

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL INC., DELL TECHNOLOGIES INC., HP INC., AND LENOVO (UNITED STATES) INC.,

Petitioner

v.

UNIVERSAL CONNECTIVITY TECHNOLOGIES INC.,

Patent Owner.

DECLARATION OF ERIC WELCH

Case No. IPR2024-01478

Mail Stop Patent Board
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

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TABLE OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 8,680,712 (the “’712 Patent”)
1002	Prosecution history of the ’712 Patent
1003	Declaration of Eric Welch
1004	Curriculum Vitae of Eric Welch
1005	U.S. Pat. App. Pub. No. 2006/0089230 A1 to Biederman et al. (“Biederman”)
1006	IEEE Standard for Information Technology, Part 3, Amendment: Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) (“IEEE 802.3af”)
1007	U.S. Pat. App. Pub. No. 2006/0100799 A1 to Karam (“Karam”)
1008	U.S. Pat. App. Pub. No. 2008/0168283 A1 to Penning (“Penning”)
1009	Declaration of James L. Lansford, Ph.D. regarding IEEE 802.3af
1010	<i>Intentionally left blank</i>
1011	UCT’s Amended Infringement Contentions, Ex. H, <i>Universal Connectivity Technologies Inc. v. Dell Technologies Inc. et al.</i> , 1:23-cv-01506-RP (W.D. Tx. Apr. 3, 2024)
1012	Universal Serial Bus Type-C Cable and Connector Specification, Release 2.0
1013	Declaration of Nathaniel Frank-White Regarding WayBack Machine URLs
1014	Galit Mendelson, <i>All you Need to Know About Power over Ethernet (PoE) and the IEEE 802.3af Standard</i> (June 2004), available at https://web.archive.org/web/20050302031350/http://www.powerdsine.com/Documentation/WhitePapers/PoE_and_IEEE802_3af.pdf .
1015	Texas Instruments, <i>An Engineer’s Guide to Current Sensing</i>
1016	DigiKey, <i>Current Shunt Monitors</i> , YouTube 0:13, 0:34 (August 12, 2010), https://www.youtube.com/watch?v=PDqbIOik9tY .

I. Introduction

1. My name is Eric Welch. I have prepared this Declaration in connection with Dell Inc., Dell Technologies Inc., HP Inc., and Lenovo (United States) Inc.’s Petition for *Inter Partes* Review of U.S. Patent No. 8,680,712 (the “’712 Patent”) (EX1001), which is to be filed concurrently with this Declaration.

2. In the course of preparing this Declaration, I reviewed the ’712 Patent, its prosecution file history, as well as the other documents discussed in this Declaration.

3. I have been retained by Dell Inc., Dell Technologies Inc., HP Inc., and Lenovo (United States) Inc. (“Petitioners”) as an expert in the fields of electrical and software engineering, and product development for consumer, medical, industrial, aerospace, and other applications. I have been asked to provide my opinion regarding the state of the art of the technology described in the ’712 Patent and on the patentability of the claims of this patent. I am being compensated at my normal consulting rate for my time. My compensation is not dependent on and in no way affects the substance of my statements in this Declaration. I have no financial interest in the Petitioners, the ’712 Patent, or the owner of the ’712 Patent.

II. Background and Qualifications

4. My professional qualifications, experience, publications, and presentations, as well as a list of previous cases in which I have provided expert testimony, are outlined in my curriculum vitae (EX1004).

5. I am an expert with over 50 years of experience in the fields of electrical and software engineering, and product development for consumer, medical, industrial, aerospace, and other applications.

6. From 1976 to 2007, I was Vice President of Engineering and CTO of InnoSys Incorporated and its Keyspan division. The Keyspan division developed and marketed to the retail channel several lines of computer peripheral and communications devices such as USB adapters, computer remote control devices, USB and FireWire add on cards, and related technology. I personally designed and developed core technology for the Keyspan business, resulting in an increase in sales from less than \$1MM in 1997 to \$13MM in 1999.

7. From 2007 to the present, I have been president of Bramson Welch & Associates, Inc., an Engineering Services consultancy specializing in embedded systems, USB, Bluetooth, data communications, mobile devices, iPhone accessories, and litigation services, including data analysis and expert witness work. I serve as System Architect and Project Strategist on all Bramson Welch projects. I frequently

work with multiple client groups to coordinate design and architecture across many different technical and organizational domains.

8. I have over twenty-five years of significant experience specifically with the development of USB peripherals, adapters, hosts, and special purpose devices. For example, I was responsible for the design and development of the Keyspan USB/serial adapter, the first working serial adapter for the Apple iMac in the mid-1990s, which is still shipping today. Also, for example, I was responsible for the design and development of Keyspan's network-attached host adapter, a device with an ethernet network connection and four USB Host ports. As yet other examples, while at Keyspan and later at Bramson Welch, I was responsible for the design and development of dozens of USB peripheral devices, including class device interface (i.e., storage, HID, and communication adapters), and vendor-specific devices that do not fit any of the existing USB classes. I am also a senior member of the Institute of the Electrical and Electronics Engineers association (IEEE).

9. I also have specific experience with USB entities that can function either as a USB Host or as a USB Device, including several prominent smartphone platforms, where role detection and role switching are important features.

10. While many of my projects have been USB focused, I also have experience with other communication protocols, such as HDMI and Power Over Ethernet ("PoE"), among others. For example, I worked on a design study with

HDMI to evaluate existing USB adapter technology to assess its applicability. I have also worked on a number of smart phone USB/Ethernet adapters, including several with PoE technology.

11. I have significant experience providing expert witness services in the areas of electrical and computer engineering, and in the course of this work and my own research and patenting activities, I have gained experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

12. My curriculum vitae contains further details regarding my experience, education, publications, and other qualifications which allow me to render expert opinions in connection with this proceeding.

III. Documents and Materials Considered

13. In forming my opinions, in addition to my knowledge, education, training, and experience, I have considered the materials cited in this Declaration and the documents and things that I have obtained, or that have been provided to me, as listed in the Table of Exhibits.

14. I reserve the right to supplement or amend this Declaration if additional information that affects my opinions becomes available.

IV. Relevant Legal Principles

15. I am not an attorney, and I offer no opinions on the law. Counsel has informed me of legal standards that apply to the issue of patent validity. I have applied these standards in arriving at my conclusions.

16. I understand that in an *inter partes* review the petitioner has the burden of proving a proposition of unpatentability by a preponderance of the evidence. I understand this standard is different from the standard that applies in a district court, where I understand a challenger bears the burden of proving invalidity by clear and convincing evidence.

17. I understand that a patent claim is invalid based on anticipation if a single prior art reference discloses all of the features of that claim in a way that enables one of ordinary skill in the art to make and use the invention. Each of the claim features may be expressly or inherently present in the prior art reference. I understand that if the prior art necessarily functions in accordance with, or includes a claim's feature, then that prior art inherently discloses that feature.

18. I understand that to establish inherency, the evidence must make clear that the missing descriptive matter is necessarily present in the item of prior art and that it would be so recognized by persons of ordinary skill in the art. I also understand that prior art use of the claimed patented invention that was accidental,

unrecognized, or unappreciated at the time of filing can still be an invalidating anticipation.

19. I understand that although multiple prior art references may not be combined to show anticipation, additional references may be used to interpret the allegedly anticipating reference and shed light on what it would have meant to those skilled in the art at the time of the invention. These additional references must make it clear that the missing descriptive matter in the patent claim is necessarily present in the allegedly anticipating reference, and that it would be so recognized by persons of ordinary skill in the art.

20. I understand that a patent may not be valid even though the invention is not identically disclosed or described in the prior art if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art in the relevant subject matter at the time the invention was made.

21. I understand that obviousness must be tested as of the time the invention was made. I understand that the test for obviousness is what the combined teachings of the prior art references would have suggested, disclosed, or taught to one of ordinary skill in the art.

22. To determine if a claim is obvious, the following factors should be considered: (1) the level of ordinary skill in the art at the time the invention was

made; (2) the scope and content of the prior art; (3) the differences between the claimed invention and the prior art; and (4) secondary considerations, including evidence of commercial success, long-felt but unsolved need, unsuccessful attempts by others, copying of the claimed invention, unexpected and superior results, acceptance and praise by others, independent invention by others, and the like.

23. For example, I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand that an obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim because a court can take account of the inferences and/or creative steps that a person of ordinary skill in the art would employ.

24. I understand that the following rationales may be used to determine whether a piece of prior art can be combined with other prior art or with other information within the knowledge of one of ordinary skill in the art:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Predictable use or combination of prior art elements according to their established functions;
- Use of known techniques to improve similar devices (methods, or products) in the same way;

- Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- “Obvious to try” - choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art; or
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

25. I understand that when a work is available in one field of endeavor, design incentives and/or other market forces, for example, can prompt variations of it, either in the same field or a different one. Moreover, if a person of ordinary skill can implement a predictable variation, I understand this likely bars its patentability.

26. I understand that another factor to be considered is common sense. For example, I understand that common sense teaches that familiar items may have obvious uses beyond their primary purposes, and, in many cases, a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle.

27. I understand that the Supreme Court articulated additional guidance for obviousness in its *KSR* decision. My understanding is that the Supreme Court said that technical people of ordinary skill look for guidance in other solutions to problems of a similar nature, and that the obviousness inquiry must track reality, and

not legal fictions. I have relied on these understandings in expressing the opinions set forth below.

28. I understand that, for purposes of my analysis in this *inter partes* review proceeding, the terms appearing in the patent claims should be interpreted according to their “ordinary and customary meaning.” In determining the ordinary and customary meaning, the words of a claim are first given their plain meaning that those words would have had to a person of ordinary skill in the art (“POSITA”). I understand that the structure of the claims, the specification, and the file history also may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. Moreover, treatises and dictionaries may be used, albeit under limited circumstances, to determine the meaning attributed by a POSITA to a claim term at the time of filing. I have followed this approach in my analysis.

29. I also understand that the words of the claims should be interpreted as they would have been interpreted by a POSITA at the time the alleged invention was made (not today). I have been asked to use the priority date of December 11, 2008.

V. Person of Ordinary Skill in the Art

30. In order to determine the characteristics of a POSITA of the ’712 Patent, I have used December 11, 2008 as the relevant time frame. My understanding is that this is the alleged earliest priority date of the application that resulted in the

'712 Patent. For purposes of this Declaration, any reference to the priority date of the '712 Patent is intended to refer to this December 11, 2008 date.

31. In determining the characteristics of a person of ordinary skill in the art for the '712 Patent, I have considered the state of the art of data communications devices and interfaces at that time, the types of problems encountered with delivering power over a communications network, connecting communications devices in a daisy chain network, and determining power requirements of connected devices, and the solutions that then existed. I have also considered the then-existing technology for delivering power over such communication networks, including the sophistication of the technology involved, and the education and experience of those working in the field at that time. I have also considered my personal knowledge and experience in the field at that time, including those I worked and interacted with regarding communication systems. I have also considered the knowledge, education, and experience of those in academia and industry at that time that were working, innovating, or performing research in the field of audio/visual communications.

32. It is my opinion that a POSITA for the '712 Patent at the time of this filing date would have had a bachelor's degree in electrical engineering, computer engineering, computer science, or equivalent training, and three years of experience with data communications systems or interfaces, including at least some experience with serial or display data communications systems or interfaces.

33. Given this background, a POSITA would have been familiar with at least the IEEE 802.3af industry standard on Power over Ethernet (“PoE”) and knowledgeable about the design and operation of standardized PoE systems.

34. Based on my background and qualifications, I am currently and was as of the priority date of the ’712 Patent at least a POSITA in the subject matter of the ’712 Patent. In addition, I have participated in numerous engineering projects that involved working with POSITAs in the subject matter of the ’712 patent.

VI. ’712 Patent

A. Overview

35. U.S. Patent No. 8,680,712 to Lee et al. is entitled “Power Delivery Over Digital Interaction Interface for Video and Audio (DIIVA)” and was issued on March 25, 2014.

36. The ’712 Patent is directed to “[a] system for delivering power over a network of devices connected through a serial link,” where the devices support the bi-directional transfer of “user data,” including “audio data, control data, Ethernet data, and bulk data,” and may be connected in a daisy chain via Ethernet CAT5, CAT6, or CAT7 cables. EX1001 at abstract, 1:18-25, 1:36-38, 2:54-57. Independent claims 1 and 7 are specifically directed to a power delivery circuit (a “POD circuit”) for delivering power to the plurality of devices, and a method of

delivering power to the plurality of devices connected in a daisy chain, respectively.

Id. at 7:2-4, 8:7-8.

37. As shown in Fig. 4, below, the claimed power delivery circuit 401 includes:

a voltage source 410 configured to generate a voltage (or equivalently, electric power); a power relay switch 420 configured to relay, when closed, the voltage generated by the voltage source 410 to one or more of the connected devices; a signature resistor 430 connected to the switch 420 and configured for power source detection from one or more of the connected devices; and a load detector 450 connected to the switch 420 and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current.

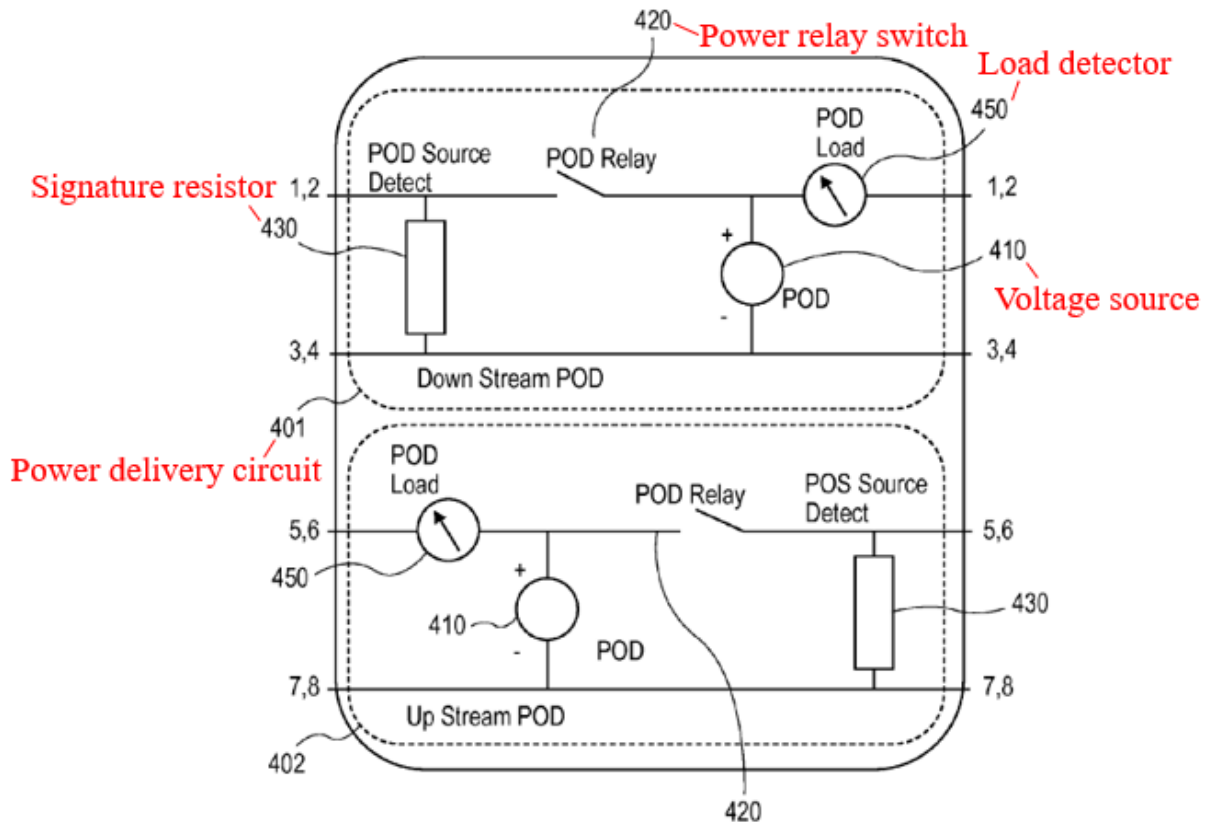


FIG. 4

Id. at 4:35-48, Fig. 4 (annotated).¹

38. The power delivery circuit also includes a controller (not shown in Fig. 4), which controls the opening and closing of the power relay switch 420. *Id.* at 4:46-48. According to the '712 Patent, the circuit illustrated in Fig. 4 can perform several functions, including: “detecting power source from a neighboring device; detecting POD load in a neighboring device; detecting removal of a device and/or connection of a new device; detecting a hot plug; detecting a POD client device; detecting

¹ All color annotations in figures have been added unless otherwise stated.

power-on or power-off state of a connected device; and relaying POD power, i.e. relaying POD current from one side to the other.” *Id.* at 5:3-10, Fig. 4.

39. The ’712 Patent further explains that the information extracted by the load detector 450 may include, without limitation, information regarding the identity of the connected device, whether the connected device is powered on or powered off, and whether the connected device needs a supply of power. *Id.* at 4:51-55. For example, the load detector may determine that “the device is self-powered, and thus does not need to be supplied with power,” or may “receive information from a connected device indicating that the device needs to be supplied with power.” *Id.* at 4:63-5:2; *see also* Fig. 7 (“All devices *that are not locally powered* receive power from TV (POD server)”) (emphasis added). The load detector may also detect removal of a device from the network and/or the connection of a new device. *Id.* at 4:55-58. More specifically, when a load (typically one or more load resistors) is connected to the circuit, the load detector 450 “detects current flow therethrough, to determine whether a device is connected, and if so, to obtain information about the connected device based on the load resistor value.” *Id.* at 4:59-63.

40. As illustrated in Fig. 6, the devices can be connected in a “daisy chain,” in which bi-directional data is transmitted from a source device S4 to a sink device (TV) through a daisy chain of POD devices S3, S2, and S1. *Id.* at 5:38-43. The ’712 Patent explains that the devices in the chain can operate in an “active mode, a POD

mode, or an off mode.” *Id.* at 5:55-56. In the active mode, the device is turned on (locally powered and fully functional) and data is processed on chip using local power. *Id.* at 56-58. In the POD mode, “the video and hybrid link data is processed and serviced by the device....[and] the transmitter is able to communicate with the receiver in entirety through the POD mode device.” *Id.* at 5:60-63. In the off mode, the circuit is off and no communication takes place. *Id.* at 5: 63-64. During operation, the sink device (TV) receives digital video data from the source device, and exchanges user data with the source device through a bi-directional hybrid link. *Id.* at 6:18-21.

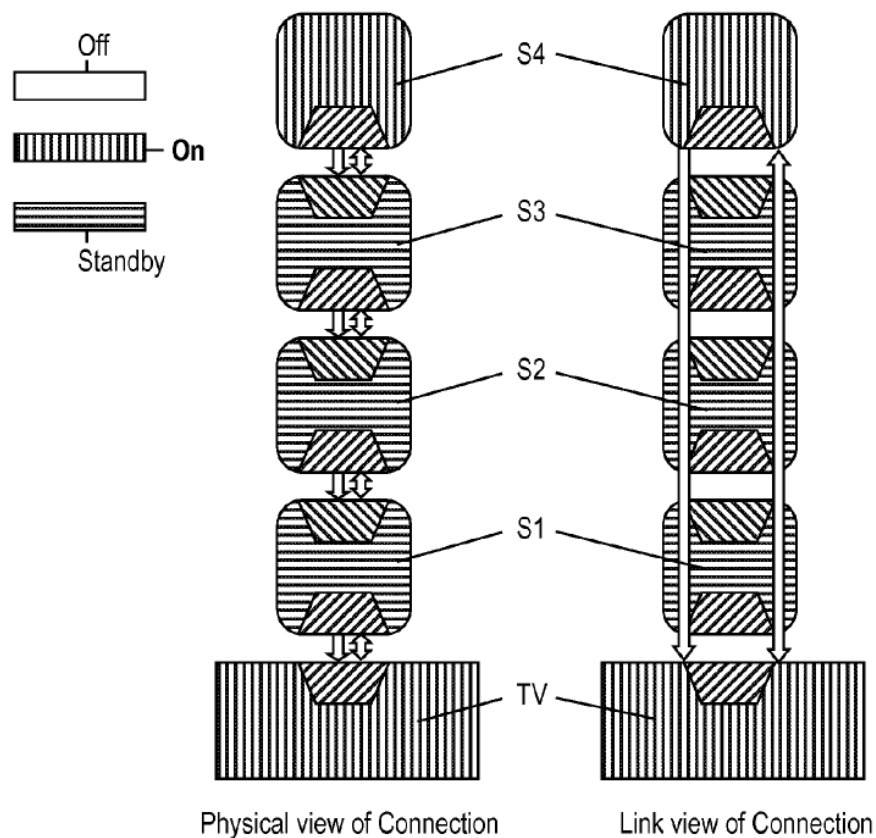


FIG. 6

Id. at Fig. 6.

41. The flowchart of Fig. 7 outlines a process for delivering power to devices in a daisy chain configuration comprising a source device (DVD player), a POD client (set-up box), and a sink device (TV). *Id.* at 6:28-33, Fig. 7. The TV sends power to the devices in the daisy chain, such that “[a]ll source devices not local powered (i.e. ‘turned on’) receive power from the TV.” *Id.* at 6:34-36. The devices discover each other, and the TV sends a command to the DVD player to turn itself

on. *Id.* at 40-41. The DVD player turns on, leaves POD client mode, and sends video signals to the TV. *Id.* at 6:40-43.

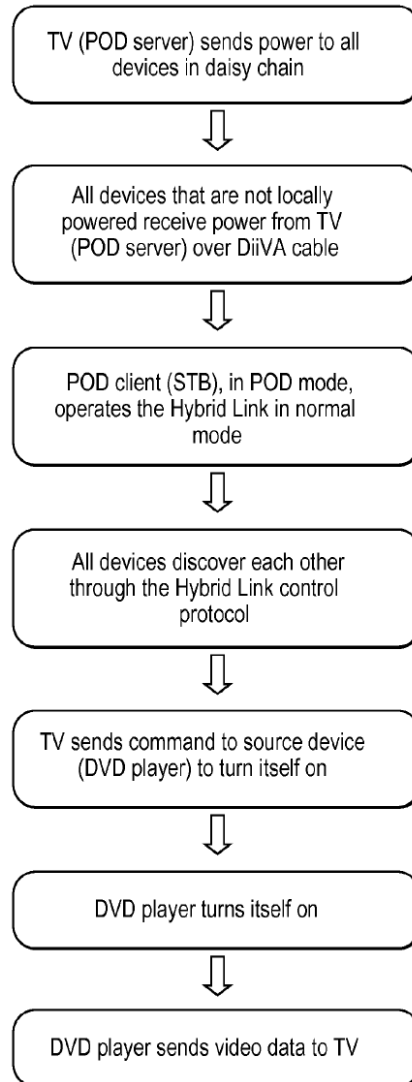


FIG. 7

Id. at Fig. 7.

B. Prosecution History

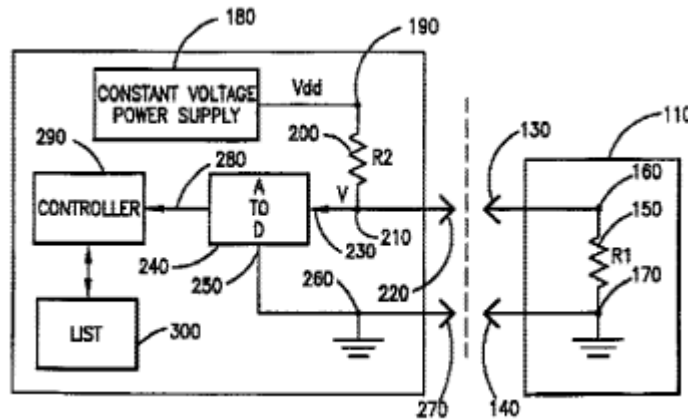
42. On December 11, 2009, the '712 Patent was filed as Application No. 12/636,063 (the "'063 Application") entitled "Power Delivery Over Digital

Interaction Interface for Video and Audio (DiiVA).” EX1002 at 545. The ’063 Application claims priority to Provisional Application No. 61/201,727, filed on December 11, 2008, and originally listed 23 claims. EX1002 at 476, 531-34.

43. The PTO issued a non-final rejection on February 1, 2013, in which the examiner rejected claims 13-16, 18-19, and 22-23 as obvious over U.S. Patent No. 5,783,926 (“Moon”) in view of U.S. Patent App. Pub. No. 2006/0100799 (“Karam”). *Id.* at 420-26. The examiner objected to claim 17 as being dependent upon a rejected base claim, but noted without explanation that it would be allowable if rewritten in independent form. *Id.* at 425. Claim 17 recited “[t]he power delivery circuit of claim 13, wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off; and whether or not the connected device needs a supply of power.” *Id.* at 441.

44. In rejecting claims 13-16, 18-19, and 22-23, the examiner explained that Moon discloses:

a power delivery circuit comprising a voltage source 180, a signature resistor R1, and a load detector to detect a load of connected device 110 and to extract information about the connected device based on the load current. The load on resistor 150 (R1) is V which is a product of a current produced by $V_{dd}/R2$ and R1.



Id. at 423.

45. The examiner further explained that Karam discloses:

a power delivery circuit and power device discovery and identification system comprising a switch for selectively connecting applying voltage across a signature resistor to identify power devices....

a controller...to control opening and closing of the power relay switch....[and]

connecting devices in daisy chain and providing power delivery circuit for each of the daisy-chained devices.

Id. at 424-25.

46. In response, the applicant did not argue that the examiner's rejection was incorrect, but instead amended independent claims 13 and 22 (corresponding to issued claims 1 and 7, respectively) to "incorporate the allowable subject matter of claim 17." *Id.* at 409, 406-08. The PTO then allowed the claims. *Id.* at 394-99.

47. While the examiner found the subject matter of original claim 17 allowable, that limitation is disclosed by Biederman, Karam, IEEE 802.3af, and Penning.

VII. Technology Background

48. The technology of the '712 Patent generally relates to the provision of power over a network of data communication devices. As of the filing date of the '712 Patent, Power Over Ethernet ("PoE") was a well-known standard for providing power to a network of ethernet devices. PoE "allows IP telephones, wireless LAN Access Points, Security network cameras and other IP-based terminals to receive power, in parallel to data, over the existing CAT-5 Ethernet infrastructure without the need to make any modifications in it." EX1014 at 5. PoE thus avoids the need for separate installation of data and power infrastructures and allows powered devices ("PDs") to be moved wherever there is an ethernet connection. *Id.* PoE is governed by the IEEE 802.3af standard. *Id.*

49. A typical PoE system consists of a power sourcing equipment ("PSE") and a powered device ("PD"). *Id.* at 10. The PSE provides power over the ethernet cable to a PD, which may be "an IP phone, a WLAN access point or any other IP device [that] requires power." *Id.* The PSE generally includes a CPU for controlling the PoE process, as well as analog components for switching, sensing, and power filtering functions. *Id.* at 11.

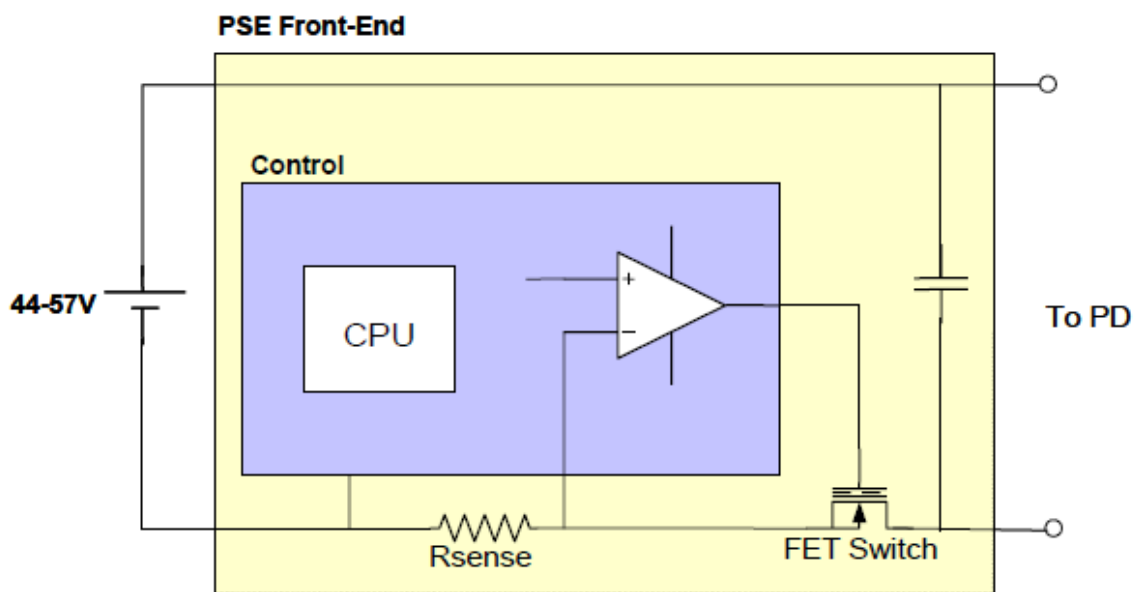


Figure 5 – Basic PSE Front-End (single port)

Id. at Fig. 5.

50. The PD is a device that is either drawing power or requesting power from a PSE. *Id.* at 12. To comply with the IEEE 802.3af standard, a resistive element (a 25 Ω resistor signature resistor) “must be positioned across the [power] supply line, as detection is performed on the same path on which power is provided.” *Id.* To detect the resistor and the PD, the PSE induces low probing voltages, which is harmless to pre-IEEE 802.3af equipment. *Id.* If the PSE does not detect a valid PD, it will not provide power over the line. *Id.*

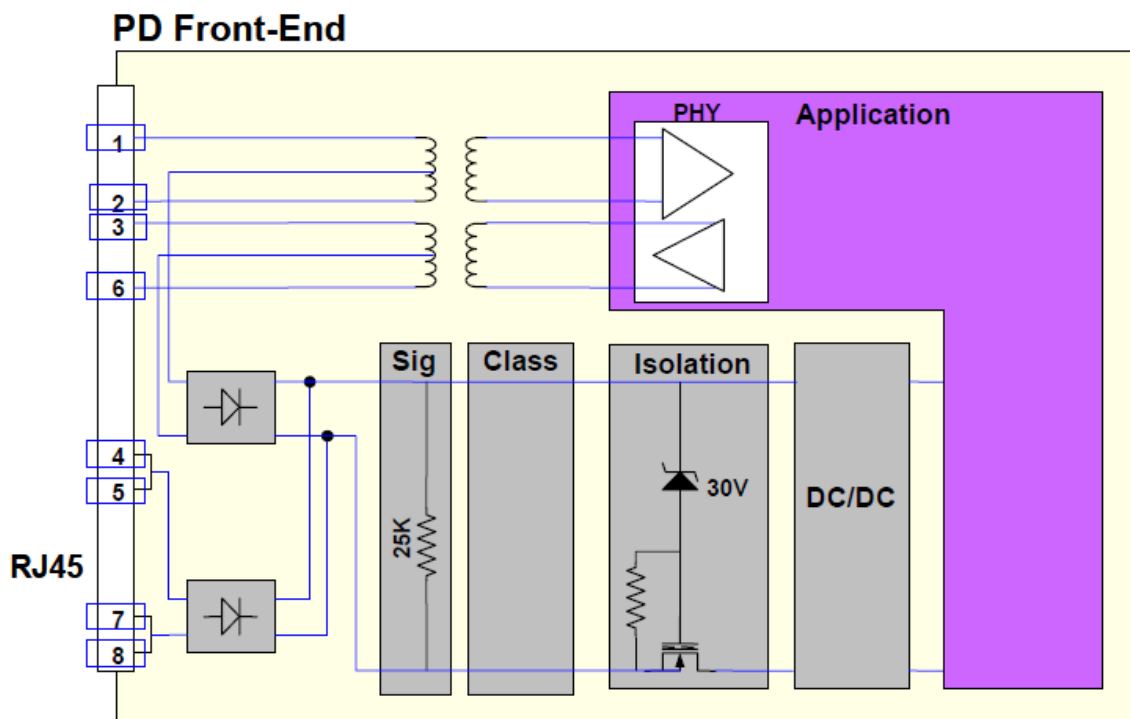


Figure 8 – Basic PD Front-End

51. In operation, the PSE probes for a valid signature resistor via voltage induction and current measurement until a valid PD is detected. *Id.* at 14. Then, the PSE may optionally perform classification to estimate the amount of power to be consumed by the PD. *Id.* The PSE then supplies power to the PD until “it is physically or electrically disconnected,” at which point voltage and power shut down. *Id.* The cycle is then restarted. *Id.*

52. The IEEE 802.3af standard requires that PDs be disconnected safely— i.e., that power is shut down shortly after a PD is disconnected. *Id.* at 18. This prevents the PD from being replaced with a non-PoE device while power is still on, which may damage the connected hardware. *Id.* The PSE may cut off power after it

senses that the current flow has stopped, or when the AC impedance at the port terminals reaches a certain threshold. *Id.* at 18 -19.

53. The PoE standardization process was largely driven by 3Com, Intel, Nortel, Cisco, and PoweDSine. *Id.* at 8. These companies were and are major innovators in the PoE space. Thus, a POSITA looking for information concerning PoE technology would have paid particular attention to products, publications, and patents produced by these companies, such as Biederman and Karam (assigned to Cisco).

54. PoE networks and devices implementing the IEEE 802.3af standard were ubiquitous well before December 11, 2008 (the Priority Date of the '712 Patent). Follow-on innovations to standard PoE networks—like those disclosed in Biederman, Karam, and Penning—include systems for connecting multiple PoE devices in a series, assessing the devices' power requirements, and providing power accordingly. These daisy-chained systems generally utilize hybrid PoE devices with PD *and* PSE functionality.

VIII. Claim Construction

55. I have interpreted the terms of the '712 Patent according to their plain meaning. In interpreting the terms, I have carefully considered and applied the claim construction standards referred to in Section IV above.

IX. Summary of Opinions

56. In my opinion, U.S. Pat. App. Pub. No. 2006/0089230 A1 to Biederman et al. (“Biederman”), entitled “Bidirectional Inline Power Port,” in various combinations with IEEE Standard for Information Technology, Part 3, Amendment: Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) (“IEEE 802.3af”), U.S. Pat. App. Pub. No. 2006/0100799 A1 to Karam (“Karam”), and U.S. Pat. App. Pub. No. 2008/0168283 A1 to Penning (“Penning”), renders obvious claims 1, 2, 3, 5, 7, and 9 of the ’712 Patent.

57. A table of the grounds is provided below for ease of reference:

Grounds		Claims
1	35 U.S.C. §103 over Biederman in view of IEEE 802.3af	1, 2, 3, and 5
2	35 U.S.C. §103 over Biederman in view of Karam	1, 2, 3, and 5
3	35 U.S.C. §103 over Biederman in view of IEEE 802.3af and Penning	1, 2, 3, and 5
4	35 U.S.C. §103 over Biederman in view of Karam and Penning	1, 2, 3, and 5
5	35 U.S.C. §103 over Biederman in view of IEEE 802.3af, Karam, and Penning	1, 2, 3, and 5
6	35 U.S.C. §102 over Karam	7 and 9

A. Overview of IEEE 802.3af (EX1006)

58. The IEEE Standard for Information Technology, Part 3, Amendment on Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) (“IEEE 802.3af”) is a well-known specification authored by the Institute of Electrical and Electronics Engineers (“IEEE”) Computer Society for providing

power to devices connected in an Ethernet network—otherwise known as Power over Ethernet (“PoE”). EX1006 at 1.

59. PoE is governed by the IEEE 802.3af standard, which “defines the functional and electrical characteristics of...a Powered Device (PD) and Power Sourcing Equipment (PSE),” which “allow devices to supply/draw power using the same generic cabling as is used for data transmission.” IEEE 802.3af at 27. The standard provides “[a] protocol allowing the detection of a device that requires power,” “a method to classify devices based on their power needs,” and “[a] method for scaling supplied power back to the detect level when power is no longer requested or required.” *Id.* The PSE’s “main functions are to search the link section for a PD, optionally classify the PD, supply power to the link section (only if a PD is detected), monitor the power on the link section, and scale power back to the detect level when power is no longer requested or required.” *Id.* at 29. One example of when power is no longer required is “[a]n unplugged link section.” *Id.* A PSE may also detect a PD but opt not to power it. *Id.* at 37. A PD “is a device that is either drawing power or requesting power by participating in the PD detection algorithm.” *Id.* at 49. A PD may be able to draw power from an alternate source, in which case the PD may not require power from the PSE. *Id.*

60. During the detection process, the PSE checks for a valid signature resistance in the PD. *Id.* at 38-39. The PD “shall present a valid detection

signature...while it is in a state where it will accept power” from the PSE. *Id.* at 51. The PD will present a non-valid signature “while it is in a state where it will not accept power” from the PSE. *Id.* A valid PD detection signature is between 23.75K Ω and 26.25 K Ω . *Id.* at 52, Table 33-8. The PSE may detect the signature via “voltage or current measurement.” *See id.* at 39. The IEEE 802.3af standard explains that this detection process is vital and “should not be overlooked” because, [g]iven the large number of legacy devices (both IEEE 802.3 and other types of devices) that could be connected...and the possible consequences of powering such devices, the protocol to distinguish compatible devices and noncompatible devices is important to prevent damage to non-compatible devices.” *Id.* at 27.

61. After detection, the PSE may classify the maximum power required by the PD during operation. *Id.* at 53. The PSE performs classification of a PD by “applying voltage and measuring current.” *Id.* at 40. “The PSE shall measure IClass and classify the PD based on the observed current according to Table 33–4,” which defines classes 0 through 4 based on current ranges. *Id.* at 40, 53. IEEE 802.3af further defines the power requirements for each class in Table 33-10; as one example, default class O requires 0.44 to 12.95 Watts. *Id.* at 53, Table 33-10.

B. Overview of Biederman (EX1005)

62. U.S. Pat. App. Pub. No. 2006/0089230 A1 to Biederman et al. (“Biederman”) was filed as Application No. 10/961,864 on October 7, 2004, and published on April 27, 2006. EX1005 at 1.

63. Biederman is generally directed to “[a] method and apparatus for bidirectional provision of inline power,” “also known as Power over Ethernet and PoE.” EX1005 at [0013]-[0014], [0018]. Specifically, Biederman teaches a networked device that “may operate as a powered device (PD) under certain circumstances, may be off for power purposes under other circumstances and may operate as a power Sourcing equipment (PSE) under yet other circumstances.” EX1005 at [0032]. In Fig. 2, Biederman illustrates media dependent interfaces (“MDI”) 14a and 14b, each with a PD functional block and a PSE functional block. *Id.* at [0034]. The MDI connected to the PSE has the PD block activated, while the MDI connected to the PD has the PSE block activated. *Id.* Biederman teaches that the PSE portion of the device includes a 48-volt power supply 70 to power a connected PD, and that the device includes a controller for selectively activating the PD block, the PSE block, neither, or both via switching circuitry which may include “diodes, transistors, relays, and the like.” *Id.* at fig. 5, [0038].

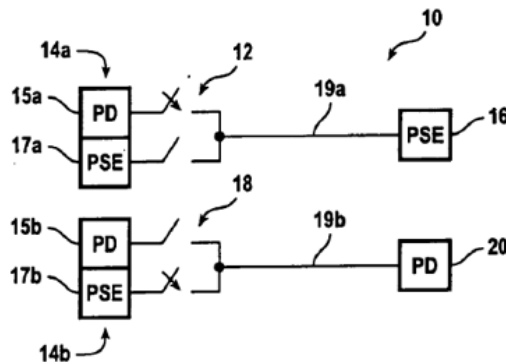


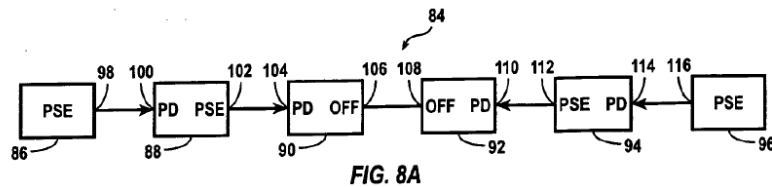
FIG. 2

EX1005 at Fig. 2.

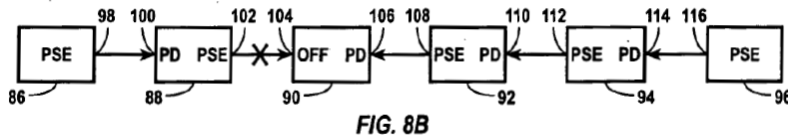
64. Biederman also teaches that “the power requirements of a PD may change from time to time depending upon how it is used,” so “it would be desirable to adjust the power delivered to the PD from time to time to meet these new requirements, either by increasing the power delivered or decreasing it, as appropriate.” *Id.* at [0042]. Biederman explains that “[a] number of mechanisms are provided by the present invention to accomplish this,” and that “[t]hose of ordinary skill in the art will [] realize that other equivalent mechanisms are available to periodically revise the amount of power made available by the PSE to the PD.” *Id.* at [0042]. As one example, Biederman notes that “[t]here are mechanisms within the IEEE 802.3af standard to allocate a requested amount of power.” *Id.* at [0014].

65. Finally, Biederman teaches that the networked devices may be arranged in a daisy chain configuration to provide redundant data and inline power so that data or power interruption does not occur if the cabling is cut. *Id.* at [0043]-[0045]. In the below example, port 100 of device 88 is configured as a PD to receive power

from PSE 826, and port 102 of device 88 is configured as a PSE to send power to device 90. *Id.* at [0044]. When a cable in the chain is cut, the adjacent devices reconfigure themselves—as illustrated below in Fig. 8B, when devices 88 and 90 are disconnected, port 104 of device 90 is turned off and port 108 of device 92 is turned on and configured to operate as a PSE. *Id.* at [0045].



EX1005 at Fig. 8A.



EX1005 at Fig. 8B.

C. Overview of Karam (EX1007)

66. U.S. Pat. App. Pub. No. 2006/0100799 A1 to Karam was filed as U.S. Application No. 10/982,383 on November 5, 2004, and published on May 11, 2006. EX1007 at 1.

67. Karam also relates to PoE and teaches “a method and apparatus for managing an Inline Power relationship between a network device and a Powered

Device (PD) where the network device is acting as power sourcing equipment (PSE) to provide Inline Power to a first PD (PD1) which is, in turn, powering another PD (PD2).” EX1007 at [0039], Fig. 2A.

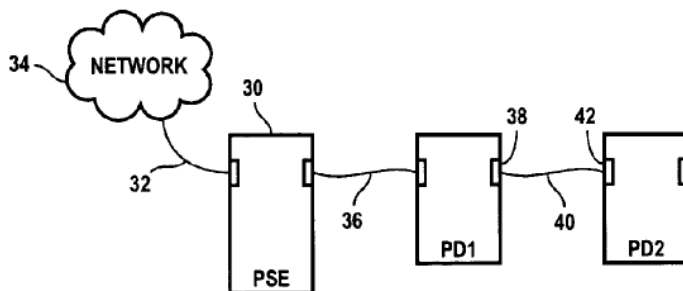


FIG. 2A

EX1007 at Fig. 2A.

68. The PSE may also provide power to a longer daisy chain of PD devices. *Id.* at [0046] and Fig. 2D (“In FIG. 2D an arrangement is shown where a PSE provides power and data to three PDs: PD1, PD2 and PD3. This is again accomplished over a series of single 8 conductor (4 pair) cables daisy-chained between the various devices.”). The first PD, PD1, receives power from a voltage source in the PSE. *Id.* at [0044].

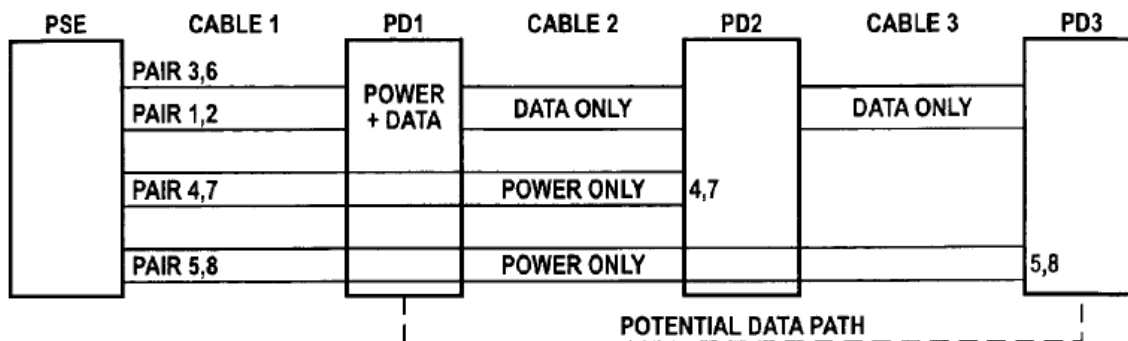


FIG. 2D

EX1007 at Fig. 2D.

69. Karam explains:

In order to provide regular Inline Power to a PD from a PSE it is a general requirement that two processes first be accomplished. First, a “discovery” process must be accomplished to verify that the candidate PD is, in fact, adapted to receive Inline Power. Second, a “classification” process must be accomplished to determine an amount of Inline Power to allocate to the PD, the PSE having a finite amount of Inline Power resources available for allocation to coupled PDs.

Id. at [0018].

70. Referencing the IEEE 802.3af standard, Karam explains that the discovery process looks for an “identity network” in the PD, which is a 25,000Ω resistor. *Id.* at [0019]. To detect the identity network, the PSE applies voltage discovery signals, measures the “return currents responsive to application of the discovery signals,” and calculates the resistance. *Id.* at [0020]. If the resistance is the proper value, an optional classification process may begin to determine whether the maximum inline power level should be 15.4 Watts, 7.0 Watts, or 4.0 Watts. *Id.* at [0020], [0065]. Again referencing the IEEE 802.3af standard, Karam explains that the classification process involves applying a voltage to the PD, which responds by sending a classification current back to the PSE. *Id.* at [0021]. This current corresponds to a “class,” which represents a device’s specific power requirements. *Id.* at [0021], Table I.

71. Karam teaches that the first PD 50 in the chain includes a connector 52 to connect to the PSE, a second connector 54 which may be coupled to another

cell phone. *Id.* at [0051], Fig. 4A.



EX1007 at Fig. 4A.

72. Karam explains that, in order to supply power to device 50, “the PSE port must see the proper identity network characteristics,” which, “in accordance with the IEEE 802.3af standard,” is a 25,000Ω resistance in response to “certain discovery voltage signals.” *Id.* Accordingly, the controller 58 of the device 50 provides the identity network signal back to the PSE so that inline power may be provided. *Id.* at [0052].

73. The device 50 is also adapted to “act as a PSE device to determine if an attached device at a second connector 54 has an appropriate identity network so that inline power may be provided to it.” *Id.* The device 50 senses the identity network via current sensor R2SENSE. *Id.* at Fig. 4A, [0058] (explaining that a similar current sense resistor 81 coupled to the control circuitry 78 and a port 76 measures the

current at the port). If the device 50 does not verify that the attached device can receive power, it may leave switches S1-S4 open, cutting off data and power to second connector 54. *Id.* Karam further explains that the controller 58 may keep switch S5 to third connector 56 closed “only when current [is] being drawn from third connector 56 so that if the device were unplugged from third connector 56 the power would turn off.” *Id.* at [0051].

D. Overview of Penning (EX1008)

74. U.S. Pat. App. Pub. No. 2008/0168283 A1 to Penning was filed as U.S. Application No. 11/649,913 on January 5, 2007, and published on July 10, 2008. EX1008 at 1.

75. Penning teaches a system for powering multiple devices connected over a network that may employ PoE network connections. EX1008 at [0028]-[0030]. The system includes a data distribution device 105, an independent power supply 115, a remote data distribution device 110, network devices 125-1 to 125-N, and externally powered network devices 120-1 to 120-N. *Id.* at [0029], Fig. 1. Remote data distribution device 110 acts as a PSE providing data and power to data distribution device 105, which can then provide data and power to network devices 125-1 through 125-N. *Id.* “Data distribution device 105 may sense the amount of power required by one or more network devices 125-1-125-N, and provide power accordingly.” *Id.* Network devices 125-1 through 125-N may also be powered by a

local AC/DC wall adapter, instead of data distribution device 105. *Id.* at [0039]-[0040].

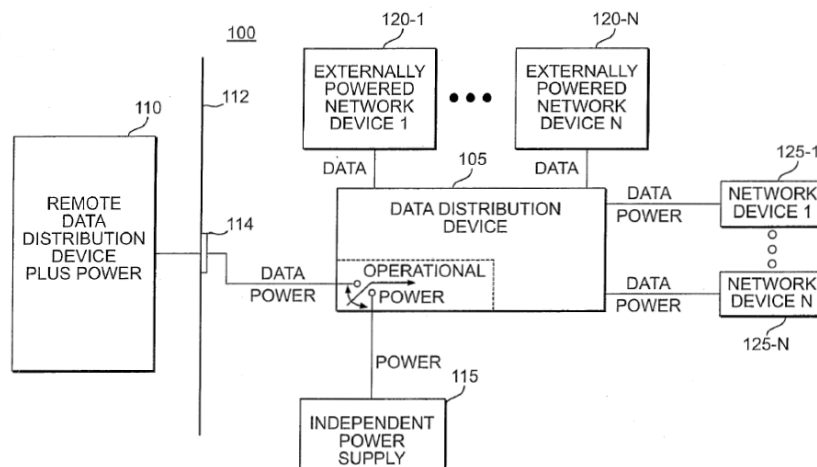
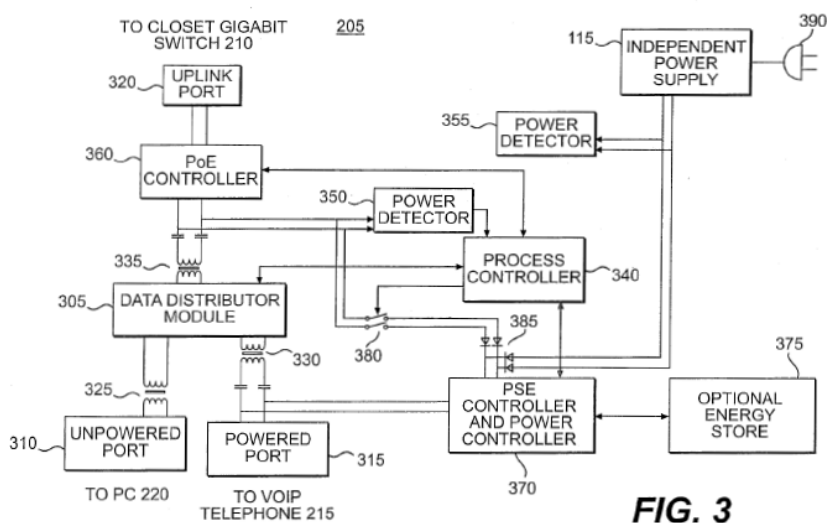


FIG. 1

EX1008 at Fig. 1.

76. Data distribution device 105 may power itself and network devices 125-1 through 125-N from one of several power sources, including remote data distribution device 110 and independent power supply 115. *Id.* at [0032]. The device 105 switches between power supplies using “relays, transistors, or any other known switching device.” *Id.* More specifically, as illustrated in Fig. 3, power detectors 350 and 355 of the data distribution device 205, which may be “voltage or current detectors...of any appropriate type known to one of ordinary skill in the art,” indicate whether power is available from independent power supply 115 or uplink port 350, respectively, by sending a signal to process controller 340. *Id.* at [0049], [0056], Fig. 3. After process controller 340 determines which power supply to use, it sends a

command signal to switch 380, “which may be a relay, one or more transistors, or any other type of switch which may be controlled by an electronic signal.” *Id.* at [0051], [0047]. If the data distribution device is powered locally by the independent power supply, process controller 340 signals PoE controller 360 to set a signature resistance on uplink port 320 in accordance with IEEE 802.3af to inform closet gigabit switch 210 that device 205 does not require power. *Id.* at [0056].



EX1008 at Fig. 3.

77. Penning further teaches that the “[p]rocess controller 340 may provide a signal to PoE controller 360 in order to provide feedback to closet gigabit switch 210 regarding how much power to allocate and supply” to data distribution device 205. *Id.* at [0052]. PoE controller 360 may in turn “set up a signature resistance in accordance with IEEE 802.3af, to signal a class 0, 1, 2, and/or 3 power signatures.” *Id.* The closet gigabit switch 210 senses the resistance during initialization to provide

the appropriate amount of power. *Id.* Process controller 340 may also “provide control signals to [PSE controller and power controller] PCPC 370 which may include instructions for providing the appropriate amount of power to VOIP telephone 215” according to the 802.3af standard. *Id.* at [0053], Fig. 3; *see also* [0063] (“the VOIP phone may include...a power controller 43 for...designating a power signature for the VOIP phone”); [0068] (“The network device may be provided with hardware circuitry, such as the power controller 435, which designates the power signature of the VoIP phone 400 and all of the associated auxiliary devices” connected to VOIP phone 400.”). After requesting the power signature from VOIP phone 215, which may be class 0, 1, 2, or 3, the process controller may instruct the power controller in PCPC 370 to provide port 315 with the appropriate amount of power for use by VOIP telephone 215.” *Id.* The PSE controller 370 may also collect the classification information from the VOIP telephone to send to process controller 340 to report back to the closet switch 210 for powering data distribution device 205. *Id.*

78. VOIP telephone may also include a USB port for connecting peripheral devices, as shown in Fig. 4. *Id.* at [0065]. The VOIP phone may include a current sensor to detect the power draw at USB port 415, which is used by process controller 435 to determine the total power consumption for the VOIP phone and any connected peripheral devices. *Id.* at [0065]-[0066]. Each time a peripheral device is

connected to or disconnected from VOIP phone 400 and each time the VOIP phone is reset, the controller recalculates the total power available to the VOIP phone and the total power consumption of the VOIP phone and any peripheral devices. *Id.* at [0066], [0067], Fig. 5; *see also* [0085] (“[T]he power controller 435 may be configured to scan the auxiliary devices periodically, e.g., every 3 seconds, to recognize each time an auxiliary device has been disconnected from the phone.”). If the total required power is more than the total available power, the user may be prompted to remove the peripheral device. *Id.* The power management process terminates when the power consumption is adequately lowered—i.e., when the user removes the peripheral device. *Id.*

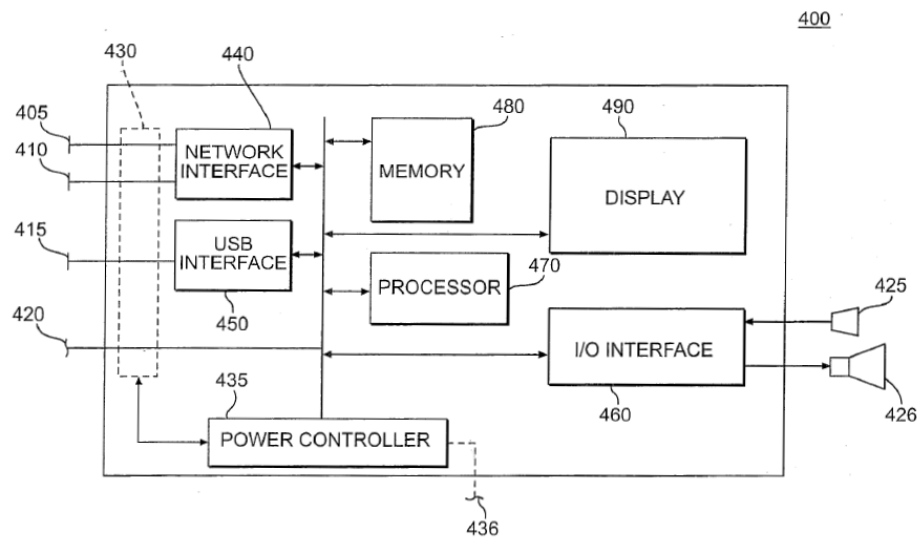


FIG. 4

Id. at Fig. 4.

X. Claims 1, 2, 3, 5, 7, and 9 are Invalid

A. Ground 1: Claims 1, 2, 3, and 5 are obvious over Biederman in view of IEEE 802.3af

79. In my opinion, Biederman in combination with IEEE 802.3af renders obvious claims 1, 2, 3, and 5 of the '712 Patent.

1. Motivation to Combine Biederman with IEEE 802.3af

80. As explained above in Section IX.B, Biederman is generally directed to “[a] method and apparatus for bidirectional provision of inline power,” “also known as Power over Ethernet and PoE,” which is defined in the IEEE 802.3af standard. EX1005 at [0013]-[0014], [0018]. In its background section, Biederman explains:

PoE is defined in the IEEE (The Institute of Electrical and Electronics Engineers, Inc.) Standard Std 802.3af-2003 published 18 Jun. 2003.... The IEEE 802.3af standard is a globally applicable standard for combining the transmission and reception (collectively: “transceiving”) of Ethernet packets with the transmission and reception of DC-based power over the same set of wires in a single Ethernet cable.... There are mechanisms within the IEEE 802.3af standard to allocate a requested amount of power. Other proprietary schemes also exist to provide a finer and more sophisticated allocation of power than that provided by the IEEE 802.3af standard while still providing basic compliance with the standard.

EX1005 at [0014].

81. Biederman’s background section further explains that PoE “is a technology for providing electrical power over a wired data telecommunications network (such as, for example, the well-known Ethernet) from power source

equipment (PSE) to a powered device (PD) over a link section.” *Id.* at [0013]. Biederman provides electrical schematic diagrams of three different configurations of PoE as contemplated by the IEEE 802.3af standard, each illustrating a PSE connected with a PD.

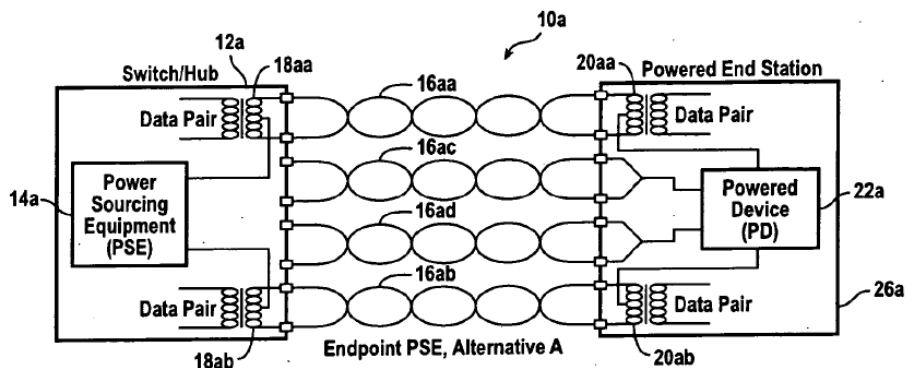


FIG. 1A

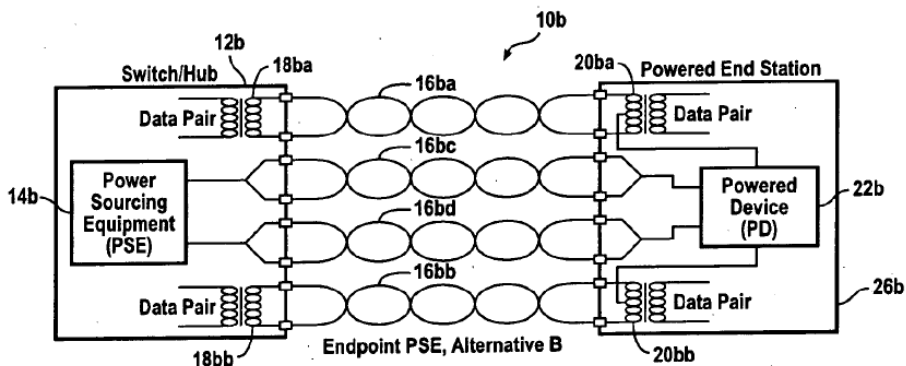


FIG. 1B

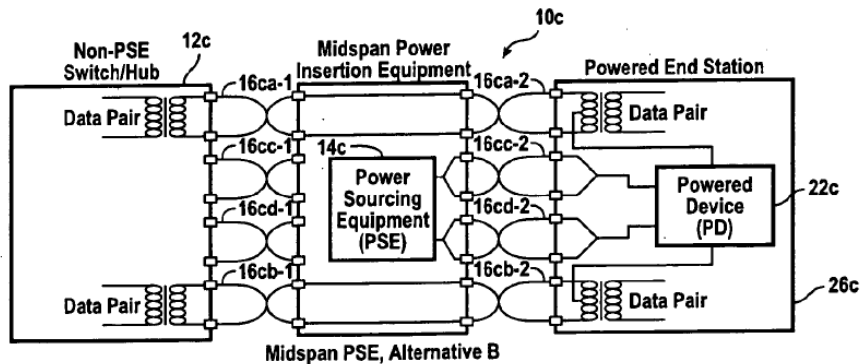


FIG. 1C

Id. at Figs. 1A-1C.

82. Biederman notes that, “[i]n the interest of clarity, not all of the routine features of the implementations described herein are shown and described. It will, of course, be appreciated that in the development of any such actual implementation, numerous implementation-specific decisions must be made in order to achieve the developer’s specific goals, such as compliance with application- and business-related constraints.” *Id.* at [0031]. Biederman explains that such development “would...be a routine undertaking of engineering for those of ordinary skill in the art having the benefit of this disclosure.” *Id.*

83. In view of the above, Biederman’s disclosure omits certain routine details of PoE devices that are governed by the IEEE 802.3af standard. In Fig. 2, Biederman illustrates media dependent interfaces (“MDI”) 14a and 14b, each with a PD functional block and a PSE functional block. *Id.* at [0034]. Biederman teaches that the device includes a controller for selectively activating the PD block, the PSE block, neither, or both via switching circuitry which may include “diodes, transistors, relays, and the like.” *Id.* at Fig. 5, [0038].

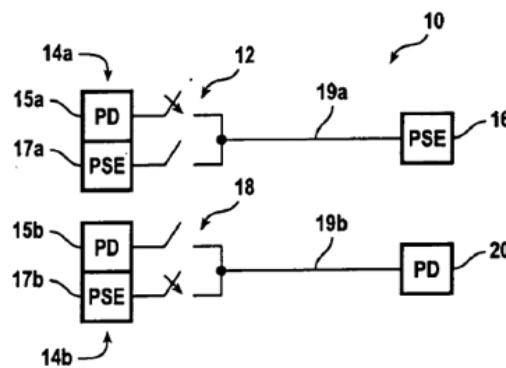


FIG. 2

EX1005 at Fig. 2.

84. Biederman also teaches that “the power requirements of a PD may change from time to time depending upon how it is used,” so “it would be desirable to adjust the power delivered to the PD from time to time to meet these new requirements, either by increasing the power delivered or decreasing it, as appropriate.” *Id.* at [0042]. Biederman explains that “[a] number of mechanisms are provided by the present invention to accomplish this,” and that “[t]hose of ordinary skill in the art will [] realize that other equivalent mechanisms are available to periodically revise the amount of power made available by the PSE to the PD.” *Id.* at [0042]. As one example, Biederman notes that “[t]here are mechanisms within the IEEE 802.3af standard to allocate a requested amount of power.” *Id.* at [0014].

85. As described above in Section IX.A, the IEEE 802.3af standard describes “[a] protocol allowing the detection of a [PD] device that requires power,” “a method to classify [PD] devices based on their power needs,” and “[a] method for scaling supplied power back to the detect level when power is no longer requested or required.” EX1006 at 27. During the detection process, the PSE checks for a valid signature resistance in the PD. *Id.* at 38-39. The PD “shall present a valid detection signature...while it is in a state where it will accept power” from the PSE. *Id.* at 51. The PD will present a non-valid signature “while it is in a state where it will not accept power” from the PSE. *Id.* A valid PD detection signature is between 23.75K Ω

and 26.25 K Ω . *Id.* at 52, Table 33-8. The PSE may detect the signature via “voltage or current measurement.” *Id.* at 39. The IEEE 802.3af standard explains that this detection process is vital and “should not be overlooked” because, [g]iven the large number of legacy devices (both IEEE 802.3 and other types of devices) that could be connected...and the possible consequences of powering such devices, the protocol to distinguish compatible devices and noncompatible devices is important to prevent damage to non-compatible devices.” *Id.* at 27.

86. A PD presenting a valid detection signature has a default power class of 0 and requires 0.44 to 12.95 Watts. *Id.* at 53, Table 33-10. The PSE may also optionally classify the PD in one of the power classes 0-3 after the detection process. *Id.* at 53 (while Table 33-10 also includes class 4, this is reserved for future use). The PSE performs classification of a PD by “applying voltage and measuring current.” *Id.* at 40. “The PSE shall measure IClass and classify the PD based on the observed current according to Table 33-4,” which defines classes 0 through 4 based on current ranges. *Id.* at 40, 53. IEEE 802.3af further defines the power requirements for each class in Table 33-10. *Id.* at 53, Table 33-10.

87. It would have been obvious to a POSITA to implement the standardized detection and classification features of IEEE 802.3af—including the signature resistor, load detector, and classification current elements—in the PoE system of Biederman, such that the PD portion of each device includes a signature resistor, and

the PSE portion of each device includes a load detector for detecting a PD signature resistor and a PD classification current. A POSITA would have been motivated by Biederman's own disclosure to make this combination, because Biederman explains that (a) PoE is governed by IEEE 802.3af; (b) "[t]hose of ordinary skill in the art will [] realize that other equivalent mechanisms are available to periodically revise the amount of power made available by the PSE to the PD;" and (c) "[t]here are mechanisms within the IEEE 802.3af standard to allocate a requested amount of power." *Id.* at [0014], [0042]. A POSITA also would have been motivated by the disclosure of IEEE 802.3af to make this combination, because IEEE 802.3af emphasizes the importance of its detection process to prevent damage to non-compatible devices. EX1006 at 27.

88. Indeed, a POSITA would have understood that inadvertently providing PoE power to a non-PoE device would not be "a pretty picture." EX1014 at 18. Specifically, providing power to a non-PoE device which is not designed to receive power via network lines may burn out the terminal of the non-PoE device. Accordingly, a POSITA would have understood that it would be vital for Biederman's PSE to be able to determine whether a connected device can receive power over the ethernet cable. A POSITA also would have understood that compliance with the IEEE 802.3af standard would be important for Biederman's

device to be interoperable with other IEEE 802.3af compliant PoE devices in the network.

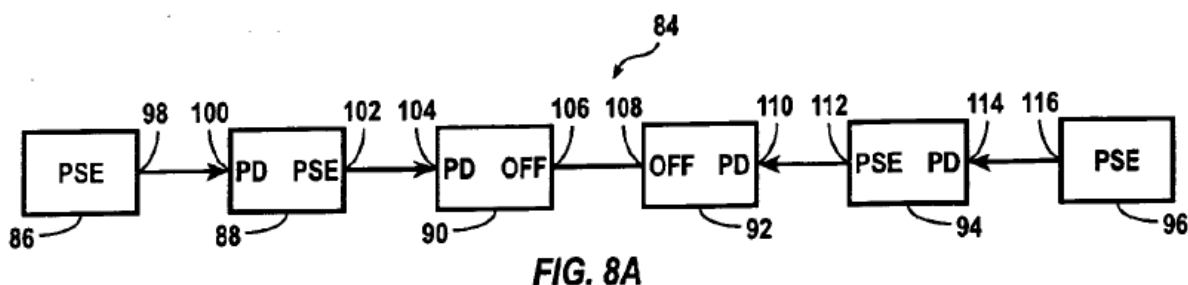
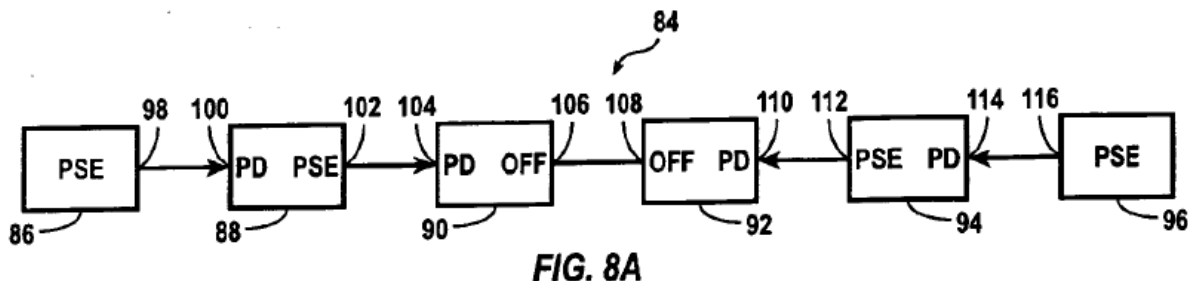
89. Such an improvement is no more than the predictable use of prior art IEEE 802.3af detection and classification elements according to their established functions, or the combination of familiar IEEE 802.3af detection and classification elements according to known methods disclosed by IEEE 802.3af to yield predictable results. Furthermore, a POSITA would have had a reasonable expectation of success in making this combination because, as Biederman explains, the elements added from IEEE 802.3af are merely “routine features,” the implementation of which would be a “routine undertaking of engineering for those of ordinary skill in the art.” EX1005 at [0031]. A primary goal of the IEEE 802.3af standard is to define the functions, behaviors, and components of PoE PDs and PSEs. Thus, these features are fundamental to the IEEE 802.3af standard and would routinely be implemented in PoE devices.

2. Claim 1

a. “A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising:” 1[P]

90. To the extent the preamble is limiting, Biederman teaches this limitation. Biederman explains that a plurality of PoE network devices 86, 88, 90, 92, and 94 can be connected in a daisy chain network. EX1005 at Figs. 8A-8B,

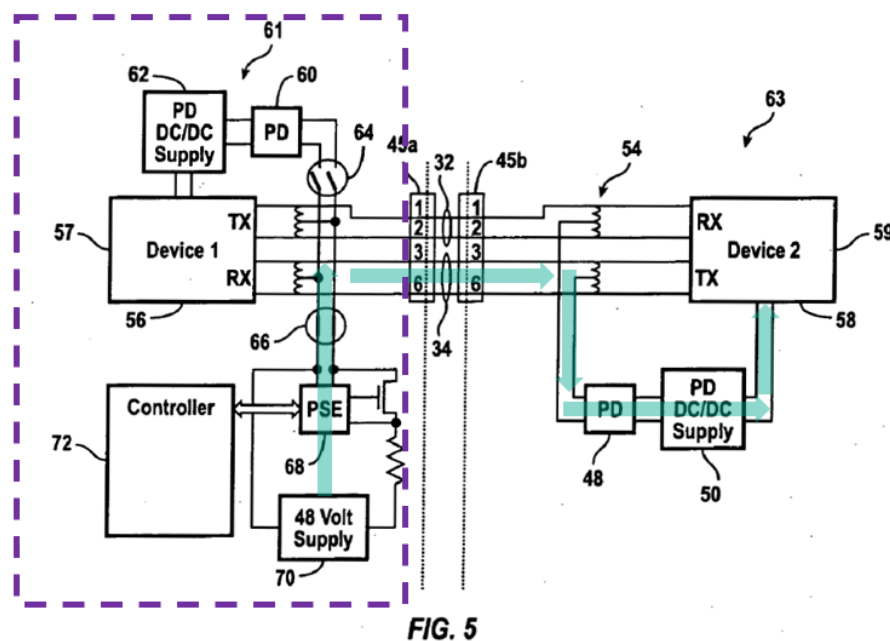
[0043]-[0044]. Each device has at least one port for carrying out data telecommunications and inline power transmission. *Id.* at [0043]. For example, a network device 88 in the chain has two ports 100 and 102 for connecting to devices 86 and 90, where each port can be configured as a PD, a PSE, off, or both PSE *and* PD. *Id.* at [0043]-[0045], [0041], [0039].



Id. at Fig. 8A.

91. An embodiment of a port of a network device is shown in greater detail in Fig. 5. While Biederman does not explicitly teach that the port depicted in Fig. 5 is the same as the ports of the network devices in Fig. 8A, it would have at least been

obvious to a POSITA to combine embodiments and use the port circuitry depicted in Fig. 5 to implement the ports of the network devices in Fig. 8A. In fact, Biederman explains that “not all of the routine features of the implementations...are shown and described” for the sake of clarity, but notes that implementing the invention “would...be a routine undertaking of engineering for those of ordinary skill in the art having the benefit of this disclosure.” EX1005 at [0031]. Thus, a POSITA would have been motivated to refer to other figures and/or more detailed embodiments in Biederman for guidance concerning routine implementation features of other, less detailed embodiments.



Id. at Fig. 5.

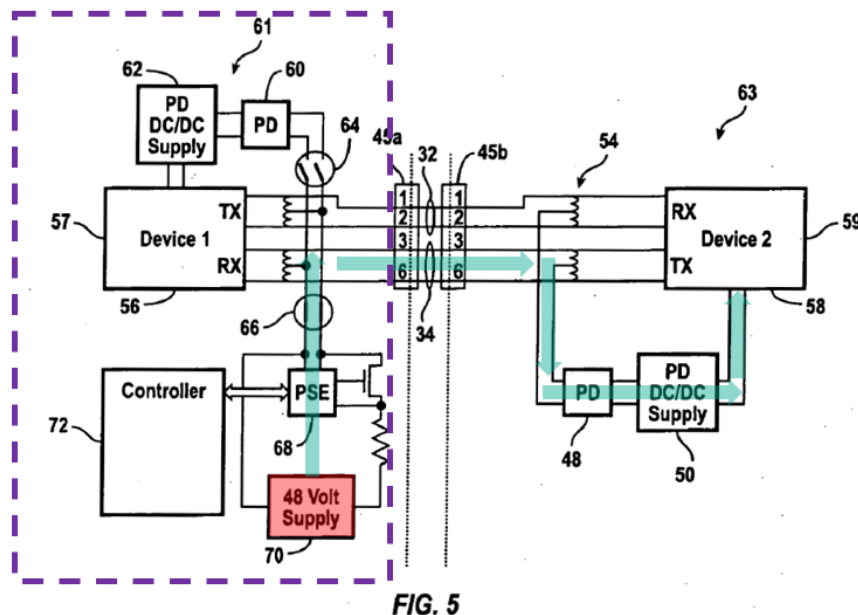
92. Fig. 5 illustrates a first networked device 57 with a port 61 (the claimed “power delivery circuit,” annotated above in purple) coupled to a port 63 of a second

network device 59 via two pairs of wires 32 and 34. *Id.* at Fig. 5, [0038] (“[A] first functional block 56 representing the data portion of a port 61 of a first network device 57 is coupled to first MDI 45a, and from first MDI 45a...to a second MDI 45b, and from there to a second functional block 58 representing the data portion of a port 63 of a second network device 59.”). The port 61 includes a PSE functional block 68 and a 48 Volt power supply 70. *Id.* In operation, controller 72 may cause switching circuitry 66 to selectively couple PSE block 68 and power supply block 70 to MDI 45a. *Id.* When the power supply 70 is connected to MDI 45a, it can supply power to second networked device 59 via wire pair 34. *Id.* at [0038], [0037] (explaining that in a conventional inline PoE system, the PD DC/DC power supply of the second networked device receives power from the first networked device’s PSE power supply and transmits that power to a power input of the second networked device). The provision of power from PSE to PD through wire pair 34 is annotated in green, above. *Id.* at Fig. 5.

**b. “a voltage source configured to generate a voltage;”
1[a]**

93. Biederman teaches this limitation. As explained above, the power delivery circuit includes a PSE functional block 68 and a power supply block 70 (highlighted below in red), which may be a conventional grid-powered or battery-powered power supply. *Id.* at Fig. 5, [0038]-[0039]. In operation, the power supply can generate a voltage to power a second networked device 59. *Id.* at [0038], [0037]

(explaining that in a conventional inline PoE system, the PD DC/DC power supply of the second networked device receives power from the first networked device's PSE power supply and transmits that power to a power input of the second networked device). The provision of power from PSE to PD through wire pairs 32 and 34 is illustrated in green, below.

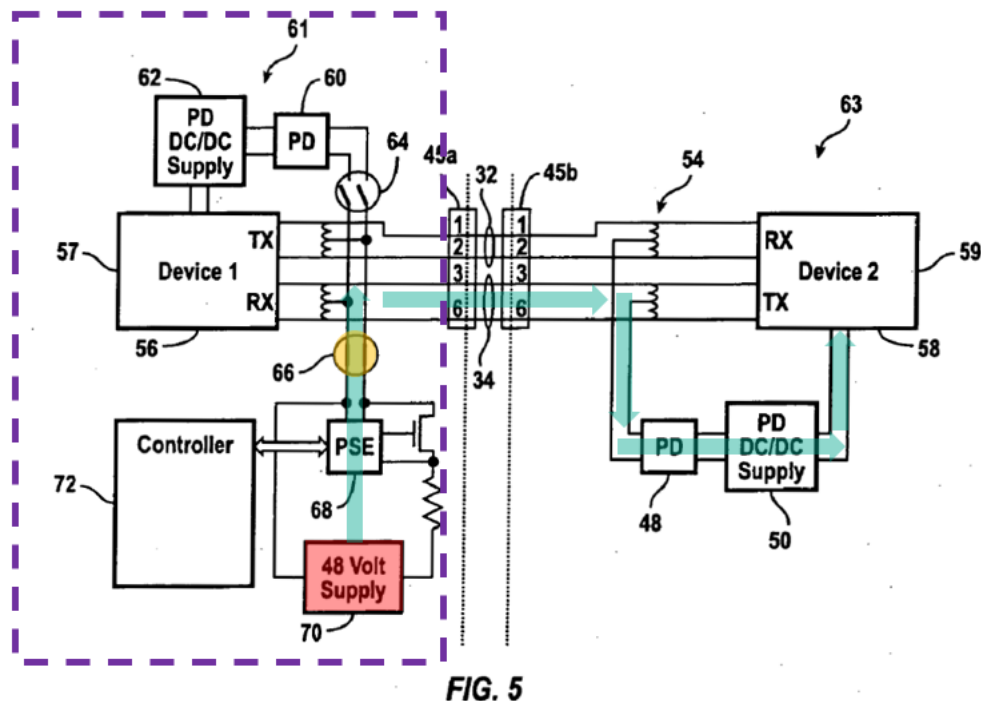


Id. at Fig. 5.

c. “a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices;” 1[b]

94. Biederman also discloses this limitation. Specifically, Biederman teaches that the power delivery circuit (port 61) includes a power relay switch 66 (annotated below in orange). *Id.* at Fig. 5, [0038]. In operation, the controller 72 causes switch 66 to selectively couple PSE block 68 and power supply block 70 to first MDI 45a in order to power the second connected device 59. *Id.* at [0037]-[0038],

Fig. 5. Biederman explains that the switching mechanisms 66 and 64 for enabling either the PD or PSE modes may be “switches...or other equivalent switching equipment such as diodes, transistors, **relays** and the like as will now be apparent to those of ordinary skill in the art.” *Id.* at [0038] (emphasis added).

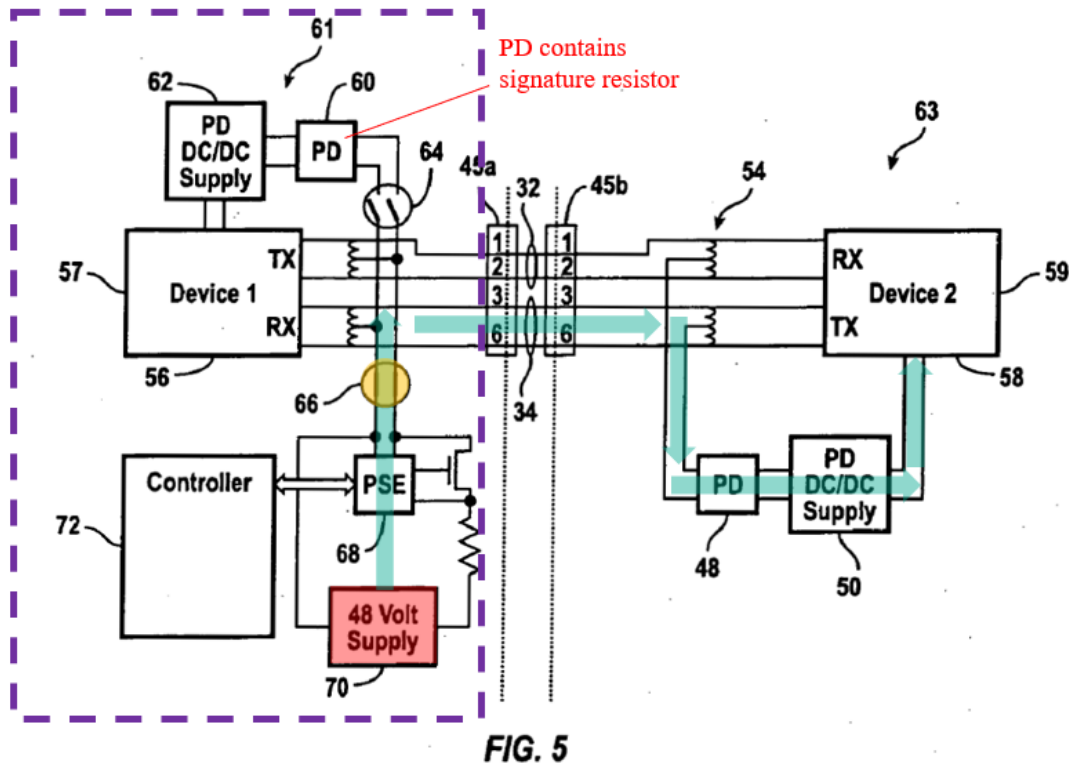


Id. at Fig. 5.

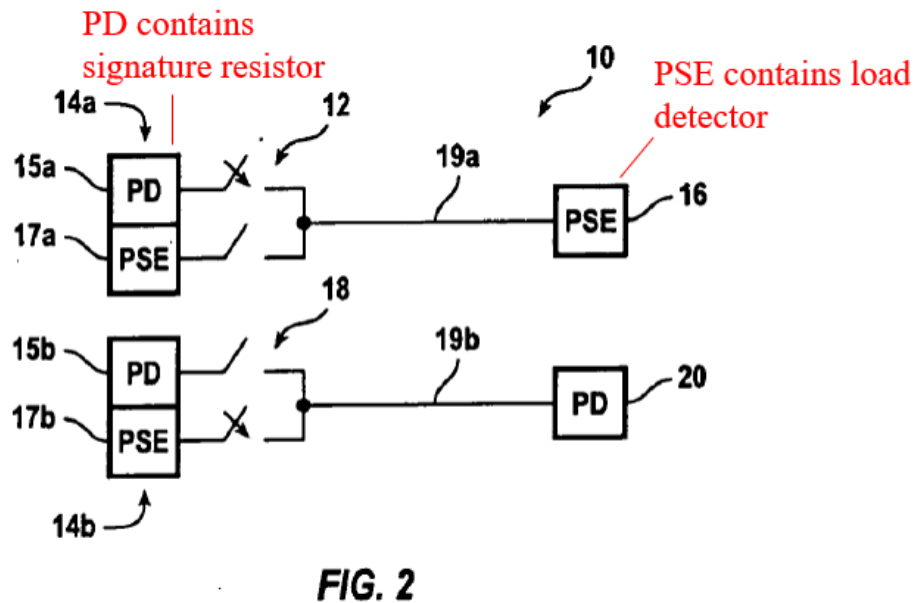
d. “a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and” 1[c]

95. This limitation is taught by Biederman in view of IEEE 802.3af. As explained above (*supra* Section X.A.1), the PD (60) and PSE (68) functional blocks of Biederman’s device 57 as informed by the requirements of IEEE 802.3af would include the detection and classification features of IEEE 802.3af compliant PSE and PD devices. More particularly, IEEE 802.3af teaches that the PSE’s “main functions

are to search the link section for a PD, optionally classify the PD, supply power to the link section (only if a PD is detected), monitor the power on the link section, and scale power back to the detect level when power is no longer requested or required.” EX1006 at 29. During the PD detection process, the PSE checks for a valid signature resistance in the PD. *Id.* at 38-39. The PD “shall present a valid detection signature...while it is in a state where it will accept power” from the PSE. *Id.* at 51. The PD will present a non-valid signature “while it is in a state where it will not accept power” from the PSE. *Id.* A valid PD detection signature is between 23.75K Ω and 26.25 K Ω . *Id.* at 52, Table 33-8. Accordingly, in light of Biederman’s teachings as informed and modified by those of IEEE 802.3af, a POSITA would have understood that PD unit 60 of the power delivery circuit (port 61) includes a signature resistor (annotated in Fig. 5 below). Furthermore, the PD unit 60 and its signature resistor are connected to the switch 66 and are capable of being detected by a PSE connected to the device 57 (as in the top configuration of Fig. 2); EX1005 at Fig. 5, Fig. 2.



Id. at Fig. 5.



Id. at Fig. 2.

e. “a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current;” 1[d]

96. Biederman in view of IEEE 802.3af also teaches this limitation. As explained above (*supra* Section X.A.1), the PD (60) and PSE (68) functional blocks of Biederman’s device 57 as informed and modified by the requirements of IEEE 802.3af would include the detection and classification features of IEEE 802.3af-compliant PSE and PD devices. More particularly, IEEE 802.3af teaches that the PSE’s “main functions are to search the link section for a PD, optionally classify the PD, supply power to the link section (only if a PD is detected), monitor the power on the link section, and scale power back to the detect level when power is no longer requested or required.” EX1006 at 29. During the PD detection process, the PSE checks for a valid signature resistance in the PD (the signature resistor discussed with respect to limitation 1[c]—i.e., the load in the connected device). *Id.* at 38-39. The PD “shall present a valid detection signature...while it is in a state where it will accept power” from the PSE. *Id.* at 51. The PD will present a non-valid signature “while it is in a state where it will not accept power” from the PSE. *Id.* The PSE may detect the signature via “voltage or current measurement.” *Id.* at 39.

97. A PD presenting a valid detection signature has a default power class of 0 and requires 0.44 to 12.95 Watts. *Id.* at 53, Table 33-10. The PSE may also

optionally classify the PD in one of the power classes 0-3 after the detection process. *Id.* at 53 (while Table 33-10 also includes class 4, this is reserved for future use). The PSE performs classification of a PD by “applying voltage and measuring current” from the PD. *Id.* at 40. “The PSE shall measure IClass and classify the PD based on the observed current according to Table 33–4,” which defines classes 0 through 4 based on current ranges. *Id.* at 40, 41, 53. IEEE 802.3af further defines the power requirements for each class in Table 33-10; classes 1-3 correspond to narrower bands of power within the default range of 0.44 to 12.95 Watts, and class 4 is reserved for future use. *Id.* at 53, Table 33-10.

98. Accordingly, in light of Biederman’s teachings as informed and modified by IEEE 802.3af, a POSITA would have understood that the PSE unit 68 includes a load detector (annotated in Fig. 5 below). Furthermore, that PSE unit 68 and its load detector are connected to the switch 66 and configured to read a current flowing through the signature resistor of PD 48 of the connected device 59 and flowing back through the switch 66 to PSE unit 68, and to extract information about the connected device based on that value. EX1005 at Fig. 5. This information includes whether the PD is a compatible device, whether it will accept power, and whether it requires some amount of power from the PSE in the range of 0.44-12.95 Watts (where the required power can be further limited to a smaller band within that range via the optional classification process). EX1006 at 27, 51, 53.

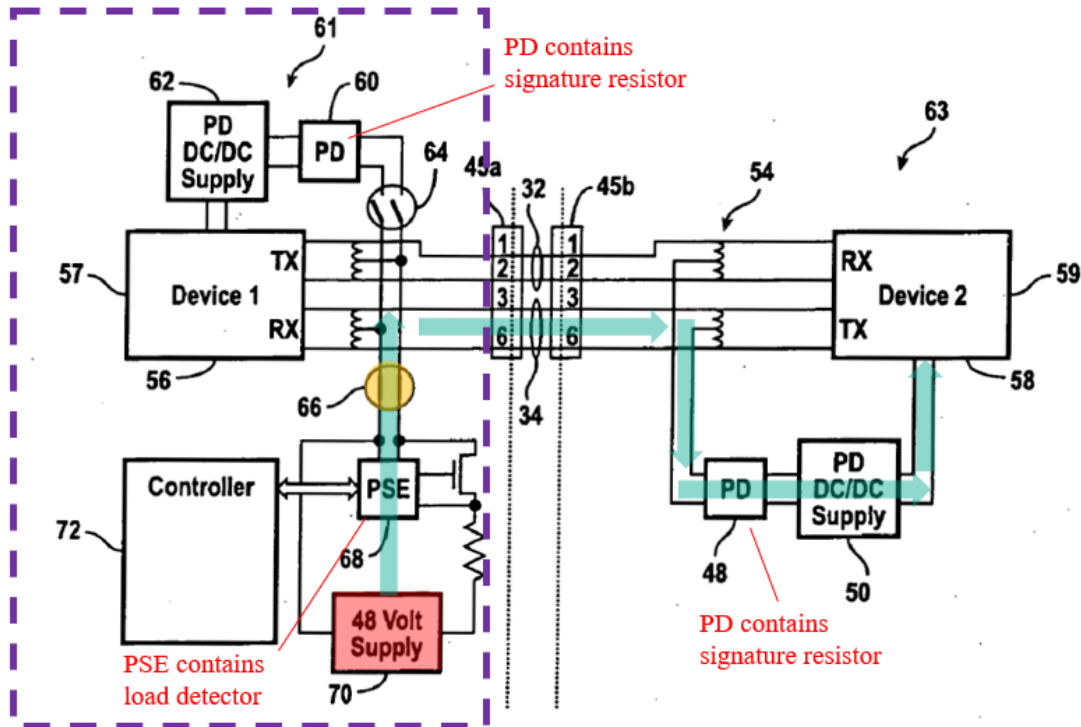


FIG. 5

f. “wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off, and whether or not the connected device needs a supply of power.” 1[e]

99. Biederman in view of IEEE 802.3af also discloses this limitation. First, with respect to “information regarding...whether or not the connected device needs a supply of power,” IEEE 802.3af explains that if the PD does not require power, it can present a non-valid signature, which will be detected by the PSE’s load detector. EX1006 at 51. If the PD requires power, it presents a valid signature for detection by the PSE. *Id.* The valid signature indicates that the PD requires some amount of power in the range of 0.44-12.95 Watts, but the PD can also communicate more specific power requirements within that range to the PSE via the optional

classification process, during which the PSE's load detector will measure the classification current of the PD. *Id.* at 40-41, 53.

100. Second, with respect to “information regarding whether the connected device is powered on or off,” the ’712 Patent explains that a device is powered on when it is “locally powered and fully functional.” EX1001 at 5:56-58. The ’712 Patent further explains that a connected device does not need a supply of power when it is locally powered. *Id.* at 4:63-5:2 (The load detector may determine that “the device is self-powered, and thus does not need to be supplied with power.”); *see also* Fig. 7. IEEE 802.3af similarly explains that a PD may not require power from the PSE if the PD can draw power from an alternate source or is locally powered. EX1006 at 49, 54 (“The PD may be capable of drawing power from a local power source. When a local power source is provided, the PD may draw some, none, or all of its power from the [PSE].”). In this scenario, the device will indicate to the PSE that it is locally powered, and thus, “powered on,” by presenting a non-valid signature for detection by the PSE. *Id.* at 51.

101. IEEE 802.3af also teaches that the PSE can detect whether the PD is currently being powered by the PSE. Specifically, when power is present on the link between the PSE and PD, there is an “indication from the circuitry that power is present on the link” and the PD asserts the maintain power signature (“MPS”) for

detection by the PSE. *Id.* at 49-51. The MPS is a 27 k Ω resistance signature. *Id.* at 47.

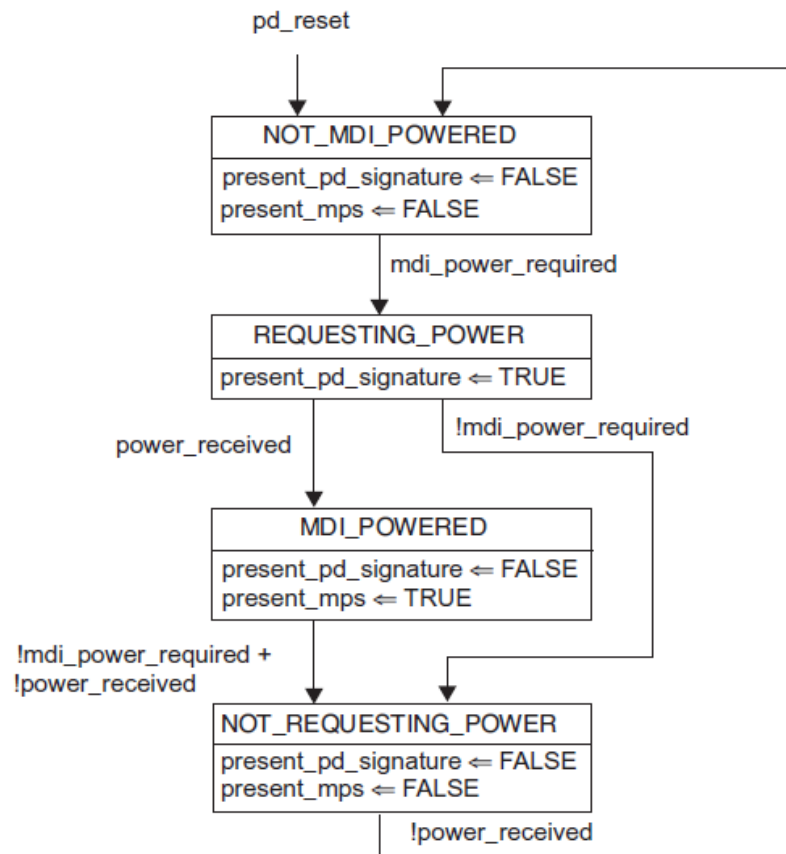


Figure 33–12—PD state diagram

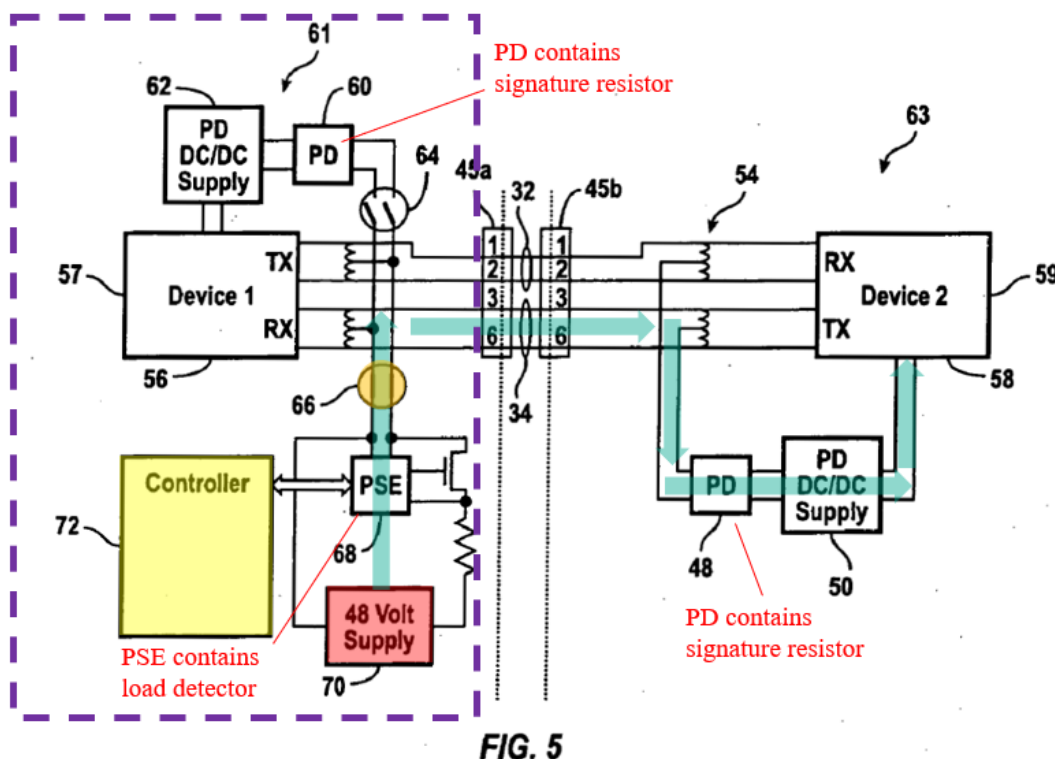
102. When the PD does not maintain a minimum input current of 10mA and an input impedance with the below resistive and capacitive components (i.e., when the PD is or disconnected and powered off), it stops asserting the MPS and the PSE will stop providing power. *Id.* at 56-57.

Table 33–13—PD Maintain Power Signature

Item	Parameter	Symbol	Unit	Min	Max	Additional information
1	Input current	I_{port}	mA	10		See 33.3.6.1
2	Input resistance	R_{pd_d}	$K\Omega$		26.25	
3	Input capacitance	C_{pd_d}	μF	0.05		With 0V to 57V DC bias applied

3. Claim 2: “The power delivery circuit of claim 1, further comprising a controller that controls opening and closing of the power relay switch.”

103. Biederman in view of IEEE 802.3af discloses the limitations of Claim 2. Specifically, Biederman teaches that the power delivery circuit 61 includes a controller 72 (annotated below in yellow) for causing switching circuitry 66 (annotated below in orange) to “selectively couple[] PSE block 68 (and power supply block 70)...to first MDI 45a.” EX1005 at [0038], Fig. 5.



EX1005 at Fig. 5.

4. Claim 3: “The power delivery circuit of claim 1, wherein the plurality of devices are connected to each other through a daisy chain, and wherein the power delivery circuit is included within each one of the devices in the daisy chain.”

104. Biederman in view of IEEE 802.3af also teaches Claim 3. Biederman teaches that several network devices can be arranged in a daisy chain network configuration, where each network device includes at least one port (i.e., the claimed power delivery circuit). EX1005 at [0043]-[0044], Figs. 8A-8B.

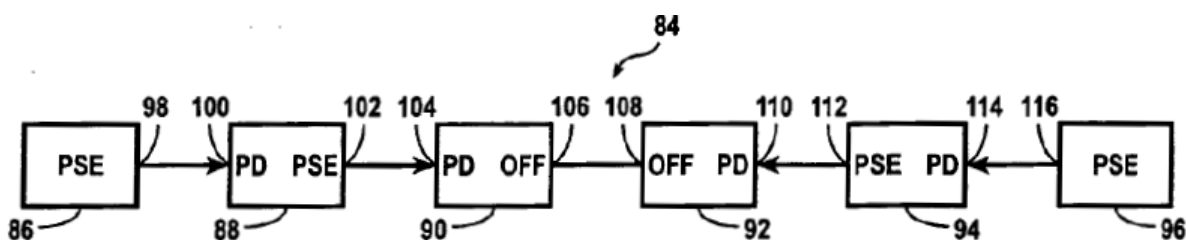


FIG. 8A

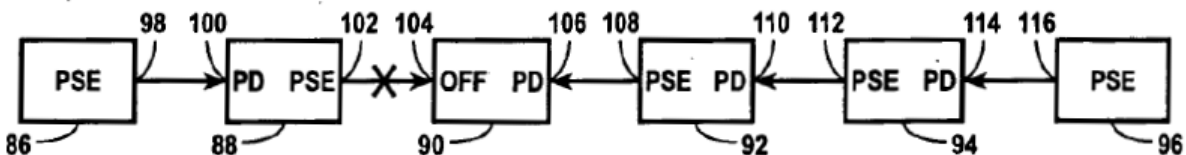
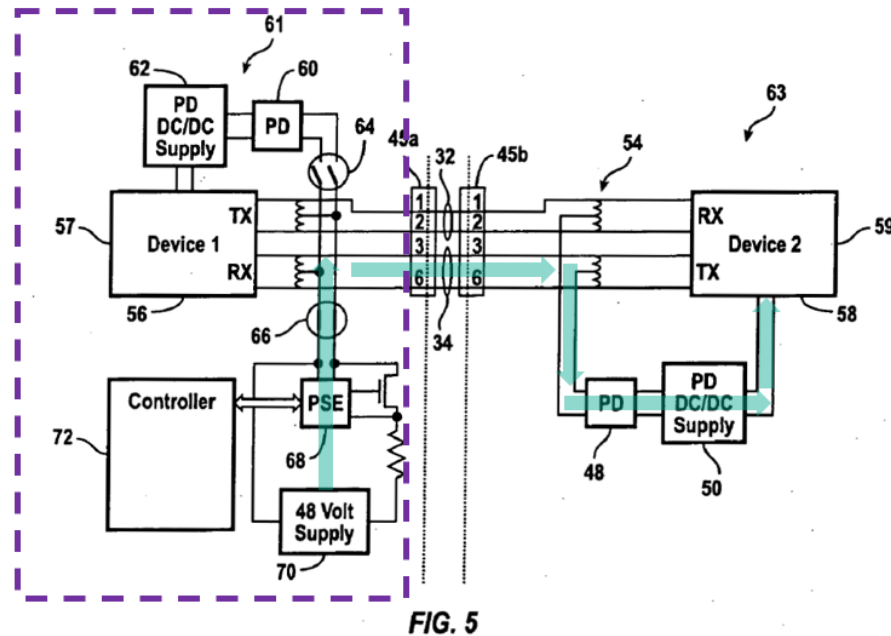


FIG. 8B

EX1005 at Figs. 8A-8B.

105. As explained above with reference to limitation 1[p], it would have been obvious to a POSITA to implement each port in the devices of Fig. 8A as the port 61 illustrated in the embodiment of Fig. 5. *Supra* Section X.A.2.a, Fig. 5

(showing the port 61, which is the claimed power delivery circuit, annotated in purple below).



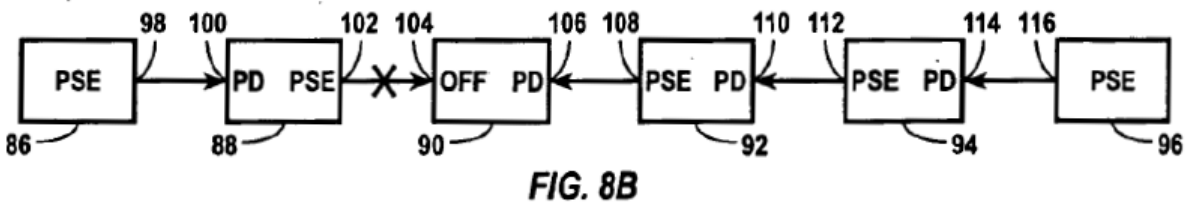
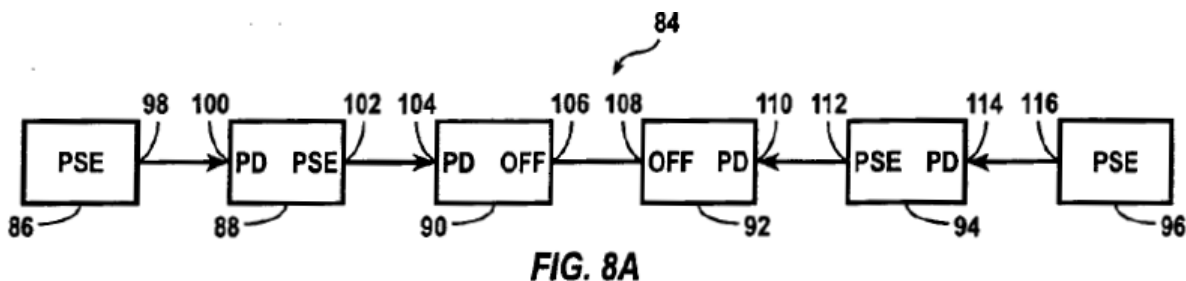
EX1005 at Fig. 5.

5. Claim 5: “The power delivery circuit of claim 1, wherein the load detector is further configured to detect removal of one of the plurality of devices from the network.”

106. Biederman in view of IEEE 802.3af also teaches claim 5. IEEE 802.3af explains that “[t]he PSE’s “main functions are to search the link section for a PD, optionally classify the PD, supply power to the link section (only if a PD is detected), monitor the power on the link section, and scale power back to the detect level when power is no longer requested or required.” EX1006 at 29. IEEE 802.3af further explains that one example of when power is no longer required is “[a]n unplugged link section.” *Id.* When a PD is disconnected, the PSE is configured to detect the

change in the Disconnect Detection time, T_{MPDO} , and turn off power. *Id.* at 99-100, 104-06.

107. Biederman similarly teaches that, when the network devices are arranged in a daisy chain, the devices can detect when the cabling has been “cut or disrupted” and adjust their functions accordingly. EX1005 at [0044]. In the example of Fig. 8B, the “cabling has been cut or disrupted in some fashion between port 102 and port 104.” *Id.* at [0045], Fig. 8A-8B. “[S]ince port 104 can no longer receive inline power from port 102, it has been reconfigured [by the controller] so that inline power is off.” *Id.* Similarly, “[p]ort 106 which had been off in FIG. 8A is...reconfigured to receive power in PD mode,” and “[p]ort 108 which had been off is...reconfigured in response to the demand from port 106 in PD mode so that it is now in PSE mode.” *Id.* This reconfiguration necessarily requires the network device of Biederman to be capable of detecting the removal of a device from the network.



EX1005 at Figs. 8A-8B.

B. Ground 2: Claims 1, 2, 3, and 5 are obvious over Biederman in view of Karam

108. In my opinion, Biederman in combination with Karam renders obvious claims 1, 2, 3, and 5 of the '712 Patent.

1. Motivation to Combine Biederman and Karam

109. As explained above in Section IX.B and X.A.1, Biederman is generally directed to “[a] method and apparatus for bidirectional provision of inline power,” “also known as Power over Ethernet and PoE.” EX1005 at [0013]-[0014], [0018]. Biederman notes that, “[i]n the interest of clarity, not all of the routine features of the implementations described herein are shown and described,” but implementing the invention “would...be a routine undertaking of engineering for those of ordinary skill in the art having the benefit of this disclosure.” *Id.* at [0031]. As a result, Biederman’s disclosure omits certain routine details of PoE devices that are governed by the IEEE 802.3af standard, in the interest of brevity. As explained in Section X.A.1, some of these omitted details relate to the detection and classification features of IEEE 802.3af, including the signature resistor, load detector, and classification current elements.

110. As described above in Section IX.C, Karam discloses an “apparatus for managing an Inline Power relationship between a network device and a Powered Device (PD) where the network device is acting as power sourcing equipment (PSE)

to provide Inline Power to a first PD (PD1) which is, in turn, powering another PD (PD2).” EX1007 at [0039], Fig. 2A.

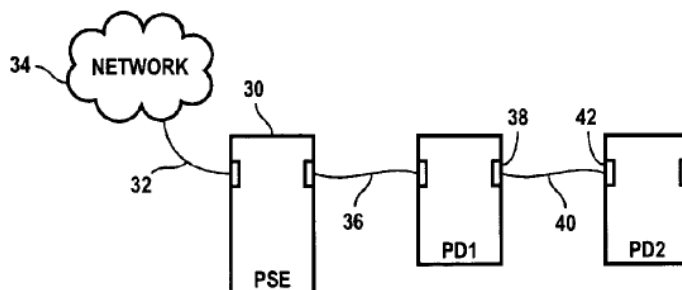


FIG. 2A

EX1007 at Fig. 2A.

111. Like Biederman, Karam also refers to the IEEE 802.3af standard. *Id.* at [0014]. Unlike Biederman, Karam discloses the details of the PoE classification and detection components governed by the IEEE 802.3af standard. For example, Karam explains:

In order to provide regular Inline Power to a PD from a PSE it is a general requirement that two processes first be accomplished. First, a “discovery” process must be accomplished to verify that the candidate PD is, in fact, adapted to receive Inline Power. Second, a “classification” process must be accomplished to determine an amount of Inline Power to allocate to the PD, the PSE having a finite amount of Inline Power resources available for allocation to coupled PDs.

Id. at [0018].

112. Referencing the IEEE 802.3af standard, Karam explains that the discovery process looks for an “identity network” in the PD, which is a 25,000Ω resistor. *Id.* at [0019]. To detect the identity network, the PSE applies voltage

discovery signals, measures the “return currents responsive to application of the discovery signals,” and calculates the resistance. *Id.* at [0020]. If the resistance is the proper value, classification may begin. *Id.* Again referencing the IEEE 802.3af standard, Karam explains that the classification process involves applying a voltage to the PD, which responds by sending a classification current back to the PSE. *Id.* at [0021]. This current corresponds to a “class,” which represents a device’s power requirements. *Id.* at [0021], Table I. Karam indicates that the classification process is optional. *Id.* at [0065].

113. It would have been obvious to a POSITA to implement the detection and classification features of IEEE 802.3af as carried out in Karam—including the signature resistor, load detector, and classification current elements—in the PoE system of Biederman, such that the PD portion of each device of Biederman includes a signature resistor, and the PSE portion of each device of Biederman includes a load detector for detecting a PD signature resistor and a PD classification current. A POSITA would have been motivated by Biederman’s own disclosure to make this combination, because Biederman explains that (a) PoE is governed by IEEE 802.3af; (b) “[t]hose of ordinary skill in the art will [] realize that other equivalent mechanisms are available to periodically revise the amount of power made available by the PSE to the PD;” (c) “[t]here are mechanisms within the IEEE 802.3af standard to allocate a requested amount of power;” and (d) Karam illustrates one

implementation of the classification and detection features of the IEEE 802.3af specification. *Id.* at [0014], [0042]. A POSITA also would have been motivated by IEEE 802.3af to make this combination, because IEEE 802.3af emphasizes the importance of its detection process to prevent damage to non-compatible devices. EX1006 at 27. Indeed, a POSITA would have understood that inadvertently providing PoE power to a non-PoE device would not be “a pretty picture.” EX1014 at 18. Specifically, providing power to a non-PoE device which is not designed to receive power via network lines may burn out the terminal of the non-PoE device. Accordingly, a POSITA would have understood that it would be vital for Biederman’s PSE to be able to determine whether a connected device can receive power over the ethernet cable. A POSITA also would have understood that compliance with the IEEE 802.3af standard would be important for Biederman’s device to be interoperable with other IEEE 802.3af compliant PoE devices in the network.

114. Such an improvement is no more than the predictable use of prior art IEEE 802.3af detection and classification elements according to their established functions, the combination of familiar IEEE 802.3af detection and classification elements according to known methods” disclosed by Karam to yield predictable results, or the use of a known technique (PoE detection and classification) to improve a similar PoE device in the same way. Furthermore, a POSITA would have had a

reasonable expectation of success in making this combination because the elements added from Karam, as Biederman explains with regard to such elements, are merely “routine features” of IEEE 802.3af devices, the implementation of which would be a “routine undertaking of engineering for those of ordinary skill in the art.” EX1005 at [0031]. A primary goal of the IEEE 802.3af standard is to define the functions, behaviors, and components of PoE PDs and PSEs. Thus, these features are fundamental to the IEEE 802.3af standard and would routinely be implemented in PoE devices.

2. Claim 1

a. “A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising:” 1[P]

115. To the extent the preamble is limiting, Biederman teaches the limitation for the same reasons explained above with respect to limitation 1[p] in Ground 1. *Supra* Section X.A.2.a; *see* EX1005 at [0031], [0037]-[0038], [0043]-[0044], [0041], [0039], and Figs. 8A-8B, 5.

b. “a voltage source configured to generate a voltage;” 1[a]

116. For the same reasons explained above with respect to limitation 1[a] in Ground 1, Biederman teaches this limitation. *Supra* Section X.A.2.b; *see* EX1005 at [0037]-[0039], Fig. 5.

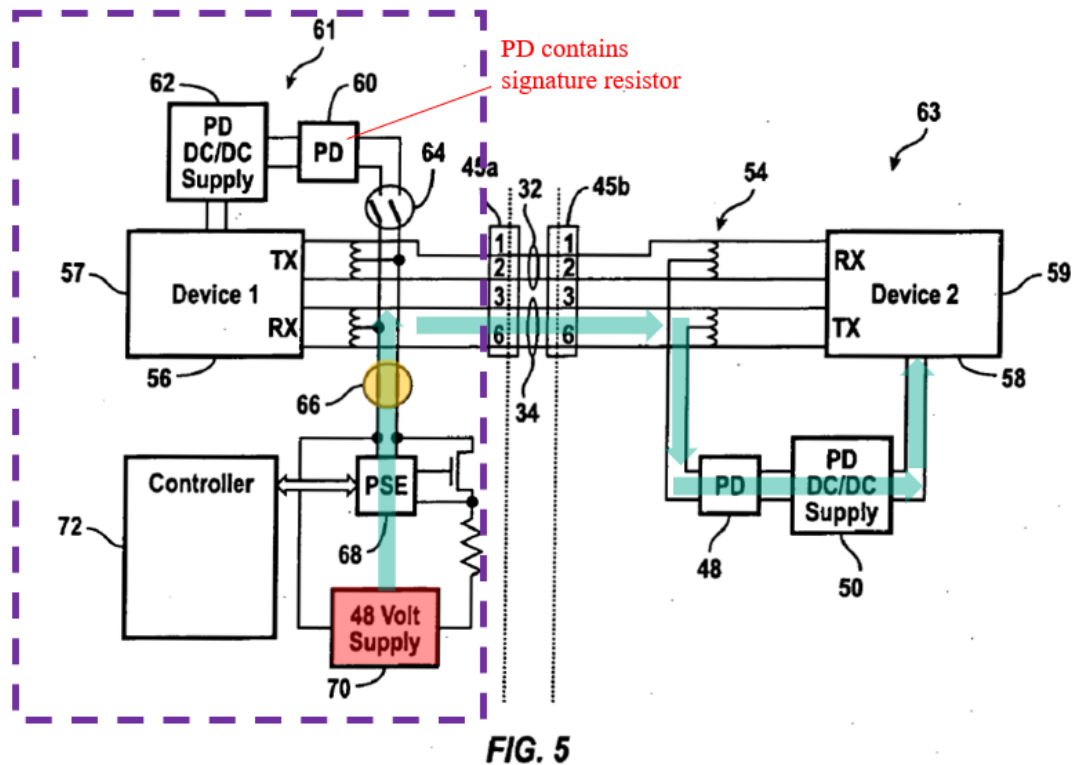
c. “a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices;” 1[b]

117. For the same reasons explained above with respect to limitation 1[b] in Ground 1, Biederman teaches this limitation. *Supra* Section X.A.2.c; *see* EX1005 at [0037]-[0038], Fig. 5.

d. “a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and” 1[c]

118. This limitation is taught by Biederman in view of Karam. As explained above (*supra* Section X.B.1), the PD (60) and PSE (68) functional blocks of port 61 of Biederman’s device 57 as modified by Karam include the detection and classification features of IEEE 802.3af compliant PSE and PD devices. Referencing the IEEE 802.3af standard, Karam explains that the discovery process looks for an “identity network” in the PD, which is a 25,000 Ω resistor. EX1007 at [0019]. To detect the identity network, the PSE applies voltage discovery signals, measures the “return currents responsive to application of the discovery signals,” and calculates the resistance. *Id.* at [0020]. If the resistance is the proper value, classification may begin. *Id.* Again referencing the IEEE 802.3af standard, Karam explains that the classification process involves applying a voltage to the PD, which responds by sending a classification current back to the PSE. *Id.* at [0021]. This current corresponds to a “class,” which represents a device’s power requirements. *Id.* at

[0021], Table I. Accordingly, Biederman's device as modified by Karam includes a signature resistor (annotated in Fig. 5 below) in the functional PD unit 60, which is connected to the switch 66 and which is capable of being detected by a PSE connected to the device 57 (as in the top configuration of Fig. 2). EX1005 at Fig. 5, Fig. 2.



EX1005 at Fig. 5.

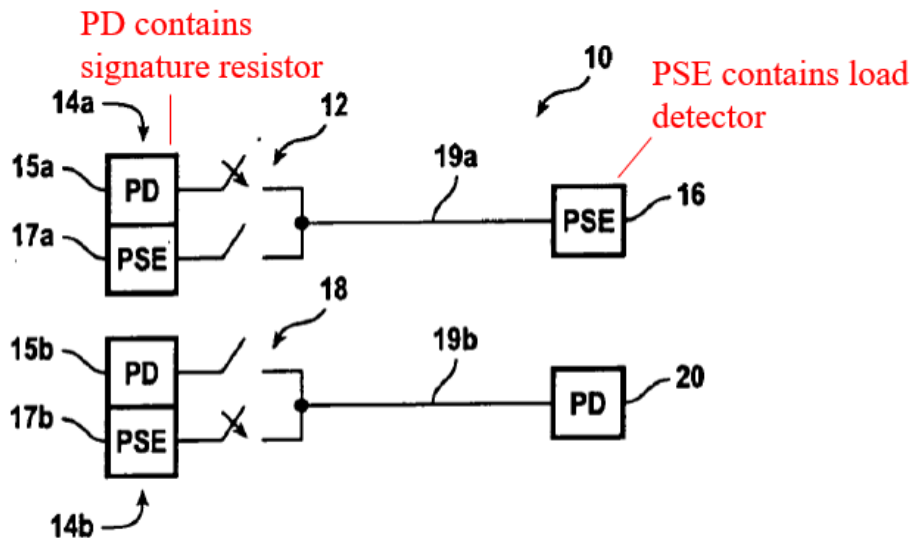


FIG. 2

Id. at Fig. 2.

e. “a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current;” 1[d]

119. Biederman in view of Karam also teaches this limitation. Karam explains that, to detect the PD identity network, the PSE applies voltage discovery signals, measures the “return currents responsive to application of the discovery signals,” and calculates the resistance on the connection with the PD. EX1007 at [0020]. If the resistance is the proper value (i.e., the $25,000\Omega$ signature resistance), classification may begin to determine whether the device should receive a maximum of 15.4 Watts, 7.0 Watts, or 4.0 Watts. *Id.* The classification process involves applying a voltage to the PD, which responds by sending a classification current

back to the PSE. *Id.* at [0021]. This current corresponds to a “class,” which represents a device’s power requirements. *Id.* at [0021], Table I. Accordingly, Biederman’s device as modified by Karam includes a load detector (annotated in Fig. 5 below) in the functional PSE unit 68, which is connected to the switch 66 and which is configured to read a current flowing through the signature resistor of PD 48 of the connected device 59, and to extract information about the connected device based on that value. EX1005 at Fig. 5. As taught by Karam, this information includes whether a connected PD is “off or disconnected” (EX1007 at [0058]); whether a connected device is a “legacy” device that cannot receive inline power (*id.* at [0022]); and whether the PD requires *some* amount of power, the specific amount to be determined via the classification process (*id.* at [0018], [0021], [0065].).

detector via the classification process (*id.* at [0018], [0021], [0065]). *Supra* Section X.B.2.e.

3. Claim 2: “The power delivery circuit of claim 1, further comprising a controller that controls opening and closing of the power relay switch.”

121. For the same reasons explained above with respect to claim 2 in Ground 1, Biederman teaches this claim. *Supra* Section X.A.3; EX1005 at [0038], Fig. 5.

4. Claim 3: “The power delivery circuit of claim 1, wherein the plurality of devices are connected to each other through a daisy chain, and wherein the power delivery circuit is included within each one of the devices in the daisy chain.”

122. For the same reasons explained above with respect to claim 3 in Ground 1, Biederman teaches this claim. *Supra* Section X.A.4; EX1005 at [0043]-[0044], Figs. 8A-8B, 5.

5. Claim 5: “The power delivery circuit of claim 1, wherein the load detector is further configured to detect removal of one of the plurality of devices from the network.”

123. Biederman in view of Karam also teaches claim 5. For the same reasons explained above with respect to claim 5 in Ground 1, Biederman teaches this claim. *Supra* Section A.5; EX1005 at [0044]-[0045], Figs. 8A-8B. Karam also teaches the limitations of this claim. With reference to the embodiment of Fig. 5, Karam explains:

Inline power is provided to the third port 76 by closing switch 88...If the control circuitry 78 sees that power is applied and then **the current in current sensor 92 goes to zero (device at second port 74 is off or disconnected)** while current is still being used by third port

76 then it forces normally closed switch 90 to open making sure that a 'hot cable' situation is not created at second port 74 by removing the inline power to second port 74. To provide inline power again to second port 74 the control circuitry 78 must identify the presence of an appropriate identity network across the 1-2 pair and the 3-6 pair. This may be achieved, for example, by control circuitry 78 reducing the applied voltage and closing switch 90 to carry out a conventional inline power discovery process which may also be followed up by a classification process, if desired in the particular application.

EX1007 at [0058].

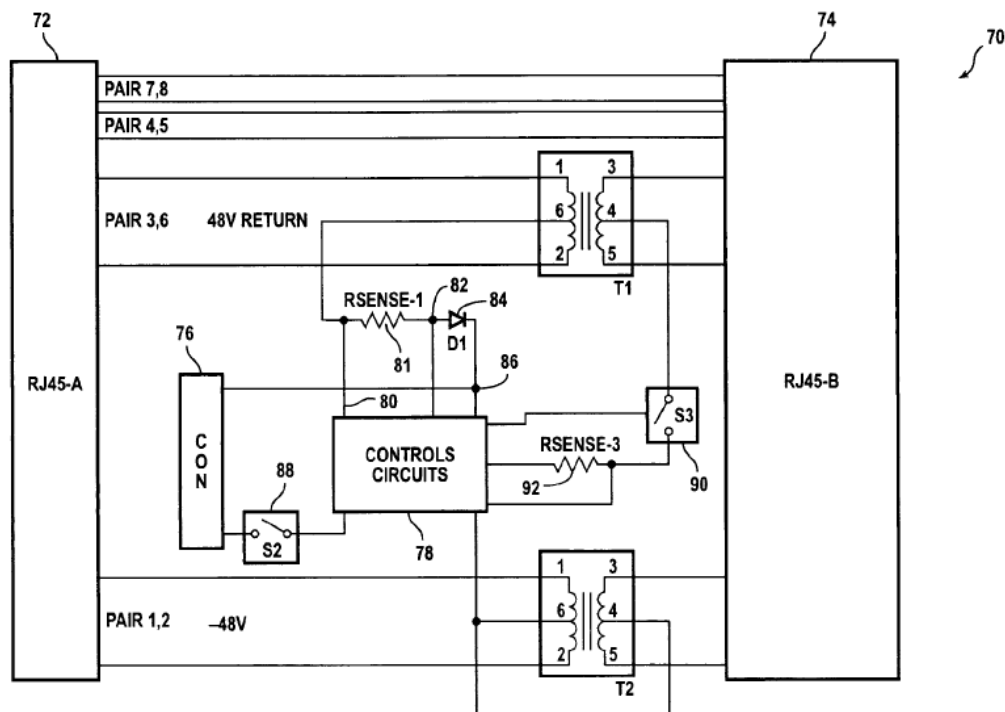


FIG. 5

EX1007 at Fig. 5.

124. Thus, Karam teaches that the load detector 92 can sense when the current drops to zero when the device is disconnected from port 74.

C. Grounds 3-5: Claims 1, 2, 3, and 5 are obvious over Biederman in view of IEEE 802.3af and Penning (Ground 3); Biederman in view of Karam and Penning (Ground 4); and Biederman in view of IEEE 802.3af, Karam, and Penning (Ground 5)

125. In my opinion, Biederman in combination with (a) IEEE 802.3af and Penning; (b) IEEE 802.3af, Penning, and Karam; and/or (c) Karam and Penning renders obvious claims 1, 2, [3], and 5 of the '712 Patent.

1. Motivation to Combine the Combination of Biederman and Karam and/or IEEE 802.3af with Penning

126. Claims 1, 2, 3, and 5 are obvious over Biederman in view of IEEE 802.3af (Ground 1) or in view of Karam (Ground 2). *Supra* Sections X.A, X.B. To the extent that Patent Owner were to incorrectly argue that neither Biederman, IEEE 802.3af, nor Karam discloses a “signature resistor connected to the switch and configured to detect a power source from one of the connected devices,” as recited in limitation 1[c], or “wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off, and whether or not the connected device needs a supply of power,” as recited in limitation 1[e], those limitations are obvious over Biederman-Karam, Biederman-IEEE 802.3af, and Biederman-IEEE802.3af-Karam in further view of Penning. The mapping for all other claim limitations in claims 1, 2, 3, and 5 is as set forth in Grounds 1 and/or 2. *Supra* Sections X.A, X.B.

127. Biederman teaches that it may be “useful to provide backup sources of power to a network at locations where power happens to be available....[s]uch as generator-supplied power or emergency power.” EX1005 at [0046]. Biederman is silent as to how a device in the daisy chain PoE network of Figs. 8A-8B would detect and select between sources of power, such as a PSE and a local power supply. However, Penning discloses a similar PoE device with a “power detector” for detecting connected power sources and a controller for switching between them.

128. As explained in Section IX.D, Penning teaches a system for powering multiple devices in a PoE network. EX1008 at [0028]-[0030]. The system includes a data distribution device 105, an independent power supply 115, a remote data distribution device 110, network devices 125-1 to 125-N, and externally powered network devices 120-1 to 120-N. *Id.* at [0029], Fig. 1.

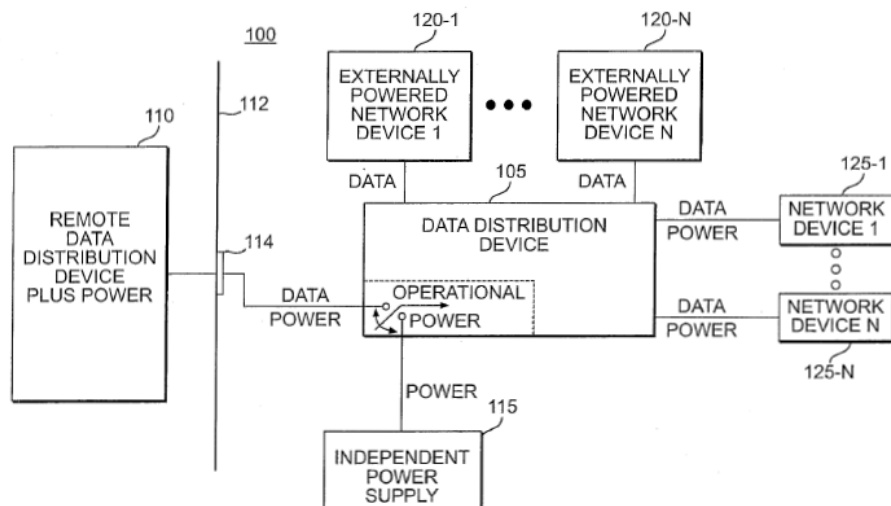


FIG. 1

Id. at Fig. 1.

129. Remote data distribution device 110 acts as a PSE providing data and power to data distribution device 105, which can then provide data and power to network devices 125-1 through 125-N. *Id.* at [0029]. Data distribution device 105 may power itself and network devices 125-1 through 125-N from one of several power sources, including remote data distribution device 110 and independent power supply 115. *Id.* at [0032]. The device 105 switches between power supplies using “relays, transistors, or any other known switching device.” *Id.*

130. As illustrated in Fig. 3, power detectors 350 and 355 of the data distribution device 205 indicate whether power is available from independent power supply 115 or uplink port 320, respectively, by sending a signal to process controller 340. *Id.* at [0049], [0056], Fig. 3. The process controller 340 determines which power supply to use based on these signals and sends a command signal to switch 380, “which may be a relay,” to select the power source. *Id.* at [0051], [0047], [0049]. If the data distribution device is powered locally by the independent power supply, process controller 340 signals PoE controller 360 to set a signature resistance on uplink port 320 in accordance with IEEE 802.3af to inform closet gigabit switch 210 that device 205 does not require power. *Id.* at [0056].

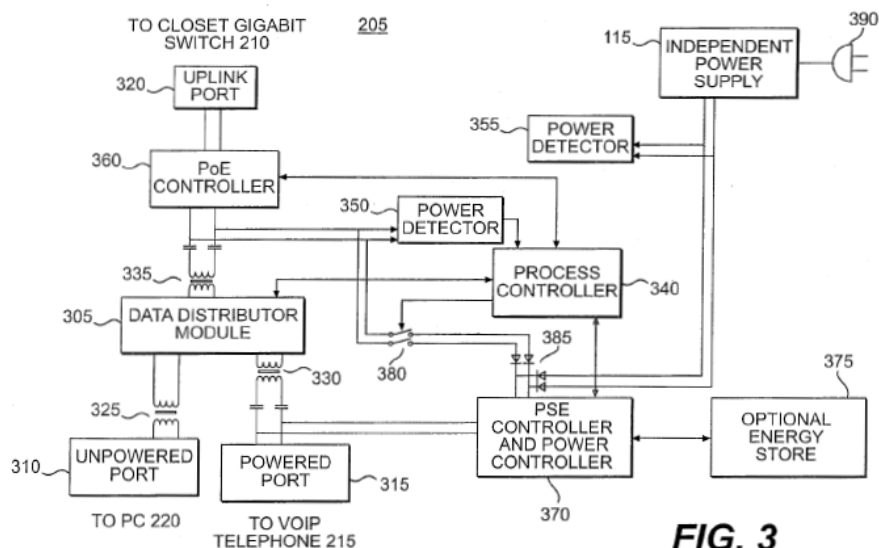


FIG. 3

EX1008 at Fig. 3.

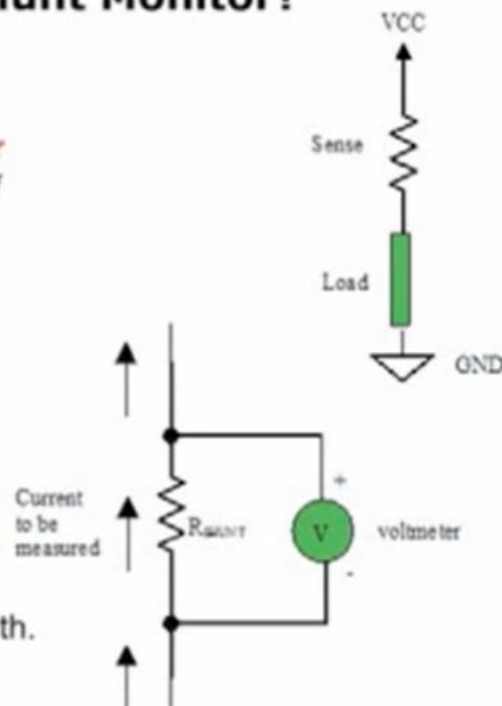
131. Penning teaches that the power detectors may be “voltage or current detectors...of any appropriate type known to one of ordinary skill in the art.” *Id.* at [0049]. A POSITA would have understood based on common general knowledge or Karam (EX1007 at [0058]) that one common type of current detector is a current sense resistor or current shunt monitor, which includes a resistor and a sensor for measuring the voltage drop across the resistor and calculating current. EX1015 at 6 (explaining that “[c]urrent measurements can...be made by measuring the voltage developed across a resistor as current passes through,” where “[t]his type of resistor is called a current sensing, or shunt, resistor.”); EX1016 at 2 (explaining that a current shunt monitor “measure[s]...the current flow by measuring the voltage drop

across a resistor placed in the current path” and outputs “a voltage, current, or digital signal that is proportional to the current”).

What is a Current Shunt Monitor?

High Side Current Sensors:

- A special type of **difference amplifier** that is designed for the specific use of high side current measurement.
- Measure/Monitor the current flow by measuring the **voltage drop across a resistor** placed in the current path
- Output either a voltage, current or digital signal that is **proportional to the current** through the measured path.



EX1016 at 2.

132. For example, a common current sense resistor configuration includes a shunt resistor in series with the current path, an operational amplifier to convert the small differential voltage into a larger output voltage, and an analog to digital converter, which digitizes the output voltage before sending it to a controller.

EX1015 at 11.

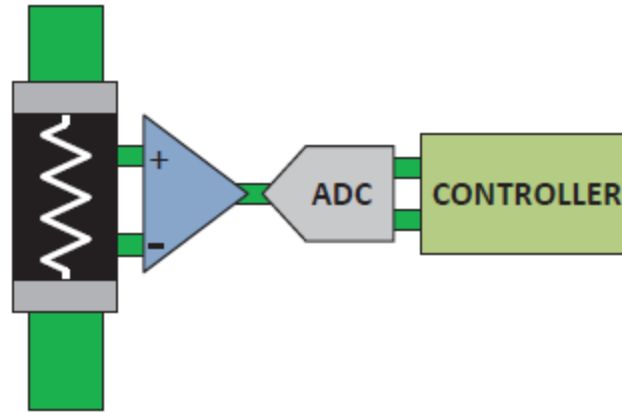


Figure 1. Current Sensing Signal Chain

EX1015 at 11, Fig. 1.

133. Current sense resistors like the one illustrated above are ubiquitous in the art and would have been well within the knowledge of a POSITA. EX1015 at 8 (“The most common sensor for measuring current is a current sensing, or shunt, resistor. Placing this component in series with the current being measured develops a proportional differential voltage as the current passes through the resistor.”); EX1016 at 3 (explaining that a current shunt monitor can be used in “any application that...needs to measure current... [or] needs [to] know the current to control other parameters,” and is especially useful for power management applications).

134. Thus, in the combination PSE/PD device of Biederman as modified by Penning, the device includes current sense resistors, each one comprising a resistor and a sensor for measuring the voltage drop across the resistor (the resistor and

sensor together comprising the claimed “signature resistor”), connected to the switch to detect connected power sources and facilitate switching between them.

135. A POSITA would have been motivated by Biederman’s disclosure concerning backup sources of power to modify Biederman with Penning to provide a means for the network devices to detect connected power sources and switch between them. A POSITA also would have been motivated by Penning’s disclosure to make such a combination to boost data transfer rates, as Penning explains that a “user may require faster data transfer rates...which may necessitate operating off of an independent power supply, e.g., so that all of the twisted pairs of the Ethernet connection are being utilized for data transfer and not data and PoE.” EX1008 at [0062].

136. Such an improvement is no more than the predictable use of prior art PoE power detection elements according to their established functions, or the combination of familiar PoE power detection elements according to known methods to yield predictable results. This straightforward modification also reflects the application of a known technique (Penning’s technique for detecting connected power sources and switching between them) to improve a similar PoE device (Biederman’s combination PD/PSE device) in the same way (to enable the device to detect and switch between power sources) to yield predictable results. *Id.* A POSITA would have had a reasonable expectation of success in making the above

modifications because each reference teaches a PoE device that can be connected in a network to multiple power sources, including local backup power supplies.

2. Claim 1

a. “a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and;” 1[c]

137. This limitation is taught by Biederman in view of IEEE 802.3af and Penning (Ground 3); Biederman in view of Karam and Penning (Ground 4); and Biederman in view of IEEE 802.3af, Karam, and Penning (Ground 5). *See* X.C.1. Specifically, Penning teaches the use of current or voltage detectors in a PoE device to detect connected power sources and send signals to a controller to switch between them. EX1008 at [0028]-[0030], [0032], [0049], [0056], [0051], [0047], [0049], Figs. 1, 3. A POSITA would have understood based on common general knowledge or Karam (EX1007 at [0058]) that the current detectors could be current sense resistors, each of which comprises a resistor and a voltage measuring element for calculating the voltage drop across the resistor. This combination of resistor and voltage measuring element constitutes the claimed “signature resistor.”

b. “wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off, and whether or not the connected device needs a supply of power.” 1[e]

138. Biederman in view of IEEE 802.3af and Penning (Ground 3); Biederman in view of Karam and Penning (Ground 4); and Biederman in view of

IEEE 802.3af, Karam, and Penning (Ground 5) also disclose this limitation. IEEE 802.3af explains that if the PD does not require power, it can present a non-valid signature, which will be detected by the PSE's load detector. EX1006 at 51. If the PD requires power, it presents a valid signature for detection by the PSE. *Id.* The valid signature indicates that the PD requires some amount of power in the range of 0.44-12.95 Watts, but the PD can also communicate more specific power requirements within that range to the PSE via the optional classification process, during which the PSE's load detector will measure the classification current of the PD. *Id.* at 40-41, 53.

139. IEEE 802.3af also explains that a PD may not require power from the PSE if the PD can draw power from an alternate source or is locally powered. EX1006 at 49, 54 (“The PD may be capable of drawing power from a local power source. When a local power source is provided, the PD may draw some, none, or all of its power from the [PSE].”). In this scenario, the device will indicate to the PSE that it is locally powered, and thus, “powered on,” by presenting a non-valid signature for detection by the PSE. *Id.* at 51.

140. Penning similarly teaches that, when a PD receives power from a local power supply and is thus already “powered on,” the PD sets an invalid signature resistance on the port connected to the PSE to inform the PSE that it does not require power from the PSE. EX1008 at [0056].

D. Ground 6: Claims 7 and 9 are anticipated by Karam

141. In my opinion, Karam anticipates claims 7 and 9 of the '712 Patent.

1. Claim 7

**a. “A method of delivering power to one of a plurality of devices connected in a daisy chain, the method comprising:”
7[p]**

142. To the extent the preamble is limiting, Karam teaches this limitation. Karam teaches “a method and apparatus for managing an Inline Power relationship between a network device and a Powered Device (PD) where the network device is acting as power sourcing equipment (PSE) to provide Inline Power to a first PD (PD1) which is, in turn, powering another PD (PD2).” EX1007 at [0039], Fig. 2A. As shown in Fig. 2A below, the PSE, PD1, and PD2 are connected in a daisy chain configuration. The PSE may also provide power to a longer daisy chain of PD devices. *Id.* at [0046] and Fig. 2D. The first PD, PD1, receives power from a voltage source in the PSE. *Id.* at [0044].

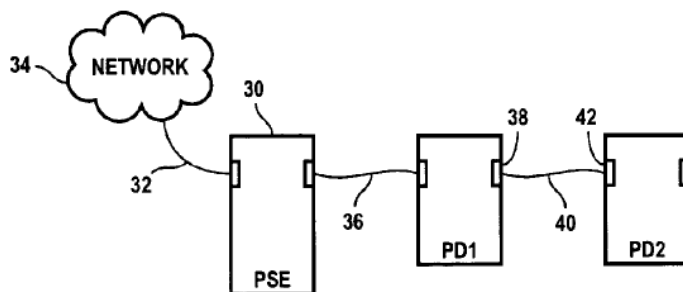
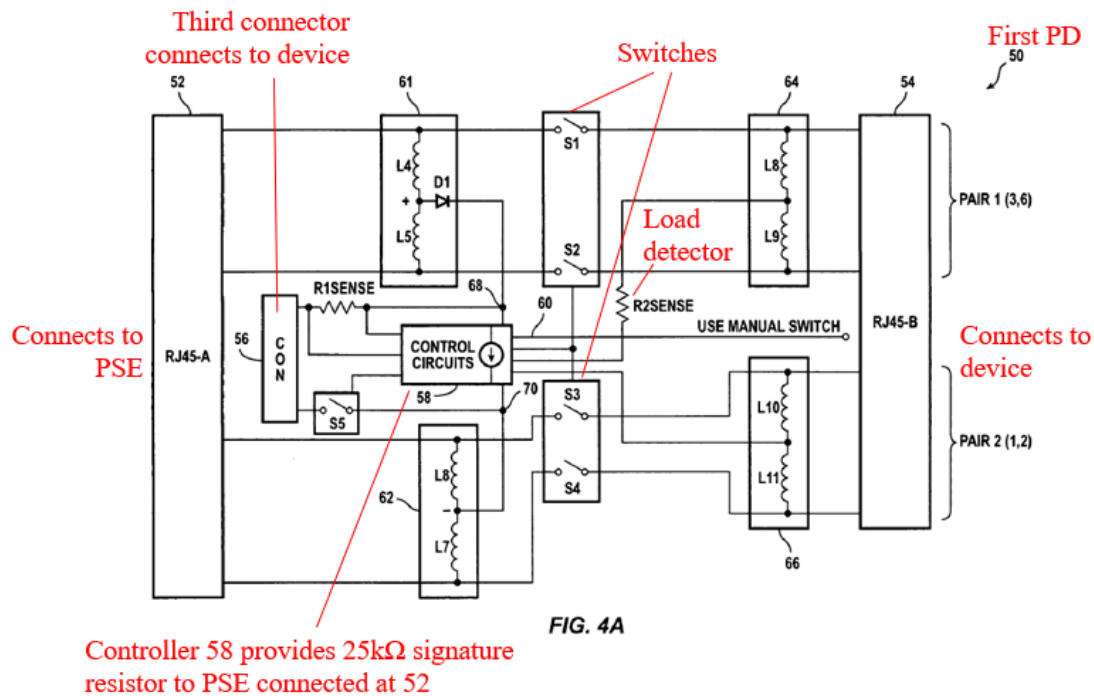


FIG. 2A

EX1007 at Fig. 2A.

143. In the more detailed embodiment shown in Fig. 4A, a PSE may be coupled to connector 52 of device 50 (corresponding to PD1 of Fig. 2A), which in turn may be coupled to downstream devices (such as PD2 of Fig. 2A) at connectors 54 and/or 56. *Id.* at [0051]-[0052], Fig. 4A (annotated below). The PSE may provide power to device 50 as it would a PD, and device 50 may also act as a PSE to provide a portion of the power from the PSE to devices coupled to connectors 54 and 56. *Id.*



EX1007 at Fig. 4A.

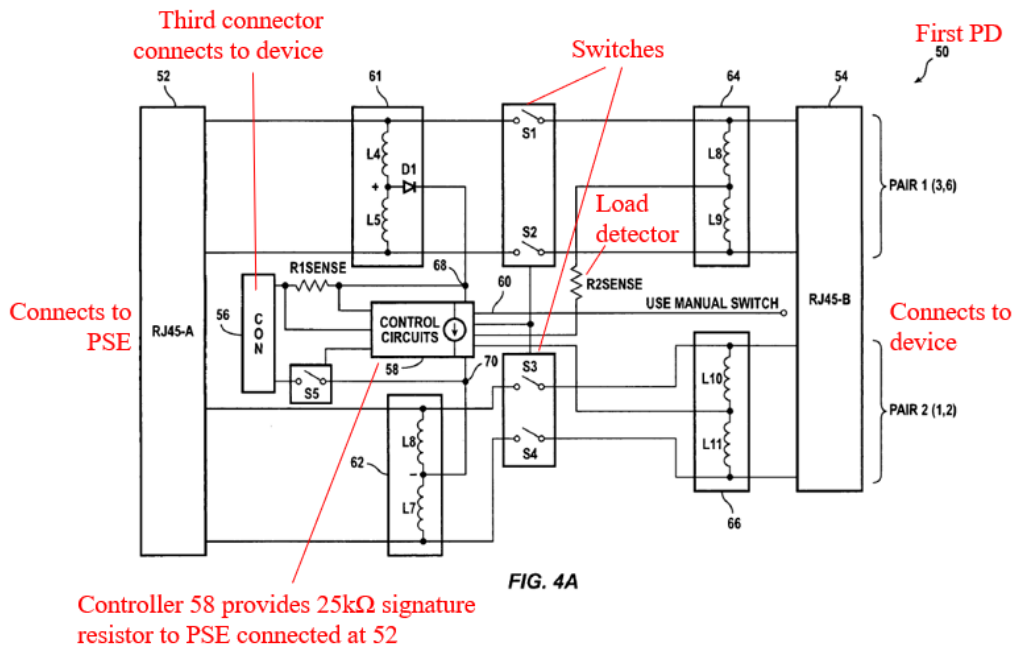
b. “detecting a load in a first device of the plurality of devices including detecting a load current flowing through the load;” 7[a]

144. Karam teaches this limitation. Karam explains that “[i]n order to provide regular Inline Power to a PD from a PSE it is a general requirement that two

processes first be accomplished. First, a ‘discovery’ process must be accomplished to verify that the candidate PD is, in fact, adapted to receive Inline Power. Second, a ‘classification’ process must be accomplished to determine an amount of Inline Power to allocate to the PD, the PSE having a finite amount of Inline Power resources available for allocation to coupled PDs.” *Id.* at [0018]. Referencing the IEEE 802.3af standard, Karam explains that the discovery process looks for an “identity network” in the PD, which is a 25,000Ω resistor. *Id.* at [0019]. To detect the identity network, the PSE applies voltage discovery signals, measures the “return currents responsive to application of the discovery signals,” and calculates the resistance (the load in the PD). *Id.* at [0020]. If the resistance is the proper value, classification may begin. *Id.* Again referencing the IEEE 802.3af standard, Karam explains that the classification process involves applying a voltage to the PD, which causes a classification current to flow on the circuit connecting the PD and the PSE. *Id.* at [0021]. This current corresponds to a “class,” which represents a device’s power requirements. *Id.* at [0021], Table I.

145. With respect to the system illustrated in Fig. 4A, Karam teaches that the device 50 in the chain, which corresponds to PD1 of Fig. 2A, includes a connector 52 to connect to the PSE, a second connector 54 which may be coupled to another PD device, and a third connector 56 for providing power to another PD device, such as a cell phone. *Id.* at [0051], Fig. 4A. To supply power to device 50,

“the PSE port must see the proper identity network characteristics,” which, “in accordance with the IEEE 802.3af standard,” is a $25,000\Omega$ resistance in response to “certain discovery voltage signals.” *Id.* Accordingly, the controller 58 of the device 50 provides the identity network signal back to the PSE so that inline power may be provided. *Id.* at [0052]. Thus, Karam teaches limitation 7[a] through its disclosure of the PSE measuring current to determine the signature resistance (load) in the connected PD (device 50).



EX1007 at Fig. 4A.

146. The device 50 is also adapted to “act as a PSE device to determine if an attached device at a second connector 54 has an appropriate identity network so that inline power may be provided to it.” *Id.* at [0052]. The device 50 senses the identity network via current sensor R2SENSE. *Id.* at Fig. 4A, [0058]. If the device 50 does

not verify that the attached device can receive power, it may leave switches S1-S4 open, cutting off data and power to second connector 54. *Id.* Karam further explains that the controller 58 may keep switch S5 to third connector 56 closed “only when current [is] being drawn from third connector 56 so that if the device were unplugged from third connector 56 the power would turn off.” *Id.* at [0051]. Thus, Karam teaches limitation 7[a] through its disclosure of the device 50 acting as a PSE and measuring current to determine the signature resistance (load) in the PD(s) connected to connectors 54 and/or 56.

c. “extracting information from the first device based on the detected load current; and;” 7[b]

147. Karam also teaches this limitation. As explained above with respect to limitation 7[a] in this ground, the PSE extracts information from first device 50 via the detection and classification processes, and the device 50 similarly extracts information from PD devices coupled to connectors 54 and 56 via the detection and classification processes. *Supra* Section X.D.1.b. This information concerns whether the devices are “off or disconnected” (EX1007 at [0058]); whether a connected device is a “legacy” device that cannot receive inline power (*id.* at [0022]); and whether the PD requires *some* amount of power, the specific amount to be determined via the classification process (*id.* at [0018], [0021], [0065]).

d. “relaying power to the first device based on the extracted information;” 7[c]

148. Karam also teaches this limitation. Specifically, the discovery and classification procedures are used to determine whether a connected PD is adapted to receive inline power and whether the PD requires *some* amount of power, the specific amount to be optionally determined via the classification process, EX1007 at [0018], [0021], [0065]. For example, a class 1 device requires a maximum amount of 4.0 W of power. *Id.* at [0021]. The classification process is used to determine the “amount of Inline Power to allocate to the PD,” where “the PSE...[has a] finite amount of Inline Power resources available for allocation to coupled PDs.” *Id.* at [0018].

149. In operation, device 50 acts as a PSE with respect to a first device coupled to connector 54 “to determine if an attached device at a second connector 54 has an appropriate identity network so that inline power may be provided to it.” *Id.* at [0052]. The device 50 senses the identity network via current sensor R2SENSE. *Id.* at Fig. 4A, [0058]. If the device 50 does not verify that the attached device can receive power, it may leave switches S1-S4 open, cutting off data and power to second connector 54. *Id.*

150. Device 50 may also act as a PSE with respect to a first device connected to third connector 56. Karam explains that the controller 58 may keep switch S5 to third connector 56 closed “only when current [is] being drawn from third connector

56 so that if the device were unplugged from third connector 56 the power would turn off.” *Id.* at [0051].

e. “wherein the information extracted comprises information regarding whether the first device is powered on or powered off, and whether or not the first device needs a supply of power.” 7[d]

151. Karam teaches this limitation. As explained above, the PSE extracts information from first device 50 via the detection and classification processes, and the device 50 similarly extracts information from devices coupled to connectors 54 and 56 via the detection and classification processes. This information concerns whether the devices are “off or disconnected” (EX1007 at [0058]); whether a connected device is a “legacy” device that cannot receive inline power (*id.* at [0022]); and whether the PD requires *some* amount of power, the specific amount to be optionally determined via the classification process (*id.* at [0018], [0021], [0065].).

2. Claim 9: “The method of claim 7, further comprising: detecting removal of a device of the plurality of devices.”

152. Karam also teaches the limitations of claim 9. With respect to the system of Fig. 4A, Karam discloses that the PSE extracts information from first device 50 via the detection and classification processes, and the device 50 similarly extracts information from devices coupled to connectors 54 and 56 via the detection and classification processes. This information concerns whether the devices are “off

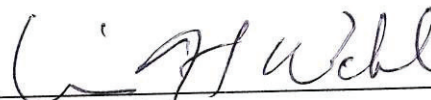
or disconnected.” EX1007 at [0058]. Karam further explains that “[r]emoval of the device coupled at third connector 56 removes the current drain which may...cause controller 58 to stop requesting inline power from the PSE coupled to first connector 52.” *Id.* at [0057]. Karam explains that the system removes power shortly after a device is disconnected to avoid a “hot cable” situation. *Id.* at [0058].

153. Karam’s removal procedure comports with the requirement in IEEE 802.3af for a PSE to stop providing power promptly after a device is removed. EX1006 at 99-100. This requirement is designed to prevent the PSE from continuing to provide power when a non-PoE device is connected to the PSE shortly after a PD is disconnected, which would not be a “pretty picture.” EX1014 at 18.

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

Dated:

Sept. 30, 2024


Eric Welch