses the electronics, which a POSITA would recognize include the circuit board, are inside the case 12, the

circuit boards must be mounted in the circuit board mounting part positioned on the outer surface of the rear case. See, e.g., Ex. 1009, Abstract, 6:22-24.

152. Karppanen does not expressly disclose this limitation. Takahashi, however, remedies this deficiency. For example, a POSITA would have been motivated to modify Karppanen based on Takahashi to position Karppanen's circuit board mounting part on an outer surface of the rear case, as disclosed in Takahashi, to efficiently cool the heat producing components.

153. Takahashi discloses "the wall embedded liquid crystal panel unit 1 is divided into two space front and back by the rear surface liquid crystal panel cover 23," and the "rear surface liquid crystal panel cover 23 also forms a mounting space for the driving printed circuit board 3," "a plurality of spacers 231 are mounted to the rear surface liquid crystal panel cover 23," and "the driving printed circuit board 3 is mounted on the rear side of this rear surface liquid crystal panel cover 23 via a plurality of spacers 231, which creates a partition within the panel unit body that separates the front side arranged by the liquid crystal panel body 21 and the two spaces arranged by the driving printed circuit board 3, preventing the distribution of heat between each space." Ex. 1011, [0026], [0018].

154. A POSITA would understand Takahashi discloses the rear case includes a circuit board mounting part provided on an outer surface of the rear case

to prevent heat from the circuit board from entering the space with the display panel.

155. A POSITA would have been motivated to combine Karppanen with Takahashi as they sought to solve the same problems associated with temperature increase inside a display device casing, such as degradation of the display, and aim to provide systems for managing the temperature within the device while still providing large screens, high resolution graphics, and displays that are protected from the environment. Further, a POSITA would have had a reasonable expectation of success in doing so as such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

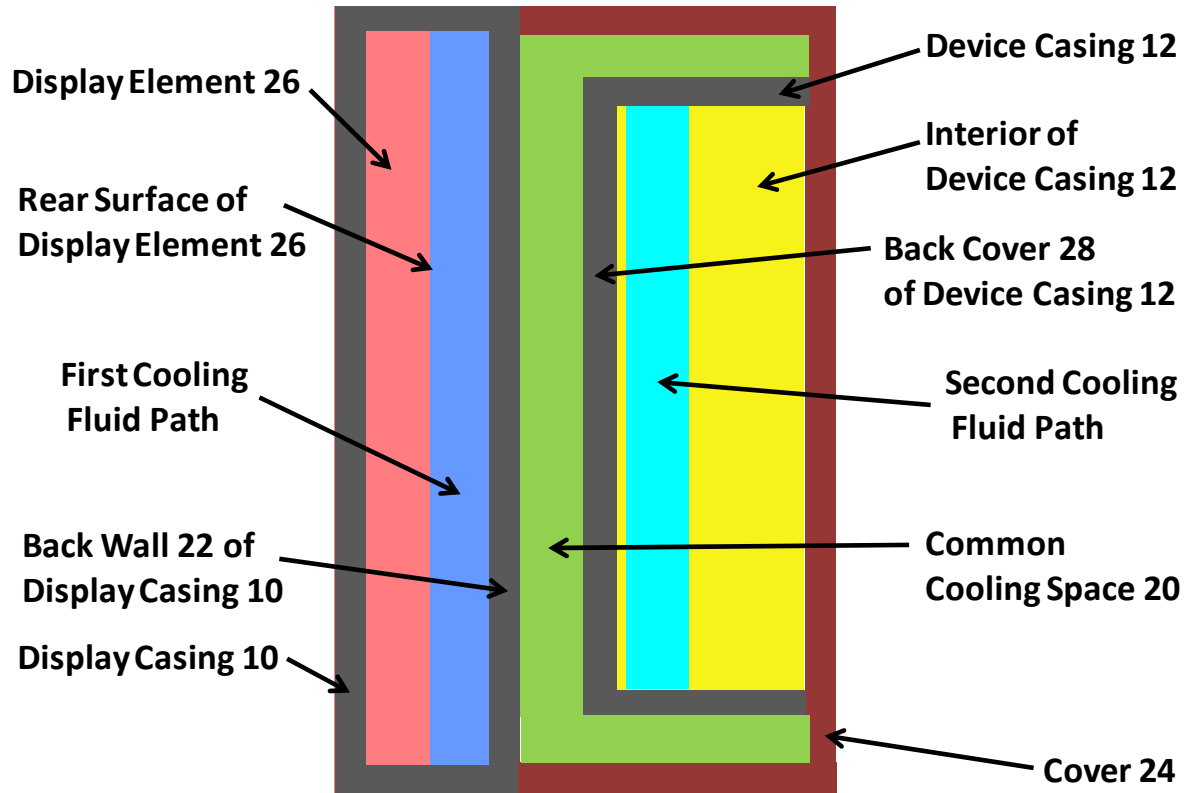
156. It is my opinion that Karppanen, as modified by Takahashi, therefore teaches each limitation of claim 2.

C. Dependent claim 5 – The panel display device as claimed in claim 2, wherein the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the rear case, and the second cooling fluid path includes an internal space of the circuit board mounting part.

157. As set forth for claim [1a], claim [1g], and claim [2a], Karppanen as modified by Takahashi discloses the limitations in this claim. Ex. 1009, Abstract, 3:21-34, 6:16-31, 7:7-25, 8:4-11, 10:6-18, 10:20-23, 12:18-20, claim 1, Figs. 1-2.

158. As discussed above and shown below, Karppanen discloses the first cooling fluid includes a space between a rear surface of display element 26 and an inner surface 28 of rear case 12 and the second cooling fluid path includes an internal space of the circuit board mounting part, such as shown when the device casing 12 is latched to the display casing 10.

159. Provided below is a cross section of the Karppanen device when the device casing 12 is latched to the display casing 10:



Ex. 1009, Fig. 1 (annotated).

160. As seen in the annotated Figure above, the first cooling fluid path includes a space between a rear surface of display element 26 and an inner surface 28 of rear case 12. Thus, Karppanen discloses this claim element.

161. Karppanen, as modified by Takahashi for claims 1 and 2 above, therefore teaches each limitation of claim 5.

IX. Ground 2: Claims 1, 2, and 5 are invalid as obvious over Nagayama in View of Kaneko

162. It is my opinion that asserted claims 1, 2, and 5 of the '117 Patent are invalid Nagayama in view of Kaneko.

163. Motivations to make the asserted combinations are discussed below, but also include known market forces and recognition in the art of the predictable and known uses of these systems and techniques. In 2006, a person of ordinary skill in the art (“POSITA”) would have been aware of and familiar with various display devices and their components—e.g., a display panel, circuit board, and case—and techniques for heat dissipation and cooling of display devices. *See* '117 Patent, at 1:32–51. While some of the display and cooling technologies have evolved, the components for providing an electronic display and the principles of heat dissipation have not changed since before Nagayama, so a POSITA would have been motivated to look to Nagayama in combination with Kaneko when designing an electronic display device. Like the '117 Patent, Nagayama and Kaneko are directed to techniques and designs for minimizing temperature increase

in the interior of the case due to heat produced by the display panel and circuit board housed therein, which can lead to degradation of the display panel. *See, e.g.*, Ex. 1013, Summary (“A display device is provided that can efficiently dissipate heat generated from a flat panel type display device.”); Ex. 1014, [0017] (“According to the first aspect, therefore, the heat dissipating path for creating an air flow in order to dissipate the heat, generated from the heat-generating electronic components, from the plasma display panel device into the atmosphere, can be provided sufficiently between the heat-generating electronic components, resulting in efficient heat dissipation.”).

164. One of skill in the art would have considered Nagayama’s teachings about heat dissipation and considered different, available cooling methods and arrangements of components to produce the desired electronic display device.

165. I understand predictability of results is an important obviousness consideration. The substantial overlaps I have identified between the various references confirm that the proposed combinations would have been obvious because each combination led to predictable, well-understood results. None of the combinations I have proposed involves references “teaching away” from the combination, or would involve modifying references to be inconsistent with their purpose. And, in my opinion, a POSITA would have had far more than a reasonable expectation of success in making the proposed combination as it would

have been implementing one of a finite number of well-known techniques in a predictable manner, to achieve well-known, predictable results.

A. Claim 1

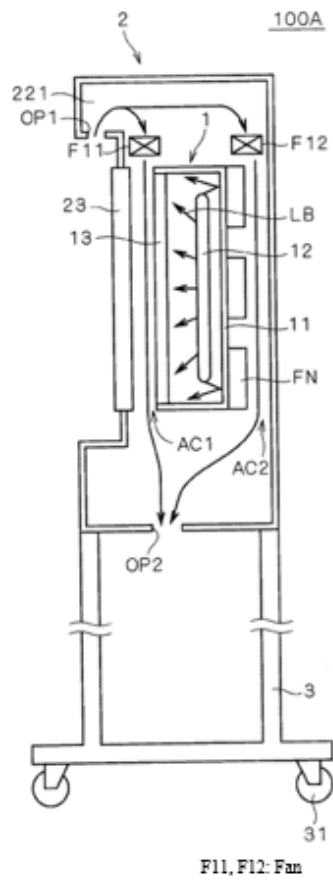
166. Element [1pre]: “A panel display device comprising:”

167. I understand the preamble is not a limitation. Nevertheless, Nagayama discloses a panel display device. Ex. 1013, Summary, [0001], [0013], [0015], Figs. 3-6.

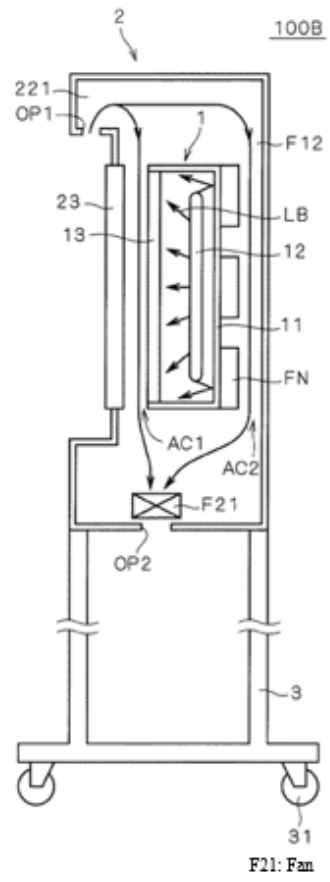
168. For example, Nagayama discloses “a display device,” such as “an outdoor display device using a flat panel type display device as a display section.” *Id.* at [0001]. Nagayama discloses “[t]he liquid crystal display device 1 comprises a liquid crystal panel 13 (display panel), a backlight thereof (e.g., a fluorescent light) 12, and a housing 11 that houses the backlight 12 and also the drive circuit, etc. of the liquid crystal panel 13,” and “[t]he desired image is displayed in the liquid crystal panel 13 when the light LB emitted from the backlight 12 is partially transmitted or blocked from the liquid crystal panel 13.” *Id.* at [0015].

169. Examples of Nagayama’s device are shown in Figures 3-6, reproduced below.

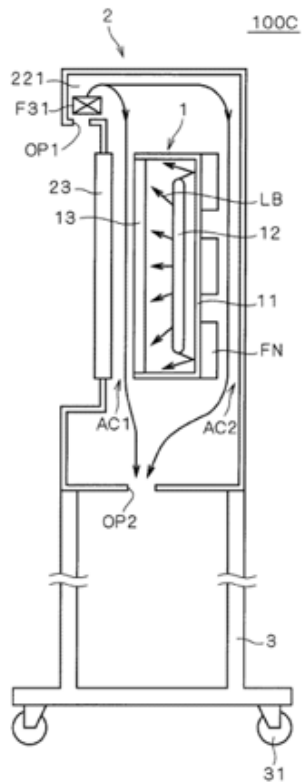
[FIG. 3]



[FIG. 4]

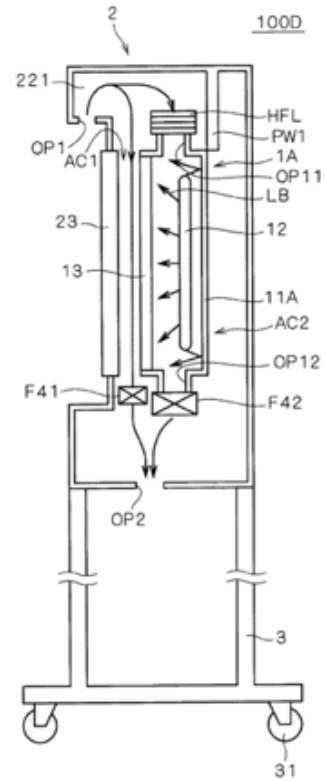


[FIG. 5] [FIG. 6]



F31: Fam

[FIG. 6]



F41, F42: Fan

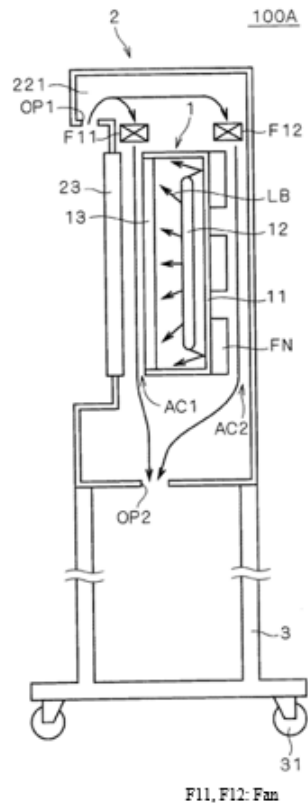
170. Nagayama discloses Element [1pre].

171. Element [1a]: “a case”

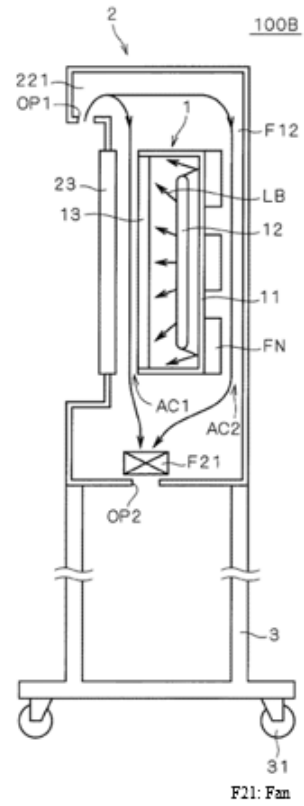
172. Nagayama discloses a panel display device with a case. Ex. 1013, Summary, [0007], [0013], [0019], Figs. 1, 3-6.

173. For example, Nagayama discloses “the outdoor display 100 is broadly divided into a liquid crystal display 1, a device box 2 in which it is stored, and a leg 3 supporting the device box 2.” *Id.* [0013]. Further, “[t]he device box 2 is configured to surround the liquid crystal display 1 and prevent the liquid crystal display 1 from being directly exposed to rainwater or dust.” *Id.* at [0019]. These elements are shown in Figures 3-6 below:

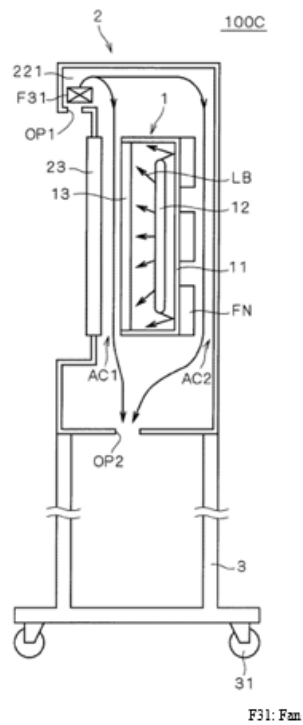
[FIG. 3]



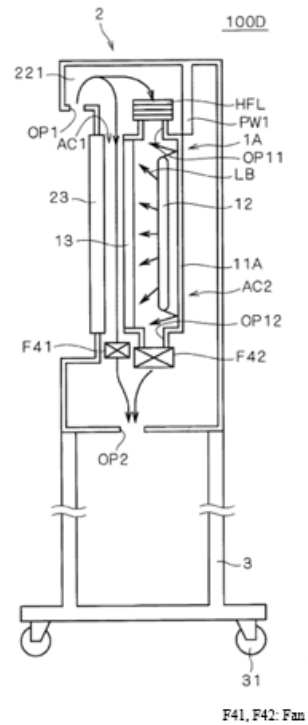
[FIG. 4]



[FIG. 5]



[FIG. 6]



Ex. 1013, Figs. 3-6.

174. Nagayama also states “for outdoor use, it is necessary to surround the liquid crystal display device in some kind of enclosure so that rainwater and dust do not directly reach the liquid crystal display device, but in such a case, it was difficult to efficiently dissipate heat emitted from the liquid crystal display device.”

Ex. 1013, [0007].

175. Nagayama discloses Element [1a].

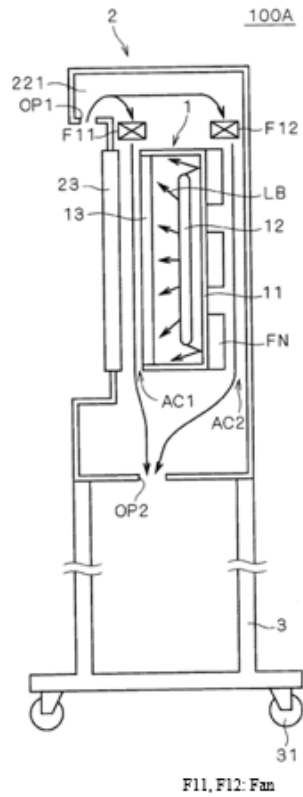
176. **Element [1b]: “a display panel mounted in an interior of the case”**

177. Nagayama discloses a display panel mounted in an interior of the case. Nagayama, at Summary, [0007], [0010], [0013], [0015], [0019], Figs. 1, 3-6.

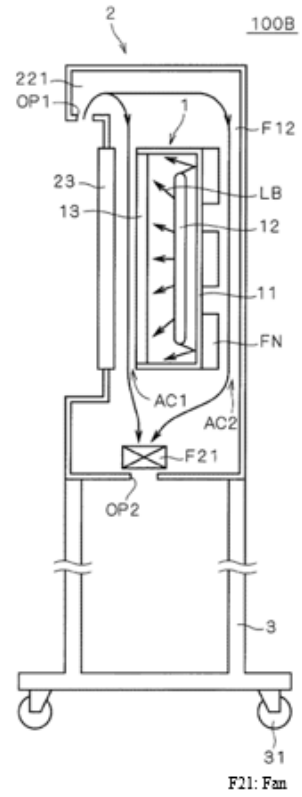
178. For example, Nagayama discloses “[t]he liquid crystal display device 1 comprises a liquid crystal panel 13 (display panel)” (Nagayama, at [0015]), and “[t]he device box 2 is conFigured to surround the liquid crystal display 1 and prevent the liquid crystal display 1 from being directly exposed to rainwater or dust” (Nagayama, at [0019]).

179. That the display panel 13 is mounted in an interior of the case 2 is shown below in Figures 3-6:

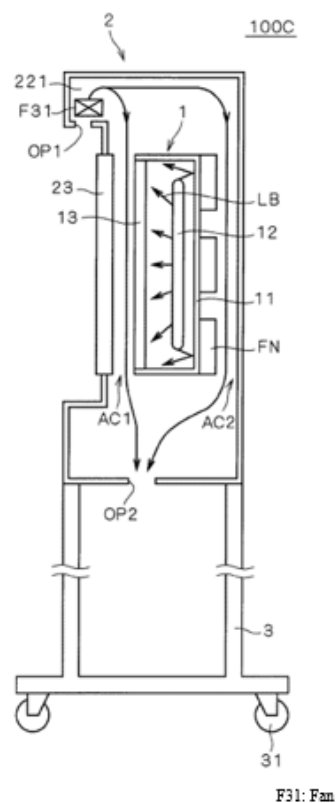
[FIG. 3]



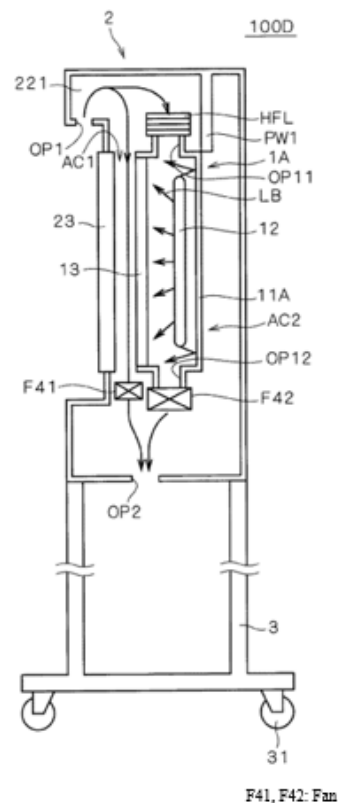
[FIG. 4]



[FIG. 5]



[FIG. 6]



Ex. 1013, Figs. 3-6.

180. I understand that in the related ITC proceeding, Samsung has proposed the plain and ordinary meaning of “display panel” is flat-type electronic display for displaying images and MRI has proposed “display panel” should be construed as “a flat type screen on which images are displayed, such as a Liquid Crystal Display or Plasma Display Panel.” As set forth above, Nagayama discloses “a display panel” under either party’s construction.

181. Nagayama discloses Element [1b].

182. Element [1c]: “at least one circuit board which controls the display panel”

183. Nagayama discloses at least one circuit board which controls the display panel. Ex. 1013, [0015], [0019], [0037], Figs. 3-6.

184. For example, Nagayama discloses “[t]he liquid crystal display device 1 comprises a liquid crystal panel 13 (display panel), a backlight thereof (e.g., a fluorescent light) 12, and a housing 11 that houses the backlight 12 and also the drive circuit, etc. of the liquid crystal panel 13.” *Id.* at [0015]. Further, Nagayama states “it is desirable to store electronic devices such as the backlight 12 and the drive circuit of the liquid crystal panel 13 in the housing 11, and seal the housing 11 with packings, fillers, etc. so that there is no gap.” *Id.* at [0037]. Although Nagayama does not specifically use the term “circuit board”, a POSITA would understand that for a complex device, such as the LCD device of Nagayama, a circuit board would be used. At a minimum, it would be obvious to a POSITA that for a reasonably complex drive circuit, a POSITA would know to implement the drive circuit onto a circuit board.

185. It is therefore my opinion that Nagayama discloses Element [1c], either alone or in view of the common general knowledge of a POSITA.

186. Element [1d]: “a first cooling fluid path which cools the display panel”

187. Nagayama discloses a first cooling fluid path which cools the display panel. Ex. 1013, Summary, [0009]-[0011], [0019]-[0021], [0028]-[0032], [0033], [0041]-[0057], Figs. 1, 3-6.

188. For example, Nagayama discloses “within the device box 2, the liquid crystal display 1 is arranged such that the liquid crystal panel 13 of the liquid crystal display 1 and the transparent plate 23 do not adhere, and there is a gap between the two, and the gap is referred to as the front air passage AC1.” *Id.* at [0020]. Nagayama explains that “liquid crystal panel 13 is heated by heat emitted by the backlight 12 (e.g., a fluorescent light),” so “a gap is provided between the liquid crystal panel 13 and the transparent plate 23 to form the front air passage AC1, and a configuration is adopted to cool the front surface of the liquid crystal panel 13 by sending air to the front air passage AC1 by the fan F1.” Ex. 1013, [0028]-[0029]. As Nagayama explains, “a circulation path of air is formed within the device box 2” and “since an air current is also generated in the rear air passage AC2, the cooling ability of the air cooling fins FN provided on the rear surface of the liquid crystal display device 1 is increased, and the housing 11 can be efficiently cooled...leading to suppression of temperature rise of the liquid crystal panel 13.” *Id.* at [0030]-[0032].

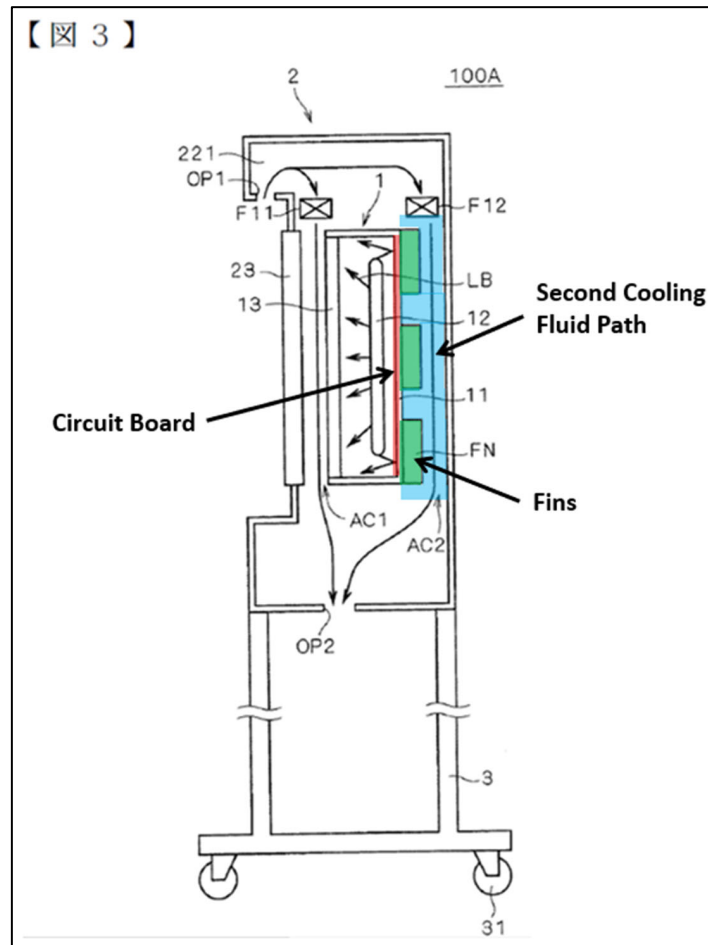
189. In addition, Nagayama states “[b]y using fans F11 and F12 arranged in this way, air entering through opening OP1 is fed by fan F11 to the front air

passage AC1,” and “the fan F11 can be referred to as a liquid crystal panel cooling fan because it mainly cools the front surface of the liquid crystal panel 13, and the fan F12 can be referred to as a housing cooling fan because it cools the housing 11,” and “fan F11 and fan F12 can independently pump air into the front and back air passages AC1 and AC2 without circulating air within the device box 2, allowing the front and the housing 11 of the liquid crystal panel 13 to be cooled together with high flow rate ambient air, further increasing the cooling efficiency of the liquid crystal panel 13.” Ex. 1013, [0041]-[0045]. This “without circulating air” language in Nagayama is important as it tracks the same goal elucidated in the ’117 Patent at column 3, lines 47-55 for keeping the two paths separate. This makes sense because if there was recirculation of the air, then cooling of first cooling path could influence cooling of the second cooling path, and vice versa.

190. In annotated Nagayama, Fig. 3 below, the first cooling path AC1 (blue) can be seen between the LC panel 13 (red) and the transparent plate 23 (green). Nagayama states this explicitly at [0029]: “Therefore, a gap is provided between the liquid crystal panel 13 and the transparent plate 23 to form the front air passage AC1, and a configuration is adopted to cool the front surface of the liquid crystal panel 13 by sending air to the front air passage AC1 by the fan F1.”

facing it, and the gap is referred to as the back air passage AC2.” Id. at [0021](emphasis added). Further, “[t]he air cooling fins FN are arranged on the rear surface of the liquid crystal display device 1” and “may be arranged multiple times at the back of the liquid crystal display device 1 as shown in Fig. 1, but only one display element having the same area as the rear surface may be arranged.” Nagayama, at [0021]. A POSITA would understand that fins FN are connected to the electronic boards inside display 1, so AC2 is a second cooling fluid path which cools the circuit board.

195. As can be seen in annotated Fig 3 below, in accordance with the Nagayama teaching above, the circuit boards (red) must be in the housing 11, but behind the BLU reflector (to avoid blocking the light). Thus, the circuit boards (red) are located as shown. Cooling path AC2 (blue) extracts heat from the (green) fins (FN) and cools the circuit boards (red). This is shown in the annotated Figure below.



Ex. 1013, Fig. 3.

196. Although Nagayama illustrates two cooling fluid paths, Nagayama does not explicitly teach this limitation. This deficiency is cured by Kaneko.

197. Kaneko describes a “heat dissipating path for creating an air flow in order to dissipate the heat, generated from the heat-generating electronic components, from the plasma display panel device into the atmosphere, can be provided sufficiently between the heat-generating electronic components, resulting in efficient heat dissipation.” Ex. 1014, [0017]. Kaneko discloses a structure for a

display device where “it is possible to place an exhaust hole, an exhaust fan or the like above the required circuit board on which the electronic component with the heat-generating property is mounted for collective exhausting, which results in further efficiency in performing the heat dissipation.” Ex. 1014, [0019]-[0020]; see also id. at [0058], [0062], [0065]-[0069], [0071]-[0075].

198. Figures 1, 4, 6, and 7 of Kaneko (reproduced below) show the cooling path that cools the circuit board.

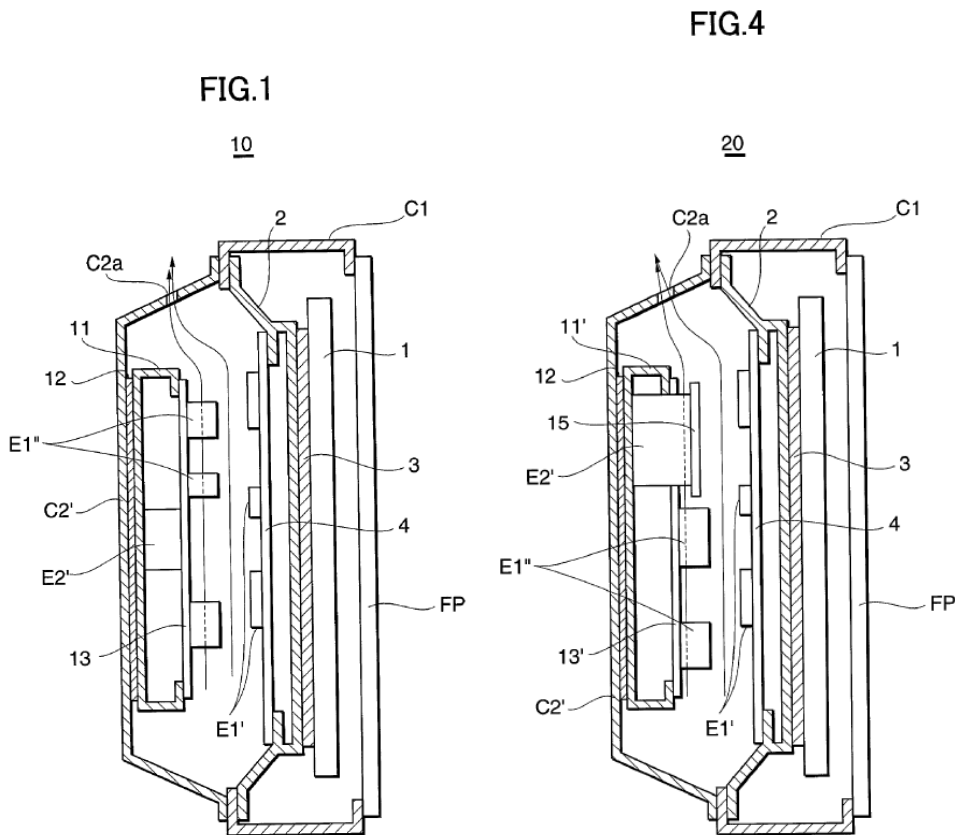


FIG.6

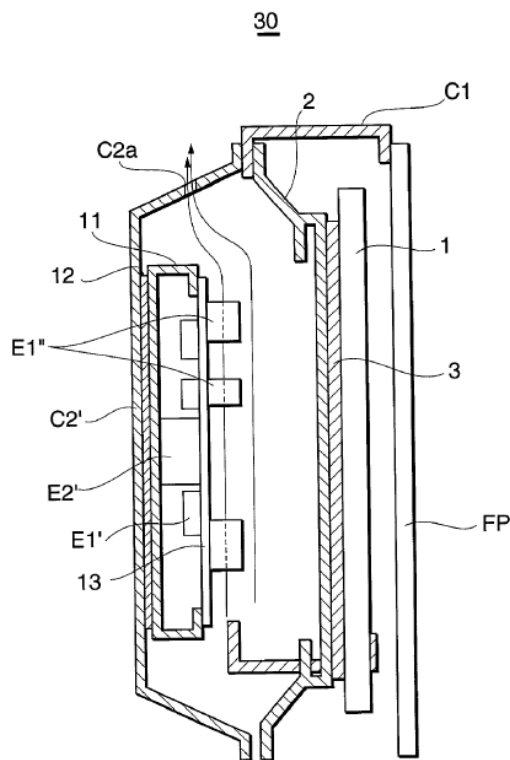
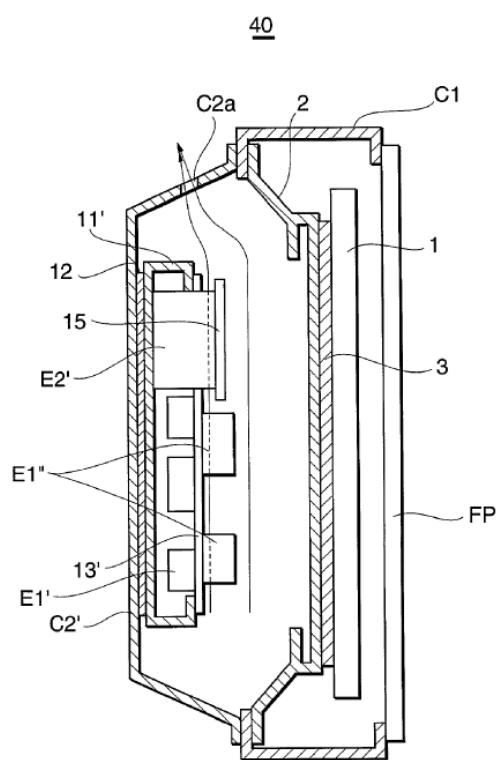


FIG.7



Ex. 1014, Figs. 1, 4, 6-7.

199. It would have been obvious to modify Nagayama to include a second cooling fluid path which cools the circuit board, based on Kaneko. As Kaneko explains, “[a] drive unit developing the high voltage to drive the PDP generates high heat,” so “the PDP device needs a heat-dissipation structure for dissipating the heat generated in the drive unit into the atmosphere.” Ex. 1014, [0006]. Because each of these references contains familiar elements within the same field of endeavor to address the same known problems, combining them would be obvious and yield predictable results.

200. Therefore, it is my opinion that Nagayama as modified by Kaneko teaches element [1e].

201. **Element [1f]: “wherein the first and second cooling fluid paths are separated from each other”**

202. Nagayama as modified by Kaneko for element [1e], discloses separate cooling fluid paths as detailed for elements [1d] and [1e] above. Ex. 1013, Summary, [0001], [0009]-[0011], [0019]-[0021], [0028]-[0032], [0033], [0041]-[0057], Figs. 1, 3-6; Ex. 1014, [0006], Figs. 1, 4, 6, 7.

203. For example, in reference to Figure 3, Nagayama discloses “in the outdoor display 100A, a fan F11 (first fan) is arranged in the vicinity of the upper opening of the front air passage AC1 and a fan F12 (second fan) is arranged in the vicinity of the upper opening of the back air passage AC2.” Ex. 1013, [0042]. The first cooling fluid path, AC1 is separate from the second cooling fluid path, AC2, so air can be “independently” pumped into the paths. *Id.* at [0043]-[0045]; *see also id.* at [0046]-[0050], Figs. 4-5, [0051]-[0057], Fig. 6. Further, Nagayama discloses, “Fan F11 can be referred to as a liquid crystal panel cooling fan...and the fan F12 can be referred to as a housing cooling fan because it cools the housing 11.” *Id.* at [0044]. It is my opinion that independent fan control can prevent air recirculation, and therefore avoid the first path from influencing the second path, and vice versa,

see ' 117 3:47-55. Thus, each path has its own flow of air, pushed by a fan in one direction, to cool the liquid crystal panel (F11) and to cool the housing (F12).

204. Thus, Nagayama's design includes two separate cooling fluid paths. As set forth in [1d] and [1e], Nagayama discloses or renders obvious the claimed cooling fluid paths. Thus, having separate first and second cooling fluid paths to cool the display panel and the circuit board would have been obvious based on Nagayama.

205. Moreover, a POSITA would have been motivated to include the separate cooling paths in Nagayama's device to efficiently cool the heat producing components, and would have had a reasonable expectation of success in doing so as such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

206. Nagayama in combination with Kaneko renders obvious Element [1f].

207. **Element [1g]: “wherein the case includes a circuit board mounting part provided on a rear surface of the case and partitioned from a space in which the display panel is mounted such that the circuit board is received in the circuit board mounting part,**

208. Nagayama in combination with Kaneko disclose the limitations in this claim element. Ex. 1013, [0013], [0015], [0019]-[0021], [0041]-[0057], claims 10-12, Figs. 1, 3-6; Ex. 1014, [0066].

209. MRI proposes “circuit board mounting part” is subject to 35 U.S.C. § 112, ¶ 6, with the function being to receive and mount the circuit board and structure being the specific structure recited in column 3, lines 3-65 and illustrated in Figures 1-2 of the ’117 Patent.

210. Nagayama discloses “it is desirable to store electronic devices such as the backlight 12 and the drive circuit of the liquid crystal panel 13 in the housing 11” and the use of partition walls to direct air flow. Ex. 1013, [0037], claims 10-12, Figs. 3-6. Nagayama does not explicitly disclose a circuit board mounting part provided on a rear surface of the case and partitioned from a space in which the display panel is mounted. Kaneko cures this deficiency.

211. Kaneko discloses a circuit board mounting part recessed from rear to front of the rear case. *See, e.g.*, Ex. 1014, [0066] (“As is clear from Fig. 5, the circuit board 13' is formed with a notch 13a in the upper left corner in Fig. 5.”); [0067] (“While a high heat-generating module E2 is secured to and has a back face in close contact with the heat dissipative chassis 11", it is disposed in the notch 13a of the circuit board 13". Further, the module E2 is mounted on a circuit board 15 Such that a face thereof opposing the circuit board 4 faces the circuit board 15.”).

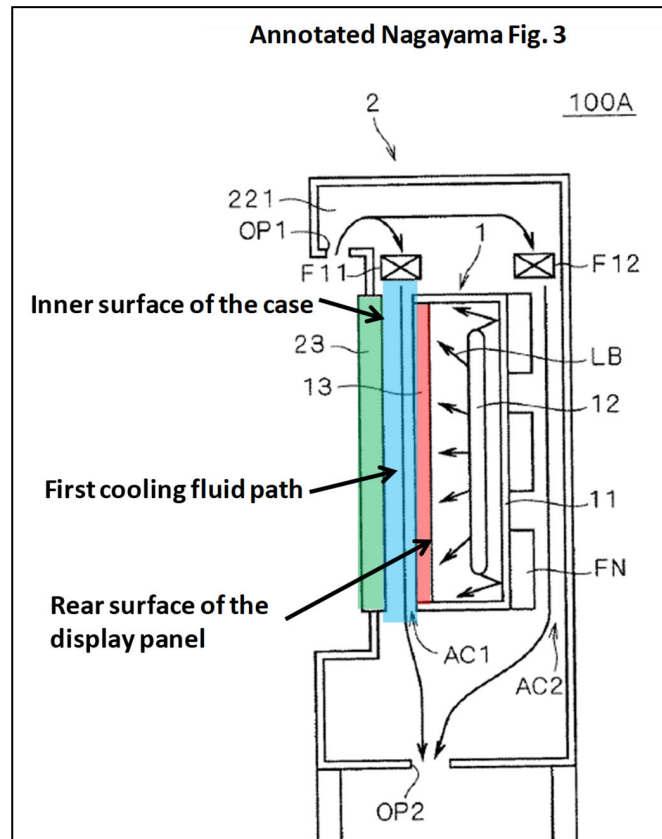
Further, Kaneko explains that this configuration, where “the high heat generating module E2 is ... disposed in the notch 13a...allows a minimizing of the increase in the depth dimension of the PDP device due to the provision of the foregoing heat-dissipation structure.” *Id.* at [0070].

212. A POSITA would have been motivated to use the circuit board mounting parts disclosed in Kaneko in Nagayama’s device to save space while maintaining separation of heat generating components for efficient cooling. This would have been an obvious design choice and one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

213. Nagayama in combination with Kaneko teaches this limitation.

214. **Element [1h]“the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the case”**

215. As explained in [1d] above, Nagayama describes a “first cooling fluid path” that cools the display panel. Further, Nagayama discloses the first cooling path is between the rear surface of the display panel and the inner surface of the housing 11. *See, e.g.*, Ex. 1013, [0030]. The transparent panel 23 is part of the device box 2 (a case). Further, the first cooling path (AC1) is between the rear surface of the LC panel and an inner surface of the case (plate 23), which is shown in annotated Figure 3 below:



216. Nagayama discloses this limitation.

217. ***Element [1i] “the second cooling fluid path includes an internal space of the circuit board mounting part”***

218. Nagayama illustrates a second cooling path that is separate from the first cooling path, which is the “gap between the side (back side) opposite the liquid crystal panel 13 of the liquid crystal display 1 and the wall surface of the device box 2 facing it, and the gap is referred to as the back air passage AC2” (the corresponding structure of the ‘117 “circuit board mounting part”). Additionally, Nagayama describes, “fan F11 and fan F12 can independently pump air into the front and back air passages AC1 and AC2.” *Id.* at [0045]. This makes sense as

independent fan control can prevent air recirculation, and therefore avoid the first path from influencing the second path, and vice versa. *See* Ex. 1001, 3:47-55.

Further, as explained for Elements [1e] and [1f] above, it would have been obvious to modify Nagayama to have a second cooling fluid path directed to cooling the circuit board, which would include an internal space of the circuit board mounting part, as described in Kaneko. Ex. 1014, Abstract, [0015]-[0017], [0019]-[0021], [0056]-[0063], [0065]-[0075], Figs. 1, 2, 4, 5.

219. Nagayama in combination with Kaneko teaches this limitation.

Accordingly, it is my opinion that Nagayama, as modified by Kaneko, teaches each limitation of claim 1.

B. Claim 2: “The panel display device as claimed in claim 1, wherein the case includes front and rear cases coupled to each other, and the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part.”

220. Nagayama discloses the limitations in this claim. Ex. 1013, [0020]-[0021], [0038]-[0039], [0041]-[0057], Figs. 3-6.

221. *“wherein the case includes front and rear cases coupled to each other”*

222. Nagayama discloses the case includes front and rear cases coupled to each other. For example, Nagayama discloses “it is desirable to have a removable structure on the top surface and the back surface of the device box 2 (the side

opposite the window side surface 21) to ensure maintenance, and to have a structure that makes it easy to clean the filter.” *Id.* at [0039].

223. ***“the rear case includes a circuit board mounting part provided on an outer surface of the rear case such that the circuit board is mounted in the circuit board mounting part”***

224. Nagayama discloses “it is desirable to store electronic devices such as the backlight 12 and the drive circuit of the liquid crystal panel 13 in the housing 11” and the use of partition walls to direct air flow. Nagayama, at [0037], claims 10-12, Figs. 3-6. Thus, to the extent Nagayama does not disclose a circuit board mounting part provided on an outer surface of the case, this would have been an obvious design choice based on Nagayama’s teachings directed to providing independent cooling paths and using partitions to direct air flow to cool components of the display device. It would have been obvious to a POSITA to partition the circuit board mounting part from the interior of the display case in which the display panel is mounted so that the cooling paths could cool both heat producing components independently and efficiently.

225. I understand from Counsel for MRI that in the ITC proceeding, Samsung has taken the position that “outer surface” means “the surface facing away from the display panel.” However, the ’117 Patent makes clear the “outer surface” is on the rear surface of the case and thus outside of the case, and the

device may have covers over the circuit boards, but this is not required. '117

Patent, at 3:10-12. Nevertheless, under this interpretation, Nagayama discloses this limitation as it discloses the circuit boards are mounted on the surface of the rear case facing away from the display panel as discussed above.

226. Nagayama as modified by Kaneko discloses Claim 2.

C. Claim 5: “The panel display device as claimed in claim 2, wherein the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the rear case, and the second cooling fluid path includes an internal space of the circuit board mounting part.”

227. As set forth for Elements [1a], [1g], and [2a], Nagayama discloses the limitations in this claim. Ex. 1013, Summary, [0007], [0013], [0019], [0020]-[0021], [0041]-[0057], Figs. 3-6.

228. For example, Nagayama discloses the first cooling fluid path includes a space between a rear surface of the display panel and an inner surface of the rear case (*see* Elements [1d], [1f], [1g]).

229. Nagayama as modified by Kaneko also discloses a second cooling fluid path (*see* claim [1e]) and renders obvious a cooling path that includes an internal space of the circuit board mounting part (*see* Elements [1e], [1f], [1g]).

230. Kaneko describes a cooling fluid path includes an internal space of the circuit board mounting part. For example, Kaneko discloses “in the PDP device 10, the air heated by the heat generation of the electronic component E1” and the high

heat-generating module E2' moves upward through the heat-dissipating paths formed between the electronic components E1" and between the modules E2', and then is exhausted from the exhaust hole C2 a, provided in the upper portion of the rear case C2', to the outside of the casing. Moreover, the heat generated by the high heat-generating module E2' is transferred through the heat-dissipative chassis 11 and the thermal conductor 12 to the rear case C2' to be dissipated therefrom into the atmosphere. Thus, the heat dissipation from the inside of the casing is performed efficiently." Ex. 1014, [0062]; *see also Id.* at [0065]-[0069].

231. Kaneko also discloses "In both the PDP device 30 of the third example and the PDP device 40 of the fourth example, sufficient heat dissipating paths are provided between the electronic components by means of mounting the electronic components separately on both the faces of the circuit board, as in the cases of the first and second examples. Further, the heat dissipation is efficiently performed by means of transferring heat to the rear case C2'." Ex. 1014, [0075]; *see also id.* at [0019]-[0020], Figs. 1, 4, 6, 7.

232. A POSITA would have been motivated to modify Nagayama's display device to have the first cooling fluid path include a space between a rear surface of the display panel and an inner surface of the rear case and the second cooling fluid path include an internal space of the circuit board mounting part, as disclosed in Kaneko, to efficiently cool the components of the display device. It

would have been obvious to combine Nagayama and Kaneko as they sought to solve the same problems associated with temperature increase inside a display device casing, such as degradation of the display, and aim to provide systems for managing the temperature within the device while still providing large screens, high resolution graphics, and displays that are protected from the environment. Further, a POSITA would have had a reasonable expectation of success in doing so as such an implementation simply reflects one of a finite number of well-known techniques implemented in a predictable manner, to achieve well-known, predictable results.

233. Nagayama as modified by Kaneko discloses Claim 5.

X. Conclusion

234. For the foregoing reasons, it is my opinion that claims 1, 2, and 5 of the '117 Patent are invalid.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 14th day of July, 2023.

A handwritten signature in cursive script, reading "Carl D. Meinhart", is written over a horizontal line.

Dr. Carl D. Meinhart