

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMAZON.COM, INC. and AMAZON.COM SERVICES LLC,
Petitioner,

v.

COUNTERFLO AB,
Patent Owner.

IPR2023-00362
U.S. Patent No.: 8,791,829
Issued: July 29, 2014
Application No.: 11/885,697
Filed: March 6, 2006

Title: VISUALISATION ARRANGEMENT

DECLARATION OF GARY L. WOODS, Ph.D

AMAZON.COM, INC. ET AL.
EXHIBIT 1003

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I, Gary L. Woods, do hereby declare as follows:

I. INTRODUCTION AND ENGAGEMENT

1. My name is Gary Woods. I have been retained as an independent expert on behalf of Amazon.com, Inc. and Amazon.com Services LLC in connection with the above-captioned Petition for *Inter Partes* Review (“IPR”) to provide my analyses and opinions on certain technical issues related to U.S. Patent No. 8,791,829 (hereinafter “the ’829 Patent”).

2. I am being compensated at my usual and customary rate for the time I spent in connection with this IPR. My compensation is not affected by the outcome of this IPR.

3. Specifically, I have been asked to provide my opinions on the technological background or state of the art of the ’829 patent around its alleged priority date, the skills and knowledge of persons of ordinary skill in the art (“POSITAs”) in the field of the ’829 patent around its priority date, the teachings of prior art references considered by the above-captioned IPR, how POSITAs would have interpreted these prior art references, POSITAs motivations to make certain combinations of these references, and how these prior art references relate to patentability of the ’829 patent’s claims. Ultimately, I have been asked to provide my opinions regarding whether claims 1-17 (each a “Challenged Claim” and collectively the “Challenged Claims”) of the ’829 Patent would have been obvious

to a POSITA as of March 7, 2005. It is my opinion that each Challenged Claim would have been obvious to a POSITA after reviewing the prior art discussed herein.

II. BACKGROUND AND QUALIFICATIONS

4. I am an expert in the fields of electrical engineering, lasers, and fiber optics. In formulating my opinions, I have relied upon my training, knowledge, and experience in the relevant art. A copy of my curriculum vitae is filed as Exhibit No. 1004 and provides a description of my professional experience, including my academic and employment history, publications, conference participation, awards and honors, and more. The following is a brief summary of my relevant qualifications and professional experience.

5. My current primary employment is as a Distinguished Professor in the Practice in the Department of Electrical and Computer Engineering (ECE) at Rice University in Houston, Texas.

A. Educational Background

6. I earned my undergraduate degrees – BSEE and BA (Physics) – at Rice University in 1988. My graduate degrees are from Stanford University in Applied Physics – MS (1991) and Ph.D. (1997). My graduate research involved electro-optic effects in semiconductor devices. I have experience in optics, lasers, light-emitting diodes, electrical measurements, cryogenics, radio frequency devices, and fiber optics.

7. I was a postdoctoral fellow in the ECE Department at the University of California, Santa Barbara, from 1996-1998, where I worked on electro-optic effects in semiconductor devices and in atomic spectroscopy.

B. Industrial Career

8. From 1998-2008, I worked in industry in Silicon Valley. I worked at Intel Corp., using lasers and optics to debug integrated circuits; at Spectralane, a fiber-optic telecom company I co-founded; at Optonics (later acquired by Credence), a manufacturer of optical-probing equipment for integrated circuits; and as an independent consultant. During this time, I interacted with many people who would have met the definition of a person of ordinary skill in the art (POSITA) relevant to this patent. I discuss the definition of a POSITA in more detail in paragraphs 30-35 below.

C. Academic Career

9. In 2008, I joined the Rice University Dept. of Electrical and Computer Engineering (ECE) with the title of Professor in the Practice. Since 2009, this has been my primary employment. My work at Rice includes teaching various courses such as device physics, electronic circuits, senior design, and optics. I also participate in some research activities related to optics and to engineering education. My CV lists my publications. (Ex. 1004.) For the past few years, my title has been Distinguished Professor in the Practice.

10. Students have generally valued my performance as an instructor. I have twice won, and twice been a finalist for, the George R. Brown award for Superior Teaching, an honor based on the input of recent alumni given to the top 10 instructors University-wide.

11. My Electrical and Computer Engineering senior design (“capstone”) course lasts for an entire year and is integrated with its counterparts in the programs of BioEngineering, Mechanical Engineering, and Global Health. The students in all these courses work on projects, many interdisciplinary, that involve solving real-world engineering-design problems. I provide expertise and guidance to many of the senior teams and also to a few master’s-level design teams every year. My teams have won numerous national and international student-design awards over the years. (*See Ex. 1004.*)

12. Through my teaching, especially the senior design course, I maintain familiarity with the types of engineering problems and methods that are routinely employed by recent bachelor’s and master’s graduates in Electrical Engineering and related disciplines.

13. I am also the faculty mentor of the Rice Electric Vehicle Club. Through my involvement with them, which began in about 2011, I have maintained familiarity with electronics that are used in electric vehicles.

14. I am also significantly involved in the design of and recent updates to the Rice ECE Dept. curriculum and in the engineering accreditation process. I am thus intimately familiar with the Rice ECE curriculum and knowledgeable about the content of Electrical Engineering or similar programs at other universities.

III. MATERIALS CONSIDERED AND INFORMATION RELIED UPON REGARDING '829 PATENT

15. In preparing this declaration, I have reviewed the following materials bearing Exhibit Nos. that I understand are being referenced in the IPR to which my declaration accompanies:

LIST OF EXHIBITS

No.	Description
1001	U.S. Patent No. 8,791,829 (“the ’829 Patent”)
1002	File History of U.S. Patent No. 8,791,829
1005	International Publication No. WO 2005/052443 to Jablonski (“ Jablonski ”)
1007	U.S. Patent No. 7,324,006 to Godard (“ Godard ”)
1009	U.S. Patent Application Publication No. 2005/0146827 to Borden et. al. (“ Borden ”)
1011	U.S. Patent No. 7,233,086 to Borden et. al. (“ Issued Borden Patent ”)
1012	U.S. Patent Application Publication No. 2005/0124209 to Currie et. al. (“ Currie ”)
1014	U.S. Patent No. 7,019,658 to Erickson et. al. (“ Erickson ”)

No.	Description
1016	Excerpts from Rudolf F. Graf, <i>Modern Dictionary of Electronics</i> , Newnes (7 th ed. 1999) (“ Graf ”)
1017	Excerpts from <i>McGraw-Hill Dictionary of Electrical and Computer Engineering</i> , McGraw-Hill (2004) (“ Dictionary of Electrical and Computer Engineering ”)
1018	Excerpts from Julie K. Peterson, <i>Fiber Optic Illustrated Dictionary</i> , CRC Press (2003) (“ Peterson ”)
1019	Excerpts from Jacob Fraden, <i>Handbook of Modern Sensors</i> , Springer (3 rd ed. 2004) (“ Fraden ”)
1020	Excerpts from David R. Goff, <i>Fiber Optic Reference Guide</i> , Focal Press (3 rd ed. 2002) (“ Goff ”)
1021	Excerpts from Stephen H. Lampen, <i>Wire, Cable, and Fiber Optics for Video & Audio Engineers</i> , McGraw-Hill (1998) (“ Lampen ”)
1022	Excerpts from R.M. Marston, <i>Optoelectronics Circuits Manual</i> , Newnes (2 nd ed. 1999) (“ Marston ”)
1023	Excerpts from R.S. Popovic, <i>Hall Effect Devices</i> , Adam Hilger (1991) (“ Popovic ”)
1024	Excerpts from <i>Electrical, Measurement, Signal Processing, and Displays</i> , edited by John G. Webster, CRC Press (2004) (“ Webster ”)
1026	Allegro Microsystems ACS750xCA-050 Datasheet
1027	Triad Magnetics UL1560 Datasheet

IV. THE '829 PATENT

16. I have reviewed the specification, drawings, and claims of the '829 patent. (Ex. 1001.) As discussed below, I understand that the '829 patent is directed to visually indicating an electrical quantity through a conductor.

17. The '829 patent issued on July 29, 2014 from US national phase application No. 11/885,697 derived from PCT application No. PCT/SE2006/00283 filed on March 6, 2005 and published as WO2006/096115. I understand that the '829 patent claims priority to a Swedish patent application filed on March 7, 2005.

18. For purposes of this declaration, I have been asked to consider March 7, 2005 as the priority date of the '829 patent. However, I offer no opinions in this declaration as to whether the '829 patent is entitled to this priority date.

V. UNDERSTANDING OF PATENT LAW

19. I am not an attorney. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my opinions. My understanding of the law was provided to me by the Petitioner's attorneys.

20. I understand that when considering the scope of the claims of a patent that the patent claim terms should generally be given the ordinary meaning that the terms would have to a person of ordinary skill in the art in question after reading the patent as of the earliest claimed priority date.

21. I understand that the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the term appears, but in the context of the entire patent, including the specification. I further understand that the principal considerations regarding the scope and meaning of the claims are the plain language of the claim (including the surrounding claim language and context), the patent specification, and the prosecution history. I understand that while a claim is to be read in light of the specification, one must generally avoid importing limitations into the claim from the specification. I am also informed that the prosecution history can often inform the meaning of the claim by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it would otherwise be. I applied these understandings when considering the scope and meaning of the claims of the '829 patent.

22. I understand that a prior art reference anticipates an asserted claim, and thus renders the claim unpatentable, if all elements of the claim are disclosed in that prior art reference, either explicitly or inherently (i.e., necessarily present or implied).

23. I further understand that a claim is unpatentable if it would have been obvious. Obviousness of a claim requires that the claim would have been obvious from the perspective of a POSITA at the time the alleged invention was made. I

understand that a claim could have been obvious from a single prior art reference or from a combination of two or more prior art references.

24. I understand that an obviousness analysis requires an understanding of the scope and content of the prior art, any differences between the alleged invention and the prior art, and the level of ordinary skill in evaluating the pertinent art.

25. I further understand that a claim would have been obvious if it unites old elements with no change to their respective functions, or merely substitutes one element for another known in the field, and that combination yields predictable results. While it may be helpful to identify a reason for this combination, I understand that there is no strict requirement of finding an express teaching, suggestion, or motivation to combine within the references. When a product is available, design incentives and other market forces can prompt variations of it, either in the same field or different one. If a POSITA can implement a predictable variation, obviousness likely bars its patentability. For the same reason, if a technique has been used to improve one device and a POSITA would recognize that it would improve similar devices in the same way, using the technique would have been obvious. I understand that a claim would have been obvious if common sense directs one to combine multiple prior art references or add missing features to reproduce the alleged invention recited in the claims.

26. I understand that in considering obviousness, it is important not to determine obviousness using the benefit of hindsight derived from the descriptions found in the patent being considered.

27. I understand that other challenges to the patentability of a patent, including patent ineligibility, enablement, written description, and definiteness or clarity of claim language, cannot be raised in IPR proceedings before the Board.

28. I understand that Petitioner has the burden of proving unpatentability by a preponderance of evidence, which means that the claims are more likely than not unpatentable.

29. The analysis in this declaration is in accordance with the above-stated legal principles.

A. Person Of Ordinary Skill In The Art

30. I understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who has the experience and skills of a typical person working in the field of the alleged invention at the time the invention was allegedly made.

31. Around March 2005, I believe a person of ordinary skill in the art (POSITA) working in the field of the ’829 patent would have possessed a bachelor’s degree in Electrical Engineering or a related field plus two years of industry experience designing power electronics or, alternatively, would have possessed a bachelor’s and a master’s degree in electrical engineering or a related field.

Additional experience would have offset lesser education, and vice versa. For example, a person without an undergraduate degree in electrical engineering but with significant experience in the field could also qualify as a POSITA.

32. In my view, a POSITA would have at least the following knowledge and skills: (a) a working knowledge of electrical engineering gained from education and/or experience on the job, including: AC & DC power electronics, digital electronics, light emitting diodes, embedded software, and some basic fiber optics or optical communication; (b) the ability to read and understand data sheets for components used in building the circuits and systems relevant to the present patent; (c) the ability to write specifications related to products or subsystems in the present patent; (d) the ability to fill in gaps in knowledge by referring to existing products or to documents provided by manufacturers, such as application notes or reference designs; and (e) the ability to consult with other engineering team members if the POSITA encountered the need for specialized information.

33. I am confident in my assessment of the knowledge and skills of a POSITA in the fields relevant to the '829 patent in 2004 and early 2005. First, the ECE program at Rice instructs students in this material (some of it through my own classes). Two years of industry experience would solidify the knowledge of a recent bachelor's of science in electrical engineering ("BSEE") graduate and enable him or her to perform at the level described above. I know this because I have kept in touch

with many recent Rice ECE graduates and am familiar with their career paths and skill sets in the years following their graduation. Second, I am confident in my assessment of the relevant knowledge and skills of a POSITA during the relevant time frame because during my time in industry, I have interacted with many engineers who would have been POSITAs based on their knowledge and skills, as I have described.

34. I believe that the topics conventionally covered in undergraduate electrical engineering curricula would count as within the scope of the knowledge and skills of a POSITA. As I will describe below, there are several aspects of the '829 patent that would have been known to students freshly graduating with bachelor's in electrical engineering in 2004 or early 2005, even without significant industry experience.

35. Unless otherwise noted, my opinions in this declaration are based on the state of electrical engineering, fiber optics, and other relevant disciplines in early 2005 or before. My opinions apply the knowledge and skills of students graduating in electrical engineering or a related field and persons working in electrical engineering or a related field in 2004 or early 2005.

VI. TECHNICAL BACKGROUND

A. Explanation Of Relevant Technical Terms

Current

36. *Current* or *electric current* is the flow of electric charge. It is measured in units of Amperes (“amps”) that reflect charge flow per unit time. Almost always, the flow of electric charge is carried by sub-atomic particles called electrons. Electric charge can be conveyed by other means than electrons, including positive ions, negative ions, or “holes.” Those other means do not need to be discussed for purposes of analyzing the ‘829 patent, because it is concerned with measuring current flowing in wires, in which electrical current is predominantly carried by electrons. In electrical engineering, the amount of current flowing at a particular location is often denoted by the symbol *I*.

37. A representative definition of current is given in the 1999 publication of Rudolf F. Graft’s Seventh Edition of the *Modern Dictionary of Electronics*:

current – 1. The movement of electrons through a conductor. Current is measured in amperes, milliamperes, microamperes, nanoamperes, or picoamperes.

(Ex. 1016 at 165.)

38. Another representative definition is given in Julie K. Peterson’s 2003 publication of the *Fiber Optics Illustrated Dictionary*:

current (*symb.* – I) Movement of electrons through a conducting medium, usually expressed in amperes. Electricity moving through a wire or cable is current. See ampere.

(Ex. 1018 at 224.)

Conductors, Wires, And Cables

39. Materials like metals that are good at carrying current (that is, allowing the flow of electrons) are called conductors. Materials that do not readily allow current to flow are called insulators. Glass, most plastics, and rubber are examples of insulators.

40. Current usually flows in metal wires (often made of copper) that are good conductors. Wires are usually surrounded by an insulator to confine the current to within the wire.

41. Bundles of electrical wires are often called cables or cords. Electrical power cords, phone-charging cables, and car-battery jumper cables are all examples of cables that contain wires that carry current.

42. A representative definition of conductor is given by the 2004 publication of the McGraw-Hill Dictionary of Electrical and Computer Engineering:

conductor A wire, cable, or other body or medium that is suitable for carrying electric current. Also known as electrical conductor.

(Ex. 1017 at 111.)

43. Other representative definitions of conductor are given by Graf (*Modern Dictionary of Electronics*):

conductor – 1. A bare or insulated wire or combination of wires not insulated from one another, suitable for carrying an electric current. 2. A body of conductive material so constructed that it will serve as a carrier of electric current. [...] 4. A material, such as copper or aluminum, that offers low resistance or opposition to the flow of electric current. 5. A medium for transmitting electrical current. A conductor usually consists of copper, aluminum, steel, silver, or other material.

(Ex. 1016 at 145.)

Voltage

44. Voltage is the difference in energy between two electrons at different places in a circuit. Voltage is measured in units of Volts, which represents energy per unit charge.

45. A representative definition of voltage provided by Graf (*“Modern Dictionary of Electronics”*) is:

voltage – 1. Electrical pressure; i.e., the force that causes current through and electrical conductor. [or] 2. [...] The greatest effective difference of potential between any two conductors of a circuit.

(Ex. 1016 at 835.)

Circuits

46. For current to flow, there needs to be a complete conductive loop, or circuit, so that the current ends up returning to its original source. Otherwise, charge would accumulate at one location. Quickly it would become impossible to force additional current into that location due to the mutual repulsion of the charge accumulated at that location.

47. Graf (“Modern Dictionary of Electronics”) provides a number of relevant definitions of circuit, including:

circuit – 1. Path through which electrical signals flow. 2.
An electric path between two or more points [...] [and] 3.
A number of conductors connected together for the
purpose of carrying electrical current.

(Ex. 1016 at 116.)

Electrical Resistance And Impedance

48. For many electrical devices, there is a fixed ratio between the current and voltage flowing. Such devices are said to be resistors. The ratio of voltage to current is called the resistance: $R = V/I$. The units of resistance are Ohms. Even in cases where the ratio between voltage and current in a device is not exactly constant, electrical engineers still sometimes refer to the resistance of the device.

49. In a resistor of resistance R , if one knows any one of the current, voltage, or power (I , V , or P), then one can infer the remaining two quantities. For

example, $P = \frac{V^2}{R} = I^2 \times R = V \times I$; or $I = V/R$; or $V = I \times R$. Electrical power is defined in paragraphs 52-54 below.

50. There is a concept related to resistance called *impedance* that is used in the context of high-data-rate cables and circuits. Impedance (symbol Z) is also measured in Ohms. For purposes of this declaration, we can treat resistance and impedance as essentially equivalent.

51. A representative definition of impedance provided by Graf (*“Modern Dictionary of Electronics”*) is:

impedance – 1. The total opposition (i.e., resistance and reactance) a circuit offers to the flow of alternating current at a given frequency; the ratio of the potential difference across a circuit or element of a circuit to the current through the circuit or element...

(Ex. 1016 at 364.)

Electrical Power

52. Whenever there is current flowing through a difference in voltage, *electrical power* is also being absorbed or delivered. Power in general is measured in Watts, which represent energy per unit time. Electrical power absorption or delivery (denoted by P) is given by $P = V \times I$, where V is the voltage difference across some location in the circuit, and I is the current flowing through that location. (Ex. 1024 at 3-1.) This makes sense from analysis of the units in this equation:

$P[\text{Watts, or energy/time}] = V [\text{Volts, or energy/charge}] \times I [\text{Amperes, or charge/time}]$.

53. The chapter on “Power Management” by Pasquale Arpaia et. al. in John G. Webster’s 2004 anthology on *Electrical Measurement, Signal Processing, and Displays* provides as a general definition that “electrical power is the electrical work or energy dissipated per unit time.” (Ex. 1024 at 3-1.)

54. Another reasonable definition of power is provided by Graf (“*Modern Dictionary of Electronics*”):

power – 1. The energy dissipated in an electrical or electronic circuit or component that is conducting either ac or dc.

(Ex. 1016 at 581.) “AC,” alternating current and “DC,” direct current, are further explained in paragraphs 59-62, below.

55. From the definition of power, it is clear that if current is flowing through a voltage difference, then nonzero electrical power is being delivered. Likewise, if nonzero electrical power is being delivered, then necessarily both a current and a voltage difference are present. In other words, if $P \neq 0$, then it must be the case that both $I \neq 0$ and $V \neq 0$. Thus, there is an inextricable linkage among voltage, current, and power.

56. In any operating circuit, there is necessarily some power delivered from the source to the receiver. This is obviously true when the circuit is driving a

receiver, such as a motor or a light-emitting diode, that necessarily requires power in order to operate. Even in the case where a data signal is being sent over a cable from a source to a separately-powered receiver, the circuit in the cable still necessarily provides voltage, current, and power to the receiver.

57. Thus, under the definition from Webster above, a signal sent to a receiver would consume electrical power because “electrical work or energy [is] dissipated per unit time” that the signal is sent. (Ex. 1024 at 3-1.)

58. *Stephen H. Lampen’s* 1999 publication of *Wire, Cable, and Fiber Optics for Video & Audio Engineers* provides the example of a light bulb that is turned on-and-off or flashed in Morse code. The flashing of the lightbulb transmits a signal but the light bulb itself also consumes electrical power by converting it into heat and light. (Ex. 1021 at 2-5.)

Alternating Current (AC) And Direct Current (DC)

59. Direct current (DC) means that there is a voltage applied to a receiver that has a constant sign and small variations over time (e.g., always about +5 Volts). The corresponding current flowing to the receiver also has the same sign (direction of flow). A representative definition of direct current from around the ’829 patent priority date is provided by McGraw-Hill’s 2004 publication of *Dictionary of Electrical and Computer Engineering*:

direct current Electrical current that flows in one direction only, as opposed to alternating current. Abbreviated dc.

(Ex. 1017 at 162.)

60. Alternating current (AC) means that a voltage source is oscillating in time like a sine wave. The average value of an AC voltage is zero, but its peak amplitude can be large. A circuit carrying an AC signal delivers much of its power near the peaks of the sinewaves, when voltage (and usually current) are maximized. A representative definition of alternating current is provided by McGraw-Hill's 2004 publication of *Dictionary of Electrical and Computer Engineering*:

alternating current Electrical current that reverses direction periodically, usually many times per second. Abbreviated ac.

(Ex. 1017 at 15.)

61. The power supplied by alternating current at a particular instant in time is called the instantaneous power, and is a function of the instantaneous voltage and the instantaneous current: $p(t) = v(t) \times i(t)$. (Ex. 1024 at 3-3.) Over time the power provided by alternating current may be expressed as the mean value of instantaneous power integrated over a defined time interval. (Ex. 1024 at 3-3.)

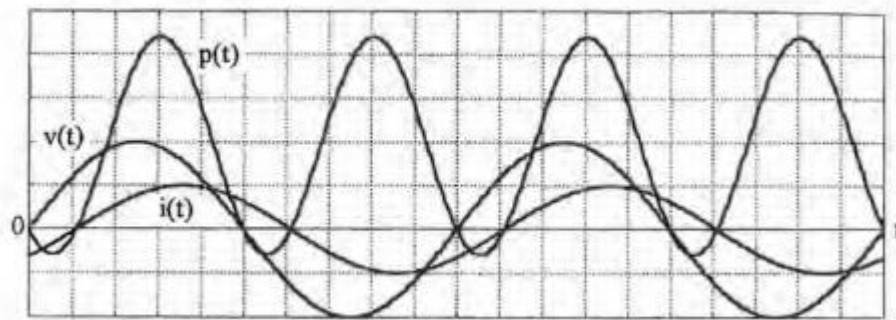


FIGURE 3.4 Waveforms of instantaneous power (p), voltage (v), and current (i).

(Ex. 1024 at 3-5.)

62. The power grid essentially all over the world uses AC power, which oscillates at either 50 Hz or 60 Hertz (cycles per second) depending on the country. When electrical engineers refer to the voltage and current in an AC signal, they usually are referring to the so-called “root-mean-squared (RMS)” amplitude of voltage or current signals. (Ex. 1024 at 4-1 through 4-2.) Even though the sinusoidal voltages and currents in an AC signal are oscillating at 50-60 times per second, the RMS amplitudes typically are relatively slowly varying. Electrical instruments that report voltage or current in an AC power signal usually report this RMS amplitude.

63. In the ‘829 patent and in the prior art I will discuss below, both AC and DC power are mentioned. For either AC or DC voltages, finite current flows whenever power is delivered.

Light Emitting Diodes (LEDs)

65. Light-emitting diodes (LEDs) are small, solid state electrical devices that emit light when current flows through them in one direction. (See Ex. 1022 at 24.)

66. For example, a representative definition of light-emitting diode provided by Graf (*Modern Dictionary of Electronics*) is:

light-emitting diode – Abbreviated LED. A pn junction that emits light when biased in the forward direction.

(Ex. 1016 at 422.)

67. LEDs are highly efficient, requiring small voltages (a few volts at most) and currents (a few milliamps are often sufficient) to generate readily visible amounts of light. Virtually all undergraduate electrical engineers learn to use LEDs in their studies. For example, R.M. Marston's 1999 *Optoelectronics Circuits Manual* describes LEDs as "the most important and widely used of all modern optoelectronic devices." (Ex. 1022 at 23.)

68. An additional representative definition of light-emitting diode provided by Peterson (*Fiber Optics Illustrated Dictionary*) is:

light-emitting diode LED. An inexpensive semiconductor p-n junction structure used in many electronic displays, particularly small ones. The LED lights up when current is provided. LEDs are common in

digital clocks, calculators, microwave readouts,
electronics instrument displays, and much more.

(Ex. 1018 at 586.)

69. A device, such as an LED, that emits light when current flows through it is called “electroluminescent.” Reasonable definitions of electroluminescent provided by Graf (*Modern Dictionary of Electronics*) are:

Electroluminescence – 1. Luminescence resulting from a high-frequency discharge through a gas or from application of an alternating current to a layer of phosphor.
2. Direct conversion of electrical energy into light energy in a liquid or solid; for example, photoemission as a result of electron-hole recombination in a pn junction....

(Ex. 1016 at 240.)

70. LEDs are generally covered under the second definition of “electroluminescence” from Graf (*Modern Dictionary of Electronics*), as recited in paragraph 69 above. For example, David R. Goff’s 2002 publication of the *Fiber Optic Reference Guide* discusses light-emitting diodes as “several layers of p-type and n-type semiconductors” with “[a] p-n junction [that] generates the photons.” (Ex. 1020 at 62.) Additionally, the chapter on Light-Emitting Diodes by Mohammad A. Karim in John G. Webster’s 2004 anthology on *Electrical Measurement, Signal Processing, and Displays* discusses the luminescence process of LEDs as electroluminescence. (Ex. 1024 at 35-1.)

71. I also note that an LED's conversion of "electrical energy into light energy" as described in the second definition in paragraph 69 above is an example of providing electrical power as defined in paragraphs 52-53 above.

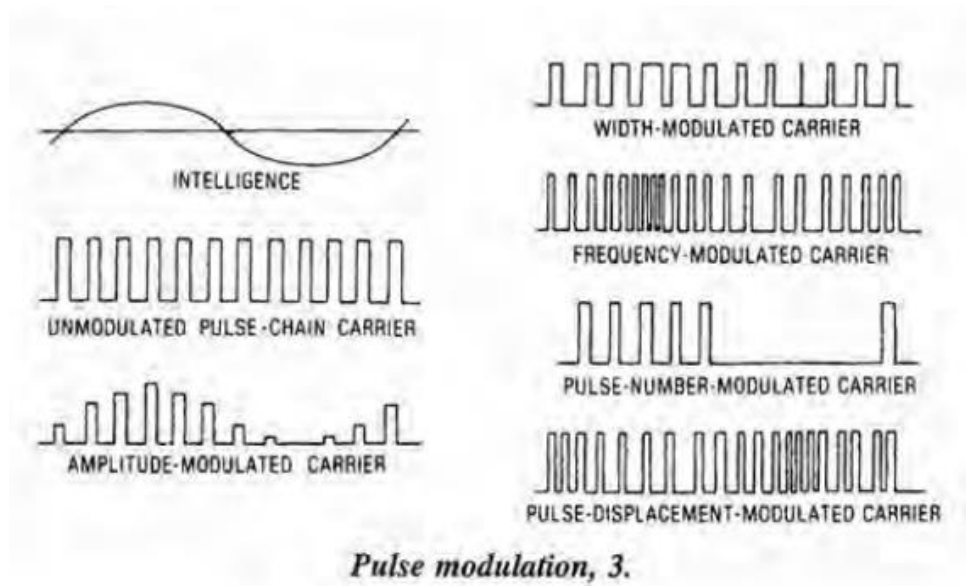
Pulse-Width Modulation

72. Pulse-width modulation is also called pulse-duration modulation. (Ex. 1016 at 601.) A representative definition provided by Graf (*Modern Dictionary of Electronics*) is:

pulse-duration modulation – Abbreviated PDM. Also called by the less preferred terms pulse-width modulation and pulse-length modulation. 1. Pulse-time modulation in which the duration of a pulse is varied.

(Ex. 1016 at 559.)

73. Pulse width modulation ("PWM") changes the duration of pulses at a set frequency. Of the various pulse-modulation schemes shown below, the "width modulated carrier" is the PWM representation of the "intelligence" waveform. For instance, the "duty cycle" (see paragraph 75 below) is higher at the beginning of the PWM waveform, just as the "intelligence" waveform has its highest amplitude at that point.



(Ex. 1016 at 600.)

74. A pulse width modulator is a device that produces PWM pulses, Peterson (*Fiber Optics Illustrated Dictionary*) provides a representative definition:

pulse width modulator PWM. An electronic circuit that can be configured to produce a pulse with desired characteristics (periods, cycles, etc.). [...] A PWM can be used for a variety of purposes, including device control (DC motors and servos), power bridge switching, light intensity control, and the modulation of transmission signals.

(Ex. 1018 at 768-69.)

75. As further discussed in Graf (*Modern Dictionary of Electronics*) the duty cycle of a PWM signal is: “**duty cycle** – 1. Ratio of working time to total time for intermittently operated devices.” (Ex. 1016 at 225.) In the context of pulse width

modulation, the “[r]atio of the length of any pulse to its total period.” (Ex. 1016 at 600 (“**pulse ratio**”).)

76. Sometimes an electrical engineer needs to deliver a continuously variable amount of voltage, current, or power to a receiver. With modern digital electronics, it is far more convenient to turn a signal on and off many times per second using PWM than to continuously vary the voltage, current, or power. The average voltage, current, or power delivered to the receiver is then proportional to the duty cycle of the PWM signal. With modern electronics, the duty cycle of the PWM signal can easily be made to vary continuously between 0% and 100%.

77. The average power P_m delivered by a pulse waveform, such as a PWM waveform, is related to the peak power P_p within a single pulse by the duty cycle T_d :

$$P_p = \frac{P_m}{T_d}. \text{ (Ex. 1024 at 3-30.)}$$

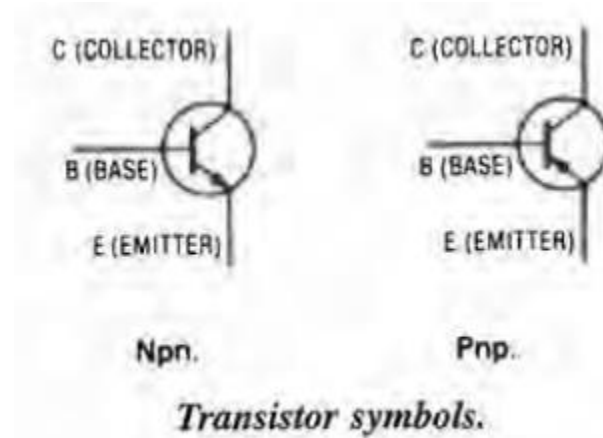
78. A transistor is an electrical switch. A representative definition of a transistor is provided by Graf (*Modern Dictionary of Electronics*):

transistor – [...] 2. A tiny chip of crystalline material, usually silicon, that amplifies or switches electrical current. It is a three-terminal semiconductor device. A small current (base current) applied to one terminal can control a larger current (collector current) between the other two terminals.

(Ex. 1016 at 795.)

79. As noted by Graf (*Modern Dictionary of Electronics*), circuit diagrams represent transistors with the following symbols:

transistor symbols – Symbols used to represent transistors on schematic diagrams.



(Ex. 1016 at 795.) In this figure, there is a base terminal that receives a small amount of base current, which controls the transmission of a much larger current between a collector terminal and an emitter terminal.

80. One example of pulse-width modulation is a light-emitting diode (LED) lightbulb controlled by a transistor drive circuit. The LED is connected to a voltage source in series with a transistor. A digital signal applied to the base of the transistor turns the transistor on or off. When current passes from the collector terminal of the transistor to the emitter terminal of the transistor the LED is on and when this current is interrupted the LED is off. The transistor and LED are then switched on and off many times per second (maybe thousands of times per second).

David R. Goff's 2002 *Fiber Optic Reference Guide* discusses several examples of LED driver circuits with transistors controlled by a signal (*e.g.*, "data in"). (Ex. 1020 at 64.) A PWM signal is applied to the base terminal of the transistor such that the duty cycle of the PWM signal determines the duration that current and voltage flow through the transistor each cycle, and, thereby, the duration that the LED is on each cycle.

81. The human eye can only perceive flashes that are separated by at least 20 milliseconds. (Ex. 1022 at 35-36.) In other words, at a 50% duty cycle, the human eye can only see flashing at a rate slower than about 25 Hz. If an LED flashes faster or if the duty cycle is greater, such that on-pulses are separated by less than 20 milliseconds, the human eye will perceive the LED as always on, but with a brightness that depends on the width of the driving pulses (or, equivalently, the duty cycle.) This is called the "persistence of vision effect period" and occurs after the end of a light pulse. (Ex. 1022 at 36.)

82. When LEDs are flashed faster than the human eye can perceive, their intensity (*i.e.*, brilliance) is perceived according to the fraction of time they are on versus the fraction of time they are off. (As noted above in paragraph 75, this fraction of time is known as the "duty cycle" or "duty ratio".) For example, when LEDs are flashed at a rate of 250 Hz (or every 4 milliseconds) the human eye will perceive a

brightness that depends on the fraction of time that the voltage is in the “on” rather than “off” state.

83. Typically, PWM-controlled LEDs, like strings of LED lights with dimmer switches, flash at hundreds to thousands of hertz (i.e., kilohertz, kHz).

Phantom Power

84. Phantom power is a term for a technique in which a cable carries both DC power for powering a remote device, and also a signal from the remote device back to the source. This is a common technique that has been used for many decades in the audio community to power microphones. An example of phantom power from modern computer networking is the arrangement of network cables such as Ethernet cables to carry DC power in addition to information (in which case the technique is known as “Power over Ethernet (PoE)”.

Optical Fiber

85. For purposes of this declaration, an optical fiber is a substantially transparent, cord-like structure which transmits light along its length. A light source is coupled into an end face of the fiber. Light from the light source then travels down the fiber, conveying information signals. Typically, fibers are made from glass or else transparent polymers. The McGraw-Hill *Dictionary of Electrical and Computer Engineering* provides a similar, succinct definition of optical fiber: “A long, thin

thread of fused silica, or other transparent substance, used to transmit light. Also known as light guide.” (Ex. 1017 at 404.)

86. For many applications, fibers are designed to prevent essentially any light at all from escaping through the sides of the fiber. In such fibers, light can travel for distances of many kilometers with minimal loss of light. This type of fiber is used, for example, in undersea data cables thousands of kilometers long through which much of the world’s internet traffic flows.

87. In some applications which are relevant to the technologies I discuss in this declaration, the fiber is intentionally designed to allow the scattering out of a small amount of light per unit length. This means that one could shine a single light source (such as an LED) into the end face of such a fiber. The light from the LED then scatters laterally out of the fiber over a distance of perhaps a few inches to a few feet or more. This way, the light from a single LED could be spread over a fairly large area.

VII. STATE OF THE ART

A. Knowledge And Skills Of POSITAs Before March 2005

88. The ‘829 patent does not describe in any detail how to use components and subsystems to design systems embodying the alleged invention of the ‘829 patent.

89. As I will explain below, it is my opinion that each of the '829 patent's allegedly inventive elements were already known to POSITAs before the patent's alleged March 2005 priority date. In these sections, I refer to patent documents which I will describe in more detail later in this declaration.

B. Minimal Changes In The Relevant Art Since Before 2005

90. My teaching career began in 2008. Based on my experience in academia and in industry, skilled artisans would have had the skills and knowledge discussed in paragraph 32 above at or even well before the 2005 priority date and would have known how to apply these skills to enable: Embedded control; LED lighting; current, voltage and power measurement; visual display and illumination, including by transferring light to an optical fiber; and the use of cables for transmission of alternating and direct current.

91. Electrical Engineering and related fields have rapidly evolved in recent decades and continue to rapidly evolve. However, the technologies necessary to enable the '829 patent's alleged invention were well established long before its priority date.

92. For example, programmable integrated circuits known as microcontrollers were rapidly improving from the 1990s (and even earlier) through 2005 and even much later. By the timeframe of 2004 or early 2005, simple and compact microcontrollers capable of implementing the functions described in the

'829 patent and other prior art references were available commercially. Use of such microcontrollers was widely taught in undergraduate electrical engineering curricula.

Current Sensors

93. There are many methods to measure current in an electronic circuit without significantly perturbing the current being measured. Several of these methods would have been known to a POSITA at the time of the priority date for the '829 patent.

94. The simplest method for measuring current is to use a simple current-viewing or current-sensing resistor to generate a voltage proportional to the current. A current-sensing resistor can work with AC or DC currents. For example, Graf (*Modern Dictionary of Electronics*) discusses a current-sensing resistor as:

current-sensing resistor – A resistor of low value placed in series with a load to develop a voltage proportional to the output current.

(Ex. 1016 at 166.)

95. This method has been taught in undergraduate circuits courses for probably as long as electrical engineering has been a recognized discipline, and any POSITA would understand how to use it.

96. A slightly more sophisticated current-viewing resistor is called a Kelvin-connected resistor. Kelvin-connected resistors are used when a large current

has to be measured accurately. Some of my undergraduate students have used Kelvin-connected resistors in my courses. Kelvin-connected resistors are commonly available from major electronics distribution companies. I believe a POSITA would have known how to find such a component and to learn its proper employment. I regularly discuss the Kelvin technique when discussing electronic design with my undergraduate students.

97. Another method to measure current is to use a Hall-effect sensor. A Hall-effect sensor can generate a voltage proportional to the current in a nearby electrical wire. A Hall-effect sensor can work with AC or with DC currents. Hall-effect sensors are also widely used in motor-control applications, both for measuring current delivered to a motor, and for measuring the revolutions per minute (RPMs) of a rotating motor or shaft. Undergraduates are likely to learn about Hall-effect sensors in courses on motor control. An example in the prior art of the use of Hall-effect sensors is shown in the Godard patent (Ex. 1007 at 4:39-65, Fig. 3.) They are also explicitly mentioned in contemporaneous reference books such as Graf, which discusses a Hall-effect generator/sensor:

Hall-effect generator – Also called Hall sensor. 1. A magnetic sensor using the Hall effect to give an output voltage proportional to magnetic field strength.

(Ex. 1016 at 337.)

98. For example, as discussed by Godard, the Allegro Microsystems ACS750 was a commercially-available Hall-effect sensor available for current sensing implementations by Godard's October 7, 2004 filing date. (Ex. 1007 at 4:50-54.) Indeed, the Allegro Microsystems ACS750xCA-050 datasheet has a 2003 copyright. (Ex. 1026.) This datasheet describes the ACS750 as a "family of current sensors [that] provides economical and precise solutions for current sensing in industrial, commercial, automotive, and communications systems." (Ex. 1026 at 1.)

99. Another method to measure current relatively non-invasively is to use a so-called "current transformer" to convert the magnetic field surrounding a current-carrying wire into a voltage that can be measured by a separate circuit. Graf (*Modern Dictionary of Electronics*) discusses current transformers as:

current transformer – A transformer, intended for measuring or control purposes, designed to have its primary winding connected in series with a circuit carrying current to be measured or controlled.

(Ex. 1016 at 166.) Current transformers only work with AC currents.

100. Current transformers were well known and commercially available before the priority date of the '829 patent. For example, the Borden publication (Ex. 1009) incorporates current transformers in a design. Specifically, figure 9 of Borden shows an embodiment that includes six current sensors 44 (Ex. 1009, Fig. 9; *see also* Ex. 1011, Fig. 9 ("Borden Patent Fig. 9")). One example of a commercially available

current transformer that a POSITA would have been able to incorporate into a 2004 or early 2005 design was a Triad Magnetics UL1560 Current Sense, Low Frequency Transformer. (Ex. 1027.) The Triad Magnetics UL1560 datasheet provides that it could “monitor current from 0.1 to 30 amperes at frequencies from 50 Hz to 400 Hz. (Ex. 1027 at 1.)

101. Additionally, the chapter on Current Measurement by Douglas P. McNutt in John G. Webster’s 2004 anthology on *Electrical Measurement, Signal Processing, and Displays* provides that “CTs [(current transformers)], shunts, and some other sensors are commodity items available from a variety of manufacturers and distributors.” (Ex. 1024 at 2-13.) The chapter then provides a table with 24 different sources for current sensors, including names of manufacturers and distributors, addresses, emails, websites, and phone numbers. (Ex. 1024 at 2-13 through 2-16.) For example, this list includes F.W. Bell and Honeywell Inc. which are described as offering Hall-effect-based current sensors in 2004. (Ex. 1024 at 2-14, 2-15.)

Visual Display Of Current Measurements Using LEDs

102. Using LEDs to display information has been known since the 1970s at least. For instance, virtually everyone is familiar with various electronic devices that, when plugged into a wall, have one or more LEDs to indicate status such as “power on”, “charging”, “error detected”, and so on. (*See e.g.*, Ex. 1022 at 24-31.)

103. Using collections of LEDs to display characters or numbers has also been known since the 1970s. Many people who have been around since the 1970s probably recall using calculators that had red LED displays. Use of those formerly ubiquitous 7-segment LED character displays has been part of undergraduate electrical engineering curricula since the 1980s, and any POSITA would understand how to use them to display any desired quantity, including electrical current.

104. A POSITA would have known how to use LEDs for displaying a measured current before March 2005. For example, LEDs and corresponding circuits are described by R.M. Marston's 1999 publication of *Optoelectronics Circuits Manual* (Ex. 1022 at 24-40) and by David R. Goff's 2002 *Fiber Optic Reference Guide* (Ex. 1020 at 62-66). The use of LEDs for display is further discussed in the chapter on Light-Emitting Diode Displays by Mohammad A. Kim in John G. Webster's 2004 anthology on *Electrical Measurement, Signal Processing, and Displays*. (Ex. 35-1 through 35-10.)

Illumination Along A Cable

105. Illumination along a cable by a side-emitting fiber was well-known in the art by the priority date of the '829 patent, which itself states that the prior art included illumination along a cable. (Ex. 1001 at 1:23-31.) Additionally, both Jablonski and Currie disclose illuminating the length of cable for safety,

informational and decorative purposes. (*E.g.*, Ex. 1005 at 5:5-23, 9:6-21; Ex. 1012 at [0029], [0048].)

106. For example, the Jablonski reference discloses illuminating the length of a cable with a linear lighting element that may be a side-scattering optical fiber or light guide or an electroluminescent wire for decorative or informational purposes. (*See, e.g.*, Ex. 1005 at 10:32-11:13.)

107. The Currie reference also describes the illumination of a cable by means of coupling the light from an LED via a lens into an outer, translucent jacket of a cable. (*E.g.*, Ex. 1012 at [0052]-[0053].) Side-emitting optical fiber systems for illumination were already commercially available by the priority date of the '829 patent.

108. Illumination using electroluminescent strands or tapes was also well established before the priority date for the '829 patent. In fact, the '829 patent explicitly refers to this as prior art. (Ex. 1001 at 1:58-60.) Jablonski also mentions embodiments involving electroluminescent tapes or wires. (Ex. 1005 at 11:9-31, 24:29-26:2, Fig. 11.)

Coupling Of Light Via A Lens Into An Optical Fiber

109. Coupling light via a lens into an optical fiber was well known in the art prior to the priority date of the '829 patent. I am quite familiar with such techniques, as I was the co-founder of a startup company (Spectralane) that manufactured

subsystems for use in optical-fiber-communication systems. I worked for Spectralane from 2000 through the end of 2002. During this time, I was well acquainted with people whose background matched that of a POSITA as I described above. These people were very knowledgeable about fiber optics, including coupling light into a fiber using a lens.

110. Coupling light from LEDs into and out of fibers using lenses or directly contacted couplers was a well-known technique before March 2005. For instance, R.M. Marston's 1999 *Optoelectronic Circuits Manual* shows the pattern of light output from an LED (Ex. 1022 at 26), how to collect this light using lenses (Ex. 1022 at 164-165) and how to couple light with optical fibers (Ex. 1022 at 167-168), including feeding a series of light beams into the butt-end input of a glass rod representing an optical fiber using a focusing lens. (Ex. 1022 at 172.)

111. Currie also discloses using a lens to couple light from an LED into a scattering fiber-like light-guide. (Ex. 1012 at [0052]-[0053], [0057], [0060], [0067].)

112. I believe a POSITA with only minimal experience in optics would have been able to design such a side-emitting fiber-illumination system.

Programming A Microcontroller

113. Programming a compact, embedded microcontroller integrated circuit has been a part of standard electrical engineering curricula for decades. A microcontroller would be sufficient to perform the functions required by the '829

patent or those described in Jablonski (Ex. 1005) or Borden (Ex. 1009). The requisite measurements, calculations, and outputs need only happen on the time scale of roughly 1000 times per second or less, and are well within the abilities of microcontrollers that have been commercially available since at least the late 1990s. Any POSITA would have known how to program a microcontroller chip to interpret signals from a current sensor and generate signals that control illumination to visually display measured current as discussed in Jablonski or Borden.

VIII. PRIOR ART REFERENCES

A. The Jablonski Reference

114. I understand that the Jablonski patent application was filed in November 26, 2004, and I have been asked to consider Jablonski to be prior art as of this date.

115. The Jablonski patent disclosure (Ex. 1005) (“Jablonski”) describes illuminating a cable that carries an electrical signal, in which the illumination provides some information about the signal in the cable. The illumination should be visible from the side of the cable. The pattern of illumination could vary in pulse rate, brightness, or color (or other properties) to create a “pleasing display that can complement the music or other sounds played” (Ex. 1005 at 2:8).

116. Indeed, Jablonski first considers exemplary applications involving audio cables (Ex. 1005 at 9:28, 2:1-6) such as a cable running from an electric guitar

to the input of an amplifier, or a cable running from the output of an amplifier to a speaker.

117. Jablonski also considers the case where the signals in the cable could carry digital information from, for example, a computer or a game controller. (Ex. 1005 at 2:9-15.)

118. The cable can also carry signals conveying both information (such as audio signals) and sufficient electrical power to support the illumination, as is the case with phantom power. (Ex. 1005 at 4:22-25.) The cable could also be used just as an illuminator without any separate electrical signals present inside it. (Ex. 1005 at 10:1-5.) Jablonski also considers the possibility that the cable could convey signals using light and optical fibers rather than electrical wires. (Ex. 1005 at 2:16-20.)

119. A POSITA would know that every embodiment considered by Jablonski that comprises electrical signals also necessarily involves current and power flow, as I explained above in paragraphs 51-57.

120. Jablonski discloses numerous aspects to embodiments of illuminated cables. Some of the aspects involve using a computer chip embedded in the connector at one end of the cable in order to control the flashing of the lights. (Ex. 1005 at 18:8-13.) Others involve using different types of lighting technologies, such as light-emitting diodes (LEDs) plus side-emitting optical fibers, or else

electroluminescent wires. (Ex. 1005 at 5:27-29, 14:7-10, 11:3-8.) Others involve: the controller harvesting power for illumination from the signals in the cable; an add-on attachment to convert any cable into an illuminated cable; and measuring the strength of the signals in the cable via direct electrical contact or by non-contact means such as inductive coupling. (Ex. 1005 at 4:22-25, 5:10-16, 15:8-11.)

121. Jablonski also discusses numerous ways of modulating the illumination based on signals in a cable. For example, the controller-directed illumination could change colors or pulsation rate based on the beat of the audio signal of a song being carried in the cable, or based on pressing certain buttons on a game controller. (Ex. 1005 at 2:21-28, 3:15-20.) The modulation of the illumination could also provide practical information, such as speed of data transfer. (Ex. 1005 at 2:32-33.)

B. The Currie Reference

122. The Currie publication (Ex. 1012) (“Currie”) addresses the problem of illuminating an electrical power cord along its length for purposes of safety or for indication of the state of power flowing in the cable. Currie considers several ways to illuminate the length of various electrical cords with either an internal or external light source. Embodiments with an external light source include both a wall outlet with LEDs positioned to shine into connected electrical cords and a power strip/distributor with LEDs positioned to shine from the power strip into connected electrical cords. (Ex. 1012, [0066], Fig. 5, [0075], Fig. 8.)

123. Currie considers illumination of a cable with a translucent outer covering from one end by a light source such as an LED. Currie considers a focusing lens to transfer light from an internal or external light source onto the illuminating cover, sleeve, or sheath of an associated electrical cord. (Ex. 1012, [0052]-[0053], [0057], [0060], [0067].) As discussed in paragraphs 109-110 and 112 above, a POSITA would recognize that similar lenses are used to transfer to and from fiber optic cables.

124. One of Currie's embodiments considers illuminating an auxiliary power cord that terminates in a jack-type connector plug. (Ex. 1012, [0057], [0059].) Currie illustrates this auxiliary power cord in figures 1c and 1d and contemplates that it powers at least a transformer and LED. (Ex. 1012, [0058], Fig. 1c, Fig. 1d.) A POSITA would recognize similarities between the auxiliary power cord discussed in Currie and the signal line discussed and illustrated in Jablonski. (*Compare* Ex. 1012, Fig. 1c; *with* Ex. 1005, Fig. 4.)

C. The Godard Reference

125. The Godard patent (Ex. 1007) ("Godard") discloses several embodiments for measuring electrical quantities such as power, current, and voltage, in devices such as power strips, power cords, and power cord adaptors. The measured electrical quantities are then displayed through a (possibly remote) display unit.

126. Each embodiment in Godard includes a current sensor for detecting current flow through the power supply cord. (Ex. 1007 at 1:57-60, 2:61-64, 3:13-16.) For this purpose, Godard discloses a current sensing module which includes, for example, a Hall effect sensor. (Ex. 1007 at 4:29-46.) Godard discusses the Allegro MicroSystems ACS750 as one example of a suitable Hall sensor for detecting current through a power supply cord. (Ex. 1007 at 4:50-54.)

127. Godard discloses some embodiments that contain a current sensor electrically coupled with wires transferring electricity through the cord or adaptor and detecting the flow of current therein. (Ex. 1007 at 2:58-64, 3:6-16, 6:11-24, 6:29-40.) A POSITA would have known how to mount and electrically couple a current sensor to detect the current flow through a power cord as discussed in Godard.

128. Figure 3 of Godard has been annotated for clarity:

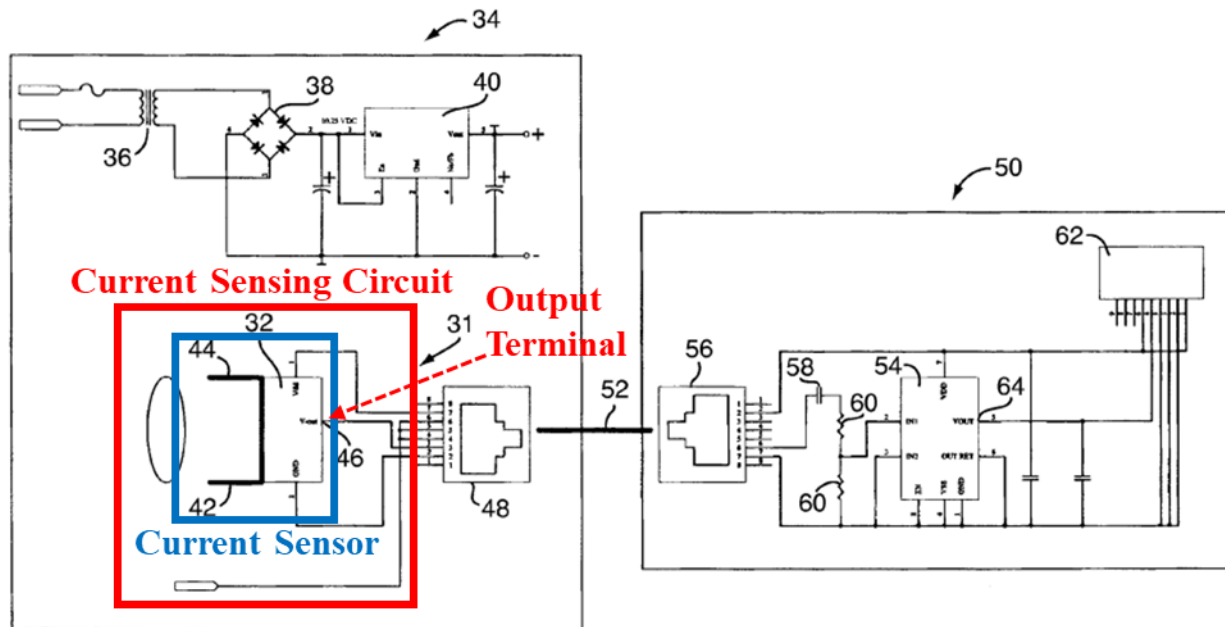


FIG. 3

Ex. 1007, Fig. 3 (annotations added)

I confirm that these annotations are accurate.

D. The Borden Reference

129. The Borden reference (Ex. 1009) (“Borden”) describes a circuit for conditioning the AC power delivered from an AC outlet to multiple AC plug sockets that can provide power to downstream devices. Conditioning in this context means generating a desired voltage and current rating within some acceptable limits on quantities such as noise delivered to the downstream devices, noise radiated upstream of the conditioner, or immunity to voltage surges from the AC outlet. The embodiments discussed in Borden comprise circuits for measuring the current delivered to a downstream device and displays for reporting said current.

130. Borden appears to use current transformers as its current-sensing elements [Fig. 9, devices 44 whose output signals are labeled “CT-V”]. The signal representing the current measurement is then filtered to remove noise, then digitized by a microcontroller. One or more microcontrollers then generate pulse-width modulated signals which are delivered to LED driver circuits and thence to LEDs (labeled LED1-LED3 in Fig. 8).

131. The microcontroller in Fig. 8 of Borden appears to be from the popular PIC series, which was manufactured by Microchip, Inc. PIC-series microcontrollers were generally compact, power-efficient, and capable of delivering the simple calculations needed for displaying current measurements via, for example, an LED digital display or PWM brightness-modulation of an LED. A POSITA would have known how to use such microcontrollers as disclosed in Borden.

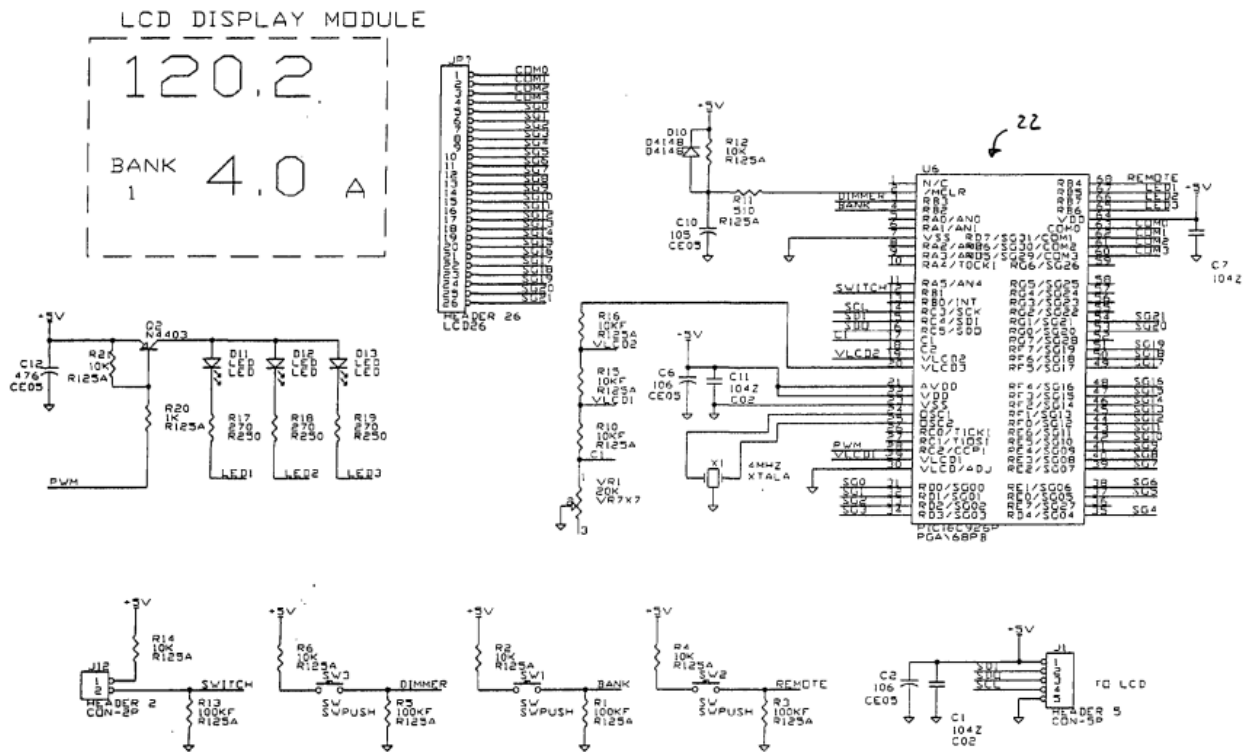


FIG. 8

(Ex. 1009, Fig. 8.)

132. The microcontroller in Fig. 8 of Borden appears to send a pulse-width modulated signal (labeled “PWM”) to a transistor circuit that drives 3 LEDs. As discussed in paragraphs 80-82 above, the intensity (*i.e.*, brightness) of these LEDs would correspond to the PWM signal. While the “high-side” transistor drive circuit in Borden Fig. 8 is somewhat different from the drive circuits discussed in David R. Goff’s 2004 *Fiber Optic Reference Guide*, the functionality of driving an LED according to a data input is similar. (Ex. 1020 at 64-65.) A PWM signal reflecting

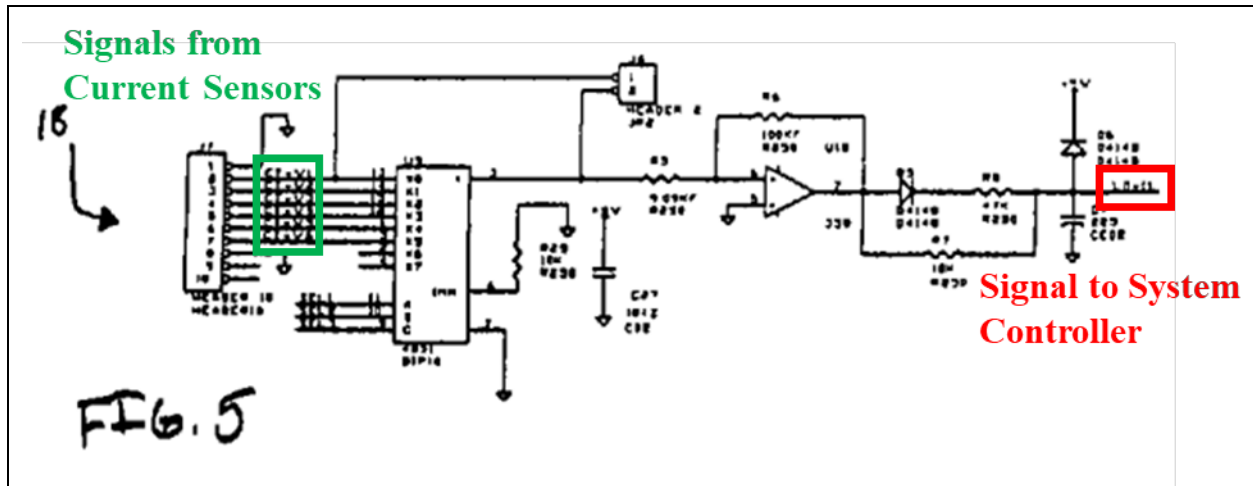
current measurements would cause the intensity (*i.e.*, brightness) of driven LEDs to coincide with measured current.

E. The Borden Figures

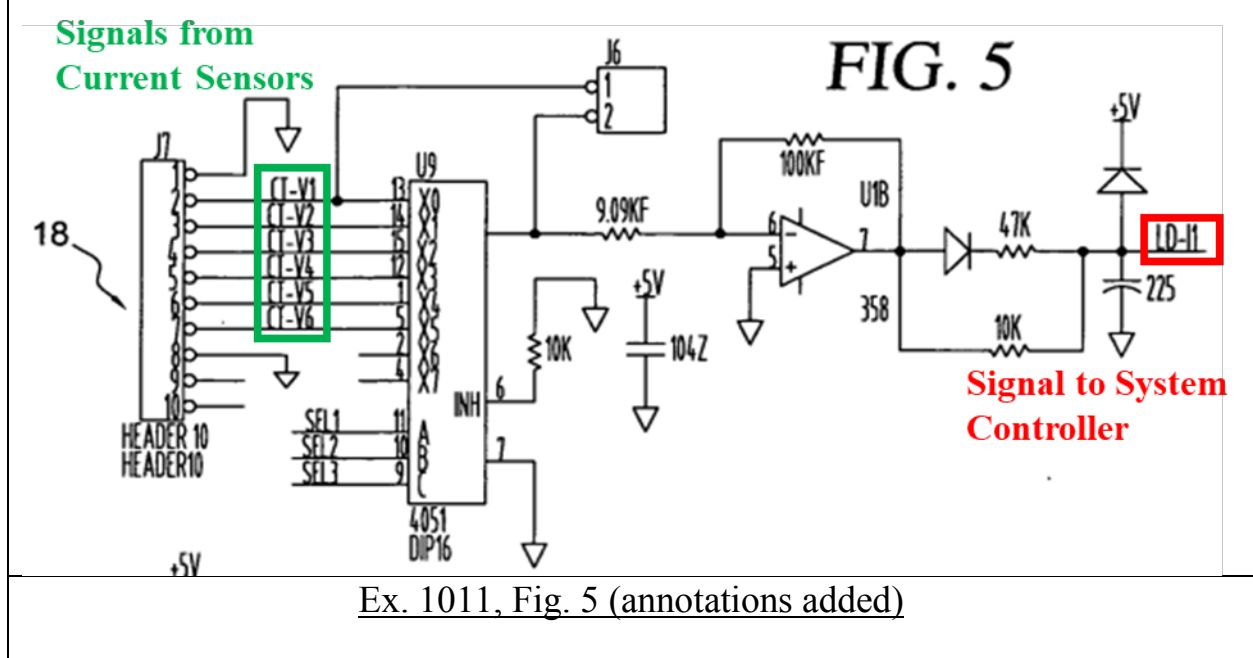
133. I have reviewed drawings 1, 5, 6, 8, and 9 included in U.S. Publication 2005/0146827 (Ex. 1009) to Borden which I have been informed were originally filed with U.S. application 10/752854 to Borden on January 7, 2004. (Ex. 1010, Figs. 1, 5, 6, 8, and 9.) I have also reviewed formal drawings 1, 5, 6, 8, and 9, which I have been informed were updated during Borden's prosecution and issued with U.S. Patent No. 7,233,086 to Borden. (Ex. 1011, Figs. 1, 5, 6, 8, 9.)

134. It is my opinion that originally-filed Borden figure 1 (Ex. 1009, Fig. 1) is structurally and functionally equivalent to updated Borden Patent figure 1 (Ex. 1011, Fig. 1), which provides improved clarity and readability.

135. It is my opinion that originally-filed Borden figure 5 of a current-signal conditioner (Ex. 1009, Fig. 5) is structurally and functionally equivalent to updated Borden Patent figure 5 of a current-signal conditioner (Ex. 1011, Fig. 5), which provides improved clarity and readability. It is also my opinion that the annotations provided in both versions of Fig. 5 by the Petitioners correctly identify the "Signals from Current Sensors" (green) and "Signal to System Controller" (red).



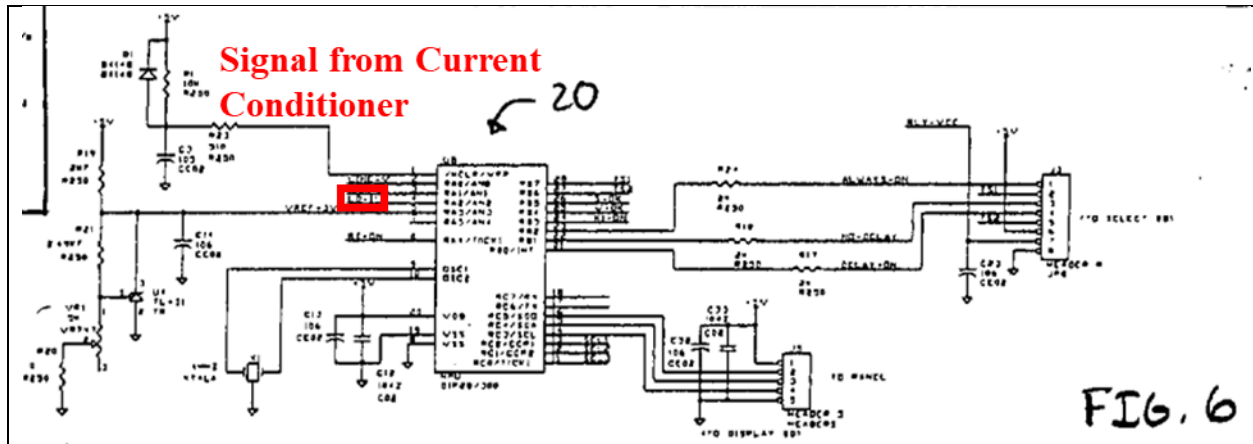
Ex. 1009, Fig. 5 (annotations added)



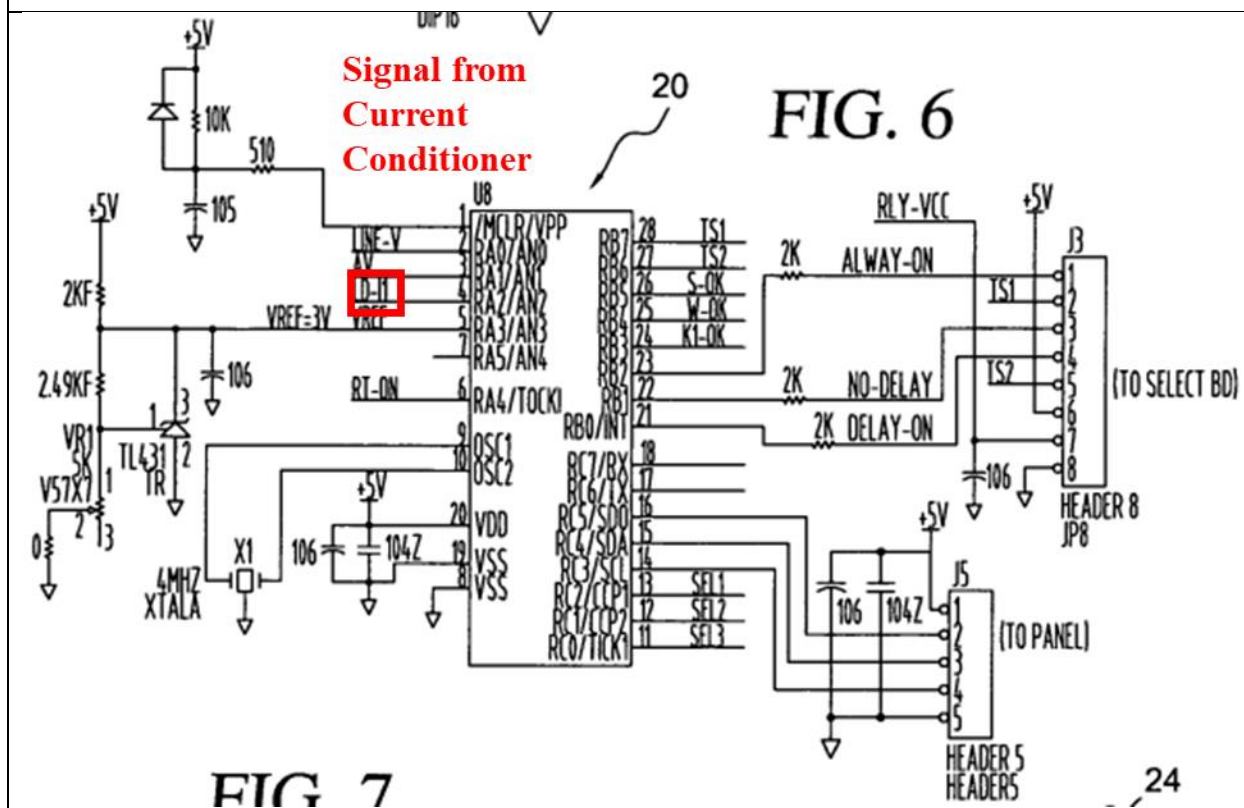
Ex. 1011, Fig. 5 (annotations added)

136. It is my opinion that originally-filed Borden figure 6 of a system controller (Ex. 1009, Fig. 6) is structurally and functionally equivalent to updated Borden Patent figure 6 of a system controller (Ex. 1011, Fig. 6), which provides improved clarity and readability. It is also my opinion that the red annotations

provided in both versions of Fig. 6 by the Petitioners correctly identify the “Signal from Current Conditioner.”

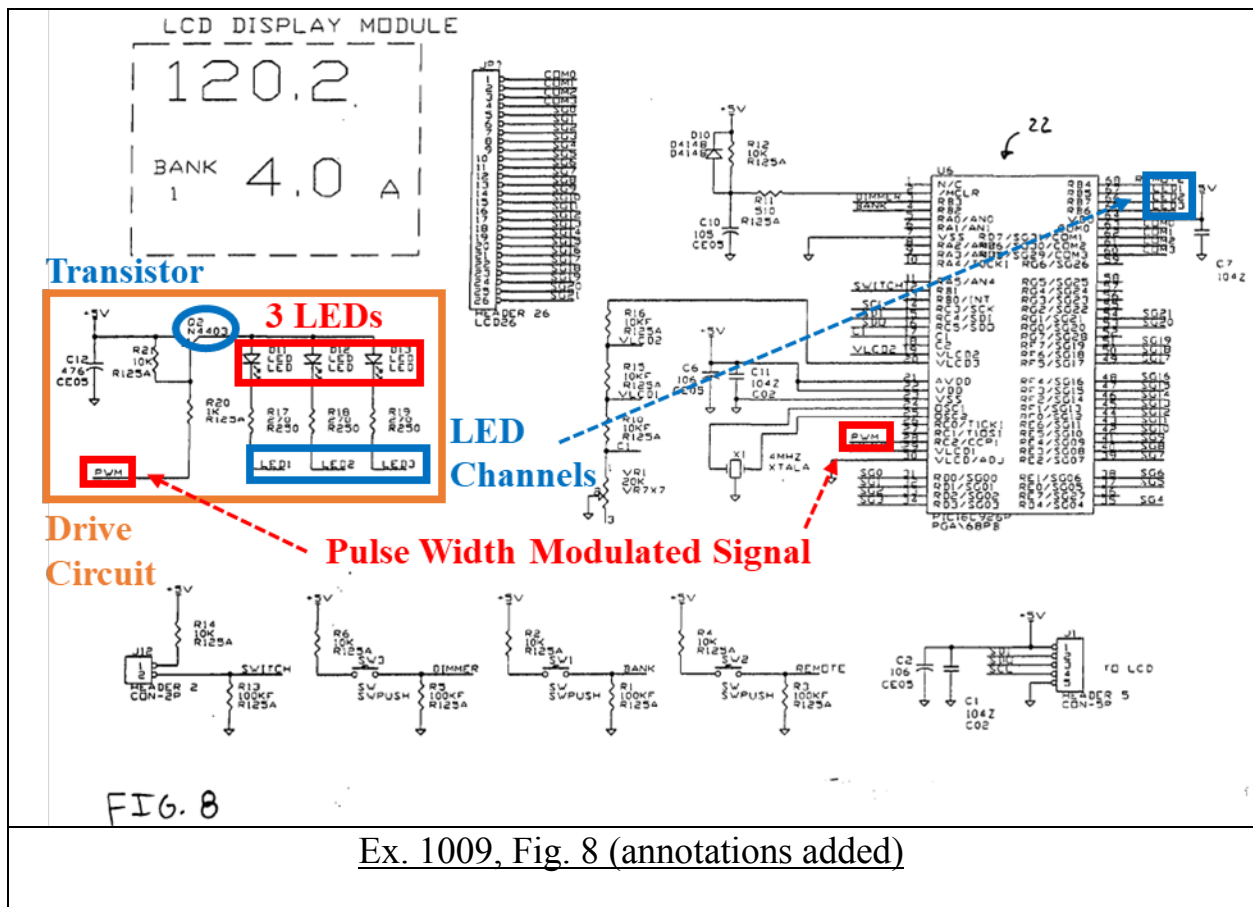


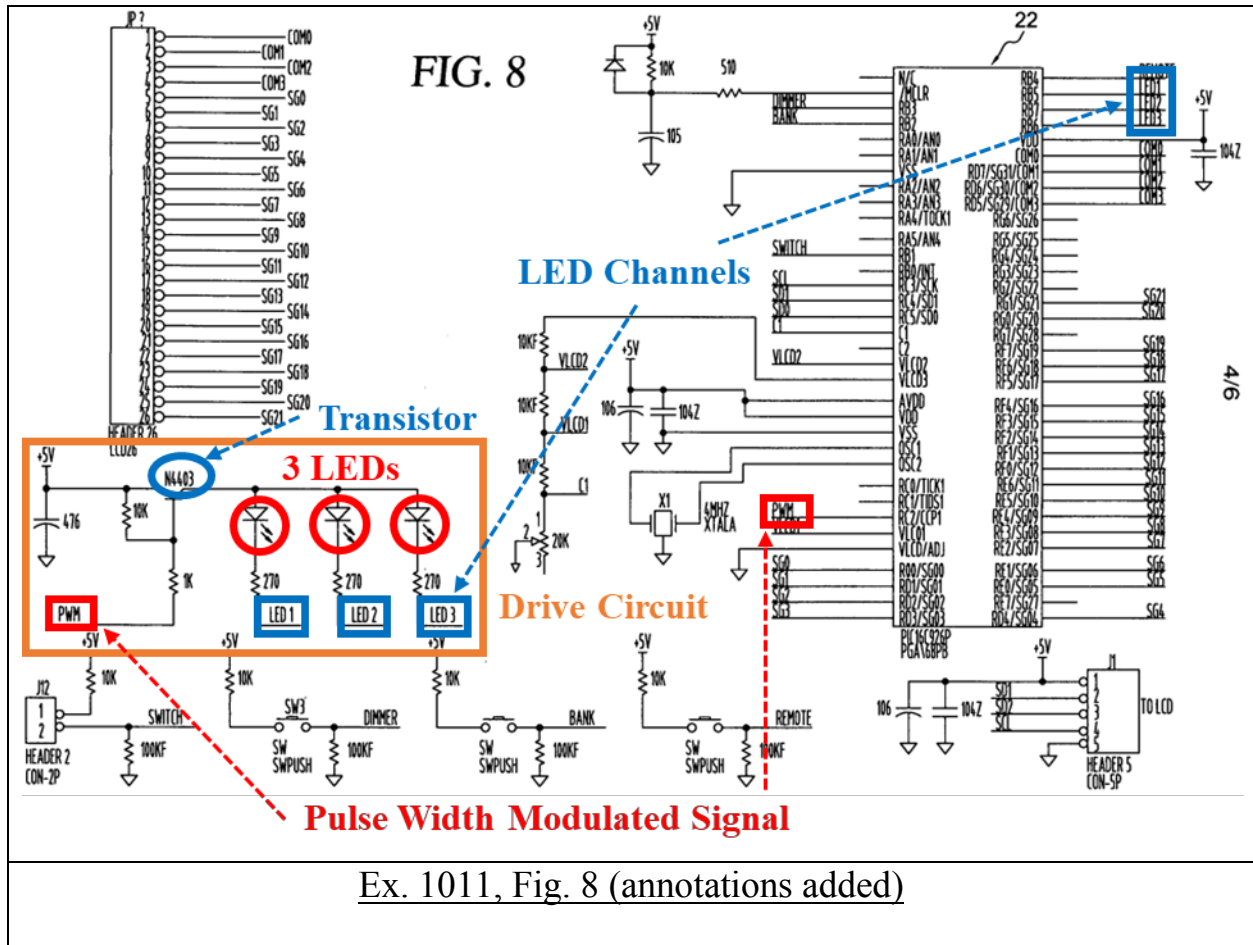
Ex. 1009, Fig. 6 (annotations added)



Ex. 1011, Fig. 6 (annotations added)

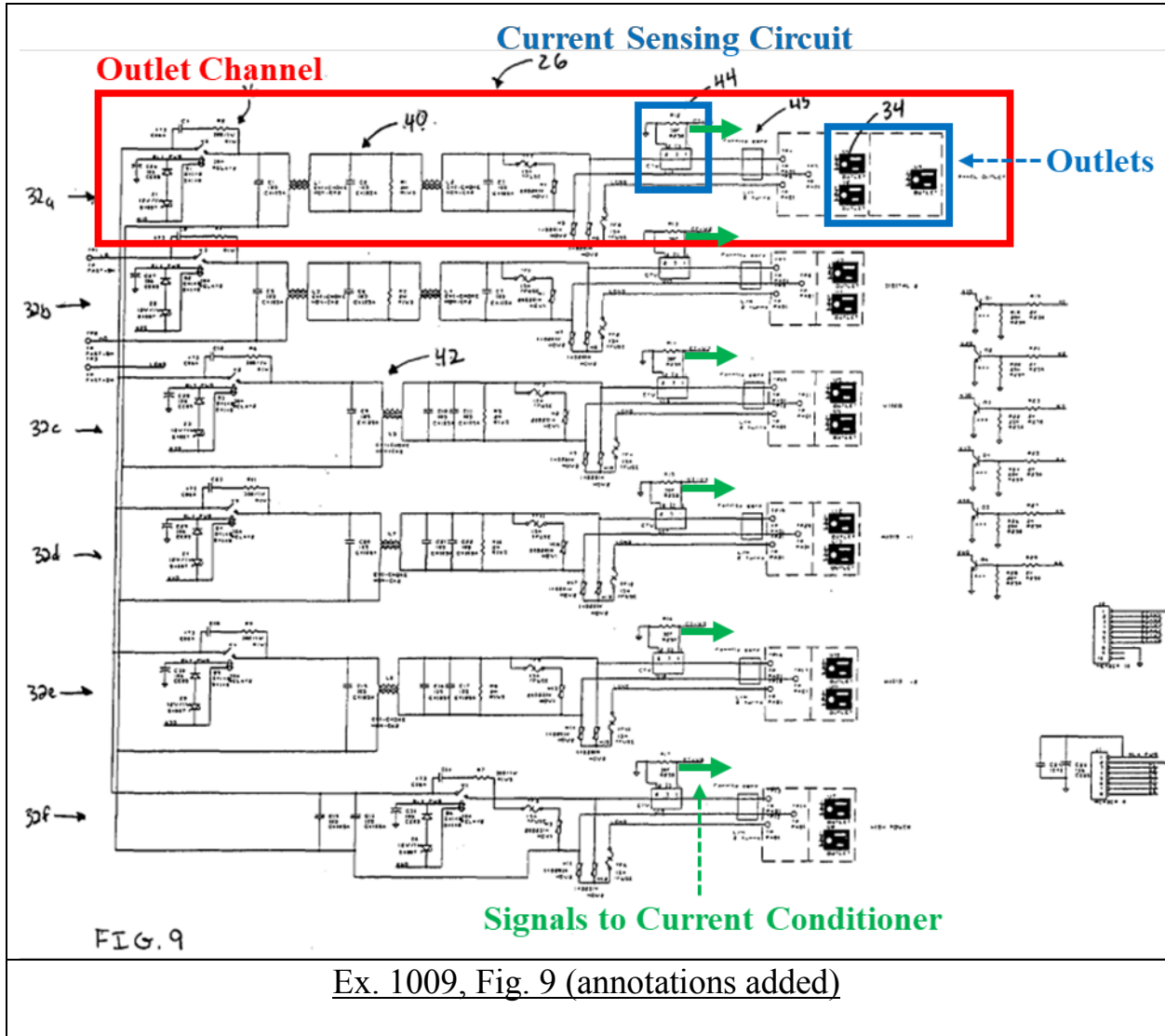
137. It is my opinion that originally-filed Borden figure 8 of a user interface and display controller (Ex. 1009, Fig. 8) is structurally and functionally equivalent to updated Borden Patent figure 8 of a user interface and display controller (Ex. 1011, Fig. 8), which provides improved clarity and readability. It is also my opinion that the annotations provided in both versions of Fig. 8 by the Petitioners correctly identify the “Transistor” (blue), “3 LEDs” (orange & red), “Pulse Width Modulated Signal,” (red) and “LED Channels” (blue).

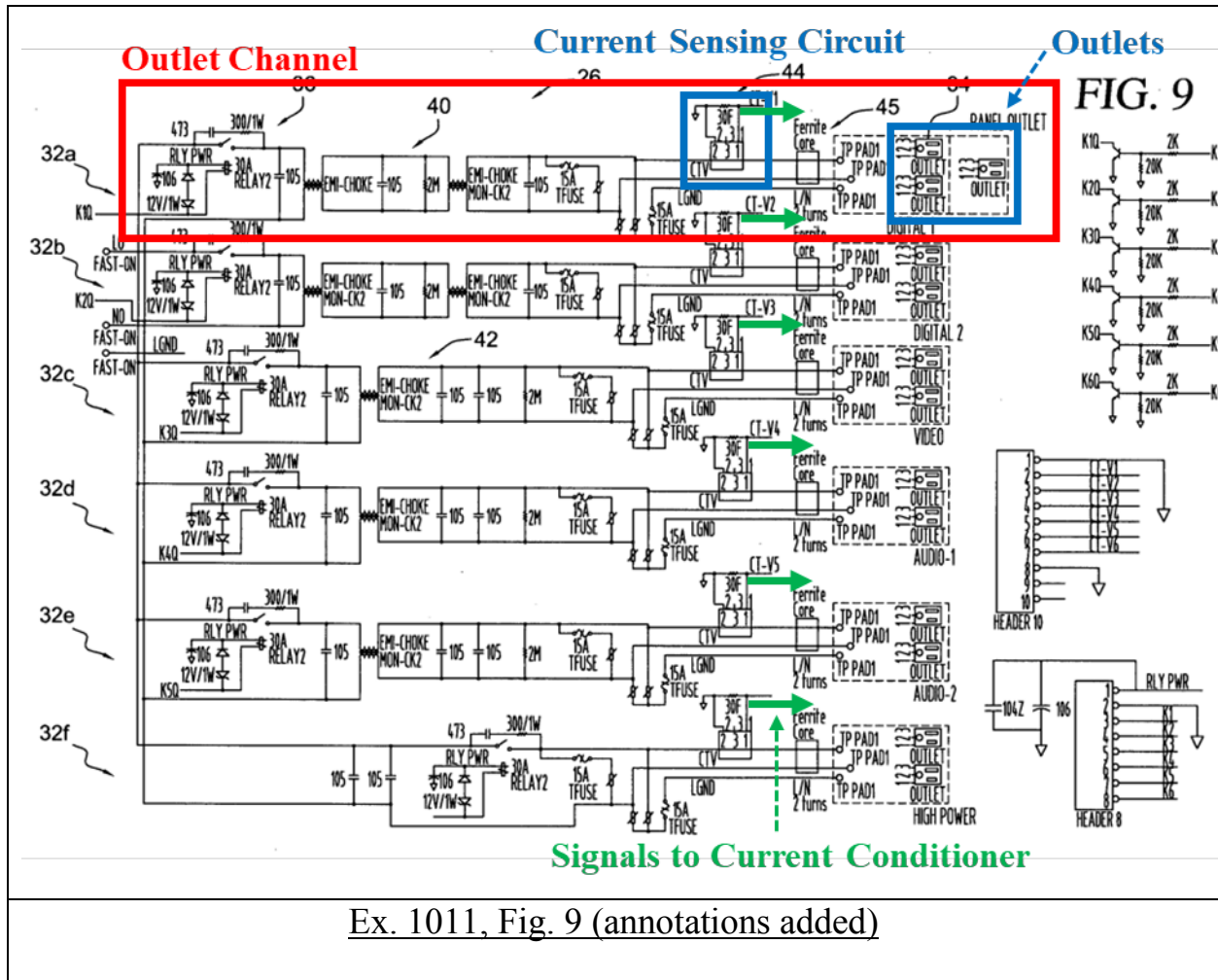




138. It is my opinion that originally-filed Borden figure 9 of power distributor outlet channels (Ex. 1009, Fig. 9) is structurally and functionally equivalent to updated Borden Patent figure 9 of power distributor outlet channels (Ex. 1011, Fig. 9), which provides improved clarity and readability. Except, I note that the updated formal Borden figure 9 is missing a label for the “CT-V6” signal that is present in the originally-filed figure. It is also my opinion that the annotations provided in both versions of Fig. 9 by the Petitioners correctly identify an “Outlet

Channel” (red), a “Current Sensing Circuit” (blue), an “Outlet[s]” (blue), and “Signals to Current Conditioner” (green).





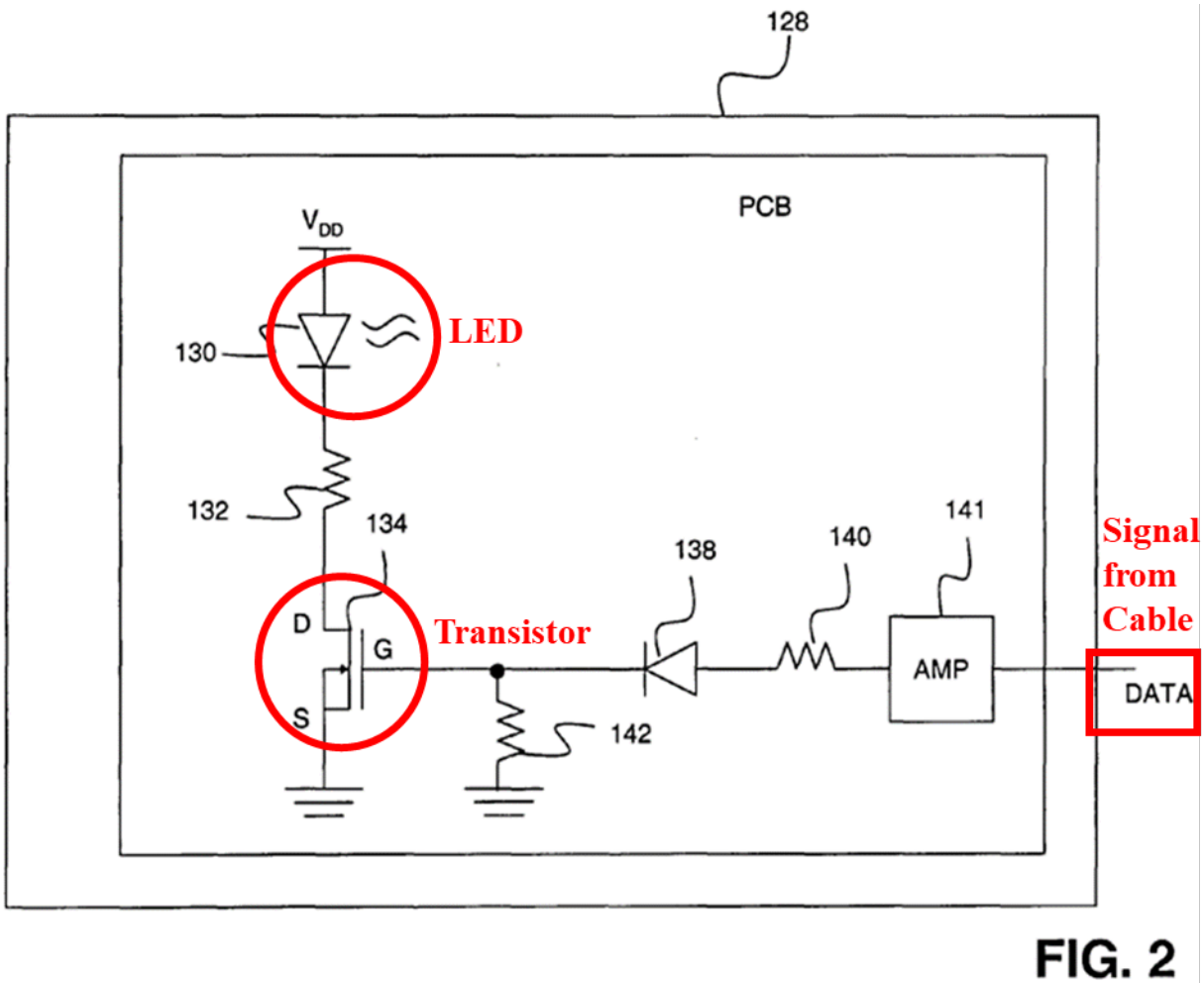
139. I have reviewed the annotations to originally-filed Borden figures 5, 6, 8, and 9 (Ex. 1009, Figs. 5, 6, 8, 9) and updated formal Borden figures 5, 6, 8, and 9 (Ex. 10011, Figs. 5, 6, 8, 9). As I detailed above, it is my opinion that the added annotations accurately label the associated features of these circuit diagrams.

F. The Erickson Reference

140. The Erickson patent (Ex. 1014) (“Erickson”) discloses a cable for carrying digital data (called “traffic” in the disclosure) wherein a connector on the

cable includes a traffic-detection circuit. The traffic-detection circuit generates an electrical signal related to the amount of traffic on the cable. The electrical signal drives an indicator such as an LED for visually indicating the properties of the traffic on the cable.

141. Figure 2 of Erickson has been annotated for clarity:



Ex. 1014, Fig. 2 (annotations added)

I confirm that these annotations are accurate.

142. Erickson explicitly contemplates the data cable having a translucent covering, so that light generated in a connector at one end of the cable can propagate down the cable to give the appearance that part or all of the cable is illuminated. (Ex. 1014 at 3:39-46.)

**IX. THE GROUNDS AND
COMBINATIONS OF THE ABOVE CAPTIONED IPR**

A. The ‘829 Patent

143. The alleged invention of ‘829 patent is the arrangement, device, and method of illuminating an electrical cable such that the illumination represents one or more properties of the electrical signal in the cable, such as current, voltage or power. Said properties of the electrical signal are measured within the cable via an unspecified measurement device. (Ex. 1001 at Fig. 4, block 43.) The measurement is processed in an unspecified microprocessor (Ex. 1001 at Fig.4, block 42.) Then unspecified pulse width-modulation circuits (Ex. 1001 at Fig. 4, blocks 44) are used to control the unspecified driver circuits (Ex. 1001 Fig.4, blocks 45) which energize the illuminating wires (Ex. 1001 at Fig. 4, blocks 14-16) along the cable.

144. The illuminating wires can be side-emitting optical fibers connected to LEDs or else electroluminescent wires (Ex. 1001 at 3:56-64).

B. Jablonski

145. I understand that PTC patent application No. PCT/AU2004/001664 that published as the Jablonski reference was filed November 26, 2004, and I have been asked to consider the Jablonski publication to be prior art as of this date. (Ex. 1005 at 1.)

146. For the reasons discussed below, it is my opinion that the Jablonski discloses each element of claims 1-17 of the '829 patent.

147. Jablonski discloses:

a signal line, the line including a side-emissive light guide extending along at least a part of said line, a light source for illuminating the light guide, and a controller for controlling the light source based upon a signal on the line, e.g. based upon a signal current flowing therein. The signal line may include suitable electrical conductors/wires along its length for transmitting electrical signal current from one end of the line to the other.

(Ex. 1005 at 1:26-33).

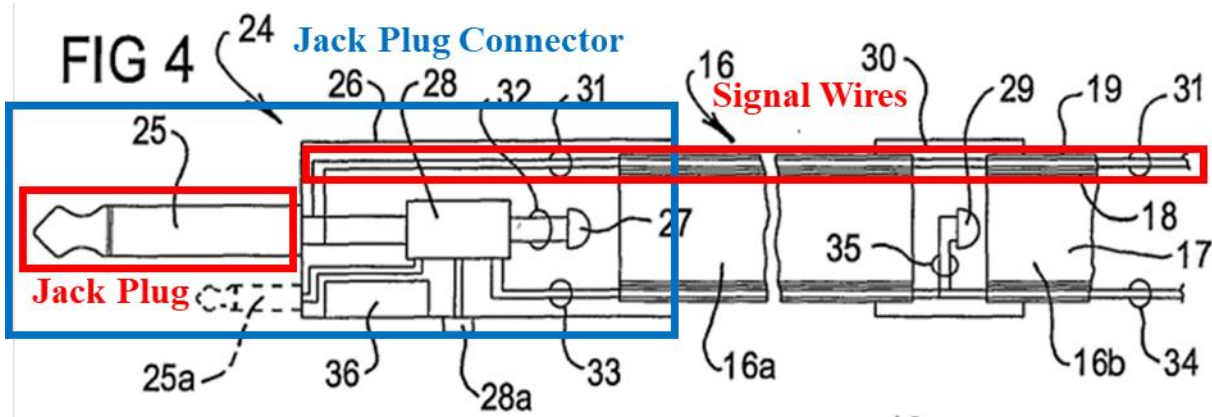
148. As discussed above, “current” (i.e., a flow of electrons through an electrical conductor) includes signals or other currents that convey information.

149. Jablonski explains that “the term ‘signal line’ should be interpreted broadly” (Ex. 1005, 2:16-19), and includes electrical lines (Ex. 1005 at 2:19-20,

13:9-11, 24:21-23), a pair of electrical wires (Ex. 1005 at 4:29-30), and cables (Ex. 1005 at 5:10-14, 13:11-13) with suitable connectors for the input or output of an associated device, including jack plugs (Ex. 1005 at 4:26-28).

150. Jablonski discloses signal lines that also provide power. (Ex. 1005 at 4:23-25, 17:34-18:2.) For example, Jablonski discloses an illuminated cable with jack plug connection 24 and jack plug 25. (Ex. 1005 at 16:22, 16:26-28, Fig. 4.) As noted above, a POSITA would understand that audio cables with jack plugs can carry sufficient current to power transformers and LEDs. As further noted above, a POSITA would recognize that audio cables may power remote devices, *e.g.*, a microphone. For example, as discussed above, Jablonski's provision of "phantom power" to power its microprocessor controller and the light source(s) (*e.g.*, LEDs) in various embodiments is an example of carrying power. (Ex. 1005 at 4:23-25, 17:34-18:2.) Additionally, as noted above, a POSITA would recognize the similarities between the signal line in Jablonski figure 4 and the auxiliary cord in Currie figures 1c and 1d. For the reasons explained above, Currie explains that the auxiliary cord in figures 1c and 1d powers at least a transformer and LED(s). A POSITA would recognize Jablonski signal line, specifically the embodiments in Jablonski figures 4 and 7, would function similarly to the auxiliary cord in Currie and power at least a transformer (or a microprocessor controller) and LED(s).

151. Based on Jablonski's specification (Ex. 1005 at pg. 16-17), the below annotations correctly identify the jack plug, jack plug connector, and signal wires of Jablonski Fig. 4:



(Ex. 1005 at Fig. 4 (annotated).)

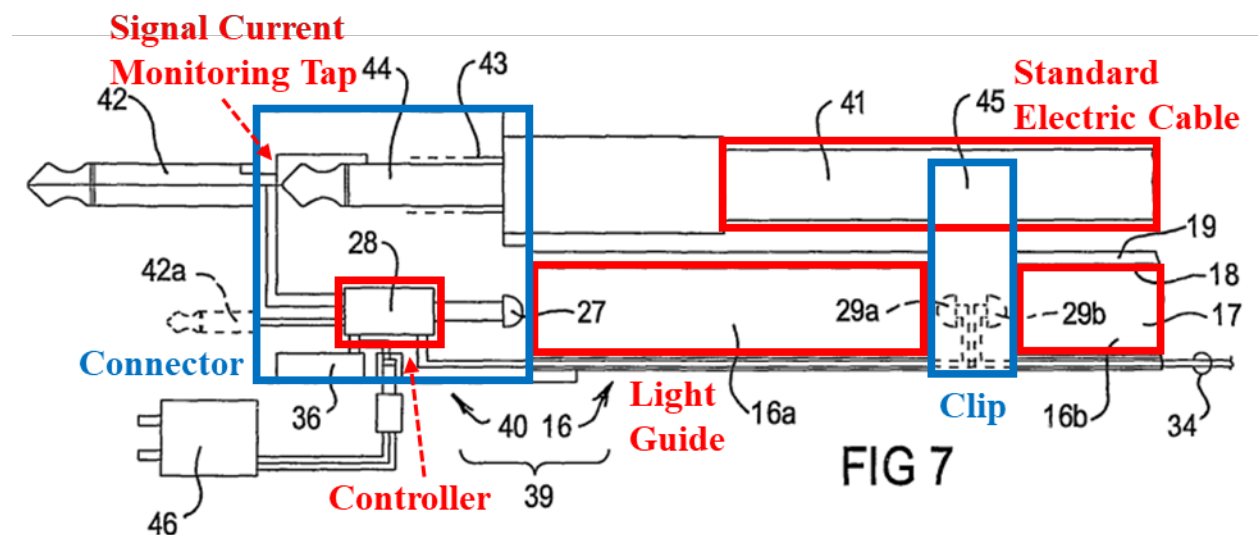
152. Jablonski discloses several variations of “linear lighting element[s]” (Ex. 1005 at 10:34-11:8) to illuminate the signal line, including one or more optical “light guides” illuminated by one or more LEDs (Ex. 1005 at 5:26-6:4, 7:9-12, 7:18-29, 8:12-19, 16:22-25, 19:24-20:14, 22:27-24:10, Figs. 4-10), and electroluminescent wires or tape (Ex. 1005 at 11:9-19, 11:25-31, 13:1-3; 24:29-26:2, Fig. 11.) The optical light guides and electroluminescent wires are interchangeable in all embodiments. (Ex. 1005 at 10:32-11:28, 12:3-5, 26:1-2.)

153. The Jablonski controller is preferably a programmable microprocessor. (Ex 1005 at 6:5-12.) It modulates illumination characteristics, like intensity, frequency, and color based on the measured characteristics of signal currents in the signal line. (Ex. 1005 at 2:21-28, 3:15-18, 6:5-7, 14:15-20.) The controller

determines “signal current flowing” in the signal line in various ways (Ex. 1005 at 1:28-30, 11:4-6), including by tapping into the signal wires or through a “capacitive, magnetic or inductive sensor.” (Ex. 1005 at 14:3-7.)

154. Jablonski discloses a “light guide attachment” that is attached or mounted to an existing signal cable with a “coupling adapter” or “connector.” (Ex. 1005 at 5:10-21, 9:6-21.) Jablonski Fig. 7 illustrates this light guide-attachment constructed from standard electric cable 41 and attachment 39, which includes light guide(s) 16 and connector 40. (Ex. 1005, 21:24-27.)

155. Based on Jablonski’s specification (Ex. 1005 at pgs. 21-22 and 24) the below annotations correctly identify the controller, standard electrical or standard guitar cable, light guide, connector between the light guide and electrical cable, a clip for attached the light guide and cable, and the location where the controller taps into signal wires of Jablonski Fig. 7:



(Ex. 1005 at Fig. 7 (annotated).)

1. Claim 1

[1.a]¹ *An arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor,*

156. Jablonski discloses the “[a]n arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor” element of ’829 patent claim 1.

157. Jablonski provides a visual indication (through its modulated lighting element) of an electrical quantity (*e.g.*, detected signal currents through a conductor). Specifically, Jablonski modulates a light source that illuminates a “linear lighting element” to indicate the state of detected signal currents through wires/conductors in a signal line. (Ex. 1005 at 1:26-30, 9:7-33, 10:32-11:6.) Jablonski determines the state of “signal current flowing” through the signal line’s conductor wires (Ex. 1005 at 1:29-31, 19:1-4), including by detecting signal current with a “capacitive, magnetic or inductive sensor.” (Ex. 1005 at 14:3-7; *see also* Ex. 1005 at 3:21-24,

¹ I understand that it is convention to number independent claims element by element for clarity. For simplicity, I have adopted the same numbering presented in the petition.

15:8-11, 24:17-20.) Jablonski then modulates the intensity, frequency, color, or other characteristics of a light source illuminating the linear lighting element according to this detected signal current, to provide a visual indication of this current. (Ex. 1005 at 2:21-28, 3:15-18, 11:13-19, 14:15-20, 18:8-13, 25:17-21.) For the reasons explained above, this results in a visual indication of current through a conductor. For example, Jablonski provides that “illumination could provide practical information, *e.g.*, a confirmation that information is flowing, and the illumination could vary depending on the speed of data transfer, type of data, its direction.” (Ex. 1005, 16:15-18.)

[1.b] *wherein the arrangement comprises a substantially wire shaped illuminator, and*

158. Jablonski discloses the “wherein the arrangement comprises a substantially wire shaped illuminator” element of ’829 patent claim 1.

159. Jablonski discloses light guides, electroluminescent wires, and other light elements that are substantially wire shaped because they are linear, elongated, and/or cylindrical (Ex. 1005 at 10:32-11:8, 19:33-34, 22:27-23:10, 24:29-31, Figs. 1-3, 8-10) and because they extend along the length of a cable or electric wire(s). (Ex. 1005 at 1:26-33, 5:14-16, 5:22-23, 8:5-19, 9:6-12, 9:22-33, 11:3-8, 11:25-31, 13:17-19.)

[1.c] a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity, and

160. Jablonski discloses the “a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity” element of ’829 patent claim 1.

161. Jablonski discloses a microprocessor controller that monitors signal currents flowing through the wires/conductors of a signal line (Ex. 1005, 1:26-30, 2:25-31, 17:20-21, 19:1-4), including by measuring these currents with a capacitive, magnetic or inductive sensor (Ex. 1005 at 3:21-24, 14:3-7; 15:8-11, 24:17-20), and modulating the intensity, frequency, color, or other illumination characteristic of a linear lighting element (optical light guide(s) or electroluminescent wire(s)) according to the signal currents. (Ex. 1005 at 1:12-17, 2:22-3:3, 3:15-18, 6:1-4, 9:19-21, 9:23-27, 11:13-19, 14:15-20, 18:8-13, 25:14-21.) The monitored signal currents power a device (*e.g.*, headphones, loudspeaker, keyboard) in some embodiments. (Ex. 1005 at 4:23-25, 17:34-18:2.)

[1.d] feeding the wire shaped illuminator with varying current or voltage corresponding to the electrical quantity measured in the conductor.

162. Jablonski discloses the “feeding the wire shaped illuminator with varying current or voltage corresponding to the electrical quantity measured in the conductor” element of ’829 patent claim 1.

163. Jablonski discloses its controller modulating illumination of its linear lighting element according to signal currents measured in the wires/conductors of a cable by varying the frequency and/or voltage of an alternating current signal applied to an electroluminescent wire (Ex. 1005, 11:13-24, 25:14-26) or by outputting signals to control illumination of LEDs (Ex. 1005 at 17:20-28, 18:8-13) or other light sources for light guide(s) (Ex. 1005 at 5:26-34, 13:17-20, 20:1-12, 20:23-31, 24:9-10).

2. Claim 2

The arrangement of claim 1, wherein said wire shaped illuminator is arranged along said conductor.

164. Jablonski discloses the claim 2 of the ’829 patent.

165. Jablonski discloses linear lighting elements (optical light guide(s) or electroluminescent wire(s)) arranged along the length of the monitored signal cable conductor. (Ex. 1005 at 1:26-33, 11:3-8, 13:17-19.) For example, in some embodiments Jablonski’s light element(s) are attached with clips mounted to the appropriate cable. (Ex. 1005 at 5:10-23, 9:6-21, 22:1-6, Fig. 7.)

3. Claim 3

The arrangement of claim 1, wherein said wire shaped illuminator is electroluminescent.

166. Jablonski discloses the claim 3 of the '829 patent.

167. Jablonski discloses some embodiments with linear electroluminescent, light-elements. (*E.g.*, Ex. 1005, 11:9-31, 24:29-26:2, Fig. 11.)

4. Claim 4

The arrangement of claim 1, wherein said wire shaped illuminator is an optical fiber.

168. Jablonski discloses the claim 4 of the '829 patent.

169. In some embodiments of Jablonski, the linear lighting elements are optical “light guides” of various forms illuminated by one or more LEDs. (Ex. 1005, 3:30-4:10, 5:26-6:4, 7:9-12, 7:18-29, 8:13-15, 19:24-20:14, 21:24-22:15, 22:27-24:10, Figs. 4-5, 7-10.) For example, one construction of Jablonski’s Fig. 4 embodiment “includes a light guide 16 comprising a core 17, e.g. a transparent polymer, a core cladding 18, e.g. a transparent layer of PTFE, and an outer cover 19, e.g. a transparent sleeve of PVC.” (Ex. 1005 at 16:22-25.)

170. As I discuss above, these optical light guides are examples of optical fiber.

5. Claim 5

The arrangement of claim 1, wherein said controller further sends a control signal to control said wire shaped illuminator.

171. Jablonski discloses the claim 5 of the '829 patent.

172. The Jablonski controller sends control signals along control leads, control wires, etc. to a light source, like one or more LEDs (Ex. 1005, 7:1-8, 17:20-28, 18:8-13, 20:32-21:4, 22:14-15), or applies a variable alternating-current signal to electroluminescent wire(s) (Ex. 1005 at 11:13-24, 25:14-26) to modulate illumination characteristics of its linear lighting element.

6. Claim 6

The arrangement of claim 3, wherein said electroluminescent includes a central conductive wire coated with a phosphorus material coating and transmitter wires wrapped around it, and covered by a coating and a colored vinyl coat.

173. Jablonski discloses the claim 6 of the '829 patent.

174. Jablonski discloses:

Thus, in one embodiment, the signal line could include a length of electroluminescent wire having a copper core, a phosphor coating about the core, one or more transmission wires around the coating, and one or more protective and/or colour-altering layers, e.g. PVC layers, around the core, coating and wires. The light controller will apply an a.c. signal between the copper core and transmission

wire(s) in order to stimulate the phosphor coating and illuminate the line, and may vary the frequency and/or applied voltage to vary the light intensity. Colour may also be varied in some circumstances, e.g. by varying the frequency of the stimulating voltage, ...

(Ex. 1005 at 11:9-17.)

7. Claim 7

The arrangement of claim 1, wherein said controller comprises a processing arrangement and a measuring arrangement and a driver for driving said wire shaped illuminator receiving control signals from said processing arrangement.

175. Jablonski discloses the claim 7 of the '829 patent.

176. In combination, Jablonski's microprocessor controller and capacitive, magnetic or inductive sensor(s) are a measuring arrangement and a processing arrangement. As discussed above, the sensor continuously detects current in the wires/conductors of a signal line, including changes in current over time. (Ex. 1005 at 3:21-24, 15:8-11). Jablonski discloses monitoring measured current with a microprocessor controller (Ex. 1005 at 14:3-7, 24:17-20), that quantifies and processes this current to modulate the linear lighting element (Ex. 1005 at 6:5-12, 9:10-12, 9:19-21, 11:5-6, 16:26-31, 17:20-23, 21:31-34).

177. Jablonski discloses these same drivers. In some embodiments, Jablonski's controller controls an inverter that applies 50 to 120-volts of alternating

current to modulate illumination of electroluminescent wire. (Ex. 1005 at 11:9-24, 25:14-26.) In others, LEDs are illuminated and modulated by “suitable controllers.” (Ex. 1005 at 13:17-20, 17:20-23, 18:8-13.)

178. As discussed above, one suitable LED driver is a transistor drive circuit controlled by a pulse-width modulated signal.

8. Claim 8

The arrangement of claim 1, wherein said illumination characteristic is one or several of intensity, color or frequency.

179. Jablonski discloses the claim 8 of the '829 patent.

180. Jablonski modulates the intensity, color or frequency of illumination to indicate the level of measured currents through the wires/conductors of a signal cable. (Ex. 1005, 1:26-33, 11:3-6, 13:14-16.) “For example, the intensity of the light, the frequency and/or duration of light pulses and/or the colour (wavelength) of the light in the guides may be varied based on the signal frequencies or the like.” (Ex. 1005 at 14:17-20.)

9. Claim 9

[9.a] A cord comprises at least one electric wire and a substantially wire shaped illuminator at least partly arranged along an extension of said at least one electric wire,

181. Jablonski discloses the “[a] cord comprises at least one electric wire and a substantially wire shaped illuminator at least partly arranged along an extension of said at least one electric wire” element of ’829 patent claim 9.

182. Jablonski discloses:

a signal line, the line including a side-emissive light guide extending along at least a part of said line, a light source for illuminating the light guide, and a controller for controlling the light source based upon a signal on the line, e.g. based upon a signal current flowing therein. The signal line may include suitable electrical conductors/wires along its length for transmitting electrical signal current from one end of the line to the other.

(Ex. 1005 at 1:26-33.)

[9.b] said substantially wire shaped illuminator having means for illumination when energized to indicate an electrical quantity, being one or several of power, current or voltage through the at least one electric wire,

183. Jablonski discloses the “said substantially wire shaped illuminator having means for illumination when energized to indicate an electrical quantity, being one or several of power, current or voltage through the at least one electric wire” element of ’829 patent claim 9.

184. Jablonski discloses several variations of “linear lighting element[s]” (Ex. 1005 at 11:1) to illuminate the signal line, including one or more “light guides” illuminated by one or more LEDs (Ex. 1005 at 3:30-4:10, 5:26-6:4, 7:9-12, 7:18-29, 8:13-15, 16:22-25, 19:24-20:14, 21:24-22:15, 22:27-24:10, Figs. 4-5, 7-10), electroluminescent wire (Ex. 1005 at 11:9-19, 24:29-25:26, 26:1-2, Fig. 11), and electroluminescent tape (Ex. 1005 at 11:25-31, 25:27-26:2). Jablonski discloses inverters that apply alternating current to electroluminescent wires to energize them. (Ex. 1005 at 25:20-24.)

185. The Jablonski controller (Ex. 1005 at 6:5-12) modulates the linear lighting element’s illumination characteristics, like intensity, frequency, or color according to signal currents in the signal line. (Ex. 1005 at 2:22-28, 3:15-18, 11:13-19, 14:15-20, 18:8-13, 25:17-21.)

[9.c] wherein said substantially wire shaped illuminator indicates the current or voltage through said at least one electric wire when at least one illumination characteristic of said substantially wire shaped illuminator is controlled with respect to said electrical quantity by feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through at least one electrical wire.

186. Jablonski discloses the “wherein said substantially wire shaped illuminator indicates the current or voltage through said at least one electric wire when at least one illumination characteristic of said substantially wire shaped illuminator is controlled with respect to said electrical quantity by feeding the

substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through at least one electrical wire” element of ’829 patent claim 9.

187. The Jablonski controller indicates the measured current by modulating the characteristics of the light, like its intensity, frequency, or color. (Ex. 1005 at 2:22-28, 3:15-18, 11:13-19, 14:15-20, 18:8-13, 25:17-21.) One way the controller modulates the illumination is to vary the frequency and/or voltage of signals applied to an LED or electroluminescent wire. (Ex. 1005 at 11:13-24, 17:20-28, 18:8-13, 25:14-26.)

10. Claim 10

The cord of claim 9, further comprising a substantially translucent coating, covering said at least one electric wire and substantially wire shaped illuminator.

188. Jablonski discloses the claim 10 of the ’829 patent.

189. Jablonski discloses that “[s]ignals output from the player 2 are received by the jack plug 25 and pass along the length of the electric line 6 through positive and negative signal wires 31 that pass through the jack plug housing 26 and along the light guides 16 within the outer cover 19” where “outer cover 19, [is] e.g. a transparent sleeve of PVC.” (Ex. 1005 at 16:22-25; 17:4-7; *see also* 17:17-19.)

11. Claim 11

The cord of claim 9, wherein said substantially wire shaped illuminator is an electroluminescent wire.

190. Jablonski discloses the claim 11 of the '829 patent for the reasons discussed above.

12. Claim 12

The cord of claim 9, wherein said substantially wire shaped illuminator is an optical fiber.

191. Jablonski discloses the claim 12 of the '829 patent for the reasons discussed above.

13. Claim 13

The cord of claim 9, wherein said substantially wire shaped illuminator indicates current or power through said at least one electric wire.

192. Jablonski discloses the claim 13 of the '829 patent for the reasons discussed above.

14. Claim 14

[14.a] A method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of:

193. Jablonski discloses the “[a] method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the

method comprising the steps of” element of ’829 patent claim 14 for the reasons discussed above.

[14.b] *energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity and*

194. Jablonski discloses the “energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity” element of ’829 patent claim 14 for the reasons discussed above.

[14.c] *feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor.*

195. Jablonski discloses the “feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor” element of ’829 patent claim 14 for the reasons discussed above.

15. Claim 15

[15.a] *A device for providing a variable visual indication of consumption of electricity comprising:*

196. Jablonski discloses the “[a] device for providing a variable visual indication of consumption of electricity comprising” element of ’829 patent claim 15.

197. Jablonski discloses a broad class of signal cables for loudspeakers, headphones, music players, keyboards, game consoles, computer monitors, televisions, and printers, or as a replacement for standard cabling. (Ex. 1005, 2:1-6, 13:9-13, 15:28-31, 16:10-15, 17:1-3, 17:10-13, 22:16-19.) Some of these cables transmit power (*e.g.*, phantom power) (Ex. 1014 at 4:23-25, 17:34-18:2).

[15.b] *a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity associated with said electricity; and*

198. Jablonski discloses the “a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity associated with said electricity” element of ’829 patent claim 15.

199. Jablonski discloses a capacitive, magnetic or inductive sensor(s) that together with a microprocessor controller detects and quantifies (*i.e.*, measures) current in a signal cable connected to a consuming device. (Ex. 1005 at 3:21-24,

14:3-7, 15:8-11, 24:17-20.) For example, Jablonski discloses signal cables from a music player, amplifier, or game console/computing device to corresponding accessories, like a microphone, loudspeaker, headphones, instrument, controller, keyboard, or display (Ex. 1005 at 13:4-13, 15:12-15, 15:28-31, 16:10-12, 21:28-31, Figs. 1-3), and a light guide attachment that is adapted “for placement between an electrical device and a standard signal cable” (Ex. 1005 at 5:12-19).

[15.c] a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity;

200. Jablonski discloses the “a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity” element of ’829 patent claim 15.

201. For example, Jablonski’s controller receives signal-current measurements from a capacitive, magnetic or inductive sensor(s). (Ex. 1005 at 3:21-24, 14:3-7, 15:8-11, 24:17-20.) Jablonski discloses control of plural LEDs and light guides (Ex. 1005 at 1:18-21, 5:26-34, 13:17-20, 18:8-22, 20:3-31, 23:17-34) or “electroluminescent cables or tapes.” (Ex. 1005 at 24:29-31.)

[15.d] wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity.

202. Jablonski discloses the “wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity” element of ’829 patent claim 15 for the reasons discussed above.

203. One way the Jablonski controller modulates the illumination characteristics of LED(s) or electroluminescent wire(s) is to vary the frequency and/or voltage of signals applied to them according to variations in the measured current. (Ex. 1005 at 1:26-30; 2:25-28, 11:3-6, 11:13-24, 13:14-16 17:20-28, 18:8-13, 25:14-26.)

16. Claim 16

The device of claim 15, wherein said plurality of illumination devices each comprise a copper wire coated with a phosphorous material and two transmitter wires wrapped around the copper wire.

204. Jablonski discloses the claim 16 of the ’829 patent for the reasons discussed above.

205. Jablonski discloses:

The electroluminescent wire 50 is formed from a central copper core 51 that is coated in phosphors, a connection line 52 for connecting the copper core 51 with the controller 28, a pair of transmitter wires 53 that are

connected together and that wrap around the phosphor coating along the length of the core 51, a vinyl protective layer 54 and an outer protective layer 55.

(Ex. 1005 at 25:7-12.)

17. Claim 17

The device of claim 15, wherein said light output by said plurality of illumination devices varies in at least one of intensity, color or frequency over time based on said measured variable electrical quantity.

206. Jablonski discloses the claim 17 of the '829 patent for the reasons discussed above.

C. The Combination Of Jablonski And Godard

207. For the reasons explained below and based on my review of the '829 patent, the Jablonski reference, and the Godard reference, I believe that the Jablonski-Godard combination renders all claims of the '829 patent obvious.

1. Godard

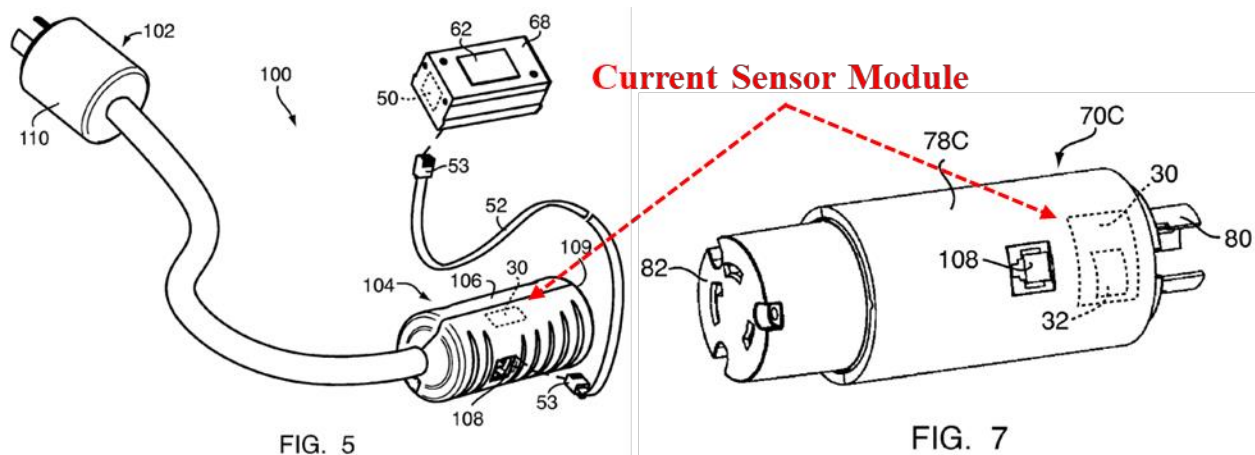
208. I understand that US patent application No. 10/960,844 that issued as the Godard reference was filed on October 7, 2004, and I have been asked to consider the Godard patent to be prior art as of this date. (Ex. 1007 at 1.)

209. Godard discloses a current sensor that detects electrical current flow through a power cord (Ex. 1007, Fig. 5) or power cord adaptor (Ex. 1007 at Fig. 7). (Ex. 1007 at 2:58-64, 3:6-16.) Godard also discloses that its current sensor provides

an output signal that varies in proportion to detected current flow and is coupled to a processing circuit and display for displaying characteristics of this current flow. (Ex. 1007 at 2:61-3:1; 3:13-19.)

210. Based on Godard's specification, Godard figure 3 illustrates current sensor module 30 with current sensor 32 mounted inside of power cord 100 to detect current flow. (Ex. 1007 at 4:29-38; 6:29-53, Fig. 5.) Based on the Godard specification, Godard figure 7 illustrates current sensor module 30 with current sensor 32 mounted inside of power cord adaptor 70C to detect current flow. (Ex. 1007 at 4:29-38; 6:11-28, Fig. 7.)

211. Based on Godard's specification (Ex. 1007 at 6:11-53), I confirm that the below annotations correctly identify the current sensor module in Godard Figs. 5 and 7:



(Ex. 1007, Figs. 5, 7 (annotated).)

212. Based the Godard specification, Godard Fig. 3 is a circuit diagram that illustrates a current sensing circuit 31 with current sensor 32. (Ex. 1007 at 6:29-49.) I confirm that, based on my review, the below annotations correctly identify the current sensing circuit, current sensor, and output terminal (labeled V_{out}) of the current sensor in Godard figure 3:

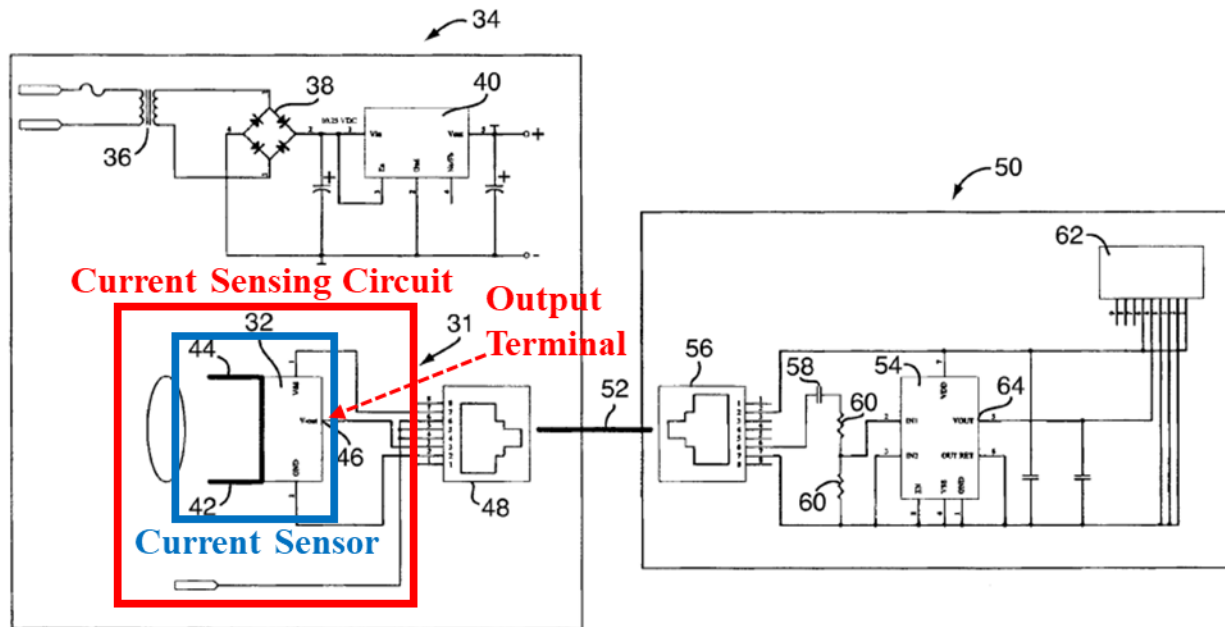


FIG. 3

(Ex. 1007 at Fig. 3 (annotated).)

213. Current sensor 32 detects current flow through a power supply cord and provides a proportional output voltage at output terminal 46. (Ex. 1007 at 4:39-46.) One example of a suitable current sensor is the Allegro Micro Systems AC750 Hall effect sensor. (Ex. 10017 at 4:50-64.)

2. Combination Of Jablonski And Godard

214. It is my opinion that a useful and reasonable combination of the Jablonski publication (Ex. 1005) and the Godard patent (Ex. 1007) modifies the Jablonski embodiments (Ex. 1005, Figs. 4-5, 7, 11) with the types of current sensor taught by Godard (Ex. 1007, Figs. 3, 5, 7) to detect the current drawn through a power cable supplying electrical energy (Ex. 1005 at 1:57-62, 3:13-19, 5:8-12) and displays the level of this current with Jablonski's linear lighting element.

215. The combination's power cables may be any type of power cable, including those disclosed in Jablonski. Jablonski discloses embodiments of a music player (*e.g.*, hi-fi system, karaoke machine, etc.) with illuminated cables connected to a microphone, loudspeaker, or headphones (Ex. 1005 at 13:4-8), an amplifier connected to an instrument (*e.g.*, electric guitar) (Ex. 1005 at 15:12-15), and a games console or computing device connected to a controller, keyboard, computer monitor, television, or other display (Ex. 1005 at 15:28-31). As explained above, in these embodiments, both peripheral devices (*e.g.*, loudspeaker, keyboard, etc.) and the music player, amplifier, or game console itself receive electrical power through a power cable.

216. Jablonski provides for illumination of ordinary electrical cables. (Ex. 1005, 5:1-4, 17:10-13, 21:24-27.) It would also be reasonable for the combination to employ the type of power cables disclosed in Godard because, for example, Godard teaches "detecting electrical current flow through the power supply cord" (Ex. 1007

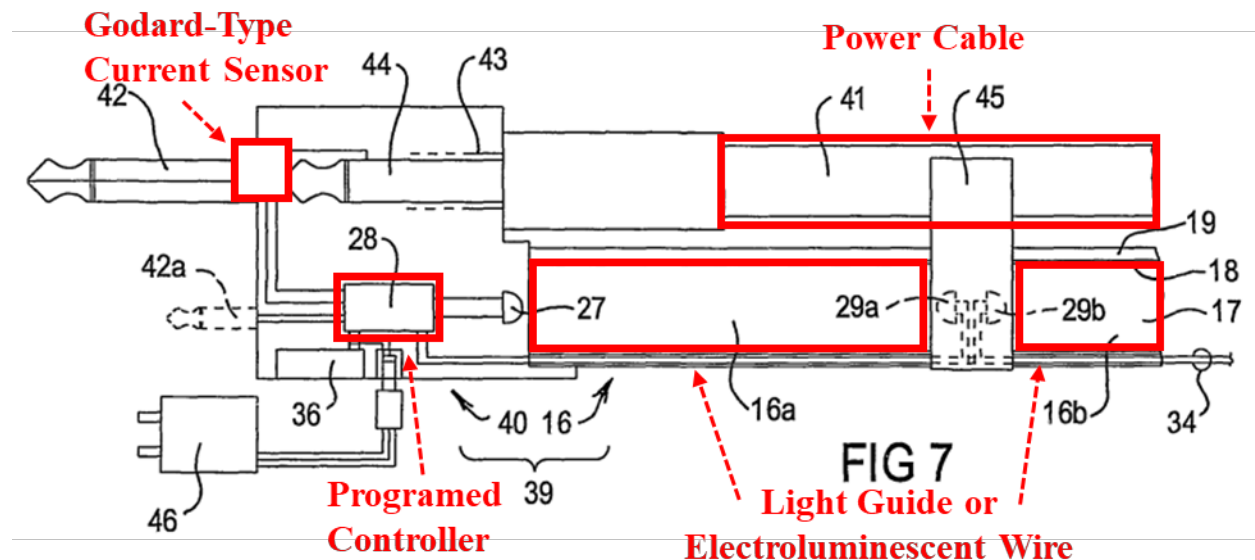
at 1:57-60) and displaying the level of current through this cord (Ex. 1007 at 2:64-3:1, 3:16-19) as well as displaying the electric load of connected devices. (Ex. 1007 at 2:5-10.)

217. It would be reasonable for the combination's current sensor to be any type of current sensor taught by Godard. Godard discloses detecting the power cord's current with a current sensor (Ex. 1007 at 2:58-64, 3:13-16), which provides an output signal at least partially "proportional to the detected current flow." (Ex. 1007 at 4:61-64.) Godard identifies a magnetic Hall effect sensor as an example of a suitable sensor. (Ex. 1007 at 4:42-46.)

218. It is my opinion that Jablonski discloses monitoring signal current with "a capacitive, magnetic or inductive sensor located adjacent" to signal wires. (Ex. 1005, 14:3-7.)

219. In my opinion, as discussed above, the Jablonski microprocessor controller would reasonably have been programmed or, as necessary, reprogrammed (Ex. 1005, 3:18-20, 6:7-12) to modulate Jablonski's linear lighting element according to the output signal of Godard's current sensor. For example, Jablonski's light guide attachment (Fig. 7) would reasonably have been combined with Godard's current sensor to detect and display the current in a power cable used to power devices (*e.g.*, games console, music player, loudspeaker, keyboard, etc.).

220. A combination of Jablonski and Godard would have employed Godard's current sensor to detect current through Jablonski's illuminated power cable (Ex. 1005, Fig. 4) or a power cable with Jablonski's light guide attachment (Ex. 1005, Fig. 7). For example, Jablonski's light guide attachment would have been mounted to an electric cable with connector 40 and clips 45 (Ex. 1005 at 21:24-22:6), as illustrated in the figure of a light guide attachment combination of Jablonski and Godard below.



221. In this combination of Jablonski and Godard, Godard's current sensor is placed adjacent to the wires between plug 42 and socket 43 as illustrated in the light guide attachment combination of Jablonski and Godard figure above—and as disclosed in Jablonski (Ex. 1005 at 14:3-7, 21:28-31)—to detect current drawn through a power cable as disclosed in Godard (Ex. 1007, 1:57-60). The combination

would provide a proportional output signal to Jablonski's programmed controller as disclosed in Godard (Ex. 1007 at 4:61-64), such that Jablonski's controller would modulate the light guide as disclosed in Jablonski. (Ex. 1005 at 21:31-34.)

**3. Motivation To Combine Jablonski
And Godard And Expectation Of Success**

222. POSITAs would have been motivated to combine Jablonski and Godard, including making the light guide attachment combination of Jablonski and Godard as described above, because it maintains Jablonski's advantages of indicating current along a cable and applies them to indicate current along a power cable to solve the issues addressed in Godard.

223. Godard addresses the issue of monitoring current or power usage when power cords are plugged into an obscured location like the inside of a cabinet, behind an appliance, or below a machine. (Ex. 1007 at 1:25-40.) Godard addresses this issue by providing a remote ammeter display. (Ex. 1007 at 2:64-3:5, 3:29-31.) Jablonski displays varying light (*i.e.*, modulates illumination) for the similar purpose of visually indicating dynamic electrical signals that normally are hidden inside a cable. (Ex. 1005 at 1:16-17, 2:25-33, 3:15-18, 6:1-4, 13:14-16, 16:13-18, 18:11-13, 19:1-4.)

224. POSITAs would have been motivated to solve Godard's issue of displaying current through a power cable plugged into an obscured location by

illuminating the cable itself with a lighting element that modulates illumination to display the same electrical current. This would provide the advantages of: (1) making a visual indication of power cord status more visible (*i.e.*, more noticeable to the person being informed), especially in low-light environments; (2) making the power cord or cable itself more visible for safety reasons; and (3) providing a modulating light for decorative reasons. For the reasons explained above, all three were known goals in the art.

225. In my opinion, Jablonski and Godard are an especially natural combination because Jablonski's linear lighting element is illuminated for an *informative purpose*: Jablonski modulates illumination according to measured "signal currents" through a signal cable, thereby indicating the transmission of data, audio, etc. through the cable. (Ex. 1005 at 1:26-33, 11:3-6, 13:14-16.) And Godard also serves an *informative purpose* by providing a remote ammeter for displaying the current of a power supply cord. (Ex. 1007 at 1:66-2:2, 2:54-3:1, 3:16-19, 6:45-53.)

226. In view of the state-of-the-art discussed above, POSITAs motivated to display current supplied through a power cable for informative, safety, and/or decorative reasons would have combined Jablonski and Godard with a high expectation of success. The only necessary modification was to measure current supplying electrical energy through a power cable with an appropriate sensor as

disclosed in Godard (Ex. 1007, 1:57-62, 3:13-19, 4:39-46, 5:8-12). For the reasons explained above, POSITAs knew how to measure current through a power supply with an appropriate sensor, including, as discussed above: Hall sensors like the Allegro Microsystems ACS750 described in Godard. The Jablonski microprocessor controller already monitors this output and generates control signals to modulate the linear lighting element(s) accordingly (Ex. 1005 at 13:17-20, 14:3-7) and would have been programmed or reprogrammed (Ex. 1005 at 5:24-25, 6:5-12) as necessary to display current associated with a power cable (Ex. 1007, 1:66-2:2, 3:16-19, 3:25-28, 6:45-49). For the reasons explained above, commercial microprocessor controllers were capable of this operation and POSTIAs know how to use them.

4. Claim 1

[1.a] <i>An arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor,</i>
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227. For the reasons explained above, Jablonski discloses the “[a]n arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor” element of ’829 patent claim 1. The Jablonski-Godard combination would have disclosed this element for the same reasons.

228. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably applied Jablonski’s techniques and designs to illuminate a power

cord or cable according to its transmission of current associated with supplying electrical energy. Godard discloses measuring current through a power cord and displaying characteristics of this current. (Ex. 1007 at 1:66-2:2, 2:61-3:1, 3:13-19, 4:39-42, 5:12-17, 6:45-49.) Jablonski would have been modified, as needed, with an appropriate current sensor (Ex. 1007 at 4:39-46, 50-64) to measure current through a power cable, and to control illumination of Jablonski's linear lighting element according to that measured current.

[1.b] *wherein the arrangement comprises a substantially wire shaped illuminator, and*

229. For the reasons explained above, Jablonski discloses the “wherein the arrangement comprises a substantially wire shaped illuminator” element of '829 patent claim 1. The Jablonski-Godard combination would have disclosed this element for the same reasons.

[1.c] *a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity, and*

230. For the reasons explained above, Jablonski discloses the “a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical

quantity” element of ’829 patent claim 1. The Jablonski-Godard combination would have disclosed this element for the same reasons.

231. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably modified Jablonski’s current sensor and controller as needed to measure current in a power cable. The Jablonski controller would then have modulated illumination characteristics of the wire shaped illuminator to indicate this measured current.

[1.d] feeding the wire shaped illuminator with varying current or voltage corresponding to the electrical quantity measured in the conductor.

232. For the reasons explained above, Jablonski discloses the “feeding the wire shaped illuminator with varying current or voltage corresponding to the electrical quantity measured in the conductor” element of ’829 patent claim 1. The Jablonski-Godard combination would have disclosed this element for the same reasons.

233. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably relied on Jablonski controller to modulate a linear lighting element according to measured current as disclosed in Godard.

5. Claim 2

The arrangement of claim 1, wherein said wire shaped illuminator is arranged along said conductor.

234. For the reasons explained above, Jablonski discloses claim 2 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

6. Claim 3

The arrangement of claim 1, wherein said wire shaped illuminator is electroluminescent.

235. For the reasons explained above, Jablonski discloses claim 3 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

7. Claim 4

The arrangement of claim 1, wherein said wire shaped illuminator is an optical fiber.

236. For the reasons explained above, Jablonski discloses claim 4 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

8. Claim 5

The arrangement of claim 1, wherein said controller further sends a control signal to control said wire shaped illuminator.

237. For the reasons explained above, Jablonski discloses claim 5 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

9. Claim 6

The arrangement of claim 3, wherein said electroluminescent includes a central conductive wire coated with a phosphorus material coating and transmitter wires wrapped around it, and covered by a coating and a colored vinyl coat.

238. For the reasons explained above, Jablonski discloses claim 6 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

10. Claim 7

The arrangement of claim 1, wherein said controller comprises a processing arrangement and a measuring arrangement and a driver for driving said wire shaped illuminator receiving control signals from said processing arrangement.

239. For the reasons explained above, Jablonski discloses claim 7 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

240. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably relied on Godard's current sensor to measure current, and Jablonski's microprocessor controller to quantify, process, etc. this measured current and to drive illumination of Jablonski's linear lighting element.

11. Claim 8

The arrangement of claim 1, wherein said illumination characteristic is one or several of intensity, color or frequency.

241. For the reasons explained above, Jablonski discloses claim 8 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

12. Claim 9

[9.a] A cord comprises at least one electric wire and a substantially wire shaped illuminator at least partly arranged along an extension of said at least one electric wire,

242. For the reasons explained above, Jablonski discloses the “[a] cord comprises at least one electric wire and a substantially wire shaped illuminator at least partly arranged along an extension of said at least one electric wire” element of '829 patent claim 9. The Jablonski-Godard combination would have disclosed this element for the same reasons.

243. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably integrated or attached Jablonski's linear illuminators with a power cable.

[9.b] said substantially wire shaped illuminator having means for illumination when energized to indicate an electrical quantity, being one or several of power, current or voltage through the at least one electric wire,

244. For the reasons explained above, Jablonski discloses the “said substantially wire shaped illuminator having means for illumination when energized to indicate an electrical quantity, being one or several of power, current or voltage through the at least one electric wire” element of ’829 patent claim 9. The Jablonski-Godard combination would have disclosed this element for the same reasons.

245. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably modified Jablonski as necessary to measure current through a power cable. For example, Godard discloses detecting electrical current flow through a power cord (Ex. 1007 at Fig. 5) or power cord adaptor (Ex. 1007 at Fig. 7) with a current sensor. (Ex. 1007 at 2:58-64; 3:6-16.)

[9.c] wherein said substantially wire shaped illuminator indicates the current or voltage through said at least one electric wire when at least one illumination characteristic of said substantially wire shaped illuminator is controlled with respect to said electrical quantity by feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through at least one electrical wire.

246. For the reasons explained above, Jablonski discloses the “wherein said substantially wire shaped illuminator indicates the current or voltage through said at least one electric wire when at least one illumination characteristic of said

substantially wire shaped illuminator is controlled with respect to said electrical quantity by feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through at least one electrical wire” element of ’829 patent claim 9. The Jablonski-Godard combination would have disclosed this element for the same reasons.

13. Claim 10

The cord of claim 9, further comprising a substantially translucent coating, covering said at least one electric wire and substantially wire shaped illuminator.

247. For the reasons explained above, Jablonski discloses claim 10 of ’829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

14. Claim 11

The cord of claim 9, wherein said substantially wire shaped illuminator is an electroluminescent wire.

248. For the reasons explained above, Jablonski discloses claim 11 of ’829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

15. Claim 12

The cord of claim 9, wherein said substantially wire shaped illuminator is an optical fiber.

249. For the reasons explained above, Jablonski discloses claim 12 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

16. Claim 13

The cord of claim 9, wherein said substantially wire shaped illuminator indicates current or power through said at least one electric wire.

250. For the reasons explained above, Jablonski discloses claim 13 of '829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

17. Claim 14

[14.a] A method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of:

251. For the reasons explained above, Jablonski discloses the “[a] method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of” element of '829

patent claim 14. The Jablonski-Godard combination would have disclosed this element for the same reasons.

[14.b] *energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity and*

252. For the reasons explained above, Jablonski discloses the “energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity” element of ’829 patent claim 14. The Jablonski-Godard combination would have disclosed this element for the same reasons.

[14.c] *feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor.*

253. For the reasons explained above, Jablonski discloses the “feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor” element of ’829 patent claim 14. The Jablonski-Godard combination would have disclosed this element for the same reasons.

18. Claim 15

[15.a] A device for providing a variable visual indication of consumption of electricity comprising:

254. For the reasons explained above, Jablonski discloses the “[a] device for providing a variable visual indication of consumption of electricity comprising” element of ’829 patent claim 15. The Jablonski-Godard combination would have disclosed this element for the same reasons.

255. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably measured current with a current sensor as discussed in Godard. (Ex. 1007 at 2:61-64, 3:13-16; 6:19-24.) Jablonski would have been modified, as needed, with an appropriate current sensor (Ex. 1007 at 4:39-46, 4:50-64) to measure current through a power cable, and to control illumination of Jablonski’s linear lighting element according to this measured current.

[15.b] a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity associated with said electricity; and

256. For the reasons explained above, Jablonski discloses the “a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity

associated with said electricity” element of ’829 patent claim 15. The Jablonski-Godard combination would have disclosed this element for the same reasons.

257. In addition to Jablonski itself, the Jablonski-Godard combination would have reasonably measured current in a power cable connecting a consuming device to an external power source as disclosed in Godard. For example, Godard discloses power cord and power cord adaptor embodiments that provide a plug and socket for connecting an electrical device to an external power source. (Ex. 1007 at 2:58-61, 3:6-12, 6:11-16, 6:29-35, 6:49-53, Figs. 5, 7.) The combination would have indicated this current as disclosed in Jablonski.

[15.c] a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity;

258. For the reasons explained above, Jablonski discloses the “a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity” element of ’829 patent claim 15. The Jablonski-Godard combination would have disclosed this element for the same reasons.

[15.d] wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity.

259. For the reasons explained above, Jablonski discloses the “wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity” element of ’829 patent claim 15. The Jablonski-Godard combination would have disclosed this element for the same reasons.

19. Claim 16

The device of claim 15, wherein said plurality of illumination devices each comprise a copper wire coated with a phosphorous material and two transmitter wires wrapped around the copper wire.

260. For the reasons explained above, Jablonski discloses claim 16 of ’829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

20. Claim 17

The device of claim 15, wherein said light output by said plurality of illumination devices varies in at least one of intensity, color or frequency over time based on said measured variable electrical quantity.

261. For the reasons explained above, Jablonski discloses claim 17 of ’829 patent. The Jablonski-Godard combination would have disclosed this claim for the same reasons.

D. Borden

262. I understand that US patent application No. 10/752,854 that published as the Borden reference was filed January 7, 2004, and I have been asked to consider the Borden publication to be prior art as of this date. (Ex. 1009 at 1.)

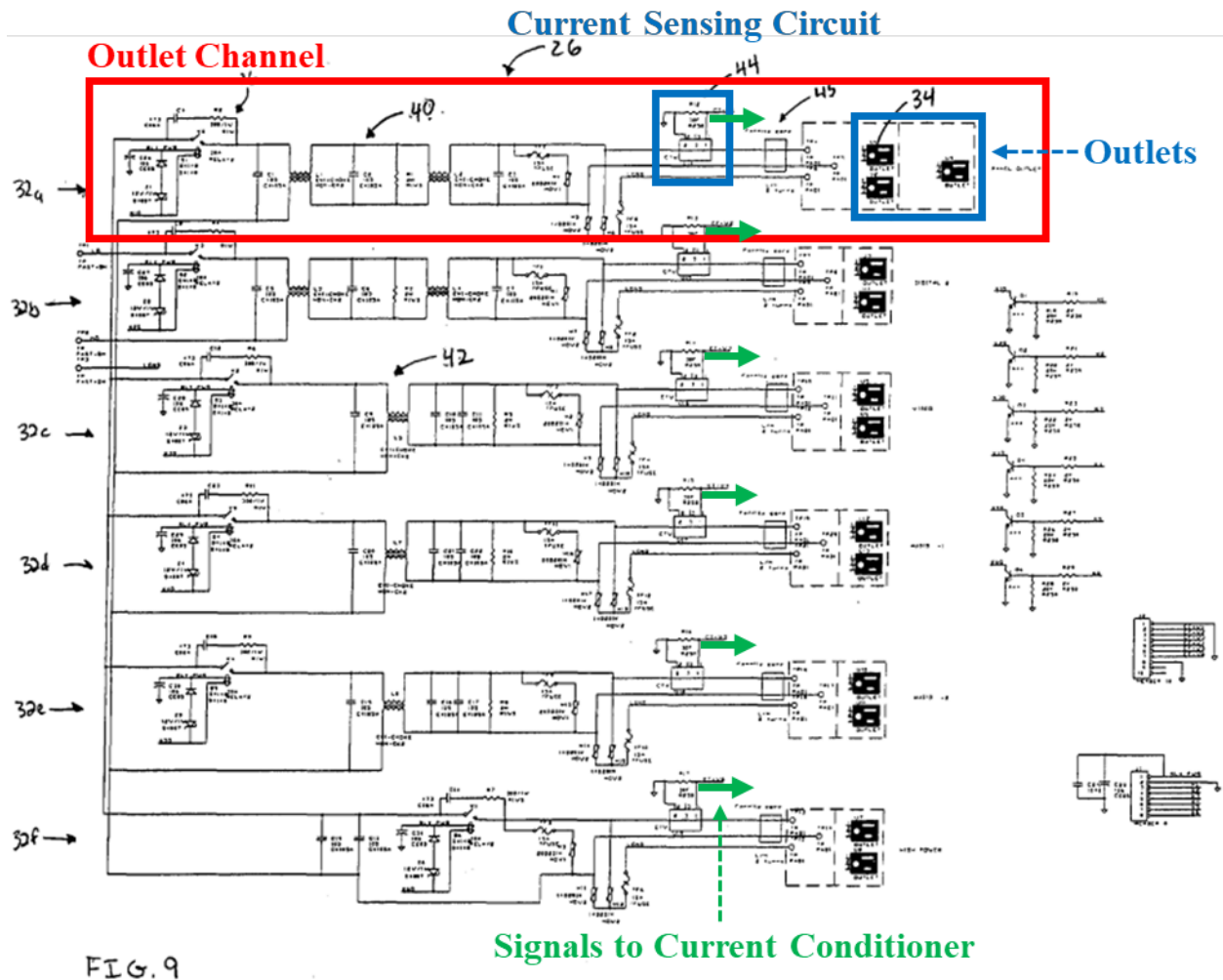
263. For the reasons explained below and based on my review of the '829 patent and the Borden reference, I believe that the Borden reference anticipates claims 15 and 17 of the '829 patent.

264. Borden discloses measuring the current at an outlet socket, generating various signals according to this measurement, and modulating the illumination of LEDs to indicate the measured current. Borden provides a power line conditioner (*e.g.*, power strip) that measures current delivered through an outlet socket to an electrical device and a display that visually indicates those current measurements. (Ex. 1009 at [0019], [0029].)

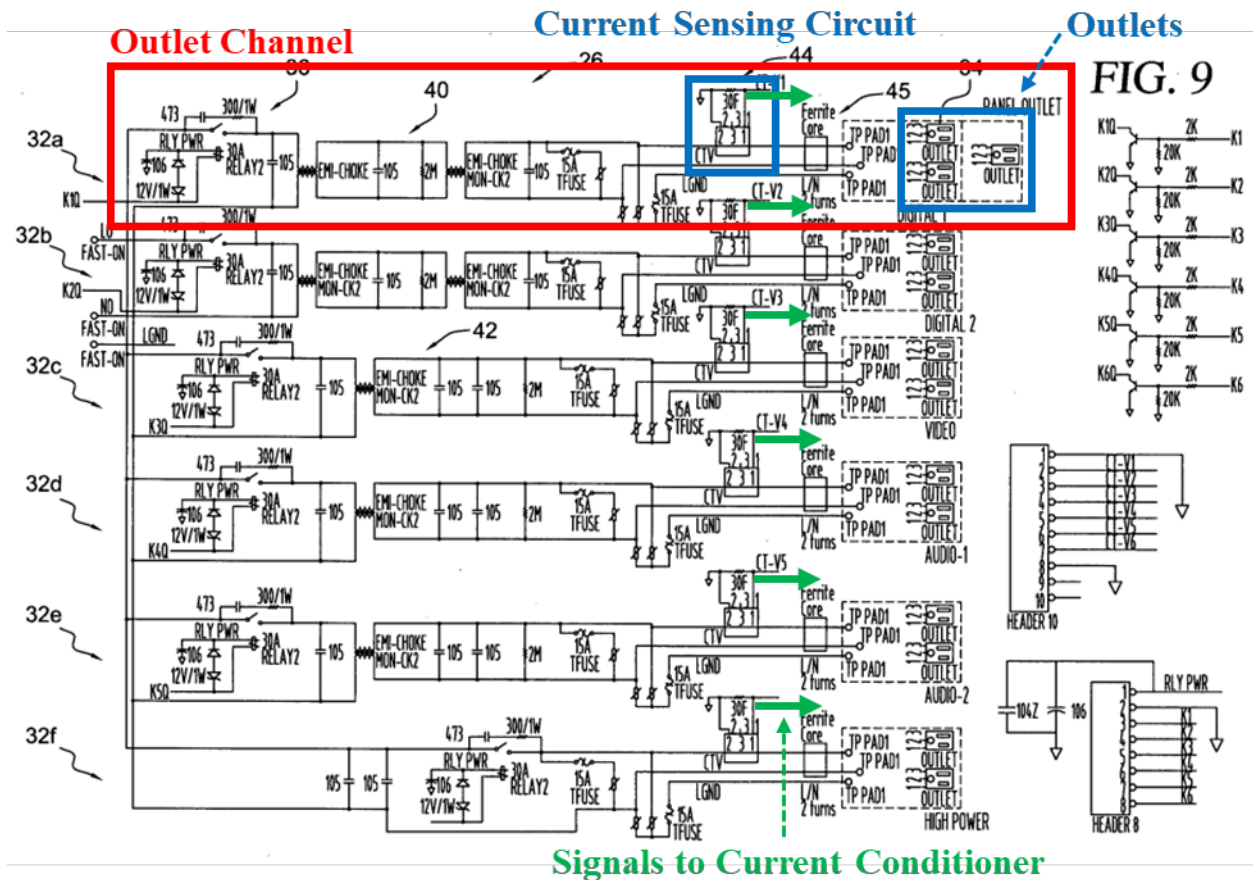
265. Borden Fig. 1—which is substantively and functionally equivalent to Issued Borden Patent Fig. 1 as discussed above—illustrates the preferred embodiment of power line conditioner apparatus 10 with current signal conditioner 18, system controller 20, user interface controller 22, and outlet channels 26. (Ex. 1009 at [0020].)

266. Borden figure 9—which is substantively and functionally equivalent to Issued Borden Patent Fig. 9 as discussed above—discloses current sensing circuits 44 located on the power conditioner's outlet channels close to electrical outlets 34

to accurately measure current delivered to these outlets and the electrical devices they power (Ex 1009 at [0029]):

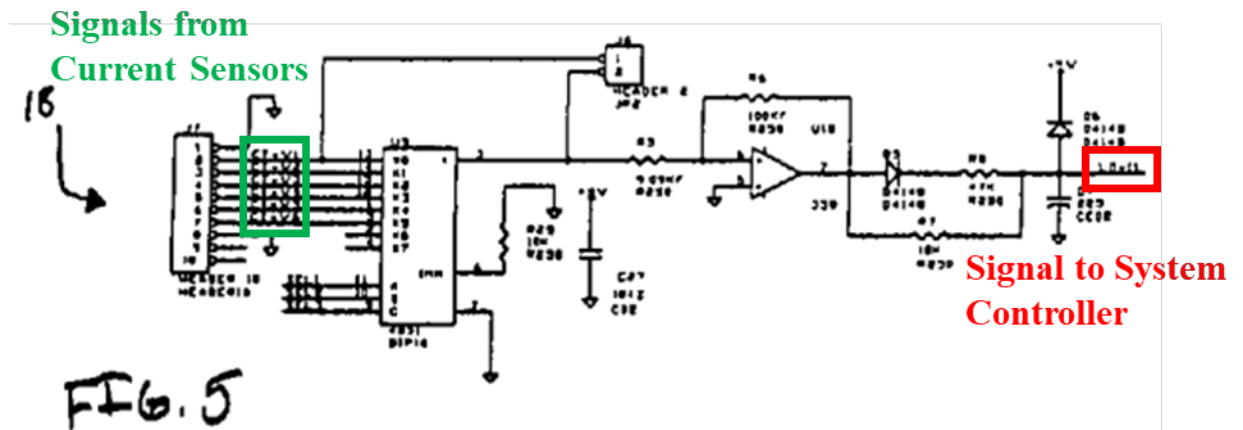


Ex. 1009 at Fig. 9 (annotated).

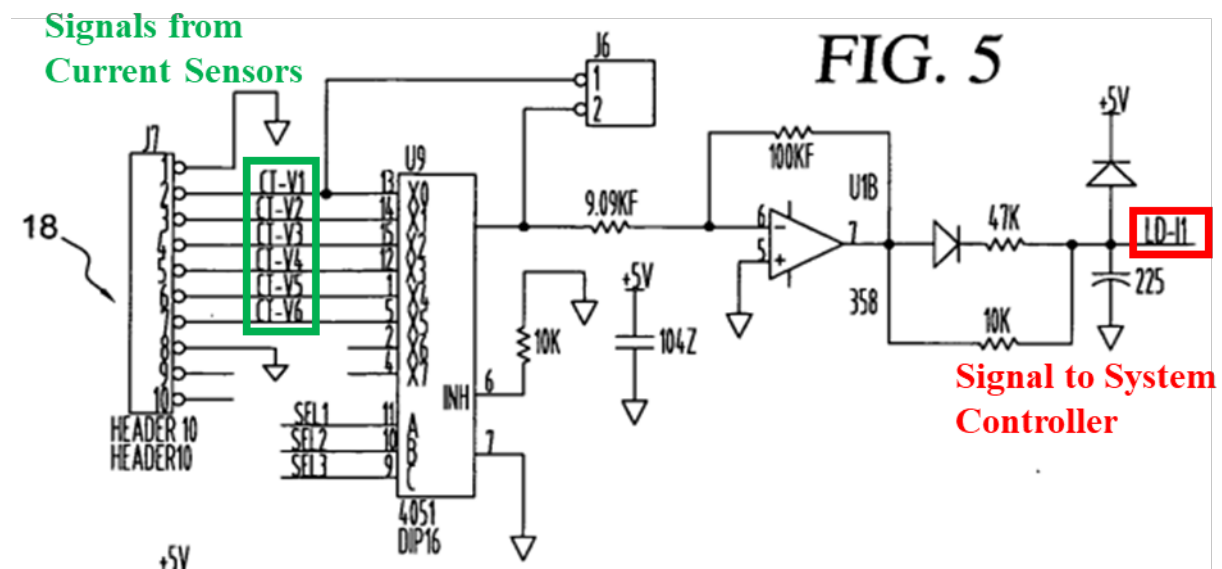


Ex. 1111 at Fig. 9 (annotated).

267. As part of the same embodiment, Borden Fig. 5—which is substantively and functionally equivalent to Issued Borden Patent Fig. 5 as discussed above—discloses current signal conditioner 18 which is electrically connected with current sensing circuits 44 disclosed in Fig. 9 and receives an alternating current signal from these current sensing circuits (Ex. 1009 at [0024]):



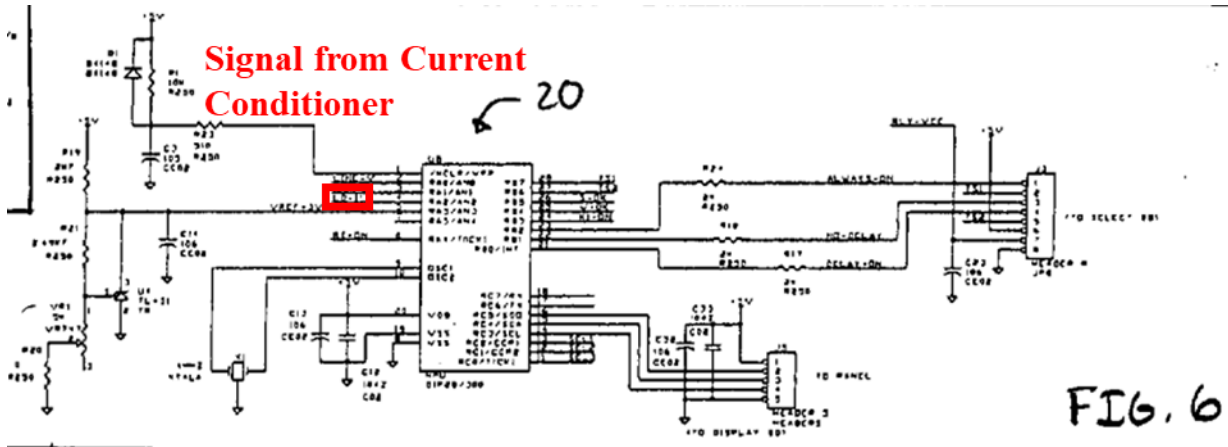
(Ex. 1009 at Fig. 5 (annotated).)



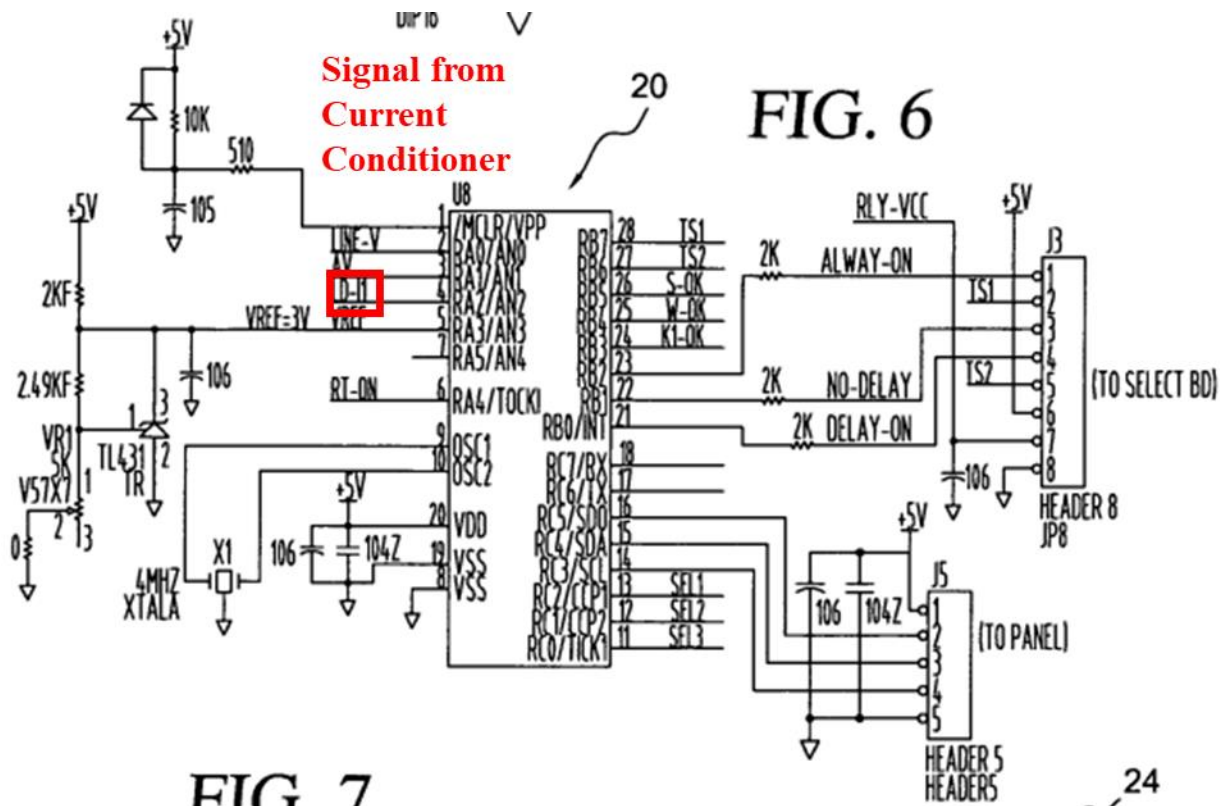
(Ex. 1011 at Fig. 5 (annotated).)

268. For the reasons explained above, the Borden current signal conditioner converts the signal from current sensor 44 to a signal that is transmitted to system controller 20. (Ex. 1009 at [0024].)

269. As part of the same embodiment, system controller 20, which includes a processor, is illustrated in Fig. 6 (Ex. 1009 at [0025])—which is substantively and functionally equivalent to Issued Borden Patent Fig. 6 as discussed above:



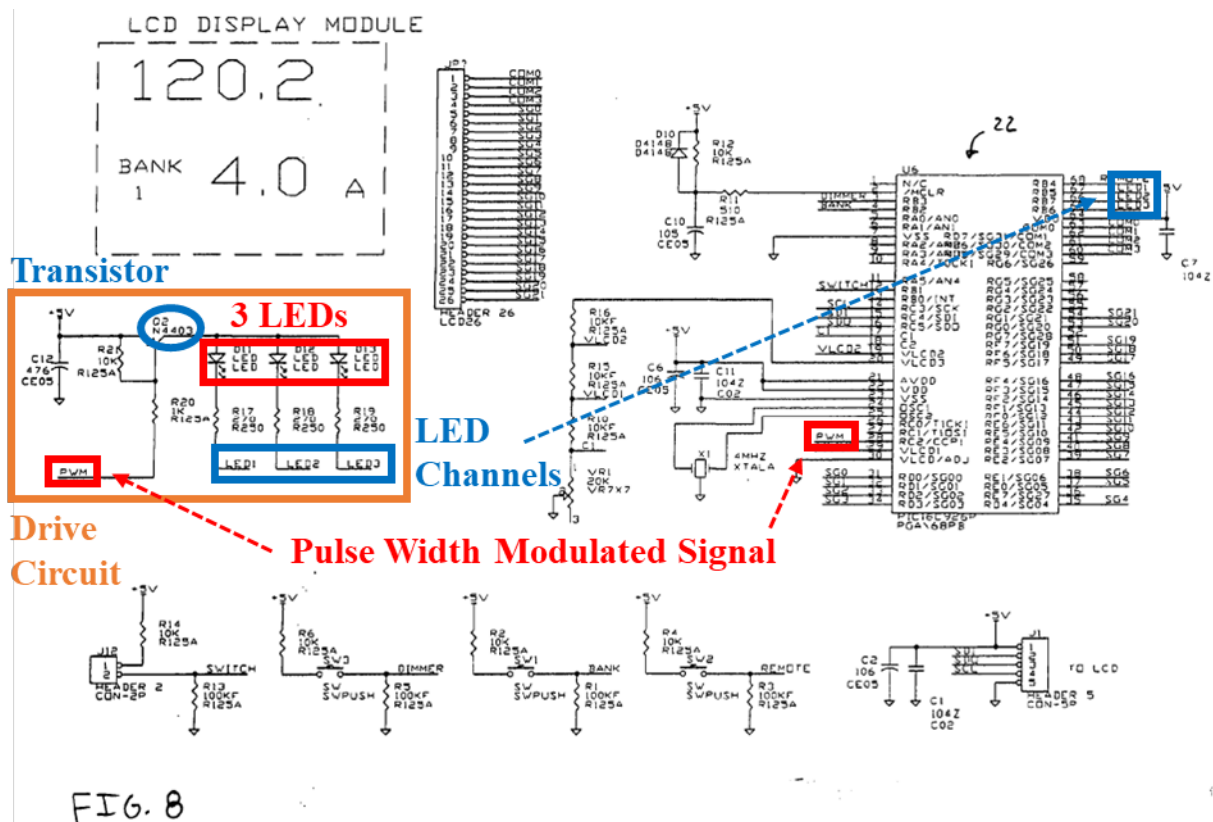
(Ex. 1009 at Fig. 6 (annotated).)



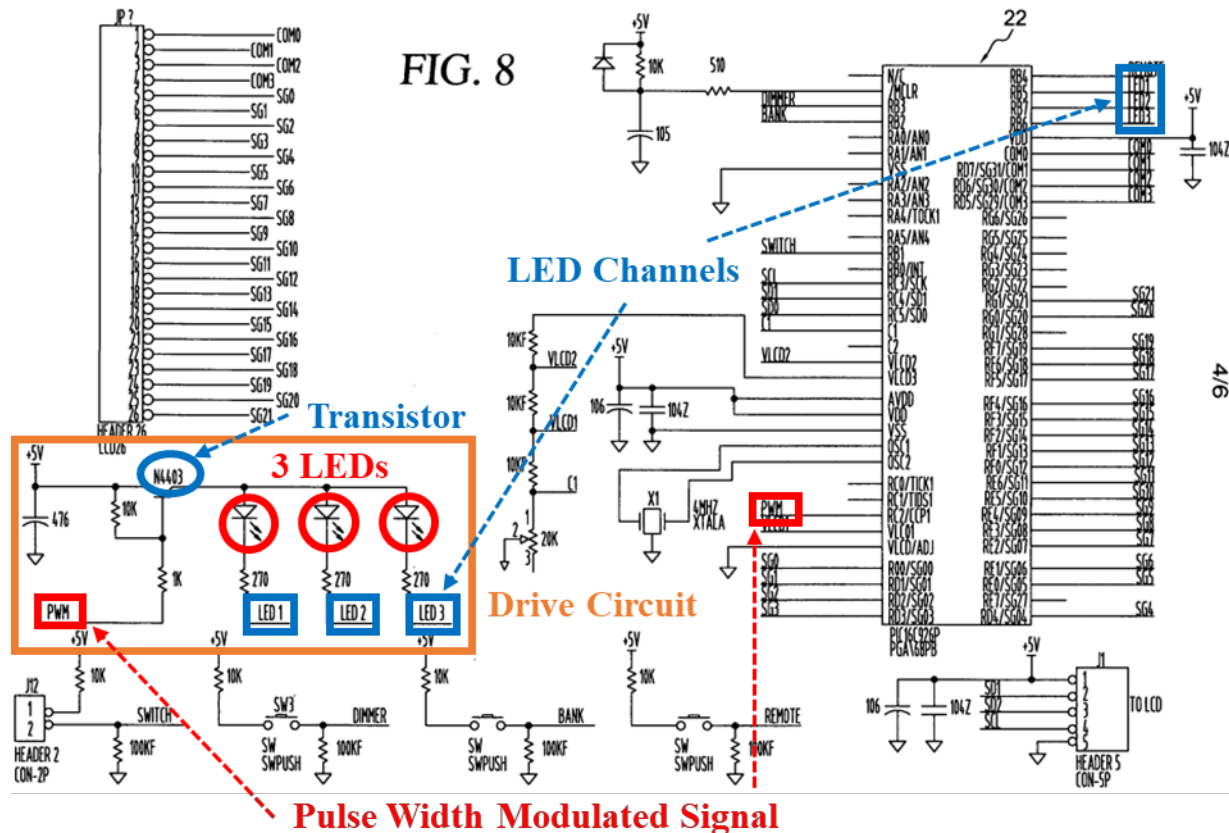
(Ex. 1011 at Fig. 6 (annotated).)

270. The Borden system controller 20 receives proportional direct current signals from current signal conditioner 18, processes those signals, and transmits control signals to user interface and display controller 22. (Ex. 1009 at [0025].)

271. As part of the same embodiment, Borden Fig. 8—which is substantively and functionally equivalent to Issued Borden Patent Fig. 8 as discussed above—illustrates user interface and display controller 22, which displays a visual indication of measured current (Ex. 1009 at [0027]):



(Ex. 1009 at Fig. 8 (annotated).)



(Ex. 1011 at Fig. 8 (annotated).)

272. For the reasons explained above, user interface and display controller 22 generates a “PWM” signal that controls transistor N4403 to power a series of three LEDs on channels LED 1, LED 2, and LED 3.

273. For the reasons explained above, a PWM signal is a pulse width modulated control signal with “on” pulses and “off” pulses that vary in duration at a set frequency (*e.g.*, 250 Hz).

274. For the reasons explained above, the proportionate duration of the “on” pulse to the pulse width is referred to as the “duty cycle.” For the reasons explained

above, a POSITA would recognize that variations of the PWM “duty cycle” would vary the average current and voltage provided per cycle and over time.

275. For the reasons explained above, for example, a 50% duty cycle at a frequency of 250 Hz would provide current and voltage for 2 milliseconds every 4 milliseconds.

276. For the reasons explained above, the Borden LED drive circuit switches transistor N4403 to illuminate LEDs for the duration of the PWM “on” (i.e. low-voltage in Fig. 8) pulse.

277. For the reasons explained above, as was known in the art, modulating LEDs according to a PWM drive signal varies the average illumination over time and causes the LEDs to appear brighter and dimmer according to the “duty cycle.”

1. Claim 15

[15.a] *A device for providing a variable visual indication of consumption of electricity comprising:*

278. Borden discloses the “[a] device for providing a variable visual indication of consumption of electricity comprising” element of ’829 patent claim 15.

279. Borden’s current sensing circuit 44 is positioned close to electrical outlets 34 in order to measure current “actually delivered to” (i.e., consumed by) powered electrical devices. (Ex. 1009 at [0029].) Borden further discloses one or

more displays “electrically connected to the current measuring circuit to provide a visual indication of current measurements” (Ex. 1009 at [0019]), including the user interface and display controller 22 in Fig. 8. (Ex. 1009 at [0027].)

[15.b] a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity associated with said electricity; and

280. Borden discloses the “a measurement unit, disposed between an external power source and a device which consumes said electricity, configured to measure a variable electrical quantity associated with said electricity” element of ’829 patent claim 15.

281. Borden discloses that power conditioner 10 receives power from a standard wall outlet or another power source. (Ex. 1009 at [0020].) Current sensing circuit 44 is disposed between this power source and electrical outlets 34 to measure current delivered to each of these outlets and the devices they power. (Ex. 1009 at [0029], Fig. 9.)

[15.c] a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity;

282. Borden discloses the “a controller connected to said measurement unit and configured to receive said measured variable electrical quantity from said

measurement unit, and further configured to control a plurality of illumination devices based on said received said measured variable electrical quantity” element of ’829 patent claim 15.

283. Borden’s current signal conditioner 18 is electrically connected to and receives an alternating current signal from current sensing circuit 44, and transmits a proportional direct current signal to electrically connected system controller 20. (Ex. 1009 at [0024], Figs. 5, 6, 9.) System controller 20 processes this direct current signal and transmits a control signal to user interface and display controller 22. (Ex. 1009 at [0025].)

284. As illustrated in Fig. 8 and discussed above, user interface and display controller 22 drives three LEDs with a PWM signal to “provide[] a visual indication of current and voltage measurements” (Ex. 1009 at [0027], Fig. 8).

[15.d] wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity.

285. Borden discloses the “wherein said plurality of illumination devices output light which varies over time as a function of said measured variable electrical quantity” element of ’829 patent claim 15.

286. For the reasons explained above, the three LEDs illustrated in Fig. 8, are driven by a PWM signal from user interface and display controller 22. (Ex. 1009 at Fig. 8.)

287. For the reasons explained above, a POSITA would recognize that illumination of these LEDs would vary according to the duty cycle of the PWM signal to “provide[] a visual indication of current and voltage measurements” (Ex. 1009 at [0027]).

2. Claim 17

The device of claim 15, wherein said light output by said plurality of illumination devices varies in at least one of intensity, color or frequency over time based on said measured variable electrical quantity.

288. For the reasons explained above and below, Borden discloses this limitation.

E. The Combination Of Borden And Currie Patents

1. Currie

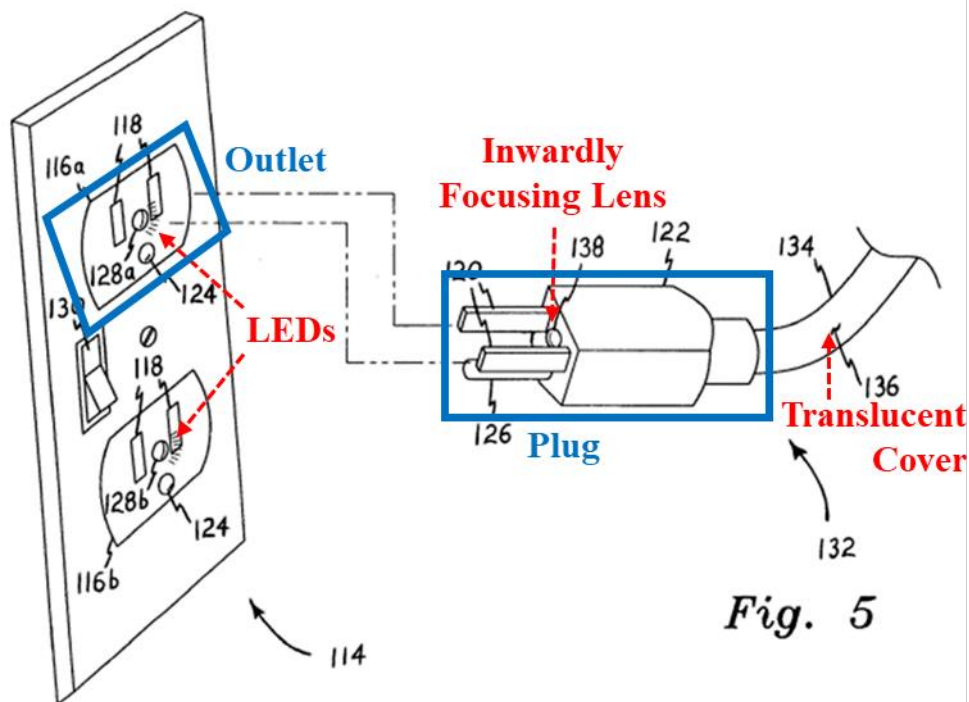
289. I understand that US patent application No. 10/948,186 that published as the Currie reference was filed September 24, 2004, and I have been asked to consider the Currie publication to be prior art as of this date. (Ex. 1012 at 1.)

290. For the reasons explained above, Currie describes several ways to illuminate a power cable for safety or decorative reasons, including illuminating a translucent outer cover with one or more LEDs (Ex. 1012 at [0048].) Specifically, Currie discloses illuminated electrical cords that encompass an electrical conductor having a translucent cover (e.g., sheath, coating, wrap, sleeve) that receives

illumination from a lighting element (*e.g.*, LED) and emits light radially along the length of the cord. (Ex. 1012 at [0003], [0029], [0048]-[49], [0065].)

291. In several embodiments, the illuminating light source is located within an “electrical outlet [...] or power strip to which the illuminated electrical cord is connected,” the outlet or power strip having “means for transmitting light to the illuminated electrical cord[.]” (Ex. 1012 at [0031]-[32].)

292. Based on Currie’s specification (Ex. 1012 at [0066]-[67]), Currie figure 5 illustrates an electrical outlet embodiment of Currie’s illuminated cord assembly. Based on Currie’s specification, the outlet, plug, LEDs, translucent cover, and inwardly focusing lens are correctly annotated in the below figure:



(Ex. 1012 at Fig. 5 (annotated).) In this outlet embodiment, illuminated cord 134 is plugged in such that plug 122 abuts electrical receptacle 116_a, inwardly focusing lens 138 receives light from light source (*e.g.*, LED) 128, and focuses it through plug 122 to illuminate the translucent cover 136 of the cord assembly 134. (Ex. 1012 at [0068].)

293. Based on Currie's specification (Ex. 1012 at [0075]-[76]), Currie figure 8 illustrates a power strip embodiment of Currie's illuminated cord assembly. I confirm, based on Currie's specification, that the outlet, plug, and LED are correctly annotated in the below figure:

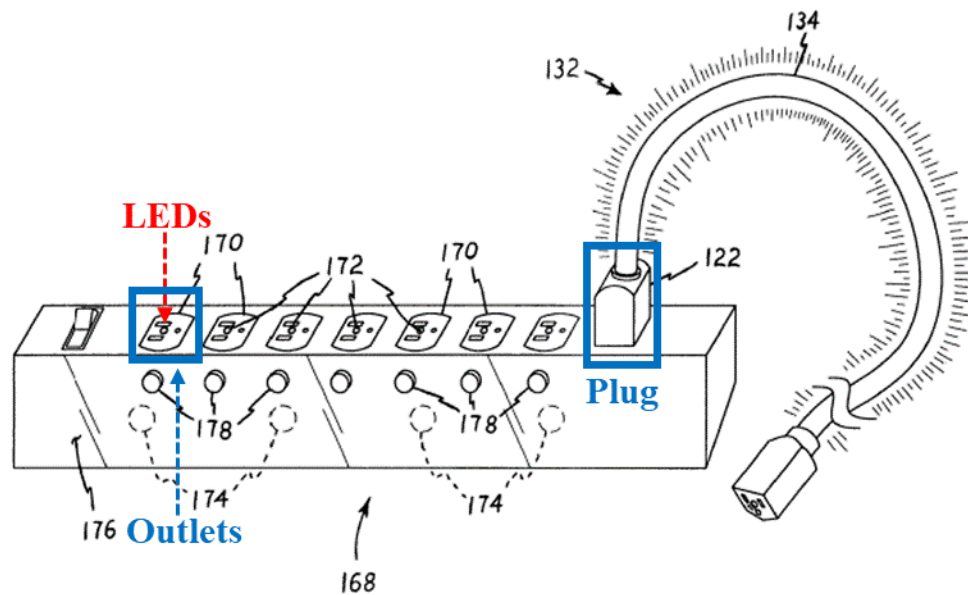


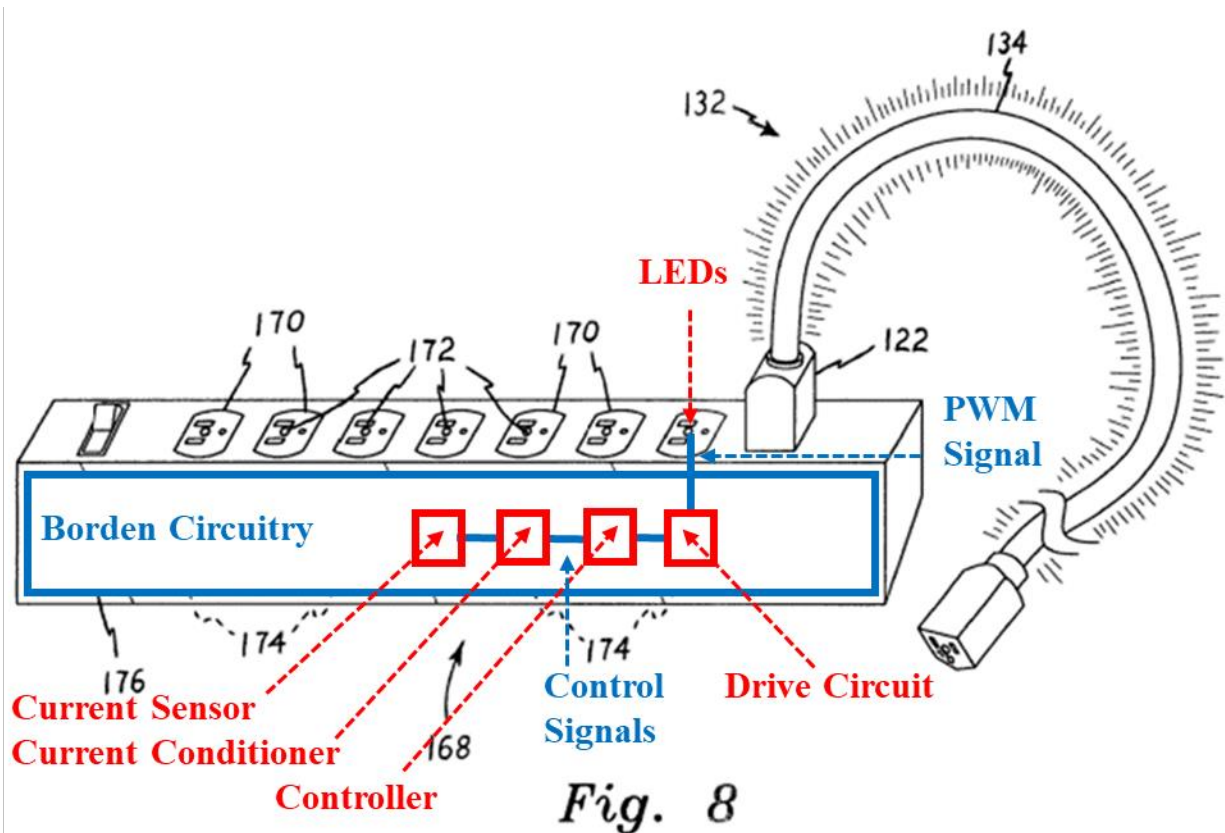
Fig. 8

(Ex. 1012 at Fig. 8 (annotated).) In this power strip embodiment, electrical receptacles 170 have lights 172 positioned to shine into male plug 122, which has an internally directed lens that illuminates cord assembly 132. (Ex. 1012 at [0075].)

294. Currie's outlet and power strip embodiments both include electrical cord assembly 134 with male plug 122, which are plugged into the corresponding outlet sockets of each embodiment. (Ex. 1012 at [0066], [0068], [0075].)

2. Combining Borden And Currie

295. It is my opinion that a useful and reasonable combination of the Borden and Currie publications would have replaced the Currie circuitry in the Currie power strip with the Borden circuitry, with the Borden circuit providing a current-indicating level of illumination to the Currie LEDs 172 (Ex. 1012 at Fig. 8) to illuminate the Currie cord according to measured current as illustrated in the below figure:



296. This combination of Borden and Currie would have reasonably incorporated the Borden current sensing circuit to measure the current delivered to Currie's illuminated cord assembly through Currie's illuminated electrical receptacles. As in Borden, a current signal conditioner (Borden Fig. 5) receives an alternating current signal from Borden's current sensing circuit (Borden Fig. 9) and generates a proportional direct current signal that is converted to a PWM signal by one or more controllers (Borden Figs. 6, 8).²

297. For the reasons explained above, the PWM signal drives an LED by modulating a transistor (*e.g.*, N4403) as illustrated by the circuit diagram of Borden's user interface and display controller (Borden Fig. 8). Borden's PWM signal would have driven LEDs in each of Currie's outlet sockets, and these LEDs would have been positioned to shine into the internally directed lens of a plug to illuminate the translucent cover of Currie's illuminated cord assembly along its length.

²The Borden-Currie combination would have also incorporated an internal power supply as necessary to supply dc power to various internal components, including the microprocessor controller(s). (Ex. 1009, [0022], Fig. 3.)

298. For the reasons explained above, the Borden current sensor would reasonably have encompasses a current transformer in some embodiments of the combination.

3. Motivation To Combine Borden And Currie And Expectation Of Success

299. POSITAs would have been motivated to combine Borden and Currie because Borden and Currie both provide visual indication of power conditions, and a Borden-Currie combination, like the power strip combination of Borden and Currie discussed above, would combine Borden's visual quantification of delivered current with Currie's qualitative indication that current is flowing through an illuminated cord.

300. POSITAs would have been motivated to illuminate a power cord with the Borden-Currie combination to maintain Borden's visual quantification of current (Ex. 1009 at [0021], [0048]) while also advancing Currie's safety purpose of alerting users to tripping hazards, unsafe overload conditions, or whether safety or medical equipment is receiving appropriate power, especially in low light environments. (Ex. 1012 at [0048].)

301. Currie is an especially natural combination with Borden because Currie's illuminated cord assembly utilizes an LED that may be located in an outlet (Ex. 1012 at [0010]) which may be located on the exterior of a power strip (Ex. 1012

at [0075]), and Borden controls the illumination of LEDs on the exterior of a power strip. (Ex. 1009 at [0019], [0027], Fig. 8.)

302. POSITAs would have had a high expectation of success placing Borden's circuitry inside Currie's power strip, at least because Borden already places its circuitry within a multi-outlet power conditioner. For example, as illustrated in Borden figure 1 below, Borden discloses various surge suppression, outlet channel, current sensing, control, and display circuits that are not limited to a specific physical package. (Ex. 1009 at [0019]-[20], Fig. 1.)

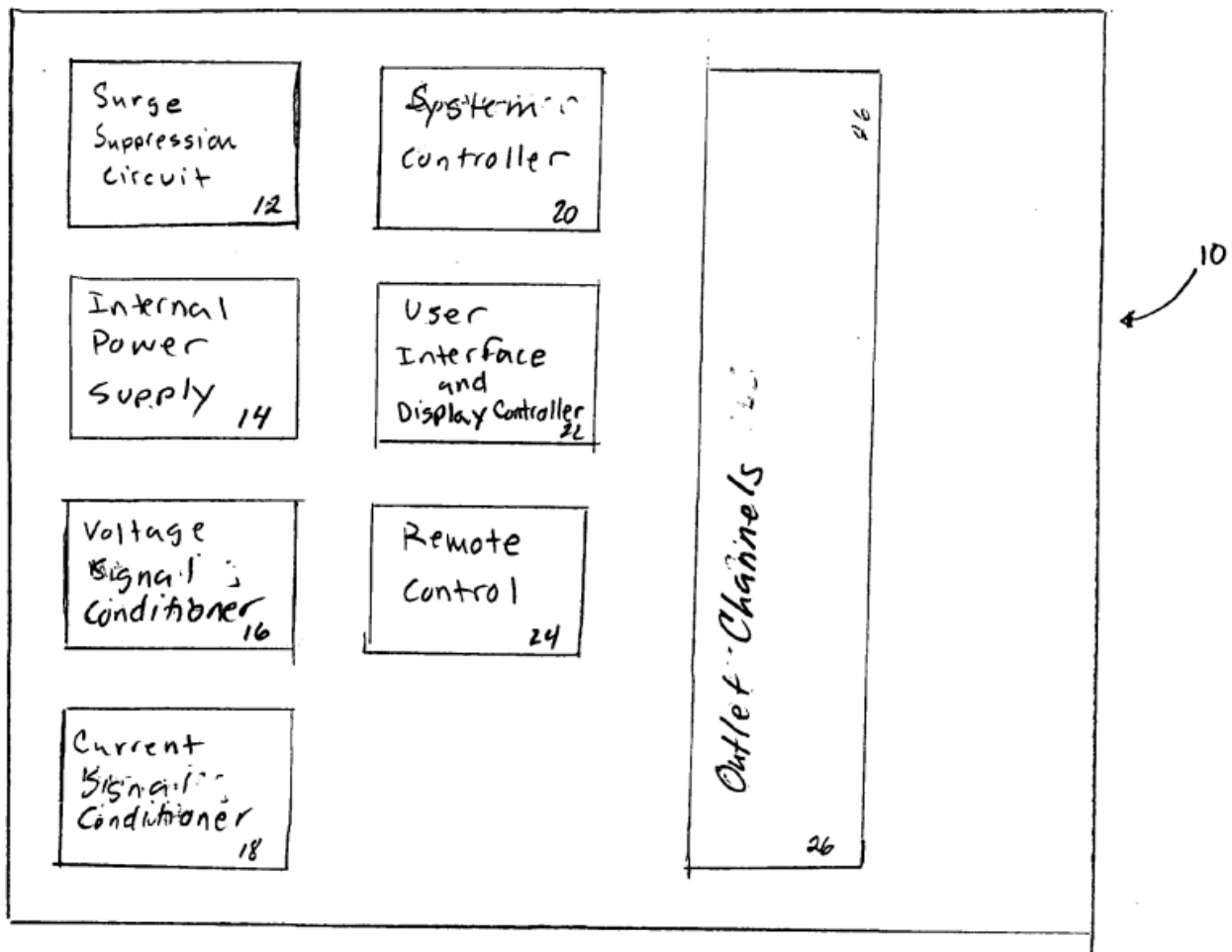


FIG. 1

(Ex. 1009 at Fig. 1.)

303. POSITAs would have incorporated this circuitry into a variety of multi-outlet power apparatuses, including a power strip as discussed in Currie (Ex. 1012 at [0075], Fig. 8).

304. Once Borden's circuitry was incorporated into a power strip, a POSITA would merely have needed to position the LEDs of Borden's user interface and display controller as illustrated in Currie's power strip embodiment. (Ex. 1012

at [0075], Fig. 8.) As Borden does not limit the location of LEDs and Currie discloses specific locations, this would have been within a POSITA's level of skill.

4. Claim 1

[1.a] An arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor,

305. Borden discloses the “[a]n arrangement for visual indication of an electrical quantity, being one or several of power, current or voltage through a conductor” element of ’829 patent claim 1.

306. Borden discloses displaying current actually received by connected electronic devices (Ex. 1009 at [0004]) by measuring the current delivered to these devices through an electrical outlet (Ex. 1009 at [0029]) and visually indicating this measured current with a connected display. (Ex. 1009 at [0006], [0019].) For example, as explained above, the circuit diagram of Borden's user interface and display controller (Ex. 1009 at Fig. 8) illustrates LED(s) driven by a PWM signal to display “a visual indication of current and voltage measurements” (Ex. 1009 at [0027]).

307. Borden indicates current through a conductor because, as explained above, electrical devices connect to electrical outlets through a cord, cable, or other conductive wiring.

308. The Borden-Currie combination would have reasonably projected Borden's visual indication of measured current delivered to an electrical outlet onto an illuminated power cord plugged into this outlet as disclosed in Currie. In Currie's power strip embodiment, an LED positioned within an electrical outlet shines into the inwardly focusing lens of an abutting plug and onto the translucent cover of a connected power cord to illuminate that cord along its length. (Ex. 1012 at [0068], [0075], Fig. 8.) For the reasons explained above, in the Borden-Currie combination would have been illuminated this LED according to the current delivered to its encompassing outlet by the PWM signal from Borden's user interface and display controller.

[1.b] wherein the arrangement comprises a substantially wire shaped illuminator, and

309. Currie discloses that when Currie's illuminated cord assembly is plugged into the socket of Currie's electrical outlet or power strip embodiments, the LED within this socket illuminates the cord. (Ex. 1012 at [0068], [0075], Figs. 5, 8.) Currie's illuminated electrical cords have a cover, coating, wrap, or sleeve of optically transmissive material that receives and radially re-radiates light along the length of the cord. (Ex. 1012 at [0049], [0064]-[65], [0067], Figs. 1A, 2-4.)

[1.c] a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity, and

310. The combination of Borden and Currie discloses the “a controller for control (sic) at least one illumination characteristic of said wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity” element of ’829 patent claim 1.

311. Borden discloses a user interface and display controller that displays an indication of current measurements. (Ex. 1009 at [0027], [0019].) For the reasons explained above, the circuit diagram for the user interface and display controller illustrates LEDs that are driven by a PWM signal to a transistor drive circuit (Ex. 1009 at Fig. 8). For the reasons explained above, these LEDs will dim and brighten according to the PWM duty cycle.

312. The Borden-Currie combination would have reasonably relied on Borden’s circuitry to control the LED that projects light onto an illuminated electrical cord as disclosed in Currie.

[1.d] *feeding the wire shaped illuminator with varying current or voltage corresponding to the electrical quantity measured in the conductor.*

313. The Borden-Currie combination would have reasonably controlled illumination of the illuminated cord assembly with a PWM signal from Borden’s user interface and display controller. For the reasons explained above, the PWM signal illuminates the cord assembly’s illuminating LED according to measured

current by driving a transistor drive circuit with a variable “duty cycle.” For the reasons explained above, variation of this “duty cycle” varies the average amount of current and voltage provided to the LED per cycle and over time.

314. In the Borden-Currie combination, Borden’s current sensor measures current through the conductor elements (*e.g.*, wires) of the illuminated cord because it measures current delivered to the outlet socket and received by connected devices (Ex. 1009 at [0029]), and the illuminated cord is plugged into and receives power from the corresponding socket (Ex. 1012 at [0066]-[67]).

5. Claim 2

The arrangement of claim 1, wherein said wire shaped illuminator is arranged along said conductor.

315. Currie’s illuminated electrical cords have a coating, wrap, or sleeve of optically transmissive material. This optically transmissive material either comprises or is applied to the insulating cover of the electrical conductor elements (*i.e.*, wire) of an electrical cord (Ex. 1012 at [0049], [0064]-[65]) to illuminate the cord substantially along its length. (Ex. 1012 at [0003].)

6. Claim 3

The arrangement of claim 1, wherein said wire shaped illuminator is electroluminescent.

316. As explained above, LEDs are electroluminescent.

317. Borden and Currie each disclose LED illumination. (Ex. 1009 at Fig. 8; Ex. 1012, [0051].)

318. A combination of Borden and Currie would have reasonably illuminated an electrical cord as disclosed in Currie (Ex. 1012 at [0053], [0075], Fig. 5.) by positioning LEDs according to Currie's power strip embodiment (Ex. 1012 at [0075]-[76], Fig. 8).

7. Claim 4

The arrangement of claim 1, wherein said wire shaped illuminator is an optical fiber.

319. Currie discloses an electrical cable that is illuminated by a longitudinal shell, spirally wrapped striped sheet, or braided sleeve of translucent material. (Ex. 1012 at [0064]-[65], Figs. 2-4.) The braided sleeve is composed of "hollow core polyethylene rope." (Ex. 1012 at [0065].) As explained in above, a translucent shell, sheet, or sleeve would have been considered an optical fiber. (Ex. 1012 at [0010], [0020], [0023]).

8. Claim 5

The arrangement of claim 1, wherein said controller further sends a control signal to control said wire shaped illuminator.

320. As explained above, the PWM control signal from Borden's user interface and display controller controls illumination of Currie's illuminated cord

assembly through the LED light positioned within outlets of Currie's power strip embodiment.

9. Claim 7

The arrangement of claim 1, wherein said controller comprises a processing arrangement and a measuring arrangement and a driver for driving said wire shaped illuminator receiving control signals from said processing arrangement.

321. Borden has a current sensing circuit that measures current delivered to an electrical outlet (Ex. 1009 at [0029]), and controllers that receive signals indicative of measured current. (Ex. 1009 at [0024]-[25], [0027], [0029].) The system controller processes this signal (E. 1009 at [0025]), and, as explained in above, the user interface and display controller provides a PWM signal that drives an LED drive circuit (*i.e.*, driver) (Ex. 1009 at [0027]) to illuminate the cord assembly as disclosed by Currie's power strip embodiment (Ex. 1012 at [0075]).

10. Claim 8

The arrangement of claim 1, wherein said illumination characteristic is one or several of intensity, color or frequency.

322. For the reasons explained above, LEDs driven by a pulse width modulated signal appear to brighten and dim (*i.e.*, change intensity) according to the PWM signal's duty cycle.

11. Claim 14

[14.a] A method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of:

323. For the reasons explained above, Borden discloses the “[a] method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of” element of ’829 claim 14. The Borden-Currie combination discloses this limitation because it would have reasonably projected Borden’s illumination onto an illuminated cord assembly.

[14.b] energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity and

324. For the reasons explained above, Currie discloses an illuminated cord assembly with an optically transmissive cover, coating, wrap, or sleeve illuminated by an LED.

[14.c] feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor.

325. For the reasons explained above, Borden discloses a PWM controlled LED drive circuit that feeds varying current and voltage.

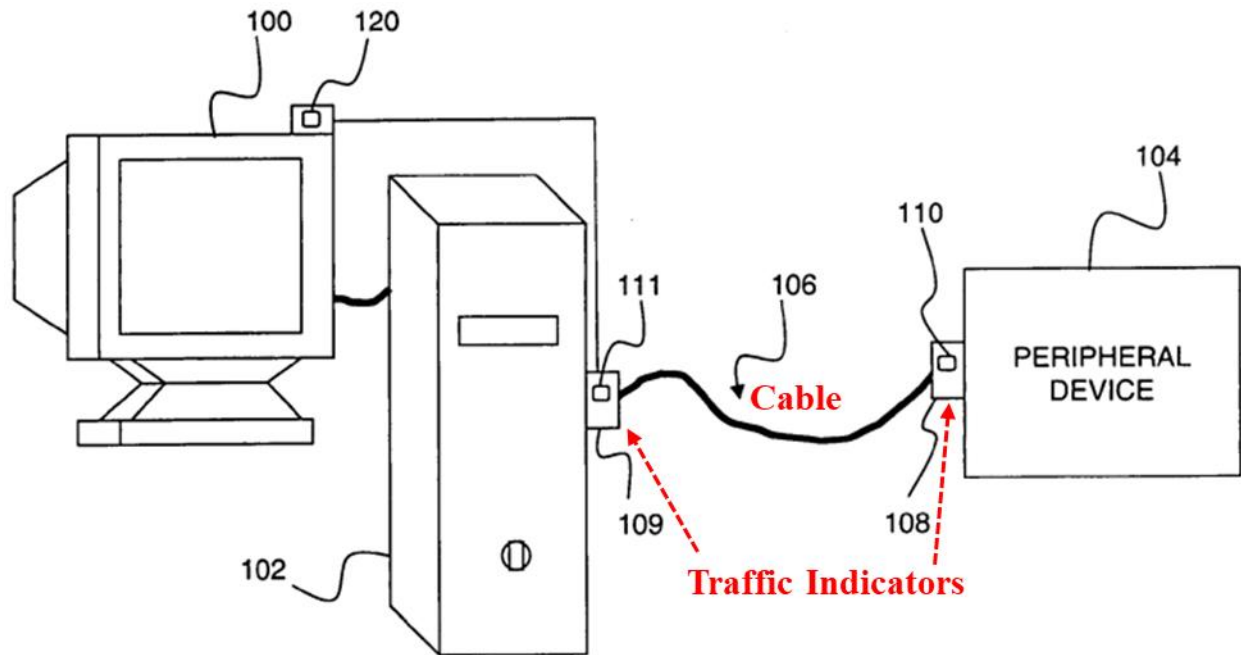
F. Erickson

326. I understand that US patent application No. 10/677,994 that issued as the Erickson reference was filed October 2, 2003, and I have been asked to consider the Erickson patent to be prior art as of this date. (Ex. 1014 at 1.)

327. Erickson discloses a cable that detects data traffic signals and provides a visual indication of these signals. (Ex. 1014, 1:30-44.)

328. The cable in Erickson is a communication cable, like a USB, FireWire, COM, LPT, or SCSI cable that carries video, audio, or other data signals. (Ex. 1014 at 3:2-5, 3:16-18, 4:20-23.) For example, Erickson Fig. 1 illustrates cable 106 extending between computer 102 and peripheral device 104. (Ex. 1014 at 2:66-3:2.)

329. Based on Erikson's specification (Ex. 1014 at 2:66-3:19), the cable and traffic indicators are correctly labeled in the below figure:

**FIG. 1**

(Ex. 1014 at Fig. 1 (annotated).)

330. Fig. 1 illustrates traffic indicators 110 and 111 illuminated by one or more LEDs (Ex. 1014 at 3:20-24, 3:49-51) but Erickson also discloses translucent wire coverings that disperse light to appear as though they are conducting the light. (Ex. 1014 at 3:43-46.) Erickson discloses monitoring data signals through at least one of the wires of the cable and that traffic indicators generate a visual indication (*e.g.*, light flashing) in response to detected signals. (Ex. 1014 at 1:33-38, 3:14-16, 3:54-58.)

331. Erickson discloses detection circuitry that senses a data signal on a wire, and driver circuitry that switches a transistor drive circuit to feed current

according to this signal and illuminate traffic indicators to provide a visual indication of measured data traffic. (Ex. 1014 at 1:38-44, 4:1-7, 4:30-33.)

332. Based on Erikson's specification (Ex. 1014 at 3:66-4:58), the LED, Transistor, and Signal from Cable are correctly labeled in the below figure:

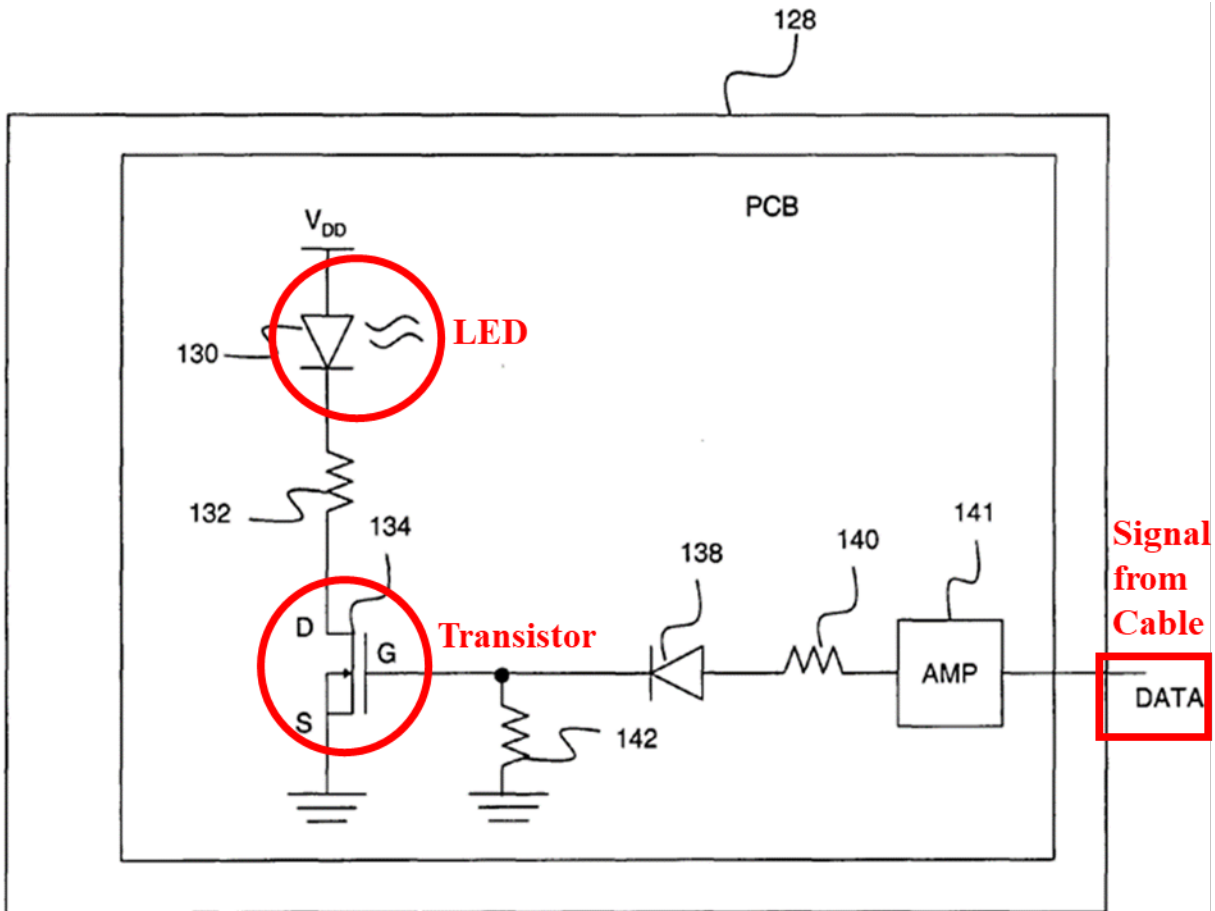


FIG. 2

(Ex. 1014, Fig. 2 (annotated).) Fig. 2 illustrates transistor 134 in series with LED 130 (Ex. 1014 at 4:24-29), which detects signals in a data cable through amplifier 141. (Ex. 1014 at 4:30-43.) Transistor 134 conducts current when the data signal is high and interrupts current when the signal is low. (Ex. 1014 at 4:44-58). This type

of transistor circuit is discussed above. Specifically, LED 130 turns on when current flows through transistor 134 and off when current is interrupted such that it flashes according to data signals through the cable (Ex. 1014 at 4:44-58), illuminating the traffic indicator to provide a visual indication of these signals. (Ex. 1014 at 3:14-19, 4:8-12.)

1. **Claim 9**

[9.a] *A cord comprises at least one electric wire and a substantially wire shaped illuminator at least partly arranged along an extension of said at least one electric wire,*

333. Erickson discloses a cable including one or more wires, and traffic indicators that include translucent wire coverings that disperse and appear to conduct light. (Ex. 1014 at 1:32-38, 3:43-46.)

[9.b] *said substantially wire shaped illuminator having means for illumination when energized to indicate an electrical quantity, being one or several of power, current or voltage through the at least one electric wire,*

334. Erickson discloses traffic indicators illuminated by one or more LEDs that are driven by a transistor to provide a visual indication (*i.e.*, flashing) of video, audio, or data signals detected in at least one wire of a cable. (Ex. 1014 at 3:14-30,

3:54-58.) For the reasons explained above, a POSITA would recognize that video, audio, and data signals are transmitted as current and voltage.

[9.c] *wherein said substantially wire shaped illuminator indicates the current or voltage through said at least one electric wire when at least one illumination characteristic of said substantially wire shaped illuminator is controlled with respect to said electrical quantity by feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through at least one electrical wire.*

335. Erickson discloses detection circuitry that senses signals on a wire carrying data through a cable and a transistor drive circuit that conducts (*i.e.*, feeds) current through an LED to indicate the detected signal by flashing on and off. (Ex. 1014 at 1:32-44, 4:30-34, 4:44-55.) The data rate of signals through the cable is indicated by the rate of flashing. (Ex. 1014 at 3:24-26, 4:52-55.) The LED illuminates a traffic indicator, including a translucent wire covering that disperses and appears to conduct light. (Ex. 1014 at 3:43-48, 4:8-12.)

2. Claim 10

The cord of claim 9, further comprising a substantially translucent coating, covering said at least one electric wire and substantially wire shaped illuminator.

336. For the reasons explained above, Erikson discloses a translucent wire covering.

3. Claim 12

The cord of claim 9, wherein said substantially wire shaped illuminator is an optical fiber.

337. Erickson discloses a translucent wire covering that disperses light to appear as though it is conducting the light. (Ex. 1014 at 3:43-46.) For the reasons explained above, this translucent wire covering is an example of optical fiber.

4. Claim 13

The cord of claim 9, wherein said substantially wire shaped illuminator indicates current or power through said at least one electric wire.

338. Erickson discloses detection circuitry that monitors data signals, including audio and video signals, through a wire and indicates these signals with traffic indicators, including translucent wire coverings. (Ex. 1014 at 1:32-44, 3:14-19, 3:43-48, 3:54-58, 4:30-22.) As discussed in above, a POSITA would recognize that data, video, and audio signals are each transmitted as current.

5. Claim 14

[14.a] A method of visually indicating an electrical quantity, being one or several of power, current or voltage through a conductor, the method comprising the steps of:

339. For the reasons explained above, Erickson indicates the traffic of signals on a cable with an LED traffic indicator.

[14.b] *energizing a substantially wire shaped illuminator and controlling at least one illumination characteristic of said substantially wire shaped illuminator with respect to said electrical quantity by measuring the electrical quantity and*

340. For the reasons explained above, Erickson controls the illumination of LED traffic indicators according to signal traffic on a cable.

[14.c] *feeding the substantially wire shaped illuminator with varying current or voltage corresponding to the current or voltage through the conductor.*

341. For the reasons explained above, Erickson discloses a transistor circuit that drives an LED. As further explained above, transistors connect and interrupt voltage and current between a collector and emitter terminal according to the signal at a base terminal.

X. SIGNATURE

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

Dated: December 21, 2022.



Gary L. Woods Ph.D