

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

Polaris PowerLED Technologies, LLC,
Patent Owner.

**DECLARATION OF MILTIADIS HATALIS, PH.D.,
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,740,456**

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LIST OF EXHIBITS¹

Ex-1001	U.S. Patent No. 8,740,456
Ex-1002	Declaration of Dr. Hatalis
Ex-1003	Curriculum Vitae of Dr. Hatalis
Ex-1004	Prosecution History of U.S. Patent No. 8,740,456
Ex-1005	U.S. Pub. No. 2010/0315752 to Rabu et al (“Rabu”)
Ex-1006	United Kingdom Published Patent Application 2,276,783 to Shoji (“Shoji”)
Ex-1007	Japanese Published Patent Application 2011-15581 to Katayama, with certified translation (“Katayama”)
Ex-1008	U.S. Patent No. 7,593,747 to Karam et al (“Karam”)
Ex-1009	INTENTIONALLY LEFT BLANK
Ex-1010	INTENTIONALLY LEFT BLANK
Ex-1011	INTENTIONALLY LEFT BLANK
Ex-1012	INTENTIONALLY LEFT BLANK
Ex-1013	INTENTIONALLY LEFT BLANK
Ex-1014	INTENTIONALLY LEFT BLANK
Ex-1015	INTENTIONALLY LEFT BLANK
Ex-1016	INTENTIONALLY LEFT BLANK
Ex-1017	INTENTIONALLY LEFT BLANK
Ex-1018	INTENTIONALLY LEFT BLANK

¹ Four-digit pin citations that begin with 0 are to the page stamps added by Samsung in the bottom right corner of the exhibits. All other pin citations are to original page, column, paragraph, and/or line numbers.

Ex-1019	INTENTIONALLY LEFT BLANK
Ex-1020	Claim Mapping Table
Ex-1021	INTENTIONALLY LEFT BLANK
Ex-1022	Milton Ohring, <i>Reliability and Failure of Electronic Materials and Devices</i> (Academic Press) (1998)
Ex-1023	Daniel Minzari, <i>Investigation of Electronic Corrosion Mechanisms</i> (2010) (Technical University of Denmark)
Ex-1024	J. Starlet Vimala, M. Natesan & Susai Rajendran, <i>Corrosion and Protection of Electronic Components in Different Environmental Conditions - An Overview</i> , 2 Open Corrosion J. 105 (2009)
Ex-1025	U.S. Pat. No. 7,408,132 to Wambsganss et al (“Wambsganss”)
Ex-1026	U.S. Pub. No. 2002/0064008 to Hennig et al (“Hennig”)
Ex-1027	U.S. Pat. No. 6,222,716 to Chiang et al (“Chiang”)

I. INTRODUCTION

1. I have been retained as an independent expert witness on behalf of Samsung Electronics, Co., Ltd. and Samsung Electronics America, Inc. (collectively, “Samsung”) in the above-captioned inter partes review (“IPR”) relating to U.S. Patent No. 8,740,456 (“the ’456 Patent”) (Ex-1001).

2. I understand that Samsung is petitioning for IPR of claims 1-13 of the ’456 patent and requests that the United States Patent and Trademark Office (“PTO”) cancel those claims.

3. In preparing this Declaration, I have reviewed the ’456 patent and considered the documents identified below in light of the general knowledge in the relevant art. In forming my opinions, I relied upon my education, knowledge, and experience, and considered the level of ordinary skill in the art as discussed below.

4. I am being compensated for my work in this matter at my standard consulting rate, which is \$400 per hour, plus actual expenses. My compensation is not dependent in any way upon the outcome of this matter.

II. BACKGROUND AND QUALIFICATIONS

5. My complete qualifications and professional experience are described in my academic curriculum vitae, a copy of which is provided as Exhibit 1003. The following is a brief summary of my relevant qualifications and professional experience.

6. I am currently a Professor in the Department of Electrical and Computer Engineering at Lehigh University. I hold a B.S. degree in physics from Aristotle University, Greece, an M.S. degree in electrical engineering from SUNY Buffalo, and a Ph.D. (1987) in electrical engineering from Carnegie Mellon University. In 1987, I joined Lehigh University as an assistant professor in the Department of Electrical & Computer Engineering. I served as an associate professor at Lehigh University from 1991 to 1995, and have been a full professor at Lehigh University since 1995. From 1988 to 1993, I served as associate director of the Microelectronics Research Laboratory at Lehigh University. Since 1992, I have served as director of the Display Research Laboratory at Lehigh University. From 2010 to 2013, I served as interim director of the Sherman Fairchild Center for Solid State Studies at Lehigh University. From 2003 to 2008, I concurrently served as professor in the Department of Computer Science at Aristotle University, Greece.

7. From 1987 to 2015, I also worked as an independent consultant for a number of major technology companies in the flat panel display and semiconductor field, including IBM, Kodak, Sharp and Motorola Solutions. In 1992, I was a visiting scientist at XEROX Palo Alto Research Laboratory.

8. As discussed below, my technical expertise is in flat panel display technologies, including thin film transistor (“TFT”) and active-matrix organic light-emitting diode (“AMOLED”) technologies.

9. I am the author or co-author of 180 technical publications including three issued patents, and two book chapters, including one on AMOLED pixel electronic circuits and one on polysilicon TFT technology. As of this writing, I have a total of 4,536 citations and my h-index is 30 according to Google Scholar.

10. In 1992, I founded, and became Director of, the “Display Research Laboratory,” which was the first academic laboratory in the United States dedicated to research and development of electronic thin film materials and devices, including thin film transistors, for flat panel displays, flexible electronics and novel large area microelectronic system applications. As Director of Lehigh’s Display Research Laboratory, I have raised over \$13 million through research contracts and grants to support the laboratory's research activities. These contracts and grants were funded by the Defense Advanced Research Program Agency (DARPA), the Army Research Laboratory (ARL), the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), the State of Pennsylvania, and a variety of industrial companies including Corning, IBM, Kodak, Sharp, Northrop Grumman, and others.

11. From 1987 to present I have conducted research in microelectronics, including semiconductors, electronic materials, devices and circuits for integrated circuits and integrated microsystems. My research mainly focuses on electronic thin film materials and devices, microelectronic fabrication processes, novel electronic circuits, and integrated microsystems. My research group pioneered the development of electronic materials, devices, and circuits on flexible substrates, active matrix organic light emitting diode displays, and addressable arrays for integrated sensor applications such as fingerprint sensors for biometrics and multichannel gas sensors.

12. As a faculty member, I supervised the research of twenty Ph.D. dissertations in the technical field of semiconductors/microelectronics. Upon graduating, all twenty of my Ph.D. graduate students moved either to industrial positions in the electronic or flat panel display industry, including positions at Apple, IBM, Intel, Sharp, TSMC, and Motorola, or into academic positions in the United States or abroad. I have also supervised the research of several post-doctoral researchers and research associates at Lehigh. Moreover, I have supervised a large number of graduate student Master's theses and numerous undergraduate research projects. I have been an invited lecturer at numerous universities, industrial laboratories, and conferences in the United States and overseas.

13. The list of peer-reviewed journals in which my papers were published include Thin Solid Films, Journal of the Electrochemical Society, Solid State Electronics, Journal of Applied Physics, Journal of the Society for Information Display, Journal of Materials Science, and multiple IEEE journals including the IEEE Journal of Display Technology, IEEE Transactions on Electronic Devices, IEEE Solid State Circuits, and IEEE Electron Device Letters. The technical conferences where my papers were presented have been organized by scientific societies including: Society of Information Display (SID), Materials Research Society (MRS), Electrochemical Society (ECS), and Institute of Electrical and Electronics Engineers (IEEE).

14. I am also a named inventor on U.S. Patent No. 8,390,536, directed at controlling current to pixels in an active matrix display by adjusting voltage on the data lines and two international patents associated with the above invention, one issued in Korea and one in Japan.

15. I have taught a number of different undergraduate and graduate level courses in the Electrical and Computer Engineering department at Lehigh University. These courses have generally centered on physics, technology, and the design and fabrication of solid-state devices and integrated circuits. I have also introduced several new courses which include “Introduction to VLSI Design,” “Semiconductor Material and Device Characterization,” and “Introduction to

Photovoltaic Energy Systems.” I also regularly teach the “Principles of Electrical Engineering,” “Introduction to Computer Engineering,” “Electronic Circuits,” and “Introduction to VLSI Circuits” courses.

16. As part of my research, I utilize much of the same equipment and many of the same microfabrication processes that are in use by the semiconductor or flat panel display industry including: Plasma-Enhanced Chemical Vapor Deposition (PECVD) for the deposition of amorphous silicon, silicon nitride and silicon dioxide films; sputter and e-beam deposition tools for aluminum, copper, nickel tungsten, titanium, gold, tantalum, and other metallic thin films; photolithographic tools for defining photoresist patterns on the substrates; as well as reactive ion etching or wet etching tools for removing various thin film materials from the substrates. I also utilize several tools for the characterization of the materials and structures used in microelectronic devices including: optical microscopes, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Atomic Force Microscopy (AFM). I further utilize a variety of electrical characterization techniques and instruments for testing the electrical performance of completed electronic circuits and systems.

17. As part of my research, I pioneered a technique for crystallizing amorphous silicon. Similar techniques have been used in the manufacturing of integrated circuits and flat panel displays. In addition, my research group at Lehigh

pioneered the fabrication of electronic devices and circuits on novel flexible substrates and the development of integrated microsystems on flexible substrates, including active matrix organic light emitting diode displays, and addressable arrays for integrated sensor applications such as fingerprint sensors for biometrics and multichannel gas sensors. Many industrial and academic laboratories currently pursue similar research activities; such research flows from the accomplishments of my research group in this technical field.

18. My industrial experience includes work at the XEROX Palo Alto Research Laboratory and various consulting projects with companies in the flat-panel display or semiconductor technical fields. Those projects related to electronic materials, semiconductor devices and their application to microelectronic systems.

19. I am a member of several professional organizations including the Electron Device Society of the IEEE and the SID. I have also been the chair or co chair at numerous national and international conferences and symposiums, including several SID-sponsored Workshops on Active Matrix Liquid Crystal Displays and a Materials Research Society Symposium on Flat Panel Displays. I have co authored two book chapters, one dealing with the “Polysilicon TFT Technology” and another on the application of “Polysilicon TFTs in AMOLED Displays.” I have served as a reviewer for technical papers submitted to several scientific journals and have also served as a reviewer for several years for the

National Science Foundation Small Business Innovative Research (SBIR) program.

20. A detailed list of my publications, education and professional experience, research grants, Ph.D. dissertations for which I served as advisor, publications, and litigation cases in which I served as a technical expert, can be found in my curriculum vitae attached and submitted as Exhibit 1003.

III. INFORMATION CONSIDERED

21. In preparation for this declaration, I have considered the materials discussed in this declaration, including, for example, the '456 Patent, the references cited by the '456 Patent, the prosecution histories of the '456 Patent and applications from which it derives (including the references cited therein), various background articles and materials referenced in this declaration, and the prior art references identified in this declaration. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

22. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

23. I have been informed and understand that in an IPR proceeding, claims are to be interpreted according to the Phillips claim construction standard. I have been informed and understand that claim construction is a matter of law and that the final claim constructions for this proceeding will be determined by the Patent Trial and Appeal Board (“PTAB”).

B. Written Description

24. I understand that determining whether a particular patent or printed publication constitutes prior art to a challenged patent claim can require determining the effective filing date (also known as the priority date) to which the challenged claim is entitled. I understand that for a patent claim to be entitled to the benefit of the filing date of an earlier application to which the patent claims priority, the earlier application must have described the claimed invention in sufficient detail to convey with reasonable clarity to the POSITA that the inventor had possession of the claimed invention as of the earlier application’s filing date. I understand that a disclosure that merely renders the claimed invention obvious is not sufficient written description for the claim to be entitled to the benefit of the filing date of the application containing that disclosure.

C. Perspective of One of Ordinary Skill in the Art

25. I have been informed and understand that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I understand that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

D. Obviousness

26. I have been informed and understand that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

27. I understand that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, longfelt but unmet need, failure of others, copying by others, and skepticism of experts).

28. I understand that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I understand that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I further understand that a POSITA is presumed to know the relevant prior art. I understand that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

29. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I understand that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the Patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the Patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether the combination involves the substitution of one known element for another that yields predictable results;

- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results
- whether the combination is “obvious to try”;
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

30. I understand that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I understand, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

31. Claims 1-13 of the '456 Patent are obvious on the following grounds:

- **Ground 1:** Claims 1, 5-9, 12 and 13 are rendered obvious by U.S. Patent Publication No. 2010/0315752 to Rabu et al (“Rabu”) (Ex-1005) in view of Japanese Published Patent Application 2011-15581 to Katayama, with certified translation (“Katayama”) (Ex-1007).
- **Ground 2:** Claims 1, 5-9, 12 and 13 are rendered obvious by Rabu-Katayama in further view of UK Published Patent application 2,276,783 to Shoji (“Shoji”) (Ex-1006).
- **Ground 3:** Claims 1-13 are rendered obvious by Rabu-Katayama, and further in view of U.S. Patent No. 7,593,747 to Karam et al (“Karam”) (Ex-1008).

The following table is a summary of the above enumerated grounds:

Ground	Prior Art	Claims
1	Rabu and Katayama	1, 5-9, 12, and 13

2	Rabu, Katayama, and Shoji	1, 5-9, 12, and 13
3	Rabu, Katayama, and Karam	1-13

VI. THE CHALLENGED PATENT

32. The '456 Patent relates to a “system configured to modify current (or power) delivered [] between a first device 100 and a second device 150.” Ex-1001, 3:46-47. One device provides current (e.g., power) to the other device over the connection. Ex-1001, 1:37-40. As described in the specification, the first device 100 may be any of numerous devices (e.g., mobile/portable devices) that receives power from another device or power source, *id.* at 4:24-35, and the second device 150 may be any of various devices (e.g., a computer system) that provide power to the first device 100, *id.* at 4:36-41.² A connection couples the first device and the second device. Ex-1001, 5:15-17. Indeed, as shown in Figures 1A and Figure 2A,³

² The labels “first device” and “second device” as used in the specification are transposed compared to their use in the claims, but this is a difference of form, not substance. For all independent and dependent claims, the “first device” refers to the device that provides current, while the “second device” refers to the device that receives current. *See* Ex-1001, independent Claim 1 (10:33-34 (“while the first device provides current to the second device”); 10:39-40 (“current being provided from the first device to the second device”)); independent Claim 9 (12:2-3 (“current being provided from the first device to the second device”).

³ Throughout this Declaration, all annotations and emphasis have been added, unless otherwise noted.

“[i]n one embodiment, the electrical assemblies 202 and 210 may be ports (or connectors) of the first device 100 and second device 150. Thus, in FIG. 2, the connection 200 may be connected to both the first device 100 and the second device 150 via the corresponding connectors [(i.e., connectors 204 and 208)] of the connection and the electrical assembly of the respective device.” Ex-1001, 5:22-27.

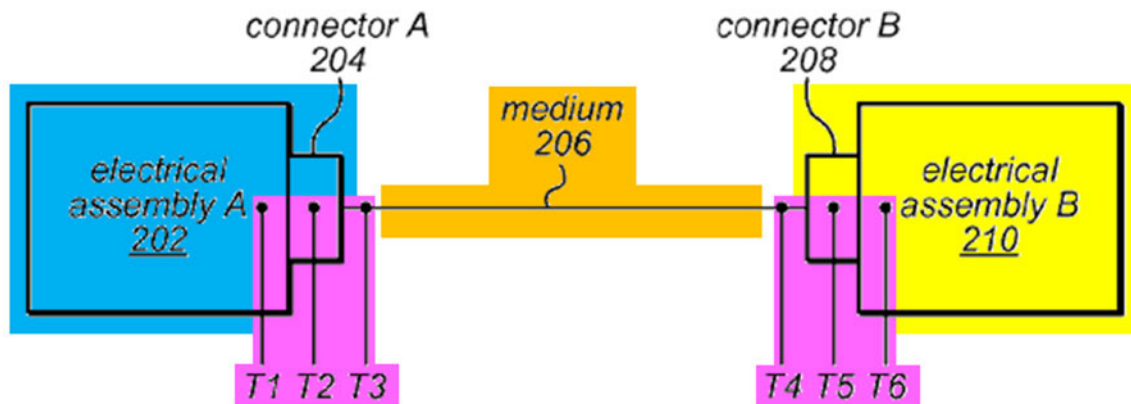
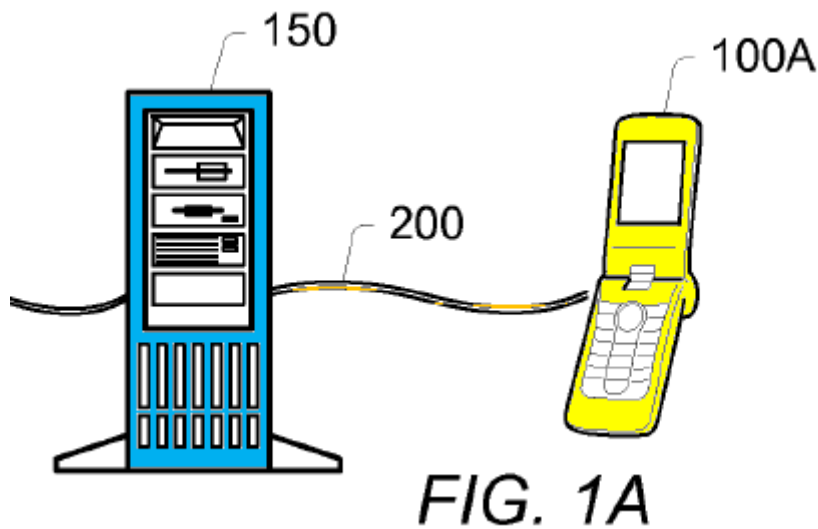


FIG. 2A

33. Figure 3 shows an exemplary first device 100 or second device 150. Ex-1001, 5:49-50. The device may include electrical assembly 310 “for connecting to connection 200” and power logic 330 that “may include any circuitry or processor(s) necessary to provide or receive power over the connection 200.” *See id.* at 5:50-6:1. Figure 3 also discloses temperature logic 320, “which may be configured to compare the measured temperature [] with a threshold temperature [] and initiate a change in current provided over the connection 200 when the threshold is exceeded.” *Id.* at 6:11-16. For example, “temperature logic 320 may indicate the threshold has been exceeded to power logic 330, which may in turn cause a reduction in current received or provided over the connection 200” connecting the first device and second device. *Id.* at 6:16-19. Temperature logic 320 also may include a temperature sensor used to measure the temperature at various places, such as those shown in FIGS. 2A labeled as T1-T6. *Id.* at 6:20-22, Fig. 2A (above, pink).

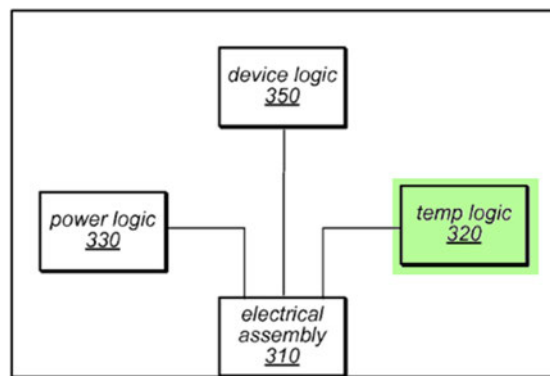


FIG. 3

34. As explained in detail below, the '456 patent claims are obvious in view of the prior art.

VII. PATENT PROSECUTION HISTORY

35. I understand that the '456 Patent's file history is submitted as Ex-1004. I further understand that the '456 Patent issued from application 13/109,446, filed on May 17, 2011.

36. On August 19, 2013, the Office rejected claims 1-7, 10-15 under 35 U.S.C. § 102 as anticipated by each of several prior art references. Ex-1004, 74-78 (Office Action (08/19/2013), 4-8). In response, on December 2, 2013, Applicants submitted amended claims and remarks distinguishing the cited prior art. *Id.*, 100-10 (Response to Office Action (12/02/2013)). Applicants emphasized that the amended claims measure temperature at two locations: "The amended Claims recite the measurement of temperature changes at both ends of the electrical connection between the first device and the second device." *Id.*, 107 (Response to Office Action (12/02/2013), 8). Applicants further emphasized comparing temperature change measurements: "the current is of the electrical connection is adjusted based on the greater of the temperature change measurements made at the first and second devices." *Id.*

37. In remarks, Applicants distinguished the cited prior art as not disclosing temperature sensors at both ends of an electrical connection or at both

devices, and as not measuring temperature changes. Ex-1004, 107-09 (Response to Office Action (12/02/2013), 8-10). For example, applicants acknowledged that prior art reference Reusche discloses multiple sensors included in the outlet, but distinguished Reusche “because they would all be on the same side of the electrical connection, rather than having sensors measuring temperature changes on both sides of the electrical connection.” *Id.* (Response to Office Action (12/02/2013), 9).

38. Applicants did not challenge the Office’s determination that “it is very well known in the art to determine change in temperature by taking an initial temperature and a current temperature difference.” Ex-1004, 76, 78 (Office Action, 6, 8).

39. On February 2, 2014, the Office issued a Notice of Allowability. Ex-1004, 118 (Notice of Allowability (02/04/2014)). And on June 3, 2014, the Office issued the application as U.S. Patent No. 8,740,456. Ex-1004, 150 (Issue Notification (06/03/2014)).

VIII. LEVEL OF ORDINARY SKILL IN THE ART

40. One of ordinary skill in the art would have had a bachelor’s degree in electrical engineering, computer engineering, materials science, or a related field, and at least two years of experience in the research, design, development, and/or testing of computer circuitry, wired connections, temperature sensors, power

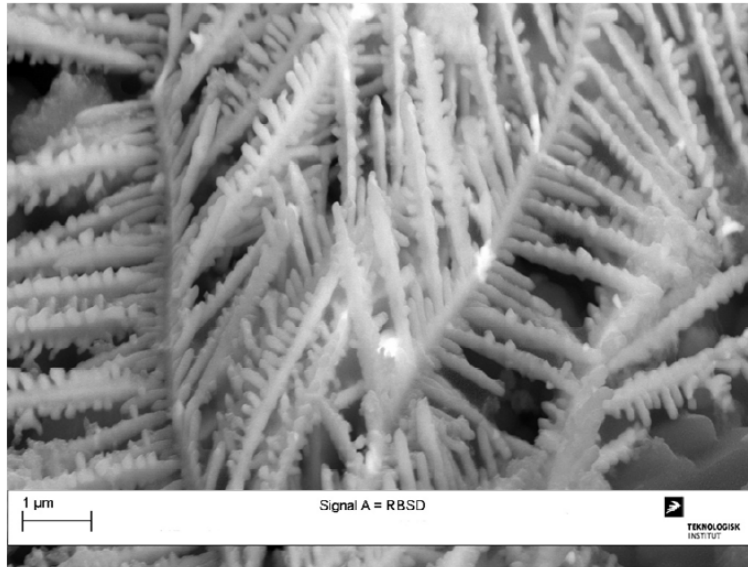
charging, and related firmware and software, or the equivalent, with additional education substituting for experience and vice versa.

IX. TECHNOLOGY BACKGROUND

41. Before 2011, it was well known in the art that electronic devices are subject to environmental damage that can cause dendritic growths and short circuits that lead to increasing temperature at contacts. Moreover, it was well known that overheating of a device can result in a catastrophic failure. Ex-1001, 1:20-25. Ex-1022, 0059. It also was well-known in the art to use temperature sensors in circuits to detect overheating caused by short circuits and reduce or turn off power to prevent resulting damage.

A. Dendritic growths causing short circuits

42. Various experiments placing circuit components in ionic solutions resulted in dendrite formation. Ex-1023, 0110-40. Dendrites are characterized by their branch-like structures, as shown in the image below:



Ex-1024, 0118.

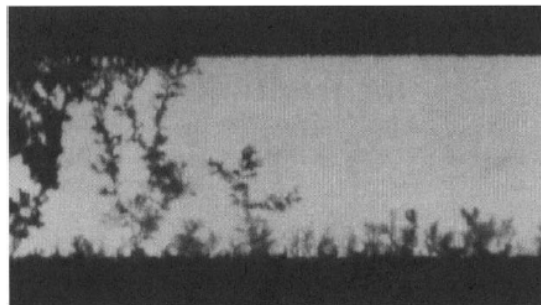
43. It was well known in the art that moisture induces damage to metal in electronics and causes electrical shorting. Ex-1022, 0007. A thin surface oxide layer generally protects a metal from its environment, and a thin film of water alone on the metal surface generally does not cause damage. *Id.*, 0008. “However, when airborne pollutants of reactive chlorides, sulfides, sulfates, and oxygen and nitrogen compounds simultaneously impinge on the surface, the trouble begins,” because they “dissolve in the thin moisture films” resulting in “high concentrations of corrosive ions [that] initiate and perpetuate damage.” *Id.*

44. For example, outside sources such as humid atmospheres and airborne contaminant particles can cause degradation and damage to electronic products. Ex-1022, 0003. Indeed, “[e]ven in the very early years of microelectronics it was already recognized that moisture and atmospheric particulates, often ionic in

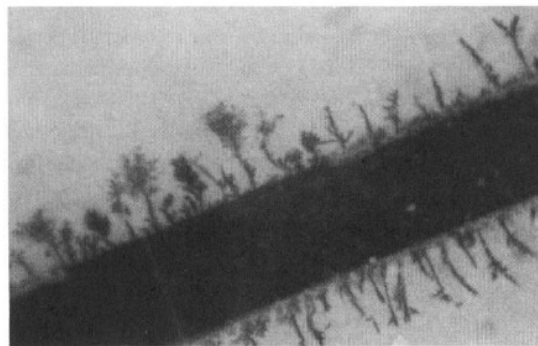
nature, posed serious reliability problems in devices, components, and packages.”

Id. Such contaminants result from air pollution, acid rain, wind-induced abrasion, natural sources such as volcanic ash and fossil fuels, release from fertilization, and biological decay. *Id.* at 0004. The “[m]ost common moisture borne contaminant is salt (sodium chloride) near the sea coast.” Ex-1024, 0003.

45. Once contaminants infiltrate electronics, the chemical reactions between metals and contaminants to create dendrites is well known. For example, aluminum, gold, nickel, and copper react with contaminants resulting in corrosion and dendritic growths. Ex-1022, 0020-26. Below are example images of silver dendrites (a) and copper dendrites (b):



(a)



(b)

Id. at 0030, Fig. 7-9.

46. Various studies in the art are directed to understanding the conditions and circumstances that lead to dendritic growth. For example, one study by Vimala examines “whether a dendrite will grow or not in a given material following certain processes through which contamination occurs.” Ex-1024, 0005. Studies like this one are important because corrosion and dendrite formation in electronic devices results in short circuits, corrosion and failure of electronic devices, and expensive damage for repairs, downtime, and replacements. *Id.*, 0001, 0005.

47. Generally, dendritic growth results from a combination of: (i) moisture, (ii) ionic contamination in the moisture and in the migration path of the dendritic growth, and (iii) sufficient applied voltage and current density at the tip of the dendrite. Ex-1024, 0003. No dendrites are obtained with water having neutral pH of 7 and when the applied voltage is below a certain threshold. *Id.*, 0005. On the other hand, acidic environments promote the growth of dendrites, and dendrites produced at higher voltages are heavier and have a ramiform structure while those produced at lower voltages are thinner and occur in fascicles aligned with the electric field. *Id.*, 0005.

48. Environments with higher humidity have increased moisture, which promotes the growth of dendrites. Ex-1024, 0003. When in high humidity, a thin moisture layer will be present on the surface, which decreases surface insulation resistance, resulting in corrosion or formation of metallic dendrites. *Id.* The degree

of humidity is directly proportional to the degree of dendritic growth: the higher the humidity, the thicker the moisture layer and faster the corrosion or dendrite growth. *Id.*

49. Separable connectors and contacts of electronic devices are prone to dendritic growths as well. Ex-1024, 0002. These contacts are copper coated with electroplated nickel and gold for resisting corrosion. *Id.* Since these coatings are thin and porous, the contacts retain water by capillary forces and are susceptible to corrosion. Ex-1024, 0002. “Even noble metals such as gold and silver as well as copper, lead and tin” are susceptible to failure by dendritic growth.” *Id.*, 0005.

B. Temperature sensors to detect circuit overheating and reducing power when temperature exceeds a threshold

50. It was well-known in the art to use temperature sensors in electronic devices to measure temperature, detect overheating caused by short circuits, and reduce or disable the power supply if the temperature is above a threshold temperature.

51. For example, Wambsganss, titled “Temperature Sensor For Power Supply,” is U.S. Pat. No. 7,408,132, issued August 5, 2008. Ex-1025. Wambsganss discloses a temperature sensor, such as a thermistor, for sensing temperature inside a power source connector. *Id.*, Abstract. The sensed temperature then may be considered for determining whether the power should be reduced or switch off in order to avoid overheating the connector. *Id.* A microcontroller may monitor the

sensed temperatures and reduce or disable the power supply if the temperature is above a threshold temperate. *Id.*

52. Wambsganss further teaches that short circuits may cause heat capable of melting the plastic cable housing or causing other damage to the electronic device. Ex-1025, 1:36-41. But current power supplies may not recognize such an overheating condition because they monitor temperature only inside the main power supply housing, not outside at connectors. *Id.* at 1:41-44. Accordingly, Wambsganss discloses monitoring the temperature of components outside of the power supply housing, such as in cables and connectors. *Id.* at 1:44-47.

53. Similarly, Hennig, titled “Method And Apparatus For Providing Thermal Shutdown And Current Limiting Protection,” is U.S. Pub. No. 2002/0064008. Ex-1026. Hennig discloses shutting down electronic devices to prevent excessive heat caused by a short circuit and resulting damage to the system. For example, Hennig discloses that it has long been known in the prior art to provide thermal shutdown for electronics to prevent excessive heat that can damage the electronics. *Id.* ¶4. A short circuit generates heat because it allows the flow of excess current, which induces a high power dissipation, which in turn causes the system to heat up. *Id.* Once the system has reached a predefined temperature, protection mechanism may initiate to prevent the system from continuing to supply the excess current to the short circuit. *Id.*

54. Likewise, Chiang, titled “Power Line Protection Devices And Methods For Providing Overload Protection to Multiple Outputs,” is U.S. Pat. No. 6,222,716, issued April 24, 2001. Ex-1027. Chiang discloses shutting down or reducing power when temperature exceeds a threshold. For example, Chiang discloses detecting the over-temperature status of switches and overcurrent status of ports in an electronic device. *Id.* at Abstract. If there is an over-temperature, then ports with an overcurrent are switched off. *Id.* After waiting a predetermined amount of time, the over-temperature status is again checked whether it persists or has disappeared. Chiang discloses a sensor for detecting whether an over-temperature status is present. *Id.* at 4:26-28.

X. PRIORITY DATE

55. I have been informed that Petitioner takes no position on the proper priority date for each claim of the '456 Patent. The earliest possible priority for the '456 Patent is May 17, 2011, based on the filing date of Application No. 13/109,446. I have been asked to apply this date for purposes of the invalidity arguments presented in my declaration.

XI. CLAIM CONSTRUCTION

56. I do not believe that any term requires explicit construction to resolve the issues presented in this declaration. I ascribe the plain meaning to each claim term, as that plain meaning would have been understood by a POSITA.

XII. BRIEF DESCRIPTION OF THE APPLIED PRIOR ART REFERENCES

A. Rabu (Ex-1005)

57. Rabu, titled “Thermal Protection Circuits and Structures for Electronic Devices and Cables,” is U.S. Pub. No. 2010/0315752, published Dec. 16, 2010. I understand that Rabu is §102(a) prior art and §102(e) prior art. Ex-1005.

58. As shown in Figure 1, Rabu discloses electronic device 12 and electronic device 14 coupled by path 16. Ex-1005, Fig. 1. Rabu explains that “[a] wired path such as path 16 may be used to connect electronic device 12 to electronic device 14.” *Id.* ¶34. Rabu discloses that “path 16 includes one or more conductive lines and a connector at each end.” *Id.* “The conductive lines in path 16 may be used to convey signals such as data and power signals over path 16.” *Id.*

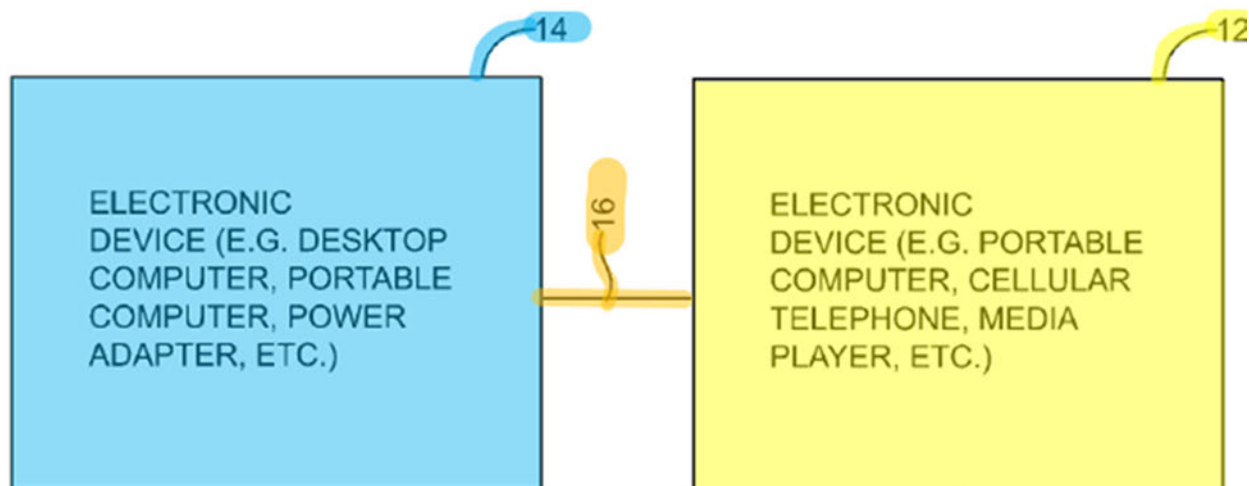


FIG. 1 (rotated)

59. As shown in Figure 15, Rabu discloses “temperature sensor 1500 in electronic device 12” and further states that temperature sensor 1500 “may be able to sense the temperature of connector 38 of cable 16 and convey signals to cutoff switch 1502 representative of the temperature of connector 38.” Ex-1005 ¶¶77. This occurs when “the temperature of the first connector has exceeded a threshold temperature.” *Id.* ¶8.

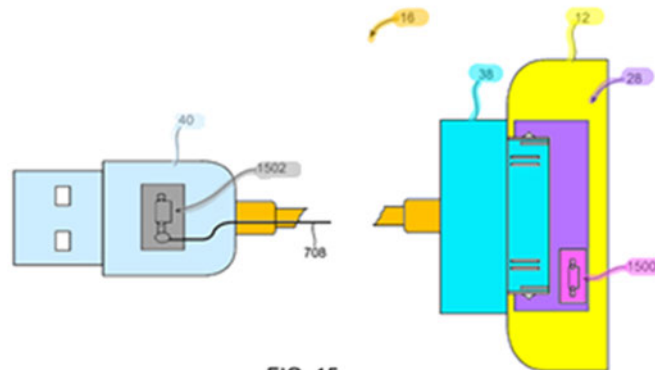


FIG. 15

60. Moreover, Rabu explains that a temperature sensor may be provided at both ends of the connection, in both device 14 and device 12. Specifically, “[t]hermal protection circuitry 710 may include a temperature-sensitive device such as a temperature sensor” and “thermal protection circuitry may be provided in electronic device 12 and in electronic device 14.” Ex-1005 ¶¶46, 78.

B. Katayama (Ex-1007)

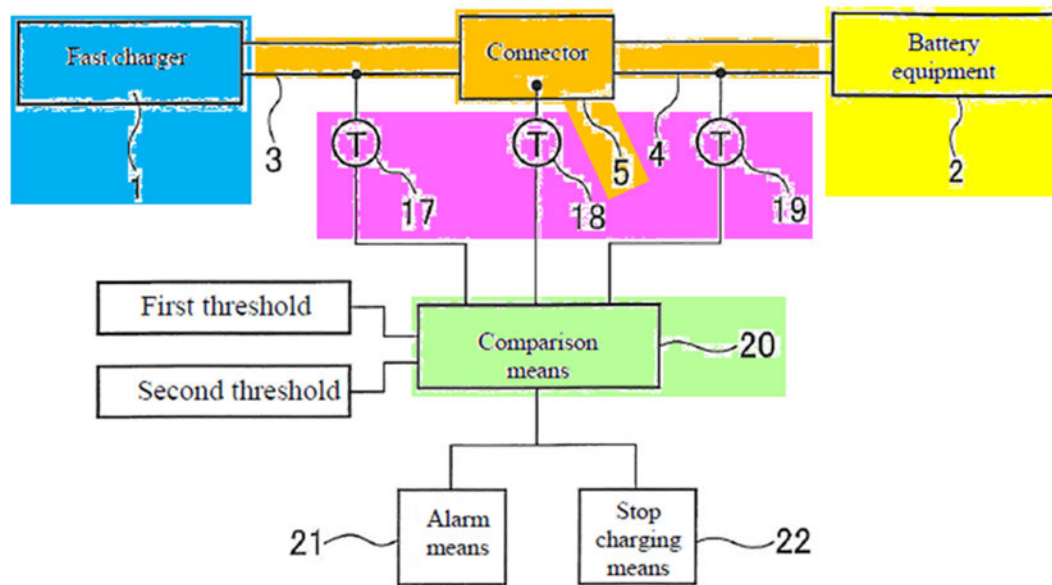
61. Katayama, titled “Deterioration Detection Device For Electric Vehicle Fast Charger,” is Japanese Published Patent Application 2011-15581, published on

January 20, 2011. I understand that Katayama is §102(a) prior art. A certified translation is included in Ex-1007. Citations are made to the translated document.

62. Katayama discloses a deterioration detection device for electric vehicle fast charger that stops charging when a temperature difference is at or above a certain threshold value. Ex-1007, Means To Solve The Problem, ¶1. The charging device includes multiple temperature sensors for measuring temperature at different locations and connects to a battery equipment via a connector. *Id.*, Abstract.

63. As shown in Figure 3, Katayama discloses fast charger (1) connected to battery equipment (2) installed on an electric vehicle via connector (5). Ex-1007, Abstract, ¶14. Fast charger (1) connects to connector (5) via charging cable (3), and connector (5) connects to battery equipment (2) via charging cable (4). *Id.*

FIG. 3



64. As shown in Figure 3, Katayama teaches temperature sensors and a means for stopping charging when any of the measured temperatures is at or above a certain threshold value. Ex-1007 ¶18. Charging cable (3), connector (5), and charging cable (4) each is equipped with temperature sensor (17, 18, and 19), respectively. *Id.* A first threshold value is defined as the value by which the measured temperature of temperature sensors (17, 18, and 19) that is greater than the normal value. *Id.* And a second threshold value is defined as the temperature at which charging cable 3 or 4 or connector 5 may burn out. *Id.* Comparison means 20 is provided to compare the measured temperature of any one of temperature sensors (17, 18, or 19) to a first or second threshold value. *Id.* Means (21) is

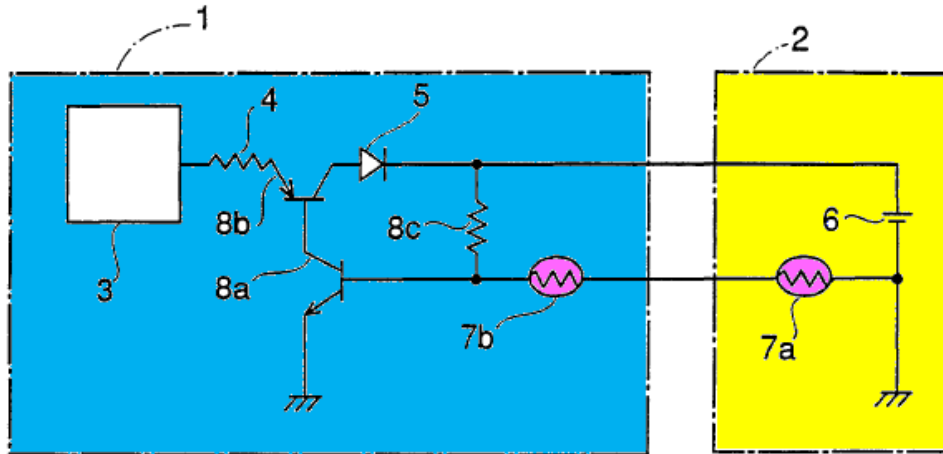
provided for sounding a minor alarm, and means (22) is provided for stopping charging. *Id.*

C. Shoji (Ex-1006)

65. Shoji, titled “Battery Charging Apparatus,” is United Kingdom Published Patent Application 2,276,783, published on October 10, 1994. I understand that Shoji is §102(b) prior art.

66. Shoji discloses a charging device to supply power to a battery of a separate portable device. Ex-1006, Abstract. Shoji also teaches that a temperature sensor should be located both in the charger and in the device being charged. This is shown, for example, in Shoji’s Figure 3. Charger 1 (blue) includes thermistor 7b (pink). *Id.*, 10, 13. The charger is connected to battery-operated device 2 (yellow), which includes thermistor 7a (pink). *Id.*, 10, 13. Additionally, Charger 1 and Device 2 are removably connected via a “three-terminal” or “two-terminal” connector. *Id.*, 15. Shoji teaches to stop charging if the temperature of either device is too high. *Id.*, Abstract.

Fig.3



D. Karam (Ex-1008)

67. Karam, titled “Techniques for Controlling Delivery of Power to a Remotely Powerable Device based on Temperature,” is U.S. Patent No. 7,593,747, issued on Sep. 22, 2009. I understand that Karam is §102(b) prior art.

68. Karam discloses an improved method for delivering power to a remotely powerable device. Ex-1008, Abstract. The method involves comparing an operating resistance to an initial resistance to generate a temperature change result, and selectively changing the delivery of power to the remotely powerable device based on the temperature change result. Ex-1008, Abstract.

69. As shown in Figure 1, Karam discloses “layout 20 for a Power-over-Ethernet (PoE) system 22” which “includes power-sourcing equipment (PSE) 24, a

remotely powerable device (PD) 26, and a communications pathway 28.” Ex-1008, 3:38-39, 3:41-43.

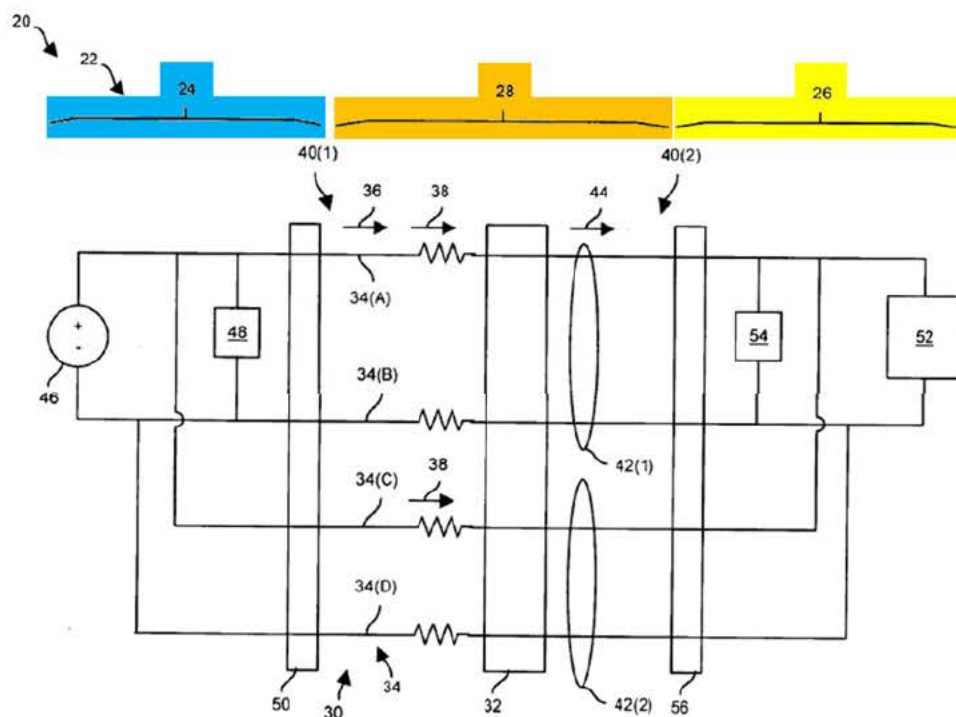


FIG. 1

70. As shown in Figure 3, PSE 24 includes local voltage monitor 80, local current monitor 82, analog to digital converter (ADC) 84, receiver 86, controller 88, and non-volatile memory 85. Ex-1008, 6:4-7. “Controller 88 includes a processor 98 and memory 100 which stores a specialized application 102” and when the application is executed, “processor 98 calculates the resistance ‘R’ through the communications pathway 28.” *Id.*, 7:23-27. “Accordingly, the controller 88 computes the resistance ‘R’ through the communications pathway 28 at different times in order to determine a temperature change.” *Id.*, 7:28-30. Karam

discloses that “controller 88 periodically generates a temperature change result [] and compares this temperature change result [] to a predetermined threshold value [].” *Id.*, 8:22-25. Based on the temperature change result, processor 98 then either enables or disables power delivery to PD 26. *Id.*, 9:26-29.

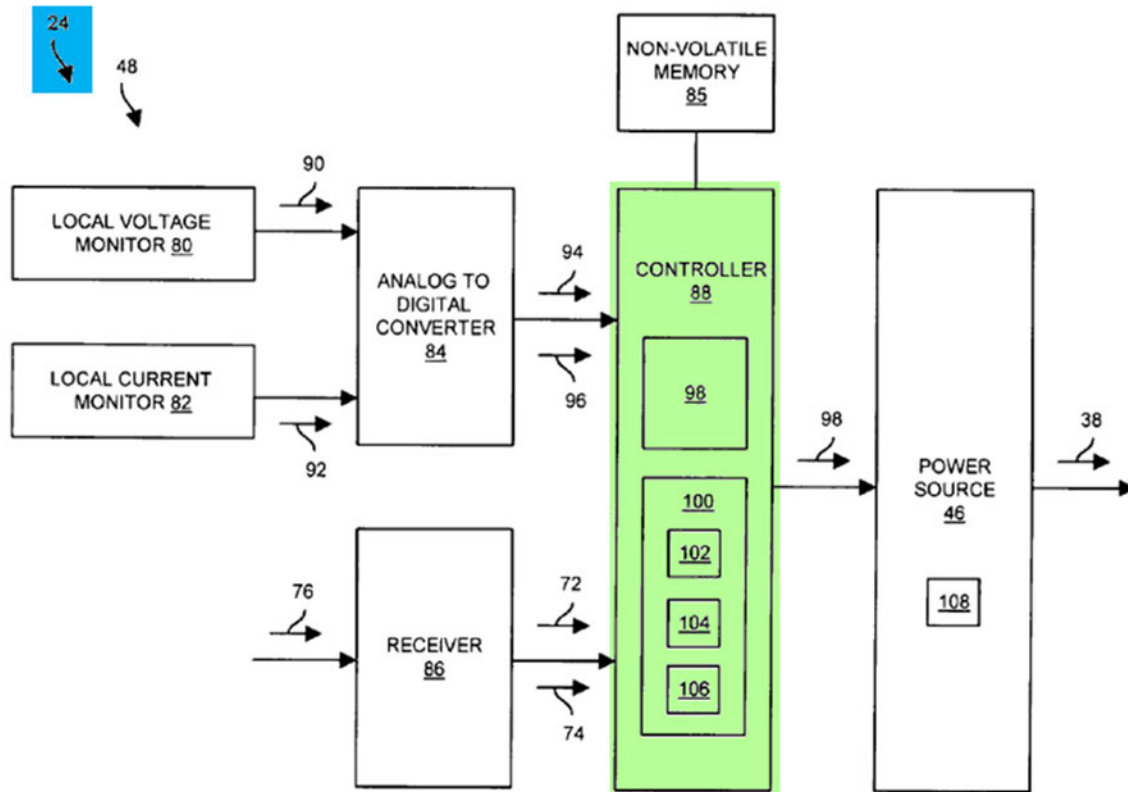


FIG. 3

XIII. DETAILED EXPLANATION OF THE UNPATENTABILITY GROUNDS

71. The '456 Patent contains 13 claims, two of which (claims 1 and 9) are independent. The independent claims 1 and 9 are similar, with a few minor variations in some of the elements. Exhibit 1020 is a summary table showing

correspondence between challenged claims and elements. As explained below, the challenged claims are disclosed and/or taught by the prior art.

A. Ground 1: Claims 1, 5-9, 12, and 13 are rendered obvious by Rabu, Ex-1005, in view of Katayama, Ex-1007.

1. A POSITA would have been motivated to combine the teachings of Rabu and Katayama, and would have had a reasonable expectation of success in doing so.

72. In addition to the reasons set out below with respect to specific claim elements, a POSITA would have been motivated to combine the teachings of Rabu and Katayama, and would have a reasonable expectation of success in doing so, at least because each relates to predictable ways of safely charging electronic devices using thermal protection of circuits.

73. Rabu relates to thermal protection of circuit connections using temperature sensors. Ex-1005 ¶¶3-5. For example, cables and their connectors inadvertently exposed to moisture can lead to dendrite growth,⁴ which in turn can cause damaging short circuits. *Id.* ¶30. If repeatedly exposed to moisture, “dendrites will eventually grow sufficiently to form a high-current path between the conductive portions of the connector (i.e., conductors at different potentials),” which will cause heating that “will sometimes be sufficient to burn plastic housing

⁴ Dendrites are formed by the small conductive deposits that are pulled across the insulating dielectrics and deposited by moisture in the presence of voltage differences. Ex-1005 ¶42.

structures in the connector.” *Id.* Rabu teaches locating temperature sensors and power cutoff switches in connectors or in the connected electronic devices and measuring temperature in those locations. *Id.* ¶¶7-8, 10.

74. That is, a POSITA would have recognized that Rabu teaches measuring temperature at points where the electrical components are likely to short because of dendrites and thereby cause overheating. Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4. A POSITA would have recognized that temperature sensors should be placed close to where shorts occur so as to respond quickly and accurately to localized short circuits. Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4.

75. Rabu teaches “[e]lectronic devices may also be provided with thermal protection circuits and structures (in addition to, or instead of, providing the cables with thermal protection circuits and structures).” Ex-1005 ¶¶31. Specifically, Rabu teaches that temperature protection circuits, including temperature sensors, may be included in both the portable computer 14 and the device 12 being charged, as Rabu discloses “[w]ith another suitable arrangement, thermal protection circuitry may be provided in electronic device 12 and in electronic device 14.” *Id.* ¶78. Moreover, Rabu teaches that the “[t]hermal protection circuitry 710 may include a temperature-sensitive device such as a temperature sensor.” *Id.* ¶46.

76. Like Rabu, Katayama also relates to a charging device using temperature sensors to measure temperature at different locations in the circuit, so

as to stop charging and prevent burnout of charging cables and devices. Ex-1007

¶¶5, 18. Specifically, Katayama teaches stopping the current when any of multiple measured temperatures is above a certain threshold value that may cause “burn out.” *Id.* ¶18.

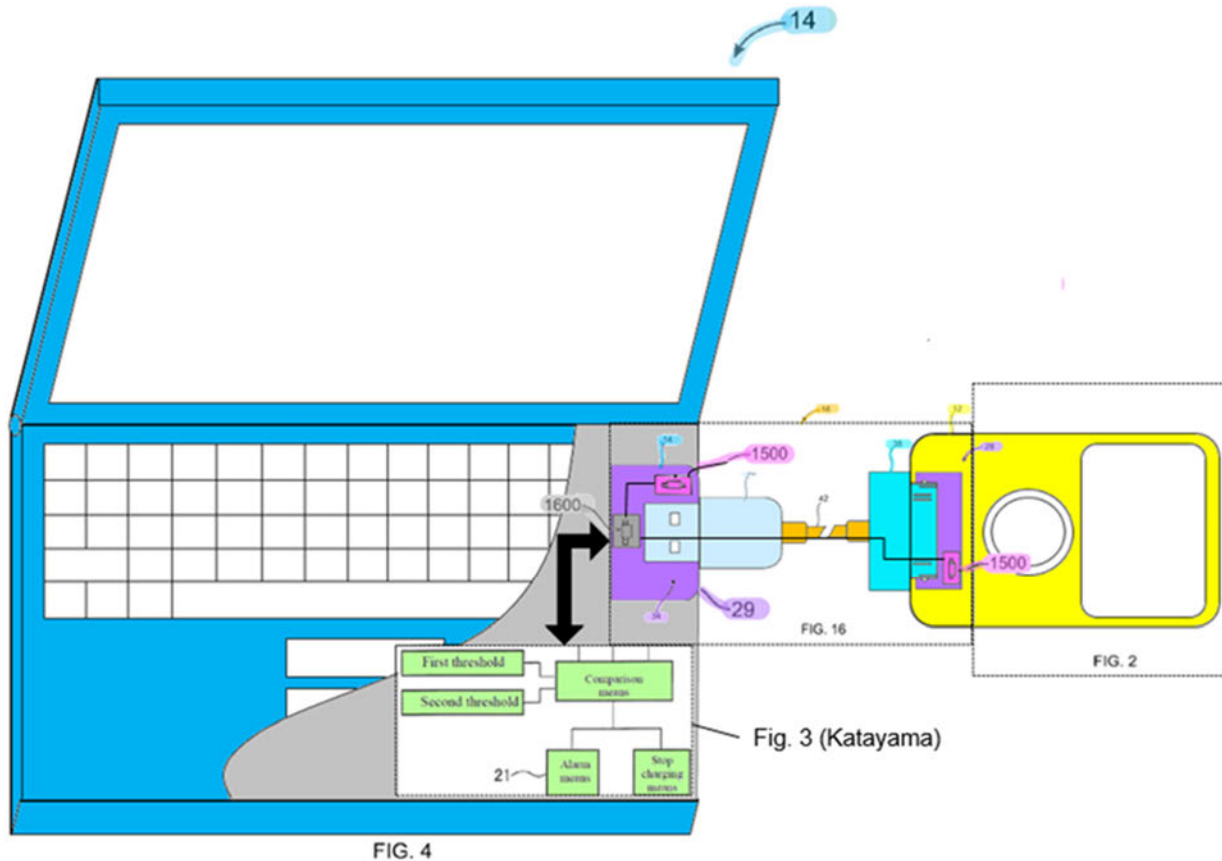
77. In view of these related teachings, a POSITA would have been motivated to combine the teachings of Rabu and Katayama. A POSITA would have been motivated to combine these interrelated teachings because the end result would be a better design for preventing overheating and damage caused by electrical shorts. As Rabu explains, thermal protection circuits are beneficial for limiting the damage caused by moisture-induced dendrite growth and resulting short circuits, by cutting the current. Ex-1005 ¶¶31, 32. Rabu also recognizes that such dendrite-induced shorts could occur at either or both ends of a connection. Ex-1005 ¶86 (dendritic shorts may occur in cable 16 or connectors 38 and 40). Indeed, when the temperature of the connector has risen above a given threshold, thermal protection circuitry in a cable reduces or eliminates power supply signals in the cable. *Id.*, ¶32. Similarly, Katayama explicitly explains the benefit of using thermal protection circuits at both the device providing power and the device receiving power to measure temperature at these locations. Ex-1007 ¶¶18, 12 (preventing “the degradation of the charging cable or connector from the fast charger to the battery” and “enabling reliable and accurate detection”), Fig. 3. As

such, in the combined Rabu-Katayama system, a POSITA would have been motivated to achieve the most complete possible thermal and power control using the benefits taught by each reference because such a system would operate more efficiently and with less risk of catastrophic failure to the device attached at each end of the connection. The benefit of an improved system preventing dendritic shorts is to protect cables, their connectors, and connected electronic devices from excessive heat buildup, permanent damage, and risk of fire. Ex-1022, 0003-04; Ex-1024, 0001-02; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4.

78. A POSITA would have a reasonable expectation of success in combining the teachings of Rabu and Katayama, at least because each teaches similar and familiar structures and components for charging electronic devices. Rabu teaches electronic device 12 (e.g., cellular telephone, media player) connected via cable path 16 to electronic device 14 (e.g., portable computer, power adapter). Ex-1005, Fig. 1. Rabu further teaches incorporating thermal protection circuitry into the charging system through use of temperature sensor 902 in connector 38, or temperature sensor 1500 in electronic device 12. Ex-1005, Figs. 9, 15, 16, ¶¶50, 54, 77. Like Rabu, Katayama teaches fast charger (1) connected via connector (5) to battery equipment (2) installed on an electric vehicle. Ex-1007, Means To Solve The Problem, ¶14. And further like Rabu, Katayama teaches

equipping charging cable (3), connector (5), and charging cable (4) with temperature sensors (17, 18, and 19), respectively. Ex-1007 ¶14.

79. It would have been easy for a POSITA to combine those components into one system because it was well known in the art that analog components can be adapted for connection with digital components, and vice versa, as well as that hardware components may be converted into software components, and vice versa, to construct an operable system. For example, as it was known in the prior art, Rabu's temperature "may include an integrated circuit having a temperature sensor and circuitry configured to convert a reading from the temperature sensor to a digital representation of the temperature. In this embodiment, the integrated circuit communicates this digital representation to the microcontroller." Ex-1025, 5:21-26. For example, a combined system could take the below form:



80. Rabu's cable 16 (orange) would attach portable computer 14 (blue) to mobile device 12 (yellow). Ex-1005 ¶¶36-40. As explained in Rabu's Figure 16, thermal sensor 1500 (pink) is located in port 28 of device 12, where it measures the temperature of port 28. Ex-1005 ¶¶77, 78. A comparable temperature sensor would have been included in portable computer 14 as well, as taught by Rabu. Ex-1005 ¶¶43, 46, 47, 78. Additionally, as taught by Rabu, the second thermal sensor would be included near the connector, e.g. in port 29 of portable computer 14, where it would measure the temperature of port 29. Ex-1005 ¶¶43, 46, 47, 78. As further explained by Rabu in connection with its Figure 16, cutoff circuitry 1600

(gray) would also be located in portable computer 14 to turn off power if either temperature sensor sensed too high of a temperature change in the ports. Ex-1005 ¶78. And as taught by Katayama, Rabu's cutoff circuitry 1600 would have included Katayama's temperature threshold comparison logic 20, thresholds, and "stop charging" means 22 (green) to determine when to cut off the power (power cut-off being taught by both Rabu and Katayama). Ex-1007 ¶18. A POSITA would have included Katayama's comparison of changed temperatures to each other and a threshold to cut-off or limit when the greater of the changed temperatures exceeds the threshold.

2. Independent claim 1

a. 1[Pre] - A method for adjusting current based on temperature, comprising:

81. Rabu teaches the preamble of claim 1 to the extent limiting.

82. Rabu teaches "thermal protection circuitry that reduces or eliminate[s] power supply signals flowing to a connector in the cable." Ex-1005 ¶32. Rabu also teaches that power and current are directly related quantities: "[s]witch 900 may include a number of circuit components such as transistors, resistors, capacitors, etc. that allow switch 900 to block power delivery when desired (i.e., by interrupting the flow of current)." *Id.* ¶55. It is well known in physics theory that the electrical power delivered to a circuit element, e.g. a resistor, is proportional to the flow of electrical current through that element. Based on Ohm's law, the

electrical power delivered to a resistor is directly proportional to the square of the current flowing through that resistor; hence reducing the current will have a large effect on reducing the power delivered. Ex-1023, 0045 (describing Ohm's law); Ex-1025, Abstract; Ex-1026 ¶4; Ex-1027, Abstract. Rabu thus teaches a method for adjusting the flow of current based on the temperature of a connector (as measured either on the connector itself or in a device location near the connector) in order to reduce the delivery of electrical power and thus eliminate potential failure problems due to overheating, "the heat that is produced may melt part of the cable or connector and cause a failure." Ex-1005 ¶0003.

b. 1[A] - determining a change temperature at a first device wherein said temperature is measured at a first port of the first device that is configured to receive a connection to a second device;

83. Rabu teaches the limitations of element 1[A].

84. Rabu teaches "a first device," "a second device," and "the first device that is configured to receive a connection to a second device." As shown in Figure 1, Rabu teaches two electronic devices, 12 (second device, yellow) and 14 (first device, blue),⁵ connected via path 16 (connection, orange). Ex-1005 ¶12. Wired path 16 connects electronic device 12 (e.g. a "Cellular Telephone") to electronic

⁵ Because claim element 1[C] requires that the "first device provides current to the second device," I map Rabu's portable computer 14, or other devices 14 that provide power to the second device, to the claimed "first device."

device 14 (e.g. a “Portable Computer”) and may be used to convey data and/or power signals between the two devices. Ex-1005 ¶¶34.

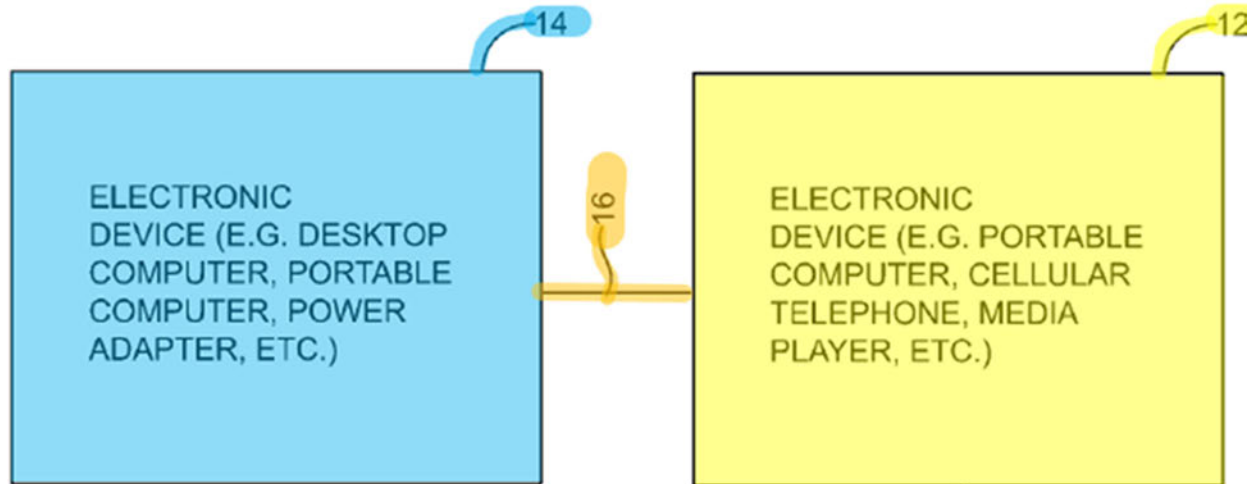
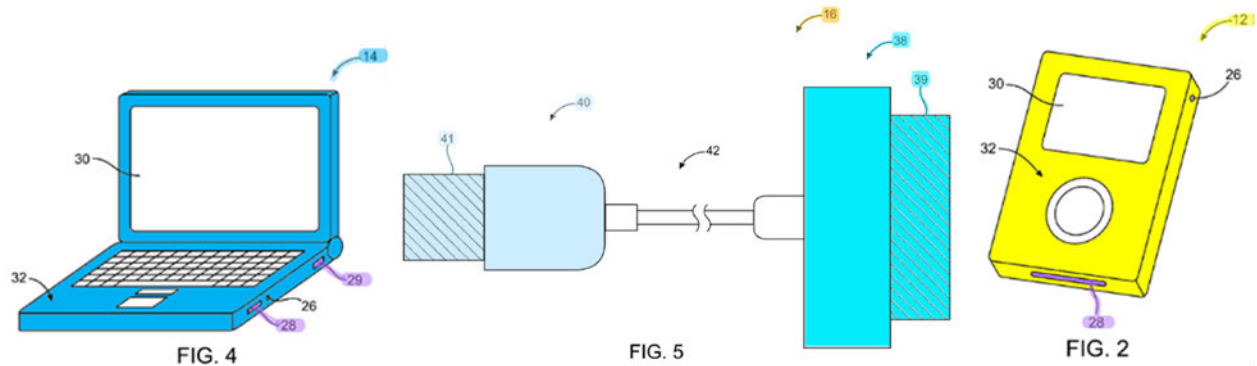
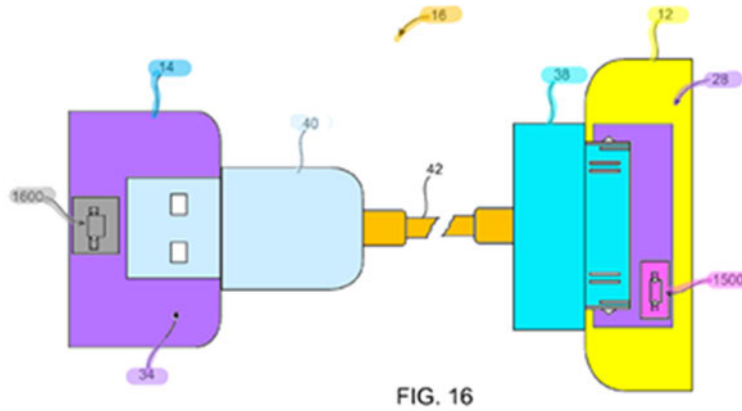


FIG. 1 (rotated)

85. Rabu teaches that device 14 (the first device) may have connectors that couple to one or more connectors in path 16. Ex-1005 ¶¶39, 40, Fig. 4. For example, as shown in Figure 4, Rabu discloses that “[d]evice 14 may [] have connectors such as connector 28 and connector 29,” which “may be 30-pin connectors, Universal Serial Bus (USB) ports, connectors that couple to one or more connectors in path 16.” Ex-1005 ¶¶39, 40, Fig. 4. A POSITA would have understood that connector (28, 29) of a portable computer 14 may be “a port of the first device” because connector (28, 29) expressly may be a USB port. Portable computer 14 charges device 12. Ex-1005 ¶81 (“cable 16 may convey power signals from electronic device 14 to electronic device 12 (e.g., to power electronic device 12 and/or to charge a battery in electronic device 12)"); Ex-1005 ¶38, Fig. 3.



86. Rabu also explains that temperature protection circuits, including temperature sensors, may be included in either portable computer 14 (first device), device being charged 12 (second device), or both. As shown in Figure 16, Rabu teaches placing thermal protection circuitry in device 12 and in device 14. Ex-1005 ¶78 (“thermal protection circuitry may be provided in electronic device 12 and in electronic device 14”). Such thermal protection circuitry “may include temperature sensor 1500 in electronic device 12 (e.g., sensor 1500 in connector 28) and a cutoff switch 1600 in electronic device 14.” Ex-1005 ¶78. For the reasons discussed below, it would be obvious to a POSITA to include a temperature sensor, i.e. “temperature sensor 1500,” in the thermal protection circuitry of device 14 (first device).



87. First, Rabu expressly teaches that the thermal protection circuitry “may include a temperature sensor and a voltage (power) cutoff switch,” which can be provided on one side of the connection either as an integrated unit or as separate units. Ex-1005 ¶46. For example, as shown in Figure 7, “[t]hermal protection circuitry 710 may include a temperature-sensitive device such as a temperature sensor and a voltage (power) cutoff switch” together as one unit on the same side of the connection. Ex-1005 ¶46, Fig. 7. Alternatively, as shown in Figure 8, the thermal protection circuitry (element 710) may include the “power cutoff switch 800” and “temperature sensor 802” as separate units on the same side of the connection. Ex-1005 ¶47, Fig. 8.

88. Second, Rabu teaches measuring temperature at various places in the system where there exist vulnerabilities for short circuits caused by “dendritic” build up. Ex-1005 ¶¶46, 50, 77, 78 (sensors in connector 28 and 38), 86 (cable connectors 38 and 40). Rabu also teaches measuring temperature where shorts are

likely to form by incorporating temperature sensors and cutoff switches in those vulnerable locations. Ex-1005 ¶¶31, 46, 77. For example, a POSITA would have understood that dendritic growths and potential shorts may form near the device ports or cable connectors of both device 12 and device 14 for essentially the same reasons—both devices’ ports and cable connectors are uncovered, exposing them to ambient moisture infiltration. Ex-1005 ¶¶48, 78, 83.

89. Rabu discloses several embodiments as examples for the placement of thermal protection circuitry in addition to the ones discussed above. In one embodiment, Rabu discloses placing the temperature sensor in the port of the device receiving power, while placing the cutoff switch at the device providing power. Ex-1005, Fig. 15, Fig. 16, ¶78 (“thermal protection circuitry in system 10 may include temperature sensor 1500 in electronic device 12 (e.g., sensor 1500 in connector 28) and a cutoff switch 1600 in electronic device 14”). For example, Rabu’s Figure 15 has the temperature sensor in the port of device 12 (the claimed second device), into which the cable connector connects. Rabu explains that “temperature sensor 1500 [is] in electronic device 12” and states that temperature sensor 1500 “may be able to sense the temperature of connector 38 of cable 16.” Ex-1005 ¶77. Indeed, “temperature sensor 1500 may detect the increasing temperature and direct power cutoff switch 1502 to shut off power to connector 38 (e.g., to shut off a positive power supply voltage on conductor 708).” *Id.* ¶77.

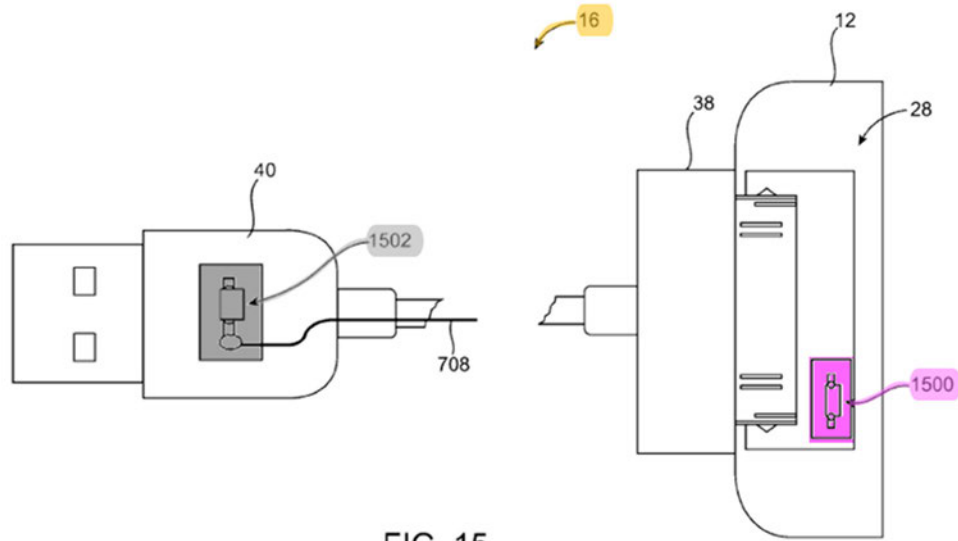


FIG. 15

90. Another example, shown in Figure 9, teaches that “cable 16 may include thermal protection circuitry,” such as “a power cutoff switch” and “circuit 902 may be a temperature sensor.” Ex-1005 ¶50. In this example, temperature sensor 902 is located in the connector of the cable that connects the devices.

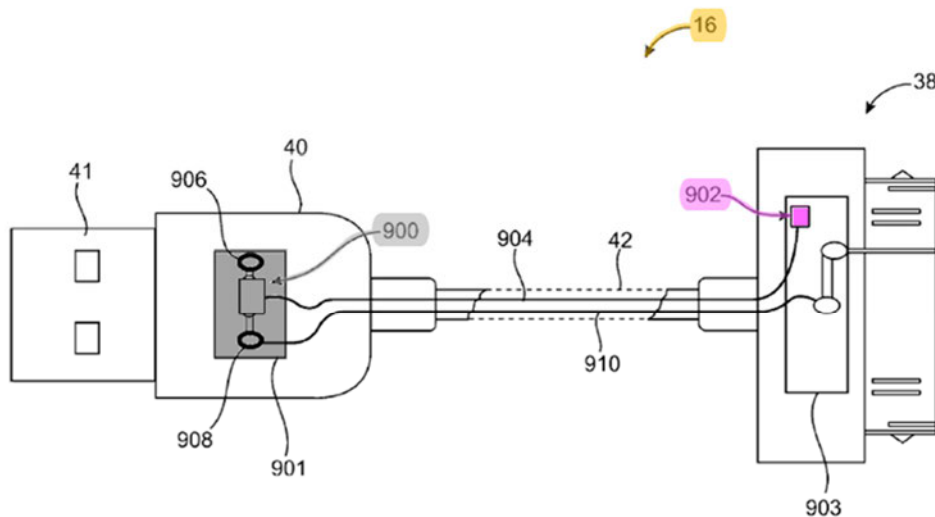


FIG. 9

91. As another example, Rabu teaches using “power measuring circuitry,” to determine temperature at places vulnerable to failure and dendritic shorts, such as cable 16 or its connectors 38 and 40 to devices 12 and 14. Ex-1005 ¶86. The “power measuring circuitry [] measures the amount of power that is lost in transmission between electronic device 12 and 14 through cable 16.” *Id.* “The ***power measuring circuitry*** may be used in place of or ***in addition to the temperature sensors***,” and “may be provided in cable 16, in electronic device 12, in electronic device 14, or in any suitable combination of cable 16 and electronic devices 12 and 14.” *Id.* For example, if the difference between power delivered and power received exceeds a threshold limit, the devices may determine “that a short has likely formed in cable 16 and that cable 16 is likely being heated from the short (e.g., because lost power may typically be transformed into heat).” *Id.* ¶87.

92. For example, power measuring circuitry in devices 14 and 12 can measure the amounts of power delivered and power received to the devices through cable 16. Ex-1005 ¶87. If the difference between power delivered and power received exceeds a threshold limit, the devices may determine “that a short has likely formed in cable 16 and that cable 16 is likely being heated from the short (e.g., because lost power may typically be transformed into heat).” *Id.* ¶87. Based on Rabu’s teaching of measuring power loss at locations where shorts are likely to occur, it would be obvious to a POSITA that temperature changes, instead of

power loss, could be measured at those same locations to detect shorts. Ex-1025, Abstract; Ex-1026 ¶4. Indeed, Rabu itself teaches that the cable “is likely being heated from the short” and that “lost power may typically be transformed into heat.” Ex-1005 ¶87. So instead of measuring power loss, a POSITA could achieve the same goal of detecting shorts by measuring heat or temperature change. Since Rabu teaches using power measuring circuitry at various locations, such as in both devices and cable connecting them, to determine temperature change at the devices and their connections for the purpose of detecting shorts, a POSITA would find it obvious to measure the temperature change in both devices, e.g. devices 12 and 14.

93. Third, Rabu’s teachings across its Figures and embodiments are cross-applicable because they comprise consistent components directed to the common goal of strategically placing temperature sensors in vulnerable locations for thermal protection of circuits. Indeed, Rabu teachings are “merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.” Ex-1005 ¶88. Accordingly, it would be obvious to a POSITA to modify any of Rabu’s Figures or embodiments with any of Rabu’s other Figures or embodiments because doing so furthers the spirit of the invention.

94. Accordingly, a POSITA would have understood from Rabu’s teachings to use a temperature sensor to measure temperature at any of many

locations where a dendritic short is likely to occur, including in the port of the device providing power (14) (first device) and/or the port of the device receiving power (12) (second device).

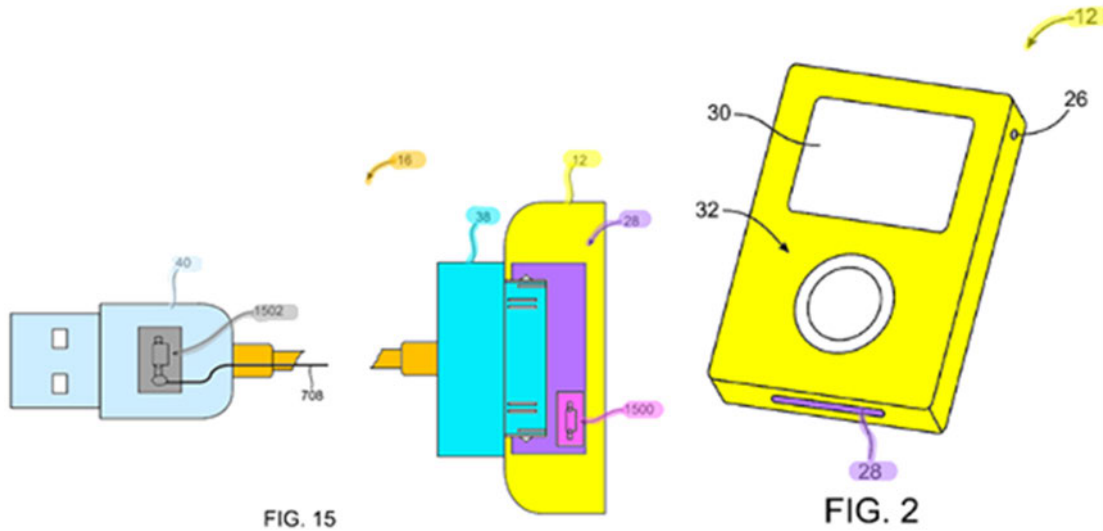
95. Additionally, Rabu teaches “determining a change temperature.”⁶ Rabu teaches that “temperature sensor 902 may be formed from a temperature-sensitive resistor such as thermistor 1016 (i.e., a resistor with a resistance that varies with temperature) coupled to power cutoff switch 900 over conductors 1008 and 1018.” Ex-1005 ¶54. A POSITA would have understood that a temperature sensor and a temperature-sensitive resistor, or thermistor, is used to determine a change in temperature. Ex-1025, Abstract, 1:36-47. For example, Rabu expressly teaches to take corrective action when “a rise in temperature is detected.” Ex-1005 ¶67. This “rise in temperature” may reflect, for example, a change in temperature over an ambient level, or a temperature change “rising above a threshold level.” *Id.* ¶46, 57.

⁶ To the extent that this claim element can be understood, I apply the prior art such that “determining a change temperature” means “determining a change [in] temperature” or “determining a temperature change.” My application of the prior art is the same under either of these meanings, which are stated here expressly for clarity.

- c. 1[B] - determining a change temperature at a second device wherein said temperature is measured at a second port of the second device that is configured to receive the connection to the first device;**

96. Rabu teaches the limitations of element 1[B].

97. As explained above for element 1[A], Rabu teaches measuring temperature at various places in the system where there exist vulnerabilities for shorts or “dendritic” build up. Ex-1005 ¶¶46, 50, 77, 78, Fig. 16. As shown in Figures 15, 16, and 2, Rabu expressly teaches including a temperature sensor (element 1500) in the port (element 28) of device 12 (the claimed second device), into which the cable connector connects. Rabu explains that “temperature sensor 1500 [is] in electronic device 12” and states that temperature sensor 1500 (pink) “may be able to sense the temperature of connector 38 of cable 16.” Ex-1005 ¶77. Indeed, “temperature sensor 1500 may detect the increasing temperature and direct power cutoff switch 1502 to shut off power to connector 38 (e.g., to shut off a positive power supply voltage on conductor 708).” *Id.* ¶77. An “increasing temperature” being detected by Rabu in device 12 corresponds to the claimed “change temperature at a second device.”



98. Rabu teaches “a second port of the second device” based on its disclosures in Figures 2 and 15. Rabu teaches that “temperature sensor 1500 may be included in connector 28 of electronic device 12.” Ex-1005 ¶77, Figs 2, 15. And device 12’s “[c]onnector 28 may be a 30-pin connector, a Universal Serial Bus (USB) port, a connector that couples to a connector in path 16.” Ex-1005 ¶37, Fig. 2. A POSITA would have understood that connector (28) of device 12 may be “a port of the second device” because connector (28) expressly can be a USB port.

99. Rabu thus teaches “a second device wherein said temperature is measured at a second port of the second device that is configured to receive the connection to the first device.” Specifically, the claimed “second device” corresponds to Rabu’s device that receives power, e.g. device 12. Ex-1005 ¶¶34, 35. Additionally, connector 28 in device 12 receives the connection to the first

device. *Id.* ¶40. As shown in Figures 15 and 16, temperature sensor 1500 (pink) is in the connection port of connector 28 (purple) of device 12 (yellow). *Id.* ¶¶77, 78.

100. Rabu further teaches “determining a change temperature at a second device” for the same reasons discussed in Section XIII.A.2.b (for element 1[A]). Rabu teaches placing a temperature sensor in a port on a device to measure temperature there, where a short and resulting heat buildup may occur. Ex-1005 ¶¶50, 77. Rabu explains that temperature sensor 1500 may detect increasing temperature if “a dendritic structure forms in connector 38 and forms a short that heats up connector 38.” Ex-1005 ¶77. Rabu also explains that temperature sensor 1500 may be in different locations, such as in device 12 or included in connector 28 of electronic device 12. *Id.* For example, in Figure 15, temperature sensor 1500 is located in the port of device 12. *Id.* In this way, “temperature sensor 1500 in electronic device 12 may be able to sense the temperature of connector 38 of cable 16.” *Id.*

d. 1[C] - determining the greater of the changes in temperature measured at the first device and the second device, wherein said determining is performed while the first device provides current to the second device over the connection;

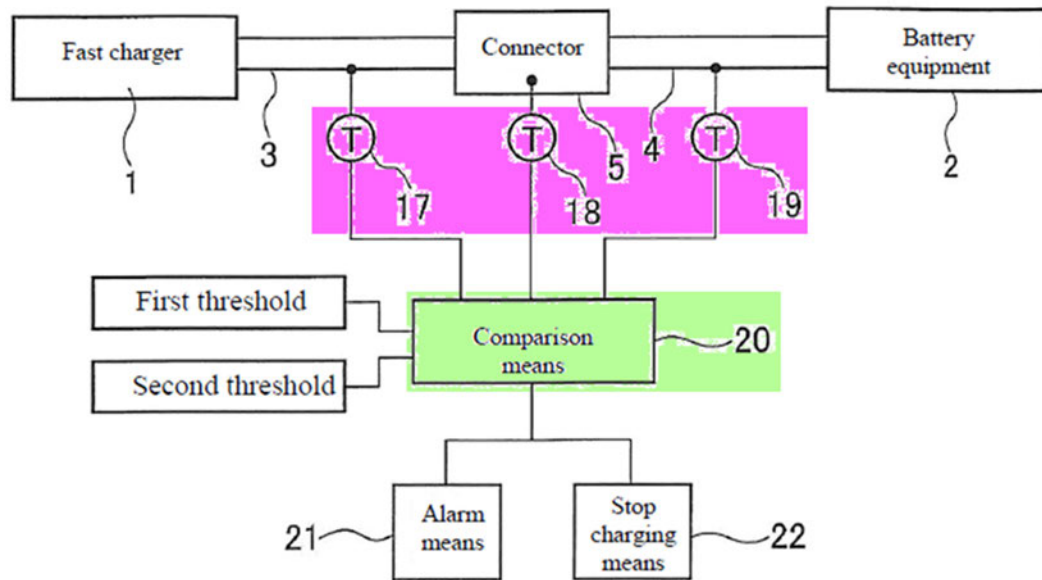
101. Rabu and Katayama teach the limitations of element 1[C].

102. As explained in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]), the combined system would have temperature sensors at both ends of the

connection: both at the device providing power (Rabu's device 14) and at the device receiving power (Rabu's device 12). Additionally, temperature changes would have been measured at both devices, as also explained in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]). Both Rabu and Katayama teach that a temperature change greater than a fixed value may cause damage to the system. Ex-1005 ¶75; Ex-1007, Cl. 3. With multiple temperature change measurements taken, it would have been obvious to a POSITA to determine the worst case temperature change. That is, a POSITA would have "determine[d] the greater of the changes in temperature measured at the first device and the second device" in the combined system because it was well known in the prior art that the greater change in temperature poses the greater risk of damage to the system. Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract.

103. Katayama expressly teaches measuring temperature changes in a charging system at multiple locations, reflecting multiple temperature change measurements at different locations in the system. Ex-1007 ¶18, Cl. 3. As shown in Figure 3 below, these multiple points include: on wires (3) of fast charger 1, on wires (4) of battery-operated equipment 2, and on connector 5. Ex-1007, Fig 3, ¶18.

FIG. 3

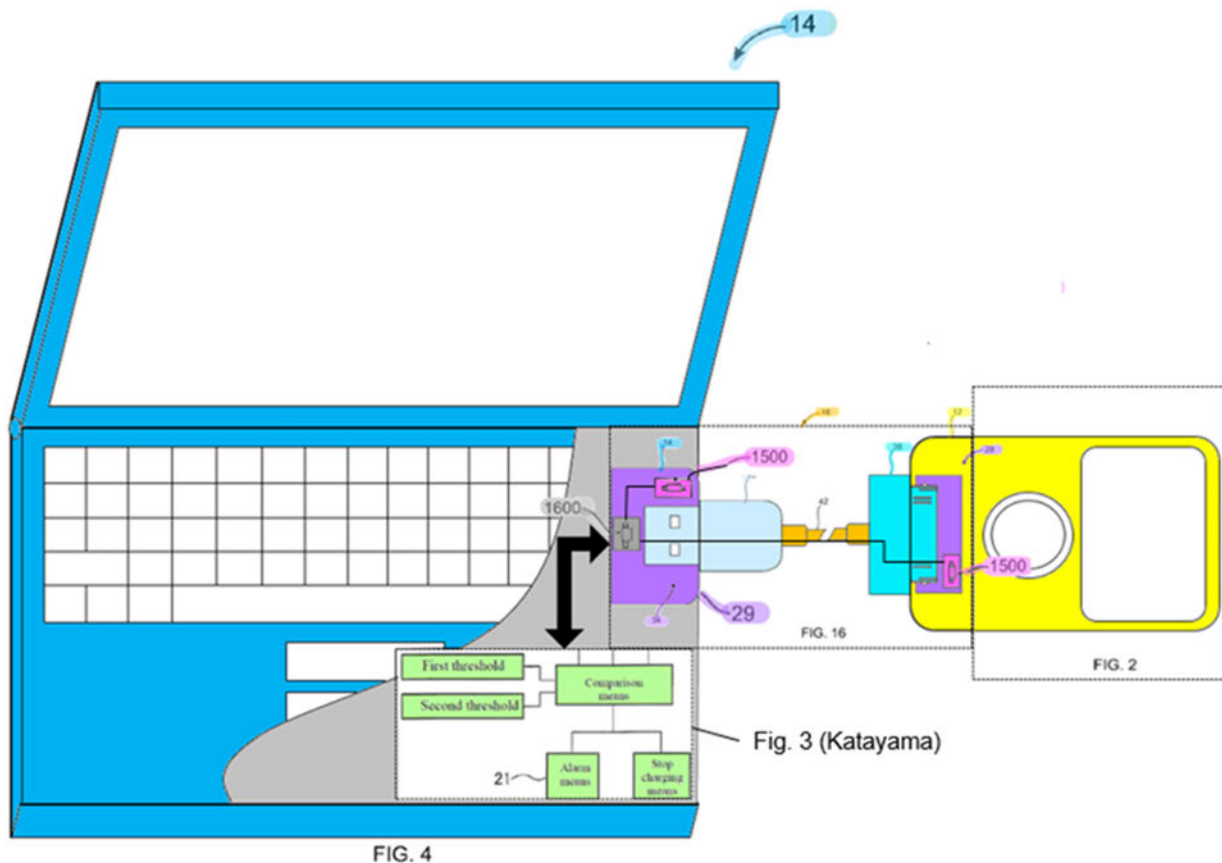


104. Katayama thus teaches measuring temperature changes at least at each end of a charging connection, and in the connection itself.

105. Katayama also teaches “comparison means 20” for comparing measured temperatures from “temperature sensors 17, 18, 19.” Ex-1007 ¶18. Katayama teaches that there is a “temperature at which the charging cable 3 or 4 or the connector 5 may burn out.” *Id.* Katayama teaches to determine, using comparison means 20, “if any one of the temperature sensors 17, 18, 19 is at or above” the temperature where such burn-out damage may occur. *Id.* A POSITA would have understood that the greatest risk of damage is at the sensor measuring the greatest temperature change as that would burn out before places experiencing a lesser temperature change. Ex-1022, 0059; Ex-1025, Abstract, 1:36-47; Ex-1026

¶4; Ex-1027, Abstract. Accordingly, a POSITA would have understood that determining which of “temperature sensors 17, 18, 19” measures the greatest temperature change, identifies where the circuit has the greatest risk of thermal failure and where temperature needs to be reduced in order to lessen such risk.

106. Combining these teachings of Rabu and Katayama is a system in which power supply 14 and battery-operated mobile device 12 (taught by Rabu), each contain thermal protection sensors and circuits (taught by Rabu and Katayama), for taking temperature change measurements in multiple locations (as suggested by Rabu and disclosed by Katayama) such as depicted here:



107. In this way, in the Rabu-Katayama combined thermal protection circuit, a temperature sensor measures temperature at second device 12, another sensor measures temperature at first device 14, and a power cutoff circuit at first device 14 can shut off power to the second device 12. Ex-1005, Figs. 9, 15, ¶¶50, 77, 86; Ex-1007 ¶18, Fig. 3. A POSITA would have been motivated to design the protection circuit with a comparison means (taught by Katayama) for determining which of the two measured temperature changes (that is, the temperature rise measured at device 12 and the temperature rise measured at device 14) is greater, because the greater temperature change poses the greater danger of permanent damage to the system. Ex-1007 ¶18. A POSITA would further have been motivated to combine, and had a reasonable expectation of success in, implementing the combined system for the reasons discussed in Section XIII.A.1.

108. To the extent that Patent Owner argues that this “determining” step further requires a specific comparison of two different temperature change values, measured at two different sensor locations, such a comparison also would have been obvious in view of Katayama’s teachings. Katayama specifically includes a “comparison means” for comparing the results of multiple sensor measurements to a threshold value. Ex-1007 ¶18, Fig. 3. It would have been obvious to use the same comparison means also to compare two different temperature change values to each other. This would allow for the system to detect, for example, an accelerated

rise in temperature at one wire as compared to the other. A POSITA would have been motivated to make this comparison in order to identify and locate the short circuit as early as early as possible. Ex-1025, Abstract; Ex-1026 ¶4; Ex-1027, Abstract.

109. It would have been obvious based on Rabu as well. For example, Rabu describes an example of its “thermal protection circuit,” which may do temperature measurements “depending on ambient temperature.” Ex-1005 ¶46. A POSITA would have understood that these temperature changes could have been quantified and compared to provide yet another level of monitoring for, and control against, potentially dangerous conditions. This is further evidenced by the fact that the ’456 Patent does not discuss how temperature changes are measured and compared.

110. As another example, Rabu describes its “thermal protection circuitry” that determines when “the temperature of the connector has risen above a given threshold.” *Id.* ¶32. Those teachings would have further taught a POSITA that each temperature sensor in the system should measure and respond to temperature changes over ambient temperature, and they provide additional motivations for calculating specific changes in temperature relative to some reference value (e.g., an ambient temperature). Measuring temperature changes relative to a reference would have provided another level of monitoring for and control against

potentially dangerous conditions. Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract.

111. Rabu further teaches that the determination “is performed while the first device provides current to the second device over the connection.” For example, Rabu discloses that “path 16 includes one or more conductive lines and a connector at each end.” Ex-1005 ¶34. Rabu explains that “[t]he conductive lines in path 16 may be used to convey signals such as data and power signals over path 16.” *Id.* ¶34, Fig. 1.

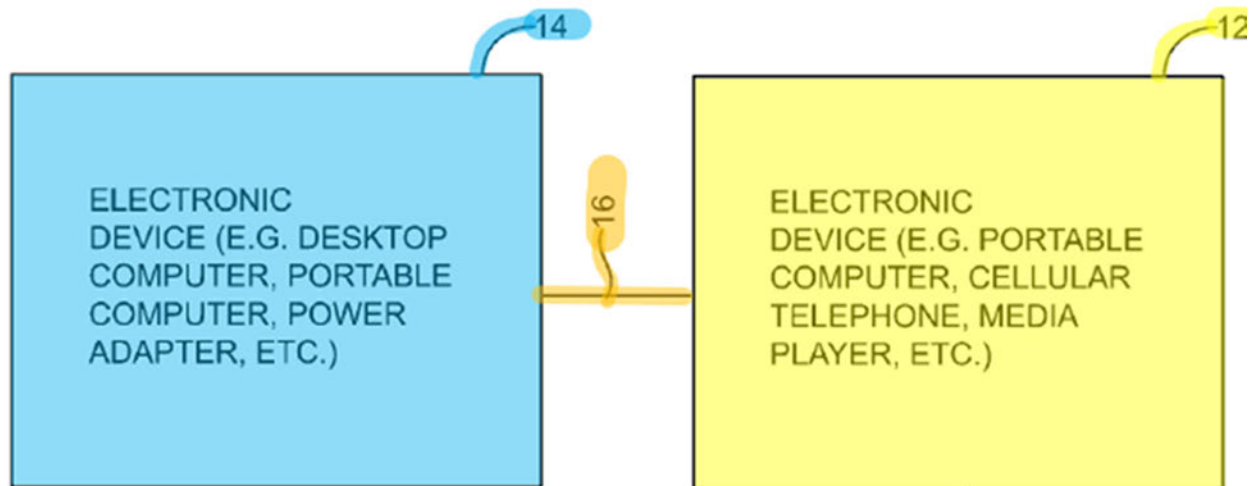


FIG. 1 (rotated)

112. Rabu explains that “power measuring circuitry in electronic device 14 may measure the amount of power being delivered to cable 16 while power measuring circuitry in electronic device 12 can measure the amount of power being received through cable 16.” Ex-1005 ¶87. Rabu teaches that if “the difference between the power being delivered to cable 16 and the power being received

through cable 16” is significant, then “a short has likely formed” because the system is “likely being heated from the short (e.g., because lost power may typically be transformed into heat).” *Id.* Accordingly, the device “being heated” from a short, and the corresponding temperature rise being measured in the device, happens when current is being provided over the connection, as claimed.

113. A POSITA would have thus understood that, because power loss typically is transformed into heat, power loss correlates with temperature. Ex-1022, 0059; Ex-1025, Abstract; Ex-1026 ¶4. A POSITA also would have understood that measuring power loss and resulting increased temperatures occurs while the electronic devices are connected via a cable and current is flowing on that cable. Ex-1022, 0059; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract.

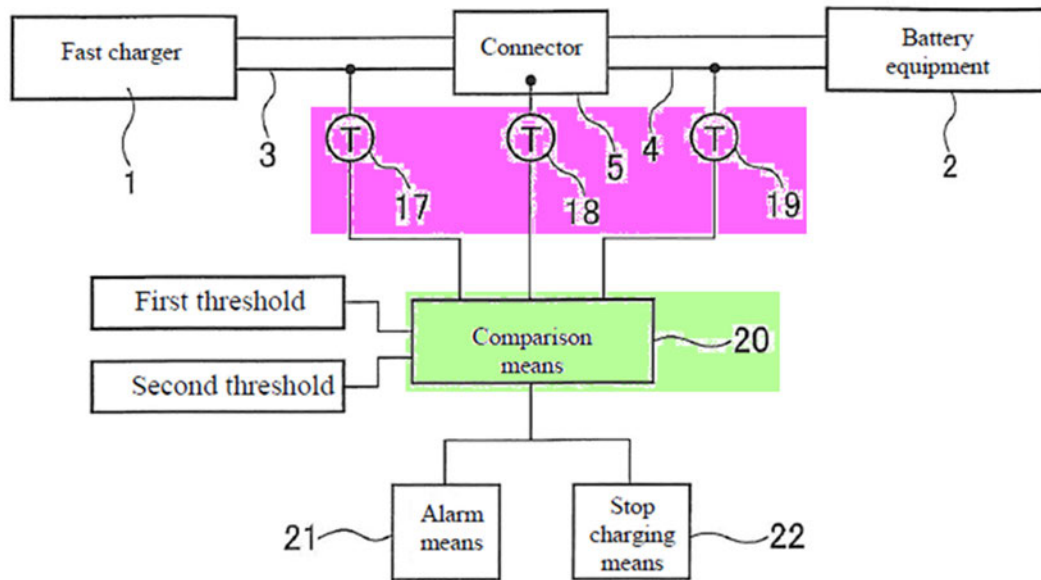
e. 1[D] - determining if the greater of the changes in temperature is above a threshold;

114. Rabu and Katayama teach the limitations of element 1[D].

115. For example, Rabu teaches determining “[w]hen the temperature of connector 38 exceeds a threshold temperature such as a threshold value less than 85° C., a threshold value of 85° C., a threshold value of 90° C., a threshold value of 95° C., a threshold value of 100° C., a threshold value of greater than 100° C., *or any other suitable threshold temperature.*” Ex-1005 ¶52.

116. Additionally, Katayama teaches two different temperature thresholds, as shown in Figure 3:

FIG. 3



117. Katayama teaches “comparison means 20 for comparing whether or not the measured temperature of any one of the temperature sensors 17, 18, 19 is at or above or at or below *the first threshold value* or is at or above or at or below *the second threshold value*.” Ex-1007 ¶18.

118. In the combined system, the greater temperature change, determined as described above in Section XIII.A.2.d (for element 1[C]), would have been compared to a threshold as described in each of Rabu and Katayama. As previously discussed, the greater temperature change would represent the greater risk of harm to the system. A POSITA would have applied Rabu’s and Katayama’s threshold teachings to establish a pre-set or predefined temperature change threshold that would be used by the protection circuit to prevent harm to the

device. As both of these references establish, a POSITA understood that the use of temperature thresholds was a common technique to evaluate the output of temperature sensors and take appropriate corrective action. Ex-1025, Abstract; Ex-1026 ¶4; Ex-1027, Abstract.

f. 1[E] - if the greater of the changes in temperature is above the threshold, reducing the current being provided from the first device to the second device.

119. Rabu and Katayama teach the limitations of element 1[E].

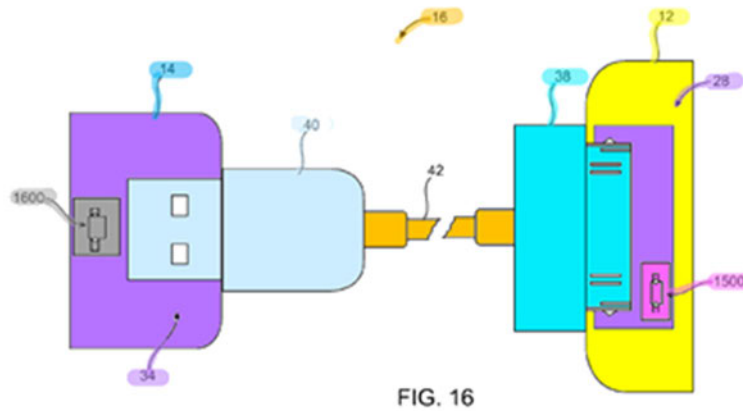
120. Rabu teaches when “temperature is above the threshold, reducing the current being provided from the first device to the second device.” For example, the current is reduced to zero when the power is shut off. Rabu teaches that “a cable may include thermal protection circuitry that reduces or eliminate[s] power supply signals flowing to a connector in the cable when it is determined that the temperature of the connector has risen above a given threshold.” Ex-1005 ¶32. Rabu teaches another embodiment where thermal protection circuitry shuts off power “when the temperature in the connector 38 exceeds a threshold level.” *Id.* ¶48. Rabu explains that the purpose of shutting off power is to “help to protect electronic device 12 from excessive heat.” *Id.* Rabu also explains that the power delivery can be shut off “by interrupting the flow of current” and that switches that block the power, “such as switch 900” may also be referred as “current cutoff switches.” Ex-1005 ¶55.

121. It is important to note that to the extent that the term “reducing the current” is interpreted as reducing the current from an initial high value gradually to lower values, a POSITA would have understood that Rabu’s “power cutoff switch 900” discloses this. Rabu explains that the circuit that forms the “power cutoff switch 900” includes several resistors and two transistors and there are several ways to implement this circuit. Ex-1005 ¶¶56-59. According to Rabu’s teaching, a POSITA would have understood that transistor 1025 allows current to flow when the voltage at node 1028 is at a value that sets the transistor 1025 in the “on” state, and this value depends on the state of transistor 1024. Ex-1005 ¶59. The latter is a function of the voltage at the node 1026 which is set by the voltage divider that includes the two 1020 resistors connected to node 1026 and the resistance of the thermistor 902 as shown in Fig. 10. *Id.* ¶¶57, 59, Fig. 10. With respect to one of the ways to implement switch 900 (the one in which both transistors, i.e. 1024 and 1025, are n-channel), Rabu explains that when temperature increases and the resistance of the thermistor 902 drops, voltage in node 1026 rises causing transistor 1024 to be turned on which forces voltage at node 1028 to drop and then transistor 1025 turns off. *Id.* ¶59.

122. A POSITA would have understood that as changes in thermistor resistance values are gradual (i.e. not abrupt, as they are a function of temperature) the change in the voltage at node 1026 will be gradual over time. A POSITA

would also have understood that since the current flowing through a transistor is a function of the voltage value at its gate terminal (e.g. voltage value at node 1026 for transistor 1024 and at node 1028 for transistor 1025), when the voltage at its gate terminal changes gradually the current flowing through the transistor, such as transistor 1025, will also change gradually. A POSITA would have understood that when both transistors 1024 and 1025 are n-channel, transistor 1025 will allow a high value of current when thermistor resistance is high. However, as the thermistor resistance decreases and transistor 1024 starts to conduct, then transistor 1025 will flow a lesser current as its gate terminal voltage, i.e. voltage at node 1028, is reduced as explained above.

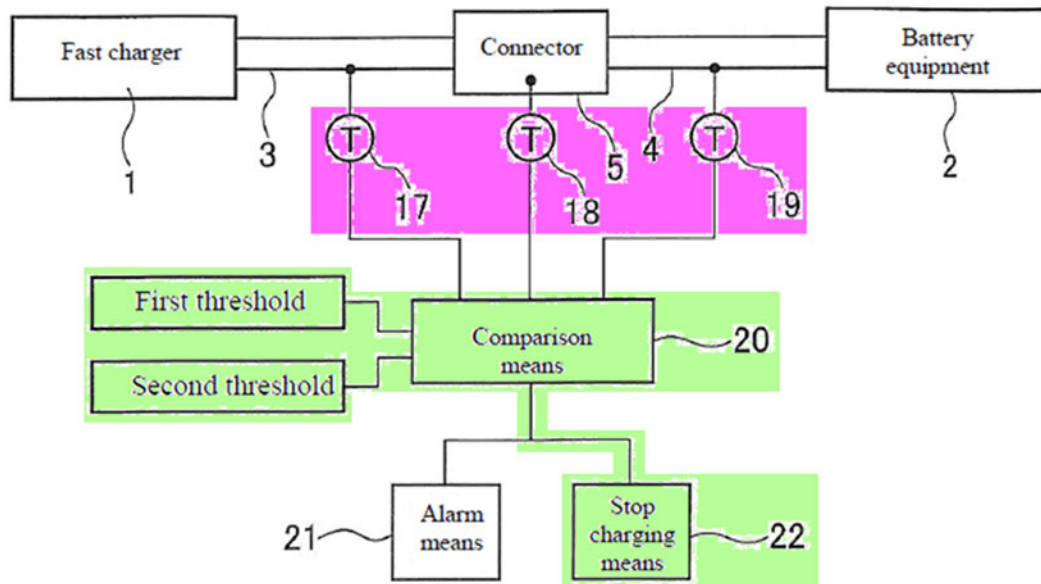
123. Rabu further teaches temperature “sensor 1500 may determine the temperature of connector 38 and may relay signals to cutoff switch 1600 indicative of the temperature of connector 38.” Ex-1005, Fig. 16, ¶78. Locating the cutoff switch in portable computer 14 allows the system to cut off power at the device that provides power.



124. Alternatively, the cutoff switch may be located in the cable connector. Ex-1005, Fig. 15, ¶77 (“temperature sensor 1500 in electronic device 12 may be able to sense the temperature of connector 38 of cable 16 and convey signals to cutoff switch 1502 representative of the temperature of connector 38”).

125. Katayama also teaches this feature, namely shutting off the charging current when the temperature threshold is exceeded. Katayama discloses “comparison means 20 for comparing whether or not the measured temperature of any one of the temperature sensors 17, 18, 19 is at or above or at or below the first threshold value or is at or above or at or below the second threshold value is provided.” Ex-1007 ¶18. As shown in Figure 3, the comparison means 20 connects to each of the temperature sensors 17, 18, and 19 and triggers “charging stop means 22” when a temperature threshold is exceeded. *Id.*, Fig. 3.

FIG. 3



126. A POSITA would have been motivated to combine the teachings of Rabu and Katayama to design a system that reduces current when any of several temperature readings exceeds a certain temperature threshold because the resulting system is safer and more efficient.

127. Rabu teaches reducing the current when temperature is above a certain threshold so as to prevent formation of dendritic shorts. Ex-1005 ¶¶30, 32, 48, 52. And Katayama teaches comparing temperature readings from several locations in the circuit to determine the greatest temperature and to similarly prevent damage to the charging cables and circuitry. Ex-1007 ¶18. Indeed, Katayama expressly teaches that the system's multiple measurements have to be collected and

compared to thresholds using a “comparison means” so that appropriate action can be taken to prevent damage to the system, such as by shutting off power. *Id.*

128. A POSITA would have been motivated to combine those teachings because dendritic shorts can form at any of many locations, resulting in excessive temperatures and shorts that can damage the charging components. Ex-1022, 0003-04, 0059; Ex-1024, 0001-02; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract. A POSITA would have understood that the location with the greatest temperature change poses the greatest risk of permanent damage to the system components. Ex-1022, 0059; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract. With temperature sensors both at the device providing power and at the device receiving power, the Rabu-Katayama combination results in a system that operates with less risk of dendritic shorts forming.

129. A POSITA would have a reasonable expectation of success in combining Rabu and Katayama as related to this element for the same reasons explained in Sections XIII.A.1 and XIII.A.2.e (for element 1[D]).

3. Independent claim 9

a. 9[Pre] - A device, comprising:

130. Rabu teaches the limitations of element 9[Pre], for the same reasons discussed in Section XIII.A.2.b (for element 1[A]).

b. 9[A] - a connection coupling a first device and a second device;

131. Rabu discloses the limitations of element 9[A], for the same reasons discussed in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]).

132. Indeed, as shown in Figure 1, Rabu teaches two electronic devices, 12 and 14, that may communicate over a communications path 16 (the claimed connection coupling a first device and a second device). Ex-1005 ¶12. A wired path, such as path 16, may be used to connect electronic device 12 to electronic device 14 and may be used to convey signals such as data and power signals over path 16. *Id.* ¶34. A POSITA would have understood that wired path 16 is a connection coupling one device to another device.

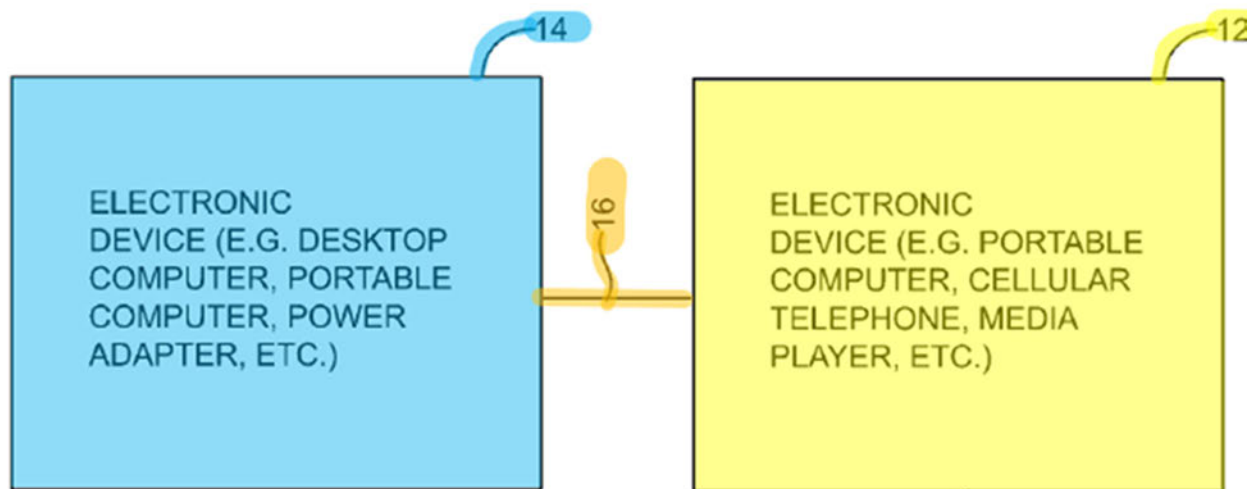
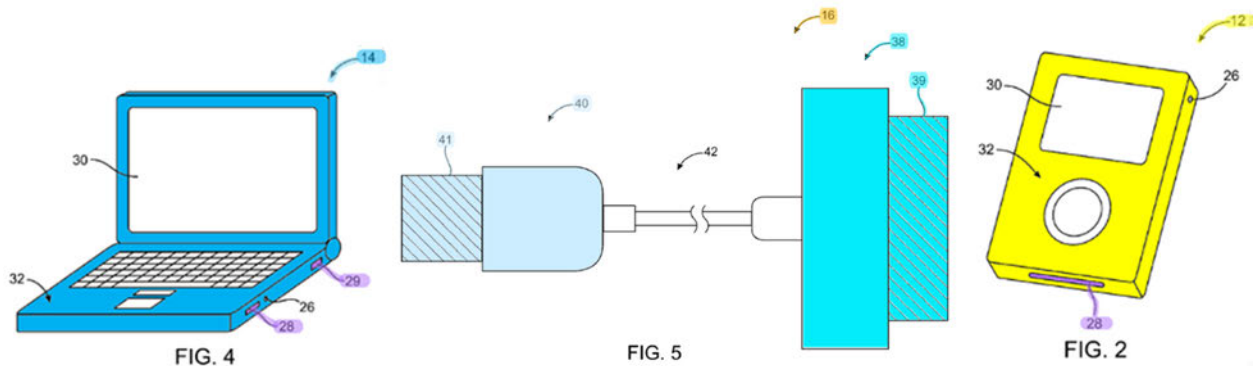


FIG. 1 (rotated)

133. As shown below in Figures 4, 5, and 2, cable path 16 connects device 14 (the claimed first device)⁷ with device 12 (the claimed second device). Ex-1005, Figs. 2, 3, 5, ¶40. Rabu explains that the cable includes connectors for coupling devices: “cable 16 includes first connector 38, second connector 40, and communications path 42 between connectors 38 and 40.” Ex-1005, ¶40. Connector 38 can couple with connector 28 of device 12. *Id.* Connector 40 can couple with connector 29 of device 14. *Id.*



- c. **9[B] - a first port of the first device, wherein the first port is configured to receive a first connector of the connection;**

134. Rabu discloses the limitations of element 9[B], for the same reasons discussed in Section XIII.A.2.b (for element 1[A]).

⁷ Because claim element 9[D] requires that the “the second logic [of the first device] is configured to provide current to the second device,” I map Rabu’s portable computer 14, or other devices 14 that provide power to the second device, to the claimed “first device.”

135. Rabu teaches that device 14 (the first device) may have connectors that couple to one or more connectors in path 16. Ex-1005, Fig. 4; ¶¶39, 40. For example, as shown in Figure 4, Rabu discloses that “[d]evice 14 may [] have connectors such as connector 28 and connector 29,” which “may be 30-pin connectors, Universal Serial Bus (USB) ports, connectors that couple to one or more connectors in path 16” and “may be used to convey power signals over path 16 from device 14 to device 12 (e.g., for powering device 12 and for charging a battery in device 12).” Ex-1005 ¶¶38-40, Figs. 3-4.

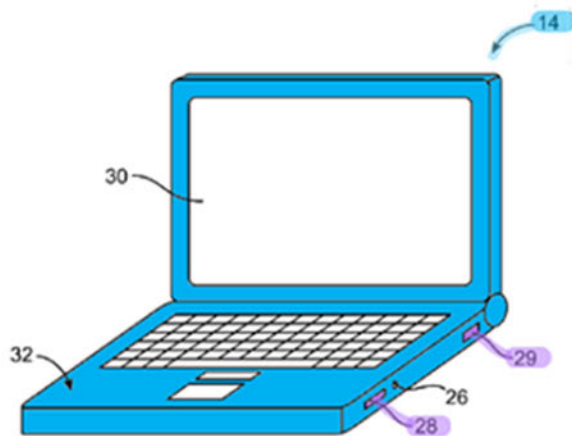


FIG. 4

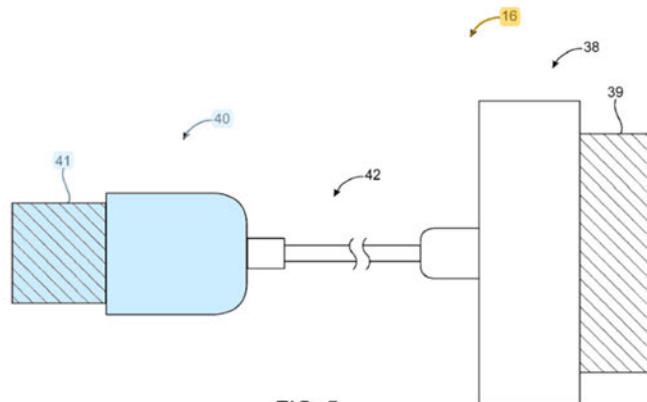


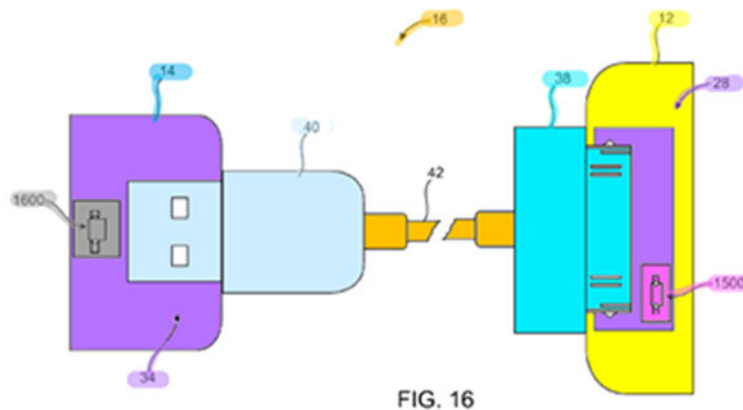
FIG. 5

- d. **9[C] - first logic of the first device coupled to the first port, wherein the first logic is configured to determine a temperature of the connection at the first connector;**

136. Rabu teaches the limitations of element 9[C], for the same reasons discussed in Section XIII.A.2.b (for element 1[A]).

137. As shown in Figure 16, Rabu teaches that the system’s “thermal protection circuitry ... may include temperature sensor 1500 in electronic device

12 (e.g., sensor 1500 in connector 28) and a cutoff switch 1600 in electronic device 14.” Ex-1005 ¶78. Rabu also explains that temperature protection circuit provided in portable computer 14 may include temperature sensors. *See* Ex-1005 ¶¶78 (“thermal protection circuitry may be provided in electronic device 12 and in electronic device 14”), ¶46 (“[t]hermal protection circuitry 710 may include a temperature-sensitive device such as a temperature sensor”).



138. Rabu teaches that a temperature sensor placed at a port of a device, e.g. sensor 1500 in electronic device 12, is used to monitor the temperature of the connector inserted at that port: “a temperature sensor 1500 in electronic device 12 may be used to monitor temperature in connector 38.” Ex-1005 ¶82. As per Rabu’s teaching, repeated in this paragraph, and for the reasons stated in Section XIII.A.2.b (for element 1[A]), a POSITA would find it obvious to use a temperature sensor like “temperature sensor 1500” also in ports 28 and 29 of the

electronic device 14 (claimed first device) to monitor the temperature of a connector inserted in one of these ports (claimed first connector).

139. Rabu also discloses that a temperature sensor may be formed from a temperature-sensitive resistor (i.e., a resistor (e.g. element 1016 in Figure 10) with a resistance that varies with temperature), which is called a thermistor. Ex-1005

¶54. Based on Rabu's disclosures, a POSITA would find it obvious to use a thermistor as a temperature sensor in ports 28 or 29 of the electronic device 14 (claimed first device). It was well known in the prior art that a thermistor changes its resistance value when the temperature changes. Ex-2025, 5:1-4. POSITA would have understood that when a thermistor is used as a temperature sensor temperature readings would be in the form of a value of a voltage, current or resistance. It was well known in the prior art how to obtain temperature readings from a thermistor using a variety of circuitry including an integrated circuit that outputs a data signal indicating the temperature. Ex-2025, 5:6-29. Rabu discloses in Figure 10 a thermistor (element 1016) within a circuit that includes other components (e.g. the two resistors 1020) connected in series between a positive power supply voltage and a low or ground voltage (GRND), "the positive power supply voltage may be conveyed over conductor 1008 and the ground voltage may be conveyed over conductor 1010." *Id.* ¶53, Fig. 10.

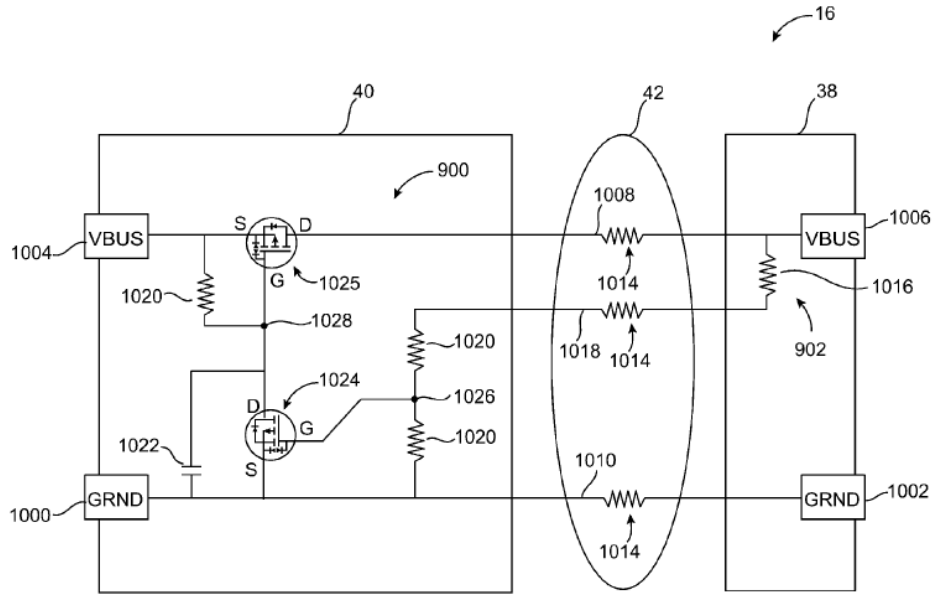


FIG. 10

140. Rabu also discloses that a temperature sensor, e.g. element 902 in Figure 11, may include control circuitry and may be provided as an integrated circuit (element 1100) referred to as control and temperature sensing circuitry. Ex-1005 ¶60, Fig. 11. A portion of a circuit connected to a thermistor in the port 28 or 29 of device 14 (first device) for formulating the temperature readings, or Rabu's integrated circuit (the control and temperature sensing circuitry 1100) placed in the port 28 or 29 of device 14 is the claimed "first logic."

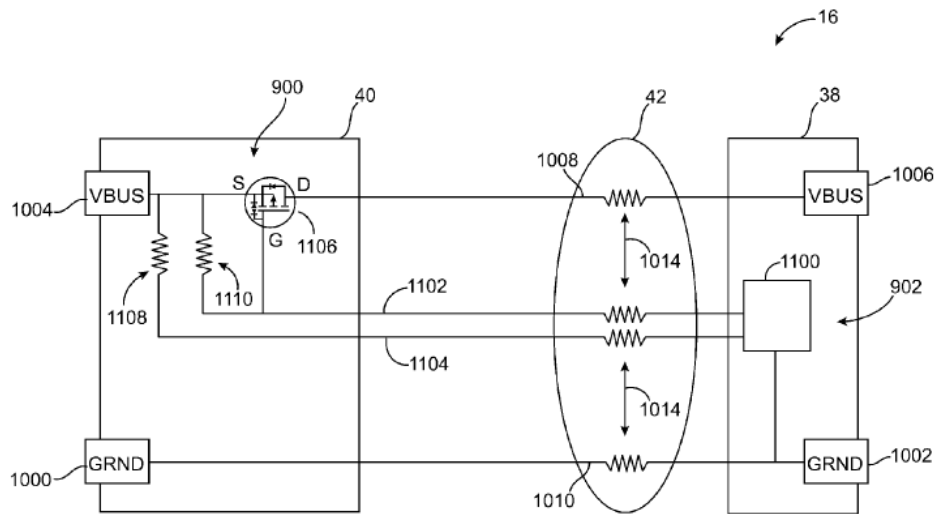


FIG. 11

- e. **9[D] - second logic of the first device, wherein the second logic is configured to provide current to the second device over the connection;**

141. Rabu teaches the limitations of element 9[D].

142. Rabu discloses conductors to carry power and signals from the device providing power to the device receiving power. For example, “the positive power supply voltage may be conveyed to connector 38 over conductor 910 (e.g., one of a plurality of conductors in path 42)” within cable 16. Ex-1005 ¶44, Fig. 9.

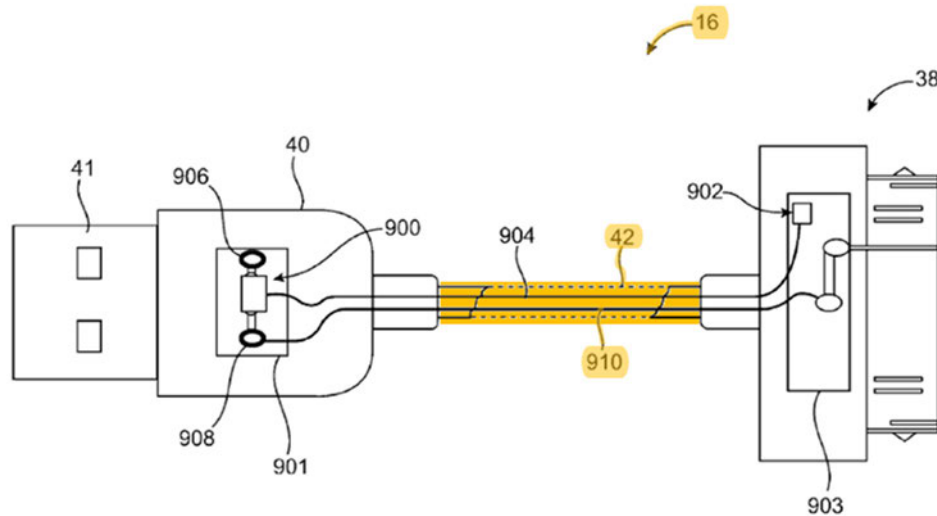


FIG. 9

143. Rabu also discloses that a thermal protection circuitry may include a “power cutoff switch” (also referred to as “current cutoff switch”). Ex-1005 ¶¶46, 55, 78, Fig. 16. As depicted in Figure 16, this switch (element 1600) is located in the electronic device 14 (claimed first device). Ex-1005 ¶78, Fig. 16. Rabu explains that a current cutoff switch (e.g. element 900 in Fig. 10 and Fig. 11) “may include a number of circuit components such as transistors, resistors, capacitors, etc., that allow switch 900 to block power delivery when desired (i.e., by interrupting the flow of current).” Ex-1005 ¶¶55, 56, 62, Fig. 10, Fig. 11.

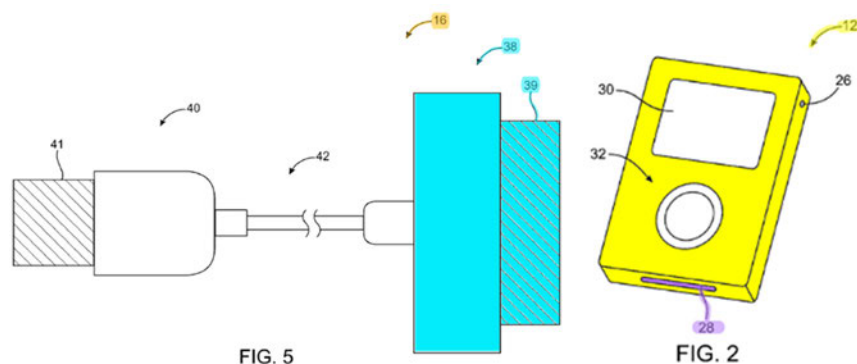
144. A POSITA would have understood that conductors are “configured to provide current to the second device over the connection.” Moreover, a POSITA would have understood that Rabu’s power cutoff switch is actually a circuit as it includes several components as explained above. The portion of Rabu’s thermal

protection circuit, specifically the part of the circuit that forms “the power cutoff switch” or “current cutoff switch,” which controls the provision of power (i.e. supply of current) over the connection to second device 12 is the claimed “second logic.” Ex-1005, Abstract.

f. 9[E] - a second port of the second device, wherein the second port is configured to receive a second connector of the connection;

145. Rabu teaches the limitations of element 9[E], for the same reasons discussed in Section XIII.A.2.c (for element 1[B]).

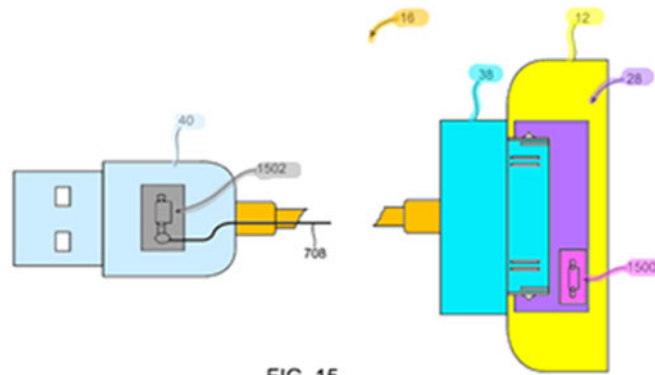
146. This is shown, for example, in Rabu as item 28 in Figure 2 (second port) and item 38 in Figure 5 (second connector). Ex-1005, Figs. 2, 5. Figures 15 and 16 of Rabu expressly show item 38 (claimed second connector) connected to item 28 (claimed second port) of device 12 (claimed second device). Ex-1005, Figs. 15, 16.



- g. 9[F] - third logic of the second device coupled to the second port, wherein the third logic is configured to determine a temperature of the connection at the second connector;**

147. Rabu teaches the limitations of element 9[F], for the same reasons discussed in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]).

148. Rabu teaches “third logic of the second device coupled to the second port [of the second device]” for the same reasons discussed in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]). Specifically, as shown in Figures 15 and 16, Rabu teaches including the temperature sensor in the port 28 (the claimed second port) of device 12 (the claimed second device), into which the cable connector 38 (the claimed second connector) connects. Rabu explains that “temperature sensor 1500 [is] in electronic device 12” and states that temperature sensor 1500 (pink) “may be able to sense the temperature of connector 38 of cable 16.” Ex-1005 ¶77; *id.* ¶78 (“thermal protection circuitry ... may include temperature sensor 1500 in electronic device 12 (e.g., sensor 1500 in connector 28) and a cutoff switch 1600 in electronic device 14” and “sensor 1500 may determine the temperature of connector 38 and may relay signals to cutoff switch 1600 indicative of the temperature of connector 38”).

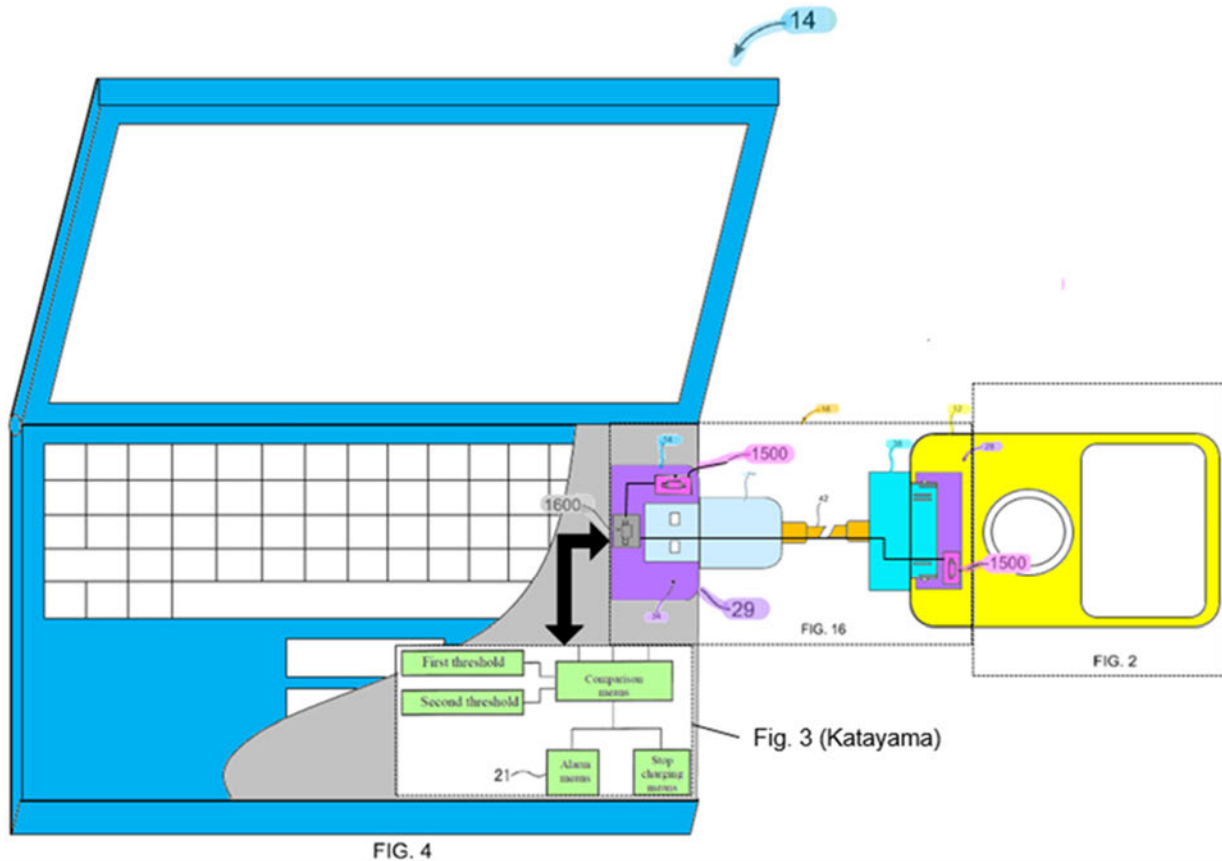


149. As shown, in Rabu's Figure 15, temperature sensor 1500 sits in port 28 of device 12. As explained above in Section XIII.A.3.d. (for element 9[C]), the temperature sensor 1500 would include an associated circuit for formulating its temperature readings, or "may be provided as an integrated circuit" which is referred by Rabu as the "control and temperature sensing circuitry 1100." Ex-1005 ¶60. A portion of a circuit connected to temperature sensor 1500 in the port 28 of device 12 (claimed second device) for formulating the temperature readings, or Rabu's integrated circuit (the control and temperature sensing circuitry 1100) placed in the port 28 of device 12, is the claimed "third logic."

- h. 9[G] - wherein, in response to the greater of the change in temperature determined by the first logic and the change in temperature determined by the third logic being above a threshold, the second logic is configured to reduce the current being provided from the first device to the second device.**

150. Rabu and Katayama teach the limitations of element 9[G], for the same reasons discussed in Sections XIII.A.2.d-f (for elements 1[C], 1[D], and

1[E]). While using slightly different words, Rabu and Katayama teach this claim element for the reasons described in connection with Claim 1. Specifically, in the combined system, the “first logic” and “third logic” correspond to Rabu’s temperature sensing circuitry measuring temperature (pink) in first device (14) (blue) and in second device (12) (yellow), respectively. The “second logic” corresponds to Rabu’s power supply and “cutoff switch 1600” (gray), combined with Katayama’s comparison means 20 and stop charging means (green), which as Rabu explains may be located in portable computer 14 (the first device). Ex-1005 ¶78; Ex-1007 ¶18, Fig. 3. With these identifications, this claim element is taught by the prior art as described above for Claim 1.



4. Dependent claims 5-8, 12, and 13

- a. **Claim 5 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature of a first connector of the connection by measuring a temperature of an electrical assembly connected to the first connector of the first device or the second device.**

151. Rabu and Katayama teach the limitations of Claim 5, for the same reasons discussed in Sections XIII.A.2.b-c (for elements 1[A] and 1[B]).

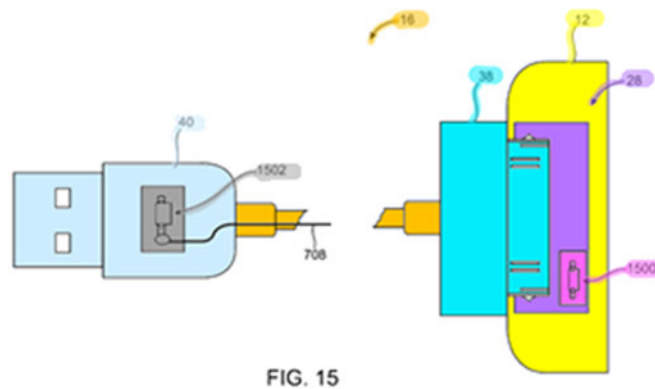
b. Claim 6 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature near a power pin of the first connector of the connection.

152. Rabu and Katayama teach the limitations of Claim 6 for the same reasons discussed in Section XIII.A.2.b (for element 1[A]).

153. Rabu discloses “a power pin of the first connector of the connection.” Rabu teaches device 14 may have connectors that couple to one or more connectors in path 16. Ex-1005, Figs. 3, 4, ¶39. For example, in Figure 3, Rabu discloses “[c]onnector 34 may be a ... a 30-pin connector,” which “may mate with a connector in path 16 of FIG. 1 and may be used to convey power signals over path 16 from device 14 to device 12 (e.g., for powering device 12 and for charging a battery in device 12).” *Id.* ¶38. Connector 34 is a port in the device providing power, which connects with connector 40 of the cable. *Id.*, Figs. 3, 5, ¶40. Indeed, the “cable may have a 30-pin connector,” which may be used to deliver power from one device to another device. *Id.* ¶29. “Pins in the 30-pin connector receive power from the conductors in the cable and deliver power with corresponding pins in a media player, cellular telephone, or other electronic device.” *Id.* ¶29. A POSITA would have understood that Rabu’s teaching of a 30-pin connector is an example of a power pin of the first connector of the connection.

154. Rabu also teaches “determining a temperature near” the power pins of the connectors for the same reasons discussed in Section XIII.A.2.b (for element

1[A]). For example, the temperature sensor shown in Figure 15 is near the pins, including the power pin, of connector 38, because the temperature sensor is in the port where the connector pins connect to the device. A POSITA would have located the temperature sensor near a power pin because this is a location where dendritic shorts would be expected to occur. Ex-1024, 0002; Ex-1025, Abstract, 1:36-47.



c. Claim 7 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature near a data pin of the first connector of the connection.

155. Rabu and Katayama teach the limitations of Claim 7, for the same reasons discussed in Section XIII.A.4.b (for Claim 6).

156. The pins of the 30-pin connector at the end of cable 16 deliver data as well as power: “The conductive lines in path 16 may be used to convey signals such as data and power signals over path 16.” Ex-1005 Figs. 3, 4, ¶34. As explained for Claim 6, the temperature sensor in Figure 15 is near the pins,

including the data pin, of connector 38, because the temperature sensor is in the port where the connector pins connect to the device. A POSITA would have located the temperature sensors near a data pin because this is a location where dendritic shorts would be expected to occur. Ex-1024, 0002; Ex-1025, Abstract, 1:36-47.

d. Claim 8 - The method of claim 1, wherein said reducing the current is performed by the first device.

157. Rabu and Katayama teach the limitations of Claim 8, for the same reasons discussed in Section XIII.A.2.f (for element 1[E]). As explained by Rabu, the “cutoff switch,” which reduced power to the second device, may be located in portable computer 14 (the first device). Ex-1005 ¶78.

e. Claim 12 - The device of claim 9, wherein said first logic is configured to: determine a temperature of the first connector of the connection by measuring a temperature of the port.

158. Rabu and Katayama teach the limitations of Claim 12, for the same reasons discussed in Sections XIII.A.3.b-c (for elements 9[A] and 9[B]).

f. Claim 13 - The device of claim 9, wherein said first logic is configured to: determine a temperature near a power pin of the first connector of the connection; or determine a temperature near a data pin of the first connector of the connection.

159. Rabu and Katayama teach the limitations of Claim 13, for the same reasons discussed in Sections XIII.A.4.b (for Claim 6) and XIII.A.4.c (for claim 7).

B. Ground 2: Claims 1, 5-9, 12, and 13 are rendered obvious by Rabu-Katayama and Further in View of Shoji, Ex-1006.

1. A POSITA would have been motivated to combine the teachings of Rabu-Katayama and Shoji, and would have had a reasonable expectation of success in doing so.

160. As explained above on Section XIIA.1, a POSITA would have been motivated to combine the teachings of Rabu and Katayama (“Rabu-Katayama”). To the extent that a POSITA would have required additional teachings about temperature sensors at both ends of a charging circuit, those teachings would have been found in Shoji.

161. Like Rabu and Katayama, Shoji also relates to a portable charging device with thermal sensors designed to protect the devices by turning off the current in response to excessive heat. Ex-1006, Abstract. Specifically, Shoji teaches equipping both the charger and the device being charged with temperature sensing circuits to stop charging if either the charger or device gets too hot. *Id.*, 13, Fig. 3.

162. In view of these related teachings, a POSITA would have been motivated to combine the teachings of Rabu, Katayama, and Shoji, and a POSITA would have a reasonable expectation of success in doing so. A POSITA would have been motivated to combine these interrelated teachings because the end result would be a better design for preventing temperature spikes and damage caused by electrical shorts. Like Rabu and Katayama, Shoji teaches the benefit of using

thermal protection circuits in both the device providing power and the device receiving power to measure temperature at these locations. Ex-1006, 11, 13. And further like Rabu and Katayama, Shoji also teaches incorporating temperature sensors to protect the devices. *Id.*, 11. And it would have been easy for a POSITA to combine those components into one system because it was well known in the art that analog components can be adapted for connection with digital components, and vice versa, as well as that hardware components may be converted into software components, and vice versa, to construct an operable system. As such, in the combined Rabu-Katayama-Shoji system, a POSITA would have been motivated to achieve the most complete possible thermal and power control using the benefits taught by each reference because such a system would operate more efficiently and with less risk of catastrophic failure to the device attached at each end of the connection. The benefit of an improved system preventing dendritic shorts is to protect cables, their ports and connectors, and the connected electronic devices themselves from excessive heat buildup, permanent damage, and risk of fire. Ex-1022, 0003-04; Ex-1024, 0001-02; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract.

163. Shoji is combined with Rabu-Katayama for additional teachings as to claim elements 1[A], 1[C], 9[C], 9[D], and 9[G] as discussed below. For all other elements (1[Pre], 1[B], 1[D], 1[E], 9[Pre], 9[A], 9[B], 9[C], 9[E], and 9[F]) and

claims (5-8, 12, and 13) of this ground, the teachings of Rabu-Katayama apply the same as were applied in the discussion of Ground 1, in Section XIII.A, above.

2. Independent claim 1

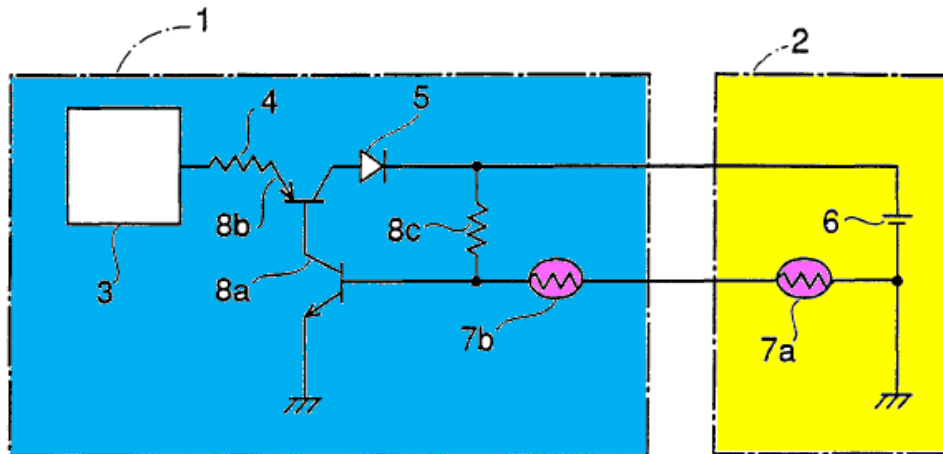
- a. 1[A] - determining a change temperature at a first device wherein said temperature is measured at a first port of the first device that is configured to receive a connection to a second device;**

164. Rabu and Shoji teach the limitations of element 1[A].

165. Regarding Rabu, *see* Section XIII.A.2.b, above.

166. Shoji expressly teaches to include a temperature sensor both in the power supply device and in the battery-operated device receiving current from the power supply. This is shown, for example, in Shoji's Figure 3. Charger 1 (blue, corresponding to the claimed first device) includes thermistor 7b (pink). The charger is connected to battery-operated device 2 (yellow, corresponding to the claimed second device), which includes thermistor 7a (pink). Ex-1006, 10, 13. Moreover, Charger 1 and Device 2 are removably connected via a "three-terminal" or "two-terminal" connector. *Id.*, 15.

Fig.3



167. Shoji expressly teaches reasons to include a temperature sensor at both the charger (claimed first device) and the battery-powered device receiving the current (claimed second device). Regarding the temperature sensor in the claimed second device, Shoji teaches that temperature sensor 7a allows for “overcharging and overheating of the secondary battery [to] be prevented by a simple circuit.” Ex-1006, 15. Regarding the temperature sensor in the claimed first device, Shoji teaches that “the charger also includes a second temperature detecting element for detecting the temperature of the charger,” so that “the stability of the charging operation even during when the charger is at high temperature is secured.” *Id.*, 6-7. Accordingly, a POSITA would have been motivated to measure temperature in both Rabu’s portable computer and the device

being charged so that “the stability of the charging operation ... is secured,” as taught by Shoji, in the event of Rabu’s shorts or dendritic growths developing at either location. Ex-1005, Fig. 3; Ex-1006, 6-7, Fig. 3.

168. A POSITA would have been motivated to combine the teachings of Rabu and Shoji to implement a system in which both power supply 14 and battery-operated mobile device 12 (taught by Rabu) each are protected by thermal protection sensors and circuits (taught by Rabu and Shoji). A POSITA would have recognized from Rabu’s teachings that dendritic structures could form and cause a short circuit at the power source end and its corresponding connector (the claimed first device) for the same reasons that dendritic growth could cause a short circuit at the device end and its corresponding connector (the claimed second device). Rabu teaches “thermal protection circuitry may be provided in electronic device 12 and in electronic device 14” where shorts caused by dendritic buildup are likely to occur. Ex-1005 ¶77. Rabu also teaches that a thermal protection circuitry “may include a temperature sensitive device such as a temperature sensor and a voltage (power) cutoff switch” and depicts such an arrangement in Fig. 8 where the thermal protection circuitry 710 includes “temperature sensor 802” and “power cutoff switch 800.” *Id.* ¶46, Fig. 8. Moreover, Rabu discloses that a temperature sensor “may be formed from a temperature-sensitive resistor such as thermistor.” *Id.* ¶52. Though Rabu’s teaching in regards to placing a thermal protection circuit

that would include a temperature sensor in both the first and the second device is explicit as discussed in Ground 1, there is no explicit description of an embodiment that depicts the use of two temperature sensors for measuring the temperature in each of the two devices. Shoji clearly depicts in the second embodiment the use of two distinct temperature sensors for measuring temperature at both devices, i.e. the thermistor 7b “inside the charger 1” and the thermistor 7a “in the battery cell 2.” Ex-1006, Fig. 3, 6-7, 15. A POSITA would have been motivated to combine Shoji’s two temperature sensors into Rabu for a better system to detect shorts, wherever they may occur, in order to prevent overheating and circuit damage. Accordingly, a POSITA would have been motivated to measure temperature in Rabu’s portable computer 14, so that “the stability of the charging operation ... is secured,” as taught by Shoji, in the event of Rabu’s shorts or dendritic growths developing in the charger. Ex-1005, Fig. 4; Ex-1006, 6-7, Fig. 3.

169. A POSITA would have had a reasonable expectation of success in implementing Rabu with a thermal circuit in its power supply device 14, as taught by Shoji. Each teaches similar structures and basic well-known components, including a “thermistor” (Ex-1005 ¶¶54, 57; Ex-1006, 13), a power source device (Ex-1005, Fig. 1 (Rabu’s 14); Ex-1006, Fig. 3 (item 1), and a connector connecting a power source device and a portable electronic device (Ex-1005 ¶40 (Rabu’s 16); Ex-1006, 15). A POSITA would see no impediment to implementing such circuits

in either of Rabu's device 14 or device 12 because the power supply components of such devices are so similar and standard. Further, a POSITA would have a reasonable expectation of success in combining Rabu and Shoji because Rabu teaches measuring temperature at various locations (i.e., wherever shorts are likely to occur), so it would be obvious to implement Shoji's teaching of using multiple sensors to measure temperature at those various locations.

b. 1[C] - determining the greater of the changes in temperature measured at the first device and the second device, wherein said determining is performed while the first device provides current to the second device over the connection;

170. Rabu-Katayama and Shoji teach the limitations of element 1[C].

171. Regarding Rabu-Katayama, *see* Section XIII.A.2.d, above.

172. Shoji teaches that a temperature change greater than a fixed value may cause damage to the system. Ex-1006, 11. A POSITA would have understood that the greatest risk of damage is at the sensor measuring the greatest temperature change. Ex-1022, 0059; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract. Accordingly, a POSITA would have understood that determining which sensor measures the greatest temperature change identifies where the circuit has the greatest risk of thermal failure and where temperature needs to be reduced in order to lessen such risk. Ex-1022, 0059; Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4; Ex-1027, Abstract.

173. Combining those teachings of Rabu, Shoji, and Katayama is a system in which portable computer 14 and battery-operated mobile device 12 (taught by Rabu), each contain thermal protection sensors and circuits (taught by Rabu and Shoji), for taking temperature change measurements in multiple locations (taught by Katayama). In this way, in the Rabu-Katayama-Shoji combined thermal protection circuit, a temperature sensor measures temperature at device 12, another sensor measures temperature at device 14, and a power cutoff circuit at device 14 can shut off power to the connector. Ex-1005, Figs. 9, 16, ¶¶50, 77; Ex-1006, 13, Fig. 3; Ex-1007 ¶18, Fig. 3.

174. To the extent that Patent Owner argues that the claim language “greater of the changes in temperature” should be understood as requiring a specific calculation of how much temperature has changed over a reference value (e.g. an amount over ambient temperature or threshold temperature), as opposed to measuring the absolute temperature as it changes, a POSITA would have found that obvious as well.

175. For example, Shoji discusses operating at certain ambient temperatures and potentially unsafe conditions related to “temperature rise” over ambient. Ex-1006, 3. Those teachings would have further taught a POSITA that each temperature sensor in the system should measure and respond to temperature changes over ambient temperature, and they provide additional motivations for

calculating specific changes in temperature relative to some reference value (e.g. an ambient temperature). Measuring such temperature changes relative to a reference would have provided another level of monitoring for and control against potentially dangerous conditions.

3. Independent claim 9

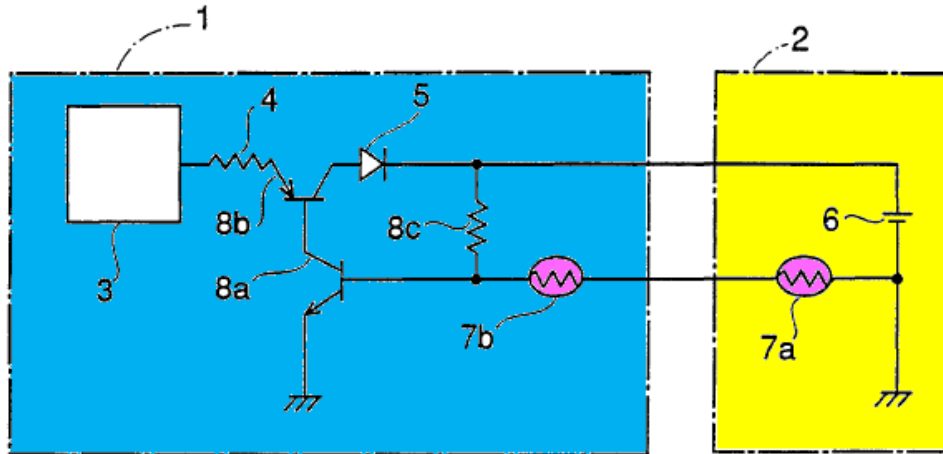
- a. 9[C] - first logic of the first device coupled to the first port, wherein the first logic is configured to determine a temperature of the connection at the first connector;**

176. Rabu-Katayama and Shoji teach the limitations of element 9[C], for the same reasons discussed in Section XIII.B.2.a (for element 1[A]).

177. Regarding Rabu, *see* Section XIII.A.3.d, above.

178. Additionally, as discussed above in Section XIII.B.2.a (for element 1[A]), Shoji expressly teaches measuring temperature using temperature sensors both in the power supply device and in the battery-operated device receiving current from the power supply. This is shown, for example, in Shoji's Figure 3. Charger 1 (blue, corresponding to the claimed first device) includes thermistor 7b (pink). Thermistor 7b determines the temperature, and components 8a, 8b, and 8c comprise logic used to determine when to shut-off the power based on that temperature. Ex-1006, 10-11.

Fig.3



179. A POSITA would have been motivated to combine the teachings of Rabu and Shoji to implement a system in which both the device 14 (e.g. portable computer) that provides the power and battery-operated mobile device 12 are protected by thermal protection sensors and logic circuits for the reasons discussed above in Section XIII.B.2.a (for element 1[A]).

b. 9[D] - second logic of the first device, wherein the second logic is configured to provide current to the second device over the connection;

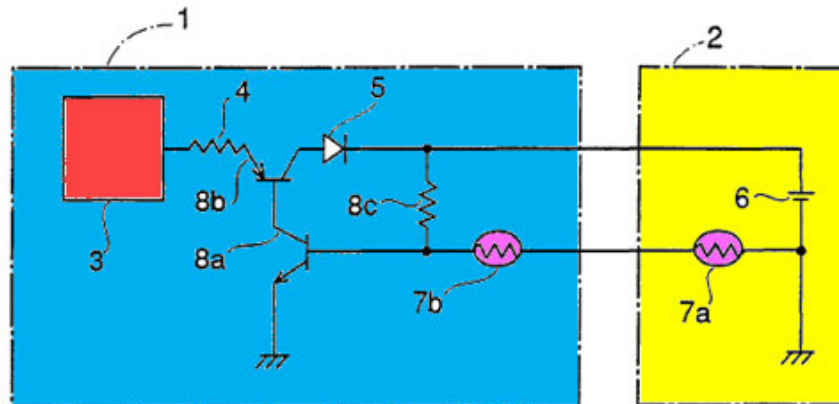
180. Rabu-Katayama and Shoji teach the limitations of element 9[D].

181. Regarding Rabu, *see* Section XIII.A.3.e, above.

182. Shoji expressly teaches a second logic configured to provide current to the second device in form of voltage source 3 (red)), resistor 4, diode 5,

transistors 8a and 8b, resistor 8c, and thermistor 7a. Ex-1006, 9. Shoji refers to this current charging approach as “quasi-constant current charging.” *Id.* at 13.

Fig.3

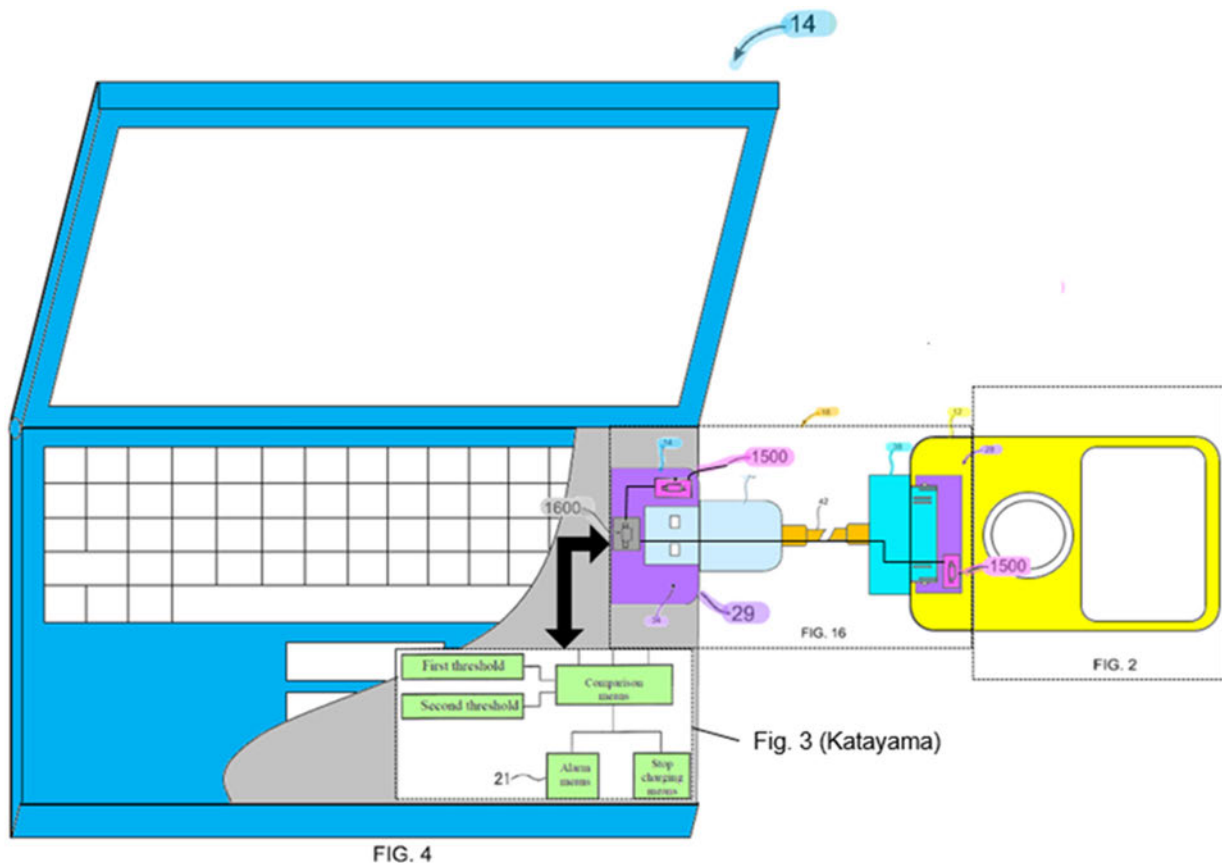


183. A POSITA would have been motivated to combine the teachings of Rabu and Shoji to implement a system with the second logic as claimed for the reasons discussed above in Section XIII.B.2.a (for element 1[A]).

- c. **9[G] - wherein, in response to the greater of the change in temperature determined by the first logic and the change in temperature determined by the third logic being above a threshold, the second logic is configured to reduce the current being provided from the first device to the second device.**

184. Rabu, Katayama, and Shoji teach the limitations of element 9[G], for the same reasons discussed in Sections XIII.A.3.h (for element 9[G]) and XIII.B.2.b (for element 1[C]). While using slightly different words, Rabu, Katayama, and Shoji teach this claim element for the reasons described in

connection with Claim 1. Specifically, in the combined system, the “first logic” and “third logic” correspond to Rabu’s temperature sensing circuitry measuring temperature (pink) in first device (14) (blue) and in second device (12) (yellow), respectively. The “second logic” corresponds to Rabu’s power supply and “cutoff switch 1600” (gray), combined with Katayama’s comparison means 20 and stop charging means (green), which as Rabu explains may be located in portable computer 14 (the first device). Ex-1005 ¶78; Ex-1007 ¶18, Fig. 3. With these identifications, this claim element is taught by the prior art as described above for Claim 1.



C. Ground 3: Claims 1-13 are rendered obvious by Rabu-Katayama and further in view of Karam, Ex-1008.

1. A POSITA would have been motivated to combine the teachings of Rabu-Katayama and Karam, and would have had a reasonable expectation of success in doing so.

185. In addition to the reasons set out below with respect to specific claim elements, a POSITA would have been motivated to combine the teachings of Rabu, Katayama, and Karam, and would have a reasonable expectation of success in doing so, at least because each relates to safely charging electronic devices using thermal protection of circuits.

186. For the same reasons in Section XIII.A.1, a POSITA would be motivated to combine Rabu and Katayama. A POSITA additionally would have been motivated to combine Karam with Rabu-Katayama.

187. Karam, like Rabu, relates to a method for controlling current based on temperature for electronic devices through a communication pathway. Ex-1005 ¶3; Ex-1008, 2:36-50. Specifically, Rabu discloses that a “cable may include thermal protection circuitry that reduces or eliminate power supply signals flowing to a connector in the cable when it is determined that the temperature of the connector has risen above a given threshold.” Ex-1005 ¶32. Karam discloses “generating a temperature change result” and “one of (i) enabling, (ii) scaling back, or (iii) disabling delivery of power to the remotely powerable device through the communications pathway based on the temperature change result.” Ex-1008, 2:45-

50. A POSITA would have understood that Karam discloses an additional method of determining and controlling temperature for electronic devices and communication pathways. Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4. Thus, a POSITA would have combined the teachings of Rabu with Karam with a reasonable expectation of success as an alternative design choice. And it would have been easy for a POSITA to combine those components into one system because it was well known in the art that analog components can be adapted for connection with digital components, and vice versa, as well as that hardware components may be converted into software components, and vice versa, to construct an operable system.

2. Independent claim 1

a. 1[Pre] - A method for adjusting current based on temperature, comprising:

188. Rabu teaches the limitations of element 1[Pre], for the same reasons discussed in Section XIII.A.2.a (for element 1[Pre]).

b. 1[A] - determining a change temperature at a first device wherein said temperature is measured at a first port of the first device that is configured to receive a connection to a second device;

189. Rabu and Karam teach the limitations of element 1[A].

190. Rabu teaches the limitations of element 1[A], for the same reasons discussed in Section XIII.A.2.b (for element 1[A]).

191. To the extent Patent Owner argues that claim element “change temperature” should be narrowly construed as requiring a specific calculation of the temperature change, Karam expressly discloses a calculation for a change in temperature. Karam discloses that “controller 88 performs one or more additional temperature calculations to confirm that the communications pathway 28 is at a dangerous temperature.” Ex-1008, 8:35-38. Karam explains that “the change in temperature of the communications pathway 28 which can be assumed to be the change in temperature of the copper material within the cabling 30 is capable of being determined using Equation (2)” shown below. *Id.*, 7:57-61.

$$\text{Change in Temperature} = \frac{R_OPERATING - R_INITIAL}{R_INITIAL \times 0.00393} \quad (2)$$

192. Karam discloses that:

In Equation (2), 0.00393 in Ohms per degrees Celsius is the temperature coefficient of copper.” Also, “R_INITIAL is the resistance of the communications pathway 28 when the PSE 24 makes an initial baseline measurement (e.g., during an initial discovery phase prior to supplying power through the communications pathway 28).” “R_OPERATING is the resistance of the communications pathway 28 when the PSE 24 makes periodic measurements over time while supplying power to the PD 26.

Ex-1008, 8:1-9.

193. A POSITA would have understood that Karam discloses determining an initial temperature (R_INITIAL) a first time, a current temperature

(R_OPERATING) a second time, and the difference between the two based on the equation disclosed.

194. A POSITA would have been motivated to combine the teachings of Karam with Rabu and Katayama because all are directed to methods for controlling current based on temperature of electronic devices. Ex-1005 ¶3; Ex-1007 ¶18, Fig. 3; Ex-1008, 2:36-50. Further, all teach measuring a change in temperature. Ex-1005 ¶76; Ex-1007 ¶18, Fig. 3; Ex-1008, 7:64-8:9. Karam's disclosure of measuring a change in temperature over time benefits the Rabu-Katayama system because it protects the circuit and components from a rapid rise in temperature, which would likely result from a significant short.

195. A POSITA would have a reasonable expectation of success in combining Karam with Rabu because both teach similar structures and components, including a power source device (Ex-1005, Fig. 1 (Rabu's 14); Ex-1008, 3:41-43 (Karam's 24)), an electronic device (Ex-1005, Fig. 1 (Rabu's 12); Ex-1008, 3:41-43 (Karam's 26)), and a connector connecting a power source device and a portable electronic device (Ex-1005 ¶40 (Rabu's 16); Ex-1008, 3:41-43 (Karam's communications pathway 28)).

- c. **1[B] - determining a change temperature at a second device wherein said temperature is measured at a second port of the second device that is configured to receive the connection to the first device;**

196. Rabu and Karam teach the limitations of element 1[B], for the same reasons discussed in Sections XIII.A.2.c (for element 1[B]) and XIII.C.2.b (for element 1[A]).

- d. **1[C] - determining the greater of the changes in temperature measured at the first device and the second device, wherein said determining is performed while the first device provides current to the second device over the connection;**

197. Rabu, Katayama, and Karam teach the limitations of element 1[C].

198. Rabu and Katayama teach the limitations of element 1[C], for the same reasons discussed in Section XIII.A.2.d (for element 1[C]).

199. To the extent Patent Owner argues that claim element “changes in temperature” should be narrowly construed as requiring a specific calculation of how the temperature has changed, Karam expressly discloses a calculation for a change in temperature for the same reasons discussed in Section XIII.C.2.b (for element 1[A]). Ex-1008, 7:49-8:9.

e. 1[D] - determining if the greater of the changes in temperature is above a threshold;

200. Rabu, Katayama, and Karam teach the limitations of element 1[D], for the same reasons discussed in Sections XIII.A.2.e (for element 1[D]) and XIII.C.2.d (for element 1[C]).

f. 1[E] - if the greater of the changes in temperature is above the threshold, reducing the current being provided from the first device to the second device.

201. Rabu, Katayama, and Karam the limitations of element 1[E], for the same reasons discussed in Sections XIII.A.2.f (for element 1[E]) and XIII.C.2.d (for element 1[C]).

3. Independent claim 9

a. 9[Pre] - A device, comprising:

202. Rabu and Karam disclose the limitations of element 9[Pre], for the same reasons discussed in Sections XIII.A.3.a (for element 9[Pre]) and XIII.C.2.b (for element 1[A]).

b. 9[A] - a connection coupling a first device and a second device;

203. Rabu and Karam disclose the limitations of element 9[A], for the same reasons discussed in Sections XIII.A.3.b (for element 9[A]) and XIII.C.2.b-c (for elements 1[A] and 1[B]).

- c. **9[B] - a first port of the first device, wherein the first port is configured to receive a first connector of the connection;**

204. Rabu and Karam disclose the limitations of element 9[B], for the same reasons discussed in Sections XIII.A.3.c (for element 9[B]) and XIII.C.2.b (for element 1[A]).

- d. **9[C] - first logic of the first device coupled to the first port, wherein the first logic is configured to determine a temperature of the connection at the first connector;**

205. Rabu and Karam disclose the limitations of element 9[C], for the same reasons discussed in Sections XIII.A.3.d (for element 9[C]) and XIII.C.2.b (for element 1[A]).

- e. **9[D] - second logic of the first device, wherein the second logic is configured to provide current to the second device over the connection;**

206. Rabu discloses the limitations of element 9[D], for the same reasons discussed in Section XIII.A.3.e (for element 9[D]).

- f. **9[E] - a second port of the second device, wherein the second port is configured to receive a second connector of the connection;**

207. Rabu and Karam disclose the limitations of element 9[E], for the same reasons discussed in Sections XIII.A.3.f (for element 9[E]) and XIII.C.2.c (for element 1[B]).

- g. 9[F] - third logic of the second device coupled to the second port, wherein the third logic is configured to determine a temperature of the connection at the second connector;**

208. Rabu and Karam disclose the limitations of element 9[F], for the same reasons discussed in Sections XIII.A.3.g (for element 9[F]) and XIII.C.2.b-c (for elements 1[A] and 1[B]).

- h. 9[G] - wherein, in response to the greater of the change in temperature determined by the first logic and the change in temperature determined by the third logic being above a threshold, the second logic is configured to reduce the current being provided from the first device to the second device.**

209. Rabu, Katayama, and Karam disclose the limitations of element 9[G], for the same reasons discussed in Sections XIII.A.3.h (for element 9[G]), and XIII.C.2.d-f (for elements 1[C], 1[D], and 1[E]).

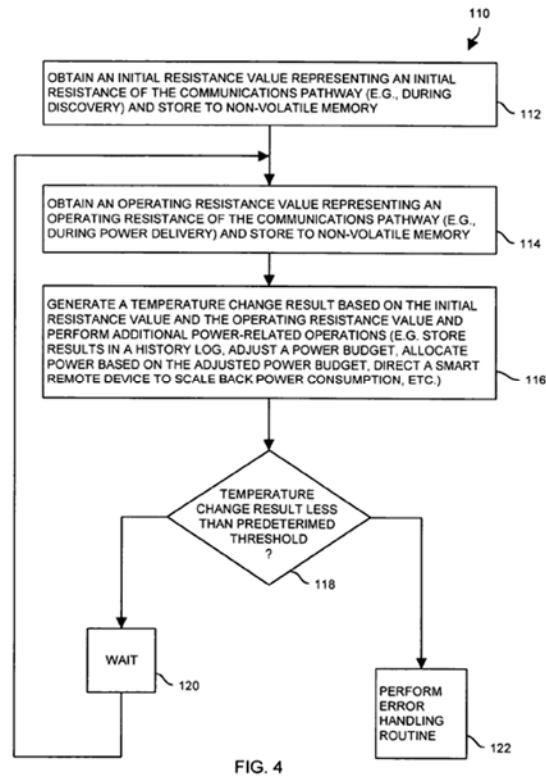
4. Dependent claims 2-8, 10-13

- a. Claim 2 - The method of claim 1, wherein said determining the change in temperature, said determining if the change in temperature is above the threshold, and said reducing the current is performed a plurality of times while the first device provides current to the second device over the connection.**

210. Rabu and Karam teach the limitations of Claim 2.

211. Rabu teaches the “while the first device provides current to the second device over the connection” portion of this claim for the same reasons discussed in Section XIII.A.2.d (for element 1[C]).

212. Karam teaches “wherein said determining the change in temperature, said determining if the change in temperature is above the threshold, and said reducing the current is performed a plurality of times.” Shown below in Karam’s Figure 4 is procedure 110 which is performed by controller 88 of PSE 24. Ex-1008, 8:46-47. In step 116, Karam discloses that processor 98 of controller 88 “calculates the actual power loss through the communications pathway, adjusts a power budget of the PSE 24, and allocates power to other devices based on the adjusted power budget.” *Id.*, 9:3-6. Karam explains that “processor 98 repeats steps 114 and 116 (e.g., without waiting) at least one more time to confirm the rise in temperature before turning off delivery of power to the PD 26.” *Id.*, 9:26-29. Accordingly, a POSITA would have understood that repeating steps 114 and 116 includes reducing current a plurality of times by adjusting the power budget of PSE 24.



213. A POSITA would have been motivated to combine the teachings of Rabu and Karam because both are directed to methods for controlling current based on temperature of electronic devices. Ex-1005 ¶3; Ex-1008, 2:36-50. Karam's disclosure of repeating steps to confirm the rise in temperature benefits Rabu's system to ensure that a temperature exceeds a threshold amount before proceeding to reduce or eliminate current.

214. A POSITA would have had a reasonable expectation of success in combining Rabu and Karam because both teach similar structures and components, including a power source device (Ex-1005, Fig. 1 (Rabu's 14); Ex-1008, 3:41-43 (Karam's 24)), an electronic device (Ex-1005, Fig. 1 (Rabu's 12); Ex-1008, 3:41-

43 (Karam's 26)), and a connector connecting a power source device and a portable electronic device (Ex-1005 ¶40 (Rabu's 16); Ex-1008, 3:41-43 (Karam's communications pathway 28)).

- b. Claim 3 - The method of claim 1, wherein said determining the change in temperature comprises: determining an ambient temperature at the first device; determining a temperature of a first connector of the connection; and determining the difference between the ambient temperature and the temperature of the first connector of the connection.**

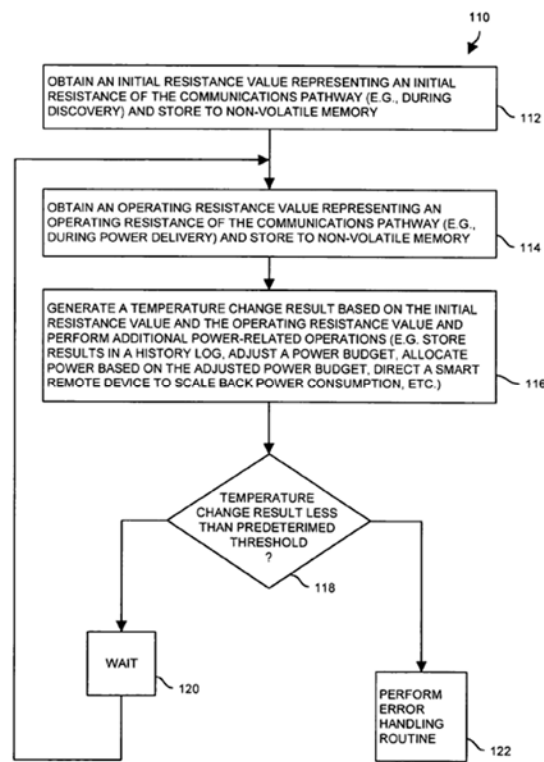
215. Rabu and Karam teach the limitations of Claim 3.

216. As discussed in Section XIII.A.2.b (for element 1[A]), Rabu teaches determining a temperature of a first connector of the connection. Rabu teaches that connector 38 may include "thermal protection circuitry 710," which "may include a temperature-sensitive device such as a temperature sensor." Ex-1005 ¶46, Fig. 7. A POSITA would have understood that a temperature sensor is typically used to determine an ambient temperature. Rabu also explains that "circuitry 710 may include a temperature-sensitive fuse or other suitable device that changes state depending on ambient temperature." Ex-1005 ¶46, Fig. 7. A POSITA would have understood circuitry 710 can be used to determine an ambient temperature and in view of Karam's teaching as discussed below would be motivated to add an additional circuitry 710 at another location of the first device to determine the ambient temperature.

217. And Karam teaches determining the operational temperature of the cables by factoring in the measured temperature of the cables' ambient surroundings. Karam explains that "a sudden rise in ambient temperature of the building where the cable run is present on a hot summer day that contributes to the rise in the temperature of the cables can be factored in the decision and would help account for the operational temperature of the cables as dictated in their specifications." Ex-1008, 6:61-67. Karam discloses that in step 122 of Figure 4, performed by controller 88, "the ambient temperature is evaluated (assuming sensors are present) to analyze if the rise [of temperature] is due to environmental issues." Ex-1008, 9:33-35. Karam also teaches generally reading temperature from different locations in a building to track the changes in ambient temperature. *Id.*, 6:52:56.

218. A POSITA would have been motivated to compare current cable temperatures to those general building ambient temperatures because the cables are housed inside of the building and their ambient surroundings (i.e., the building) affect their operating temperatures. Alternatively, a POSITA would be motivated to add an additional circuitry 710 for determining the ambient temperature. A POSITA would place the temperature sensor of circuitry 710 at a location of the first device away from any heat generating components, so its reading would reflect the ambient temperature. A POSITA would have understood that the

difference between the ambient temperature and temperature of the first connector is determined to assess whether the temperature rise is due to environmental influences (e.g., increased building temperature on a hot summer day) or due to internal electrical problems (e.g., a short causing heat buildup). Ex-1025, Abstract, 1:36-47; Ex-1026 ¶4.



219. A POSITA would have been motivated to combine the teachings of Rabu and Karam because both are directed to methods for controlling current based on temperature of electronic devices. Ex-1005 ¶3; Ex-1008, 2:36-50. Further, both teach measuring the ambient temperature of electronic devices. Ex-1005 ¶46; Ex-1008, 9:33-35.

220. A POSITA would have a reasonable expectation of success in combining Rabu and Karam for the reasons discussed above in Section XIII.C.4.a (for Claim 2).

- c. **Claim 4 - The method of claim 1, wherein said determining the change in temperature comprises: determining an initial temperature of a first connector of the connection at a first time; determining a current temperature of the first connector of the connection at a second time; and determining the difference between the initial temperature and the current temperature.**

221. Rabu and Karam teach the limitations of Claim 4.

222. Rabu discloses that if connector 38 exceeds a threshold temperature such as a threshold value “less than [] 85° C., 90° C., 95° C., 100° C., greater than 100° C., or any other suitable threshold temperature,” thermal protection circuitry 710 may be configured to shut off power. Ex-1005 ¶76. Thus, A POSITA would have understood Rabu to disclose determining a change in temperature.

223. Moreover, Rabu discloses “[i]f desired, the thermal protection circuitry 710 may be configured to shut off power to contact 1006 only after the threshold temperature has been exceeded for a given time period such as 1 minute, 5 minutes, 10 minutes, 30 minutes, etc.” Ex-1005 ¶76. A POSITA would have understood that Rabu teaches determining the temperature at two different times separated by a set time difference (e.g. 5 minutes). The first of such measurements would be the claimed “initial temperature ... at a first time” while the second

measurement would be the claimed “current temperature ... at a second time.”

Rabu also discloses “determining the difference between the initial temperature and the current temperature” as Rabu seeks to determine a time period that the threshold temperature has been exceeded as a precondition to shutting off the power.

224. Karam discloses the limitations of Claim 4 for the same reasons discussed in Section XIII.C.2.b (for element 1[A]).

- d. Claim 5 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature of a first connector of the connection by measuring a temperature of an electrical assembly connected to the first connector of the first device or the second device.**

225. Rabu, Katayama, and Karam teach the limitations of Claim 5, for the same reasons discussed in Sections XIII.A.4.a (for Claim 5) and XIII.C.2.b-c (for elements 1[A] and 1[B]).

- e. Claim 6 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature near a power pin of the first connector of the connection.**

226. Rabu, Katayama, and Karam teach the limitations of Claim 6, for the same reasons discussed in Sections XIII.A.4.b (for Claim 6) and XIII.C.2.b (for element 1[A]).

- f. Claim 7 - The method of claim 1, wherein said determining the change in temperature comprises: determining a temperature near a data pin of the first connector of the connection.**

227. Rabu, Katayama, and Karam teach the limitations of Claim 7, for the same reasons discussed in Section XIII.C.4.e (for Claim 6).

- g. Claim 8 - The method of claim 1, wherein said reducing the current is performed by the first device.**

228. Rabu, Katayama, and Karam teach the limitations of Claim 8, for the same reasons discussed in Section XIII.A.4.d (for Claim 8) and Section XIII.C.2.f (for element 1[E]).

- h. Claim 10 - The device of claim 9, wherein said first logic is configured to: determine an ambient temperature at the first device; and determine the difference between the ambient temperature and the temperature of the first connector of the connection.**

229. Rabu and Karam teach the limitations of Claim 10, for the same reasons discussed in Section XIII.C.4.b (for Claim 3).

- i. Claim 11 - The device of claim 9, wherein said first logic is configured to: determine an initial temperature of the first connector of the connection at a first time; determine a current temperature of the first connector of the connection at a second time; and determine the difference between the initial temperature and the current temperature.**

230. Rabu and Karam teach the limitations of Claim 11, for the same reasons discussed in Section XIII.C.4.c (for Claim 4).

- j. **Claim 12 - The device of claim 9, wherein said first logic is configured to: determine a temperature of the first connector of the connection by measuring a temperature of the port.**

231. Rabu, Katayama, and Karam teach the limitations of Claim 12, for the same reasons discussed in Sections XIII.A.4.e (for Claim 12) and XIII.C.3.b-c (for elements 9[A] and 9[B]).

- k. **Claim 13 - The device of claim 9, wherein said first logic is configured to: determine a temperature near a power pin of the first connector of the connection; or determine a temperature near a data pin of the first connector of the connection.**

232. Rabu, Katayama, and Karam teach the limitations of Claim 13, for the same reasons discussed in Section XIII.A.4.f (for claim 13) and XIII.C.4.e-f (for Claims 6 and 7).

XIV. CONCLUSION

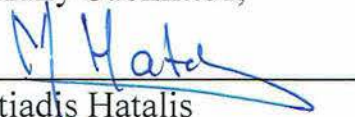
233. For at least these reasons, claims 1-13 are invalid over the prior art.

234. In signing this declaration, I understand 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 acknowledge that I may be subject to cross-examination in this 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 the time allotted for cross-examination.

235. I declare that all statements made herein of my knowledge are true, that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

236. I declare under penalty of perjury that the foregoing is true and correct.

Respectfully Submitted,



Dr. Miltiadis Hatalis