

**UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.**

**Before The Honorable Monica Bhattacharyya
Administrative Law Judge**

In the Matter of

**CERTAIN OUTDOOR AND SEMI-
OUTDOOR ELECTRONIC
DISPLAYS, PRODUCTS
CONTAINING SAME, AND
COMPONENTS THEREOF**

Inv. No. 337-TA-1331

DECLARATION OF ROBERT SMITH-GILLESPIE

I, Robert Smith-Gillespie, pursuant to 28 U.S.C. § 1746, declare under penalty of perjury that the following is true and correct:

I. INTRODUCTION

1. My name is Robert Smith-Gillespie. I am currently working in a consulting role as a manufacturing systems engineer for Alveo Technologies providing process development expertise for micro-fluidic diagnostic product manufacturing.

2. I have been retained by counsel for Respondents Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung Electronics”), Samsung SDS Co. Ltd. and Samsung SDS America, Inc. (collectively, “Samsung SDS”), Industrial Enclosures Corporation d/b/a Palmer Digital Group (“Palmer”), Coates Signco Pty Limited and Coates US Inc., (collectively, “Coates”) (collectively, “Respondents”), in the above captioned Investigation. I have knowledge of the matters stated in this Declaration and, if called to do so, I could and would competently testify about them.

3. I understand that Complainant Manufacturing Resources International Inc. (“Complainant” or “MRI”) alleges that Responses infringe certain claims of U.S. Patent Nos.

8,854,595 (“the ’595 patent”), 9,173,322 (“the ’322 patent”), 9,629,287 (“the ’287 patent”), 10,506,740 (“the ’740 patent”) and 11,013,142 (“the ’142 patent”) (collectively, “the Asserted Patents”). I further understand that Complainant alleges that certain of its products practice certain claims of the Asserted Patents. I have been asked by Defendants to offer opinions regarding the construction of certain claim terms in these patents.¹ The asserted and domestic industry claims of the Asserted Patents are shown below:

Asserted Patent	Asserted Claims	Domestic Industry Claims
’595 patent	1, 4, 7, 8	1, 4, 7, 9, 13, 16, 18
’322 patent	4, 5, 8, 9, 12, 13, 16	1-5, 7
’287 patent	1, 4, 8, 9, 10, 11, 12, 15, 21, 22, 23	12, 17-19
’740 patent	1, 5, 6	1-3, 5, 6, 8, 10, 13, 15-18, 20
’142 patent	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15	6, 7, 10, 12, 15

4. I am being compensated for my time at my standard rate of \$350/hour. My compensation has not, and will not, affect my opinions in this matter and my compensation is not dependent on the content of my opinions. I have no financial interest in the outcome of this Investigation, and my compensation will be unaffected by the outcome of this Investigation.

¹ While I understand that the parties dispute the meaning of other claim terms not addressed herein, I reserve the right to respond to any expert testimony submitted by MRI.

5. I have reviewed and relied upon numerous materials in forming the opinions set forth in this Declaration. For example, I reviewed the '595, '322 and '287 patents, the prosecution history for these patents and other related patent applications, as well as the materials that I cite throughout this declaration. A complete list of the materials I reviewed and relied upon in forming my opinions as set forth in this declaration are attached as Appendix A.

II. BACKGROUND AND QUALIFICATIONS

6. My qualifications for forming the opinions set forth in this declaration are summarized here and explained in more detail in my *curriculum vitae*, which is attached as Appendix B and incorporated herein. Appendix B also includes a list of my publications and the patent cases in which I have testified at a deposition, hearing, or trial during the past ten years. The following description is meant to be exemplary, and for brevity I omit some of my relevant experience from the roughly 35 years I have spent working in the optoelectronics field.

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

8. My first role involving display products was as a Manufacturing Engineer for Sperry Aerospace Corporation from 1985 through 1987. Sperry was purchased by Honeywell Inc., and I continued at Honeywell's Air Transport Systems Division until 1989. In 1989, I moved

into the Flight Deck Packaging group as a Senior Project Engineer where I was responsible for illuminated controls (switches, lighted panels, light emitting diode (“LED”) annunciators and numeric LCD modules). I continued at Honeywell through 1997 working as a Principal Engineer where I was responsible for mechanical and optical designs of the primary displays on the Boeing 777 aircrafts.

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

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

11. After leaving Rosen Products LLC, I established and served as president of FPD Design & Consulting LLC, a display product design and development consulting company specializing in integration of ruggedized display components into customer specified products. I have worked at FPD Design & Consulting LLC from 2002 to the present. Projects I have worked on include direct-view backlight designs for aviation simulators, cold cathode fluorescent lamp (“CCFL”) to LED backlight conversions, commercial-off-the-shelf LCD display ruggedization and optical enhancement. During this time, I prepared a number of technical papers on display ruggedization, optical enhancement and backlight thermal design, the later as a “how-to” workshop for a local chapter of the Society for Information Display (“SID”).

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

13. From 2013 to September 2018, I worked at Riverwood Solutions, Inc. (“RWS”) as the Senior Technical Specialist. RWS provides electronic manufacturing services management for leading product development companies worldwide. As the Senior Technical Specialist, I provided technical expertise on technology, materials, design, and manufacturability for product applications including medical products, solar powered devices, LED lamps, and LED illumination in electronic consumer products.

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

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

16. I am an inventor of U.S. Patent No. 7,660,040, entitled “Diffuse reflective article.” I am the author or co-author of 15 scientific and engineering publications, including articles, conference presentations, technical and scientific reports, and tutorials. These publications cover a wide variety of topics, including but not limited to flat panel display backlighting techniques, LED backlights, thermal design principles and analysis, design requirements for automotive entertainment displays, development of a high luminance, high contrast fixed format LCD and other areas.

17. As I noted, this summary of my experience is meant only to provide general background, and additional experience is set forth in my curriculum vitae. Nevertheless I believe that my experience provides the background necessary for me to provide expert testimony on the issues set forth in this declaration.

III. LEGAL STANDARDS

18. I am not an attorney. For purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my analysis and opinions, as set forth below.

19. I understand that under legal principles, claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art (“POSITA”) in question at the time of the invention, i.e., as of the effective filing date of the patent application. To assess the level of ordinary skill in the art, in addition to reading the patent in question, I understand one can consider the types of problems encountered in the field of the invention, the prior solutions to those problems found in prior art references, the sophistication of the technology, and the level of education of active workers in the field.

20. I further understand that the POSITA is deemed to read the claim term not only in the context of the particular claim in which a claim term appears, but in the context of the entire patent, including the specification.

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

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

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

24. I have been informed by counsel that the claims of a patent shall be construed using what I understand is called the “*Phillips*” claim construction standard, which includes construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

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

IV. PERSON OF ORDINARY SKILL IN THE ART (“POSITA”)

26. I understand that the POSITA is a hypothetical person who is presumed to have a comprehensive knowledge of the available prior art and a level of skill commensurate with a typical practitioner in the relevant field when the patent was filed. In determining the level of skill a POSITA would have, I understand the following factors may be considered: (1) the type of problems encountered in the art; (2) the prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the educational level of active workers in the field. I also understand that the hypothetical POSITA may be comprised of a team of hypothetical persons with complementary expertise.

27. I have been informed by counsel that Complainant’s position is that the earliest effective filing date for the asserted claims of the ’595 and ’322 patents is March 26, 2008, the earliest effective filing date for the asserted claims of the ’287 and ’740 patents is March 3, 2008, the earliest effective filing date and for the asserted claims of the ’142 patent is May 30, 2008.² Solely for the purposes of this report, I assume these are the earliest effective filing dates for the Asserted Patents.

² I understand that MRI has not yet come forth with any position as to the priority date for the non-asserted claims that MRI is nonetheless relying on to support its domestic industry contentions. I reserve the right to supplement my opinions if MRI puts forth a position that the domestic industry claims are entitled to a priority date earlier than the asserted claims.

28. In my opinion, the POSITA at the time of the alleged invention of the Asserted Patents would have had a (1) Bachelor's degree in a pertinent discipline, such as mechanical engineering, physics, product design, or a related field and (2) have 2–4 years of experience in working with electronic displays and have an understanding of product design issues and failure modes associated with electronic displays. Alternatively, a POSITA would have had 5–7 years of experience in the field working with electronic displays and have a similar understanding of product design issues and failure modes associated with electronic displays. To the extent necessary, a POSITA would have been able to collaborate with one or more other persons of skill in another art (e.g., one of skill in the art of electrical engineering) for one or more aspects with which the other person may have expertise, experience, and/or knowledge that was obtained through her own education, industrial or academic experience. My opinion regarding the qualifications of a POSITA is based on my knowledge, skill, training, experience and review of the materials discussed herein.

29. I believe that my education and experience provide me with expertise, and I consider myself to be expert, in electronic displays including LCD module design, integration, and ruggedization, CCFL and LED backlight design and thermal management, and materials development. Given my Bachelor's degrees in Physics and Mechanical Engineering and my experience of over roughly 35 years that I have spent working in the optoelectronics field, I believe that I qualify as at least a POSITA under the definition above both today and at the priority date for the Asserted Patents.

30. I understand that Complainant has yet to provide its proposed definition of a POSITA. If Complainant provides a definition that differs from Respondents' definition, I reserve

the right to respond and to supplement or amend this report to take Complainant's definition into account.

V. FUNDAMENTALS OF HEAT TRANSFER AND CONVECTIVE COOLING IN ELECTRONIC DISPLAYS

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

32. A typical LCD display in 2008 (and today) is comprised of three main components: an LCD panel, an electronic driver circuit, and a backlight. The LCD panel comprises a thin layer of liquid crystal material constrained between two sheets of glass, one of which includes a thin film transistor ("TFT") array and the other which includes a color filter array. Electronic control circuits are attached to the LCD panel via flexible printed circuits and connect to row and column lines on the TFT substrate glass. A lighting assembly (backlight unit) provides a light source to the rear of the LCD panel. The light from the backlight unit is modulated pixel-by-pixel in the LCD panel to provide a color image to the viewer. In typical applications today, the LCD panel, electronic driver circuit and backlight may be packaged into a single module.

33. As electronic displays started being used in outdoor environments, those skilled in the art realized the need to address potential thermal stresses when designing the display. Thermal stress is a general term for both short- and long-term performance reduction of electronic components subject to operation at elevated temperature. The phenomena of thermal stress has been well known for at least the last 50 years, with initial research and requirements developed by and for military equipment electronics. Thermal stress may cause premature failure of components. Thermal stress can also cause component performance to drift or decay temporarily (i.e. at elevated temperature). Thermal stress may be induced by: (i) self-heating of components

due to high power dissipation; (ii) exposure to elevated ambient temperatures; and (iii) convective, conductive or radiative heating of the immediate environment by other equipment's heat dissipation or by external sources such as solar radiation. Solar radiation is a significant factor for displays used in outdoor environments where the sun may impinge directly on the display.

34. Heat generated by the electronics must be efficiently and effectively removed from the components to ensure continued reliability and performance. This process is generally called "cooling." Cooling is accomplished by heat transfer, the movement of thermal energy from one body to another. The three primary modes of heat transfer used to cool electronic equipment are conduction, radiation, and convection.³

35. Conductive heat transfer occurs between two bodies that are in physical contact. In electronic displays, heat is often conducted to a heat sink (a substance with absorbs heat and ultimately facilitates transfer to an external environment) or a heat exchanger.⁴ Metals such as aluminum and copper are particularly highly heat conductive and have been used to remove heat from electronic displays for as long as there have been electronic displays.⁵

36. In radiation heat transfer, heat energy is lost to surroundings passively (e.g., without any force being applied to it). Radiation heat transfer takes place when hot objects emit thermal energy through electromagnetic waves.⁶ Radiation waves from the first object will strike a second object, which may absorb, reflect, or transmit the radiation energy.⁷ The amount of radiation transferred from one object to the next depends on temperature, surface characteristics,

³ RXM-001, DAVE S. STEINBERG, COOLING TECHNIQUES FOR ELECTRONIC EQUIPMENT 2 (John Wiley & Sons, 1980) ("Steinberg") (RESPONDENTS001464 at -1479).

⁴ RXM-002, Heat Transfer Sys. & Method for Elect. Displays, U.S. Patent No. 5,991,153, 4:56-62 (RESPONDENTS002184 at -2192) (filed Oct. 30, 1998) (issued Nov. 23, 1999) ("Heady").

⁵ *Id.* (RESPONDENTS002184 at -2192).

⁶ RXM-001, STEINBERG at 132 (RESPONDENTS001464 at -1609).

⁷ *Id.* (RESPONDENTS001464 at -1609).

body geometry, the material of the object, and the wavelength of the energy.⁸ As relevant here, backlights and microelectronic components (microprocessors, memory chips, drivers, controllers, etc.) each radiate heat.

37. Convective heat transfer is accomplished via the flowing of a fluid, either liquids or gases, across a surface.⁹ In heat transfer from a surface, energy is transferred to the fluid by conduction across a boundary layer of air at the surface.¹⁰ This energy is carried away by the now warmed bulk fluid.¹¹ The flow of air can be due to the buoyancy induced in the gas by thermal expansion (natural convection), or it can be induced by mechanical means such as a fan (forced convection).¹² Often, and as is the case in the Asserted Patents, air acts as the heat transfer fluid. Convective heat transfer can take place from a hot object to a cooler airstream, or from a hot airstream to a cooler object. The efficiency of the convective heat transfer depends on several factors including fluid density, air velocity, surface area and temperature differential, as well as the thermal conductivity of the object.

38. A plenum is a cavity through which a fluid, normally air, flows. The ductwork in a typical heating and air-conditioning system is an example of a plenum system which constrains air flows to and from various regions of a building. In electronics cooling applications, the walls of the plenum may be formed of a thermally conductive material on at least the side in contact with the heat source. This encourages conductive heat transfer through the plenum wall and into the moving air stream.¹³ In an electronic device, such as a desktop computer, there may be an

⁸ *Id.* (RESPONDENTS001464 at -1609).

⁹ *Id.* at 3. (RESPONDENTS001464 at -1480).

¹⁰ *Id.* (RESPONDENTS001464 at -1480).

¹¹ *See id.* (RESPONDENTS001464 at -1480).

¹² *Id.* (RESPONDENTS001464 at -1480).

¹³ RXM-003, Environmentally-Sealed, Convectively-Cooled Active Matrix Liquid Crystal Display (LCD), U.S. Patent No. 5,748,269, 5:18-23 (RESPONDENTS004392 at -4403) (issued

opening in the case through which air may enter. The interior of the case where the electronic components are housed would comprise a plenum. Often the computer will have a fan at the opening, designed to run either all of the time the computer is in operation, or only when the temperature inside the case reaches a certain temperature. Depending on operating environment and other factors, the opening may have a grill or filter to restrict the types and sizes of materials that may enter the computer case.

39. When using fans to cool electronic displays, the positioning of the fans is an important design consideration. Fans “can be used to draw air through a box or blow air through a box.”¹⁴ Fans that are used to “draw air” are typically referred to as “drawing” or “exhaust” fans. This is because the fan is placed at the exit or exhaust. As shown in Steinberg Figure 6.2, “cooling air passes through an axial flow fan as the air exists from the box.”¹⁵ Fans that are used to “blow air” are commonly referred to as “forcing” fans. This is because the fan is placed at the entrance or inlet. As shown in Steinberg Figure 6.1, an axial flow fan will blow cooling air through a box, “which will tend to heat the air as it enters the box.”¹⁶

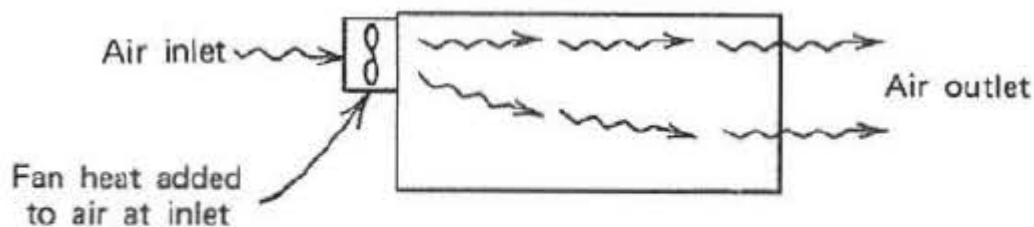


Figure 6.1 Axial flow fan blowing cooling air through a box.

May 5, 1998) (“Harris”).

¹⁴ RXM-001, STEINBERG at 165 (RESPONDENTS001464 at -1642).

¹⁵ *Id.* (RESPONDENTS001464 at -1642).

¹⁶ *Id.* (RESPONDENTS001464 at -1642).

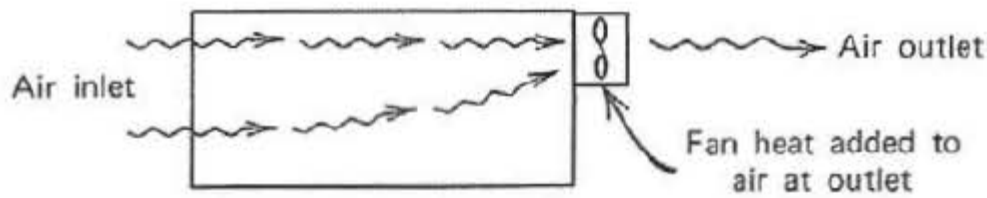


Figure 6.2 Axial flow fan drawing cooling air through a box.

40. An example of a common application of the difference between drawing and forcing fans in everyday life is the orientation of a fan relative to a window in a home on a hot day. The fan may be placed in such a way that it blows outside air into the room, in which case it is acting as a forcing fan. Alternatively, the fan may be oriented such that it pulls hot air out of the room, in which case it is acting as a drawing fan. As discussed below, in electronic displays, the decision to use drawing fans or forcing fans is largely driven by the size and specific circumstances in which the display is being used.

41. All fans induce a change in static pressure. The static pressure in a system is proportional to the volume of air in it and the rates of airflow into and out of the system. When used to cool electronics within a housing, a forcing fan “will raise the internal air pressure within the” housing relative to the pressure outside the housing.¹⁷ A forcing fan also creates more turbulence than a drawing fan and this can result in improved heat transfer within the housing.¹⁸ In contrast, a drawing fan “will reduce the internal air pressure within the” housing.¹⁹ This creates a negative pressure within the housing relative to the outside, which may result in dust being pulled into the display through uncontrolled leakage of dirt laden air.²⁰ While both systems may

¹⁷ *Id.* (RESPONDENTS001464 at -1642).

¹⁸ *Id.* (RESPONDENTS001464 at -1642).

¹⁹ RXM-001, STEINBERG at 165 (RESPONDENTS001464 at -1642).

²⁰ *Id.* (RESPONDENTS001464 at -1642).

be equipped with filters to reduce the amounts of dust inside a display housing, a drawing fan, which creates a negative pressure, inherently may be “dirtier,” as it would tend to draw dust-laden air into the housing through any openings or leaks in the housing.

42. Whether to choose a forcing fan or a drawing fan depends on application and priorities. As noted above, forcing fans may be implemented in a manner that introduces less dust into the system. Forcing fans are also quieter than drawing fans because they push air into a chamber where sound waves expand, dissipate, and are absorbed by the chamber.²¹

43. On the other hand, in a forcing fan system, the cooling air entering the system will be warmer than in a drawing fan system. This is because when an “axial fan is used in a blowing system, the air may be forced to pass over the hot fan motor, which will tend to heat the air as it enters the electronic box.”²² In addition, air can be forced into parts of the system where it may be trapped and warmed, thereby limiting the ability of the fan to cool the system. In contrast, in an exhaust fan system, which pulls or draws air through the box, the air passes through the “fan as the air exits from the box” and this results in cooler air entering the box in an exhaust fan system as compared with a blowing fan system.²³

44. With these considerations in mind, a POSITA would have appreciated that forcing fans may be more appropriate for use in systems with small key electronic components that need to be directly convectively cooled. In such systems, multiple fans can be utilized to direct the cooling air flow precisely. One downside of implementing multiple forcing fans that the power dissipation of the fans is an added heat load on the system and, additionally, may cause annoying

²¹ See RXM-004, E.J. Margetts, *A Demonstration That an Axial Fan in a Ducted Inlet Ducted Outlet Configuration Generates Predominantly Dipole Noise*, 117 J. SOUND & VIBRATION 399, 403 (1987) (RESPONDENTS004542 at -4546).

²² RXM-001, STEINBERG at 165 (RESPONDENTS001464 at -1642).

²³ *Id.* (RESPONDENTS001464 at -1642).

cyclic noise patterns when, for some electrical or mechanical reasons, the fan speeds vary from one another causing audible beat patterns.

45. On the other hand, drawing fans may be more appropriate for use in systems where it is desirable to obtain uniform air flow across large areas. Drawing fans are suitable for environments that require a higher selectivity in positioning and placing the fans, such as systems where there are multiple entries, where fans can be directed into inlet areas that needs to be cooled, and where dead zones need to be eliminated. As noted above, drawing fans may introduce more dust into the housing due to the creation of negative pressure and the difficulty of controlling input air quality or these areas. Drawing fans also tend to be louder than forcing fans because noise will travel with the air that is being pulled out of the chamber.

VI. BRIEF OVERVIEW OF THE '595, '322 AND '287 PATENTS

A. Overview of the '595 and '322 Patents

46. The '595 patent and the '322 patent are related by a claim of priority and share the same specifications. I will confine the below discussion to follow the '595 patent specification with the understanding that the same discussion applies to the '322 patent because equivalent citations can be found in the '322 patent.

47. The '595 patent, which is titled "Constricted convection cooling system for an electronic display," issued from U.S. Application Ser. No. 12/411,925 filed on March 26, 2009.²⁴

48. The '322 patent, which is titled "Constricted convection cooling system for an electronic display," issued from U.S. Application Ser. No. 14/508,621 filed on October 7, 2014.²⁵

²⁴ '595 patent, Face Page (MRI-ITC-1331_0000000001 at -0003).

²⁵ '322 patent, Face Page (MRI-ITC-1331_0000000021 at -0023).

49. The '595 and '322 patents each relates to cooling of electronic displays, including LCD displays, through convective cooling air flowing through a “constricted convection channel.”²⁶ According to the '595 and '322 patents, it is necessary to uniformly cool a display with an LED backlight as “individual LEDs may fail prematurely if exposed to high levels of heat for an extended period of time.”²⁷

50. The specification of the '595 and '322 patents includes examples where (i) only forcing fans are used, (ii) only drawing fans are used and (iii) both forcing fans and drawing fans are used. Indeed, as noted in the specification,

The fans **52** may either force the air through the constricted convection channel **50** or pull the air through the constricted convection channel **50**. Alternatively, a plurality of fans may be used to both push and pull air through the constricted convection cooling channel **50**.²⁸

51. Forcing fan-only examples. In Figure 5C, “one or more fans **52** are used to force ambient air between the posterior display surface **22** and the constricted convection plate **30**.”²⁹ In Figure 5E, “an air conditioning unit **110** is used to both cool the air and to force the cooled air between the posterior display surface **22**.”³⁰

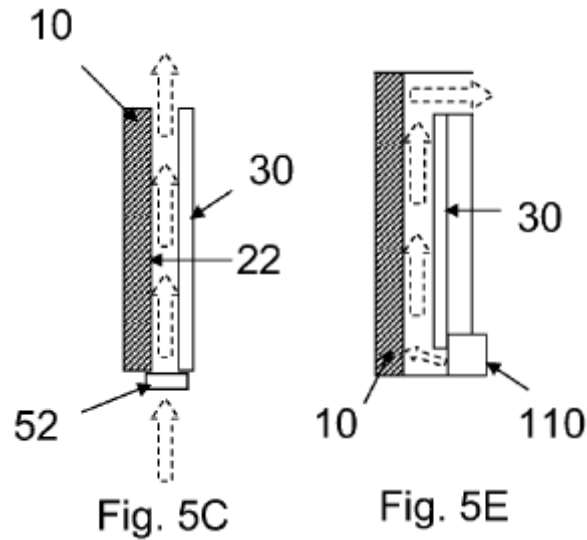
²⁶ '595 patent, Abstract, 4:60-65 (MRI-ITC-1331_0000000001 at -0003, -0016). All citations to the shared specification in the '595 patent and '322 patent are to the '595 patent, unless specifically noted.

²⁷ *Id.*, 3:5-8 (MRI-ITC-1331_0000000001 at -0016).

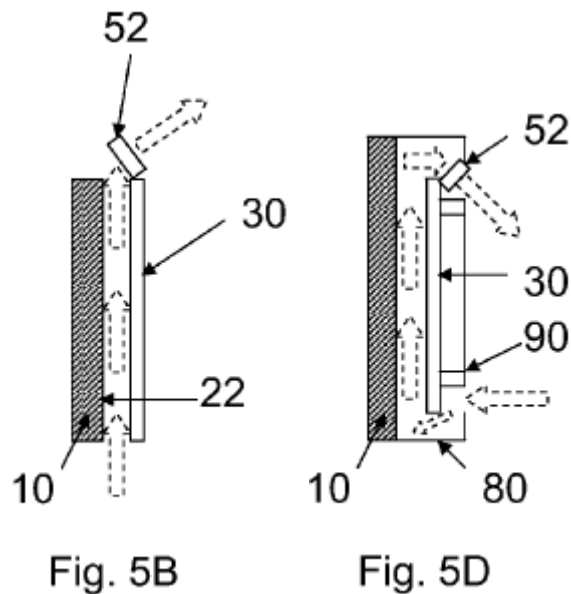
²⁸ *Id.*, 5:50-54 (emphasis added) (MRI-ITC-1331_0000000001 at -0017).

²⁹ *Id.*, 6:5-7 (MRI-ITC-1331_0000000001 at -0017).

³⁰ *Id.*, 6:9-11 (MRI-ITC-1331_0000000001 at -0017).



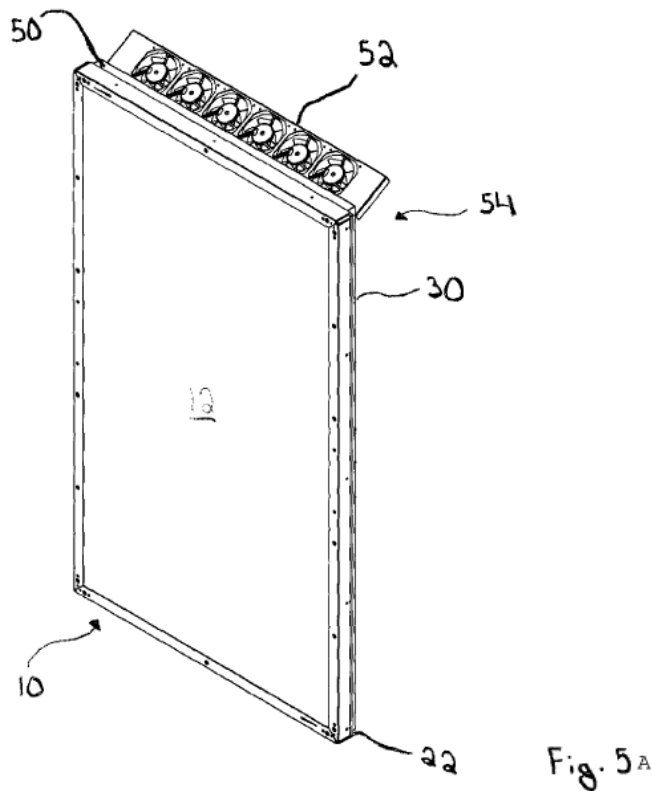
52. Drawing fan-only examples. In Figure 5B, “one or more fans **52** are used to draw ambient air between the posterior display surface **22** and the constricted convection plate **30**.”³¹ Figure 5D is a similar to Figure 5B, but “the housing **80** and the septum **90** are used to direct the flow of air.”³²



³¹ *Id.*, 6:1-5 (MRI-ITC-1331_0000000001 at -0017).

³² '595 patent, 6:7-9 (MRI-ITC-1331_0000000001 at -0017).

53. Examples where both forcing fans and drawing fans are used. In Figure 5A, a constricted convection cooling channel **50** is defined by a “constricted convection plate **30** and display posterior **22**.”³³ The constricted convection cooling system **54** “may include one or more fans **52** which may be positioned near the opening of the constricted convection cooling channel **50**” to “either force the air through the constricted convection channel or pull the air through the constricted convection channel **50**.”³⁴



³³ *Id.*, 5:37-39 (MRI-ITC-1331_0000000001 at -0017).

³⁴ *Id.*, 5:47-54 (MRI-ITC-1331_0000000001 at -0017).

54. Figure 5F shows “an air conditioning unit **110** . . . used in combination with one or more fans **52**.”³⁵ Here, the air conditioning unit operates as a forcing fan while fan **52** operates as a drawing fan.³⁶

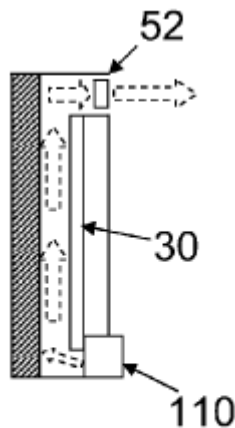


Fig. 5F

B. Overview of the '287 Patent

55. The '287 patent, which is titled “System for Using Constricted Convection with Closed Loop Cooling System as the Convection Plate,” issued from U.S. Application Ser. No. 15/280,968 (the '968 Application”) filed on January 13, 2016.³⁷

56. The '287 patent includes three independent claims, each of which covers an electronic display that is cooled by both a “closed loop” of air and an “open loop” of ambient air. Claim 12 covers an LCD display “having a backlight” which is “coolable by a combination of a

³⁵ *Id.*, 6:12-13 (MRI-ITC-1331_0000000001 at -0017).

³⁶ *Id.*, 9:37-41 (MRI-ITC-1331_0000000001 at -0019) (A “refrigeration unit may also cool the air which travels within the constricted convection channel **50**,” by “contain[ing] a means to force the cooled air into the constricted convection channel **50**,” “which may include one or more fans and one or more septa”).

³⁷ '287 patent, Face Page (MRI-ITC-1331_0000000041 at -0043).

closed loop of isolated gas which circulates within the housing and open loop of ambient air which passes through the housing and along the backlight.”³⁸

57. Figure 3B is an exemplary embodiment of the invention of claim 12 where a “constricted convection fan **200** is used to push air between the backlight **140** and the rear cooling chamber **40**” (which is described elsewhere as containing a closed loop of air).³⁹

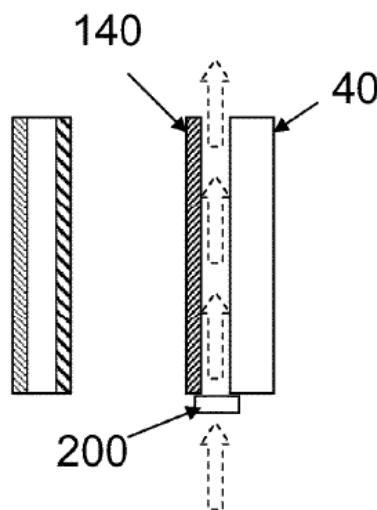


Fig. 3B

VII. OPINIONS REGARDING CONSTRUCTION OF THE DISPUTED TERMS

- A. **“a fan positioned[/placed] to draw air [from outside of the housing] through the constricted convection channel” / “a fan [placed/positioned] to draw [ambient] air between the constricted convection plate and the [rear posterior/posterior surface]”** (’595 Patent, claims 1, 4; ’322 Patent, claims 1, 4)⁴⁰

58. I have been asked to provide an opinion as to the meaning of the claim terms directed to “a fan [placed/positioned] to draw air” as bolded below in claims 1 and 4 of the ’595 and ’322 patents:

³⁸ *Id.*, claim 12 (MRI-ITC-1331_0000000041 at -0050).

³⁹ *Id.*, 5:18-22 (MRI-ITC-1331_0000000041 at -0049).

⁴⁰ Citations to the ’595 patent also refer to those in the ’322 patent because the specifications of the ’595 and ’322 patents are the same.

'595 patent:

1. A system for cooling an electronic display having a posterior display surface and contained within a housing, the system comprising:

a constricted convection plate placed posterior to the posterior display surface;

two side panels placed adjacent to the constricted convection plate and the posterior display surface, defining a constricted convection channel having an entrance and an exit; and

a fan placed to draw air from outside of the housing through the constricted convection channel.

4. A liquid crystal display (LCD) comprising:

a liquid crystal stack;

a backlight assembly behind the liquid crystal stack and comprising:

a metal core printed circuit board (PCB) having front and back sides;

a plurality of LEDs mounted on the front side of the PCB;

a posterior surface on the rear side of the PCB;

a constricted convection plate placed behind the posterior surface of the PCB, defining a constricted convection channel having an entrance and an exit; and

a fan positioned to draw air through the constricted convection channel.

'322 patent:

1. A system for cooling an electronic display having a posterior display surface and contained within a housing, the system comprising:

a constricted convection plate placed posterior to the posterior display surface covering the majority of the posterior display surface;

at least one bracket which connects the posterior display surface with the constricted convection plate; and

a fan placed to draw ambient air between the constricted convection plate and the rear posterior.

4. A liquid crystal display (LCD) comprising:

a liquid crystal stack;

a backlight assembly behind the liquid crystal stack and comprising:

a printed circuit board (PCB) having front and back sides;

a plurality of LEDs mounted on the front side of the PCB;

a posterior surface on the rear side of the PCB;

a constricted convection plate placed behind and substantially parallel with the posterior surface of the PCB; and

a fan positioned to draw air between the constricted convection plate and the posterior surface.

59. In my opinion, a POSITA in 2008 would have understood these claim terms to mean the following:

Asserted Patent(s) and Asserted Claim(s)	Claim Term⁴¹	Respondents' Proposed Construction
'595 patent: claim 1	"a fan placed to draw air from outside of the housing through the constricted convection channel"	"a fan positioned to pull air from outside the housing through and out of the constricted convection channel"

⁴¹ I understand that MRI's position is that each of these phrases should be construed consistent with their "plain and ordinary meaning" but they have not taken any position as to what the plain and ordinary meaning is. I have endeavored to construe these phrases consistent with their plain and ordinary meaning and the specification and as would be understood by a POSITA. To the extent that MRI takes a position as to what the plain and ordinary meaning of these phrases is, I reserve the right to supplement my opinions.

Asserted Patent(s) and Asserted Claim(s)	Claim Term⁴¹	Respondents' Proposed Construction
'595 patent: claim 4	"a fan positioned to draw air through the constricted convection channel"	"a fan positioned to pull through and out of the constricted convection channel"
'322 patent: claim 1	"a fan placed to draw ambient air between the constricted convection plate and the rear posterior"	"a fan positioned to pull ambient air through and out of the space that separates ⁴² the constricted convection plate and the rear posterior"
'322 patent: claim 4	"a fan positioned to draw air between the constricted convection plate and the posterior surface"	"a fan positioned to pull air through and out of the space that separates the constricted convection plate and the posterior surface"

60. Respondents' proposed construction of the "fan [placed/positioned] to draw air" terms in claims 1 and 4 of each of the '595 and '322 patents is consistent with the claims in the '595 and '322 patents, the language in the shared specification, and usage of the terms in the art and in general purpose dictionaries.

61. First, the claims distinguish between "drawing" fans and "forcing" fans and uses each term in a manner consistent with Respondents' proposed constructions. For example, in light of the technological differences noted in Section V above, including that between "drawing" and "forcing," a POSITA would have recognized the distinction between the use of the term "draw" as recited in claims 1 and 4 of each of the '595 and '322 patents, as compared with the use of the term "forcing" as recited in claim 9 of each of the '595 and '322 patents. A POSITA would have

⁴² I understand that Respondents propose that the plain and ordinary meaning of the word "between" is "in the space that separates" and that this interpretation is the same as that ordered by Judge Richard Andrews of the U.S. District Court for the District of Delaware in a case where MRI asserted these same patents against various companies including Civiq Smartscapes, LLC. I adopt Judge Andrews's interpretation for purposes of my opinions expressed herein.

understood that by using different words in the claims, the patentee intended to distinguish a “fan [placed/positioned] to draw air” from a fan positioned for “forcing air.”

62. Also, claim 7 of the '595 patent which depends from claim 4, indicates that “the fan is placed near the exit of the constricted convection channel” such that air is drawn in a direction that flows from the entrance to the exit. Likewise, claim 13 of the '322 patent, which depends from claims 9 and 12, supports the construction of the “fan [placed/positioned] to draw air” terms, because it makes clear that forcing air means placing a fan at the entrance such that air flows in a direction from the entrance to the exit.⁴³

63. Second, and as noted above, the specification of the '595 and '322 patents repeatedly distinguishes between fans that “draw,” or pull, air through a channel and fans that “force” air through a channel. For example, the '595 patent specification states, “[t]he fans **52** may either *force* the air through the constricted convection channel **50** or *pull* the air through the constricted convection channel **50**.”⁴⁴

64. The specification of the '595 and '322 patents also describes how a septum may direct air into the constricted convection cooling channel. For example, “[o]ne or more fans may be used to *draw* the cooling air,” but “[i]n other embodiments, one or more fans may be used to *force* air through the constricted convection cooling channel.”⁴⁵ In addition, “exemplary embodiments [include] a plurality of fans [that] are used to *draw* a substantially uniform flow of

⁴³ '322 patent, claim 13 (MRI-ITC-1331_0000000021 at -0039) (“The cooling system from claim 12 wherein: the means for forcing air between the constricted convection plate and the posterior surface of the electronic display comprises a plurality of fans placed near the entrance aperture.”).

⁴⁴ '595 patent, 5:50-52 (emphasis added) (MRI-ITC-1331_0000000001 at -0017).

⁴⁵ *Id.*, 2:65-3:2 (MRI-ITC-1331_0000000001 at -0015).

air through the constricted convection cooling channel.”⁴⁶ In each of these drawing examples, air is being pulled from outside the housing through and out of the constricted convection channel.

65. The distinction between “drawing” and “forcing” is further clarified by the specification’s discussion of fan location. For example, a “fan **52** may be associated with the exit opening **64** and may *draw* air from the constricted convection channel **50**.”⁴⁷ Alternatively, “fan **52** may be associated with the entrance opening **62** and may force air into the constricted convection channel **50**.”⁴⁸ Thus, drawing fans are placed at the exit, or outlet, to pull air into the housing, through the constricted convection channel, and exhaust it out of the housing at the outlet. In contrast, forcing fans are placed at the entrance, or inlet, and force air into the constricted convection channel.

66. Comparing the embodiments shown in Figures 5B and 5D with the embodiment shown in Figure 5C showcases this distinction. Each of these figures show side views of a fan operating to either draw or force air into the constricted convection channel.⁴⁹

⁴⁶ *Id.*, 3:2-4 (MRI-ITC-1331_0000000001 at -0015).

⁴⁷ *Id.*, 7:43-45 (MRI-ITC-1331_0000000001 at -0018).

⁴⁸ *Id.*, 7:45-47 (MRI-ITC-1331_0000000001 at -0018).

⁴⁹ *Id.*, 6:1-5, FIGs. 5B and 5D (MRI-ITC-1331_0000000001 at -0017, -0010).

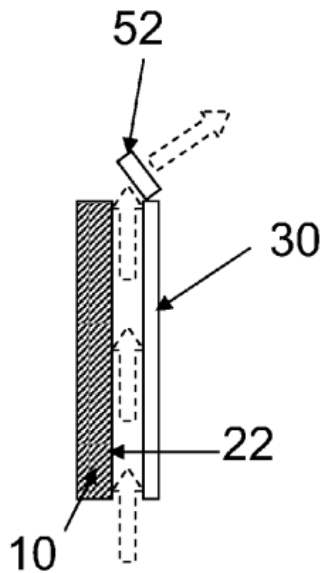


Fig. 5B

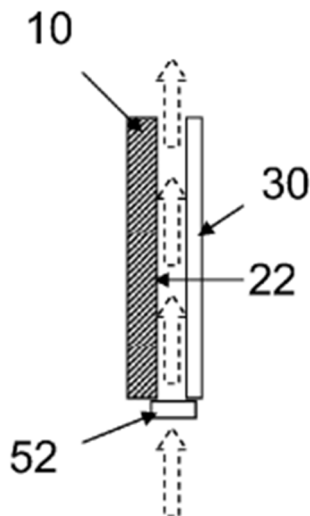


Fig. 5C

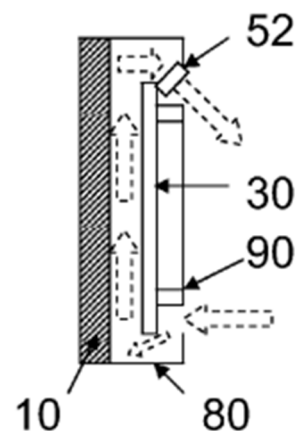


Fig. 5D

67. In Figure 5B, “one or more fans **52** are used to *draw* ambient air between the posterior display surface **22** and the constricted convection plate **30**.”⁵⁰ Similarly, Figure 5D shows that “the housing **80** and the septum **90** are used to direct the flow of air,” but is otherwise “similar to FIG. 5B.”⁵¹ A POSITA would have understood that the fans **52** in Figures 5B and 5D are drawing (or exhaust) fans located at the exit opening, that function by drawing or pulling air through and out of the constricted convection channel. In contrast, Figure 5C depicts an embodiment in which “one or more fans **52** are used to *force* ambient air between the posterior display surface **22** and the constricted convection plate **30**.”⁵² Figure 5E further illustrates the distinction between draw and force by describing “an air conditioning unit **110** is used to both cool the air and to *force* the cooled air between the posterior display surface **22**.”⁵³

⁵⁰ '595 patent, 6:2-5 (MRI-ITC-1331_0000000001 at -0017).

⁵¹ *Id.*, 6:7-9 (MRI-ITC-1331_0000000001 at -0017).

⁵² *Id.*, 6:5-7 (MRI-ITC-1331_0000000001 at -0017).

⁵³ *Id.*, 6:9-11 (MRI-ITC-1331_0000000001 at -0017).

68. Third, Respondents proposed constructions comports with usage in the art. Steinberg, for example, notes that “[w]hen a fan is used for cooling electronic equipment, the air flow direction can be quite important.”⁵⁴ Steinberg distinguishes between fans that draw, or pull air through and out of an electronic system and those that force air into an electronics system.⁵⁵ As Steinberg explains, forcing fans induce positive pressure within the housing relative to the outside while drawing fans induce negative pressure relative to the outside.⁵⁶ Therefore, a POSITA would thus have understood that “drawing” and “forcing” refer to distinct types of fan systems that operate in different ways, with different results.

69. Finally, my opinion is further supported by a review of general purpose dictionaries. Below is a summary of various dictionaries that provide definitions for the term “draw.” Each of these definitions indicate that “draw” is generally understood to mean “pull.”

Reference	Definition
Webster’s Collegiate Dictionary (11th Ed. 2007) at 379 (RXM-005, RESPONDENTS004539 at -4541).	Draw defined as “to pull up or out of a receptacle or place where seated or carried.”
The Oxford English Dictionary (2d. Ed., 1989) at 1023 (RXM-006, RESPONDENTS00407 at -4409).	Draw defined as “[t]o cause (anything) to move toward oneself by the application of force; to pull.”
Random House Webster’s College Dictionary (2000) at 400 (RXM-007, RESPONDENTS004417 at -4419).	Draw defined as “to cause to move in a particular direction by or as if by a pulling force; pull; drag.”

⁵⁴ See RXM-001, STEINBERG at 165 (RESPONDENTS001464 at -1642) (“The fan can be used to draw air through a box or to blow air through a box.”).

⁵⁵ See *id.* (RESPONDENTS001464 at -1642).

⁵⁶ *Id.* (RESPONDENTS001464 at -1642).

B. “open loop of ambient air which passes through the housing and along the backlight” (’287 Patent, claim 12)

70. I have also been asked to provide an opinion as to the meaning of the term “open loop of ambient air which passes through the housing and along the backlight” as recited in claim 12 of the ’287 patent:

12. An electronic display assembly comprising:

a housing;

a liquid crystal display (LCD) positioned within the housing and having a backlight;

wherein the electronic display is coolable by a combination of a closed loop of isolated gas which circulates within the housing and an **open loop of ambient air which passes through the housing and along the backlight.**⁵⁷

71. In my opinion, a POSITA in 2008 would have understood that the term “open loop of ambient air which passes through the housing and along the backlight” means “open loop of ambient air which passes through the housing and is in thermal communication with, the backlight,” as proposed by Respondents.

72. First, in some cases, the backlight may be limited to the circuit board(s) which include the LED sources that provide the illumination. The backlight may also be considered as containing either internal support structures or even external housings that may or may not be part of the overall display assembly. In my experience, these various usages have been applied to products wherein the backlight was deeply embedded in the display assembly as in a notebook computer LCD module, or configured as a fully separable assembly as in some desktop monitors, as well as configurations between these examples. The “backlight” may even include electronic

⁵⁷ ’287 patent, claim 12 (MRI-ITC-1331_0000000041 at -0050). The claim term to be construed has been bolded for ease of reference.

components that drive the display or the backlight. Therefore, based on the stated objective of the '287 patent, to provide "cooling systems for electronic displays"⁵⁸ the clearest interpretation of the term "along the backlight" should include the extent of the backlight which allows thermal communication with said backlight.

73. Second, my opinion is supported by statements made by the patentee during prosecution of a related patent application. During the prosecution of U.S. Patent No. 9,089,079 (the "'079 patent," of which the '287 patent is a continuation), the Examiner rejected a pending claim covering "an open loop of cooling air traveling along the rear surface of the LED backlight where the cooling air is not permitted to mix with the circulating gas" based on U.S. Patent No. 5,991,153 ("Heady") where the ambient air flows through a heat exchanger mounted to the side of the display.⁵⁹

⁵⁸ *Id.*, 1:58-59 ((MRI-ITC-1331_0000000041 at -0048).

⁵⁹ RXM-008, '079 patent file history at 204 (Jan. 30, 2015 Office Action) (RESPONDENTS004095 at -4298).

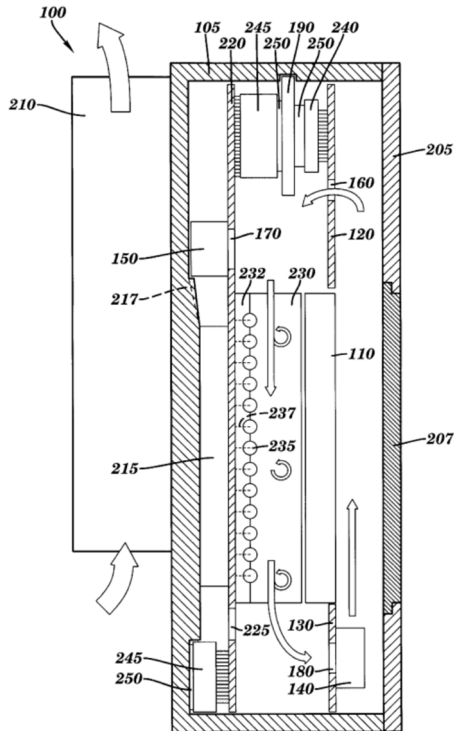


FIG. 3

74. I understand that, in response to the Examiner's rejection, rather than trying to traverse the characterization of Heady, the patentee instead amended the claim to recite "contacting the . . . backlight" as shown in the excerpt from the prosecution history below.⁶⁰

17. **(currently amended)** A thermally regulated liquid crystal display assembly, the system comprising:

- a liquid crystal stack having a display surface;
- an LED backlight with a thermally conductive rear surface positioned posterior to the liquid crystal stack;
- a glass plate placed in front of the display surface, the space between the glass plate and display surface defining a channel;
- a closed loop of circulating gas positioned to surround the liquid crystal stack and LED backlight where circulating gas flows through the channel; and
- an open loop of cooling air contacting ~~travelling along~~ the rear surface of the LED backlight ~~where the cooling air is not permitted to mix with the circulating gas.~~

⁶⁰ *Id.* at 223 (RESPONDENTS004095 at -4317).

75. I thus understand the applicant to be emphasizing a difference between air flow traveling “along a backlight” and airflow which “contacts a backlight.” This is consistent with how a POSITA would understand the two phrases. A POSITA at the time of the priority date of the ’287 patent would have understood that a backlight generates excessive heat which must be removed from the system. In general, due to the lower thermal resistance in a system where the cooling air makes direct contact with the heat generating components, more heat can be removed from a system where ambient air is traveling in contact with the backlight than one where the ambient air is merely traveling along components that are in thermal communication with the backlight. Nonetheless, technological considerations could lead a POSITA to deploy one approach for introducing ambient air into the system over the other.

76. Indeed, I note that in Heady, the open loop fan (not shown) cools the fins **210**⁶¹ mounted to the rear of the display **110** and, while in thermal communication with the display, the cooling air does not actually contact the backlight **220, 232, 235, 237, 230**.⁶² Yet I also note that the Examiner nonetheless considered this to be “along the backlight” and stated that “[a]lthough the cooling air is separated from the rear surface, it travels ‘along’ the rear surface of the backlight.”⁶³ The examiner’s statement additionally supports my opinion as stated above in paragraph 72.

77. In response to the rejection, the patentee further stated that “the Examiner has acknowledged that the open loop of cooling air does not contact the rear surface of the LED backlight, since the cooling air ‘is separated from the rear surface’ of the LED backlight.”⁶⁴ The

⁶¹ RXM-002, Heady, 6:67 (RESPONDENTS002184 at -2193).

⁶² RXM-008, ’079 patent file history at 204 (Jan. 30, 2015 Office Action) (RESPONDENTS004095 at -4298).

⁶³ See *id.* (RESPONDENTS004095 at -4298).

⁶⁴ *Id.* at 226 (RESPONDENTS004095 at -4320).

applicant is thus acknowledging that air traveling on a surface in thermal communication with the backlight is sufficient and that, of course, actual contact between the ambient air is merely a sufficient, but not necessary, condition. This is consistent with my opinion that the term “open loop of ambient air which passes through the housing and along the backlight” does not require that air directly contact the backlight. As such, the prosecution history of this related patent application supports Respondents’ proposed construction.

VIII. CONCLUSION

78. In summary, it is my opinion that a POSITA in 2008 would understand “a fan positioned[/placed] to draw air [from outside of the housing] through the constricted convection channel”/ “a fan [placed/positioned] to draw [ambient] air between the constricted convection plate and the [rear posterior/posterior surface]” to mean “a fan positioned to pull air [from outside the housing] through and out of the constricted convection channel”/“a fan positioned to pull [ambient] air through and out of the space that separates the constricted convection plate and the [rear posterior/posterior surface,” as proposed by Respondents.

79. It is also my opinion that a POSITA would understand “open loop of ambient air which passes through the housing and along the backlight” to mean “open loop of ambient air which passes through the housing and is in thermal communication with, the backlight,” as proposed by Respondents.

80. I reserve the right to supplement the opinions set forth above should additional information become available and/or in response to opinions offered by other witnesses in response to the opinions stated herein.

Dated: January 17, 2023



Robert Smith-Gillespie

APPENDIX A

Appendix A: List of Materials Considered

- Each of the documents and things cited or referenced in my Declaration
- The Asserted Patents:
 - U.S. Patent No. 8,854,595 (MRI-ITC-1331_0000000001-MRI-ITC-1331_0000000020)
 - U.S. Patent No. 9,173,322 (MRI-ITC-1331_0000000021- MRI-ITC-1331_0000000040)
 - U.S. Patent No. 9,629,287 (MRI-ITC-1331_0000000041- MRI-ITC-1331_0000000051)
- File histories of the Asserted Patents:
 - U.S. Patent No. 8,854,595 (MRI-ITC-1331_0000001916-MRI-ITC-1331_00000002320)
 - U.S. Patent No. 9,173,322 (MRI-ITC-1331_0000002321- MRI-ITC-1331_0000002569)
 - U.S. Patent No. 9,629,287 (MRI-ITC-1331_0000002570- MRI-ITC-1331_0000002677)
- The parties' draft Joint Claim Construction Statement
- File history of U.S. Patent No. 9,089,079 (RXM-008, RESPONDENTS004095-RESPONDENTS004391)
- Environmentally-Sealed, Convectively-Cooled Active Matrix Liquid Crystal Display (LCD), U.S. Patent No. 5,748,269, 5:18-23 (filed Nov. 21, 1996) (issued May 5, 1998) ("Harris") (RXM-003, RESPONDENTS004392-RESPONDENTS004406)
- DAVE S. STEINBERG, COOLING TECHNIQUES FOR ELECTRONIC EQUIPMENT 2 (John Wiley & Sons, 1980) ("Steinberg") (RXM-001, RESPONDENTS001464 -RESPONDENTS001718)
- Heat Transfer Sys. & Method for Elect. Displays, U.S. Patent No. 5,991,153 (filed Oct. 30, 1998) (issued Nov. 23, 1999) ("Heady"), 4:56-62 (RXM-002, RESPONDENTS002184-RESPONDENTS002197)
- E.J. Margetts, *A Demonstration That an Axial Fan in a Ducted Inlet Ducted Outlet Configuration Generates Predominantly Dipole Noise*, 117 J. SOUND & VIBRATION 399, 403 (1987) (RXM-004, RESPONDENTS004542- RESPONDENTS004549)
- Webster's Collegiate Dictionary (11th Ed. 2007) (RXM-005, RESPONDENTS004539-RESPONDENTS004541)
- The Oxford English Dictionary (2d. Ed., 1989) (RXM-006, RESPONDENTS004407-RESPONDENTS004416)
- Random House Webster's College Dictionary (2000) (RXM-007, RESPONDENTS004417-RESPONDENTS004419)

APPENDIX B

Robert Smith-Gillespie
Eugene, Oregon 97405 | (541) 914.2586 | rsg.fpd@comcast.net
LinkedIn www.linkedin.com/in/robert-smith-gillespie

SUMMARY OF QUALIFICATIONS

Product development engineer with electro-optical and mechanical systems background. Experienced new product development leader with design, analysis and manufacturing experience in high-complexity products integrating illumination and imaging components across a broad range of applications including medical devices, avionics controls and displays, area illumination and illuminated consumer products. Experience in patent litigation support spans over 20 cases and 15 years.

PROFESSIONAL EXPERIENCE

FPD Design & Consulting LLC, Eugene, Oregon

20 years concurrent

Principal Engineer

July 2021 - Present

Product design and development consultancy specializing in new product introduction. Projects include design of folded optics, CMOS-based imaging microscope for optical scanning of biological samples. Provided litigation expert services on 20+ LCD/LED display related patent and trade dispute lawsuits. Currently engaged part-time on diagnostic medical device for COVID-19 testing.

Magstim-EGI, Eugene, Oregon *(same business entity as Philips Neuro)*

Jul. 2020 – Dec. 2021

Philips Neuro, Eugene, Oregon

Sep. 2018 – Apr. 2020

Systems Engineer

Medical device hardware systems engineer for high-density EEG products. Focused on systems requirements development, HW specification and systems compliance verification for a network-based EEG system for clinical diagnosis of brain disorders. Specific competencies include:

Riverwood Solutions, Inc., San Francisco, California

Jan. 2013 – Sep. 2018

Sr. Technical Specialist

Provided NPI and manufacturing development support for consumer products companies including project management, design for manufacturing & assembly (DFX) analyses, manufacturing planning and support and start-up / scale-up troubleshooting. Led client team design reviews and performed DFMEA, PFMEA and competitive product analyses. Long-term assignments include:

- Technical project manager for automated high-speed fluid dosing line for FDA controlled consumable. Responsible for factory and site acceptance testing and configuration management for eight (8) \$2.3M filling lines.
- Directed CM's quality team in variation reduction investigation on high-speed filling line resulting in 20% yield improvement and a \$5.8M PBT increase per month. Solved supplier quality issue via RCCA investigation on precision pump component.
- Procurement engineer for \$70M glass coating line for US owned Asian factory covering 8 custom process machines.
- DFX analyses and BOM optimization for specialty products including board-level CMOS cameras, LED illumination and injection molded optical components. Supported client engineering team developing LCD /e-Paper license plate system.

E3 Displays, LLC, Phoenix, Arizona

Aug. 2007 - Apr. 2013

Chief Technologist

Led technology development and design for ruggedized LCD components for military, avionics, medical and specialty products. Worked closely with domestic supplier of custom optical adhesive and with Asian suppliers of optical components for LCD backlights, optical filters and touch panels. Other roles include:

- Managed process development and qualification of basic materials for touch panel and EMI filter optical bonding to LCDs.
- Designed and implemented UV-cured bonding system and semi-automated assembly line.
- Performed FEA and spreadsheet thermal analyses for improved lighting performance at high temperatures. (See paper/presentation #7 in publications list – available upon request)
- Developed mechanical tolerance analysis tool including temperature impacts at system level.
- Led design team for large-format, military LCD including CCFL-to-LED conversion, optically bonded EMI filter & heater, and thermal and optical feedback control system.
- Applied for patent on dual-mode night vision compatible LED backlight system (U.S. patent Pub. No.: US 201410036533 A1, withdrawn).

ADDITIONAL EXPERIENCE

Rosen Products LLC, Eugene, Oregon

1999 - 2002

Technical Staff Engineer

Member of senior technical staff reporting to engineering V.P. Roles included management of LCD display technology, strategic planning and product benchmarking for automotive and aircraft entertainment systems. Conceived and directed "Technology Platform Champion" team for advancing knowledge base in product critical technology areas. Product engineering manager for business aviation Cabin Entertainment Display Systems. Performed environmental (thermal & mechanical) and EMI testing of airborne electronics systems.

Three-Five Systems, Inc., Tempe, Arizona

1997 - 1999

Technical Specialist, Displays

Cross-functional specialist working with LCD mechanical and electrical design teams integrating custom LCDs into consumer products. Designed COB LED backlights for early handheld products. Developed Asian suppliers for injection molded mechanical parts polycarbonate light guides. Provided guidance for lighting design, photometry, colorimetry and optical films.

Honeywell, Air Transport Div., Phoenix, Arizona

1987 - 1997

Project Engineer thru Principal Engineer

Responsible for mechanical/optical/thermal design of the primary displays Boeing 777 airplane including aircraft integration and lighting design to optimize display system performance. Developed novel, active thermal management system for high-power fluorescent backlight system.

Led effort to improve backlight aging performance and performed sensitivity analyses with LCD manufacturer to reduce LCD color variation (see publications). Led design and supplier development for integrated switch panel for 737-700 MCP using high-luminance LCDs and annunciators.

Recipient of Honeywell's prestigious Technical Achievement Award recognizing significant technical contributions leading to a >2X backlight life improvement for the Boeing 777 LCD display program.

Sperry Corp. (Honeywell ATSD), Phoenix, Arizona

1985 - 1987

Manufacturing Engineer

EDUCATION

Embry-Riddle Aeronautical University

Master of Systems Engineering

2021

Arizona State University, Tempe, Arizona

BS Mechanical Engineering

1989

State University of New York, Plattsburgh, NY

BA Physics

1981

PROFESSIONAL MEMBERSHIPS

International Council on Systems Engineering (INCOSE)

Project Management Institute (PMI)

Society for Information Display (SID) – Conference organizing/paper review committee

Society for Automotive Engineers (SAE) Automotive FDP Metrology Working Group

Professional Ski Instructors of America (PSIA) – Certified Level III Instructor

PATENTS, PUBLICATIONS AND AWARDS

- 1) **U.S. Patent 7,660,040 - Diffuse Reflective Article**, Feb. 9, 2010. To E.I. DuPont de Nemours & Co., Wilmington, DE.
- 2) **U.S. Patent Pub. No.: US 201410036533 A1 - Dual Mode LCD Backlight** Filed 1 Aug. 2012. NVIS compatible, single rail LED backlight with optical device for improved uniformity in night mode. [Withdrawn]
- 3) **Don't Skimp on Your PRD**. EPP Europe; Oct. 2013.
- 4) **2008 LCD Backlight Report: Including LCD-TV, Monitor & Notebook PC Displays, An Opportunity Analysis**. Insight Media, Inc., Norwalk, CT; May 2008
- 5) **Ruggedized flat panel displays using COTS components**. 2008 SPIE Defense and Security Conference, Paper #6956-17, Orlando, FL; March 2008
- 6) **Advanced flat panel display backlighting techniques**. 2008 SPIE Defense and Security Conference, Paper #6956-21, Orlando, FL; March 2008
- 7) **LCD Backlight Design Tutorial**. SID 2008 Symposium Applications Session, L.A.; CA. May 2008
- 8) **Design Considerations for LED Backlights**. SID Display Applications Conference; Oct. 2007
- 9) **Display Technology Overview**, National Association of Science Teachers annual meeting, Costa Mesa, CA; April 6, 2006.
- 10) **LCD Ruggedization in Displays with Optically Bonded AR Cover Glass**. Americas Display Engineering Applications Conference (ADEAC) – Society for Information Display; Oct. 2006
- 11) **Design Considerations for LED Backlights in Large Format LCDs**. LEDs in Displays - SID Technical Symposium; Jan. 2006
- 12) **Characterization of Reflective Properties of Displays using Optical Fourier Transform Photometry**. Aerospace Lighting Institute; Feb. 2004
- 13) **Design Requirements for Automotive Entertainment Displays**. 8th Annual Symposium on Vehicle Displays, Soc. for Information Display; Oct. 2001.
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- 16) **Fixed Format Liquid Crystal Display Readability in Bright Ambient Environments**. IEEE 13th Digital Avionics Systems Conference; Nov. 1994.
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LITIGATION SUPPORT CASE SUMMARY

Bayes PLCC	[Patent infringement – 3/2020 – 12/2020]
Ultravision Technologies, LLC v. Ledman Optoelectronics, Ltd. Case No. 2:18-cv-00101-JRG-RSP	
Orrick, Herrington & Sutcliffe, LLP	[Patent infringement – 6/2020 – 1/2021]
Ultravision Technologies, LLC v. Yaham Optoelectronics Co., Ltd. & Ledman Optoelectronics Co., Ltd. , et. al. 337-TA-1114; 2:18-cv-00100, 2-18-cv-00118, USDC - Marshall, TX	
Covington & Burling, LLP	[Patent infringement – 3/2020 – present]
LG Electronics, Inc. v. Hisense Electronics Mfg Co. of America , Civil Case No. 2:19-cv-9474 (C.D. Cal.); Also, IPR support.	
McGuire Woods	[Patent infringement – 8/2019 – 11/2019]
Global Value Lightning, LLC et al. v. Current Lighting Solutions	
Orrick, Herrington & Sutcliffe, LLP	[Patent infringement – 9/2018 – 12/2018]
Ultravision Technologies, LLC v. Yaham Optoelectronics Co., Ltd. ITC Investigation No. 337-TA-1114 (ITC case)	
Sterne, Kessler, Goldstein & Fox P.L.L.C.	[Patent infringement – 9/2016 – 10/2017]
MiiCs & Partners America, Inc. v. Funai Electric Co. Ltd.	
Dorsey & Whitney LLP	[Patent infringement – 9/2016 – 12/2017]
MiiCs & Partners America, Inc. v. Toshiba America, Inc. LCD panel designs & structures	
Chen & Malin LLP	[Patent infringement – 8/2016 – 4/2017]
LakeSouth Holdings, LLC v. Home Depot	IPR/Litigation support
Latham & Watkins LLP	[Patent infringement – 1/2015 – 9/2015]
Samsung Electronics Co., Ltd. et al. v. NVIDIA Corp. Electro-mechanical design of computer chassis	
Foley & Lardner LLP, Milwaukee, WI	[Patent infringement – 4/2015 – 6/2015]
Innovative Display Technologies, LLC v. Sprint	
Dykema Gossett PLLC	[IPR 10/2014 – Present]
LakeSouth Holdings, LLC v. Wal-Mart Stores, Inc.	
Mayer-Brown LLP, Chicago, IL	[Patent infringement – 8/2014 – 2/2015]
Innovative Display Technologies, LLC v. Acer et. al.	
Erise IP, P.A., Overland Park, KS	[Patent infringement – 3/2014: Settled]
Innovative Display Technologies, LLC v. Garmin International, Inc. et al. LCD backlight patent infringement	
Kenyon & Kenyon LLP, New York, NY	[Patent infringement – 5/2013 to 1/17/2014]
Techknowledge Law Group LLP, San Francisco, CA Round Rock Research v. Lenovo & Acer. Thermal mgmt in LCD panel	
Foley & Lardner LLP, Washington, DC	[Patent Re-exam support – 1/2013 to 12/2013]
Xilinx Inc. v. Intellectual Ventures I LLC (Two IPRs); Depo 1.5 days	
Klein, O’neill, Singh LLP, Santa Ana, CA	[Trade secret & patent infringement – 7/11 to 9/12]
LCD shutter 3-D glasses manufacturing and product design dispute Expert support on behalf of Li-Tek Corp. and GDC Technology of America LLC	
Finnegan, Henderson, Wash., D.C.	[Patent Re-exam support – 3/11 to 4/12]
Provide technical support for LG Display, Inc. re-exam request on U.S. Patent No. 7,125,157 et.al. (4 total)	
McKenna Long & Aldridge, Wash., D.C.	[Patent infringement – 8/08 to 7/10]
LG Display v. AUO & CMO. LCD backlight and structures litigation. Depo 3 days; Trial 1 day	
Shook Hardy & Bacon LLP, Kansas City. MO	[Patent infringement – 1/08 to 4/08: Settled]
Mobile Traffic Systems., v. Cobra Elec., Garmin USA ; U.S. District Court, No. District of Alabama.	
Oblon, Spivak, McClelland, Maier & Neustadt, P.C.	[Patent Infringement, Settled]
Optrex USA v. Honeywell, Inc. (Deposed, no trial)	
Morgan Lewis & Brokious LLP, Wash. D.C.	[Patent infringement – 7/05 to 9/06: Settled]
LG Philips LCD Co. Ltd., v. Chungwa Picture Tubes, Inc.; U.S. District Court, So. District of California. Deposed 3 days; No trial	
Jacobson Holman LLP, Washington D.C.	[Patent infringement – 5/05 to 7/05: Settled]
Audiovox v. Epsilon Electronics, Inc. Civil Action No. 03 Civ 6235, Eastern District of N.Y.	

Shaw Pittman LLP and Bingham McCutchen LLP

[Patent infringement – 6/04 to 7/05: Settled]

Richard Ditzik v. **ViewSonic Corp.**, et. al., filed in the U.S. District Court, Eastern District of Michigan, Southern Division; Case No. 03-74043. Deposed 2 days, No trial

Alschuler Grossman Stein & Kahn LLP

[Patent infringement – 12/04 7/05: Settled]

Sharp Corporation v. **AU Optronics Corporation**, et. al., Case No. C03-04244 MMC filed in the United States District Court, Northern District of California. Deposed 2 days, No trial

Note: Parties for whom expert services were provided are in listed bold font.