

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL TECHNOLOGIES INC. AND DELL INC.,
Petitioners

v.

CLOUD BYTE LLC
Patent Owner

U.S. Patent No. 9,629,265

**DECLARATION OF HIMANSHU POKHARNA, PH.D. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,629,265**

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I, Himanshu Pokharna, Ph.D., declare as follows:

1. I make this declaration based upon my own personal knowledge and, if called upon to testify, would testify competently to the matters stated herein.

2. I have been asked by the petitioners to provide technical assistance in connection with the *inter partes* review of U.S. Patent No. 9,629,265 (which I will refer to as the “’265 Patent”). This declaration is a statement of my opinions on issues related to the patentability of claims 1-8 (which I will refer to as the “challenged claims”) of the ’265 Patent.

3. My compensation is not based on the content of my opinions or the resolution of this matter. I have no financial interest in the outcome of this proceeding.

I. BACKGROUND AND QUALIFICATIONS

4. In formulating my opinions expressed in this declaration, I have relied on my knowledge, training, and experience in the relevant field, which I will summarize briefly. Additional details are provided in my curriculum vitae, which I understand has been marked as Exhibit 1004.

5. I received my Bachelors of Technology and Masters of Technology degrees (equivalent to B.S. and M.S. in the United States) in Mechanical Engineering from the Indian Institute of Technology, Bombay, India in 1990 and 1992, respectively. I received my Ph.D. degree in Nuclear Engineering from

Purdue University, West Lafayette, Indiana, in 1997. My Ph.D. thesis focused on modeling of two-phase flow dynamics in heat transfer systems and specifically developed analytical models for the simultaneous flows of water and water vapor in a system during heat absorption. In addition, I received by MBA degree from The Wharton School of University of Pennsylvania, Philadelphia, Pennsylvania, in 2006.

6. For over 25 years, I have led various companies in their thermal technology development. I founded and currently serve as the CEO and Director of Deep Materials Inc., a company devoted to developing thermal management components, such as thermal interface materials and heat sinks for computing and consumer electronic systems. Deep Material products are widely used in servers as well as PCs for thermal management of some of the key components. I am also the Founder and Board Member of Inficold Inc., a company specializing in the design and manufacture of thermal storage integrated refrigeration products, including cold storages, PCM packs, and air conditioners. Additionally, I am the Owner of Deeia Inc., a thermal consulting business that has developed a new loop thermosyphon technology for data center cooling. I also serve as a senior technical advisor/CTO to Ventiva, a company specializing in a new kind of air mover technology development. Ventiva air mover is a fan replacement with primary application in electronics cooling and computing system thermal management. My

main responsibility is to guide the technical team on system design, using Ventiva technology.

7. Before my current positions, I co-founded and served as Board Member and Vice President of Business Development for Sheetak Inc., a company that applies an innovative thermoelectric cooling technology to power generation and refrigeration. I also served as the Vice President of Product Development for k-Technology Corp., a defense hardware company developing high thermal conductivity materials. I also worked for Intel Corp. as Staff Engineer, Thermal Technology Manager, and then Group Manager, overseeing thermal technology development and deployment for the mobile products group and developing thermal architecture for laptop personal computers.

8. During my career, I also have authored and co-authored over 20 papers and keynote addresses on thermal technology for various journals and conferences. For example, I co-authored “Skin Cooling and Other Challenges in Future Mobile Form Factor Computing Devices,” published in volume 39 of the Microelectronics Journal in 2008. I co-authored “Lid Cooling for Notebooks,” published in the proceedings for the 11th Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems in 2008. I co-authored and presented “Mobile Thermal Challenges in Future Platforms” at THERMES 2007: Thermal Challenges in Next Generation Electronic Systems, Santa Fe, NM, in

2007. I also co-authored and presented “Challenges and Advances of Heat Pipes in Cooling Notebook Systems” at the ASME InterPACK Conference, Vancouver, Canada, in 2007. I also co-authored “Use of Heat Pipes in Multiple Component Cooling in Laptop PCs,” published in the proceedings for the 8th International Heat Pipe Symposium in 2006. I also co-authored and presented “Remote Heat Pipe Based Heat Exchanger Performance in Notebook Cooling” at the ASME Summer Heat Transfer Conference, San Francisco, CA, in 2005.

9. I was selected as a speaker and delivered “Application of Thermal Management in Energy Devices” at the 2011 Annual Taiwan Thermal Management Association Meeting, Taipei, Taiwan. I also delivered “Notebook Thermal Technology: Need for Standardized Metrology—Call to Action for Taiwan Thermal Management Association” at the 2007 Annual Taiwan Thermal Management Association Meeting, Taipei, Taiwan. I was the co-author for a keynote paper titled “Heat Pipe Needs in Future Mobile Platforms” at the 14th International Heat Pipe Conference, Florianopolis, Brazil, in 2007. I was also the author of the keynote paper titled “Design and Test Methodologies of Use of Heat Pipes in Laptop PCs” which was presented at the 8th International Heat Pipe Symposium, Kumamoto, Japan, in 2006. I was also the keynote speaker and delivered “Microchannel Cooling in Computing Platforms: Performance Needs and Challenges in Implementation” at the 2nd ASME-JSME International

Microchannel Conference, Rochester, NY, in 2004.

10. These are examples. A full list of my publications and addresses is included in my curriculum vitae (EX1004).

11. Furthermore, I am the named inventor for more than 120 issued and pending patents on thermal technology. For example, I am the inventor of U.S. Patent No. 9,903,621 B1, entitled “Cooling System with Thermal Battery.” I am also the inventor of U.S. Patent No. 9,574,832 B2, entitled “Enabling an Aluminum Heat Exchanger with a Working Fluid.” I am also the inventor of U.S. Patent No. 8,043,703 B2, entitled “Thermally Conductive Graphite Reinforced Alloys.” I am also the inventor of U.S. Patent No. 7,308,931 B2, entitled “Heat Pipe Remote Heat Exchanger (RHE) with Graphite Block.” I am also the inventor of U.S. Patent No. 7,269,005 B2, entitled “Pumped Loop Cooling with Remote Heat Exchanger and Display Cooling.” I am also the inventor of U.S. Patent No. 7,243,497 B2, entitled “Apparatus to Use a Refrigerator in Mobile Computing Device.”

12. These are examples. A full list of the issued and pending patents are set forth in my curriculum vitae (EX1004).

13. Based on my substantial academic and professional experiences, I believe that I am qualified in the technology fields pertaining to the '265 Patent, as at least a person of ordinary skill in the relevant art at the time of the claimed

invention.

II. MATERIALS CONSIDERED

14. In preparation of this declaration, I have considered the materials discussed in this declaration, including for example the '265 Patent and its prosecution history. In particular, I have reviewed and considered the following documents, among others, in connection with my analysis:

- EX1001: The '265 Patent;
- EX1002: The prosecution history of U.S. Patent Application No. 13/780,005, which led to the issuance of the '265 Patent;
- EX1005: U.S. Patent No. 9,332,679 (“Carl”);
- EX1006: Provisional Application No. 61/574,593 (“Carl-Provisional”);
- EX1007: U.S. Patent Application Publication No. US 2008/0218949 (“Hughes”);
- EX1008: U.S. Patent No. 7,042,722 (“Suzuki”);
- EX1009: U.S. Patent No. 5,612,854 (“Wiscombe”);
- EX1010: U.S. Patent No. 7,643,281 (“Okamoto”);
- EX1011: U.S. Patent No. 7,738,253 (“Araujo”);
- EX1012: New Oxford American Dictionary (3rd. ed. 2010) (excerpt);
- EX1013: The American Heritage Dictionary of the English Language

(5th ed. 2011) (excerpt);

- EX1014: Collins Dictionary (10th ed. 2009) (excerpt);
- EX1015: Merriam-Webster's Collegiate Dictionary (11th ed. 2009) (excerpt);
- EX1016: The New Penguin Dictionary of Civil Engineering (2005) (excerpt);
- EX1017: Microsoft Computer Dictionary (5th ed. 2002) (excerpt);
- EX1018: Random House Webster's Computer & Internet Dictionary (3d ed. 1999) (excerpt);
- EX1019: Dictionary of Computer and Internet Terms (10th ed. 2009) (excerpt);
- EX1020: Dictionary of Computing (6th ed. 2008) (excerpt);
- EX1021: U.S. Patent No. 5,412,534 ("Cutts");
- EX1022: U.S. Patent Application Publication No. 2010/0002374 ("Sasagawa");
- EX1023: U.S. Patent No. 6,906,918 ("Rabinovitz");
- EX1024: U.S. Patent. No. 7,800,894 ("Davis");
- EX1025: U.S. Patent Application Publication No. 2004/0078712 ("Rajamani");
- EX1026: U.S. Patent Application Publication No. 2005/0015632

(“Chheda”);

- EX1027: Complaint for Patent Infringement; and
- EX1028: Cloud Byte’s Preliminary Infringement Contentions with attached Exhibits 7 and 8.
- EX1032: Cloud Byte’s Disclosure of Proposed Claim Constructions and Extrinsic Evidence with Attached Exhibit A

15. My analysis and opinions are further based on my education, training, experience, and knowledge in the relevant field.

III. RELEVANT LEGAL STANDARDS

16. I am not an attorney. For the purposes of this declaration, I have been informed by counsel for the petitioners about certain aspects of the law that are relevant to forming my opinions. My understanding of the relevant law is as follows.

A. Prior Art

17. I understand that for an invention claimed in a patent to be found patentable, it must be (among other things) new and not obvious based on what was known before the invention was made.

18. I understand that the information used to evaluate whether a claimed invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes all patents and printed publications that

existed before the earliest filing date of the patent. This includes foreign language material. I also understand that a patent is prior art if it was filed before the effective filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the effective filing date.

19. I understand that in this *inter partes* review proceeding, the petitioners have the burden of proving that the challenged claims are unpatentable in light of the prior art by a preponderance of the evidence. I understand that a preponderance of the evidence is evidence sufficient to show that a fact is more likely true than not true.

20. I understand that patent claims in an *inter partes* review are interpreted by applying the same standard that applies in district court litigation. After the claims are construed, they are then compared to the prior art.

21. I understand that in this *inter partes* review proceeding, the prior art that may be used to evaluate whether the challenged claims are new and not obvious is limited to patents and printed publications. My analysis, which is set out in detail below, compares the challenged claims to patents and printed publications that I have been informed constitute prior art to the claims.

B. Person of Ordinary Skill in the Art

22. I understand that my assessment of the challenged claims and the teachings of the prior art as well as my analysis and opinions herein must be

undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the challenged patent on its priority date and in light of the specification and file history of the patent. I may refer to such a person as a “POSITA.”

23. I further understand that in determining the level of ordinary skill in the art, I may consider factors including:

- (a) the type of problems encountered in the art or field of invention,
- (b) prior art solutions to those problems,
- (c) the rapidity with which innovations are made,
- (d) sophistication of the technology, and
- (e) the educational level of active workers in the field.

24. I understand that a person of ordinary skill in the art, or POSITA, is not a specific real individual but is instead a hypothetical individual having the qualities reflected by the factors above. This hypothetical person has knowledge of all prior art in the relevant field and takes from each reference what it would teach to a person having the skills of a POSITA.

C. Anticipation

25. I understand that a patent claim may be “anticipated” if each element of that claim is present either explicitly or inherently in a single prior art reference, and that the elements should be arranged in the prior art reference as in the claim.

I understand that for a claimed limitation to be inherently present, the prior art reference need not expressly disclose the limitation so long as the claimed limitation necessarily flows from a disclosure in the reference.

D. Obviousness

26. I understand that prior art can render the claim “obvious” to a person of ordinary skill in the art. My understanding of this legal standard is set out below.

27. I understand that prior art can render a patent claim unpatentable where subject matter falling within the scope of the claim would have been obvious to a person of ordinary skill in the art. I understand that the following standards govern the determination of whether a patent claim is rendered “obvious” in light of the prior art. I have applied these standards in my evaluation of whether the challenged claims are obvious in light of the prior art.

28. I understand that a claimed invention is not patentable if it would have been obvious to a person of ordinary skill in the field of the invention at the time the claimed invention was made. Even if all the elements of a claim were not found in a single prior art reference, the claim is not patentable if the differences between the subject matter in the prior art and the subject matter in the claim would have been obvious to a POSITA at the time the application was filed. Prior art disclosing a method or device that falls within the scope of a claim can render

that claim obvious even if other, different methods or devices might also fall within the scope of the claim.

29. I understand that a determination as to whether a claim would have been obvious should be based on four factors (though not necessarily in the following order): (i) the level of ordinary skill in the art at the time the application was filed; (ii) the scope and content of the prior art; (iii) the differences between the claimed invention and the prior art; and (iv) any “objective factors” indicating obviousness or non-obviousness that may exist in a particular case.

30. I understand that an obviousness analysis should not be based on hindsight but must be performed using the perspective of a person of ordinary skill in the relevant art as of the effective filing date of the patent claim.

31. I understand that secondary indicia of non-obviousness may include: (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I also understand that there must be a relationship between any such secondary considerations and the claimed invention. I further understand that contemporaneous and independent invention

by others is a secondary consideration supporting an obviousness determination.

32. I understand that the teachings of two or more prior art references may be combined in the manner disclosed in a challenged claim if such a combination would have been obvious to one having ordinary skill in the art. In determining whether a combination would have been obvious, the following exemplary rationales may support a conclusion of obviousness:

- combining prior art elements according to known methods to yield predictable results;
- simple substitution of one known element for another to obtain predictable results;
- use of a known technique to improve similar devices (methods, or products) in the same way;
- applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- “obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- 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 are predictable to one of ordinary skill in the art;

- some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention; and
- common sense.

33. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, but instead can take account of the ordinary innovation and experimentation in the relevant field that does no more than yield predictable results.

34. I understand that, in assessing whether there was an apparent reason to modify or combine known elements as claimed, it may be necessary to look to interrelated teachings of multiple patents and printed publications, the effects of commercial demands, and the background knowledge of a person of ordinary skill in the art. I further understand that any motivation that would have applied to a person of ordinary skill in the art, including motivation from common sense or derived from the problem to be solved, is sufficient to explain why references would have been combined.

35. I understand that modifications and combinations suggested by common sense are important and should be considered. Common sense suggests that familiar items can have obvious uses beyond the particular application being

described in a prior art reference, that if something can be done once it would be obvious to do it multiple times, and that in many cases a person of ordinary skill in the art can fit the teachings of multiple patents together in an obvious manner to address a particular problem. Further, the prior art does not need to be directed to solving the same problem that is addressed in the challenged claims.

36. I understand that a person of ordinary skill in the art is also a person of ordinary creativity. In many fields, it may be that there is little discussion of obvious techniques, modifications, and combinations, and it may be the case that market demand, rather than scientific research or literature, will drive a new design. When there is market pressure or design need to solve a particular problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has a good reason to employ the known options. If this leads to the expected success, then it is likely the product of ordinary skill and common sense as opposed to patentable innovation. I understand that if a combination was obvious to try, that may show that it was obvious and therefore unpatentable. That a particular combination of prior art elements was obvious to try suggests that the combination was obvious even if no one made the combination.

E. Written Description

37. I have been informed that patent claims must be supported by an adequate written description. In order for a patent to obtain a priority date based

on a prior application, that prior application must provide adequate written description support for the claims. To meet the written description requirement, the particular disclosure must reasonably convey to those of skill in the art that, as of the relevant filing date, the inventor was in possession of the claimed subject matter. I further understand that the level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology. The test for the written description requirement requires an objective inquiry into the four corners of the relevant disclosure from the perspective of a person of ordinary skill in the art.

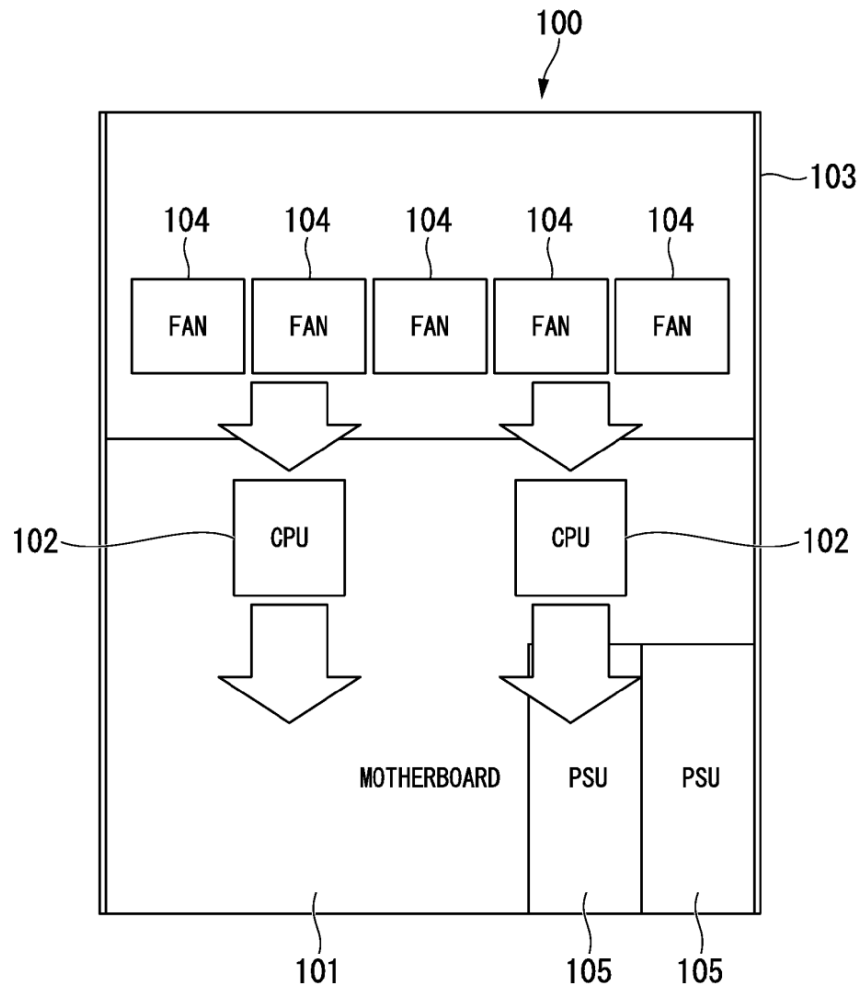
IV. TECHNICAL ANALYSIS OF THE '265 PATENT

38. The '265 Patent is entitled "Cooling Structure of Electronic Device." EX1001, 1. The patent is based on U.S. Patent Application No. 13/780,005, which was filed on February 28, 2013, and the patent issued on April 18, 2017. The '265 Patent claims priority to Japanese Patent Application No. 2012-48062 filed on March 5, 2012.

A. Overview of the Patent Specification

39. The '265 Patent relates to "[a] cooling structure...designed for an electronic device[.]" EX1001, 1 (Abstract). It states that "[v]arious technologies regarding cooling structures of electronic devices have been developed[.]"

EX1001, 1:22-23. However, according to the '265 Patent, examples of such technologies were “disadvantageous because of [their] complex structure” or because they did “not demonstrate a good cooling effect when one power source additionally applie[d] its heat to the other power source, thus totally increasing heat produced by a pair of power sources vertically combined together.” EX1001, 1:37-39, 1:57-62. This is illustrated in Figure 6, which shows a server with “a motherboard 101, a pair of CPUs 102, a housing 103, a plurality of fans 104, and a pair of power source units (or power supply units: PSU) 105.” EX1001, 1:63-2:1; *see also* EX1001, 2:20-24.



EX1001, Fig. 6. As illustrated, the server “is designed to adjacently dispose the two power source units 105 in a further downstream side of a cooling air flow compared to the CPUs 102.” EX1001, 2:14-19.

40. The patent identifies two problems with the configuration illustrated in Figure 6. First, “one CPU 102 and one power source unit 105 are positioned linearly along a cooling air flow; hence, a cooling air flow caused by the fan 104 is temporarily warmed by heat caused by the CPU 102 and subsequently flows into the power source unit 105.” EX1001, 2:20-24. “This may degrade a cooling effect

for the power source unit 105 in the server 100.” EX1001, 2:24-26. Second, “[d]ue to the adjacent arrangement of the power source units 105, one power source unit 105 additionally applies its heat to the other power source unit 105,” which “may further degrade a cooling effect for the power source units 105.” EX1001, 2:27-30.

41. For the configuration depicted in Figure 6, the ’265 Patent states that “[i]n order to adequately cool the power source units 105 in the server 100, it is necessary to increase the speed of rotation of the fans 104 or the internal fans (not shown) embedded in the power source 105” or “increase the number of fans 104 or to use high-performance fans for the server 100,” which “may increase the cost price of the server 100” and “may entail unnecessary limitation to the size and capacity of the server 100 so as to prevent an increase in heating value of each power source unit 105.” EX1001, 2:31-42.

42. To address the problems identified in the prior art, the ’265 Patent offers as a purported solution “a simple cooling structure of an electronic device demonstrating a high cooling effect for power source units supplying electric power to CPUs.” EX1001, 2:54-57. Specifically, the ’265 Patent describes the invention as “directed to an electronic device covered with a housing having a front face and a rear face which are distanced from each other in the longitudinal direction.” EX1001, 2:58-61. The electronic device includes “a plurality of fans

which are arranged inside the housing so as to cause cooling air to propagate in the longitudinal direction of the housing, a plurality of electronic parts (e.g., CPUs) serving as heat sources, which are arranged inside the housing and positioned in the downstream side of the cooling air caused by the plurality of fans, and a plurality of power source units which are arranged inside the housing.” EX1001, 2:61-3:1. The power source units are “spaced out from each other in the width direction of the housing, perpendicular to the cooling airflow direction of cooling air, in such a way that the power source units do not overlap with the electronic parts in the cooling airflow direction.” EX1001, 3:8-12. As the ’265 Patent explains, “[a]mong the electronic parts included in the server 1, the CPUs 4 are the heat sources producing the highest heat value, while the power source units 6 are the heat sources producing the second highest heat value.” EX1001, 5:33-36.

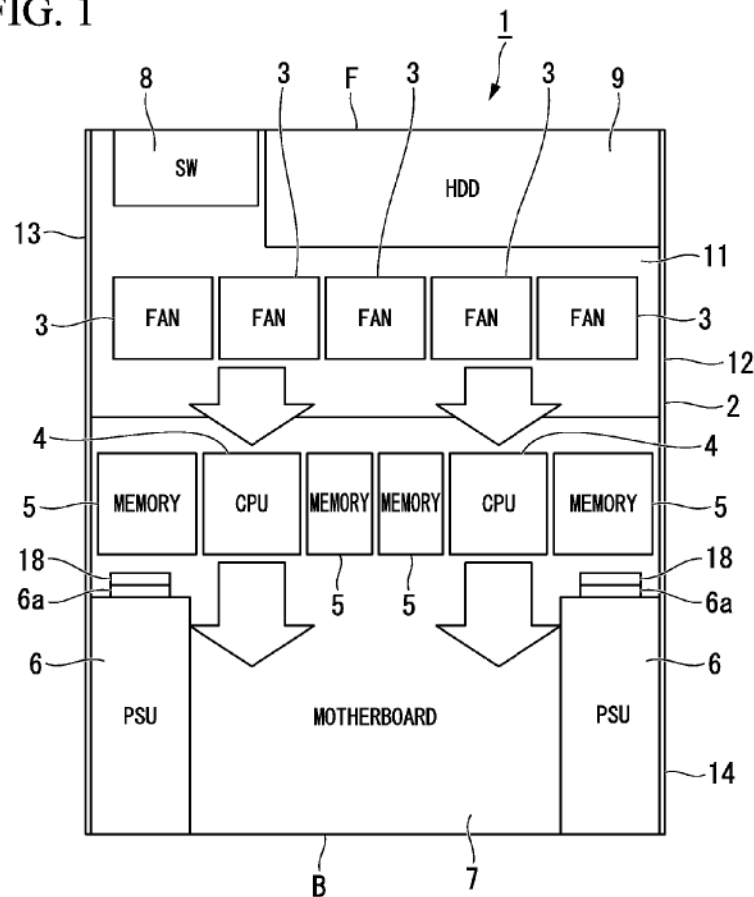
43. “Since the CPUs 4 do not longitudinally overlap with the power source units 6 in the cooling airflow direction, cooling air firstly cools the CPUs 4 and then propagates straight through a cap area formed between the power source units 6; thereafter, cooling air may flow out of the rear face of the housing 2,” which “reliably prevents cooling air, which is temporarily warmed by the CPUs 4, from directly flowing into the power source units 6.” EX1001, 5:39-46.

“Meanwhile, cooling air passing through the memories 5 flows into the power source units 6, wherein cooling air actually applied to the power source units 6 is

sufficiently low in temperature.” EX1001, 5:47-50.

44. Figure 1 of the '265 Patent, reproduced below, illustrates the claimed solution.

FIG. 1



EX1001, Fig. 1. The '265 Patent explains that, as illustrated, “each CPU 4 is accompanied with a pair of memories 5 on the left and right sides thereof” and that a “reference sign F denotes a front face of the server 1, while a reference sign B denotes a back face (or a rear face) of the server 1.” EX1001, 3:55-58.

45. “The fans (i.e. cooling fans) 3 are linearly aligned in the width

direction of the main frame 14 and are positioned in the back side of the main frame 14 compared to the switching device 3 and the hard disk drive 9.” EX1001, 4:23-26. Further, “[e]ach fan 3 is appropriately positioned and designed to cause an air flow in a longitudinal direction from the front side to the rear side in the housing 2.” EX1001, 4:26-29. “This causes a cooling airflow in the longitudinal direction (see arrows) from the front side to the rear side of the housing 2.” EX1001, 5:21-23.

46. In Figure 1, “both the power source units 6 are positioned in the downstream side of a cooling air flow compared to the CPUs 4, whereas the power source units 6 are not longitudinally aligned to follow the CPUs 4 in a cooling airflow direction[.]” EX1001, 5:24-28.

47. According to the ’265 Patent, this structure allows for “maximiz[ing] a cooling effect for the power source units 6,” “reduc[ing] an airflow rate of the fans 3 cooling the power source units 6 while reducing the speed of rotation of the cooling fans,” and “reduc[ing] power consumption of the cooling fans while reducing noise caused by the cooling fans.” EX1001, 5:59-60, 5:66-6:4.

The ’265 Patent states that “it is possible to reduce the number of cooling fans for cooling the power source units 6” and “may contribute to a reduction of the cost price of the server 1.” EX1001, 6:5-8. And “suppressing an increase of temperature in the power source units 6” makes it possible “to reduce a failure rate

of the power source units 6 and to improve the durability of the power source units 6, thus increasing the life of the server 1.” EX1001, 6:6-12.

48. The '265 Patent also states that “all the electronic parts of the server 1 (i.e. the fans 3, the CPUs 4, the memories 5, the power source units 6, the switching devices 8 and the hard disk drive 9) are horizontally arranged in the same plane,” which “may reduce the height of the server 1 while simplifying the structure of the server 1.” EX1001, 6:29-34.

B. Overview of the Prosecution History

49. The '265 Patent issued based on Patent Application No. 13/780,005, which was filed on February 28, 2013. EX1002, 2-56. The application contained five claims, including two independent claims (i.e., application claims 1 and 5). EX1002, 25-26.

50. On June 19, 2015, the examiner rejected all application claims. EX1002, 184-191. The examiner rejected most of the claims (i.e. application claims 1-3 and 5) as obvious over U.S. Patent Application Publication No. 2014/0073234 (“Elison”) in view of U.S. Patent. No. 7,839,624 (“Lin”). EX1002, 187-189. The examiner rejected application claim 4 as obvious over Elison combined with Lin and Japanese Patent No. 2006-099773 (“Dey”). EX1002, 189-190.

51. On November 19, 2015, the applicant filed a response making a

number of amendments to the application claims and asserting various arguments in an effort to distinguish the cited prior art. EX1002, 213-219. For example, the applicant amended the claims to recite that the claimed “plurality of electronic parts” are “each serving as a central processing unit (CPU)” (EX1002, 214) and argued that it was therefore incorrect for the examiner to equate memory units in the prior art with the “plurality of electronic parts” (EX1002, 217-218). The applicant amended the claims to require that the “plurality of power source units” must be “positioned not to be aligned linearly with the plurality of electronic parts in both the width direction and the longitudinal direction” (EX1002, 214-215) and argued that the cited prior art did not meet this new limitation (EX1002, 218).

52. On February 9, 2016, the examiner issued a Final Office Action rejecting all application claims. EX1002, 227-235. The examiner again rejected the claims as obvious based on Elison, Lin, and Dey. EX1002, 230-235.

53. On May 4, 2016, the applicant filed a response making additional amendments to the application claims, cancelling a claim and adding several new claims, and asserting various arguments in an effort to distinguish the cited prior art. EX1002, 242-248. For example, the applicant amended the claims to add a new limitation requiring “a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing[.]” EX1002, 243. The applicant argued that the cited prior art did “not

disclose or reasonably suggest either arranging memory devices adjacent to a CPU or that such an arrangement is in a ‘width direction’ as described by the claim.” EX1002, 246-247. In addition, the applicant changed the claims so that the phrase “a plurality of electronic parts, each serving as a central processing unit (CPU)” now read “a central processing unit (CPU).” EX1002, 243.

54. On May 18, 2016, the examiner again rejected all pending application claims. EX1002, 255-263. The examiner rejected most of the claims (i.e., application claims 1-5, 6, and 8) as obvious over Elison combined with Lin, Dey, and U.S. Patent No. 7,382,613 (“Vinson”). EX1002, 258-261. The examiner rejected the remaining claim (i.e., application claim 7) as obvious over Elison combined with Lin, Dey, Vinson, and U.S. Patent Application Publication No. 2010/0000716 (“Lian”). EX1002, 261-263.

55. On August 16, 2016, the applicant filed a response making additional amendments to the application claims and asserting various arguments in an effort to distinguish the prior art. EX1002, 269-276. For example, the applicant argued that “it would not have been obvious to combine the cited references at least to include the claimed ‘a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing’ in combination with the claimed ‘plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices’ at

least” because in the cited prior art “the power supplies 34 are not downstream of and instead separated from the cooling air from the memory modules 30.”

EX1002, 275.

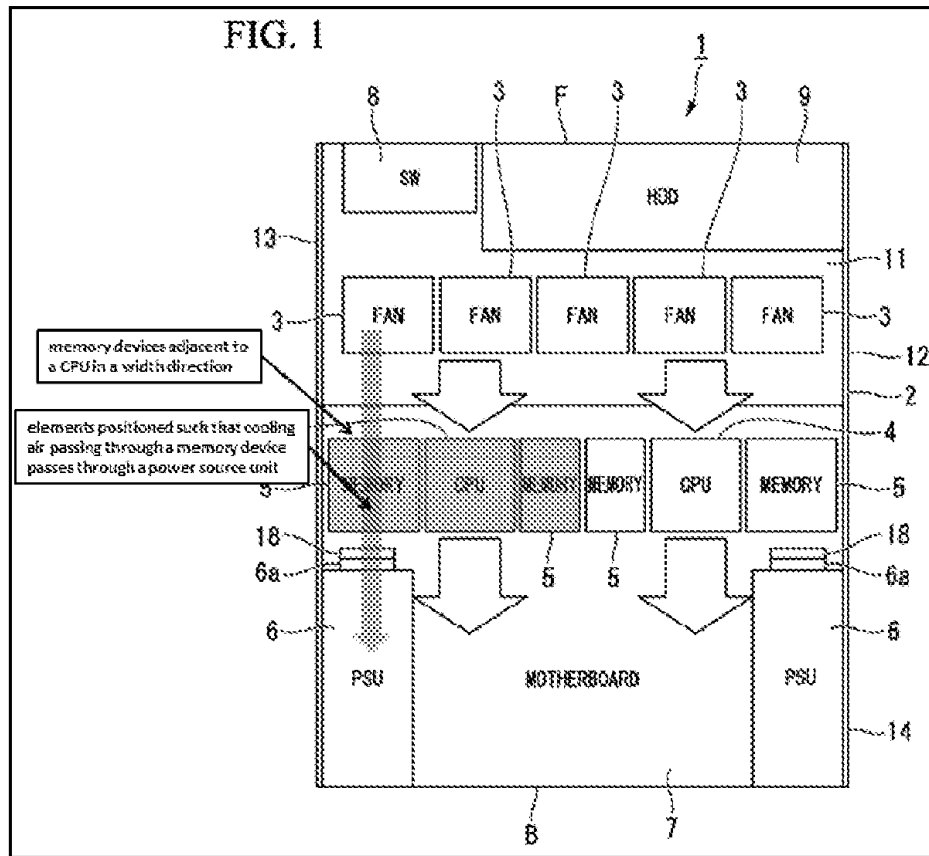
56. On August 31, 2016, the examiner again rejected the pending application claims. EX1002, 280-290. The examiner rejected most of the claims (i.e., application claims 1-5, 6, and 8) as obvious over Elison combined with Lin, Dey, and Vinson. EX1002, 284-287. The examiner rejected claim 7 as obvious over Elison combined with Lin, Dey, Vinson, and Lian. EX1002, 287-288. In addition, the examiner withdrew from consideration newly added claim 9 because it was directed to an invention that was independent or distinct from the invention originally claimed. EX1002, 282.

57. On November 18, 2016, the applicant and the examiner conducted an applicant-initiated interview and discussed potential amendments that might overcome the pending rejection. EX1002, 301.

58. On November 30, 2016, the applicant filed a response making a further amendment to the application claims, arguing that all application claims should be allowed in light of that amendment, and adding a new claim. EX1002, 296-305. Specifically, the applicant amended application claim 1 to add the following underlined language: “wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of

memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units....” EX1002, 297 (emphasis in original); *see also* EX1002, 298 (same amendment to application claim 5).

59. The applicant argued that “even if it were obvious for Elison to be modified as alleged by the rejection, *arguendo*, the rejection’s cited references provide no disclosure or reasonable suggestion of any ‘power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passes through one of the memory devices passes into one of the power source units.’” EX1002, 303. The applicant provided an annotated version of application Figure 1 (included below).



Applicant's Fig. 1 (annotated)

EX1002, 303. The applicant argued that in the figure, “the elements are arranged such that cooling air passing through one of memory devices, widthwise adjacent to the CPU, also passes through a power source unit,” while “the rejection’s cited references and combinations thereof fail to disclose or reasonably suggest such features much less those specifically claimed.” EX1002, 304.

60. On December 12, 2016, the examiner issued a Notice of Allowance. EX1002, 312-316.

61. The '265 Patent issued on April 18, 2017. EX1001, 1.

C. The Patent Claims

62. The '265 Patent contains eight claims, including two independent claims (i.e., claims 1 and 4).

63. Claim 1 reads as follows:

[1pre] An electronic device comprising:

[1a] a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction;

[1b] a plurality of fans which are arranged inside the housing close to the front face so as to cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing;

[1c] a central processing unit (CPU) which is arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough;

[1d] a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing; and

[1e] a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing,

[1f] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing

through one of the memory devices passes into one of the power source units, and

[1g] wherein the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing.

I added the paragraph numbering in brackets in claim 1 for ease of reference in my analysis below.

64. Claim 4 is the other independent claim. Dependent claims 2, 3, 5, 6, and 8 depend from claim 1. Dependent claim 7 depends from claim 4.

D. Person of Ordinary Skill in the Art

65. As discussed above, I have been informed and understand that the level of ordinary skill in the relevant art at the time of the claimed invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures in prior art references, and the reasons that a person of ordinary skill in the art might have combined the teachings of certain prior art references.

66. In my opinion a person of ordinary skill in the art with regard to the '265 Patent would have had had an undergraduate degree (or equivalent) in mechanical engineering, electrical engineering, computer engineering, computer science, or a comparable subject and would have had two to three years of work experience in the design and architecture of thermal management systems of electronic devices. Alternatively, a person of ordinary skill in the art would have

had an advanced degree (or equivalent) in mechanical engineering, electrical engineering, computer engineering, computer science, or a comparable subject and would have had one year of post-graduate research or work experience in the design and architecture of thermal management systems of electronic devices. Similar skills and knowledge could be acquired by other means. Further, a person of ordinary skill in the art would have been aware of, familiar with, and generally knowledgeable about the thermal management technology used in electronic devices, such as servers and storage devices, and would have been familiar with then-existing thermal management principles and techniques for electronic devices.

67. In reaching my opinion about the level of ordinary skill in the art, I have considered the types of problems, and techniques for addressing them, discussed in the '265 Patent and in the prior art references cited on its face. The patent discusses the problem of cooling heat sources in electronic devices using fans to generate a flow of cooling air through the electronic device's enclosure. EX1001, Abstract, 1:7-10, 1:15-21, 1:57-62. The patent does not dictate the number of most disclosed components or how to install and operate the electronic components in the device, indicating that a person of ordinary skill in the art would be someone familiar with cooling structures, the layout of components within electronic devices, and thermal management of such devices. EX1001, 7:7-15. The cited prior art on the face of the '265 Patent also discusses airflow through

electronic device enclosures, the structure of such devices, the arrangement of components, and heat dissipation. Thus, the '265 Patent and cited prior art address problems and technical solutions to those problems that support my opinion regarding the level of ordinary skill in the art.

68. Further, for over 25 years, including when the '265 Patent was filed, I led various companies in their thermal technology development. From my work in the industry in the 2000s and into the 2010s, I am familiar with the rapidity with which innovations were being made in the art and the education level of active works in the relevant field. Thus, my personal experience also informs and supports my opinion regarding the level of ordinary skill in the art.

69. In view of my educational background, as well as my decades of academic and professional experience (as discussed above), I was a person of more than the ordinary level of skill in the art in the 2012-2013 timeframe. My Ph.D. thesis focused on modeling of two-phase flow dynamics in heat transfer systems. I have been designing, building, and analyzing thermal management systems, including those relying on airflow generated by fans, for over 25 years. I have also been working with and presenting to individuals who met the above criteria for persons of ordinary skill in the art for many years. I have worked in a number of industry positions, including leading up to and through the 2012-2013 timeframe, including working for Intel Corp., k-Technology Corp., Ventiva Inc., and Sheetak,

where I worked alongside or oversaw the work of engineers and others whose experience level is consistent with my definition of a person of ordinary skill in the art. Thus, I was, and am, familiar with the understanding and knowledge of persons of ordinary skill in the art as of 2012-2013, and I was, and am, familiar with the subject matter of the '265 Patent, including technology relating to cooling structures of electronic devices.

70. Although my qualifications and experience exceed those of the hypothetical person of ordinary skill in the art defined above, my analysis and opinions regarding the '265 Patent have been based on the perspective of a person of ordinary skill in the art in 2012-2013.

71. To the extent that a person of ordinary skill in the art may be defined slightly differently than I define it above, or the qualifications have minor substantive differences, I would also be at least a person of ordinary skill in the art based on my academic and industry background described in this declaration. I have considered whether my opinions expressed in this declaration would change if the level of ordinary skill in the art were varied by a few years or varied somewhat with respect to subject matter. My opinions would not change in light of such minor variations.

E. Claim Construction

72. I have been advised and understand that patent claims in an *inter*

partes review are interpreted by applying the same standard that applies in federal district court proceedings, which I understand is referred to as the *Phillips* standard.

73. I understand that under the *Phillips* standard, claim terms are typically given their ordinary and customary meaning as would have been understood by a POSITA at the time of the invention based on the language of the claims, the patent specification, and the prosecution history. I understand that these sources of evidence are often referred to as “intrinsic evidence” or the “intrinsic record” of the patent. I understand that under the *Phillips* standard, extrinsic evidence such as expert or inventor testimony, dictionary definitions, and prior art publications can also be considered but are given less weight than the intrinsic evidence.

74. For purposes of my analysis of the challenged claims of the '265 Patent, I have applied the plain and ordinary meaning of the words in the claims as they would be understood by a person of ordinary skill in the art, with one exception.

75. Dependent claim 3 recites that “the plurality of power source units are...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.” EX1001, 8:7-13 (emphasis added). The reference to “the plurality of electronic parts” has no antecedent basis, meaning that there is no other reference

to a “plurality of electronic parts” in claim 3 or claim 1. The plain meaning of “electronic parts” could be quite broad, but I have been asked to assume that the claim language refers to the “central processing unit (CPU)” recited in claim 1 (limitation 1c). This is a reasonable understanding of the claim language.

76. Certainly, a person of ordinary skill in the art would understand that a CPU is an “electronic part.” Further, the prosecution history shows that in the original application, application claim 1 recited “[a]n electronic device” including “a plurality of electronic parts serving as heat sources....” EX1002, 25. The applicant later amended the reference to electronic parts to read as follows: “a plurality of electronic parts, each serving as a central processing unit (CPU), ...” EX1002, 214. At the same time, the applicant amended claim 3 to require that the plurality of power source units do “not...directly interfere with the cooling air flown downwardly from the plurality of electronic parts.” EX1002, 215. That amendment to claim 3 appears to refer back to the amended language equating “electronic parts” with “a central processing unit (CPU).” The applicant later amended claim 1 to remove the reference to “electronic parts” and refer instead to “a central processing unit (CPU)....” EX1002, 243. But the applicant did not make a corresponding change to dependent claim 3, which continued to refer back to “the plurality of electronic parts.” EX1002, 244. This sequence of events at least suggests that the applicant should have modified claim 3 in parallel with

claim 1 to refer to “the central processing unit (CPU).” I am comfortable understanding the phrase “the plurality of electronic parts” in claim 3 to refer to the “central processing unit (CPU)” recited in claim 1.

77. Further, a POSITA would understand that the term “the plurality of electronic parts” in claim 3 does not refer to the “memory devices” recited in claim 1. This is so because claim 1 states that “the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units[.]” EX1001, 7:56-60. Thus, claim 1 requires the power supplies to be downstream from the memory devices. If claim 3 were read to require placing the power supply units such that they are not downstream of the memory devices (i.e., if “the electronic parts” of claim 3 were read to include the “memory devices” of claim 1), then claim 3 would be directly inconsistent with claim 1. A POSITA would not read claim 3 in a manner that makes it inconsistent with claim 1.

V. PRIOR ART REFERENCES

78. I am informed that each of the following references constitutes prior art to the '265 Patent.

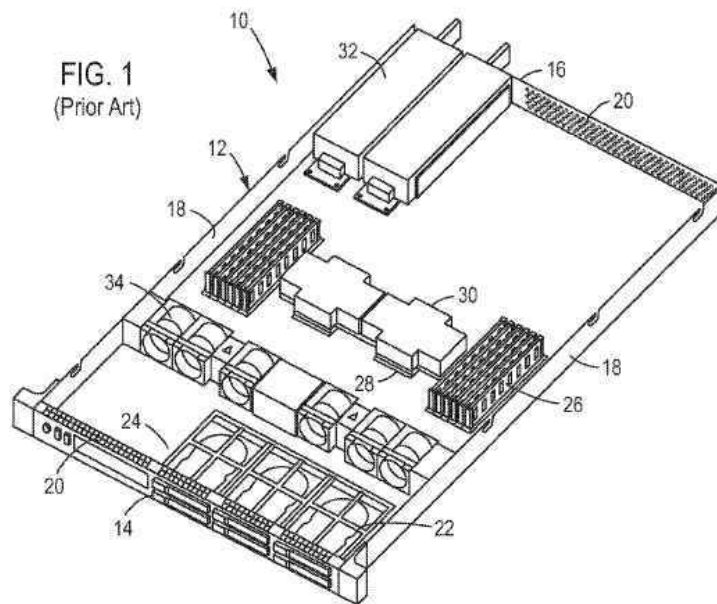
A. Carl (EX1005)

79. U.S. Patent Number 9,332,679 B2 (“Carl”) is entitled “Fan Assembly

for Rack Optimized Server Computers.” EX1005, 1. The Carl patent was filed on August 3, 2012, and was issued on May 3, 2016. EX1005, 1. It is based on and claims priority to U.S. Provisional Patent Application No. 61/574,593, which was filed on August 5, 2011. EX1005, 1.

80. Carl relates to “a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer.” EX1005, 1:9-12. The patent describes prior art whereby “[p]rior art server computers typically include a number of heat generating electrical components mounted in an enclosure,” and thus “usually include a number of internal fans for generating an airflow over the components.” EX1005, 1:21-26.

81. Figure 1 to the Carl patent shows an example of a prior art server computer. EX1005, 1:30-31.



EX1005, Fig. 1. The prior art server computer 10 has several electrical components stored in a 1 u rack enclosure 12 with a front wall 14, a rear wall 16, and two parallel sidewalls 18. EX1005, 1:31-34. The front and rear walls each have several apertures 20 to allow airflow. EX1005, 1:34-36. During operation of the server computer, several electrical components generate heat, such as the disk drives 22, the memory modules 26, the processors 28, and the power supplies 32. EX1005, 1:36-40. The server computer also includes fans 34, which are oriented with their axes parallel to the sidewalls 18. EX1005, 1:40-44. When the server computer 10 is in operation, the fans 34 draw air in through the apertures in the front wall 14, over the heat generating components, and then back out through the rear wall 16. EX1005, 1:44-47. The air flowing over the components absorbs the heat they generate, thereby cooling the components. EX1005, 1:47-50.

82. The Carl patent claims priority to a provisional application filed in August 2011. EX1006. I have been asked to provide my opinion as to whether the provisional application provides written description support for at least one claim of the Carl patent. In the following chart, I cite passages from the Carl provisional application that in my opinion provide written description support for at least claim 1 and claim 2 of Carl.

Carl (claims 1-2)	Carl-Provisional
1. A fan assembly for an electrical device which comprises a number of heat generating electrical components mounted in an enclosure that includes a front wall, a rear wall and two generally parallel sidewalls, the fan assembly comprising:	“The present invention relates to a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer. In particular, the invention relates to a fan assembly comprising a row of fans which are oriented with their axis of rotation at an angle, such as ninety degrees, to the side walls of the enclosure. The fan assembly enables the required airflow distribution and magnitude through the enclosures with less power, lower noise and fewer fans.” EX1006, 3 (1:3-9). “This server computer, generally 10, includes a number of electrical components which in this example are housed in a 1u rack enclosure 12. The rack enclosure 12 comprises a front wall 14, a rear wall 16 and two parallel side walls 18.” EX1006, 3

Carl (claims 1-2)	Carl-Provisional
	(1:16-19). “Referring to Figure 2, one embodiment of the fan assembly of the present invention, generally 110, is shown installed in a representative server computer 112, such as a 1u enterprise class rack optimized server. The sever computer 112 includes a number of heat generating electrical components, such as memory modules, processors and power supplies (represented generally by the rectangle 114a) located downstream of the fan assembly 110, and a number of disk drives 114b located downstream of the fan assembly. These components are mounted in an enclosure 116 which comprises an air permeable front wall 118, an air permeable rear wall 120 and two parallel, generally solid side walls 122. As shown in Figure 2, the fan assembly 110 extends transversely between the side walls 112 between the front wall 118 and the electrical components 114.” EX1006, 6-7 (4:23-5:2). <i>See also</i> EX1006, 3-4 (1:16-2:8), 4-5 (2:20-3:8), 6 (4:18-20), 7 (5:14-16), 14 (12:17-22), Figs. 1, 2, 9.
a plurality of vane-axial fans which are arranged in a row that extends	“The fan assembly includes a unique fan tray which is mounted in the enclosure and extends between the side walls.” EX1006, 4-5 (2:22-23).

Carl (claims 1-2)	Carl-Provisional
generally perpendicularly between the sidewalls, each fan comprising an inlet end, an outlet end and an axis of rotation which is oriented at an angle relative to the sidewalls, the inlet and outlet ends being axially aligned with the axis of rotation and the fan being operable to generate an airflow which enters the inlet end and exits the outlet end;	“As shown in Figure 2, the fan assembly 110 extends transversely between the side walls 122 between the front wall 118 and the electrical components.” EX1006, 7 (5:8-10). “Referring also to Figures 3 and 4, the fan assembly 110 includes a number of fans 124, in this example three, which are mounted in a generally rectangular fan tray 126. The fans 124 are preferably vane-axial fans, such as the Flurry™ 100 Series van-axial fan manufactured by Xcelaero Corporation of San Luis Obispo, California.” EX1006, 7 (5:16-17). “In this example, each fan 124 includes an impeller 128 which is driven by a motor 130 that is supported in a cylindrical fan housing 132 having an inlet end 134 and an outlet end 136. Although not required, the fan housing 132 may also be provided with a generally square inlet end flange 138 which surrounds the inlet end 134 and a generally square outlet end flange 140 which surrounds the outlet end 136.” EX1006, 7 (5:17-22). In my opinion, Figures 2 and 4 disclose to a POSITA that the fan inlet and outlet ends are “axially aligned with the axis of rotation.” “As shown most clearly in Figure 2, each fan 124 is

Carl (claims 1-2)	Carl-Provisional
	oriented such that its axis of rotation A forms an angle α of between about 45° and 90° with the sidewalls 122. In the embodiment of the invention shown in Figure 2, for example, the axis of rotation A of each fan 124 is perpendicular to the side walls 122. In this manner, the depth of the envelope occupied by the fans 124 is significantly smaller than would be the case if the fans were oriented with their axis of rotation A parallel to the side walls 122.” EX1006, 7-8 (5:23-6:5). “This orientation provides room within the standard envelope for the fan tray to include an exhaust plenum for each fan through which the airflow generated by the fan is directed. In addition, the fan tray includes a number of specially configured guide vanes which are positioned in each exhaust plenum. The exhaust plenum and guide vanes serve to distribute the airflow across a larger portion of the enclosure than would be the case if the fans were oriented with their axes of rotation parallel to the side walls as in the prior art.” EX1006, 5 (3:2-8). “The function of the inlet plenums 142 is to turn the airflow upstream of the fan assembly 110 into the fans 124, and the function of the outlet plenums 144

Carl (claims 1-2)	Carl-Provisional
	is to turn the airflow existing the fans into a direction generally parallel to the sidewalls 122 of the enclosure 116.” EX1006, 8 (6:13-19). <i>See also</i> EX1006, 3 (1:3-9), 11 (9:14-21), 14 (12:22-13:4), Figs. 1-4, 9.
a plurality of inlet plenums, each of which communicates with the inlet end of a corresponding fan;	“In order to maintain the air flow generated by the fans 124 generally parallel to the side walls 122 of the enclosure 116, each fan is mounted in the fan tray 126 between an inlet plenum 142 and an exhaust plenum 144. Each inlet plenum 142 is defined by a generally concave front facing inlet wall section 146 which extends frontward from the rear edge 148 of the inlet end 134 of the fan housing 132.” EX1006, 8 (6:6-10). “The function of the inlet plenums 142 is to turn the airflow upstream of the fan assembly 110 into the fans 124....” EX1006, 8 (6:13-19). “In the exemplary embodiment of the invention shown in the drawings, each inlet plenum 142 is provided with a number of optional inlet guide vanes 154 and each exhaust plenum 144 is provided with a number of exhaust guide vanes 156. The inlet guide vanes 154 if present, assist the inlet plenum 142 in turning the airflow into the fans 124 and also spread

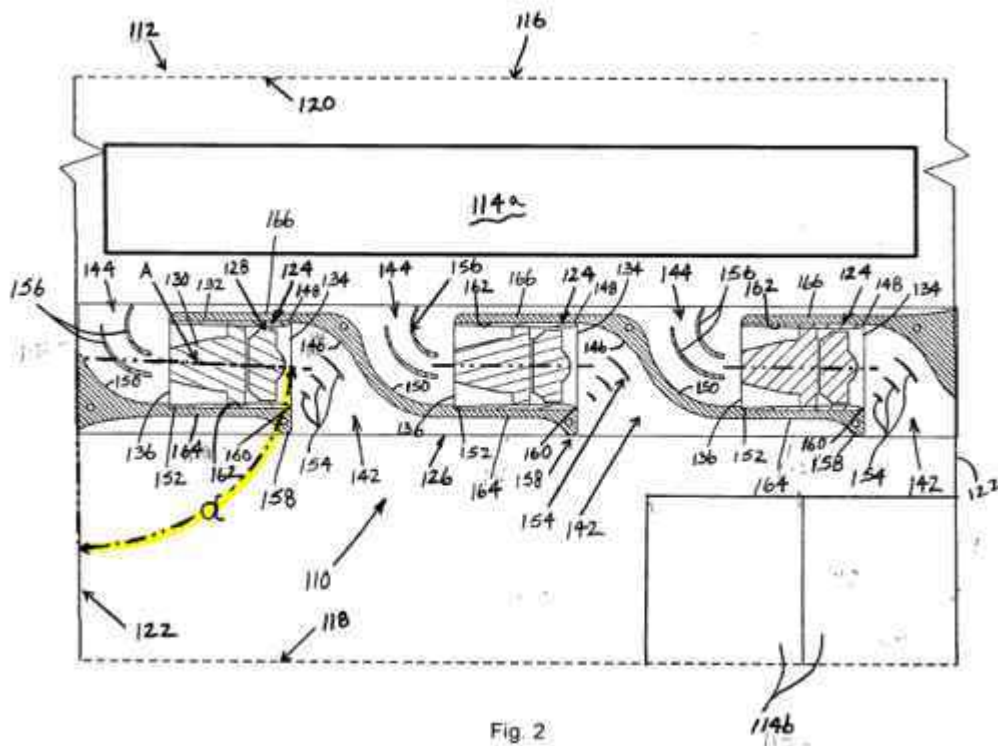
Carl (claims 1-2)	Carl-Provisional
	the airflow uniformly across the fan inlet 134.” EX1006, 9 (7:7-11). <i>See also</i> EX1006, 10 (8:13-16), 15 (13:5-10), Figs. 2, 4, 9.
a plurality of exhaust plenums, each of which communicates with the outlet end of a corresponding fan, each exhaust plenum being configured to turn the airflow in a direction which diverges from the axis of rotation of the fan;	“In order to maintain the air flow generated by the fans 124 generally parallel to the side walls 122 of the enclosure 116, each fan is mounted in the fan tray 126 between an inlet plenum 142 and an exhaust plenum 144. ... Similarly, each exhaust plenum 144 is defined by a generally concave rear facing outlet wall section 150 which extends rearward from a forward edge 152 of the outlet end 136 of the fan housing 132.” EX1006, 8 (6:6-10). “[T]he function of the outlet plenums 144 is to turn the airflow existing the fans into a direction generally parallel to the sidewalls 122 of the enclosure 116.” EX1006, 8 (6:13-19). “In the exemplary embodiment of the invention shown in the drawings, each inlet plenum 142 is provided with a number of optional inlet guide vanes 154 and each exhaust plenum 144 is provided with a number of exhaust guide vanes 156. ... In addition to aiding the exhaust plenum 144 in turning the airflow exiting the fans 124 into a direction generally

Carl (claims 1-2)	Carl-Provisional
	parallel to the side walls 122, the exhaust guide vanes 156 spread the airflow across the components 114. The exhaust guide vanes 156 also serve to inhibit the backflow of air through a corresponding fan 124 which is not operating.” EX1006, 9 (7:7-16). “[T]he function of the outlet plenums 144 is to turn the airflow exiting the fans into a direction generally parallel to the sidewalls 122 of the enclosure 116.” EX1006, 8 (6:13-19). “In addition to aiding the exhaust plenum 144 in turning the airflow exiting the fans 124 into a direction generally parallel to the side walls 122, the exhaust guide vanes 156 spread the airflow across the components 114.” EX1006, 9 (7:12-15). <i>See also</i> EX1006, 15 (13:10-19), Figs. 2, 4, 6, 7, 9.
wherein the airflow is distributed by the inlet and exhaust plenums through the enclosure to thereby cool the electrical components; and	“In operation, the fan assembly 110 generates a flow of air which enters the enclosure 116 through the front wall 118, flows over the electrical components 114 to thereby convectively cool these components, and then exists the enclosure through the rear wall 120.” EX1006, 7 (5:10-13). “The function of the inlet plenums 142 is to turn the airflow upstream of the fan assembly 110 into the

Carl (claims 1-2)	Carl-Provisional
	fans 124, and the function of the outlet plenums 144 is to turn the airflow existing the fans into a direction generally parallel to the sidewalls of the enclosure 116.” EX1006, 8 (6:13-19). <i>See also</i> EX1006, 3 (1:10-15), 4 (2:6-8), 6 (4:18-20), 8 (6:16-19), Figs. 2, 4, 6, 7, 9.
wherein the axis of rotation of each fan is oriented at an angle of between about 20° and 90° relative to the sidewalls.	“In particular, the invention relates to a fan assembly comprising a row of fans which are oriented with their axis of rotation at an angle, such as ninety degrees, to the side walls of the enclosure.” EX1006, 3 (1:5-7). “[T]he depth of the envelope occupied by the fans 124 is significantly smaller than would be the case if the fans were oriented with their axes of rotation A parallel to the side walls.” EX1006, 8 (6:3-5). “In this manner, even with the fans 124 mounted with their axis A at an angle α relative to the side walls 122, the fan assembly 110 is still able to achieve a flow distribution which produces a desired degree of cooling for the components.” EX1006, 8 (6:16-19). <i>See also</i> EX1006, Fig. 2.
2. The fan assembly of claim 1, wherein the	“As shown most clearly in Figure 2, each fan 124 is oriented such that its axis of rotation A forms an

Carl (claims 1-2)	Carl-Provisional
axis of rotation of each fan is orientated at an angle of between about 45° and 90° relative to the sidewalls.	angle α of between about 45° and 90° with the sidewalls 122. In the embodiment of the invention shown in Figure 2, for example, the axis of rotation A of each fan 124 is perpendicular to the side walls 122. In this manner, the depth of the envelope occupied by the fans 124 is significantly smaller than would be the case if the fans were oriented with their axis of rotation A parallel to the side walls 122.” EX1006, 7-8 (5:23-6:5). <i>See also</i> EX1006, 3 (1:5-7), 8 (6:16-19), Fig. 2.

83. In my opinion, claim 1 of Carl is supported by the Carl provisional application. The final “wherein” clause of claim 1 recites that “the axis of rotation of each fan is oriented at an angle of between about 20° and 90° relative to the sidewalls.” I recognize that this range is not explicitly recited in the provisional application. In my opinion, the provisional application’s passages that I cite above and Figure 2, shown below, all indicate to a person of ordinary skill in the art that the fans of Carl’s invention would be oriented at an angle ranging from something slightly greater than 0° at the low end and up to 90° at the high end, including a range of 20° and 90° as recited in Carl’s claim 1.



EX1006, Fig. 2 (highlighted).

84. There is no question that the provisional application discloses the range recited in claim 2 (i.e., “an angle of between about 45° and 90° relative to the sidewalls”). The provisional application explicitly recites this exact range.

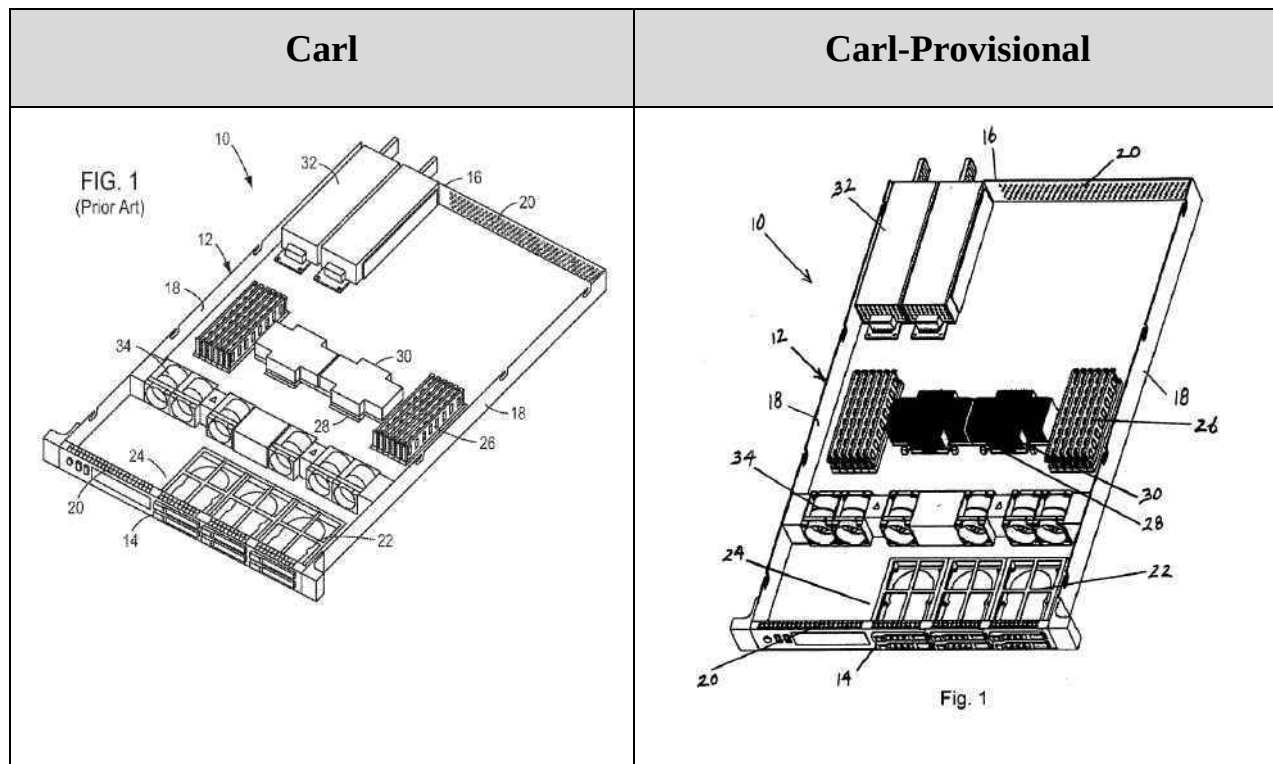
EX1006, 7-8 (5:23-6:1) (“an angle α of between about 45° and 90° with the sidewalls 122.”).

85. Thus, in my opinion the Carl provisional application provides written description support for at least one claim of the Carl patent.

86. I have also been asked to provide my opinion as to whether the subject matter in Carl that I rely on to show that the challenged claims of the '265 Patent are unpatentable as obvious was also disclosed in the Carl

provisional application.

87. My analysis of the challenged claims in light of Carl is focused on Carl's Figure 1 and the discussion of that figure in the patent specification. Carl's provisional application disclosed the same Figure 1, as shown below.



EX1005, Fig. 1; EX1006, Fig. 1. There is no material difference between Figure 1 in Carl and Figure 1 in the Carl provisional application. Everything I discuss below in Carl's Figure 1 is also present in Figure 1 of the provisional application.

88. In addition, there is no material difference between the description of Figure 1 in Carl and the corresponding description of the figure in the provisional application. The following chart compares the relevant language from both (with bold and underlining to indicate differences).

Carl	Carl-Provisional
BACKGROUND OF THE INVENTION The present invention relates to a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer. In particular, the invention relates to a fan assembly comprising a row of fans which are oriented with their axis of rotation at an angle, such as ninety degrees, to the sidewalls of the enclosure. <u>This will enable the fan assembly to deliver a required airflow through the enclosure with fewer fans. The number of fans can be chosen to achieve operation at peak efficiency without concern for the uniformity of the flow across the enclosure, as would be the case if the fans were mounted parallel to the sidewalls.</u> Prior art server computers typically include a number of heat generating	BACKGROUND OF THE INVENTION The present invention relates to a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer. In particular, the invention relates to a fan assembly comprising a row of fans which are oriented with their axis of rotation at an angle, such as ninety degrees, to the side_walls of the enclosure. <u>The fan assembly enables the required airflow distribution and magnitude through the enclosure with less power, lower noise and</u> fewer fans. Prior art server computers typically include a number of heat generating

Carl	Carl-Provisional
electrical components mounted in an enclosure. Such computers commonly employ air to cool the components. Thus, prior art server computers usually include a number of internal fans for generating an airflow over the components. The airflow cools the components through the process of convection by absorbing the heat generated by the components and then dissipating the heat outside the enclosure. An example of a prior art server computer is shown in FIG. 1. This server computer, generally 10, includes a number of electrical components which in this example are housed in a 1_u rack enclosure 12. The rack enclosure 12 comprises a front wall 14, a rear wall 16 and two parallel sidewalls 18. The front and rear walls each comprise a plurality of holes or apertures 20 through which air can pass. Several of the electrical components generate heat during	electrical components mounted in an enclosure. Such computers commonly employ air to cool the components. Thus, prior art server computers usually include a number of internal fans for generating an airflow over the components. The airflow cools the components through the process of convection by absorbing the heat generated by the components and then dissipating the heat outside the enclosure. An example of a prior art server computer is shown in Figure 1. This server computer, generally 10, includes a number of electrical components which in this example are housed in a 1u rack enclosure 12. The rack enclosure 12 comprises a front wall 14, a rear wall 16 and two parallel side_walls 18. The front and rear walls each comprise a plurality of holes or apertures 20 through which air can pass. Several of the electrical components generate heat during

Carl	Carl-Provisional
operation of the server computer 10, such as a number of disk drives 22 which are located in a drive bay 24, a plurality of memory modules 26, two processors 28 (each of which is positioned under a corresponding heat sink 30), and <u>one or more</u> power supplies 32. In order to dissipate the heat generated by these components, the server computer 10 also includes a number of fans 34, in this case six, which are oriented with their axes parallel to the sidewalls 18. During operation of the server computer 10, the fans 34 draw air into the enclosure 12 through the apertures in the front wall 14 and force the air over the heat generating components and through the apertures in the rear wall 16. As the air flows over the components, the heat generated by the components is absorbed by the air to thereby cool the components. In order to reduce the power consumed by the server computer, it is desirable	operation of the server computer 10, such as a number of disk drives 22 which are located in a drive bay 24, a plurality of memory modules 26, two processors 28 (each of which is positioned under a corresponding heat sink 30), and <u>a</u> power supply 32. In order to dissipate the heat generated by these components, the server computer 10 also includes a number of fans 34, in this case six, which are oriented with their axes parallel to the side_walls 18. During operation of the server computer 10, the fans 34 draw air into the enclosure 12 through the apertures in the front wall 14 and force the air over the heat generating components and through the apertures in the rear wall 16. As the air flows over the components, the heat generated by the components is absorbed by the air to thereby cool the components. In order to reduce the power consumed by the server computer, it is desirable

Carl	Carl-Provisional
to tailor the airflow distribution over the components so that each component will receive the airflow required to cool the component sufficiently. The current state of the art requires that a number of fans be distributed across the enclosure to provide a uniform airflow over all of the components, as well as to provide redundancy in the event one of the fans should stop operating. With the fans oriented parallel to the side <u>ails</u> as shown in FIG. 1, this often results in the use of a large number of fans operating at less than peak efficiency in order to generate the required airflows over each of the components.	to tailor the airflow distribution over the components so that each component will receive the airflow required to cool the component sufficiently. The current state of the art requires that a number of fans be distributed across the enclosure to provide a uniform airflow over all of the components, as well as to provide redundancy in the event one of the fans should stop operating. With the fans oriented parallel to the side <u>walls</u> as shown in Figure 1, this often results in the use of a large number of fans operating at less than peak efficiency in order to generate the required airflows over each of the components.

EX1005, 1:7-62; EX1006, 3-4 (1:2-2:17).

89. There are no material differences in the portions of Carl that I rely on below in my analysis and the corresponding text in the Carl provisional application. There are a few differences in the first paragraph above, but the differences are insubstantial, and I do not rely on that portion of Carl in any event. Of the portions I rely on, there are basically two differences. First, the Carl

provisional application refers to “side walls 18,” while Carl refers to “sidewalls 18.” A person of ordinary skill in the art would know that these are the same thing. Second, the Carl provisional states that the “prior art server computer” includes “a power supply 32,” while the Carl patent states that it includes “one or more power supplies 32.” Figure 1 in the Carl provisional application unambiguously depicts a server computer with two power supplies 32. A person of ordinary skill in the art would understand from the figure and text of the provisional application, that the prior art server computer has two power supplies 32. Because I cite in my analysis below the two power supplies 32 of the server computer illustrated Figure 1 (in both Carl and the Carl provisional), the same subject matter is disclosed in the Carl provisional as in the Carl patent.

90. Thus, in my opinion the Carl provisional application provides written description support for the portions of Carl I rely on in my analysis of the challenged claims. In other words, the same subject matter I rely on in Carl in my analysis below is also disclosed in the Carl provisional application.

B. Hughes (EX1007)

91. U.S. Patent Application Publication No. 2008/0218949 (“Hughes”) is entitled “Enclosure for Containing One or More Electronic Devices and Cooling Module.” EX1007, 1. Hughes was filed on January 10, 2008, and claims priority to U.S. Patent Application Serial Number 60/884,537, filed January 11, 2007.

92. Hughes relates to “an enclosure for containing one or more electronic devices and to a cooling module.” EX1007, [0002]. Embodiments include “storage enclosures for a plurality of disk drives, RAID arrays, SAN or NAS storage, server enclosures and the like....” EX1007, [0002].

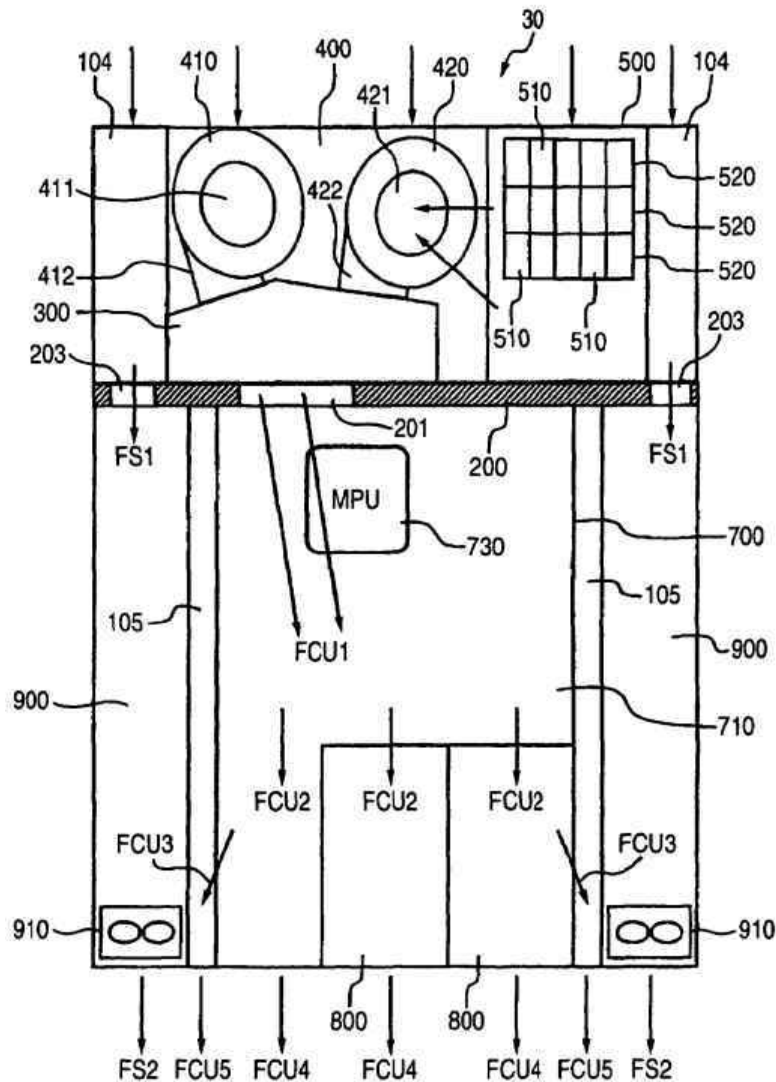
94. Hughes further discloses “common enclosure layouts, where modules may be inserted into/removed from the enclosure through square/rectangular bays

in the rear of the enclosure.” EX1007, [0017]. Hughes also describes rear enclosure 5, which “comprises a number of bays into which can be received...two power supply units 7[.]” EX1007, [0028].

C. Suzuki (EX1008)

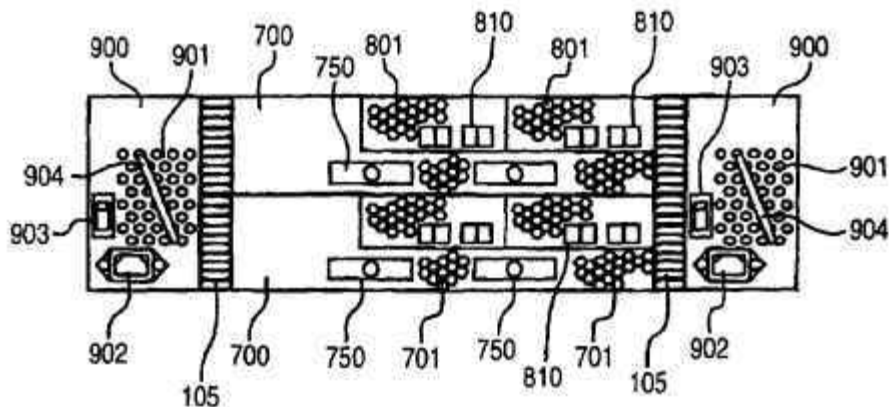
95. U.S. Patent Number 7,042,722 (“Suzuki”) is entitled “Electronic Equipment.” EX1008, 1. Suzuki issued on May 9, 2006. EX1008, 1. Suzuki relates to and claims priority to Japanese Patent Application Number 2003-270426, filed on July 2, 2003, and Japanese Patent Application Number 2003-15222, filed May 29, 2003. EX1008, 1:5-8. Suzuki’s foreign priority application, Japanese Patent Application Number 2005-011304, was cited but not discussed during the prosecution of the ’265 Patent.

96. Suzuki generally relates to cooling “electronic equipment preferably used for disk array control devices or equivalents thereto.” EX1008, 1:13-15. Suzuki’s discloses in Figure 4 “a schematic diagram of the control unit 30....” EX1008, 8:22-26. The control unit 30 includes “two power supply modules 900 being respectively disposed on the both sides of the rear side space of the chassis 100.” EX1008, 8:32-35.



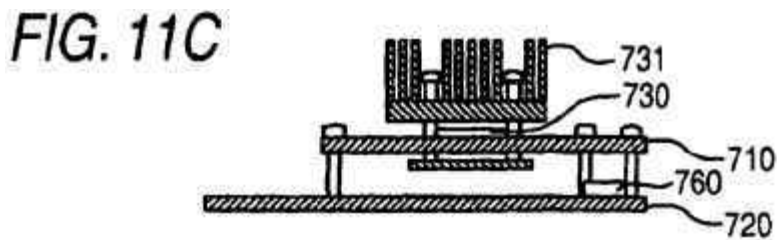
EX1008, Fig. 4.

97. Suzuki further discloses that the chassis 100 of its Suzuki's control unit includes a "rear side opening 102." EX1008, 4:58-60. Figure 12 provides the back view of control unit 30 and shows power supply modules 900 that are "detachably attached to the both sides of each of up/down-stacked control modules 700, respectively." EX1008, 15:35-37.



EX1008, Fig. 12.

98. As shown in Figure 11C of Suzuki, Suzuki further discloses a heat sink 731 on MPU [(micro processing unit)] 730 that is “attach[ed].” EX1008, 14:49-55.



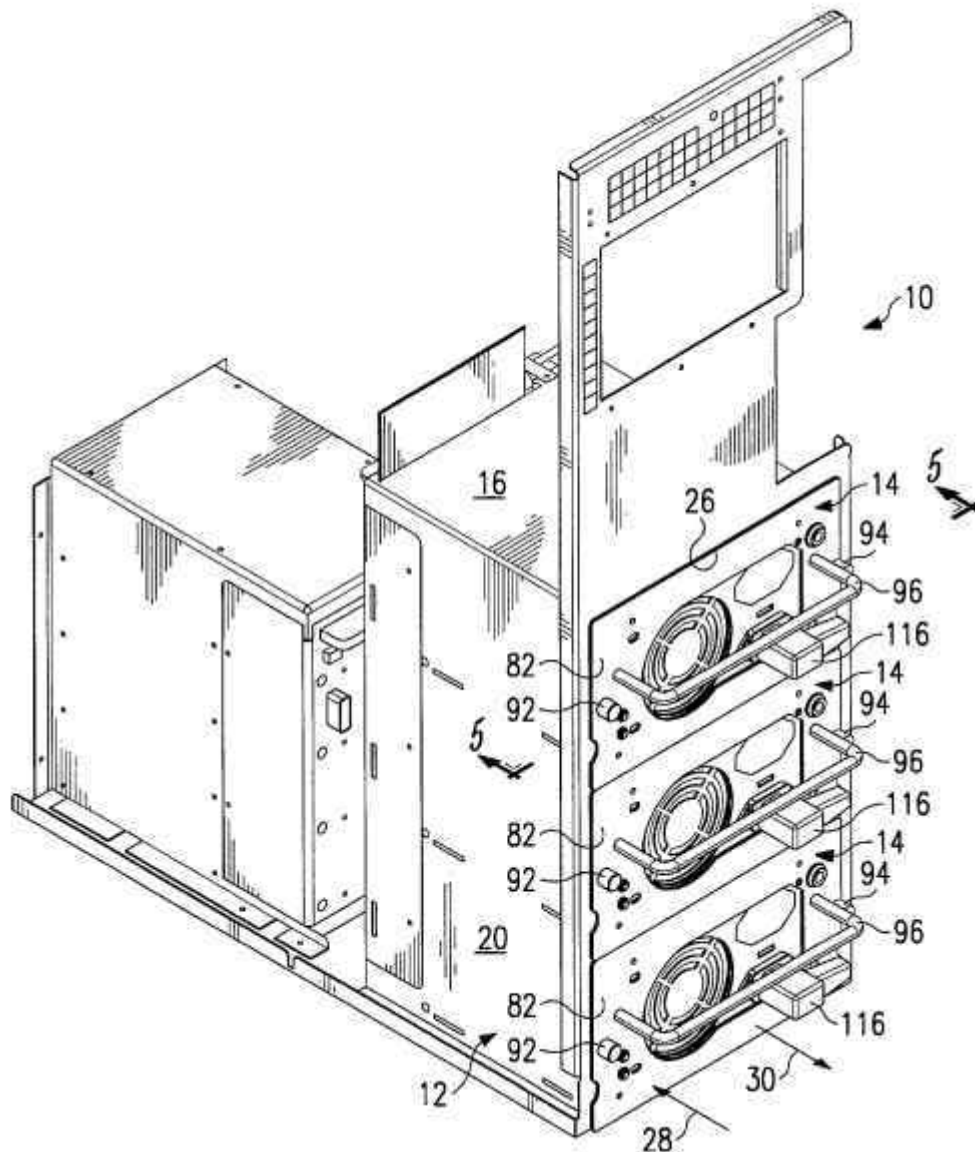
EX1008, Fig. 11C.

D. Wiscombe (EX1009)

99. U.S. Patent Number 5,612,854 (“Wiscombe”) is entitled “Computer Power Supply Apparatus.” EX1009, 1. Wiscombe was filed on January 24, 1995, and issued on March 18, 1997. EX1009, 1.

100. Wiscombe relates to “computer apparatus, and more particularly relates to power supply structures incorporated in computers.” EX1009, 1:6-8. In

particular, Wiscombe discloses a “housing section 12” with a “top end wall 16” and “opposite left and right side walls 20 and 22” into which “each of the power supply assemblies 14 may be inserted inwardly....” EX1009, 3:19-25. Housing section 12 is illustrated in Figure 1 of Wiscombe.



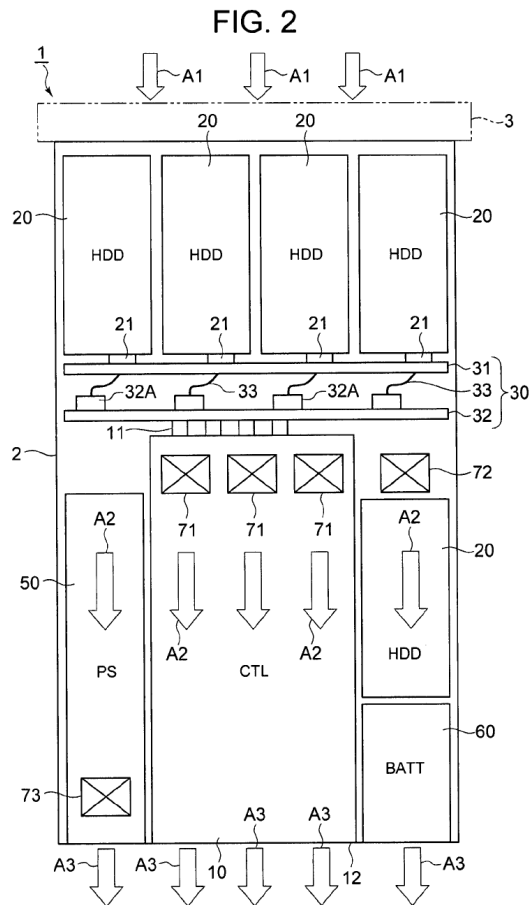
EX1009, Fig. 1.

E. Okamoto (EX1010)

101. U.S. Patent Number 7,643,281 (“Okamoto”) is entitled “Storage Controller.” EX1010, 1. Okamoto issued on January 5, 2010. EX1010, 1. Okamoto relates to and claims priority to Japanese Patent Application Number 2006-335312, filed on December 13, 2006. EX1010, 1:5-7. Okamoto also relates to and claims priority to Japanese Patent Application Number 2007-191820 filed on July 24, 2007. EX1010, 1:5-9. Japanese Patent Application Number 2008-171386, which also claims priority to Japanese Patent Application Number 2007-191820, was cited, but not discussed, during the prosecution of the ’265 Patent.

102. Okamoto discloses a “a storage controller,” which “can provide large capacity storage services to a host computer.” EX1010, 1:14-17. “[A] rack-mounted disk array apparatus is also known as a storage controller.” EX1010, 1:24-25.

103. Okamoto describes a number of different embodiments. For instance, Figure 2 illustrates a “plan view” of an embodiment of Okamoto’s storage controller. EX1010, 3:34-35, 4:56-59.



EX1010, Fig. 2

104. Each of Okamoto’s embodiments includes “an enclosure 2, a plurality of storage devices 20,...at least one control board 10,...at least one power device 50,...at least one or more cooling fans 71, 72, 73, which are disposed inside the enclosure 2, and which are for taking in air from outside the enclosure 2 and generating a cooling airflow inside the enclosure 2, and at least one device connector 40....” EX1010, 4:13-31.

VI. THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BASED ON CARL AS PRIMARY PRIOR ART REFERENCE

105. It is my opinion that the challenged claims of the ’265 Patent are

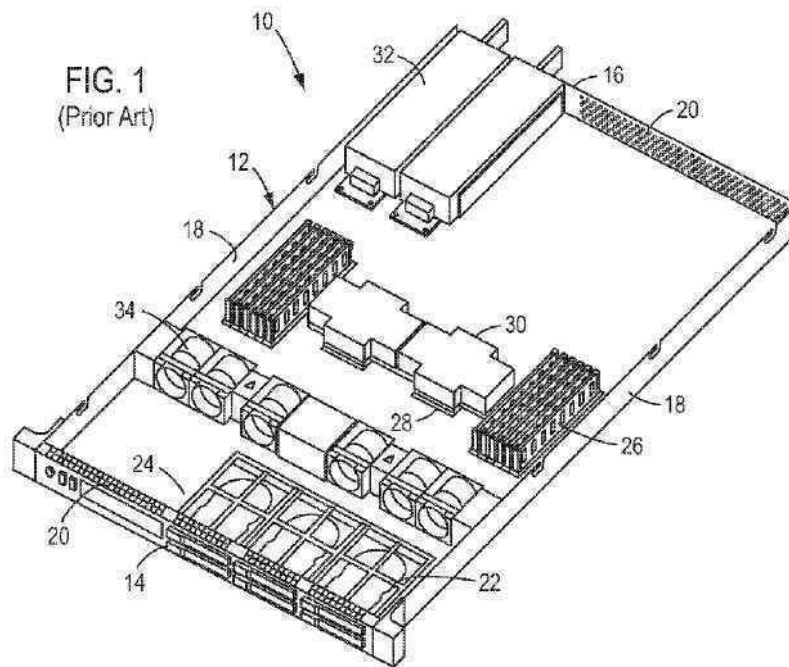
invalid as obvious in light of at least the prior art discussed below.

A. The Combination of Carl with Hughes or Suzuki Renders Claims 1-8 Obvious

1. Overview of Carl

106. As discussed above, Carl discloses “[a] fan assembly for an electrical device which comprises a number of heat generating electrical components mounted in an enclosure that includes a front wall, a rear wall and two generally parallel sidewalls.” EX1005, 1 (Abstract). Carl’s “invention relates to a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer.” EX1005, 1:9-12.

107. In Figure 1, Carl discloses “[a]n example of a prior art server computer....” EX1005, 1:29-30. “This server computer, generally 10, includes a number of electrical components which in this example are housed in a 1u rack enclosure 12.” EX1005, 1:30-31.



EX1005, Fig. 1.

108. Carl describes an improved fan assembly for use in electrical devices like the prior art server computer 12 illustrated in Figure 1.

109. Carl is in the same field of endeavor as the '265 Patent (i.e., electronic devices, such as computer servers) and addresses the same problem of cooling components within electronic device enclosures. EX1005, Abstract, 1:9-20; EX1001, Abstract, 1:6-10.

2. The Combination of Carl and Hughes

110. Carl describes an electronic device that discloses all of the limitations of the challenged claims except that in Carl's server computer 12, the two power supplies 32 are positioned side-by-side against one sidewall of enclosure 12. The

power supplies are not *positioned opposite to each other and spaced out from each other in the width direction of the housing* as recited in claim 1 (limitation 1e).

(Note that I have italicized claim language in my analysis for ease of review.)

Hughes discloses a similar electronic device enclosure in which two power supply units are positioned apart with each power supply unit against an opposing sidewall of the enclosure. Thus, the combination of Carl's server computer 10 with the teachings of Hughes discloses, and renders obvious, the challenged claims.

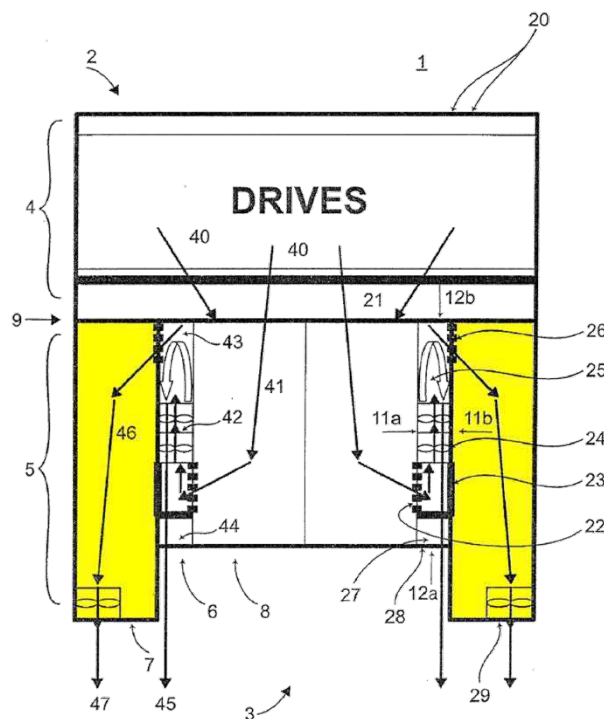
a. Overview of Hughes

111. Hughes discloses an invention that “relates to an enclosure for containing one or more electronic devices and to a cooling module.” EX1007, [0002]. Embodiments of the invention include “storage enclosures for a plurality of disk drives, RAID arrays, SAN or NAS storage, server enclosures and the like....” EX1007, [0002]. A POSITA would understand that Hughes' reference to “server enclosures” refers to the type of enclosure described in Carl.

112. Figure 1 illustrates “an example of a storage enclosure 1” viewed from the top. EX1007, [0028]. Enclosure 1 includes two power supply units 7 that “are positioned at the sides of the enclosure....” EX1007, [0006]. Hughes explains that “[t]he power supply units 7 are typically the heaviest components in the enclosure 1, and are therefore naturally situated at either side of the enclosure

1, so as to receive support from the rack in which the enclosure 1 is mounted.”

EX1007, [0029].



EX1007, Fig. 1 (highlighted).

113. Hughes is in the same field of endeavor as the '265 Patent (i.e., electronic devices, such as computer servers) and addresses the same problem of cooling components within electronic device enclosures. EX1007, Abstract, [0002]; EX1001, Abstract, 1:6-10.

b. Motivation to Combine Carl and Hughes

114. It would have been natural for a person of ordinary skill in the art to consider both Carl and Hughes because, like the '265 Patent, both prior art references are directed to electronic (or electrical) devices. EX1001, 1 (Abstract);

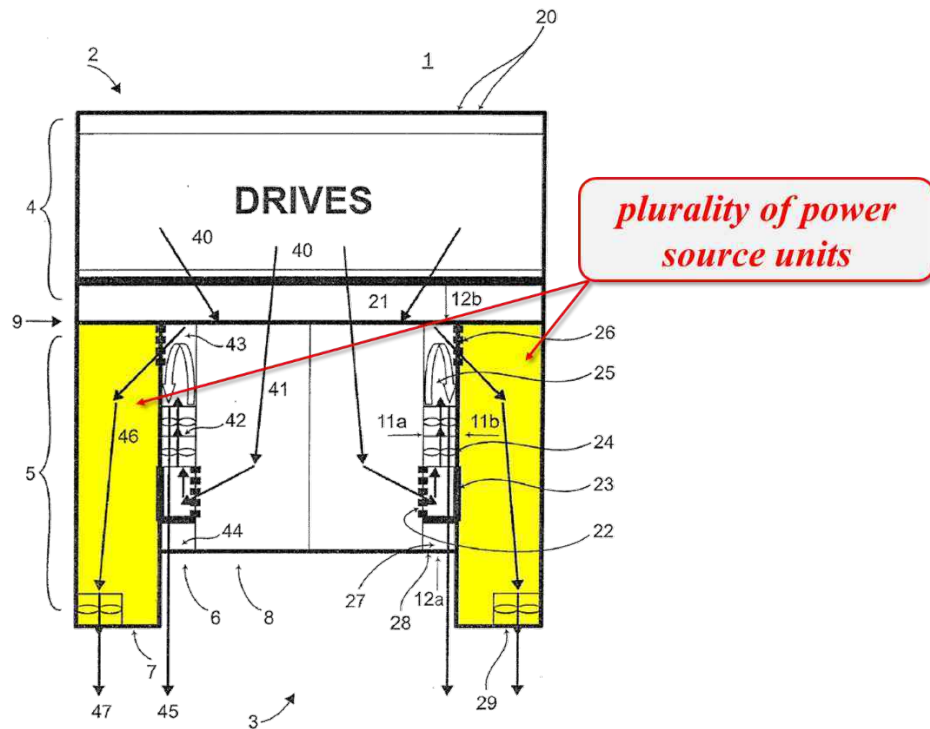
EX1005, 1 (Abstract); EX1007, 1 (Abstract). More particularly, like the '265 Patent, both prior art references relate to improving the cooling of electronic (or electrical) devices, such as a servers. EX1005, 1:29-32, 1:51-54; EX1007, [0002], [0004]. Thus, a POSITA seeking to improve the cooling of Carl's enclosure would look to other cooling-related references for additional techniques—including those discussing the arrangement of power supply units within an enclosure—to implement.

115. Like the '265 Patent, Carl describes the arrangement or positioning of components within a housing or enclosure, including memory, processors, power supplies, and fans. EX1001, 3:50-54; EX1005, 1:29-50. Further, like the '265 Patent, Carl describes the cooling of the components within the housing or enclosure. EX1001, 5:47-54; EX1005, 1:51-54.

116. Likewise, Hughes describes the arrangement or positioning of components or modules within storage enclosures, and the cooling of components within the enclosures. EX1007, [0003]-[0004].

117. Specifically, Carl discloses a server computer that “includes a number of electrical components...housed in a 1u rack enclosure 12.” EX1005, 1:30-32. The electrical components including two “power supplies 32.” EX1005, 1:35-40. The two power supplies 32, as illustrated in Figure 1, are located next to each other on one side of the enclosure. EX1005, Fig. 1. Hughes also discloses an invention

for “server enclosures.” EX1007, [0002]. Hughes’ enclosure also contains two power supply units 7, but in Hughes the power supplies are positioned on opposite sides of the enclosure. EX1007, Fig. 1.



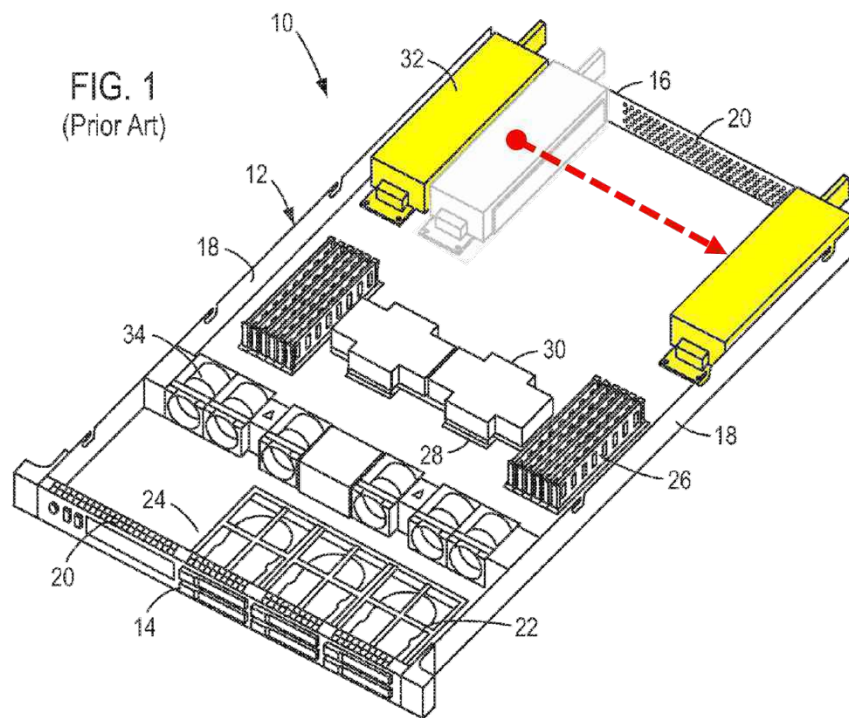
EX1007, Fig. 1 (annotated).

118. Carl discloses a server that “includes a number of electrical components...housed in a 1u rack enclosure 12” including two “power supplies 32.” EX1005, 1:30-40, Fig. 1. Carl also recognizes the need to cool heat generating components in the enclosure. EX1005, 1:21-28. A POSITA would have naturally looked to Hughes, which discloses an invention for “server enclosures” having two “power supply units 7” improving cooling of heat-generating components. EX1007, [0002]; *see also id.*, [0013], Fig. 1. Like Carl,

Hughes recognizes the need for such cooling. As Hughes explains, “components of the enclosure generate heat, which must be removed from the enclosure to keep the operating temperature of the components within acceptable limits....”

EX1007, [0004]. Hughes describes an invention directed to cooling such components. EX1007, [0009]-[0011]. A POSITA implementing Carl’s server would have considered Hughes because it addresses cooling heat-generating components in such a device.

119. A POSITA would have been motivated to modify Carl’s server computer based on the teachings of Hughes to position Carl’s two power supplies 32 on opposite sides of the enclosure against the two sidewalls 18, as illustrated below.



EX1005, Fig. 1 (modified).

120. A person of ordinary skill in the art would have been motivated to implement Hughes' arrangement of power source units on opposite sides of the enclosure because power source units are "typically the heaviest components" in an enclosure and situating them on either side of the enclosure would allow them to "receive support from the rack in which the enclosure [] is mounted." EX1007, [0029].

121. A POSITA would also have known that power supply units were commonly located on opposite sides of an enclosure as in Hughes. EX1008, Fig. 4; EX1022, [0076], Fig. 5; EX1023, 24:44-47, Fig. 50; EX 1024, Figs. 2a, 2b.

122. A POSITA would recognize that Carl's "rack enclosure 12" would benefit from positioning the power supplies 32 on either side of the enclosure for the reasons identified by Hughes. A POSITA would also recognize that positioning the power supplies 32 against opposing sidewalls would better balance Carl's enclosure 12.

123. Additionally, a POSITA would understand that separating the power source units would allow for thermal benefits because it would allow the flow of cooling air to be more uniform, which would provide more efficient cooling. EX1010, 14:34-40.

124. Modifying the layout of power supplies in Carl's enclosure 10 would

have been well within the skill of a POSITA without undue experimentation and with a reasonable expectation of success. The modification would have involved simply positioning one of the two power supplies 32 disclosed by Carl in a different location in the enclosure and making minor adjustments to rear wall 16. The enclosure illustrated by Figure 1 of Carl shows two power source units and space for one of the power source units to be placed at the opposite side of the enclosure.

125. Modifying Carl based on Hughes would have involved no more than the use of prior art elements according to known methods to yield predictable results.

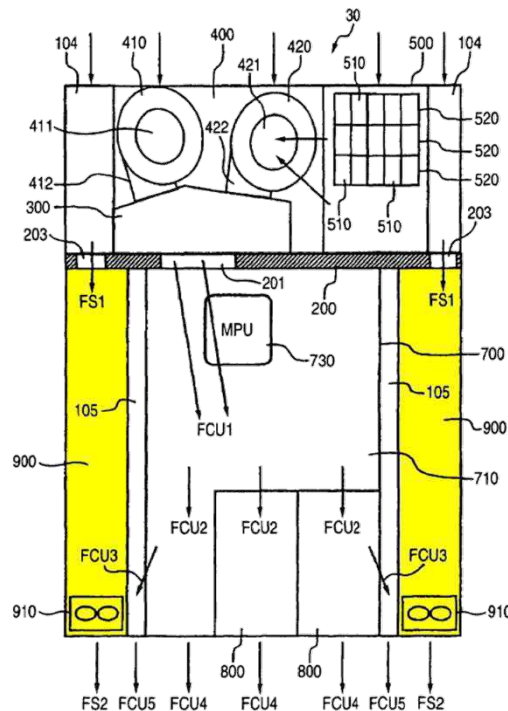
3. The Combination of Carl and Suzuki

126. Like Hughes, Suzuki discloses an electronic device enclosure in which two power supply units are positioned apart such that each power supply unit is against an opposing sidewall of the enclosure. Thus, the combination of Carl's server computer 10 with the teaching of Suzuki discloses, and renders obvious, the challenged claims.

a. Overview of Suzuki

127. Suzuki's invention generally relates to cooling "electronic equipment preferably used for disk array control devices or equivalents thereto." EX1008, 1:13-15. Suzuki's Figure 4 "is a schematic diagram of the control unit 30," which

includes “two power supply modules 900 being respectively disposed on both sides of the rear side space of the chassis 100.” EX1008, 8:22-26, 8:32-35.



EX1008, Fig. 4 (highlighted).

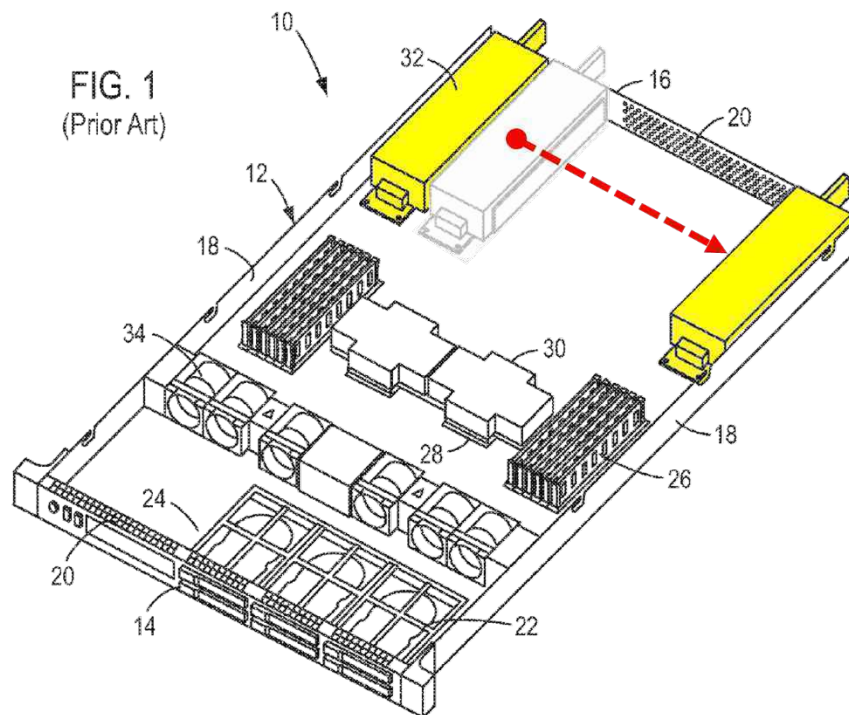
128. Suzuki is in the same field of endeavor as the '265 Patent (i.e., electronic devices) and addresses the same problem of cooling components within electronic device enclosures. EX1008, Abstract, 1:13-15, 1:29-51; EX1001, Abstract, 1:6-10.

b. Motivation to Combine Carl and Suzuki

129. A POSITA implementing Carl's server would have naturally looked to Suzuki, which (like Carl) discloses a rack-mounted electronic device with an enclosure containing heat-generating components needing cooling. EX1008, 1:20-

24, 5:4-6. The object of Suzuki “is to provide an electronic equipment capable of performing effective cooling operations to thereby enable performance enhancement while increasing the reliability.” EX1008, 1:47-51. A POSITA would have considered such prior art because it offers benefits applicable to Carl’s server.

130. For the same reasons discussed for the combination of Carl and Hughes, a POSITA would have been motivated to modify Carl’s server computer based on Suzuki by placing the two power supplies 32 against opposite sidewalls 18, as illustrated below.



EX1005, Fig. 1 (modified).

131. The power supplies would be the heaviest components and therefore it

would have been beneficial to position them on either side of the enclosure against the sidewalls to receive support from the rack in which the enclosure is mounted. EX1007, [0029]. Separating the enclosure would also make the enclosure better balanced.

132. A person of ordinary skill in the art would understand that separating the power source units would allow for thermal benefits because it would allow the flow of cooling air to be more uniform, which would provide more efficient cooling. EX1010, 14:34-40.

133. A POSITA would have known that power supply units were commonly located on opposite sides of an enclosure as in Suzuki. EX1007, Fig. 1; EX1008, Fig. 4; EX1022, [0076], Fig. 5; EX1023, 24:44-47, Fig. 50; EX 1024, Figs. 2a, 2b.

134. The modification would have involved simply positioning one of the two power supplies 32 disclosed by Carl in a different location in the enclosure and making minor adjustments to rear wall 16. Thus, modifying Carl based on Suzuki would have been well within the skill of a POSITA without undue experimentation and with a reasonable expectation of success. The enclosure illustrated by Figure 1 of Carl shows two power source units and space for one of the power source units to be placed at the opposite side of the enclosure.

135. Modifying Carl based on Suzuki would have involved no more than

the use of prior art elements according to known methods to yield predictable results.

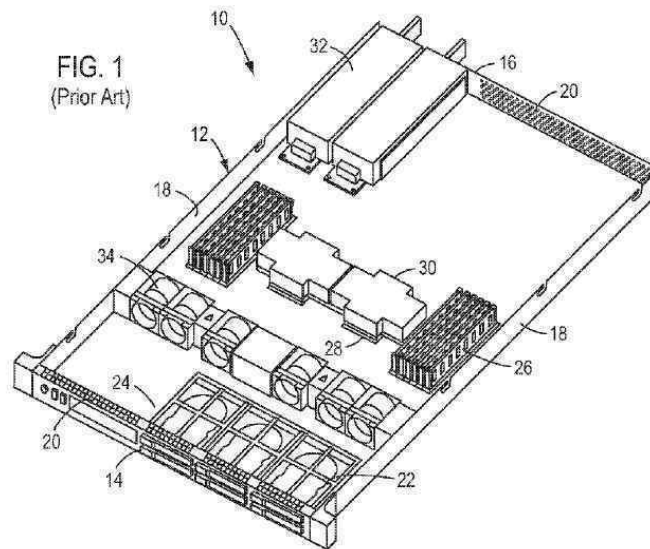
4. Independent Claim 1

a. [1pre] An electronic device comprising:

136. Carl discloses this limitation.

137. Carl discloses, and illustrates in Figure 1, “[a]n example of a prior art server computer....” EX1005, 1:29-30. The “server computer, generally 10, includes a number of electrical components which in this example are housed in a 1u rack enclosure 12.” EX1005, 1:30-31; *see also* EX1005, 1:9-12 (“The present invention relates to a fan assembly for cooling an electronic device comprising a plurality of heat generating electrical components mounted in an enclosure, such as a server computer.”).

138. The “prior art server computer” illustrated in Figure 1 is an *electronic device* as recited in the preamble of claim 1.



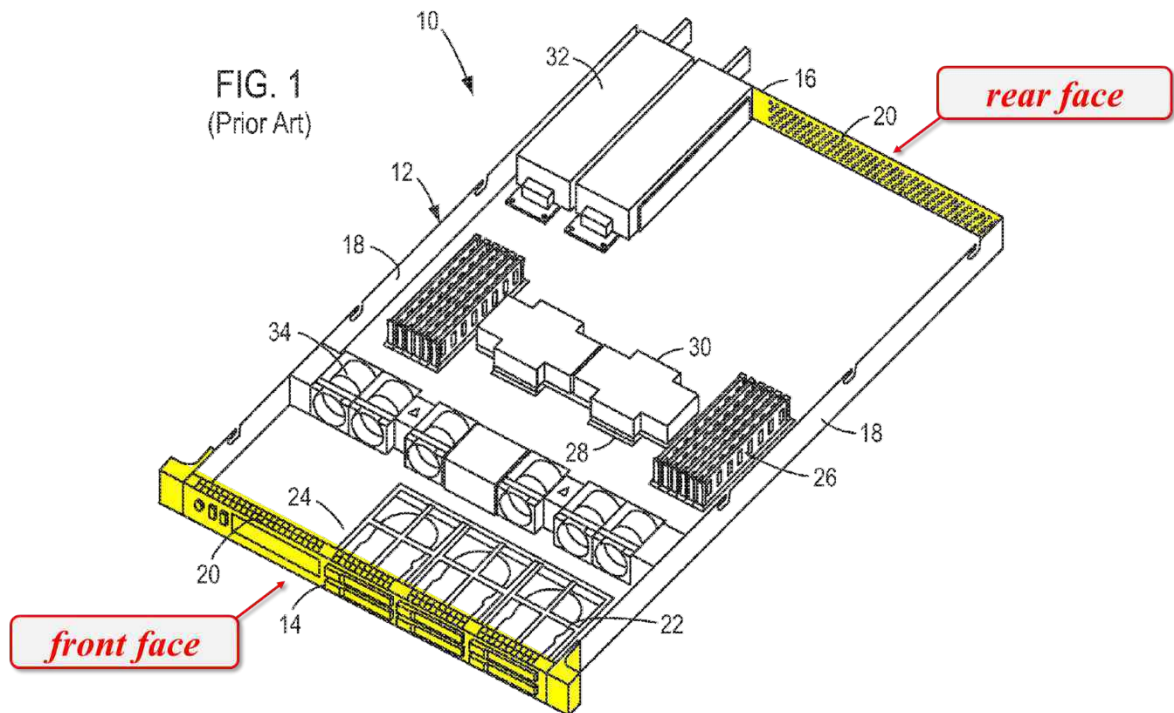
EX1005, Fig. 1.

139. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3 (1:16-18), Fig. 1.

b. [1a] a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction;

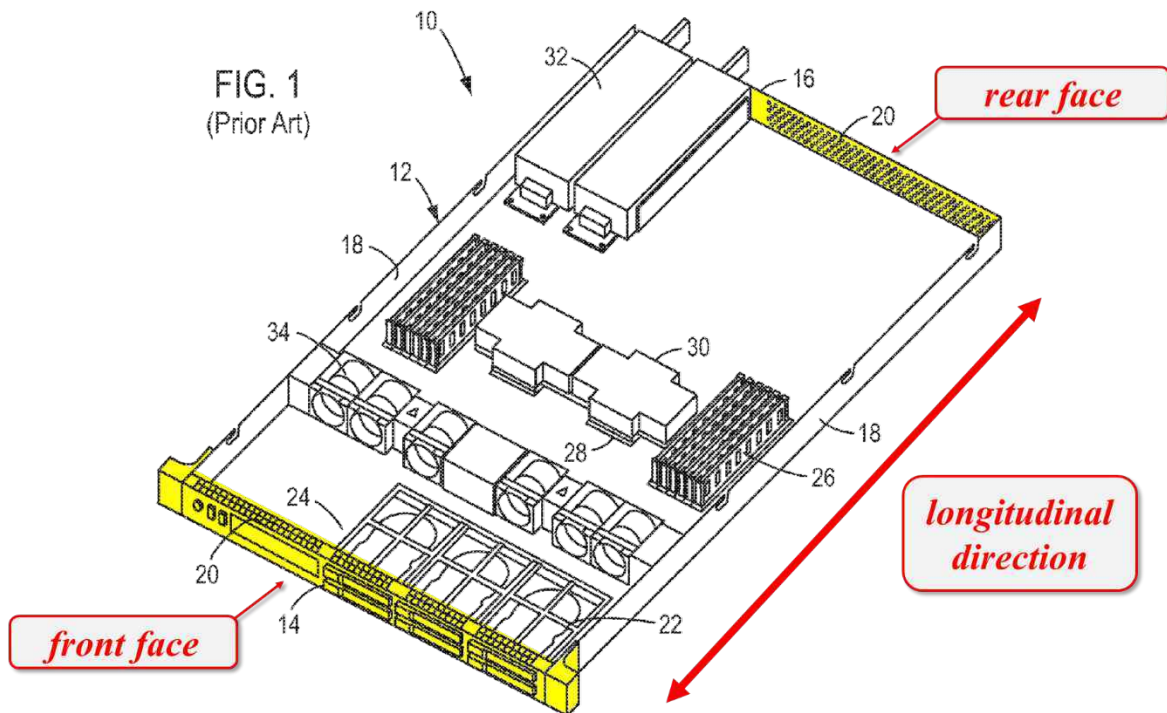
140. Carl discloses this limitation.

141. Carl discloses *a housing comprising a front face and a rear face* as claimed. Carl states that the “server computer, generally 10, includes a number of electrical components which in this example are housed in a 1 u rack enclosure 12” (i.e., *a housing*). EX1005, 1:30-32. Carl also states that “[t]he rack enclosure 12 comprises front wall 14, a rear wall 16 and two parallel sidewalls 18.” EX1005, 1:32-33. Thus, rack enclosure 12 (*a housing*) includes front wall 14 (*a front face*) and rear wall 16 (*a rear face*), as illustrated in Figure 1.



EX1005, Fig. 1 (annotated).

142. Figure 1 also shows that front wall 14 (*front face*) and rear wall 16 (*rear face*) are distanced from each other in a longitudinal direction.



EX1005, Fig. 1 (annotated).

143. The term *longitudinal direction* refers to the lengthwise (i.e., longer) direction in a rectangular housing. EX1012, 3 (defining “longitudinal” as “running lengthwise rather than across”); EX1013, 3 (defining “longitudinal” as “[p]laced or running lengthwise”); EX1014, 3 (defining “longitudinal” as “placed or extended lengthways”); EX1015, 4 (defining “longitudinal” as “placed or running lengthwise” and “of or relating to the length or the lengthwise dimension”). The claim language of ’265 Patent confirms this understanding. For instance, limitation 1b states that air flows “downstream in the longitudinal direction from the front face to the rear face of the housing.” EX1001, 7:42-45 (emphasis added); *see also* EX1001, 4:27-29 (same), 5:29-23 (same), Fig. 1 (arrows point in

longitudinal direction).

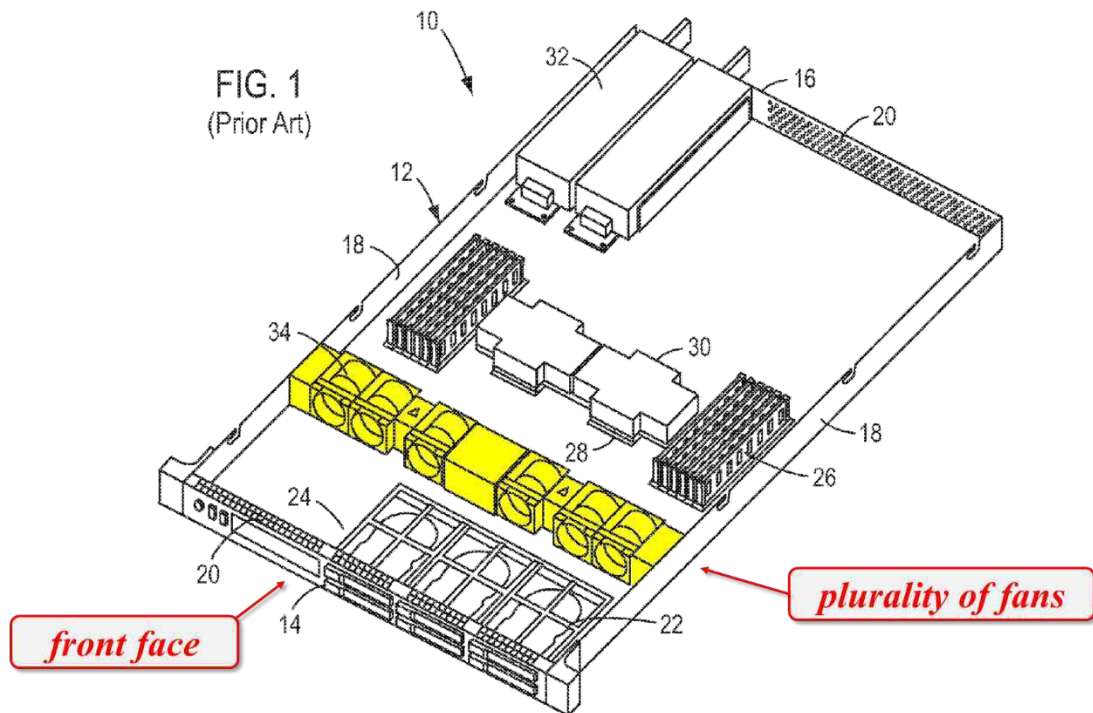
144. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3 (1:16-19), Fig. 1.

- c. **[1b] a plurality of fans which are arranged inside the housing close to the front face so as to cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing;**

145. Carl discloses this limitation.

146. Carl's "server computer 10" includes "a number of fans 34, in this case six, which are oriented with their axes parallel to the sidewalls 18." EX1005, 1:40-44.

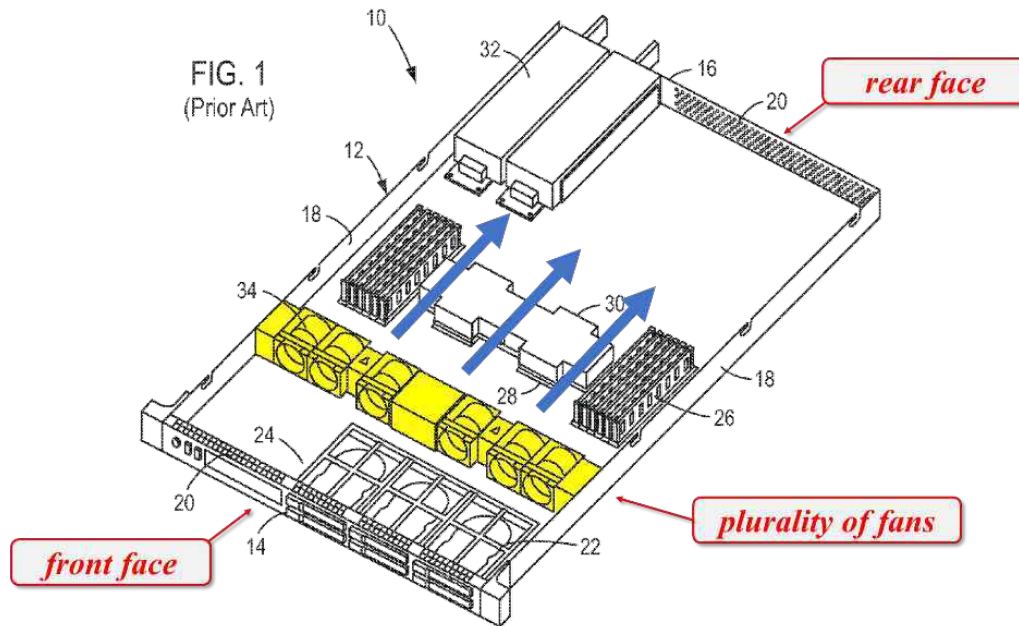
147. Figure 1 shows that the *plurality of fans* (fans 34) are inside the enclosure and *close to the front face* (front wall 14). Thus, Carl discloses *a plurality of fans which are arranged inside the housing close to the front face* as illustrated in Figure 1.



EX1005, Fig. 1 (annotated). Thus, Carl discloses *a plurality of fans which are arranged inside the housing close to the front face.*

148. Further, Carl discloses that the *plurality of fans* (fans 34) *cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing.* Carl states that “the fans 34 draw air into the enclosure 12 through the apertures in the front wall 14 and force the air over the heat generating components and through the apertures in the rear wall 16” and that the “air flows over the components.” EX1005, 1:42-48. In other words, the fans cause the air to *flow downstream in the longitudinal direction from the front face to the rear face of the housing.* The blue arrows in the annotated figure below illustrate the flow of air in the *downstream* direction. As illustrated, the fans cause

the air to flow downstream in the longitudinal direction from the front face to the rear face of the housing.



EX1005, Fig. 1 (annotated). As illustrated, fans cause air to flow downstream in the longitudinal direction from the front face to the rear face of the housing.

149. Carl states that several of the electronic components in the rack enclosure “generate heat during operation of the server computer 10” and that fans 34 (the *plurality of fans*) are used to “dissipate the heat generated by these components[.]” EX1005, 1:35-41. “As the air flows over the components, the heat generated by the components is absorbed by the air to thereby cool the components.” EX1005, 1:47-50. Thus, the fans cause *cooling air to flow* (i.e., air that dissipates heat) as claimed. EX1005, 1:40-44 (“In order to dissipate the heat generated by these components, the server computer 10 also includes a number of

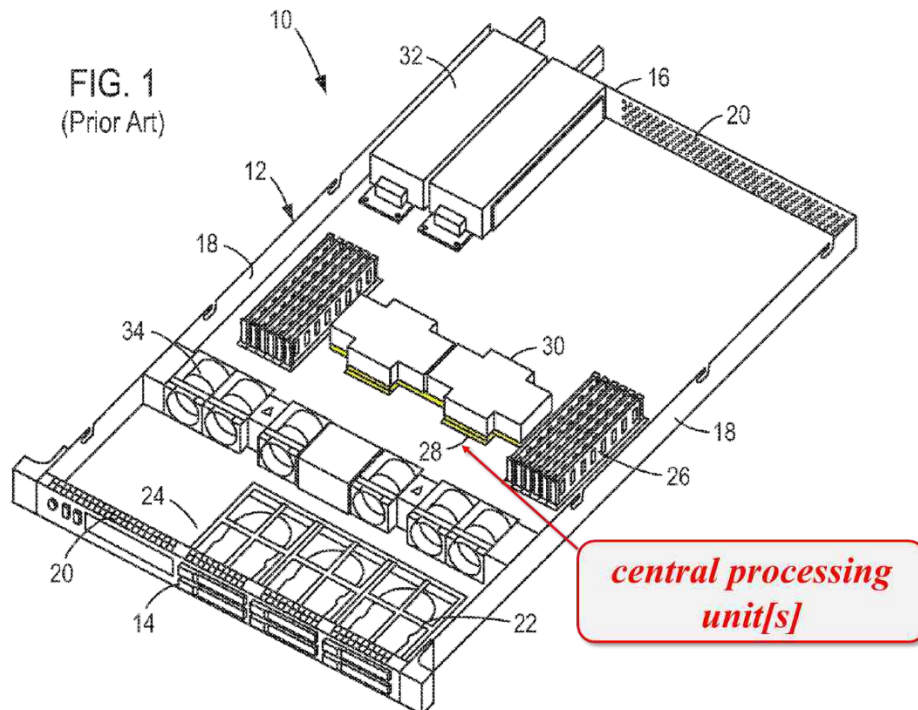
fans 34....”). Thus, the *plurality of fans* cause *cooling air to flow* as claimed.

150. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3-4 (1:20-2:8), Fig 1.

- d. **[1c] a central processing unit (CPU) which is arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough;**

151. Carl discloses this limitation.

152. Carl’s server computer 10 includes *a central processing unit (CPU)*. Indeed, Carl discloses “two processors 28 (each of which is positioned under a corresponding heat sink 30).” EX1005, 1:38-40.

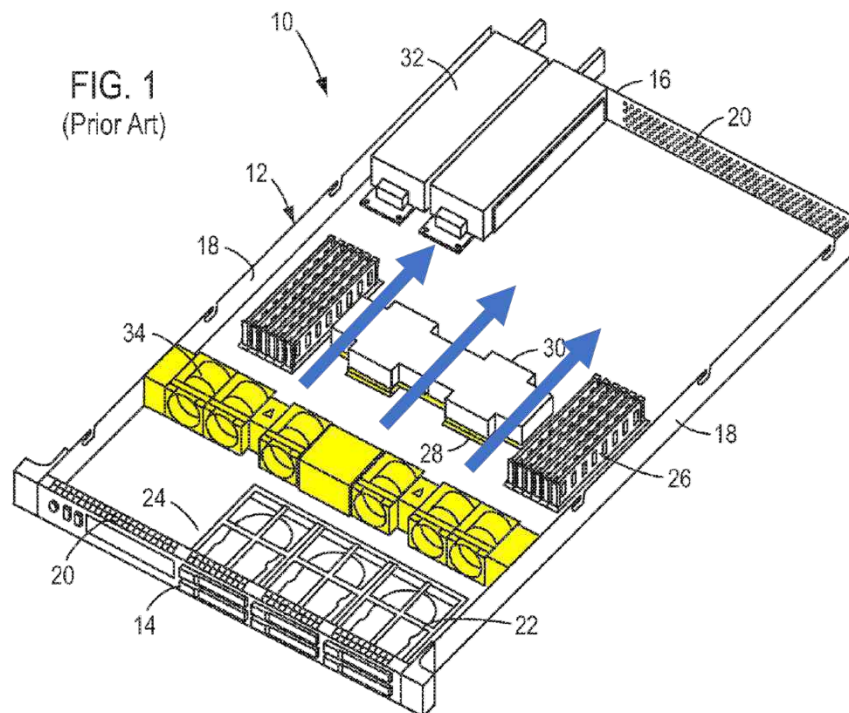


EX1005, Fig. 1 (annotated).

153. A person of ordinary skill in the art would understand that each of

“processors 28” is a *central processing unit (CPU)* because the “processor” in a “server computer” is a *CPU*. EX1017, 3 (“**processor** *n.* See central processing unit, microprocessor.”); EX1018, 3 (“**CPU**...Sometimes referred to simply as the *processor* or *central processor*...”), 5 (“**processor** Short for *microprocessor* or *CPU*.”); EX1019, 6 (“**processor** *see*...*CPU*...”); EX1020, 7 (“**processor** A computer, usually/often the central processor.”).

154. In Carl’s server computer 10, each *central processing unit* (processor 28) is *arranged downstream of the plurality of fans in the housing* (fans 34). Each processor 28 is *downstream* because it is in the direction that air flows from the fans toward rear wall 16.



EX1005, Fig. 1 (annotated).

155. Further, each *CPU* is *positioned to allow the cooling air to directly flow therethrough* because it is located so that air flowing from the fans will directly hit and flow over and around the processor to dissipate heat from the processor. EX1005, 1:40-47 (“In order to dissipate the heat generated by these components, the server computer 10 also includes a number of fans 34” that “draw air into the enclosure 12 through the apertures in the front wall 14 and force the air over the heat generating components” including processors 28.). A person of ordinary skill in the art would understand that this is what the claim means when it states that the *CPU* is *positioned to allow the cooling air to directly flow therethrough* (i.e., air flows over and around the CPU exactly as in Carl). A POSITA would not understand the word *therethrough* to suggest that air flows into or through the *CPU*, because a *CPU* is a solid object.

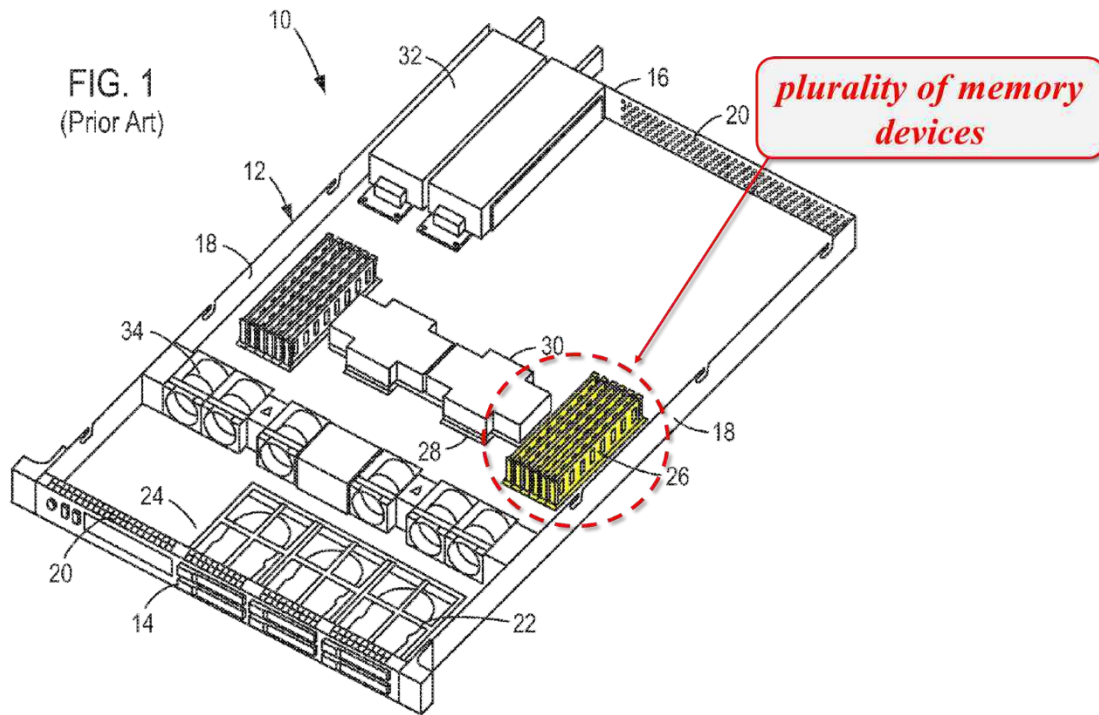
156. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3-4 (1:22-2:6), Fig 1.

- e. **[1d] a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing; and**

157. Carl discloses this limitation.

158. Carl’s server includes “a plurality of memory modules 26.” EX1005, 1:38. Memory modules 26 constitute the claimed *plurality of memory devices* in two different ways.

159. First, a POSITA would know that the structure highlighted below is composed of multiple individual memory modules (i.e., dual in line memory modules or DIMMs). It is therefore *a plurality of memory devices*.

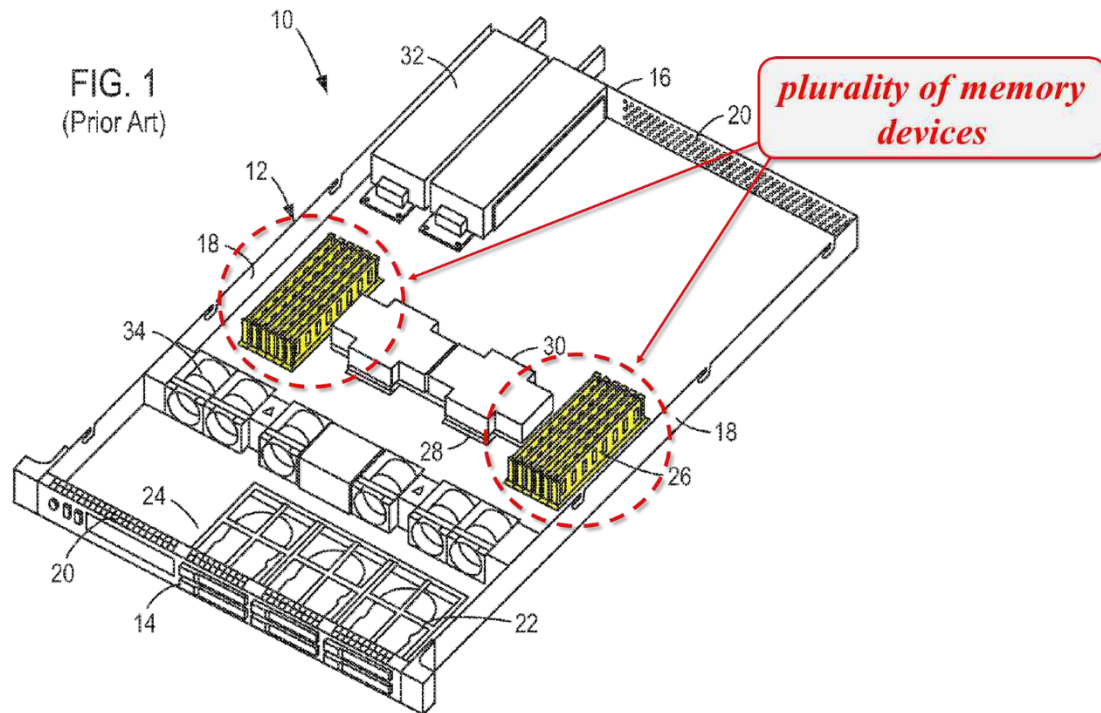


EX1005, Fig. 1 (annotated). As illustrated above, the *plurality of memory devices* are located *adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing*. The *width direction* is from side-to-side in Carl's server and *normal* (i.e., perpendicular) *to the longitudinal direction*.

EX1016, 3 ("normal...Perpendicular, right angled..."). Thus, the highlighted *plurality of memory devices* are shown located *adjacent to processor 28 (CPU) in the width direction* as claimed.

160. Second, Carl illustrates two similar memory structures (*a plurality of*

memory devices) identified below.



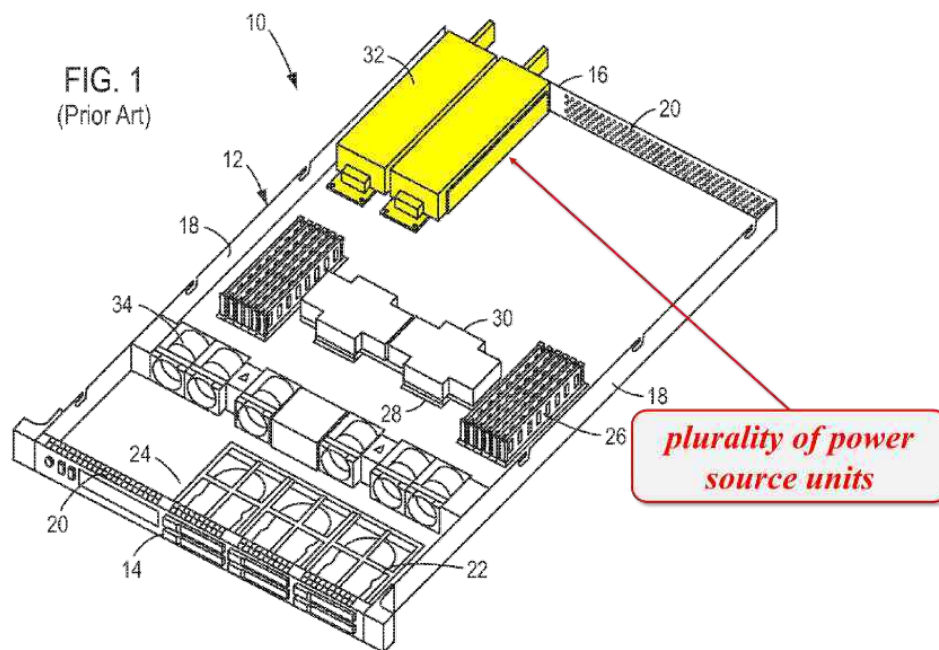
EX1005, Fig. 1 (annotated). As illustrated, the *plurality of memory devices* are located *adjacent to* either CPU 28 in a width direction, substantially normal to the longitudinal direction, of the housing. I do not believe that the plain meaning of the claim language requires a memory structure immediately adjacent each side of a CPU in the width direction, it even if so it would be no more than an obvious design variation for Carl's server to have one CPU instead of the two depicted in Figure 1, with memory modules 26 on each side, as a POSITA would have known. Server computers commonly had one, two, or more CPUs depending on the application and particular design needs. See, e.g., EX1025, [0006] (disclosing a testing method for "computer systems from those of servers with 1 or 2

processors...to those of massive machines with 64 processors...”); EX1026, [0019], [0021], Fig. 1 (illustrating a server with one CPU).

161. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3 (1:22-23), Fig 1.

f. [1e] a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing,

162. Carl’s server computer 10 includes “one or more power supplies 32,” which constitutes *a plurality of power source units* as claimed. Carl’s server computer 10 includes two “power supplies 32” illustrated in Figure 1. EX1005, 1:40.

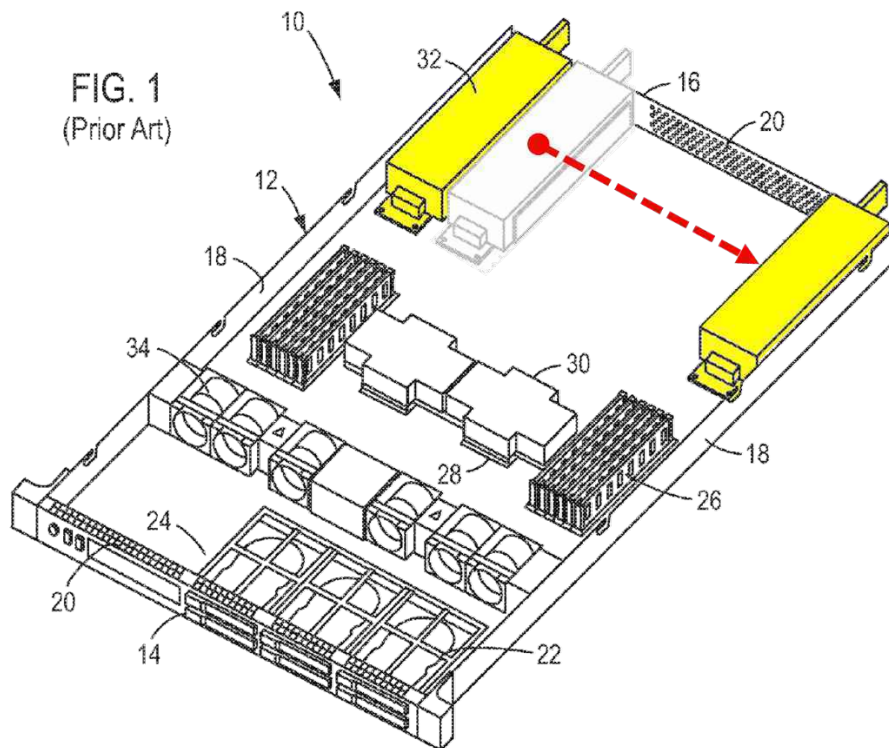


EX1005, Fig. 1 (annotated). These constitute the claimed *plurality of power source units*.

163. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 4 (2:1), Fig. 1. The Carl-Provisional specification described server computer 10 including a number of components including “a power supply 32” (which was changed to “one or more power supplies 32” in Carl). But Figure 1 in the Carl-Provisional shows two power supplies just like Figure 1 in Carl, so the same subject matter is disclosed in the provisional application.

164. **Carl and Hughes:** The combination of Carl and Hughes discloses *a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing* as recited in claim 1.

165. Carl does not disclose *a plurality of power source units* located on opposite sides of the enclosure, but (as I discuss above) a POSITA would have been motivated to modify Carl based on the teaching of Hughes to position Carl’s power sources 32 *opposite to each other and spaced out from each other in the width direction of the housing*. See Section VI.A.2.b. Instead of locating the two power supplies 32 side-by-side against one sidewall of the enclosure (as in Figure 1), a POSITA would have been motivated to position Carl’s two power supplies 32 on opposite sides of the enclosure with each against opposite sidewalls (as illustrated below).

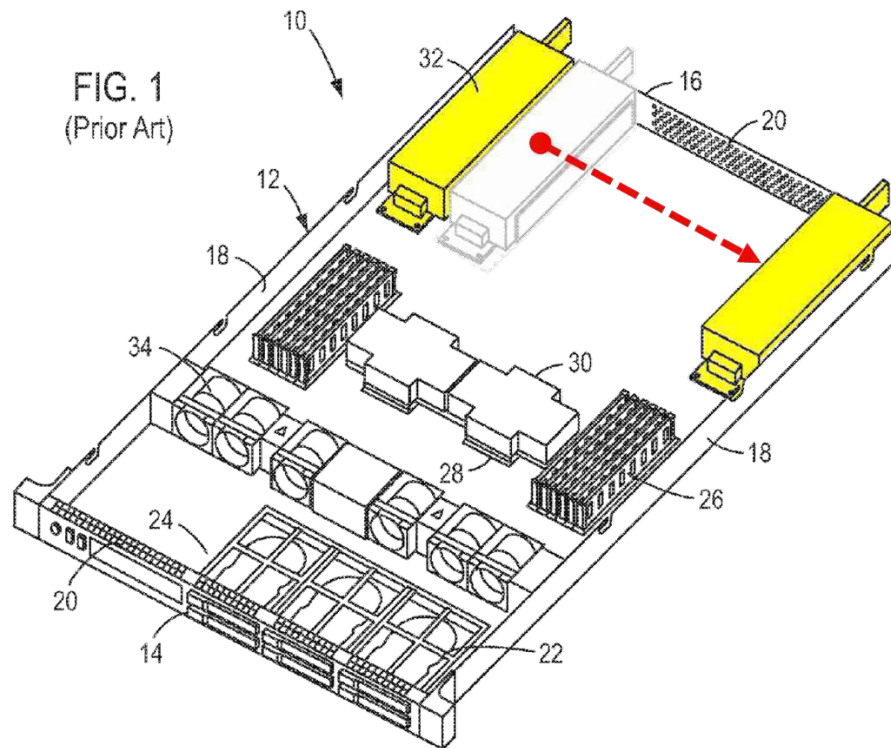


EX1005, Fig. 1 (modified). Thus, the Carl-Hughes combination discloses *a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing as claimed.*

166. **Carl and Suzuki**: A POSITA would have been motivated to modify Carl in the same way based on the teaching of Suzuki. Instead of locating the two power supplies 32 side-by-side against one sidewall of the enclosure (as in Figure 1), a POSITA would have been motivated to position Carl's two power supplies 32 on opposite sides of the enclosure with each against the opposite sidewalls (as illustrated below). See Section VI.A.3.b.

167. A POSITA would be motivated to modify Carl based on the teaching of Suzuki to shift one of the two power supplies in Carl's server computer 10 to the

opposite side of enclosure 12 against the opposite sidewall 18, as illustrated in the demonstrative illustration below:

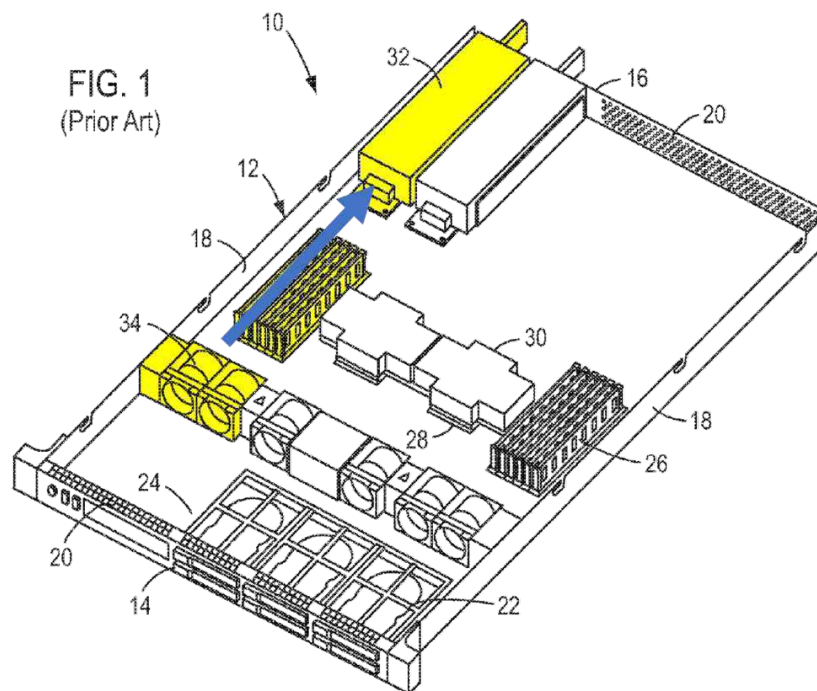


EX1005, Fig. 1 (modified). Thus, the combination of Carl and Suzuki discloses *a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing as recited in claim 1.*

- g. [1f] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units, and**

168. Carl alone or combined with Hughes or Suzuki discloses this limitation of claim 1.

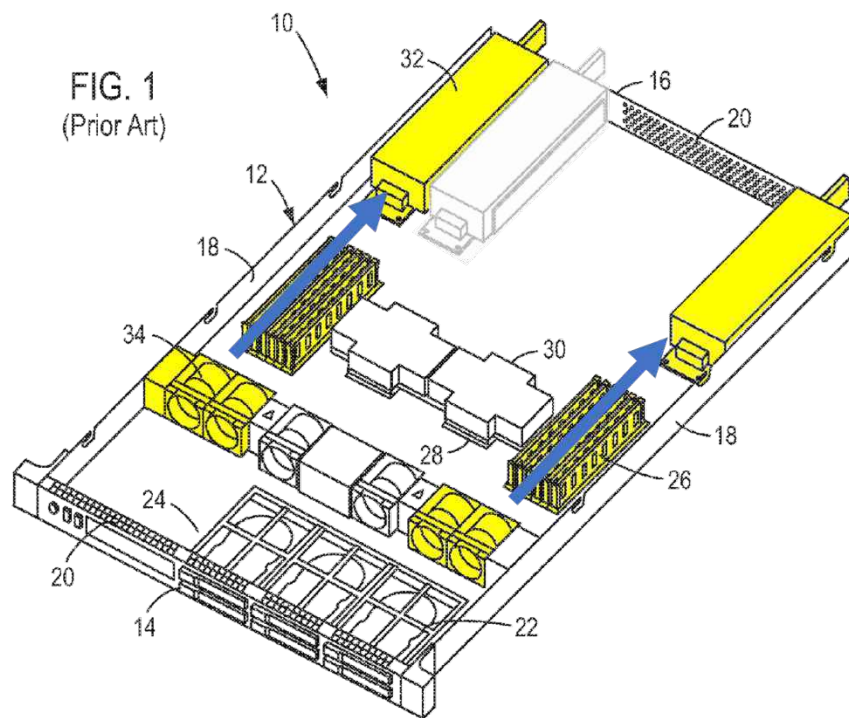
169. First, Carl discloses this limitation. In Carl's server computer 10, *the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices*. As illustrated in Figure 1, the plurality of power supplies 32 are located between the memory devices (memory modules 26) and the rear wall of the enclosure (i.e., *downstream...from the plurality of memory devices*). Further, the plurality of power supplies 32 are located so that *the cooling air passing through one of the memory devices passes into one of the power source units* as indicated by the arrow below.



EX1005, Fig. 1 (annotated). A POSITA would know that cooling air goes around and into the power supply housing (*into one of the power source units*). As Hughes states, the cooling air is drawn “through the PSUs.” EX1007, [0008].

170. In addition, while Carl alone discloses this limitation, the combination

of Carl and Hughes or the combination of Carl and Suzuki also discloses this limitation. In either combination, Carl's server computer 10 is modified so that the right-hand power supply (as viewed in Figure 1) is located against the opposite sidewall 18 of the rack enclosure 12, as illustrated below. As a result, the power supply units 32 are on opposite sides of enclosure 12 located against the two sidewalls 18. In that position, they are *positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units.*



EX1005, Fig. 1 (modified). Again, Hughes expressly discloses that cooling air is drawn “through the PSUs” (*into one of the power source units*). EX1007, [0008].

171. As indicated by the arrows in the figure above, *the plurality of power*

source units (power supplies 32) are each positioned further downstream of the cooling air from the plurality of memory devices (memory modules 26) such that the cooling air passing through one of the memory devices passes into one of the power source units. A POSITA would further understand that the *cooling air would pass[] into one of the power sources* because Carl discloses the “heat generated by the components” (electrical components such as power supplies 32) being “absorbed by the air to thereby cool the components” and would understand that the cooling air could pass into and through power supplies 32 to absorb the generated heat. EX1005, 1:35-40 (“Several of the electrical components generate heat during operation of the server computer 10, such as...one or more power supplies 32.”), 1:47-50 (“As the air flows over the components, the heat generated by the components is absorbed by the air to thereby cool the components.”).

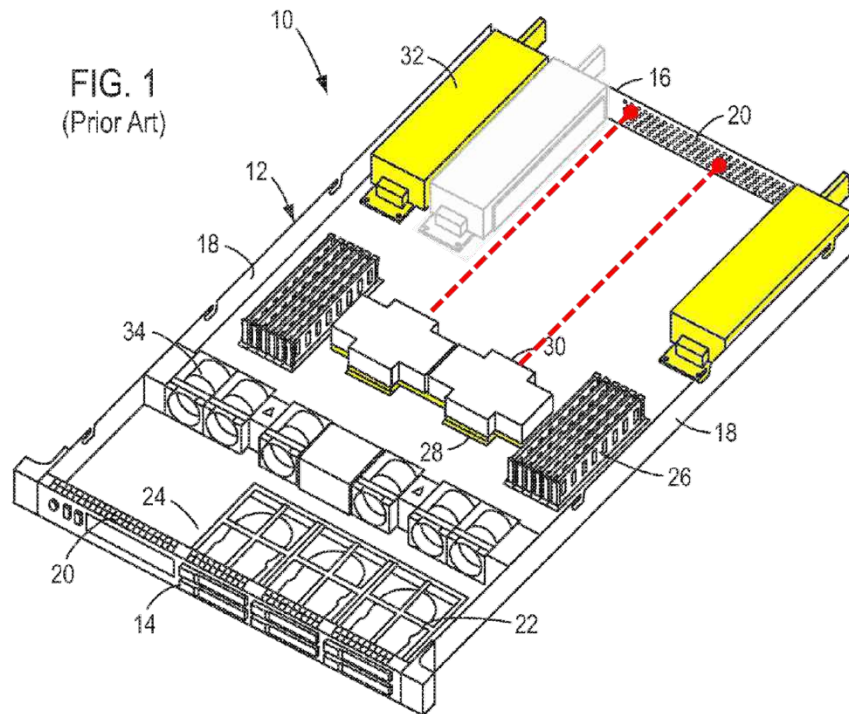
172. The disclosures from Carl in this section are based on Figure 1, which is also in the Carl provisional application.

h. [1g] wherein the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing.

173. Carl combined with Hughes or Suzuki discloses this limitation.

174. In either combination, the second power supply 32 (the one to the right in Figure 1) is located against the opposite sidewall 18 (the right sidewall in the figure). Thus, in Carl’s server computer 10, as modified based on Hughes or

Suzuki, the power supplies 32 are positioned with one against sidewall 18 on one side of enclosure 12 and the other power supply against the opposite sidewall 18.



EX1005, Fig. 1 (modified). As illustrated above, neither power supply 32 is positioned directly between processors 28 and rear wall 16. Thus, *the plurality of power source units (power supplies 32) are each positioned not to be aligned linearly with the CPU (processors 28) in the longitudinal direction of the housing (enclosure 12).*

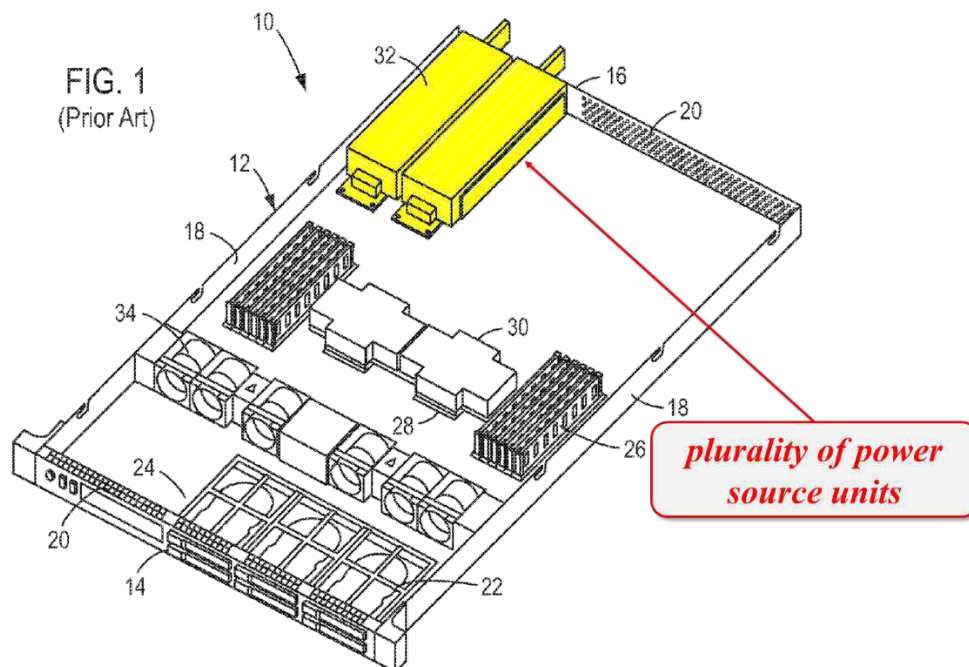
175. The disclosures from Carl in this section are based on Figure 1, which is also in the Carl provisional application.

5. Dependent Claim 2: The electronic device according to claim 1, wherein the plurality of power source units are each arranged to be pulled out from the rear face of the housing.

176. The combination of Carl and Hughes and the combination of Carl and Suzuki discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

177. Further, for the reasons described for limitation 1e, Carl discloses a *plurality of power source units* (power supplies 32), which are located against rear wall 16. See Section VI.A.4.f.

178. Figure 1 in Carl illustrates power supply units 32 with a handle on the back side, suggesting that they *are each arranged to be pulled out from the rear face of the housing* as recited in claim 2.

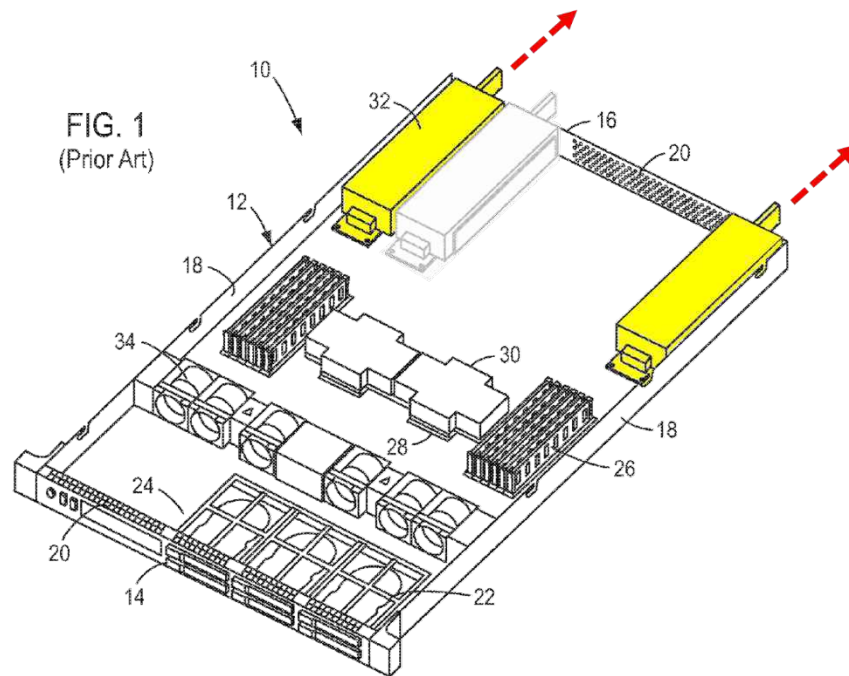


EX1005, Fig. 1. A POSITA would have known that such power supply units commonly had handles to allow them to be inserted and removed from the enclosure.

179. For example, Sasagawa describes a disk array system. EX1022, 1. Sasagawa describes “modules to be installed in each of the chassis including various types of modules in the present embodiment, for example, the CTL module 10, the HDD module 30, the power source module 40, the batter module 50, the panel module 60, the ENC module 70, and the power source module 80. EX1022, [0069]. Sasagawa further states that the “[o]perations such as insertion/removal and fixation of each module to and from the chassis (100 and 200) by a person are performed by using an operating lever and the like provided in the module.” EX1022, [0069]; see also EX1022, [0070], Fig. 5. Suzuki also discloses power supplies with handles for insertion/removal as discussed below. EX1008, 15:35-38, 15:49-53, Fig. 12.

180. **Carl and Hughes**: Hughes describes a “form factor that can conveniently be used with common enclosure layouts, where modules may be inserted into/removed from the enclosure through square/rectangular bays in the rear of the enclosure” (EX1007, [0017]), and expressly states that Hughes’ enclosure 1 includes “bays into which can be received...two power supply units 7...” (EX1007, [0028]). A POSITA would understand from Hughes’ disclosures

that power supply units 7 are removable through the rear wall of the enclosure.



EX1005, Fig. 1 (modified). Further, a POSITA would have been motivated to implement Carl's server computer 10 such that the plurality of power source units are each *arranged to be pulled out from the rear face of the housing*, as taught by Hughes, and illustrated above.

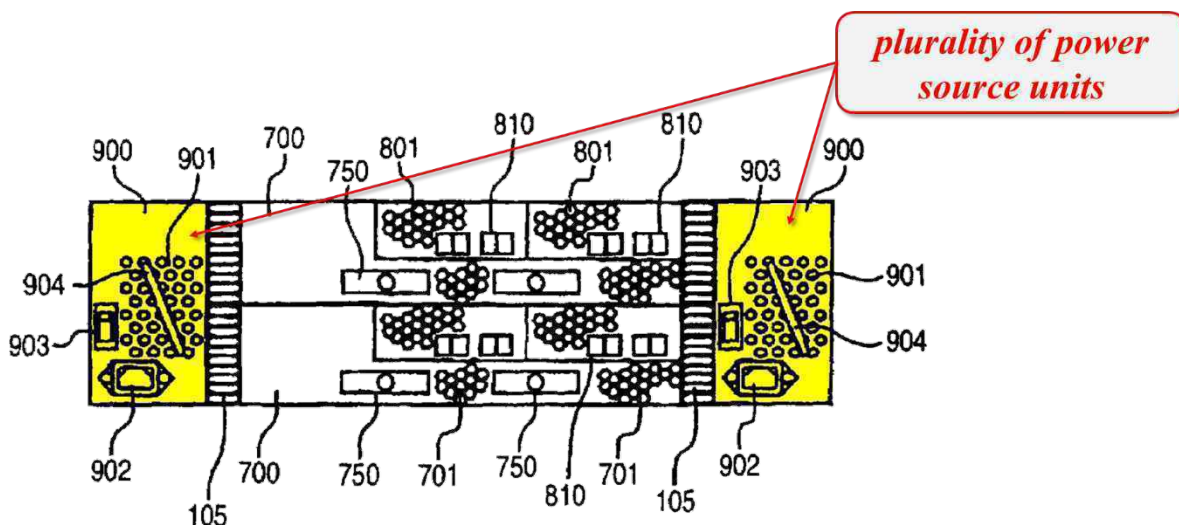
181. A POSITA would have recognized the benefit of this design because it would allow a user to easily replace a defective or damaged power supply 32 in Carl's server computer 1. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem."). Further, a POSITA could have implemented this design with a reasonable expectation of success because such

removable power supplies were well known and readily available for purchase long before 2012. EX1008, 15:35-37, Fig. 12; EX1009, Abstract, 1:59-67; EX1021, 2:28-31 (“[A] preferred housing further includes at least two replaceable power supply units arranged within the second compartment of the chassis and removable via one of the chassis openings.”), Fig 4, Fig. 6; EX1022, [0069], [0070] (“The operation in the case of the modules (... power source module 40, battery module 50, ...) provided with the operating lever is as follows.... When taking out the module from the chassis, the customer engineer or end user moves up the operating lever to release the fixed state by a latch release action and removes the module from the predetermined area in the chassis.”), Fig. 5.

182. Thus, Carl alone or combined with Hughes discloses the additional limitation recited in claim 2.

183. **Carl and Suzuki**: Suzuki’s Figure 12 is a “back view of the control unit 30” and illustrates power supply modules 900 on either side of the control unit. EX1008, 15:35, 4:58-60. Suzuki states that “[p]ower supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively.” EX1008, 15:35-38. A handle 904 is “provided on the rear side of each power supply module 900.” EX1008, 15:49-53. A POSITA would understand from Suzuki’s disclosures that power supply units 7 are removable

through the rear wall of the enclosure.



EX1008, Fig. 12 (annotated).

184. A POSITA would have been motivated to implement Carl's server computer 10 such that the plurality of power source units are each *arranged to be pulled out from the rear face of the housing*, as taught by Suzuki. A POSITA would have recognized the benefit of this design because it would allow a user to easily replace a defective or damaged power supply 32 in Carl's server computer 1. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem."). Further, a POSITA could have implemented this design with a reasonable expectation of success because such removable power supplies were well known and readily available for purchase long before 2012. EX1007, [0017],

[0028]; EX1009, Abstract, 1:59-67; EX1021, 2:28-31 (“[A] preferred housing further includes at least two replaceable power supply units arranged within the second compartment of the chassis and removable via one of the chassis openings.”), Fig 4, Fig. 6; EX1022, [0070] (“The operation in the case of the modules (... power source module 40, battery module 50, ...) provided with the operating lever is as follows.... When taking out the module from the chassis, the customer engineer or end user moves up the operating lever to release the fixed state by a latch release action and removes the module from the predetermined area in the chassis.”), Fig. 5.

185. Thus, Carl alone or combined with Suzuki discloses the additional limitation recited in claim 2.

186. The disclosures from Carl in this section are based on Figure 1, which is also in the Carl provisional application.

6. Dependent Claim 3: The electronic device according to claim 1, wherein the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards, and positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.

187. The combination of Carl and Hughes or Carl and Suzuki discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

188. In addition, as described for 1e, Carl discloses a server computer 10

and a pair of side boards containing the electronics of the *power source units*.

Thus, Carl alone or combined with Hughes or Suzuki discloses that *the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards*.

191. To the extent claim 3 may be construed more narrowly to require the claimed *power box* to be a housing into which a separate power supply structure can be inserted and removed, Hughes discloses just such a housing.

192. Hughes discloses “power supply unit 7” “may be provided in a housing of its own” through which cooling air is drawn. EX1007, [0037]-[0038]. The housing constitutes a *power box* as that term is used in claim 3. Hughes explains that air flows through the power supply housing by entering through “an aperture” and exists through an “outlet vent 26.” EX1007, [0037]. A POSITA would recognize from Hughes’ description of the airflow into and out of the power supply housing, that the housing is a generally closed structure with at least *a top board and a pair of side boards*. EX1007, [0037]. (power supply has “an air path 46 between outlet vent 26 and the rear face of the power supply 7.”).

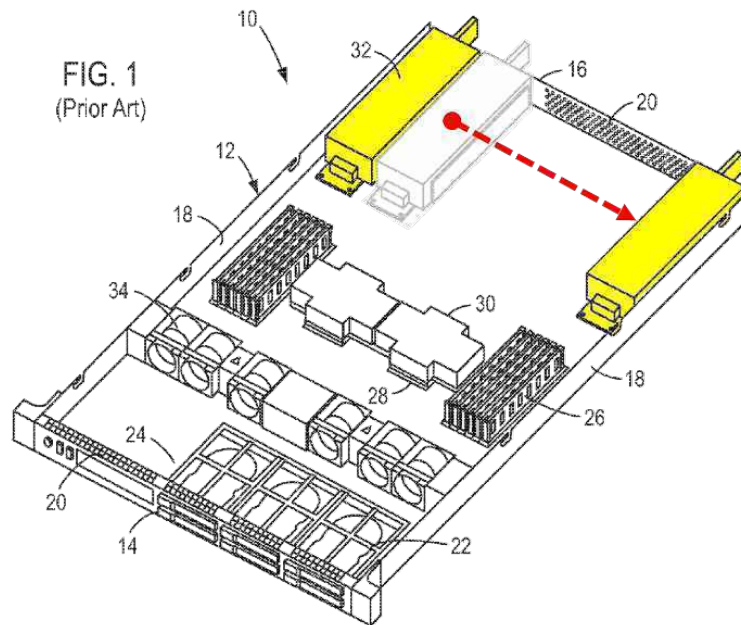
193. A POSITA would be motivated to implement Hughes’ power supply housing in Carl’s server computer because it would protect the power supply unit while permitting cooling air to enter and exit the housing and would also allow the power supply unit to be inserted and removed from the housing. A person of

ordinary skill in the art could have implemented Hughes' power supply housing with a reasonable expectation of success. Hughes describes a well known structure that a POSITA would have understood well and been able to implement without need for experimentation or unreasonable effort.

194. For these further reasons, the combination of Carl and Hughes discloses that *the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards.*

195. The combination of Carl and Hughes or Carl and Suzuki discloses that *the plurality of power source units are...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts* as explained for 1e and 1g. See Sections VI.A.4.f and VI.A.4.h.

196. Indeed, the PSUs in in Carl's server computer 10 are implemented on the opposite sides of enclosure 12 against sidewalls 18 (*positioned close to each of side faces of the housing*, as shown in the demonstrative illustration below:



EX1005, Fig. 1 (modified).

197. As a result, in the combination of Carl and Hughes or Carl and Suzuki, *the plurality of power source units are each...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts*. For the reasons I discuss above regarding limitation 1b, Carl's fans cause cooling air to *flow downstream in the longitudinal direction from the front face to the rear face of the housing*. See Section VI.A.4.c. Thus, *cooling air flown downwardly from the plurality of electronic parts* means the cooling air from the fans that flows over the *electronic parts*.

198. As I discuss above, a POSITA would understand that in the context of this patent and its prosecution history, *the plurality of electronic parts* can refer

to the *central processing unit* of claim 1. See Section IV.E.

199. Thus, because the power source units disclosed by the combination of Carl and Hughes are not directly behind the CPU, they are *positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts*.

200. The disclosures from Carl in this section are based on Figure 1, which is also in the Carl provisional application.

7. Independent Claim 4

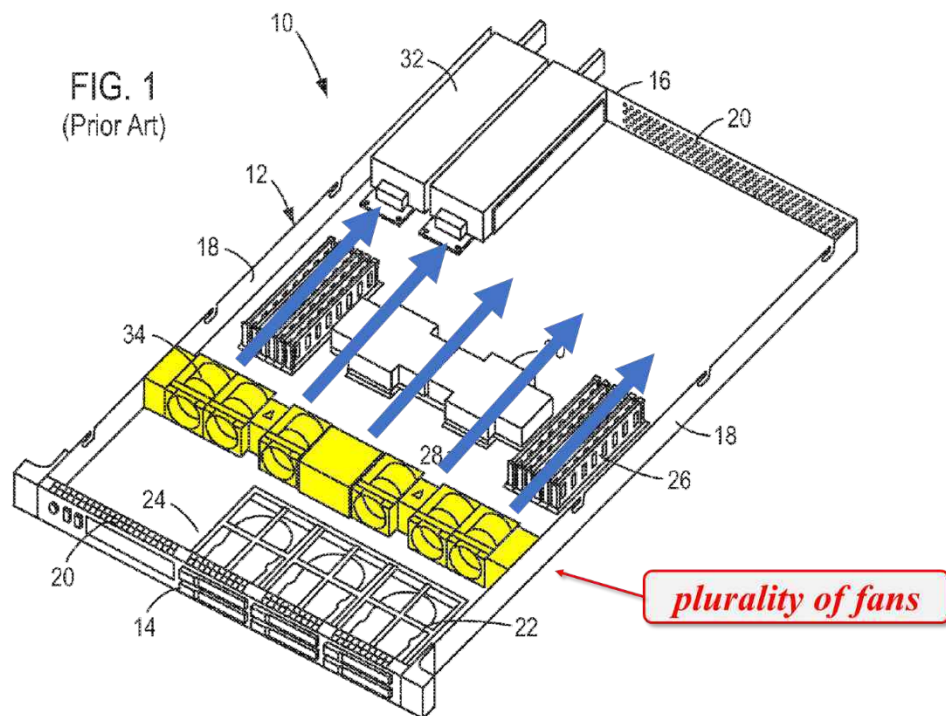
201. Independent claim 1 includes a number of limitations that are the same as, or quite similar to, limitations in claim 4. In some parts of my analysis of claim 4 below, I will refer back to and rely on my analysis of claim 1 without repeating my earlier analysis.

- a. **A cooling structure of an electronic device comprising a plurality of fans causing cooling air to flow downstream, a central processing unit (CPU), a plurality of memory devices adjacent to the CPU, and a plurality of power source units, all of which are arranged along a flowing direction of the cooling air corresponding to a longitudinal direction in a housing,**

202. To the extent the preamble of claim 4 is limiting, Carl discloses it.

203. Carl's server computer 10 includes fans 34, which constitute a cooling structure of an electronic device. The *electronic device* (server computer 10) includes *a plurality of fans causing cooling air to flow downstream* as I explain for

1b. See Section VI.A.4.c. The *electronic device* includes a *central processing unit (CPU)* as I explain for 1c. See Section VI.A.4.d. The electronic device includes a *plurality of memory devices adjacent to the CPU* as explained for 1d. See Section VI.A.4.e. The *electronic device* includes a *plurality of power source units* as I explain for 1e. See Section VI.A.4.f. As illustrated below and as I explain for 1a and 1b, all of these components are arranged in the *electronic device* (server computer 10) *along a flowing direction of the cooling air corresponding to a longitudinal direction in a housing*. See Sections VI.A.4.b and VI.A.4.c.



EX1005, Fig. 1 (annotated)

204. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3-4 (1:16-2:8), Fig 1.

- b. wherein the CPU is arranged downstream of the plurality of fans and positioned to allow the cooling air to directly flow therethrough,**

205. This limitation is similar to 1c. This limitation is disclosed by Carl for the reasons I discuss above for limitation 1c. See Section VI.A.4.d.

- c. wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units,**

206. This limitation is identical to limitation 1f and disclosed for the reasons I discuss above for limitation 1f. See Section VI.A.4.g.

- d. wherein the plurality of power source units are positioned opposite to each other and spaced out from each other in a width direction of the housing such that the plurality of power source units are positioned not to be aligned linearly with the CPU in the longitudinal direction.**

207. This limitation is disclosed by Carl in combination with Hughes and by Carl in combination with Suzuki for the reasons I discuss above for limitations 1e and 1g. See Sections VI.A.4.f and VI.A.4.h. The combination of Carl with Hughes or with Suzuki discloses that *the plurality of power source units are positioned opposite to each other and spaced out from each other in a width direction of the housing* for the reasons explained for 1e. See Section VI.A.4.f. The combination of Carl and Hughes or Carl and Suzuki discloses that *the plurality of power source units are positioned not to be aligned linearly with the CPU in the*

longitudinal direction for the reasons explained for 1g. See Section VI.A.4.h.

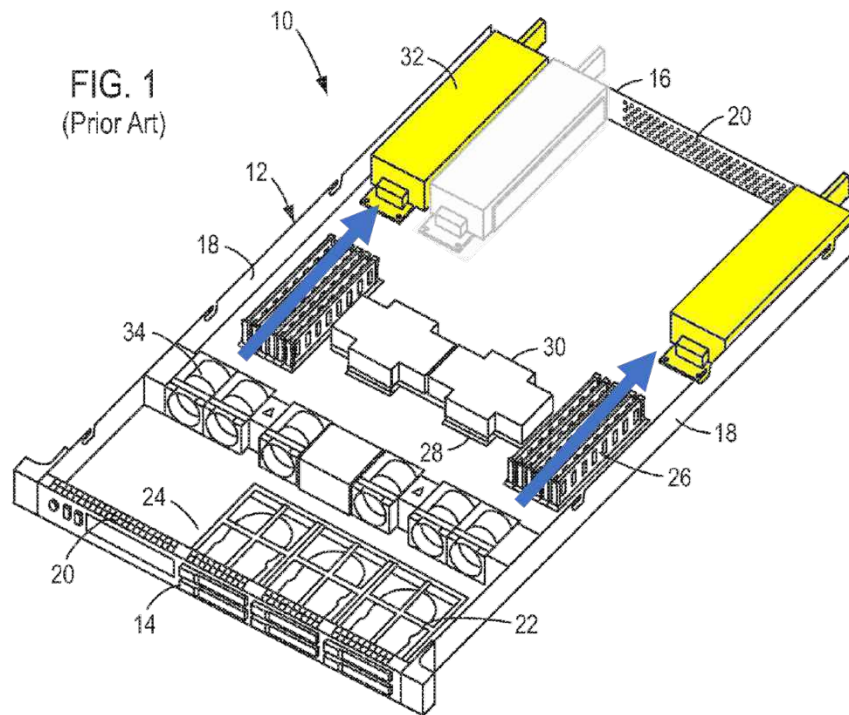
8. Dependent Claim 5: The electronic device according to claim 1, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.

208. The combination of Carl and Hughes or Carl and Suzuki disclose the limitations of claim 1 for the reasons I discuss above in connection with that claim.

209. For the reasons I discuss for limitation 1e above, Carl discloses a *plurality of power source units*. See Section VI.A.4.f.

210. For the reasons I discuss for limitation 1d above, Carl discloses a *plurality of memory devices*. See Section VI.A.4.e.

211. In addition, the combination of Carl with either Hughes or Suzuki discloses the additional limitation of claim 5. As illustrated below and as I discuss above for 1f, *the plurality of power source units* (power supplies 32) *are each positioned along an extension downstream from the plurality of memory devices* (memory modules 26).



EX1005, Fig. 1 (modified)

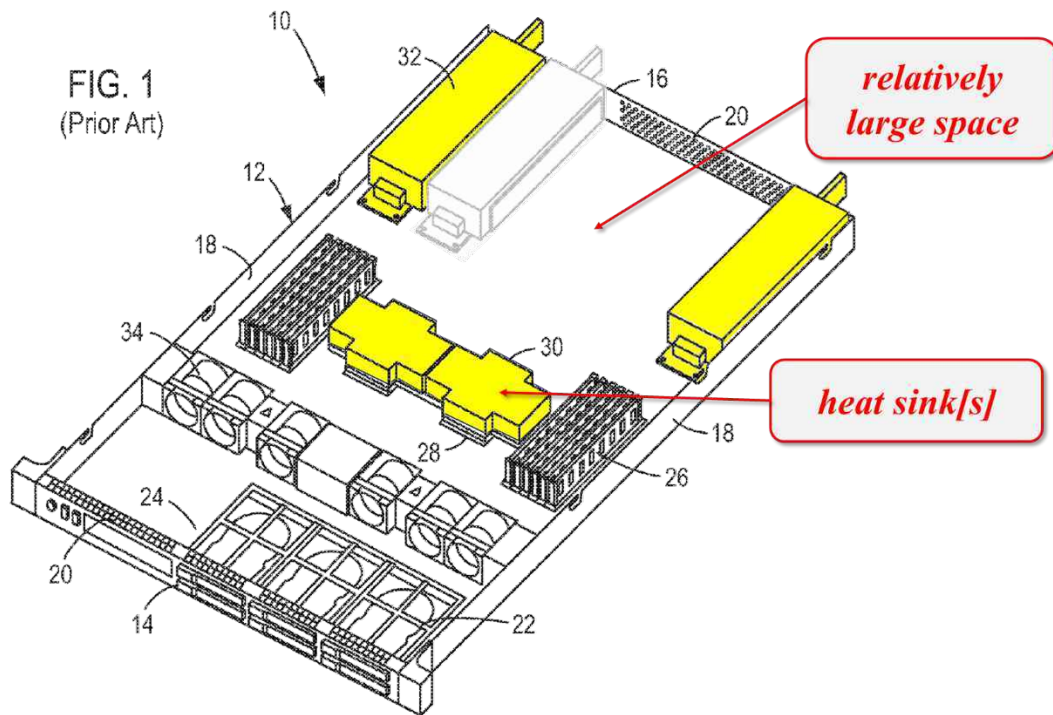
212. The power supplies 32 are positioned against the opposing sidewalls of the enclosure, downstream from memory modules 26 (as indicated by the arrows above), and oriented in a lengthwise direction (i.e., *along an extension*). Thus, the power supplies 32 in Carl's enclosure, as modified based on Hughes or Suzuki, *are each positioned along an extension downstream from the plurality of memory devices*.

213. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3-4 (1:16-2:8), Fig 1.

9. Dependent Claim 6: The electronic device according to claim 1, wherein the cooling air flows through a heat sink, attached onto the CPU, and further flows downstream via a relatively large space formed between the plurality of power source units.

214. The combination of Carl and Hughes and Carl and Suzuki discloses the limitations of claim 1 for the reasons I discuss above in connection with that claim.

215. The combination of Carl with either Hughes or Suzuki discloses the additional limitation of claim 6. Carl discloses that processors 28 (each a *CPU*) are each “positioned under a corresponding heat sink 30.” EX1005, 1:38-40. In Carl, fans 34 cause *cooling air* to flow *through a heat sink, attached onto the CPU* as claimed. Further, in Carl’s enclosure modified based on either Hughes or Suzuki, has a relatively large space between the two power sources 32, as illustrated below.



Carl, Fig. 1 (modified)

216. Thus, Carl-Hughes or Carl-Suzuki discloses that *cooling air...further flows downstream via a relatively large space formed between the plurality of power source units.*

217. A POSITA would understand that having a processor “positioned under a corresponding heat sink” is what the claim means when it states *a heat sink attached onto the CPU* because this is consistent with the ’265 Patent’s specification, which describes heat sinks as follows: “[a] pair of heat sinks 17 is positioned above a pair of CPUs 4.” EX1001, 4:44-45; *see also* EX1001, Fig. 2. Further, a POSITA would know that a CPU is kept in “position[] under a corresponding heat sink” by having the *heat sink attached onto the CPU*.

218. The disclosures from Carl in this section are also in the Carl provisional application. EX1006, 3-4 (1:23-2:1), Fig. 1.

10. Dependent Claim 7: The cooling structure of an electronic device according to claim 4, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.

219. The combination of Carl and Hughes or Carl and Suzuki discloses the limitations of claim 4 for the reasons I discuss above in connection with that claim.

220. The additional limitation of claim 7 is identical to the one recited in claim 5. It is disclosed for the same reasons I discuss above in connection with that claim. *See* Section VI.A.8.

11. Dependent Claim 8

a. The electronic device according to claim 1, wherein

221. The combination of Carl and Hughes or Carl and Suzuki discloses the limitations of claim 1 for the reasons I discuss above in connection with that claim.

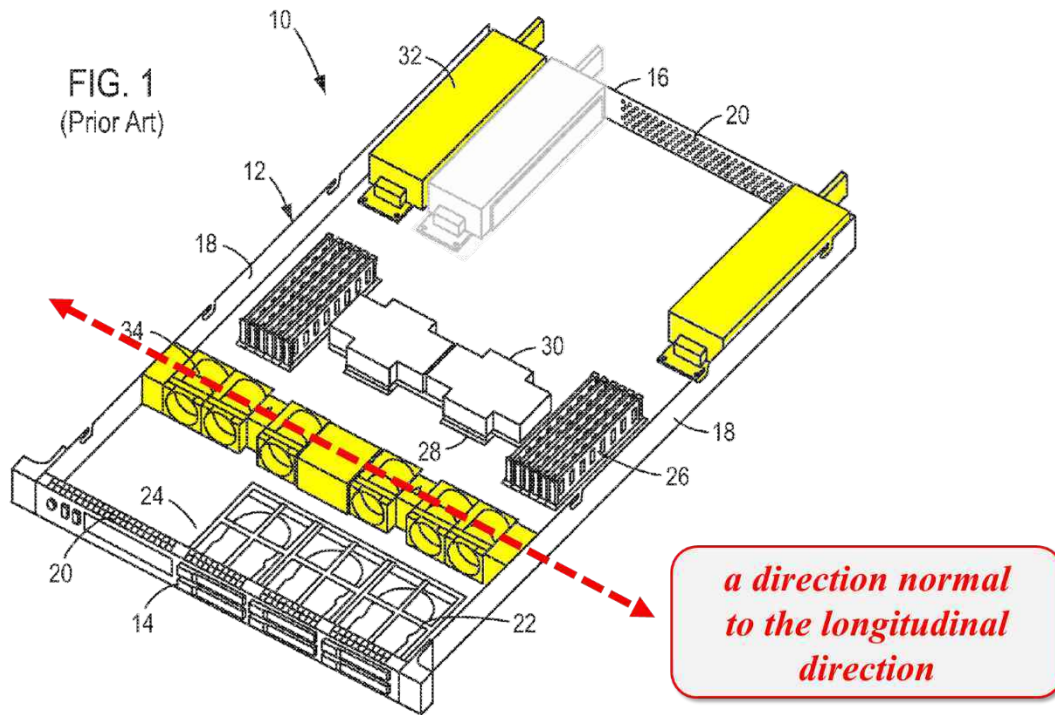
222. The disclosures from Carl I discuss regarding claim 8 are also in the Carl provisional application. EX1006, 3-4 (1:16-2:8), Fig 1

b. the plurality of fans are arranged in a direction normal to the longitudinal direction,

223. Carl-Hughes or Carl-Suzuki discloses this limitation.

224. In Carl's server computer 10 (as modified based on Hughes or Suzuki), *the plurality of fans (fans 34) are arranged in a direction normal (i.e., perpendicular) to the longitudinal direction*, as illustrated below. This limitation

defines the term *a direction* to mean the direction indicated by the arrow in the figure below. The term in this limitation reciting *a direction* is referred to as *the direction* in later limitations.

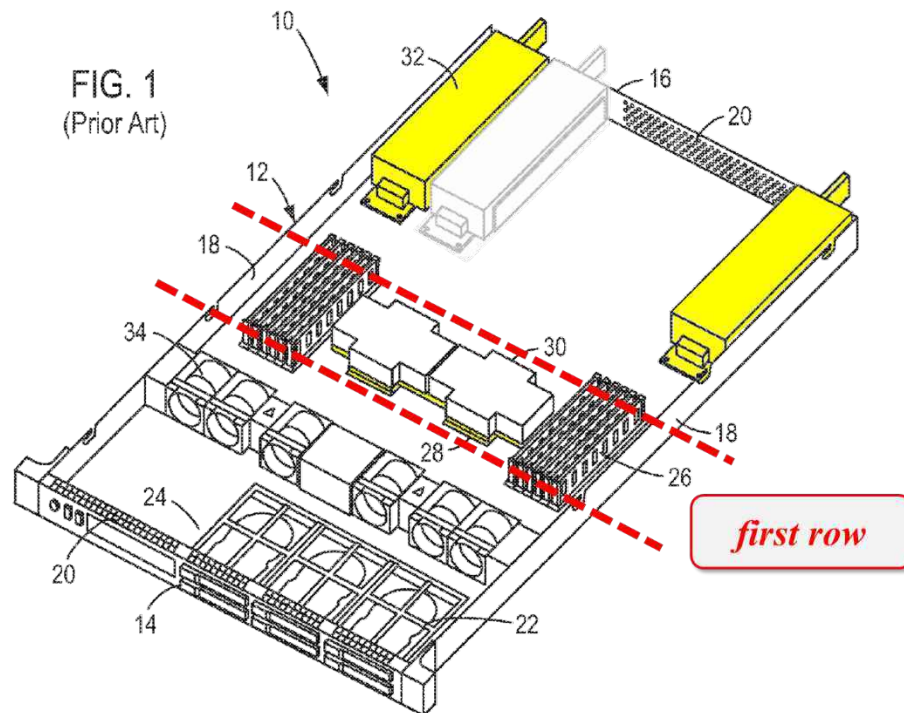


EX1005, Fig. 1 (modified); *see also* EX1005, 1:42-44.

c. the central processing unit is positioned in a first row,

225. Carl-Hughes or Carl-Suzuki discloses this limitation.

226. In Carl's server computer 10 (as modified based on Hughes or Suzuki), *the central processing unit* (either of processors 28) *is positioned in a first row*, as illustrated below.

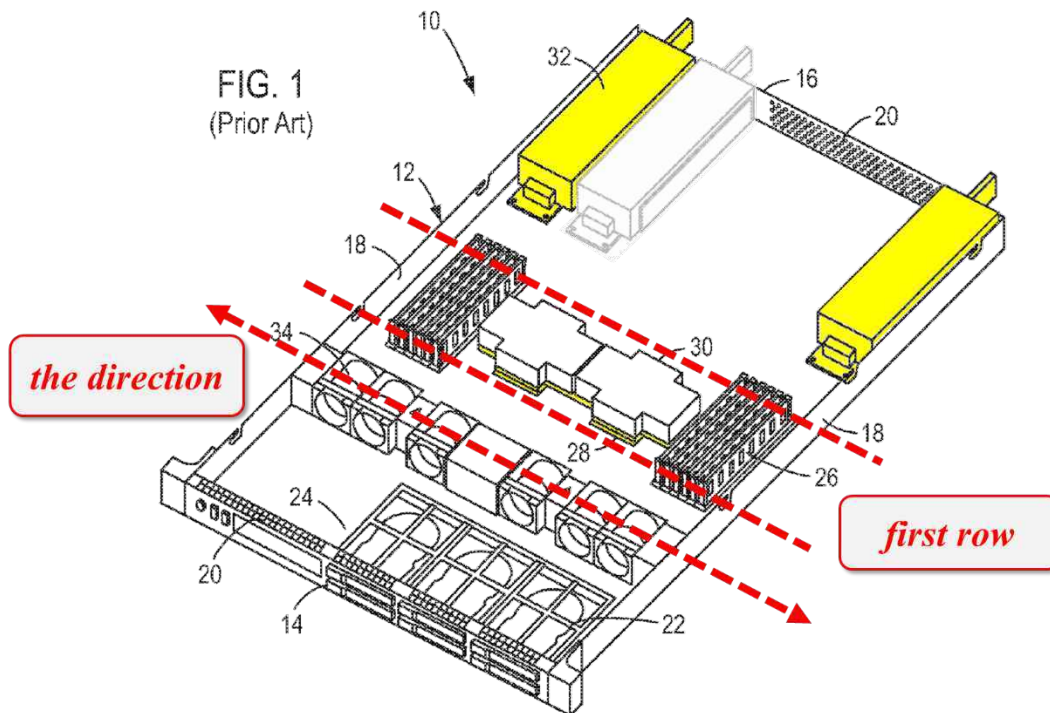


EX1005, Fig. 1 (modified).

d. the first row extending parallel to the direction,

227. Carl-Hughes and Carl-Suzuki discloses this limitation.

228. In Carl's server computer 10 (as modified based on Hughes or Suzuki), *the first row of processors 28 is parallel to the direction* (i.e., the direction normal to the longitudinal direction), as illustrated below.



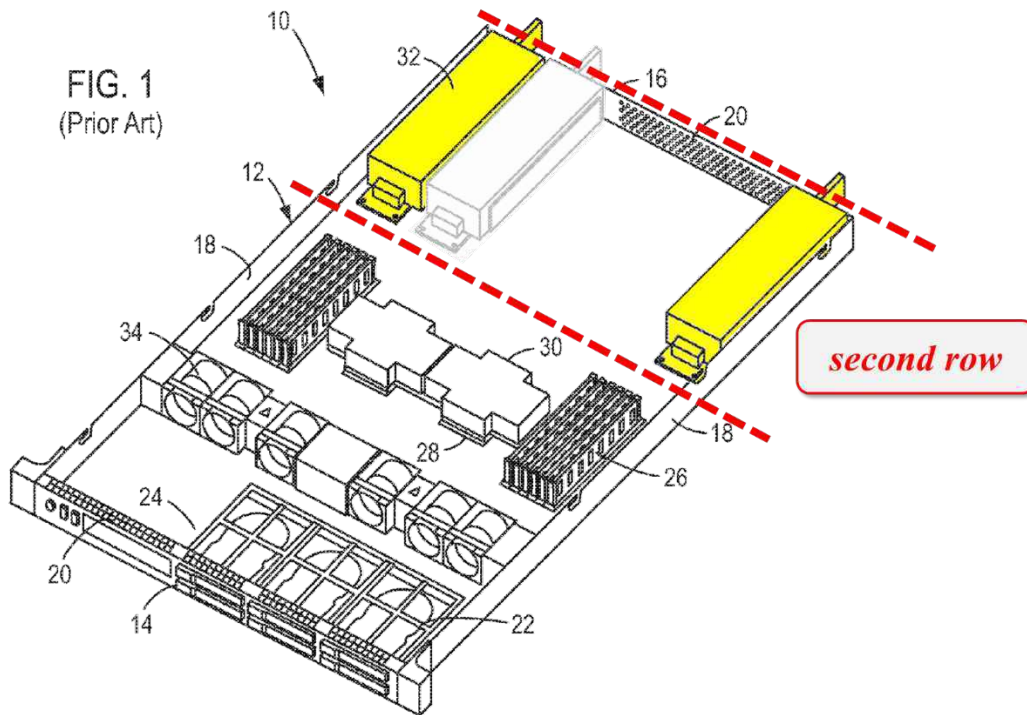
EX1005, Fig. 1 (modified).

229. Carl discloses a *first row*, which *extends parallel to the direction*. The term *the direction* refers back to the term “a direction normal to the longitudinal direction” recited in the first limitation of claim 8. Therefore, the claim language requires that the first row must extend parallel to the same direction as the plurality of fans, which is perpendicular to the longitudinal direction.

e. the plurality of power source units are each positioned in a second row,

230. Carl-Hughes or Carl-Suzuki discloses this limitation.

231. In Carl’s server computer 10 (as modified based on Hughes or Suzuki), *the plurality of power source units* (power supplies 32) *are each positioned in a second row*, as illustrated below.



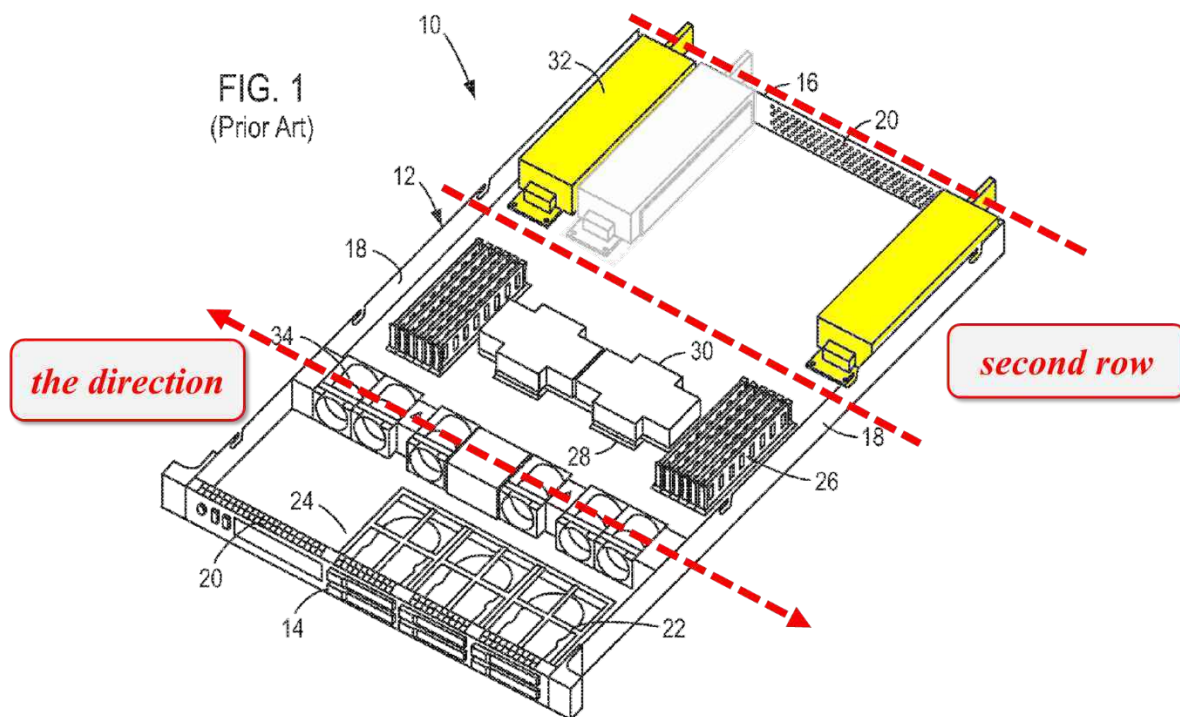
EX1005, Fig. 1 (modified).

232. The PSUs are in a *second row*, which merely distinguishes the row from the *first row* I discuss above in connection with earlier limitations. As I discuss further below, the *second row* of PSUs meets later limitations.

f. the second row extending parallel to the direction,

233. Carl-Hughes or Carl-Suzuki discloses this limitation.

234. In Carl's server computer 10 (as modified based on Hughes or Suzuki), *the second row of power supplies 32 is extending parallel to the direction* (i.e., the direction normal to the longitudinal direction), as illustrated below.



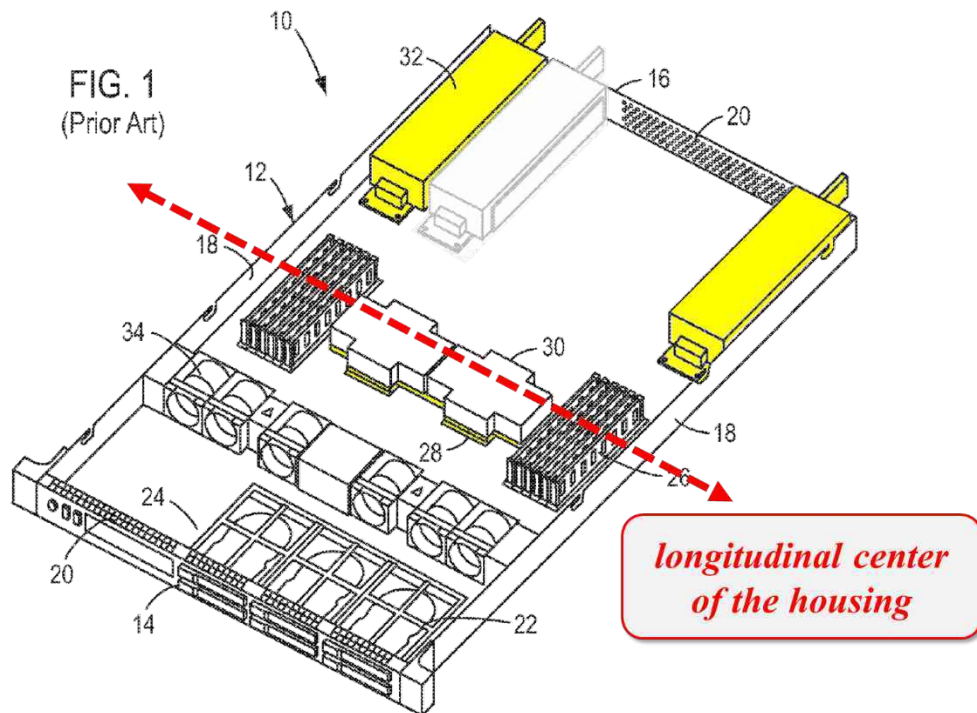
EX1005, Fig. 1 (modified).

235. Carl discloses that *the second row of PSUs extends parallel to the direction*. The term *the direction* is the same direction as the plurality of fans and the first row (i.e., perpendicular to the longitudinal direction).

g. the second row being positioned farther from a longitudinal center of the housing than the first row,

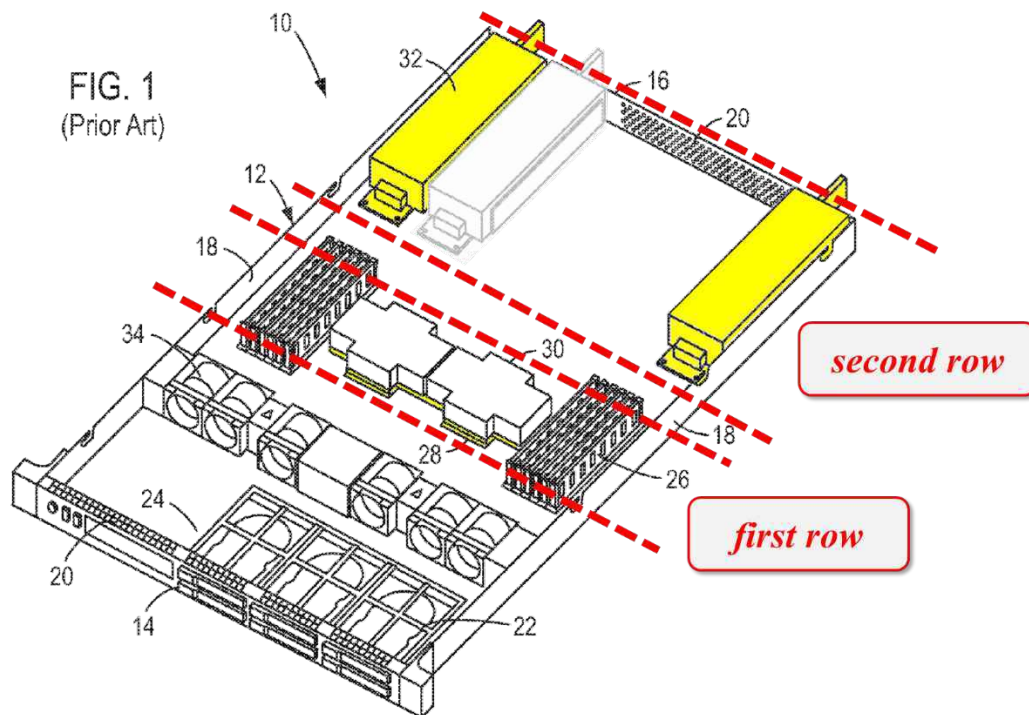
236. Carl-Hughes or Carl-Suzuki discloses this limitation.

237. This limitation refers to the *longitudinal center of the housing* (i.e., midway between front wall 14 and rear wall 16), illustrated below.



EX1005, Fig. 1 (modified).

238. In Carl's server computer 10 (as modified based on Hughes or Suzuki), the second row of power supplies 32 is positioned farther from a longitudinal center of the housing (i.e., midway between front wall 14 and rear wall 16) than the first row, as illustrated below.



EX1005, Fig. 1 (modified). As shown, the *first row* includes the *longitudinal center*.

h. [8g] and the second row being positioned farther from the plurality of fans than the first row.

239. Carl-Hughes or Carl-Suzuki discloses this limitation.

240. In Carl's server computer 10 (as modified based on Hughes or Suzuki), the *second row* of power supplies 32 is *positioned farther from plurality of fans (fans 34) than the first row*, as illustrated below. In other words, the first row is closer to the fans than the second row is.

drawer-like in a vertically stacked orientation.” EX1009, 3:14-19. “The housing section 12 has a top end wall 16, a bottom end wall 18..., opposite left and right side walls 20 and 22, a rear side wall 24, and a front side opening 26.” EX1009, 3:19-22. Wiscombe states that “each of the power supply assemblies 14 may be inserted inwardly through the front side opening 26, into the interior of the housing section 12...and outwardly removed through the front side opening 26....”

243. Wiscombe in in the same field of endeavor as the '265 Patent, i.e., electronic devices such as computers. EX1009, Abstract, 1:6-8; EX1001, Abstract, 1:6-10.

2. Motivation to Combine Carl-Hughes or Carl-Suzuki with Wiscombe

244. Carl discloses a server computer that “includes a number of electrical components” including two “power supplies 32.” EX1005, 1:30-40. Wiscombe describes a “specially designed carrier structures on which...power supply boxes are mounted” that permit “drawer-like movement” into and out of a computer enclosure. EX1009, 1:63-67, 2:15-31.

245. As I discuss above, Carl’s power supplies are removable through the rear wall. *See* Section VI.A.5, above. Were that not so, a POSITA would have been motivated to make the minor modification to Carl’s server computer (alone or as modified based on Hughes or Suzuki) based on the teachings of Wiscombe to permit easy insertion and removal of power supplies 32 through the rear wall of

Carl's computer in a "drawer-like movement." EX1009, 1:63-67, 2:15-31. A POSITA would recognize the benefit of allowing a user to replace a defective or damaged power supply quickly and easily without having to disassemble Carl's computer. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem.").

246. Further, Wiscombe's invention is intended for use with "conventional, off-the-shelf" power supplies (EX1009, Abstract, 1:59-67), which reduces the cost and provides a further motivation for modifying Carl's server computer (modified or not) based on Wiscombe. EX1009, 3:33-38, 3:55-63; Section VI.A.5.

247. Wiscombe describes "a representative computer chassis structure" with "three removeable, slide-in power supply assemblies" stacked vertically. EX1009, 2:57-60, Fig. 1. The description of this "representative" structure is "by way of illustration and example only," and Wiscombe's patent claims are not limited to any number of power supply assemblies. EX1009, 6:17-47. A POSITA would recognize that Wiscombe can be implemented with a different number of power supplies, including a single power supply, and in different configurations, including as arranged in Carl's server computer (whether or not modified based on Hughes or Suzuki). A POSITA would recognize that even in a different

configuration or for a different number of power supplies, Wiscombe provides ease-of-use benefits as well as potential thermal-management advantages and reduced electromagnetic interference.

248. A POSITA would also understand that using a housing (*power box*) disclosed by Wiscombe on each power supply would provide further thermal management benefits as a dedicated power box for each power source unit would prevent thermal interference with other components within the enclosure. Having a separate power box for each power supply would also make it easier for replace individual power supplies without affecting the entire power system server, thereby enhancing server uptime and reducing maintenance complexity. Finally, having a power box for each power supply can guard against and reduce electromagnetic noise and interference between power supplies and other components in the server.

249. Modifying Carl's server computer in this minor fashion to implement Wiscombe's invention would have been well within the skill of a POSITA without any need for undue experimentation and with a reasonable expectation of success. Wiscombe provides a detailed description of the required modifications, which are intended for use with conventional power supplies. Indeed, modifying Carl based on Wiscombe would have involved no more than the use of prior art elements according to known methods to yield predictable results.

3. Claim 2: The electronic device according to claim 1, wherein the plurality of power source units are each

arranged to be pulled out from the rear face of the housing.

250. The combination of Carl and Hughes or Carl and Suzuki discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

251. Further, for the reasons described for limitation 1e, Carl discloses a *plurality of power source units* (power supplies 32), which are located against rear wall 16. See Section VI.A.4.f.

252. Wiscombe discloses a “specially designed carrier structures” that permits conventional power supply boxes to be inserted or removed through the rear wall of a computer in a “drawer-like movement.” EX1009, 1:59-67, 2:15-31; *see also* EX1009, 5:11-21, 5:32-36, Fig. 1

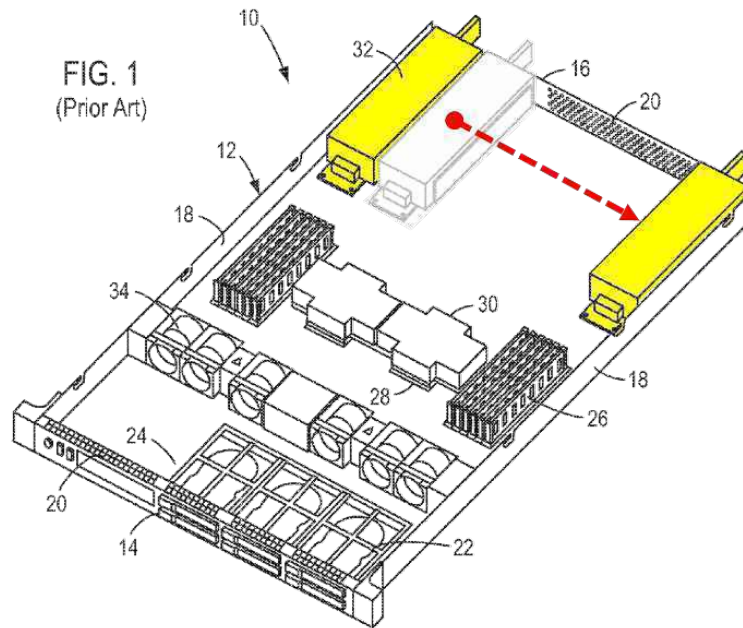
253. Thus, both Carl-Hughes and Carl-Suzuki further combined with Wiscombe discloses the limitation recited in claim 2.

- 4. Claim 3: The electronic device according to claim 1, wherein the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards, and positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.**

254. The combination of Carl and Hughes and Carl and Suzuki discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

255. In Carl-Hughes and Carl-Suzuki, the power supplies in Carl’s server

computer 10 would be implemented on the opposite sides of enclosure 12 against sidewalls 18 (*positioned close to each of side faces of the housing*, as shown in the illustration below:



EX1005, Fig. 1 (modified).

256. As a result, in Carl-Hughes and Carl-Suzuki, *the plurality of power source units are each...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts*, as I discuss above for limitations 1e and 1g. See Sections VI.A.4.f and VI.A.4.h. For the reasons I discuss above regarding limitation 1b, Carl's fans cause cooling air to *flow downstream in the longitudinal direction from the front face to the rear face of the housing*. See Section VI.A.4.c. Thus, *cooling air flown downwardly from the plurality of electronic parts* means the cooling air

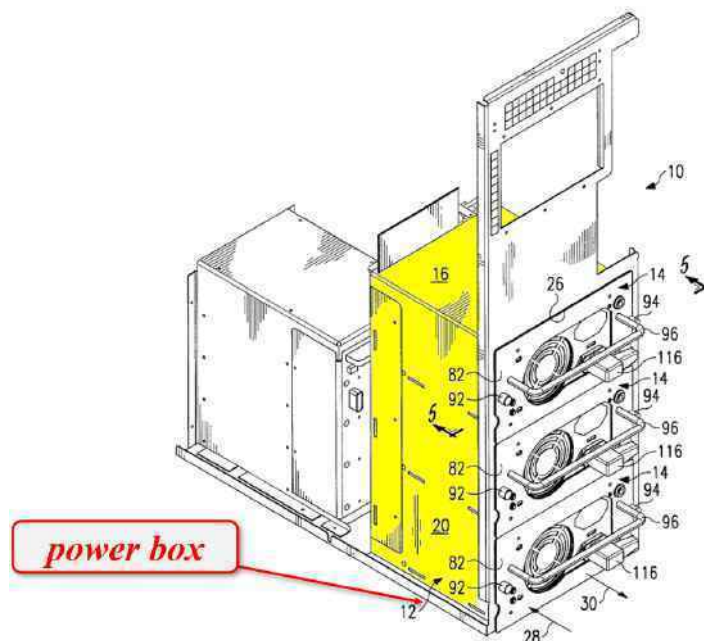
from the fans that flows over the *electronic parts*.

257. In addition, the combination of Carl with Hughes or with Suzuki discloses that *the plurality of power source units are...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts* as I explain above for 1e and 1g.

258. As I discuss above, a POSITA would understand that in the context of this patent and its prosecution history, *the plurality of electronic parts* can refer to the *central processing unit* of claim 1. See Section IV.E.

259. Carl-Hughes and Carl-Suzuki disclose the power box of claim 3. In addition, either combination further combined with the teaching of Wiscombe also discloses claim 3.

260. Wiscombe discloses a “housing section 12” (*a power box*) that has a “top end wall 16” (*a top board*) and “opposite left and right side walls 20 and 22” (*a pair of side boards*) into which “each of the power supply assemblies 14 may be inserted inwardly....” EX1009, 3:19-25. Housing section 12 is illustrated in Figure 1 of Wiscombe.



EX1009, Fig. 1 (annotated). While the housing illustrated in Figure 1 shows, as an example, three power supplies, a POSITA would readily understand that the invention disclosed by Wiscombe could be used for a different number of power supplies including one as I discussed above.

VII. THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BASED ON OKAMOTO AS A PRIMARY PRIOR ART REFERENCE

261. It is my opinion that the challenged claims of the '265 Patent are invalid as obvious in light of at least the prior art discussed below.

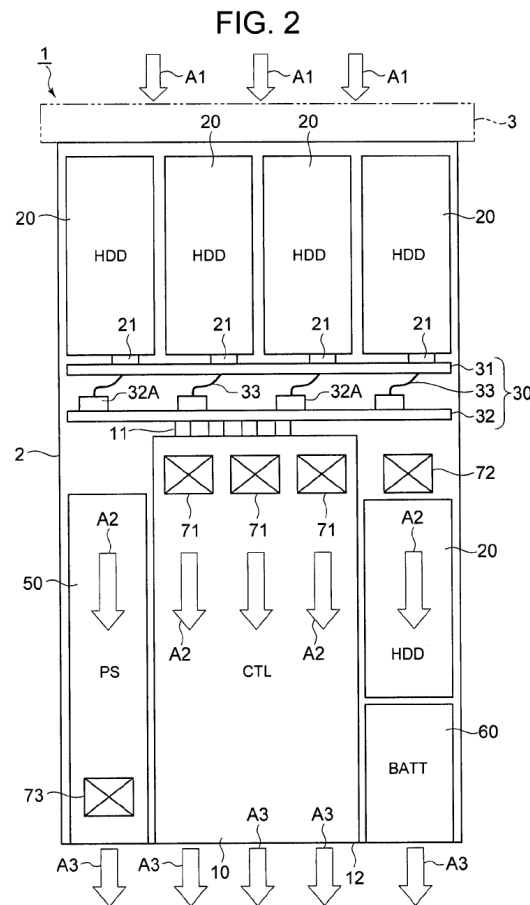
A. Okamoto Renders Claims 1, 4, 5, 7, 8 Obvious

1. Overview of Okamoto

262. Okamoto discloses “a storage controller.” EX1010, 1:14. As Okamoto explains, “[a] storage controller can provide large capacity storage services to a host computer....” EX1010, 1:16-17. “[A] rack-mounted disk array

apparatus is also known as a storage controller.” EX1010, 1:24-25.

263. Okamoto describes a number of similar embodiments. For instance, Figure 2 illustrates a “plan view” of an embodiment of Okamoto’s storage controller. EX1010, 3:34-35, 4:56-59.



EX1010, Fig. 2.

264. Each of Okamoto’s embodiments includes “an enclosure 2, a plurality of storage devices 20,...at least one control board 10,...at least one power device 50,...at least one or more cooling fans 71, 72, 73, which are disposed inside the enclosure 2, and which are for taking in air from outside the enclosure 2 and

generating a cooling airflow inside the enclosure 2, and at least one device connector 40....” EX1010, 4:13-31.

2. Independent Claim 1

a. [1pre] An electronic device comprising:

265. To the extent the preamble is limiting, Okamoto discloses it.

266. Okamoto discloses multiple embodiments of “a storage controller,” which constitutes an *electronic device*. EX1010, 4:12-31, *see also* EX1010, 1:16-17, 14:63-64, 12:7-12. Okamoto’s storage controller includes “electronic circuitry,” including “host interfaces 110[.]” EX1010, 15:4-7. In particular, Okamoto’s storage controller illustrated in Figure 16 discloses an *electronic device* as claimed. Okamoto also explains that “[a] storage controller can provide large capacity storage services to a host computer....” EX1010, 1:16-17. The “storage controller” illustrated in Figure 16 is an *electronic device* as recited in claim 1.

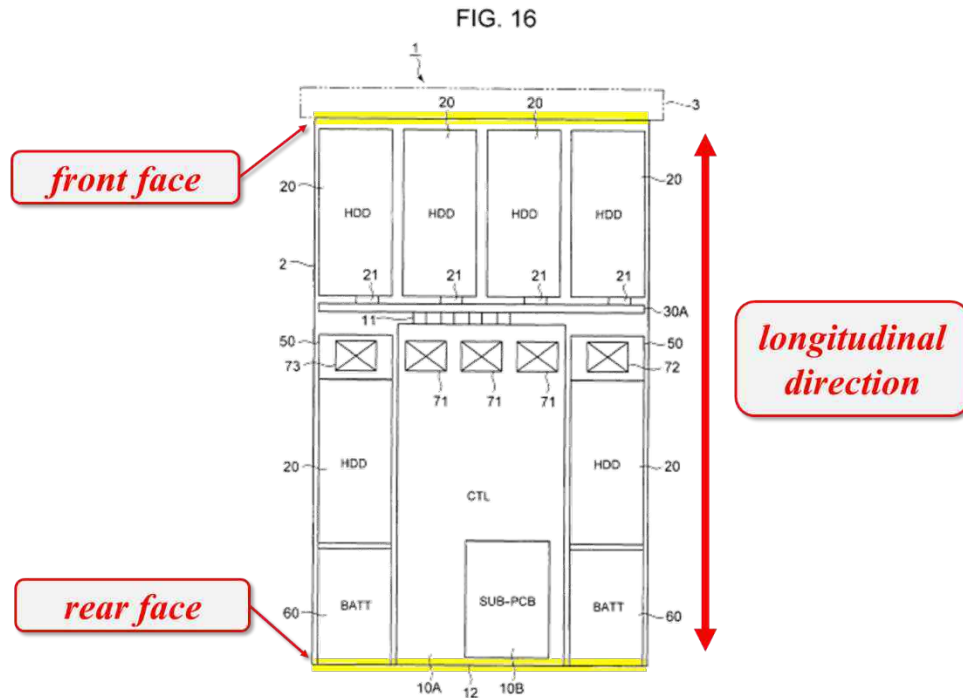
b. [1a] a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction;

267. Okamoto discloses this limitation.

268. In particular, Okamoto’s server controller 1 includes enclosure 2, which is a *housing*. EX1010, 4:13-15. Okamoto states that “a front bezel 3...is provided so as to cover the front side of the enclosure 2” and that “a plurality of disk drives 20” are “arranged in a matrix in the front side of the enclosure 2.” EX1010, 4:38-41; *see also* EX1010, 4:56-59, 7:3-31, Figs. 3 and 4. Okamoto

further discloses “the rear of the enclosure 2” (i.e., *a rear face*). EX1010, 6:63.

Thus, Okamoto’s enclosure 2 is a *housing comprising a front face and a rear face*, as illustrated below.

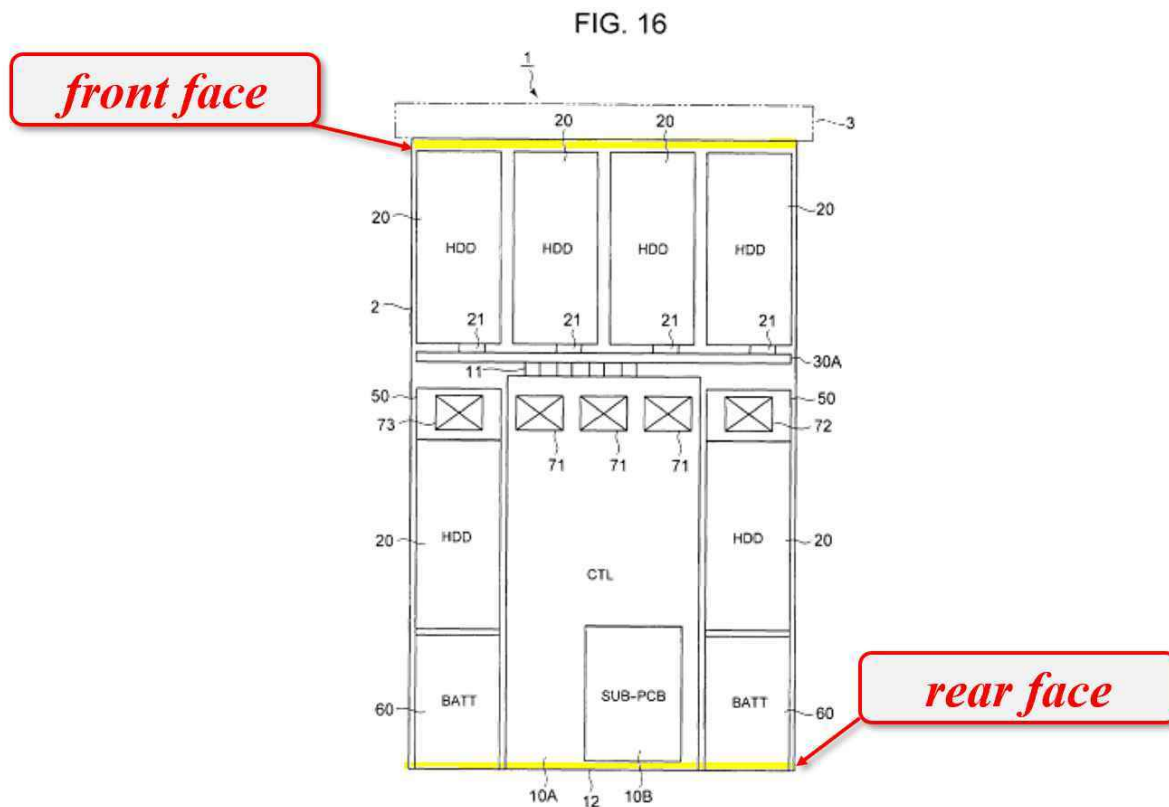


EX1010, Fig. 16 (annotated).

269. Further, the *front face* and *rear face* of enclosure 2 are distanced from each other in a *longitudinal direction*, as illustrated. The term *longitudinal direction* refers to the lengthwise (i.e., longer) direction in the rectangular enclosure 2 (*housing*), as I discuss above. See Section VI.A.4.b.

270. Figure 16 of Okamoto also shows *a housing comprising a front face and a rear face which are distanced from each other in a longitudinal direction*. Although Figure 2 is discussed in the context of the first embodiment of Okamoto

and Figure 16 is discussed in the context of the sixth embodiment of Okamoto, a POSITA would recognize that Figure 16, like Figure 2, also shows a front bezel 3 at the front side of enclosure 2 and a corresponding rear of enclosure 2, and thus, the sixth embodiment also discloses this limitation. See EX1010, 12:7-12.



EX1010, Fig. 16 (annotated).

- c. **[1b] a plurality of fans which are arranged inside the housing close to the front face so as to cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing;**

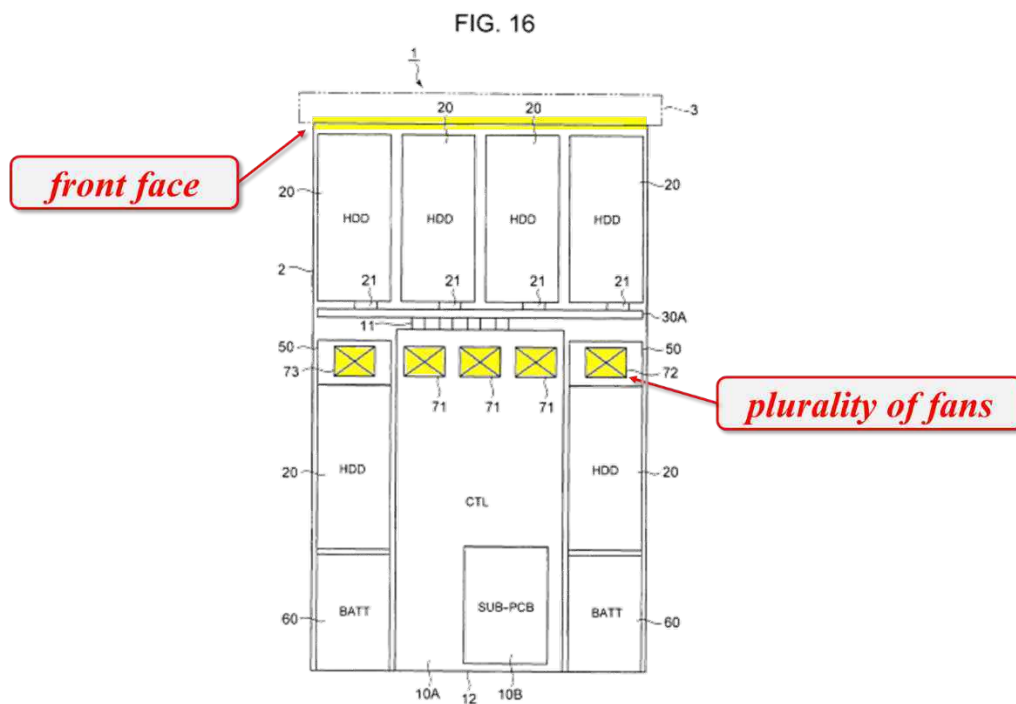
271. Okamoto discloses this limitation.

272. Okamoto storage controller 1 includes “at least one or more cooling

fans 71, 72, 73, which are disposed inside the enclosure 2, and which are for taking in air from outside the enclosure 2 and generating a cooling airflow inside the enclosure 2[.]” EX1010, 4:13-25; *see also* EX1010, 2:31-34, 3:7-11, 6:24-40.

Okamoto’s cooling fans constitute *a plurality of fans*.

273. A POSITA would recognize that the same would hold for fans 71, 72, 73 in the sixth embodiment illustrated in Figure 16 of Okamoto because nearly all of the fans are positioned in the same place. *See* EX1010, 12:7-12. Thus, the sixth embodiment of Okamoto, discloses *a plurality of fans which are arranged inside the housing that cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing* because the fans are positioned similarly within enclosure 2.

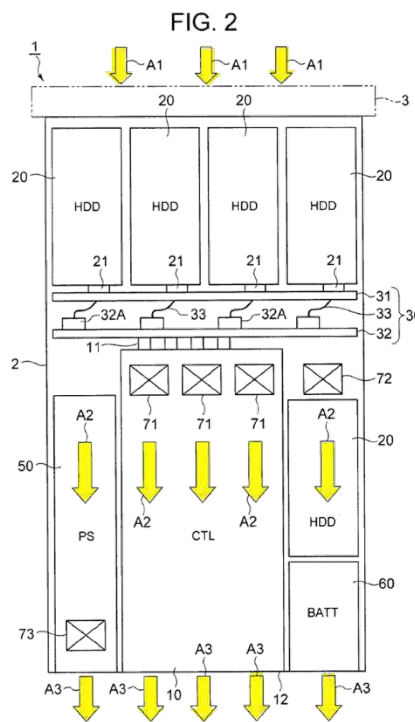


EX1010, Fig. 16 (annotated)

274. Further, although Okamoto refers to its fans being “arranged in the center part of the enclosure” (*see e.g.*, EX1010, Abstract), fans 71, 72 in Figure 2 and fans 71, 72, 73 in Figure 16 are depicted inside enclosure 2 (i.e., *the housing*) and relatively close to the front face. *See* EX1010, 6:18-20 (“A plurality of cooling fans 71, 72, 73 can be disposed inside the enclosure 2. For example, three cooling fans 71 are disposed in the front side of the respective control boards 10.”). Thus, Okamoto discloses *a plurality of fans which are arranged inside the housing close to the front face*. Moreover, a POSITA would understand that Okamoto’s fans are *close to the front face* because on the front face of the enclosure, the distance between fans 71, 72, 72 and the front face in Figure 16 is approximately the length of the HDD, whereas the distance between fans 71, 72, 73 and the rear is at least approximately the length of the HDD and at least one battery 60. In addition, as illustrated, the fans are located in the front part of the enclosure immediately behind backboard 34 and the HDDs 20 against the front face. As POSITA would know, in practice the HDDs are smaller than depicted in comparison to the control boards and components in the back part of the enclosure between the fans and rear wall and therefore would realistically be closer to the front wall than suggested by the figure. Thus, Okamoto discloses *a plurality of fans which are arranged inside the housing close to the front face*.

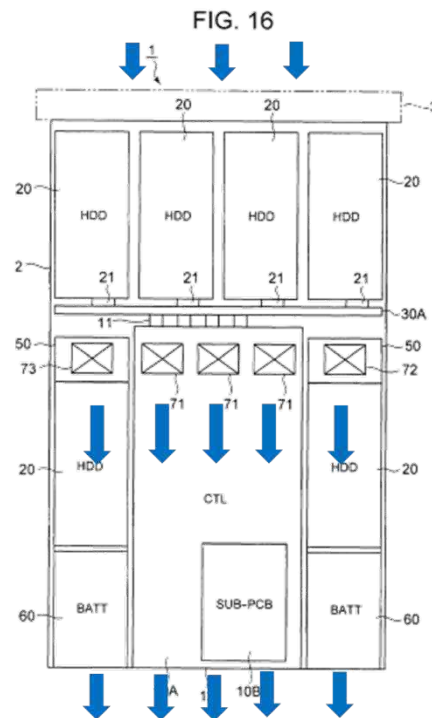
275. In describing the first embodiment illustrated by Figure 2, Okamoto further discloses that that “air outside of the enclosure 2...flow[s] into the inside of the enclosure 2” by way of a “large number of openings...disposed in the front bezel 3.” EX1010, 4:47-49. Okamoto further discloses that “[w]hen the respective cooling fans 71, 72, 73 operate, air A1 on the outside of the enclosure 2 is drawn into the inside of the enclosure 2 by way of gaps between the respective disk drives 20.” EX1010, 6:54-58, Fig. 2. Okamoto’s air A1 “becomes cooling air A2, and flows toward the rear of the enclosure 2 while cooling the respective parts inside the enclosure 2.” EX1010, 6:62-64, *see also* EX1010, 7:24-28.

276. Okamoto describes the air flow in reference to Figure 2. The arrows indicating air flow are highlighted yellow.



EX1010, Fig. 2 (annotated).

277. A POSITA would understand that the same description of the cooling air flow would apply to the embodiment illustrated in Figure 16 as indicated by the arrows added to Figure 16 below.



EX1010, Fig. 16 (annotated).

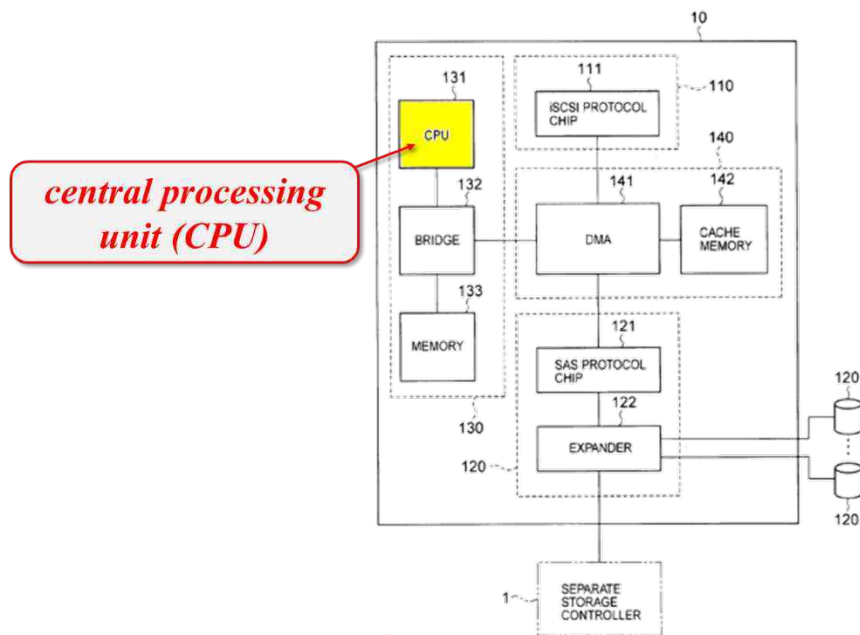
278. Thus, Okamoto discloses *a plurality of fans which are arranged inside the housing that cause cooling air to flow downstream in the longitudinal direction from the front face to the rear face of the housing.*

- d. **[1c] a central processing unit (CPU) which is arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough;**

279. Okamoto discloses this limitation.

280. Each embodiment of Okamoto's storage controller includes "at least one control board 10...which is for controlling the operation of the respective storage devices 20..." EX1010, 4:13-19; *see also* EX1010, 4:42-43, 7:46-48, 12:7-12. Figure 6 illustrates "the constitution of the control board 10." EX1010, 8:35-36; *see also* EX1010, 8:39-42. The "processor unit 130" includes "a microprocessor 131, a bridge 132, and a memory 133." EX1010, 8:52-59. "The microprocessor 131 processes an access request from the host H by reading in and executing various programs stored beforehand in the memory 133." EX1010, 8:56-59. A POSITA would understand that Okamoto's microprocessor 131 is *a central processing unit (CPU)*, as recited in claim 1. EX1017, 3 ("**processor** *n*. *See* central processing unit, microprocessor."); EX1018, 4 ("**microprocessor**...In the world of personal computers, the terms microprocessor and CPU are used interchangeably."); EX1019, 4 ("**microprocessor** an integrated circuit containing the entire CPU of a computer...."); EX1020, 5 ("**microprocessor** A semiconductor chip, or chip set, that implements the central processor of a computer."). Indeed, as illustrated in Figure 6, Okamoto identifies microprocessor 131 as a "CPU."

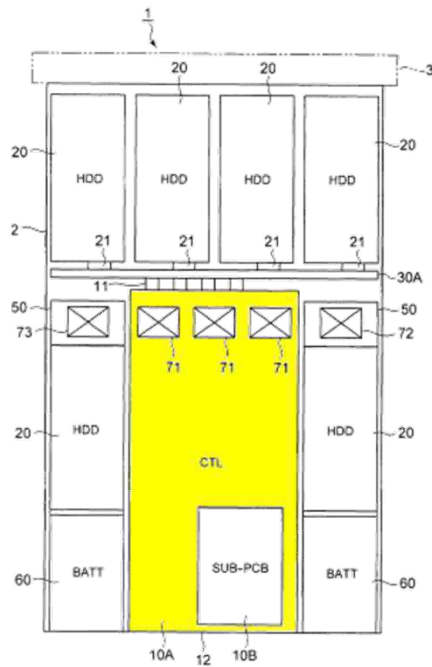
FIG. 6



EX1010, Fig. 6 (annotated).

281. Further, Okamoto’s *CPU* (microprocessor 131) is *arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough*. Okamoto explains that, in the storage controller illustrated in Figure 16, the “control board is constituted from a main board 10A, which is located on the bottom side of the enclosure 2, and a sub-board 10B, which is mounted on top of the main board 10A.” EX1010, 14:55-58; *see also* EX1010, 14:44-48, Fig. 17. Control circuit 130, which includes microprocessor 132 (*CPU*), is “disposed on the main board 10A.” EX1010, 15:17-21. The main board 10A is highlighted in the figure below.

FIG. 16



EX1010, Fig. 16 (highlighted).

282. A POSITA would know that microprocessor 131 (*CPU*) is located on main board 10A between fans 71 and the rear of enclosure 2. Thus, Okamoto’s *CPU* (microprocessor 131) is *arranged downstream of the plurality of fans in the housing and positioned to allow the cooling air to directly flow therethrough*.

EX1010, 6:19-20 (“[T]hree cooling fans 71 are disposed in the front side of the respective control boards 10.”), 6:54-7:2, 15:28-29, 8:52-53, Fig. 2.

283. In Okamoto’s storage controller, each *CPU* (i.e., microprocessor 131) is *arranged downstream of the plurality of fans in the housing* (i.e., cooling fans 71). Because cooling fans 71 are located at the “front side of the respective control boards 10,” (EX1010, 6:19-20), a POSITA would understand that microprocessor

131, which is also located on control board 10, is further away from the front side of the control board such that it is *downstream* because air flows from the front to the rear.

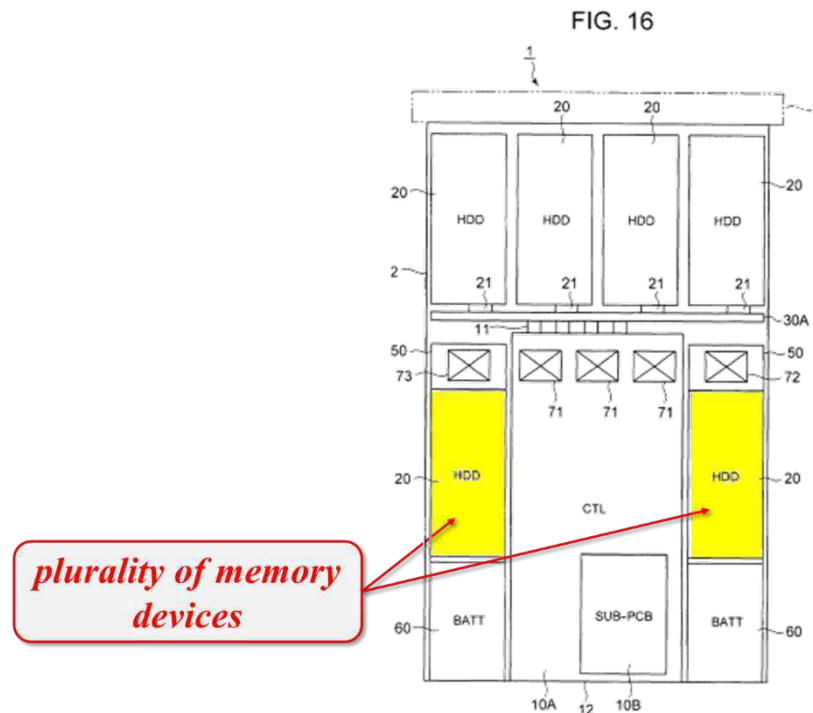
284. Further, each *CPU* is *positioned to allow the cooling air to directly flow therethrough* because it is located so that the air flowing through the storage controller will directly hit and flow by the microprocessor. Okamoto discloses the cooling air caused by the fans cooling “the respective parts inside the enclosure 2,” which include microprocessor 131. EX1010, 6:61-64 (“The air A1 that flows inside the enclosure 2 via the gaps between the respective disk drives 20 becomes cooling air A2, and flows toward the rear of the enclosure 2 while cooling the respective parts inside the enclosure 2.”).

285. A POSITA would understand that the CPU is cooled by cooling air A2 because cooling air A2 flows over and around the CPU, and that is what the claim means when it states that the *CPU* is *positioned to allow the cooling air to directly flow therethrough*. A POSITA would not understand the word *therethrough* to suggest that air flows through the *CPU*, because a *CPU* is a solid object.

- e. **[1d] a plurality of memory devices adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing; and**

286. Okamoto discloses this limitation.

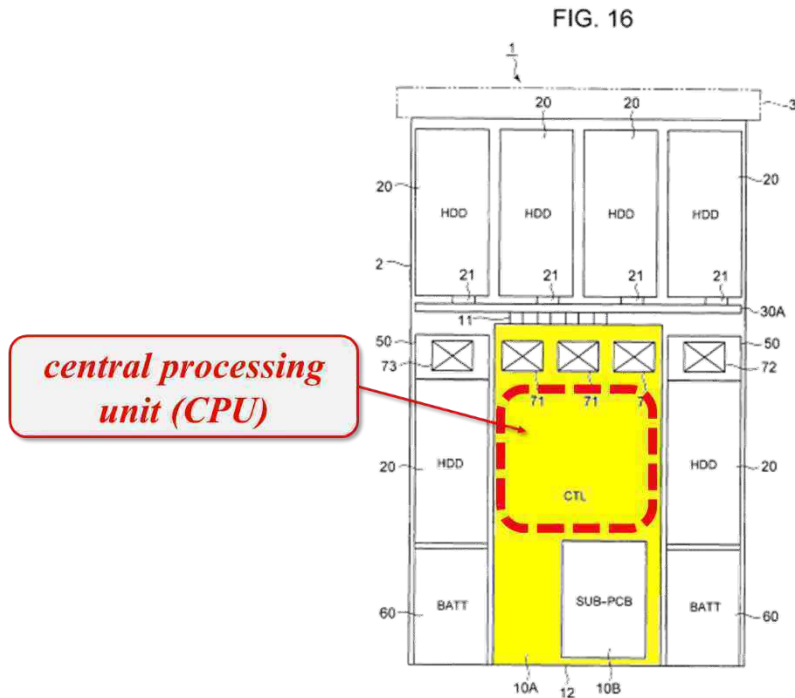
287. All embodiments of Okamoto's storage controllers include "a plurality of storage devices 20, which are disposed inside this enclosure 2, and which are for storing data...." EX1010, 4:13-16; *see also* EX1010, 2:25-26. In the embodiment illustrated in Figure 16, as well as the embodiment in Figure 13, two such storage devices 20 are located on either side of the enclosure. EX1010, 14:34-38 ("disk drives 20...are arranged in bilateral symmetry on the right and left sides"). A POSITA would understand that Okamoto's description regarding disk drives 20, power devices 50, and batteries 60 for the embodiment illustrated in Figures 13 and 14 (EX1010, 14:18-40) also applies to the embodiment illustrated in Figure 16. *See* EX1010, 12:7-12.



EX1010, Fig. 16 (annotated).

288. A POSITA would recognize that these two storage devices 20 constitute *a plurality of memory devices*. Indeed, while the figure above indicates two hard disk drives, Okamoto expressly states that the “invention is not limited to hard disk drives, and, for example, various rewritable and nonvolatile storage devices, such as a flash memory or other such semiconductor memory device...can also be utilized.” EX1010, 4:65-5:4; *see also* EX1010, 7:64-8:21. Thus, storage devices 20 are *memory devices* as recited in the claim.

289. Further, a POSITA would understand that Okamoto’s *plurality of memory devices* are located *adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing*. As I discuss above for 1c, Okamoto’s microprocessor 131 (*CPU*) is located on main control board 10A in Figure 16. EX1010, 15:17-21. A POSITA would understand that the *CPU* is located on the portion of main board 10A between fans 71 and sub-board 10B, as shown below.

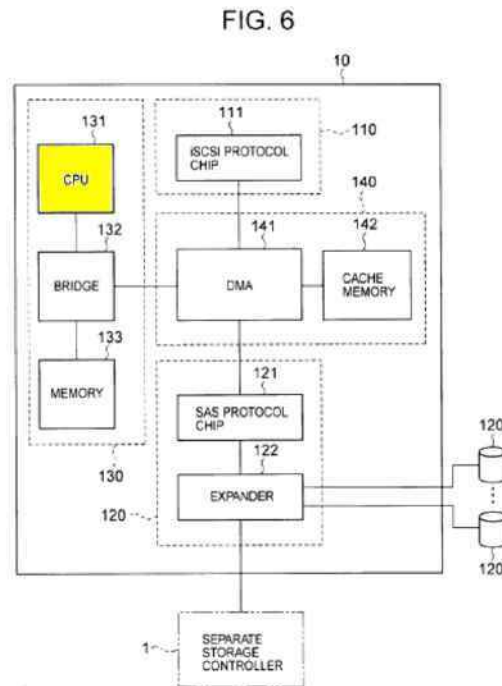


EX1010, Fig. 16 (annotated).

290. A POSITA would understand that the *CPU* is located in the area indicated in the figure above for several reasons. For instance, there is more room in the indicated area of main board 10A for microprocessor 131 (*CPU*). Further, Okamoto illustrates microprocessor 131 located in the front portion of the control board in several other figures.

291. For example, Figure 6 is “a block diagram showing the constitution of the control board 10” and illustrates the “CPU” toward the front of the control board opposite the “communication port” located “in the posterior part of the control board 10” for communicating with a separate storage controller. EX1010, 9:5-12, 8:52-53 (“The processor unit 130, for example, is constituted comprising a

microprocessor 131....”), Fig. 6.



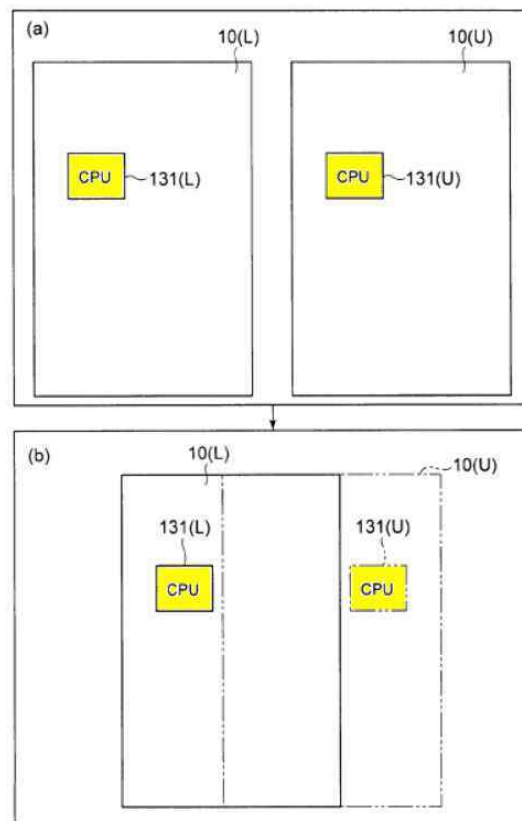
EX1010, Fig. 6 (highlighted).

292. Although Figure 6 is primarily discussed in relation to the first embodiment of Okamoto, a POSITA would understand that the layout of control board 10 would apply to other embodiments, including to the main board 10A illustrated in Figure 16. For example, because both the first embodiment and the sixth embodiment disclose storage controllers with control boards located near the rear half of the enclosure between components on either side, a POSITA would also be motivated to combine the sixth embodiment's main board 10A with the layout of the control board disclosed by the first embodiment, such that Okamoto's disk drives 20 are adjacent to microprocessor 131.

293. Further, Figure 20(a), disclosed in reference to the eighth embodiment, illustrates a “schematic plan view of control boards 10 focusing on the location of the microprocessors 131” (each a *CPU*), which are located toward the front of the control board in the figure. EX1010, 16:49-50, Fig. 20A; *see also* 14:66-15:2 (“As shown in FIGS. 16 and 17, the sub-board 10B, for example, can be located toward the posterior of the enclosure 2....”), 15:11-16 (“Further, when an electronic circuit, like the host interface unit 110, which is connected by cable to a device (here, a host H) outside of the enclosure 2 is mounted to the sub-board 10B, as shown in FIG. 13, connection to the external device becomes easier if the sub-board 10B is positioned close to the outside of the enclosure 2.”).

294. Figure 20(a) and Figure 20(b) provides an arrangement of control board 10(L) and control board 10(U) with microprocessor 131(L) and microprocessor 131(U) located near the front half of the control boards, further supporting that in Okamoto’s storage controller, microprocessors 131 would be located adjacent to disk drives 20.

FIG. 20



EX1010, Fig. 20 (highlighted).

295. A POSITA would understand that the eighth embodiment, which “gives examples of the arrangement of a microprocessor 131 and the arrangement of a control board 10” (EX1010, 16:46-48) could be combined with the storage controller arrangement disclosed by the sixth embodiment because control board 10 is an example of the type of control board that that the sixth embodiment discloses.

296. A POSITA would also find it obvious to try locating microprocessor 131 in the area indicated above because it is one of a finite number of options for

positioning it on main board 10A.

297. Further, as illustrated in Figure 16 above, the two storage devices 20 are located *adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing*. The *width direction* is from side-to-side in Okamoto's storage controller and *normal* (i.e., perpendicular) *to the longitudinal direction*. EX1016, 3 (“**normal**...*Perpendicular*, right angled, such as to a line or a *plane* or to the *tangent* to a *curve* at a point of contact.”). The *width direction* is from side-to-side of enclosure 2 of Okamoto's storage controller 1 and *normal* (i.e., perpendicular) *to the longitudinal direction* (i.e., front-to-back). The plurality of HDD 20 are located next to microprocessors 131 in the *width direction* rather than in front or behind them in the longitudinal direction. Thus, a POSITA would understand that Okamoto's *plurality of memory devices* are located *adjacent to the CPU in a width direction, substantially normal to the longitudinal direction, of the housing*.

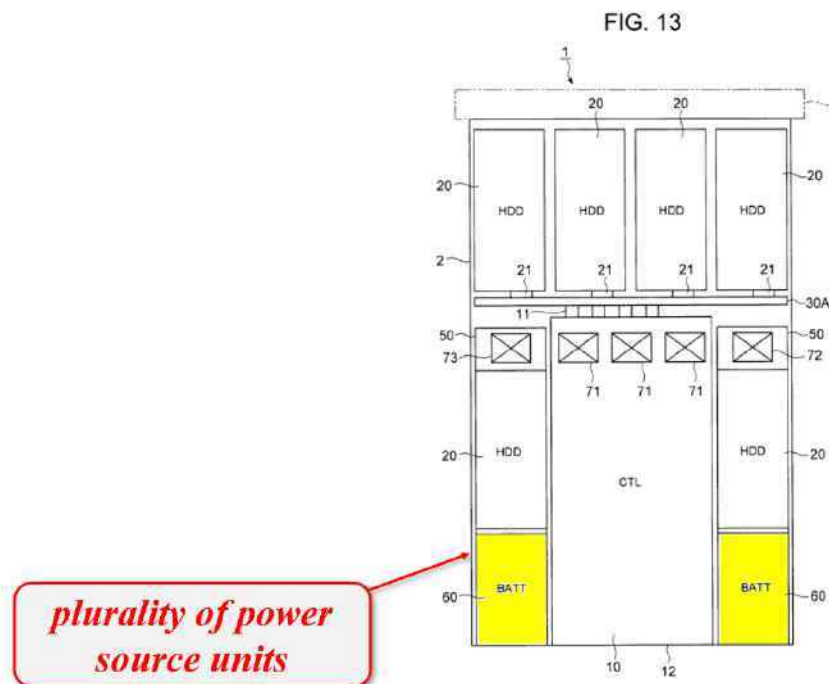
- f. **[1e] a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing,**

298. Okamoto discloses this limitation in two independent ways.

299. **Batteries 60**: A number of Okamoto's storage controller embodiments include one or more batteries 60. EX1010, Figs. 2, 11, 12, 13, 14, 16, 21, 24. For examples, in describing the fifth embodiment, Okamoto discloses

“batteries 60,” which are “arranged in bilateral symmetry on the right and left sides” of control boards 10. EX1010, 14:34-38. Indeed, Okamoto expressly states that “[a] battery 60 supplies power at a prescribed voltage for a short period of time to the respective disk drives 20 and respective control boards 10 when the power output from the power device 50 is interrupted.” EX1010, 6:11-15.

300. Thus, a POSITA would understand that batteries 60 constitute *a plurality of power source units* because as disclosed by Okamoto, each of batteries 60 “supplies power.” EX1010, 6:11-15. As illustrated in Figure 13, batteries 60 are positioned opposite to each other and spaced out from each other in the width direction of the housing because “batteries 60 are arranged in bilateral symmetry on the right and left sides” of the control board. EX1010, 14:34-38.



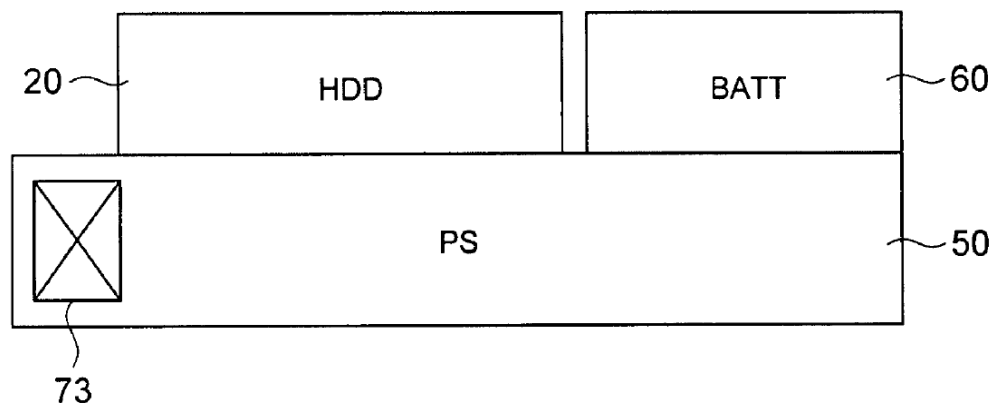
301. Similarly, in Figure 16, which illustrates the sixth embodiment of Okamoto, also shows batteries 60 constitute *a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing* because “batteries 60 are arranged in bilateral symmetry on the right and left sides” of the control board. EX1010, 14:34-38; see also EX1010, 12:7-12.



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302. **Power Devices 50:** Separately, Okamoto also discloses this limitation in a second way. Okamoto's storage controller embodiment illustrated in Figure 16, as well as the embodiment in Figure 13, discloses "power devices 50" that are "disposed one each on both sides of the respective control boards" on the right and left side. EX1010, 14:24-26, Fig. 13, Fig. 16; *see also* EX1010, 2:29-30, 4:19-22, 9:14-20. These power devices 50 constitute *a plurality of power source units* as claimed, and (as illustrated in Figure 13 and Figure 16 of Okamoto) power devices 50 *are positioned opposite to each other and spaced out from each other in the width direction of the housing.*

303. Each power device 50 is positioned below the battery 60 as illustrated in Figure 14, which provides a side view. EX1010, 14:26-29 ("The disk drives 20 are disposed on the front side (the backboard 30A side) and the batteries 60 are disposed rearward on the power devices 50."), 14:30-32 ("disk drive 20 and battery 60 are located on top of the power device 50").



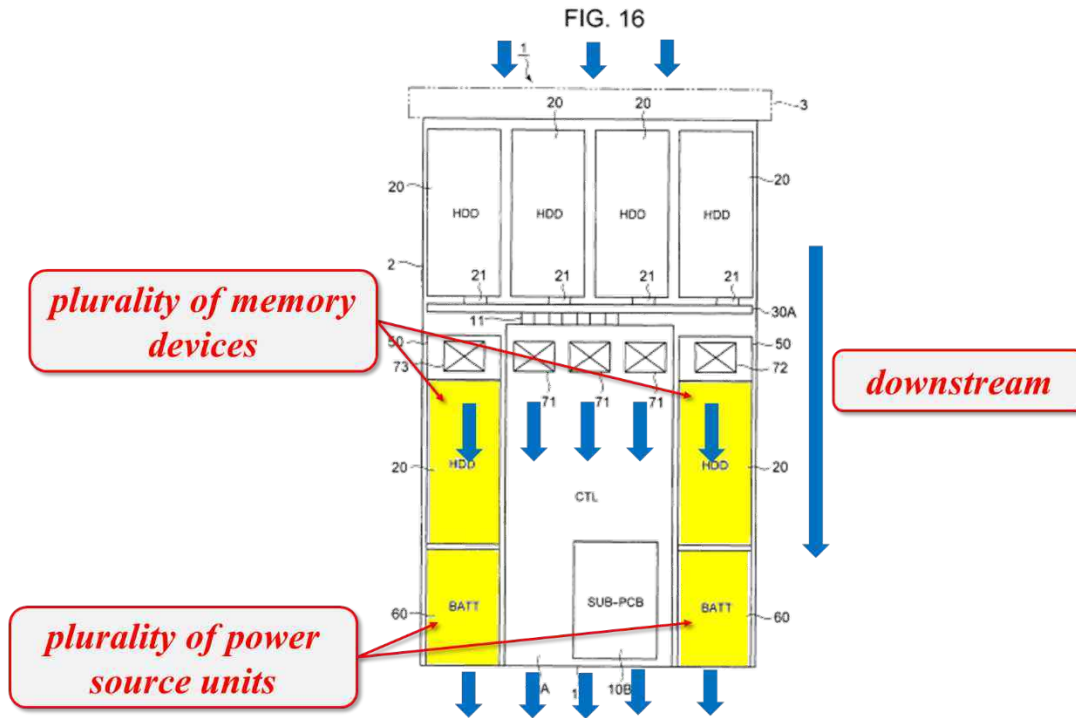
EX1010, Fig. 14; *see also* EX1010, Fig. 13. A POSITA would recognize that power devices 50 in the Figure 16 embodiment also constitute *a plurality of power source units which are positioned opposite to each other and spaced out from each other in the width direction of the housing.*

304. Thus, Okamoto discloses this limitation in two separate and independent ways.

- g. [1f] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units, and**

305. Okamoto discloses this limitation.

306. As I discuss above for limitations 1d and 1e, Okamoto's storage controller illustrated in Figure 16 includes *a plurality of power source units* (batteries 60), which are *positioned downstream of the cooling air from the plurality of memory devices* (storage devices 20). *See* Sections VII.A.2.e and VII.A.2.f.



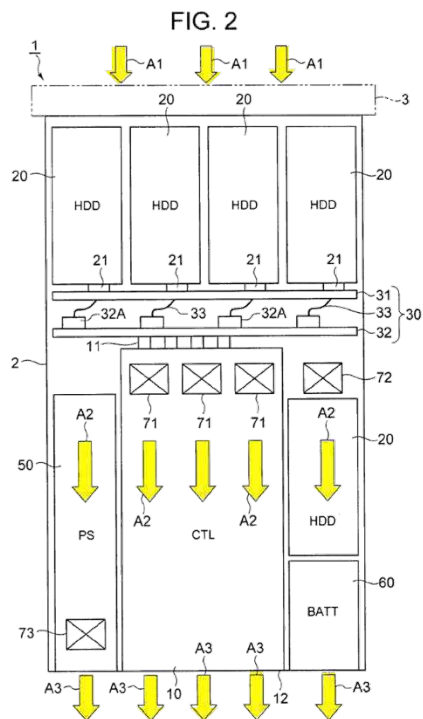
EX1010, Fig. 16 (annotated).

307. As illustrated in Figure 16, batteries 60 (i.e., *the plurality of power source units*) are located between disk drives 50 (i.e., *the memory devices*) and the rear of the enclosure and are therefore *downstream* because the cooling air flows from front to back in Okamoto's storage controller (as I discuss above for 1b). See Section VII.A.2.c. Thus, batteries 60 (i.e., *the plurality of power source units*) are *each positioned further downstream...from the plurality of memory devices*. Further, batteries 60 (i.e., *the plurality of power source units*) are located so that *the cooling air passing through one of the memory devices passes into one of the power source units*. EX1010, 6:54-7:2

308. In describing the first embodiment, Okamoto discloses that its

Okamoto's cooling air enters through the front face, travels rearward, and is discharged to the outside via a gap in the rear of the enclosure. EX1010, 6:61-7:1, Figure 2. Thus, the *cooling air that pass[es] through one of the memory devices* (i.e., disk drive 20) *passes into one of the power source units* (i.e., batteries 60) as it travels rearward to the rear of the enclosure.

309. This is further confirmed by Figure 2, which shows cooling air A2 traveling rearward across the disk drive 20 toward battery 60 and being discharged to the outside of the enclosure via a gap in the rear of the enclosure as discharged cooling air A3. EX1010, 6:64-7:1.



EX1010, Fig. 2 (annotated).

310. Because Okamoto discloses that “[b]y flowing through the gaps

between the respective disk drives 20, the air A1 captures the heat from each disk drive 20, thereby cooling each disk drive 20” in reference to disk drives 20 at the front of the enclosure 2 (EX1010, 6:58-60), a POSITA would understand that cooling air similarly passes *through* Okamoto’s *memory devices* (i.e., disk drives 20 on either side of the enclosure) and into the *power source units* (i.e., batteries 60). Moreover, as shown in Figure 2 above, cooling air A1 on the outside of the enclosure “flow[s] through the gaps between the respective disk drive 20” and “becomes cooling air A2,” which parts inside the enclosure and is eventually discharged through the rear of the enclosure as cooling air A3, thus, the cooling air must pass into and through the power source units in order to be discharged through the rear of the enclosure. EX1010, 6:54-7:2.

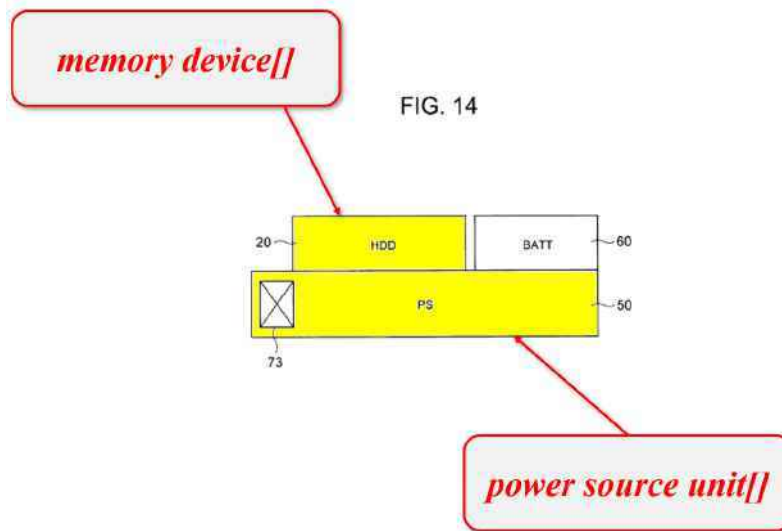
311. A POSITA would further understand that the same holds true for the sixth embodiment, where nearly all the fans are positioned substantially similarly as in the first embodiment, and where the cooling needs would be substantially similar. See EX1010, 12:7-12. Accordingly, Okamoto discloses a *plurality of power source units* that are *each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units*.

312. In addition, Okamoto also discloses this limitation in a second way because the embodiment illustrated in Figure 16 includes power devices 50 (a

plurality of power source units) that are located beneath batteries 60 and at least partially *positioned further downstream of the cooling air from the plurality of memory devices* (storage devices 20) *such that the cooling air passing through one of the memory devices passes into one of the power source units*, as claimed.

EX1010, 6:54-7:2

313. For example, in Figure 14, which is a side view of the power device 50 and disk drive 20 with fan 73 on the left, power device 50 extends further downstream than disk drive 20, which means that *the plurality of power source units* (i.e., power devices 50) *are each positioned further downstream of the cooling air from the plurality of memory devices*.



EX1010, Fig. 14 (annotated).

314. Although Figure 14 illustrates the fifth embodiment, a POSITA would understand that the relative arrangement of the memory device and the power

source unit is consistent with the arrangement of the sixth embodiment as shown in Figure 16, and thus would apply to Figure 16 as well.

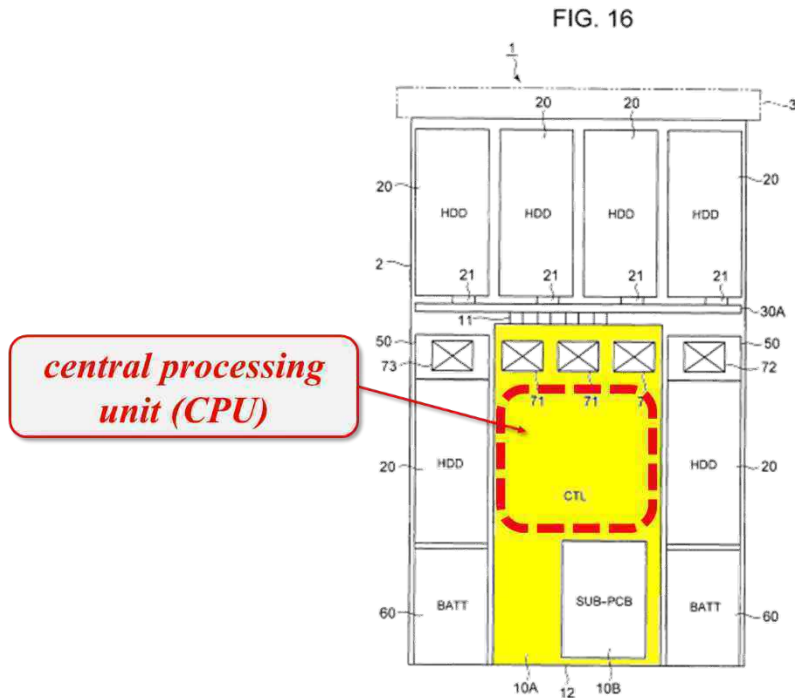
315. Thus, in two separate and independent ways, Okamoto discloses this limitation.

h. [1g] wherein the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing.

316. Okamoto discloses this limitation.

317. As I discuss above for 1c, a POSITA would know that Okamoto's storage controller illustrated in Figure 16 includes a microprocessor 131 (*CPU*) located on the forward side of main board 10A. See Section VII.A.2.d.

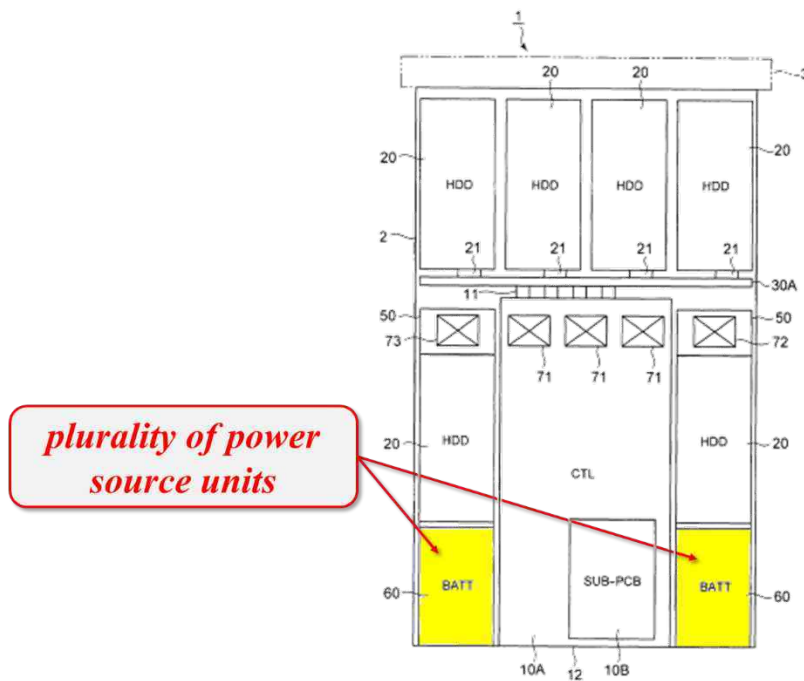
318. In the embodiment illustrated by Figure 16 (and the embodiment illustrated by Figure 13), "the control boards 10 are arranged in the center, and the power devices 50, disk drives 20 and batteries 60 are arranged in bilateral symmetry on the right and left sides thereof." EX1010, 14:34-38. In other words, *the plurality of power source units* (whether batteries 60 or power devices 50) *are each positioned not to be aligned linearly with the CPU* (which is located on main board 10A) *in the longitudinal direction of the housing*.



EX1010, Fig. 16 (annotated).

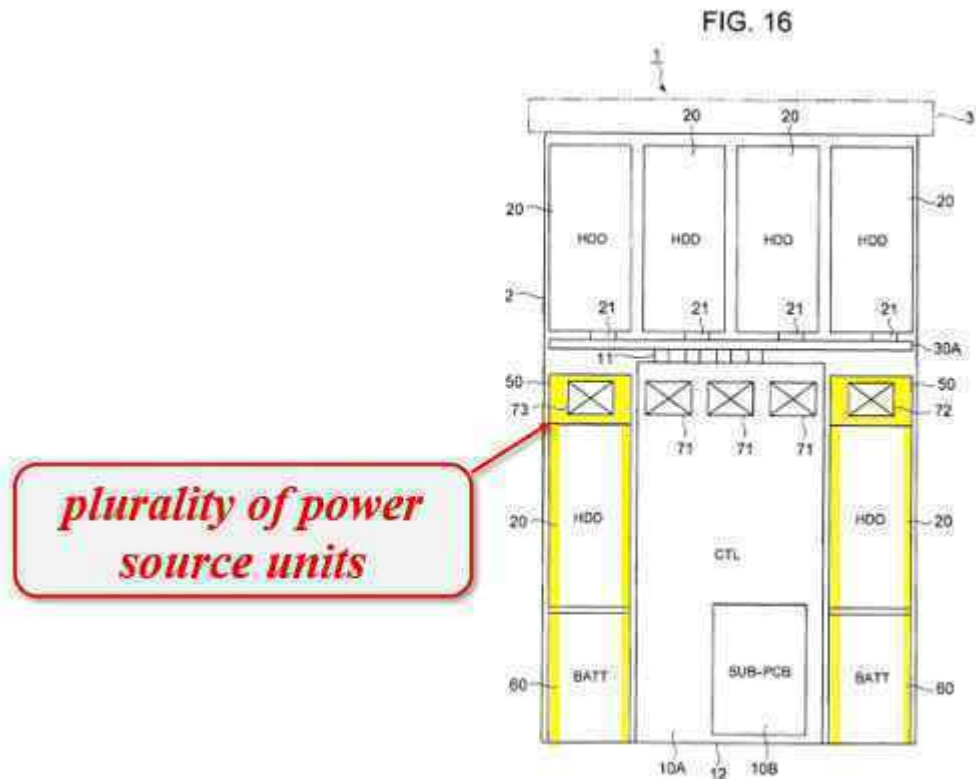
319. For example, Figure 16, which illustrates the sixth embodiment, shows that batteries 60 are also located along the sides of Okamoto's enclosure and not located directly behind the *CPU* (i.e., microprocessor 131 located on main board 10A).

FIG. 16



EX1010, Fig. 16 (annotated).

320. In addition, Okamoto's Figure 16 shows that *the plurality of power source units are each positioned not to be aligned linearly with the CPU in the longitudinal direction of the housing* because power devices 50 are each located along the sides of Okamoto's enclosure and not located directly behind the *CPU* (i.e., microprocessor 131 located on main board 10A).



EX1010, Fig. 16 (annotated).

3. Independent Claim 4

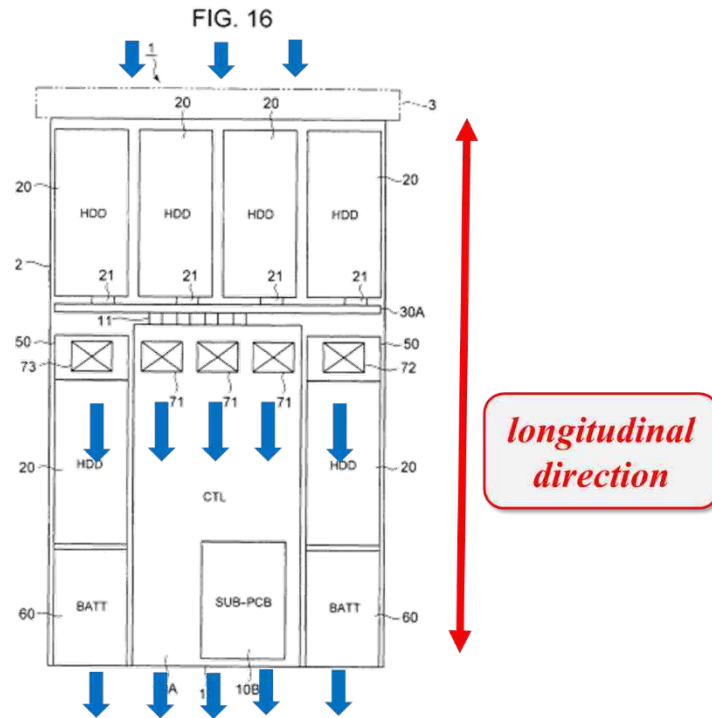
321. Independent claim 1 includes a number of limitations that are the same as, or quite similar to, limitations in claim 4. In some part of my analysis of claim 4 below, I will refer back to and rely on my analysis of claim 1 without repeating my earlier analysis.

- a. **[4pre] A cooling structure of an electronic device comprising a plurality of fans causing cooling air to flow downstream, a central processing unit (CPU), a plurality of memory devices adjacent to the CPU, and a plurality of power source units, all of which are arranged along a flowing direction of the cooling air corresponding to a longitudinal direction in a**

housing,

322. To the extent the preamble of claim 4 is limiting, Okamoto discloses it.

323. Okamoto's storage controller includes fans 71, 72, 73, which constitute a cooling structure of an electronic device. EX1010, 4:13-25; *see also* Section VII.A.2.c. The *electronic device* (storage controller) includes *a plurality of fans causing cooling air to flow downstream* as I discuss above for 1b. *See* Section VII.A.2.c. The *electronic device* includes *a central processing unit (CPU)* as I discuss above for 1c. *See* Section VII.A.2.d. The electronic device includes *a plurality of memory devices adjacent to the CPU* as I discuss above for 1d. *See* Section VII.A.2.e. The *electronic device* includes *a plurality of power source units* as explained for 1e. *See* Section VII.A.2.f. As illustrated below and as I discuss above for 1a and 1b, all of these components are arranged in the *electronic device* (storage controller) *along a flowing direction of the cooling air corresponding to a longitudinal direction in a housing*. *See* Sections VII.A.2.b and VII.A.2.c.



EX1010, Fig. 16 (annotated).

- b. **[4a] wherein the CPU is arranged downstream of the plurality of fans and positioned to allow the cooling air to directly flow therethrough,**

324. This limitation is similar to 1c. This limitation is disclosed by

Okamoto for the reasons I discuss above for limitation 1c. See Section VII.A.2.d.

- c. **[4b] wherein the plurality of power source units are each positioned further downstream of the cooling air from the plurality of memory devices such that the cooling air passing through one of the memory devices passes into one of the power source units,**

325. This limitation is identical to limitation 1f and disclosed by Okamoto for the reasons I discuss above for limitation 1f. See Section VII.A.2.g.

- d. **[4c] wherein the plurality of power source units are positioned opposite to each other and spaced out from**

each other in a width direction of the housing such that the plurality of power source units are positioned not to be aligned linearly with the CPU in the longitudinal direction.

326. This limitation is disclosed by Okamoto for the reasons I discuss above for limitations 1e and 1g. See Sections VII.A.2.f and VII.A.2.h.

327. Okamoto discloses that *the plurality of power source units are positioned opposite to each other and spaced out from each other in a width direction of the housing* for the reasons explained for 1e. See Section VII.A.2.f. Okamoto discloses that *the plurality of power source units are positioned not to be aligned linearly with the CPU in the longitudinal direction* for the reasons explained for 1g. See Section VII.A.2.h.

4. Dependent Claim 5: The electronic device according to claim 1, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.

328. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

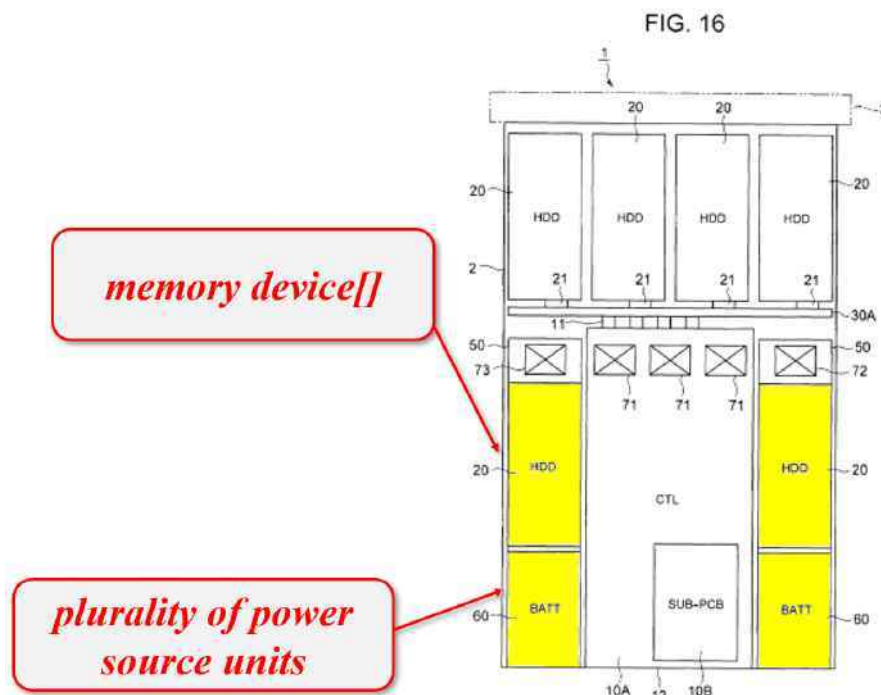
329. Okamoto also discloses the additional limitation of claim 5.

330. Okamoto discloses the *plurality of memory devices* for the reasons I discuss above for 1d.

331. As discussed for 1f, Okamoto's *plurality of power source units* (whether batteries 60 or power devices 50) *are positioned along an extension*

downstream from the plurality of memory devices (storage devices 20) because Okamoto's *power source units* are positioned downstream of its memory devices and oriented in the same direction as the memory, i.e. lengthwise. In other words, both batteries 60 and power devices 50 are positioned against the opposing sidewalls of the enclosure, *downstream* from storage devices 20 and oriented in a lengthwise direction.

332. Okamoto's batteries 60 are downstream of disk drives 20 and oriented lengthwise like disk drive 20, as shown in Figure 16



EX1010, Fig. 16 (annotated).

333. Separately, Okamoto's power device 50 extends further downstream than disk drive 20 (i.e., positioned downstream of disk drive 20) and is oriented

lengthwise like disk drive 20, as shown in Figure 14.

334. Thus, batteries 60 and power devices 50 in Okamoto's storage controller *are each positioned along an extension downstream from the plurality of memory devices.*

5. Dependent Claim 7: The cooling structure of an electronic device according to claim 4, wherein the plurality of power source units are each positioned along an extension downstream from the plurality of memory devices.

335. Okamoto discloses *the cooling structure of an electronic device* of claim 4 for the reasons I discuss above in connection with that claim.

336. The additional limitation of claim 7 is identical to the one recited in dependent claim 5 and is disclosed for the same reasons I discuss above in connection with that claim. *See* Section VII.A.4.

6. Dependent Claim 8

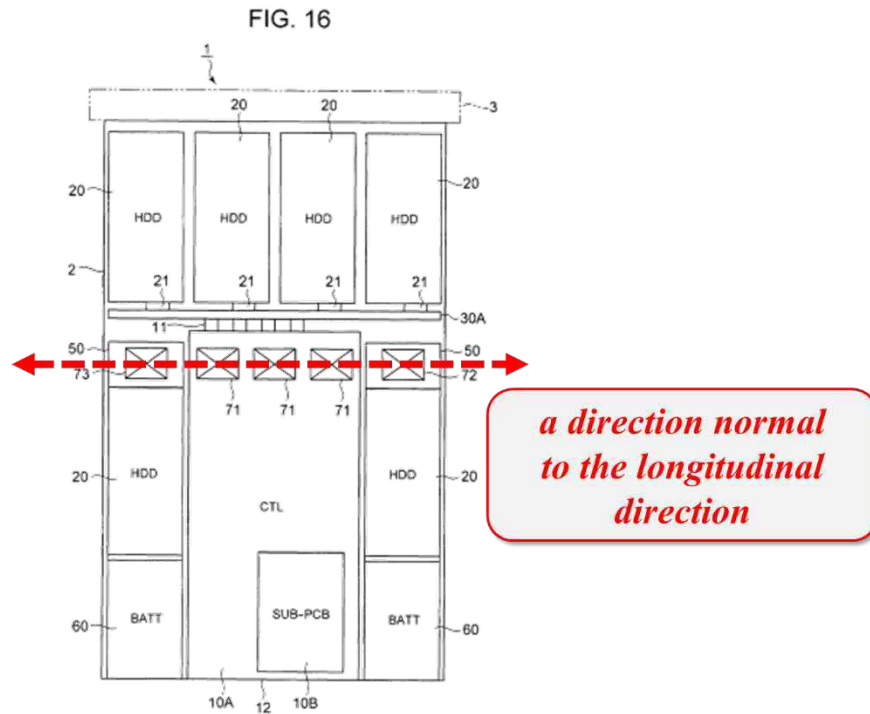
a. The electronic device according to claim 1, wherein

337. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

b. the plurality of fans are arranged in a direction normal to the longitudinal direction,

338. Okamoto discloses this limitation.

339. For the reasons I discuss above for 1b, Okamoto discloses a *plurality of fans* (i.e., fans 71, 72, 73). Further, the fans are arranged in a row across the width of Okamoto's enclosure, as shown in Figure 16.



EX1010, Fig. 16 (annotated).

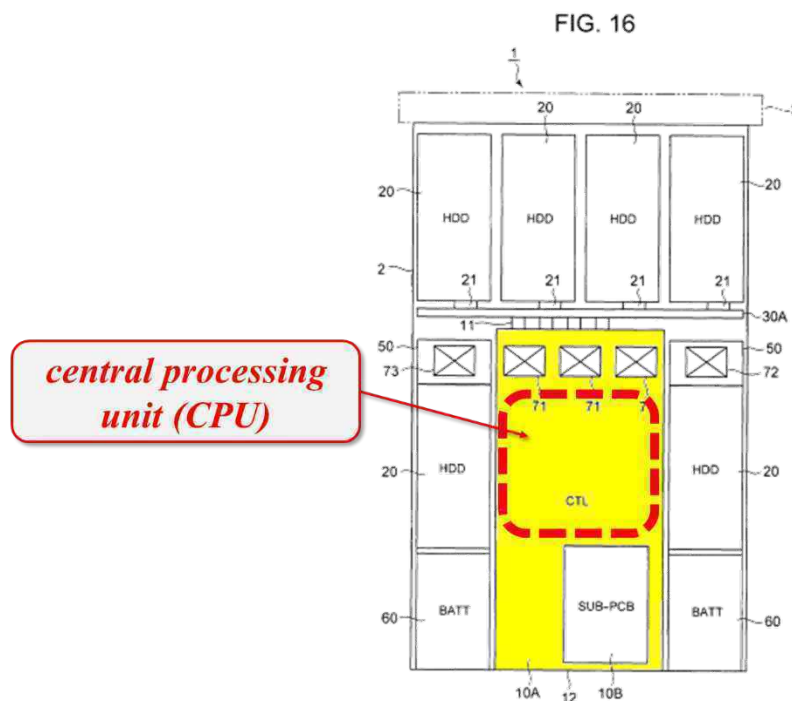
340. For the reasons I discuss above for 1a, the term *longitudinal direction* refers to the lengthwise (i.e., longer) direction in a rectangular housing. The *width direction* is from side-to-side of enclosure 2 of Okamoto's storage controller 1 and *normal* (i.e., perpendicular) *to the longitudinal direction* (i.e., front-to-back) for the reasons described for [1d]. Accordingly, Okamoto's fans 71, 72, 73 *are arranged in a direction normal to the longitudinal direction*.

341. This limitation defines the term *a direction* (which is referred to as *the direction* in later limitations) to mean the direction indicated by the arrow in the figure below.

c. the central processing unit is positioned in a first row,

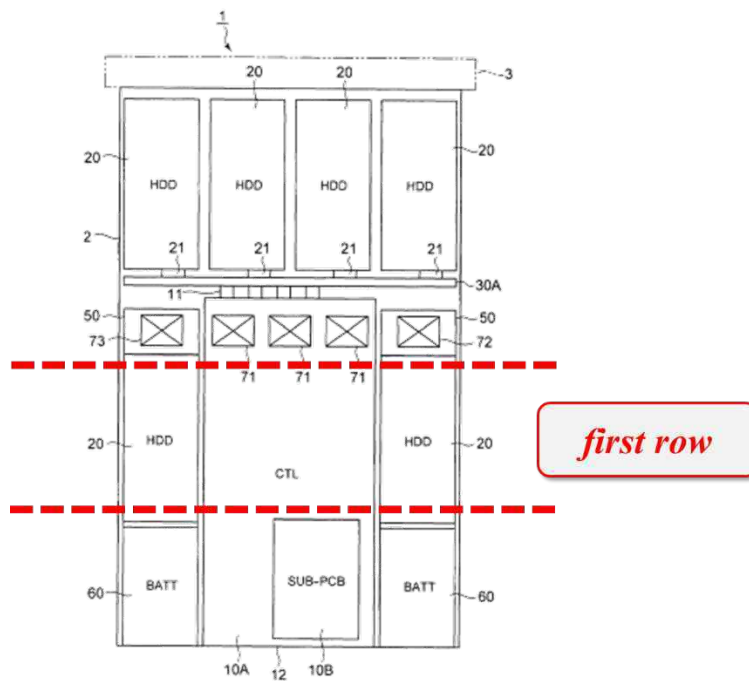
342. Okamoto discloses this limitation.

343. For the reasons I discuss above for 1c, a POSITA would understand that, in Okamoto's storage controller illustrated in Figure 16, microprocessor 131 is located on main board 10A between fans 71 and sub-board 10B. For the reasons I discuss above for 1d, a POSITA would understand that microprocessor 131 of Okamoto's control board is located near the front of main board 10A as illustrated below.



EX1010, Fig. 16 (annotated). Thus, in Okamoto's storage controller illustrated in Figure 16, the *central processing unit* (microprocessor 131) is positioned in a first row, as illustrated below.

FIG. 16



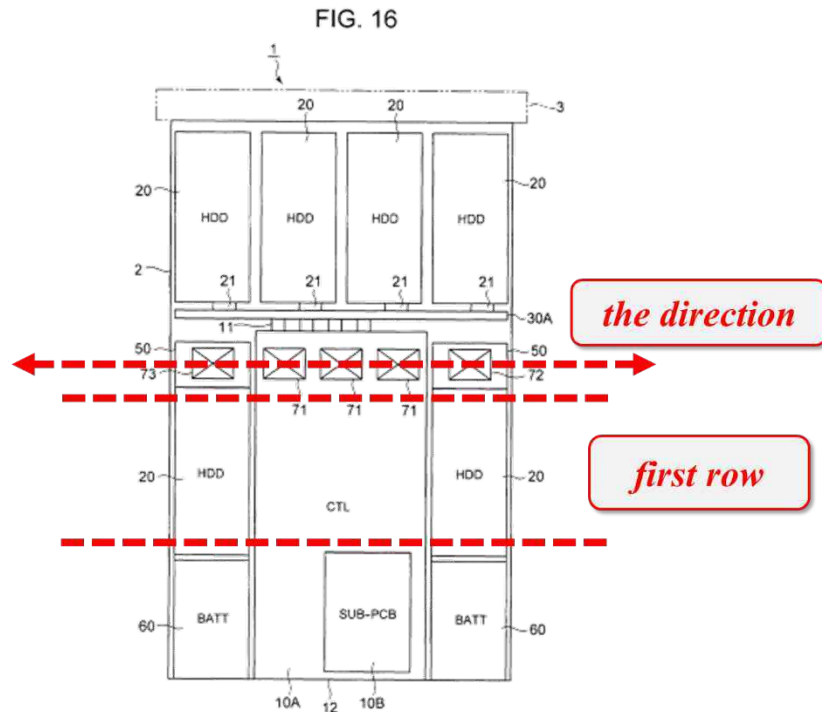
EX1010, Fig. 16 (modified).

344. Further, this row is a *first row* because there is no row of components downstream of the fans (claim 1 requires that the *central processing units (CPU)* be *arranged downstream of the plurality of fans*) that is closer to the fans, and consistent with the claim language. The row “extend[s] parallel to the direction” of the plurality of the fans as required by limitation 8c, is separate from the second row, which contains power source units required by limitation 8d, and is closer to the fans and longitudinal center of the housing than the second row as required by limitations 8f and 8g.

d. the first row extending parallel to the direction,

345. Okamoto discloses this limitation.

346. For the reasons I discuss above, Okamoto discloses a *first row*.
Okamoto further discloses the *first row extending parallel to the direction*, i.e., parallel to the direction normal (perpendicular) to the longitudinal direction required for [8a], illustrated in Figure 16.



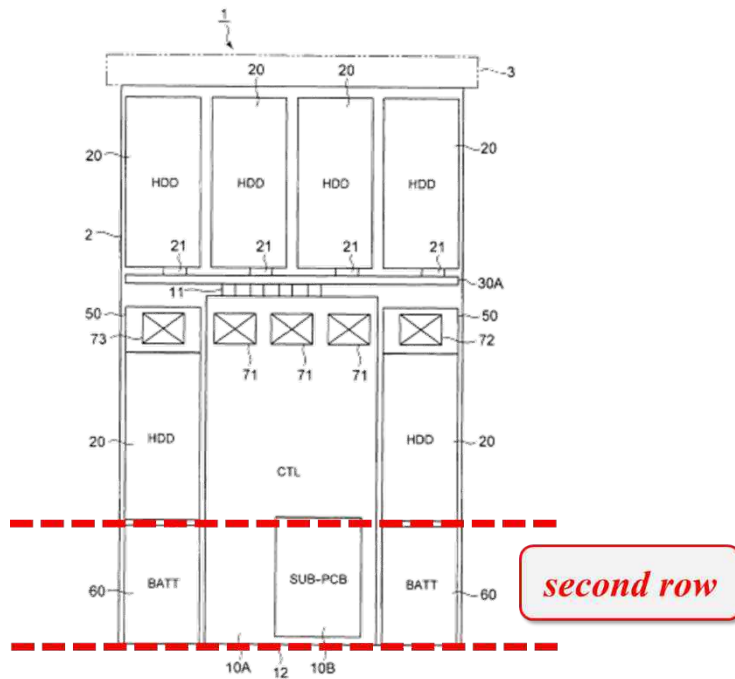
EX1010, Fig. 16 (annotated).

- e. the plurality of power source units are each positioned in a second row,**

347. Okamoto discloses this limitation.

348. For the reasons I discuss above for 1e, Okamoto discloses a *plurality of power source units*. Okamoto's *power source units* (i.e., batteries 60) are *each positioned in a second row*, as shown in Figure 16 of Okamoto.

FIG. 16



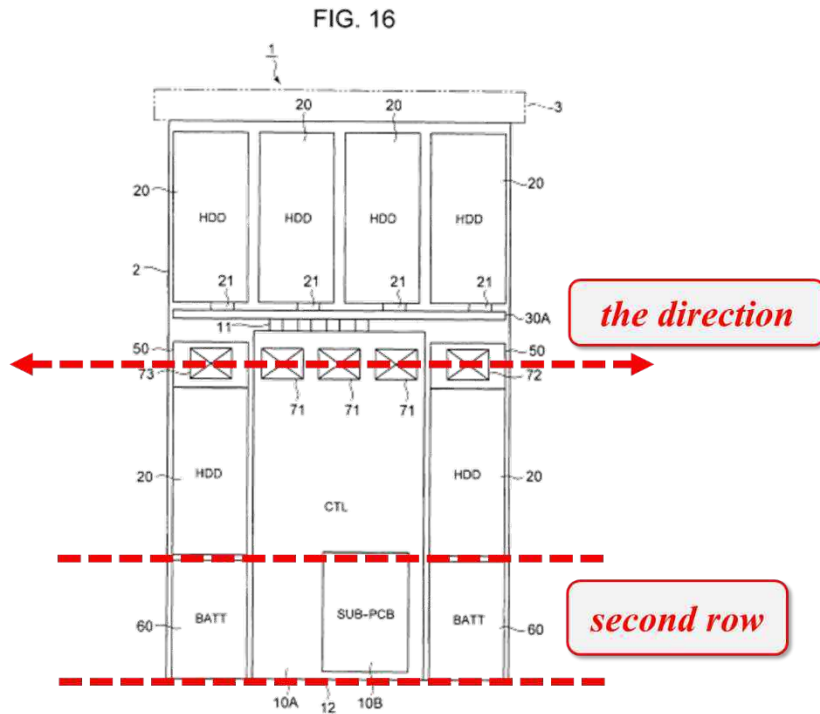
EX1010, Fig. 16 (annotated).

f. the second row extending parallel to the direction,

349. Okamoto discloses this limitation.

350. For the reasons I discuss above, Okamoto discloses a *second row*.

Okamoto further discloses the *second row extending parallel to the direction*, i.e., parallel to the direction normal (perpendicular) to the longitudinal direction required for [8a], as shown in Figure 16 of Okamoto.



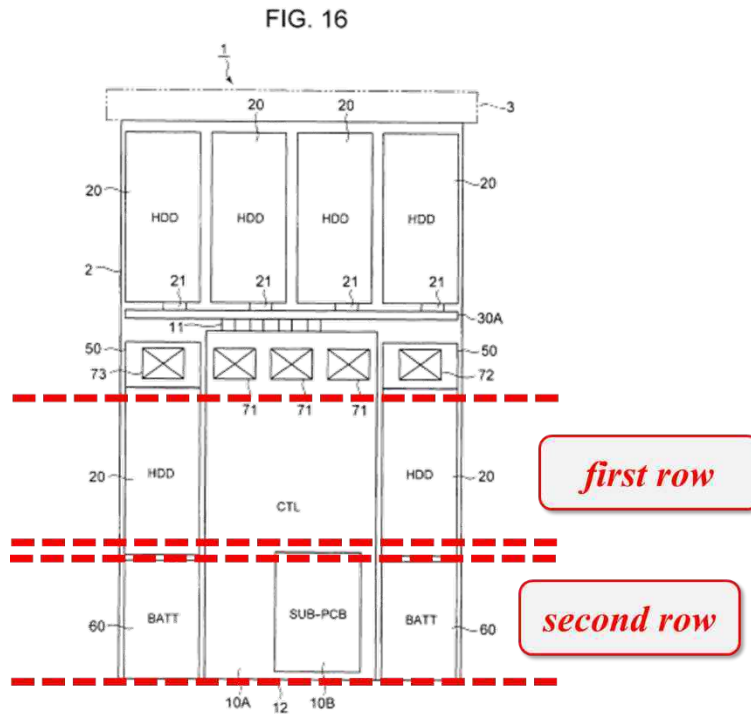
EX1010, Fig. 16 (annotated).

g. [8f] the second row being positioned farther from a longitudinal center of the housing than the first row,

351. Okamoto discloses this limitation.

352. For the reasons I discuss above, Okamoto discloses a *second row*. For the reasons discuss for 1a, the term “longitudinal direction” refers to the lengthwise (i.e., longer) direction in a rectangular housing. Thus, the *longitudinal center of the housing* refers to the lengthwise center of the housing. See Section VI.A.11.g.

353. Okamoto further discloses the *second row being positioned farther from a longitudinal center of the housing than the first row*, as shown illustrated in Figure 16.



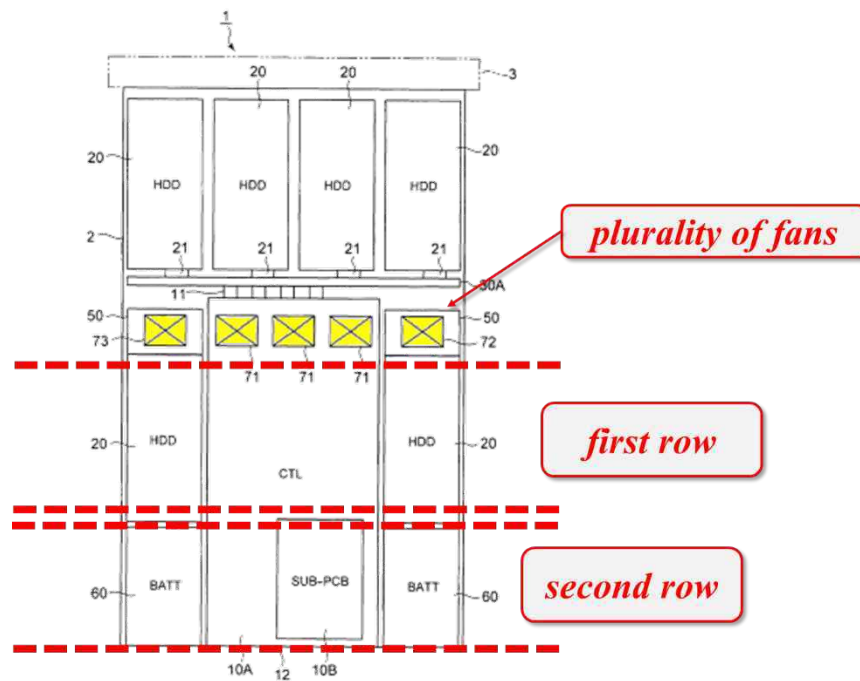
EX1010, Fig. 16 (modified).

- h. and the second row being positioned farther from the plurality of fans than the first row.**

354. Okamoto discloses this limitation.

355. For the reasons I discuss above for 1b, Okamoto discloses a *plurality of fans*. For the reasons I discuss above for 8b, Okamoto discloses a first row. For the reasons described for [8d], Okamoto also discloses a *second row*. Okamoto further discloses *the second row being positioned farther from the plurality of fans than the first row*, as shown in Figure 16. In other words, the first row is closer to the fans than the second row is.

FIG. 16



EX1010, Fig. 16 (modified).

B. The Combination of Okamoto and Hughes Renders Claim 2 Obvious

356. Okamoto does not expressly disclose a *plurality of power source units* that *are each arranged to be pulled out from the rear face of the housing*, but Hughes does. The combination of Okamoto and Hughes discloses this limitation.

1. Motivation to Combine Okamoto and Hughes

357. A POSITA would be motivated combine Okamoto with the teaching of Hughes.

358. Hughes describes a “form factor that can conveniently be used with common enclosure layouts, where modules may be inserted into/removed from the enclosure through square/rectangular bays in the rear of the enclosure” (EX1007,

[0017]), and expressly states that Hughes' enclosure 1 includes "bays into which can be received...two power supply units 7..." (EX1007, [0028]). A POSITA would understand from Hughes' disclosures that power supply units 7 are removable through the rear wall of the enclosure. A POSITA would have been motivated to implement Okamoto's storage controller such that the plurality of power source units are each *arranged to be pulled out from the rear face of the housing*, as taught by Hughes.

359. A POSITA would have recognized the benefit of this design because it would allow a user to easily replace a defective or damaged power device 50 or battery 60 in Okamoto's storage controller. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem."). While Okamoto describes making many of the components "irreplaceable under normal circumstances" (EX1010, 4:30-31), Okamoto also describes an embodiment that includes "at least one replaceable-type storage device" (EX1010, 18:19-23). The replaceable storage device is for use if irreplaceable storage devices "become unusable." EX1010, 2:40-44; *see also* EX1010, 8:32-34. Similarly, a POSITA would have been motivated to make at least one *power supply unit* in Okamoto replaceable should any "become unusable." A POSITA could have implemented this design with a

reasonable expectation of success because such removable power supplies were well known before 2012. EX1008, 15:35-37, Fig. 12; EX1021, 2:28-31 (“[A] preferred housing further includes at least two replaceable power supply units arranged within the second compartment of the chassis and removable via one of the chassis openings.”), Fig 4, Fig. 6; EX1022, [0070] (“The operation in the case of the modules (... power source module 40, battery module 50, ...) provided with the operating lever is as follows.... When taking out the module from the chassis, the customer engineer or end user moves up the operating lever to release the fixed state by a latch release action and removes the module from the predetermined area in the chassis.”), Fig. 5; *see also* Section VI.A.5.

360. Indeed, modifying Okamoto based on Hughes would have involved no more than the use of prior art elements according to known methods to yield predictable results.

2. Dependent Claim 2: The electronic device according to claim 1, wherein the plurality of power source units are each arranged to be pulled out from the rear face of the housing.

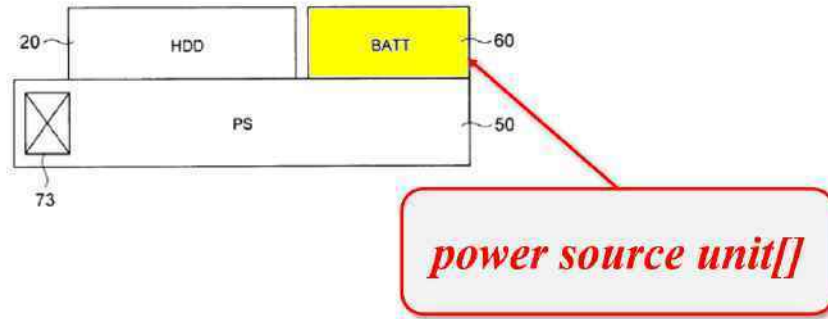
361. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

362. For the reasons I discuss for limitation 1e, Okamoto discloses a *plurality of power source units*. *See* Section VII.A.2.f.

363. Figure 14 and Figure 16 of Okamoto illustrate that Okamoto’s

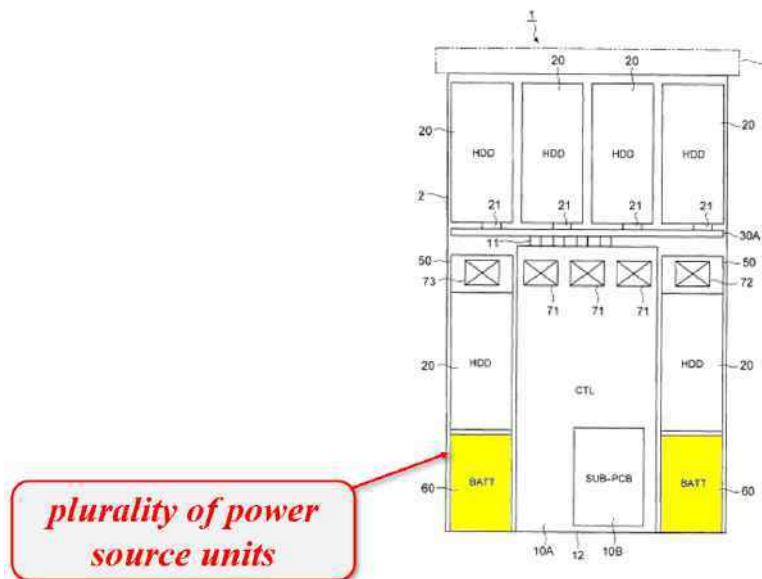
batteries 60 are located at the rear of the enclosure.

FIG. 14



EX1010, Fig. 14 (annotated).

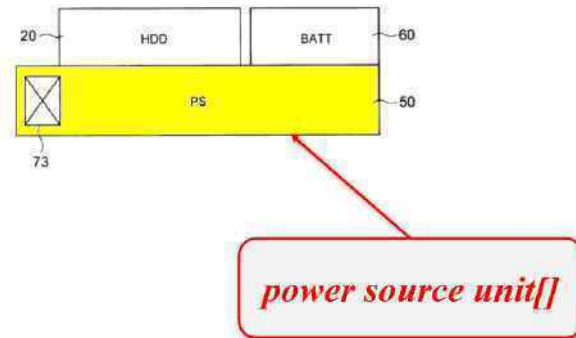
FIG. 16



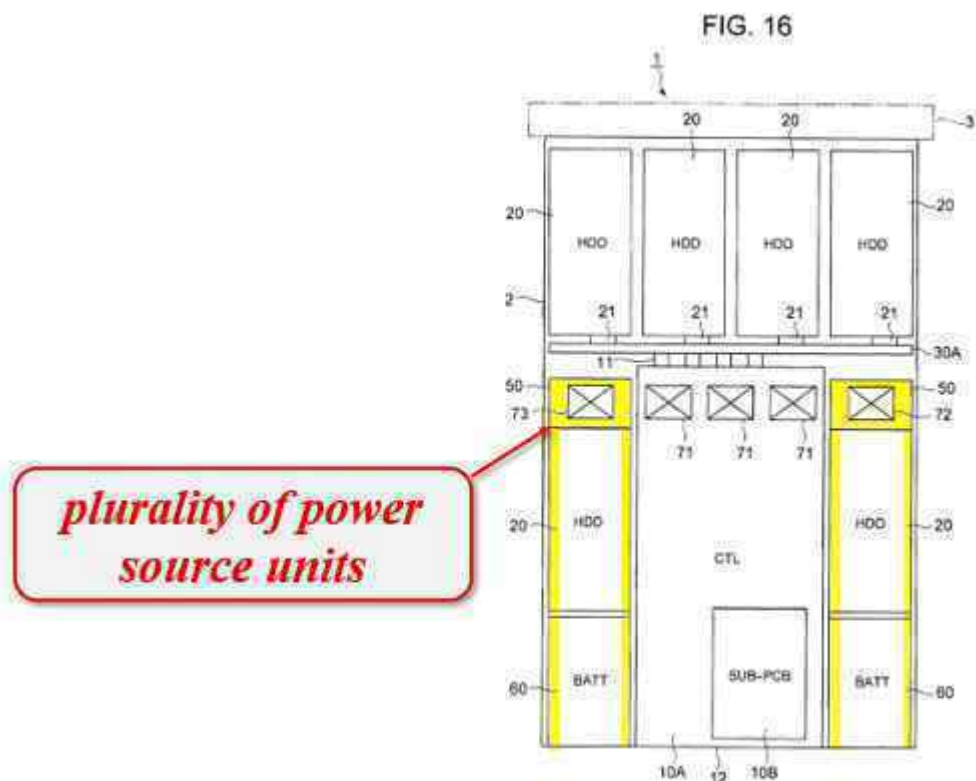
EX1010, Fig. 16 (annotated); *see also* EX1010, 14:26-29.

364. Okamoto's power devices 50 are also located along the rear of Okamoto's enclosure, as shown in Figure 14 and Figure 16.

FIG. 14



EX1010, Fig. 14 (annotated); *see also* Fig. 4, 7:17-23.



EX1010, Fig. 16 (annotated).

365. Although Figure 16 appears to show power devices 50 closer to the front of the enclosure than the HDD 20, a POSITA would be informed by the

illustration of Figure 14 and understand that the power devices 50 in Figure 16 are actually located underneath the HDD and Battery 60 such that it extends to the rear of the enclosure.

366. While Okamoto does not expressly disclose that *the power source units are each arranged to be pulled out from the rear face of the housing*.

Okamoto combined with Hughes meets this limitation.

367. Hughes discloses “common enclosure layouts, where modules may be inserted into/removed from the enclosure through square/rectangular bays in the rear of the enclosure.” EX1007, [0017]. Hughes further describes rear enclosure 5, which “comprises a number of bays into which can be received...two power supply units 7.” EX1007, [0028].

368. Because Okamoto’s batteries 60 and power devices 50 (i.e., *power source units*) are located near the rear of the enclosure, a POSITA would be motivated to modify Okamoto’s batteries 60 and power devices 50, with the teachings of Hughes so that Okamoto’s *power source units* are *arranged to be pulled out* (i.e., able to “be removed” as described by Hughes) *from the rear face of the housing* (i.e., “from the enclosure... through...the rear of the enclosure” as described by Hughes), as I discuss above. See Section VII.B.1.

369. While Okamoto generally discloses irreplaceable mounting of components within an enclosure, Okamoto also discloses that “a new storage

device can be replaceably attached to the device connector in order to make data storage possible.” EX1010, 2:40-44; *see also* EX1010, 18:58 (“said new storage device can be replaceably attached...”), 5:66-6:2, 8:29-34.

370. Thus, Okamoto alone or combined with Hughes discloses the additional limitation recited in claim 2.

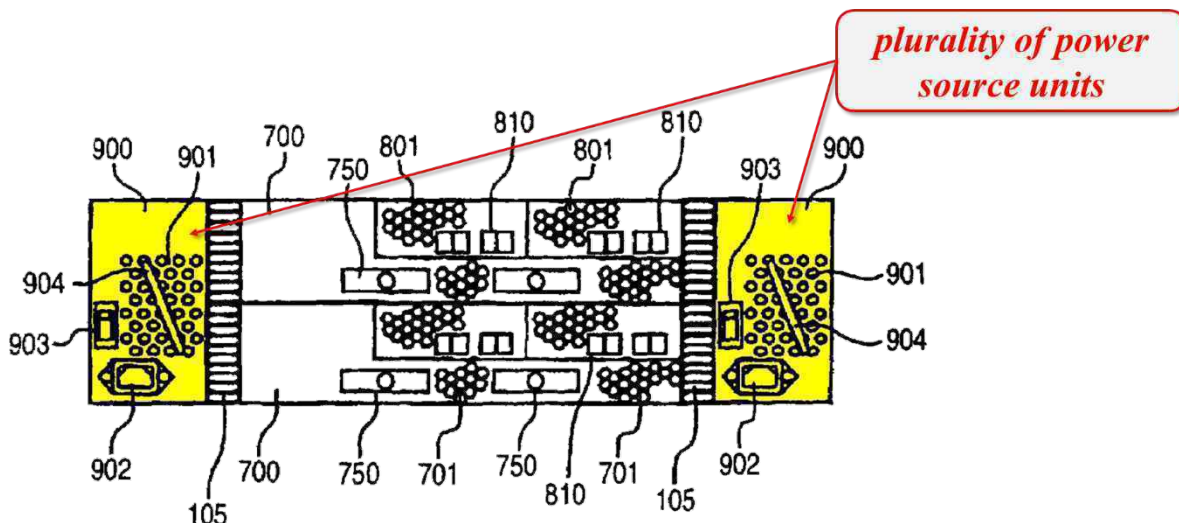
C. The Combination of Okamoto and Suzuki Renders Claims 2 and 6 Obvious

371. Okamoto does not disclose claims 2 and 3, but in combination with Suzuki discloses these limitations.

1. Motivation to Combine Okamoto and Suzuki

372. Suzuki discloses a control unit including power supply units 7 that are removable through the rear wall of the enclosure. *See* Section VI.A.5.

373. Suzuki’s Figure 12 is a “back view of the control unit 30” and illustrates power supply modules 900 on either side of the control unit. EX1008, 15:35, 4:58-60. Suzuki states that “[p]ower supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively.” EX1008, 15:35-38. A handle 904 is “provided on the rear side of each power supply module 900.” EX1008, 15:49-53. A POSITA would understand from Suzuki’s disclosures that power supply units 7 are removable through the rear wall of the enclosure.



EX1008, Fig. 12 (annotated).

374. A POSITA would have been motivated to modify Okamoto to provide removeable power supplies as in Suzuki. A POSITA would have recognized the benefit of this design because it would allow a user to easily replace a defective or damaged battery 60 or power device 50 in Okamoto's storage controller. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem."). Further, a POSITA could have implemented this design with a reasonable expectation of success because such removable power supplies were well known and readily available for purchase long before 2012. EX1007, [0017], [0028]; EX1009, Abstract, 1:59-67; EX1021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the

whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem.”), 2:28-31 (“[A] preferred housing further includes at least two replaceable power supply units arranged within the second compartment of the chassis and removable via one of the chassis openings.”), Fig 4, Fig. 6; EX1022, [0070] (“The operation in the case of the modules (... power source module 40, battery module 50, ...) provided with the operating lever is as follows.... When taking out the module from the chassis, the customer engineer or end user moves up the operating lever to release the fixed state by a latch release action and removes the module from the predetermined area in the chassis.”), Fig. 5; *see also* Sections VII.B.1 and VI.A.5.

375. Further, Suzuki discloses attaching a *heat sink* to a *CPU* as recited in claim 6. EX1008, 14:49-55, Fig. 11C. A POSITA would have been motivated to implement Suzuki’s heat sink on Okamoto’s CPU as it would provide more effective cooling, as a POSITA would have known. Further, a POSITA could have implemented a CPU with attached heat sink with at least a reasonable expectation of success because CPUs with attached heat sinks were widely used and well known before the ’265 Patent. EX1005, 1:38-40, Fig. 1. Indeed, modifying Okamoto based on Suzuki would have involved no more than the use of prior art elements according to known methods to yield predictable results.

2. Dependent Claim 2: The electronic device according to claim 1, wherein the plurality of power source units are

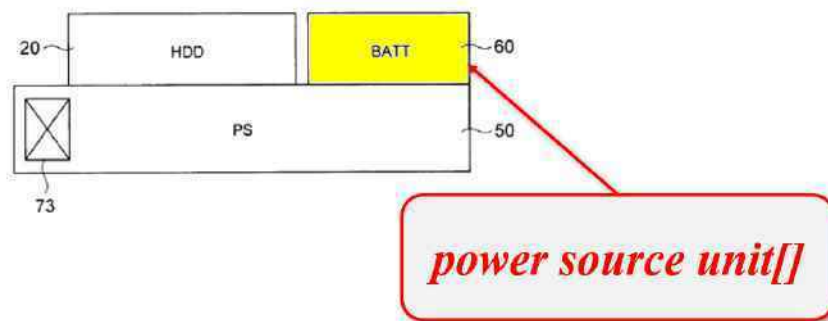
each arranged to be pulled out from the rear face of the housing.

376. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

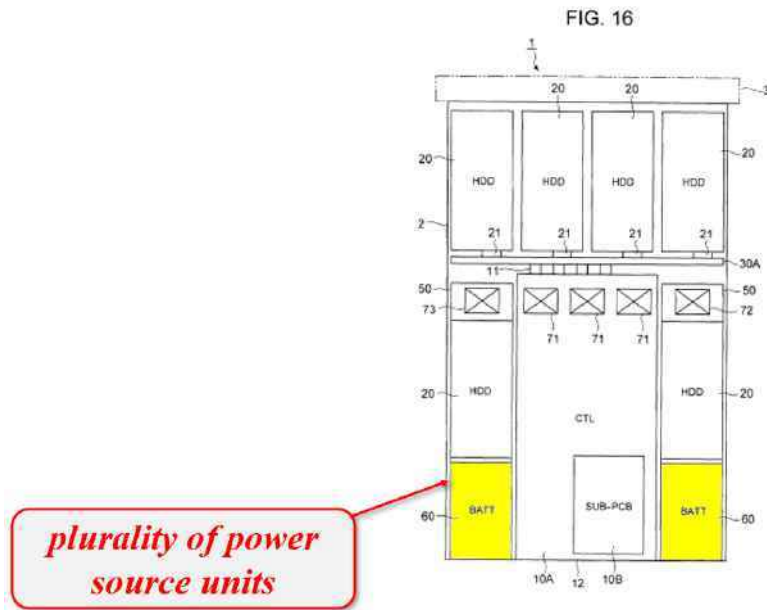
377. For the reasons I discuss for limitation 1e, Okamoto discloses a *plurality of power source units*. See Section VII.A.2.f.

378. Figure 14 and Figure 16 of Okamoto illustrate that Okamoto's batteries 60 are located at the rear of the enclosure.

FIG. 14

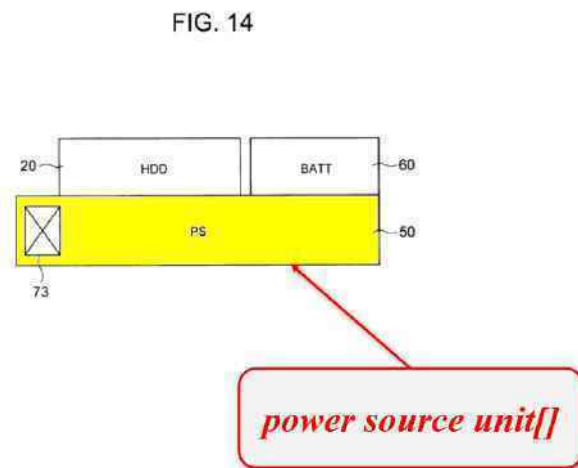


EX1010, Fig. 14 (annotated).

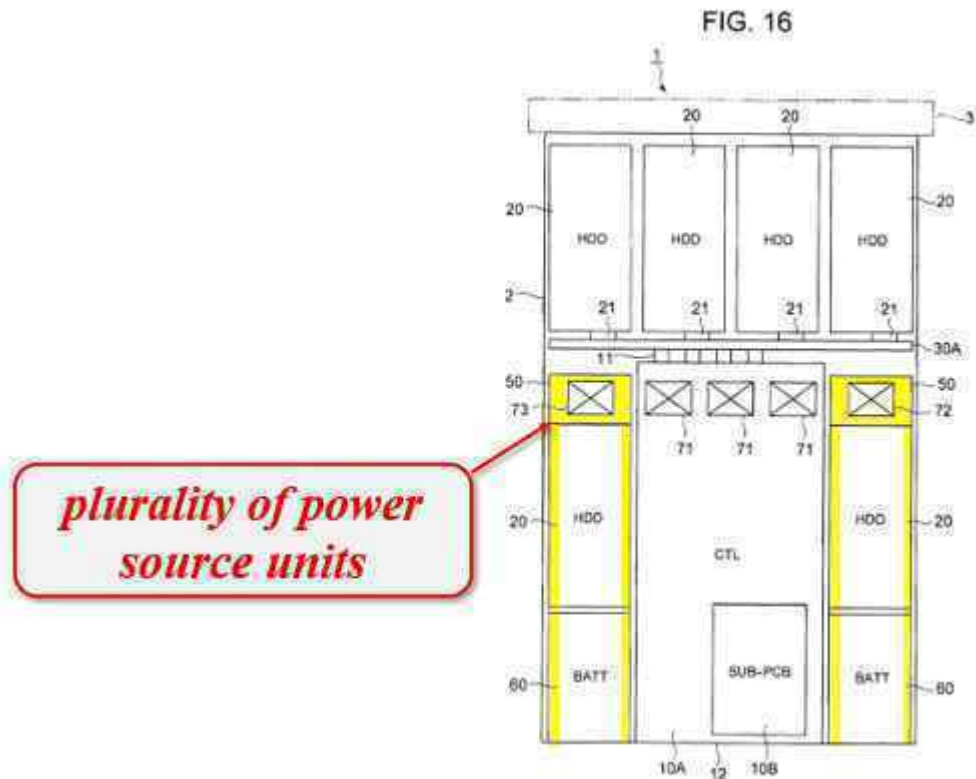


EX1010, Fig. 16 (annotated); *see also* EX1010, 14:26-29.

379. Okamoto's power devices 50 are also located along the rear of Okamoto's enclosure, as shown in Figure 14 and Figure 16.



EX1010, Fig. 14 (annotated); *see also* Fig. 4, 7:17-23.



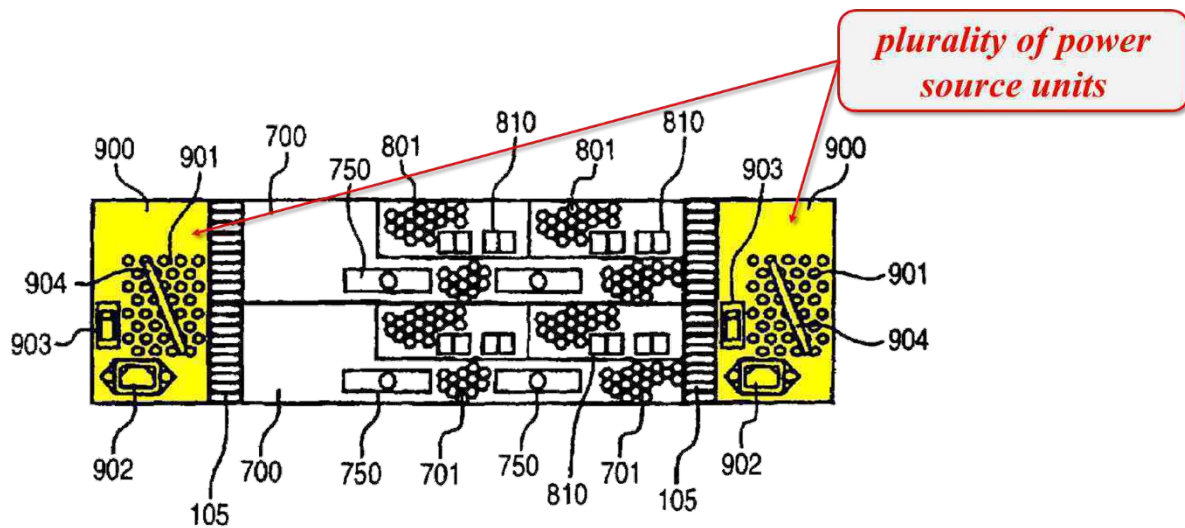
EX1010, Fig. 16 (annotated).

380. Although Figure 16 appears to show power devices 50 closer to the front of the enclosure than the HDD 20, a POSITA would be informed by the illustration of Figure 14 and understand that the power devices 50 in Figure 16 are actually located underneath the HDD and Battery 60 such that it extends to the rear of the enclosure.

381. Okamoto does not expressly disclose that *the power source units are each arranged to be pulled out from the rear face of the housing*. But Okamoto combined with Suzuki meets this limitation.

382. Suzuki's Figure 12 is a "back view of the control unit 30" and

illustrates power supply modules 900 on either side of the control unit. EX1008, 15:35, 4:58-60. Suzuki states that “[p]ower supply modules 900 are detachably attached to the both sides of each of up/down-stacked control modules 700, respectively.” EX1008, 15:35-38. A handle 904 is “provided on the rear side of each power supply module 900.” EX1008, 15:49-53. A POSITA would understand from Suzuki’s disclosures that power supply units 7 are removable through the rear wall of the enclosure.



EX1008, Fig. 12 (annotated).

383. A POSITA would have been motivated to implement Okamoto’s storage controller such that the plurality of *power source units* are each *arranged to be pulled out from the rear face of the housing*, as taught by Suzuki for the reasons I discussed above. See Section VII.C.1 and Section VII.C.2.

384. Okamoto discloses that *the plurality of power source units*

are...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts, as explained for 1e and 1g.

385. Thus, the combination of Okamoto and Suzuki discloses the additional limitations of claim 2.

3. Dependent Claim 6: The electronic device according to claim 1, wherein the cooling air flows through a heat sink, attached onto the CPU, and further flows downstream via a relatively large space formed between the plurality of power source units.

386. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

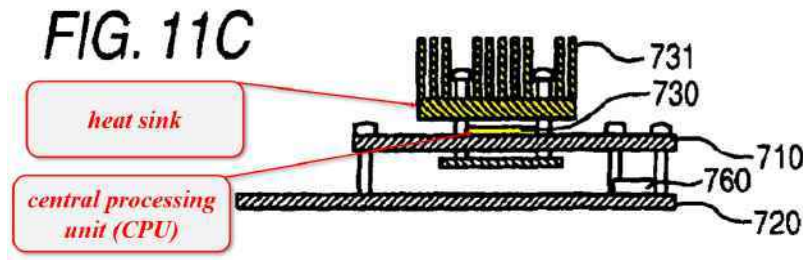
387. For the reasons I discuss above for 1c, in Okamoto's storage controller, microprocessors 131 are *CPU[s]* and are located on main board 10A.

388. While, Okamoto does not explicitly disclose a heat sink, Suzuki does. Okamoto combined with Suzuki discloses *a heat sink is attached onto the CPU*.

389. Suzuki discloses attaching a *heat sink* to the *CPU* and that *the cooling air flows through a heat sink, attached onto the CPU* as recited in claim 6.

EX1008, 14:23-26 (“[A] heat sink 731...for cool down of the MPU 730 and other electronic parts...are laid out in a longitudinal direction, along the direction of a cooling wind....”), 14:55-58 (“[I]t is the heat sink 731 that is expected to offer the cooling wind rectification effect, the heat sink being placed near the cooling wind

inflow port.”), Fig. 11C. As shown in Figure 11C of Suzuki, Suzuki discloses a heat sink 731 on MPU [(micro processing unit)] 730 that is “attach[ed].” EX1008, 14:49-55. Thus, a POSITA would understand that Suzuki’s *heat sink is attached onto the CPU*.



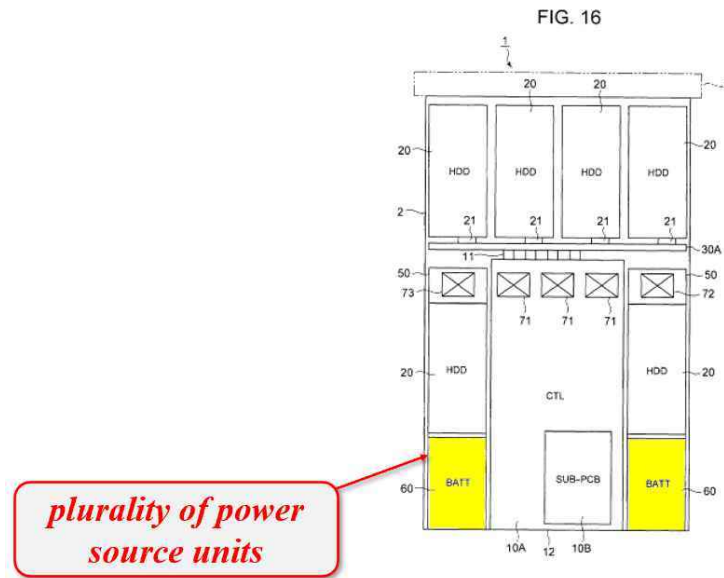
EX1008, Fig. 11C.

390. Moreover, Suzuki discloses inflow cooling wind FCU1 that is “rectified by the heat sink 731.” EX1008, 16:7-9. “Rectified” is used here to mean “straightened.” When the cooling wind, which is in a “direction slightly tilted with respect to the longitudinal direction of control module 700[,]” goes through the straight fins of the heat sink 731, the wind direction gets straightened, or rectified. EX1008, 16:5-7. Thus, a POSITA would understand that the cooling wind *flows through a heat sink, attached onto the CPU*.

391. A POSITA would be motivated to modify Okamoto’s CPU (i.e., microprocessor 131) with the teaching of Suzuki to include a heat sink, such that *cooling air flows through a heat sink, attached onto the CPU*. See Section VII.C.1 and Section VII.C.3.

392. Further, for the reasons described for 1b, Okamoto's fans cause cooling air to *flow downstream in the longitudinal direction from the front face to the rear face of the housing.*

393. As shown in Figure 16, Okamoto's batteries 60 are located on the sides of the enclosure, with main board 10A, which includes the *CPU*, in between.



EX1010, Fig. 16 (annotated).

394. Separately and independently, as shown in Figure 16, Okamoto's power devices 50 are located on the sides of the enclosure, with main board 10A, which includes the *CPU*, in between.

$\frac{1}{2}$ 

395. As a result, there would *be a relatively large space formed between the plurality of power source units.*

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Wiscombe to permit easy insertion and removal of at least one battery 60 or power device 50 through the rear wall. A POSITA would recognize the benefit of this because a user could easily replace a defective or damaged battery or power device quickly and easily without having to disassemble Okamoto's storage controller. EX2021, 2:31-35 ("If one of the [two replaceable] power supply units were designed to provide sufficient power for the whole subsystem, then it would be possible to remove a defective power supply without impacting the availability of the subsystem.").

400. Further, Wiscombe's invention is intended for use with "conventional, off-the-shelf" power supplies (EX1009, Abstract, 1:59-67), which limits the cost and provides a further motivation for modifying Okamoto based on Wiscombe. EX1009, 3:33-38, 3:55-63; EX1021, 2:28-31 ("[A] preferred housing further includes at least two replaceable power supply units arranged within the second compartment of the chassis and removable via one of the chassis openings."), Fig. 4, Fig. 6; EX1022, [0070] ("The operation in the case of the modules (... power source module 40, battery module 50, ...) provided with the operating lever is as follows.... When taking out the module from the chassis, the customer engineer or end user moves up the operating lever to release the fixed state by a latch release action and removes the module from the predetermined area in the chassis."), Fig. 5; *see also* Sections VII.B.1 and VI.A.5.

401. A POSITA would also understand that using a power box disclosed by Wiscombe on each power supply would provide further thermal management benefits as a dedicated power box for each power source unit would prevent thermal interference with other components within the enclosure. Having a separate power box for each power supply would also make it easier for replace individual power supplies without affecting the entire power system server, thereby enhancing server uptime and reducing maintenance complexity. Finally, having a power box for each power supply can guard against and reduce electromagnetic noise and interference between power supplies and other components in the server. See Sections VI.B.1 and VI.B.2.

402. Modifying Okamoto's storage controller to implement Wiscombe's teachings would have been well within the skill of a POSITA without any need for undue experimentation and with a reasonable expectation of success. Wiscombe provides a detailed description of the required modifications, which are intended for use with conventional power supplies. Modifying Okamoto based on Wiscombe would have involved no more than the use of prior art elements according to known methods to yield predictable results.

2. Dependent Claim 2: The electronic device according to claim 1, wherein the plurality of power source units are each arranged to be pulled out from the rear face of the housing.

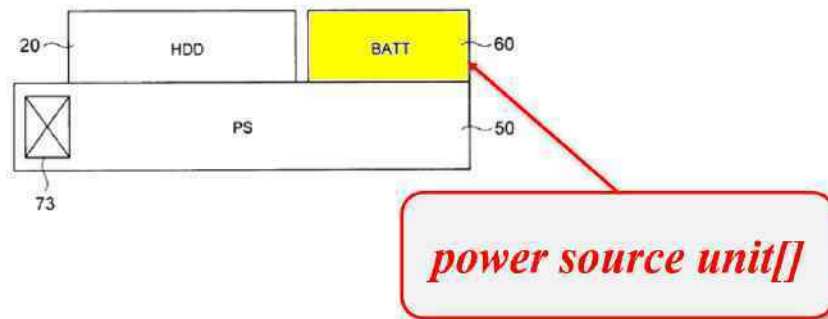
403. Okamoto discloses *the electronic device* of claim 1 for the reasons I

discuss above in connection with that claim.

404. For the reasons I discuss for limitation 1e, Okamoto discloses a *plurality of power source units*. See Section VII.A.2.f.

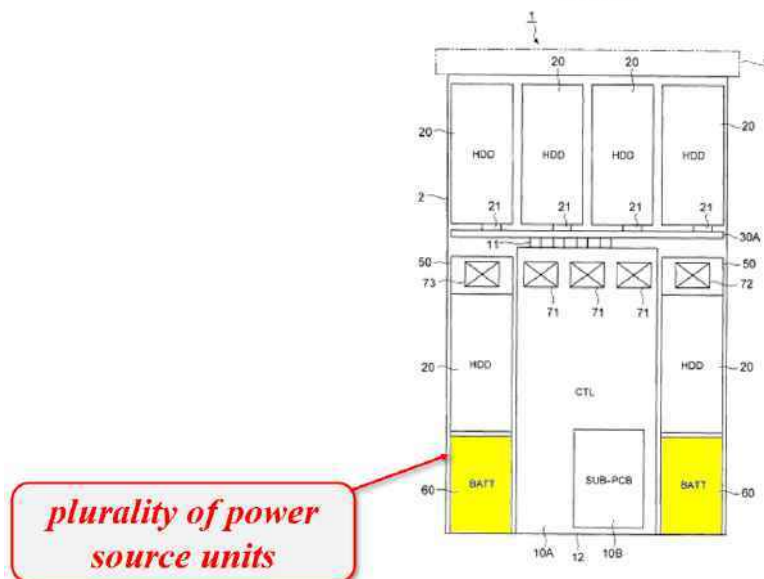
405. Figure 14 and Figure 16 of Okamoto illustrate that Okamoto's batteries 60 are located at the rear of the enclosure.

FIG. 14



EX1010, Fig. 14 (annotated).

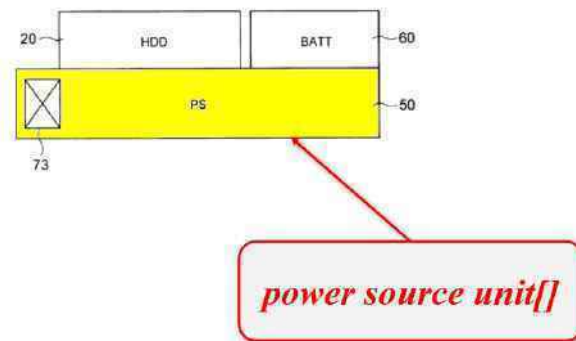
FIG. 16



EX1010, Fig. 16 (annotated); *see also* EX1010, 14:26-29.

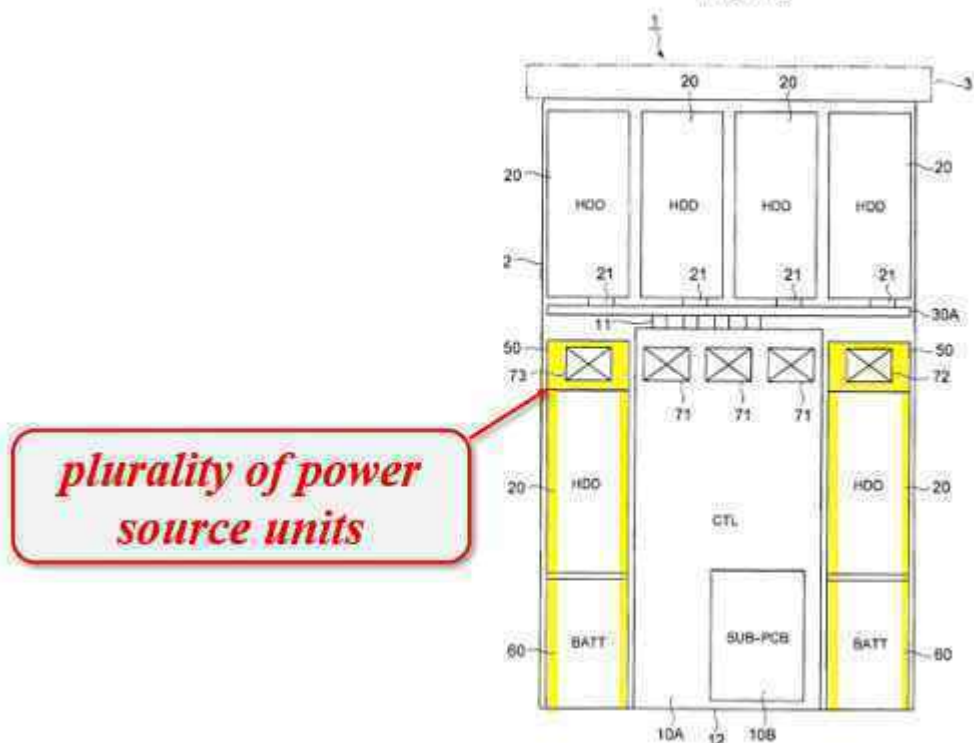
406. Okamoto's power devices 50 are also located along the rear of Okamoto's enclosure, as shown in Figure 14 and Figure 16.

FIG. 14



EX1010, Fig. 14 (annotated); *see also* Fig. 4, 7:17-23.

FIG. 16



EX1010, Fig. 16 (annotated).

407. Although Figure 16 appears to show power devices 50 closer to the front of the enclosure than the HDD 20, a POSITA would be informed by the illustration of Figure 14 and understand that the power devices 50 in Figure 16 are actually located underneath the HDD and Battery 60 such that it extends to the rear of the enclosure.

408. Okamoto does not expressly disclose that *the power source units are each arranged to be pulled out from the rear face of the housing*. But Okamoto combined with Wiscombe meets this limitation.

409. Wiscombe discloses a “specially designed carrier structures” that permits conventional power supply boxes to be inserted or removed through the rear wall of a computer in a “drawer-like movement.” EX1009, 1:59-67, 2:15-31; *see also* EX1009, 5:11-21, 5:32-36, Fig. 1.

410. Because Okamoto’s batteries 60 (i.e., *power source units*) are located near the rear of the enclosure, a POSITA would be motivated to modify Okamoto’s batteries 60, with the teachings of Wiscombe so that Okamoto’s batteries 60 are *arranged to be pulled out from the rear face of the housing*. *See* Section VII.D.1. Doing so would provide the benefit of permitting the user to remove and easily replace a damaged or defective battery.

411. Okamoto’s power devices 50 (i.e., *power source units*) are also

located near the rear of the enclosure, a POSITA would be motivated to modify Okamoto's power devices 50, with the teachings of Wiscombe so that Okamoto's power devices 50 are *arranged to be pulled out from the rear face of the housing*. See Section VII.D.1. Doing so would provide the benefit of permitting the user to remove and easily replace a damaged or defective power device.

412. While Okamoto generally discloses irreplaceable mounting of components within an enclosure, Okamoto also discloses that “a new storage device can be replaceably attached to the device connector in order to make data storage possible.” EX1010, 2:40-44; *see also* EX1010, 18:58 (“said new storage device can be replaceably attached...”), 5:66-6:2, 8:29-34. A POSITA would recognize the benefit of having at least one *power source unit* replaceable as well as it would permit easy replacement with disassembly.

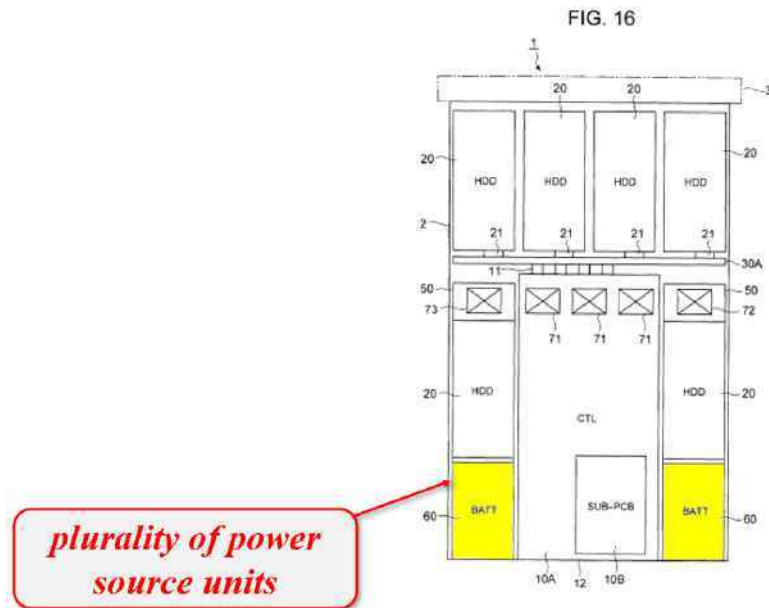
3. Dependent Claim 3: The electronic device according to claim 1, wherein the plurality of power source units are each kept inside a power box, comprising a top board and a pair of side boards, and positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.

413. Okamoto discloses *the electronic device* of claim 1 for the reasons I discuss above in connection with that claim.

414. Okamoto discloses that *the plurality of power source units are...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic*

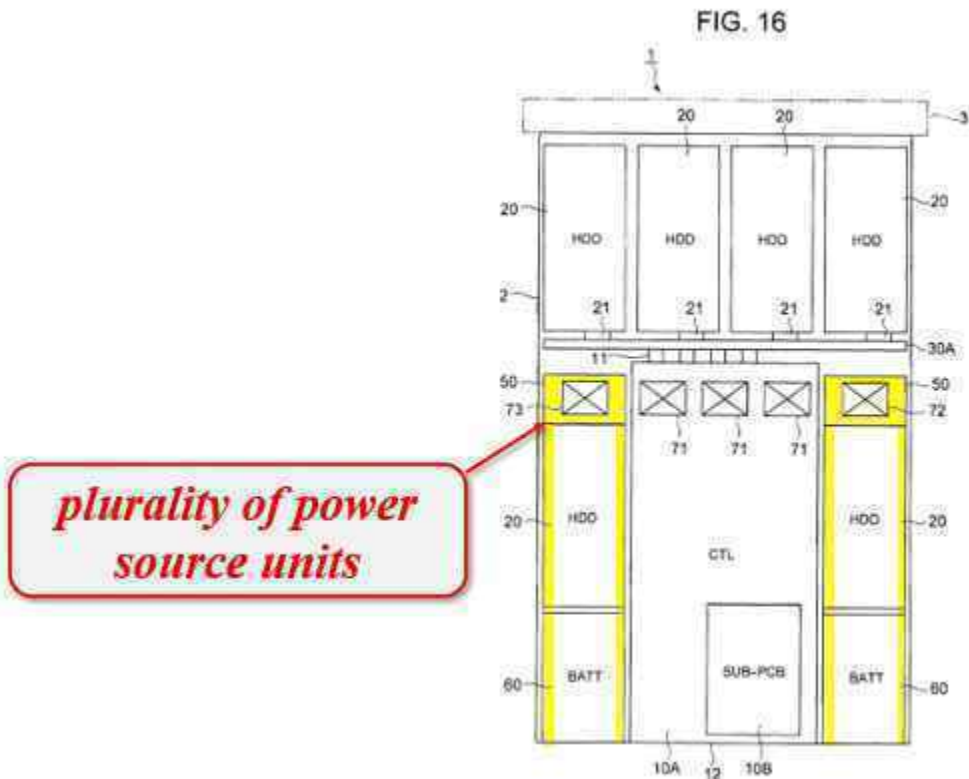
parts, as I discuss above for 1e and 1g. See Sections VII.A.2.f and VII.A.2.h.

415. Okamoto's batteries 60 are located on either side of the enclosure as illustrated in Figure 16.



EX1010, Fig. 16 (annotated).

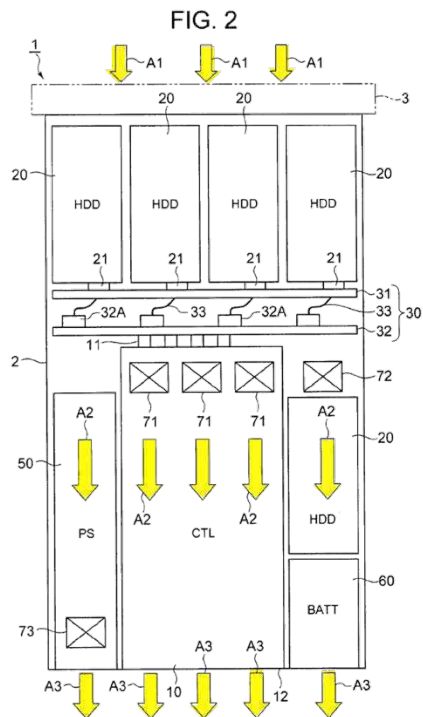
416. Okamoto's power devices 50 are located on either side of the enclosure as illustrated in Figure 16.



EX1010, Fig. 16 (annotated).

417. As a result, in Okamoto, *the plurality of power source units are each...positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts.*

418. For the reasons I discuss above for 1b, Okamoto's fans cause cooling air to *flow downstream in the longitudinal direction from the front face to the rear face of the housing. Thus, cooling air flown downwardly from the plurality of electronic parts* means the cooling air moving from the front to the rear flows over the *electronic parts*, as shown in Figure 2 of Okamoto.



EX1010, Fig. 2 (annotated).

419. As I discuss above, I understand that *the plurality of electronic parts* in this limitation refers to the central processing unit. See Section IV.E.

420. Thus, because the power source units disclosed by Okamoto are not directly behind the CPU, they are *positioned close to each of side faces of the housing so as not to directly interfere with the cooling air flown downwardly from the plurality of electronic parts*.

421. Wiscombe discloses a “housing section 12” (*a power box*) that has a “top end wall 16” (*a top board*) and “opposite left and right side walls 20 and 22” (*a pair of side boards*) into which “each of the power supply assemblies 14 may be inserted inwardly....” EX1009, 3:19-25. Housing section 12 is illustrated in

This diagram shows an exploded view of a power box assembly. The main component is a yellow rectangular power box (16) with a handle (20) and a latch (12). It is shown being inserted into a larger metal frame (10). The frame has three horizontal slots (26) for the power box. The slots are secured by screws (14) and washers (94). The power box is also secured by screws (82) and washers (92). The frame has a top panel (10) and a bottom panel (28). The power box is shown in an exploded position, with arrows indicating its movement into the frame.

422. A POSITA would be motivated to modify Okamoto's power supply units with Wiscombe's teachings so that the power supply units are *each kept inside a power box, comprising a top board and a pair of side boards*. See Section VII.D.1. A POSITA would recognize that Wiscombe's power box allows for a power supply unit to be guided into and maintained in a precise position within an enclosure and that the technique would provide similar benefits to power supply units that are spaced out within an enclosure, where it would be important to maintain the arrangement of components within the enclosure.

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VIII. SECONDARY CONSIDERATIONS

424. I have considered the impact of secondary considerations of obviousness, but I am not aware of any relevant information related to secondary considerations of obviousness that would impact my opinions at this time. To the extent the Patent Owner comes forward with any such information, I will consider it.

IX. AVAILABILITY FOR CROSS-EXAMINATION

425. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during a time as mutually agreed between the parties.

X. RIGHT TO SUPPLEMENT

426. I reserve the right to supplement my opinions in the future to respond to any arguments that the Patent Owner raises. This declaration represents only those opinions that I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information that becomes available to me and on my continuing analysis of the materials already provided.

XI. CONCLUSION

427. For the reasons discussed in this declaration, it is my opinion that the challenged claims of the '265 Patent are unpatentable in view of the prior art I have discussed above.

Acknowledgement of Oath

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1101 of Title 18 of the United States Code.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Him Pokharna', written in a cursive style.

Himanshu Pokharna, Ph.D.,

Dated: July 9, 2025