

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. 9,651,320

**DECLARATION OF HIMANSHU POKHARNA, PH.D. IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,651,320**

TABLE OF CONTENTS

I.	BACKGROUND AND QUALIFICATIONS.....	6
II.	MATERIALS CONSIDERED.....	11
III.	RELEVANT LEGAL STANDARDS.....	12
	A. Prior Art.....	12
	B. Person of Ordinary Skill in the Art	13
	C. Anticipation.....	14
	D. Obviousness	15
	E. Written Description.....	19
IV.	TECHNICAL ANALYSIS OF THE '320 PATENT	20
	A. Overview of the Patent Specification.....	20
	B. Overview of the Prosecution History.....	28
	C. The Patent Claims	32
	D. Person of Ordinary Skill in the Art	33
	E. Claim Construction	37
	1. declination index value calculation unit (claims 1, 7, 8).....	39
	2. control unit (claims 1, 7, 8).....	41
V.	PRIOR ART REFERENCES	43
	A. Sato (EX1005).....	43
	B. Nakamura (EX1007)	58
	C. Jin (EX1009)	70
VI.	THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BY THE COMBINATION OF SATO AND NAKAMURA.....	75
	A. Motivation to Combine Sato and Nakamura	75
	1. Independent Claim 1	83
	a. [1pre] ICT (information and Communication Technology) equipment having an electronic component, the ICT equipment comprising:.....	84
	b. [1a] a cooling fan;.....	89

TABLE OF CONTENTS

(continued)

c.	[1b] a first temperature sensor that detects a component temperature of the electronic component included in the ICT equipment;.....	92
d.	[1c] a second temperature sensor that detects a temperature of an intake air; and.....	96
e.	[1d] a microprocessor including:.....	98
f.	[1e] a declination index value calculation unit that calculates an index value indicating a degree of declination of the component temperature of the electronic component based on a detection result of the first temperature sensor; and	102
g.	[1f] a control unit that controls the number of rotations of the cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.....	105
2.	Dependent Claim 2: The ICT equipment according to claim 1, wherein the index value is a declined temperature per unit time of the component temperature of the electronic component.....	110
3.	Dependent Claim 3: The ICT equipment according to claim 1, wherein the index value is an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods.....	116
4.	Dependent Claim 4: The ICT equipment according to claim 1, wherein the index value is a difference between a highest value of the component temperature of the electronic component in a past certain period and a current component temperature.	120
5.	Dependent Claim 5: The ICT equipment according to claim 1, wherein the control unit controls the number of rotations of the cooling fan to be lower as the degree of declination of the component temperature of the electronic component, indicated by the index value calculated by the declination index value calculation unit, is larger.	121

TABLE OF CONTENTS

(continued)

6.	Dependent Claim 6: The ICT equipment according to claim 1, wherein if the index value is not less than a predetermined threshold, the control unit stops the cooling fan.....	125
7.	Independent Claim 7	126
a.	A control device for ICT (Information and Communication technology) equipment having a cooling fan, electronic component, a first temperature sensor for detecting a temperature of the electronic component, and a second temperature sensor that detects a tmperature of an intake air, the control device comprising:.....	126
b.	a microprocessor including:	127
c.	a declination index value calculation unit that calculates an index value indicating a degree of declination of a component temperature of the electronic component included in ICT equipment, based on a detection result of the first temperature sensor tha detects the component temperature of the electronic component; and.....	127
d.	a control unit that controls the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.....	128
8.	Independent Claim 8.....	129
a.	A temperature controlling method comprising:	129
b.	by a declination index value calculation unit, calculating an index value indicating a degree of declination of a component temperature of an electronic component included in ICT (Information and Communication Technology) equipment, based on a detection esult of a first temperature sensor that detects the component temperature of the electronic	

TABLE OF CONTENTS
(continued)

	component and a second temperature sensor that detects a temperature of an intake air; and	129
	c. by a control unit, controlling the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.....	131
VII.	CLAIM 3 IS ALSO RENDERED OBVIOUS BY THE COMBINATION OF SATO, NAKAMURA, AND JIN	131
	1. Motivation to Combine	132
	2. Claim 3: The ICT equipment according to claim 1, wherein the index value is an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods.	135
VIII.	SATO AND ITS COMBINATIONS ARE NOT CUMULATIVE OF ART CITED IN PROSECUTION	139
IX.	SECONDARY CONSIDERATIONS	140
X.	AVAILABILITY FOR CROSS-EXAMINATION	141
XI.	RIGHT TO SUPPLEMENT	141
XII.	CONCLUSION	141

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. 9,651,320 (which I will refer to as the “’320 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 ’320 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 '320 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 '320 Patent and its prosecution history. In particular, I have reviewed and considered the following documents, among others, in connection with my analysis:

- EX1001: The '320 Patent;
- EX1002: The prosecution history of U.S. Patent Application No. 13/782,490, which led to the issuance of the '320 Patent;
- EX1005: U.S. Patent Application Publication 2011/0176275 (“Sato”);
- EX1006: Japanese Patent Application JP 2011-151131A;
- EX1007: English Translation of Japanese Patent No. JP4511444B2 (“Nakamura”);
- EX1008: Declaration Certifying Translation of Japanese Patent No. JP4511444B2;
- EX1009: English Translation of Korean Patent Application Publication No. KR20100028353A (“Jin”);
- EX1010: Declaration Certifying Translation of Korean Patent Application Publication No. KR20100028353A;

- EX1011: Electronic Failure Analysis Handbook by Perry L. Martin, Chapter 1 (McGraw-Hill 1999);
- EX1012: Complaint for Patent Infringement; and
- EX1013: Cloud Byte’s Preliminary Infringement Contentions with attached Exhibit 9.
- EX1017: 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 '320 PATENT

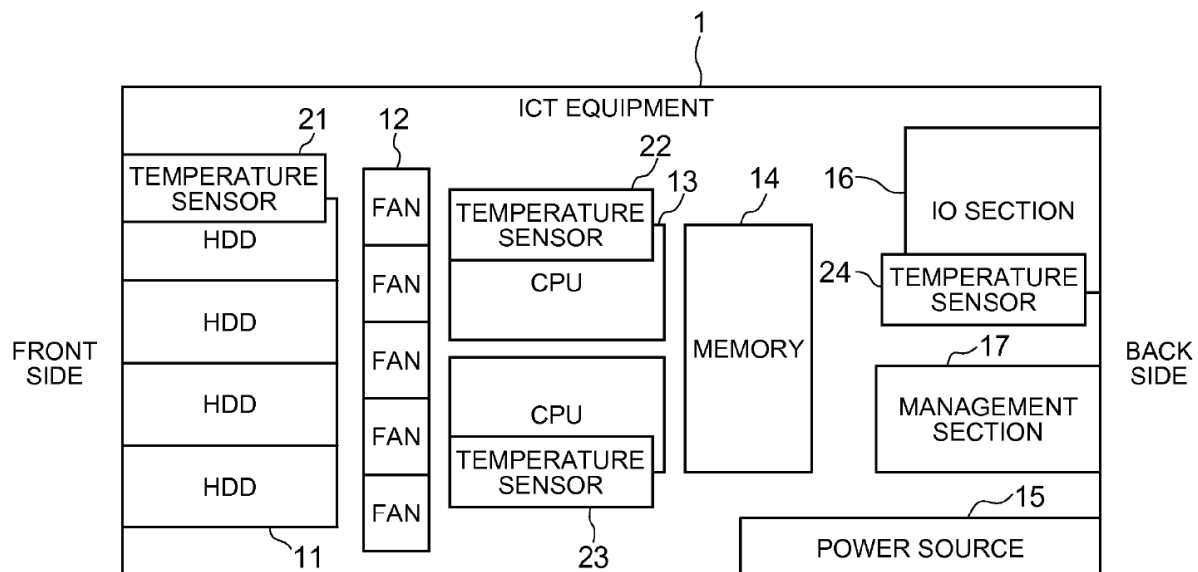
A. Overview of the Patent Specification

38. The '320 Patent is entitled "ICT Equipment." EX1001, 1. The patent was filed on March 1, 2013, issued on May 16, 2017, and claims priority to a Japanese patent application filed on March 2, 2012.

39. The '320 Patent relates to "ICT ('Information and Communication Technology') equipment such as a server device having a cooling fan, a control device thereof, and a program." EX1001, 1:12-15. It states: "Conventionally, ICT equipment such as a server device is installed in a machine room equipped with air

conditioning, and is operated in an environment of an almost constant temperature in most cases.” EX1001, 1:19-22. “However, in order to reduce investment cost and operating costs of a machine room, attention is focused on a machine room where outside air is taken in, which is used to cool the inside of ICT equipment” rather than using air conditioning. EX1001, 1:22-25. But the “room temperature of a machine room utilizing outside air varies widely, compared with that of a machine room equipped with air conditioning.” EX1001, 1:26-28. Therefore, according to the ’320 Patent, it is desirable to have ICT equipment that “has a function of controlling the internal temperature by itself.” EX1001, 1:28-30.

40. Figure 1 in the ’320 Patent “is a block diagram showing an exemplary configuration of ICT equipment 1 according to a first exemplary embodiment....” EX1001, 3:13-15.



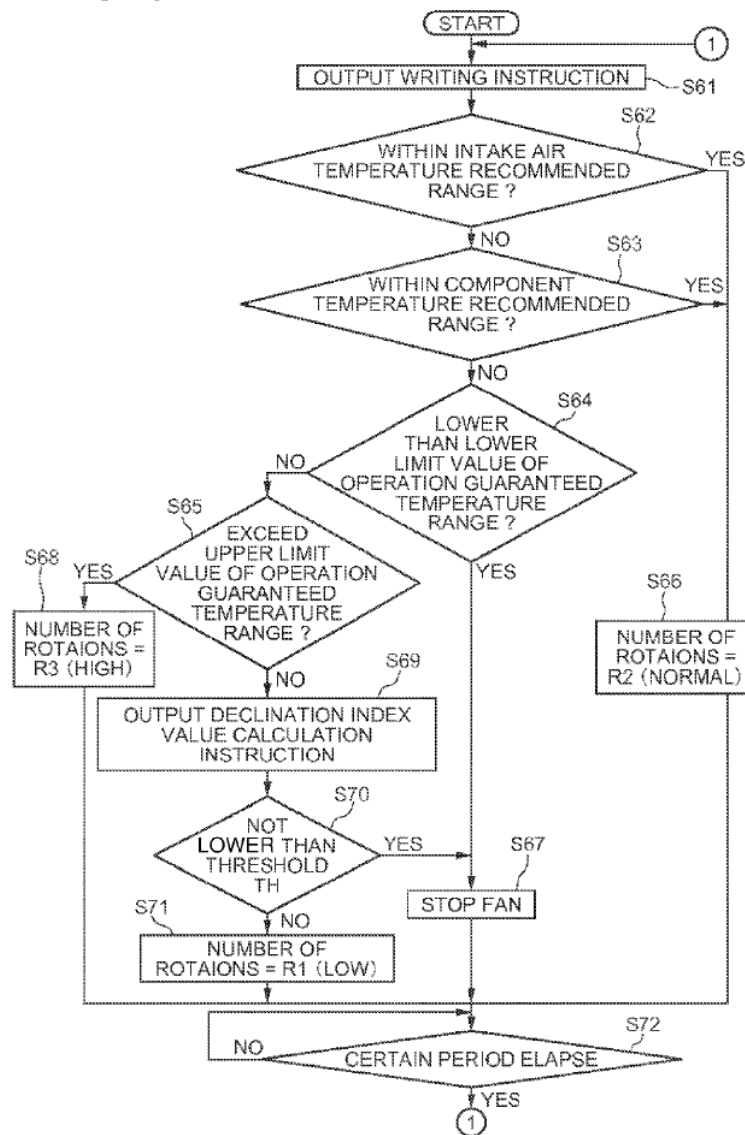
EX1001, Fig. 1. As shown in the figure, “ICT equipment 1” includes “a plurality of hard disk drives (HDD) 11 and a temperature sensor 21, which detects intake air temperature,” and is “arranged on the front side of the casing, and a plurality of cooling fans 12...” EX1001, 3:46-51. “Behind the cooling fans 12, a plurality of CPUs 13 having high heating values, and temperature sensors 22 and 23 which detect component temperatures of the CPUs 13, are arranged.” EX1001, 3:52-55. Additionally, ICT equipment 1 includes a “management section 17 [that] has a function of controlling the number of rotations of the cooling fans 12, based on the detection results of the temperature sensors 21 to 24.” EX1001, 3:61-63.

41. The '320 Patent purports to “provide ICT equipment capable of solving a problem that damage or malfunction may occur in electronic components when an intake air temperature drops sharply” describing ICT equipment that includes “a cooling fan; a temperature sensor that detects a component temperature of an electronic component included in the ICT equipment; a declination index value calculation means (unit) for calculating an index value indicating the degree of declination of the component temperature of the electronic component based on a detection result of the temperature sensor; and a control means (unit) for controlling the number of rotations of the cooling fan in accordance with the index value calculated by the declination index value calculation means.” EX1000, 2:20-37.

42. The '320 Patent describes “calculating, for each of the temperature sensors 22 to 24, a declination index value indicating the degree of declination of a component temperature detected by each temperature sensor....” EX1000, 5:9-15. The patent provides three examples for calculating the declination index value: “(1) A quantity of declination of the component temperature of the ICT equipment 1 per unit time. (2) An average value of the component temperature declination rates of the ICT equipment 1 in a plurality of measurement periods. ... (3) A difference between the highest value of the component temperature of the ICT equipment 1 in a past certain period of time and the current component temperature.” EX1000, 5:15-29.

43. Figure 6 in the '320 Patent is a flowchart showing the operation of a first exemplary embodiment. EX1001, 5:62-63.

FIG. 6



EX1001, Fig. 6.

44. The flow chart in Figure 6 shows that an initial determination is made whether the intake air temperature is within a recommended range. The '320 Patent specifically states that “[u]pon reception of the detection results of the temperature sensors 21 to 24, the control means 172 first determines whether or not the intake air temperature detected by the temperature sensor 21 is within the

intake air temperature recommended range stored in the intake air temperature recommended range storing section 181 (step S62).” EX1001, 6:7-13. “[I]f the temperature is within the intake air temperature recommended range (Yes at step S62), the control means 172 determines that the number of rotations of the cooling fans 12 to be ‘R2 (normal)’, and notifies the fan driving section 174 of the determined number of rotations (step S66).” EX1001, 6:13-18.

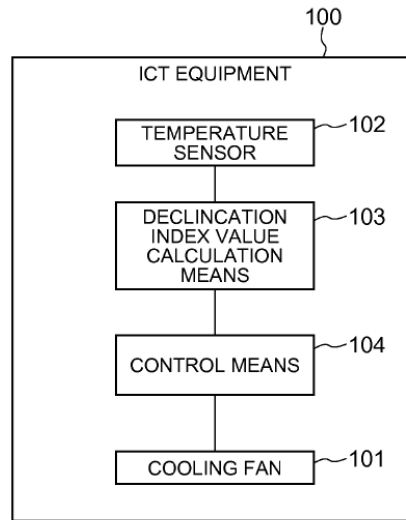
45. On the other hand, “if the control means 172 determines that the intake air temperature is out of the intake air temperature recommended range (No at step at S62)” and another determination is made (at S63) “whether all of the component temperatures detected by the temperature sensors 22 to 24 are within the component temperature recommended range stored in the component temperature recommended range storing section 182 (step S63).” EX1001, 6:21-28. Then, if “all of the component temperatures detected by the temperature sensors 22 to 24 are within the component temperature recommended range (Yes at step S63), the control means 172 determines the number of rotations of the fan to be ‘R2’, and notifies the fan driving section 174 of the determined number of rotations ‘R2’ (step S66).” EX1001, 6:29-34.

46. But, “if even one of the component temperatures detected by the temperature sensors 22 to 24 is out of the component temperature recommended range (No at step 63),” the process continues to S64 and the control section 172

will “calculates a declination index value indicating the degree of declination of the component temperature...” and determine whether the component temperatures detected are “lower than the lower limit value” or “higher than the higher limit value” of the “operation guaranteed temperature range stored in the operation guaranteed temperature range storing section 183.” EX1001, 6:29-7:7. The index value is then used to adjust fan speed. EX1001, 8:3-26, Fig. 6. If the temperature is lower, “the control means 172 instructs the fan driving section 174 to stop the cooling fans 12 (step S67),” and if the temperature is higher “the control means 172 determines the number of rotations of the fans to be ‘R3 (high speed)’ and provides the fan driving section 174 with the determined number of rotations of the fans ‘R3’ (step S68).” EX1001, 6:44-63.

47. Figure 10 shows a second exemplary embodiment of the ’320 Patent. EX1001, 8:59-63.

FIG. 10



EX1001, Fig 10. The figure illustrates ICT equipment 100 that “includes a cooling fan 101, a temperature sensor 102, a declination index value calculation means (unit) 103, and a control means (unit) 104. EX1001, 8:59-64. “The temperature sensor 102 detects component temperatures of the hard disk drive, the CPU, and the like installed in the ICT equipment 100.” EX1001, 8:65-67. “The declination index value calculation means 103 calculates a declination index value”—such as a quantity of declination of a component temperature per unit time or a difference between the highest component temperature in a past certain period of time and the current component temperature—“indicating the degree of declination of each component temperature based on the detection result of the temperature sensor

102.” EX1001, 9:1-8. The “control means 104 controls the number of rotations of the [cooling] fan [101] to be lower as the degree of declination of the component temperature...is larger.” EX1001, 9:9-16.

B. Overview of the Prosecution History

48. The ’320 Patent issued based on Patent Application No. 13/782,490, which was filed on March 1, 2013. EX1001, Cover. The application contained eight claims, including three independent claims (i.e., application claims 1, 7, and 8). EX1002, 26-28.

49. On December 10, 2015, the examiner issued an Office Action rejecting all application claims. EX1002, 161-167. The examiner rejected application claims 1-5 and 7-8 as anticipated by Japanese Patent Application Publication No. 05-100063 (“Takeshi”). EX1002, 163. The examiner rejected the remaining application claim (claim 6) as obvious over Takeshi combined with Japanese Patent Application Publication No. 06-252608 (“Yutaka”). EX1002, 165.

50. On March 10, 2016, the applicant filed a response making certain amendments to the application claims and asserting various arguments to distinguish the prior art. EX1002, 222. Among other things, the applicant argued that Takeshi does not anticipate independent claims 1, 7, and 8 because Takeshi does not disclose “a declination index value calculation unit **that calculates an index value indicating a degree of declination of the component temperature**

of the electronic component based on a detection result of the temperature sensor... EX1002, 222 (emphasis in original). The applicant argued that “Takeshi at most calculates the value in which the temperature in a chassis rises, not ‘an index value indicating a degree of declination’ as recited in the claims.” EX1002, 223 (emphasis in original). The applicant further argued that Takeshi not only fails to disclose “controlling ‘the number of rotations of a cooling fan in accordance with the index value’ as recited by the claims,” but that “Takeshi at most suggests the exact opposite by using temperature rise value data.” EX1002, 224. With regard to application claim 6, the applicant argued that combining Takeshi with Yutaka would not “make up for Takeshi’s deficiencies,” because “Yutaka, like Takeshi, at most discloses stopping a fan when the temperature is below a cooling finishing temperature.” EX1002, 224. The applicant further argued that “Yutaka does not disclose or suggest calculating ‘an index value indicating a degree of declination’ and controlling fan speed in accordance to the index value calculated as recited in the claims.” EX1002, 224.

51. On March 29, 2016, the examiner issued a Final Office Action rejecting all application claims. EX1002, 231. The examiner again rejected most of the application claims (i.e., claims 1-5 and 7-8) as anticipated by Takeshi and rejected the remaining application claim (claim 6) as obvious over Takeshi combined with Yutaka. EX1002, 232-235.

52. On June 29, 2016, the applicant filed a response making certain amendments and arguing that all application claims should be allowed in light of the amendments. EX1002, 248-258. Among other things, the applicant argued that Takeshi fails to anticipate each and every element of independent claim 1. EX1002, 253. The applicant argued that Takeshi has “[n]o consideration of declination to protect against decrease in temperature.” EX1002, 253 (emphasis in original). The applicant argued that the temperature rise value of Takeshi does not account for both rises and declines in temperature, because “Takeshi aims to protect a substrate and the like from being **damaged by heat,**” and “at most, discloses that a cooling fan is rotated a low speeds only for **saving power** by restricting unnecessary operation.” EX1002, 253 (emphasis in original). The applicant argued that, by contrast, the application claims require “a configuration to calculate ‘a degree of declination’ and control a cooling fan on the basis of the calculated degree of declination.” EX1002, 253. The applicant further argued that “Takashi merely aims to protect a substrate from being damaged by **heat** caused by **increase** of temperature in a housing....” EX1002, 254 (emphasis in original). According to the applicant, neither Takeshi nor Yutaka “recognize an issue of the damage or malfunction of an electronic component due to **sudden decrease of temperature**[.]” EX1002, 254 (emphasis in original).

53. The applicant amended the claims to require that the “number of

rotations of the cooling fan” is based on both the declination index value and the intake air temperature. EX1002, 249-251. The applicant argued that the cited prior art has “[n]o control unit that controls based on the index value and the temperature.” EX1002, 254 (emphasis in original). The applicant further argued that unlike the cited prior art, “the present application controls a fan on the basis of ‘a degree of declination’ and ‘a temperature of an intake air.’” EX1002, 254.

54. On August 16, 2016, the examiner issued a Non-Final Office Action rejecting all application claims for failure to comply with the written description requirement. EX1002, 275-277. The examiner explained that independent application claims 1, 7, and 8 are unclear as to whether “the temperature of the electronic component and the temperature of the intake air are detected by the same temperature sensor or different temperature sensors” and requested that the claims be amended to clarify this point. EX1002, 277. The examiner further explained that independent application claims 1, 7, and 8 are unclear as to whether the “index value” is “calculated based on the temperature of the intake air” or “the temperature of the electronic component,” and requested that the claims also be amended to clarify this point as well. EX1002, 277.

55. On November 16, 2016, the applicant filed a response amending independent application claims 1, 7, and 8 to clarify that there are two temperature sensors: “a first temperature sensor that detects a component temperature of the

electronic component included in the ICT equipment” and “a second temperature sensor that detects a temperature of an intake air.” EX1002, 292. The applicant also amended the claims to clarify that the “index value” is calculated based on the component temperature detected by the first temperature sensor. Ex. 1002, 292.

56. Following a round of clarifying amendments, the examiner allowed the application claims. EX1002, 275-277, 292. The examiner issued a Notice of Allowance on January 26, 2017. EX1002, 300. The ’320 Patent issued on May 16, 2017. EX1001, 1.

C. The Patent Claims

57. The ’320 Patent contains eight claims, including three independent claims (i.e., claims 1, 7, and 8).

58. Claim 1 reads as follows:

[1pre] ICT (information and Communication Technology)
equipment having an electronic component, the ICT equipment
comprising:

[1a] a cooling fan;

[1b] a first temperature sensor that detects a component
temperature of the electronic component included in the ICT
equipment;

[1c] a second temperature sensor that detects a temperature of
an intake air; and

[1d] a microprocessor including:

[1e] a declination index value calculation unit that calculates an

index value indicating a degree of declination of the component temperature of the electronic component based on a detection result of the first temperature sensor; and
[1f] a control unit that controls the number of rotations of the cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.

I have separately identified each limitation (i.e., 1pre, 1a, 1b, etc.) for reference.

59. Independent claim 7 recites a “control device for ICT (Information and Communication Technology) equipment having a cooling fan, electronic component, a first temperature sensor for detecting a temperature of the electronic component, and a second temperature sensor that detects a temperature of an intake air,” and independent claim 8 recites a “temperature controlling method.”

60. The patent also includes five dependent claims (i.e., claims 2-6) that all depend directly from claim 1.

D. Person of Ordinary Skill in the Art

61. 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.

62. In my opinion a person of ordinary skill in the art with regard to

the '320 Patent would have 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.

63. 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 '320 Patent and in the prior art references cited on its face. The '320 Patent is directed to providing ICT equipment with cooling control functionality and in particular to address “the problem that damage or malfunction may occur in electronic components when an intake air temperature drops

sharply.” EX1001, 2:19-22. The ’320 Patent discloses ICT equipment with “a declination index value calculation means (unit) for calculating an index value indicating the degree of declination of the component temperature” and “a control means (unit) for controlling the number of rotations of the cooling fan in accordance with the index value calculated....” EX1001, 2:29-37. The patent does not dictate the programming for calculating the index value for fan rotation speed control, indicating that a persons of ordinary skill in the art would be someone capable of implementing the logic described in the patent without detailed instruction. Further, the patent’s disclosure suggestions someone familiar with the functioning of electronic components as well as temperature and fan rotation speed control. The cited prior art on the face of the ’320 Patent also discusses the ICT equipment, internal temperature control, intake air temperature and electronic component temperature. Thus, the ’320 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.

64. Further, for over 25 years, including when the ’320 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.

65. 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 '320 Patent, including technology relating to thermal management of electronic devices.

66. 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 '320 Patent have been based on the perspective of a person

of ordinary skill in the art in 2012-2013.

67. To the extent that a person of ordinary skill in the art is 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

68. 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.

69. 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.

70. I understand that when a claim limitation recites a generic term (e.g., “means”) with associated functional language it may invoke means-plus-function treatment under Section 112 of the Patent Act. I also understand that when a claim limitation uses the term “means” and functional language, a presumption arises that means-plus-function treatment applies. I understand that means-plus-function language typically begins with “means for” followed by functional language. I also understand that other generic nonce words can substitute for “means” and may still invoke means-plus-function treatment. I further understand that means-plus-function treatment is not appropriate where the claim language supplies sufficient structure for performing the claimed function.

71. I understand that when claim language invokes means-plus-function treatment, the specification must provide corresponding structure such that a person of ordinary skill in the art will understand the structure that performs the recited function. I also understand that the scope of means-plus-function terms will be construed to cover that corresponding structure and equivalents of it. As such, I understand that construction of means-plus-function terms requires identification of a function as well as corresponding structure for that function. I also understand that, for a reference to anticipate or render obvious a means-plus-

function term, it must provide equivalent structure for performing an equivalent function.

72. For purposes of my analysis of the challenged claims of the '320 Patent, I have used the plain and ordinary meaning to a POSITA.

73. I have been asked to address the following two claim terms to clarify how I have applied them in my analysis.

1. declination index value calculation unit (claims 1, 7, 8)

74. Claim 1 of the '320 Patent recites “a declination index value calculation unit that calculates an index value indicating a degree of declination of the component temperature of the electronic component based on a detection result of the first temperature sensor.” EX1001, 9:53-57 (emphasis added). Claim 7 similarly recites “a declination index value calculation unit that calculates an index value indicating a degree of declination of a component temperature of the electronic component included in ICT equipment, based on a detection result of the first temperature sensor that detects the component temperature of the electronic component[.]” EX1001, 10:32-38 (emphasis added). Claim 8 recites the following step: “by a declination index value calculation unit, calculating an index value indicating a degree of declination of a component temperature of an electronic component included in ICT (Information and Communication Technology) equipment, based on a detection result of a first temperature sensor

that detects the component temperature of the electronic component and a second temperature sensor that detects a temperature of an intake air[.]” EX1001, 10:44-52 (emphasis added).

75. I understand that Petitioners do not contend the term “declination index value calculation unit” in claims 1, 7, and 8 is a mean-plus-function limitation under Section 112 ¶6. The claims do not refer to a “means for” performing a function and the term was not construed as a means-plus-function term during prosecution. EX1002, 163-166, 222-225, 232-236, 252-255, 276-278, 295-296. I understand that the Patent Owner does not contend that the term is a means-plus-function limitation in the related litigation. EX1013, 9, 41-51. For purposes of my analysis, I have applied the plain meaning of the term “declination index value calculation unit” in claims 1, 7, and 8.

76. I have also been asked to consider if my opinions expressed below would change if I applied a different construction assuming that the recited “declination index value calculation unit” were construed as a means-plus-function claim. If I make that assumption, I believe that for claim 1 the relevant function performed by the “declination index value calculation unit” would be “calculat[ing] an index value indicating a degree of declination of the component temperature of the electronic component based on a detection result of the first temperature sensor.” For claim 7, the relevant function would be “calculat[ing] an

index value indicating a degree of declination of a component temperature of the electronic component included in ICT equipment, based on a detection result of the first temperature sensor that detects the component temperature of the electronic component.” For claim 8, the relevant function would be “calculat[ing] an index value indicating a degree of declination of a component temperature of an electronic component included in ICT (Information and Communication Technology) equipment, based on a detection result of a first temperature sensor that detects the component temperature of the electronic component and a second temperature sensor that detects a temperature of an intake air.” For each of the three claims, the structure corresponding to the “declination index value calculation unit” would be “CPU 13” configured to calculate the “declination index values” identified in the specification (i.e., EX1001, 5:17-29) and equivalents. I have reviewed my analysis of limitation 1e and the corresponding limitations in claims 7 and 8, and I have concluded that the same disclosures I cite in the prior art would also apply under this assumed reading of the claims. In other words, my opinions expressed below would not change.

2. control unit (claims 1, 7, 8)

77. Claim 1 of the '320 Patent recites “a control unit that controls the number of rotations of the cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the

second temperature sensor.” EX1001, 9:58-10:3 (emphasis added). Claim 7 similarly recites “a control unit that controls the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.” EX1001, 10:38-42 (emphasis added). Claim 8 recites the step: “by a control unit, controlling the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.” EX1001, 10:53-57 (emphasis added).

78. I understand that Petitioners do not contend that the recited “control unit” limitation is a mean-plus-function limitation under Section 112 ¶6. The claims do not refer to a “means for” performing a function and the term was not construed as a means-plus-function term during prosecution. EX1002, 163-166, 222-225, 232-236, 252-255, 276-278, 295-296. I understand that Patent Owner does not contend that the term is a means-plus-function limitation in the related litigation. EX1013, 9, 51-61. For purposes of my analysis, I have applied the plain meaning of the term “control unit” in claims 1, 7, and 8.

79. I have also been asked to consider if my opinions expressed below would change if I applied a different construction assuming that the recited “control unit” were construed as a means-plus-function claim. If I make that

assumption, I believe that for claim 1 the relevant function performed by the “control unit” would be “control[ing] the number of rotations of the cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.” For claim 7, the relevant function would be “control[ing] the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.” For claim 8, the relevant function would be “controlling the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.” For each of the three claims, the structure corresponding to the “control unit” would be “CPU 13” configured to implement the “the control means 172 in the management section 17” identified in the specification (EX1001, 5:45-46) and equivalents. I have reviewed my analysis of limitation 1f and the corresponding limitations in claims 7 and 8, and I have concluded that the same disclosures I cite in the prior art would also apply under this assumed reading of the claims. In other words, my opinions expressed below would not change.

V. PRIOR ART REFERENCES

A. Sato (EX1005)

80. Sato is U.S. Patent Application Publication No. 2011/0176275 entitled

“Cooling Controlling Apparatus, Electronic Apparatus, and Cooling Controlling Method.” EX1005, 1. Sato was filed on January 12, 2011, and was published on July 21, 2011. Sato claims priority to Japanese Patent Application No. 2010-010167, filed on January 20, 2010. EX1005, 1.

81. The Japanese patent application to which Sato claims priority was cited during prosecution of the '320 Patent. The published version (JP 2011-151131) was submitted and identifies itself as Japanese Patent Application No. 2010-010167 (i.e., the Sato priority application). EX1002, 46, 50. An English translation was not requested or provided during prosecution. The Sato priority application was not discussed at all during prosecution.

82. The Japanese application to which Sato claims priority was identified and discussed as “Patent Document 1” in the '320 Patent. EX1001, 1:31-33 (“As ICT equipment having a function of controlling the internal temperature, one disclosed in JP 2011-151131 A (Patent Document 1) has been known, for example.”). Again, the cited “Patent Document 1” is the publication of Japanese Patent Application No. 2010-010167, which is the same foreign application to which Sato claims priority.

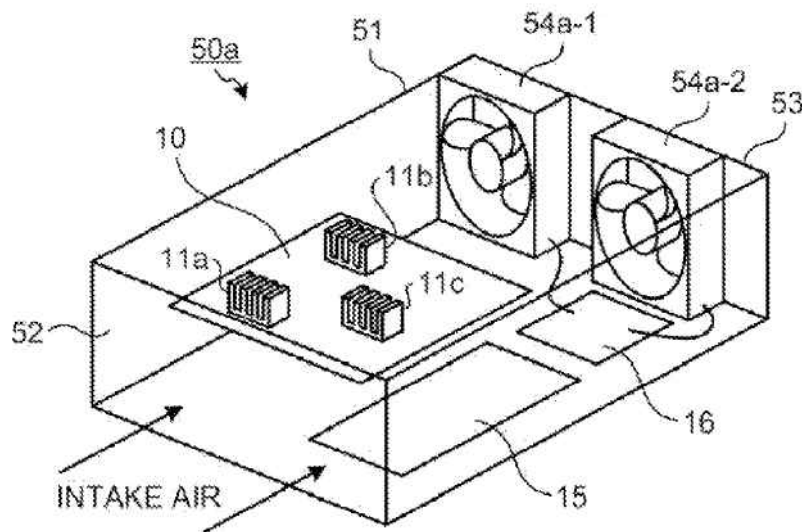
83. Sato discloses a “cooling controlling apparatus that cools an electronic apparatus” that includes cooling fans. EX1005, [0013]. “[A]n intake air temperature detector...detects a temperature of air taken into the electronic

apparatus” and a “part temperature detector...detects a temperature of an electronic part arranged inside the electronic apparatus....” EX1005, [0013]. “[A] fan controller...controls a rotation number of the cooling fan based on the detected temperature of the electronic part and the detected intake air temperature.” EX1005, [0013].

84. Sato describes several embodiments of the disclosed invention using a “server installation” as an example, though Sato states the disclosed technique can be used in other types of electronic devices. EX1005, [0032]; see also EX1005, [0012] (“Here, the challenge lies not only in an information processing apparatus such as a server installation but also similarly in various types of electronic apparatuses which cool a plurality of heat generating parts by using a cooling device.”).

85. Figure 1B provides a perspective view of a first embodiment described by Sato. EX1005, [0033].

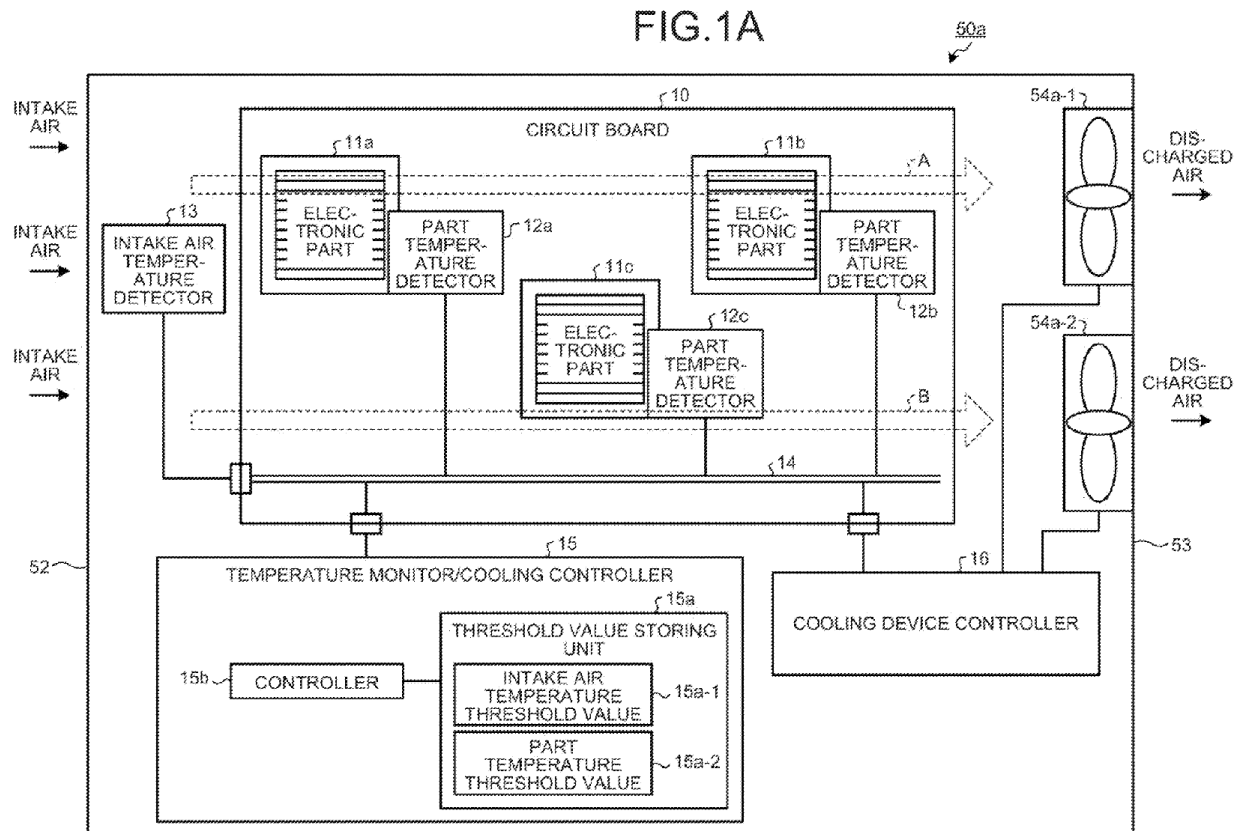
FIG.1B



EX1005, Fig. 1B. “An electronic apparatus 50a according to the first embodiment is provided with, in an inside housing 51 having a cubic shape for example, a circuit board 10, a temperature monitor/cooling controller 15, a cooling device controller 16, and cooling fans 54a-1 and 54a-2....” EX1005, [0033]. The electronic parts 11a, 11b, and 11c are mounted on the circuit board 10 and generate heat. EX1005, [0033]-[0034]. “Cooling air taken in the inside of the housing 51 cools the electronic parts 11a to 11c mounted on the circuit board 10” as indicated by the two arrows in the figure. EX1005, [0039].

86. Figure 1A illustrates “a configuration of an electronic apparatus according to a first embodiment.” EX1005, [0033]. As shown in the figure, each of electronic parts 11a, 11b, and 11c has an associated part temperature detector 12a, 12b, and 12c. Each “part temperature detector” is a “sensor which detects a

temperature of the electronic part....” EX1005, [0042].



EX1005, Fig. 1A. The apparatus also includes an “intake air temperature detector 13” that “detects a temperature of intake air of the cooling air taken in the inside of the housing 51 via the intake air surface of the front plate 52.” EX1005, [0044].

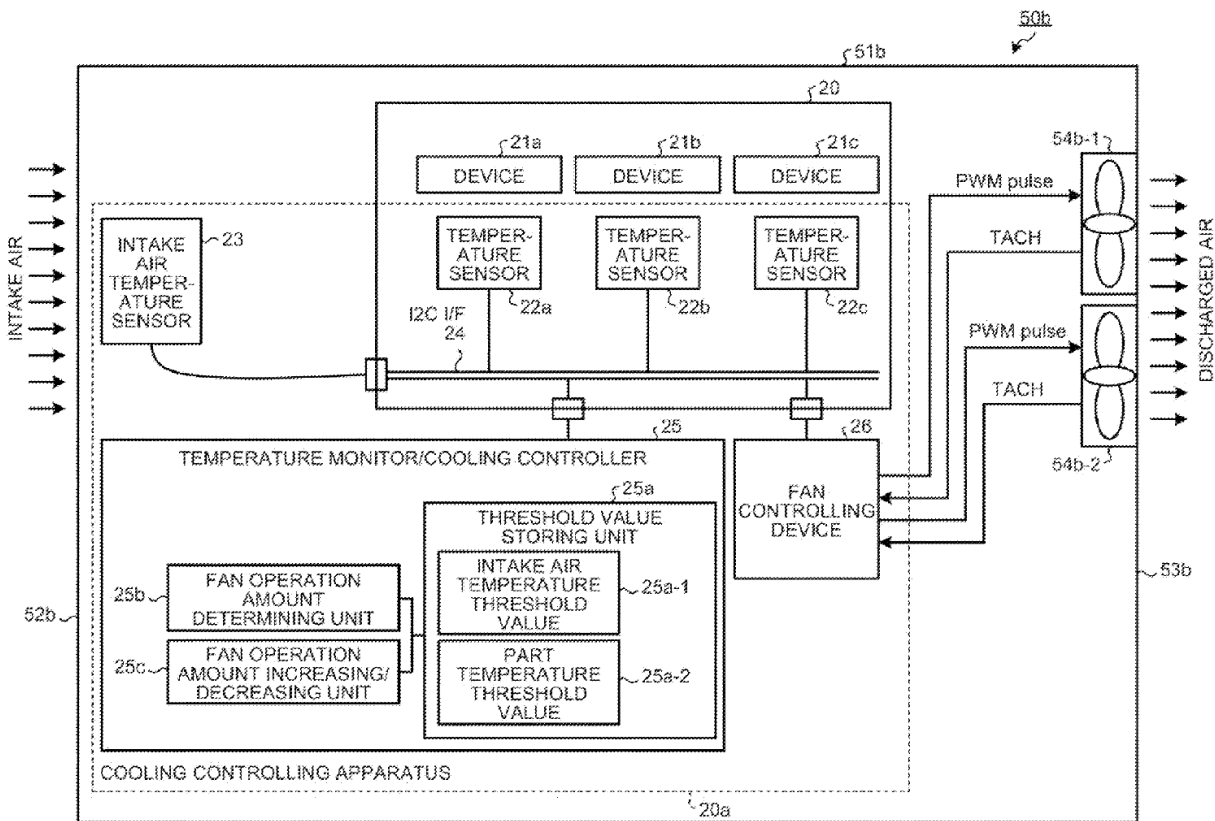
87. The temperatures detected by the part temperature detectors and the intake air temperature detector are provided to “the temperature monitor/cooling controller 15.” EX1005, [0045]. The temperature monitor/cooling controller 15 includes “controller 15b,” which “compares the intake air temperature of the cooling air detected by the intake air temperature detector 13” it to certain threshold values. EX1005, [0046], [0050]. Based on the comparison, “the

controller 15b determines the number of rotation of the cooling fans 54a-1 and 54a-2....” EX1005, [0051]. After a “waiting time period,” the controller 15b compares the temperatures of the electronic parts to certain threshold values and, based on the comparison, adjusts the number of rotations up or down. EX1005, [0053], [0057]-[0058]. After another “waiting time period,” controller 15b repeats the process of using the intake air temperature to set the fan speed and then further adjusts it based on the electronic part temperatures. EX1005, [0059].

88. Thus, in Sato’s fan control technique, the number of rotations of the cooling fans 54a-1 and 54a-2 is “determined based on the intake air temperature” and “is further increased/decreased according to a temperature of each electronic part in the first embodiment.” EX1005, [0064]. Sato states that by using the disclosed technique, “noise of a fan rotation of a cooling device and an excessive electric power consumption caused by an excessive cooling of an electronic part can be avoided appropriately.” EX1005, [0064].

89. Figure 2 illustrates a second embodiment employing a similar cooling technique. Like the first embodiment, this embodiment is illustrated as “a server installation 50b” with “an inside housing 51b, a system board 20, an intake air temperature sensor 23, a temperature monitor/cooling controller 25, a fan controlling device 26, and cooling fans 54b-1 and 54b-2.” EX1005, [0065].

FIG.2



EX1005, Fig. 2. As illustrates, several “devices” (i.e., electronic parts that generate heat) are mounted on the system board 20. EX1005, [0067]-[0068]. Each device 21a, 21b, and 21c has an associated “temperature sensor” 22a, 22b, and 22c. EX1005, [0068]. “The temperature sensors 22a to 22c notify detected temperatures of the devices respectively to the temperature monitor/cooling controller 25.” EX1005, [0071]. In addition, “the intake air temperature sensor 23 detects the temperature of intake air” and “notifies a detected intake air temperature to the temperature monitor/cooling controller 25.” EX1005, [0070]-[0071].

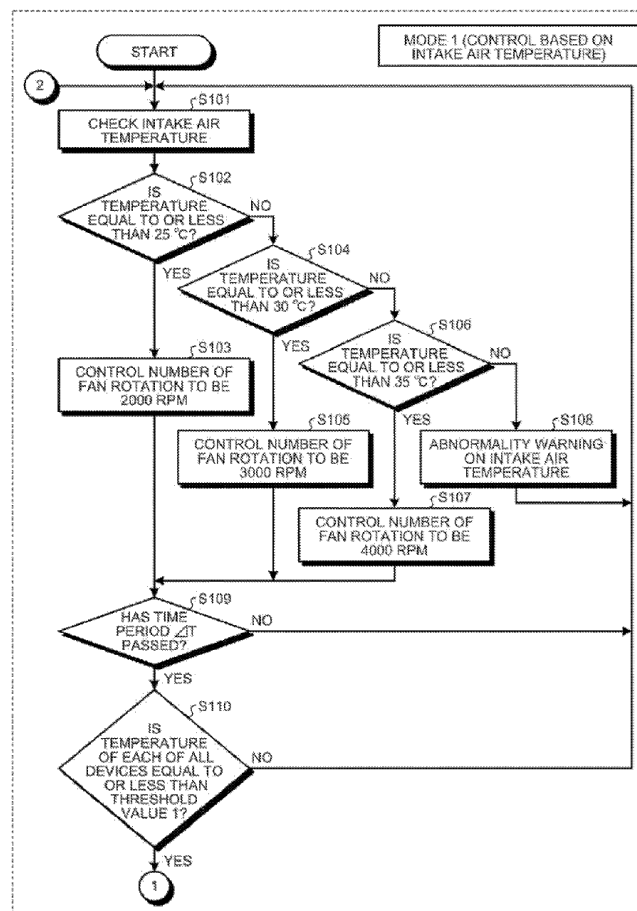
90. In the apparatus, a “fan operation amount determining unit 25b compares an intake air temperature of the cooling air detected by the intake air temperature sensor 23 to the intake air temperature value 25a-1.” EX1005, [0076]. “The fan operation amount determining unit 25b then determines the number of rotation of the cooling fans 54b-1 and 54b-2 depending on a result of the comparison.” EX1005, [0076]. “[A]fter a waiting time period,” the “fan operation amount determining unit 25b then performs” adjustments to the fan speed based on a comparison of device temperatures to certain threshold values. EX1005, [0078]-[0080]. Thus, as in the first embodiment, the fan control technique of the second embodiment sets the number of rotations of the cooling fans based on “intake air temperature” and then adjusts the fan speed based on component temperatures (as I will discuss further in connection with Figures 4A and 4B). *Id.*, [0085]-[0103], Figs. 4A-4B.

91. Figures 4A and 4B are flow charts that together illustrate the fan control technique disclosed by Sato. The flow charts are described in the context of Sato’s second embodiment, but the process is similar to the fan control described for the first embodiment as well (i.e., set the fan speed based on intake air temperature, adjust it based on device temperature, and repeat). EX1005, [0050]-[0064]. The fan control technique of the second embodiment sets the number of rotations of the cooling fans based on “intake air temperature” and then

adjusts the fan speed based on component temperatures. EX1005, [0085]-[0103].

92. The two figures show separate parts of a single flow chart illustrating the fan control process performed by the temperature monitor/cooling controller 25. EX1005, [0085]. Figure 4A illustrates the part of the process Sato refers to as “mode 1,” which is fan control primarily based on the intake air temperature. EX1005, [0085].

FIG.4A



EX1005, Fig. 4A. The process begins at the top of Figure 4A (“START”). In step S101, the intake air temperature is obtained. EX1005, [0086]. Based on a

comparison of the intake air temperature to certain thresholds, the number of fan rotations is selected. EX1005, [0086]-[0087]. For example, if the intake air temperature is at or below the lowest threshold value (S102=Yes), the number of fan rotations is set at 2000 rotations per minute (S103). EX1005, [0087]. If the intake air temperature is above the lowest threshold value but at or below the next threshold (S104=Yes), the number of fan rotations is set at 3000 rotations per minute. EX1005, [0091]. After a certain period of time has passed (S109=Yes), the device temperatures are checked and if they are below a particular threshold value the process reaches the point indicated by the number “1” at the bottom of the flow chart in Figure 4A.

93. When the process reaches the point indicated by the number “1” in Figure 4A, it proceeds to the top of the flow chart in Figure 4B. EX1005, [0097].

FIG.4A

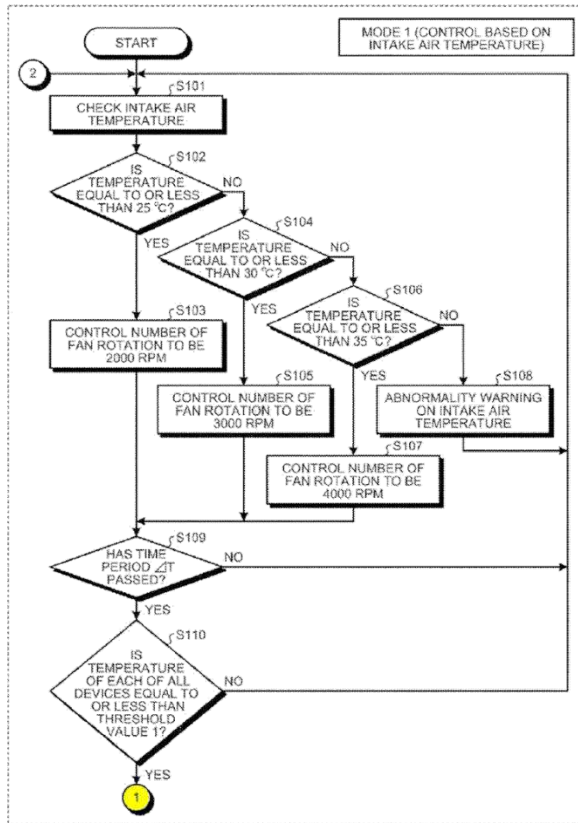
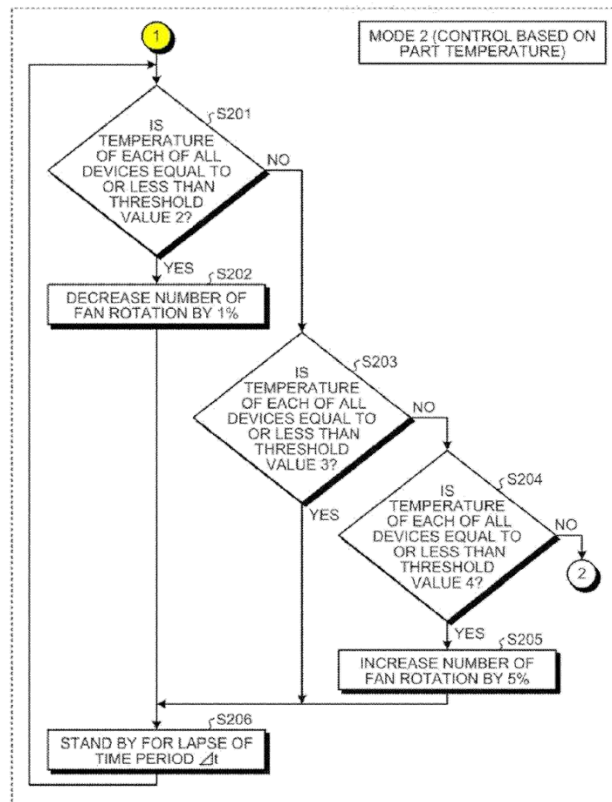


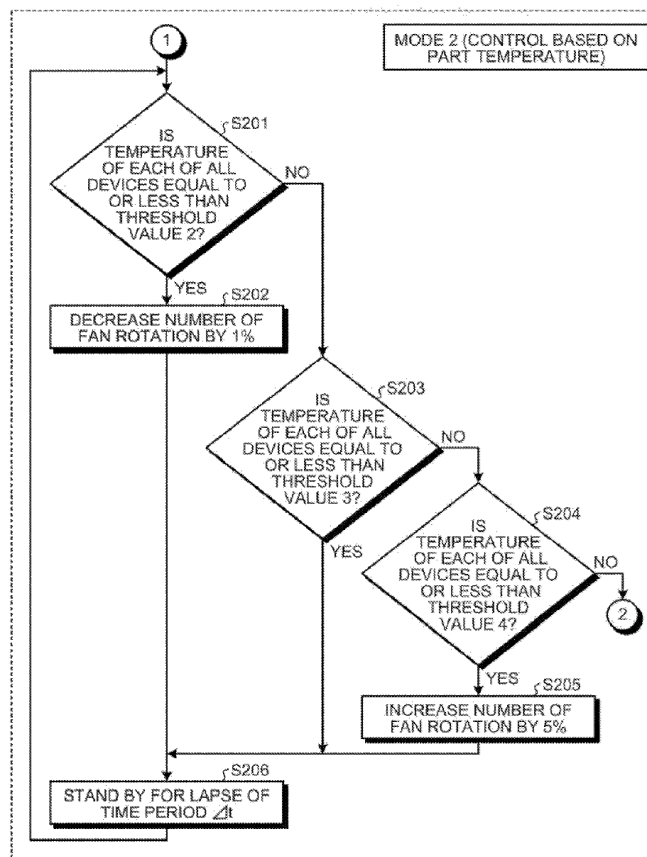
FIG.4B



EX1005, Figs. 4A-4B (highlighted).

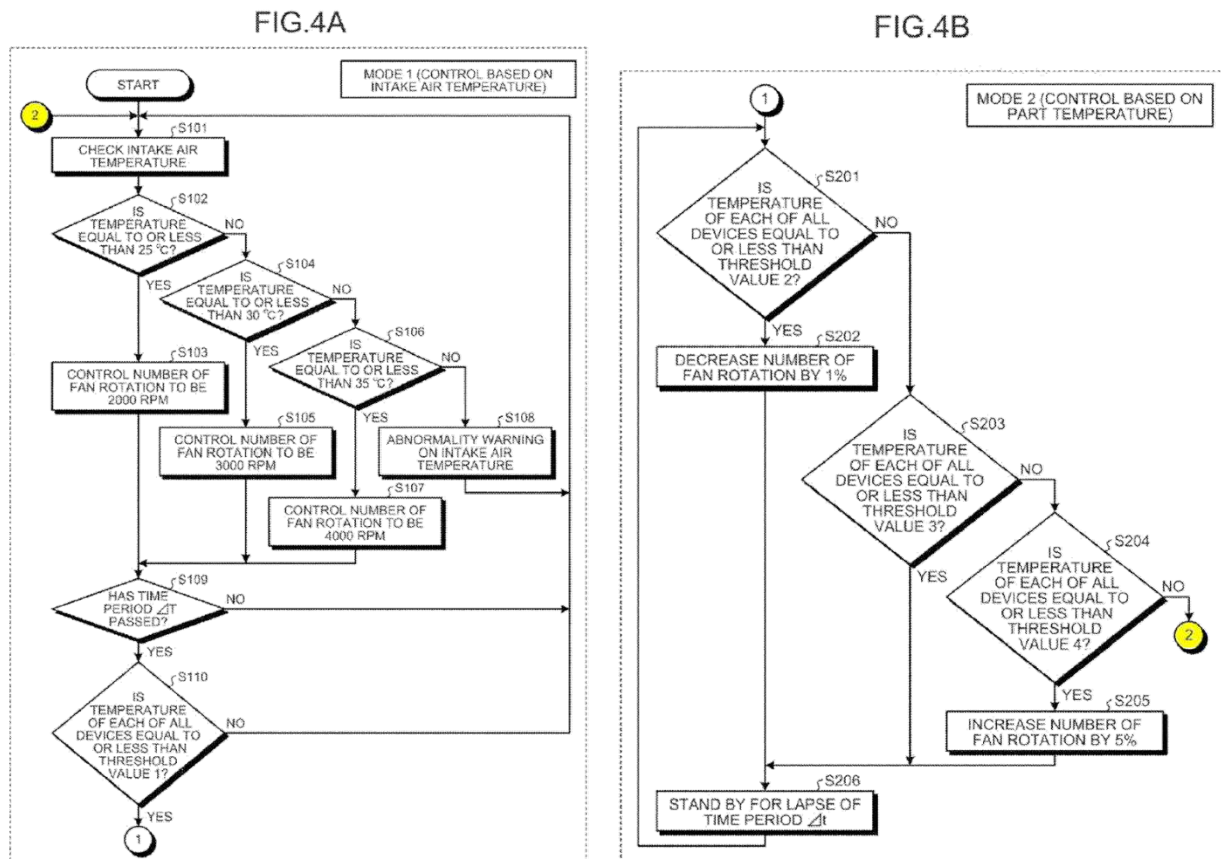
94. Figure 4B illustrates the part of the process that Sato refers to as “mode 2,” which is primarily based on device temperature. EX1005, [0085].

FIG.4B



EX1005, Fig. 4B. In mode 2, the device temperatures are used to make adjustments to the fan speed. If the device temperatures are at or below a lower threshold value (S202=Yes), the number of fan rotations is decreased by 1% (S202). If the device temperatures are above the lower threshold but at or below the next threshold value (S203=Yes), the number of fan rotations is unchanged. If the device temperatures exceed this next threshold but are at or below the next higher threshold value (S204=Yes), the number of fan rotations is increased by 5% (S205). Finally, if the device temperature exceed the highest threshold (S204=No), the process reaches the point indicated by the number “2” in the figure.

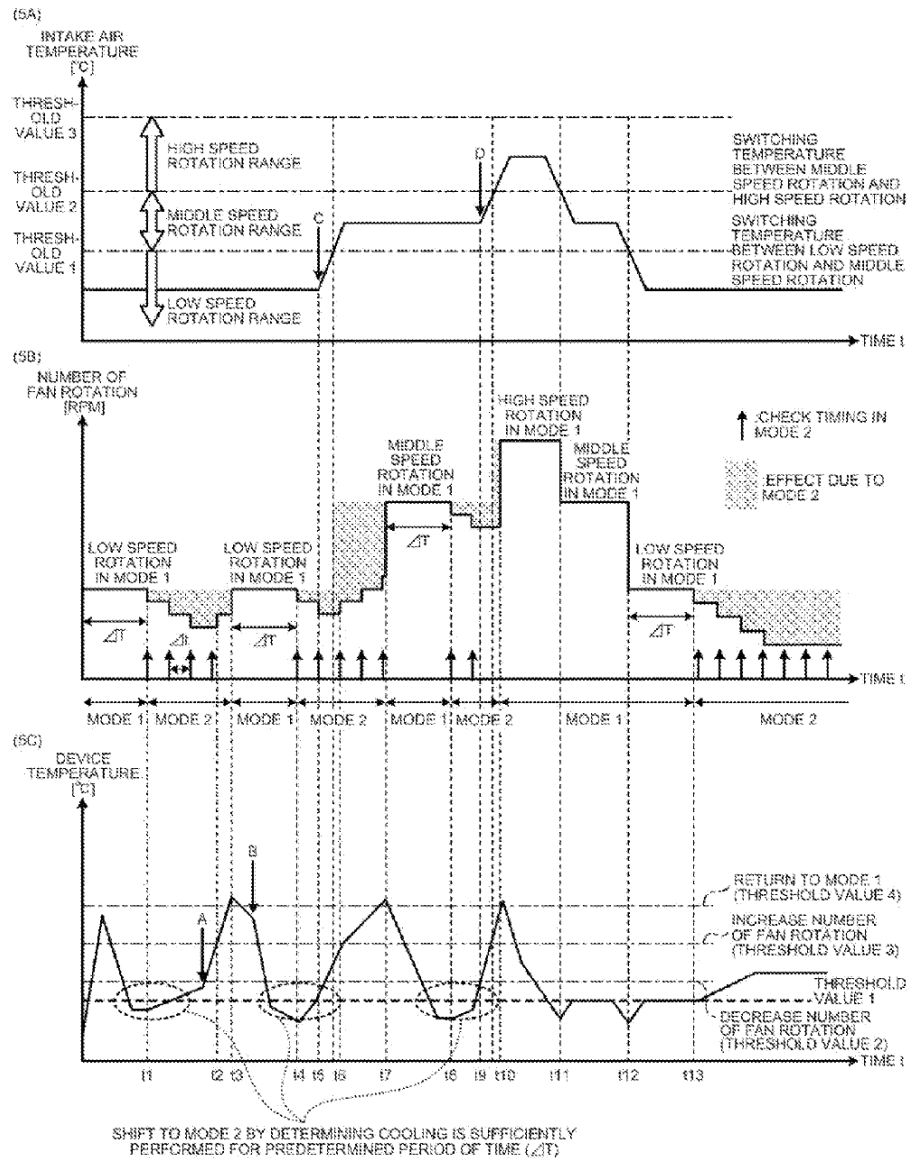
95. When the process reaches the point in Figure 4B indicated by the number “2” the process returns to the top of the flow chart in Figure 4A. EX1005, [0101].



EX1005, Figs. 4A-4B (highlighted). Thus, the two figures illustrate a single flow chart describing Sato’s fan control process that shifts back and forth between mode 1 and mode 2 in a permanent loop.

96. Figure 5 shows three related charts illustrating the temporal change of the number of fan rotations (5B) depending on the intake air temperature (5A) and device temperatures (5C) based on “the cooling fan controlling process according to the second embodiment.” EX1005, [0104].

FIG. 5



EX1005, Fig. 5. Starting from the left side of the charts, the fan speed is initially set at low speed (in 5B) because the intake air temperature (in 5A) is below the lowest threshold. After a period of time indicated by ΔT (e.g., 30 minutes), the process switches from mode 1 to mode 2 at the point in time indicated by t_1 (in 5C). EX1005, [0105]. Because the device temperatures are below the lowest

threshold at that point in time, the process decreases the fan speed three times between t1 and t2 (in 5C). EX1005, [0106]. At t2, the device temperature has risen sufficiently to cause the process to increase the fan speed, and at t3 the device temperatures are high enough to exceed the highest threshold and cause the process to switch back to mode 1 with the fan speed set based on the intake air temperature, which is still below the lowest threshold value. EX1005, [0106].

97. Continuing from left to right, the three charts show how changes in the intake air temperature and device temperature lead to changes in the fan speed. As Sate states: “FIG. 5 illustrates an intake air temperature, the number of fan rotation, and a device temperature based on the intake air temperature (mode 1) and the control based on the part temperature (mode 2)....” EX1005, [0104]. In 5B, “a hatching portion in the number of fan rotation represents a region in which a fan electric power and a noise can be reduced compared to the conventional technique.” EX1005, [0104].

98. As explained in Sato, “since the number of rotation of the cooling fans 54b-1 and 54b-2 r [RPM] which is determined according to the intake air temperature is further increased or decreased according to the temperature of each device, the number of fan rotation can be controlled carefully in the second embodiment.” EX1005, [0114].

99. A person of ordinary skill in the art would naturally consider Sato.

Both Sato and the '320 Patent are in the same field of endeavor (i.e., electronic devices including computers). Also, Sato and the '320 Patent both address the same problem of cooling semiconductor components within electronic device enclosures.

B. Nakamura (EX1007)

100. Nakamura is an English translation of Japanese Patent No. 4511444 entitled “Electronic device enclosure interior cooling system, cooling method and electronic device.” EX1006, 1. Nakamura was filed on October 26, 2005, was registered on May 14, 2010, and was published on July 28, 2010. Nakamura was not cited during prosecution of the '320 Patent.

101. Nakamura describes “a control scheme for a cooling fan for evacuating generated heat from the interior of an electronic device enclosure...” EX1007, [0001]. “Electronic devices such as computer systems comprise electrical components inside an enclosure” including “chips such as CPUs,” “storage devices such as hard disks, power supply units,” etc., “where the respective electrical components generate heat during operation.” EX1007, [0002]. Nakamura explains that “the amount of heat generated by internal electrical components varies depending on the operational state.” EX1007, [0003]. “For example, in the case of a CPU, heat generation increases during high-load processing when executing application software, while during low-load processing,

heat generation decreases.” EX1007, [0003]. Thus, “computer systems are provided with mechanisms to control cooling fan rotational speed according to the interior temperature of the enclosure.” EX1007, [0003].

102. Nakamura explains that “[w]hen the amount of heat generated in the interior of the enclosure becomes nearly equal to the amount of heat evacuated to the exterior and the interior of the enclosure approaches thermal equilibrium, the interior temperature of the enclosure can no longer decrease readily and so the rate of temperature decrease stagnates.” EX1007, [0007]. “[I]f the rate of decrease of the interior temperature of the enclosure becomes stagnated at a temperature value higher than the set temperature” at which the fan is turned off, “the cooling fan continues to rotate without stopping” even though the fan is no longer reducing the internal temperature (i.e., it has stagnated). EX1007, [0008]. Nakamura states that “[t]his phenomenon is likely to occur when switching a computer from a high-load state to a temporary standby state, and since the cooling fan continues to rotate even after their work is finished,” the fans cause more noise and use more power than necessary. EX1007, [0008].

103. Nakamura discloses providing “a cooling system that can detect the state where the rate of temperature decrease has stagnated before the interior temperature of the enclosure reaches the set temperature value for transitioning from low speed rotation to stop, and can stop the rotation of the cooling fan,

reducing both user discomfort from noise and power consumption.” EX1007, [0009]. Nakamura also states that “[w]hen it is determined that the rate of decrease of the internal temperature of the enclosure has stagnated, instead of immediately stopping rotation of the cooling fan, the rotational speed of the cooling fan can also be temporarily increased to lower the internal temperature of the enclosure to the first set temperature value before stopping.” EX1007, [0015]. Nakamura refers to this brief increase in fan speed before stopping as a “pre-stop state.” EX1007, [0015].

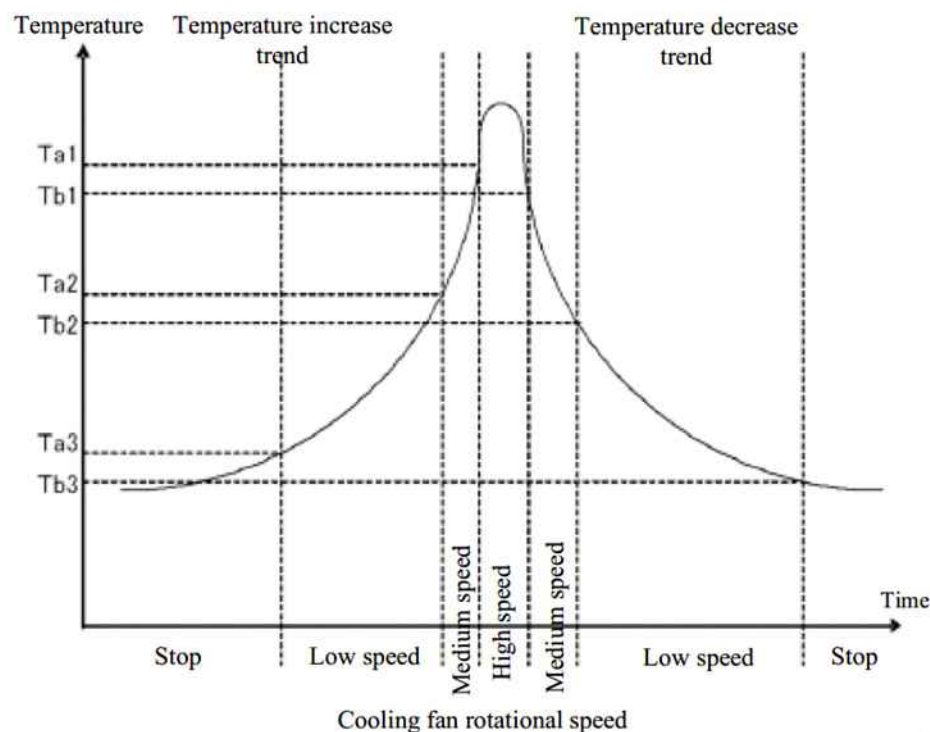
104. Nakamura’s process uses “interior temperature” in controlling the rotational speed of the cooling fan. “The interior temperature of the enclosure is measured by means of a temperature sensor installed in the interior space of the enclosure, a temperature sensor embedded in the CPU, a temperature sensor attached to the board, etc.” EX1007, [0011]. In particular, Nakamura explains, in reference to Figure 2, that “[m]ultiple temperature sensors 58...are mounted on the boards of, or in the vicinity of, the CPU 22, video subsystem 34, hard disk drive 44, power supply unit (not illustrated), etc.” EX1007, [0028]. “[T]he temperatures measured by these various temperature sensors [are] referred to as the interior temperature of the enclosure” by Nakamura. EX1007, [0028].

105. A “cooling fan drive circuit generates and supplies voltage at a frequency corresponding to the speed signal received from the environment system

controller 56 to the cooling fan 14, changing the speed of or stopping the cooling fan 14.” EX1007, [0029].

106. Nakamura’s Figure 3 “shows the relationship between the interior temperature of the enclosure and the operation of the cooling fan 14.” EX1007, [0031].

[FIG. 3]



EX1007, Fig. 3. As illustrated, the fan speed is changed at predetermined threshold values, shown on the Y axis by values Ta1, Ta2, and Ta3 (increasing temperatures) and values Tb1, Tb2, and Tb3 (decreasing temperatures). EX1007, [0031]. Nakamura explains that “[w]hen the temperature measured by the temperature sensor 58 has an increasing trend, the set temperature values include

set temperature value Ta3 for transitioning from stop to low speed rotation, set temperature value Ta2 for transitioning from low speed rotation to medium speed rotation, and set temperature value Ta1 for transitioning from medium speed rotation to high speed rotation.” EX1007, [0031]. Similarly, “[w]hen the interior temperature of the enclosure has a decreasing trend, the set temperature values include set temperature value Tb1 for transitioning from high speed rotation to medium speed rotation, set temperature Tb2 for transitioning from medium speed rotation to low speed rotation, and set temperature value Tb3 for transitioning from low speed rotation to stop.” EX1007, [0031].

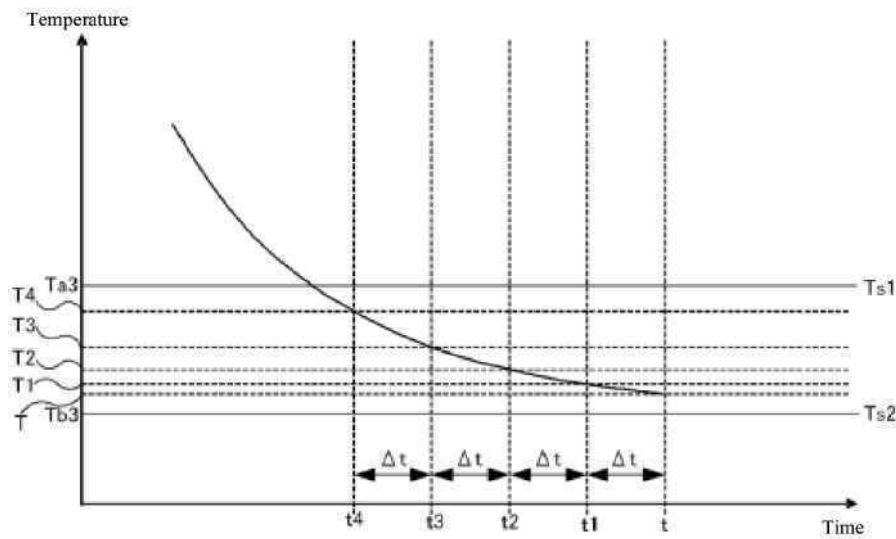
107. Nakamura describes the particular case “where processing that places a large load on the CPU 22 terminates and the CPU transitions to an idle state.” EX1007, [0032]. Because “CPU 22 transitions from a state of high heat generation to a state of low heat generation,” cooling fan 14 initially operates at high speed rotation but switches to medium and then low speed rotations as the interior temperature decreases. EX1007, [0032]. “When the rotational speed of the cooling fan 14 decreases to low speed rotation, since the amount of heat evacuated to the exterior of the enclosure 12 decreases, the rate of temperature decrease also becomes more gradual,” as can be seen in Figure 3. EX1007, [0032]. Nakamura explains that “[i]f the interior temperature of the enclosure 12 continues to decrease in the same manner and falls below Tb3, the cooling fan will stop.”

EX1007, [0032]. This is the situation illustrated in Figure 3. But “[i]f the interior temperature of the enclosure 12 stagnates at a temperature value slightly above Tb3, the cooling fan 14 will continue to rotate without stopping.” EX1007, [0032].

108. In Nakamura’s disclosed invention, “the state where the rate of decrease of the interior temperature of the enclosure 12 has stagnated is appropriately detected, and the cooling fan 14 is stopped.” EX1007, [0033]. Nakamura notes that “[t]here are several methods conceivable for detecting this state” and described three such “detection methods.” EX1007, [0033].

109. First detection method: Nakamura’s Figure 4 “illustrates the concept of the first detection method.” EX1007, [0034]. The figure shows the internal temperature reading provided by sensor 58 with a “declining trend” as it decreases below the temperature Ta3, which is the point at which the fan speed is transitioned from medium to low. EX1007, [0035]; *see also* Fig. 3. (I will note that Nakamura also identifies the temperature Ta3 as Ts1, which indicates the upper end of the “set temperature range” with Ts2 at the lower end).

[FIG. 4]



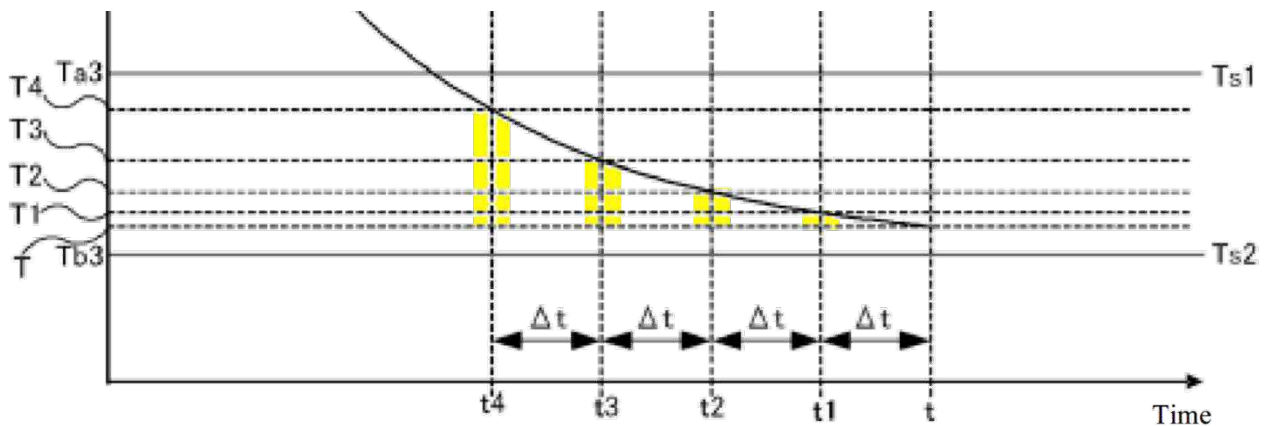
EX1007, Fig. 4. The temperature continues to decrease but stays above T_{b3} , which is the point at which the fan would be instructed to stop. EX1007, [0035]; *see also* Fig. 3. Thus, the graph shows the temperature stagnating at a temperature level that would normally cause the fan to remain on low speed indefinitely, which is the situations Nakamura’s invention is intended to address. EX1007, [0032] (“If the interior temperature of the enclosure 12 stagnates at a temperature value slightly above T_{b3} , the cooling fan 14 will continue to rotate without stopping.”).

110. In Nakamura’s first detection method, “the interior temperature of the enclosure 12 is sampled at fixed sampling intervals Δt ...” EX1007, [0034]. As Nakamura explains, “when the interior temperature of the enclosure 12 is within the set temperature range between T_{s1} and T_{s2} , the environment system controller 56 processes signals from the temperature sensor 58 at a sampling interval Δt .” EX1007 [0036]. In Figure 4, the current time is indicated by t on the x-axis and

the temperature at that time is indicated by T on the y-axis. EX1007, [0036]. The “past sampling times” are indicated by t_1 , t_2 , t_3 , and t_4 , while the temperatures at those sampling times are indicated by T_1 , T_2 , T_3 , and T_4 , respectively. EX1007, [0036].

111. Nakamura’s first detection method uses the difference in temperature at each sampling time compared to the current temperature to determine if the rate of decreasing temperature has stagnated. EX1007, [0037]. As Nakamura explains, “[w]hen the rate of temperature decrease stagnates, the difference between the current temperature value T and the temperature values at each sampling time gradually becomes smaller.” EX1007, [0037]. “For example, the temperature difference ($T_3 - T$) between current time t and time t_3 becomes smaller than the temperature difference ($T_4 - T$) between the current time t and time T_4 .” EX1007, [0037].

112. The following partial view of Figure 4 illustrates the temperature comparisons used in Nakamura’s first detection method to determine the rate of temperate decrease over time.

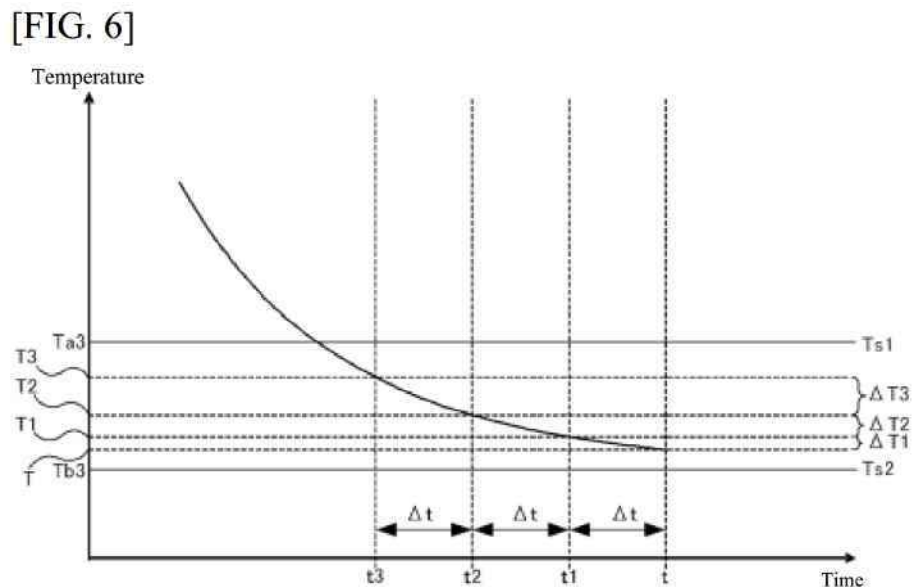


EX1007, Figure 4 (partial, highlighted). As illustrated, Nakamura determines the rate of temperature decrease by calculating the difference in temperature over time compared to the current temperature is becoming smaller (i.e., the line is becoming closer to horizontal).

113. Nakamura’s “temperature control program” can determine that the rate of temperature decrease has stagnated when the temperature difference “between current time t and the previous sampling time t_1 is at or below a predeterminate value.” EX1007, [0037]. “Alternatively, to more reliably determine the stagnation state, the temperature control program” can determine that the rate of temperature decrease has stagnated when “the differences between the current temperature value T and three past temperature values ($T_1 - T$, $T_2 - T$, $T_3 - T$) are all at or below a predetermined value.” EX1007, [0037]. When Nakamura’s “environment system controller” detects that the rate of decrease of the interior temperature has stagnated, it stops the cooling fan 14. EX1007, [0037]. In the example of Figure 4, “the cooling fan 14 is stopped before the decreasing

temperature of the interior of the enclosure 12 reaches set temperature T_{b3} ” (i.e., the temperature threshold that would otherwise trigger stopping the fan). EX1007, [0037].

114. Second detection method: Nakamura’s Figure 6 “is a diagram describing the concept of the second detection method.” EX1007, [0038]. As in the prior figure, Figure 6 shows the internal temperature with a “declining trend” as it decreases below the temperature T_{a3} , which is the point at which the fan speed is transitioned from medium to low. EX1007, [0038]; *see also* Fig. 3. (Nakamura refers to T_{s1} , which is the upper end of the set temperature range and is equal to T_{a3} .)

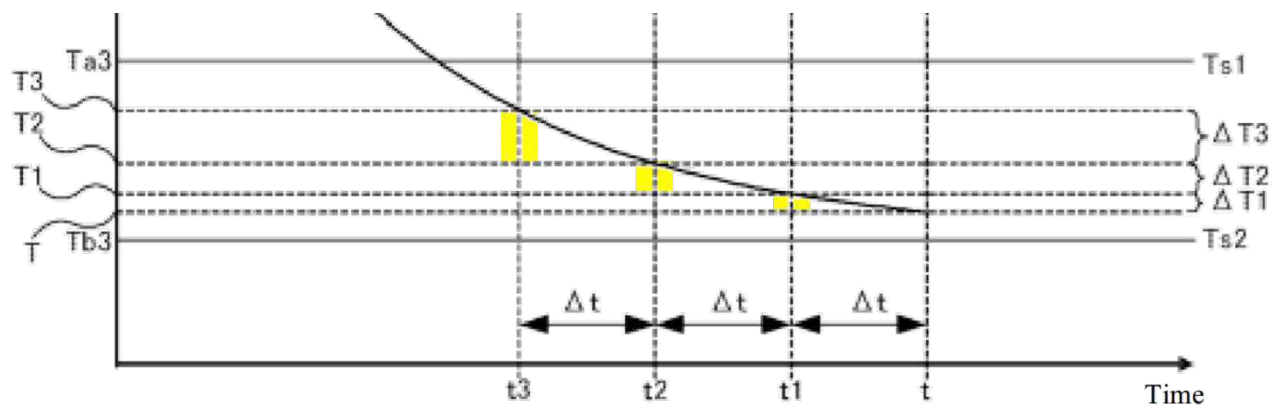


EX1007, Fig. 6. As in the first detection method, the internal temperature of the enclosure is obtained using sensor 58 at the current time t and past sampling times t_1 , t_2 , and t_3 . But unlike the first detection method, the second detection method is

based on a comparison of the temperatures from one sampling time to the next.

The relevant temperature differences for this method are “ $\Delta T1=T-T1$, $\Delta T2=T1-T2$, $\Delta T3=T2-T3$” EX1007, [0038]. “[A]s the rate of temperature decrease stagnates, the temperature differences become smaller in the order $\Delta T3$, $\Delta T2$, $\Delta T1$.” EX1007, [0038].

115. The following partial view of Figure 6 highlights the temperature comparisons used in Nakamura’s second detection method to determine the rate of temperate decrease over time.

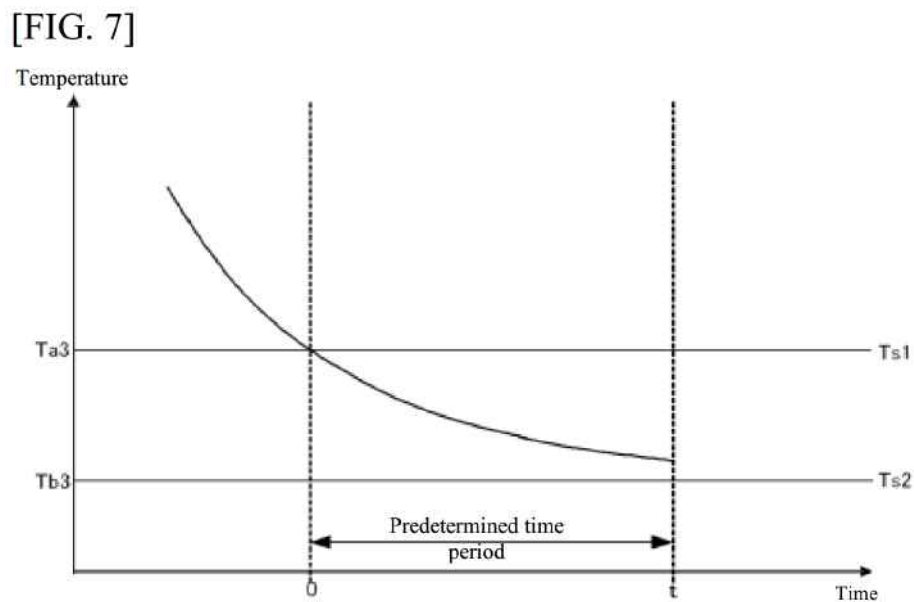


EX1007, Fig. 6 (partial, highlighted). As illustrated, Nakamura determines the rate of temperature decrease by determining that the difference in temperature from one sampling time to the next sampling time is becoming smaller (i.e., the line is becoming closer to horizontal).

116. Nakamura’s “temperature control program” determines that the rate of temperature decrease has stagnated when the “change in temperature difference between sampling intervals becomes smaller than a predetermined value.”

EX1007, [0038]. Then Nakamura's "environment system controller" stops the cooling fan 14. EX1007, [0038].

117. Third detection method: Nakamura's Figure 7 "is a diagram describing the concept of the third detection method." EX1007, [0039]. As in the prior figures, Figure 7 shows the internal temperature with a "declining trend" as it decreases below the temperature T_{a3} , which is the point at which the fan speed is transitioned from medium to low. EX1007, [0039]; *see also* Fig. 3. (As noted above, Nakamura refers to T_{s1} and T_{s2} as the set temperature range, which is the same as the range between T_{a3} —where the fan switches from medium to low speed—and T_{b3} —where the fan stops.)



EX1007, Fig. 7.

118. In the third detection method, a "time measurement starts at $t=0$ at the

time point the interior temperature of the enclosure 12 decreases and falls below Ts1.” EX1007, [0039]. If the temperature remains within the range between Ts1 and Ts2 (or Ta3 and Tb3) for a predetermined amount of time, the “environment system controller detects a state where the decrease in interior temperature of the enclosure 12 has stagnated” and stops cooling fan 14. EX1007, [0039].

119. A person of ordinary skill in the art would naturally consider Nakamura. Both Nakamura and the '320 Patent are in the same field of endeavor (i.e., electronic devices including computers). Also, Nakamura and the '320 Patent both address the same problem of cooling semiconductor components within electronic device enclosures.

C. Jin (EX1009)

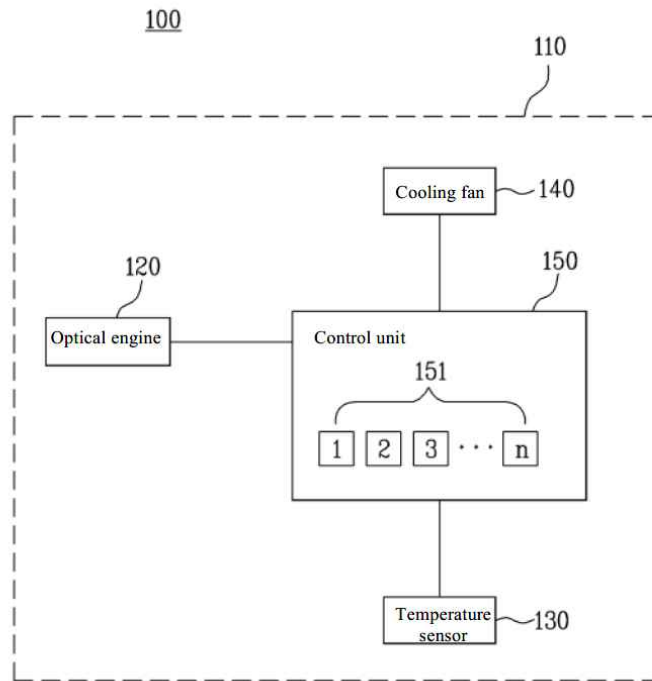
120. Jin is an English translation of Korean Patent Publication No. KR20100028353 entitled “Projector and a Method of Controlling the Projector.” EX1009, 1. Jin was filed on September 4, 2008, and was published on March 12, 2010. Jin was not cited during prosecution of the '320 Patent.

121. Jin states that in prior art projectors, “[t]he lamp used as the light source is mounted inside the projector housing and generates a large amount of heat.” EX1009, [0003]. “In addition to the lamp, the substrates equipped with various circuit components and the composite-based components that convert the image signals and synthesize them to light supplied by the lamp also have a

significant amount of heat generation.” EX1009, [0003]. “Thus, the projector is provided with a cooling fan, temperature sensor, etc., inside it, and the speed of the cooling fan increases or decreases depending on the temperature inside the projector to cool it down.” EX1009, [0004].

122. Jin describes an invention that “relates to a projector and a method for controlling the projector, which can effectively control the rotation speed of a fan by predicting temperature changes inside the projector.” EX1009, 1 (Summary); *see also* EX1009, [0001]. Because “the temperature change inside the projector can be predicted in advance, the temperature inside the projector can be effectively reduced, and noise generated by the cooling fan provided inside the projector can be minimized.” EX1009, 1 (Summary).

123. Figure 1 is a “schematic illustration of a projector according to the present invention” that includes “a housing (110) forming an outer shape; wherein an optical engine (120) that converts an input image signal into projection light and projects it; at least one temperature sensor (130) mounted inside the housing (110); a cooling fan (140) mounted inside the housing (110); and a control unit (150) that controls the cooling fan (140) using the temperature measured by the temperature sensor (130) and has a plurality of memory buffers (151) capable of storing the temperature measured by the temperature sensor (130).” EX1009, [0030].

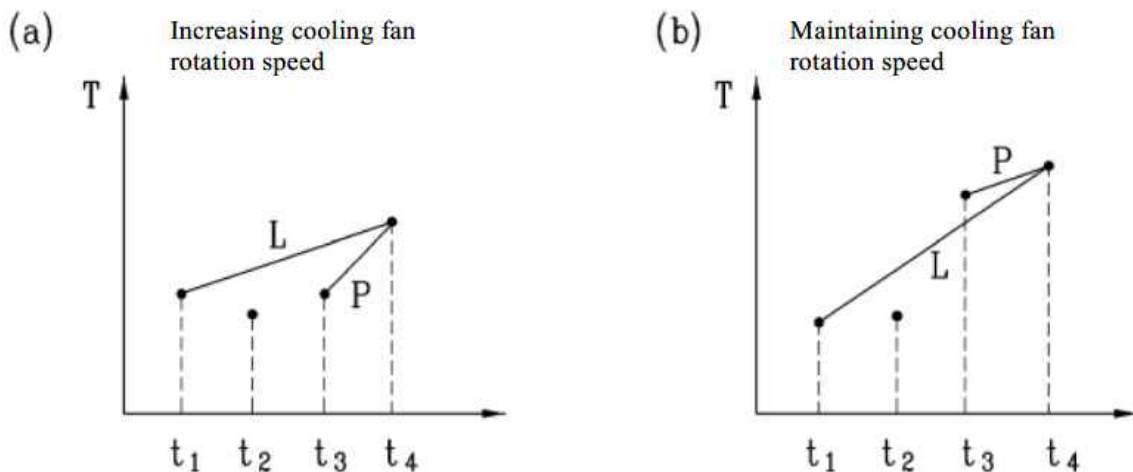


EX1009, Fig. 1.

Jin explains that, “[b]y providing a plurality of memory buffers (151) in the control unit (150) to store the temperature inside the projector housing (110) at predetermined time intervals, the temperature within the projector housing (110) can be predicted and the rotation speed of the cooling fan (140) can be controlled by the method” described by Jin. EX1009, [0039]. Thus, in Jin, “the temperature may be measured and stored at predetermined time intervals.” EX1009, [0047]. Then “[t]he temperature inside the projector is predicted based on the calculated temperature change rate by calculating the temperature change rate of at least two or more using the temperature stored in the memory buffer (151).” EX1009, [0040].

124. Jin describes a “change rate calculation step (S200),” with regard to Figure 2, used “to predict the future temperature changes by comparing the overall temperature changes with the recent temperature changes.” EX1009, [0052]. As illustrated in Figure 5, Jin compares “the rate of change of temperature...that can determine the trend of overall temperature change inside the projector” (referred to as “L”) “with the rate of change of temperature...that can determine the trend of recent temperature change inside the projector” (referred to as “P”). EX1009, [0061].

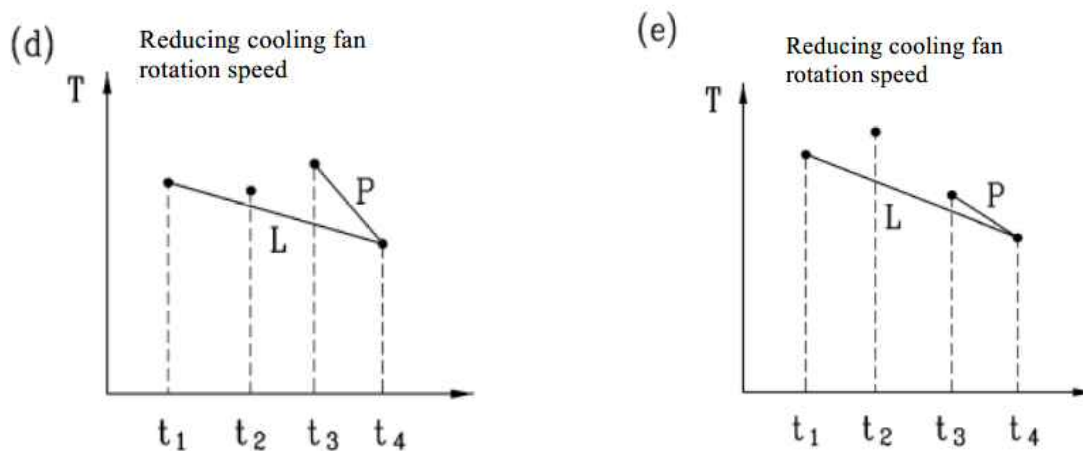
125. For example, in Figure 5(a), the trend of overall temperature change (L) is increasing modestly while the trend of recent temperature change (P) is increasing more steeply. In this, case Jin would predict further increase in temperature and increase the cooling fan rotation speed.



EX1009, Fig. 5(a), (b). In Figure 5(b), the trend of overall temperature change (L)

is increasing steeply while the trend of recent temperature change (P) is increasing more modestly. In this, case Jin would predict slowing of temperature increase and maintain the cooling fan rotation speed. EX1009, [0076]-[0085], [0091].

126. Jin's temperature control method also applies when temperature is declining. EX1009, [0072], [0075]. For example, in Figures 5(d) and 5(e), the tend of overall temperature change (L) is cooling and the trend of recent temperature change (P) is cooling even more quickly.



EX1009, Fig. 5(d), (e). Jin states that “[i]n cases of (d) and (e), the temperature decrease is occurring at a sufficient rate with reference to the overall first temperature change rate (L) and second temperature change rate (P) inside the projector, so it can be determined that the speed of the cooling fan (140) can be reduced.” EX1009, [0092].

127. A person of ordinary skill in the art would naturally consider Jin. Both Jin and the '320 Patent are in the same field of endeavor (i.e., electronic

devices). While Jin discloses a projector and the '320 Patent discloses a computer, these electronic devices are in the same field of endeavor because they similarly involve an electronic device enclosure containing heat generating semiconductor components, cooling fans, temperature sensors, and fan controllers. Further, both Jin and the '320 Patent address the same problem of managing the temperature of electronic components within the electronic device enclosure. Also, they address the same problem in a similar manner by using temperature readings from temperature sensors to adjust the speed of cooling fans in the enclosure to manage temperature.

VI. THE CHALLENGED CLAIMS ARE RENDERED OBVIOUS BY THE COMBINATION OF SATO AND NAKAMURA

128. In my opinion, the challenged claims of the '320 Patent are rendered obvious by Sato in combination with Nakamura for the reason I discuss below.

A. Motivation to Combine Sato and Nakamura

129. It would have been natural for a POSITA to consider both Sato and Nakamura because, like the '320 Patent, both prior art references are directed to cooling systems that use fans to direct outside air to cool a computer system or to evacuate generated heat from the interior of the system. EX1001, 3:63-66 ("By rotating the cooling fans 12, outside air is taken from the air intake surface (not shown) provided on the front side of the casing, and the air is discharged from the discharge surface (not shown) provided on the rear side of the casing...");

EX1005, [0037] (“cooling air is taken in the inside of the housing 51 from the air intake surface of the front plate 52.”), Fig. 1B; EX1007, [0001] (“a cooling fan for evacuating generated heat from the interior of an electronic device enclosure”), Fig. 1.

130. Further, like the '320 Patent, both Sato and Nakamura relate to cooling systems in which the fan can operate at different speeds depending on the cooling needs of the computer system. EX1001, 5:34-37 (“The control means 172 [determines] which of R1 (low speed), R2 (intermediate speed), and R3 (high speed) the number of rotations of the cooling fans 12 should be....”); EX1005, Abstract (“a fan controller that controls a rotation number of the cooling fan based on the detected temperature of the electronic part and the detected intake air temperature”); EX1007, [0031] (“FIG. 3 shows the relationship between the interior temperature of the enclosure and the operation of the cooling fan ... the cooling fan 14 can switch between three levels of rotational speed: high speed, medium speed, and low speed....[t]he temperature control program executed by the environment system controller includes set temperature values for switching the rotational speed of the cooling fan for each temperature sensor 58.”).

131. Additionally, like the '320 Patent, both Sato and Nakamura disclose measuring the temperature of the CPU and other internal components using internal sensors. EX1001, Abstract (“The temperature sensor detects a component

temperature of an electronic component included in the ICT equipment.”); EX1005, [0004] (“In the fan-attached heatsink, a temperature sensor dedicated to the CPU is provided.”); EX1007, [0011] (“The interior temperature of the enclosure is measured by means of a temperature sensor installed in the interior space of the enclosure, a temperature sensor embedded in the CPU, a temperature sensor attached to the board, etc.”). Sato discloses the same type of sensors, speed-controllable fans, and controller that Nakamura’s temperature control program utilizes. EX1005, [0033], [0044], [0065], [0070]-[0071]; EX1007, [0019], [0027]-[0030].

132. Furthermore, like the ’320 Patent, both Sato and Nakamura are directed to techniques for controlling the speed of cooling fans used to cool components in an electronic device. EX1001, Abstract (“the control means causes the number of rotations of the fan to be lower as the degree of declination of the component temperature indicated by the declination index value is larger”); EX1005, [0013] (“a cooling controlling apparatus that cools an electronic apparatus includes...a fan controller that controls a rotation number of the cooling fan based on the detected temperature of the electronic part and the detected intake air temperature”); EX1007, [0001] (“The present invention relates to a control scheme for a cooling fan for evacuating generated heat from the interior of an electronic device enclosure, particularly to a control scheme for reducing the noise

generated by such a fan.”).

133. Additionally, the techniques disclosed in both Sato and Nakamura are intended to reduce unnecessary fan operation, which would lead to unnecessary noise and power waste. Sato states that unnecessary use of cooling fans leads to “a problem in noise and excessive electric power consumption associated with the rotation of the cooling device....” EX1005, [0060]. Sato’s invention is intended to reduce excess noise and power consumption. EX1005, [0011], [0012], [0064], [0104], [0115], Fig. 5. Similarly, Nakamura’s temperature control technique is also intended to reduce excessive fan noise and to lower power consumption in then-existing electronic devices (like Sato’s server). EX1007, [0004], [0009], [0017].

134. A POSITA would have been motivated to modify Sato using Nakamura’s temperature control program including “methods for determining a state where the rate of decrease of the interior temperature of the enclosure has stagnated” (EX1007, [0017]), because both Sato and Nakamura state the goals of power savings and noise reduction via reducing unnecessary fan usage. EX1005, [0005], [0011] (“The excessive cooling performed on the assumption of the maximum operation despite no increase in temperature of each heat generating part in this manner causes problems of an increase in an electric power consumption and a noise both associated with the rotation of the cooling fan.”), [0012]

(“Because of the problems described above, there has been a challenge in how to realize an electric power saving and a noise reduction in cooling heat generating parts in a server installation. Here, the challenge lies not only in an information processing apparatus such as a server installation but also similarly in various types of electronic apparatuses which cool a plurality of heat generating parts by using a cooling device.”), [0060], [0064], [0104], [0115]; EX1007, [0004] (“As computer systems have become widely used in human living environments and office environments, noise reduction has become an important issue ... [t]he majority of noise generated by computer systems comes from the operating sound of rotating cooling fans.”), [0009] (“[I]t is an object of the present invention to provide a cooling system that prevents situations where the electronic device cooling fan continues to rotate when the interior temperature of the enclosure has been decreased. It is another object of the present invention to provide a cooling system that can detect the state where the rate of temperature decrease has stagnated before the interior temperature of the enclosure reaches the set temperature value for transitioning from low speed rotation to stop, and can stop the rotation of the cooling fan, reducing both user discomfort from noise and power consumption.”), [0010] (“The present invention relates to a control scheme for a cooling fan for evacuating generated heat from the interior of an electronic device enclosure, particularly to a control scheme for reducing the noise generated by such a fan.”),

[0017]. Nakamura would have furthered the goal of saving power and reducing unnecessary noise, which are both goals stated in Sato. While Sato discloses techniques for meeting these goals, Nakamura would have improved Sato by providing further, additional techniques for meeting them.

135. A POSITA would have been motivated to combine Nakamura with Sato because implementing Nakamura's fan control technique in Sato's server would have furthered Sato's goal of reducing excess fan operation and power consumption. For example, Sato does not disclose stopping the cooling fans, but Nakamura discloses stopping them when the internal component temperature reaches a particular low threshold value. EX1007, [0006] ("[w]hen a computer transitions to a low-load state after being operated in a high-load state," the interior temperature drop causes the fan to switch from high speed to medium speed to low speed), [0031] ("The rotation of the cooling fan stops when the measured temperature reaches the set temperature value 509."), Fig. 3. Sato's fan control technique would be improved by including the function of stopping the fan when the internal temperature is sufficiently low, as taught by Nakamura. Modifying Sato with Nakamura and allowing the fan to be fully stopped, would further limit unnecessary fan operations (more than Sato alone), reducing noise and power consumption, and would thereby enhance Sato's fan control technique.

136. Further, Nakamura's temperature-control program stops the fan even

if the internal component temperature is above the lowest threshold temperature when the program determines that the rate of temperature decrease has “stagnated.” Nakamura “provide[s] a cooling system that can detect the state where the rate of temperature decrease has stagnated before the interior temperature of the enclosure reaches the set temperature value for transitioning from low speed rotation to stop, and can stop the rotation of the cooling fan, reducing both user discomfort from noise and power consumption.” EX1007, [0009]. Because Sato does not contemplate stopping the fans even when internal component temperatures stagnate, a POSITA would have recognized that Nakamura’s fan-control technique enhances Sato by further limiting unnecessary fan operation (more than in Sato alone) thereby reducing noise and power consumption.

137. In addition, a POSITA would have recognized other benefits of determining the rate of temperature decline, as in Nakamura. For example, determining the rate of temperature decline, as taught by Nakamura, would allow Sato’s server to detect and mitigate a sharp decline in temperature, which could lead to condensation in the electronic device enclosure as was known well before the ’320 Patent. EX1011, 24 (“Rapid cooling of equipment can cause condensation.”).

138. A person of ordinary skill in the art would have been able to modify

Sato's server installation to implement Nakamura's temperature control program with a reasonable expectation of success and without undue experimentation. It would have been well within the ability of such a person to modify Sato's temperature monitor/cooling controller executed by "a semiconductor processing device such as a micro processing unit (MPU)" (EX1005, [0046]) to include the temperature control functionality taught by Nakamura, which is described as software stored on a ROM that can be run on a microprocessor. EX1007, [0030] ("The main components of the cooling system according to the present invention are implemented by means of a temperature control program stored in the ROM of the environment system controller 56 and executed by the processor of the environment system controller 56.").

139. Because Sato and Nakamura share similar control systems, including temperature sensors, fans and fan control circuits, and microprocessor-driven controllers to govern fan speed, it would have been a straightforward task for a POSITA to modify the software of Sato's temperature monitor/cooling controller (EX1005 at [0046]) to include Nakamura's temperature control program functionality. Such a modification would have simply required modifying Sato's temperature control program. EX1007, [0030] ("[O]nly the temperature control program used in conventional systems needs to be modified."). Modifying Sato based on Nakamura would have involved no more than use of prior art elements

according to known methods to yield predictable results.

140. Nakamura discloses an embodiment as “notebook personal computer system 10” but does not limit the disclosed invention to notebook computers. EX1007, [0018]. In fact, Nakamura expressly states that the disclosed invention is not limited to computer systems at all, but “is broadly applicable to electronic devices in which heat evacuation is performed from the interior of the enclosure by means of a cooling fan.” EX1007, [0045]. Nakamura’s reference to a notebook computer would not have dissuaded a POSITA from implementing Nakamura’s cooling program in Sato’s server. Indeed, Sato itself is not limited to the particular described “server installation” embodiments, as Sato stated that “a challenge in how to realize an electric power saving and a noise reduction in cooling heat generated parts...lies not only in [] a server installation but also similarly in various types of electronic apparatuses which cool a plurality of heat generating parts by using a cooling device.” EX1005, [0012]. Thus, the disclosures in Sato and Nakamura would not dissuade a POSITA from combining the teaching of Nakamura in Sato’s computer system—indeed, the general applicability of the disclosures would encourage such a combination.

1. Independent Claim 1

141. As I discuss further below, Sato combined with Nakamura discloses to a person of ordinary skill in the art every limitation of claim 1.

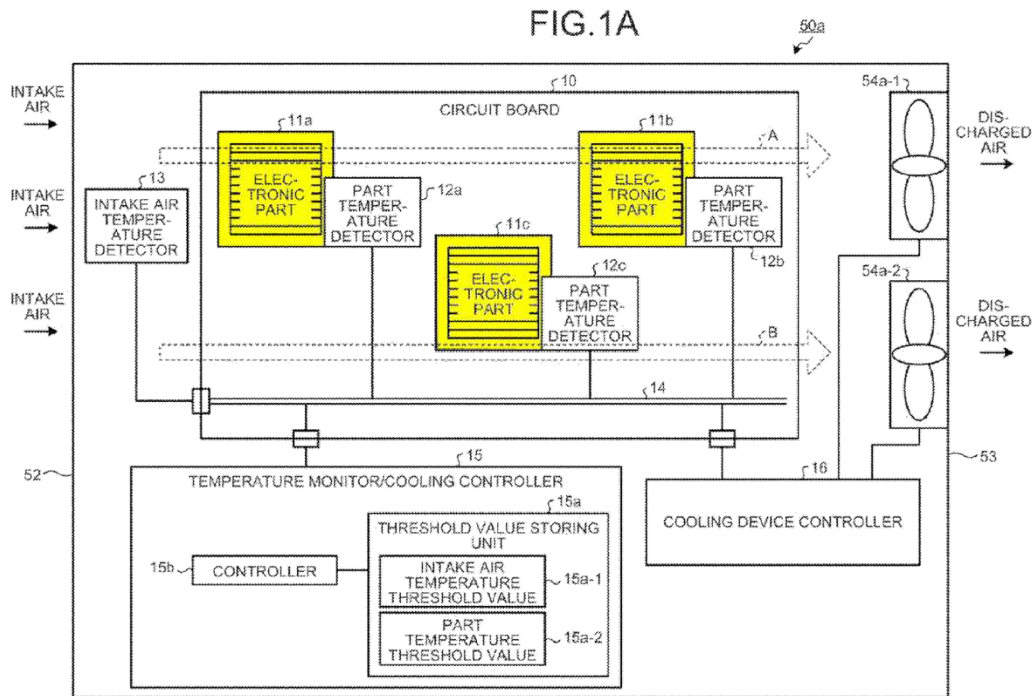
a. [1pre] ICT (information and Communication Technology) equipment having an electronic component, the ICT equipment comprising:

142. Sato discloses *ICT (information and Communication Technology) equipment having an electronic component*, as recited in the preamble of claim 1.¹ The '320 Patent discloses that the claimed *ICT ([I]nformation and Communication Technology) equipment* can be a “server device having a cooling fan, a control device thereof, a temperature controlling method thereof, and a program.” EX1001, 1:12-15. Sato discloses several embodiments of electronic apparatus and servers that satisfy the language of the preamble. Each embodiment in Sato is a “server installation” (i.e., a server computer). EX1005, [0032]. And the '320 Patent states that “ICT equipment” can be a “server device.” EX1001, 1:19-22. Thus, each of Sato’s embodiments constitutes *ICT ([I]nformation and Communication Technology) equipment*.

143. Sato discloses a first embodiment in Figure 1A, which illustrates “a configuration of an electronic apparatus according to a first embodiment” including “circuit board 10” incorporating “electronic parts” 11a, 11b, and 11c. EX1005, [0033], [0042]. In Sato’s first embodiment “electronic apparatus 50a” constitutes *ICT ([I]nformation and Communication Technology) equipment* and

¹ I will put claim language in italics for ease of reference throughout my analysis.

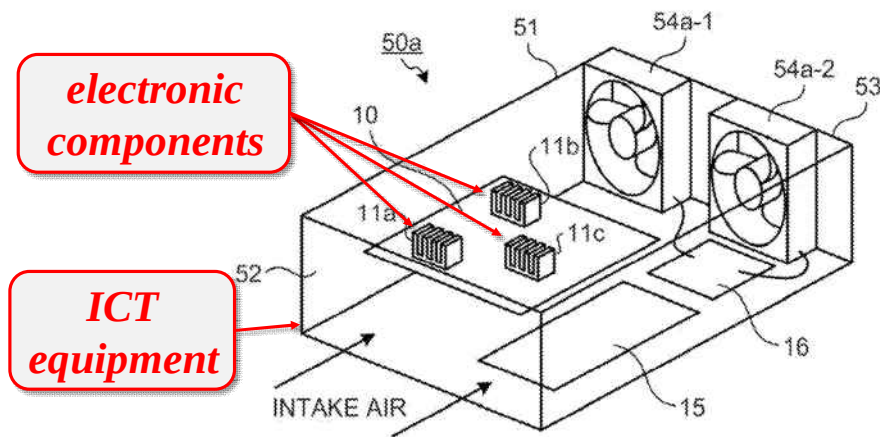
each of “electronic parts” 11a, 11b, and 11c is *an electronic component*. Sato also discloses the first embodiment with “an electronic apparatus” containing a circuit board, “for example, a system board or a motherboard.” EX1005, [0033]-[0034].



EX1005, Fig. 1A (highlighted). In Sato’s first embodiment, “electronic apparatus 50a” constitutes *ICT...equipment* and each of “electronic parts” 11a, 11b, and 11c is *an electronic component*.

144. Sato’s Figure 1B also illustrates the first embodiment of Sato’s server, and again shows *ICT (information and Communication Technology) equipment having an electronic component*.

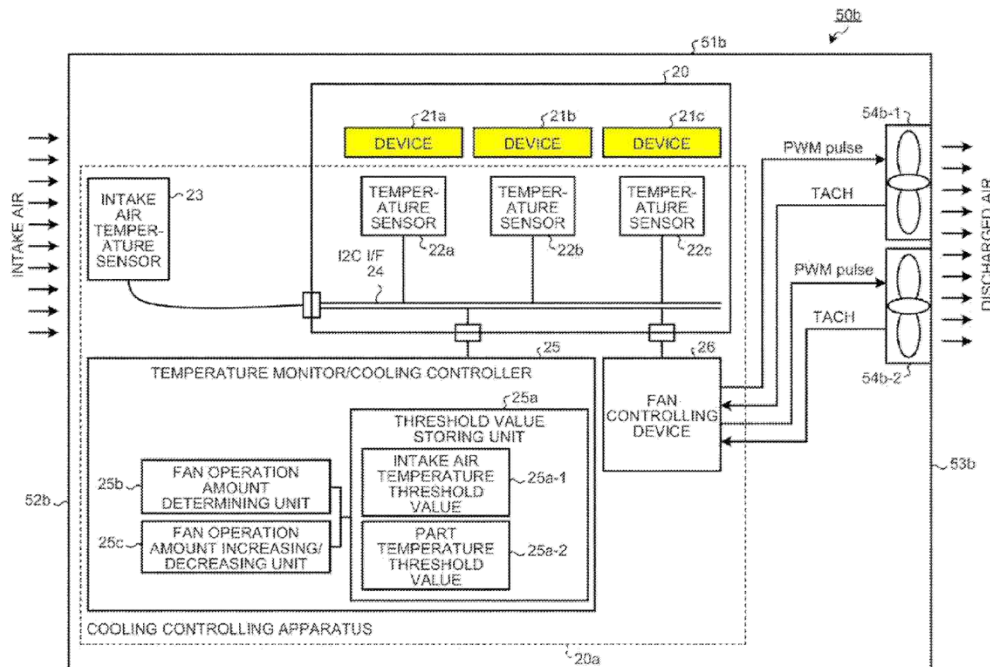
FIG.1B



EX1005, Fig. 1B (annotated).

145. Sato further discloses a second embodiment in which “a server installation is taken as an example of an electronic apparatus to be illustrated...” and shows Figure 2 which is “a block diagram of a configuration of a server *installation* according to a second embodiment.” EX1005, [0018], [0065]. Sato states that in the description of “the second embodiment, only a different part from the first embodiment will be explained and an explanation for the same configuration will be omitted.” EX1005, [0065].

FIG.2



EX1005, Fig. 2 (annotated).

146. In Sato’s second embodiment, the claimed *electronic component* is a device 21a, 21b, and 21c. See EX1005, [0068] (“In the system board 20, a temperature sensor 22a adjacent to the device 21a mounted on the system board 20 is arranged... the “device” represents an electronic part such as a semiconductor element which generates heat according to an operation or a heat generating part which generates heat.”). Sato continues to refer to the apparatus of his second embodiment as a “server.” See EX1005, [0072], [0080], [0095], [0116]. In Sato’s second embodiment, “server installation 50b” constitutes *ICT...equipment* and each of “devices 21a to 21c” is *an electronic component*.

147. Nakamura also discloses *ICT (information and Communication*

Technology) equipment having an electronic component, as recited in the preamble of claim 1. Nakamura discloses “a control scheme for a cooling fan for evacuating generated heat from the interior of an electronic device enclosure....” EX1007, [0001]. Nakamura describes his invention in the context of “[e]lectronic devices such as computer systems [that] comprise electrical components inside an enclosure, including boards (substrates) on which various LSI chips such as CPUs are mounted, storage devices such as hard disks, power supply units, and an input/output devices, where the respective electrical components generate heat during operation.” EX1007, [0002].

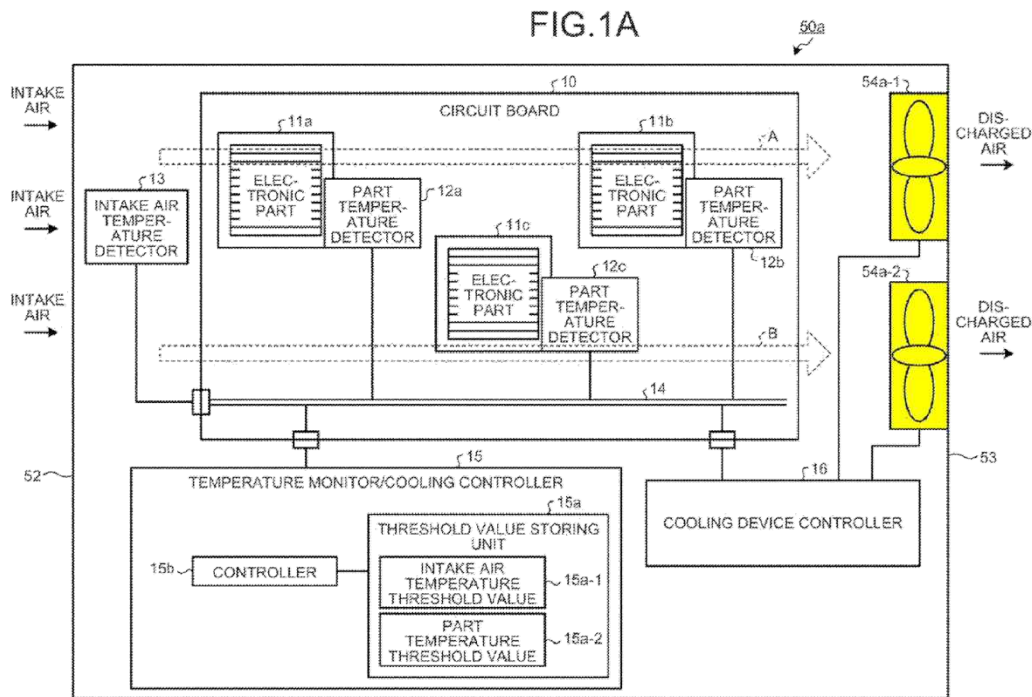
148. The “electronic device enclosure” described by Nakamura constitutes the claimed *ICT ([I]nformation and Communication Technology) equipment*. Nakamura describes his inventive “control scheme” in the context of a “PC system” (EX1005, [0030]), but a POSITA would recognize that the “electronic device enclosure” could be essentially any computer system.

149. Nakamura discloses the above-discussed ICT equipment *having an electronic component*. The “CPU” in Nakamura’s “computer system” constitutes the claimed *electronic component*. The ’320 Patent states that a CPU is an *electronic component*: “In general, a component temperature becomes higher than the intake air temperature because electronic components (such as a CPU) constituting the ICT equipment 1 are heating elements.” EX1001, 4:24-27.

150. Thus, Nakamura also discloses *ICT (information and Communication Technology) equipment having an electronic component*, as recited in the preamble of claim 1.

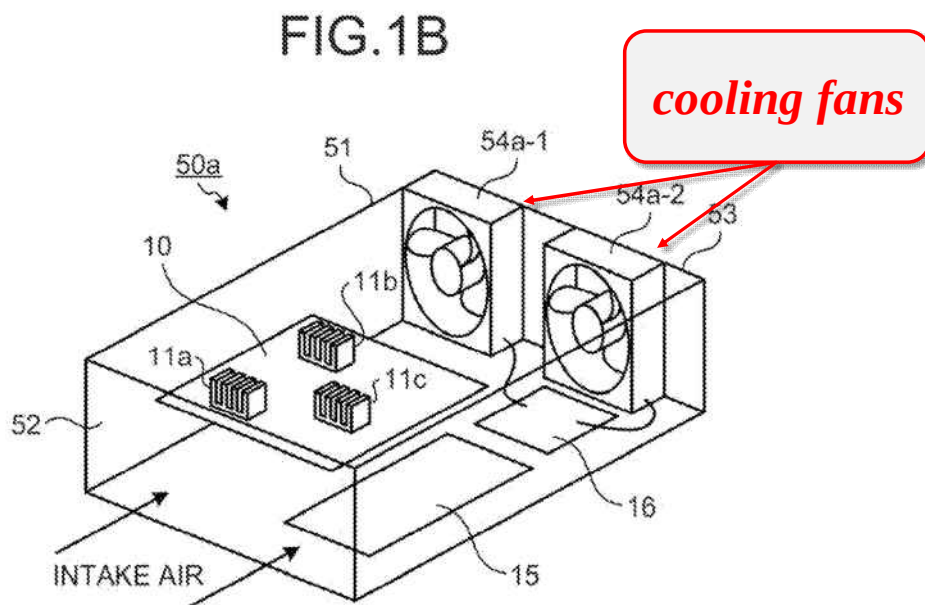
b. [1a] a cooling fan;

151. In the first embodiment disclosed in Sato, electronic apparatus 50a includes “cooling fans 54a-1 and 54a-2.” EX1005, [0041]. As illustrated in Fig. 1A, each of the cooling fans 54a-1 and 54a-2 in Sato constitutes the claimed *cooling fan*.



EX1005, Fig. 1A (highlighted).

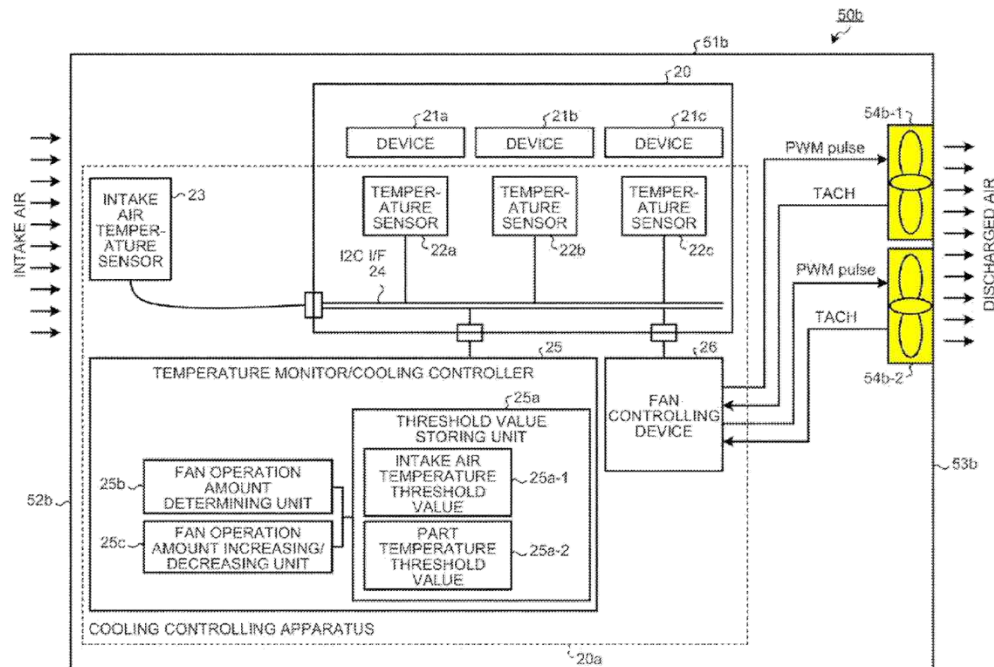
152. Sato similarly shows cooling fans in his Figure 1B.



EX1005, Fig. 1B (annotated).

153. Sato discloses the second embodiment, showing server installation 50b includes “cooling fans 54b-1 and 54b-2.” EX1005, [0065]. Sato also states that “[t]he cooling fans 54b-1 and 54b-2 are arranged in a manner of fronting onto a back plate 53b in the inside of the housing 51b.” EX1005, [0066]. “Through a rotation of the blade part of the cooling fans 54b-1 and 54b-2, cooling air is taken in the inside of the housing 51 from an air intake surface of a front plate 52b.” EX1005, [0066]. “Cooling air taken in the inside of the housing 51b cools devices 21a to 21c mounted on the system board 20 and is then discharged by the cooling fans 54b-1 and 54b-2 to an outside of the housing 51b via an air discharge surface of the back plate 53b.” EX1005, [0067].

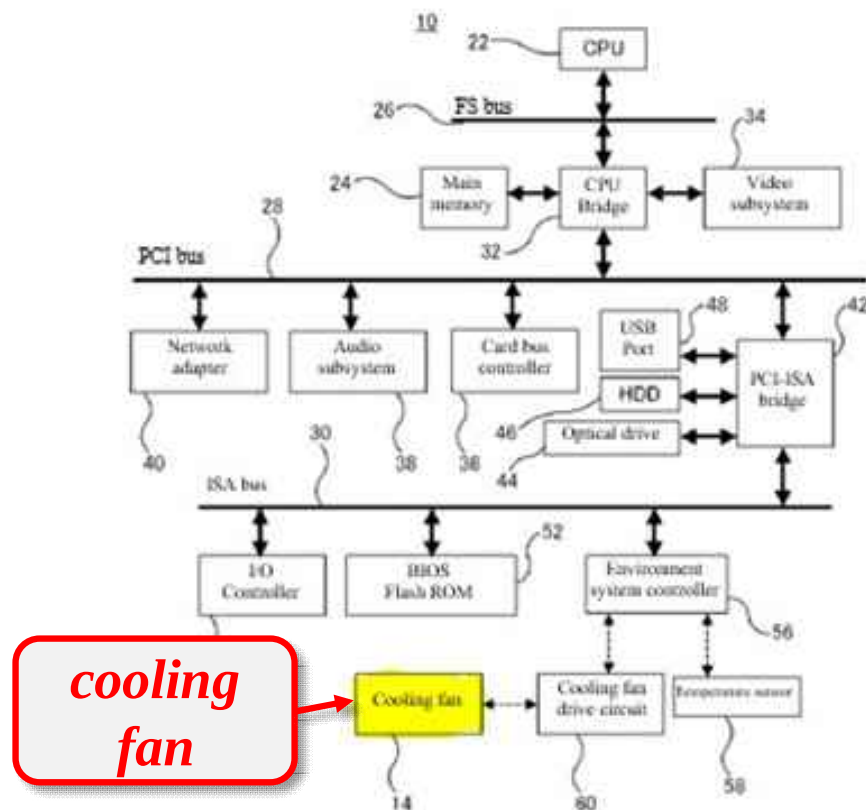
FIG.2



EX1005, Fig. 2 (highlighted). Each of cooling fans 54b-1 and 54b-2 constitutes a claimed *cooling fan*.

154. Nakamura’s computer system also includes *a cooling fan*. Nakamura explains that “electronic devices are provided with **cooling fans** to evacuate heat generated in the interior of the enclosure to the exterior of the enclosure in order to maintain the interior temperature of the enclosure within a certain temperature range.” EX1007, [0002] (emphasis added). Figure 2 also shows a “cooling fan.”

[FIG. 2]



EX1007, Fig. 2 (annotated).

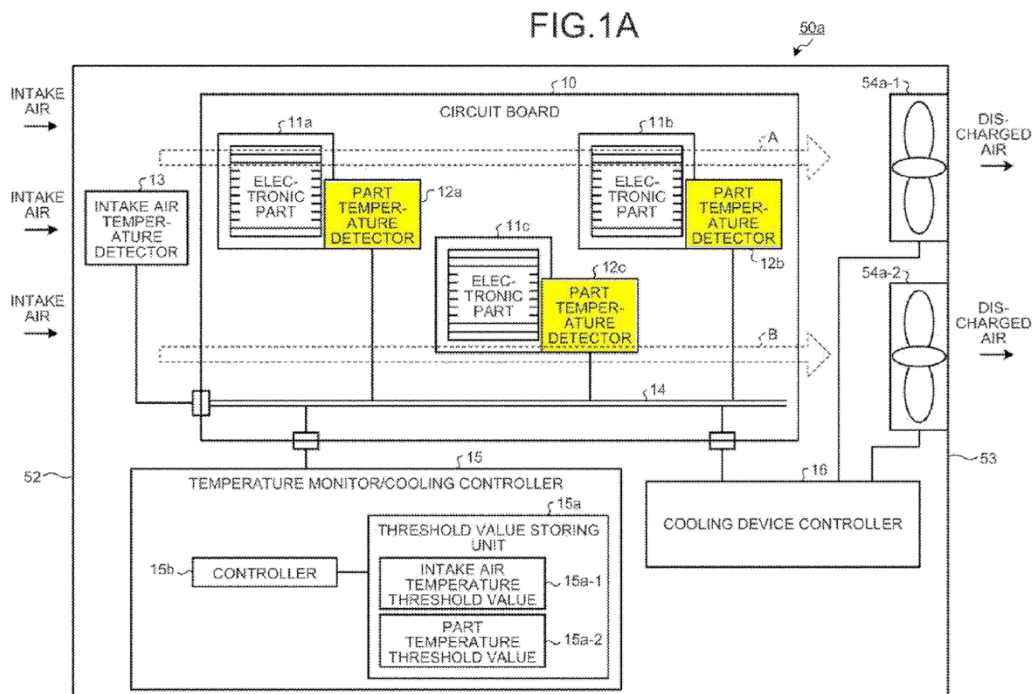
155. Therefore, Nakamura also discloses *a cooling fan*.

- c. **[1b] a first temperature sensor that detects a component temperature of the electronic component included in the ICT equipment;**

156. Sato discloses *a first temperature sensor that detects a component temperature of the electronic component included in the ICT equipment*.

157. In Sato's first embodiment, "a part temperature detector 12a adjacent to the electronic part 11a mounted on the circuit board 10 is arranged." EX1005,

[0042]. Sato further discloses that “[t]he part temperature detector 12a is a temperature sensor such as a thermistor and a semiconductor temperature sensor which detects a temperature of the electronic part 11a.” EX1005, [0042]. And, additional “part temperature detectors 12b and 12c respectively adjacent to the electronic parts 11b and 11c are arranged.” EX1005, [0042]. Temperature detectors 12a, 12b and 12c “are preferably arranged at leeward sides of the electronic parts 11a to 11c in the flow path A or the flow path B of the cooling air, respectively.” EX1005, [0043]. Sato states: “This arrangement of each electronic part allows measuring a temperature of each electronic part after cooling by cooling air more precisely.” EX1005, [0043].

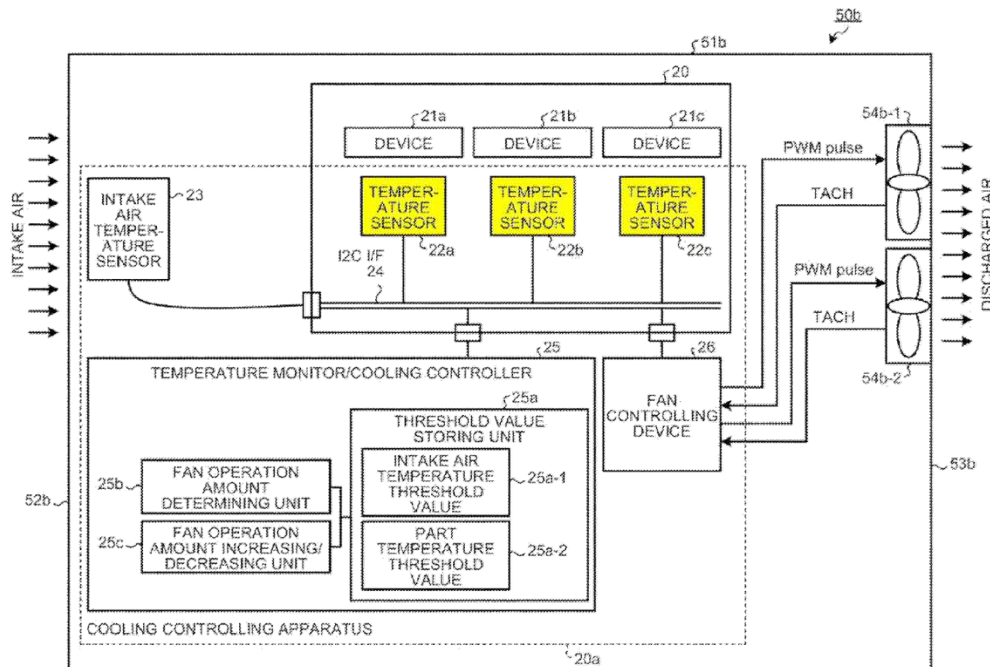


EX1005, Fig. 1A (highlighted). Each of part temperature detectors 12a, 12b, and

12c detects *a component temperature of the electronic component* (electronic part 11a, 11b, or 11c) *included in the ICT equipment*. Thus, each part temperature detector constitutes *a first temperature sensor that detects a component temperature of the electronic component included in the ICT equipment*.

158. In Sato's second embodiment, as shown in Fig. 2server installation 50b includes "temperature sensors" 22a, 22b, and 22c. EX1005, [0068]. "Here, the 'device' represents an electronic part such as a semiconductor element which generates heat according to an operation or a heat generating part which generates heat. The temperature sensor 22a is a temperature sensor such as a thermistor and a semiconductor temperature sensor which detects a temperature of the device 21a. Similarly, temperature sensors 22b and 22c respectively adjacent to the devices 21b and 21c are arranged. The temperature sensors 22b and 22c are temperature sensors which detect the temperatures of the devices 21b and 21c, respectively." EX1005, [0068].

FIG.2



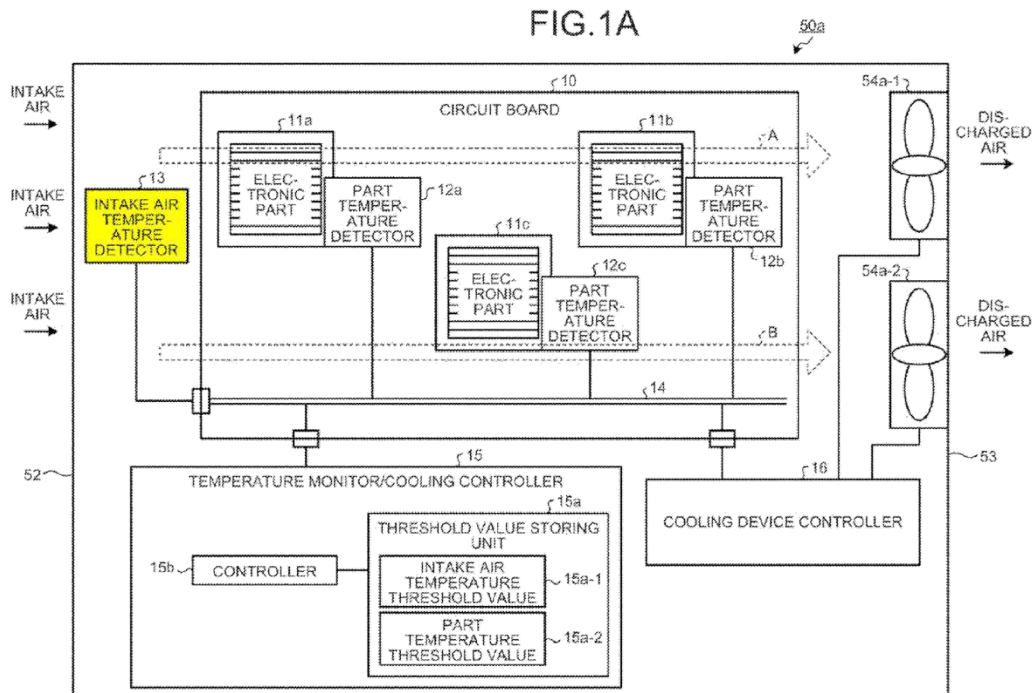
EX1005, Fig. 2 (highlighted). Each temperature sensor 22a, 22b, or 22c constitutes *a first temperature sensor that detects a component temperature of the electronic component included in the ICT equipment.*

159. Nakamura’s computer system also includes *a first temperature sensor that detects a component temperature of the CPU, which is the electronic component included in the ICT equipment.* Nakamura discloses that the “temperature inside the housing” can be “measured by...a temperature sensor embedded in the CPU....” EX1007, [0011]. Nakamura further discloses that “multiple temperature sensors 58 are present in the interior of the enclosure 12” and “are mounted on the boards of, or in the vicinity of, the CPU 22, video subsystem 34, hard disk drive 44, power supply unit (not illustrated), etc.”

EX1007, [0028]. Nakamura discloses that “the temperatures measured by these various temperature sensors will be referred to as the interior temperature of the enclosure.” EX1007, [0028].

d. [1c] a second temperature sensor that detects a temperature of an intake air; and

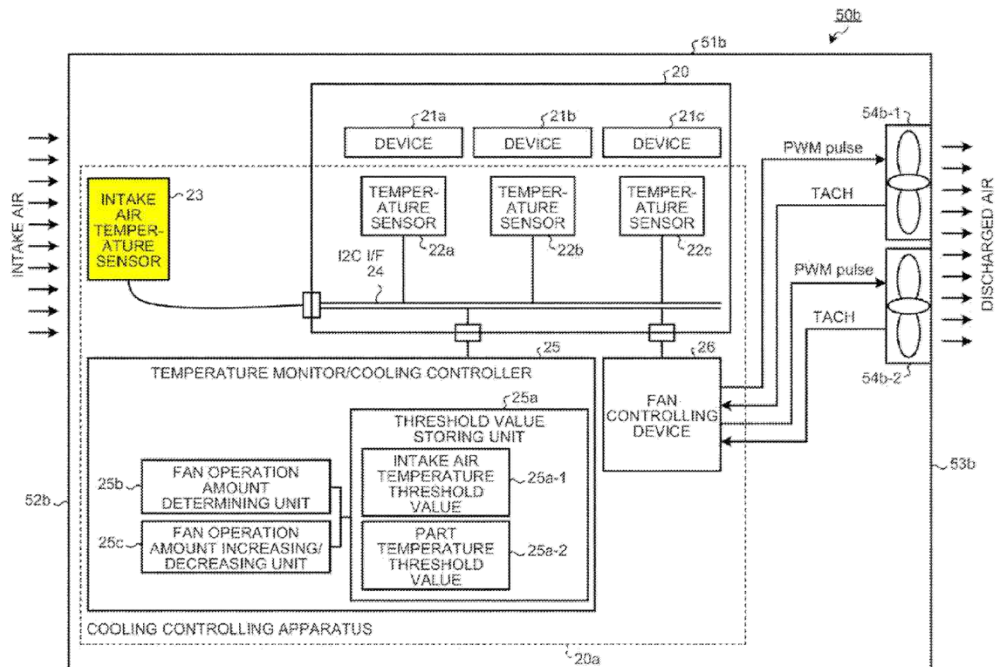
160. Sato discloses *a second temperature sensor that detects a temperature of an intake air*. In Sato’s first embodiment, “in FIG. 1A, the electronic apparatus 50a is provided with the circuit board 10, an intake air temperature detector 13, the temperature monitor/cooling controller 15, the cooling device controller 16, and the cooling fans 54a-1 and 54a-2.” EX1005, [0041]. “The intake air temperature detector 13 is arranged between the front plate 52 of the housing 51 and the circuit board 10.” EX1005, [0044]. It “detects a temperature of intake air of the cooling air taken in the inside of the housing 51 via the intake air surface of the front plate 52.” EX1005, [0044].



EX1005, Fig. 1A (highlighted). Sato's intake air temperature detector 13 constitutes *a second temperature sensor that detects a temperature of an intake air.*

161. Similarly in Sato's second embodiment, "[t]he intake air temperature sensor 23 is arranged between the front plate 52b of the housing 51b and the system board 20." EX1005, [0070]. "[T]he intake air temperature sensor 23 detects the temperature of intake air of the cooling air taken in the inside of the housing 51b via the intake air surface of the front plate 52b." EX1005, [0070].

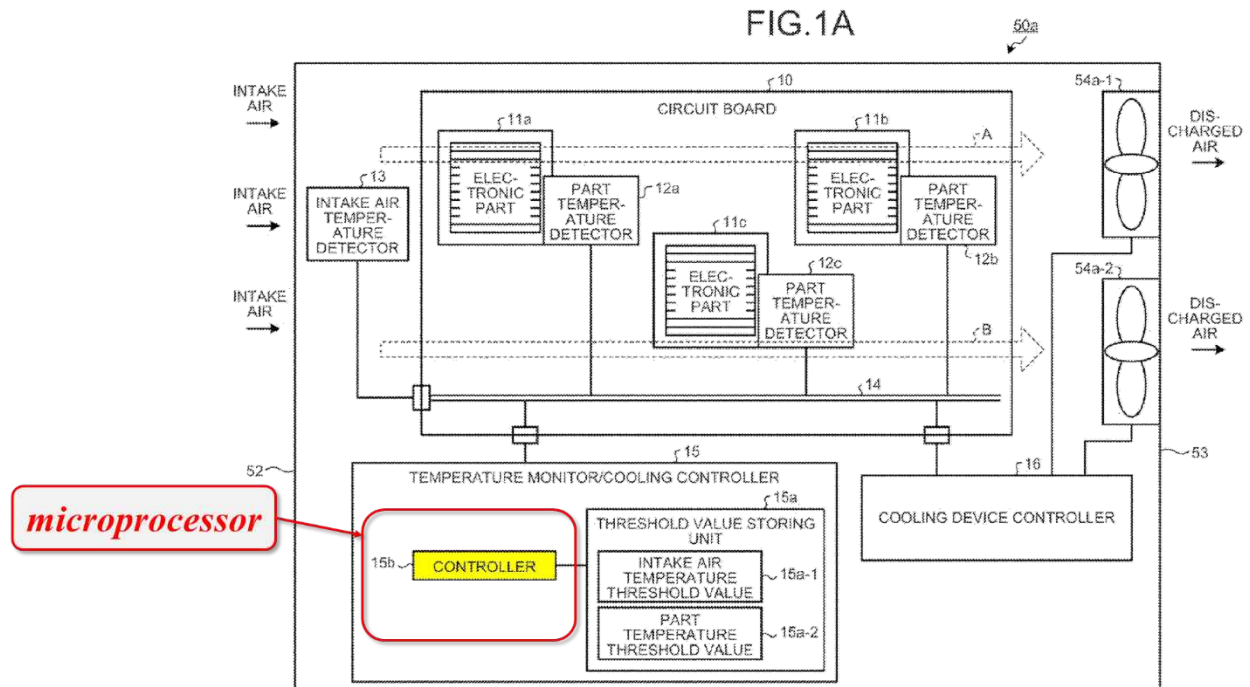
FIG.2



EX1005, Fig. 2 (highlighted). Sato’s intake air temperature sensor 23 constitutes *a second temperature sensor that detects a temperature of an intake air.*

e. [1d] a microprocessor including:

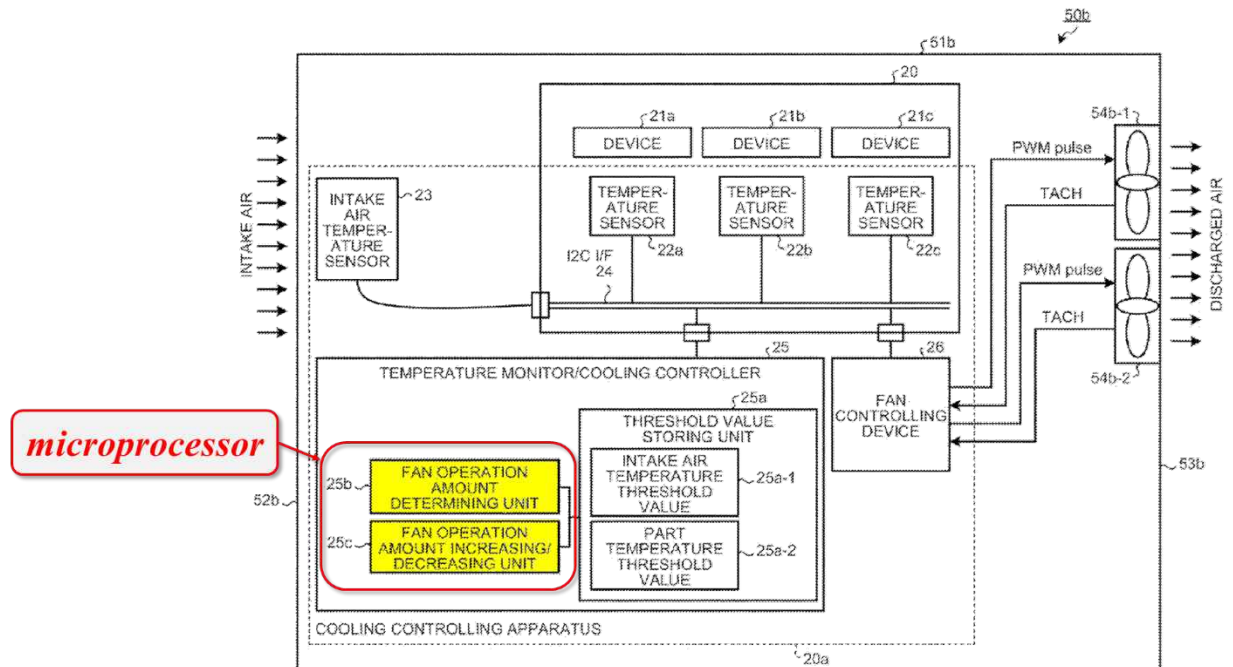
162. Sato discloses *a microprocessor*. In Sato’s first embodiment, “[t]he temperature monitor/cooling controller 15 includes a semiconductor storage device such as a read-only memory (ROM) and a semiconductor processing device such as a micro processing unit (MPU).” EX1005, [0046]. “The threshold value storing unit 15a is realized by the ROM and the controller 15b is realized by the MPU, for example.” EX1005, [0046]. The MPU is *a microprocessor*.



EX1005, Fig. 1A (annotated). Sato’s controller 15b is control logic executed on (i.e., “realized by”) the claimed *microprocessor*.

163. In Sato’s second embodiment, server installation 50b includes “a temperature monitor/cooling controller 25,” which includes “a threshold value storing unit 25a, a fan operation amount determining unit 25b, and a fan operation amount increasing/decreasing unit 25c.” EX1005, [0065], [0072].

FIG.2



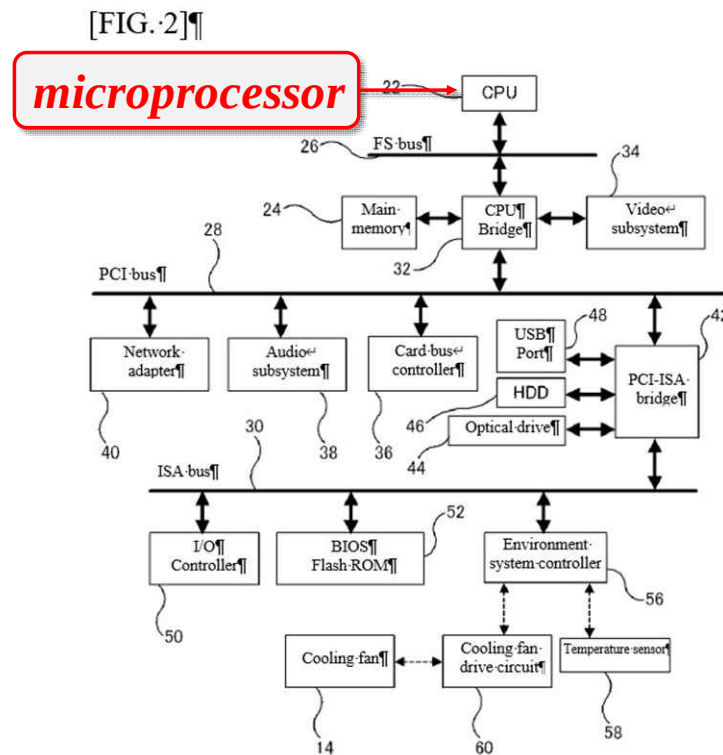
EX1005, Fig. 2 (annotated). Sato’s “server installation 50b...is provided with, in an inside of a housing 51b, a system board 20, an intake air temperature sensor 23, a temperature monitor/cooling controller 25, a fan controlling device 26, and cooling fans 54b-1 and 54b-2.” EX1005, [0065]. The temperature monitor/cooling controller 25 “is provided with a threshold value storing unit 25a, a fan operation amount determining unit 25b, and a fan operation amount increasing/decreasing unit 25c.” EX1005, [0072].

164. While Sato does not explicitly identify the microprocessor unit (MPU) of the second embodiment, a POSITA would understand that the fan operation amount determining unit 25b and the fan operation amount increasing/decreasing unit 25c are “realized by” a “semiconductor processing device such as a micro

processing unit (MPU)” like controller 15b in Sato’s first embodiment. EX1005, [0046]. The two fan operation units 25b and 25c perform essentially the same fan control functions as controller 15b. EX1005, [0050], [0076]. Further, the functions performed by fan operation units 25b and 25c are the type of logical determinations and calculations most commonly performed by a microprocessor. EX1005, Fig. 4; see Section V.A, above. Sato also states that the disclosure focuses on differences between the first and second embodiment (EX1005, [0065]) but does not suggest any difference in the way fan operation units 25b and 25c are implemented compared to controller 15b. Thus, a POSITA would know that fan operation amount determining unit 25b and the fan operation amount increasing/decreasing unit 25c are executed by *a microprocessor*.

165. Additionally, Nakamura also discloses an “environment system controller 56” within the computer system that includes *a microprocessor*. EX1007, [0026]. For example, Nakamura states that “[t]he environment system controller 56 includes an 8-16 bit microprocessor along with RAM, ROM, analog input, timer, digital input/output, etc., and can execute programs related to the operating environment of the PC system 10 without placing excessive load on the CPU22.” EX1007, [0027]. The environmental system controller 56, including the claimed *microprocessor*, “sends control signals for controlling the rotational speed of the cooling fan 14 to the cooling fan drive circuit.” EX1007, [0027].

166. Nakamura also shows a CPU (element 22) in Figure 2:



EX1007, Fig. 2 (annotated).

167. Thus, Sato and Nakamura both disclose *a microprocessor*. In addition, the combination of Sato and Nakamura discloses *a microprocessor including* the following two limitations as discussed below for 1e and 1f.

- f. **[1e] a declination index value calculation unit that calculates an index value indicating a degree of declination of the component temperature of the electronic component based on a detection result of the first temperature sensor; and**

168. The combination of Sato and Nakamura discloses this limitation.

169. In Nakamura, the “main components of the cooling system” are

“implemented by means of a temperature control program stored in the ROM of the environment system controller 56 and executed by the processor...” EX1007, [0030]. The “temperature control program” is *a declination index value calculation unit* because it determines the “rate of temperature decrease” of enclosure 12.

170. Nakamura describes three methods for calculating the rate of temperature decrease to determine if the rate has sufficiently slowed to indicate stagnation. EX1007, [0034]-[0039], Fig. 4, 6, 7; see Section V.B, above. Nakamura’s rate of temperature decrease is based on temperature sensors 58, which are mounted near, or embedded in, electronic components like the CPU, hard disk drive, or power supply unit. EX1007, [0011], [0028]. Thus, Nakamura’s “rate of temperature decrease” calculated by the temperature control program constitutes the claimed *index value* because it *indicat[es] a degree of declination of the component temperature of the electronic component*.

171. In addition, Nakamura discloses calculating the “rate of temperature decrease” (*index value*) using the particular manner recited in claim 2 (i.e., the index value is a declined temperature per unit time of the component temperature of the electronic component). See Section VI.A.2, below.

172. Nakamura also discloses calculating the “rate of temperature decrease” (*index value*) using the particular manner recited in claim 2 (i.e., the

index value is a declined temperature per unit time of the component temperature of the electronic component). See Section VI.A.3, below.

173. Nakamura also discloses calculating the “rate of temperature decrease” (*index value*) using the particular manner recited in claim 2 (i.e., the index value is a declined temperature per unit time of the component temperature of the electronic component). See Section VI.A.4, below.

174. Sato combined with Nakamura discloses calculating the *index value...based on a detection result of the first temperature sensor*. In Sato’s server modified to include Nakamura’s temperature control program, component temperatures would be provided by Sato’s “part temperature detectors” 12a, 12b, 12c or “temperature sensors” 22a, 22b, 22c, any one of which is a *first temperature sensor* as I discussed for 1b. See Section VI.A.1.c, above. Thus, the combination of Sato and Nakamura discloses determining an *index value* (“rate of temperature decrease”) indicating *a degree of declination of the component temperature of the electronic component that is based on a detection result of the first temperature sensor*.

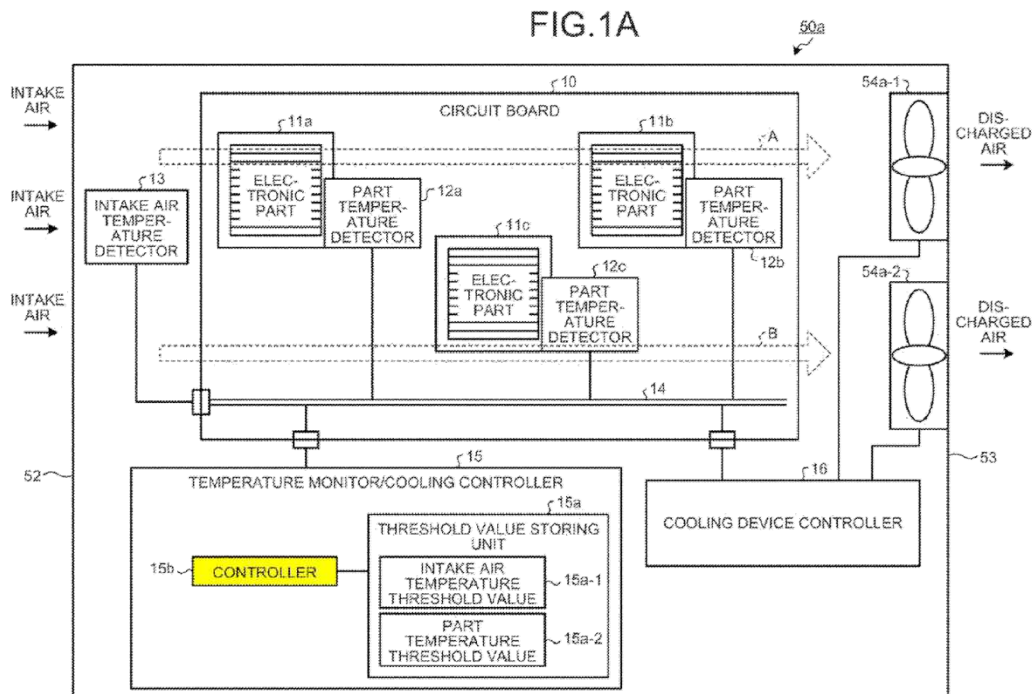
175. In addition, I have considered whether limitation 1e is disclosed by Sato-Nakamura if it should be construed as a means-plus-function limitation. See Section IV.E.1, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1e. Sato’s MPU is configured to

perform the functions I have discussed for this limitation and is equivalent to the '320 Patent's CPU 13 configured to calculate the "declination index value" as described in the specification (EX1001, 5:17-29).

- g. [1f] a control unit that controls the number of rotations of the cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.

176. The combination of Sato and Nakamura discloses this limitation.

177. In Sato's first embodiment, electronic apparatus 50a has a "temperature monitor/cooling controller 15" including "controller 15b," which is executed by the claimed *microprocessor*. EX1005, [0046].

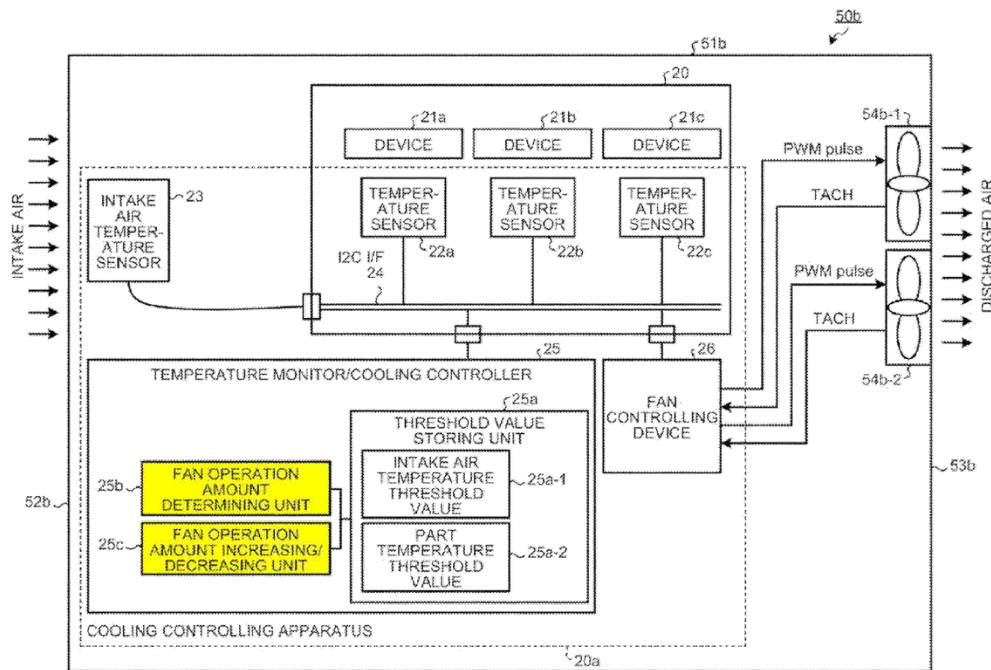


EX1005, Fig. 1A (highlighted). Sato's controller 15b constitutes the claimed

control unit. It controls the number of rotations of the cooling fan. EX1005, [0050] (“The controller 15b then determines the number of rotation of the cooling fans 54a-1 and 54a-2....”), [0051] (“the controller 15b determines the number of rotation of the cooling fans 54a-1 and 54a-2”).

178. Sato discloses, in its second embodiment, server installation 50b has a “temperature monitor/cooling controller 25” including “a fan operation amount determining unit 25b, and a fan operation amount increasing/decreasing unit 25c” executed by the claimed *microprocessor*. EX1005, [0046].

FIG.2



EX1005, Fig. 2 (highlighted).

179. Sato’s fan operation units 25b and 25c together constitute the claimed *control unit*. Each controls the number of rotations of the cooling fan. EX1005,

[0076] (“The fan operation amount determining unit 25b then determines the number of rotation of the cooling fans 54b-1 and 54b-2....”), [0077] (“the fan operation amount determining unit 25b determines the number of rotation of the cooling fans 54b-1 and 54b-2”), [0080] (“the fan operation amount increasing/decreasing unit 25c decreases the number of rotation of the cooling fans 54b-1 and 54b-2”), [0080] (“the fan operation amount increasing/decreasing unit 25c increases the number of rotation of the cooling fans 54b-1 and 54b-2”). Fan operation amount determining unit 25b sets the fan speed at high, medium, or low based on the intake air temperature (EX1005, [0076]) and fan operation amount increasing/decreasing unit 25c adjusts the fan speed based on device temperature (EX1005, [0080]).

180. In both Sato’s first and second embodiments, the *control unit controls the number of rotations of the cooling fan[s]* based on: (1) the temperature of components (“electronic parts” or “devices”) and (2) *the temperature of the intake air by the second temperature sensor*. Sato claims “a fan controller that controls a rotation number of the cooling fan based on the detected temperature of the electronic part and the detected intake air temperature.” EX1005, 25 (claim 1). In Sato’s first embodiment, controller 15b sets the fan speed at high, medium, or low based on the intake air temperature (EX1005, [0050]) and further adjusts the fan speed based on electronic part temperature (EX1005, [0057]). In the second

embodiment, fan operation amount determining unit 25b sets the fan speed at high, medium, or low based on the intake air temperature (EX1005, [0076]) and fan operation amount increasing/decreasing unit 25c further adjusts the fan speed based on device temperature (EX1005, [0080]).

181. The '320 Patent itself acknowledges that the “ICT equipment” disclosed in Sato’s foreign priority document includes a “controller” that “controls the number of rotations of the fan based on the detection result of the intake air temperature sensor and the detection result of the component temperature sensor.” EX1001, 1:40-43.

182. When Sato is modified to incorporate Nakamura’s temperature control program, Sato’s control unit would have the added capability to control fan speed based on: (1) *the index value calculated by the declination index value calculation unit* (as in Nakamura’s temperature control program) and (2) *the temperature of the intake air by the second temperature sensor* (as in Sato alone). As I discussed previously, Sato’s server would be enhanced by the added functionality provided by Nakamura’s temperature control program. For instance, the modified server would set fan speed based on intake air temperature and adjust (or stop) the fan based on the “rate of temperature decrease” (*index value*) determined using Sato’s “part temperature detectors” 11a, 11b, 11c or “temperature sensors” 22a, 22b, 22c (*second temperature sensor*). Thus, the combination of Sato and Nakamura

discloses this limitation.

183. The '320 Patent describes a fan control technique that similarly assesses the intake air temperature first, then the component temperature, and only if both are outside specified temperature ranges will a *declination index value* be determined and used to modify fan speed. EX1001, 6:7-7:7, 8:3-24, Fig. 6. The combination of Sato and Nakamura combination discloses the similar sequence of first using the *temperature of intake air* to set fan speed and then using a *declination index value* to adjust it, which is entirely consistent with the '320 Patent's disclosed technique for controlling fan speed *based on the index value calculated by the declination index value calculation unit and the temperature of the intake air*. Therefore, the Sato-Nakamura combination discloses limitation 1f in the same way the '320 Patent does.

184. In addition, I have considered whether limitation 1f is disclosed by Sato-Nakamura if it should be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I have discussed in this section regarding limitation 1f. Sato's MPU is configured to perform the functions I have discussed for this limitation and is equivalent to the '320 Patent's CPU 13 configured to implement the "the control means 172" in "the management section 17" identified in the specification (EX1001, 5:45-47).

2. Dependent Claim 2: The ICT equipment according to claim 1, wherein the index value is a declined temperature per unit time of the component temperature of the electronic component.

185. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. In addition, Nakamura discloses an *index value* as recited in claim 2.

186. Nakamura tracks the temperature of the CPU at fixed sampling intervals so that it can track the rate of temperature decrease. Nakamura discloses determining the “rate of temperature decrease” in which sensor 58 provides component temperatures at predetermined time intervals. EX1007, [0034]. The temperature of Nakamura’s CPU 22 (the claimed *component temperature of the electrical component*) is stored as T at current time t, and as T1, T2, T3, and T4 for past sampling times t1, t2, t3, and t4, respectively. EX1007, [0036]; see also EX1007, [0028] (“Multiple temperature sensors 58...are mounted on the boards of, or in the vicinity of, the CPU 22...[and] the temperatures measures by these various temperature sensors will be referred to as the interior temperature of the enclosure.”). Nakamura discloses that the “rate of temperature decrease has stagnated when the temperature difference (T-T1) between current time t and the previous sampling time t1 is at or below a predetermined value.” EX1007, [0037]. Nakamura discloses that the *index value is a declined temperature per unit time*, i.e. the “rate of temperature decrease” and the “temperature difference (T-T1)

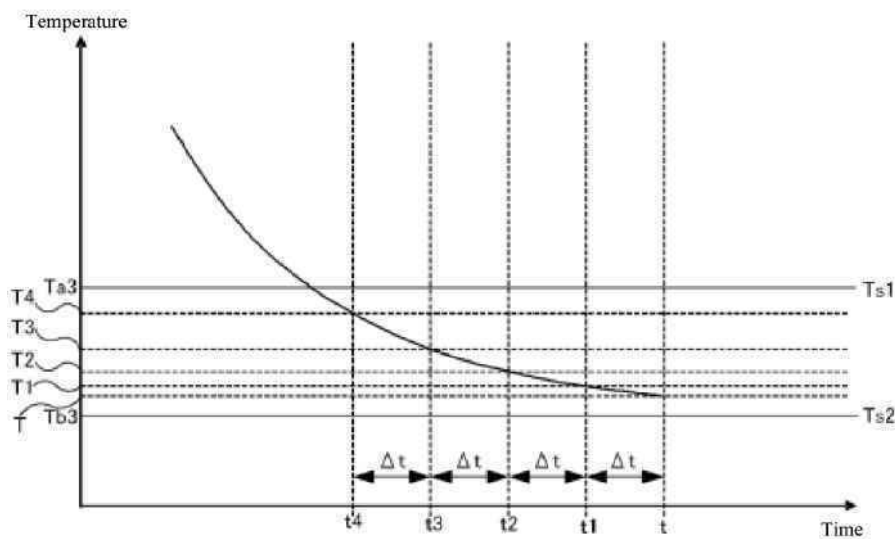
between current time t and the previous sampling time t_1 .” EX1007, [0037].

Thus, each sampled temperature provided by sensor 58 constitutes *the component temperature of the electronic component*.

187. Nakamura’s Figure 4 discloses a “first detection method” for determining whether the “rate of temperature decrease” (*index value*) has stagnated. See EX1007, [0034]. “[T]he interior temperature of the enclosure 12 is sampled at fixed sampling intervals Δt ” based on temperature readings from temperature sensors 58. EX1007, [0034], [0036] (“[W]hen the interior temperature of the enclosure 12 is within the set temperature range between T_{s1} and T_{s2} , the environment system controller 56 processes signals from the temperature sensor 58 at a sampling interval Δt .”). Each sampled temperature reading is a *component temperature of [an] electronic component* as claimed.

188. Figure 4 also discloses that the current time is indicated by t on the x-axis and the temperature at that time is indicated by T on the y-axis. EX1007, [0036]. The “past sampling times” are indicated by t_1 , t_2 , t_3 , and t_4 , and the temperatures at those sampling times are indicated by T_1 , T_2 , T_3 , and T_4 , respectively. See EX1007, [0036].

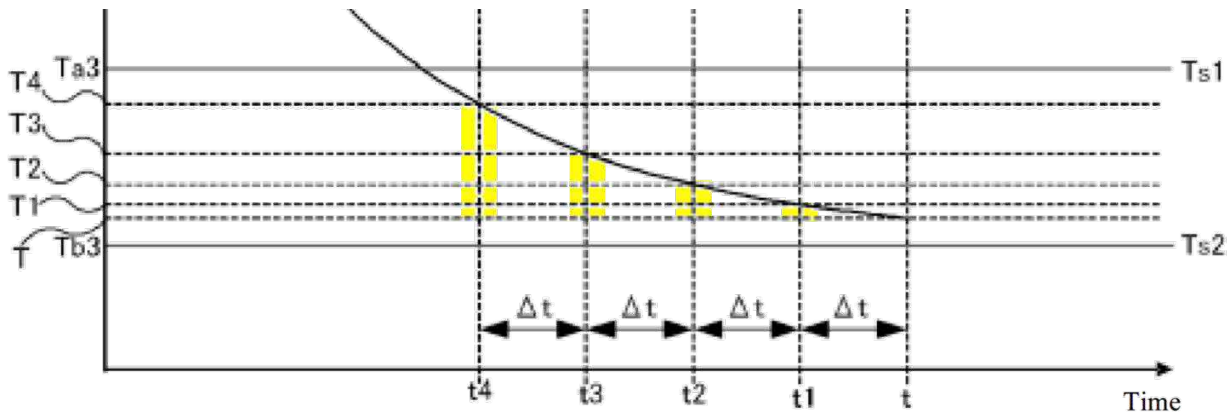
[FIG. 4]



EX007, Fig. 4.

189. Nakamura further discloses that its first detection method uses the difference in temperature at each sampling time compared to the current temperature to determine the stagnation of temperature decrease rate. EX1007 at [0037]. Nakamura further discloses, “[w]hen the rate of temperature decrease stagnates, the difference between the current temperature value T and the temperature values at each sampling time gradually becomes smaller.” EX1007 at [0037]. “For example, the temperature difference $(T_3 - T)$ between current time t and time t_3 becomes smaller than the temperature difference $(T_4 - T)$ between the current time t and time T_4 .” EX1007 at [0037]. Nakamura determines the rate of temperature decrease by calculating the difference in temperature at each past sampling time and the current time—in other words, it calculates $T_4 - T$, $T_3 - T$, $T_2 - T$, and $T_1 - T$. EX1007, [0037].

190. As illustrated by the following partial view of Figure 4, Nakamura's first detection method shows the temperature calculations to determine the rate of temperature change decrease over time. Nakamura calculates the rate of temperature decrease by measuring the change in temperature over time relative to the current temperature.



EX1007, Fig. 4 (partial, highlighted).

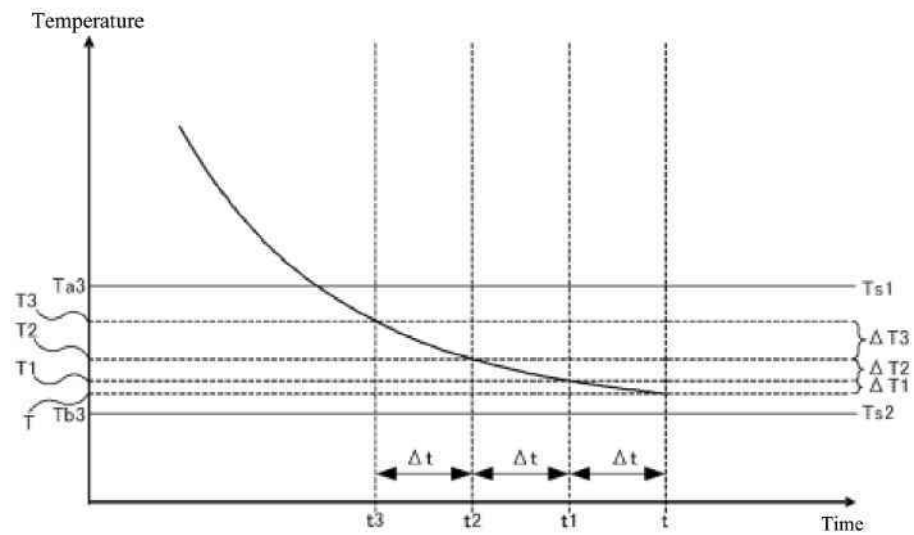
191. Nakamura's temperature control program can be configured to detect stagnation in the rate of temperature decrease by calculating the temperature difference "between current time t and the previous sampling time t_1 " to determine whether it meets or falls below a predetermined threshold. EX1007, [0037]. Nakamura's program computes $T_1 - T$, representing *a declined temperature* (from T_1 to T) *per unit time* (from t_1 to t) *of the component temperature of the electronic component*.

192. Nakamura also describes an alternative technique to determine stagnation by calculating "the difference between the current temperature value T

and three past temperature values ($T_1 - T$, $T_2 - T$, $T_3 - T$) to assess whether “all [are] at or below a predetermined value.” EX1007, [0037]. In this example, the program determines an *index value* based on *a declined temperature* ($T_1 - T$, $T_2 - T$, $T_3 - T$) *per unit time* (from t_1 to t , t_2 to t , t_3 to t) *of the component temperature of the electronic component*.

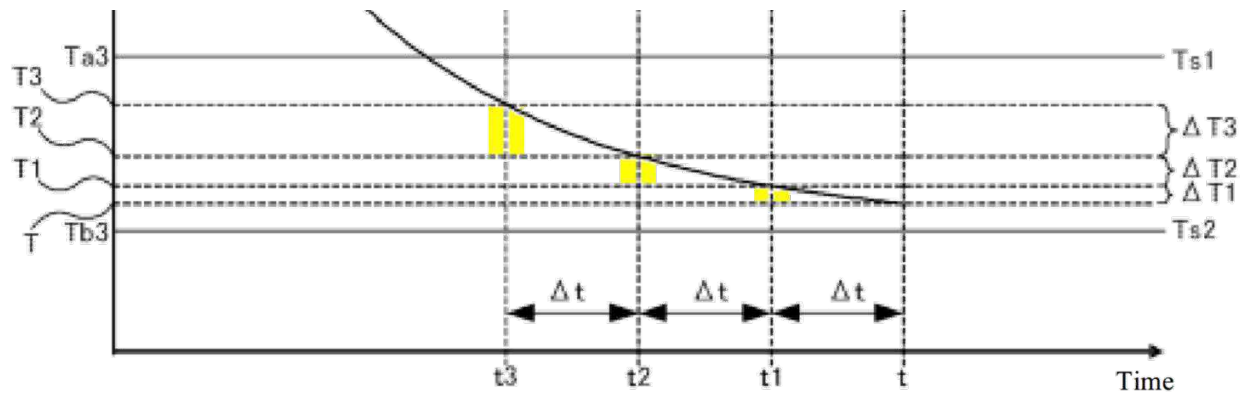
193. In addition, Nakamura discloses a “second detection method” as illustrated in Figure 6. *See* EX1007, [0038]. Sensor 58 captures the internal temperature of the enclosure at the current time t and past sampling times t_1 , t_2 , and t_3 . EX1007, [0034]. Unlike the first detection method, the second detection method is based on a comparison of the temperatures from one sampling time to the next. EX1007, [0038]. The relevant temperature differences for this method are “ $\Delta T_1 = T - T_1$, $\Delta T_2 = T_1 - T_2$, $\Delta T_3 = T_2 - T_3 \dots$ ” EX1007, [0038]. “[A]s the rate of temperature decrease stagnates, the temperature differences become smaller in the order ΔT_3 , ΔT_2 , ΔT_1 .” EX1007, [0038].

[FIG. 6]



EX1007, Fig. 6.

194. The following partial view of Figure 6 illustrates the temperature calculations in Nakamura's second detection method to determine the rate of temperate decrease over time.



EX1007 at Fig. 6 (partial, highlighted).

195. As illustrated in Figure 6, Nakamura determines the rate of temperature decrease by determining that the difference in temperature from one

sampling time to the next sampling time is becoming smaller. For instance, Nakamura's temperature control program can be configured to determine that the rate of temperature decrease has stagnated by calculating the "change in temperature difference between sampling intervals" to detect when it "becomes smaller than a predetermined value." EX1007, [0038]. In this example, the program calculates " $\Delta T1 = T - T1$, $\Delta T2 = T1 - T2$, $\Delta T3 = T2 - T3$," each of which is *a declined temperature (T-T1, T1-T2, T2-T3) per unit time (Δt) of the component temperature of the electronic component (i.e., an index value)*.

196. Nakamura discloses an *index value, which is a declined temperature per unit time of the component temperature of the electronic component* as recited in claim 2, in multiple different ways.

197. In addition to Nakamura's disclosures, a POSITA would have known that there are a finite number of identified, predictable techniques to determine the rate of temperature decline using temperature sensors in electronic equipment as described in Sato and Nakamura. It would have been obvious to try the particular option described in claim 2.

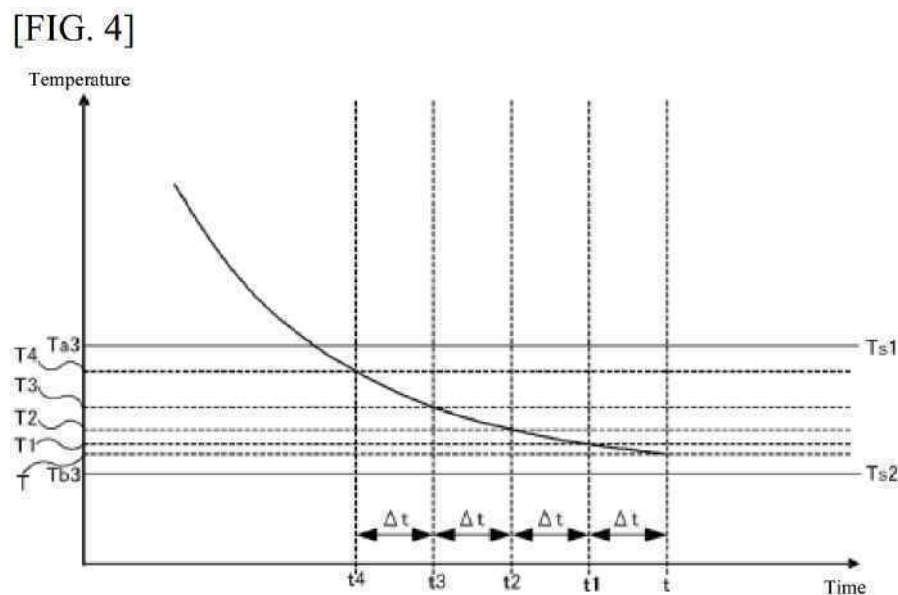
3. Dependent Claim 3: The ICT equipment according to claim 1, wherein the index value is an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods.

198. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. In addition, Nakamura discloses an *index*

value as recited in claim 3.

199. Nakamura describes a fan-control technique that calculates the “rate of temperature decrease” (*index value*) to determine when internal component temperature has stagnated. EX1007, [0010]. In Nakamura, temperature stagnation “refers to a state where, when the cooling fan 14 is in a low speed rotation state..., the interior temperature of the enclosure 12 is slightly higher than T_{b3} , and the change over time is minimal.” EX1007, [0033].

200. Nakamura discloses several “detection methods” to determine when temperature has stagnated (i.e., when “change over time is minimal”). EX1007, [0033]-[0039]. Among them, Nakamura describes sampling the temperature “at fixed sampling intervals Δt ” (*a plurality of measurement periods*). EX1007, [0034]. This is illustrated in Figure 4.



EX1007, Fig. 4. Nakamura states the rate of temperature decrease can be

determined by calculating the temperature difference “between current time t and the previous sampling time t_1 .” EX1007, [0037].

201. In the example illustrated in Figure 4, the temperature-control program determines whether “the change over time is minimal” by calculating T_1 minus T over the period Δt (i.e., time t_1 to t). While Nakamura does not refer to this as an “average,” a POSITA would recognize that the difference in sampled temperatures from (T_1 to T) over a fixed time period (time t_1 to t) is an *average value* of the rate of temperature decline during that time period. Thus, Nakamura discloses using the average rate of temperature decline to determine whether “the change over time is minimal.”

202. The '320 Patent itself describes calculating the “average value” of the declination rate by “dividing a difference Δt , between a component temperature t_1 detected at a time when the measurement period starts and a component temperature t_2 detected at a time when the measurement period ends, by the measurement period.” EX1001, 5:21-26. This is the same calculation described by Nakamura. Thus, Nakamura discloses the *index value* of claim 3 in the same way that the '320 Patent does.

203. I will also note that Nakamura refers repeatedly to the “rate” of temperature decrease, which means the change in temperature over a specific period of time. A POSITA would know that Nakamura’s program would not

determine a “rate” if it merely calculated the difference between two temperatures (T1 and T) without regard to any time period (t1 to t).

204. In addition, Nakamura teaches determining the rate of temperature decrease “on the basis of the difference between the current sampling temperature value and multiple past sampling temperature values.” EX1007, [0013]. For instance, the temperature control program can determine “the difference between the current temperature value T and three past temperature values (T1-T, T2-T, T3-T)[.]” EX1007, [0037]. A POSITA would recognize that this means, or at least suggests, determining the average rate of temperature change between t1 and t (as explicitly stated in Nakamura) as well as the average rate of change for multiple other temperature readings including T2-T over the period t2 to t, T3-T over the period t3 to t, etc. In this way, Nakamura suggests and renders obvious to a POSITA determining an *index value* that is based on *an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods*.

205. In addition to Nakamura’s disclosures, a POSITA would have known that there are a finite number of identified, predictable techniques to determine the rate of temperature decline using temperature sensors in electronic equipment as described in Sato and Nakamura. It would have been obvious to try the particular option described in claim 3.

4. Dependent Claim 4: The ICT equipment according to claim 1, wherein the index value is a difference between a highest value of the component temperature of the electronic component in a past certain period and a current component temperature.

206. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. In addition, Nakamura discloses an *index value* as recited in claim 4.

207. Nakamura uses temperature readings from sensor 58 at predetermined time intervals to determine the “rate of temperature decrease”. EX1007, [0034]. Each sampled temperature obtained by Nakamura’s sensor 58 constitutes *the component temperature of the electronic component* as I explained for 1e above. EX1007, [0011], [0028].

208. According to Nakamura’s “first detection method,” the temperature control program calculates the temperature difference “between current time t and the previous sampling time t_1 ” ($T_1 - T$) to determine if it is at or below a predeterminate value. EX1007, [0037]. Using this method, Nakamura’s temperature control program can be configured to determine that the rate of temperature decrease has stagnated. This calculation is performed when temperature readings are on a “declining trend,” so the temperature T_1 at time t_1 is necessarily the highest sampled temperature in the time period from t_1 to t . EX1007, [0035]. Thus, Nakamura’s program determines an *index value* by

calculating *a difference between a highest value of the component temperature of the electronic component (T1) in a past certain period (t1 to t) and a current component temperature (T)* as recited in claim 4.

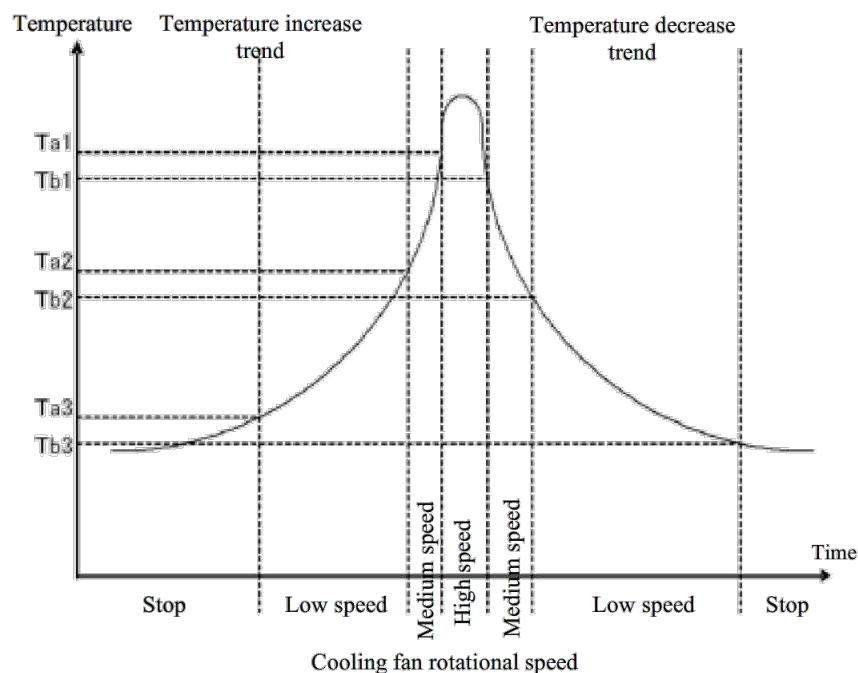
209. In addition to Nakamura's disclosures, a POSITA would have known that there are a finite number of identified, predictable techniques to determine the rate of temperature decline using temperature sensors in electronic equipment as described in Sato and Nakamura. It would have been obvious to try the particular option described in claim 4.

5. Dependent Claim 5: The ICT equipment according to claim 1, wherein the control unit controls the number of rotations of the cooling fan to be lower as the degree of declination of the component temperature of the electronic component, indicated by the index value calculated by the declination index value calculation unit, is larger.

210. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. In addition, Nakamura discloses the limitation recited in claim 5.

211. Nakamura's Figure 3 "shows the relationship between the interior temperature of the enclosure and the operation of the cooling fan 14." EX1007, [0031]. "[T]he cooling fan drive circuit 60 and the environment system controller 56 are configured so that the cooling fan 14 can switch between three levels of rotational speed: high speed, medium speed, and low speed." EX1007, [0031].

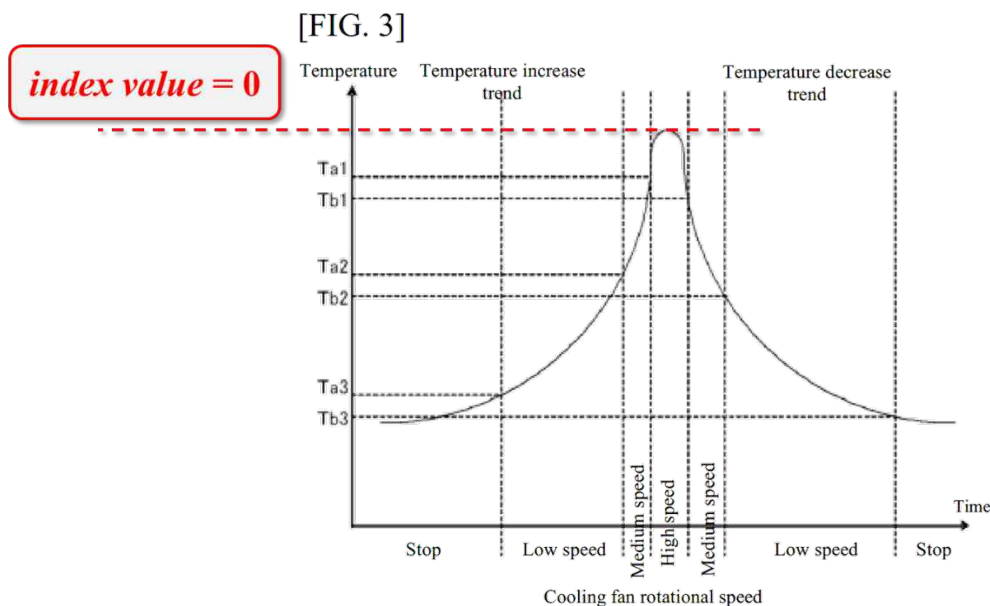
[FIG. 3]



EX1007 at Fig. 3.

212. Nakamura's environment control system controller, including the temperature control program, increases fan speed at certain threshold temperatures when "temperature sensor 58 has an increasing trend" and reduces fan speed at different threshold temperatures when the temperature "has a decreasing trend." EX1007, [0031], [0012] (there are separate thresholds for increasing and decreasing trends to avoid "the phenomenon of cooling fan chattering"). A POSITA would recognize that Nakamura's temperature control program necessarily determines the increasing or decreasing trend of internal component temperatures over time, so that the program uses the correct threshold values to switch fan speed.

213. As an example, in Fig. 3, Nakamura discloses how it meets the limitations of claim 5. As illustrated below, when the temperature reaches a peak value, the rate of temperature decrease (*index value*) is zero because the temperature is not decreasing at all. Figure 3 shows that the temperature peaks and how it immediately falls. A POSITA would know however that in practice the temperature can remain at a high level with little or no temperature decrease (i.e., *index value* equal to zero) for some time, for example, if a component such as a CPU is in high-load processing.

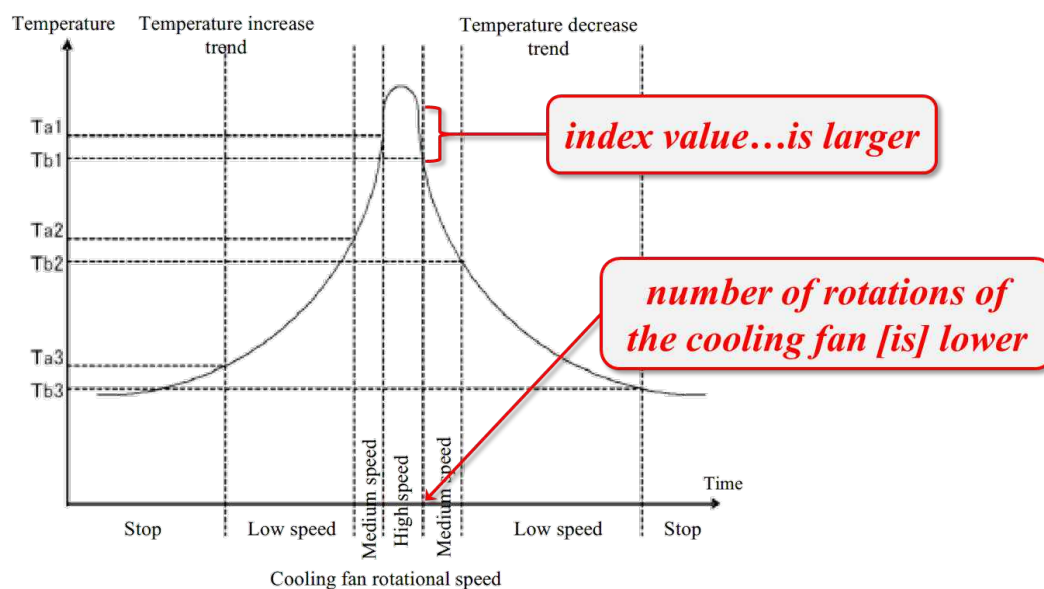


EX1007 at Fig. 3 (annotated).

214. Nakamura also teaches that when the CPU transitions from high-load processing to low-load processing “heat generation declines.” See EX1007, [0003], [0006], Fig. 11. As Figure 3 illustrates, the rate of temperature decrease

(*index value*) quickly changes from zero to a much larger value. As the declining temperature falls past Tb1 at a steep angle as claimed that *the degree of declination of the component temperature of the electronic component...is larger*. Nakamura's fan controller switches the fan speed from high speed to medium speed, as claimed that *the control unit controls the number of rotations of the cooling fan to be lower*.

[FIG. 3]



215. Therefore, Nakamura discloses an example wherein the control unit controls the number of rotations of the cooling fan to be lower as the degree of declination of the component temperature of the electronic component, indicated by the index value calculated by the declination index value calculation unit, is larger.

6. Dependent Claim 6: The ICT equipment according to claim 1, wherein if the index value is not less than a predetermined threshold, the control unit stops the cooling fan.

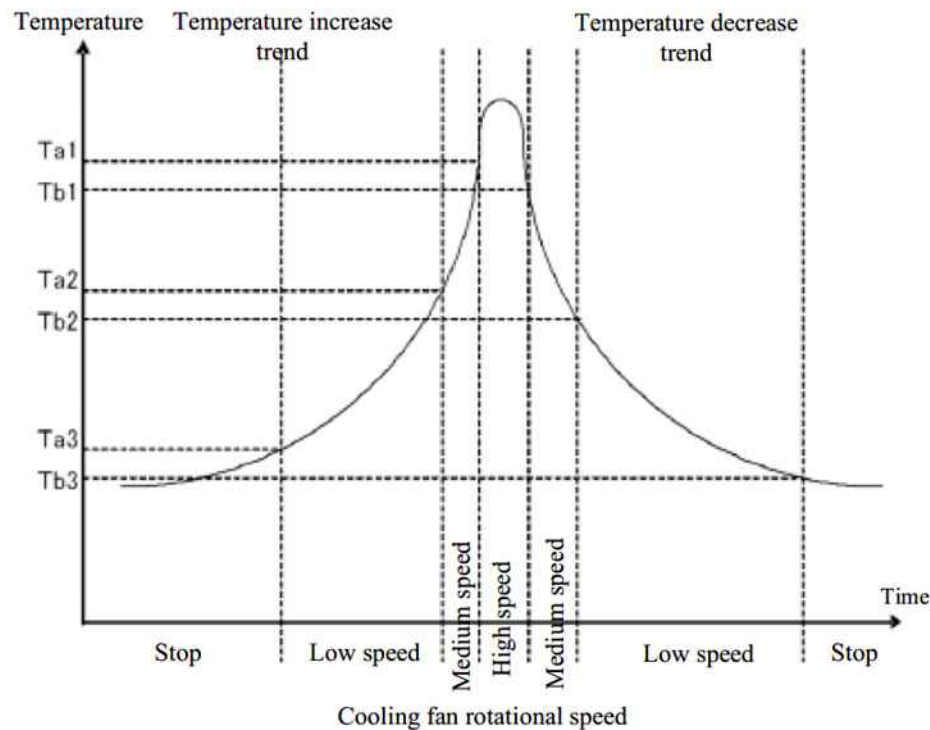
216. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. In addition, Nakamura discloses the limitation recited in claim 6.

217. As I explained for limitation 1e, Nakamura's temperature control program determines the rate of temperature decrease (*index value*). For example, Nakamura's program can be configured to calculate the temperature difference "between current time t and the previous sampling time t_1 " over time Δt (*index value*) and determine that the temperature has stagnated if it "is at or below a predetermined value." EX1007, [0037]. If the temperature decrease stagnates, the cooling fans 14 are stopped. EX1007, [0038].

218. As illustrated in Fig. 3, Nakamura also describes a different circumstance in which cooling fans 14 are stopped even though the temperature has not stagnated, i.e., *if the index value is not less than a predetermined threshold*. EX1007, [0035] ("When the cooling fan 14 is at low speed rotation and $T \leq T_{b3}$, since the temperature has a further decreasing trend, the environment system controller 56 stops the cooling fan 14 (steps 126, 128)."). As illustrated in Figure 3, the temperature declines on the right side of the figure to the temperature indicated by T_{b3} causing the cooling fans 14 to stop even though the rate of

temperature decrease has not stagnated, i.e., the rate of temperature decrease *is not less than a predetermined threshold*. See EX1007, [0035].

[FIG. 3]



EX1007, Fig. 3. In this circumstance illustrated in Figure 3, the *control unit stops the cooling fan* even though the temperature has not stagnated, i.e., even if the *index value is not less than a predetermined threshold*.

7. Independent Claim 7

- a. **A control device for ICT (Information and Communication technology) equipment having a cooling fan, electronic component, a first temperature sensor for detecting a temperature of the electronic component, and a second temperature sensor that detects a temperature of an intake air, the control**

device comprising:

219. Sato discloses the preamble of claim 7 for reasons I discussed regarding claim 1. In particular, Sato describes embodiments of a “server installation,” which constitutes *ICT (Information and Communication technology) equipment*. See Section VI.A.1.a, above. Sato’s embodiments have *a cooling fan* as discussed for 1a. See Section VI.A.1.b, above. Sato’s embodiments have *electronic component[s]* as discussed for 1pre (see Section VI.A.1.a, above). Sato discloses *a first temperature sensor for detecting a temperature of the electronic component* as discussed for 1b. See Section VI.A.1.c, above. Sato discloses *a second temperature sensor that detects a temperature of an intake air* as discussed for 1c. See Section VI.A.1.d, above. Sato discloses *a control device* as discussed for 1d-1f. See Sections VI.A.1.e-VI.A.1.g, above.

b. a microprocessor including:

220. This limitation is identical to claim limitation 1d. It is disclosed for the same reasons I explained in connection with 1d. See Section VI.A.1.e, above.

c. a declination index value calculation unit that calculates an index value indicating a degree of declination of a component temperature of the electronic component included in ICT equipment, based on a detection result of the first temperature sensor that detects the component temperature of the electronic component; and

221. This limitation is similar to limitation 1e and disclosed for the same

reasons I discussed previously. See Section VI.A.1.f, above. This limitation of claim 7 additionally recites that the *electronic component is included in the ICT equipment*, which is met for the reasons discussed for 1b similarly reciting *component temperature of the electronic component included in the ICT equipment*.

222. In addition, I have considered whether this limitation of claim 7 is disclosed by Sato-Nakamura should it be construed as a means-plus-function limitation. See Section IV.E.1, above. It is disclosed by the prior art for the same reasons I discuss for limitation 1e. See Section VI.A.1.f, above. Sato's MPU is configured to perform the function recited in this limitation as I explained for limitation 1e and is equivalent to the '320 Patent's CPU 13 configured to calculate the "declination index value" as described in the specification (EX1001, 5:17-29).

- d. a control unit that controls the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.**

223. This limitation is nearly identical to claim limitation 1f. It is disclosed for the same reasons I explained in connection with 1f. See Section VI.A.1.g, above.

224. In addition, I have considered whether this limitation of claim 7 is disclosed by Sato-Nakamura should it be construed as a means-plus-function

limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I discuss for limitation 1f. See Section VI.A.1.g, above. Sato's MPU is configured to perform the function recited in this limitation as I explained for limitation 1e and is equivalent to the '320 Patent's CPU 13 configured to implement the "the control means 172" in "the management section 17" identified in the specification (EX1001, 5:45-47).

8. Independent Claim 8

a. A temperature controlling method comprising:

225. Sato combined with Nakamura disclose *a temperature controlling method*. EX1005, [0002]; EX1007, [0009]. I discussed the method in connection with limitations 1e and 1f. See Sections VI.A.1.f-VI.A.1.g, above.

b. by a declination index value calculation unit, calculating an index value indicating a degree of declination of a component temperature of an electronic component included in ICT (Information and Communication Technology) equipment, based on a detection result of a first temperature sensor that detects the component temperature of the electronic component and a second temperature sensor that detects a temperature of an intake air; and

226. The combination of Sato and Nakamura discloses this limitation.

227. Nakamura discloses *a declination index value calculation unit* that calculates *an index value indicating a degree of declination of a component temperature...based on a detection result of a first temperature of the electronic component* also as described for 1e. See Section VI.A.1.f, above. Nakamura also

discloses the specific *index value[s]* recited in dependent claims 2, 3, and 4. See Sections VI.A.2-VI.A.4, above.

228. As discussed in the context of claims 1-4, Nakamura discloses calculating a claimed *index value* when the temperature control program is determining if the internal component temperature is “stagnating.” EX1007, [0036]-[0040]. As Nakamura explains, the temperature stagnates when the rate of temperature decrease becomes small while the cooling fans are operating at low speed. EX1007, [0036]-[0040].

229. In Sato-Nakamura, the fan controller would set the fans at low speed based on the intake air temperature as disclosed in Sato. EX1005, [0064]. Thus, in Sato combined with Nakamura, the index values described for 1e and claims 2, 3, and 4 are calculated *based on a detection result of a first temperature sensor that detects the component temperature of the electronic component and a second temperature sensor that detects a temperature of an intake air* as recited in this limitation.

230. In addition, I have considered whether this limitation of claim 8 is disclosed by Sato-Nakamura should it be construed as a means-plus-function limitation. See Section IV.E.1, above. It is disclosed by the prior art for the same reasons I discuss for limitation 1e. See Section VI.A.1.f, above. Sato’s MPU is configured to perform the function recited in this limitation as I explained for

limitation 1e and is equivalent to the '320 Patent's CPU 13 configured to calculate the "declination index value" as described in the specification (EX1001, 5:17-29).

- c. **by a control unit, controlling the number of rotations of a cooling fan based on the index value calculated by the declination index value calculation unit and the temperature of the intake air by the second temperature sensor.**

231. This limitation is nearly identical to limitation 1f. It is disclosed for the same reasons. See Section VI.A.1.g, above.

232. In addition, I have considered whether this limitation of claim 8 is disclosed by Sato-Nakamura should it be construed as a means-plus-function limitation. See Section IV.E.2, above. It is disclosed by the prior art for the same reasons I discuss for limitation 1f. See Section VI.A.1.g, above. Sato's MPU is configured to perform the function recited in this limitation as I explained for limitation 1e and is equivalent to the '320 Patent's CPU 13 configured to implement the "the control means 172" in "the management section 17" identified in the specification (EX1001, 5:45-47).

VII. CLAIM 3 IS ALSO RENDERED OBVIOUS BY THE COMBINATION OF SATO, NAKAMURA, AND JIN

233. Sato discloses a cooling system for an electronic device, such as a server, that is very similar to the cooling system recited in the challenged claims, and Nakamura discloses multiple methods for determining an *index value*. As I describe below, Jin discloses determining an *index value* that is an *average value*

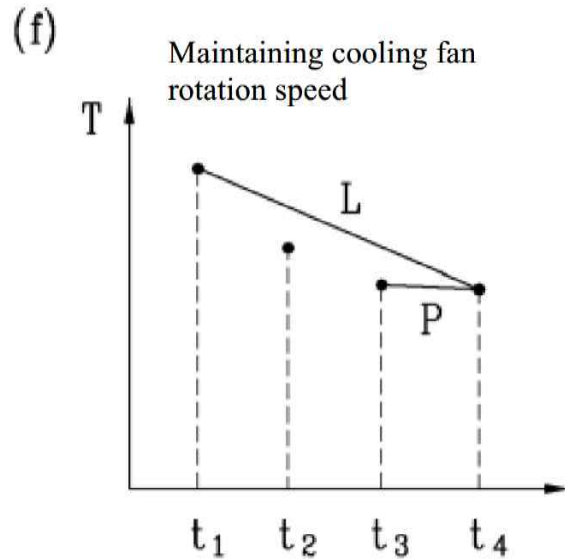
of declination rates based on temperature sensor readings *in a plurality of measurement periods* as recited in claim 3. Thus, the combination of Sato's server embodiments with the teachings of Nakamura and Jin discloses, and renders obvious, claim 3.

1. Motivation to Combine

234. Nakamura discloses multiple techniques for calculating the rate of temperature decrease to determine when internal component temperature is “stagnating” and acknowledges that other methods exist. Jin discloses another method of calculating the rate of temperature decrease and predicting whether the temperature decrease is slowing (i.e., stagnating). A POSITA would be motivated to implement Jin's temperature-change-prediction technique as an additional method of detecting stagnation in Nakamura's temperature-control program as implemented in Sato's server.

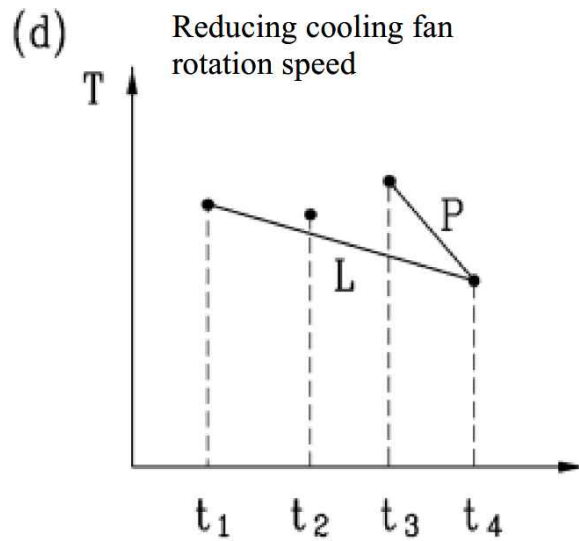
235. A POSITA would recognize the benefit of using Jin's technique to evaluate both the trend in overall temperature change over a relatively longer period of time and also the trend in recent temperature change to predict whether the internal component temperature of Sato's server is stagnating. For example, Jin's Figure 5(f) shows an example where the trend in overall temperature change (L) is decreasing but the trend in recent temperature change (P) is slowing (i.e., the rate of temperature decrease is becoming smaller). Nakamura's temperature-

control program, employing Jin's method, would use the temperature data in Figure 5(f) to determine that the temperature is stagnating.



EX1009, Fig. 5(f).

236. In contrast to Figure 5(f), Jin's Figure 5(d) shows the trend in overall temperature change (L) decreasing and the trend in recent temperature change (P) decreasing even more quickly. Nakamura's temperature control program, employing Jin's method, would use the temperature data shown in Figure 5(d) to determine that the temperature is not stagnating.



EX1009, Fig. 5(d).

237. A POSITA would be motivated to implement Jin’s method in Nakamura’s temperature control program because it uses the same sampling of temperature data but analyzes both long-term and short-term trends. A POSITA would recognize that this approach provides more accurate predictions of temperature stagnation than a technique based on the rate of change between any two given points in time, as in one of Nakamura’s disclosed detection methods.

238. Further, Jin’s technique is intended to use the fan more efficiently and to reduce noise. EX1009, 1 (Summary), [0028] (“the temperature inside the projector can be effectively reduced, and noise generated by the cooling fan provided inside the projector can be minimized”). Both Sato and Nakamura also seek to reduce fan noise. EX1005, [0005], [0011], [0012], [0060], [0104], [0115]; EX1007, [0004], [0009], [0010], [0017]. This further benefit is stated in the

references themselves and would motivate a POSITA to implement Jin's method in the Sato Nakamura combination.

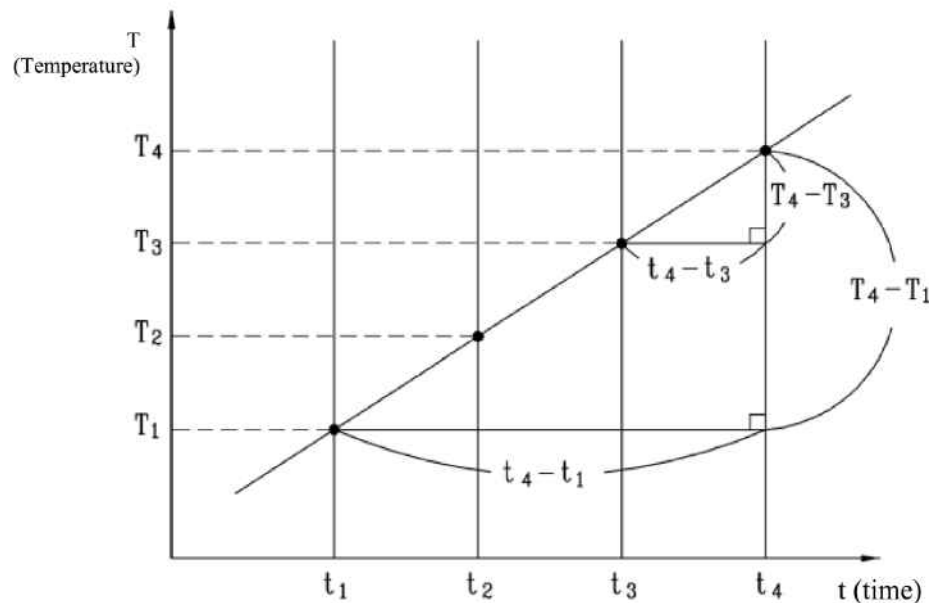
239. A POSITA could have modified Nakamura's temperature control program to incorporate Jin's method without undue experimentation and with a reasonable expectation of success. Given the many similarities between Nakamura and Jin (e.g., both sample temperatures at predetermined times to evaluate the rate of change), such a modification would have required only basic programming changes. It would have been well within a POSITA's capabilities to modify Nakamura's temperature control program to include Jin's functionality (as implemented in Sato's server). Modifying Sato-Nakamura to implement Jin's method would have involved no more than use of prior art elements according to known methods to yield predictable results.

2. Claim 3: The ICT equipment according to claim 1, wherein the index value is an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods.

240. Sato combined with Nakamura discloses the limitations of claim 1 for the reasons I explained for that claim. Jin teaches calculating an *index value* that is *an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods* as in claim 3. In particular, Jin describes controlling a cooling fan using the average rate of temperature change over two different time periods, i.e., *a plurality of*

measurement periods. Thus, the combination of Sato's server with Nakamura's temperature control program modified to include Jin's method discloses claim 3.

241. Jin's Figure 3 illustrates temperatures measured at different times. EX1009, [0056]. As in Nakamura (and the '320 Patent), Jin uses a sensor to record temperature readings at predetermined intervals. Jin uses similar notation: sampling times are denoted t_1 , t_2 , t_3 , t_4 and sampled temperatures are T_1 , T_2 , T_3 , T_4 .

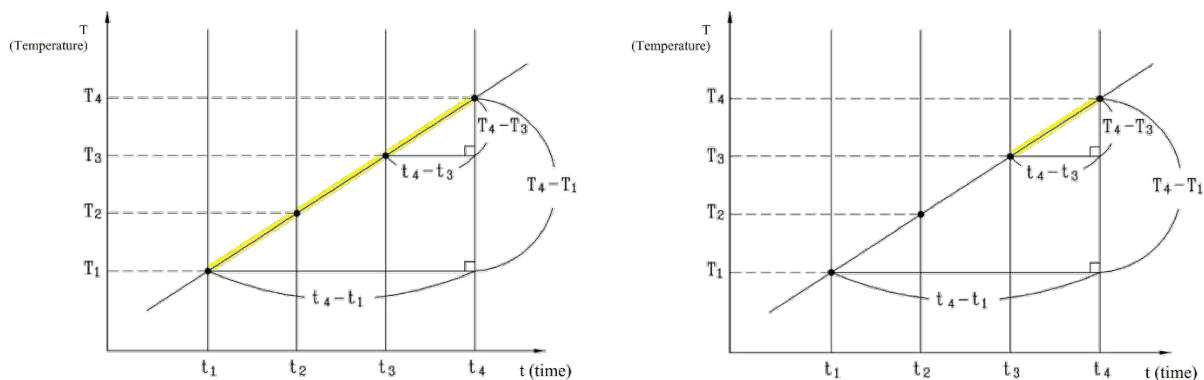


EX1009, Fig. 3. Jin explains that the “rate of change in temperature between any two timepoints of t_1 at the measurement timepoint, t_3 at the measurement timepoint, and t_4 at the measurement timepoint can be determined by the slope of the graph” in Figure 3. EX1009, [0059].

242. In Jin's temperature control technique, two average rates of

temperature change are calculated. Jin determines the average rate of temperature change over a recent time period from t_3 to t_4 , which is “calculated as $\{T_4 - T_3\} / \{t_4 - t_3\}$.” EX1009, [0059]. Jin also determines the average rate of temperature change over a longer period from t_1 to t_4 , which “can be calculated as $\{T_4 - T_1\} / \{t_4 - t_1\}$.” EX1009, [0059]. These calculations are the same as in the ’320 Patent’s description for calculating “[a]n average value of the component temperature declination rates...in a plurality of time periods” “by dividing a difference Δt , between a component temperature t_1 detected at a time when the measurement period starts and a component temperature t_2 detected at a time when the measurement period ends, by the measurement period.” EX1001, 5:21-26. So, Jin discloses claim 3 in the same way that the ’320 Patent does.

243. The highlighting of Jin’s Figure 3 shows the two different calculations.



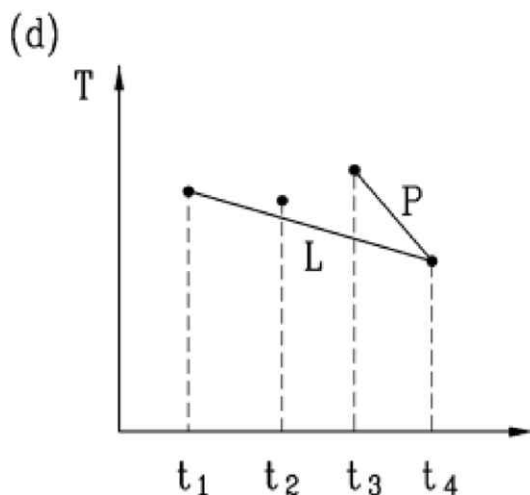
EX1009, Fig. 3 (highlighted). The average rate of change over a longer period (t_1 to t_4) is highlighted in the figure on the left side and the average rate of change

over a recent period (t_3 to t_4) is highlighted in the figure on the right side.

244. In Jin's Figure 3, the temperature is increasing but Jin also discloses calculating the two averages when temperatures are declining. EX1009, [0072], [0087]. Jin's calculations therefore constitute *an average value of declination rates...in a plurality of measurement periods* as recited in claim 3.

245. The two rates of temperature change illustrated in Figure 3 are the same, but Jin recognizes that in practice they would often be different, and Jin teaches using those differences between a longer term temperature trend and a more recent trend to predict future temperature.

246. For example, Jin's Figure 5(d) below shows the overall rate of temperature decline (labeled L) and the recent average rate of decline (labeled P). EX1009, [0087].



EX1009, Fig. 5(d).

247. Jin calculates a “prediction variable (A)” based on an equation using

L (trend in overall temperature change), P (trend in recent temperature change), and a parameter K that is determined experimentally. EX1009, [0082]-[0088]. The prediction variable is used to control the fan speed. EX1009, [0082]-[0088]. Thus, Jin's prediction variable—when implemented as part of Nakamura's temperature control program in Sato's server—constitutes the claimed *index value* of claim 3 because it is *an average value of declination rates of the component temperature of the electronic component in a plurality of measurement periods*.

VIII. SATO AND ITS COMBINATIONS ARE NOT CUMULATIVE OF ART CITED IN PROSECUTION

248. I have been asked to consider whether the combinations of Sato and Nakamura or Sato, Nakamura, and Jin I discuss above are cumulative or duplicative of the prior art discussed and relied on by the examiner during prosecution of the '320 Patent. The examiner relied on Takeshi and Yutaka, as I discuss above in my overview of the prosecution history. In my opinion, the prior art combinations that I discuss above are not cumulative or duplicative of Takeshi and Yutaka.

249. The combination I have discussed are not cumulative or duplicative of the prior art the examiner relied on because none of the three prior art references I discuss were discussed or relied on during prosecution. Even though the foreign priority document cited by Sato is reference in the '320 Patent itself, the Japanese patent was never discussed or used for any rejection during prosecution. As a

matter of fact, the Japanese patent in the file history remains in Japanese with no translation requested or provided.

250. For the reasons I explained above, Nakamura and Jin disclose what was missing from the Takeshi and Yutaka references the examiner relied on for rejections during prosecution because Nakamura and Jin disclose a “declination index value” (i.e., measurement the rate of temperature decrease of a CPU or other electronic component).

251. In the prosecution history of the '320 Patent, the applicant argued that “Takeshi at most calculates the value in which the temperature in a chassis rises, not ‘an index value indicating a degree of declination’ as recited in the claims.” EX1002, 223. The applicant also argued that “Yutaka does not disclose or suggest calculating ‘an index value indicating a degree of declination’ and controlling fan speed in accordance to the index value calculated as recited in the claims.” EX1002, 224. The applicant further argued that neither reference used component temperature and the index value to control fan speed. In light of the applicant’s arguments, the examiner allowed the claims to issue. In my opinion, Nakamura (and Jin with regard to claim 3 in particular) disclose what was missing from the prior art relied on by the examiner.

IX. SECONDARY CONSIDERATIONS

252. 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.

X. AVAILABILITY FOR CROSS-EXAMINATION

253. 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.

XI. RIGHT TO SUPPLEMENT

254. 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.

XII. CONCLUSION

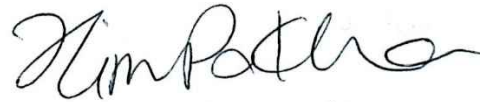
255. For the reasons discussed in this declaration, it is my opinion that the challenged claims of the '320 Patent are unpatentable in view of the prior art I have

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 'Himanshu Pokharna', written in a cursive style.

Himanshu Pokharna, Ph.D.

Dated: July 9, 2025