IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

KIWI INTELLECTUAL ASSETS CORPORATION
Patent Owner.

_____

Case No. IPR2026-00164
U.S. Patent No. RE50,307

_____

DECLARATION OF DR. SAYFE KIAEI

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EXHIBIT LIST[1]

Exhibit	Description of Documents
EX1001	U.S. Patent No. RE50,307
EX1002	Prosecution History of U.S. Patent No. RE50,307
EX1003	Declaration of Sayfe Kiaei in support of petition for *inter partes* review of U.S. Patent No. RE50,307
EX1004	*KIWI Intellectual Assets Corp. v. Samsung Elecs. Co., Ltd.*, No. 2:25-cv-00811, Dkts. 1-6 to 1-9 ("Complaint Claim Charts") (E.D. Tex. Aug. 18, 2025).
EX1005	U.S. Patent No. 7,094,089 ("Andre"), published Sep. 15, 2005 and granted Aug. 22, 2006
EX1006	Chinese Patent No. CN201038524Y ("Zhenyu"), granted Mar. 19, 2008, with certified translation
EX1007	Chinese Patent No. CN201113094Y ("Lufan"), granted Sep. 10, 2008, with certified translation
EX1008	Chinese Patent No. CN201204344Y ("Yuming"), granted Mar. 4, 2009, with certified translation
EX1009	U.S. Patent No. 7,231,473 ("Yen"), published Nov. 4, 2004 and granted Jun. 12, 2007
EX1010	U.S. Patent No. 6,854,984 ("Lee"), granted Feb. 15, 2005
EX1011	Declaration of Sylvia D. Hall-Ellis, Ph.D. in support of authenticity and public availability of documents for *inter partes* review of U.S. Patent No. RE50,307

[1] Unless otherwise indicated, all citations are to Bates pages, and citations to U.S. patents are to column:line. Patent figures are cited by figure number.

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EX1012	USB Implementers Forum, Inc., *Universal Serial Bus Specification*, rev. 1.0 (Jan. 15, 1996), published by Compaq Computer Corp., Digital Equip. Corp., IBM PC Co., Intel Corp., Microsoft Corp., NEC & Northern Telecom. Beaverton, OR: The USB-IF, 1996. ("USB1.0")
EX1013	USB Implementers Forum, Inc., *Universal Serial Bus Specification*, rev. 1.1 (Sep. 23, 1998), published by Compaq Computer Corp., Intel Corp., Microsoft Corp. & NEC Corp. Beaverton, OR: The USB-IF, 1998. ("USB1.1")
EX1014	USB Implementers Forum, Inc., *Universal Serial Bus Specification*, rev. 2.0 (Apr. 27, 2000), published by Compaq Computer Corp., Hewlett-Packard Co., Intel Corp., Lucent Techs. Inc., Microsoft Corp., NEC Corp. & Koninklijke Philips Elecs. N.V. Beaverton, OR: The USB-IF, 2000. ("USB2.0")
EX1015	USB Implementers Forum, Inc., *Universal Serial Bus 3.0 Specification*, rev. 1.0 (Nov. 12, 2008), published by Hewlett-Packard Co., Intel Corp., Microsoft Corp., NEC Corp., ST-NXP Wireless & Texas Instruments. Beaverton, OR: The USB-IF, 2008. ("USB3.0")
EX1016	U.S. Patent No. 8,198,563
EX1017	Prosecution History of U.S. Patent No. 8,198,563
EX1018	U.S. Patent No. RE49,287
EX1019	Prosecution History of U.S. Patent No. RE49,287
EX1020	U.S. Patent Publication No. 2009/0258539 ("Zheng"), published Oct. 15, 2009 and granted as U.S. Patent No. 7,744,382 on Jun. 29, 2010
EX1021	U.S. Patent No. 7,361,059 ("Harkabi"), published Feb. 24, 2005 and granted Apr. 22, 2008
EX1022	U.S. Patent No. 7,359,208 ("Ni '208"), published Apr. 5, 2007 and granted Apr. 15, 2008

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EX1023	U.S. Patent No. 7,269,004 ("Ni '004"), published Sep. 11, 2007 and granted Sep. 11, 2007
EX1024	U.S. Patent Publication No. 2006/0024997 ("Teicher"), published Feb. 2, 2006 and granted as U.S. Patent No. 7,094,086 on Aug. 22, 2006
EX1025	PCT Publication No. WO-2009069969 ("Lee PCT"), published Jun. 4, 2009
EX1026	U.S. Patent No. 7,094,086 ("Teicher '086"), published Feb. 2, 2006 and granted Aug. 22, 2006
EX1027	U.S. Patent No. 7,537,471 ("Teicher '471"), published May 22, 2008 and granted May 26, 2009
EX1028	Petitioners' Stipulation
EX1029	Chinese Patent No. CN201174439Y ("Guangmin"), granted Dec. 31, 2008, with certified translation
EX1030	Japanese Patent Publication No. JP2000277200A ("Yamada"), published Oct. 6, 2000, with certified translation
EX1031	Taiwanese Patent Publication No. TWM327587U ("Ruidu"), published Feb. 21, 2008, with certified translation
EX1032	U.S. Patent No. 5,741,148 ("Biernath"), issued April 21, 1998
EX1033	Bruno Carpentieri, *Computing beyond Moore's Law*, ResearchGate (Oct. 10, 2015), https://www.researchgate.net/publication/282704681
EX1034	Neil Cumins, *Intel Processors Over the Years*, Business News Daily (Aug. 8, 2024), https://www.businessnewsdaily.com/10817-slideshow-intel-processors-over-the-years.html
EX1035	Priya Ganapati, *USB 3.0 to Deliver a Tenfold Speed Increase*, Wired Newsletter (Nov. 15, 2000), https://www.wired.com/2008/11/superspeed-us-1/

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EX1036	*Xbox 360 First Impressions*, Hackaday (Nov. 27, 2005), https://hackaday.com/2005/11/27/xbox-360-first-impressions/
EX1037	Greg Suarez, *Sony PlayStation 2*, The Digital Bits (Nov. 15, 2000), https://archive.thedigitalbits.com/reviews/ps2/sonyps2.html
EX1038	*Apple disrespects its own Mac users with iPod's FireWire fiasco*, MacDailyNews (Feb. 24, 2005), https://macdailynews.com/2005/02/24/apple_disrespects_its_own_mac_users_with_ipods_firewire_fiasco/
EX1039	Charlie Sorrel, *Western Digital Passport 250GB Pocket Drive*, Wired Newsletter (Jun. 7, 2007), https://www.wired.com/2007/06/western-digital/
EX1040	[Filed Under Seal]

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I, Sayfe Kiaei, declare as follows:

I. INTRODUCTION

1. My name is Sayfe Kiaei. I am a professor at Arizona State University. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively "Samsung" or "Petitioner") as an independent expert consultant in this proceeding before the United States Patent and Trademark Office ("PTO").

2. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of U.S. Patent No. RE50,307 ("the '307 patent") (EX1001).[2] My opinions are set forth below. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding.

3. If called upon to do so, I would be competent to testify as to the matters set forth herein.

[2] Where appropriate, I refer to exhibits I understand will be attached to the petition for *inter partes* review of the '307 patent (the "Petition").

II. EXPERIENCE AND QUALIFICATIONS

4. In forming my opinions, I have relied on my education, experience, and knowledge regarding electrical engineering, computer science, and electronics product design. A copy of my current curriculum vitae, which details my education and professional and academic experience, is included as Appendix 1 to this declaration. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

5. I received my Ph.D. in Electrical and Computer Engineering from Washington State University in 1987. I have worked in industry and academia on the systems and analog/digital/RF circuits, related to data interface, computer architecture, MODEM, DSL, DOCSIS, Computer I/O interfaces, power management and related areas. I have been involved in research, teaching, and developing products in these areas for the last 30 years.

6. Since 2001, I have held the position of Motorola Endowed Chair Professor in Analog and Radio Frequency Integrated Circuitry at the School of Electrical, Computer, and Energy Engineering at Arizona State University ("Arizona State") in Tempe, Arizona.

7. I am also the Director of the National Science Foundation Center, Connection One. Connection One is a research center focused on developing communication system and networking technologies including I/O connectivity,

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serial data bus, RS-232, IEEE 1284 (parallel bus), SCSI, PCI, PCMCIA, USB2, USB3, IEEE 1394 (Firewire), Ethernet, and audio/video multi-media connectivity standards such as VGA, DVI, HTMI, etc.

8. From 1987 to 1993, I was an assistant/associate professor at Oregon State University ("Oregon State").

9. From 1997 to 2002, I was also an adjunct professor at the University of Texas ("UT") at Austin, while I worked full time at Motorola in Austin.

10. At Oregon State, UT, and Arizona State, I taught courses in the areas of analog, digital and RF integrated circuits, VLSI, Computer architecture, I/O interface and connectivity, power management circuits, communication systems including radio frequency ("RF") systems and circuits; radio-frequency identification ("RFID"); magnetic and electronic sensors; analog circuits; digital integrated circuits, including HDL, Verilog, and VHDL; digital signal processing; and related areas. At Arizona State, I developed a new course content and labs on analog integrated circuit, computer architecture, serial I/O interface, power management, and RF systems.

11. From 1993 to 2001, I worked at Motorola Integrated Technology Center, Analog/Digital Design group, and Motorola Telecomm group. I was responsible for the design and development of circuits and systems for MODEMS, communication, and computing systems including data interface and networking,

analog, digital, Power Management IC, DC-DC power converter, RFIC, Analog and digital baseband IC and circuits.

12. During my work in industry, I have designed and contributed to the design of many analog, RF, and power management IC's for communication and data transceivers for commercial products. Many of my designs are still in use today in products manufactured by the companies I have worked for, including Motorola, Intel, Sony, Tektronix, HP, etc.

13. I have several patents and patent applications, standards contributions, and over 150 journal and international conference publications. Several of these patents and publications are in the areas of integrated system and circuits for data and communication system. The list of my publications is included in my resume (Appendix 1).

14. I have graduated over 70 MS and Ph.D. students working under my supervision on their thesis, and many of them are professors in academia or have senior positions in industry. My research is funded by various sources, including industry and federal agencies, such as NSF, DOD, USAID, DARPA, JPL, NASA, and many industries in the electrical engineering area.

15. I am an active member of IEEE societies and have served in several technical and executive committees over the last 35 years. I am an IEEE Fellow, which is the highest level of IEEE membership awarded by the IEEE directors to

recognize a high level of demonstrated extraordinary accomplishments. The IEEE Fellow Award is a special recognition for members with extraordinary accomplishments in the IEEE technical fields. To ensure that the recognition is extraordinary, the total number of recipients each year cannot exceed 0.1% of the total higher grade membership. The IEEE is the Institute of Electrical and Electronics Engineers, the world's largest association of technical professionals whose objectives include the educational and technical advancement of electrical and electronic engineering, telecommunications, computer engineering, and related disciplines.

16. I am a member of the IEEE Circuits and Systems Society, IEEE Solid State Circuits Society, IEEE Computer Society, IEEE Signal Processing Society, IEEE Communication Society, and IEEE Microwave Society. I am also a member of the technical committee at IEEE RF, Microwave, Low Power Symposium, and IEEE Fellow Selection Committee. I have organized many international conferences including IEEE Radio Frequency Integrated Circuits (RFIC) Symposium, Circuits and Systems, Low Power Symposium, Communication, Signal Processing, and other conferences.

17. I have received several awards including IEEE Fellow award, Carter Best Teacher Award, the IEEE Darlington Award given for the best technical paper

on circuits and systems, and the Motorola 10X Rapid Design Cycle Reduction Award.

III. MATERIALS CONSIDERED

18. The analysis that I provide in this declaration is based on my education and professional experience, as well as the documents I have considered, including the '307 patent (EX001), its prosecution history (EX1002), and the prior art and other relevant documents from the Exhibit list, as set forth herein.

IV. LEGAL STANDARDS

19. My opinions are also informed by my understanding of the relevant law. I am not an attorney. I have been informed by attorneys of the relevant legal principles and have applied them to arrive at the opinions set forth in this declaration.

A. Claim Construction

20. I understand that "claim construction" is the process of determining a patent claim's meaning. I also understand that, during an *inter partes* review, a claim construction analysis begins with the plain meaning of the claim term, which is the ordinary and customary meaning given to the term by those of ordinary skill in the art at the time of the invention. I also understand that the claims of a patent must be interpreted in light of the specification—that is, the claim language itself, the written description, and the figures in the patent—as well as the patent's prosecution history

and, in the case of a continuation patent, the prosecution histories of the parent patent and/or any intervening continuation patents in the priority chain.

B. Obviousness

21. I understand that the patentability analysis is conducted on a claim-by-claim and element-by-element basis.

22. I understand that the prior art may render a patent claim invalid as obvious. I understand that two or more prior art references (*e.g.*, prior art articles, patents, or publications) that each disclose fewer than all elements of a patent claim may nevertheless be combined to render a patent claim obvious if the combination of the prior art collectively discloses all elements of the claim and one of ordinary skill in the art at the time would have been motivated to combine the prior art in such a way. I understand that this motivation to combine need not be explicit in any of the prior art, but may be inferred from the knowledge of one of ordinary skill in the art at the time the patent was filed. I also understand that one of ordinary skill in the art is not an automaton, but is a person having ordinary creativity. I further understand that one or more prior art references, articles, patents or publications that disclose fewer than all of the elements of a patent claim may render a patent claim obvious if including the missing element would have been obvious to one of skill in the art (*e.g.*, the missing element represents only an insubstantial difference over the prior art or a reconfiguration of a known system).

23. Under the doctrine of obviousness, a claim may be invalid if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA to which the subject matter pertains.

24. To assess obviousness, I understand that I am to consider the scope and content of the prior art, the differences between the prior art and the claim, the level of ordinary skill in the art, and any secondary considerations to the extent they exist.

25. I understand that any evidence of secondary indicia of non-obviousness should be considered when evaluating whether a claimed invention would have been obvious to one of ordinary skill at the time of invention. These secondary indicia of non-obviousness may include, for example:

- a long felt but unmet need in the prior art that was satisfied by the claimed invention;
- commercial success of processes claimed by the patent;
- unexpected results achieved by the invention;
- praise of the invention by others skilled in the art;
- the taking of licenses under the patent by others; and
- deliberate copying of the invention.

26. I understand that there must be a nexus between any such secondary indicia and the claimed invention.

27. It is also my understanding that there are additional considerations that may be used as further guidance as to when the above factors will result in a finding that a claim is obvious, including the following:

- the claimed subject matter is simply a combination of prior art elements according to known methods to yield predictable results;
- the claimed subject matter is a simple substitution of one known element for another to obtain predictable results;
- the claimed subject matter uses known techniques to improve similar devices or methods in the same way;
- the claimed subject matter applies a known technique to a known device or method that is ready for improvement to yield predictable results;
- the claimed subject matter would have been "obvious to try" choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;
- there is known work in one field of endeavor that may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to a POSITA;

- there existed at the time of conception and reduction to practice a known problem for which there was an obvious solution encompassed by the patent's claims; and
- there is some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed subject matter.

28. Finally, I understand that a claim may be deemed invalid for obviousness in light of a single prior art reference, without the need to combine references, if the elements of the claim that are not found in the reference can be supplied by the knowledge or common sense of one of ordinary skill in the relevant art.

V. LEVEL OF ORDINARY SKILL IN THE ART

29. I am informed and understand that the person having ordinary skill in the art ("POSITA") is a hypothetical person who is presumed to know the relevant prior art. I understand that the actual inventor's skill is not determinative of the level of ordinary skill. I further understand that factors that may be considered in determining level of skill include: (i) type of problems encountered in art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations are made; (iv) sophistication of the technology; and (v) educational level of active workers in

the field. I understand that not all such factors may be present in every case, and one or more of them may predominate. In a given case, every factor may not be present, and one or more factors may predominate.

30. In my opinion, a POSITA at the time of invention of the ’307 patent would have had either (i) a Masters of Science in Electrical Engineering or an equivalent field, or (ii) a Bachelor of Science in Electrical Engineering or an equivalent field as well as at least two years of experience in the design of electronic connectors.

31. Around the April 15, 2009 timeframe (the priority date I assume for my analysis), I personally would have had more than an ordinary level of skill in the relevant art in the relevant timeframe. I was also familiar with the level of skill of a POSITA because I had managed engineers at Motorola, and graduate students, working in this area including those with this level of skill.

32. My opinions below explain how a POSITA would have understood the technology described in the ’307 patent and the prior art references I have identified herein around the April 15, 2009 timeframe. For purposes of this declaration, in general, and unless otherwise noted, my testimony below refers to the knowledge of one of ordinary skill in the art around the April 15, 2009 timeframe.

VI. OVERVIEW OF ’307 PATENT

33. I have reviewed the ’307 patent, which is entitled “Socket Structure with Duplex Electrical Connection.” EX1001. I understand that this patent was filed on October 27, 2022 and issued on February 18, 2025. EX1001. I also understand that this patent is a reissue of a parent patent, U.S. Patent No. 8,198,563 (“the ’563 patent”), filed on April 13, 2010 and issued on June 12, 2012. EX1016.

A. Priority Date

34. The ’307 patent claims priority to four Taiwanese patents, the earliest of which was filed on April 15, 2009. For purposes of my analysis herein, I assume a priority date of April 15, 2009, the date of the earliest foreign application to which the ’307 patent claims priority.

B. Subject Matter of the ’307 Patent

35. The ’307 patent purports to solve a problem with then-existing electrical connectors, specifically with USB sockets. *See, e.g.*, EX1001, 1:40-52. The specification asserts that “the current USB socket has one row of connection terminals” and “[i]n use, the USB plug has to be correctly inserted so that the connection terminals of the USB plug and the USB socket may be electrically connected together.” EX1001, 1:40-52. According to the patent, a user has a “50%” chance of picking the wrong orientation when inserting a plug into a socket at random. EX1001, 1:52-55. The ’307 patent purports to solve this problem with a “socket structure with duplex electrical connection” wherein a “plug may be

normally and oppositely inserted into the socket structure to crease electrical connection in a simple and easy way." EX1001, 1:66-2:3.

36. Regarding the physical structure of the socket, the '307 patent discloses a socket structure with a tongue 50 having contacts on a "first surface" and a "second surface" that is "disposed opposite the first surface." EX1001, 5:50-61, Figs. 1-2. The tongue 50 is "horizontally disposed" on the end of a plastic base 30 and in a middle of a connection slot 45, such that the connection slot is formed with "compatible and symmetrical profiles on top and bottom sides of the tongue 50 and compatible and symmetrical profiles on left and right sides of the tongue 50." EX1001, 5:43-61, Figs. 1-3. Thus, a USB 2.0 plug that has contacts on one surface can be inserted "normally and oppositely" into the connection slot. EX1001, 5:61-65.

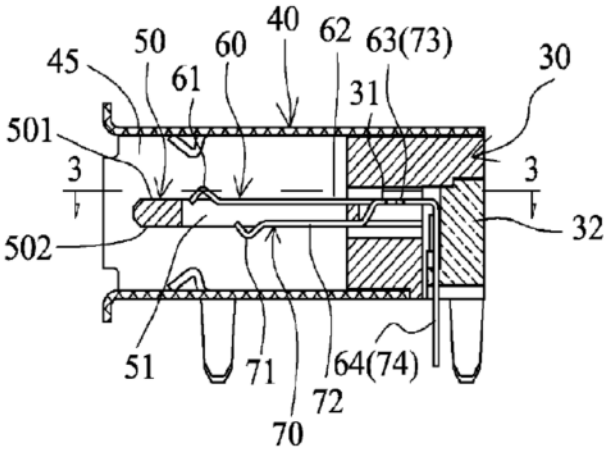


FIG. 2

EX1001, Fig. 2.

37. Regarding electrical signaling, the patent describes that the socket has a row of first terminals 60 integrally formed with first contacts 61 arranged on the first surface of the tongue 50 and a row of second terminals 70 integrally formed with second contacts 71 on a second surface of the tongue 50. EX1001, 5:66-6:23. Each of the first and second terminals 60, 70 are connected to a respective "first pin 64" and "second pin 74," which "extend[] out of the plastic base 30." EX1001, 5:67-6:23, Figs. 1-3. Moreover, the "one row of second terminals 70 and the one row of first terminals 60 have oppositely arranged serial numbers." EX1001, 6:24-25. As shown in Figures 4A and 5A below (socket on left), "the second terminals 70 on the bottom of the tongue have the serial numbers of 1, 2, 3, 4 from left to right, while the first terminals 60 on the top of the tongue have the serial numbers of 4, 3, 2, 1 from left to right." EX1001, 6:26-29. "Thus, the same signal sorting may be obtained when the USB 2.0 plug is normally and oppositely electrically connected thereto," as shown below (plug on right). EX1001, 6:30-32. The patent refers to this arrangement as "**a functional reverse mirror configuration**." EX1001, 6:48-7:8.

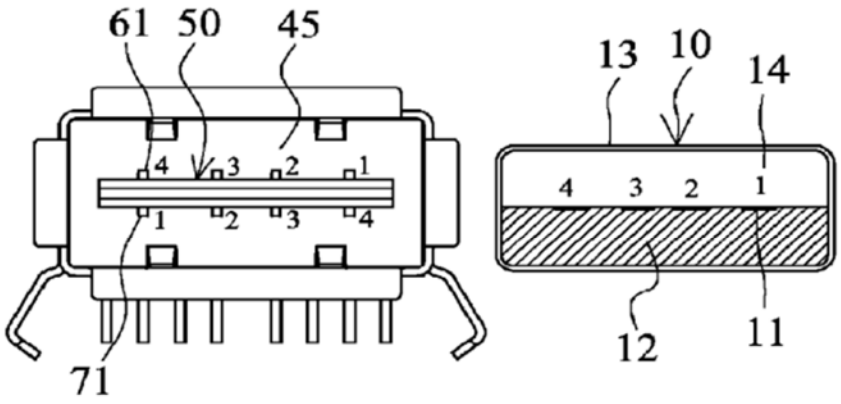


FIG. 4A

EX1001, Fig. 4A (plug in one direction).

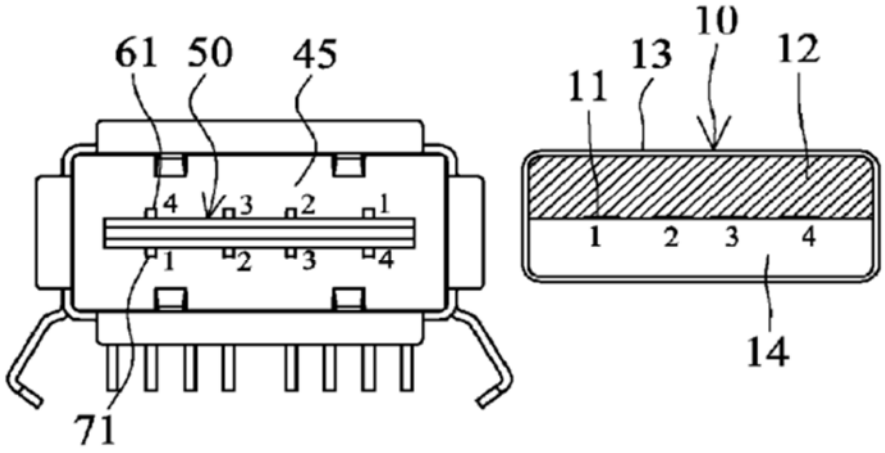


FIG. 5A

EX1001, Fig. 5A (plug in opposite direction).

38. The ’307 patent further specifies an embodiment where two plugs, such as two “light and handy mobile disk 20,” may be vertically stacked and inserted into the disclosed socket at the same time. EX1001, 8:35-9:13. In this embodiment, one plug 21 may be inserted into the upper chamber of the socket and connected to the contacts 61 on the top surface of the tongue, while a second plug 21 may be inserted

into the lower chamber of the socket and connected to the contacts 71 on the lower surface of the tongue 50. EX1001, 8:40-9:7. In this "dual-slot" socket configuration, the two plugs 21 may be inserted in opposite orientations to each other such that one plug is normally inserted while the other plug is reversely inserted. EX1001, 8:40-9:7. Moreover, both plugs 21 may be "simultaneously connected" to the contacts located on the upper and lower surfaces of the socket tongue in this configuration. EX1001; 8:48-53, 9:7-12, Figs. 18-21.

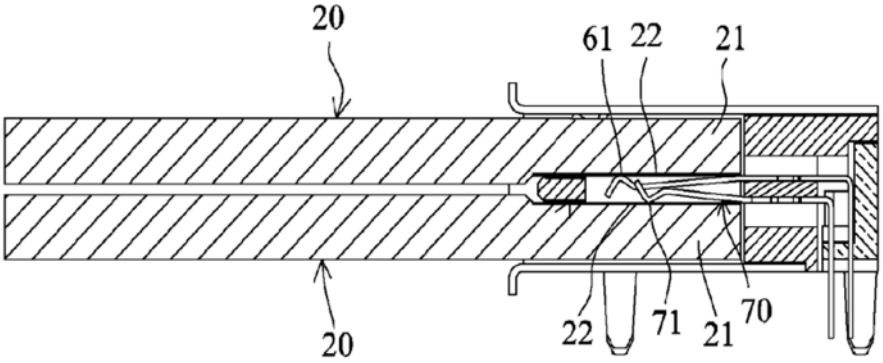


FIG. 19

EX1001, Fig. 19; *see also id.*, Fig. 21.

C. Prosecution History

39. I understand that the '307 patent is a continuation reissue of U.S. Patent No. RE49,287 ("the '287 patent" or "the first reissue patent") (EX1018), which is a reissue of U.S. Patent No. 8,198,563 ("the '563 patent" or "the parent patent") (EX1016). I have reviewed the prosecution history for the '307 patent, the '287 patent, and the '563 patent and summarize certain portions below.

i. The Parent Patent ('563 Patent)

40. The parent patent was filed on April 13, 2010, and issued June 12, 2012. EX1016, at (22), (45). During prosecution of the parent patent, the Examiner rejected certain claims that recited unclear claim language as indefinite under 35 U.S.C. § 112 and further rejected almost all original claims as anticipated or rendered obvious by prior art under 35 U.S.C. §§102 and 103. EX1017, 58-64. The Examiner argued that all elements of independent Claim 1—excerpted below—was disclosed by a single reference, U.S. Patent Publication No. 2009/0258539 ("Zheng"). EX1017, 58-62; *see also* EX1020.

> 1. A socket structure with duplex electrical connection, the socket structure comprising:
>
> a plastic base;
>
> a connection slot, which is disposed on one end of the plastic base and may be connected to a plug having at least one row of connection terminals;
>
> a tongue disposed on the one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue make the plug be normally and oppositely inserted and positioned into the connection slot;
>
> at least one row of first contacts separately arranged on one surface of the tongue, wherein each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
>
> at least one row of second contacts separately arranged on the other surface of the tongue, wherein each of the second contacts is electrically connected to a second pin extending out of the plastic base, and when the plug is inserted into the connection slot, at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts or the at least one row of second contacts.

41. Specifically, the Examiner pointed to one row of contacts (3) in Zheng that included first contacts 31 (with contact portion 311) and second contacts 32 (with arc elastic portion 324) facing the same direction for connection to one row of plug contacts as disclosing the elements of Claim 1. EX1017, 59-60; *see also* EX1020, Figures 4 and 1, reproduced below.

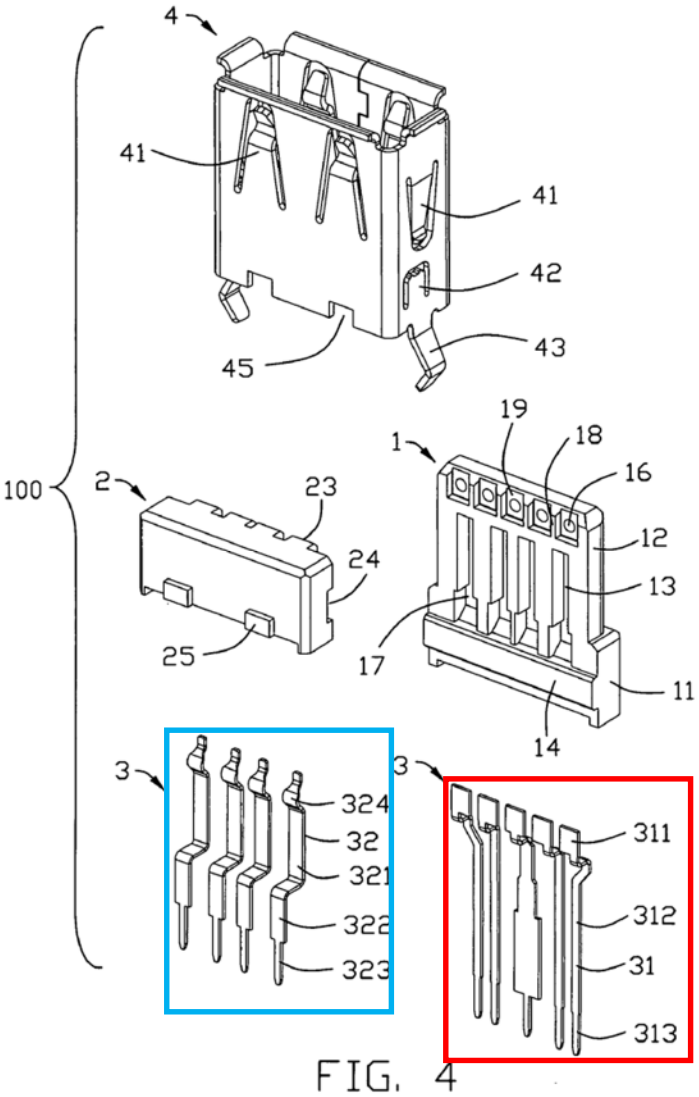


FIG. 4

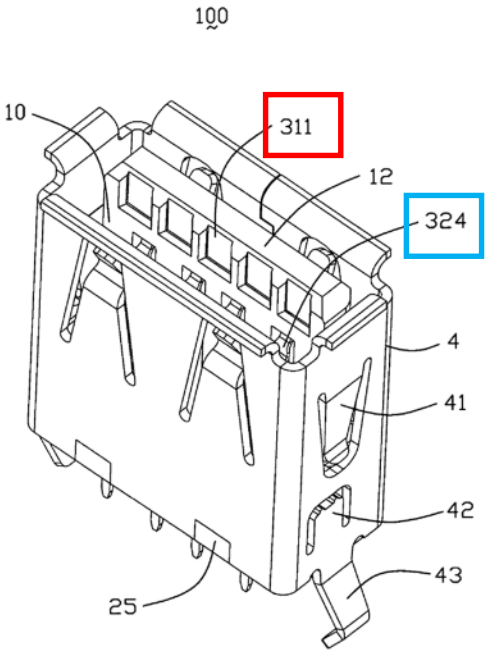


FIG. 1

EX1020, Figs. 4 and 1 (both annotated).

42. The Examiner rejected dependent claims 13-15 as obvious over Zheng in view of U.S. Patent No. 7,361,059 ("Harkabi") and U.S. Patent No. 7,359,208 ("Ni '208"). EX1017, 62-64; *see also* EX1021; EX1022. Claims 13-15 are dependent from Claim 1 and are directed to the "dual-slot" socket structure of Figures 18-21 that is configured to receive "two plugs" "simultaneously connected to the top and bottom sides of the tongue" (claim 13) such that the plug may be "normally and oppositely inserted" "facing upward or downward" (claim 14).[3] EX1001, Figs. 18-21, Claims 13-15. Specifically, the Examiner identified Harkabi as disclosing "an USB socket (40) having a center tongue (401) with two rows of contacts (403), wherein the top row of contact (403) and the bottom row of contacts (403) pertain to the same connection interface and have oppositely arranged serial numbers." EX1017, 63; *see also* EX1021, Figure 11 (reproduced below). The Examiner rejected these claims because a POSITA would have understood the modified socket of the combination of Zheng, Harkabi, and Ni '208 "would be able to ***receive two non-metal shell plugs simultaneously***."[4] EX1017, 64.

[3] Claim 15 depends from Claim 14 and recites a USB with four standard USB contacts.

[4] All emphases added unless otherwise noted. All annotations, colors, and highlighted to figures also added unless otherwise noted.

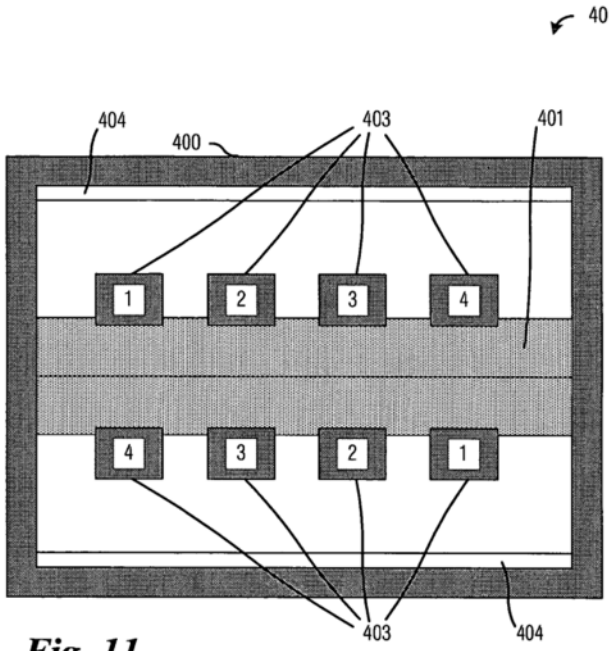


Fig. 11

EX1021, Fig. 11.

43. Lastly, the Examiner objected to dependent claim 26, which recited a first and second guide-in sheet (not claimed in the '307 patent), as allowable if rewritten in independent form. EX1017, 64.

44. To overcome the rejection for Claim 1, Patent Owner amended the claim to specify that the tongue "has a first surface and a second surface disposed opposite the first surface" such that when a plug is "normally" inserted, the plug terminals "fac[e] the second surface of the tongue," and when the plug is "oppositely" inserted, the plug terminals "fac[e] the first surface of the tongue." EX1017, 39-40, 48. Patent Owner argued that the cited Zheng reference cannot allow a plug to be

"normally and oppositely" inserted into the connector because the disclosed tongue only contains contacts "arranged at a same side." EX1017, 49.

45. Patent Owner did not further address the Harkabi or Ni '208 references, which were cited by the Examiner for dependent claims only. The Examiner then allowed the '563 patent without further rejections. EX1017, 7.

ii. The First Reissue ('287 Patent)

46. The first reissue patent was filed on September 14, 2020—more than eight years after the parent patent was granted[5]—and issued November 8, 2022. EX1018, at (22), (45).

47. The Examiner rejected all pending claims under 35 U.S.C. §§112, 102, and 103. For the §112 rejections, the Examiner argued that a POSITA could not determine whether the scope of the claims was drawn solely to the "socket structure" alone, as recited in the preamble of the claims, or to the "'socket structure' *in combination with* the 'plug,'" as recited in the body of the claims. EX1019, 100-103 (emphasis in original). For the §§102 and 103 rejections, the Examiner argued that

[5] I understand that 35 U.S.C. § 251(d) restricts reissue applications that broaden the scope of the claims of the parent patent to be filed within two years from the grant of the parent patent. Since the first reissue patent was filed more than two years after the grant of the parent patent, I understand that the claims of the first reissue patent must not be broader than the claims of the parent patent.

all elements of the claims were disclosed by U.S. Patent Publication No. 2006/0024997 ("Teicher"), or the combination of Teicher in view of U.S. Patent No. 7,269,004 ("Ni '004"). EX1019, 103-115; *see also* EX1024; EX1023.

48. To overcome the §112 rejection, Patent Owner stated that its claims are directed toward a "socket structure" only, without requiring the plug, which Patent Owner argued was "only inferentially claimed." EX1019, 80.

> As recognized by the Examiner in the "First Plausible Interpretation" the claims are directed toward a socket structure. The plug is only inferentially claimed, see for example claim 34 which states "configured to be connected to a plug," and claim 50 which states "a connection slot, which is disposed in front of the plastic base and configured to be connected to the plug having at least one row of connection terminals." Thus, and as recognized by the Examiner, a person of ordinary skill in the art would interpret the claims as limited to the socket structure alone and not to a socket and plug structure. This is reinforced with new claims 64 and 66 that recite the socket structure does not include the plug.
>
> Withdrawal of the rejection is respectfully requested.

Id. (annotated).

49. To overcome the §§102 and 103 rejections, Patent Owner argued that the socket disclosed in Teicher does not have the claimed symmetrical structure of independent claims (exemplary claim 34 copied below) because Teicher's "tongue arrangement 150 deflects within the receptacle 146" when the plug 168 is inserted. EX1019, 81-83; *see also* EX1024, Figs. 5d, 5e. "This deflection of the tongue arrangement 150 is required for the operation of Teicher" and prevents Teicher's

socket from having "symmetric profiles" around the tongue when the plug is inserted. EX1019, 81-83; *see also* EX1024, Figs. 5d, 5e.

> 34. (New) A socket structure configured for a duplex electrical connection, the socket structure comprising:
>
> a plastic base;
>
> a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
>
> a tongue, which has a first surface and a second surface disposed opposite the first surface, and is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
>
> at least one row of first contacts separately arranged on the first surface of the tongue, wherein each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
>
> at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
>
> each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
>
> when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts, and the tongue is disposed at a middle within the connection slot so that the connection slot is formed with symmetric profiles in up, down, left and right chambers around the tongue; and
>
> when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and the tongue is disposed at the middle within the connection slot so that the connection slot is formed with symmetric profiles in up, down, left and right chambers around the tongue.

50. The Examiner allowed the '287 patent without further rejections. EX1019, 16.

iii. The Challenged Patent (’307 Patent)

51. The ’307 patent was filed on October 27, 2022—more than ten years after the parent patent was granted[6]—and issued February 18, 2025. EX1001 at (22), (45).

52. During prosecution of the ’307 patent, the Examiner objected to the claim limitation reciting “a functional reverse mirror configuration” as being unsupported in the specification. EX1002, 182 (reproduced below). The Examiner stated that the term appears “to be referring to the order of the serial numbers for the first contacts being reversed relative to the second contacts as shown in Figure 4A and other figures and described in the specification,” and the Examiner requested that Patent Owner add such “limitation in the appropriate sections of the specification”:

[6] Since the ’307 patent was filed more than two years after the grant of the parent patent, I understand that the claims of the ’307 patent must not be broader than the claims of the parent patent under 35 U.S.C. § 251(d).

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the specification does not have any mention of the limitation, "a functional reverse mirror configuration". However, this appears to be referring to the order of the serial numbers for the first contacts being reversed relative to the second contacts as shown in Figure 4A and other figures and described in the specification. As such, this is the interpretation used for the Office Action below. If this is correct, Applicant should put the limitation in the appropriate sections of the specification. If this is incorrect, Applicant should explain the limitation and provide support from the specification.

Id. (annotated). Patent Owner thereafter amended the specification, as shown below. EX1002, 101 (reproduced below).

Amendments to the Specification:

On col. 6, starting at line 22 of U.S. Patent 8,198,563, please amend the specification as follows:

In a front view, the one row of connection terminals 11 have the serial numbers of 4, 3, 2, 1 from left to right (i.e., a functional reverse mirror configuration). When the connection terminals 11 of the USB 2.0 plug 10 face the second surface 502 of the tongue 50 and are normally inserted into the connection slot 45, its chamber is fitted with the tongue 50, and its one row of connection terminals 11 are turned into the serial numbers of 1, 2, 3, 4 from left to right, and are electrically connected to the second contact 71 of the one row of second terminals 70 on the bottom of the tongue 50 (the serial numbers are 1, 2, 3, 4 from left to right).

Id. (annotated).

53. The Examiner further rejected all pending claims under 35 U.S.C. §§ 112 and 103. EX1002, 185-290. For the §112 rejections, the Examiner rejected certain pending claims reciting "the tongue having rounded corners on to [*sic*] sides of the tongue" and "a thickness of the tongue is less than third of a height of the connection slot" as being unsupported in the specification and thus failing to comply with the written description requirement under 35 U.S.C. §112(a). EX1002, 185-186. For the §103 rejections, the Examiner rejected all pending claims as unpatentable over Teicher in view of PCT Publication No. WO-2009069969 ("Lee PCT"). EX1002, 186-290; *see also* EX1024; EX1025.

54. Before responding to the Office Action, Patent Owner initiated an interview with the Examiner to discuss the §112 and §103 rejections. The Application-Initiated Interview Summary is reproduced in part below. EX1002, 160.

Date of Interview: 25 September 2024

Issues Discussed:

35 U.S.C. 112

Applicant's representative pointed to Figure 53 to shown tongue with rounded ends. Examiner explained ends appeared to be chamfered rather than rounded. Applicant's representative agreed. Applicant's representative stated Figure 2 showed tongue thickness less than one third of socket opening. Examiner stated without the drawing being to scale, marking showing such, or text in the specification supporting such the limitation is not supported. Applicant's representative pointed to Figure 21 with the two plugs to support this relationship. Examiner suggested Applicant's representative make this argument in response and it would be considered.

35 U.S.C. 103

Applicant's representative discussed that Applicant's socket allows for plug to be inserted either way and two plugs to be inserted at the same time. Applicant's representative explained that Teicher allows the plug to be inserted either way but moves the tongue to block the opposite way once the plug is inserted. Applicant's representative explained that Lee allows for plug to be inserted either way, but due to the electrical circuitry only allows for one active plug at a time. Applicant's representative further explained combining Lee with Teicher is not possible due the deflection with the tongue. Examiner stated arguments appear to overcome the rejection of record but further search and consideration are need.

Id. (annotated). As stated in the summary, regarding the §112 rejection, Patent Owner and Examiner agreed that the tongue ends appear to be "chamfered rather than rounded." *Id.* Patent Owner also argued that "Figure 2 showed tongue thickness less than one third of socket opening" and further "pointed to ***Figure 21 with the two plugs*** to support this relationship." *Id*. (emphasis added). The Examiner "stated without the drawing being to scale, marking showing such, or text in the specification supporting such the limitation is not supported." *Id*. Regarding the §103 rejection, Patent Owner argued that the claimed "socket allows for plug to be inserted either way and ***two plugs to be inserted at the same time,***" but the cited prior art "***only allows for one active plug*** [to be inserted] at a time." *Id*. (emphasis added). The Examiner noted that these arguments "appear to overcome the rejection of record" but would need further search and consideration. *Id*.

55. In the written response that followed, Patent Owner amended the claims to recite a "chamfered" rather than "rounded" tongue shape. Regarding the §112 rejection relating to the "thickness" of the tongue, Patent Owner reiterated that various Figures, particularly Figures 19 and 21 (*i.e.*, figures showing the "dual-slot" socket receiving two plugs), show the tongue "occupying less than 1/3 of the connection slot" without additional explanation addressing Examiner's statement regarding the Figures. EX1002, 142 (reproduced below).

> Regarding the 35 U.S.C. §112 rejection, and by the above amendments, the claims have been amended to recite "chamfered" rather than "rounded" as recommended by the Examiners.
>
> Additionally, and with reference to at least Figures 2A, 4A, 5A, 19, and 21, the tongue can be seen as occupying less than 1/3 of the connection slot. This is particularly evident in Figs. 19 and 21 where the plugs 20 in Fig. 19, and plugs 25 in Fig. 21, each occupy approximately 40% of the connection slot. Thus, the tongue would be approximately 20% of the height of the connection slot and provide support for the claimed feature.
>
> As such, withdrawal of the rejection is respectfully requested.

Id. (annotated).

56. Regarding the §103 rejection, Patent Owner again emphasized the "simultaneously" limitation and argued that each of the cited prior art includes mechanical and/or electrical features that prevent the disclosed socket from "simultaneously electrically connect[ing] via the first and second contacts" on both sides of the tongue. EX1002, 142-144 (excerpts reproduced below).

Claims 35-136 are rejected in view of Teicher and Lee, with this rejection being respectfully traversed.

As discussed during the Interview, in Teicher, as shown in Fig. 5e, the tongue arrangement 150 is configured to move up and down such that when block 174 is inserted into the socket, the tongue arrangement 150 deflects upward to block the upper portion of the plug from being inserted. Thus, Teicher is incapable of operating, and at least fails to disclose, at least the claimed feature of *socket structure being operative to simultaneously electrically connect via the first and second contacts.*

***

Lee also at least fails to teach, suggest or disclose this claimed feature.

Specifically, in Lee, as shown in Fig. 6 below, the multiplexers (mxu, mxd, mxp) operate such that *only* the upper *or* the lower set of contacts are connected to the host controller. (Note the position of the switch in mxp, in particular, which either selects the upper *or* the lower set of contacts.

Lee does not disclose at least the claimed feature of the *socket structure being operative to simultaneously electrically connect via the first and second contacts* as claimed.

EX1002, 142-143 (annotated).

57. Patent Owner also asserted that this "simultaneously electrically connect" limitation of the pending claims, along with other limitations such as the top and bottom contacts including "at least six contacts," provide the "narrowing feature" that serves as the basis for the continuation reissue application. EX1002, 142 (reproduced below).

> Regarding the objection to the Declaration, and in accordance with the Examiners' recommendation, presented below is a proposed error statement. Should the Examiner find this new error statement to be acceptable, a new Declaration will be executed and promptly submitted.
>
> *At least one error upon which the subject reissue is based is that the patentee claimed more or less than they had the right to claim in the patent, and have therefore included at least the narrowing feature in claim 68 that "*...the at least one row of first contacts includes at least six contacts, the at least one row of second contacts includes at least six contacts, the socket structure is operative to simultaneously electrically connect via the first and second contacts..." *The originally patented claims fail to claim at least this specific combination of features.*

Id. (annotated).

58. Following these arguments, the Examiner allowed the pending claims subject to Patent Owner satisfying certain procedural requirements. EX1002, 76-79, 82. Thereafter, the '307 patent was allowed. EX1002, 41.

VII. CLAIM CONSTRUCTION

59. It is my understanding that to properly evaluate the '307 patent, the terms of the claims must first be interpreted. It is my understanding that the claims are to be construed according to the same claim construction standard that district courts use. For the Challenged Claims, I have applied their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the specification and the prosecution history, as well as the following.

A. "Simultaneously" Terms

60. I understand that Petitioner interprets terms 34[i], 48, 56[i], 57, 67[j], 68, 78[j], 79, 88[j], 89, 98[i], 99, 108[j], 109, 110[j], 111, 112[j], 113, 114[i], 115[i], 116[j], 117[i], 118[j], 119[i], 120[i], 130[i], 131[i], 132[i], 133[i], 134[i], 135[i], recited below, to each require "*a dual-slot so that two plugs may be simultaneously connected thereto*."

Claim Terms
"the socket structure is operative to simultaneously electrically connect via the first and [the] second contacts" (claims 34, 67, 78, 88, 98, 108, 114, 130, 133)
"the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue" (claims 56, 110, 112, 131, 132, 134, 135)
"the socket structure is operative to simultaneously electrically connect on both sides of the tongue via the first and second contacts" (claim 116)
"the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue" (claims 115, 117, 118, 119, 120)

61. I understand that, in Patent Owner's Complaint in district court, Patent Owner interprets these limitations to cover a socket that accepts one plug. EX1004.

62. I have considered both parties' construction, as applicable, and my conclusions would not change under either party's interpretation. Under either party's interpretation of these terms, it is my opinion that the prior art renders obvious the Challenged Claims, such that my opinions would not change.

B. "Duplex Electrical Connection" Preamble

63. I understand that Petitioner interprets the phrase "duplex electrical connection" in preambles 34[pre], 56[pre], 67[pre], 78[pre], 88[pre], 98[pre], 108[pre], 110[pre], 112[pre], 114[pre], 115[pre], 116[pre], 117[pre], 118[pre], 119[pre], 120[pre], 130[pre], 131[pre], 132[pre], 133[pre], 134[pre], 135[pre] and dependent claims 55, 57, 68 to require "*a dual-slot so that two plugs may be simultaneously connected thereto*."

64. I understand that, in Patent Owner's Complaint in district court, Patent Owner interprets these limitations to cover a socket that accepts one plug. EX1004.

65. I have considered both parties' construction of "duplex electrical connection," and my conclusions would not change under either party's interpretation. Under either party's interpretation of this term, it is my opinion that the prior art renders obvious the Challenged Claims, such that my opinions would not change.

C. "Functional Reverse Mirror" / "Reverse Mirror"

66. I understand that Petitioner interprets the limitation "functional reverse mirror" or "reverse mirror" in terms 34[j], 56[j], 67[k], 78[k], 88[k], 98[j], 108[k], 110[k], 112[k], 114[j], 118[i], 130[j], 131[j], 132[j], 133[j], 134]j], 135[j] to require the socket's tongue to have "*identical predetermined sequences of contact functions on both sides, in reverse order*."

67. I understand that, in Patent Owner's Complaint in district court, Patent Owner appears to interpret the term as to cover a socket structure that has ***different*** sequences of contact functions on each side. *See*, *e.g.*, EX1004, 20-23, 91-94, 138-141, 203-206.

68. I have considered both parties' construction of "functional reverse mirror" or "reverse mirror," and my conclusions would not change under either party's interpretation. Under either party's interpretation of this term, it is my opinion that the prior art renders obvious the Challenged Claims, such that my opinions would not change.

VIII. TECHNOLOGY BACKGROUND AND STATE OF THE ART

A. Electrical Connectors, Including USB

69. By the early 2000s, there was significant proliferation of computing and multi-media applications with highspeed peripheral Input/Output (I/O) interconnections that required electrical connectors for data transfer and power charging. Some examples are shown in the table below.

Application	**High-speed I/O requirement**
Digital cameras, mp3 players, and external hard drives	Fast transfer of large image/audio files (hundreds of MBPS)
Broadband internet and networking	Faster network interface standards (100 MBPS → 1 GBPS)
Multimedia (DVDs, HDTV, gaming)	High-bandwidth, low-latency video and audio transmission

Portable devices and laptops	Compact, reliable, and standardized data/power connectors
Expanding peripheral ecosystem	Plug-and-play compatibility across brands and systems

70. A POSITA would have been aware of several known connection interfaces that had been developed for such peripherals, with advantages and disadvantages of each.

71. For example, the art included (1) serial ports (RS-232), which were often slow (up to 115 kbps) and point-to-point only; (2) parallel ports, used for printers and scanners, which had limited distance and speed; (3) PS/2, SCSI, FireWire, and other proprietary docks, which each used its own cable, driver, and electrical specification, making handling cumbersome for a user.

72. By 2009, a POSITA would also have been familiar with USB's introduction in the late 1990s, which revolutionized peripheral I/O connectivity by replacing legacy ports with one standardized interface. The first versions, USB 1.0 (1996) and 1.1 (1998) (EX1012 and EX1013) offered data rates of 1.5 Mbps and 12 Mbps, and were faster and easier to use than serial or PS/2 connections. EX1012; EX1013. USB 2.0 (EX1014) was introduced in 2000 with transfer speeds at 480 Mbps, which enabled reliable use with external hard drives, digital cameras, and broadband peripherals. EX1014. USB 3.0 (EX1015) added pins on both sides of the plug and the socket tongue to further increase transfer speeds. EX1015.

73. The USB interfaces are published in USB specifications, which have been developed and distributed by USB Implementers Forum, Inc. on the public USB.org website, since well before 2008. Since that time, the specifications have been freely and publicly available to members of the interested public, including designers, users, and other implementers of the USB standards. By 2009, a POSITA would have readily known to look for and procure the final USB specifications at the USB.org website.

74. The USB specifications provide electrical and mechanical design details for a socket and a plug. Using USB 1.1 as an example, Figure 6.6-6.7 and table 6-1 shows the basic "USB 1.1 A" plugs and socket. EX1013, 81-83. The details of the receptable are shown in Fig. 6-8. EX1013, 84. The USB receptable has a tongue structure (annotated in orange, below) where the plug is inserted. Pin 1 is the voltage supply, and 4 is the ground. The data transfer is differential at pins 2 and 3 as D+ and D- with differential voltage range from 0.8-2.5 Volts. EX1013, 112-113. In 1998, USB 1.1 had two data rates: 1.5 Mbps (Low Speed) and 12 Mbps (Full Speed). The 12 Mbps rate, also known as "Full Speed," was the more common and

Samsung, EX1003, p. 42

faster of the two and was used for a wider range of devices. EX1013, 126.

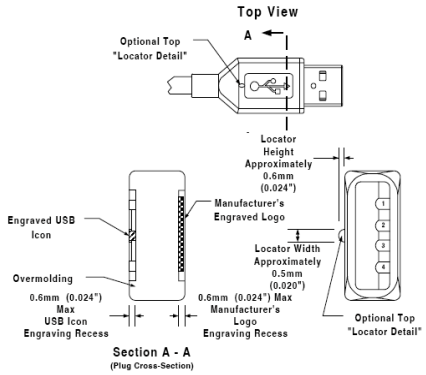
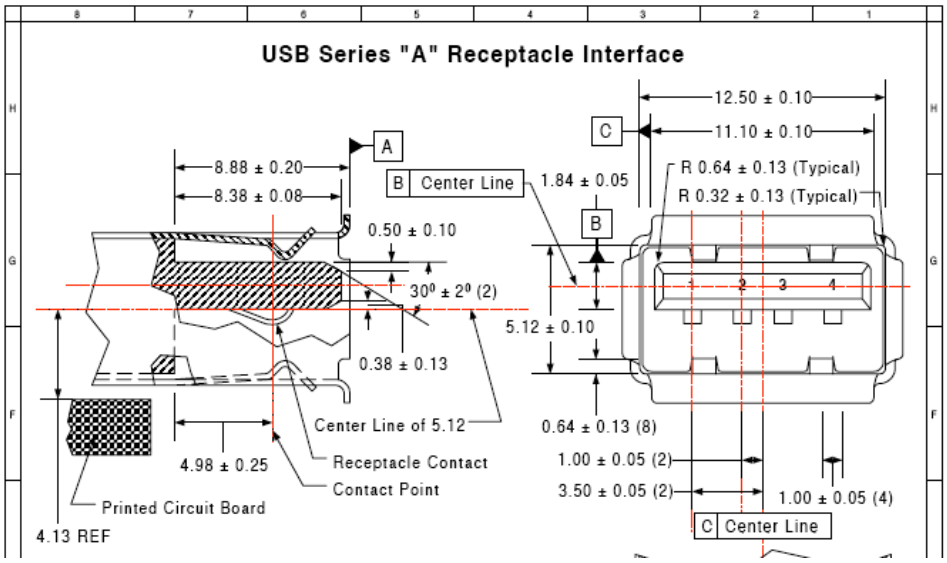


Figure 6-6. Typical USB Plug Orientation

Table 6-1. USB Connector Termination Assignment

Contact Number	Signal Name	Typical Wiring Assignment
1	V_{BUS}	Red
2	D-	White
3	D+	Green
4	GND	Black
Shell	Shield	Drain Wire

EX1013, 81-82.



EX1013, 84.

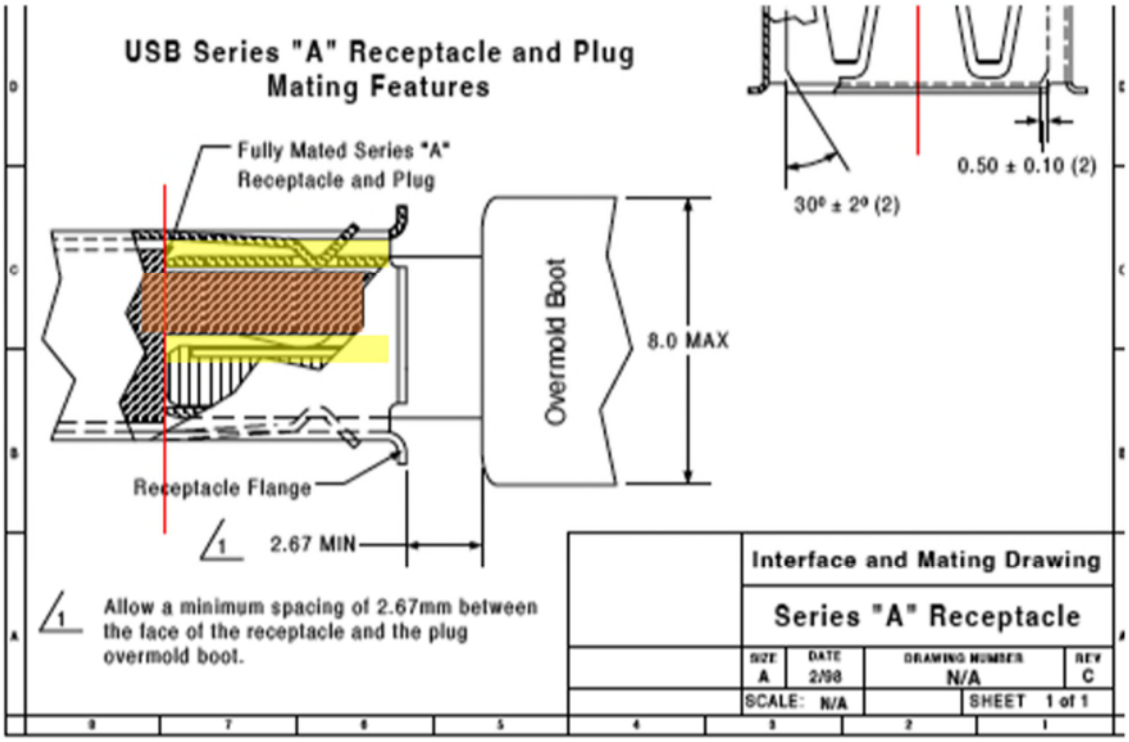


Figure 6-7. USB Series "A" Receptacle Interface and Mating Drawing

EX1013, 84 (enlarged and annotated).

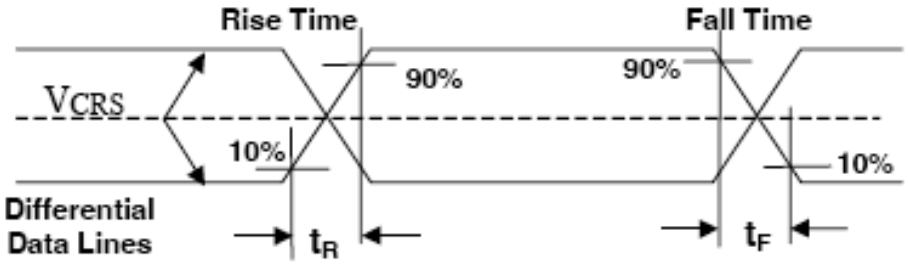


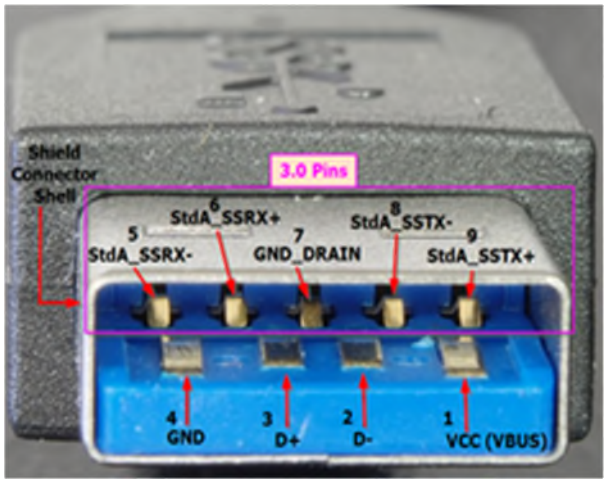
Figure 7-6. Data Signal Rise and Fall Time

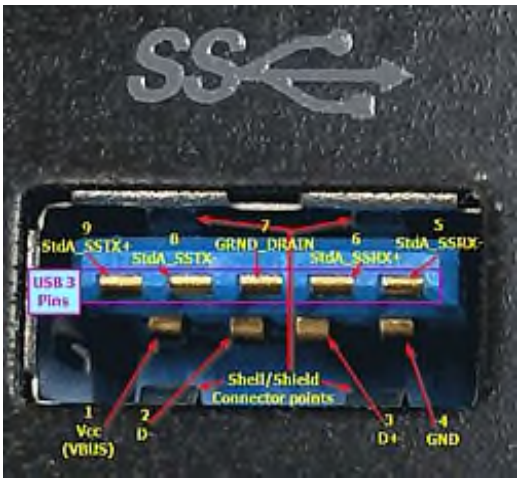
EX1013, 111.

75. USB 2.0 was introduced in April 2000. EX1014. USB 2.0 generally kept the same mechanical plug and receptable structure but with faster differential

signaling (with a data rate at 480Mbps), better shielding, and better transceivers. EX1014, 6. USB 2.0 achieved a forty-fold bandwidth increase while maintaining full mechanical compatibility with the earlier USB 1.1 standard. USB 2.0 retained the same 4-pin connector geometry as USB 1.1 (Type-A and Type-B), ensuring full backward mechanical compatibility. EX1014, 11.

76. USB 3.0 was introduced in November 2008. EX1015. USB 3.0 kept the same familiar plug form but added new differential pairs, smarter signaling, and stronger power delivery. These enhancements boosted throughput from 480 Mbps to 5 Gbps while maintaining mechanical backward compatibility. Specifically, the mechanical structure of the 3.0 was backward compatible with 2.0 but 5 additional pins were added for high-speed data. As shown in an image of the plug and receptacle (below), pins 1-4 are USB 2.0 compatible, and pins 5-9 allows high speed data connection for USB 3.0.





77. The table below compares the differences between 2.0 and 3.0 version. EX1015, 38.

Feature	USB 2.0 (2000)	USB 3.0 (2008)	Advancement
Maximum Data Rate	480 Mbps (60 MB/s)	5 Gbps (625 MB/s)	~10× faster transfer speeds
Signaling Mode	Half-duplex (shared D+ / D− pair)	Full-duplex (separate transmit & receive pairs)	Simultaneous send and receive
Physical Wires	4 wires (VBUS, D+, D−, GND)	9 wires (adds 2 Tx, 2 Rx, 1 GND)	Dual-bus design for backward compatibility and high-speed data
Connector Design	Same Type-A/B for host & device	Same outer shape, added internal pins	Full backward mechanical compatibility
Power Supply	5 V ± 5%, up to 500 mA	5 V ± 5%, up to 900 mA	Supports more power-hungry peripherals

78. By the mid-2000s, USB had become ubiquitous and was found on virtually every computer, printer, and flash drive, unifying data and power transmission under a single, hot-pluggable, self-powered standard. *E.g.*, EX1035, 1 ("Since the USB specification was first introduced in 1996, it has changed the way we Interact with our computers. USB has allowed everything from keyboards, mouse, PDAs, printers, digital cameras and personal media players - pretty much the entire spectrum of consumer electronics - to be connected to a host PC using a single standardized socket.").

79. Several key advantages drove USB's dominance. First, it was versatile: it could connect all types of peripherals from mice and keyboards to cameras, external hard drives, flash storage, and mobile phones, all through the same compact port. This standardization simplified product design and user experience, allowing manufacturers to streamline hardware at lower-cost while giving consumers plug-and-play convenience across devices from different brands. Second, its higher speed outperformed serial and parallel interfaces, while its plug-and-play design allowed users to hot-swap devices without rebooting. Third, USB could deliver up to 500 mA at 5 volts, powering small peripherals like mice, drives, and phones directly from the port. Fourth, the USB form factor also was scalable—introducing micro-versions that brought the same simplicity to smaller, portable electronics.

80. In addition to these advantages, by the mid-2000s, a POSITA would also have been aware of certain design motivations and needs driving improvements and modifications to USB and other connectors. I describe those design needs in Section VIII.B, and I describe examples of how the industry addressed those motivations and needs in Section VIII.C.

B. POSITA's Design Incentives and Motivations by 2009

81. By 2009, a POSITA would have been aware of several converging design drivers and needs for improvements to USB and other electrical connectors.

Samsung, EX1003, p. 47

82. **Reversibility, symmetry and ease-of-use:** By 2009, it was recognized that USB connectors could be difficult to handle because they were directional, and the plug could only be inserted in one orientation due to the asymmetrical internal design of the connector tongue and contact layout. A POSITA would have also considered growing device miniaturization, particularly in mobile phones, MP3 players, and digital cameras, where connector orientation errors led to damage or mechanical stress. A POSITA would have been driven to meet consumer usability expectations, emphasizing intuitive, reversible connections for frequent plug-and-unplug operations without users having to visually align or try multiple times to insert plugs correctly. Particularly as devices became smaller and more mobile, this need for an intuitive, reversible, and durable connector became increasingly apparent to a POSITA—driving designs for many applications.

83. A POSITA would have also understood that the reversibility goal would also drive other design improvements. For example, for reversible connectors, the plug and receptacle logically would be geometrically symmetric so insertion in either orientation is physically possible. Internal contact layouts also logically would mirror or duplicate signal pads so that proper circuits connect regardless of plug orientation. For example, in either orientation, data or power lines should connect to the correct internal nodes (*e.g.*, VBUS to VBUS, D+ to D+, etc.). The symmetric

design should maintain matched impedance, have minimum cross talk, and low skew for high-speed differential signaling.

84. **Increasing data transmission rate:** By 2009, there was also a need to increase external I/O connection speeds in known connection interfaces. With the advances in the integrated circuit (IC) device size (shrinking below 100nm by 2000) and the development of highspeed interconnects, the internal speed of data transfer within the processors chip was well above several GHZ. For example, in the mid-2000s, processor speeds increased rapidly, with clock speeds for mainstream processors like the Intel Pentium 4 reaching up to around 4-5 GHz by 2005. However, designers encountered limitations in external I/O connection speed, and the speed of I/O external connectivity was orders of magnitude slower than internal IC data speeds. EX1033; EX1034.

85. **Efficient use of space**: By 2009, a POSITA would have also been driven to maximize the use of space when implementing electrical connectors in a computing device. As data rates increased, memory storage requirements and the number of peripherals needed for a computing device also increased. Electrical connector designers were often faced with meeting user needs for more electrical connector sockets in a single small-sized portable computing device.

86. **USB Compatibility**: Compatibility with USB standards, including earlier versions of the USB standard, would also have been important to a POSITA

by 2009, given the ubiquity of the connectors by that time. Given the standardization of USB and its success in the market, a POSITA would have understood that a connector should support a USB interface to expand the device's marketability to users who owned or were anticipating buying peripherals employing the USB standard, who would be interested in a compatible host device.

C. Known and Predictable Designs by 2009

87. By 2009, the field of electrical connector design was mature and highly developed. A POSITA would have had a finite set of predictable design options to address the needs I described above, including the design motivations of reversibility, mechanical symmetry and robustness, electrical integrity at high data rates, human usability, and backwards compatibility with existing systems.

88. These options guided several designs described herein which unified reversibility with high-speed performance, compactness, and user simplicity. As I summarize below, several pre-2009 examples demonstrate that by 2009 reversible symmetrical, orientation-independent interconnect systems that could support high-speed signaling while eliminating the inconvenience of one-way plugs were well-established. A POSITA would have chosen among known approaches with a reasonable expectation of success, as the range of available solutions was finite and their performance characteristics well understood.

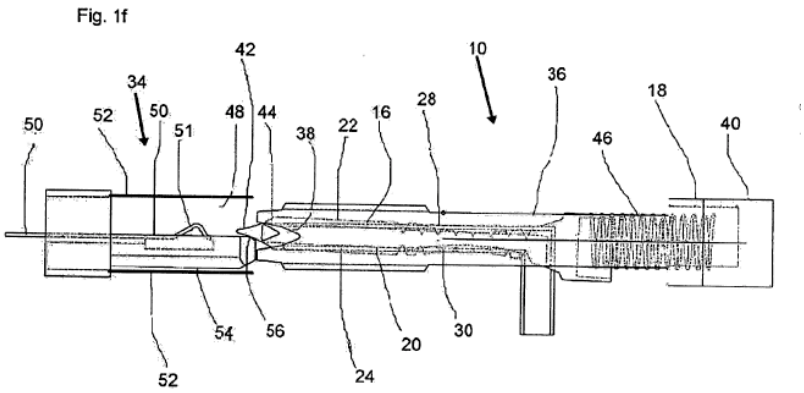
Samsung, EX1003, p. 50

i. Reversible electrical connectors were known

89. By 2009, numerous designs taught plug/receptacle pairs that provide electrical mating in either 0° or 180° orientations.

90. For example, as described in the '307 patent prosecution history, Teicher '086[7] teaches an approach to make a USB A-type connector (plug or receptacle) reversible, enabling mechanical and electrical coupling in either orientation without modifying the existing standard A-type mating part. EX1026, Abstract; EX1027, Figs. 13-15. Teicher uses contact geometry or displaceable tongue elements whose states produce correct mapping in either orientation. The tongue carries conductive contacts on both the top and bottom surfaces, ensuring that signals or power lines connect correctly regardless of plug orientation. For example, Fig. 1f of this patent shows the reversible plug 10 and a socket 34.

[7] US 7,537,471 ("Teicher '471") discloses a modified reversible-connector as well. EX1027.

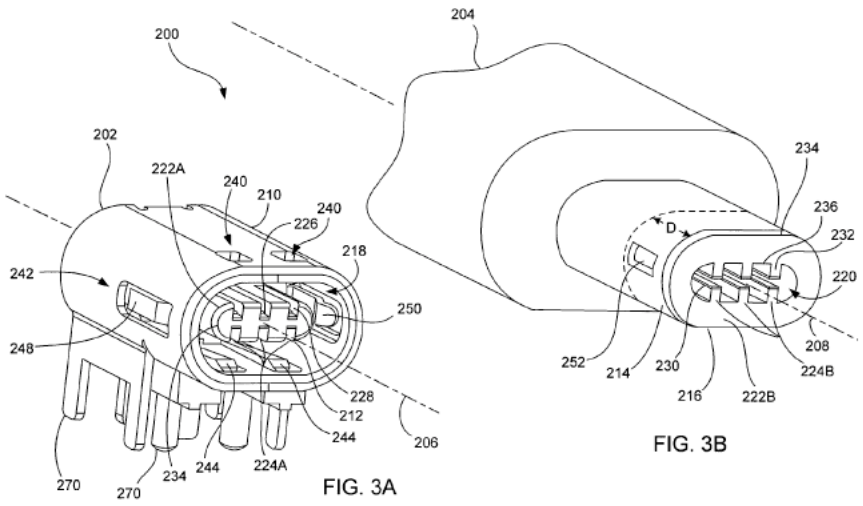


EX1026, Fig. 1f.

91. Numerous other references achieve reversibility by relying on a symmetrical female-type socket/male-type plug design with the socket having a central tongue as the structural axis for symmetry. These designs also included mirror-image contact sets on the tongue for reversible plug/sockets, showing that orientation-independent connection using mirrored contacts was an established and predictable design approach.

92. For example, Andre shows a DC plug and receptacle that allows the plug to be inserted at 0° or 180° and still complete the same circuit. EX1005, Abstract, 5:18-26, Figs. 2-4. For example, Figure 3 of Andre shows a symmetrical plug and receptacle with dual-faced contacts, allowing the plug to be inserted in either direction (0° or 180°) while maintaining reliable electrical and mechanical engagement. The receptacle includes an insulating “tongue” structure that keeps the

upper and lower contacts on each side of the tongue separated and aligned, preventing shorts and ensuring that contacts mate correctly regardless of how the plug is flipped. Redundant lateral contacts (which can be power, ground, or data) are placed equal distances about the centerline so that in the 180° orientation the opposite redundant pads mate and preserve the circuit function. EX1005, Fig. 3. Each pair of redundant contacts in Andre's plug/receptacle can independently carry power or data and may be "laterally spaced apart equally relative to a central axis" and "perform the same function" (EX1005, 2:13-14, 5:18-36).

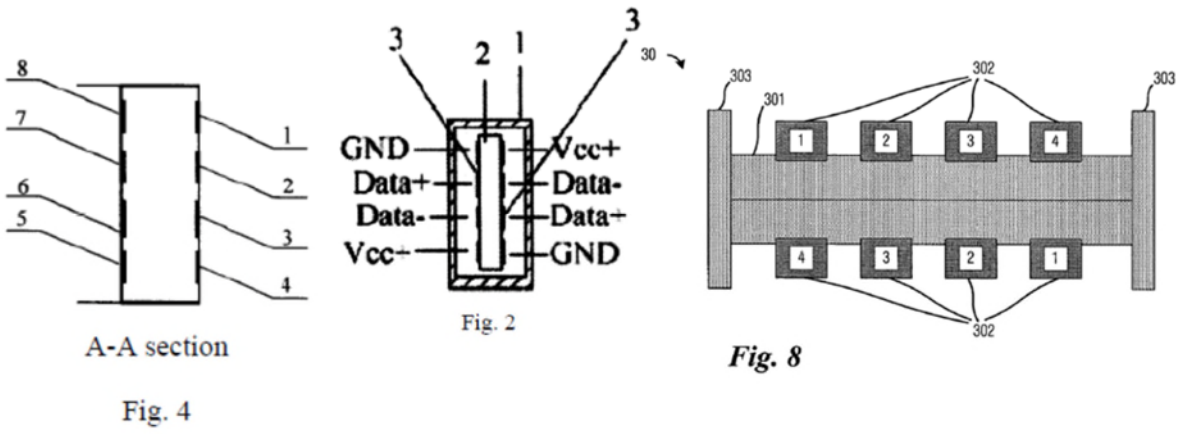


EX1005, Figs. 3A-3B.

93. Likewise, Zhenyu and Lufan show USB-style structures for reversible insertion. EX1006, Figs. 1-4; EX1007, Figs. 1-2. Zhenyu and Lufan present mirror USB layouts on opposite faces of a tongue or within upper/lower terminal slots so

the socket or plug is effectively symmetric and orientation neutral. Specifically, **Zhenyu** teaches a symmetrical, reversible USB-type plug connector (*see* Fig. 5, below left) featuring electrical contacts disposed on both interior walls of the plug. EX1006. The contacts are arranged as two full USB2.0 contact sets in reverse order. EX1006. Zhenyu (*see* Fig. 5, below left) permits orientation-free insertion of a USB plug into a corresponding receptacle while maintaining electrical compatibility with existing USB signal protocols. **Lufan** likewise discloses a symmetrical, reversible USB female-type socket (Fig. 2, below middle) that allows a USB plug to be inserted from either orientation. EX1007. The mating geometry and electrical function are symmetric with respect to the socket's horizontal mid-plane, allowing a USB plug to make correct electrical contact whether inserted face-up or face-down. Specifically, Lufan's socket comprises a metal housing (1) and a central insulating core, or tongue, (2) located midway between the upper and lower walls of the shell. Each side of the female socket provides complementary signal lines (Vcc, Data-, Data+, GND) arranged so that, upon insertion, the plug's contacts always meet the correct counterpart pads.

Samsung, EX1003, p. 54



EX1006, Fig. 4 (left); EX1007, Fig. 2 (middle); *see also* EX1021, Fig. 8 (right) (Harkabi reference cited by Examiner during prosecution of the '307 patent, also showing mirror-image contact sets on either surface of the tongue for reversible plug/sockets).

ii. <u>Sockets that increase the number of active connections were known</u>

94. Several known designs increased the number of active electrical connections between a socket and a plug.

95. For example, Zhenyu describes that of the eight contacts (four on either interior plug wall), can "all" be used (as opposed to just four contacts at a time as in USB2.0) depending on the application. EX1006, 7. As another example, as shown in Figure 7 of Yuming (below), the socket connector (10) incorporates a tongue piece (112) that extends forward from an insulating main body (111) and carries two groups of contacts (132a, 132b), with six contacts each positioned respectively on the upper and lower faces of the tongue. These two contacts sets are mechanically

fixed in upper and lower grooves (112a, 112b), creating a dual-sided contact arrangement. The plug connector (20) also has upper and lower contact portions (221a, 221b) suspended from each interior wall. Yuming expressly discloses that, when the socket and plug are mated, "the contact portions 221a and 221b of the conductive terminals 22 are electrically connected to the terminal mating parts 132a and 132b of the electrical signal terminals 13" allowing up to twelve total active contact connections.

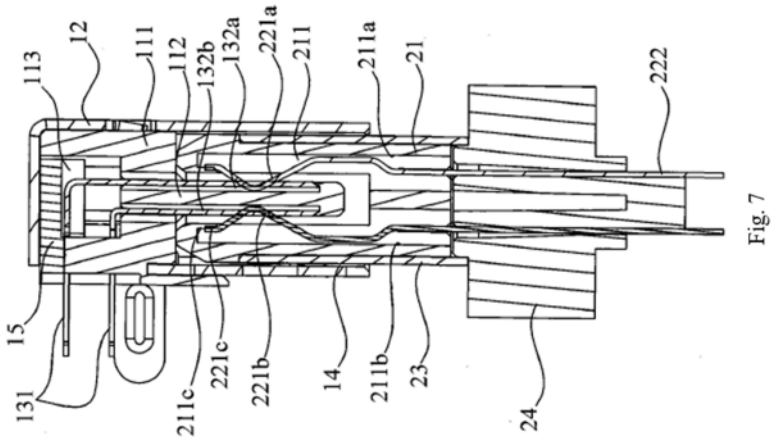


Fig. 7

EX1008, Fig. 7.

96. A POSITA would have understood by 2009 that increasing the number of active connections is one obvious way to satisfy the industry demands and motivations for increasing data transmission rates and maximizing the use of space for multiple peripheral connections. For example, Yen describes adding data signals to the USB interface to increase data transmission rate. *See, e.g.*, EX1009 at 1:31-42 (proposing a six-signal interface to "accelerate data transmission rate"). USB 3.0

likewise introduced additional data contacts for additional high speed data signals. EX1015. And other designers used additional data contacts in a socket for insertion of ***two*** plugs from two different devices to allow two sets of peripherals to connect to a computer using the same socket form factor. EX1031, Fig. 4 (socket for insertion of eSATA and USB plugs).

iii. Mechanical structures that produce a stable connection.

97. A POSITA would have also recognized mechanical structures, such as groove/rail and hook/spring elements, could be used to create a mechanical connection between a socket and a plug. These structures appear throughout the prior art as routine mechanical means to align and retain contacts.

98. For example, USB3.0 discloses known options for configuring contacts disposed on the tongue of USB sockets, including teaching that contacts may project above the surface of the socket tongue to increase compression force and ensure a stronger electrical connection with the mating plug contacts. EX1015, 77, 91. Andre shows rails on the plug that enter grooves in the receptacle to center the inner electrode and align contacts during mating. EX1005, Fig. 3. Yuming describes inward bent wall portions or hooks that capture the free ends of suspended contacts and maintain spring pressure. EX1008, Figs. 4-7. All such mechanical designs were predictable options for a POSITA designing an electrical connector.

Samsung, EX1003, p. 57

iv. Compatibility with USB

99. The prior art also expressly taught compatibility with USB signaling and form. For example, Zhenyu and Lufan are directed to USB-type interfaces: both depict the classic USB contact set (Vcc, D–, D+, GND) duplicated across faces. EX1006, 6-7; EX1007, 6, Fig. 2. Teicher's patents explicitly address USB-A reversible mating and how tongues or mirrored contacts can be used with USB connectors. EX1026; EX1027. Andre's disclosure is for DC power connectors, but, as I describe further below, its power/data transmission are directly applicable to USB connectors. A POSITA would have had several predictable options for making electrical sockets compatible with USB standards.

IX. SUMMARY OF THE PRIOR ART RELIED ON IN GROUNDS 1-7

100. There are a number of patents and publications which constitute prior art to the '307 patent. I have reviewed and considered the following publications and patents for my analysis in Grounds 1-7. I assume for purposes of my analysis that the following references are prior art to the '307 patent.

A. Andre (EX1005)

101. Andre is a U.S. Patent No. 7,094,089 B2 that was published Sept. 15, 2005 and granted Aug. 22, 2006, which predates the '307 patent's earliest potential priority date of April 15, 2009. EX1005. Andre is assigned to Apple Computer, Inc.

Id. I understand that Andre was cited on the face of the '307 patent but not discussed during prosecution. §VI.C.iii.

102. Andre discloses an embodiment of a "thin-profile[]" power receptacle and plug that are each "configured to be 0/180 symmetrical" to allow the plug to be inserted into the receptacle in either a normal or reverse orientation. EX1005, 3:66-4:2, 3:49-53, 6:17-19, 6:39-41, 8:6-8, Figs. 2B, 2C. This reversibility is accomplished by the receptacle 202 having a central tongue (elements 212/222A below) with grooves 228 on both upper and lower surfaces of the tongue and a row of contact pads 226 placed at the base of the grooves 228 on opposite surfaces of the tongue. EX1005, 9:45-51. In the embodiment shown in Figure 4A, each of the row of upper and lower contact pads 226 comprises "[a]t least a center contact" "configured for data transmissions" and "[a]t least a pair of redundant contacts" "configured for power transmission." EX1005, 9:8-12, 9:23-25, Fig. 4A. The power transmitting contacts may be configured for "transmitting the driving current" or "provid[ing] a return path for the driving current" (*e.g.*, GND). EX1005, 9:31-43. Andre also teaches that any number of the contact pads 226 may be added to the tongue and serve as either "data and/or power contacts," allowing the receptacle 202 to receive "additional inputs including other power inputs as well as data inputs" in some cases. EX1005, 9:15-18, 9:21-23, 5:14-17, 5:58-67.

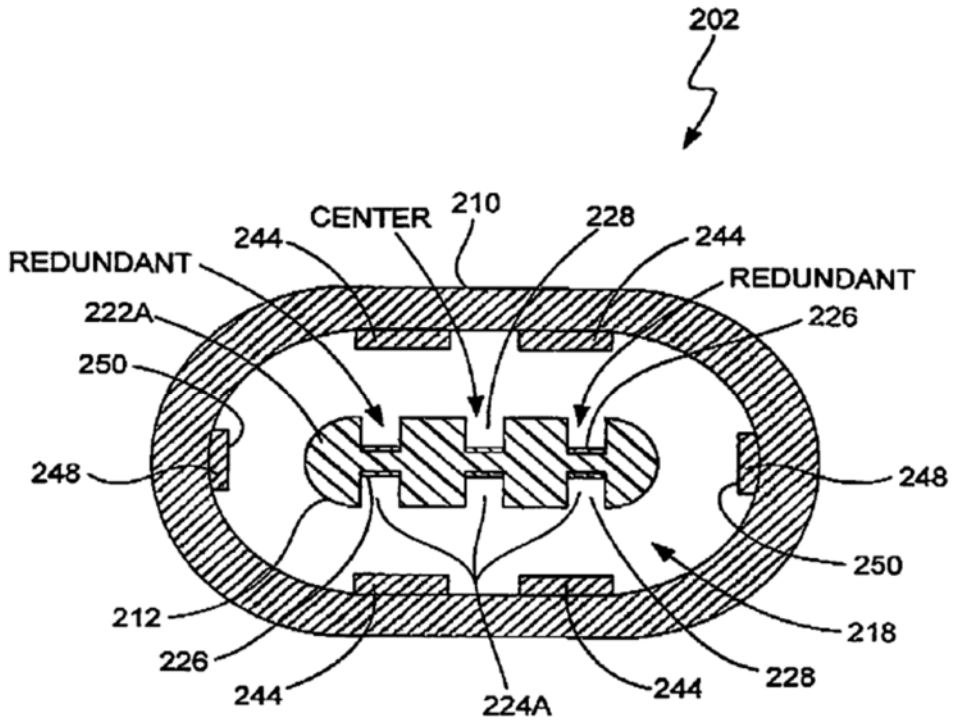


FIG. 4A

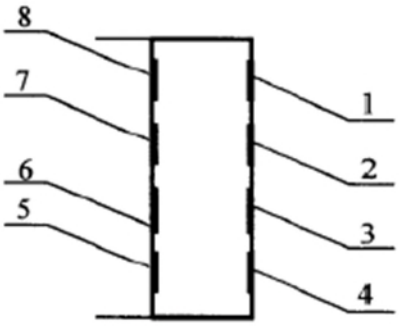
EX1005, Fig. 4A.

B. Zhenyu (EX1006)

103. Zhenyu is a Chinese Patent No. CN201038524Y that was granted Mar. 19, 2008, which predates the ’307 patent’s earliest potential priority date of April 15, 2009. EX1006. Zhenyu is assigned to the inventor, Zhenyu Sun, located in Shenzhen, Guangdong Province. EX1006 includes a certified English translation of Zhenyu, which I have reviewed. I understand that Zhenyu was cited on the face of the ’307 patent but not discussed during prosecution.

104. Zhenyu discloses a design for a USB 2.0-compliant plug that is symmetrical and reversible and therefore “user-friendly and compact.” EX1006, 1.

As shown in the embodiment of Figure 4, Zhenyu's USB plug "has a hollow cross-section with internal contact points, where each inner wall of the housing has a set of standard contact points." EX1006, 1, Fig. 4. Each set of standard contact points (*i.e.*, contacts 1-4 and contacts 5-8) are "distributed on each side of the hollow interface body" and forms a "complete set of USB interface contacts." EX1006, 6-7. The sets of contacts on either side of the plug are arranged in reverse order from each other to allow insertion of the plug in either direction. EX1006, 6-7, 1 ("this interface has two sets of symmetrical contact points, enabling it to be inserted into a USB socket in either direction for normal use"). Specifically, a left side of Zhenyu's plug contains power (8), data- (7), data+ (6), and ground (5), while a right side of Zhenyu's plug contains ground (1), data+ (2), data-(3), and power (4). EX1006, 6-7. Zhenyu teaches that each side of the disclosed plug can be used independently with a standard USB socket (*i.e.*, single-channel implementation of one pair of differential data contacts) ***or*** the two sides can both be used at the same time (*i.e.*, dual-channel implementation of two pairs of differential data contacts). EX1006, 7 ("The contact points on the right and left sides can also ***use all contact points or only some of them***, depending on the actual application of the device.").



A-A section

Fig. 4

EX1006, Fig. 4.

C. Lufan (EX1007)

105. Lufan is a Chinese Patent No. CN201113094Y that was granted Sept. 10, 2008, which predates the '307 patent's earliest potential priority date of April 15, 2009. EX1007. Lufan is assigned to an individual named Dan Cheng, locating in Hunan Province. EX1007 includes a certified English translation of Lufan, which I have reviewed. I understand that Lufan was cited on the face of the '307 patent but not discussed during prosecution.

106. Lufan discloses a USB female structure that allows a "USB plug to be inserted from both directions," thus avoiding "the inconvenience of having to reorient the USB plug when inserted in the wrong direction . . . ." EX1007, 1. The USB female structure comprises a central plug core with four metal conductive contacts disposed on either side for implementing a standard USB interface (VCC+,

Data+, Data-, Ground)— with power/ground as the outer contacts, and data+/data- as the central contacts. EX1007, 6, Fig. 2. Lufan's contacts also have an symmetrical layout: the four contacts on each side are "***arranged in reverse order*** on either side" of the plug core 2 such that one side has an "order of power Vcc+, data- (data-), data+ (data+), and ground (GND)" while the other side has an "order of ground (GND), data+ (data+), data- (data-), and power Vcc+." EX1007, 1, 6. This contact configuration mirrors and reverses the order of the contacts across the two sides of the plug core to enable identical electrical performance regardless of which way a plug is inserted.

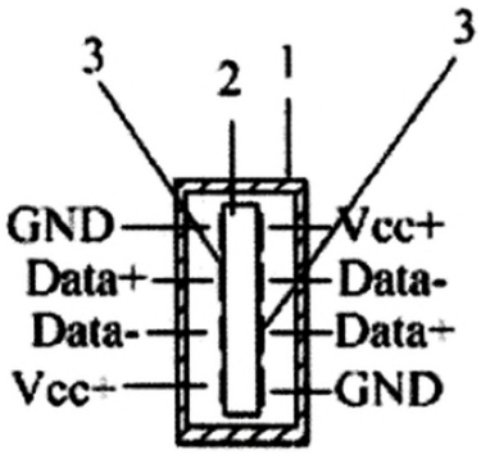


Fig. 2

EX1007, Fig. 2.

D. Yuming (EX1008)

107. Yuming is a Chinese Patent No. CN201204344Y that was granted Mar. 4, 2009, which predates the '307 patent's earliest potential priority date of April 15, 2009. EX1008. Yuming is assigned to Shiuh Chi Precision Industry Co., Ltd. in

Taiwan. EX1008 includes a certified English translation of Yuming, which I have reviewed. I understand that Yuming was not cited during prosecution of the '307 patent.

108. Yuming discloses structural details for implementing an electrical connector that ensures reliable connection between the contacts of the mated socket and plug, "especially under conditions of vibration or other impacts." EX1008, 4. Specifically, Yuming discloses a socket connector 10 having a central tongue 112 with contacts or mating parts 132a "fixedly positioned in the upper terminal groove 112a of the tongue piece 112" (*e.g.*, on a top surface of the tongue 112) and contacts or mating parts 132b "fixedly positioned in the lower terminal groove 112b of the tongue piece" (*e.g.*, on a bottom surface of the tongue 112). EX1008, 7. In the disclosed embodiment of Yuming, the socket connector 10 has a "12-pin configuration"—*i.e.*, six mating parts 132a on the top surface of the tongue 112 and six mating parts 132b on the bottom surface of the tongue 112—but Yuming teaches that "more than or fewer than 12 pins" may be implemented "without limitation." EX1008, 8. As shown in Figure 7, the mating parts 132a,b are connected to pin parts 131, which are "vertically embedded in the tail end of the main body portion 111 and extend outward from the main body portion 111." EX1008, 7. When socket connector 10 mates with a plug connector 20, the socket tongue 112 extends into the plug opening such that the plug's "contact portions 221a and 221b . . . are electrically

connected to the [socket's] mating parts 132a and 132b," respectively, thus allowing simultaneous electrical connection on both surfaces of the socket tongue 112 to "achiev[e] electrical signal continuity." EX1008, 8.

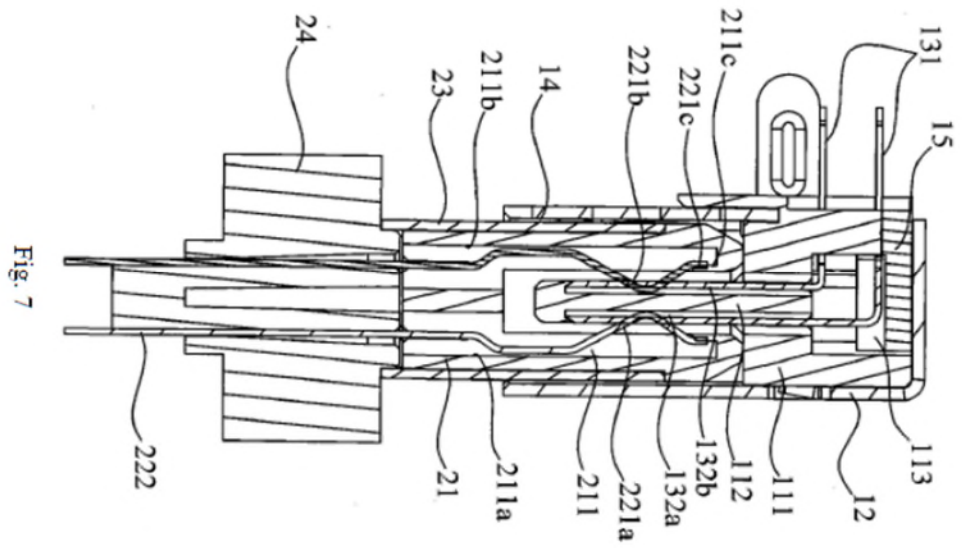


Fig. 7

EX1008, Fig. 7.

E. Yen (EX1009)

109. Yen is a U.S. Patent No. 7,231,473 B2 that was published Nov. 4, 2004 and granted Jun. 12, 2007, which predates the '307 patent's earliest potential priority date of April 15, 2009. EX1009. Yen is assigned to Power Quotient International Co., Ltd., in Taipei, Taiwan. *Id*. I understand that Yen was not cited during prosecution of the '307 patent.

110. Yen teaches a "Dual Channel Universal Serial Bus" (DCUSB) protocol designed to increase USB 2.0 data rates by adding a second differential signal pair to the conventional USB pair. EX1009, 1:13-15. In addition to the standard VBUS, D+, D–, and GND signals, Yen discloses expanding the interface to six signals—

VBUS, D0+, D0–, D1+, D1–, and GND—to "accelerate data transmission rate." EX1009, 1:31-34, 3:35-40, Fig. 5. The system employs two differential channels to increase total throughput: D0+/D0– is the Master channel performing conventional USB operations (*e.g.*, protocol coordination, chirp sequence negotiation, and host-device communication), and D1+/D1– is the Slave channel serving as an auxiliary channel that transmits data in parallel with the Master channel. EX1009, 1:62-2:27, 3:30-40. Each differential pair is connected to its own differential receiver and current driver, which are controlled by an interface controller responsible for data conversion, synchronization, and retransmission. EX1009, 4:35-50. When a conventional USB is connected, the interface controller only activates the Master channel, but when both host and device support Yen's DCUSB protocol, the interface controller automatically activates the Slave channel following a chirp-sequence handshake. EX1009, 2:9-27, 2:46-48, 2:53-3:30, Fig. 4.

Samsung, EX1003, p. 66

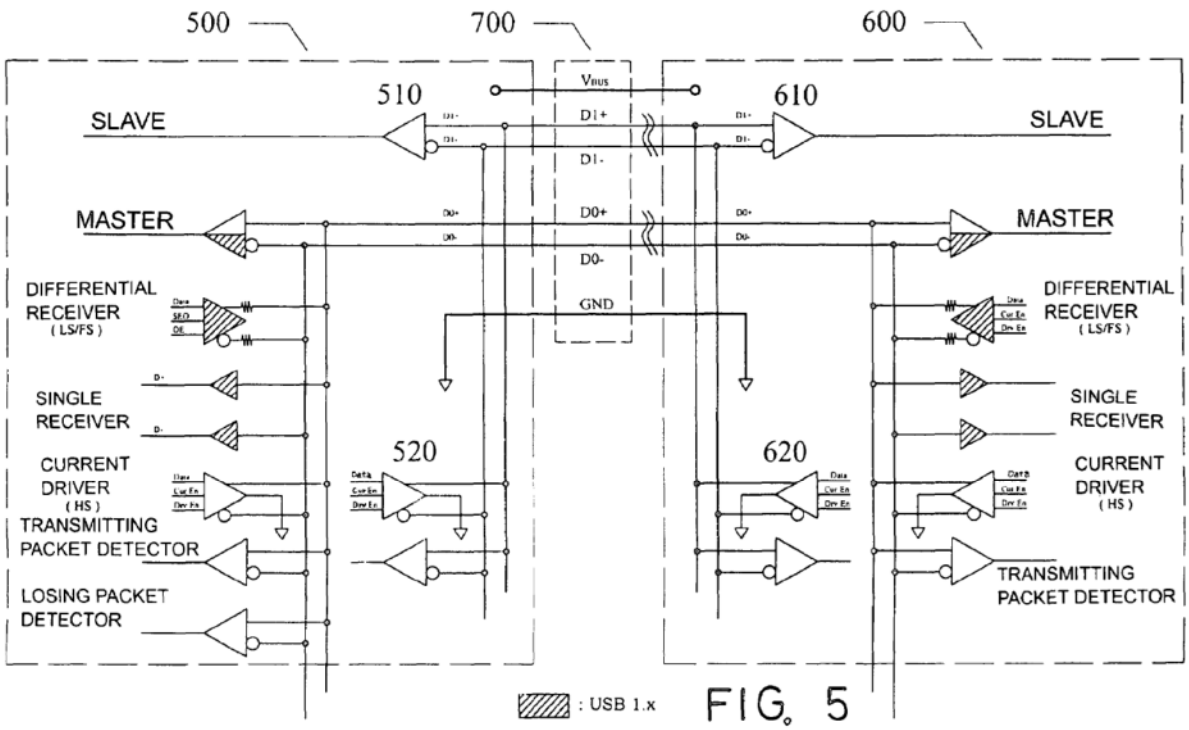


FIG. 5

EX1009, Fig. 5.

F. Lee (EX1010)

111. Lee is a U.S. Patent No. 6,854,984 B1 that was granted Feb. 15, 2005, which predates the '307 patent's earliest potential priority date of April 15, 2009. EX1010. Lee is assigned to Super Talent Electronics, Inc. *Id*. I understand that Lee was cited on the face of the '307 patent but not discussed during prosecution.

112. Lee discloses a slim USB Plug (hereinafter, "Slim-USB-Plug") with the metal housing stripped to expose the plug contacts for insertion into a slim USB socket, allowing the resulting USB connector to achieve a "half-height" of conventional USB connectors, thereby improving their "large" and "cumbersome"

profile and decreasing their "manufacturing cost." EX1010, 2:22-23, 7:51-53, Figs. 7A-7E, 10B-10C. Specifically, the embodiment of the Slim-USB-Plug shown in Figures 7A-7E removes the conventional metal case around the four metal contacts 70 (*i.e.*, Power, D+, D-, Ground) found in a standard USB 2.0 plug. EX1010, 5:36-41, 5:48-51, 8:14-17, Figs. 7A-7E. This allows the Slim-USB-Plug to be inserted into a slim USB socket, as shown in Figures 10B-10C, by fitting into an opening formed between the socket housing and the four metal contacts 28 (*i.e.*, Power, D+, D-, Ground) disposed on the top surface of connector substrate 96, which is the same four-contact configuration found in a standard female USB connector. EX1010, 7:1-7, 7:10-12, 8:14-17, Figs. 10B-10C. When mated, the plug's contacts 70 face the top surface of connector substrate 96 containing socket contacts 28 so that the corresponding standard USB contacts in the plug and socket form an electrical connection.

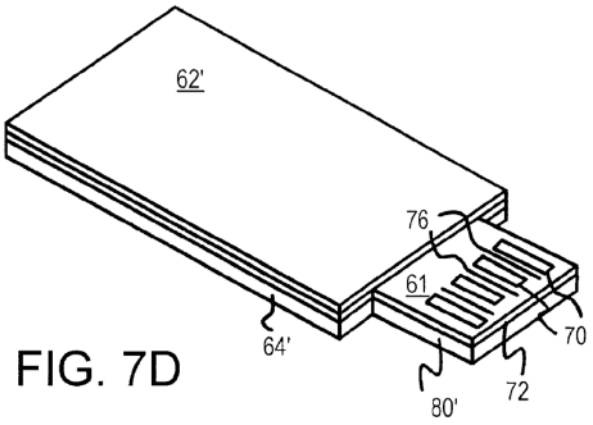


FIG. 7D

EX1010, Fig. 7D.

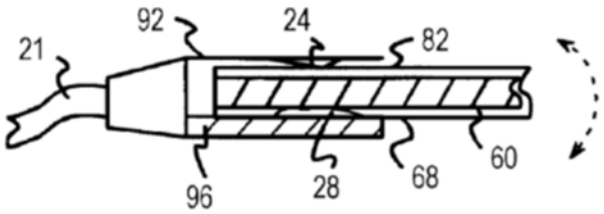


FIG. 10C

EX1010, Fig. 10C.

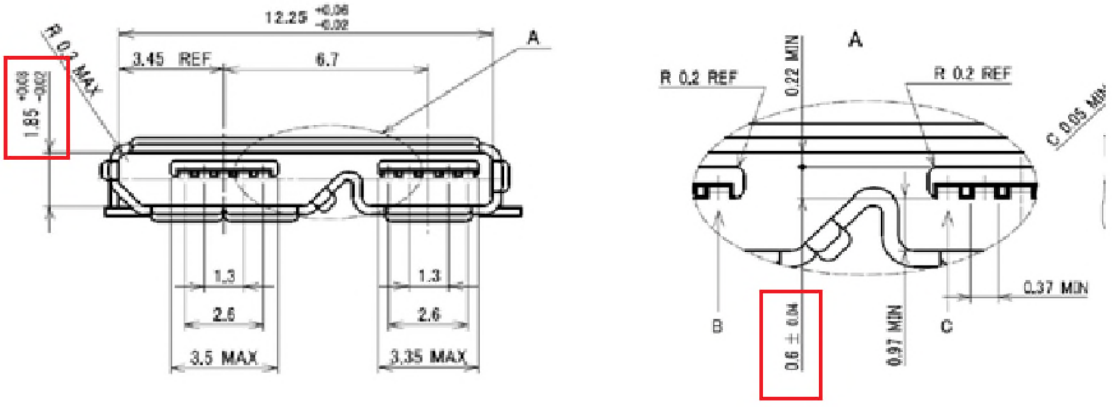
G. USB 3.0 (EX1015)

113. Various USB specifications were published and widely implemented by manufacturers in the industry by 2009. EX1012; EX1013; EX1014; EX1015. For example, revision 1.0 of the "Universal Serial Bus 3.0 Specification" (hereinafter "USB 3.0") discloses standardized specifications for USB 3.0 devices, including Micro-USB devices and USB 3.0 devices that are backwards compatible with USB 2.0 devices, and was published on November 12, 2008. EX1015. The USB 3.0 teaches various structural and electrical configurations for small-sized sockets. I have reviewed the various USB specifications, including the USB 3.0, and have implemented their teachings in my work and research. A few categories of teachings from USB 3.0 are discussed further below.

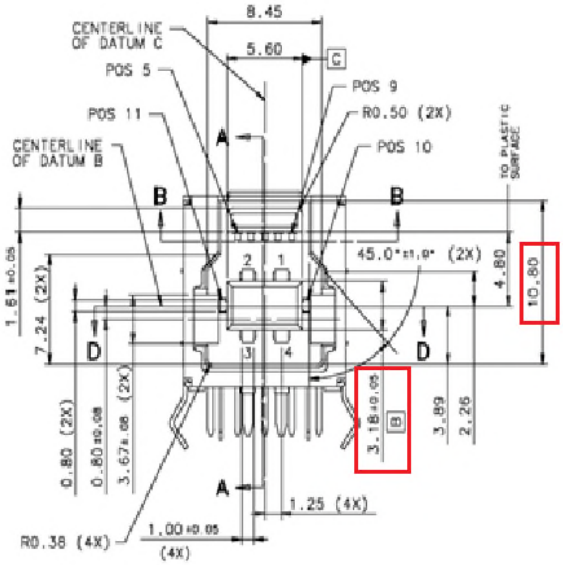
114. ***Thickness:*** USB 3.0 discloses known options for tongue dimensions within connection slots in USB sockets. For example, USB 3.0 teaches that a micro-USB receptacle has a tongue thickness of 0.6mm and an overall connection slot

Samsung, EX1003, p. 69

height of 1.85 mm. EX1015, 96. As another example, USB 3.0 also teaches that a B-type receptacle has a tongue thickness of 3.18mm and an overall connection slot height of 10.80 mm. EX1015, 91.



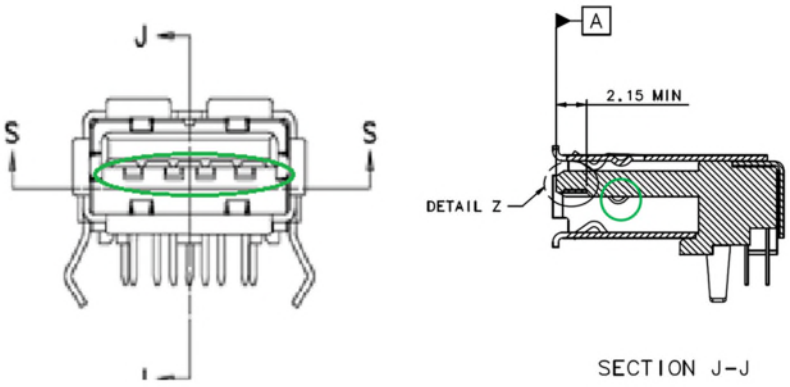
EX1015, 96.



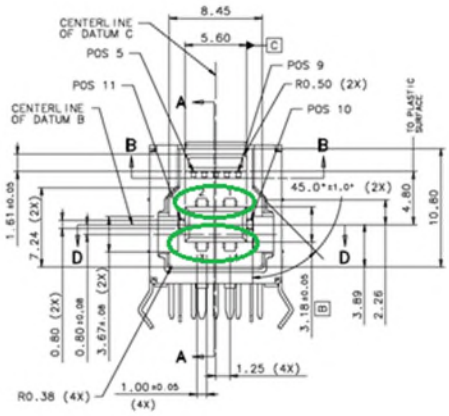
EX1015, 91.

115. ***Projecting Contacts:*** USB 3.0 discloses known options for configuring contacts disposed on the tongue of USB sockets, including teaching that contacts may project above the surface of the socket tongue to increase compression force

and ensure a stronger electrical connection with the mating plug contacts. For example, USB 3.0 teaches that contacts in USB sockets should project slightly above the surface of the socket tongue. EX1015, 77, 91.



EX1015, 77.

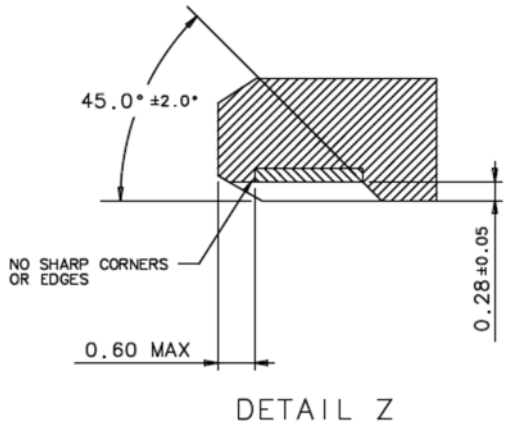


EX1015, 91.

116. ***Castellated Surfaces:*** USB3.0 discloses Micro-USB with castellated tongue surfaces, providing a POSITA reasonable expectation of success using such surfaces. EX1015, 96. Such surfaces would have been a predictable design choice

among a finite set of options available to a POSITA, with the benefit of enhancing connection interfaces.

117. ***Chamfered/tapered tongue:*** USB 3.0 discloses known options for the shape of the tongue in USB sockets, specifically the shape of the tip of the tongue for better guidance into a mating plug. For example, USB 3.0 teaches that the A-type connector has a tongue that is chamfered and tapered toward its tip. EX1015, 77.



EX1015, 77.

X. INVALIDITY

118. Based on my review and analysis of the materials cited herein, my opinions regarding the understanding of a POSITA by April 15, 2009, and my training and experience, it is my opinion that the Challenged Claims are obvious in

view of the prior art. The reasons for my conclusions are explained more fully below. For the purposes of my analysis, I have assumed that the references in each Ground are prior art to the '307 patent.

A. Ground 1: Andre Renders Obvious Claims 34-39, 41-65, 67-75, 78-86, 88-96, 98-106, 114-120, 130-135, Under Patent Owner's Interpretation of the "Simultaneously" Terms and "Duplex Electrical Connection"

119. It is my opinion that certain of the Challenged Claims, specifically those that do not specify a USB interface, are rendered obvious in view of Andre alone. Andre describes a connector that renders obvious all limitations in the Challenged Claims in this Ground—including the allegedly novel "simultaneously" limitations, under Patent Owner's interpretation. §VII.A.

i. Independent Claim 34 Is Rendered Obvious by Andre

120. In my opinion, Claim 34 is rendered obvious by Andre under Patent Owner's claim interpretations of the "simultaneously" terms and "duplex electrical connection," and under either Patent Owner's or Petitioner's claim interpretations of "functional reverse mirror"/"reverse mirror" (§VII), as explained below.

34[pre]. A socket structure with duplex electrical connection, the socket structure comprising:

121. To the extent that the preamble is limiting, Andre's receptacle 202 is "[a] socket structure with a duplex electrical connection," under Patent Owner's interpretation of the phrase "duplex electrical connection." *See* §VII.B.

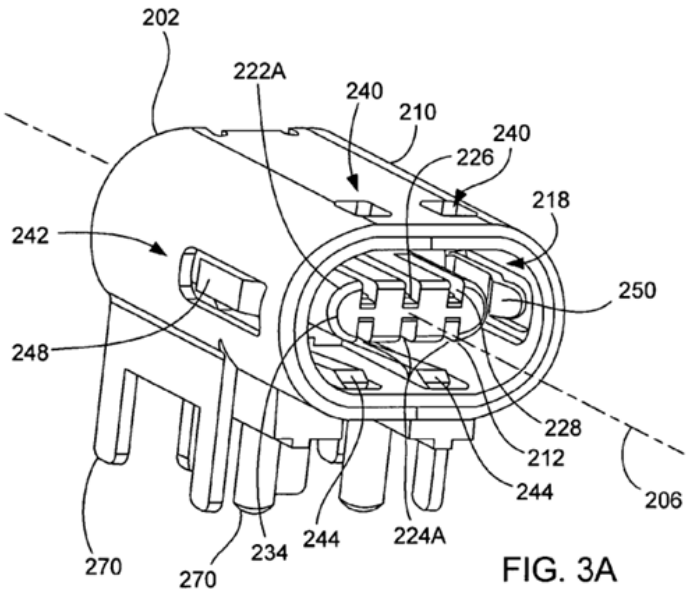


FIG. 3A

EX1005, Fig 3A.

122. First, receptacle 202 (above) is a reversible "socket structure" that receives a plug 204. For example, Andre discloses that "DC plug 204" "can be inserted and extracted into a DC ***respectable*** [*sic*] 202 . . . . In particular, the ***DC receptacle*** and plug are configured to provide 0/180 degree insertion . . . when coupling and decoupling the plug to and from the receptacle . . . ." EX1005, 7:55-63, Fig. 3A, 4A.

123. Second, as I described above, I understand that Patent Owner appears to interpret "duplex electrical connection" to cover a socket that receives a single plug. *See* §VII.B. Andre satisfies this interpretation. As shown below, receptacle 202 in Andre has an electrode 212 with "a plurality of exposed contacts 224A . . . disposed on [an] insulating member 222A" of the electrode 212. EX1005, 8:63-66. These contacts 224A are "laid out in a linear array" on "upper and lower contact

pads 226 that are separated by the insulating member 222A." EX1005, 9:5-6, 9:45-47, Figs. 3A and 4A (reproduced below). Contacts 224A on both the upper and lower surfaces of the electrode 212 allows the electrode 212 to be "configured for mating engagement so as to provide . . . [an] ***electrical connection***" on both sides of the receptacle 202. EX1005, 8:20-23.

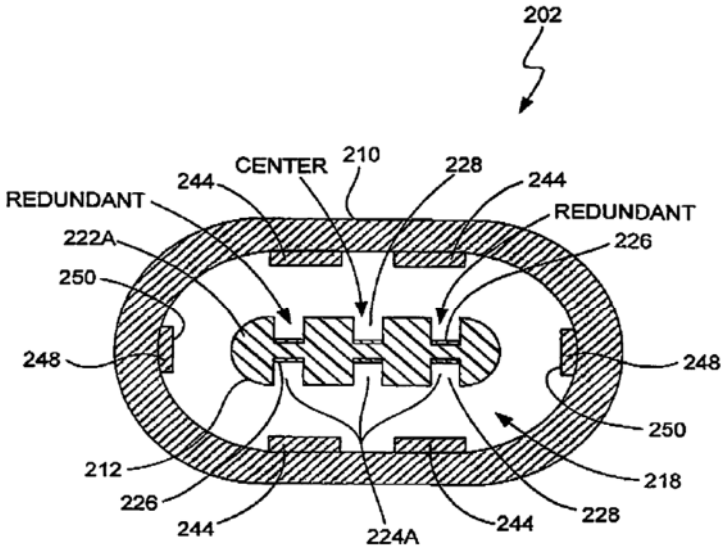


FIG. 4A

EX1005, Fig. 4A (receptacle).

34[a]. a plastic base;

124. Andre satisfies this limitation. Andre's receptacle 202 (shown in a side cross-sectional view, below on left) has a rear portion of the insulating member 222A (*plastic base*).

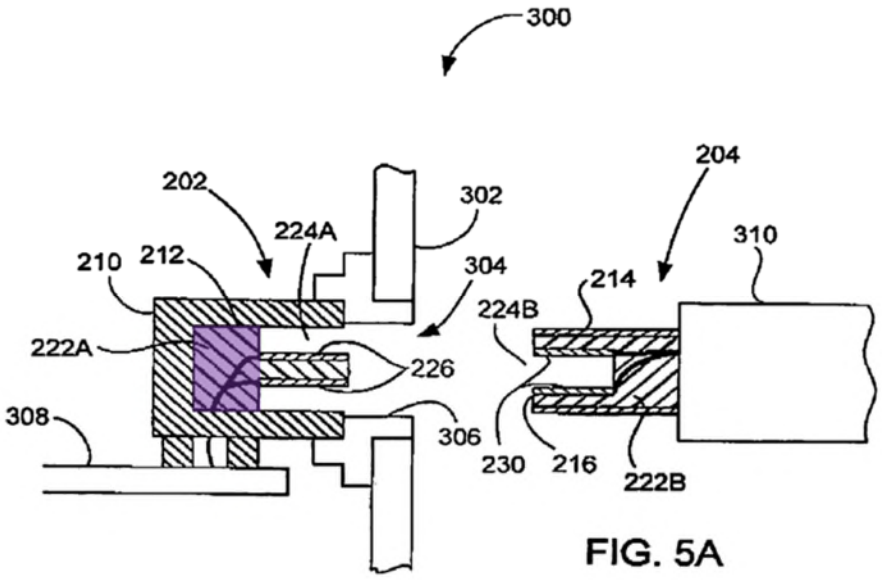


FIG. 5A

EX1005, Fig. 5A.

125. As Andre describes, the receptacle 202 "include[s] an ***insulating member 222A*** . . . ," EX1005, 8:63-66, that "may be molded from various dielectric materials including ***plastics*** such as ABS and/or nylon," and "[i]n some cases, the plastics may be glass filled to increase the durability and robustness of the insulating member." EX1005, 13:32-36. As shown in Figure 5A (above), which discloses a cross-sectional side view of receptacle 202, the insulating member 222A is "press fit into the outer conductive shell[]" such that it forms a base at a rear end of the receptacle 202. EX1005, 13:40-42. Thus, the rear portion of the insulating member 222A disclosed in Andre is a "plastic base."

34[b].	**a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;**

126. Andre satisfies this limitation. Receptacle 202's opening 304 (shown in a side cross-sectional view of receptacle 202, below left) and gap 218 (shown in a front cross-sectional view of receptacle 202, below right) form a *connection slot* in front of the rear portion of the insulating member 222A (*plastic base*) that is configured to be connected to Andre's plug 204, which has multiple rows of connection terminals.

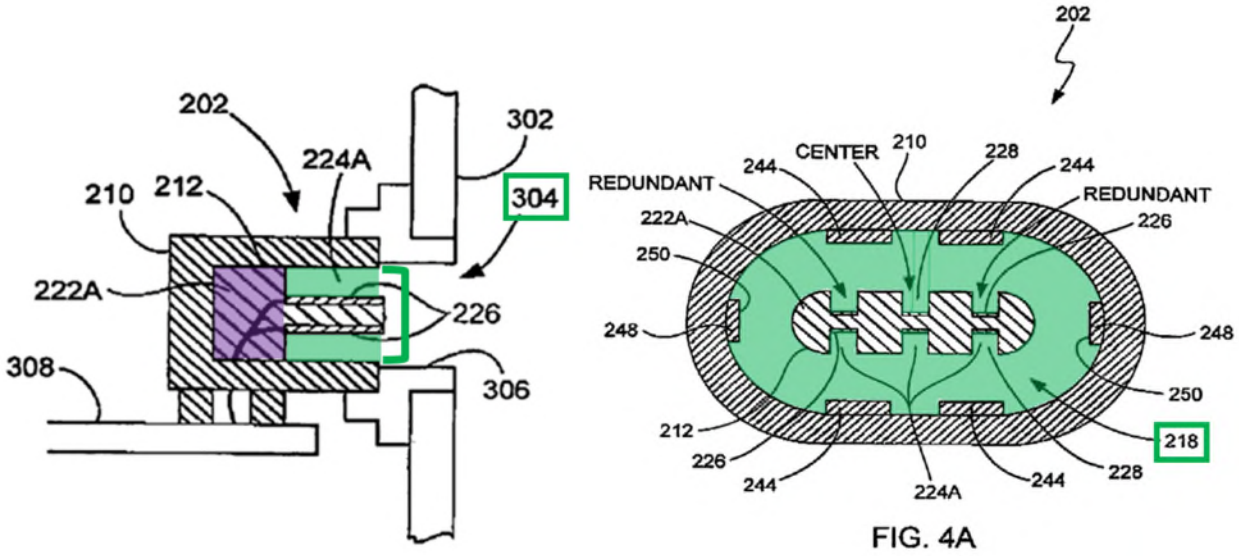


FIG. 4A

EX1005, Figs. 5A (excerpt of receptacle), 4A (receptacle) (both annotated).

127. Specifically, Andre describes both opening 304 and gap 218 as allowing insertion of plug 204 into receptacle 202. For example, Andre discloses that "[t]he DC receptacle 202 is enclosed within a device housing 302. The device housing 302 includes ***an opening 304*** and a support member 306 for supporting the

receptacle 202 next to the opening 304. The ***opening 304 allows access for insertion of the plug 204*** into the receptacle 202." EX1005, 12:48-53, Fig. 5A. In addition to opening 304, Andre further discloses that "[i]n the DC receptacle 202, there is a ***gap 218*** between the outer conductive shell 206 [*sic*][8] and at least the front portion of the inner electrode 212. That is, the front portion of the inner electrode 212 is spaced apart from the outer conductive shell 210. ***The gap 218 is configured to receive the outer conductive shell 214 and electrode 216 of the DC plug 204***." EX1005, 8:52-58, Fig. 5A; *see also id.* at Fig. 3A.

128. Andre also discloses that opening 304 and gap 218 are "disposed in front of the plastic base," as claimed. As I described for limitation 34[a], *see* §X.A.i (34[a]), the rear portion of the insulating member 222A (*plastic base*) is positioned at the rear end of receptacle 202, and, as shown in Fig. 5A above, the gap 218 and opening 304 are positioned in front of the rear portion of the insulating element 222A. Andre specifically describes the gap 218 as being at "the ***front portion*** of the inner electrode 212," which "include[s] [the] insulating member 222A." EX1005, 8:52-56, 8:63-66, Fig. 5A.

[8] The outer conductive shell for Andre's receptacle 202 should be element 210, not 206.

129. Finally, Andre also discloses that the plug 204 configured to be inserted into the receptacle 202 "ha[s] at least one row of connection terminals." The plug specifically has a center opening 220 with two rows of electrical terminal elements 224B, one on the top of the opening 220 of the plug and one on the bottom of the opening 220 of the plug, as shown below in the side cross-sectional view in Fig. 5A and in the front cross-sectional view in Fig. 4B.

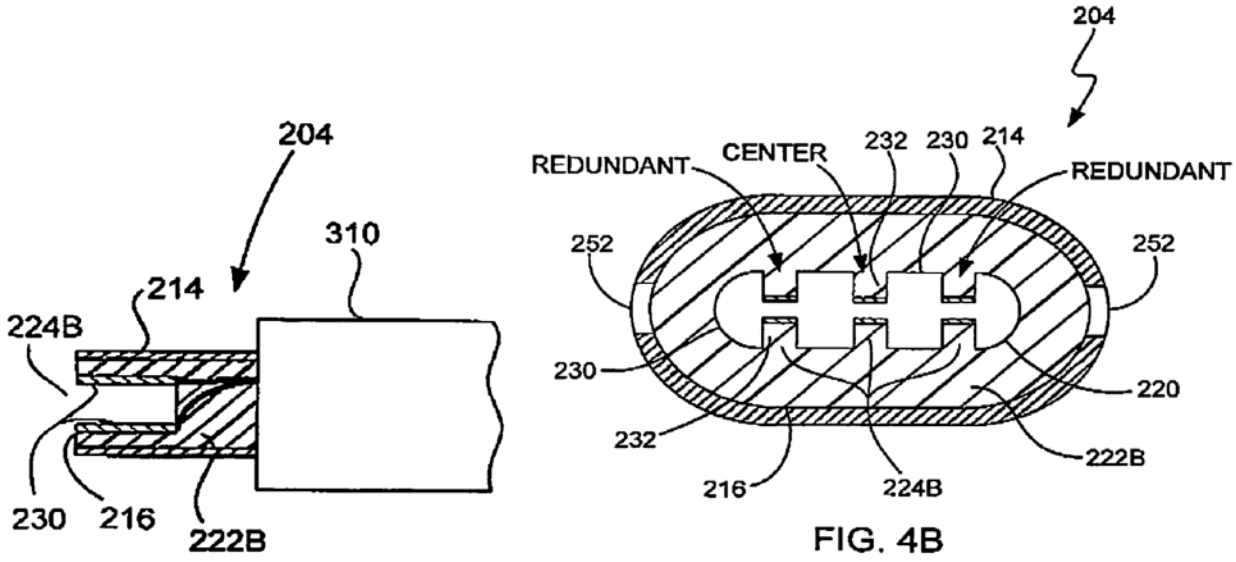


FIG. 4B

EX1005, Figs. 5A (excerpt of plug), 4B (plug). For example, Andre explains that "the DC plug 204 . . . include[s] . . . ***a plurality of exposed contacts . . . 224B*** disposed on the insulating member . . . 222B," and "each contact 224B includes both upper and lower contact pads 230 that are spaced apart from one another (via the opening 220)." EX1005, 8:63-66, 9:57-61, Figs. 4B and 5A. Thus, Andre's plug 204 has at least two rows of connection terminals—upper contact pad 230 having one

row of contacts 224B, and lower contact pad 230 having another row of contacts 224B.

34[c].	**a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,**

130. Andre discloses this limitation. As shown in Figs. 4A and 5A below, Andre's front portion of the insulating member 222A (*tongue*) that contains inner electrode 212 has an upper surface (*first surface*) disposed opposite a lower surface (*second surface*) with *grooves* 228 in each surface.

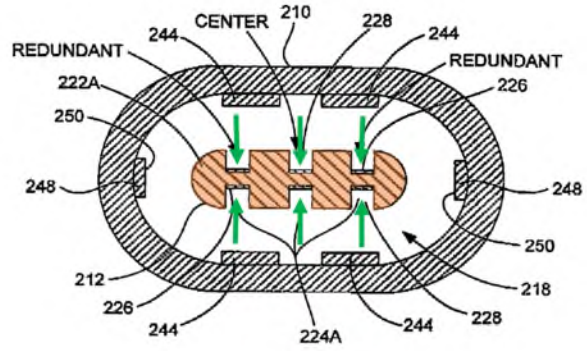


FIG. 4A

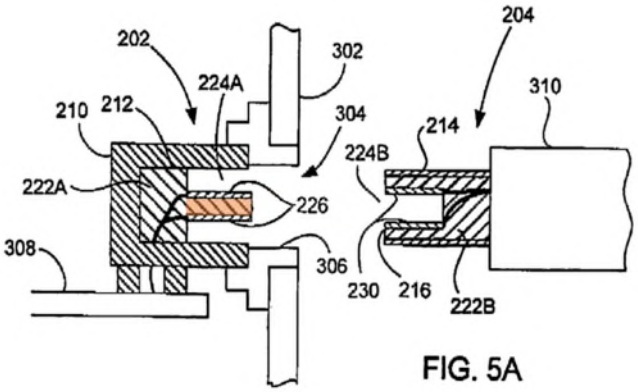


FIG. 5A

EX1005, Figs. 4A, 5A.

131. First, the front portion of the insulating member 222A of the socket in Fig. 4A is a tongue because it is a structural element in the socket that provides both structural and electrical connections to a plug. For example, as shown in Figs. 4A and 5A above, the front portion of the insulating member 222A containing the inner electrode 212 is located at the center of the receptacle 202 and is "dimensioned for sliding receipt" of the plug 204. EX1005, 8:35-36, 8:54-58. Together with the outer

electrode, the inner electrode "provide[s] both a mechanical and electrical connection" to the plug and is "easily engaged" with the plug when slid into the plug opening. EX1005, 8:21-24, 10:20-27.

132. Second, the front portion of the insulating member 222A containing the inner electrode 212 has "a first surface with grooves, and a second surface with grooves." Specifically, front portion of the insulating member 222A has a top surface (*first surface*) and a bottom surface (*second surface*). Each surface includes contacts, wherein "each contact 224A includes both upper and lower contact pads 226 that are separated by the insulating member 222A," and "[t]he contact pads 226A are substantially planar and ***positioned within upper and lower grooves or channels 228*** in the insulating member 222A." EX1005, 9:45-49, Fig. 4A; *see also id.*, 12:37-41 ("The contacts 224A are formed by upper and lower contact pads 226 ***positioned in grooves 228 of the insulating member 222A***."). Upper grooves 228 containing the upper contact pads 226 are located on the top surface (*first surface*) of the front portion of the insulating member 222A whereas the lower grooves 228 containing the lower contact pads 226 are located on the bottom surface (*second surface*) of the front portion of the insulating member 222A. Thus, this claim limitation is satisfied.

34[d].	**the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;**

133. Andre discloses this limitation. Andre's front portion of the insulating member 222A (*tongue*) is disposed at one end of the rear portion of the insulating member 222A (*plastic base*) within gap 218 and opening 304 (*connection slot*), such that the chambers of the gap 218 and opening 304 on either side of the inner electrode 212 portion of the insulating member 222A allow Andre's plug to be normally and oppositely inserted in the receptacle.

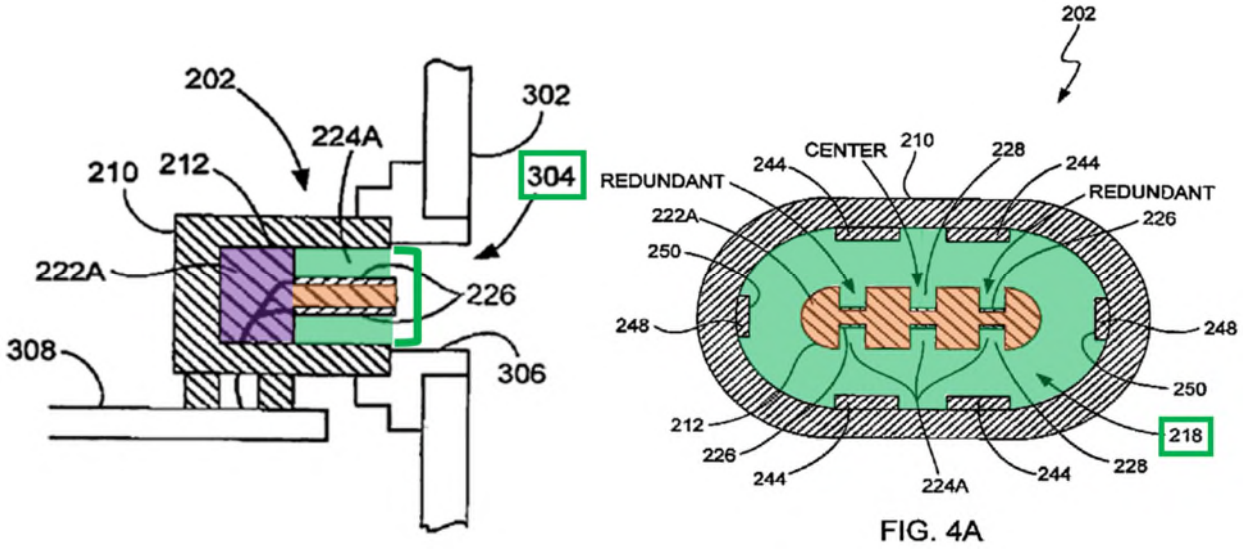


FIG. 4A

EX1005, Figs. 5A (excerpt of receptacle), 4A (receptacle) (both annotated).

134. First, Andre discloses the claimed tongue location. As explained for limitations 34[a]-34[b], the "tongue" is the front portion of the insulating member 222A, the "plastic base" is the rear portion of the insulating member 222A, and the "connection slot" comprises gap 218 and opening 304. *See* §X.A.i (34[a]-34[b]).

Figure 5A of Andre discloses that the front portion of the insulating member 222A (*tongue*) containing the inner electrode 212 (a) is disposed on one end of the rear portion of the insulating member 222A, as it is connected to and extends from the rear portion of the insulating member 222A, and (b) is positioned in the middle of the connection slot comprising gap 218 and opening 304. EX1005, 8:54-56, 8:63-66, 6:39-44, 8:6-11.

135. Second, Andre also discloses that "chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot." In Andre, the plug and receptacle (and the "connection slot" (gap 218 and opening 304) in the receptacle that receives the plug) are completely "symmetrical." *See* EX1005, 8:6-8 ("The DC plug 204 and DC receptacle 202 are configured to be 0/180 symmetrical…"), 6:41-44 ("That is, the elements are symmetrical on opposites sides of the major and minor axes, as for example, rectangles, ovals (ellipses) and the like."), 8:56-59, Fig. 5A (showing symmetry). The symmetry of the receptacle, including its chambers, allows the plug to be inserted into the receptacle 202 in "***one of two ways: at 0*** [normally inserted] ***and 180 degrees*** [oppositely inserted]"—as illustrated in Figs. 2B-2C below. EX1005, 8:6-11; 6:40-41 ("0/180 degree insertion is also accomplished with receiving and insertion elements having cross sectional shapes that are 0/180 symmetrical.").

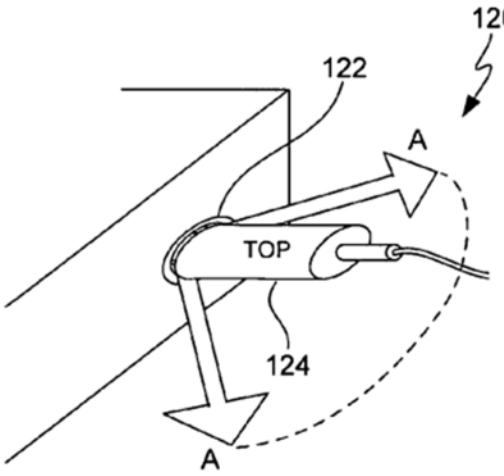


FIG. 2B

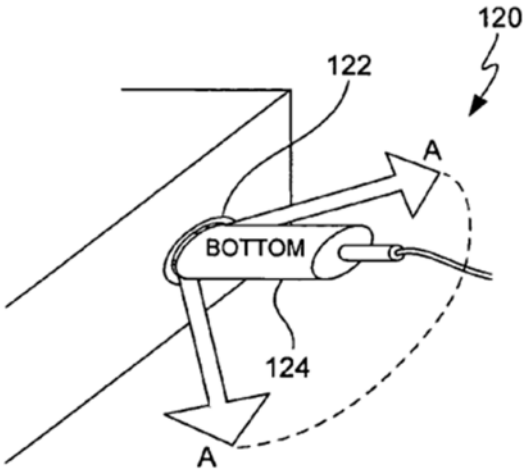


FIG. 2C

EX1005, Figs. 2B-2C.

34[e].	**at least one row of first contacts separately arranged on the first surface of the tongue, wherein**

136. Andre discloses this limitation. Each of the upper contact pads 226 (*row of first contacts*) is separately arranged from each other on the top surface (*first surface*) of the front portion of the insulating member 222A (*tongue*).

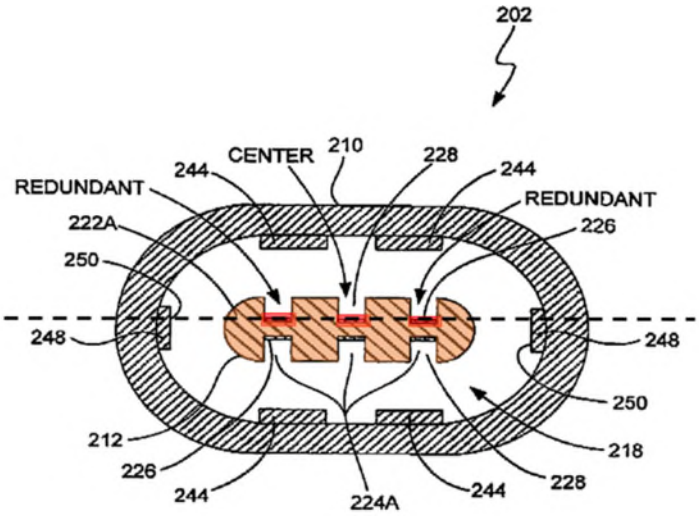


FIG. 4A

EX1005, Fig. 4A.

137. The upper contact pads 226 are within contact areas 224A. EX1005, 9:45-47. As shown in Fig. 4A, the contact areas with the upper contact pads 226 are "spaced apart" in a "linear array" within "substantially the same plane" on the top surface of the front portion of the insulating member 222A (plane annotated in dotted line above). For example, Andre discloses that the exposed contacts 224A on the front portion of the insulating member 222A (*tongue*) containing inner electrode 212 "extend longitudinally in parallel with [its] centerline[] 26 [*sic*][9]" and "are also laid out in a linear array." EX1005, 9:3-8. "That is, the contacts 224 are spaced apart and positioned laterally relative to one another within substantially the same plane (e.g., juxtaposed)." EX1005, 9:3-8. And the associated ***contact pads 226A*** in each contact area "***are substantially planar*** and ***positioned within upper*** and lower ***grooves or channels 228*** in the insulating member 222A." EX1005, 9:45-49, Fig. 4A.

34[f].	**each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and**

138. Andre discloses this limitation. Each upper contact pad 226 (*each of the first contacts*) is connected to a respective first wire extending out of the rear portion

[9] The centerline of Andre's receptacle 202 should be element 206, not 26.

of the insulating member 222A (*first pin extending out of the plastic base*), as shown below.

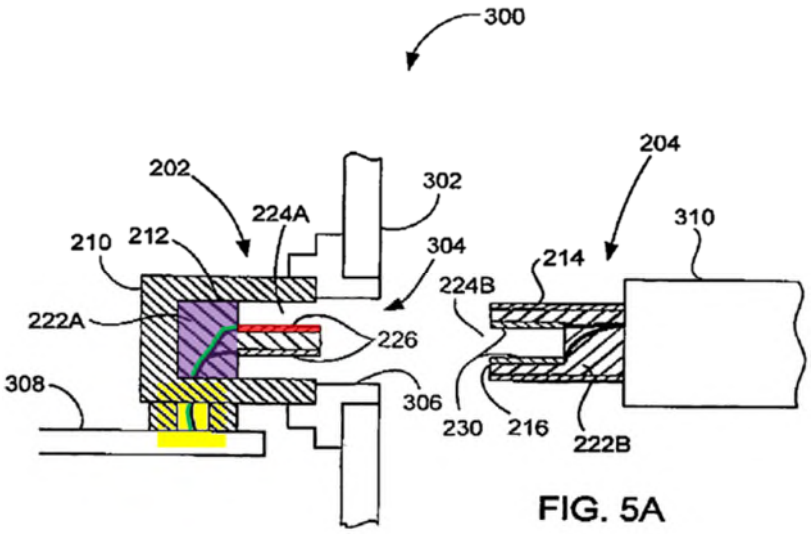


FIG. 5A

EX1005, Fig. 5A.

139. For example, Andre explains that "[e]ach set of contact pads (upper/lower) is connected to a separate terminal or post, each of which is capable of being electrically connected to a PCB." EX1005, 9:53-56. Each separate post may "include ***a wire*** embedded therein for connecting the contact pads to the PCB." EX1005, 12:27-29. Andre therefore discloses that each of the upper contact pads 226 within each contact area 224A connects to its own terminal or post including a wire for connecting to the PCB and satisfies the limitation that "each of the first contacts is electrically connected to a respective first pin." Moreover, each pin extends out of the plastic base. Andre shows that the first wire (*first pin*) extends from an upper

contact pad 226 on the top surface of the tongue through the rear portion of the insulating member 222A (*plastic base*) to a PCB 308. EX1005, Fig. 5A.

140. Andre's wires are "pins" because they serve as external leads that extend out of the rear portion of the insulating member 222A (*plastic base*). For example, Andre explicitly discloses that its "wires" may be "embedded" within posts 270 that "serve as structural members as well as a means for providing electrical connection to the internal components positioned in the housing." EX1005, 12:22-25. These posts 270 containing embedded wires (*pins*) "may be integral with . . . the inner electrode 212" such that they are "a portion of the insulating member 222A" and "protrude through an opening in the outer conductive shell 210" to "connect[] the contact pads to the [external] PCB." EX1005, 12:19-22, 12:26-29, Fig. 3A (showing posts 270, which can include the wires, extending outside the receptacle 202).

141. Andre's connector, for example, uses the posts with wires extending from the insulating body and shell to make electrical connection pathways between the contact pads (within the connector) and the circuit traces or planes on the PCB. Andre describes that each contact in the receptacle's insulating member includes "both upper and lower contact pads 226 that are separated by the insulating member 222A. […] The upper contact pad is connected to the lower contact pad. This may be done proximally, distally or somewhere in between. Each set of contact pads

(upper/lower) is connected to a separate terminal or post, each of which is capable of being electrically connected to a PCB." EX1005, 9:45-55. And Andre notes that the "posts 270 may be integral with the outer conductive shell 210 and/or the inner electrode 212," and that these posts "serve as structural members as well as a means for providing electrical connection to the internal components positioned in the housing as for example a printed circuit board (PCB)." EX1005, 12:19-29. In addition, Andre's claim 14 states that "the contacts of the DC receptacle are coupled to a PCB via wires embedded in the insulating member, and the outer conductor of the DC receptacle is coupled to the PCB via legs or posts that extend out the bottom of the outer conductive shell." EX1005, 16:7-12.

34[g].	**at least one row of second contacts separately arranged on the second surface of the tongue, wherein:**

142. Andre discloses this limitation. Andre's lower contact pads 226 (*row of second contacts*) are separately arranged on the bottom surface (*second surface*) of the front portion of the insulating member 222A (*tongue*).

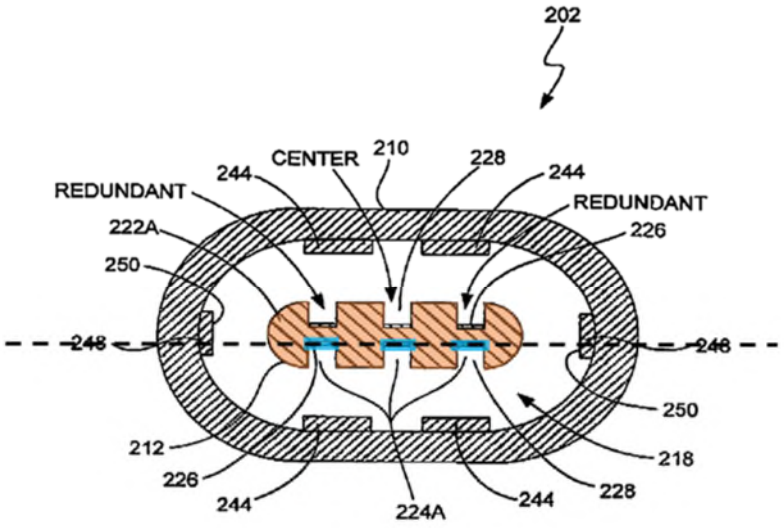


FIG. 4A

EX1005, Fig. 4A.

143. The lower contact pads 226 are within contact areas 224A. EX1005, 9:45-47. As shown in Fig. 4A, the contact areas with the lower contact pads 226 are "spaced apart" in a "linear array" within "substantially the same plane" on the bottom surface of the front portion of the insulating member 222A (plane annotated in dotted line above). For example, Andre discloses that the exposed contacts 224A on the front portion of the insulating member 222A (*tongue*) containing inner electrode 212 "extend longitudinally in parallel with [its] centerline[] 26 [*sic*][10]" and "are also laid out in a linear array." EX1005, 9:3-8. "That is, the contacts 224 are spaced apart and positioned laterally relative to one another within substantially the

[10] The centerline of Andre's receptacle 202 should be element 206, not 26.

same plane (e.g., juxtaposed)." EX1005, 9:3-8. And the associated ***contact pads 226A*** in each contact area "***are substantially planar*** and ***positioned within*** upper and ***lower grooves or channels 228*** in the insulating member 222A." EX1005, 9:45-49, Fig. 4A.

34[h].	**each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;**

144. Andre renders obvious this limitation. It would have been obvious that each lower contact pad 226 (*each of the second contacts*) is connected to a respective a second wire (*second pin*) extending out of the rear portion of the insulating member 222A (*plastic base*).

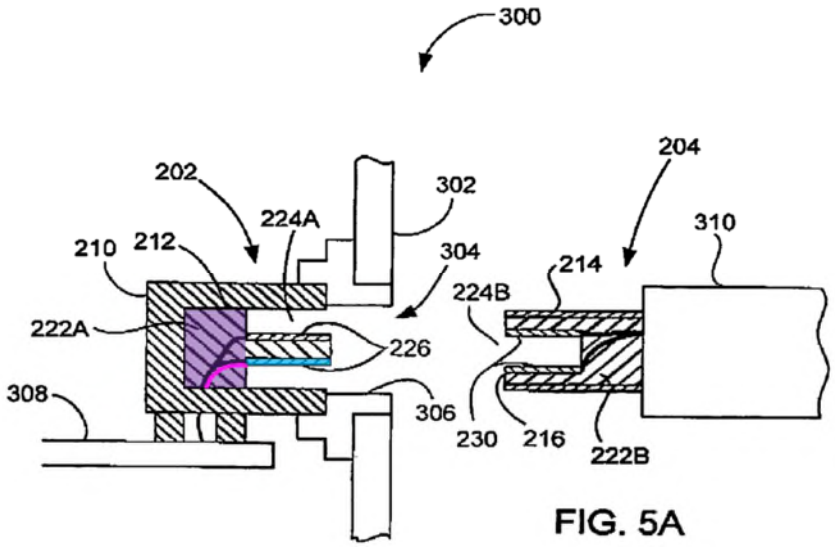


FIG. 5A

EX1005, Fig. 5A.

145. Together with limitation 34[f], this limitation requires that each of the lower contact pads 226 is connected to a "second pin" extending out of the plastic base, while each of the upper contact pads is connected to a "first pin" extending out

of the plastic base. The embodiment of Figure 5A (above) shows separate wires (*pins*) extending from the upper contact pads and lower contact pads but does not expressly disclose whether both wires separately extend out of the plastic base. EX1005, 9:53-56, 12:27-29. But as shown in modified Figure 5A (annotated below), it would have been obvious to a POSITA to implement Andre's embodiment to have two wires separately extending through the rear portion of the insulating member 222A, such that the *first pin* and *second pin* separately extend, *e.g.*, via separate posts, EX1005, 12:17-29, through a plastic base (as claimed) until connected together on the printed circuit board 308.

146. It would have been obvious to a POSITA modify Andre's embodiment to have two separate wires separately extend through the rear portion of the insulating member 222A, such that there would be two *pins* extending through a plastic base—one pin for the upper contact and one pin for the lower contact—as claimed. In this implementation, shown in modified Fig. 5A below, the wires could still connect together, but now on the printed circuit board 308 outside of the plastic base. A POSITA would have been motivated to change Andre in this way. Connecting the wires outside of the receptacle, rather than inside the receptacle as in original Figure 5A, would have added redundancy and reliability to Andre. For example, if two wires extend out of the plastic base for each upper and lower contact in a pair of redundant power contacts, then even if one wire failed, power would still

be provided to the socket. However, if only one wire extended out of the plastic base for both contacts, then if that wire failed, neither contact would receive power.

147. A POSITA would also have had a reasonable expectation of success in making this change, as it would simply involve moving the connection between two wires, and Andre already contemplates that the upper and lower contact pads could be connected in multiple locations ("proximally, distally or somewhere in between"). EX1005, 9:51-53. A POSITA would also have a reasonable expectation of success in passing two wires through the rear portion of the insulating member 222A instead of one wire. Andre already teaches that receptacle 202 can accommodate any number of additional contact pairs, *see* EX1005, 9:15-19, each of which would have at least one associated wire needing to pass through the rear portion of the insulating member 222A, even if each pair is connected together within the receptacle.

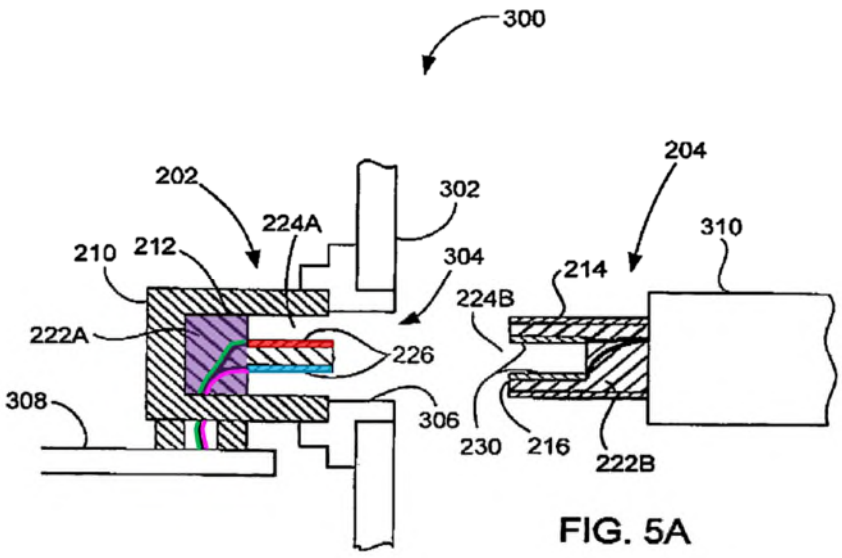


FIG. 5A

EX1005, Fig. 5A (modified).

148. Andre's disclosure does not limit the design to one conductive pin per pair extending out of the socket. Rather, it provides flexibility depending on how the pads are interconnected—if joined "proximally," the connection would occur near the rear of the insulator and feed a single terminal, but if connected "distally or somewhere in between," separate routing to two posts could be implemented.

34[i].	**the socket structure is operative to simultaneously electrically connect via the first and second contacts;**

149. Andre discloses this limitation, under Patent Owner's interpretation of the "simultaneously" terms. *See* §VII.A. The upper contact pads 226 (*first contacts*) and the lower contact pads 226 (*second contacts*) both electrically connect at the same time to different rows of contact pads 230 of Andre's plug 204.

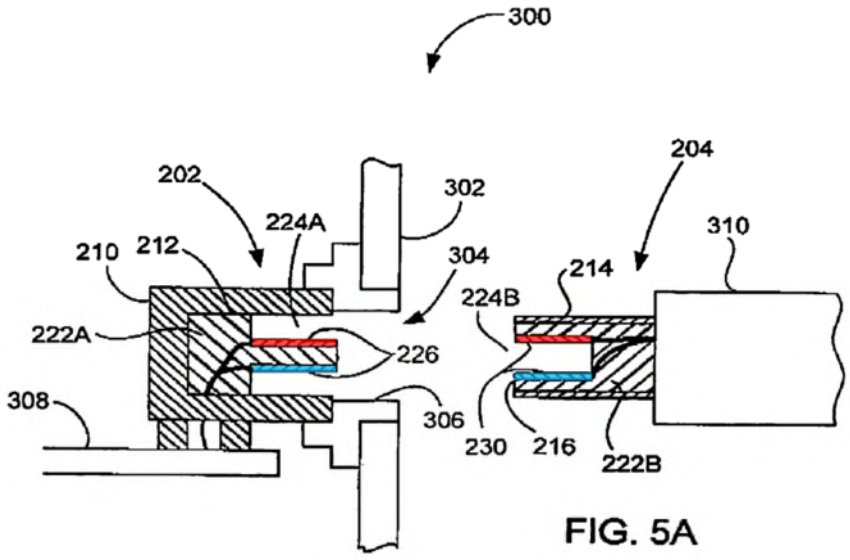


FIG. 5A

EX1005, Fig. 5A.

150. Specifically, Andre expressly discloses that "when the plug 204 is inserted into the receptacle 202," "the inner electrodes 212 [receptacle, left-hand side] and 216 [plug, right-hand side] mate thus ***ensuring electrical connection between the corresponding contacts 224A and B***, i.e., ***the upper contact pads contact each other and the lower contact pads contact each other***." EX1005, 12:64-13:3. When mated, "the rails 232 of the inner electrode 216 mate with the grooves 228 of the inner electrode 212 thus causing the ***upper*** and ***lower contact pads 230*** of the DC plug 204 to ***electrically engage the upper and lower contact pads 226 of the DC receptacle 202***." EX1005, 10:11-16, Figs. 4A-4B.

34[j].	**the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:**

151. Andre discloses this limitation under either Petitioner's or Patent Owner's interpretation of "functional reverse mirror." *See* §VII.C. The upper contact pads 226 (*first contacts*) have a functional reverse mirror configuration relative to lower contact pads 226 (*second contacts*): both sets of contacts are linearly arranged as "POWER," "DATA," "POWER," such that the reverse of the upper contact sequence is the same as the lower contact sequence. This configuration allows Andre's receptacle to receive a plug at 0 degrees or 180 degrees (*two separate operational states*).

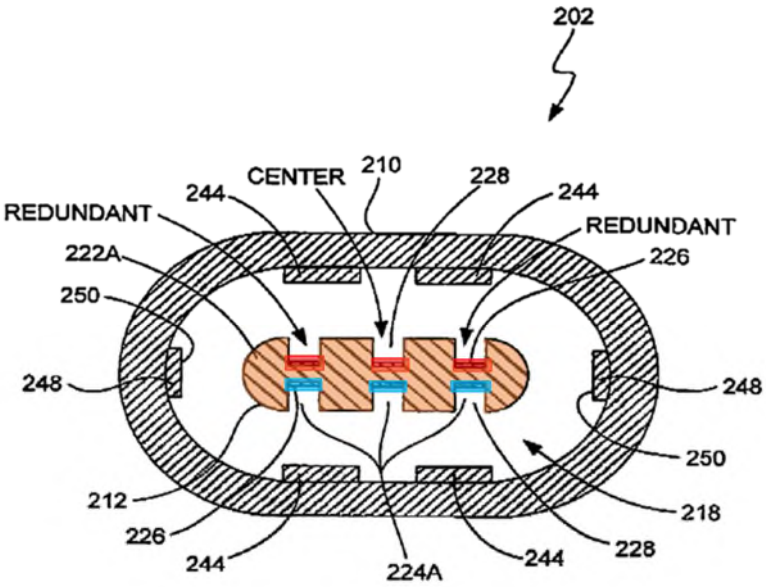


FIG. 4A

EX1005, Fig. 4A.

152. Andre discloses a functional reverse mirror configuration for the upper and lower receptacle contacts. As Andre explains, reversible insertion of the plug requires symmetry in the upper and lower contact regions: "the receiving and insertion element may include a linear array of contacts ***that have the same pin layout on both sides of the center line***." EX1005, 6:33-35. The elements on the inner electrode 212 portion of the insulating member 22A (*tongue*) are thus "symmetrical on opposite sides of the major and minor axes…" EX1005, 6:41-43.

153. As an example, in the specific embodiment in Fig. 4A, each row of contact pads 226 includes "[a]t least a center contact" configured for data transmissions and "[a]t least a pair of redundant contacts" configured for power transmission and "disposed an equal distance from the centerline 206 . . . on

opposing sides of the centerline 206 . . . .” EX1005, 9:5-25. Further, “[t]he upper contact pad is connected to the lower contact pad” (EX1005, 9:51-52), so both sets of contacts (upper and lower) are linearly arranged as “POWER,” “DATA,” “POWER.” In this embodiment, the upper and the lower contact pads are thus the reverse and the mirror of each other and are completely symmetric in the horizontal and vertical directions.

154. Andre also explains that functional reverse mirror symmetry accomplishes the reversible design of its receptacle and plug in which the receptacle can receive the plug in *two operational states:* “the insertion element is configured for 0/180 degree insertion into the receiving element while providing the same functionality from both positions.” EX1005, 6:17-19; *see also id.*, 6:20-45. Using the functional reverse mirror design, Andre’s plug “may be inserted face up as shown in FIG. 2B” (*first operational state*) “or face down as shown in FIG. 2C” (*second operational state*) “while still providing the same functionality (still providing the correct contact for power and/or data transfer).” EX1005, 6:19-23; *see also id.*, 8:6-11, (explaining that the receptacle 202 is configured to receive the plug 204 in “***one of two ways: at 0 and 180 degrees*** (or some increment thereof, i.e., 180 apart as for example 5 and 185, 90 and 270, etc.)”).

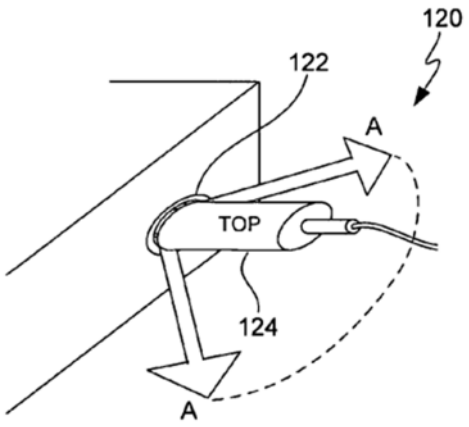


FIG. 2B

EX1005, Fig. 2B.

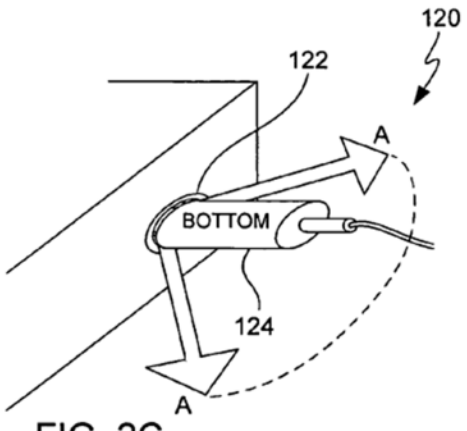


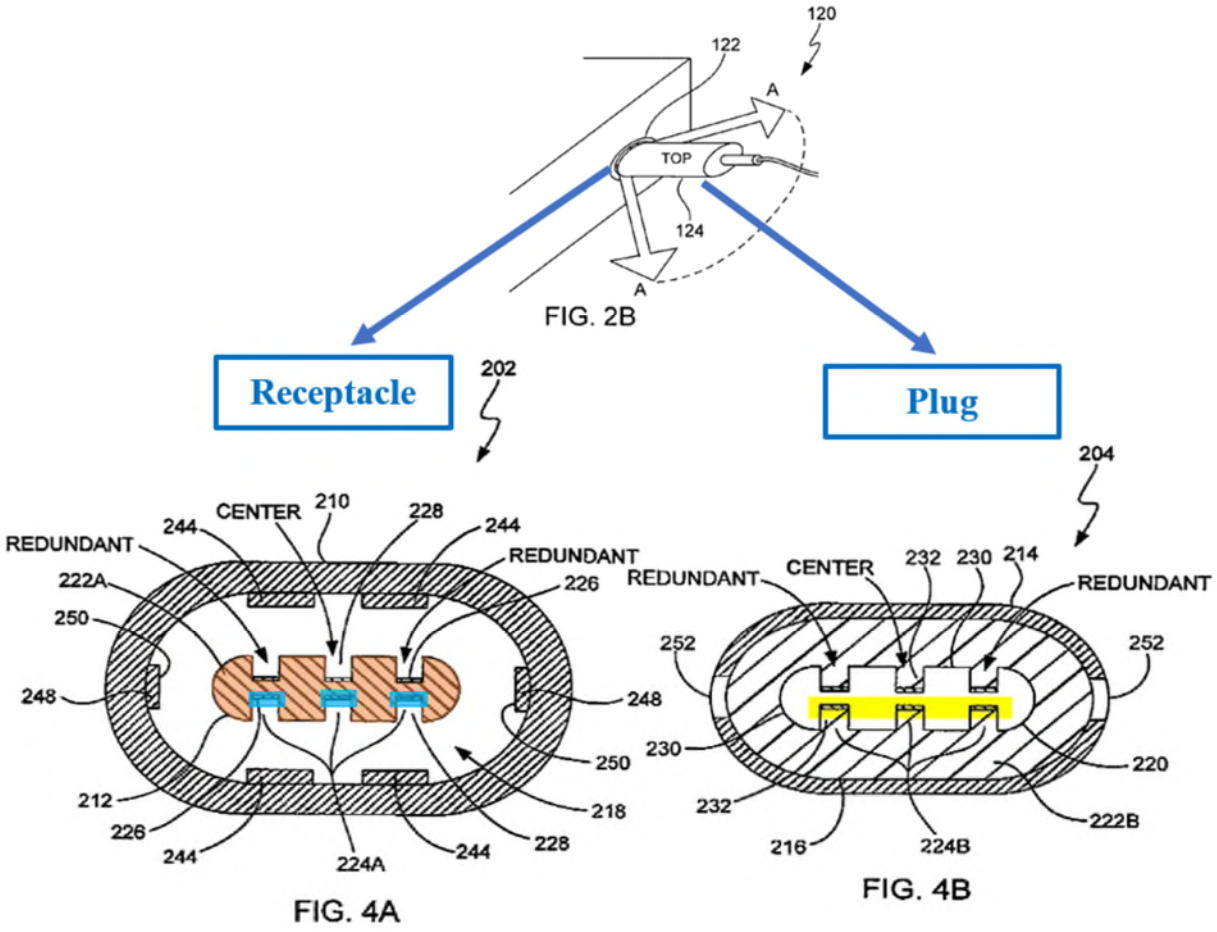
FIG. 2C

EX1005, Fig. 2C.

34[k].	**a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and**

155. Andre discloses this limitation. In Andre, the plug can be inserted face-up at 0 degrees (*first operational state when the plug is normally inserted*) such that one row of the plug's terminals (*at least one row of connection terminals of the plug*)

faces the lower surface (*second surface*) of the front portion of the insulating member 222A (*tongue*) and electrically connects to the row of lower contact pads 226 (*one row of second contacts*) in the receptacle.



EX1005, Figs. 2B, 4A-4B.

156. Andre specifically discloses that its "DC plug 204 and DC receptacle 202 are configured to be 0/180 symmetrical such that the ***DC plug 204 can be inserted into the DC plug*** [*sic*] ***202 one of two ways***: at ***0 and 180 degrees*** (or some increment thereof, i.e., 180 apart as for example 5 and 185, 90 and 270, etc.)." EX1005, 8:6-11. Figure 2B of Andre illustrates when the plug is inserted into the

receptacle at 0-degrees—or "inserted face up" (EX1005, 6:19-23)—the *first operational state when the plug is normally inserted*.

157. Andre also discloses that when normally inserted, the lower contact pads of the plug (*one row of connection terminals*) faces the lower surface of the front portion of the insulating member 222A (*second surface of the tongue*) containing inner electrode 212 and electrically connects with lower contact pads 226 (*second row of contacts*). As explained above for limitation 34[i], Andre discloses that when mated, the inner electrode 216 of the plug 204 is inserted into the inner electrode 212 of the receptacle 202 such that ***both*** rows of contact pads 230 of the plug 204 electrically engage with ***both*** rows of contact pads 226 of the receptacle 202, including specifically the lower row of contact pads on the bottom surface of the front portion of the insulating member 222A. EX1005, 12:64-13:3, 10:11-16, Figs. 4A-4B, 5A-5B; §X.A.i (34[i]).

34[l].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and**

158. Andre discloses this limitation. The front portion of the insulating member 222A (*tongue*) is disposed in the middle of the opening 304 and gap 218 (*connection slot*), creating *symmetric up and down and left and right chambers* around the front portion of the insulating member 222A.

159. As explained for limitation 34[b], Andre's plug is inserted within the gap 218, which forms chambers around the front portion of the insulating member 222A (*tongue*) containing inner electrode 212. *See* §X.A.i (34[b]). In all figures of Andre, these chambers are depicted as completely symmetrical in left-right and up-down directions in Andre's figures (*e.g.*, Fig. 3A, 4A, 5A).

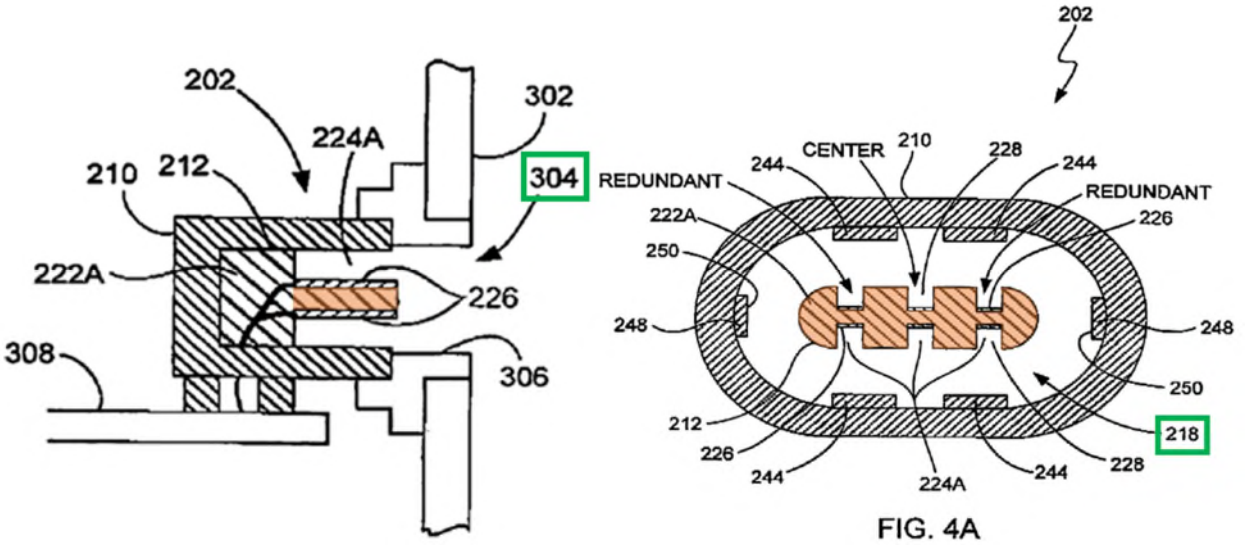


FIG. 4A

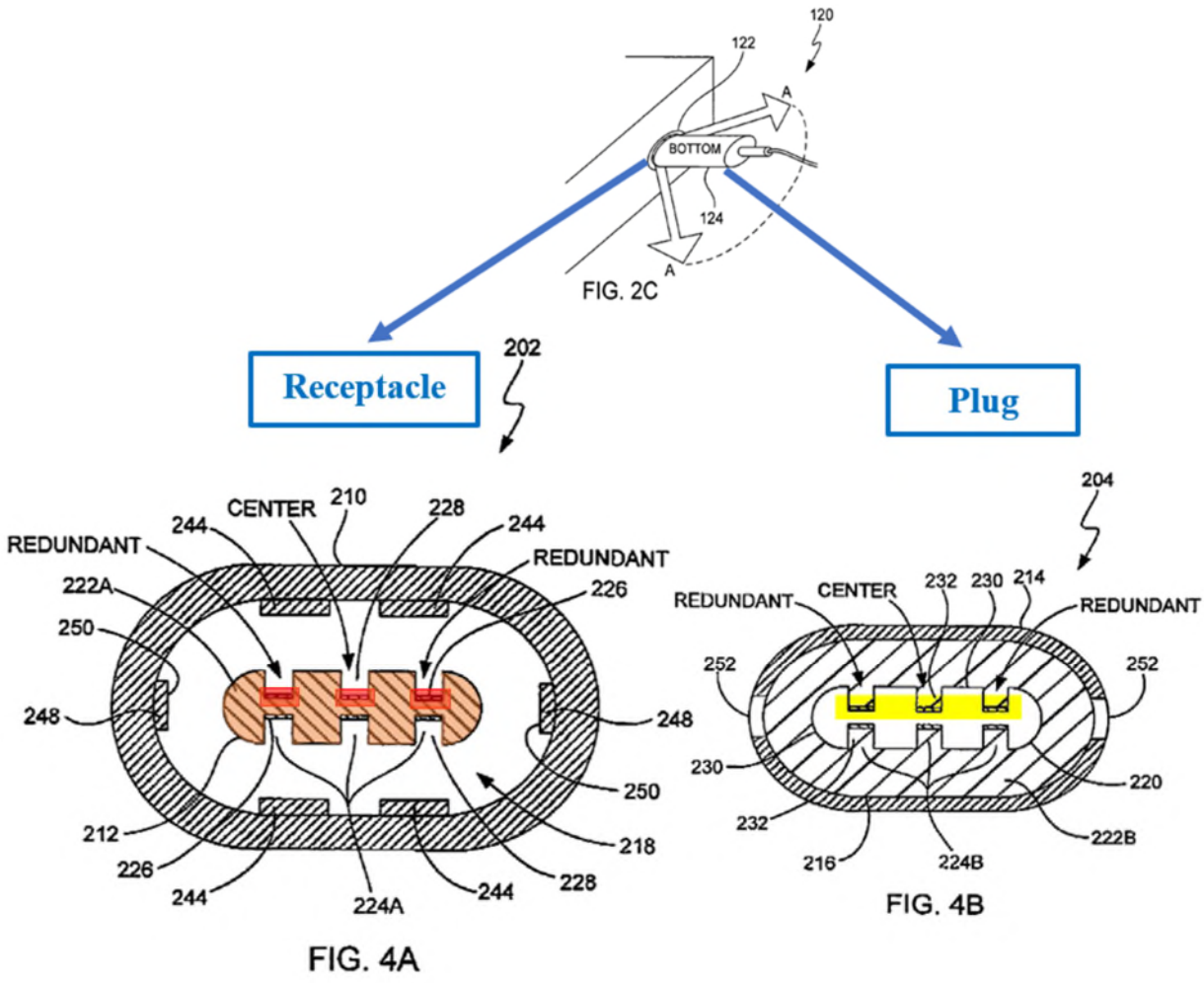
EX1005, Fig. 5A (excerpt of receptacle), Fig. 4A (receptacle).

160. Andre also expressly describes the left-right and up-down symmetry of the chambers, explaining that 0/180 degree insertion is "accomplished with ***receiving and insertion elements having cross sectional shapes that are 0/180 symmetrical***. That is, the elements are ***symmetrical on opposite sides of the major and minor axes*** . . . ." EX1005, 6:39-44, 8:6-11. This symmetry is applied to both exterior shapes and interior shapes of the plug 204 and receptacle 202 such that "the outer conductive shells 210 or 214 and their corresponding inner electrodes 212 or

216 extend longitudinally and ***are symmetrically placed*** relative to one another along their centerlines 206 or 208." EX1005, 8:45-49. These "connectors are typically dimensioned with very tight tolerances so that a good electrical contact is made therebetween." EX1005, 6:54-58, Figs. 4A-4B. To satisfy this teaching, the gap 218 created above and below the front portion of the insulating member 222A must be symmetrical, and the gap 218 created to the right and left of the front portion of the insulating member 222A must also be symmetrical.

34[m].	**a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and**

161. Andre discloses this limitation. In Andre, the plug can be inserted face-down at 180 degrees (*second operational state when the plug is oppositely inserted*) such that the one row of plug's terminals (*at least one row of connection terminals of the plug*) now faces the upper surface (*first surface*) of the front portion of the insulating member 222A (*tongue*) and electrically connects to the row of upper contact pads 226 (*one row of first contacts*) in the receptacle.



EX1005, Figs. 2C, 4A-4B.

162. Andre specifically discloses that its "DC plug 204 and DC receptacle 202 are configured to be 0/180 symmetrical such that the ***DC plug 204 can be inserted into the DC plug*** [*sic*] ***202 one of two ways***: at ***0 and 180 degrees*** (or some increment thereof, i.e., 180 apart as for example 5 and 185, 90 and 270, etc.)." EX1005, 8:6-11. Figure 2C of Andre illustrates when the plug is inserted into the receptacle at 180-degrees—or "inserted . . . face down" (EX1005, 6:19-23)—the *second operational state when the plug is oppositely inserted.*

163. Andre also discloses that when inserted, the upper contact pads of the plug (*one row of connection terminals*) face the upper surface of the front portion of the insulating member 222A (*first surface of the tongue*) containing inner electrode 212 and electrically connect with upper contact pads 226 (*first row of contacts*). As explained above for limitation 34[i], Andre explains that when mated, the inner electrode 216 of the plug 204 is inserted into the inner electrode 212 of the receptacle 202 such that ***both*** rows of contact pads 230 of the plug 204 electrically engage with ***both*** rows of contact pads 226 of the receptacle 202, including specifically the upper row of contact pads on the upper surface of the front portion of the insulating member 222A. EX1005, 12:64-13:3, 10:11-16, Figs. 4A-4B, 5A-5B; §X.A.i (34[i]).

34[n].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.**

164. This claim limitation is identical to limitation 34[l] and is therefore also disclosed by Andre. *See* §X.A.i (34[l]).

ii. Dependent Claims 35-39 and 41-55 Are Rendered Obvious by Andre

165. In my opinion, Claims 35-39 and 41-55 are also rendered obvious by Andre, as explained below.

35.	**The socket structure of claim 34, wherein the tongue only contacts an interior portion of the plug when the plug is inserted.**

166. Andre discloses this limitation. When receptacle 202 engages with plug 204, the receptacle's inner electrode 212 engages with plug's inner electrode 216 such that the front portion of the insulating member 222A (*tongue*) containing inner electrode 212 inserts into and only contacts interior rails 232 within an opening 220 of the plug 204 (*an interior portion of the plug*).

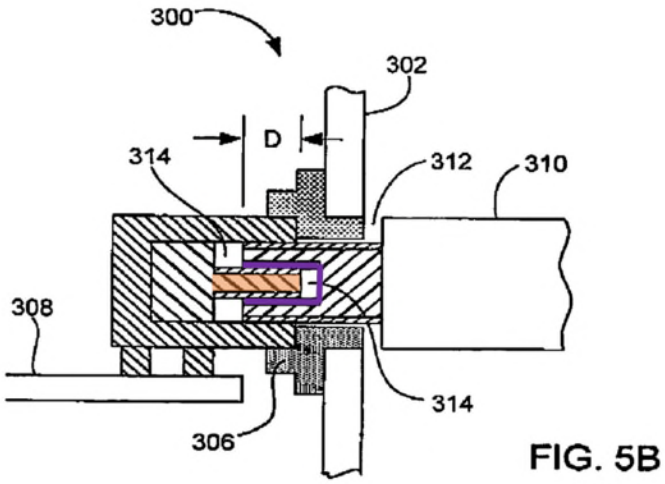
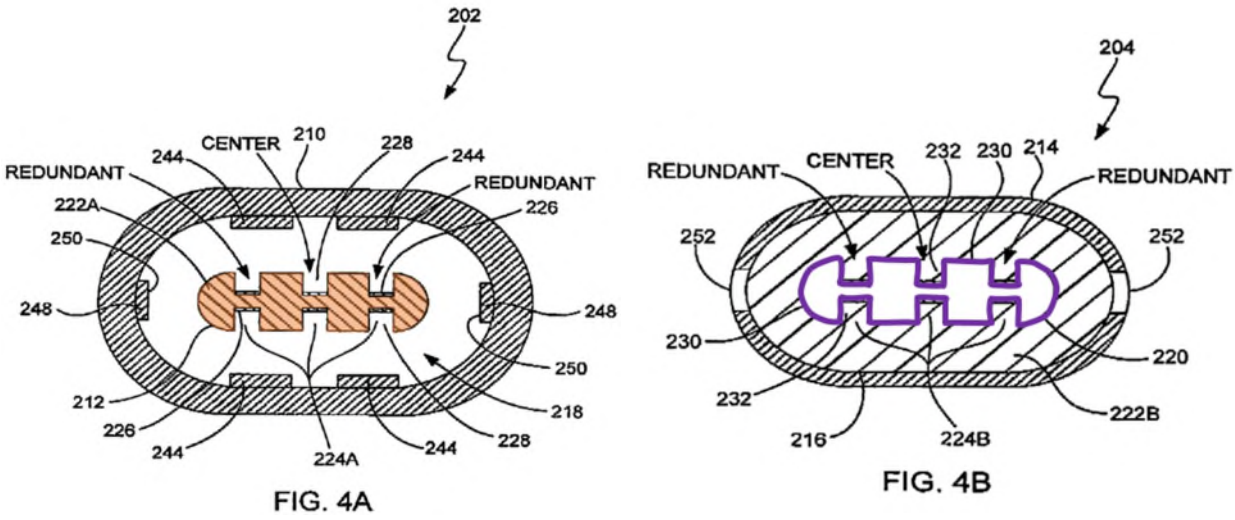


FIG. 5B

EX1005, Fig. 5B.

167. Andre describes the plug 204 includes "***an opening 220 for receiving the inner electrode 212*** of the DC receptacle 202" that "include[s] [the] insulating member 222A." EX1005, 8:60-66. Specifically, when the plug 204 is inserted into the receptacle 202, the front portion of the insulating member 222A that contains "the ***inner electrode 212*** of the DC receptacle 202 ***is mated within the inner electrode 216*** of the DC plug 204" such that "the rails 232 of the inner electrode 216

mate with the grooves 228 of the inner electrode 212 thus causing the upper and lower contact pads 230 of the DC plug 204 to electrically engage the upper and lower contact pads 226 of the DC receptacle 202." EX1005, 10:4-16. Therefore, a POSITA would have understood that the front portion of the insulating member 222A (*tongue*) only contacts the interior rails 232 within the opening 220 of the inner electrode 216 of the plug 204 (*an interior portion of the plug*) when the plug 204 is inserted into the receptacle 202.



EX1005, Fig. 4A (receptacle), 4B (plug) (both annotated); *see also id.*, Fig. 5B.

36.	**The socket structure of claim 35, wherein a thickness of the tongue is less than a third of a height of the connection slot.**

168. Andre renders this limitation obvious. Andre does not disclose a specific dimension for its tongue vis-à-vis the connection slot. But neither does the '307 patent, which fails to mention the recited relative dimension in the written description at all, let alone to ascribe any criticality or importance to the recited

limitation, or to describe how the claimed thickness range produces any meaningful distinction over that disclosed in the prior art. For example, in the ’307 patent, there is no explicit dimensional metrics or scaling discussion for the tongue thickness. In fact, the only mention of a specific numerical proportion for the dimensions of the tongue thickness in the ’307 patent occurs in the claim language. *See*, *e.g.*, EX1001, Claim 36. In general, the relative dimension recited in this claim would have been obvious to a POSITA, and particularly would have been obvious in view of the specific tongue and connection slot of Andre.

169. As I described, Andre discloses a symmetrical socket (below) that has an open connection slot around a symmetrical, central tongue to receive a corresponding symmetrical plug, such that the plug’s upper and lower walls are inserted into the socket’s open connection slot and the socket’s tongue is inserted into the plug’s middle opening.

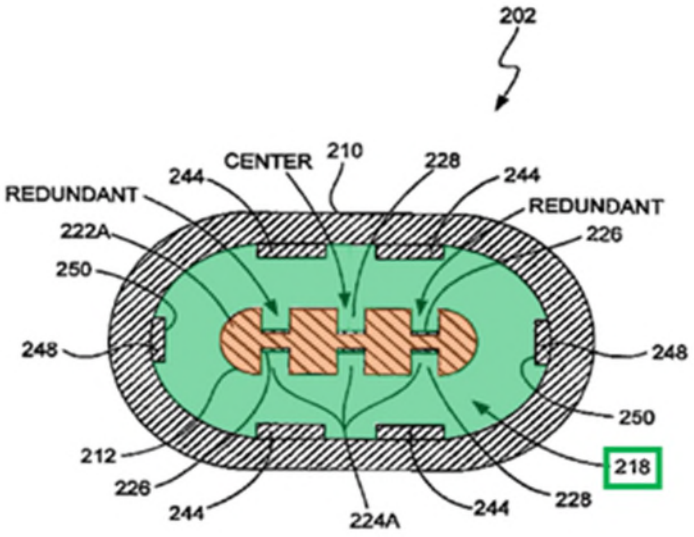


FIG. 4A

EX1005, Fig. 4A (receptacle); EX1005, 6:42-43 ("the elements are symmetrical on opposites sides of the major and minor axes"), 8:6-8 ("The DC plug 204 and DC receptacle 202 are configured to be 0/180 symmetrical…").

170. In this configuration, a POSITA would have had a finite number of predictable options for relative thicknesses of these elements. The tongue could be (a) less than 1/3 the connection slot, with larger openings above/below it; (b) exactly 1/3 the connection slot, with equal-sized openings above/below; or (c) greater than 1/3 the connection slot, with smaller openings above/below. It would have been obvious to a POSITA to choose one of these predictable, structural options.

171. Moreover, a POSITA's simple logic would have suggested and motivated the claimed range. A POSITA would have recognized that making the surrounding connection slot thicker around the tongue (thus decreasing the tongue thickness) allows more room for thicker plug walls, which promotes robustness of

the plug. And promoting robustness of the plug, the electrical component most frequently exposed to the user's environment, without having to add clunky latches is precisely one of the key goals of Andre. EX1005, 3:65-66 ("Another aspect of the invention relates to DC plugs that are more robust."), 2:19-22 ("the plug side is the side that is typically seen by the user and thus poor aesthetic qualities may cause the user to think badly about the product in which it is used."). Indeed, unlike the socket's tongue, which is protected within the socket structure, the plug is exposed to external environments and is thus more likely to be damaged by user handling. Thus, when choosing how to divide the socket between the tongue and the connection slots, a POSITA would have been motivated to devote the majority of thickness to the connection slots, so the plug walls could be ***thicker***, providing maximum mechanical strength for reliable electrical connections and promoting robustness without adding clunkiness or any latching mechanisms. And since the plug's middle opening is symmetric and in the center of the plug walls (*see*, *e.g.*, EX1005, Fig. 4B), making the plug walls thicker than its middle opening means the middle opening would be less than 1/3 the thickness of the combined plug height.

172. Correspondingly, making a plug with a middle opening less than 1/3 of the thickness of the overall plug height means that the tongue that goes ***inside*** the plug's middle opening must be less than 1/3 the thickness of the connection slot that receives the plug walls—just as recited in this claim. Accordingly, although Andre

does not expressly describe a dimension for the tongue thickness vis-à-vis the connection slot, a POSITA would have clearly been motivated to make the tongue less than a third of the overall thickness of the socket's connection slot to improve the robustness of the plug.

173. Andre's teaching of thin profile "small contact distance" would also have led a POSITA to reduce the tongue's thickness relative to slot height for the same purpose—improving insertion ease, minimizing force, and fitting compact devices. EX1005, Abstract.

174. A POSITA would have had a reasonable expectation of success in making the tongue less than one-third of the thickness of the connection slot. Dimensional scaling (ratios of thickness to slot height) is a routine optimization for mechanical connector design. Andre discloses that the tongue can comprise various materials using an injection molding process, EX1005, 13:32-42, which could easily have achieved a tongue with a range of thicknesses, including thicknesses less than 1/3 of the connection slot. Indeed, well known electrical connectors at the time had a tongue with thickness relative to a connection slot within this range. EX1015, 91, 96.

Samsung, EX1003, p. 109

37.	**The socket structure of claim 34, wherein a portion of each of the first contacts, in the at least one row of first contacts, is coplanar with a portion of the first surface of the tongue.**

175. Andre renders this limitation obvious. Andre discloses that the upper contact pads 226 (*first contacts in the at least one row of first contacts*) are substantially planar to each other and positioned at the base of the grooved portion on the top of the front portion of the insulating member 222A (*a portion of the first surface of the tongue*). It would also have been obvious to make the contacts coplanar with the base of the grooved portions.

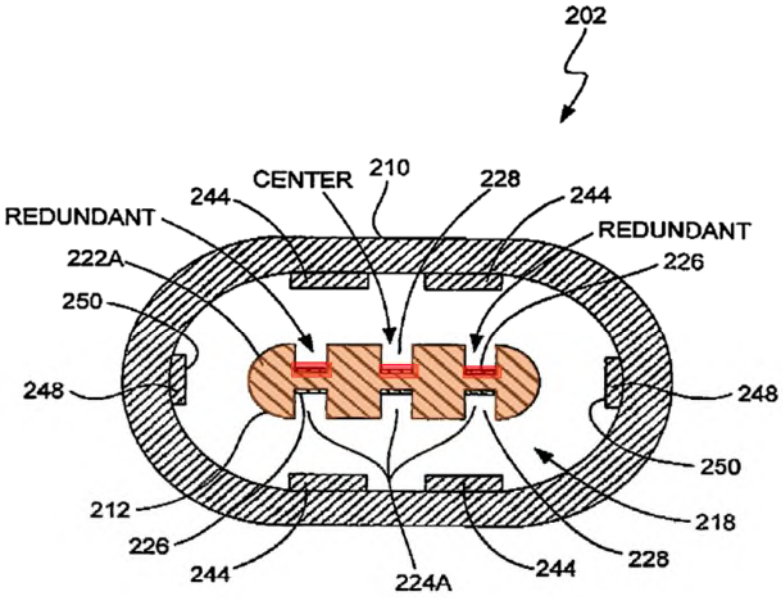


FIG. 4A

EX1005, Fig. 4A.

176. Specifically, as explained above for limitation 34[e], Andre discloses that the upper contact pads 226 (*first contacts*) are "laid out in a linear array" and "positioned laterally relative to one another within substantially the same plane (e.g.,

juxtaposed)." EX1005, 9:5-8, Fig. 4A; §X.A.i (34[e]). These "substantially planar contacts 226 are positioned at the base of the groove 228" "in the insulating member 222A" containing inner electrode 212. EX1005, 9:47-51. Andre further discloses that the contact pads may be "molded with the insulating member such that they are ***embedded*** in the insulating member." EX1005, 13:38-40. Based on this teaching, a POSITA would have been motivated to make an embedded contact pad flush with a surface of the tongue (*coplanar*) to ensure a sufficient connection point with a plug.

177. A POSITA would have had a reasonable expectation of success in implementing this modification because Andre's tongue is made through an injection molding process that could easily have been modified to embed contact pads. EX1005, 13:32-42.

38.	**The socket structure of claim 37, wherein a portion of each of the second contacts, in the at least one row of second contacts, is coplanar with a portion of the second surface of the tongue.**

178. Andre renders this limitation obvious. Andre discloses that the lower contact pads 226 (*second contacts in the at least one row of second contacts*) are substantially planar to each other and positioned at the top of the grooved portion on the bottom of the front portion of the insulating member 222A (*a portion of the second surface of the tongue*). It would also have been obvious to make the contacts coplanar with the top of the grooved portions.

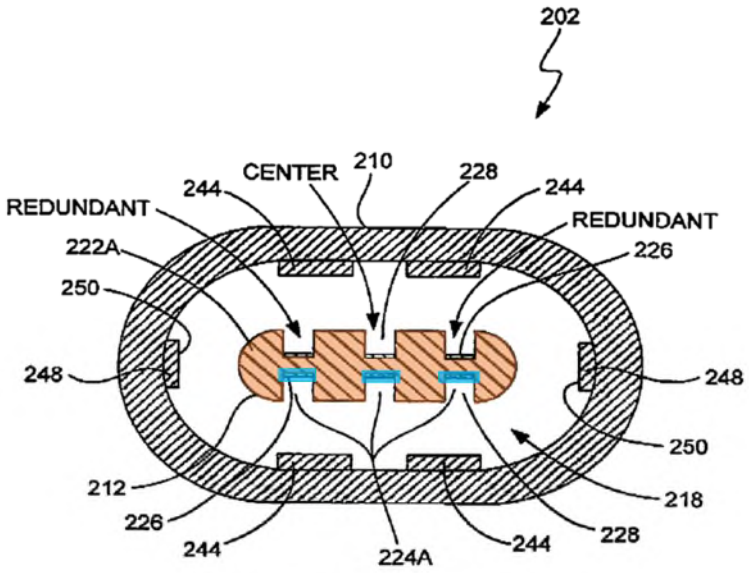


FIG. 4A

EX1005, Fig. 4A.

179. Specifically, as explained above for limitation 34[e], Andre discloses that the upper contact pads 226 (*second contacts*) are "laid out in a linear array" and "positioned laterally relative to one another within substantially the same plane (e.g., juxtaposed)." EX1005, 9:5-8, Fig. 4A; §X.A.i (34[e]). These "substantially planar contacts 226 are positioned at the base of the groove 228" "in the insulating member 222A" containing inner electrode 212 portion. EX1005, 9:47-51. Andre further discloses that the contact pads may be "molded with the insulating member such that they are ***embedded*** in the insulating member." EX1005, 13:38-40. Based on this teaching, a POSITA would have been motivated to make an embedded contact pad flush with a surface of the tongue (*coplanar*) to ensure a sufficient connection point with a plug.

180. A POSITA would have had a reasonable expectation of success in implementing this modification because Andre's tongue is made through an injection molding process that could easily have been modified to embed contact pads. EX1005, 13:32-42.

39.	**The socket structure of claim 34, further comprising a metal housing at least partially covering the plastic base.**

181. Andre discloses this limitation. The receptacle 202 "includes an ***outer conductive shell 210***" (*metal housing*) that at least partially covers the rear portion of the insulating base (*plastic base*). EX1005, 8:17-18.

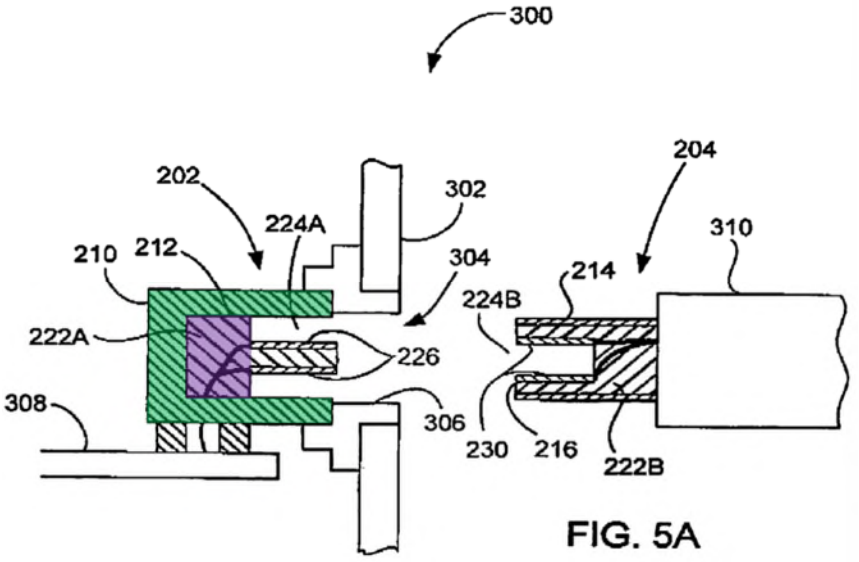


FIG. 5A

EX1005, Fig. 5A.

182. Andre discloses that "the DC receptacle 202 includes an ***outer conductive shell 210***" that "may be formed from sheet ***metals*** such as steel or copper." EX1005, 8:17-18, 13:16-18. As shown in Figures 5A-5B of Andre, the

outer conductive shell 210 (*metal housing*) covers three sides of the rear portion of the insulating member 222A (*plastic base*) press fit into the rear end of receptacle 202, thus satisfying this claim.

41.	**The socket structure of claim 34, wherein the tongue and the plastic base are integrally formed.**

183. Andre discloses this limitation. The insulating member 222A (outlined in pink) integrally forms the rear portion of the insulating member 222A (*plastic base*) and the front portion of the insulating member 222A (*tongue*).

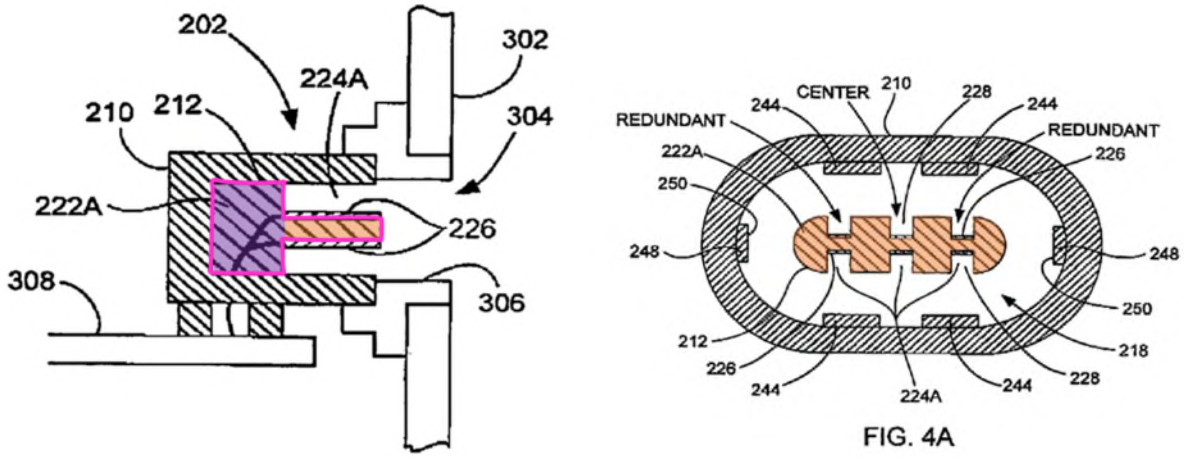


FIG. 4A

EX1005, Figs. 5A (excerpt of receptacle), 4A (showing element 222A as tongue and insulating base).

184. Specifically, as shown in the cohesive hatching of insulating member 222A in Figure 5A, the insulating member 222A integrally forms both the rear portion of the insulating member 222A (*plastic base*) and the front portion of the insulating member 222A (*tongue*) containing inner electrode 212. EX1005, Fig. 5A.

That the rear portion and front portion of the insulating member 222A are integrally formed is confirmed by Andre's description that the insulating member 222A may be "press fit into the outer conductive shell[]" at the rear of receptacle 202 and is "typically [an] injection molded part[]"—processes that a POSITA would have understood to form a single integral component. EX1005, 13:32-42.

42.	**The socket structure of claim 34, wherein each contact of the first and second contacts is a portion of a respective terminal.**

185. Andre discloses this limitation. In Andre, each of the upper and lower contact pads 226 is a portion of a *first terminal* (together, upper contact and first wire within plastic base) and a *second terminal* (together, lower contact and second wire within plastic base), as shown below.

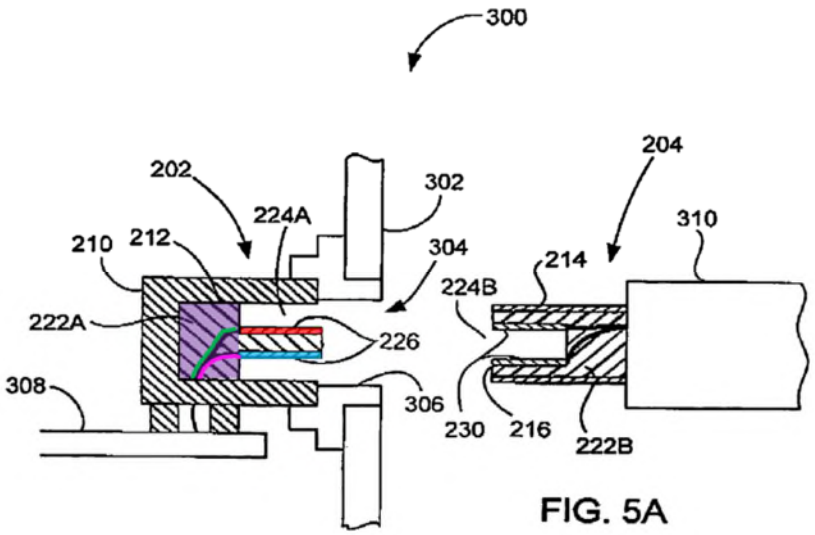


FIG. 5A

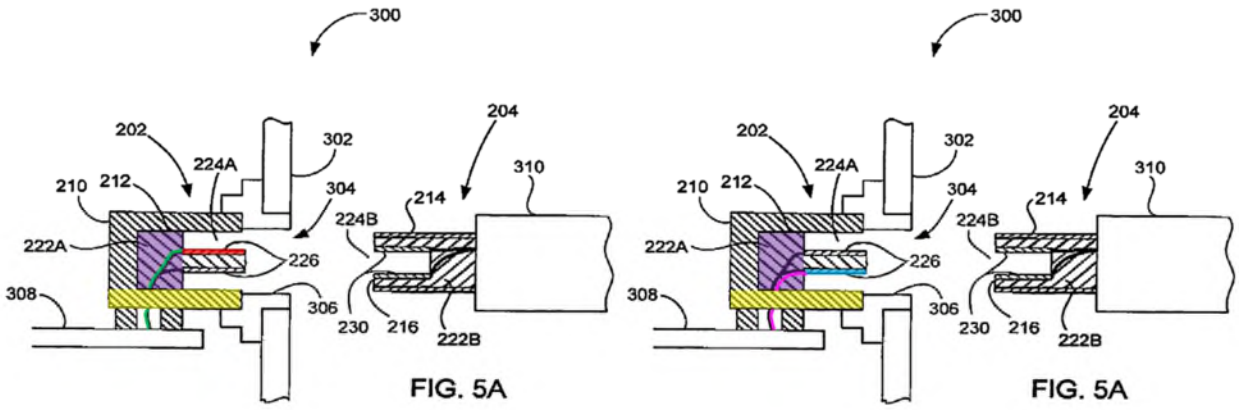
EX1005, Fig. 5A (modified).

186. Specifically, Andre discloses that "[e]ach set of contact pads (upper/lower) is connected to a ***separate terminal or post***, each of which is capable

of being electrically connected to a PCB." EX1005, 9:53-56. These terminals may be "***means for providing electrical connection to the internal components*** positioned in the housing" and may connect "the contact pads to the PCB." EX1005, 12:22-29. Thus, as shown in Fig. 5A, a respective terminal includes upper or lower contact pads (*first and second contacts*) in *a portion* connected to first and second wire in another portion.

43.	**The socket structure of claim 34, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

187. This claim limitation combines limitations 34[f] and 34[h], but with an additional requirement that the first/second pins extend out of the plastic base "through a rear cover." As explained above for limitations 34[f] and 34[h], it would have been obvious to a POSITA that the first wire (*first pin*) connecting each upper contact pad 226 (*each of the first contacts*) and second wire (*second pin*) connecting each lower contact pad 226 (*each of the second contacts*) also extend out of a plastic base through a rear portion of the outer conductive shell 210 (*rear cover*).



EX1005, Fig. 5A (showing first wire extending out of rear portion of outer conductive shell on left and showing second wire extending out of rear portion of outer conductive shell on right).

188. Figure 5A of Andre shows exemplary wires (green and pink) (*respective first and second pins*) that connects a respective upper or lower contact pad 226 (*first and second contacts*) within receptacle 202 at one end and extends out of the rear portion of the insulating member 222A (*plastic base*) by protruding through the rear portion of the outer conductive shell 210 (*rear cover*) at the other end. *See* §X.A.i (34[f], 34[h]); EX1005, 12:17-29 (describing a wire may be embedded in a post that protrudes through an opening in the outer conductive shell 210). The outer conductive shell 210 extends from the front to rear of receptacle 202, and thus the highlighted portion is a "rear cover" of the receptacle.

44.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another, and at least two of the second contacts are not in electrical communication with one another.**

189. Andre discloses this limitation. In Andre, the two power contacts in each of the two sets of "upper and lower contact pads 226" (*at least two of the first and second contacts*) are "electrically isolated within the same plane" (*not in electrical communication with one another*). EX1005, 2:31-33, 9:45-49.

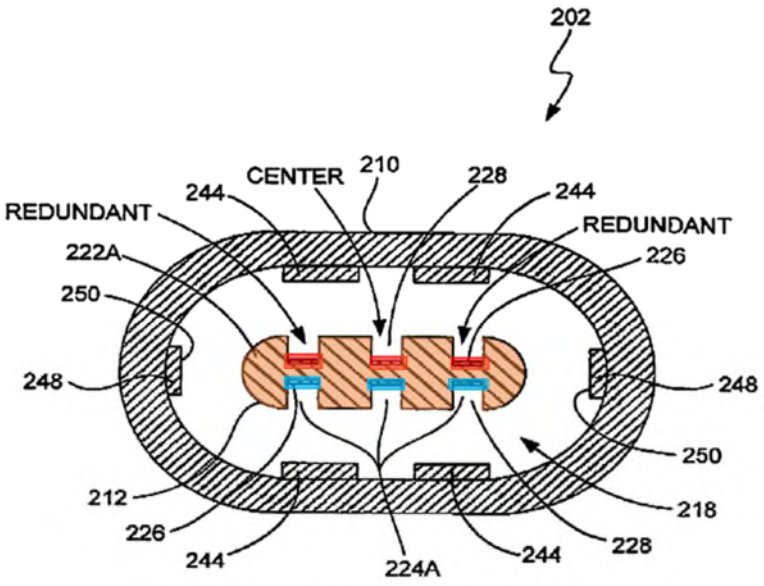


FIG. 4A

EX1005, Fig. 4A.

190. In Fig. 4A, both the top and the bottom surfaces of the front portion of the insulating member 222A containing inner electrode 212 has one center contact 225 and two redundant contacts 227. EX1005, 9:5-14, Fig. 4A. And in each of the top and bottom surfaces, the two "redundant power contacts . . . are ***electrically***

isolated within the same plane" such that the two power contacts of upper contact pads 226 (*two of the first contacts*) are electrically isolated from each other, and the two power contacts of lower contact pads 226 (*two of the second contacts*) are electrically isolated from each other. EX1005, 2:31-33.

45.	**The socket structure of claim 34, further comprising a rear cover attached to the plastic base.**

191. Andre discloses this limitation. In Andre, a rear portion of the outer conductive shell 210 (*rear cover*) extends from the front to rear of receptacle 202 and is attached to the rear portion of the insulating member 222A (*plastic base*). Indeed, Andre discloses that the insulating member 222A is typically "injection molded" and "press fit into the outer conductive shell[,]" such that the insulating member 222A is attached to at least the rear portion of the outer conductive shell. EX1005, 13:32-42.

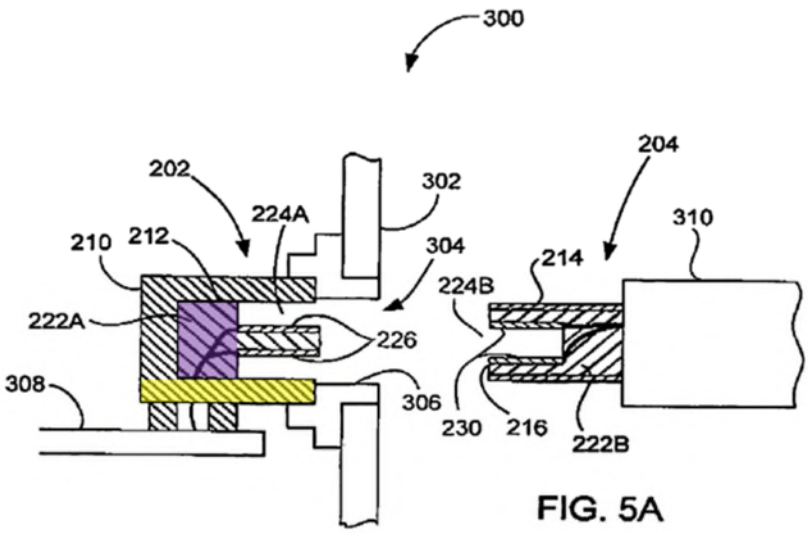


FIG. 5A

EX1005, Fig. 5A.

46.	**The socket structure of claim 45, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover.**

192. This claim is identical to limitation 43, except it depends from claim 45, which recites that the socket structure is "further comprising a rear cover attached to the plastic base." That dependency does not make a material difference to the analysis presented in limitation 43. Thus, this limitation is also disclosed by Andre for the same reasons as limitation 43. *See* §X.A.ii (43).

47.	**The socket structure of claim 45, wherein each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

193. This claim limitation is identical to limitation 43, except it depends from claim 45, which does not make a material difference to the analysis presented in limitation 43. *See* §X.A.ii (43, 46). This limitation is invalid for the same reasons as limitation 43.

48.	**The socket structure of claim 34, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

194. Andre discloses this limitation, under Patent Owner's interpretation, for the same reasons as described for claim 34[pre] and 34[i]. *See* §X.A.i (34[pre], 34[i]); §VII.A-B. In addition, Andre's socket 202 operatively connects to Andre's plug 204, as shown below:

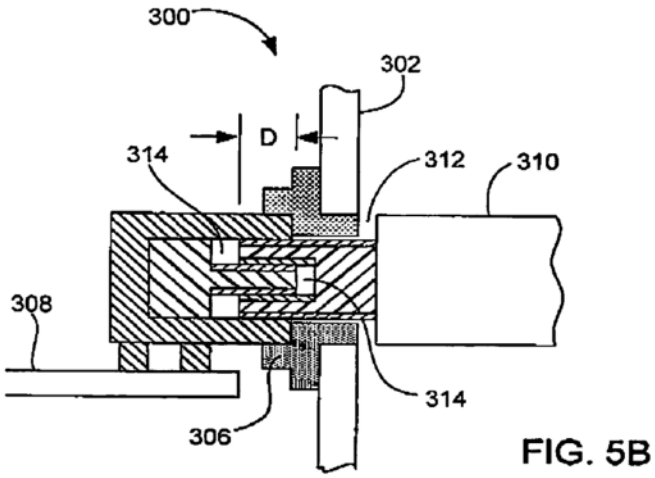


FIG. 5B

EX1005, Fig. 5B.

49.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another.**

195. This claim limitation is identical to limitation 44 and is therefore also disclosed by Andre. *See* §X.A.ii (44).

50.	**The socket structure of claim 34, wherein at least two of the second contacts are not in electrical communication with one another.**

196. This claim limitation is identical to limitation 44 and is therefore also disclosed by Andre. *See* §X.A.ii (44).

51.	**The socket structure of claim 34, wherein the at least one row of first contacts and respective first pins are located at ends of respective ones of a row of first terminals and the at least one row of second contacts and respective second pins are located at ends of respective ones of a row of second terminals.**

197. Andre renders this limitation obvious, for the reasons described for limitations 34[f], 34[h], and claim 42. *See* §§X.A.i (34[f], 34[h]), X.A.ii (42). At

either end of the *first terminal* are upper contact pads (*row of first contacts)* and first wires extending out of the plastic base (*first pins*), and at either end of the *second terminal* are lower contact pads (*row of second contacts)* and second wires extending out of the plastic base (*second pins*), as previously explained.

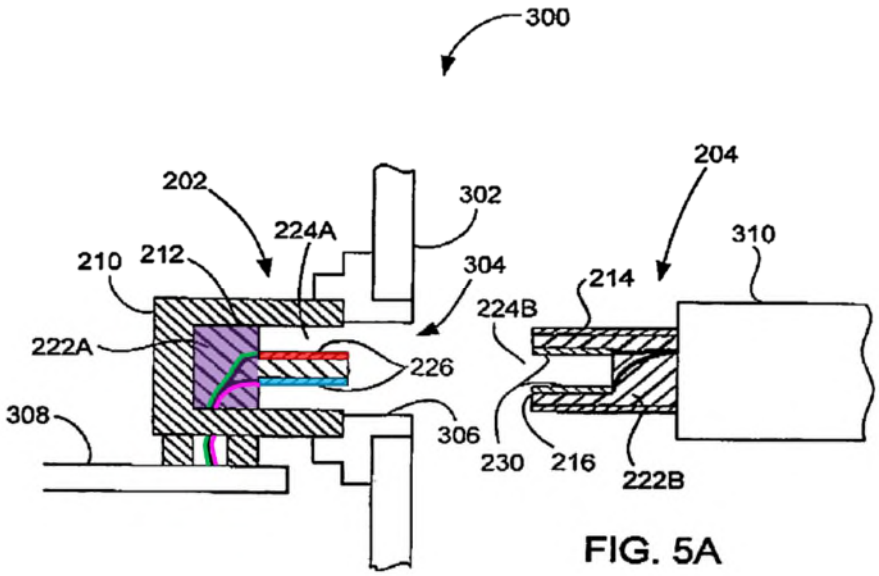


FIG. 5A

EX1005, Fig. 5A (modified).

52.	**The socket structure of claim 34, wherein a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue.**

198. Andre discloses this limitation. In Andre, the upper contact pads (*first contacts*) project beyond (and are positioned on) a surface on the top of the tongue at the base of the grooves (*one surface*), and the lower contact pads (*second contacts*) project beyond (and are positioned on) a surface on the bottom of the tongue at the top of the grooves (*another surface*).

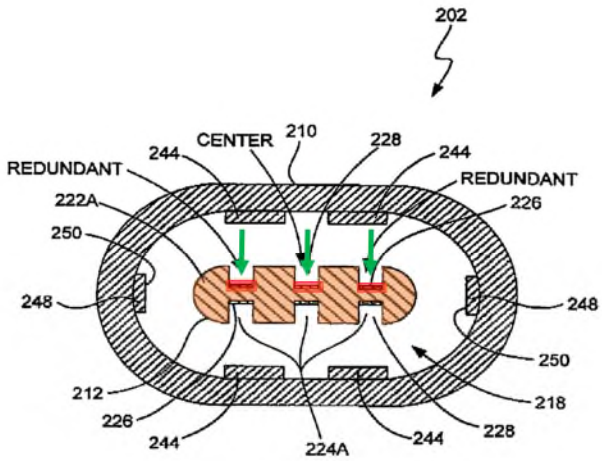


FIG. 4A

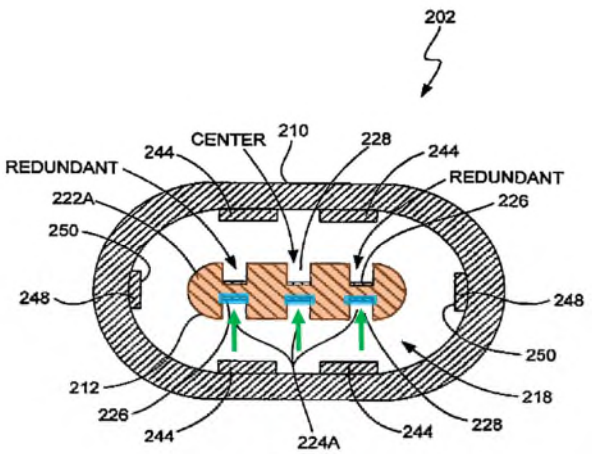


FIG. 4A

EX1005, Fig.4A; EX1005, 9:45-56.

53.	**The socket structure of claim 34, wherein a portion of one of the first contacts is at least partially included in the first surface with grooves.**

199. Andre renders this limitation obvious, for the same reasons described for limitation 34[c] and claim 37. In Andre, the upper contact pads 226 (*first contacts*) are positioned at the base of grooves 228 (*grooves*) on the top surface (*first surface*) of the front portion of the insulating member 222A (*tongue*). *See* §X.A.i (34[c]). Moreover, as described for claim 37, it would have been obvious to embed the contacts ***in*** the grooves, as recited here, as opposed to ***on*** the grooves, as shown in the figures. §X.A.ii (37).

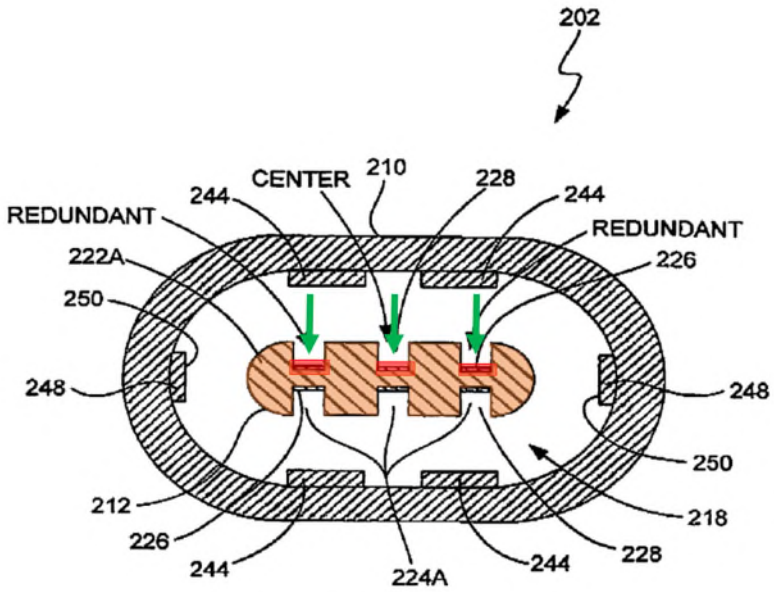


FIG. 4A

EX1005, Fig. 4A.

200. For example, Andre discloses that "***upper*** and lower ***contact pads 226*** . . . are substantially planar and ***positioned within upper*** and lower ***grooves or channels 228 in the insulating member 222A***. In the illustrated embodiment, the substantially planar ***contacts 226 are positioned at the base of the groove 228***." EX1005, 9:45-51, Fig. 4A. Andre further discloses that the contact pads may be "molded with the insulating member such that they are ***embedded*** in the insulating member." EX1005, 13:38-40.

54.	**The socket structure of claim 34, wherein a portion of one of the second contacts is at least partially included in the second surface with grooves.**

201. Andre renders this limitation obvious, for the same reasons described for limitation 34[c] and claim 37. In Andre, the lower contact pads 226 (*second*

contacts) are positioned at the top of grooves 228 (*grooves*) on the bottom surface (*second surface*) of the front portion of the insulating member 222A (*tongue*). *See* §X.A.i (34[c]). Moreover, as described for claim 37, it would have been obvious to embed the contacts *in* the grooves, as recited here, as opposed to ***on*** the grooves, as shown in the figures. §X.A.ii (37).

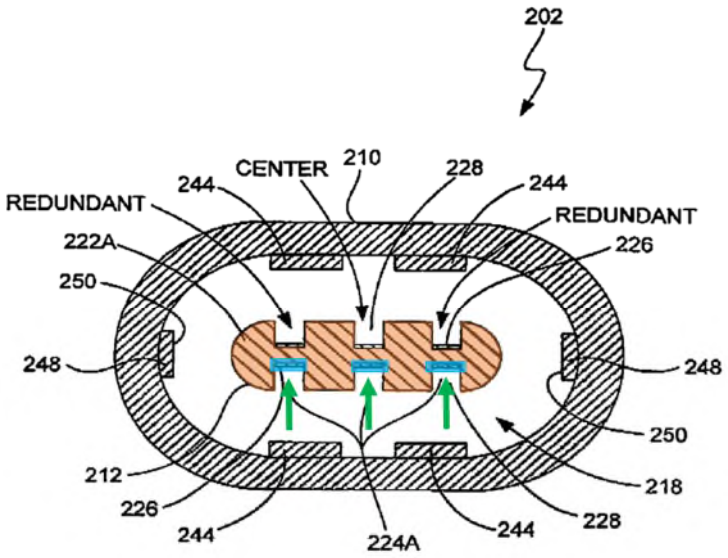


FIG. 4A

EX1005, Fig. 4A.

202. For example, Andre discloses that "upper and ***lower contact pads 226*** . . . are substantially planar and ***positioned within*** upper and ***lower grooves or channels 228 in the insulating member 222A***. In the illustrated embodiment, the substantially planar ***contacts 226 are positioned at the base of the groove 228***." EX1005, 9:45-51, Fig. 4A. Andre further discloses that the contact pads may be

"molded with the insulating member such that they are ***embedded*** in the insulating member." EX1005, 13:38-40.

55.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 34 and the plug.**

203. Andre discloses this limitation for the same reasons as claim 34, under Patent Owner's interpretation. *See* §X.A.i (34[pre], 34[i]). The socket structure and plug in Andre form an electrical connection system. *See, e.g.*, EX1005, Abstract.

iii. Independent Claim 56 and Dependent Claims 57-65 Are Rendered Obvious by Andre

204. Independent claim 56 is substantially the same as claim 34 except (a) limitation 56[c] specifies that the "first surface" of the tongue is on the "top side" and the "second surface" is on the "bottom side," (b) limitation 56[i] requires that the socket is "operative to simultaneously electrically connect ***on the top and the bottom side*** of the tongue (rather than "via the first and second contacts"), and (c) claim 56 does not include the "symmetrical" connection slot requirements of claim 34.

205. These differences do not substantively change my analysis of Andre. As already explained for claim 34, Andre's tongue has a top side and a bottom side which are simultaneously electrically connected to the plug, under Patent Owner's interpretation of the simultaneously limitations. *See* §§X.A.i (34[c], 34[i]), VII.A.

Andre therefore renders claim 56 obvious for the same reasons as described for claim 34.

206. Dependent claims 57-65 are analyzed further below.

57.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 56 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

207. Andre discloses this claim for the same reasons as claims 55 and 48. *See* §X.A.ii (55, 48). Andre's receptacle 202 has a duplex electrical connection, as Patent Owner interprets the term (§VII.B), and connects to a plug, with simultaneous electrical connections via the upper and lower contact pads 226 (*first and second contacts*), as Patent Owner interprets that term (§VII.A), on either side of the front portion of the insulating member 222A (*tongue*) containing inner electrode 212.

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58.	**The socket structure of claim 56, wherein the tongue and the plastic base are integrally formed.**
59.	**The socket structure of claim 58, further comprising a metal housing at least partially covering the plastic base.**
60.	**The socket structure of claim 59, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.**
61.	**The socket structure of claim 60, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.**

208. Claims 58-60 are identical to claims 41, 39, and 44, and are invalid in view of Andre for the same reasons. *See* §X.A.ii (41, 39, 44).

209. Claim 61 is also substantively the same as claims 53 and 54, which together recite a socket structure "wherein a portion of one of the first [second] contacts is at least partially included in the first [second] surface with grooves." Claim 61 is therefore invalid in view of Andre for the same reasons as claims 53 and 54. *See* §X.A.ii (53-54).

62.	**The socket structure of claim 61, wherein the at least one row of first contacts includes at least five contacts, and the at least one row of second contacts includes at least five contacts.**

210. Andre renders this limitation obvious. It would have been obvious to a POSITA to include two additional pairs of upper and lower contact pads 226—as suggested by Andre—such that there are *six total contacts* (more than *at least five contacts*, as claimed) in the linear array of upper contact pads 226 (*first contacts*)

and *six total contacts* (more than *at least five contacts*, as claimed) in the linear array of lower contact pads 226 (*second contacts*). The six contacts, for example, would be arranged as Power, Data, Data, Data, Data, Power, on each side of the tongue.

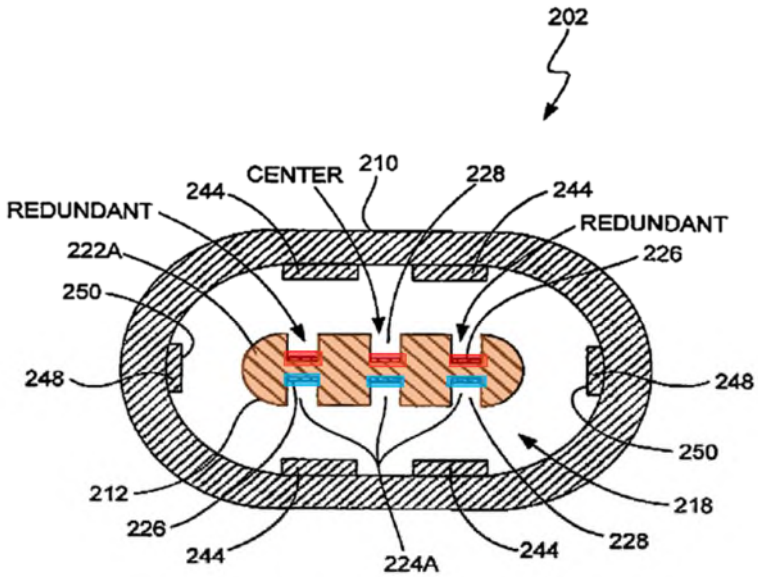


FIG. 4A

EX1005, Fig. 4A.

211. This arrangement is consistent with Andre's disclosure of adding more pairs of power or data contacts. EX1005, 6:28-30, 9:15-20. Specifically, Andre discloses an embodiment in Figure 4A illustrating three contacts 224A—one center contact 225 and two redundant contacts 227—on each of the upper and lower contact pads 226 of the tongue. EX1005, 9:5-14, Fig. 4A. Andre further discloses that "[a]lthough only one pair of redundant contacts is shown [on each surface], it should be appreciated that this is not limitation and that ***more than one pair of redundant***

contacts may be used. When plural, each set of redundant contacts is spaced further and further from the centerline within the same plane." EX1005, 9:15-20.

212. A POSITA would have thus been motivated by Andre to follow this teaching for reliability/backup (in case any contacts break) or to increase data transmission capacity using a single plug for user convenience, such as when "additional inputs" such as "Firewire, USB, network" are passed from the downstream "power converter" through the plug to the host, as Andre suggests. EX1005, 5:14-17, Fig. 1 (reproduced below).

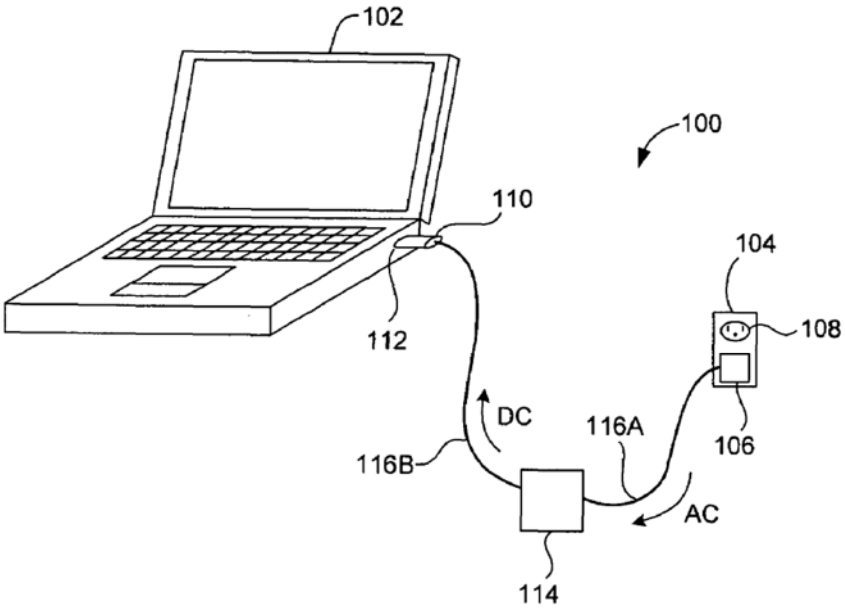


FIG. 1

EX1005, Fig. 1 (showing power converter 114 configured to receive external inputs, such as AC power or other "additional . . . data inputs," to provide to the DC receptacle 112).

213. A POSITA would have understood that if an "additional . . . data input," such as a USB, Firewire, or Ethernet cable, was plugged in to the power converter, the converter would necessarily require corresponding data conductors running through the cable and into the receptacle 112 to communicate that data to or from the host device 102. A POSITA would further recognize that these interface standards inherently rely on multiple data lines—for example, USB uses differential data pairs, FireWire carries separate data/strobe signaling, and the 10/100BASE-T Ethernet networking standard requires two twisted pairs (four wires), all of which would require receptacle 112 to include additional data contacts on the inner electrode 212 (*e.g.*, in addition to power/ground contacts, four data contacts are needed on the top surface of the tongue, and in a reverse mirror configuration (§X.A.i (34[j])), four redundant data contacts are needed on the bottom surface of the tongue). Thus, when implementing these data interfaces in Andre's receptacle, a POSITA would have been motivated to add additional data contacts on corresponding data regions in the receptacle to support bi-directional data transfer through the power converter.

214. A POSITA would have had a reasonable expectation of success in this modification because using more than four pins was known in the art, as explained above (*see also* EX1015, 84, 90 (*nine* pins)), and Andre already explains how to add

contacts to maintain the functional reverse mirror configuration (*see* EX1005, 9:18-20).

63.	**The socket structure of claim 62, wherein the tongue has chamfered corners on two sides of the tongue.**

215. Andre discloses this limitation. As explained above for limitations 34[c]-34[d], the front portion of the insulating member 222A containing inner electrode 212 is a *tongue*. §X.A.i (34[c]-34[d]). Andre further discloses that "[i]n some cases, the ***inner electrodes 212*** and 216 may include ***chamfered*** or tapered edges 234 for helping guide them into their respective gaps or openings." EX1005, 10:20-23, Fig. 3A. As shown below in Fig. 3A, the chamfered corners (highlighted in yellow) are on both the upper (red box) and lower (blue box) surfaces of the tongue.

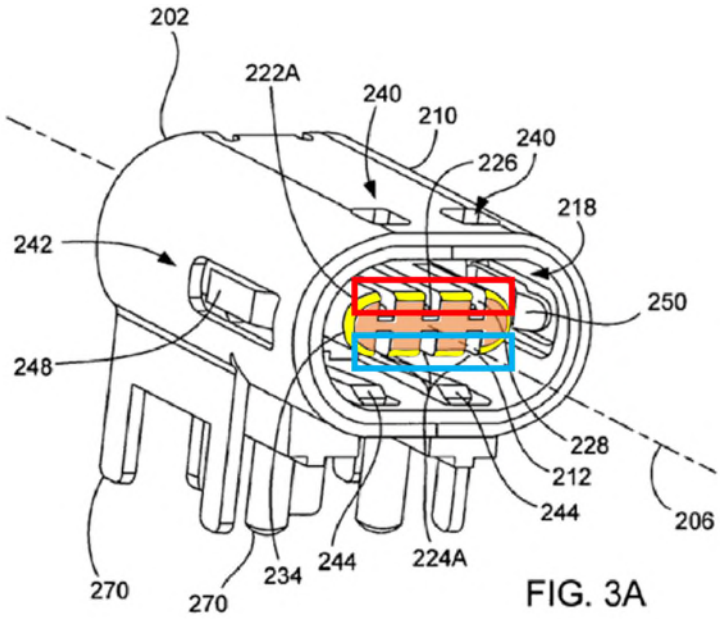


FIG. 3A

EX1005, Fig. 3A.

64.	**The socket structure of claim 63, wherein a tip of the tongue is tapered.**

216. Andre discloses this limitation. As explained, Andre's tongue is the front portion of the insulating member 222A containing inner electrode 212, and Andre further discloses that "[i]n some cases, the ***inner electrodes 212*** and 216 may include chamfered or ***tapered edges 234*** for helping guide them into their respective gaps or openings." EX1005, 10:20-23, Fig. 3A. A POSITA would have understood that the taper of the tongue to be at the tip (the outermost part) of the tongue to help guide the tongue into the insertion gap. Indeed, well known electrical connectors at the time had a tongue with a tapered tip. EX1015, 77.

65.	**The socket structure of claim 64, wherein a thickness of the tongue is less than third of a height of the connection slot.**

217. This claim limitation is identical to limitation 36 and is invalid in view of Andre for the same reasons. §X.A.ii (36). A POSITA would have had the same motivation and same reasonable expectation of success in implementing the tongue with less than 1/3 thickness of the connection slot, even with the additional requirements of intervening dependent claims 56, 58-64. Those intervening dependent claims do not change the analysis because the relative dimension of the tongue compared to the connection slot is determined by the desired thickness of the plug walls, which is not impacted by the intervening dependent claims. *Id*.

iv. Independent Claim 67 and Dependent Claims 68-75 Are Rendered Obvious by Andre

218. Independent claim 67 is substantially the same as claim 34, except (a) limitation 67[d] adds the requirement that the plug is normally and oppositely inserted "based on an operational state when the socket structure is connected to the plug"; (b) limitation 67[i] requires ***six*** contacts in each row; and (c) limitation 67[k] recites a "reverse mirror" configuration rather than "functional reverse mirror" configuration.

219. Differences (a) and (c) do not change my analysis. For limitation 67[d], Andre's plug is normally and oppositely inserted based on the operational state, as described for limitations 34[d], [j], [k], [m]. §X.A.i (34[d], 34[j], 34[k], 34[m]). For limitation 67[k], I interpret "functional reverse mirror" to be a type of "reverse mirror," and thus "reverse mirror is disclosed for the same reasons as "functional reverse mirror." EX1001, 6:48-51. Accordingly, limitation 67[k] is disclosed by Andre for the same reasons as described for limitation 34[j]. *See* §X.A.i (34[j]).

220. Regarding difference (b), relating to limitation 67[i] ("the at least one row of first contacts includes at least six contacts, the at least one row of second contacts includes at least six contacts"), this limitation is substantially similar to limitation 62 but recites the first and second contacts each include "at least six contacts" instead of "five contacts." But as I described for claim 62, it would have been obvious to implement Andre with six contacts on each side. §X.A.iii (62).

221. Accordingly, claim 67 is rendered obvious by Andre for the same reasons described for claims 34 and 62, as explained above.

222. Regarding dependent claims 68-73 and 75, these claims are identical to claims 57, 41, 39, 44, 61, 63, and 36, respectively, and are invalid for the same reasons. §§X.A.ii-iii.

223. Regarding claim 74, which recites "[t]he socket structure of claim 73, wherein a portion of the tongue opposite the plastic base is tapered," Andre discloses this claim for the same reasons I described for claims 63 and 64. §X.A.iii (63-64). Andre discloses a chamfered tongue, and the chamfers decrease the thickness (taper) a portion of the tongue opposite the plastic base (near the tip). *Id*.

v. Independent Claim 78 and Dependent Claims 79-86 Are Rendered Obvious by Andre

224. Independent claim 78 is identical to independent claim 67, except that claim 78 specifies that the socket's plastic base has a "metal housing" (78[a]) that there are "at least four" first and second contacts (78[i]), and the tongue of the socket is "at a central location" (78[m]-[n]). Andre discloses those limitations, as already described for claims 34, 39, 67, 70. §§X.A.i-ii, iv. Claim 78 is invalid for the same reasons.

225. Dependent claims 79-86 are the same as dependent claims 57, 41, 39, 44, 61, 63, 74, and 36, respectively, and are invalid for the same reasons. §§X.A.ii-iv.

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vi. Independent Claim 88 and Dependent Claims 89-96 Are Rendered Obvious by Andre

226. Claims 88-96 are substantially identical to claims 78-86 but without "metal housing" and are invalid for the same reasons. §X.A.v.

vii. Independent Claim 98 and Dependent Claims 99-106 Are Rendered Obvious by Andre

227. Claims 98-106 are substantially identical to claim 88-96 but without a limitation on the number of contacts and reciting "functional" in 98[j], and are therefore invalid for the same reasons. §X.A.vi.

viii. Independent Claims 114-120 Are Rendered Obvious by Andre

228. Claim 114 is substantially the same as claim 98 but without the "grooves" requirement, and is invalid for the same reasons. §X.A.vii.

229. Claims 115, 117-120 are invalid. All claims are substantially identical to claim 114 except (a) claims 115, 117, 119-120 remove the "functional reverse mirror" limitation; (b) claims 115, 117-120 require that "the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue" without reciting the word "simultaneously" (115[i]/117[i]/118[i]/119[i]/120[i]), and it would have been obvious for Andre to electrically connect on the top side, the bottom side, or both, depending on the inserted plug. §X.A.i (34[i]); and (c) claims 119 and 120 remove the word "respective" from certain limitations and refer to the tongue as in the "middle" of or

"centrally located" in the connection slot, which, if anything, broadens or does not substantially change the claim and does not change the obviousness in view of Andre. Claim 115 also requires "castellated" top/bottom tongue surfaces, which a POSITA would have understood to mean the top/bottom surfaces at the edge of the tongue opposite the plastic base have a series of openings between tower-like elements above the contacts, which Andre also renders obvious as I explained for claims 34 and 62. *See also, e.g.*, EX1005, Fig. 4A.

230. Claim 116 is substantially the same as claim 98 but without the "grooves" and "functional reverse mirror" requirements and adds limitations 116[g]/[i] requiring a portion of each of the first/second contacts to be proud of a top-most/bottom-most surface of the tongue. These additional limitations are met for the reasons described for claim 52—Andre's upper contact pads are positioned on top of and project beyond the top-most surface of the tongue (at the base of the upper grooves), and Andre's lower contact pads are positioned on top of and project beyond the bottom-most surface of the tongue (at the top of the lower grooves). §§X.A.ii (52), X.A.vii (98).

ix. Independent Claims 130-135 Are Rendered Obvious by Andre

231. Claims 130 and 133 are invalid because they are substantially the same as claim 34 or broader because (a) in claim 133, "functional reverse mirror" applies

only to “some” contacts” and (b) both claims recite “recesses” rather than “grooves,” and grooves are a specific type of recess. §X.A.i.

232. Claims 131-132 and 134-135 are invalid because they are substantially the same as claim 34 except they (a) broaden claim scope by removing the symmetrical connection slot requirements and, for claims 131-132, 134, removing the word “respective” from certain limitations and, in claims 134-135, applying the “functional reverse mirror” limitation to “some”/a “portion” of contacts; and (b) recite “simultaneously electrically connect on the top and the bottom side of the tongue,” which Andre does as described for claim 56. §§X.A.i, iii.

Samsung, EX1003, p. 138

B. Ground 2: Andre in view of Lufan Renders Obvious Claims 34-120 and 130-135, Under Patent Owner's Interpretation of the "Simultaneously" Terms and "Duplex Electrical Connection"

233. It is also my opinion that nearly all of the Challenged Claims, including those that expressly require a USB interface, are also rendered obvious in view of the combined teachings of Andre and Lufan, under Patent Owner's interpretations of "simultaneously" and "duplex electrical connection." In this Ground, I explain how a POSITA would have been motivated by the teachings of Andre to modify Andre's DC power connector to implement a socket with two USB interfaces, as disclosed in Lufan. The combination of Andre and Lufan discloses a USB electrical connector that renders obvious all of the Challenged Claims in this Ground—including the allegedly novel "simultaneously" limitations, as Patent Owner interprets them. §VII.A.

234. Andre and Lufan are analogous art. Both references relate to the same field of endeavor as the '307 patent—electrical connectors, including USB socket structures for electrical signal transmission of data and power to and from plugs. *See* EX1001, 1:30 ("The invention relates to an electrical connector…"). Each of the references relates to this same field of endeavor. *E.g.*, EX1005, 1:6-8 ("the present invention relates to improved techniques for DC connections"), 5:58-67 (describing data and power signal transmission), 5:14-17 (describing receiving USB inputs); EX1007, 4 ("This new utility model relates to a USB female structure, particularly

a dual-sided pluggable USB female structure," where the USB interface has data and power signals and the "USB female is also known as a USB socket").

235. Both Andre and Lufan are also specifically pertinent to the problem addressed by the '307 patent—convenience and reliability of socket-plug contact. *See, e.g.*, EX1001, 1:43-45 ("the USB plug has to be correctly inserted so that the connection terminals of the USB plug and the USB socket may be electrically connected together"), 1:54-55 ("The user often has to insert the USB plug twice in an inconvenient manner."). Indeed, Andre and Lufan each expressly describe the same problem, and, just as described in the '307 patent, solve that problem using double-sided sockets and/or plugs. *E.g.*, EX1005, 2:23-24 ("what is desired is an improved DC connector assembly that is easy to insert and extract"), Figs. 3-5 (disclosing double-sided socket and plug for electrical connector); EX1007, 1 (disclosing a "Dual-Sided Pluggable USB Female Structure" that "enabl[es] the USB plug to be inserted from both directions").

236. Given their similarities to each other and the '307 patent, a POSITA would have and could have combined Andre and Lufan to arrive at the Challenged Claims, with a reasonable expectation of success, as I further explain below.

i. Motivation to Combine

237. A POSITA would have been motivated to modify the receptacle 202 taught in Andre to implement a dual-sided USB interface with a reverse mirror

contact configuration as disclosed Lufan to arrive at the claimed "socket structure," with a reasonable expectation of success.

238. Andre relates to power assemblies for charging electronic devices, such as music players, cameras, and PDAs. EX1005, 4:11–14. These power assemblies improved upon known connectors with a streamlined and easy-to-use design. Andre achieves easy-to-use connectors by using a "thin-profile[]" reversible, symmetric receptacle, that allows a plug to be inserted in two orientations with minimal insertion force. *See* EX1005, Fig. 2B, 2C, 6:17-19, 3:49-53, 3:66-4:2. The receptacle specifically has a central tongue (elements 212/222A below) and "cross sectional shapes that are 0/180 symmetrical" to allow "0/180 degree insertion" of a plug 204 into a receptacle 202. EX1005, 3:66-4:2, 6:39-41.

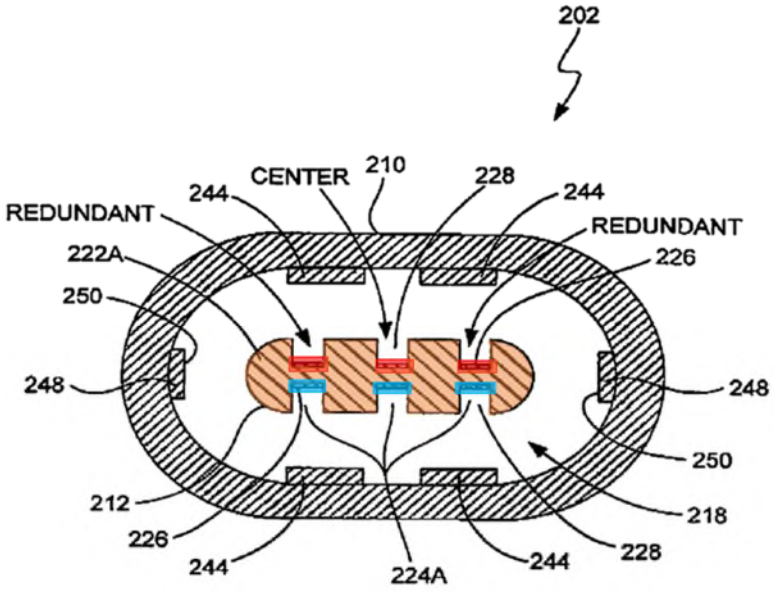


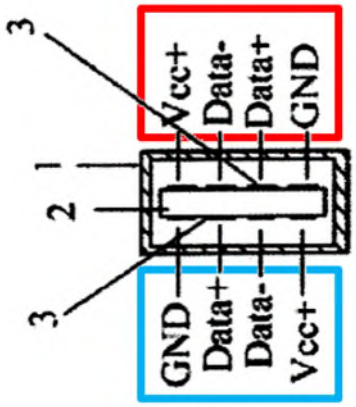
FIG. 4A

EX1005, Fig. 4A.

239. Andre describes that its improved structural connector can have a wide variety of electrical connections. For example, in addition to providing power to devices, the socket and plug can include a "variety of corresponding electrical contact regions" where any number of these contact regions may be "data contact region(s)" used for data transmission. EX1005, 5:58-67, 9:21-23 (contacts "may correspond to data and/or power contacts"). For example, Figure 4A (below) shows a row of contacts on an upper surface and a row of contacts on a lower surface, each of which has "[a]t least a center contact" "configured for data transmissions" and "[a]t least a pair of redundant contacts" "configured for power transmission." EX1005, 9:8-12, 9:23-25, Fig. 4A. In addition to data and power transmission, Andre explains that any of the power contacts are also each capable of "provid[ing] a return path for the driving current" (*e.g.*, GND). EX1005, 9:34-40, *see also id.*, 9:40-43 ("It should be noted that in some cases, the driving and return transmissions may be reversed in the inner electrode and outer conductive shell.").

240. Lufan has many overlapping characteristics with Andre's design. Like Andre, Lufan discloses an electrical connector intended to address cumbersome handling. And like Andre, Lufan specifically improves the usability of the connector with a symmetrical design with a tongue in the middle of a socket, which allows the plug "to be inserted from both directions," thus avoiding "the inconvenience of

having to reorient the USB plug when inserted in the wrong direction . . . .” EX1007, 1.



EX1007, Fig. 2.

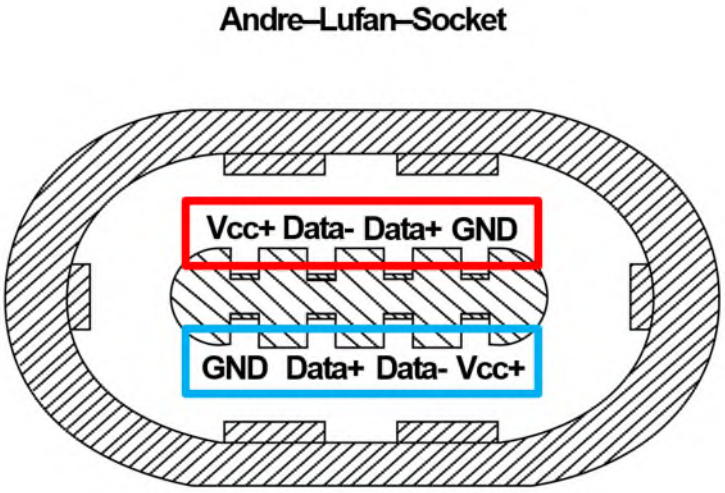
241. Lufan’s electrical connections are also similar to Andre’s. As shown in Fig. 2 above,[11] Lufan specifically implements a standard USB interface (VCC+, Data+, Data-, Ground) on each side of the plug—with power/ground as the outer contacts, and data+/data- as the central contacts. *See also* EX1014, 122. Lufan’s contacts also have a symmetrical layout: the four contacts on each side are “arranged in reverse order on either side” of the tongue such that one side has contacts 3 arranged in “order of power Vcc+, data- (data-), data+ (data+), and ground (GND),” while the other side has contacts 3 arranged in “order of ground (GND), data+

[11] The Figure 2 image quality has been cleaned up according to Lufan’s specification.

(data+), data- (data-), and power Vcc+." EX1007, 6. This contact configuration mirrors and reverses the order of the contacts across the two sides of the plug core to enable identical electrical performance regardless of which way a plug is inserted, just as Andre describes. *Id.*; §X.A.i (34[j]).

242. A POSITA would have had clear motivation to implement Andre's socket design by applying Lufan USB interfaces on either side of Andre's tongue. The combination would achieve an easy-to-use, streamlined connector requiring low insertion forces, as in Andre, with compliant USB interfaces, as in Lufan, as shown below in a modified version of Andre Fig. 4A (hereinafter, the "**Andre-Lufan-Socket**"). The combination would have been straightforward for a POSITA to implement and would simply require modifying Andre's preferred embodiment in Fig. 4A to (a) make one set of redundant power contacts provide connection to Ground rather than Vcc+, which Andre already teaches to do, *see* EX1005, 6:26-30, 9:34-40, *see also id.*, 9:40-43 ("It should be noted that in some cases, the driving and return transmissions may be reversed in the inner electrode and outer conductive shell."); and (b) to add one pair of central data contacts (one on the upper surface and one on the lower surface of Andre's tongue), for two total pairs of data contacts, corresponding to Data+ and Data- in the USB interface—again, which Andre already teaches to do. EX1005, 5:58-67 (any number of contact regions may be "data contact region(s)"), 9:21-23 (contacts "may correspond to data and/or power contacts"). As

in Andre, each pair of upper and lower contact pads would still be "connected" for redundancy and therefore identical. EX1005, 9:51-53.



243. A POSITA would have been motivated to make this combination for several reasons. For example, the combination would allow the elegant, easy-to-use design of Andre DC power connector to have a wider application to devices that could be powered via a USB interface. In view of the standardization of USB and its success in the market, a POSITA would have understood that modifying Andre to support a USB interface would expand the device's marketability to users who owned or were anticipating buying USB peripherals, and who would be interested in a compatible host device for charging and data transmission. Moreover, by 2009, the USB standard specifically could provide approximately 5V of DC power supply (*e.g.*, EX1014, 206), which falls within the range of Andre's disclosure—further motivating a POSITA to consider implementing Andre to provide a USB interface.

EX1005, 4:51-53 ("By way of example, the power converter may convert about 100 to about 240 volts AC, to about 0 to 50 volts DC and 0 to about 3 amps."). By 2009, the USB interface had been adopted by several companies for providing 5V power supply to small portable electronic devices. *See*, *e.g.*, EX1014, 199 ("Bus-powered hubs: Draw all of their power for any internal functions and downstream facing ports from VBUS on the hub's upstream facing port."); EX1015, 438 (5V of DC power); EX1038, 1; EX1039, 1.

244. Moreover, Andre itself motivates this modification by explaining that the socket could be configured for additional data contacts. *See*, *e.g.*, EX1005, 5:58-67 (any number of contact regions may be "data contact region(s)"), 9:21-23 (contacts "may correspond to data and/or power contacts"). Indeed, Andre expressly references implementing its connector to comply with USB, disclosing that its receptacle could be configured to receive "additional . . . data inputs (*e.g.*, Firewire, ***USB***, network, etc.)" via a socket on a power converter. EX1005, 5:14-17, Fig. 1. To implement this teaching of Andre, a POSITA would understand the receptacle would need to include additional pins to carry the additional data signals set forth in the USB standard.

245. And a POSITA looking to accomplish the goal of making Andre's connector compliant with the USB standard would have been particularly motivated to turn to Lufan, given the similarities between Andre's and Lufan's designs, which

both support data and power transmission. The preferred embodiments of both designs already include (a) a socket with a central tongue and symmetrical chambers around the tongue; (b) data contacts on both sides of the central tongue; (c) symmetrical data contacts; and (d) a reversible design to allow a plug to be inserted normally or oppositely without changing the devices functionality. *See, e.g.*, §§IX.A, C. Turning to Lufan would also have been consistent with Andre's teaching that a proper contact configuration should maintain reversibility, user convenience, miniaturization, and standard compatibility with USB 2.0 devices, even when "the electrical contacts are not electrically identical." EX1005, 3:55-59; *see also id.*, 6:33-35 (teaching that "the receiving and insertion element may include a linear array of contacts that have the same pin layout on both sides of the centerline"); §VIII.B.

246. A POSITA would have had a reasonable expectation of success in making this combination. Indeed, the combination is already described by Andre, which expressly discloses that its design can be modified by implementing a pair of power contacts as ground contacts and by adding pairs of redundant contacts that can be data pins in a linear array. EX1005, 1:66-2:2, 6:26-27. Andre, for example, explains that "[a]lthough only one pair of redundant contacts is shown [in Figure 4A], it should be appreciated that this is not limitation and that more than one pair of redundant contacts may be used." EX1005, 9:15-18. Andre also teaches exactly how to add the additional contacts, stating that when additional contacts are added,

they are "spaced apart and positioned laterally" relative to the other contacts "within substantially the same plane," thus maintaining the "linear array" of contacts, as shown in Figure 4A. EX1005, 9:5-8. These redundant contacts "may be dedicated to transmitting the same data, the same driving current, or the same returning current." EX1005, 6:28-30.

247. A POSITA would also have fully expected Lufan's data contact arrangement to work in Andre's design. Andre and Lufan have very similar overall structures and purposes. Lufan, like Andre, discloses a symmetrical female connector with a tongue (plug core 2) "located in the middle of the metal shell" and having two sides of contacts. EX1007, 1, 4. Lufan, like Andre, also expressly discloses that the corresponding plug can be reversibly "inserted from both directions." EX1007, 1. Lufan's socket is designed to implement the USB specification, which provided DC power to portable electronic devices at 5V, which is consistent with the DC power levels disclosed in Andre. *See* EX1005, 4:65-67 ("DC power requirement can vary from electronic device to electronic device (e.g., approximately 3 to 50 volts and 0.5 to 3 amps).").

248. The combination would have amounted to applying known elements (a double-sided USB interface on a central tongue in Lufan) to a known and flexibly designed electrical connector (Andre's socket and plug, both of which are capable of including additional data contacts) using known methods (linear data contact

arrangements in plastic sockets with symmetrical configurations) to yield predictable results (a reversible, double-sided USB connector). These changes would have been well within the skill of an ordinary artisan, without requiring undue experimentation.

ii. Independent Claim 34 Is Rendered Obvious by Andre with Lufan

249. In my opinion, Claim 34 is rendered obvious by the Andre-Lufan-Socket, as explained below.

34[pre]. A socket structure with duplex electrical connection, the socket structure comprising:

250. The Andre-Lufan-Socket discloses 34[pre], under Patent Owner's interpretation. §VII.B. The reversible USB Andre-Lufan-Socket is based on the structural elements of Andre's receptacle 202, with the addition of a pair of data contact pads disposed in a linear array with existing upper and lower contact pads 226 (*first and second contacts*) on the front portion of the insulating member 222A (*tongue*). *See* §X.B.i. The Andre-Lufan-Socket provides electrical connection to the upper and lower contact pads 226 (*first and second contacts*) on both sides of front portion of the insulating member 222A (*tongue*) at the same time, in the same manner as that explained above for Andre's receptacle 202. *See* §X.A.i (34[pre], 34[i]).

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34[a].	**a plastic base;**
34[b].	**a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;**
34[c].	**a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,**

251. The Andre-Lufan-Socket discloses limitations 34[pre]-34[c]. The Andre-Lufan-Socket is based on the structural elements of Andre's receptacle 202. *See* §X.B.i. This structural configuration discloses limitations 34[a]-34[c] for the same reasons as disclosed in §X.A.i (34[a]-34[c]). The Andre-Lufan-Socket comprises a rear portion of the insulating member 222A (*plastic base*), an opening 304 and gap 218 (*connection slot*) disposed around a front portion of the insulating member 222A (*tongue*) containing inner electrode 212, the tongue having grooves 228 on an upper surface (*first surface with grooves*) opposite grooves 228 on a lower surface (*second surface with grooves*). *See* §X.A.i (34[a]-34[c]). This Andre-Lufan-Socket is further configured to receive a plug having at least one row of connection terminals in the same way as receptacle 202. *See* §X.A.i (34[b]).

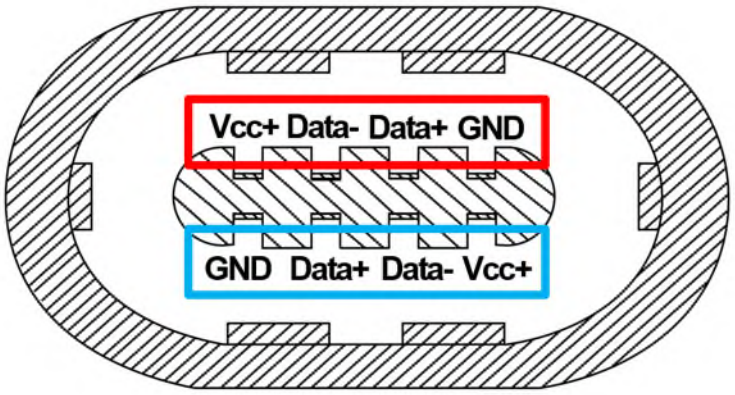
34[d].	**the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;**

252. The Andre-Lufan-Socket discloses limitation 34[d]. As I explained for limitations 34[a]-34[c], the structural configuration of the Andre-Lufan-Socket remains identical to Andre's receptacle 202. *See generally* §X.B.i. Implementing

Lufan's contact configuration in Andre's receptacle 202 does not change the reversibility feature of the resulting Andre-Lufan-Socket. Andre's receptacle 202 is already "configured for 0/180 degree insertion" of a plug 204 "while providing the same functionality from both positions." EX1005, 6:17-19. Lufan's USB female structure likewise "enabl[es] the USB plug to be inserted from both directions" by arranging the contacts on either side of the central plug core (*tongue*) in a functional reverse mirror configuration, as explained further below for limitation 34[j]. EX1007, 1, 4. Thus, implementing Lufan's contact configuration designed to allow reversibility in Andre's receptacle 202 that is already reversible does not change Andre's teachings of how the plug 204 interacts with the receptacle 202, as explained above in Ground 1. For example, the Andre-Lufan-Socket's chambers of the gap 218 and opening 304 (*connection slot*) on either side of the front portion of the insulating member 222A (*tongue*) have up-down and left-right symmetry to receive a plug inserted at both 0-degrees (*normally . . . inserted*) and at 180-degrees (*opposite inserted*). *See* § X.A.i (34[d]).

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Andre–Lufan–Socket



34[e].	**at least one row of first contacts separately arranged on the first surface of the tongue, wherein**
34[f].	**each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and**
34[g].	**at least one row of second contacts separately arranged on the second surface of the tongue, wherein:**
34[h].	**each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;**

253. The Andre-Lufan-Socket discloses limitations 34[e]-34[h]. As I explained for limitations 34[a]-34[c], the structural configuration of the Andre-Lufan-Socket remains identical to Andre's receptacle 202. *See* §X.B.i. The Andre-Lufan-Socket therefore comprises a linear array of upper and lower contact pads 226 (*row of first and second contacts*) disposed in the grooves 228 on either tongue surface, and renders obvious first and second respective wires (*first and second pins*) electrically connecting each upper and lower contact pad 226 to external components by extending out of the rear portion of the insulating member 222A (*plastic base*). *See* §X.A.i (34[e]-34[h]).

254. Given Andre's disclosure that the connection of each upper and lower contact pad 226 "may be done proximally, distally or somewhere in between" (EX1005, 9:51-53), it would have been obvious to a POSITA to connect the first and second wires (*first and second pins*) connecting the respective upper and lower differential pair of data contacts (*first and second contacts*) in the Andre-Lufan-Socket at a location outside of the rear portion of the insulating member 222A (*plastic base*), as suggested in Andre's Figure 5A, annotated below.

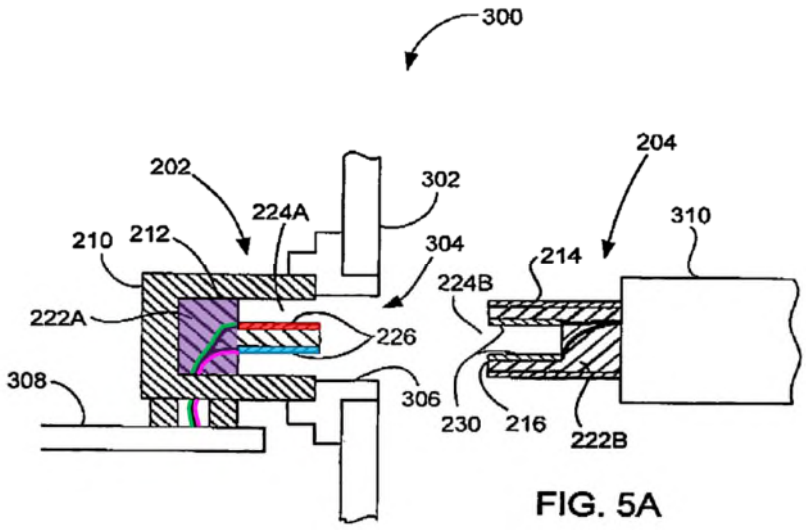


FIG. 5A

EX1005, Fig. 5A (modified).

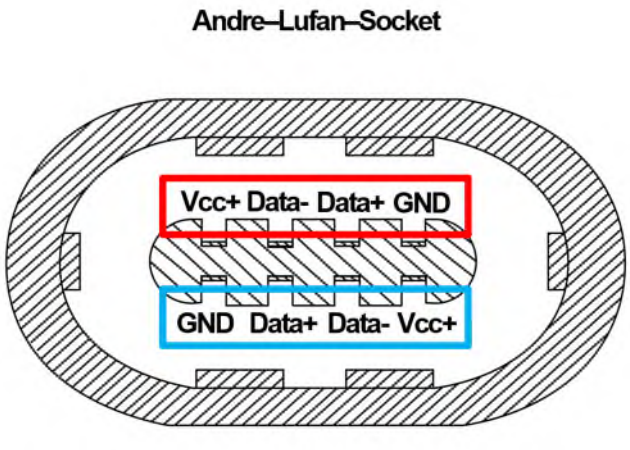
34[i].	**the socket structure is operative to simultaneously electrically connect via the first and second contacts;**

255. The Andre-Lufan-Socket discloses limitation 34[i] for the same reasons described for 34[pre], under Patent Owner's interpretation of the term. §VII.A. The Andre-Lufan-Socket is based on the structural elements of Andre's receptacle 202, with the addition of a pair of data contact pads disposed in a linear array with existing

upper and lower contact pads 226 (*first and second contacts*) on the front portion of the insulating member 222A (*tongue*). *See* §X.B.i. The Andre-Lufan-Socket provides electrical connection to the upper and lower contact pads 226 (*first and second contacts*) on both sides of front portion of the insulating member 222A (*tongue*) at the same time, in the same manner as that explained above for Andre's receptacle 202. *See* §X.A.i (34[i]).

34[j].	**the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:**

256. The Andre-Lufan-Socket discloses this limitation. The four upper contact pads 226 (*first contacts*) in the Andre-Lufan-Socket have a functional reverse mirror configuration relative to the four lower contact pads 226 in the Andre-Lufan-Socket. Both sets of contacts are linearly arranged as "VCC+," "DATA-," "DATA+," "GND" in reverse order, and each pair of upper and lower contact pads would still be "connected" for redundancy and therefore identical, EX1005, 9:51-53, such that the reverse of the upper contact sequence is the same as the lower contact sequence (*functional reverse mirror*). This configuration allows the Andre-Lufan-Socket to receive a plug at 0 degrees or 180 degrees (*two separate operational states*). *See* §X.B.i.



257. Indeed, Andre and Lufan both expressly describe a functional reverse mirror configuration of contacts on either side of a central tongue, enabling reversible insertion of a plug in two operational states. *See* §X.A.i (34[i]); EX1007, Fig. 2, 1 ("[a] plug core located in the middle of [a] metal shell" such that each side of the plug core has "***four metal conductive contacts***, which are ***arranged in reverse order on either side***.").

258. In this regard, the contacts in the Andre-Lufan-Socket track those described in the relevant embodiment of the '307 patent. Specifically, the '307 patent illustrates a "functional reverse mirror" configuration as a socket having two USB 2.0 interfaces—one on the top of a tongue 50, and another in reverse order on the bottom of tongue 50—allowing for a USB 2.0 plug to be inserted in normal or reverse orientations. Ex1001, 6:40-7:8 (describing each side of the socket as connecting to a USB 2.0 plug), Figs. 4A, 4B. "The one row of second terminals 70 and the one row of first terminals 60 have oppositely arranged serial numbers" such

that “the second terminals 70 on the bottom of the tongue have serial numbers 1, 2, 3, 4 from left to right, while the first terminals 60 on the top of the tongue have serial numbers 4, 3, 2, 1 from left to right.” EX1001, 6:24-32, Figs. 4A and 5A. As described in the ’307 patent, the illustrated plug and socket comply with prior art USB 2.0, such that the serial numbers 1, 2, 3, 4 refer to the standard USB interface: a power contact at one end, a ground contact at the other end, and two differential data contacts in the middle. EX1014, 122. The ’307 patent contact configuration therefore tracks that disclosed in the Andre-Lufan-Socket.

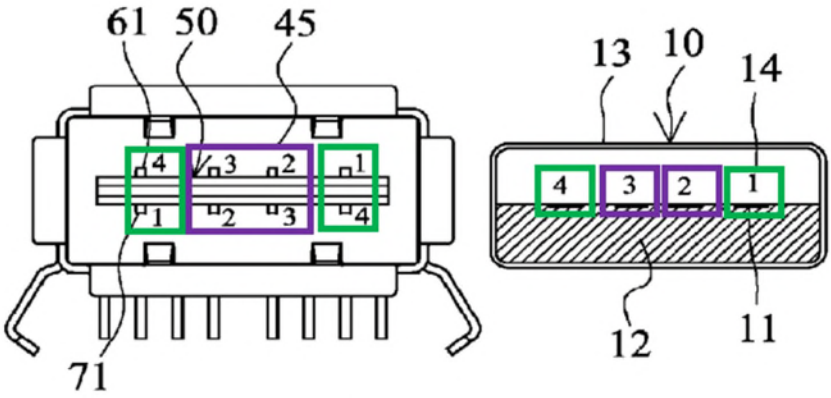


FIG. 4A

’307 patent, Fig. 4A; *see also id.*, Fig. 5A.

34[k].	**a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row**

	of connection terminals of the plug are electrically connected to the at least one row of second contacts and
34[l].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and**
34[m].	**a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and**
34[n].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.**

259. The Andre-Lufan-Socket discloses limitations 34[k]-34[n], for the same reasons described above for 34[d] and Ground 1. The Andre-Lufan-Socket design does not change the reversibility features of Andre. Andre's receptacle 202 is already "configured for 0/180 degree insertion" of a plug 204 "while providing the same functionality from both positions." EX1005, 6:17-19. Lufan's USB female structure likewise "enabl[es] the USB plug to be inserted from both directions" by arranging the contacts on either side of the central plug core (*tongue*) in a functional reverse mirror configuration, as explained for limitation 34[j]. EX1007, 1, 4. Thus, implementing Lufan's contact configuration designed to allow reversibility in Andre's receptacle 202 that is already reversible does not change Andre's teachings of how the plug 204 interacts with the receptacle 202, as explained above. §X.B.i. The Andre-Lufan-Socket's chambers of the gap 218 and opening 304 (*connection slot*) on either side of the front portion of the insulating member 222A (*tongue*) have

up-down and left-right symmetry to receive a plug inserted at both 0-degrees (*normally . . . inserted*) and at 180-degrees (*opposite inserted*), as described previously. *See* §§X.A.i (34[d], 34[k]-34[n]).

iii. Dependent Claims 35-55 Are Rendered Obvious by Andre with Lufan

260. In my opinion, claims 35-55 are also rendered obvious by Andre and Lufan, as explained below. Many of the dependent claims are rendered obvious for the same reasons as described for Ground 1, since modifying Andre's receptacle 202 to implement Lufan's contact configuration on the tongue does not alter the structural configuration of the tongue or how it engages with a plug in the resulting Andre-Lufan-Socket. §§X.B.i, X.A.ii.

35. The socket structure of claim 34, wherein the tongue only contacts an interior portion of the plug when the plug is inserted.

261. The Andre-Lufan-Socket discloses this claim for the same reasons as Ground 1. §§X.B.i, X.A.ii. The Andre-Lufan-Socket has a front portion of the insulating member 222A (*tongue*) containing inner electrode 212 that is configured to insert into and only contact an interior portion of the plug 204 when mated. §X.A.ii (35).

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36.	**The socket structure of claim 35, wherein a thickness of the tongue is less than a third of a height of the connection slot.**
37.	**The socket structure of claim 34, wherein a portion of each of the first contacts, in the at least one row of first contacts, is coplanar with a portion of the first surface of the tongue.**
38.	**The socket structure of claim 37, wherein a portion of each of the second contacts, in the at least one row of second contacts, is coplanar with a portion of the second surface of the tongue.**
39.	**The socket structure of claim 34, further comprising a metal housing at least partially covering the plastic base.**

262. The Andre-Lufan-Socket discloses or renders obvious these claims for the same reasons as Ground 1. §§X.B.i, X.A.ii. The Andre-Lufan-Socket renders obvious a front portion of the insulating member 222A (*tongue*) having a thickness that is less than a third of the height of the gap 218 and opening 204 (*connection slot*), *see* §X.A.ii (36); renders obvious that the contacts are coplanar, as claimed, *see* §X.A.ii (37, 38); and discloses an outer conductive shell 210 (*metal housing*) that at least partially covers the rear portion of the insulating member 222A (*plastic base*), *see* §X.A.ii (39).

40.	**The socket structure of claim 34, wherein the socket structure is a universal serial bus socket structure.**

263. The Andre-Lufan-Socket discloses this limitation. The Andre-Lufan-Socket is specifically designed to be a USB structure. *See* §X.B.i.

41.	**The socket structure of claim 34, wherein the tongue and the plastic base are integrally formed.**

264. The Andre-Lufan-Socket discloses this limitation for the same reasons as Ground 1. §§X.B.i, X.A.ii. The Andre-Lufan-Socket comprises an insulating member 222A that integrally forms the rear portion of the insulating member 222 (*plastic base*) and the front portion of the insulating member 222A (*tongue*). *See* §X.A.ii (41).

42.	**The socket structure of claim 34, wherein each contact of the first and second contacts is a portion of a respective terminal.**

265. The Andre-Lufan-Socket discloses this limitation for the same reasons described for Ground 1. *See* §§X.B.i, X.A.ii. In the Andre-Lufan-Socket, each of the upper and lower contact pads 226 is a portion of a *first terminal* (together, upper contact and first wire within plastic base) and a *second terminal* (together, lower contact and second wire within plastic base). Modifying Andre's receptacle 202 to implement Lufan's contact configuration does not alter the contact and terminal configuration. *See* §X.A.ii (42).

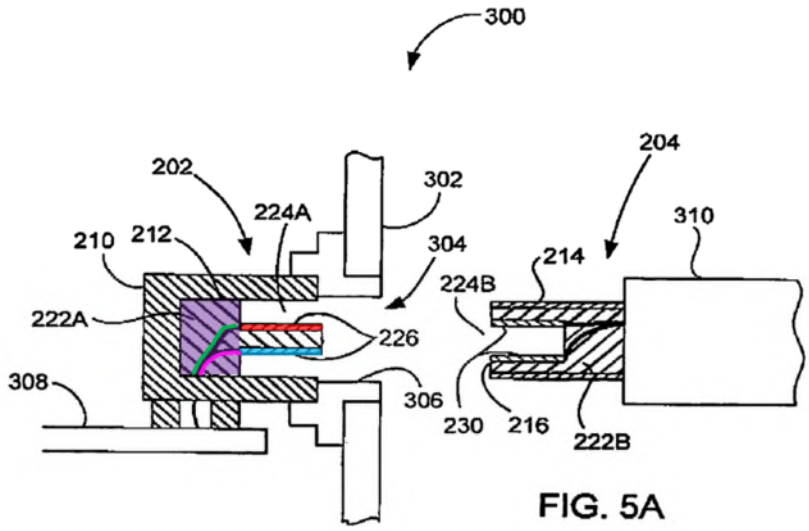


FIG. 5A

EX1005, Fig. 5A (modified).

43.	**The socket structure of claim 34, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**
44.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another, and at least two of the second contacts are not in electrical communication with one another.**
45.	**The socket structure of claim 34, further comprising a rear cover attached to the plastic base.**

266. The Andre-Lufan-Socket discloses these limitations for the same reasons described for Ground 1. §§X.B.i, X.A.ii.

267. For claims 43 and 45, for example, the Andre-Lufan-Socket, like the Andre socket, renders obvious upper and lower contact pads 226 (*first and second contacts*) electrically connected to respective wires (*first and second pins*) extending

out of the rear portion of the insulating member 222A (*plastic base*) through the rear portion of the outer conductive shell 210 (*rear cover*). *See* §§X.B.i, X.A.ii (43, 45).

268. For claim 44, in the Andre-Lufan-Socket, at least the Power and Ground upper contacts (*at least two of the first contacts*) and at least the Power and Ground lower contacts (*at least two of the second contacts*) are not in electrical communication with each other. *See* §§X.B.i, X.A.ii (44); *see also* §X.D.iii (44).

46.	**The socket structure of claim 45, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover.**
47.	**The socket structure of claim 45, wherein each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

269. Claims 46 and 47 are identical to limitation 43 and are disclosed by the Andre-Lufan-Socket for the same reasons. *See* §§X.B.i, X.B.iii (43), X.A.ii (46-47).

48.	**The socket structure of claim 34, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

270. The Andre-Lufan-Socket discloses this limitation, under Patent Owner's interpretation (§VII.A-B), for the same reasons described for 34[pre] and 34[i]. *See* §§X.B.i, X.A.ii (34[pre], 34[i]). The Andre-Lufan-Socket connects to a plug as disclosed in Andre, and, when connected, the Andre-Lufan-Socket provides electrical connection to the upper and lower contact pads 226 (*first and second contacts*) on both sides of the front portion of the insulating member 222A (*tongue*)

at the same time, in the same manner as that explained above for Andre's receptacle 202. *See* §§X.B.i, X.A.ii (34[pre], 34[i]).

49.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another.**
50.	**The socket structure of claim 34, wherein at least two of the second contacts are not in electrical communication with one another.**

271. These limitations are identical to the limitations in claim 44 and are therefore also disclosed by the Andre-Lufan-Socket. *See* §X.B.iii (44).

51.	**The socket structure of claim 34, wherein the at least one row of first contacts and respective first pins are located at ends of respective ones of a row of first terminals and the at least one row of second contacts and respective second pins are located at ends of respective ones of a row of second terminals.**

272. The Andre-Lufan-Socket renders claim 51 obvious for the same reasons described for claims 42 and 43. *See* §§X.B.i, X.B.iii (42, 43). At either end of the *first terminal* are upper contact pads (*row of first contacts)* and first wires (*first pins*) extending out of the plastic base, and at either end of the *second terminal* are lower contact pads (*row of second contacts)* and second wires (*second pins*) extending out of the plastic base.

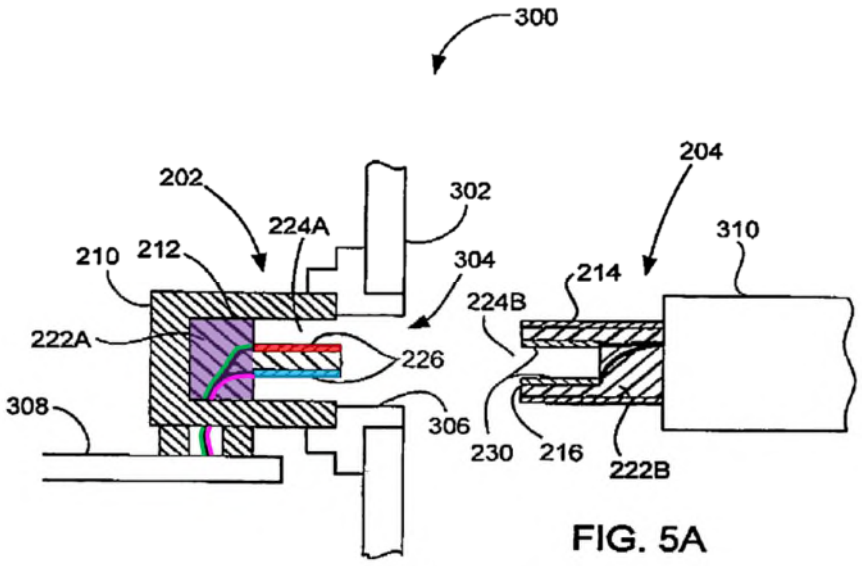


FIG. 5A

EX1005, Fig. 5A (modified).

52.	**The socket structure of claim 34, wherein a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue.**

273. The Andre-Lufan-Socket discloses this claim for the same reasons as described for Ground 1. *See* §§X.B.i, X.A.ii (52).

53.	**The socket structure of claim 34, wherein a portion of one of the first contacts is at least partially included in the first surface with grooves.**
54.	**The socket structure of claim 34, wherein a portion of one of the second contacts is at least partially included in the second surface with grooves.**

274. The Andre-Lufan-Socket renders obvious these claims for the same reasons as described for Ground 1. *See* §§X.B.i, X.A.ii (53, 54).

55.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 34 and the plug.**

275. The Andre-Lufan-Socket discloses a "duplex electrical connection" under Patent Owner's interpretation and is configured to receive a plug, as described in Andre. *See* §§X.B.i, X.A.ii (55), VII.B.

iv. Independent Claim 56 and Dependent Claims 57-66 Are Rendered Obvious by Andre with Lufan

276. Independent claim 56 is substantially the same as claim 34, §X.A.iii (56), and the differences do not substantively change my analysis of Andre in view of Lufan. As already explained for claim 34, the tongue of the Andre-Lufan-Socket has a top side and a bottom side which are simultaneously electrically connected to the plug, under Patent Owner's interpretation of the simultaneously limitations. §§X.B.ii (34[c], 34[i]), VII.A. Andre and Lufan therefore render claim 56 obvious for the same reasons described in claim 34.

277. Dependent claims 57-66 are analyzed further below.

57.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 56 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

278. Andre and Lufan disclose this claim, under Patent Owner's interpretation. The Andre-Lufan-Socket has a duplex electrical connection, as interpreted by Patent Owner (§VII.B), and connects to a plug, with simultaneous

electrical connections via the first and second contacts, as Patent Owner interprets the term (§VII.A), on either side of the tongue of the Andre-Lufan-Socket. *See* §X.B.iii (55, 48).

58.	**The socket structure of claim 56, wherein the tongue and the plastic base are integrally formed.**
59.	**The socket structure of claim 58, further comprising a metal housing at least partially covering the plastic base.**
60.	**The socket structure of claim 59, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.**
61.	**The socket structure of claim 60, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.**

279. Claims 58-60 are identical to claims 41, 39, and 44, and are invalid in view of Andre with Lufan for the same reasons. *See* §X.B.iii (41, 39, 44).

280. Claim 61 is also substantively the same as claims 53 and 54, which together recite a socket structure "wherein a portion of one of the first [second] contacts is at least partially included in the first [second] surface with grooves." Claim 61 is therefore invalid in view of Andre with Lufan for the same reasons as claims 53 and 54. §X.B.iii (53-54).

62.	**The socket structure of claim 61, wherein the at least one row of first contacts includes at least five contacts, and the at least one row of second contacts includes at least five contacts.**

281. Andre with Lufan render this limitation obvious.

Samsung, EX1003, p. 166

282. A POSITA would have been motivated to include additional pairs of Power contacts on the upper and lower surfaces of the tongue in the Andre-Lufan-Socket, consistent with Andre's preferred embodiment, which includes two Power contacts on each surface. *See* EX1005, Fig. 4A. Andre already teaches that any number of Power contacts could be added, so a POSITA would have had a reasonable expectation of success in doing so. EX1005, 9:15-20. A POSITA would have been motivated to add more Power contacts for the reasons Andre already discloses—redundancy and reliability. EX1005, 9:15-20 (describing additional "redundant" contacts). Should a Power contact fail, additional redundant contacts would maintain power to the connected device. Moreover, a POSITA would have been motivated to add the Power contacts adjacent to the current Power contacts in the Andre-Lufan-Socket to maintain the functional reverse mirror configuration of the Andre-Lufan-Socket, and thus the ability to insert the plug in any configuration.

283. A POSITA would also have been motivated to include additional data contacts to increase data transmission capacity using a single plug for user convenience, such as when "additional inputs" such as "Firewire, USB, network" are passed from the downstream "power converter" through the plug to the host. EX1005, 5:14-17; Fig. 1 (reproduced below).

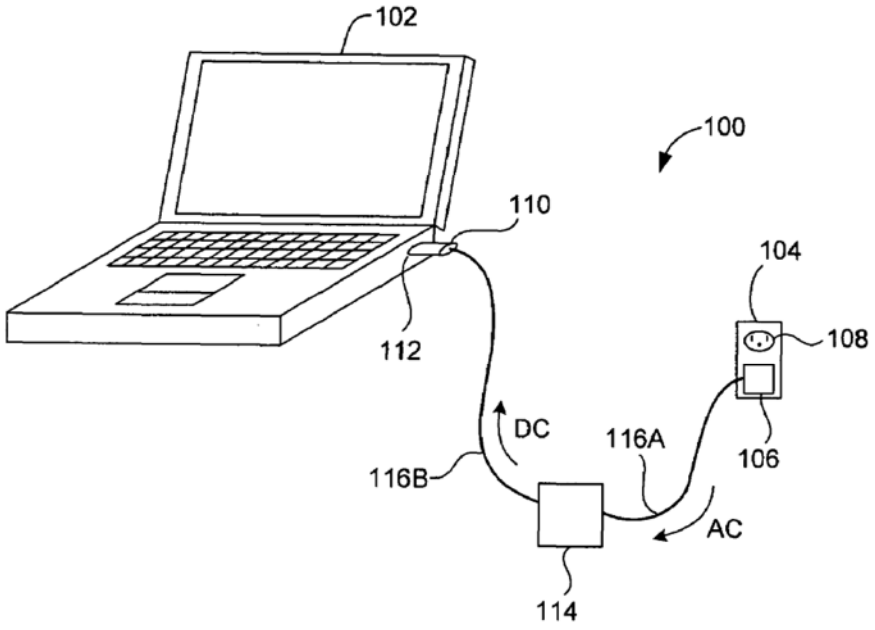


FIG. 1

EX1005, Fig. 1 (showing power converter 114 configured to receive external inputs, such as AC power or other "additional . . . data inputs," to provide to the DC receptacle 112).

284. A POSITA would have understood that if an "additional . . . data input," such as a USB, Firewire, or Ethernet cable, was plugged in to the power converter, the converter would necessarily require corresponding data conductors running through the cable and into the receptacle 112 to communicate that data to or from the host device 102. A POSITA would further recognize that these common interfaces inherently rely on multiple data lines—for example, USB uses differential data pairs, FireWire carries separate data/strobe signaling, and the 10/100BASE-T Ethernet networking standard requires two twisted pairs (four wires), all of which

would require receptacle 112 to include additional data contacts on the inner electrode 212 (*e.g.*, in addition to power/ground contacts, four data contacts are needed on the top surface of the tongue, and in a reverse mirror configuration (§X.B.ii (34[j])), four identically functioned data contacts are placed in reverse sequence on the bottom surface of the tongue). Thus, when implementing these data interfaces in the Andre-Lufan-Socket, a POSITA would have found it obvious to add additional data contacts on corresponding data regions in the Andre-Lufan-Socket to support bi-directional data transfer through the power converter.

285. A POSITA would have had a reasonable expectation of success in this modification because using more than four pins was known in the art, as explained above (*see also* EX1015, 84, 90 (*nine* pins)), and Andre already explains how to add contacts to maintain the functional reverse mirror configuration (*see* EX1005, 9:18-20).

63. The socket structure of claim 62, wherein the tongue has chamfered corners on two sides of the tongue.

286. The Andre-Lufan-Socket discloses this limitation for the same reasons described for Ground 1, as the Andre-Lufan-Socket implements the same socket structure as Andre, including its chamfered edges. §§X.B.i, X.A.iii (63).

64.	**The socket structure of claim 63, wherein a tip of the tongue is tapered.**

287. The Andre-Lufan-Socket discloses this limitation for the same reasons described for Ground 1, as the Andre-Lufan-Socket implements the same socket structure as Andre, including its tapered edges. §§X.B.i, X.A.iii (64).

65.	**The socket structure of claim 64, wherein a thickness of the tongue is less than third of a height of the connection slot.**

288. This claim is rendered invalid by the Andre-Lufan-Socket for the same reasons as described for Ground 1. §§X.B.i, X.A.iii (65).

66.	**The socket structure of claim 65, wherein the socket structure is a universal serial bus socket structure.**

289. The Andre-Lufan-Socket is a USB socket structure. §X.B.i.

v. Independent Claim 67 and Dependent Claims 68-77 Are Rendered Obvious by Andre and Lufan

290. Independent claim 67 is substantially the same as claim 34 (§X.A.iv (67)), except (a) limitation 67[d] adds the requirement that the plug is normally and oppositely inserted "based on an operational state when the socket structure is connected to the plug"; (b) limitation 67[i] requires ***six*** contacts in each row; and (c) limitation 67[k] recites a "reverse mirror" configuration rather than "functional reverse mirror" configuration.

291. Differences (a) and (c) do not change my analysis. For limitation 67[d], a plug is normally and oppositely inserted into the Andre-Lufan-Socket based on the

operational state, as described for limitations 34[d], [j], [k], [m]. §X.B.ii (34[d], 34[j], 34[k], 34[m]). For limitation 67[k], I interpret "functional reverse mirror" to be a type of "reverse mirror," and thus "reverse mirror is disclosed for the same reasons as "functional reverse mirror." EX1001, 6:48-51. Accordingly, limitation 67[k] is disclosed by the Andre-Lufan-Socket for the same reasons as described for limitation 34[j]. *See* §X.B.ii (34[j]).

292. Regarding difference (b), relating to limitation 67[i] ("the at least one row of first contacts includes at least six contacts, the at least one row of second contacts includes at least six contacts"), this limitation is substantially similar to limitation 62 but recites the first and second contacts each include "at least six contacts" instead of "five contacts." But as I described for claim 62, it would have been obvious to implement the Andre-Lufan-Socket with six contacts on each side. §X.B.iv (62).

293. Accordingly, claim 67 is rendered obvious by Andre and Lufan for the same reasons as described claim 34 and 62, as explained above.

294. Regarding dependent claims 68-73 and 75-77, those claims are identical to claims 57, 41, 39, 44, 61, 63, 36, 40, and 43, respectively, and are invalid for the same reasons. §X.B.iii-iv. For Claim 77, to the extent Patent Owner argues that the outer conductive shell 210 cannot be both the claimed "rear cover" and claimed "metal housing," it would have been obvious to make the outer conductive

shell 210 as two structures—a "metal housing" and a "rear cover." Andre itself states that the outer conductive layer can be "in one embodiment, the outer conductive shell 210 is formed from two layers 211A and 211B" to create rigidity. EX1005, 13:24-28. This disclosure would have motivated a POSITA to use two layers (which would constitute the claimed rear cover and metal housing) with a reasonable expectation of success.

295. Regarding claim 74, which recites "[t]he socket structure of claim 73, wherein a portion of the tongue opposite the plastic base is tapered," the Andre-Lufan-Socket discloses this claim for the same reasons I described for claims 63 and 64. §X.B.iv (63-64). Andre discloses a chamfered tongue, and the chamfers decrease the thickness (taper) a portion of the tongue opposite the plastic base (near the tip). *Id*.

vi. Independent Claim 78 and Dependent Claims 79-87 Are Rendered Obvious by Andre with Lufan

296. Independent claim 78 is identical to independent claim 67 (§X.A.v (78)), except that claim 78 specifies that the socket's plastic base has a "metal housing" (78[a]) that there are "at least four" first and second contacts (78[i]), and the tongue of the socket is "at a central location" (78[m]-[n]). Andre with Lufan discloses those limitations, as already described for claims 67 and 70. §X.B.v. Claim 78 is rendered invalid for the same reasons.

297. Dependent claims 79-86 are the same as dependent claims 57, 41, 39, 44, 61, 63, 74, and 36, respectively, and are invalid for the same reasons. §§X.B.iii-v.

298. Dependent claim 87 is also invalid as it recites a "universal serial bus socket structure," which the Andre-Lufan-Socket is (claim 40), with the additional limitations identical to claim 43, which the Andre-Lufan-Socket discloses, and as described for claim 77. §§X.B.i, X.B.iii (40, 43), X.B.v (77) (obviousness of separate structures for metal housing/rear cover).

vii. Independent Claim 88 and Dependent Claims 89-97 Are Rendered Obvious by Andre with Lufan

299. Claims 88-96 are substantially identical to claims 78-86 but without "metal housing" and are invalid for the same reasons, §X.B.vi. Claim 97 is invalid for the same reasons as Ground 1. §X.A.vi. Claim 97 specifically recites a combination of limitations from other claims and is rendered invalid by the Andre-Lufan-Socket for the same reasons as explained for those claims: 97[a]: USB structure (claim 40); 97[b]/[c]: contacts electrically connect to pins extending out of the plastic base through rear cover (claim 43); 97[d]: tongue contacts only an interior portion of plug (claim 35); 97[e]: contacts are a portion of terminals (claim 42); 97[f]: projections (claim 52); 97[g]/[h]: grooves include a portion of first/second contacts (claim 61), and as described for claim 77. §§X.B.iii-iv (40, 43, 35, 42, 52, 61), X.B.v (77) (obviousness of separate structures for metal housing/rear cover).

Samsung, EX1003, p. 173

viii. Independent Claim 98 and Dependent Claims 99-107 Are Rendered Obvious by Andre with Lufan

300. Claim 98-107 are substantially identical to claim 88-97 but without a limitation on the number of contacts and reciting "functional" in 98[j], and are therefore invalid for the same reasons. §X.B.vii.

ix. Independent Claim 108 and Dependent Claim 109 Are Rendered Obvious by Andre with Lufan

301. Claims 108-109 are invalid in view of Andre with Lufan. Claim 108 is substantially the same as claim 98, but adds the limitations of claim 35, 39, 40, 42, 43, and 61, all of which are disclosed by the Andre-Lufan-Socket, and claim 109 is substantially identical to claim 57, which is also disclosed by Andre with Lufan. §§X.B.iii-iv, X.A.ii-iii. *See also* §X.B.v (77) (obviousness of separate structures for metal housing/rear cover).

x. Independent Claim 110 and Dependent Claim 111 Are Rendered Obvious by Andre with Lufan

302. Claims 110-111 are invalid in view of Andre with Lufan. Claim 110 is substantially the same as claim 108, but adds the requirement that the simultaneous electrical connection is "on the top and the bottom side of the tongue" as well as the tapered and chamfered limitations. Andre with Lufan disclose those additional limitations, under Patent Owner's interpretation, as described for claims 56, 63, and 64. §§X.B.iii-iv (56, 63, 64), VII.A; *see also* §X.A.iv (67[k]). Claim 111 is substantially identical to claim 57, which is also disclosed by Andre with Lufan.

§X.B.iv (57). *See also* §X.B.v (77) (obviousness of separate structures for metal housing/rear cover).

xi. Independent Claim 112 and Dependent Claim 113 Are Rendered Obvious by Andre and Lufan

303. Claims 112 and 113 are invalid; they are substantially the same as claims 110 and 111, except they add the thickness limitation of claim 36, which is also disclosed by Andre and Lufan. §X.B.iv (57); *see also* §X.A.iv (67[k]). *See also* §X.B.v (77) (obviousness of separate structures for metal housing/rear cover).

xii. Independent Claims 114-120 Are Rendered Obvious by Andre and Lufan

304. Claim 114 is substantially the same as claim 98, §X.A.viii (114), but without the "grooves" requirement, and is therefore invalid for the same reasons. §X.B.viii (98).

305. Claims 115, 117-120 are invalid. All claims are substantially identical to claim 114, §X.A.viii (114), except (a) claims 115, 117, 119-120 remove the "functional reverse mirror" limitation; (b) claims 115, 117-120 require that "the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue" without reciting the word "simultaneously" (115[i]/117[i]/118[i]/119[i]/120[i]), and it would have been obvious for the Andre-Lufan-Socket to electrically connect on the top side, the bottom side, or both, depending on the inserted plug. §X.B.ii (34[i]); and (c) claims

119 and 120 remove the word "respective" from certain limitations and refer to the tongue as in the "middle" of or "centrally located" in the connection slot, which, if anything, broadens or does not substantially change the claim and does not change the obviousness in view of the Andre-Lufan-Socket. Claim 115 also requires "castellated" top/bottom tongue surfaces, which a POSITA would have understood to mean the top/bottom surfaces at the edge of the tongue opposite the plastic base have a series of openings between tower-like elements above the contacts, which Andre also renders obvious as I explained for claims 34 and 62. *See also, e.g.*, EX1005, Fig. 4A.

306. Claim 116 is substantially the same as claim 98 but without the "grooves" and "functional reverse mirror" requirements and adds limitations 116[g]/[i] requiring a portion of each of the first/second contacts to be proud of a top-most/bottom-most surface of the tongue. These additional limitations are met for the reasons described for claim 52—the upper contact pads of the Andre-Lufan-Socket are positioned on top of and project beyond the top-most surface of the tongue (at the base of the upper grooves), and the lower contact pads of the Andre-Lufan-Socket are positioned on top of and project beyond the bottom-most surface of the tongue (at the top of the lower grooves). §§X.B.iii (52), X.B.viii (98).

Samsung, EX1003, p. 176

xiii. Independent Claims 130-135 Are Rendered Obvious by Andre and Lufan

307. Claims 130-135 are invalid because they are substantially the same as claim 34 or broader because (a) in claim 133, "functional reverse mirror" applies only to "some" contacts" and (b) both claims recite "recesses" rather than "grooves," and grooves are a specific type of recess. §X.A.i.

308. Claims 131-132 and 134-135 are invalid because they are substantially the same as claim 34 except they (a) broaden claim scope by removing the symmetrical connection slot requirements and, for claims 131-132, 134, removing the word "respective" from certain limitations and, in claims 134-135, applying the "functional reverse mirror" limitation to "some"/a "portion" of contacts; and (b) recite "simultaneously electrically connect on the top and the bottom side of the tongue," which Andre does as described for claim 56. §§X.A.i, iii.

Samsung, EX1003, p. 177

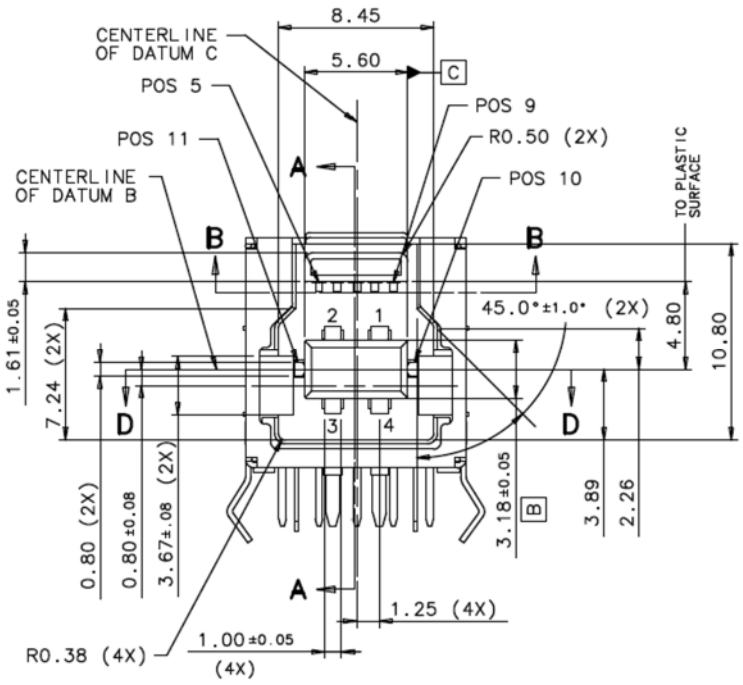
C. Ground 3: All Challenged Claims (34-120, 130-135) are further rendered obvious by Andre with Lufan and USB 3.0

309. As explained in Ground 2, the Andre-Lufan-Socket is a socket that complies with the USB standard. The socket would also have been combined with USB 3.0, which is analogous art—it relates to electrical connectors. EX1015. A POSITA would have had clear motivation to combine USB 3.0 with the Andre-Lufan-Socket to render obvious claims 36, 65, 75, 86, 96, 106, 112[x] ("thickness" limitations); claims 52, 97, 107, 116 ("proud"/"projections" limitations); and claim 115 ("castellated surface" limitations). A POSITA would have had clear motivation to refer to the USB standard, which was widely adopted as the standard guidelines for implementing USB sockets, such as the Andre-Lufan-Socket. By 2009, USB 3.0 was the most current USB infrastructure and included USB 2.0 backwards compatibility, as implemented in the Andre-Lufan-Socket. EX1015, 31.

i. Thickness Limitations: Claims 36, 65, 75, 86, 96, 106, 112[x]

310. The thickness limitation—"wherein a thickness of the tongue is less than a third of a height of the connection slot"—is further rendered obvious in view of the Andre-Lufan-Socket and USB 3.0. USB 3.0 shows known options for tongue dimensions that satisfy this limitation.

311. For example, USB3.0 discloses a known USB-B tongue less than 1/3 thickness of a connection slot. EX1015, 91 (receptacle tongue (3.18mm) less than 1/3 connection slot height (10.80 mm)).



EX1015, 91.

312. A POSITA would have made the Andre-Lufan-Socket with the same tongue-to-socket thickness ratio. A POSITA would have been motivated by the Andre-Lufan-Socket alone to adopt a tongue less than 1/3 thickness of a connection slot to increase the robustness of the connection. §X.A.ii (36), X.B.iii (36). A POSITA determining how to implement that structure would have looked to the USB 3.0-B receptacle because, similar to the Andre-Lufan-Socket, it has a USB 2.0 interface (1-2-3-4) across two sides of a tongue. EX1015, 91. A POSITA would have had a reasonable expectation of success in view of the widespread implementation of these designs. Indeed, decades-old teachings of how to make symmetrical connectors with a tongue less than 1/3 thickness of the connection slot already

existed by 2009. For example, U.S. Patent No. 5,741,148, issued April 21, 1998, discloses a tongue with a thickness of 221µm and an upper/lower layers with a thickness of 304.8µm, which would render the tongue to have a thickness of less than 1/3.

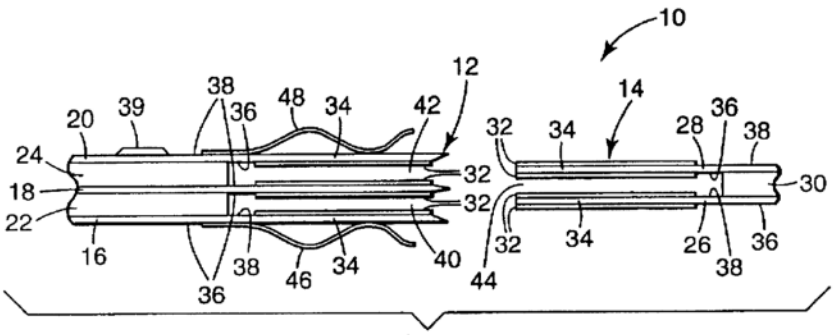
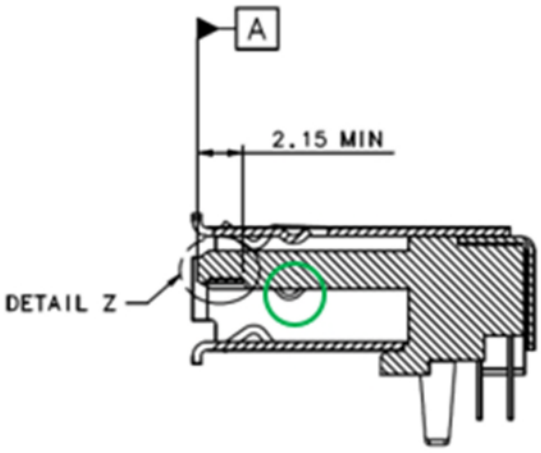


Fig. 1

EX1032, Fig. 1, *see also id*., 21:6-22:5.

ii. <u>"Proud"/"Projections" Limitations: Claims 52, 97[f], 107[f], 116[g], 116[i]</u>

313. Claim 52 recites "a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue." This limitation is obvious in view of the Andre-Lufan-Socket and USB 3.0, which also describes contacts that project slightly above the surface of a tongue.



SECTION J-J

EX1015, 77. A POSITA would have been motivated to use these design details when implementing the Andre-Lufan-Socket. Andre and Lufan do not require a specific shape of contact that could be used in the socket, and USB 3.0 would have been a clear choice, among a finite set of options, to identify implementation details for making the socket with a reasonable expectation of success. Moreover, slightly protruding contacts would be beneficial to the overall design of the socket, as they would further ensure a strong connection point with the inserted plug, a problem that both Andre and Lufan seek to solve. §X.B.i; EX1032, Fig. 10, 17:34-37 ("bumps" on contacts for "concentrating contact force").

iii. Castellated Surfaces: Claim 115

314. USB 3.0 also discloses Micro-USB with castellated tongue surfaces, providing a POSITA reasonable expectation of success using such surfaces. EX1015,

96. Such surfaces would have been a predictable design choice among a finite set of options available to a POSITA, with the benefit of enhancing connection interfaces.

Samsung, EX1003, p. 182

D. Ground 4: Lufan with Yuming and Lee Renders Obvious Claims 34-51, 53-96, 98-106, 108-114, 117-120, and 130-135, Under Petitioner's or Patent Owner's Interpretation of the "Simultaneously" Terms, "Duplex Electrical Connection," and "Functional Reverse Mirror"

315. It is my opinion that the Claims 34-51, 53-96, 98-106, 108-114, 117-120, 130-135 would have been obvious in view of Lufan with Yuming and Lee under Petitioner's or Patent Owner's claim interpretations (§VII).

316. Lufan, Yuming, and Lee are all analogous art. Lufan and Yuming both relate to the same field of endeavor as the '307 patent—electrical connectors, including USB socket structures for electrical signal transmission of data and power to and from plugs. *See* EX1001, at 1:30 ("The invention relates to an electrical connector…"); EX1007, 4 ("This new utility model relates to a USB female structure, particularly a dual-sided pluggable USB female structure," where the USB interface has data and power signals and the "USB female is also known as a USB socket"); EX1008, 4, 7 ("this utility model proposes an electrical connector assembly 100" for gaming devices such as PS2). Lee relates to the same field and is specifically directed to USB electrical connectors. EX1010, 1:8-10 ("This invention relates to electronic connectors, and more particularly to reduced-height Universal-Serial-Bus (USB) connectors.").

317. Moreover, Lufan, Yuming, and Lee are also specifically pertinent to the problem addressed by the '307 patent inventors—convenience and reliability of

socket-plug contact. *See, e.g.*, EX1001, 1:43-45 ("the USB plug has to be correctly inserted so that the connection terminals of the USB plug and the USB socket may be electrically connected together"), 1:54-55 ("The user often has to insert the USB plug twice in an inconvenient manner."). Indeed, Lufan and Yuming both expressly describe the same problem, and, just as described in the '307 patent, solve that problem using double-sided sockets and/or plugs. *E.g.*, EX1007, 1 (disclosing a "Dual-Sided Pluggable USB Female Structure" that "enabl[es] the USB plug to be inserted from both directions"); EX1008, Figs 1-7, 6 (disclosing a double-sided plug and socket that has "the advantage of . . . more secure connection structure formed by the mating of a socket connector and a plug connector. This makes installation convenient, allows for smooth electrical signal transmission, and ensures a long service life."). Lee is likewise pertinent to the convenience and reliability of socket-plug contact. EX1010, 3:6-12 ("What is desired is a slim USB connector with reduced vertical wobble. A slim USB connector that more securely fits into a standard Female USB connector is desired. A slim USB connector with a more secure fit is desired that can be integrated with the circuit board containing the flash memory chip is also desirable.").

318. Given their similarities to each other and the '307 patent, a POSITA would have and could have combined Lee with Lufan and Yuming to arrive at the

Challenged Claims, with a reasonable expectation of success, as I further explain below.

i. Motivation to Combine

319. Lufan discloses a USB socket with a central tongue 3 ("plug core") with two symmetric sides of "metal conductive contacts." EX1007, 1, Fig. 2. Lufan's two sides of contacts creates two USB interfaces in "reverse" order, as shown below. EX1007, 6, Fig. 2. The socket's symmetry allows for reversible insertion of a plug. EX1007, 1.

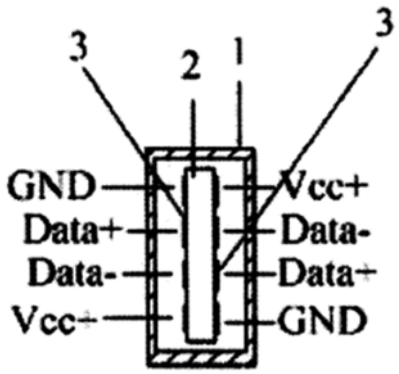


Fig. 2

EX1007, Fig. 2.

320. Yuming discloses a similar socket structure with particular application for "X-Box" and "PS2," EX1008, 4, both of which had USB connectors in 2009. EX1036; EX1037. Like Lufan, Yuming's socket has a central tongue with two groups of contacts (on upper/lower portions of the tongue). EX1008, 7, Fig. 5. The contacts on each side of Yuming's tongue are "electrically connected" to the terminals on each side of Yuming's double-sided plug. EX1008, 8.

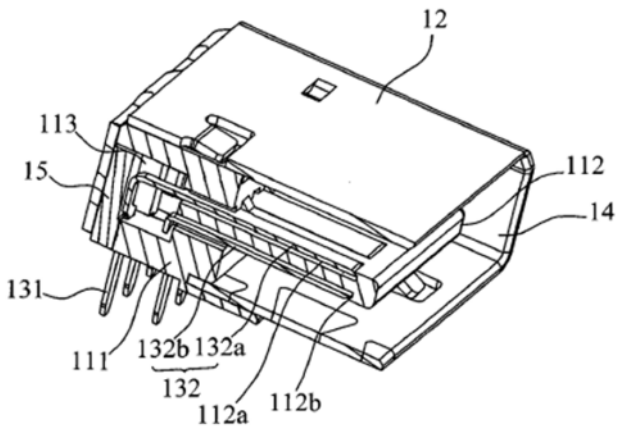
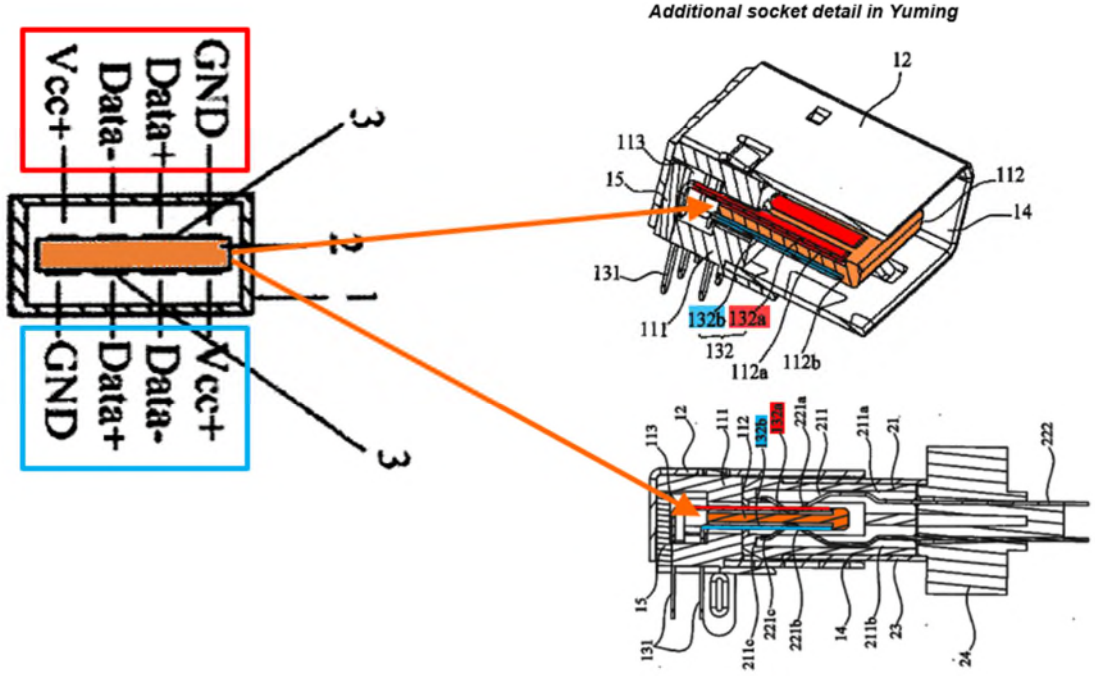


Fig. 5

EX1008, Fig. 5.

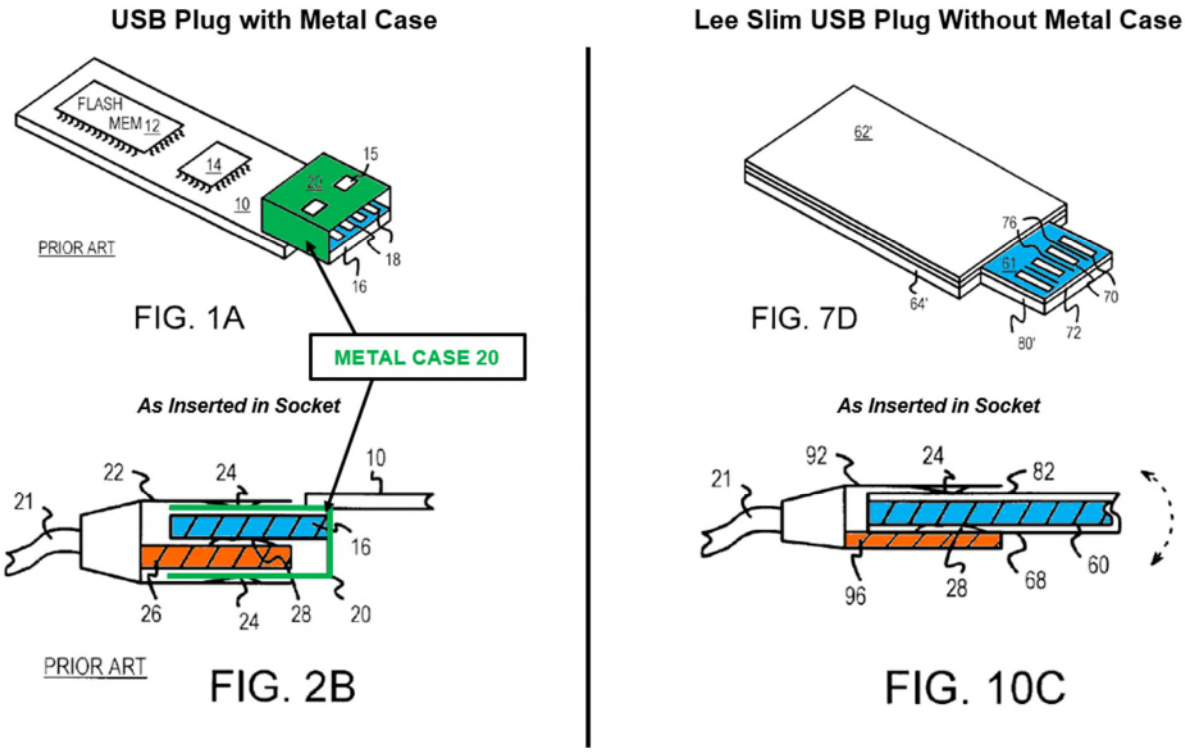
321. In view of these similarities, a POSITA would have been motivated to implement Lufan with the details of Yuming. The resulting combination shown below ("**Lufan-Yuming-Socket**") simply adds well-known details from Yuming to the existing Lufan structure, including (a) the relationship between the tongue and body of the socket, (b) the topology of the tongue and method for affixing contacts; (c) the terminals and pins for connecting the contacts to the host; and (d) the active electrical connections on both sides of the socket. A POSITA would have had a reasonable expectation of success in making this combination, which would have been a straightforward implementation consistent with ubiquitous sockets in the USB field.

Lufan–Yuming–Socket



322. It would have been further obvious to combine the two active sides of contacts in the Lufan-Yuming-Socket, with multiple USB plugs of the type in Lee. Lee discloses a USB plug that improves on "cumbersome" and expensive standard USB plugs and can be easily used with the Lufan-Yuming-Socket. Specifically, in the 2000s, typical USB plugs (below, top left) had a single row of four USB contacts (Power, D+, D-, Ground) that were inconveniently surrounded by a "metal case" (element 20). EX1010, 1:41-47. That metal case left an empty gap between the plug (element 16), such that when the plug was electrically mated with a socket (below, bottom left), not only did the plug have to be inserted on top of the socket's tongue (element 26), but the side of the metal case with the gap also had to be inserted ***below***

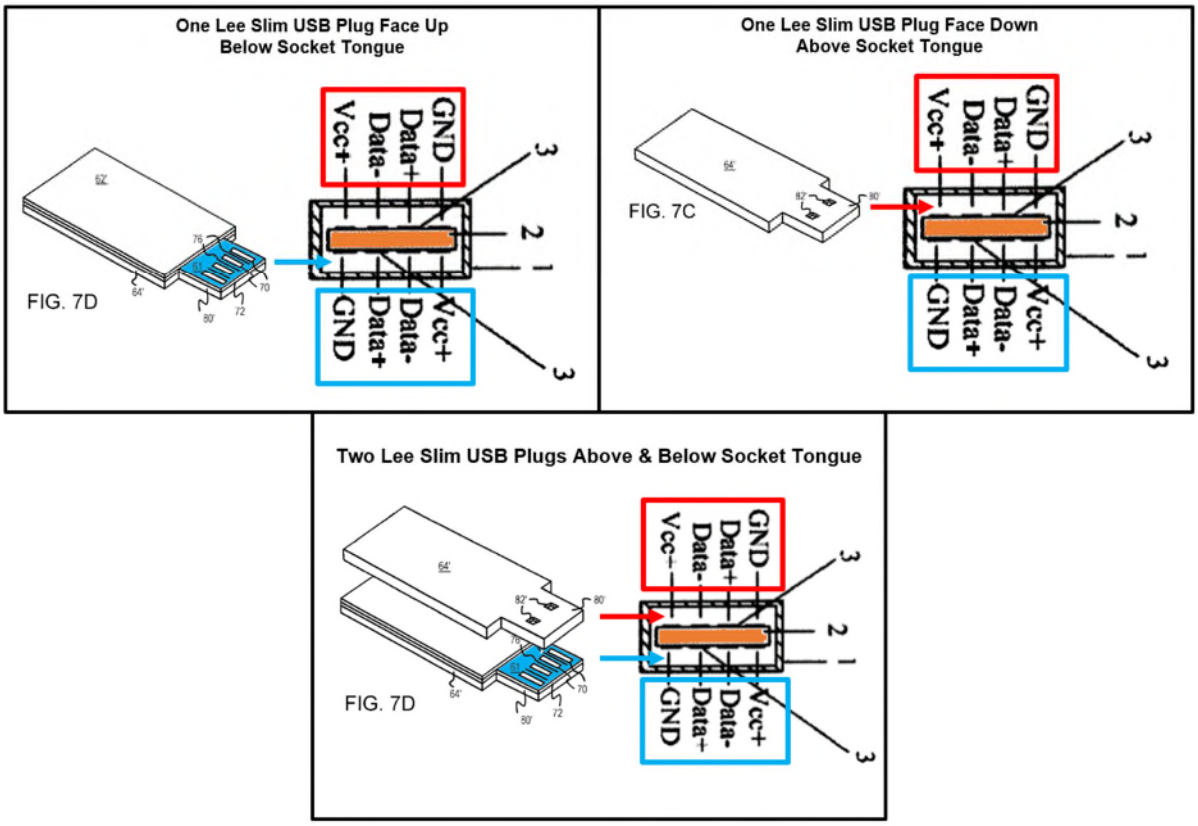
the socket's tongue, resulting in cumbersome handling for a user. EX1010, 2:19-28. Lee's new USB plug (below right) solves these issues by removing the metal case entirely. The resulting plug ("**Lee Slim-USB-Plug**") maintains the same electrical contacts (Power, D+, D-, Ground) as the standard USB plug but allows that plug to fit neatly above the standard USB 2.0 tongue without requiring insertion of a metal case below the tongue. EX1010, Fig. 10B, 7:51-58, 8:14-21. The resulting design is more streamlined and easier to handle.



323. The Lee Slim-USB-Plug is therefore designed to have the same electrical contacts as the standard USB interface and to fit in the same structure as a standard USB socket. As such, the Lee Slim-USB-Plug would have easily worked with the Lufan-Yuming-Socket—both structurally and electrically. Indeed, the

Lufan-Yuming-Socket is specifically designed to create ***two*** standard USB sockets on either side of a double-sided tongue, ***either*** or ***both*** of which can mate with a standard USB interface. EX1007, 4-5 ("By adopting this structure, there is no need to change the existing USB male connector structure, allowing the USB male connector to be inserted into the USB socket from both directions."); EX1007, 6 ("Both sides of the plug core 2 have metal contacts 3, with the arrangement order of the contacts on each side being reversed.").

324. As illustrated below, if a Lee Slim-USB-Plug is inserted face up (below, top left) it would structurally and electrically mate with the contacts on the bottom of the tongue in the Lufan-Yuming-Socket; if a Lee Slim-USB-Plug is inserted face down (below, top right), it would structurally and electrically mate with the contacts on the top of the tongue in the Lufan-Yuming-Socket; and if two Lee Slim-USB-Plugs were simultaneously inserted on both sides of the socket, they would structurally and electrically mate with contacts on both sides of the tongue in the Lufan-Yuming-Socket (below, bottom).



325. A POSITA would have been specifically motivated to use the Lufan-Yuming-Socket with either one or two plugs. Lee itself describes that the new reduced height plug would "allow more devices and/or more memory chips to be powered." EX1010, 8:30-32. Indeed, at that time, ordinary artisans were looking for ways to connect two plugs, for example attached to two memory cards, into sockets in a small-sized area. *E.g.*, EX1030, 3 ("However, providing multiple types of socket apparatuses to accommodate different kinds of input/output packages, such as memory cards and hard disks, within a single small computer device hinders efforts to reduce the size and weight of the computer device."). Multiple references solved this problem with a socket structure that allowed for simultaneous insertion of

multiple plugs. For example, CN201174439Y ("Guangmin") discloses inserting two memory cards (20 and 30) into a single socket to increase the amount of available memory while saving space. *See* EX1029, 11 ("In addition, compared to two separate single-card connectors, the flash memory card connector in this embodiment occupies less space, which makes assembly of the terminal devices easier and reduces the overall size of the terminal devices.").

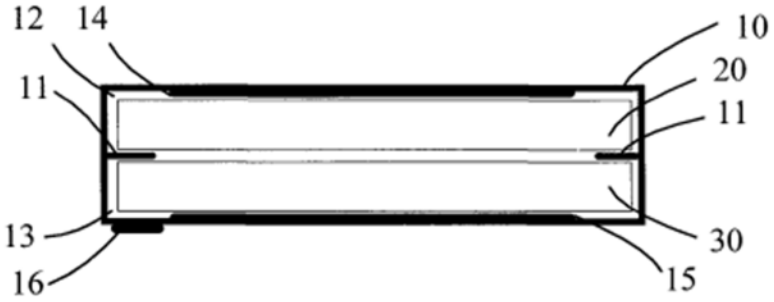


Fig. 2

EX1029, Fig. 2; *see also* EX1030, Figs. 4-5 (disclosing a similar structure). Guangmin discloses contacts on the upper and lower surfaces of the socket structure (14 and 15), but it would have been well understood by a POSITA that the same principle applies to the Lufan-Yuming-Socket, which has multiple rows of contacts positioned on two sides of a central tongue. For example, TWM327587U ("Ruidu") discloses simultaneous connection of two devices to two sets of contacts on either side of a tongue, one for USB and one for eSATA. EX1031, 10 ("this invention can provide a means for the electrical connector socket to simultaneously connect one eSATA device and one USB device through this invention.").

Samsung, EX1003, p. 191

326. A POSITA would have had a reasonable expectation of success in making the combination. As I explained, Lee is specifically designed to have the same dimensions as a standard USB 2.0 plug, and the Lufan-Yuming-Socket is specifically designed to receive one or two standard USB 2.0 plugs, on either side of the socket's tongue. Mating the Lee Slim Plug with the Lufan-Yuming-Socket would require, at most, small mechanical tweaks well known to a POSITA and already contemplated by the prior art references themselves. For example, the Lee Slim-USB-Plug already describes that its metal contacts could be flat or, similar to the plug in Yuming, "can have a bend in them to produce a spring action to provide better contact with metal contacts on a female USB connector." EX1010, 4:1-8. As another example, Lee discloses preventing "wobble" caused by additional space created above the plug without a metal case by using dividers 68 or depressions. EX1010, 3:62-67, 4:22-29, 4:35-37. But Lee explains that the dividers are optional and can be "remov[ed]" or modified in height if needed. EX1010, 8:1-4. Lee describes using "metal springs" in the female USB socket to engage with its depressions, EX1010, 6:56-57; those metal springs were likewise well known in the art in typical USB connectors (*see* EX1010, Fig. 1B) and could easily have been used with the Lufan-Yuming-Socket. The additional reliability created by the springs is consistent with the purpose of Yuming. *See* EX1008, 4 ("This utility model addresses the deficiencies present in conventional technology and aims to

provide an electrical connector assembly, which consist of a socket connector and a plug connector that form a more solid connection structure when mated. This facilitates easy installation, ensures smooth electrical signal transmission, and extends service life.").

327. For all of these reasons, it is my opinion that a POSITA would have combined the Lufan-Yuming-Socket with the Lee Slim-USB-Plug with a reasonable expectation of success. Further, Claim 34 is rendered obvious in view of the combination, under Petitioner's or Patent Owner's interpretation of the "simultaneously" terms, "duplex electrical connection," and "functional reverse mirror," as explained below. §VII.

ii. Independent Claim 34 Is Rendered Obvious by the Lufan-Yuming-Socket and Lee

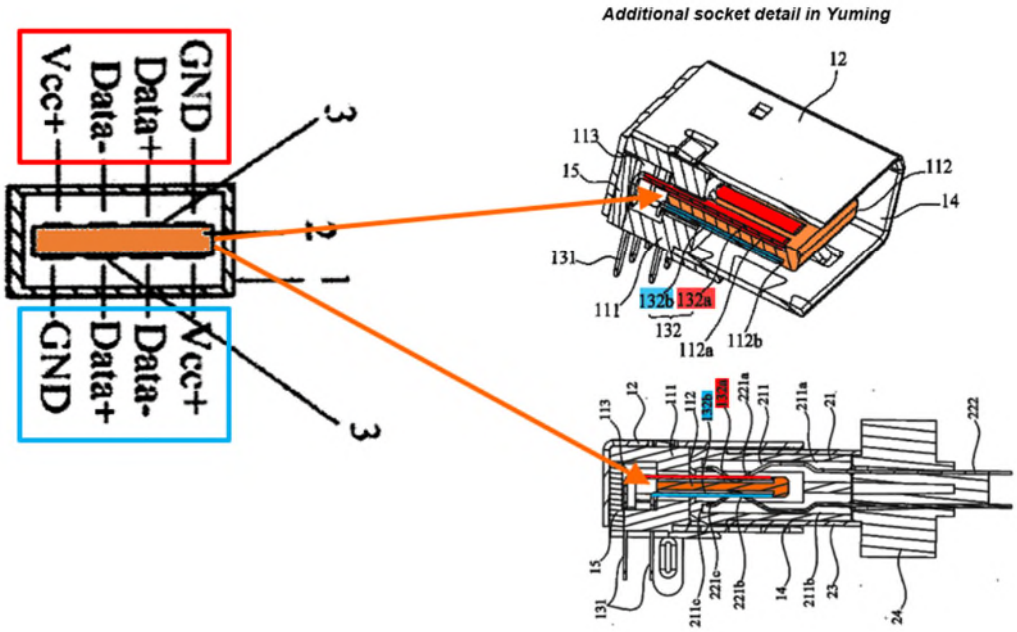
34[pre]. A socket structure with duplex electrical connection, the socket structure comprising:

328. The Lufan-Yuming-Socket discloses 34[pre], under either Patent Owner's or Petitioner's interpretation of the phrase "duplex electrical connection." *See* §VII.B. Specifically, the reversible Lufan-Yuming-Socket allows ***two*** Lee Slim-USB-Plugs to be inserted, one on either side of the socket. §X.D.i.

34[a]. a plastic base;

329. The Lufan-Yuming-Socket has an "insulating" base, shown as element 111 in Yuming Figure 5 (below right). *See* EX1008, 7 ("insulating seat 11 consists of a main body portion 111").

Lufan–Yuming–Socket



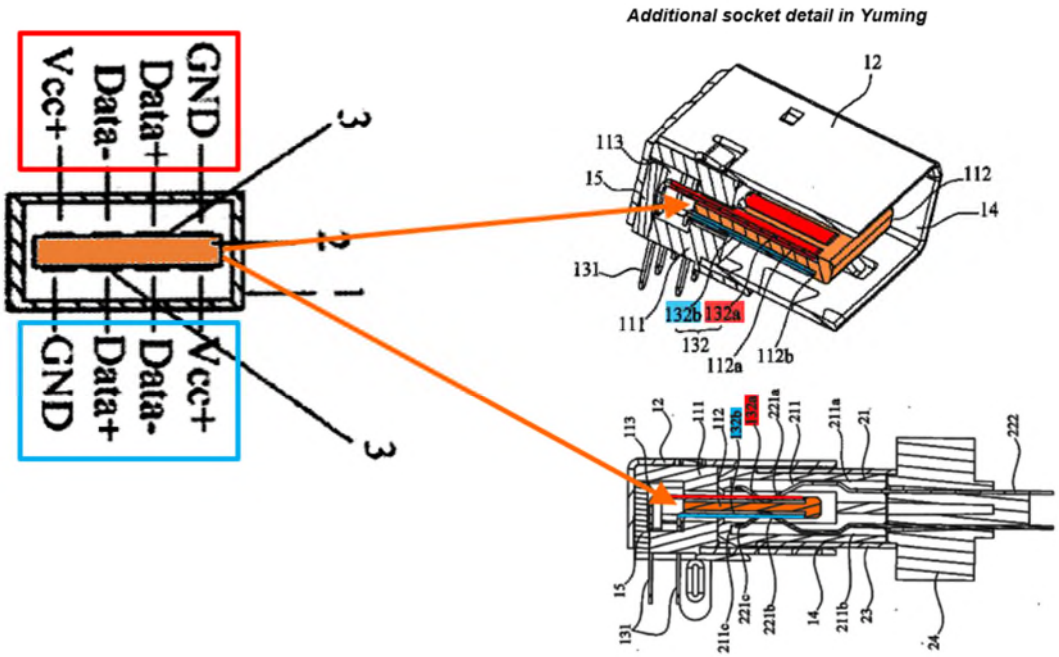
330. Yuming does not expressly disclose that the insulating seat is "plastic" as recited, but a POSITA would have been motivated to select plastic to making element 111, with a reasonable expectation of success. Plastic indeed was an obvious, common electrically insulating material for sockets and one of the most cost-effective and manufacturable materials used before 2009, as reflected in several

references. *See, e.g.*, EX1005, 13:31-33 ("The insulating members may be molded from various dielectric materials including plastics such as ABS and/or nylon.").

34[b].	**a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;**

331. The Lufan-Yuming-Socket discloses this limitation. The Lufan-Yuming-Socket allows insertion of a plug in the area (gap 14) (*connection slot*) around the central tongue, where the gap is also in front of the insulating base (element 111) (*plastic base*). As shown, Yuming (below, right) provides further details for implementing Lufan's socket (below, left) as the Lufan-Yuming-Socket. Yuming shows that the opening end of the socket around the tongue (*see* gap 14 around tongue 112) is in front of the insulating base (element 111).

Lufan–Yuming–Socket



332. Moreover, each Lee Slim-USB-Plug has a row of contacts (*row of connection terminals*), to be inserted into the Lufan-Yuming-Socket. EX1010, Figs. 7D, 10B, 7:51-58, 8:14-21.

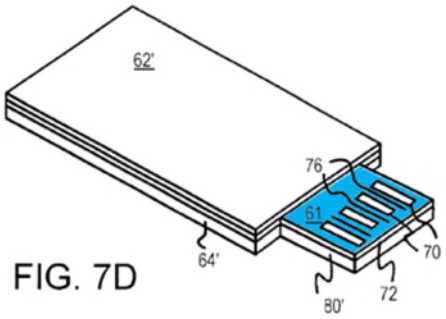


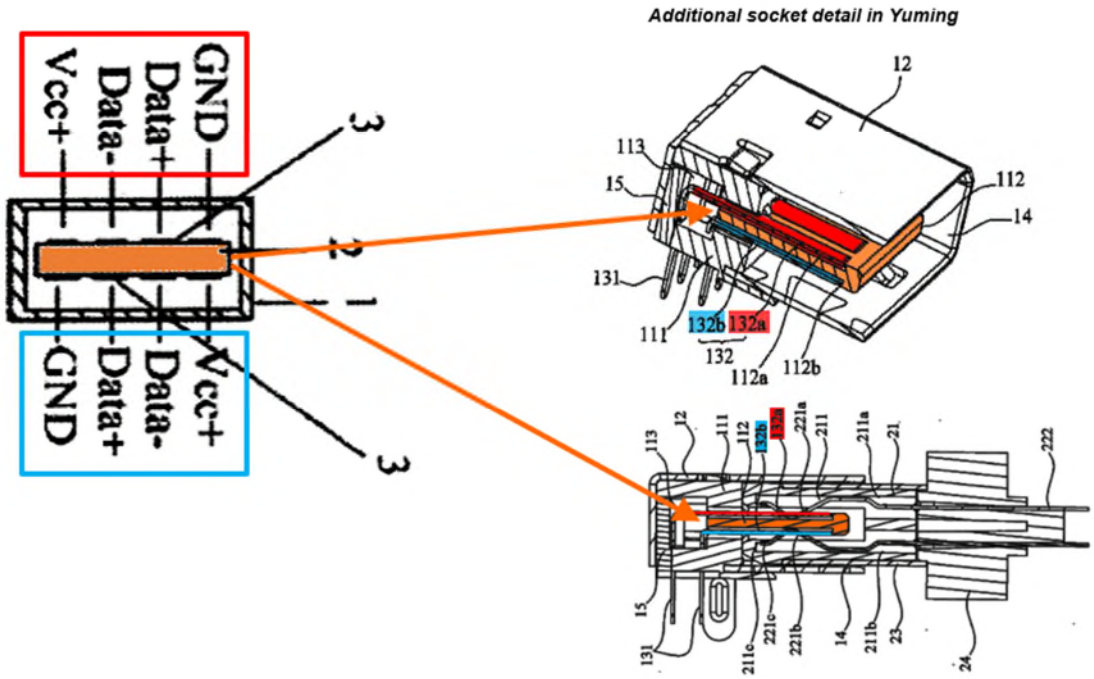
FIG. 7D

EX1010, Fig. 7D.

34[c].	**a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,**

333. The Lufan-Yuming-Socket has a tongue with first and second surfaces disposed opposite each other (upper and lower surfaces of the tongue). The tongue is shown in orange below in Lufan Figure 2 (below, left) with further detail in orange below in Yuming Figures 5 and 7 (below, right).

Lufan–Yuming–Socket



334. Yuming's further detail describes that the tongue has grooves on each surface. *See* EX1008, 7 (describing 112a, 112b as "upper" and "lower terminal groove[s]" on the tongue for "fixedly position[ing]" contacts to the tongue); EX1007, 6. Yuming explicitly teaches that the socket tongue includes two distinct

grooves, identified as 112a and 112b, which are formed respectively on the upper and lower surfaces of the tongue for the purpose of mounting and retaining electrical contacts. Yuming describes that "the distribution of multiple electrical signal terminals within the upper and lower terminal grooves of the tongue piece forms the socket connector" and that "terminal mating part 132a is fixedly positioned in the upper terminal groove 112a . . . while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b . . . ." EX1008, 6-7.

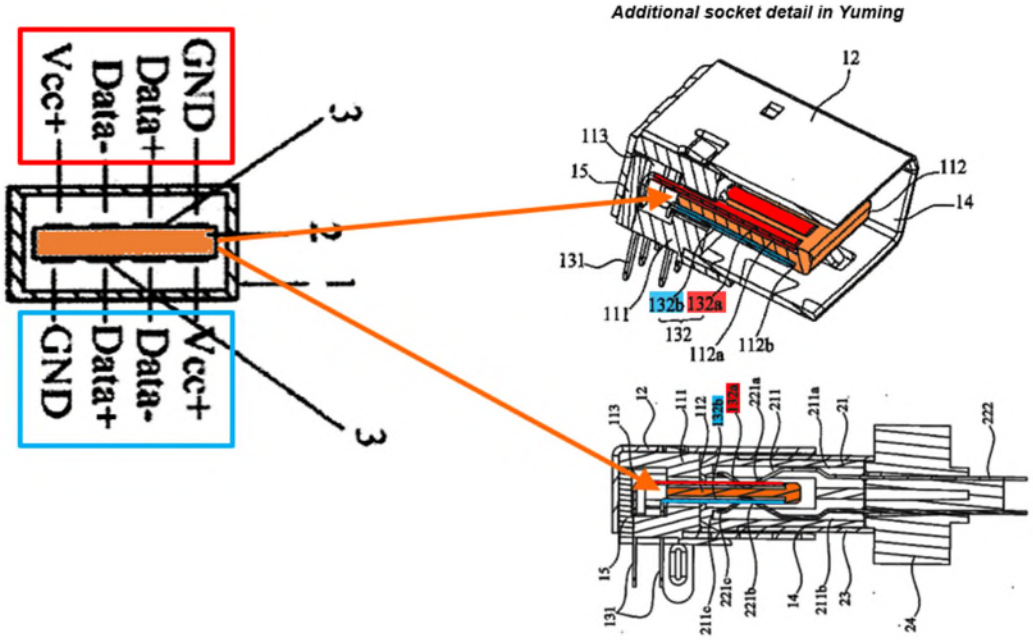
335. Yuming's upper and lower grooves 112a and 112b are also symmetrically arranged about the midplane of the tongue, thereby allowing reversible insertion of a matching plug while maintaining consistent contact alignment. Each groove functions not only as a mechanical anchoring recess but also as an electrical isolation structure, as the insulating body of the tongue separates the two terminal groups and prevents shorting or crosstalk between them. EX1008, 7.

336. When two Lee Slim-USB-Plugs are mated with the Lufan-Yuming-Socket, one plug's contact terminals engage the terminals fixed within the socket's upper groove 112a, and the other plug's contact terminals engage the terminals fixed within the socket's lower groove 112b. Thus, the additional structure disclosed in Yuming's dual-groove tongue provides a mechanically matched and electrically isolated interface that complements the Lufan-Yuming-Socket's reversible plug structure.

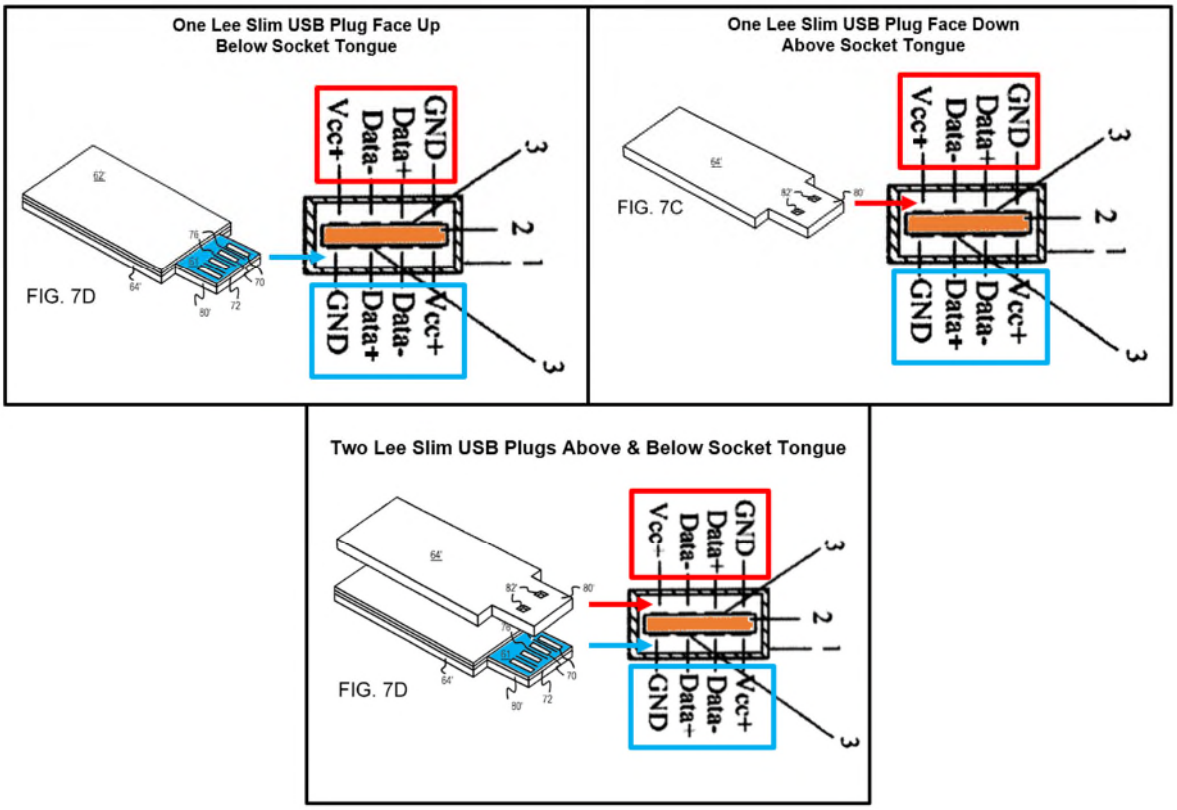
34[d].	**the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;**

337. The Lufan-Yuming-Socket discloses this limitation. Yuming Figures 5 and 7 (below, right), for example, discloses that the tongue is disposed on one end of the insulating base (element 111) in the connection slot. *See also* EX1008, 7. Moreover, as illustrated in Figure 2 of Lufan (below, left) and expressly described in Lufan, the connection slot chambers on the top and bottom of the tongue are symmetrical. Lufan specifically teaches a central tongue (3) that is "located in the middle of the metal shell . . . , enabling the USB plug to be inserted from both directions." EX1007, 1.

Lufan–Yuming–Socket



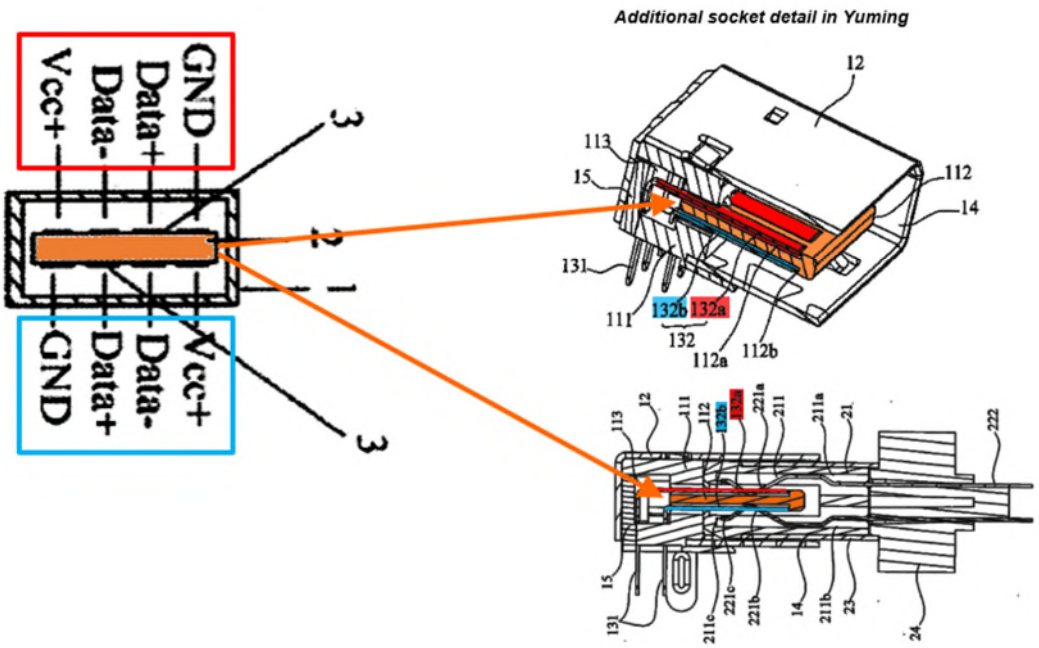
338. Lufan also describes that the central location of the tongue in the connection slot further "allow[s] the USB male connector to be inserted into the USB socket from both directions," *i.e.*, normally and oppositely, as recited in this limitation. *See* EX1007, 4-5. As I described in §X.D.i, the Lufan-Yuming-Socket is specifically designed to accommodate the Lee Slim-USB-Plug such that one plug can be inserted face down above the socket tongue and one plug can be inserted face up below the socket tongue.



34[e].	**at least one row of first contacts separately arranged on the first surface of the tongue, wherein a**

339. The Lufan-Yuming-Socket discloses this limitation. The tongue of the Lufan-Yuming-Socket has one row of first contacts on one surface of the tongue, for example on the top side of Lufan Figure 2 after rotating (below, left). EX1007, 6. The same contacts are illustrated as elements 132a on the upper side of the tongue in the further detail of Yuming Figures 5 and 7 (below, right). *See also* EX1008, 7.

Lufan–Yuming–Socket

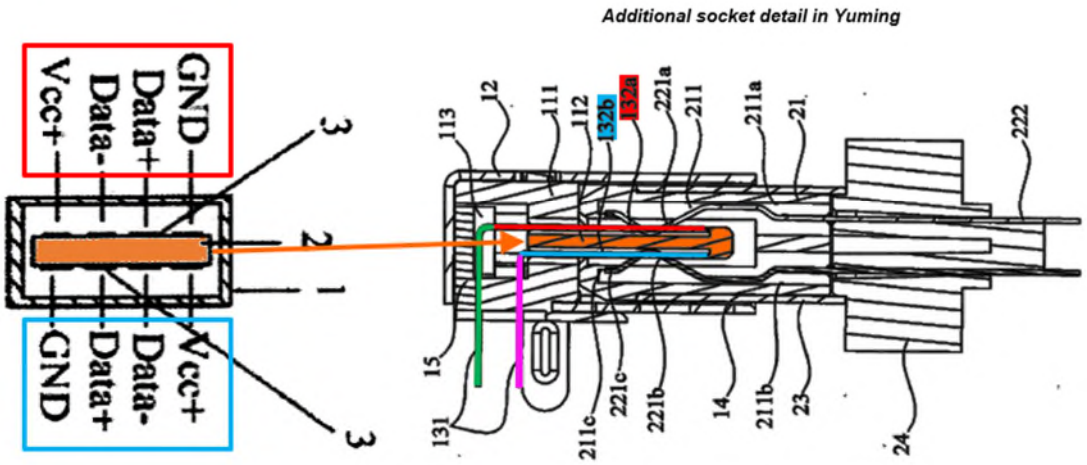


34[f].	**each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and**

340. The Lufan-Yuming-Socket discloses this limitation. The electrical connections between the first contacts and a first pin extending out of the plastic

base are shown in the further detail of Yuming Figure 7 (below, right). The contacts on the top side of the tongue (132a) are connected to pin 131 (green) extending through the insulating base (element 111) (which would have been plastic, as I described for limitation 34[a], *see* §X.D.ii (34[a])). *See also* EX1008, 7 (describing portions 131 as "vertically embedded in the tail end of the main body 111").

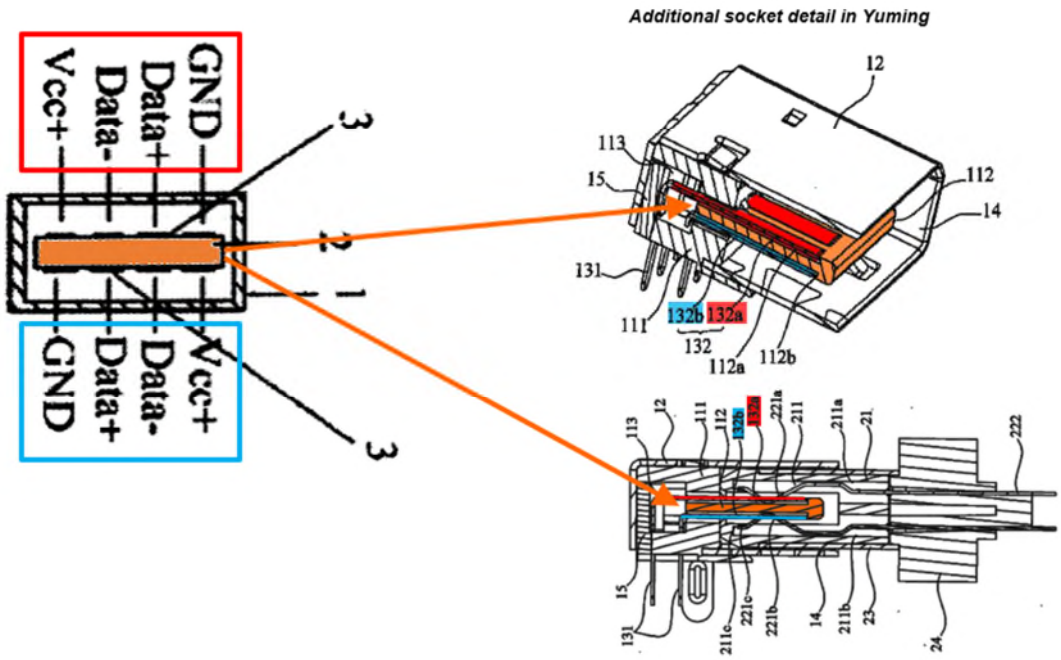
Lufan–Yuming–Socket



34[g].	**at least one row of second contacts separately arranged on the second surface of the tongue, wherein:**

341. The Lufan-Yuming-Socket discloses this limitation. Lufan's tongue has one row of second contacts on a second surface of the tongue, for example on the bottom side of Lufan Figure 2 after rotating (below, left). EX1007, 6. The same contacts are illustrated as elements 132b on the lower side of the tongue in the further detail of Yuming Figures 5 and 7 (below, right). *See also* EX1008, 7.

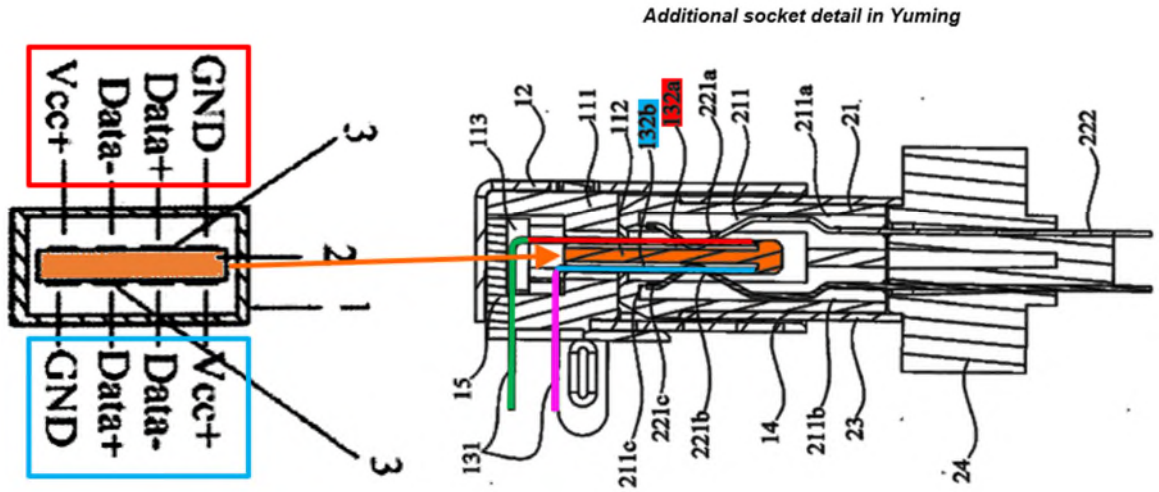
Lufan–Yuming–Socket



34[h].	**each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;**

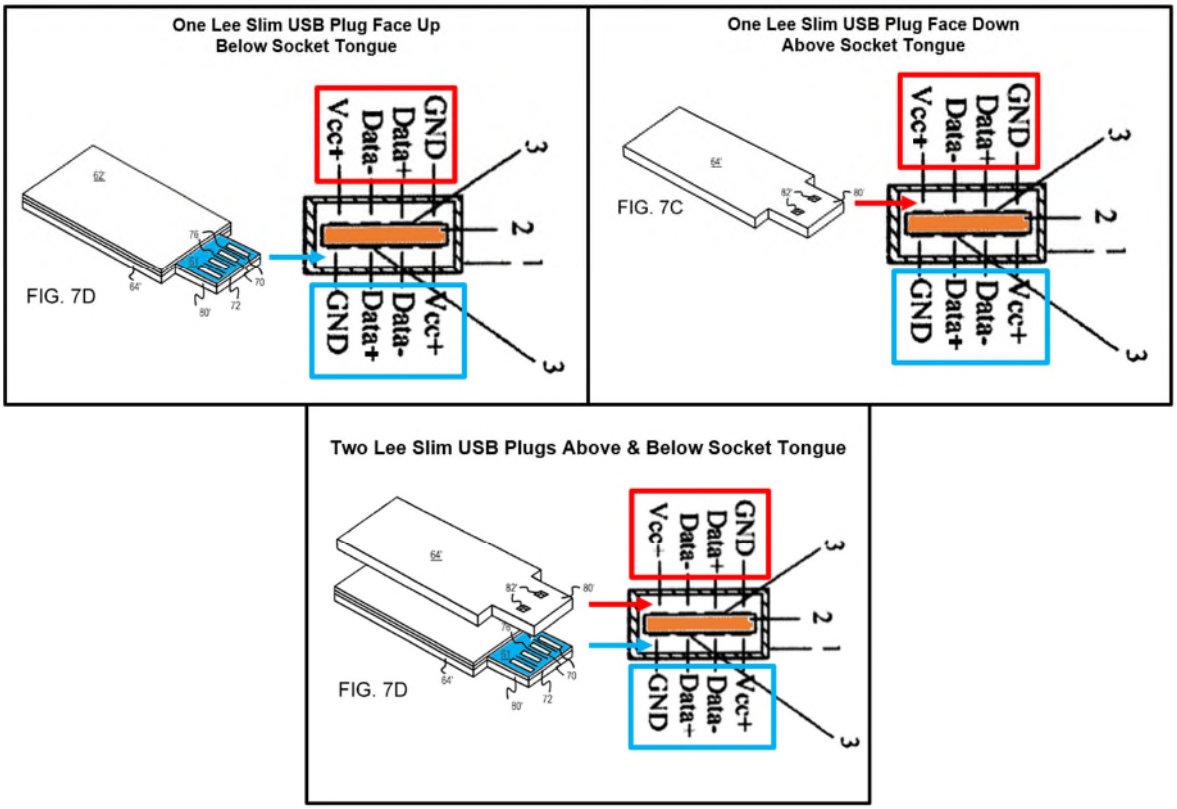
342. The Lufan-Yuming-Socket discloses this limitation. The electrical connections between the second contacts and a second pin extending out of the plastic base are shown in the further detail of Yuming Figure 7 (below, right). The contacts on the bottom side of the tongue (132b) are connected to pin 131 (pink) extending through the insulating base (element 111) (which would have been plastic, as I described for limitation 34[a], *see* §X.D.ii (34[a])). *See also* EX1008, 7 (describing portions 131 as "vertically embedded in the tail end of the main body 111").

Lufan–Yuming–Socket



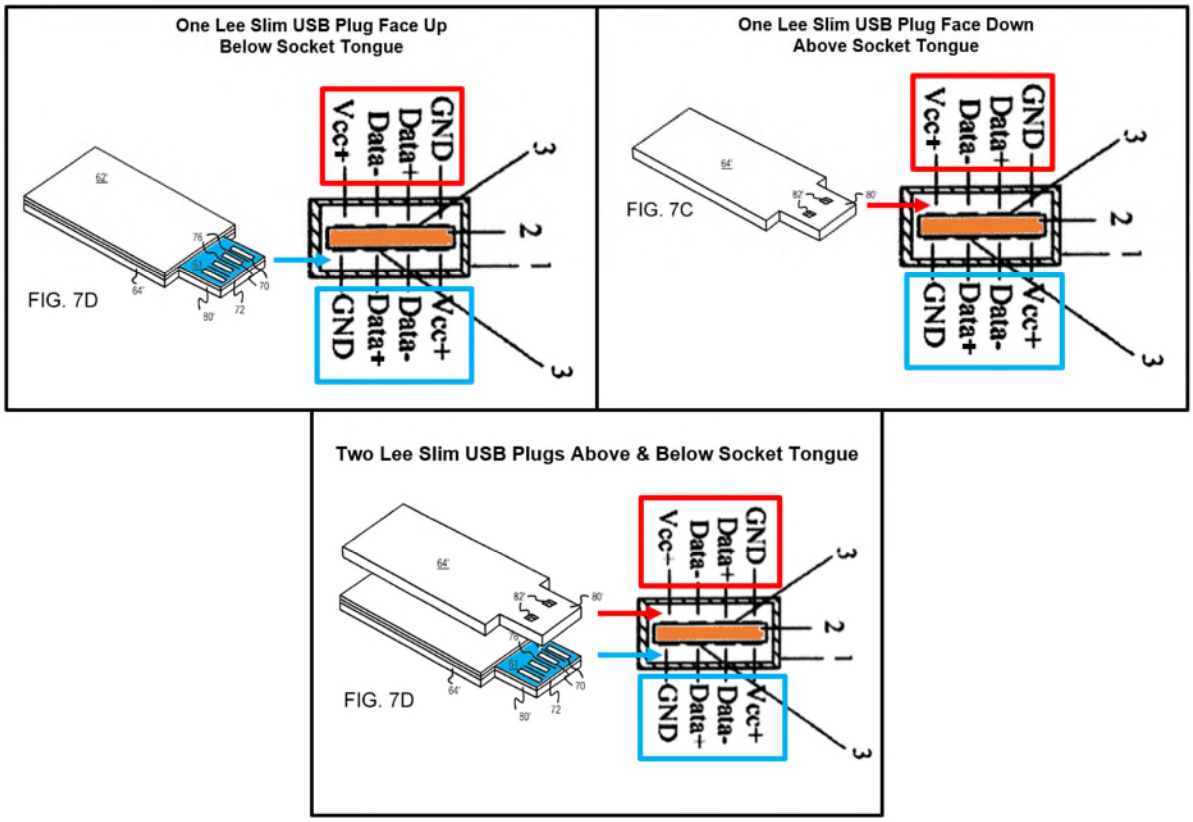
34[i].	**the socket structure is operative to simultaneously electrically connect via the first and second contacts;**

343. The Lufan-Yuming-Socket discloses this limitation, under either Patent Owner's or Petitioner's interpretation of the "simultaneously" terms. *See* §VII.A. As I described in §X.D.i, the Lufan-Yuming-Socket is designed to mate with ***two*** Lee Slim-USB-Plugs. In that implementation, each side of the Lufan-Yuming-Socket electrically connects to both plugs at the same time. *Id.*; EX1008, 8 ("The contact portions 221a and 221b" of each side of the plug "are electrically connected to the terminal mating parts 132a and 132b" on each side of a socket "thereby achieving electrical signal continuity."); §X.D.i.



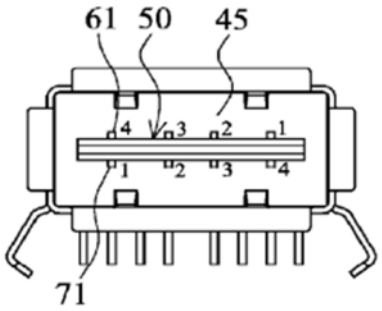
34[j].	**the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:**

344. The Lufan-Yuming-Socket discloses this limitation, under either Patent Owner's or Petitioner's interpretation of the phrase "functional reverse mirror." *See* §VII.C. The top surface contacts (*first contacts*) have a functional reverse mirror configuration relative to the bottom surface contacts (*second contacts*), allowing the Lufan-Yuming-Socket to have two operational states—one where a Lee Slim-USB-Plug is inserted at 0 degrees (*one operational state*), and one where a Lee Slim-USB-Plug is inserted at 180 degress (*another operational state*).



345. Specifically, as described in Lufan, the contacts on each side of the socket's tongue are USB 2.0 contacts in "reverse" order: "One side has the arrangement order of power Vcc+, data- (data-), data+ (data+), and ground (GND), while the other side has the arrangement order of ground (GND), data+ (data+), data- (data-), and power Vcc+." EX1007, 6. The reverse order allows for two separate operational states—namely, one Lee Slim-USB-Plug can be inserted at 0 degrees (*one operational state*) on top of the socket tongue, and another Lee Slim-USB-Plug can be inserted at 180 degrees (*another operational state*) on bottom of the socket tongue. *See also* EX1007, 4-5 (reverse order "allow[s] the USB male connector to be inserted into the USB socket from both directions").

346. In this regard, the contacts in the Lufan-Yuming-Socket track those described in the relevant embodiment of the ’307 patent. Specifically, the ’307 patent illustrates a “functional reverse mirror” configuration as a socket having two USB 2.0 interfaces—one on the top of a tongue 50, and another in reverse order on the bottom of tongue 50—allowing for a USB 2.0 plug to be inserted in normal or reverse orientations. EX1001, 6:40-7:8 (describing each side of the socket as connecting to a USB 2.0 plug). The ’307 patent contact configuration therefore tracks that disclosed in the Lufan-Yuming-Socket.



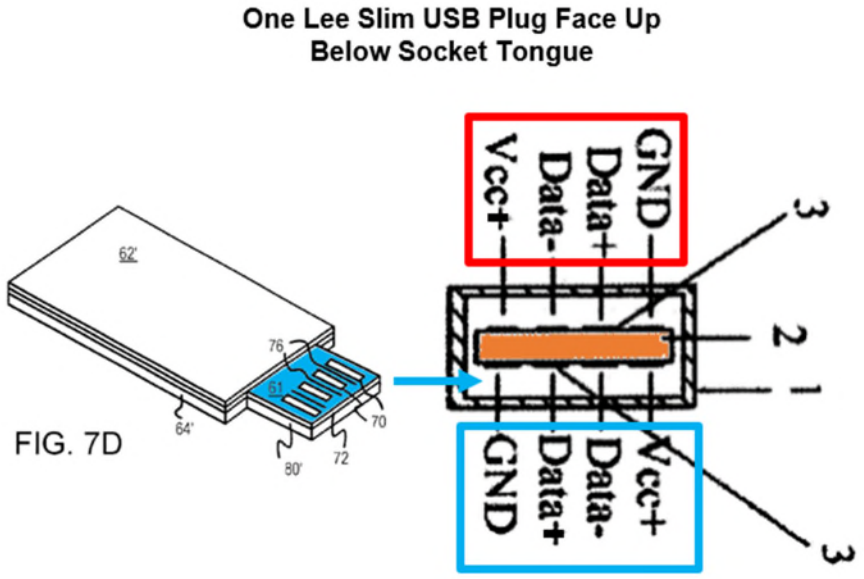
EX1001, Figs. 4A and 5A (excerpted).

34[k].	**a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and**

347. The Lufan-Yuming-Socket discloses this limitation. In the first operational state, one Lee Slim-USB-Plug can be inserted normally at 0 degrees into the connection slot (*first operational state when plug is normally inserted*), as shown

Samsung, EX1003, p. 207

below. *See also* EX1007, 4-5 (reverse order "allow[s] the USB male connector to be inserted into the USB socket from both directions").



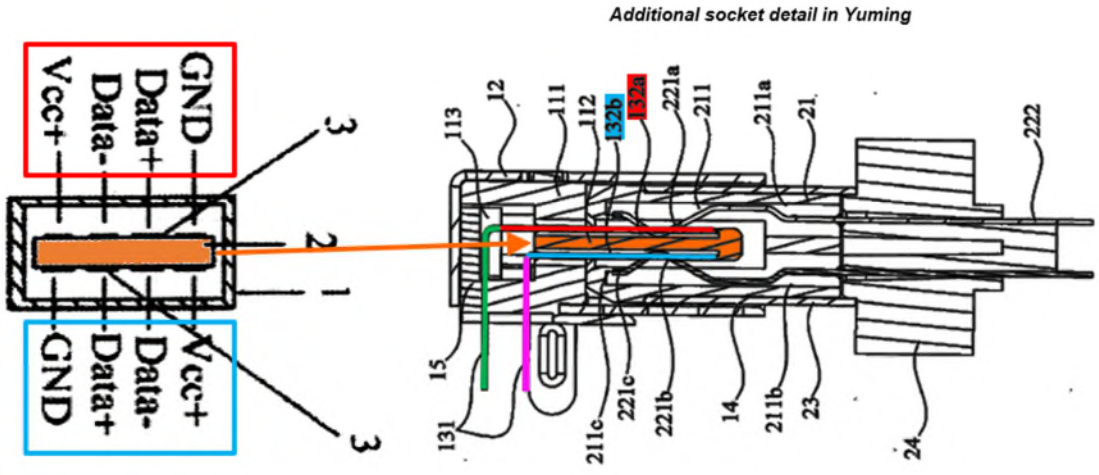
348. In this state, the Lee Slim-USB-Plug is inserted face up into the slot below the tongue such that its plug terminals connect to the contacts on the second surface of the tongue in the Lufan-Yuming-Socket. §X.D.i.

34[l].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and**

349. The Lufan-Yuming-Socket discloses this limitation. As illustrated in Figure 2 of Lufan (below, left) and described in Lufan, the connection slot chambers are symmetrical around the tongue in all directions. Lufan specifically teaches a central tongue (3) that is "located in the middle of the metal shell." EX1007, 1, 4.

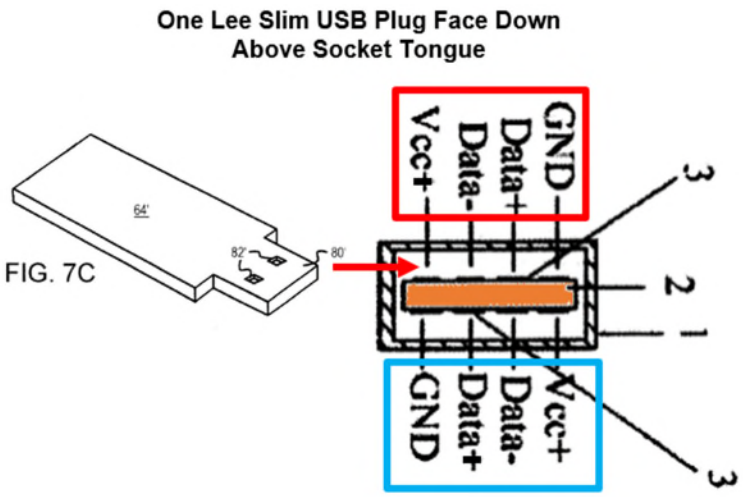
The symmetry in up/down and left/right directions is consistent with the figures of both Lufan and Yuming. *See* EX1007, Fig. 2; EX1008, Figs. 5, 7; §X.D.ii (34[j]).

Lufan–Yuming–Socket



34[m].	**a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and**

350. The Lufan-Yuming-Socket discloses this limitation. In the second operational state, one Lee Slim-USB-Plug can be inserted oppositely at 180 degrees into the connection slot (*second operational state when plug is oppositely inserted*), as shown below. *See also* EX1007, 4-5 (reverse order "allow[s] the USB male connector to be inserted into the USB socket from both directions").



351. In this oppositely inserted state, the Lee Slim-USB-Plug is inserted face down into the slot above the tongue such that its plug terminals connect to the contacts on the first surface of the tongue in the Lufan-Yuming-Socket. §X.D.i.

34[n].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.**

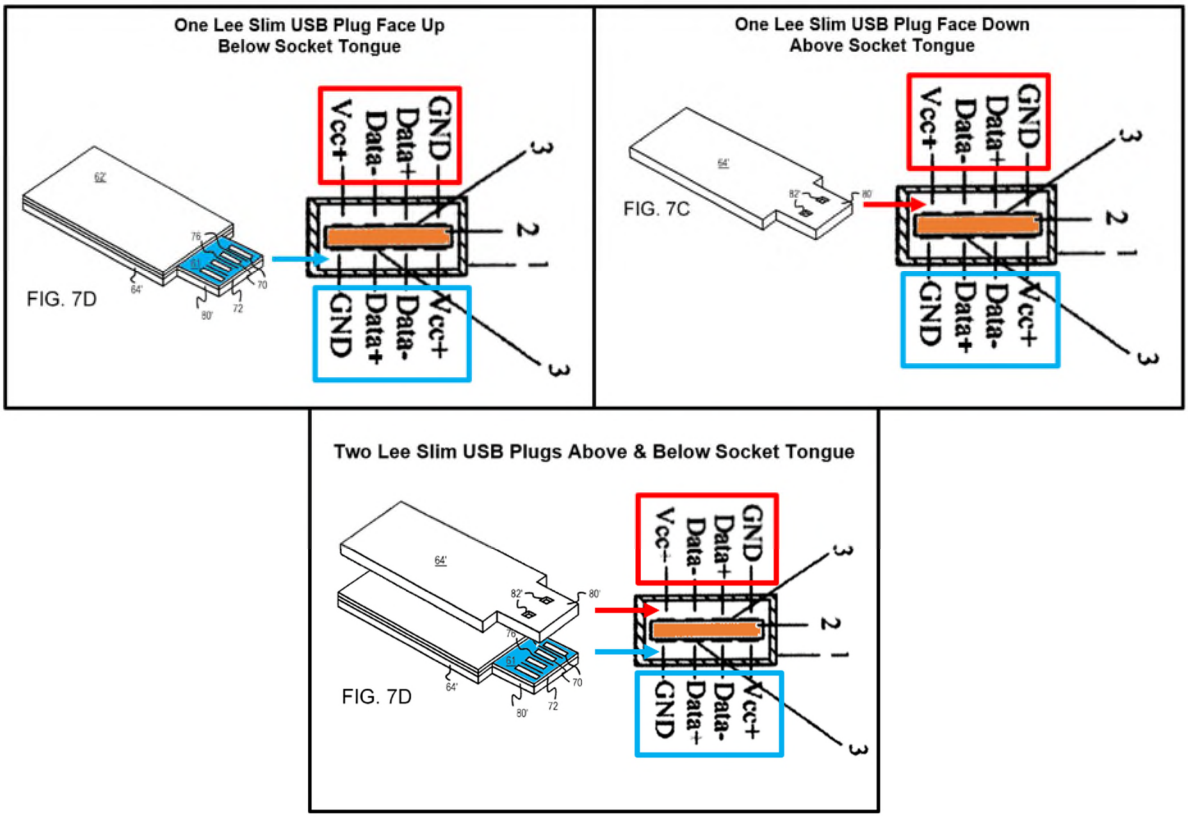
352. This limitation is the same as 34[l], and is invalid for the same reasons. *See* §X.D.ii (34[l]).

iii. Dependent Claims 35-51, 53-55 Are Rendered Obvious by the Lufan with Yuming and Lee

353. In my opinion, Claims 35-51, 53-55 are also rendered obvious by Lufan, Yuming, and Lee, under Petitioner's or Patent Owner's interpretation of Claim 34, as explained below. §VII.

35.	**The socket structure of claim 34, wherein the tongue only contacts an interior portion of the plug when the plug is inserted.**

354. The Lufan-Yuming-Socket discloses this limitation. When one or more Lee Slim-USB-Plug(s) is/are inserted into the Lufan-Yuming-Socket (face-down, face-up, or in dual-slot mode), the socket's tongue inserts into and only contacts the plug surface with USB2.0 contacts (*an interior portion of the plug*), as shown below. *See also* §§X.D.i, X.D.ii (34[b], 34[d]).



355. Indeed, by design, the exterior surface/metal casing has been removed from the Lee Slim-USB-Plugs, leaving only an interior surface. §X.D.i; EX1010, Figs. 7A-E, 10:28-33. In this regard, Ground 4 is like the '307 patent embodiment

with “simultaneous[]” connections, which discloses two Slim-USB-Plugs like Lee’s inserted into a socket with USB2.0 contacts face-down/face-up. EX1001, 8:40-9:12, Figs. 19.

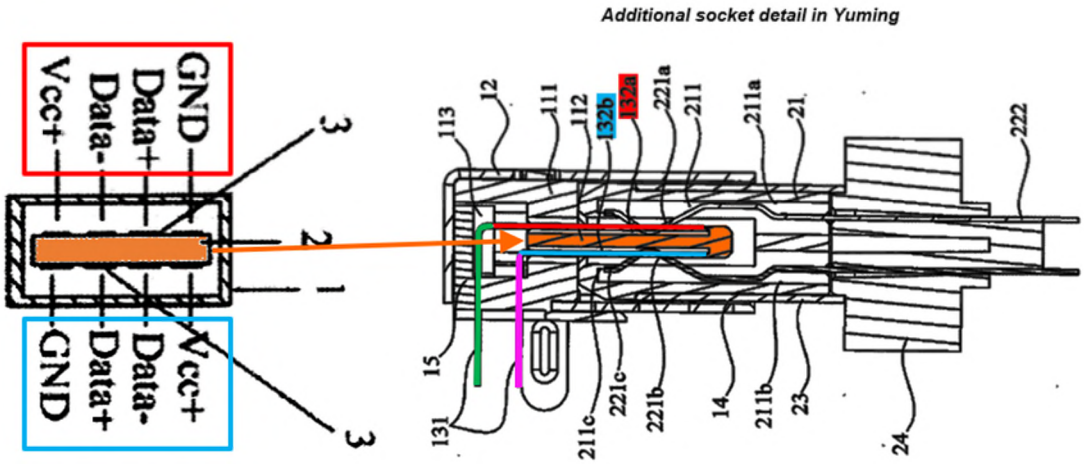
36.	**The socket structure of claim 35, wherein a thickness of the tongue is less than a third of a height of the connection slot.**

356. The Lufan-Yuming-Socket renders this limitation obvious. The Lufan-Yuming-Socket does not disclose a specific dimension for a tongue vis-à-vis the connection slot. But neither does the ’307 patent, which fails to mention the recited relative dimension in the written description at all let alone to ascribe any criticality or importance to the recited limitation, or to describe how the claimed thickness range produces any meaningful distinction over that disclosed in the prior art. For example, the ’307 patent, there is no explicit dimensional metrics or scaling discussion for the tongue thickness. In fact, the only mention of a specific numerical proportion for the dimensions of the tongue thickness in the ’307 patent occurs in the claim language. *See, e.g.*, EX1001, Claim 36. In general, the relative dimension recited in this claim would have been obvious to a POSITA, and particularly would have been obvious in view of the specific tongue and connection slot of the Lufan-Yuming-Socket.

357. Specifically, as I described, the Lufan-Yuming-Socket is a symmetrical socket that has an open connection slot around a symmetrical, central tongue

configured to receive one or two Lee Slim-USB-Plugs inserted into the opening above and/or below the tongue. §X.D.i.

Lufan–Yuming–Socket



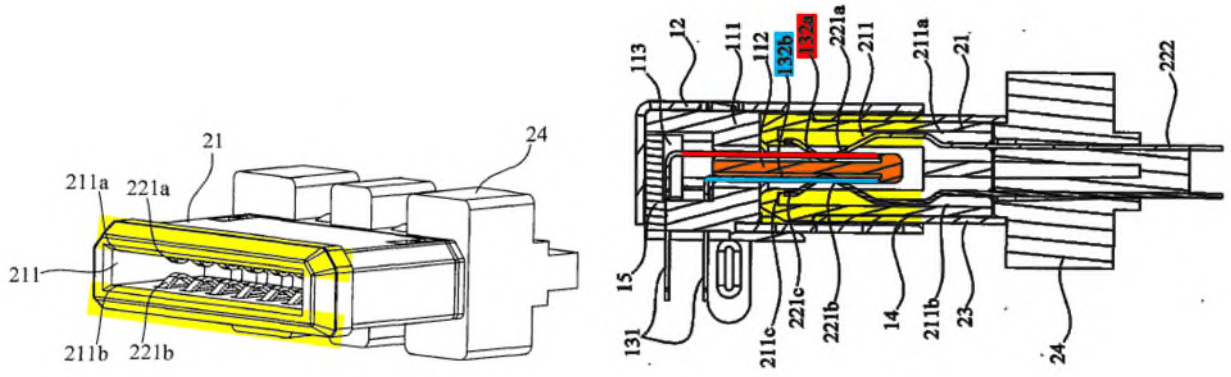
358. In this configuration, a POSITA would have had a finite number of predictable options for the relative thickness of these elements. The tongue could be (a) less than 1/3 the overall connection slot, with larger openings above/below it; (b) exactly 1/3 the connection slot, with equal-sized openings above/below; or (c) greater than 1/3 the connection slot, with smaller openings above/below. It would have been obvious for a POSITA to choose one of these predictable, structural options.

359. Moreover, a POSITA's simple logic would have suggested and motivated the claimed range. A POSITA would have recognized that making the surrounding connection slot thicker around the tongue (thus decreasing the tongue thickness) allows more room for thicker Lee Slim-USB-Plugs to be inserted on each

side of the tongue in the Lufan-Yuming-Socket, which promotes robustness of the plug. And improving robustness of the plug and socket connection is precisely one of the key goals of Yuming and Lee. EX1008, 1 ("the structure forms a more stable connection by the mating of the socket connector and the plug connector, making installation convenient and ensuring smooth, stable electrical signal transmission and a long service life"), 4 ("a socket connector and a plug connector that form a more solid connection structure when mated. This facilitates easy installation, ensure smooth electrical signal transmission, and extends service life"); EX1010, 5:52-56 (forming optional metal dividers 76 between metal contacts 70 to "help produce a better fit by filling the gap between connectors when inserted . . . ."), 4:35-41 ("Thus a more secure connection can be made using male slim USB connector 40 since gaps are filled in more precisely . . . ."), 6:63-65 ("Dividers 68 fill in the gap between board 60 and connector substrate 26. This provides a better, more secure fit, reducing wobble."). Indeed, unlike the socket's tongue, which is protected within the socket structure, the plug is exposed to external environments and is thus more likely to be damaged by user handling. Thus, when choosing how to divide the Lufan-Yuming-Socket between the tongue and the connection slots, a POSITA would have been motivated to devote the majority of thickness to the connection slots, so the corresponding plugs could be ***thicker***, providing maximum mechanical strength for reliable electrical connections while maintaining a compact and convenient design.

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360. A socket tongue thickness of less than 1/3 of the connection slot is also consistent with Lufan's and Yuming's drawings. For example, Figure 2 (above, left) of Lufan depicts a tongue thickness that is approximately 1/3 or less of the connection slot height. Likewise, Figure 7 (below, right) of Yuming further depicts a tongue that is less than 1/3 the thickness of the connection slot, which must be just large enough to receive and be fully filled by the relatively thicker upper and lower plug walls shown in Figure 4 (below, left). EX1008, 6 (describing the mated socket and plug "fully and efficiently utilizes internal space . . . resulting in a compact structure . . . .").



EX1008, Figs. 4, 7.

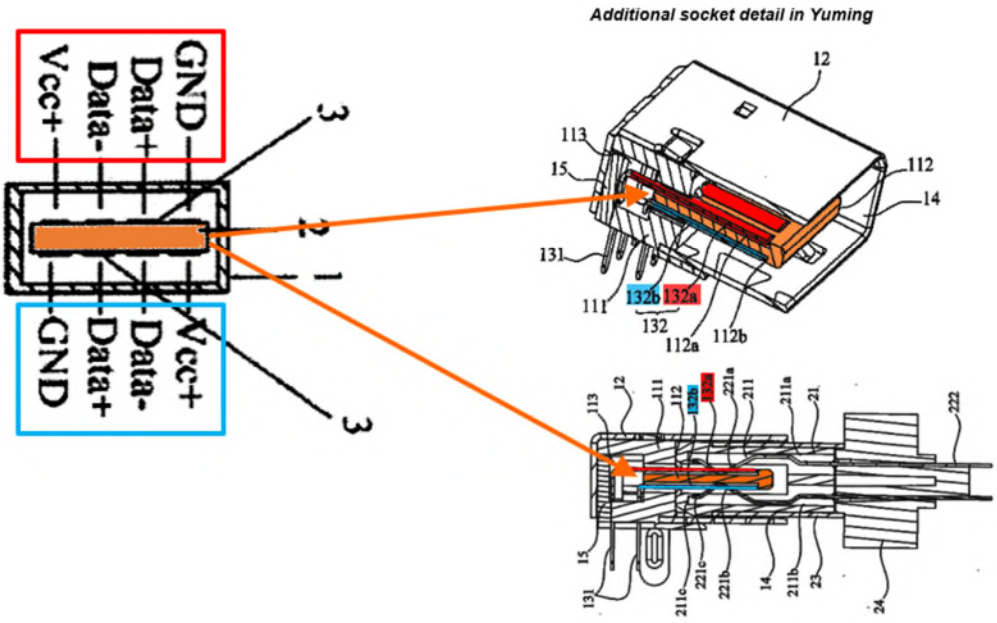
361. A POSITA would have had a reasonable expectation of success in making the tongue less than one-third of the thickness of the connection slot. Yuming discloses that the tongue is made of insulating material, EX1008, 7, which a POSITA would have known could easily form a tongue with a range of thicknesses, including thicknesses less than 1/3 of the connection slot. Indeed, well known

electrical connectors at the time had a tongue with thickness relative to a connection slot within this range. EX1015, 91, 96; EX1032, Fig. 1, 21:6-22:5.

37.	**The socket structure of claim 34, wherein a portion of each of the first contacts, in the at least one row of first contacts, is coplanar with a portion of the first surface of the tongue.**

362. The Lufan-Yuming-Socket discloses this limitation. Each upper contact 132a (*each of the first contacts in the at least one row of first contacts*) is embedded in a top surface of the tongue 112 (*a portion of the first surface of the tongue*) such that the top surface of the contact is *coplanar* with the top surface of the tongue. *See* EX1008, 7 ("the terminal mating part 132a is fixedly positioned in the upper terminal groove 112a of the tongue piece 112, while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b of the tongue piece 112"), Fig. 7.

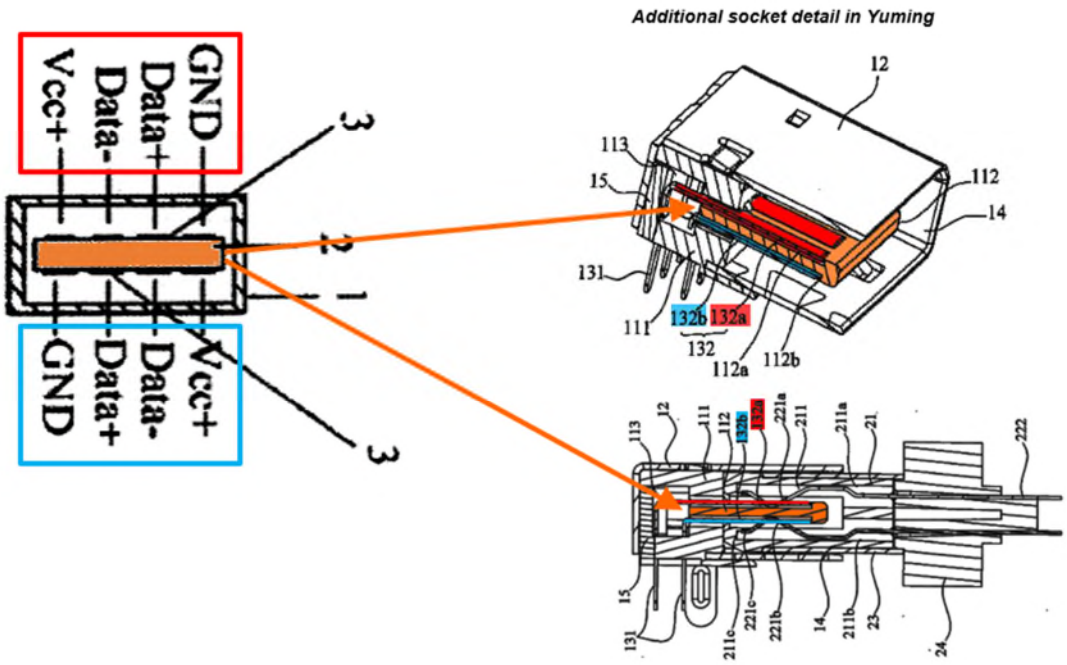
Lufan–Yuming–Socket



38.	**The socket structure of claim 37, wherein a portion of each of the second contacts, in the at least one row of second contacts, is coplanar with a portion of the second surface of the tongue.**

363. The Lufan-Yuming-Socket discloses this limitation. Each lower contact 132b (*each of the second contacts in the at least one row of first contacts*) is embedded in a bottom surface of the tongue 112 (*a portion of the second surface of the tongue*) such that the bottom surface of the contact is *coplanar* with the bottom surface of the tongue. *See* EX1008, 7 ("the terminal mating part 132a is fixedly positioned in the upper terminal groove 112a of the tongue piece 112, while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b of the tongue piece 112"), Fig. 7.

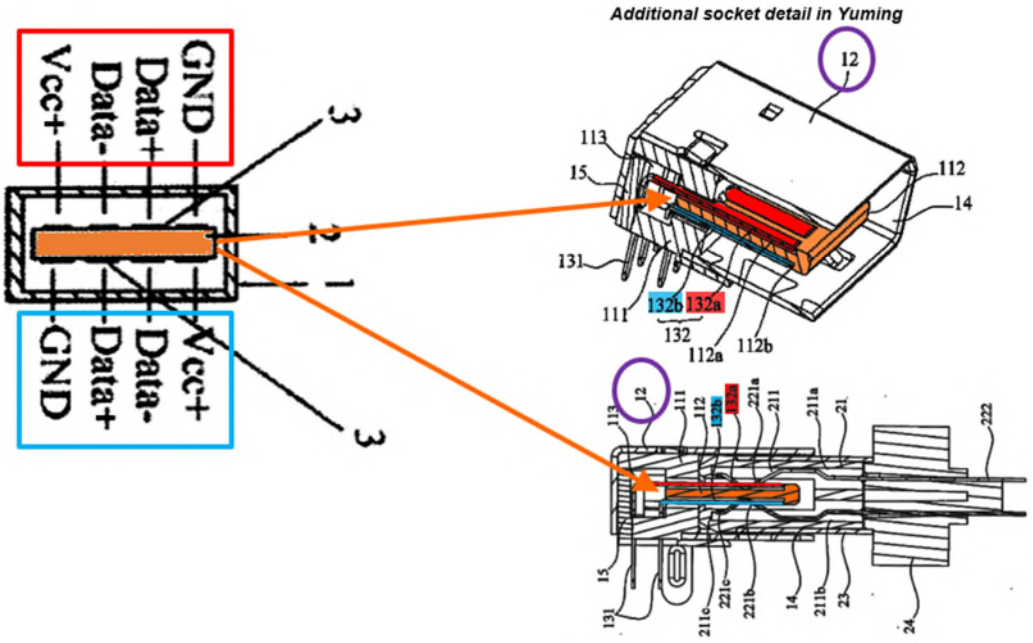
Lufan–Yuming–Socket



39.	**The socket structure of claim 34, further comprising a metal housing at least partially covering the plastic base.**

364. The Lufan-Yuming-Socket discloses this limitation. The socket includes a "shielding metal shell 12" (*metal housing*) that covers insulating base (element 111) (*plastic base*). EX1008, 7 ("shielding metal shell covers the main body").

Lufan–Yuming–Socket



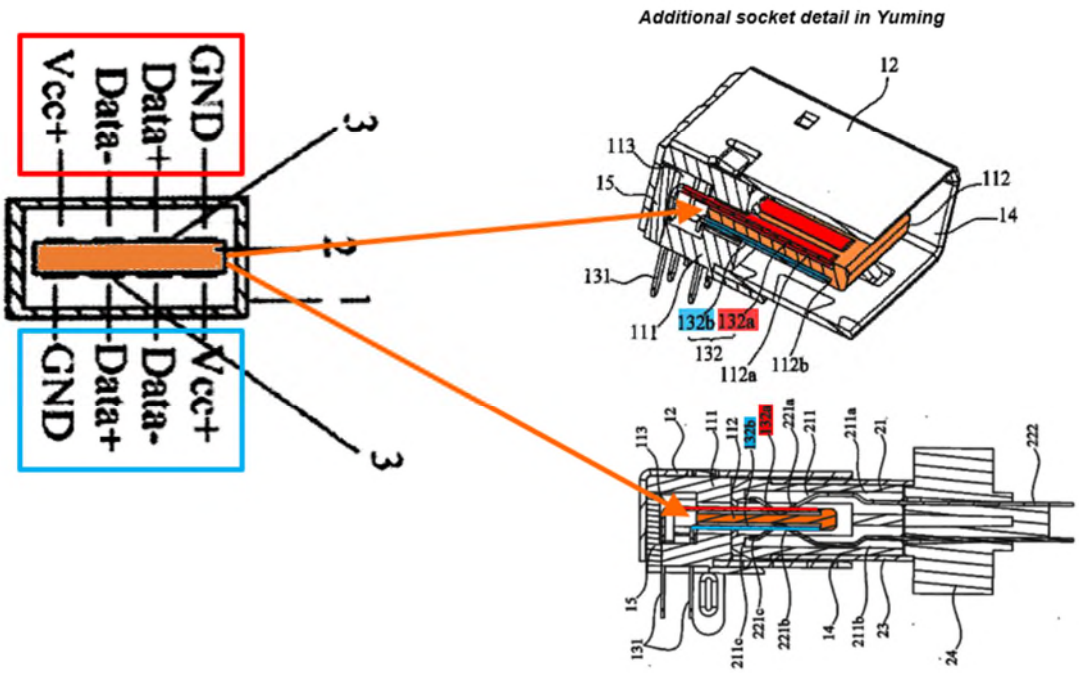
40.	**The socket structure of claim 34, wherein the socket structure is a universal serial bus socket structure.**

365. The Lufan-Yuming-Socket is a USB structure. *See* §X.D.i.

41.	**The socket structure of claim 34, wherein the tongue and the plastic base are integrally formed.**

366. The Lufan-Yuming-Socket discloses this limitation. The tongue 112 and insulating base (element 111) are *integrally formed*. EX1008, 7 (disclosing "[an] insulating seat consist[ing] of a main body portion 111 and a ***tongue piece 112 that integrally extends from the main body portion 111***").

Lufan–Yuming–Socket

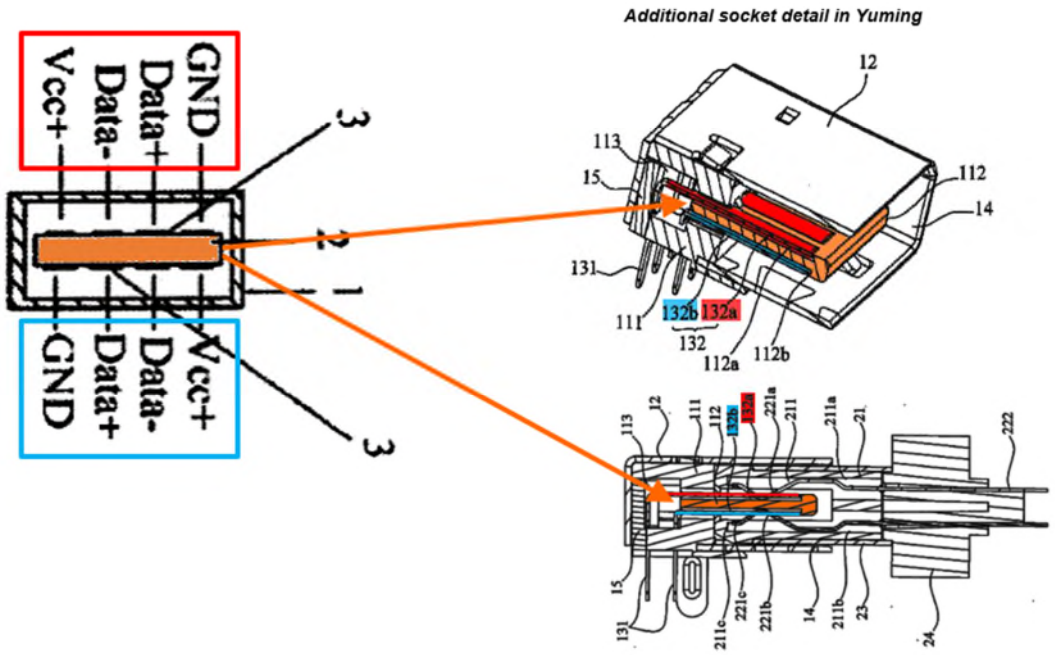


42.	**The socket structure of claim 34, wherein each contact of the first and second contacts is a portion of a respective terminal.**

367. The Lufan-Yuming-Socket discloses this limitation. The Lufan-Yuming-Socket includes upper and lower terminals 13. EX1008, 7 ("The socket connector 10 comprises an insulating seat 11, a shielding metal shell 12 and multiple

electrical signal terminals 13."). Each of the upper contacts 132a and lower contacts 132b (*each contact of the first and second contacts*) are a portion of the upper and lower signal terminals 13. *Id*.

Lufan–Yuming–Socket



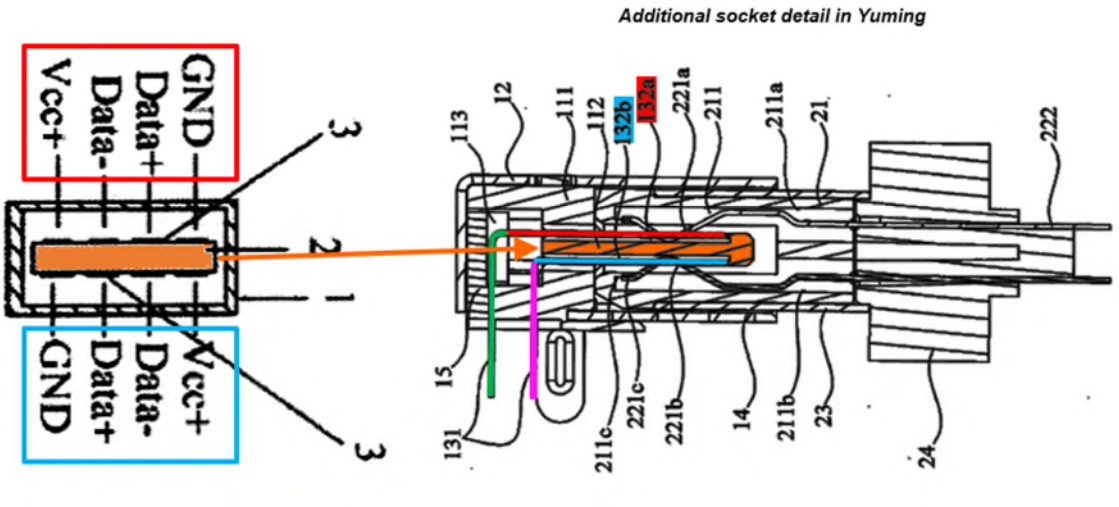
EX1008, 7 ("The aforementioned electrical signal terminal 13 include a pin part 131 that is soldered to a circuit board and ***a mating part 132*** that is formed by bending the pin part 131 into a horizontal direction 131. […] all mating parts 132 are divided into two groups; each group comprises the 6-pin terminal mating part 132a and 132b. The terminal mating part 132a is fixedly positioned in the upper terminal groove 112a of the tongue piece 112, while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b of the tongue piece 112."). Yuming's

disclosure of terminals with a front portion of contacts tracks that described in the relevant embodiment of the '307 patent. EX1001, 5:67-6:2, 6:12-14, 6:51-67, Fig. 2, Fig. 19, Fig. 21.

43.	**The socket structure of claim 34, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

368. This claim limitation combines limitations 34[f] and 34[h], but with an additional requirement that the first and second pins extend out of the plastic base "through a rear cover." As explained above for limitations 34[f] and 34[h], the Lufan-Yuming-Socket discloses that *first and second pins* connect upper contacts and lower contacts and respectively (*each of the first contacts* and *each of the second contacts*) extend out of a plastic base. §X.D.ii (34[f], 34[h]]. The pins also further extend through the shielding metal shell 12 (*rear cover*). *Id*. The shielding metal shell specifically covers the entirety of the main body 111. EX1008, 7 ("shielding metal shell 12 covers the main body portion"). The main body 111 is located on the bottom of the socket through which the pins extend. *See* EX1008, Fig. 7. Accordingly, a POSITA would have understood that the pins further extend through the shielding metal shell that covers the main body.

Lufan–Yuming–Socket

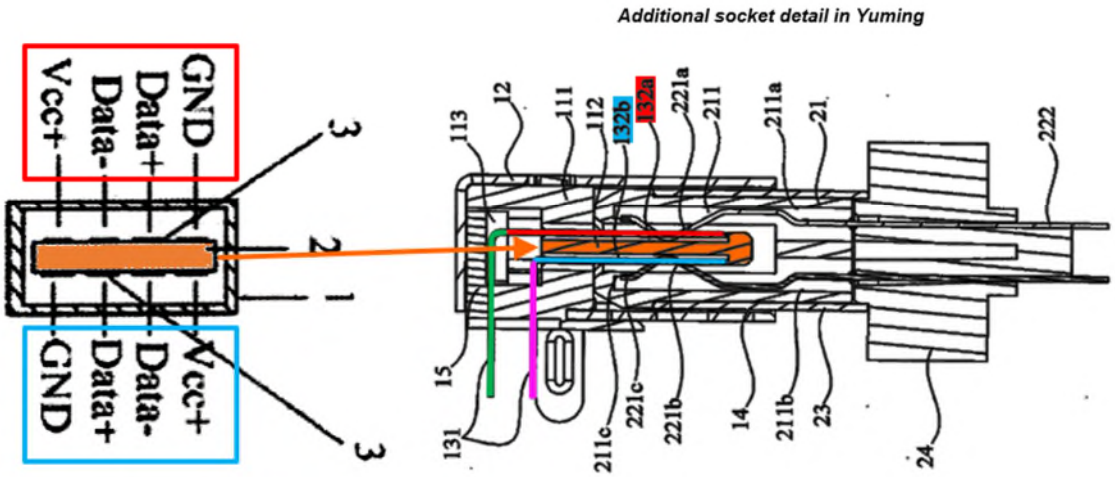


44.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another, and at least two of the second contacts are not in electrical communication with one another.**

369. The Lufan-Yuming-Socket discloses this limitation. In the Lufan-Yuming-Socket, each side of contacts includes at least one power contact (VCC+) and one ground contact (GND) (*at least two of the first and second contacts*). A POSITA would have understood that power (VCC+) and ground (GND) contacts are not in electrical communication; if they were in electrical communication, the USB circuit would not have a return path for current (*i.e.*, shorted) and the circuit would not operate.

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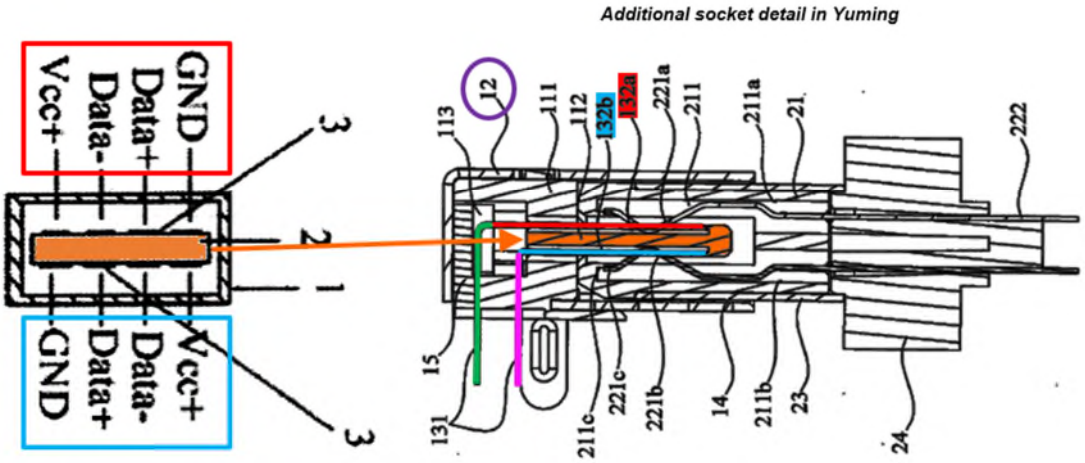
Lufan–Yuming–Socket



45.	**The socket structure of claim 34, further comprising a rear cover attached to the plastic base.**

370. The Lufan-Yuming-Socket discloses this limitation. In shielding metal shell 12 (*rear cover*, circled purple) is attached to the insulating base (element 111) portion of the main body (*plastic base*). *See* EX1008, 7 ("shielding metal shell 12 covers the main body portion" and "insulating seat 11 consists of a main body portion 111").

Lufan–Yuming–Socket



46.	**The socket structure of claim 45, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover.**

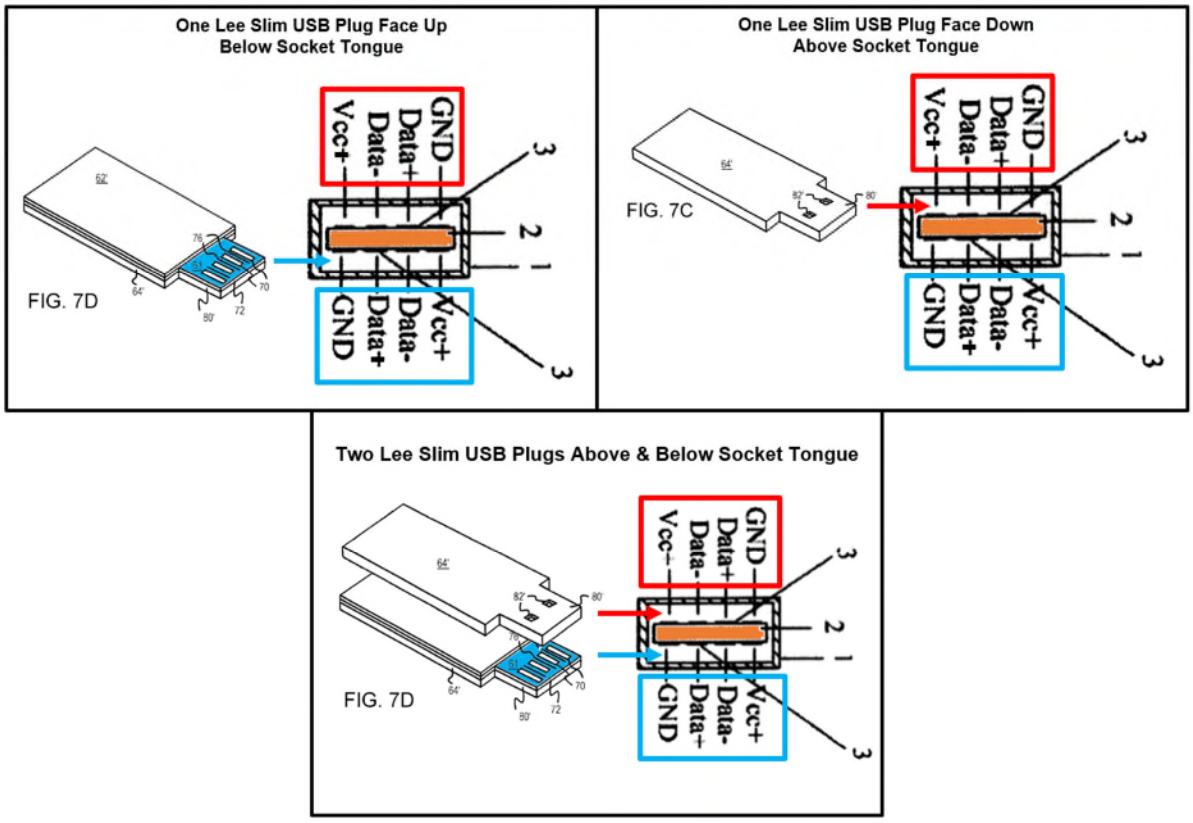
371. This claim is identical to limitation 43, except it depends from claim 45, which recites that the socket structure is "further comprising a rear cover attached to the plastic base." That dependency does not make a material difference to the analysis presented in limitation 43. Thus, this limitation is also disclosed by the Lufan-Yuming-Socket for the same reasons as limitation 43. *See* §X.D.iii (43).

47.	**The socket structure of claim 45, wherein each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

372. This claim is identical to limitation 43, except it depends from claim 45, which does not make a material difference to the analysis presented in limitation 43. *See* §X.D.iii (45). This limitation is invalid for the same reasons as limitation 43. *See* §X.D.iii (43).

48.	**The socket structure of claim 34, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

373. The Lufan-Yuming-Socket discloses this limitation for the same reasons as described for 34[pre] and 34[i]. §§X.D.ii (34[pre], 34[i]). The Lufan-Yuming-Socket may connect to one or more Lee Slim-USB-Plugs and is *operative to simultaneously electrically connect via the first and second contacts*, as shown below:



49.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another.**

374. This claim limitation is identical to limitation 44 and is therefore also disclosed by the Lufan-Yuming-Socket. *See* §X.D.iii (44).

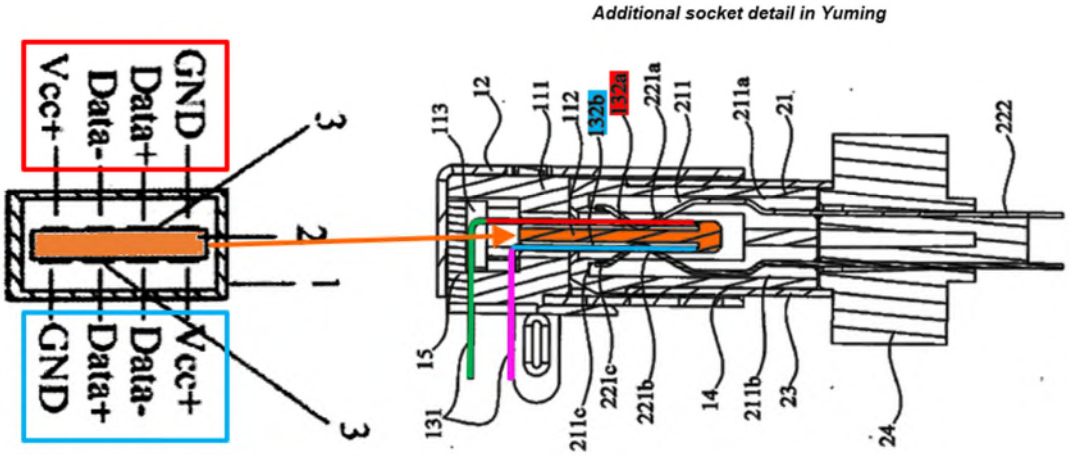
50.	**The socket structure of claim 34, wherein at least two of the second contacts are not in electrical communication with one another.**

375. This claim limitation is identical to limitation 44 and is therefore also disclosed by Lufan-Yuming-Socket. *See* §X.D.iii (44).

51.	**The socket structure of claim 34, wherein the at least one row of first contacts and respective first pins are located at ends of respective ones of a row of first terminals and the at least one row of second contacts and respective second pins are located at ends of respective ones of a row of second terminals.**

376. Lufan-Yuming-Socket discloses this limitation. As described for limitations 34[f], 34[h], and claim 42 (§§X.D.ii (34[f], 34[h]), X.D.iii (42)), in the Lufan-Yuming-Socket, the upper and lower terminals 13 (*first and second terminals*) each have one end that is a contact portion 132a and 132b (*first and second contacts*) and also each have another end that connects to two pin parts 131 (green and pink) that extend out of the plastic base (*first and second pins*).

Lufan–Yuming–Socket



53.	**The socket structure of claim 34, wherein a portion of one of the first contacts is at least partially included in the first surface with grooves.**

377. The Lufan-Yuming-Socket discloses this limitation for the same reasons described for limitation 34[c] and 37. §X.D.ii-iii (34[c], 37) ((contacts embedded ***in*** tongue surface). In Lufan-Yuming-Socket, the contacts are positioned in grooves on both surfaces of the tongue. *See* EX1008, 7 (describing 112a, 112b as "upper" and "lower terminal groove[s]" on the tongue for "fixedly position[ing]" contacts to the tongue).

54.	**The socket structure of claim 34, wherein a portion of one of the second contacts is at least partially included in the second surface with grooves.**

378. The Lufan-Yuming-Socket discloses this limitation for the same reasons described for limitation 34[c] and 37. §X.D.ii-iii (34[c], 37) (contacts embedded ***in*** tongue surface). In Lufan-Yuming-Socket, the contacts are positioned

in grooves on both surfaces of the tongue. *See* EX1008, 7 (describing 112a, 112b as "upper" and "lower terminal groove[s]" on the tongue for "fixedly position[ing]" contacts to the tongue).

55.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 34 and the plug.**

379. The Lufan-Yuming-Socket discloses this limitation for the same reasons as claim 34. §X.D.ii (34[pre], 34[i]). The socket structure forms an electrical connection system with one or two Lee Slim-USB-Plug(s) inserted above and/or below the socket tongue. §X.D.i.

iv. Independent Claim 56 and Dependent Claims 57-66 Are Rendered Obvious by Lufan with Yuming and Lee

380. Independent claim 56 is substantially the same as claim 34, §X.A.iii (56), except (a) limitation 56[c] specifies that the "first surface" of the tongue is on the "top side" and the "second surface" is on the "bottom side," (b) limitation 56[i] requires that the socket is "operative to simultaneously electrically connect ***on the top and the bottom side*** of the tongue (rather than "via the first and second contacts"), and (c) claim 56 does not include the "symmetrical" connection slot requirements of claim 34.

381. These differences do not substantively change the analysis of the Lufan-Yuming-Socket. As already explained for claim 34, the tongue in the Lufan-Yuming-Socket has a top side and a bottom side which are simultaneously

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electrically connected to one or two Lee Slim-USB-Plugs, under either Patent Owner's or Petitioner's interpretation of the simultaneously limitations. §§VII.A, X.D.ii (34[c], 34[i]). The Lufan-Yuming-Socket renders claim 56 obvious for the same reasons as described for claim 34. §X.D.ii.

382. Dependent claims 57-66 are analyzed further below.

57.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 56 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

383. The Lufan-Yuming-Socket connected to one or two Lee Slim-USB-Plugs discloses this claim. The Lufan-Yuming-Socket has a duplex electrical connection, under either Patent Owner's or Petitioner's interpretation of the term (§VII.B), and is capable of connecting to two Lee Slim-USB-Plugs, one inserted above the tongue and one inserted below the tongue, with simultaneous electrical connections via the first and second contacts on either side of the socket's tongue, under either Patent Owner's or Petitioner's interpretation of the term (§VII.A). *See* §§X.D.i, X.D.iii (55, 48).

58.	**The socket structure of claim 56, wherein the tongue and the plastic base are integrally formed.**
59.	**The socket structure of claim 58, further comprising a metal housing at least partially covering the plastic base.**
60.	**The socket structure of claim 59, wherein at least two of the first contacts are not in electrical communication with one another and at**

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least two of the second contacts are not in electrical communication with one another.

61. The socket structure of claim 60, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

384. Claims 58-60 are identical to claims 41, 39, 44 and invalid in view of the Lufan-Yuming-Socket for the same reasons. §X.D.iii (41, 39, 44).

385. Claim 61 is also substantively the same as claims 53 and 54, which together recite a socket structure "wherein a portion of one of the first [second] contacts is at least partially included in the first [second] surface with grooves." Claim 61 is therefore invalid in view of the Lufan-Yuming-Socket for the same reasons as claims 53 and 54. §X.D.iii (53-54).

62. The socket structure of claim 61, wherein the at least one row of first contacts includes at least five contacts, and the at least one row of second contacts includes at least five contacts.

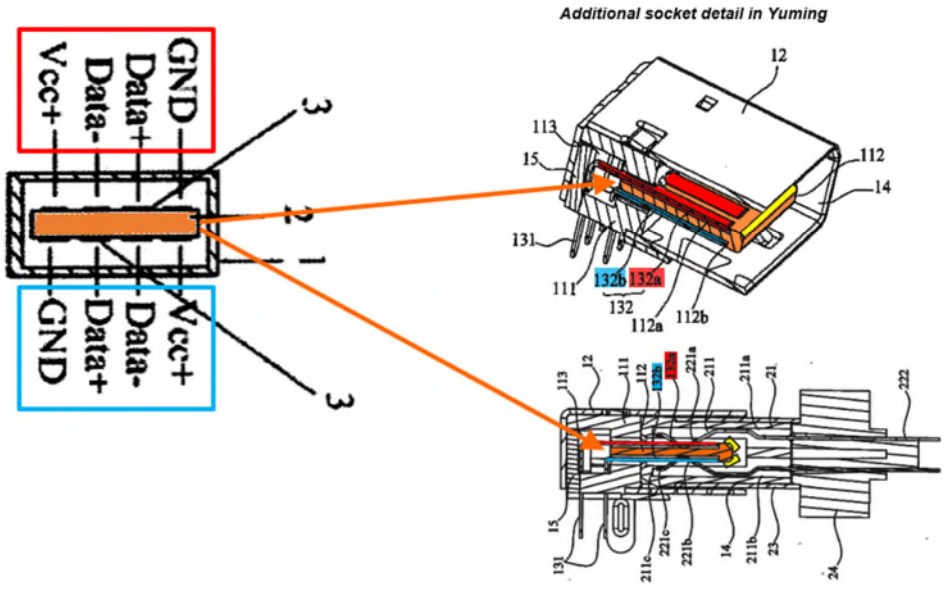
386. The Lufan-Yuming-Socket renders this limitation obvious. Yuming describes that each side of its symmetrical socket can include six or more contacts. EX1008, 7 ("…6-pin terminal mating part 132a and 132b. The terminal mating part 132a is fixedly positioned in the upper terminal groove 112a of the tongue piece 112, while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b of the tongue piece 112"). A POSITA would have been motivated to include all six contacts in the Lufan-Yuming-Socket, as Lee discloses a similar

"extended" USB interface with extra contacts, and a 6-contact socket would have provided increased flexibility in using the socket for multiple types of plugs. EX1010, 7:59-65 ("The Slim connector may be widened to accommodate extra metal contacts to become an extended-USB connector for future USB specification."); §X.D.i. A POSITA would have had a reasonable expectation of success, using more than four pins was already known in the art, as explained above (*see also* EX1015, 84, 90 (*nine* pins)). §VIII.C.ii.

63.	**The socket structure of claim 62, wherein the tongue has chamfered corners on two sides of the tongue.**

387. The Lufan-Yuming-Socket renders this limitation obvious. As shown below (right), Yuming's drawings show a tongue with chamfered edges on the top and bottom of the tongue. *See* EX1008, Fig. 5 (top right), Fig. 7 (bottom right).

Lufan–Yuming–Socket

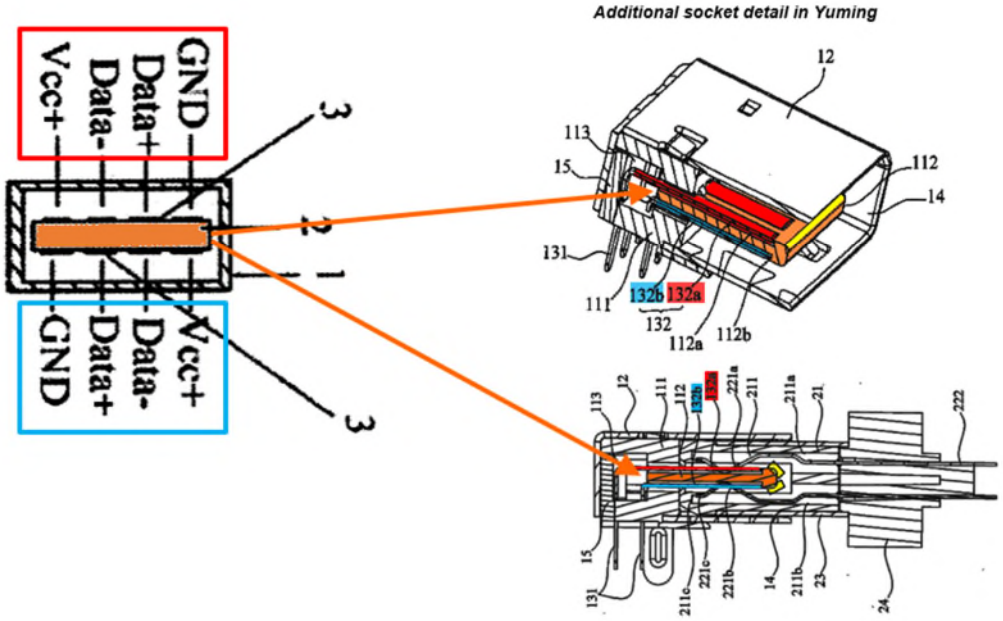


388. It would also have been obvious to a POSITA to include chamfered edges on the top and bottom of the tongue when implementing the Lufan-Yuming-Socket, and a POSITA would have been motivated to do so to help guide the tongue into the insertion gap, as described, for example, in Andre. §X.A.iii (63). Indeed, well known electrical connectors at the time had a tongue with chamfered edges. *See, e.g.*, EX1015, 77.

64.	**The socket structure of claim 63, wherein a tip of the tongue is tapered.**

389. The Lufan-Yuming-Socket renders this limitation obvious. As shown below right, Yuming's drawings show a tongue *that tapers (reduces in thickness) toward its tip*, EX1008, Fig. 5 (top right), Fig. 7 (bottom right).

Lufan–Yuming–Socket



390. It would also have been obvious to a POSITA to taper (to reduce the thickness) of the tongue toward the tip (the outermost part) of the tongue when implementing the Lufan-Yuming-Socket, and a POSITA would have been motivated to do so to help guide the tongue into the insertion gap, as described, for example, in Andre. §X.A.iii (64). Indeed, well known electrical connectors at the time had a tongue with a tapered tip. *See, e.g.*, EX1015, 77.

65. The socket structure of claim 64, wherein a thickness of the tongue is less than third of a height of the connection slot.

391. This claim limitation is identical to limitation 36, and is rendered invalid by the Lufan-Yuming-Socket for the same reasons. §X.D.iii (36). A POSITA would have had the same motivation and same reasonable expectation of success in implementing the tongue with less than 1/3 thickness of the connection slot, even with the additional requirements of intervening dependent claims 56, 58-64. Those intervening dependent claims do not change the analysis because the relative dimension of the tongue compared to the connection slot is determined by the desired thickness of the plugs, which is not impacted by the intervening dependent claims.

66. The socket structure of claim 65, wherein the socket structure is a universal serial bus socket structure.

392. The Lufan-Yuming-Socket is a USB socket structure. §X.D.i.

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v. Independent Claim 67 and Dependent Claims 68-77 Are Rendered Obvious by Lufan with Yuming and Lee

393. Independent claim 67 is substantially the same as claim 34, §X.A.iv (67), except (a) limitation 67[d] adds the requirement that the plug is normally and oppositely inserted "based on an operational state when the socket structure is connected to the plug"; (b) limitation 67[i] requires ***six*** contacts in each row; and (c) limitation 67[k] recites a "reverse mirror" configuration rather than "functional reverse mirror" configuration.

394. Differences (a) and (c) do not change my analysis. For limitation 67[d], the Lufan-Yuming-Socket accepts a plug normally and oppositely inserted based on the operational state, as described for limitations 34[d], [j], [k], [m]. §X.D.ii (34[d], 34[j], 34[k], 34[m]). For limitation 67[k], I interpret "functional reverse mirror" to be a type of "reverse mirror," and thus "reverse mirror is disclosed for the same reasons as "functional reverse mirror." EX1001, 6:48-51. Accordingly, limitation 67[k] is disclosed by the Lufan-Yuming-Socket for the same reasons as described for limitation 34[j], under either Patent Owner's or Petitioner's interpretation of the term. *See* §X.D.ii (34[j]); §VII.C.

395. Regarding difference (b), relating to limitation 67[i] ("the at least one row of first contacts includes at least six contacts, the at least one row of second contacts includes at least six contacts"), this limitation is substantially similar to limitation 62 but recites the first and second contacts each include "at least six

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contacts" instead of "five contacts." But as I described for claim 62, it would have been obvious to implement the Lufan-Yuming-Socket with six contacts on each side. §X.D.iv (62).

396. Accordingly, claim 67 is rendered obvious by the Lufan-Yuming-Socket in view of claim 34 and 62, for the reasons I explained above.

397. Regarding dependent claims 68-73, 75-77, those claims are identical to claims 57, 41, 39, 44, 61, 63, 36, 40, and 43, and are invalid for the same reasons. §X.D.iii-iv. For Claim 77, to the extent Patent Owner argues that the shielding metal shell cannot be both the claimed "rear cover" and claimed "metal housing," it would have been obvious to make the shell as two different layers to increase rigidity, which would correspond to the two claim elements, for the reasons I described above. §X.B.v.

398. Regarding claim 74, which recites "[t]he socket structure of claim 73, wherein a portion of the tongue opposite the plastic base is tapered," that claim is invalid for the same reasons I described for claims 63 and 64. §X.D.iv (63, 64). Yuming discloses and renders obvious a chamfered tongue, and the chamfers decrease the thickness (taper) a portion of the tongue opposite the plastic base (near the tip). *Id*.

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vi. Independent Claim 78 and Dependent Claims 79-87 Are Rendered Obvious by Lufan with Yuming and Lee

399. Independent claim 78 is identical to independent claim 67, §X.A.v (78), except that claim 78 specifies that the socket's plastic base has a "metal housing" (78[a]) that there are "at least four" first and second contacts (78[i]), and the tongue of the socket is "at a central location" (78[m]-[n]). The Lufan-Yuming-Socket discloses those limitations, as already described for claims 34, 39, 67, 70. §§X.D.ii-iii, v. Claim 78 is rendered invalid for the same reasons.

400. Dependent claims 79-86 are the same as dependent claims 57, 41, 39, 44, 61, 63, 74, and 36, respectively, and are invalid for the same reasons. §§X.D.iii-v.

401. Dependent claim 87 is also invalid as it recites a "universal serial bus socket structure," which the Lufan-Yuming-Socket is (claim 40), with the additional limitations identical to claim 43, which the Lufan-Yuming-Socket discloses, and as further described for claim 77. §§X.D.i, X.D.iii (40, 43), X.D.v.

vii. Independent Claim 88 and Dependent Claims 89-96 Are Rendered Obvious by Lufan with Yuming and Lee

402. Claims 88-96 are substantially identical to claims 78-86 but without "metal housing" and are invalid for the same reasons. §X.D.vi.

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viii. Independent Claim 98 and Dependent Claims 99-106 Are Rendered Obvious by Lufan with Yuming and Lee

403. Claim 98-106 are substantially identical to claim 88-96, but without a limitation on the number of contacts and reciting "functional" in 98[j], and are therefore invalid for the same reasons. §X.D.vii.

ix. Independent Claim 108 and Dependent Claim 109 Are Rendered Obvious by Lufan with Yuming and Lee

404. Claims 108-109 are invalid in view of the Lufan-Yuming-Socket. Claim 108 is substantially the same as claim 98, but adds the limitations of claim 35, 39, 40, 42, 43, and 61, all of which are disclosed by the Lufan-Yuming-Socket, and claim 109 is substantially identical to claim 57, which is also disclosed by the Lufan-Yuming-Socket. §X.D.iii-iv; *see also* §X.D.v (77) (obviousness of separate structures for metal housing/rear cover).

x. Independent Claim 110 and Dependent Claim 111 Are Rendered Obvious by Lufan with Yuming and Lee

405. Claims 110-111 are invalid in view of the Lufan-Yuming-Socket. Claim 110 is substantially the same as claims 108, but add the requirements that the simultaneous electrical connection is "on the top and the bottom side of the tongue" and that the tongue is tapered and chamfered. The Lufan-Yuming-Socket disclose those additional limitations, as described for claims 56, 63, and 64. Claim 111 is substantially identical to claim 57, which is also disclosed by the Lufan-Yuming-

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Socket. §X.D.iii-iv; *see also* §X.D.v (77) (obviousness of separate structures for metal housing/rear cover).

xi. Independent Claim 112 and Dependent Claim 113 Are Rendered Obvious by the Lufan-Yuming-Socket and Lee

406. Claims 112 and 113 are invalid; they are substantially the same as claims 110 and 111, except they add the thickness limitation of claim 36, and the Lufan-Yuming-Socket discloses that limitation as well. §X.D.iii (36); *see also* §X.D.v (77) (obviousness of separate structures for metal housing/rear cover).

xii. Independent Claim 114 Is Rendered Obvious by the Lufan-Yuming-Socket and Lee

407. Claim 114 is substantially the same as claim 98, §X.A.viii (114), but without the "grooves" requirement, and is therefore invalid for the same reasons. §X.D.viii.

xiii. Independent Claim 117-120 Are Rendered Obvious by the Lufan-Yuming-Socket and Lee

408. Claims 117-120 are invalid. All claims are substantially identical to claim 114, §X.A.viii (114), except (a) claims 117, 119-120 remove the "functional reverse mirror" limitation; (b) claims 117-120 require that "the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue" without reciting the word "simultaneously" (117[i]/118[i]/119[i]/120[i]), and as previously explained, the Lufan-Yuming-Socket can electrically connect on the top side or the bottom side or both, depending

on whether one or two plug(s) is/are inserted. §X.D.iv (56); and (c) claim 119 and 120 remove the word "respective" from certain limitations and refer to the tongue as in the "middle" of or "centrally located" in the connection slot, which, if anything, broadens or does not substantially change the claim and does not change the obviousness in view of the Lufan-Yuming-Socket.

xiv. Independent Claims 130-135 Are Rendered Obvious by the Lufan-Yuming-Socket and Lee

409. Claims 130 and 133 are invalid in view of the Lufan-Yuming-Socket because they are substantially the same as claim 34 or broader because (a) in claim 133, "functional reverse mirror" applies only to "some" contacts" and (b) both claims recite "recesses" rather than "grooves," and grooves are a specific type of recess. §X.D.ii.

410. Claims 131-132 and 134-135 are invalid because they are substantially the same as claim 34 except they (a) broaden claim scope by removing the symmetrical connection slot requirements and, for claims 131-132, 134, removing the word "respective" from certain limitations and, in claim 134-135, applying the "functional reverse mirror" limitation to "some"/a "portion" of contacts and; (b) recite "simultaneously electrically connect on the top and the bottom side of the tongue," which the Lufan-Yuming-Socket does as described for claim 56. §§X.D.iv.

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E. Ground 5: All Challenged Claims (34-120, 130-135) are further rendered obvious by Lufan with Yuming, Lee, and USB 3.0

411. As explained in Ground 4, the Lufan-Yuming-Socket is a socket that complies with the USB standard. The socket would also have been combined with USB 3.0, which is analogous art—it relates to electrical connectors. EX1015. A POSITA would have been motivated to combine USB3.0 with the Lufan-Yuming-Socket to render obvious claims 52, 97, 107, 116 ("proud"/"projections" limitations) and claim 115 ("castellated surface" limitation); and to further render obvious claims 36, 65, 75, 86, 96, 106, 112[x] ("thickness" limitations) and claims 63-64, 73-74, 84-85, 94-95, 104-105, 110[w]-110[x], 112[w], 112[y] ("chamfered"/"tapered" limitations). A POSITA would have had clear motivation to refer to the USB standard, which was widely adopted as the standard guidelines for implementing USB sockets, such as the Lufan-Yuming-Socket. By 2009, USB 3.0 was the most current USB infrastructure and included USB 2.0 backwards compatibility, as implemented in the Lufan-Yuming-Socket. EX1015, 31.

i. Thickness Limitations: Claims 36, 65, 75, 86, 96, 106, 112[x]

412. As described for §X.C.i, USB 3.0 discloses a known USB 3.0-B tongue less than 1/3 thickness of a connection slot. EX1015, 91. A POSITA would have been motivated by Lufan-Yuming-Socket alone to adopt a tongue less than 1/3 thickness of a connection slot to increase the robustness of the connection. §§X.D.iii (36). A POSITA determining how to implement that structure would have looked to

USB 3.0-B receptacle with a reasonable expectation of success because, similar to the Lufan-Yuming-Socket, it has a USB2.0 interface (1-2-3-4) across two sides of a tongue, and similar thickness ratios had been implemented for decades. EX1015, 91; EX1032, Fig. 1, 21:6-22:5.

ii. "Proud"/"Projections" Limitations: Claims 52, 97[f], 107[f], 116[g], 116[i]

413. As described in §X.C.ii, USB 3.0 discloses contacts that project slightly above the surface of a tongue. EX1015, 77. A POSITA would have been motivated to use these design details when implementing the Lufan-Yuming-Socket, which does not require a specific shape of contact used in the socket. USB 3.0, as the most current USB standard in 2009, would have been a clear choice, among a finite set of options, to identify implementation details for making the Lufan-Yuming-Socket with a reasonable expectation of success. Moreover, slightly protruding contacts would be beneficial to the overall design of the socket, as they would further ensure a strong connection point with the inserted plug, a problem that all of Lufan, Yuming, Lee, and various other references prior to 2009 sought to solve. §X.D.i; EX1032, Fig. 10, 17:34-37 ("bumps" on contacts for "concentrating contact force"). This would render obvious claim 52.

414. Claims 97 and 107 recite the same limitations as claim 52 (97[f]/107[f]: projections), as well as a combination of features from other claims (97[a]: USB structure (claim 40); 97[b]/[c]: contacts electrically connect to pins extending out of

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plastic base through rear cover (claim 43); 97[d]: tongue contacts only an interior portion of plug (claim 35); 97[e]: contacts are a portion of terminals (claim 42); 97[g]/[h]: grooves include a portion of first/second contacts (claim 61)). Claims 97 and 107 are therefore rendered obvious for the same reasons as explained for claim 52 above and those other claims. §§X.D.iii-iv, v (claim 77 obviousness).

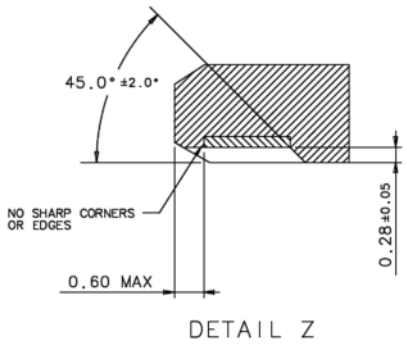
415. Claim 116 is substantially the same as claim 98 but without the "grooves" and "functional reverse mirror" requirements and adds limitations 116[g]/[i] requiring a portion of each of the first/second contacts to be proud of a top-most/bottom-most surface of the tongue. These additional limitations are rendered obvious for the reasons described above for claim 52.

iii. Castellated Surfaces: Claim 115

416. USB 3.0 also discloses Micro-USB with castellated tongue surfaces, providing a POSITA reasonable expectation of success using such surfaces. EX1015, 96. Such surfaces would have been a predictable design choice among a finite set of options available to a POSITA, with the benefit of enhancing connection interfaces.

iv. Chamfered and Tapered Tongue Limitations in Claims 63-64, 73-74, 84-85, 94-95, 104-105, 110[w]-110[x], 112[w], 112[y]

417. The chamfered and tapered limitations addressed in Ground 4 (§X.D.iv) are also disclosed by USB 3.0. EX1015. The A-type connector has a tongue that is chamfered and tapered toward its tip:



EX1015, 77. This design is consistent with Yuming's disclosures. EX1008, Fig. 5. A POSITA would have been motivated to use the claimed chamfered and tapered shapes, as explained for Ground 4 (*see*, *e.g.*, §X.D.iv (63-64)) with a reasonable expectation of success, in view of the known benefits (*e.g.*, ease of insertion) and widespread adoption of this shape, allowing use of existing manufacturing techniques.

F. Ground 6: Lufan with Yuming, Yen, and Zhenyu Renders Obvious Claims 34-51, 53-96, 98-106, 108-114, 117-120, and 130-135, Under Patent Owner's Interpretation of the "Simultaneously" Terms, "Duplex Electrical Connection," and "Functional Reverse Mirror"

418. It is my opinion that Claims 34-51, 53-96, 98-106, 108-114, 117-120, and 130-135 would have been obvious in view of Lufan with Yuming, Yen, and Zhenyu under Patent Owner's claim interpretations. *See* §VII.

419. Lufan, Yuming, Zhenyu, and Yen are all analogous art. All four references relate to the same field of endeavor as the '307 patent—electrical connectors, including USB socket structures for electrical signal transmission of data and power to and from plugs. *See* EX1001, at 1:30 ("The invention relates to an electrical connector…"); EX1007, 4 ("This new utility model relates to a USB female structure, particularly a dual-sided pluggable USB female structure," where the USB interface has data and power signals and the "USB female is also known as a USB socket"); EX1008, 4, 7 ("this utility model proposes an electrical connector assembly 100" for gaming devices such as PS2); EX1006, 1 (describing an electrical interface for a USB plug with data and power signals "capable of being inserted into a computer USB socket in both directions"); EX1009, 1:31-42 (describing USB interface including data and power for electrical signal transmission), Fig. 5 (disclosing host and device for electrical connection and signal transmission).

420. Moreover, all four references are also specifically pertinent to the problem addressed by the '307 patent inventors—convenience and reliability of

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socket-plug contact. *See*, *e.g.*, EX1001, 1:43-45 ("the USB plug has to be correctly inserted so that the connection terminals of the USB plug and the USB socket may be electrically connected together"), 1:54-55 ("The user often has to insert the USB plug twice in an inconvenient manner."). Indeed, Lufan and Yuming each describe the same problem, and solve that problem using double-sided sockets. *E.g.*, EX1007, 1 (disclosing a "Dual-Sided Pluggable USB Female Structure" that "enabl[es] the USB plug to be inserted from both directions"); EX1008, Figs. 1-7, 6 (disclosing a double-sided plug and socket that has "the advantage of . . . more secure connection structure formed by the mating of a socket connector and a plug connector. This makes installation convenient, allows for smooth electrical signal transmission, and ensures a long service life."); EX1006, 1 (describing "[a] double-sided universal serial bus (USB) interface capable of being inserted into a computer USB socket in both directions" where "both structures seamlessly integrate with standard USB sockets, making it user-friendly and compact"). Yen is also highly pertinent to the problem of a reliable USB electrical connection, as it discloses a specific protocol for ensuring signal transmission between a USB plug and socket. EX1009, 1:31-42 (describing USB interface for electrical signal transmission), Fig. 5 (disclosing host and device for electrical connection and signal transmission).

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421. Given their similarities to each other and the ’307 patent, a POSITA would have and could have combined the references to arrive at the Challenged Claims, with a reasonable expectation of success, as I further explain below.

i. Motivation to Combine

422. A POSITA would have been motivated by Yen, which is directed to a USB data protocol (EX1010, Abstract), to combine the Lufan-Yuming-Socket of Ground 4 with the USB plug of Zhenyu. The combination addresses a key problem in early 2009: how to increase the data rate of USB 2.0 connectors. As I described in §VIII.B, the problems associated with the limited data rate of USB were well known by 2009. *See also* EX1035, 1 (“Under USB 2.0 it takes about 10 minutes to transfer a high-def video from a Blu-ray disc.”); EX1015, 43 (introducing SuperSpeed USB for higher data rate compared to USB 2.0).

423. By 2009, there were also several known solutions to this problem. A POSITA seeking to address the limited data rate of USB 2.0 would have looked to (a) known protocols that could maintain compliance with USB 2.0 while increasing data rate and (b) known physical connectors that could have provided an easy-to-use physical structure to implement such protocols. For the ease of use, a POSITA would have been well aware that several well-known methods existed to make the insertion of a USB or similar connector foolproof and convenient by eliminating the need to check orientation before insertion. Yen provides an example of one known protocol

for increasing data rates while maintaining compliance with USB 2.0; and Zhenyu (plug) together with Lufan-Yuming-Socket (socket) provide the structural elements for implementing that protocol.

(i) Yen describes a protocol for adding data signals to the USB 2.0 interface to increase data rate

424. Yen sets forth a protocol for addressing the need to increase the data transmission rate in USB 2.0, particularly "suitable for the development of such products as portable data storage media." EX1009, 1:22-23. Yen specifically discloses a "Dual Channel Universal Serial Bus" protocol (referred to as DCUSB in Yen) that provides a "high-speed serial bus technology based on USB 2.0 technology" for increasing USB 2.0 data rate. EX1009, 1:13-15.

425. Yen teaches discloses a USB-compatible data interface that increases data transfer speed by adding a second differential signal channel in addition to the conventional USB channel. EX1009,1:34-37. The system uses two pairs of differential lines (D0+/D0– and D1+/D1–), configured as Master and Slave channels, which operate together to double transmission bandwidth while maintaining compatibility with existing USB 1.x and 2.0 protocols. EX1009, 1:14-23, 2:28-38. The architecture allows the interface controller to manage data conversion, synchronization, and retransmission, ensuring reliability and backward compatibility. EX1009, 3:9-25. Overall, Yen teaches that adding parallel signal channels within the USB standard can enhance data rate and stability.

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426. Yen explains that the DCUSB interface extends the conventional USB signal configuration by adding an additional differential signal pair to the standard USB pair. This results in a six-signal interface comprising **Vbus, D0+, D0–, D1+, D1–, and GND**. EX1009, 1:31-33. Each differential pair is connected to its own differential receiver and current driver, which are electrically linked through an interface controller responsible for data conversion and coordination. EX1009, 3:31-41.

427. Yen describes the DCUSB protocol in detail. As Yen explains, "in addition to using V_{BUS}, D+, D− and GND signals" in USB 2.0, the DCUSB protocol includes two new signals: D1+ and D1-. Yen discloses that these additional signals—implemented as "V_{BUS}, D0+, D0−, D1+, D1− and GND"—"accelerate data transmission rate." EX1009, 1:31-33. An exemplary wiring diagram for the additional differential pair (D1+ and D1-) at the host 500 (*e.g.*, a computer with a socket) and the device 600 (*e.g.*, data storage media with a plug to insert into host socket) is illustrated below. EX1009, Fig. 5.

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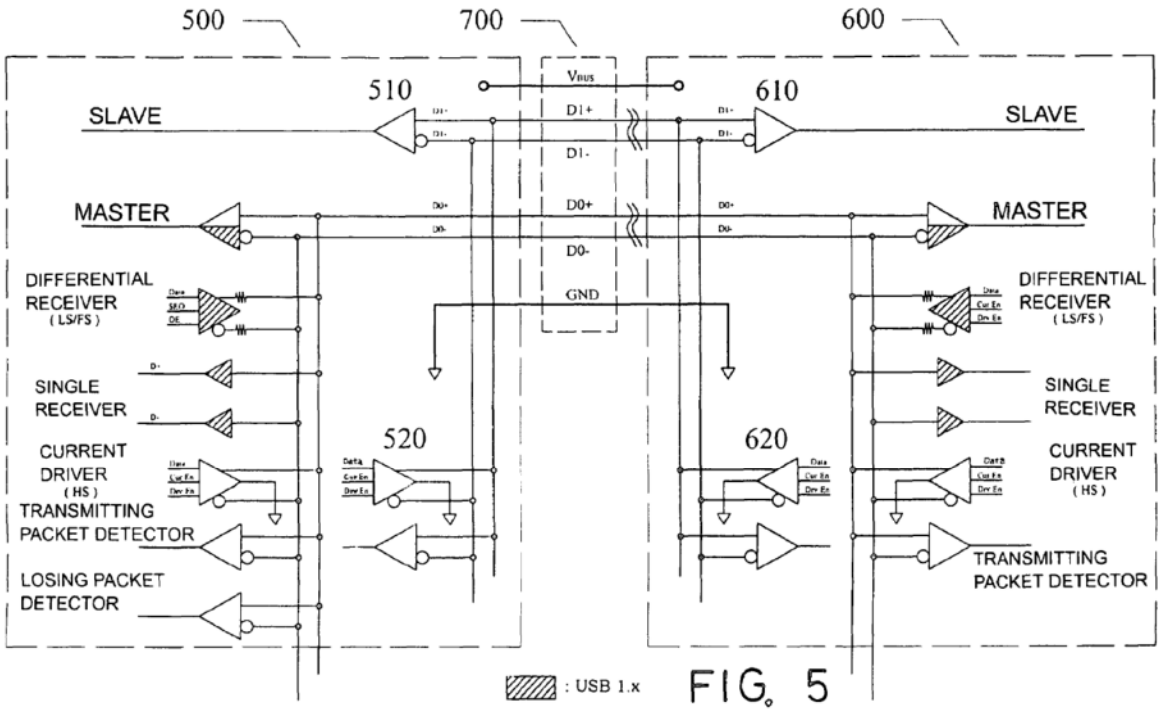


FIG. 5

EX1009, Fig. 5.

428. Functionally, Yen describes the Master channel (D0+/D0–) as performing the conventional USB operations—protocol coordination, chirp-sequence negotiation, and host-device communication—while the Slave channel (D1+/D1–) serves as an auxiliary channel to transmit data in parallel with the Master channel, thereby increasing total throughput. EX1009, 3:18-30. As such, DCUSB "uses the same packet structure as USB 2.0" where the second channel (D1+/D1-) can also provide "data transmissions" using the same type of data packets and thus "creates a dual channel mode." EX1009, 2:53-3:30, Fig. 4. If enabled, "the DCUSB

device 30 can transmit data at a rate twice as high as USB 2.0 data transmission rate." EX1009, 2:46-48.

429. Yen teaches that when connected to standard USB 1.x or 2.0 devices, only the Master channel operates, but when both host and device support DCUSB, the Slave channel activates following a chirp-sequence handshake during initialization. The chirp-sequence indicates whether the host (with the USB socket) and device (with the USB plug) will operate using USB 2.0, USB 1.x, or DCUSB protocols. EX1009, 2:9-27. If the host and device are both capable of DCUSB protocol operation, then four signal lines (D0+, D0-, D1+ and D1-) are enabled. EX1009, 2:23-27. Yen discloses that the interface controller maintains full backward compatibility with earlier USB protocols (1.x and 2.0). EX1009, 1:14-23, 2:28-38. The controller detects whether the connected host or device supports DCUSB operation, enabling or disabling the Slave channel as appropriate. EX1009, 2:23-27. This allows Yen's system to achieve significantly higher data transmission rates while retaining electrical compatibility with prior USB standards. EX1009, 1:14-23.

(ii) A POSITA would have been motivated, with a reasonable expectation of success, to use Lufan-Yuming-Socket with Zhenyu's plug to implement Yen's protocol

430. Yen describes the DCUSB protocol but does not describe the physical structure of the connector between the host (*e.g.*, a computer) and the device (*e.g.*, data storage media). A POSITA implementing Yen would have been motivated to

identify known physical structures for (a) a **plug** attached to, *e.g.*, a data storage media, for implementing Yen's protocol; and (b) a **socket** in a computer that can receive and connect to the data storage media plug for transferring data between the computer and the data storage media using Yen's protocol. Specifically, to implement Yen's protocol, a POSITA would have recognized that the plug and socket should be (a) compliant with USB 2.0 for backwards compatibility; and (b) provide two differential data pairs ("dual-channel") as well as power and ground connections for implementation of the higher data rate DCUSB disclosed in Yen.

431. In my opinion, as I explain below, the combination of Lufan-Yuming-Socket described in Ground 4 with Zhenyu and Yen would have been obvious and predictable to a POSITA to address these motivations. Lufan-Yuming-Socket and Zhenyu address well-known design incentives in USB technology—orientation inconvenience and data transmission improvement—using straightforward, compatible design principles. Combining them would have required no inventive ingenuity beyond ordinary skill. In short, Yen provides the *electrical motivation* (dual signal channels and multi-contact interface compatibility), while Lufan-Yuming-Socket and Zhenyu provide the *mechanical structure* (two-sided contact arrangement for reversible insertion). A POSITA combining these teachings would have found it obvious to implement a USB socket with contacts on both sides of a tongue to achieve both ease of use and functional reliability without departing from

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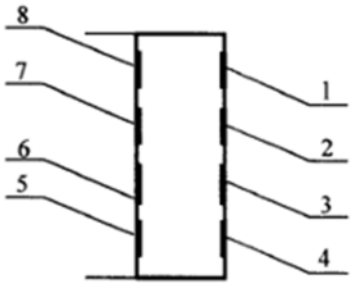
established USB principles. For a POSITA to accomplish these goals, it would have been a matter of choosing among a finite set of known, predictable plug and socket designs. Lufan-Yuming-Socket and Zhenyu's plug provide obvious structures to satisfy the design requirements.

432. **Lufan-Yuming-Socket:** As explained in Ground 4, the Lufan-Yuming-Socket is a symmetrical USB socket that has a central tongue 3 "located in the middle of the metal shell" with two symmetric sides of "metal conductive contacts," each of which provide a USB 2.0 interface. EX1007, 1, 4, Fig. 2; EX1008, 7, Fig. 5. The two sides of contacts on either side of the tongue in the Lufan-Yuming-Socket create two USB interfaces, where the USB functions of each interface are in "reverse" order from each other: "One side has the arrangement order of power Vcc+, data- (data-), data+ (data+), and ground (GND), while the other side has the arrangement order of ground (GND), data+ (data+), data- (data-), and power Vcc+." EX1007, 6. In other words, the Lufan-Yuming-Socket has two pairs of differential data contacts on each side of the tongue— when implementing Yen's dual-channel mode, one pair treated as D0+/D0- signals and one pair treated as D1+/D1- signals— that aligns with the differential data contacts on either side of Zhenyu's plug when also implementing Yen's dual-channel mode. The socket's symmetry allows for reversible insertion of a symmetric plug like Zhenyu's, at either 0 or 180 degrees. EX1007, 4-5 ("allowing the USB male connector to be inserted into the USB socket

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from both directions."). Moreover, the contacts on each side of Yuming's tongue are "electrically connected" to the terminals on ***each*** side of Yuming's double-sided plug. EX1008, 8.

433. **Zhenyu's plug:** Zhenyu correspondingly discloses a design for a USB 2.0-compliant plug that is symmetrical and reversible and therefore "user-friendly and compact" (shown below in the embodiment of Zhenyu, Figure 4). EX1006, 1. It would be immediately apparent to a POSITA that Lufan-Yuming-Socket would mate with Zhenyu's reversible plug. EX1007, 1, 4, Fig. 2. Like the Lufan-Yuming-Socket, as shown in Figure 4 of Zhenyu below, Zhenyu's USB plug has two sides of contacts (1-4 and 5-8), each of which forms a "complete set of USB interface contacts." EX1006, 6-7. The contacts on each side of the plug are in reverse order to allow insertion of the plug in either direction. EX1006, 6-7 (side 1: power (8), data-(7), data+ (6), ground (5); side 2: ground (1), data+ (2), data-(3), power (4)). As such, like Lufan-Yuming-Socket, each side of the plug includes its own set of differential data contacts—for a total of two pairs of differential data contacts—just as needed for Yen's DCUSB protocol. Moreover, like Lufan-Yuming-Socket, Zhenyu describes that each side of the disclosed plug can be used independently with a standard USB socket ***or*** the two sides can both be used at the same time, if desired: "[t]he contact points on the right and left sides can also ***use all contact points or only some of them***, depending on the actual application of the device." EX1006, 7.



A-A section

Fig. 4

EX1006, Fig. 4.

434. Lufan-Yuming-Socket and Zhenyu's plug are therefore an ideal fit for Yen's protocol. In the dual-channel implementation, Yen discloses that its DCUSB system employs two differential signal pairs—D0+/D0– and D1+/D1——configured respectively as Master and Slave channels. EX1009, 1:14-23, 2:28-38, 3:18-30. When combined with Lufan-Yuming-Socket's two-sided tongue and Zhenyu's two-sided plug, each side of the socket/plug connection can serve as one of these channels: one side carrying the Master differential signals (D0+/D0–), and the opposite side carrying the Slave differential signals (D1+/D1–). The host and device interface controllers, as taught by Yen, coordinate communication between the two channels to provide simultaneous parallel data transfer, doubling the effective bandwidth while maintaining full backward compatibility. EX1009, 2:23-27, 3:9-25, 3:31-41. Lufan-Yuming-Socket's and Zhenyu's existing physical configuration—two contact sets on opposing faces of a hollow plug—directly

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supports this electrical structure and requires no inventive modification to implement Yen's dual-channel signaling. As such, to implement Yen's dual-channel protocol, Zhenyu's plug (below, right) fits around the Lufan-Yuming-Socket tongue (below, left) and connects two data channels (one on each side) regardless of the direction of insertion. Thus, combining Yen's dual-channel signaling protocol with Lufan-Yuming-Socket's and Zhenyu's dual-sided connector geometry results in a USB-compatible interface that supports simultaneous dual-channel DCUSB transmission when both contact sets are used.

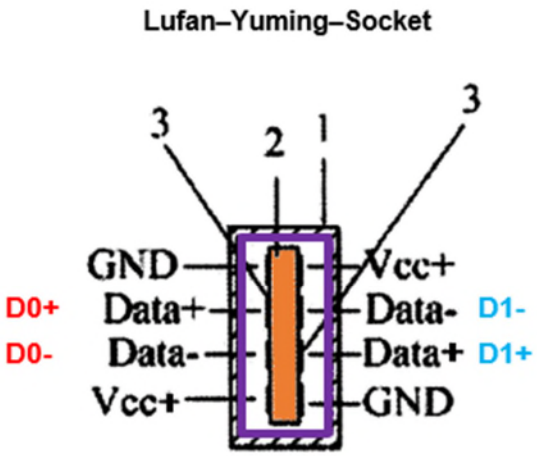


Fig. 2

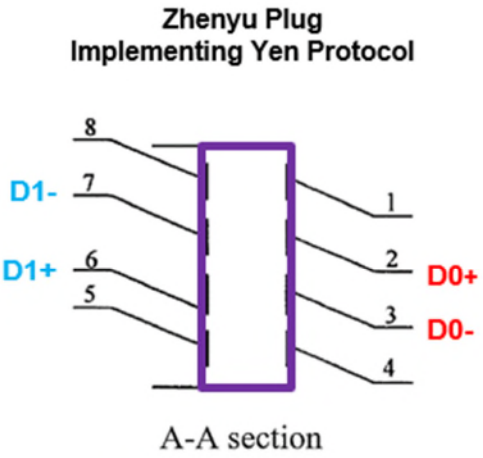


Fig. 4

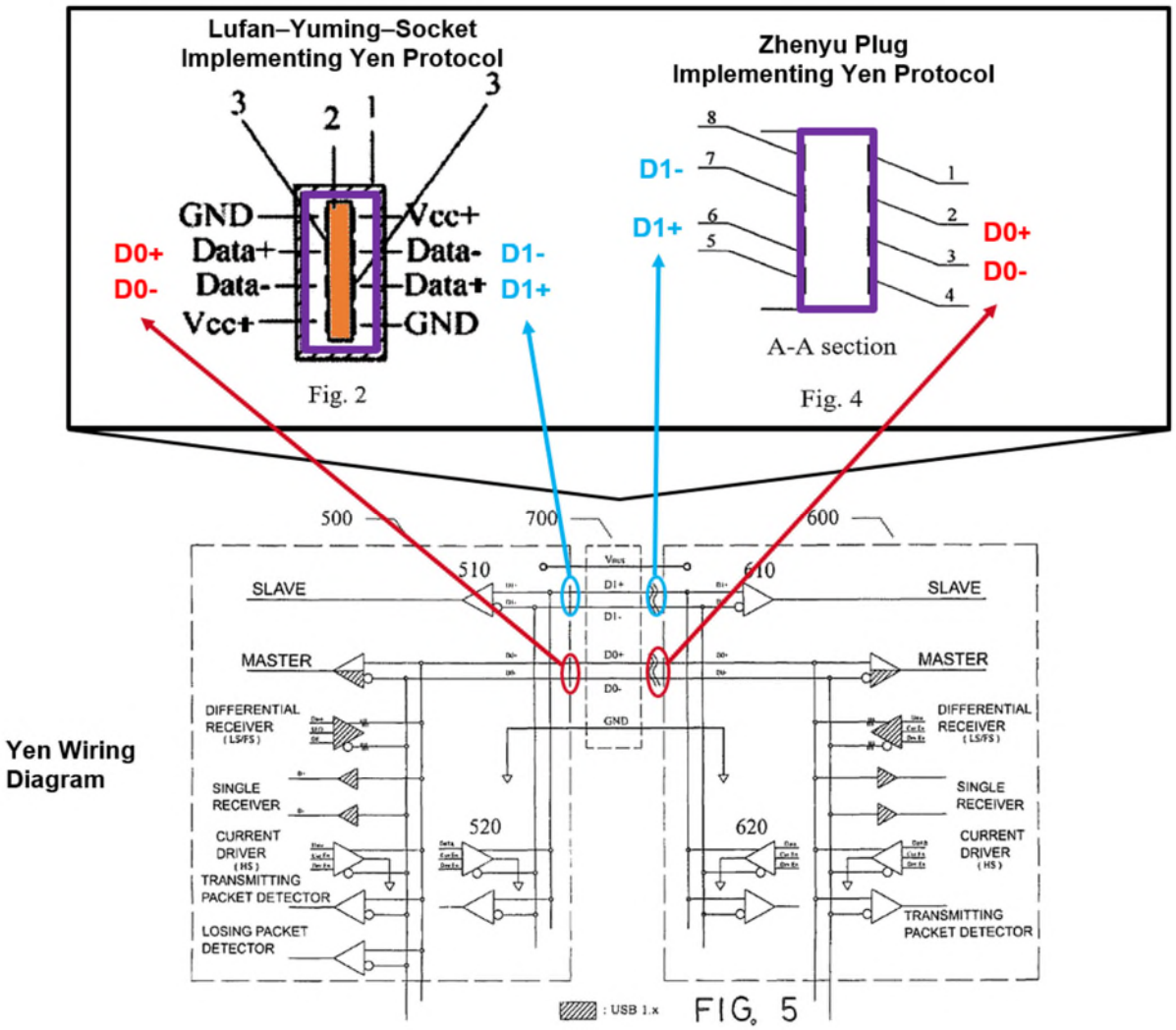
435. A POSITA would have had a reasonable expectation of success in implementing the Lufan-Yuming-Socket and Zhenyu plug with Yen's DCUSB protocol. It would have been straightforward to implement the Lufan-Yuming-Socket to connect both sides of contacts on Zhenyu's plug, as already disclosed in Zhenyu and Yuming. *See* EX1008, 8 ("The contact portions 221a and 221b" of each

side of the plug "are electrically connected to the terminal mating parts 132a and 132b" on each side of a socket "thereby achieving electrical signal continuity"); EX1006, 6-7; EX1009, 2:23-27. Yen's protocol is also fully compatible with reversibility. As Yen explains, all four contacts (D0+/D0- and D1+/D1-) have the same physical capability to send and receive all four types of USB 2.0 data packets. EX1009, 2:56-60 ("These four types of packets can be operated on Master [D0+/D0-] and Slave [D1+/D1-] signals[.]"). The only difference is that, if enabled as D0+/D0- (so-called "Master" signals), the contacts will recognize and respond to the standard "Start of Frame" and "Setup" packets. EX1009, 2:56-60. Accordingly, a POSITA would have understood that either set of differential data contacts could be treated as D0+/D0- ***or*** D1+/D1-, depending on how they are enabled. Yen already discloses a procedure (Chirp sequence) to enable the data contacts after the host and device "identify each other's operating range" as USB 1.x, USB 2.0 or DCUSB. EX1009, 2:9-18. If both host and device were capable of DCUSB communications, it would have been straightforward to implement the Chirp sequence to identify either of the two sets of differential data contacts in Zhenyu's plug as "Master" signals for receiving "Start of Frame" or "Setup" packets. Given these simple and minor adjustments, a POSITA would have had a reasonable expectation of success in implementing Yen's protocol with Zhenyu's plug regardless of the direction of

insertion, and would have achieved the described benefits of improved data transfer speed taught in Yen.

436. Moreover, Yen provides additional details of how such a socket and plug would be implemented at the host and peripheral device. Lufan specifically describes that the socket model "can be applied to computer chassis" (EX1007, 6), and Yen provides the details of exemplary electrical connections to make the Lufan-Yuming-Socket work in such a computer host. EX1009, Fig. 5, 3:31-41. The wiring diagram from Yen below shows connections for implementing the Yen protocol (a) between the host 500 (*e.g.*, computer) and the Lufan-Yuming-Socket, as well as (b) between a peripheral device 600 (*e.g.*, data storage) and Zhenyu's plug. I note that in this regard, the prior art is significantly more detailed than the '307 patent itself, which provides no description of how a socket could be implemented with two sides of enabled contacts.

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Yen Wiring Diagram

ii. Independent Claim 34 Is Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

34[pre]. A socket structure with duplex electrical connection, the socket structure comprising:

437. The Lufan-Yuming-Socket discloses this limitation, under Patent Owner's interpretation of the phrase "duplex electrical connection." *See* §VII.B. Lufan-Yuming-Socket is reversible, as described above (X.F.i), and the contacts on the Lufan-Yuming-Socket have both data and power connections on each side of the

socket's tongue, allowing for electrical connections with both sides of the Zhenyu plug at the same time. *See* EX1007, Fig. 2, 4-5 (describing contacts on two sides of tongue that "allow[] the USB male connector to be inserted into the USB socket from both directions"); EX1008, 8 (describing electrical connections on both sides of the tongue). *See* §§X.F.i, X.D.ii.

34[a].	**a plastic base;**

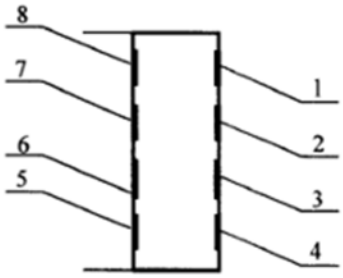
438. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. *See* §X.D.ii.

34[b].	**a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;**

439. The Lufan-Yuming-Socket discloses "a connection slot, which is disposed in front of the plastic base" for the same reasons described in Ground 4. *See* §X.D.ii.

440. The Lufan-Yuming-Socket in view of the Zhenyu plug implementing Yen's DCUSB protocol discloses a connection slot "configured to be connected to a plug having at least one row of connection terminals." Specifically, the Zhenyu plug has at least one row of connection terminals, as shown, for example, by contacts 1-4 on one side or contacts 5-8 on the other side of the plug opening. Each set of these connection terminals implement a standard USB 2.0 interface (Power, D+, D-

, Ground). EX1006, 6-7 (side 1: power (8), data- (7), data+ (6), ground (5); side 2: ground (1), data+ (2), data-(3), power (4)).



A-A section

Fig. 4

EX1006, Fig. 4.

34[c].	**a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,**

441. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. *See* §X.D.ii.

34[d].	**the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;**

442. The Lufan-Yuming-Socket discloses "the tongue being disposed on one end of the plastic base and within the connection slot" with "chambers of the connection slot on two sides of the tongue," for the same reasons described in Ground 4. *See* §X.D.ii.

443. The Lufan-Yuming-Socket in view of the Zhenyu plug implementing Yen's DCUSB protocol also discloses "the plug to be normally and oppositely inserted and positioned into the connection slot." As explained above, the Lufan-Yuming-Socket discloses a centrally located tongue forming symmetric connection slot *chambers* allowing the Zhenyu reversible plug to be inserted at 0 degrees (*normally*) or 180 degrees (*oppositely*). EX1007, Fig. 2, 1 ("located in the middle of the metal shell"), 4-5 ("allow[s] the USB male connector to be inserted into the USB socket from both directions"); EX1006, 1 ("A double-sided universal serial bus (USB) interface capable of being inserted into a computer USB socket in both directions"); §X.F.i (describing reversible insertion of Zhenyu plug).

34[e].	**at least one row of first contacts separately arranged on the first surface of the tongue, wherein**
34[f].	**each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and**
34[g].	**at least one row of second contacts separately arranged on the second surface of the tongue, wherein:**
34[h].	**each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;**

444. The Lufan-Yuming-Socket discloses limitations 34[e]-34[h] for the same reasons described in Ground 4. *See* §X.D.ii.

34[i].	**the socket structure is operative to simultaneously electrically connect via the first and second contacts;**

445. The Lufan-Yuming-Socket in view of the Zhenyu plug implementing Yen's DCUSB protocol discloses 34[i], under Patent Owner's interpretation of the

"simultaneously" terms. §VII.A. For example, the Lufan-Yuming-Socket is capable of receiving the Zhenyu plug, which is single plug with a symmetrical central opening configured to receive the socket's central tongue, thereby satisfying this limitation under Patent Owner's interpretation. *See* §§X.F.i, X.D.ii.

34[j].	**the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:**

446. The Lufan-Yuming-Socket discloses this limitation, under Patent Owner's interpretation. §VII.C. The Lufan-Yuming-Socket has two rows of USB 2.0 contacts, in reverse order, configured for dual-channels. *See* §X.F.i.

447. Moreover, this configuration allows the Lufan-Yuming-Socket to receive a plug in two separate operational states. Specifically, the Zhenyu plug implementing Yen's DCUSB protocol can be inserted into the Lufan-Yuming-Socket at 0 degrees (one *operational state*) or 180 degrees (another *operational state*). EX1006, 1 ("A double-sided universal serial bus (USB) interface capable of being inserted into a computer USB socket in both directions"); EX1007, 4-5 ("allow[s] the USB male connector to be inserted into the USB socket from both directions"), Fig. 2; §X.F.i.

34[k].	**a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and.**

448. The Lufan-Yuming-Socket in view of the Zhenyu plug discloses this limitation. Specifically, the Zhenyu plug can be inserted into the Lufan-Yuming-Socket at 0 degrees (*first operational state when the plug is normally inserted*) such that one row of contacts (*e.g.*, contacts 5-8) face and are electrically connected to the contacts on the second surface of the socket tongue (*i.e.*, lower surface of the Lufan-Yuming-Socket tongue). *See* §X.F.i.

34[l].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and.**

449. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. *See* §X.D.ii.

34[m].	**a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and**

450. The Lufan-Yuming-Socket in view of the Zhenyu plug discloses this limitation. Specifically, the Zhenyu plug can be inserted into the Lufan-Yuming-Socket at 180 degrees (*second operational state when the plug is oppositely inserted*)

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such that the row of contacts face and are electrically connected to the contacts on the first surface of the socket tongue (*i.e.*, upper surface of the Lufan-Yuming-Socket tongue). *See* §X.F.i.

34[n].	**the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.**

451. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. *See* §X.D.ii.

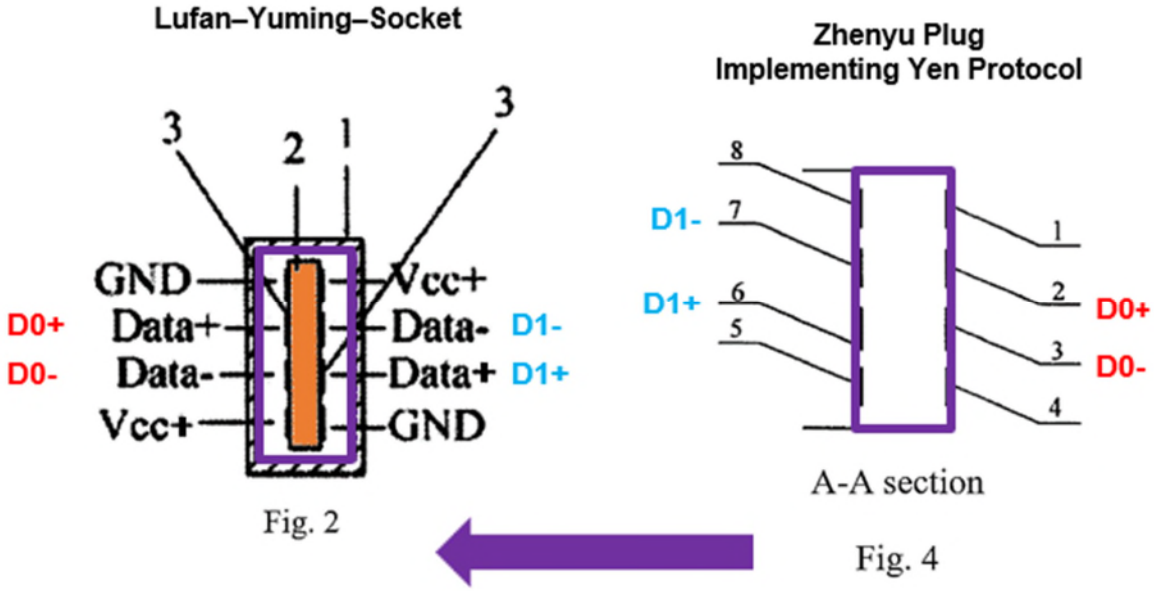
iii. Dependent Claims 35-51 and 53-55 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

452. In my opinion, Claims 35-51 and 53-55 are also rendered obvious by the Lufan-Yuming-Socket and the Zhenyu plug implementing Yen's DCUSB protocol, under Patent Owner's interpretation of Claim 34, as explained below. §VII.

35.	**The socket structure of claim 34, wherein the tongue only contacts an interior portion of the plug when the plug is inserted.**

453. The Lufan-Yuming-Socket and Zhenyu plug discloses this limitation. As shown below, when Zhenyu's plug is inserted into the Lufan-Yuming-Socket, the socket's tongue inserts into the plug's opening and only contacts the interior walls of the Zhenyu plug. This is also consistent with Yuming's disclosure of structural components of the socket tongue that is configured to receive and contact only an interior portion of a plug. EX1008, 8 ("When the plug connector 20 and the socket connector 10 are in the mating state, the receptacle 21 is inserted along the

mating interface 14, at which point the tongue piece 112 extends into the socket interface 211"); *see also* §X.D.ii (34[b], 34[d]).



36.	**The socket structure of claim 35, wherein a thickness of the tongue is less than a third of a height of the connection slot.**

454. The Lufan-Yuming-Socket in view of Zhenyu's plug renders this limitation obvious. As explained above for §X.D.iii (36), the Lufan-Yuming-Socket does not disclose a specific dimension for a tongue vis-à-vis the connection slot. But neither does the '307 patent, which fails to mention the recited relative dimension in the written description at all let alone to ascribe any criticality or importance to the recited limitation, or to describe how the claimed thickness range produces any meaningful distinction over that disclosed in the prior art. For example, in the '307 patent, there is no explicit dimensional metrics or scaling discussion for the tongue thickness. In fact, the only mention of a specific numerical proportion for the

dimensions of the tongue thickness in the '307 patent occurs in the claim language. *See, e.g.*, EX1001, Claim 36. In general, the relative dimension recited in this claim would have been obvious to a POSITA, and particularly would have been obvious in view of the specific tongue and connection slot of the Lufan-Yuming-Socket when mated with Zhenyu's plug.

455. As I described, the Lufan-Yuming-Socket is a symmetrical socket that has an open connection slot around a symmetrical, central tongue that is capable of inserting into and mating with the corresponding symmetrical middle open area of Zhenyu's plug. §§X.D.i, X.F.i.

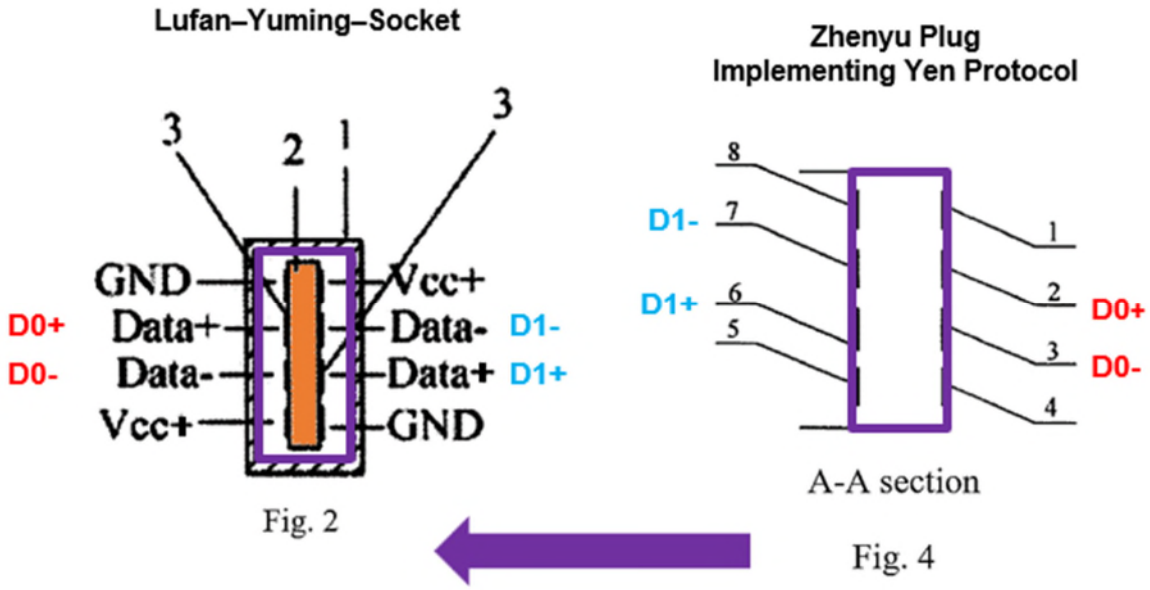


Fig. 2

Fig. 4

456. In this configuration, a POSITA would have had a finite number of predictable options for the relative thickness of these elements. The tongue could be (a) less than 1/3 the overall connection slot, with larger openings above/below it; (b)

exactly 1/3 the connection slot, with equal-sized openings above/below; or (c) greater than 1/3 the connection slot, with smaller openings above/below. It would have been obvious for a POSITA to choose one of these predictable, structural options.

457. Moreover, a POSITA's simple logic would have suggested and motivated the claimed range. A POSITA would have recognized that making the surrounding connection slot thicker around the tongue (thus decreasing the tongue thickness) allows more room for thicker plug walls of Zhenyu's plug, which promotes robustness of the plug. And improving robustness of the plug and socket connection is precisely one of the key goals of Yuming. EX1008, 1 ("the structure forms a more stable connection by the mating of the socket connector and the plug connector, making installation convenient and ensuring smooth, stable electrical signal transmission and a long service life"), 4 ("a socket connector and a plug connector that form a more solid connection structure when mated. This facilitates easy installation, ensure smooth electrical signal transmission, and extends service life"). Indeed, unlike the socket's tongue, which is protected within the socket structure, the plug is exposed to external environments and is thus more likely to be damaged by user handling. Thus, when choosing how to divide the Lufan-Yuming-Socket between the tongue and the connection slots, a POSITA would have been motivated to devote the majority of thickness to the connection slots, so the

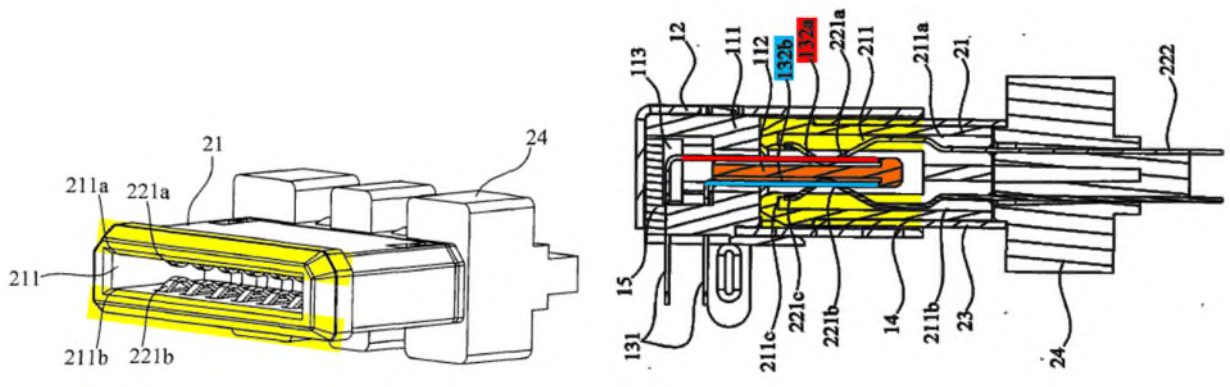
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corresponding plug walls could be ***thicker***, providing maximum mechanical strength for reliable electrical connections while maintaining a compact and convenient design.

458. A socket tongue thickness of less than 1/3 of the connection slot is also consistent with Lufan's, Yuming's, and Zhenyu's drawings. For example, Figure 2 (above, left) of Lufan depicts a tongue thickness that is approximately 1/3 or less of the connection slot height. Likewise, Figure 7 (below, right) of Yuming further depicts a tongue that is less than 1/3 the thickness of the connection slot, which must be just large enough to receive and be fully filled by the relative thicker upper and lower plug walls shown in Figure 4 (below, left). EX1008, 6 (describing the mated socket and plug "fully and efficiently utilizes internal space . . . resulting in a compact structure . . . ."). And Zhenyu's plug is similarly structured to Yuming's plug—both plugs have upper and lower plug walls that form a symmetrical middle opening in the center of the plug walls. *See also* EX1006, Fig. 4 (above, right). Since the Lufan-Yuming-Socket's connection slot is configured to receive a plug (such as Zhenyu's plug or Yuming's plug), a POSITA would have understood that making a plug with a middle opening less than 1/3 of the thickness of the overall plug height means that the socket tongue that goes ***inside*** the plug's middle opening must be less than 1/3 the thickness of the connection slot that receives the plug walls—just as recited in this claim. *See* §X.F.i; EX1008, 8 ("When the plug connector 20 and the

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socket connector 10 are in the mating state, the receptacle 21 is inserted along the mating interface 14, at which point the tongue piece 112 extends into the socket interface 211").



EX1008, Figs. 4, 7.

459. A POSITA would have had a reasonable expectation of success in making the tongue less than one-third of the thickness of the connection slot. Yuming also discloses that the tongue is made of insulating material, EX1008, 7, which a POSITA would have known could easily form a tongue with a range of thicknesses, including thicknesses less than 1/3 of the connection slot. Indeed, well known electrical connectors at the time had a tongue with thickness relative to a connection slot within this range. EX1015, 91, 96.

37.	**The socket structure of claim 34, wherein a portion of each of the first contacts, in the at least one row of first contacts, is coplanar with a portion of the first surface of the tongue.**

460. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

38. The socket structure of claim 37, wherein a portion of each of the second contacts, in the at least one row of second contacts, is coplanar with a portion of the second surface of the tongue.

461. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

39. The socket structure of claim 34, further comprising a metal housing at least partially covering the plastic base.

462. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

40. The socket structure of claim 34, wherein the socket structure is a universal serial bus socket structure.

463. The Lufan-Yuming-Socket is a USB structure. *See* §§X.D.i, X.F.i.

41. The socket structure of claim 34, wherein the tongue and the plastic base are integrally formed.

464. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

42. The socket structure of claim 34, wherein each contact of the first and second contacts is a portion of a respective terminal.

465. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

43.	**The socket structure of claim 34, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

466. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

44.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another, and at least two of the second contacts are not in electrical communication with one another.**

467. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

45.	**The socket structure of claim 34, further comprising a rear cover attached to the plastic base.**

468. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

46.	**The socket structure of claim 45, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover.**

469. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

47.	**The socket structure of claim 45, wherein each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.**

470. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

48.	**The socket structure of claim 34, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

471. The Lufan-Yuming-Socket discloses this limitation under Patent Owner's interpretation for the same reasons as described for 34[pre] and 34[i]. §§X.F.ii (34[pre], 34[i]), VII.A-B. For example, the Lufan-Yuming-Socket is capable of receiving the Zhenyu plug, which is single plug with a symmetrical central opening configured to receive the socket's central tongue, thereby satisfying this limitation under Patent Owner's interpretation. §§X.D.i, X.F.i, VII.A.

49.	**The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another.**

472. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

50.	**The socket structure of claim 34, wherein at least two of the second contacts are not in electrical communication with one another.**

473. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

51.	**The socket structure of claim 34, wherein the at least one row of first contacts and respective first pins are located at ends of respective ones of a row of first terminals and the at least one row of second contacts and respective second pins are located at ends of respective ones of a row of second terminals.**

474. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

53.	**The socket structure of claim 34, wherein a portion of one of the first contacts is at least partially included in the first surface with grooves.**

475. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

54.	**The socket structure of claim 34, wherein a portion of one of the second contacts is at least partially included in the second surface with grooves.**

476. The Lufan-Yuming-Socket discloses this limitation for the same reasons described in Ground 4. §X.D.iii.

55.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 34 and the plug.**

477. The Lufan-Yuming-Socket discloses this limitation under Patent Owner's interpretation for the same reasons as claim 34. §§X.F.ii, VII.B. The contacts on both sides of the reversible socket tongue form an electrical connection with the contacts on both sides of Zhenyu's plug when implementing Yen's DCUSB protocol. §X.F.i.

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iv. Independent Claim 56 and Dependent Claims 57-66 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

478. Independent claim 56 is substantially the same as claim 34, §X.A.iii (56), except (a) limitation 56[c] specifies that the "first surface" of the tongue is on the "top side" and the "second surface" is on the "bottom side," (b) limitation 56[i] requires that the socket is "operative to simultaneously electrically connect ***on the top and the bottom side*** of the tongue (rather than "via the first and second contacts"), and (c) claim 56 does not include the "symmetrical" connection slot requirements of claim 34.

479. These differences do not substantively change the analysis of the Lufan-Yuming-Socket in view of the Zhenyu plug implementing Yen's DCUSB protocol. As already explained for claim 34, the Lufan-Yuming-Socket's tongue has a top side and a bottom side which are simultaneously electrically connected to the contacts on either side of the central opening in Zhenyu's plug, under Patent Owner's interpretation of the simultaneously limitations. *See* §§VII.A, X.D.ii (34[c], 34[i]); X.F.ii (34[c], 34[i]). Thus, the Lufan-Yuming-Socket renders claim 56 obvious for the same reasons as described for claim 34. §X.F.ii.

480. Dependent claims 57-66 are analyzed further below.

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57.	**An electrical connection system comprising the socket structure with the duplex electrical connection of claim 56 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.**

481. The Lufan-Yuming-Socket with the Zhenyu plug discloses this claim. The Lufan-Yuming-Socket has a duplex electrical connection, as Patent Owner interprets the term (§VII.B), and is capable of connecting to the Zhenyu plug implementing Yen's DCUSB protocol such that simultaneous electrical connections, under Patent Owner interprets that term (§VII.A), are formed via the first and second contacts on either side of the socket's tongue. *See* §X.F.ii (34[pre], 34[i]).

58.	**The socket structure of claim 56, wherein the tongue and the plastic base are integrally formed.**
59.	**The socket structure of claim 58, further comprising a metal housing at least partially covering the plastic base.**
60.	**The socket structure of claim 59, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.**
61.	**The socket structure of claim 60, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.**

482. Claims 58-60 are identical to claims 41, 39, 44, are invalid in view of the Lufan-Yuming-Socket for the same reasons. §X.F.iii (41, 39, 44).

483. Claim 61 is also substantively the same as claims 53 and 54, which together recite a socket structure "wherein a portion of one of the first [second]

contacts is at least partially included in the first [second] surface with grooves." Claim 61 is therefore invalid in view of the Lufan-Yuming-Socket for the same reasons as claims 53 and 54. §X.F.iii (53-54).

62.	**The socket structure of claim 61, wherein the at least one row of first contacts includes at least five contacts, and the at least one row of second contacts includes at least five contacts.**

484. The Lufan-Yuming-Socket renders this limitation obvious. Yuming describes that each side of its symmetrical socket can include six or more contacts. EX1008, 7 ("…6-pin terminal mating part 132a and 132b. The terminal mating part 132a is fixedly positioned in the upper terminal groove 112a of the tongue piece 112, while the terminal mating part 132b is fixedly positioned in the lower terminal groove 112b of the tongue piece 112"). A POSITA would have been motivated to include all six contacts in the Lufan-Yuming-Socket to implement two full dual-channel USB interfaces disclosed in Yen—one on either side of the Lufan-Yuming-Socket—which would have further increased the data rate by doubling the number of differential data channels. EX1009, 1:35-37 ("the present invention creates a 6-signal interface and a Master-Slave architecture; wherein, D0+ and D0- are master signals: D0+ and D0- are slave signals"); §X.F.i. A POSITA would have a reasonable expectation of success in implementing the Lufan-Yuming-Socket with additional contacts for the same reasons described above—Yen provides details of the protocol needed for using additional data contacts, which would have been

straightforward to implement using the structure of the Lufan-Yuming-Socket. §X.F.i.

63.	**The socket structure of claim 62, wherein the tongue has chamfered corners on two sides of the tongue.**

485. The Lufan-Yuming-Socket renders this limitation obvious for the same reasons described for Ground 4. §X.D.iv (63).

64.	**The socket structure of claim 63, wherein a tip of the tongue is tapered.**

486. The Lufan-Yuming-Socket renders this limitation obvious for the same reasons described for Ground 4. §X.D.iv (64).

65.	**The socket structure of claim 64, wherein a thickness of the tongue is less than third of a height of the connection slot.**

487. This claim limitation is identical to limitation 36, and is rendered invalid by the Lufan-Yuming-Socket for the same reasons. §X.F.iii (36). A POSITA would have had the same motivation and same reasonable expectation of success in implementing the tongue with less than 1/3 thickness of the connection slot, even with the additional requirements of intervening dependent claims 56, 58-64. Those intervening dependent claims do not change the analysis because the relative dimension of the tongue compared to the connection slot is determined by the desired thickness of the plug walls, which is not impacted by the intervening dependent claims.

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66.	**The socket structure of claim 65, wherein the socket structure is a universal serial bus socket structure.**

488. The Lufan-Yuming-Socket is a USB socket structure. §§X.D.i, X.F.i.

v. Independent Claim 67 and Dependent Claims 68-77 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

489. Independent claim 67 is substantially the same as claim 34, §X.A.iv (67), except (a) limitation 67[d] adds the requirement that the plug is normally and oppositely inserted "based on an operational state when the socket structure is connected to the plug"; (b) limitation 67[i] requires ***six*** contacts in each row; and (c) limitation 67[k] recites a "reverse mirror" configuration rather than "functional reverse mirror" configuration.

490. Differences (a) and (c) do not change my analysis. For limitation 67[d], the Lufan-Yuming-Socket accepts a plug normally and oppositely inserted based on the operational state, as described for limitations 34[d], [j], [k], [m]. §X.F.ii (34[d], 34[j], 34[k], 34[m]). For limitation 67[k], I interpret "functional reverse mirror" to be a type of "reverse mirror," and thus "reverse mirror is disclosed for the same reasons as "functional reverse mirror." EX1001, 6:48-51. Accordingly, limitation 67[k] is disclosed by the Lufan-Yuming-Socket for the same reasons as described for limitation 34[j]. *See* §X.F.ii (34[j]).

491. Regarding difference (b), relating to limitation 67[i] ("the at least one row of first contacts includes at least six contacts, the at least one row of second

contacts includes at least six contacts"), this limitation is substantially similar to limitation 62 but recites the first and second contacts each include "at least six contacts" instead of "five contacts." But as I described for claim 62, it would have been obvious to implement the Lufan-Yuming-Socket with six contacts on each side. §X.F.iv (62).

492. Accordingly, claim 67 is rendered obvious by the Lufan-Yuming-Socket in view of claim 34 and 62, for the reasons I explained above.

493. Regarding dependent claims 68-73, and 75-77, those claims are identical to claims 57, 41, 39, 44, 61, 63, 36, 40, and 43, and are invalid for the same reasons. §X.F.iii-iv. For Claim 77, to the extent Patent Owner argues that the shielding metal shell cannot be both the claimed "rear cover" and claimed "metal housing," it would have been obvious to make the shell as two different layers to increase rigidity, which would correspond to the two claim elements, for the reasons I described above. §X.B.v.

494. Regarding claim 74, which recites "[t]he socket structure of claim 73, wherein a portion of the tongue opposite the plastic base is tapered," that claim is rendered invalid for the same reasons I described for claims 63 and 64. §X.F.iv (63, 64). Yuming discloses and renders obvious a chamfered tongue, and the chamfers decrease the thickness (taper) a portion of the tongue opposite the plastic base (near the tip). *Id*.

vi. Independent Claim 78 and Dependent Claims 79-87 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

495. Independent claim 78 is identical to independent claim 67, §X.A.v (78), except that claim 78 specifies that the socket's plastic base has a "metal housing" (78[a]) that there are "at least four" first and second contacts (78[i]), and the tongue of the socket is "at a central location" (78[m]-[n]). The Lufan-Yuming-Socket renders those limitations obvious, as already described for claims 34, 39, 67, 70. §§X.F.ii-iii, v. Claim 78 is rendered obvious for the same reasons.

496. Dependent claims 79-86 are the same as dependent claims 57, 41, 39, 44, 61, 63, 74, and 36, respectively, and are invalid for the same reasons. §§X.F.iii-v.

497. Dependent claim 87 is also invalid as it recites a "universal serial bus socket structure," which the Lufan-Yuming-Socket is (claim 40), with the additional limitations identical to claim 43, which the Lufan-Yuming-Socket discloses, and as further described for claim 77. §§X.F.i, X.F.iii (40, 43), X.F.v (77).

vii. Independent Claim 88 and Dependent Claims 89-96 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

498. Claims 88-96 are substantially identical to claims 78-86 and are invalid for the same reasons. §X.F.vi.

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viii. Independent Claim 98 and Dependent Claims 99-106 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

499. Claim 98-106 are substantially identical to claim 88-96, but without a limitation on the number of contacts and reciting "functional" in 98[j], and are therefore invalid for the same reasons. §X.F.vii.

ix. Independent Claim 108 and Dependent Claim 109 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

500. Claims 108-109 are invalid in view of the Lufan-Yuming-Socket. Claim 108 is the same as claim 98, but adds the limitations of claim 35, 39, 40, 42, 43, and 61, all of which are disclosed by the Lufan-Yuming-Socket, and claim 109 is substantially identical to claim 57, which is also disclosed by the Lufan-Yuming-Socket. §§X.F.iii-iv; *see also* §X.F.v (77) (obviousness of separate structures for metal housing/rear cover).

x. Independent Claim 110 and Dependent Claim 111 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

501. Claims 110-111 are invalid in view of the Lufan-Yuming-Socket. Claim 110 is substantially the same as claims 108, but add the requirements that the simultaneous electrical connection is "on the top and the bottom side of the tongue" and that the tongue is tapered and chamfered. The Lufan-Yuming-Socket disclose those additional limitations, as described for claims 56, 63, and 64. Claim 111 is substantially identical to claim 57, which is also disclosed by the Lufan-Yuming-

Socket. §X.F.iii-iv; *see also* §VII.F.v (77) (obviousness of separate structures for metal housing/rear cover).

xi. Independent Claim 112 and Dependent Claim 113 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

502. Claims 112 and 113 are invalid; they are substantially the same as claims 110 and 111, except they add the thickness limitation of claim 36, and the Lufan-Yuming-Socket discloses that limitation as well. §X.F.ii, iii (36); *see also* §VII.F.v (77) (obviousness of separate structures for metal housing/rear cover).

xii. Independent Claim 114 Is Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

503. Claim 114 is substantially the same as claim 98, , §X.A.viii (114), but without the "grooves" requirement, and is therefore invalid for the same reasons. §X.F.viii.

xiii. Independent Claims 117-120 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

504. Claims 117-120 are invalid. All claims are substantially identical to claim 114, , §X.A.viii (114), except (a) claims 117, 119-120 remove the "functional reverse mirror" limitation; (b) claims 117-120 require that "the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue" without reciting the word "simultaneously" (117[i]/118[i]/119[i]/120[i]), and as previously explained, the Lufan-Yuming-Socket can electrically connect on the top side or bottom side or both, under Patent

Owner's interpretation of this term. §§X.F.ii (34[i]), X.F.iii (56), VII.A; and (c) claim 119 and 120 remove the word "respective" from certain limitations and refer to the tongue as in the "middle" of or "centrally located" in the connection slot, which, if anything, broadens or does not substantially change the claim and does not change the obviousness in view of the Lufan-Yuming-Socket.

xiv. Independent Claims 130-135 Are Rendered Obvious by Lufan with Yuming, Yen, and Zhenyu

505. Claims 130 and 133 are invalid in view of the Lufan-Yuming-Socket because they are substantially the same as claim 34 or broader because (a) in claim 133, "functional reverse mirror" applies only to "some" contacts" and (b) both claims recite "recesses" rather than "grooves," and grooves are a specific type of recess. §X.F.ii.

506. Claims 131-132 and 134-135 are invalid because they are substantially the same as claim 34 except they (a) broaden claim scope by removing the symmetrical connection slot requirements and, for claims 131-132, 134, removing the word "respective" from certain limitations and, in claim 134-135, applying the "functional reverse mirror" limitation to "some"/a "portion" of contacts and; (b) recite "simultaneously electrically connect on the top and the bottom side of the tongue," which the Lufan-Yuming-Socket does under Patent Owner's interpretation of the terms as described for claim 56. §§X.F.ii, iv, VII.A.

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G. Ground 7: All Challenged Claims (34-120, 130-135) are further rendered obvious in view of Ground 6 combined with USB 3.0

507. A POSITA would have been motivated to combine the Lufan-Yuming-Socket/Zhenyu Plug with USB 3.0, for the same reasons USB 3.0 would have been combined with the Lufan-Yuming-Socket/Lee Slim-USB-Plugs, given that the socket structure is the same across both grounds. §X.E. The combination further renders obvious claims 36, 65, 75, 86, 96, 106, 112[x] ("thickness" limitations); renders obvious claims 52, 97, 107, 116 ("proud"/"projections" limitations); renders obvious claim 115 ("castellated surface" limitations); and further renders obvious claims 63-64, 73-74, 84-85, 94-95, 104-105, 110[w]-110[x], 112[w], 112[y] ("chamfered"/"tapered" limitations), all for the same reasons as described in Ground 5. §X.E.

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XI. SECONDARY CONSIDERATIONS

508. During prosecution of the ’307 patent, Patent Owner did not identify any evidence of secondary considerations of non-obviousness tied to the claimed invention of the ’307 patent. I am aware of no evidence of secondary considerations that would meaningfully rebut a finding of obviousness. To the extent Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my analysis and opinions to address it.

XII. RESERVATION OF RIGHTS

509. My opinions are based upon the information that I have considered to date. I reserve the right to supplement my opinions in the future to respond to any arguments raised by the owner of the ’307 patent and to take into account new information that becomes available to me.

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

Executed on December 3, 2025.

By: 

SAYFE KIAEI, PH.D.

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APPENDIX 1: CURRICULUM VITAE OF SAYFE KIAEI

Dr. Sayfe Kiaei

School of Electrical, Computer and Energy Engineering
Arizona State University, Tempe, AZ 85287
Sayfe@asu.edu

Sayfe Kiaei
Professor, Motorola Endowed Chair Professor in Analog and RFIC
School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

FIELDS OF SPECIALIZATION

- Digital Signal Processing, Adaptive & Array processing, Wireless and Wireline Communication System,
- Analog, Digital and RF Integrated Circuits, Sensors, Bio-Electronics, Power Management IC

DEGREES

- **Ph.D.,** Electrical and Computer Engineering, Washington State University, 1987; Thesis Topic area: VLSI implementation of Adaptive Kalman and Wiener Filtering
- **M.S.**, Electrical and Computer Engineering, Washington State University, 1984 ; Thesis area: Adaptive digital signal processing, Estimation of parametric non-stationary Markovian process
- **B.S.E.E.,** Electrical Engineering, Northeastern University/WSU, 1982

ACADEMIC POSITIONS

2001-Present: Professor, Motorola Endowed Chair Professor in Analog and RFIC School of Electrical, Computer and Energy Engineering, Arizona State University, Tempe, AZ

- **Professor:** Research and teaching in integrated circuits, RF circuits and systems, Communications, Wireless and Wireline transceiver, mixed-signal and Analog IC, Sensors, Power management IC.
- **Research Projects**:
    - Analog and digital IC, Power Management IC, Radio Frequency IC, RF transceiver
    - Digital Signal Processing, Audio processing, adaptive signal processing, Array processing, AI
    - Wireless communication system, wireless modems, 1G, 2G GSM, 3G CDMA, 4G LTE, 5G wireless mobile system, LTE, WiFi, Bluetooth, Wireless system standards
    - Wireline Communication system and transceivers, MODEM standards, CABLE MODEM DOCIS, DSL
    - Sensors, bio-electronics circuits and systems, heart monitoring system, hearing aid
- Research Funded by NSF, USAID, DARPA, JPL, NASA, Motorola Inc., Intel Inc., Broadcom, Qualcomm, Raytheon, General Dynamics, Texas Instruments, and over 10 other industries. List of Current significant research awards:
    - Partnership Center for Energy systems, USAID, 2015-2020, $18M. Principle Investigator
    - QESST NSF ERC Center on Solar Energy, NSF, 2010-2020, $36M, Co-PI, Test-bed Director
    - Solar Energy Development in ME, Private funds and World Bank, $2M
    - Connection One NSF Center, Director, 2004-Present, Total funding $10M, annual funding over $500K.

2004-Present, Director and founder of NSF IUCRC Center Connection One, School of Electrical, Computer, and Energy Engineering, Arizona State University, Tempe, AZ; https://connectionone.org

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- The NSF Connection One Industry/University Cooperative Research Center was established the center in 2002 with focus on communication system, integrated Circuits and Systems, wireless system, RF, sensors, and related areas. The center has five university member with over 30 industrial members. Total funding over $10M, annually over $500K. www.connectionone.org

2014-Present, Director, USAID, US-PCASE: Center for Advance Studies in Energy, Funding $18M.
https://uspcase.asu.edu/

- **Director and PI:** PCASE - Partnership Center for Energy systems, Energy Center funded by the USAID.
- USIAD Centers for Advanced Studies in Energy program (USPCAS-E) is a partnership between Arizona State University and two leading Pakistani universities: the National University of Science and Technology (NUST) Islamabad and the University of Engineering and Technology in Peshawar (UET).
- PCASE has developed two new Graduate schools of Energy. Within 5 years, the center has over 1000 MS and PHD Students, with 14 new energy degrees in MS and PhD, two new building with 20+ energy labs in the power system, grid, power electronics, renewable energy, PV, Wind, Hydro, bio-fuel, fuel cell, batteries and storage, and thermal areas.

2008-2012: Associate Dean of Research, Ira A. Fulton Schools of Engineering, Arizona State University

Responsible for leading the research infrastructure, promoting and developing research programs with industry and federal agencies, leading large multi-university proposals, investing and providing seed funding to foster new research areas, and promoting graduate program in the college of engineering. Research Enterprise support included:

- Increase College of Engineering research funding from $50M to over $80M.
- Working with Vice President for Research, Dean's, and directors on University-wide research initiatives.
- Established the first NSF Engineering Research Center (ERC) at the ASU on Solar Energy QESST. Managed, organized and planned the ERC proposal process. ASU is the lead school partnering with MIT, Georgia Tech, U of Delaware, Cal-Tech, U of New Mexico, and UA.
- Lead several trans-disciplinary 4M research projects (4M: multi-million, multi-investigator, multi-disciplinary, multi-university grants) in energy, security, and related initiatives.
- Oversight of over 20 existing research centers in the college of Engineering.
- Engage with industry and federal government to establish new research collaborations.
- Organized workshops and supported proposals for NSF, NIH, DOE, DOD, DARPA, etc.
- Organized workshops for new assistant professors to apply for NSF CAREER Awards. ASU CAREER awards grew from 3 annual awards in 2008 to over 15 CAREER awards by 2012.
- Research Administration and pre-award proposal administration for the schools. Developed a decentralized research administration and advancement team for the Schools supporting 5 schools, 12 departments, over 220 engineering faculty, with funding over $70M.
- Annual budget over $7M for supporting research centers, seed funding for new center, cost sharing, proposal support, equipment and infrastructure support, graduate scholarships, and research administration.
- ADR Staffs included, Director of industrial and government liaison, Director of research administration, and 14 research advancement staff.
- Graduate Programs: Recruiting, Fellowships, marketing, outreach, coordination with departments

1995-2002, Adjunct Professor, Electrical and Computer Engineering Dept., The University of Texas, Austin, Texas, Taught graduate courses at UT Austin on Introduction to Telecommunication System and Digital Communications. Co-advised two Ph.D. program committees in IC design and Telecomm (while at Motorola)

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1987-1994, NSF Center For Digital / Analog IC (CDADIC) Co-Director, NSF IUCRC Center director at Oregon State University. The CDADIC was established the center in 1987 with focus on integrated circuits at WSU, UW, and OSU with over 20 industrial members - https://cdadic.oregonstate.edu/

1987-1993, Assistant / Associate Professor (Tenured) Electrical and Computer Engineering Department, Oregon State University, Corvallis, OR

- Research and classes in Electronics, DSP, Communication system and networks, Wireless systems, MODEMS. Graduated 30 MS and Ph.D. students.
- Faculty Chair, Computer Engineering Program, Developed a new Computer Engineering Program at OSU in 1987

INDUSTRIAL POSITIONS

1993-2002: Motorola Inc., Senior Member of Technical Staff, Personal Communication Sector, Austin, Texas - Worked projects related to wireless communications, two way radios, wireless networks, ADSL and MODEM, RF, and related areas.

- **Motorola Cellular Division**, **Wireless Technology Center (WITC)**, **1997-2002.** Responsible for development of integrated circuits and systems for wireless handset. Lead number of projects including cellular (2G, 3G, 4G), wireless connectivity (Bluetooth and WIFI transceiver), GPS and location Receiver, wireless networks, 2-way radios and related areas. Worked on the development of various subcomponents including system design, link budget, RF front-end, filtering, analog front-end, power management, and baseband circuits and systems.
- **Motorola SPS, Broadband Products Operations, 1993-1997,** Worked on the development of XDSL (ADSL, VDSL, G.lite) systems including OFDM, modulation, synchronization, equalization and the development of a single chip ADSL transceiver (*CopperGold*™). The transceiver contained Analog Front End (A/D, D/A, Hybrid), DMT, modulation/demodulation, FFT, IFFT, echo canceler, time domain equalizer, front-end constellation mapping, Trellis code modulation, Viterbi decoder) and an on-chip DSP core.
- **Standards,** Represented Motorola in various standards including 2G-4G, GPS, Bluetooth, WiFi, 802.11, and DSL standards including T1E1, International Telecommunication Unit (ITU), T1E1, ETSI, 3GPPP, Universal ADSL Working Group (UAWG), Bluetooth working group, G.Lite working group, etc.
- **Land Mobile Products Sector**, Responsible for Wireless digital two-way radios, hot spot wireless network, next generation of digital two-way radios, "*Talk about Radios*", Japanese cellular systems (PHS).
- **University relations,** Responsible for the development of collaborative research programs with several universities. Responsible for funding research in the areas of Wireless Transceiver IC Design, RF, and mixed-signal and baseband system architecture.

1985-87: Member of Research Staff, Boeing Co., Bellevue, Wa, Flight Systems Research and Technology Center, summer. Design Engineer, Hardware and CAD tool development for system control.

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Dr. Sayfe Kiaei

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AWARDS

- IEEE Fellow 2004-Present
- IEEE Fellows CAS Committee Chair, 2009-2012
- Global Standards Award, For contributions in the International Telecommunication Unit (ITU) for Asymmetric Digital Subscriber Line (ADSL) G.Lite Standards. Motorola Inc., 1999.
- 10X Cycle Reduction Award, for development of new IC design process from DSP algorithm to IC layout, Motorola Inc., 1995.
- IEEE Darlington best paper Award, IEEE Circuits and Systems Society Best Paper Award, 1995. For "Characterization and Comparison of CMOS FSCL Circuits with Conventional CMOS for mixed-signal ICs," Published at: *IEEE Trans. on Circuits and Systems II, Sept. 93*.
- Carter Best Teaching Award, College of Engineering Best Teacher Award, Oregon State University, 1992. For *"outstanding and inspirational teaching in the College of Engineering"*. Award is selected by the confidential vote of all of the undergraduate students in the College of Engineering among over 125 professors in the College.
- Industrial University Fellowship (IUF) Award, National *Science Foundation*, 1993.
- Research Initiation Award, *National Science Foundation*, 1990-93.
- Outstanding Graduate Student Scholarship, Azur-*Data Inc*. WSU, 1984

RESEARCH PROJECTS

Partial list of Research Awards:

- USAID, PCASE – Center for Energy systems, 2015-2020, $18M. PI and Director
- NSF, QESST NSF ERC Center on Solar Energy, 2010-2020, $36M, Kiaei, Co-PI, Testbed Director,
- Private Donors, $1.5M, 2012-2015, Solar Energy Development
- NSF IUCRC Center, Connection One 2002-present, Over $10M as PI, over $0.5M annual center awards
- NSF, Micro-Power Multi-Phase MEMS Hearing Aid, 2007-2011, $500K
- NSF - Design for Implantable Bio-Sensors, 2007-2009, $480K
- Science Foundation of AZ, PEPER- Photovoltaic Environmental Performance and Reliability for the Arizona-Wide Electric Grid, 2009-2013, $1.2M
- SRC –Self Characterization for Calibration and Process Feedback of MEMS Devices, 2011-2014, $300K
- NSF- Cognitive MIMO Communications for Dynamic-Spectrum Wireless Networks – 2012-2014, $150K
  NSF, Autonomous Self-Healing Sensor Network Radio, 2010-2014, $250K
- DARPA, Neural-Enabled Prostheses with Sensorimotor Integration, $500K
- NSF, Microwave Sensors for Vital Signs Monitoring Device Design, 2011-2013, $250K
- NSF, Various REU funds, 8/31/12-8/31/13, $400K

- DARPA, Nano-Mechanical RF Band pass resonator for 2GhZ RF Applications, with JPL, $2.2 M, 2002-2005,
- Qualcomm, Connection One Center, Various projects in 3G-5G, WiFi (802.11), GPS, and Bluetooth , 2005-Present, $1.2M
- Texas Instruments, Various projects in Power management and RFIC, 2005-20012, $1.5M
- *Motorola Inc*., Various projects in Power management and RFIC Various projects 2002-2010, $1.2M.
- *SIRF Technologies,* GPS Transceiver, 2005, $300K.
- *Ridgetop Inc*., RF Harsh Environment, $200K
- Freescale Semiconductor, PWM Power Management, 2006, $150K
- State of Arizona, *WINTECH- Wireless Integrated Nano Technology Center Support* (2005-2009), Ranging from 450K annually from 2005-2009.
- BAE Systems; "New Techniques for Time Measurement Circuits LiDAR; 2005-2008; $650K
- SRC (Semi-conductors research Corp), Ultra-Wideband Transceivers for cellular and WiFi 802.11, $225K, 2001-2003
- Intel Corporation, Design of Multi-Standard RF Front-End Circuits for Cellular and WiFi, $300K, 2002-2005
- *National Science Foundation*, Adaptive Compensation of Analog circuits imperfections using DSP methods, $150K, 1996 (tie project with UC San Diego NSF center), 2010-2011
- Center for the Design of Analog/Digital IC's (CDADIC) 1987-1995, At Oregon State, $1.5M
- Low Power IF processing for Direct Digital Transceivers, *Motorola Inc*, $100K, 93.
- Hewlett-Packard Faculty Chair position in Mixed-Signal IC, HP, 1995-97, $500K
- *National Science Foundation, Motorola Inc*. Faculty Industry Fellowship, $250K, 93-94.
- *National Science Foundation, Research Initiation Award (RIA) (same as current CAREER Award),* Synthesis and Automatic Derivation of Multi-Rate VLSI Arrays for DSP Algorithms, , 90-93. $320K.
- CDADIC, various projects on Low-Noise Source Coupled Logic (SCL), Mixed-Mode IC's, *CDACIC* $350K, 1988-1992.
- Decimation Filters for A/D Noise Enhancements, Tektronix, Inc., $100K, 1988.
- Various grants for IC Fabrication (DARPA/MOSIS, VLSI), testing equipment (Tek, HP), DSP system development (TI, Motorola), ranging in various amounts up to $200K/year. At Oregon State, 1988-1997.

PROFESSIONAL RECOGNITION

- IEEE Fellow, 2002-Present
- IEEE Fellow Committee Chair, CAS, 2008-2010
- IEEE Fellow Committee member, 2007-2010.
- IEEE Senior Member, 1993-Present, IEEE Member 1987-1992.
- IEEE Faculty Advisor, Oregon State University, 1987-1990

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IEEE Editorials

- IEEE Microwave Magazine, Guest Editor,
- IEEE System Journal, Associate Editor, 2010-2011.
- Associate Editor, IEEE Transactions on VLSI, Jan 2001-2008.
- IEEE Comm. Magazine, guest Editor, Feature Issues on "Circuits for Wireless and Wireline Communications," April 1999.
- IEEE Transactions on Microwave Theory and Techniques , Guest editor, Special Issue on: "Radio Frequency IC Design," Dec. 1998.
- IEEE Transactions on Circuits and Systems-II , guest editor, Special Issue on: "Low-Power Wireless Communication Systems," June 1997.
- Associate Editor, IEEE Transactions on Circuits and Systems-II, 1993-1996.
- *Editor and Reviewer for IEEE ASIC/SOC Conference,*
- *Editor and Reviewer for IEEE Microwave Theory and Techniques Journal*
- *Editor and Reviewer for International Journal of Analog Integrated Circuits and Signal Processing*
- *Founding member of IEEE RF Integrated Circuits Synposium*
- *Associate Editor, IEEE Communications, Tutorial & Surveys Magazine, 2006-2009.*

Conference Organizations

- RFIC Executive Committee members, 2000-2017
- RFIC Steering Committee Member, RFIC symposium, 1996-2017.
- RFIC Founding member, 1995-96.
- Technical Program Chair, IEEE International Sym. on Circuits and Systems, Phoenix, AZ, 2002.
- ISSCC Admin Council, Conferences Committee 2000-2005.
- General Chair, Radio Frequency IC (RFIC) Symposium, Seattle, WA, 2002.
- Technical Program Chair, RFIC Symposium, Phoenix, AZ, 2001.
- Finance Chair, RFIC symposium, Boston, MA, 2000.
- Publicity Chair, RFIC symposium, Los Angeles, CA, 1999.
- Transactions Chair, RFIC symposium, Baltimore, MD, 1998.
- General Chair, Int. Sym. on Low-Power Electronics and Design (ISLPED), Monterey, CA, 97.
- Executive Committee Member, Int. Symp. On Low-Power Electronics and Design, 96-2000.
- Technical Program Committee Member of the following conferences:
  - International Conference on Circuits and Systems: 1996, 2000, 2001, 2004-2008
  - RFIC Symposium, 1996-2018
  - Application Specific Array Processing (ASAP): 2000-2002

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- Technical Program Chair, Int. Sym. on Low-Power Electronics and Design, Monterey, CA, 96.
- Arizona Telecom Comm (ATIC)
- GLS VLSI 1998, Lafayette, Louisiana, 1998
- VLSI Design 98, Chennai, India, Jan. 1998.
- ICECS, Lisbon, Portugal, 98.
- Application Specific Array Processing, 1995-97, 2000
- Vehicular Technology Conference, 1995-97.
- Inter. Conf. on Intelligent Information Systems, D.C., 1994-95.
- IEEE Pacific Rim Conference on Communications & Computers, Victoria, BC, Canada, 1991.

Invited talks, Panelist, Session Chairs, Workshop Speaker

- Conference chair, Technical Program committee chair and TPC member, tutorials, workshops, session chair, etc. in RFIC, ISSCC, ISCAS,VLSI, ICASSP, Low-Power Symposium, ICC, Application Specific IC's, IMS, MTT, etc.

CONSULTANT

- Intel Inc. Chandler, AZ, 2002-2006: Development of 3G-4G Wireless transceiver.
- Sony Inc., San Diego, CA and Tokyo, Japan, 2002-2004: Review and development of various telecom cellular system architecture including 3G system architecture, and GPS system.
- Motorola Inc. 2002-2005: Supporting development of BT, WiFi, E911, GPS integrated circuits and systems for the cellular and mobile handsets.
- Hewlett Packard, Corvallis, OR – 1990-1993: Various project on development of custom analog and digital IC's for printer and inkjet system. Some of this work was under consultation, and some under various research grants with Oregon State University.
- Tektronix Inc, Beaverton, OR - 1988-1990: Design and Implementation of Data acquisition system for Spectrum analyzer, development of custom DSP algorithm for the Tektronix spectrum analyzer including system architecture, simulation, analysis, and design of oversampled data acquisition system.
- Boeing Commercial Aircraft, BCAC, Renton, WA - 1985-1987: Development of Airplane Controller Model, Simulation and Implementation of Flight control, Model reduction, and system control.

EXPERT WITNESS (Patent, IP)

Patent litigation, patent validity, IPR, expert reports, deposition, testimony, and trade secrets in the following areas (Complete list of cases available):

- Analog and Digital IC, Radio Frequency Integrated Circuits, Power Management, Power Management IC
- Wireless communication, 3G, 4G, OFDM, WiFi, 802.11, Bluetooth, and related areas
- Communication networks, Signal Processing, Communication system, DSL, xDSL, VDSL, DOCIS MODEM, and related areas.

- Hearing AID, Bio-Electronics, Heart monitoring system, Bi-sensors
- Standards including AMPS, GSM, CDMA, WCDMA, LTE, 1G, 2G, 3G, 4G, BT, WiFi (802.11), DOCIS, and related ITU/ETRI/3G.PPP standards.
- Satellite communications, Satellite Transceiver, ECHO and Multi-path cancelation circuits
- Wireline Communications, MODEM, Digital Subscriber Line, ADSL, VDSL, MODEM
- Wireless LAN, Wi-Fi, 802.11, Bluetooth. ZIGBEE
- GPS system, GPS receiver
- MEMS, Bulk Acoustic Wave Filters, SAW, MEMS resonators, MEMS accelerometer Signal Processing, Communication Systems.

PATENTS, PUBLICATIONS

Patents

1. US-10213134-B2, Wireless in-shoe physical activity monitoring implementation
2. US-10264996-B2, Method and apparatus for wirelessly monitoring repetitive bodily movements
3. US-7528754-B1, Finite impulse response digital to analog converter
4. US-2007033000-A1, Efficient non-iterative frequency domain method and system for nonlinear analysis
5. US-7372333-B2, Monolithic supply-modulated RF power amplifier and DC-DC power converter IC
6. US-2006052988-A1, Compressed vector-based spectral analysis method and system for nonlinear rf blocks
7. US-7218085-B2, Integrated ZVS synchronous buck DC-DC converter with adaptive control
8. US-6661371-B2, Oscillator frequency correction in GPS signal acquisition

Standards Contributions

1. "Spectral Compatibility of ADSL: Frequency Overlap vs. FDM," T1E1, Dec. 97.
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GRADUATE STUDENT ADVISEES & RESEARCH PROJECT

(Partial list of Students graduated, current employment to the best of my knowledge)

1. J. Durgam, VLSI Design of Dynamically Reconfigurable Array Processors, MSEE, 1988. Intel.
2. J. Gilbert, Minimization Techniques for PLAs, MSEE, 1988, Tektronix Inc.
3. L. Luo, CCA Methods for ARMA Spectral Estimation, MSEE, 1989. Berkeley Research Center
4. E. Zahl, Enhancement Methods for A/D Noise Reduction, MSEE, 1989. AT&T
5. L. Aihua, Synthesis of MRAs, MSEE, 1990. Intel.
6. F. Aslam, Image Restoration Methods, MSEE, 1990.
7. S.H. Chee, FSCL Circuits for Mixed-Mode IC's, MSEE, 1990. Linear Tech.
8. C. Dawson, MSEE, 1990. Boeing
9. A. Chow, Source-Coupled Logic ALU, MSEE, 1990. Intel
10. S. Maskai, Decimation Filters Using FSCL Circuits, MSEE, 1991. Intel
11. L. Louis, VLSI Implementation of Toeplitz Matrices, MSEE, 1991.
12. R. Badyal, Bit/Serial VLSI Design of IIR Filters, MSEE, 1992, HP
13. Lap Mui, Piece-Wise Linear Schedule for VLSI Arrays, MSEE, 1992. HP
14. S. Abdennadher, Adaptive Sigma-Delta Modulators, MSEE, 1992. Level One / Intel.
15. H. Bribech, Second Order Adaptive A/D Schemes, MSEE, 1992.
16. B. Hickman, MSEE, 92. Tektronix
17. M. Maleki, Current-Mode Flash A/D, MSEE, 1992. University of Oregon
18. Man Wong, Low-Noise Decimation Filter for Mixed-Mode ICs, MSEE, 1993, Motorola.
19. Anu Krishna Swamy, Low Noise IC Blocks for Mixed-mode IC's, MSEE, 1993, Ph.D., 1997.
20. Manu Srivastava, Comparison of Differential Logic (FSCL, CVSL, DSLL), MSEE, 1994, Intel.
21. Joel Oren, VLSI Design of Asynchronous FIR Filters, MSEE thesis, Feb. 1994. E-Systems.
22. Y. Zheng, VLSI Design and Synthesis of Multi-Rate Arrays, Ph.D. March 94, Hughes Research.
23. Satish Kulkarni, Low-Sensitivity Filters, MSEE, 1995, Motorola.
24. Amit Dutta, Multi-user Interference Cancellation, Ph.D, Dec. 97, Faculty, India.
25. Dwight Poplin, Multiplierless MPEG Decoder, MSEE, 1996. HP.
26. Maxim Scarpa, Adaptive I/Q Miss-match Correction for Direct Conversion Receivers, MSEE 1998.
27. Jeff McNeal, Sigma-Delta Frequency-to-Time Conversion, MSEE, 1998. Level One Comm.
28. Julia Vogel, Adaptive DC offset Cancellation, MSEE, 1998. Faculty in Germany.
29. Takao Inoue, MS, Echo Cancellation for ADSL, 1998. MSEE, The U of Texas at Austin.
30. Navid Lashkarian, Frequency off-set estimation and Synchronization of OFDM systems, Ph.D., June 1999. Broadcom Inc. & Faculty at UC San Jose.

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31. Guner Arslan, (co-advisor with B. Evans), "Fast Equalization for DMT systems, with applications to ADSL," Ph.D. The University of Texas at Austin, 2000
32. Salem Abdennadher, I/Q Mismatch Correction for RF Wireless transceivers, Ph.D., Level One Comm/Intel.
33. Can Sandalci, DSL Line Driver, Ph.D., 2001, Intel.
34. Dean Badillo, Low-Cost VCO Ring Oscillators, PhD, 2004, Intel, Chandler,
35. Siamak Abedinpour, PhD, 2005 Freescale, Tempe, Arizona
36. Hemanth Shivalingaiah, Multi-Band Low Noise Amplifiers, Ph.D., 2006, Intel,
37. Shahin Farahani, PhD, 2006, Qualcomm Inc,
38. Nazanin Darbanian, M.S. Freescale, Tempe, Arizona
39. *Joe Rutkowski, Joseph, MS, 2004, Phillips.*
40. *Chaudhuri, Bikram, Synthesizer, MS/PhD, MS 2004.*
41. *Zhang, Jiandong, MEMs, MEMS, December-04*
42. *Afsahi, Ali, MS/PHD, UC San Diego, QUALCOMM, Connection One*
43. *Chen, Xiaomin, UWB, PHD, 2007, SRC/Motorola*
44. *Jali, Hilda, Power Management, MS, June-05,*
45. *Xuejin Wang, RF Optimization, 2006 CAD tools, PhD, Neo-Linear*
46. *Umar Lyles, Power Amplifier, MS, 2006. Texas Instruments*
47. MS, Erika Munoz, RADHARD, 2007, Intel
48. Waleed Khali, (Co-Advisor), Professor at Ohio State
49. Jennifer Kitchen, PhD, 2009, Professor at ASU
50. Shahin Mehdizad Taleie, RFDAC, PhD, 2009, Qualcomm
51. Ilker Deligoz, PHD, 2009, Qualcomm
52. Hyung Kim, PhD, Jan 2010, Intel
53. Jung Le, PhD 2010, Intel, TI
54. Syed Naqvi, PhD, 2012, Intel.
55. Todd Martin, MS, 2011, TI
56. Seungkee Min, PhD, 2011, Intel
57. Ali Meamar, Post Doc, RFIC 2013
58. Hitesh Khunti, MS 2013, Qualcom
59. Debashis Mandal, Post Doc, 2018
60. Edgar Martinez, PhD, 2015, Qualcomm
61. Chirag Desai, MS, 2016, Qualcom
62. Sanjay Avasarala, MS, 2016

63. Amir Ayati, PhD Aug 2018; Qualcomm
64. Pasisa Mahmoudi, PhD, May 2019, Qualcomm
65. Li Ming, MS, 2017
66. Qirong Peng, MS, 2017,
67. Yu Geng, PhD, 2018
68. Chai Yong, MS: 2015, PHD: 2019, Qualcomm
69. Shrikant Singh, MS: 2016, PhD, 2019, Movandi

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Various Committees at ASU, Oregon State University, etc.

INDUSTRY COMMITTEES

- Arizona Telecommunications and Information Council (ATIC), Board Member
- CAS Fellows Committee (ends December 31, 2006)
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- *Executive Committee, RFIC 2006.*
- *Technical Program Comm, IEEE RFIC 2006.*
- *Executive Committee, Conferences, International Solid Sate System's Conference.*
- *IEEE CAS Society, VLSI Technical Comm. Member*
- *Editorial Board, IEEE Communications Surveys & Tutorials*
- *Radio Frequency Integrated Circuits- RFIC 2006*
- *IEEE RF Integrated Circuits Conference, Committee Chair for two workshops*
- *International Microwave Symposium, IMS-MTT 2006*
- *Int. Symposium on Circuits and Systems - ISCAS 2006*
- *Wireless Networks & Emerging Technologies, WNET06*
- *Midwest Symposium on Circuits and System*
- *Arizona Governor IT Advisory Committee – GITA*
- *Arizona Telecom – ATIC*

INSTRUCTIONAL SUMMARY

- Digital IC Design, Analog IC Design, Advance CMOS Analog IC, VLSI, RFIC Design
- Wireless Transceiver Design, Wireless Communications, GPS, Telecomm Systems, Digital Communication
- Signal Processing, Advance digital signal processing, Communication, Digital Communication, Digital Audio Processing, Adaptive array processing
- Computer Architecture, Microprocessor System Architecture, Pipeline Array Processing

APPENDIX 2: CHALLENGED CLAIMS

Claim 34:

34[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
34[a]	a plastic base;
34[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
34[c]	a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,
34[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
34[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
34[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
34[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
34[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
34[i]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
34[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
34[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
34[l]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
34[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the

	plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
34[n]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 35:

35	The socket structure of claim 34, wherein the tongue only contacts an interior portion of the plug when the plug is inserted.

Claim 36:

36	The socket structure of claim 35, wherein a thickness of the tongue is less than a third of a height of the connection slot.

Claim 37:

37	The socket structure of claim 34, wherein a portion of each of the first contacts, in the at least one row of first contacts, is coplanar with a portion of the first surface of the tongue.

Claim 38:

38	The socket structure of claim 37, wherein a portion of each of the second contacts, in the at least one row of second contacts, is coplanar with a portion of the second surface of the tongue.

Claim 39:

39	The socket structure of claim 34, further comprising a metal housing at least partially covering the plastic base.

Claim 40:

40	The socket structure of claim 34, wherein the socket structure is a universal serial bus socket structure.

Claim 41:

41	The socket structure of claim 34, wherein the tongue and the plastic base are integrally formed.

Claim 42:

42	The socket structure of claim 34, wherein each contact of the first and second contacts is a portion of a respective terminal.

Claim 43:

43	The socket structure of claim 34, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.

Claim 44:

44	The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another, and at least two of the second contacts are not in electrical communication with one another.

Claim 45:

45	The socket structure of claim 34, further comprising a rear cover attached to the plastic base.

Claim 46:

46	The socket structure of claim 45, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover.

Claim 47:

47	The socket structure of claim 45, wherein each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.

Claim 48:

48	The socket structure of claim 34, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 49:

49	The socket structure of claim 34, wherein at least two of the first contacts are not in electrical communication with one another.

Claim 50:

50	The socket structure of claim 34, wherein at least two of the second contacts are not in electrical communication with one another.

Claim 51:

51	The socket structure of claim 34, wherein the at least one row of first contacts and respective first pins are located at ends of respective ones of a row of first terminals and the at least one row of second contacts and respective second pins are located at ends of respective ones of a row of second terminals.

Claim 52:

52	The socket structure of claim 34, wherein a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue.

Claim 53:

53	The socket structure of claim 34, wherein a portion of one of the first contacts is at least partially included in the first surface with grooves.

Claim 54:

54	The socket structure of claim 34, wherein a portion of one of the second contacts is at least partially included in the second surface with grooves.

Claim 55:

55	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 34 and the plug.

Claim 56:

56[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
56[a]	a plastic base;
56[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
56[c]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
56[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
56[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
56[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
56[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
56[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
56[i]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
56[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
56[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts; and

56[l]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts.

Claim 57:

57	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 56 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 58:

58	The socket structure of claim 56, wherein the tongue and the plastic base are integrally formed.

Claim 59:

59	The socket structure of claim 58, further comprising a metal housing at least partially covering the plastic base.

Claim 60:

60	The socket structure of claim 59, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.

Claim 61:

61	The socket structure of claim 60, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 62:

62	The socket structure of claim 61, wherein the at least one row of first contacts includes at least five contacts, and the at least one row of second contacts includes at least five contacts.

Claim 63:

63	The socket structure of claim 62, wherein the tongue has chamfered corners on two sides of the tongue.

Claim 64:

64	The socket structure of claim 63, wherein a tip of the tongue is tapered.

Claim 65:

65	The socket structure of claim 64, wherein a thickness of the tongue is less than third of a height of the connection slot.

Claim 66:

66	The socket structure of claim 65, wherein the socket structure is a universal serial bus socket structure.

Claim 67:

67[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
67[a]	a plastic base;
67[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
67[c]	a tongue, which has a first surface with grooves, and a second surface with grooves, disposed opposite the first surface,
67[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;

67[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
67[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
67[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
67[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
67[i]	the at least one row of first contacts includes at least six contacts, the at least one row of second contacts includes at least six contacts,
67[j]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
67[k]	the at least one row of first contacts has a reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
67[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
67[m]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
67[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
67[o]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 68:

68	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 67 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 69:

69	The socket structure of claim 67, wherein the tongue and the plastic base are integrally formed.

Claim 70:

70	The socket structure of claim 69, further comprising a metal housing at least partially covering the plastic base.

Claim 71:

71	The socket structure of claim 70, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.

Claim 72:

72	The socket structure of claim 71, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 73:

73	The socket structure of claim 72, wherein the tongue has chamfered corners on two sides of the tongue.

Claim 74:

74	The socket structure of claim 73, wherein a portion of the tongue opposite the plastic base is tapered.

Claim 75:

75	The socket structure of claim 74, wherein a thickness of the tongue is less than third of a height of the connection slot.

Claim 76:

76	The socket structure of claim 75, wherein the socket structure is a universal serial bus socket structure.

Claim 77:

77	The socket structure of claim 76, wherein each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover, and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.

Claim 78:

78[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
78[a]	a plastic base having a metal housing;
78[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
78[c]	a tongue, which has a first surface with grooves, and a second surface with grooves, disposed opposite the first surface,
78[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
78[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
78[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
78[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
78[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
78[i]	the at least one row of first contacts includes at least four contacts, the at least one row of second contacts includes at least four contacts,
78[j]	the socket structure is operative to simultaneously electrically connect via the first and the second contacts;

78[k]	the at least one row of first contacts has a reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
78[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
78[m]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
78[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
78[o]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 79:

79	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 78 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 80:

80	The socket structure of claim 78, wherein the tongue and the plastic base are integrally formed.

Claim 81:

81	The socket structure of claim 80, wherein the metal housing at least partially covers the plastic base.

Claim 82:

82	The socket structure of claim 81, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.

Claim 83:

83	The socket structure of claim 82, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 84:

84	The socket structure of claim 83, wherein the tongue has chamfered corners on two sides of the tongue.

Claim 85:

85	The socket structure of claim 84, wherein a portion of the tongue opposite the plastic base is tapered.

Claim 86:

86	The socket structure of claim 85, wherein a thickness of the tongue is less than third of a height of the connection slot.

Claim 87:

87	The socket structure of claim 86, wherein the socket structure is a universal serial bus socket structure and each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover, and each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover.

Claim 88:

88[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
88[a]	a plastic base;
88[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
88[c]	a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,
88[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
88[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
88[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
88[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
88[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
88[i]	the at least one row of first contacts includes more than four contacts, the at least one row of second contacts includes more than four contacts,
88[j]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
88[k]	the at least one row of first contacts has a reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
88[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
88[m]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and

88[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
88[o]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 89:

89	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 88 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 90:

90	The socket structure of claim 88, wherein the tongue and the plastic base are integrally formed.

Claim 91:

91	The socket structure of claim 90, wherein the metal housing at least partially covers the plastic base.

Claim 92:

92	The socket structure of claim 91, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.

Claim 93:

93	The socket structure of claim 92, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 94:

94	The socket structure of claim 93, wherein the tongue has chamfered corners on two sides of the tongue.

Claim 95:

95	The socket structure of claim 94, wherein a portion of the tongue opposite the plastic base is tapered.

Claim 96:

96	The socket structure of claim 95, wherein a thickness of the tongue is less than third of a height of the connection slot.

Claim 97:

97[a]	The socket structure of claim 96, wherein: the socket structure is a universal serial bus socket structure and
97[b]	each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover, and
97[c]	each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover,
97[d]	the tongue only contacts an interior portion of the plug when the plug is inserted,
97[e]	each contact of the first and second contacts is a portion of a respective terminal,
97[f]	a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue,
97[g]	the grooves in the first surface of the tongue each include a portion of one of the first contacts, and
97[h]	the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 98:

98[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
98[a]	a plastic base;

98[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
98[c]	a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,
98[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
98[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
98[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
98[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
98[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
98[i]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
98[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
98[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
98[l]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
98[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
98[n]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 99:

99	An electrical connection system comprising the socket structure with the duplex electrical connection of claim 98 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 100:

100	The socket structure of claim 98, wherein the tongue and the plastic base are integrally formed.

Claim 101:

101	The socket structure of claim 100, wherein the metal housing at least partially covers the plastic base.

Claim 102:

102	The socket structure of claim 101, wherein at least two of the first contacts are not in electrical communication with one another and at least two of the second contacts are not in electrical communication with one another.

Claim 103:

103	The socket structure of claim 102, wherein the grooves in the first surface of the tongue each include a portion of one of the first contacts, and the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 104:

104	The socket structure of claim 103, wherein the tongue has chamfered corners on two sides of the tongue.

Claim 105:

105	The socket structure of claim 104, wherein a portion of the tongue opposite the plastic base is tapered.

Claim 106:

106	The socket structure of claim 105, wherein a thickness of the tongue is less than third of a height of the connection slot.

Claim 107:

107[a]	The socket structure of claim 106, wherein: the socket structure is a universal serial bus socket structure and
107[b]	each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through the rear cover, and
107[c]	each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover,
107[d]	the tongue only contacts an interior portion of the plug when the plug is inserted,
107[e]	each contact of the first and second contacts is a portion of a respective terminal,
107[f]	a portion of a first contact projects beyond one surface of the tongue, and a portion of a second contact projects beyond another surface of the tongue,
107[g]	the grooves in the first surface of the tongue each include a portion of one of the first contacts, and
107[h]	the grooves in the second surface of the tongue each include a portion of one of the second contacts.

Claim 108:

108[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
108[a]	a plastic base;
108[b]	a metal housing at least partially covering the plastic base;
108[c]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;

108[d]	a tongue, which has a first surface with grooves, and a second surface with grooves, the second surface disposed opposite the first surface,
108[e]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
108[f]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
108[g]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
108[h]	at least one row of second contacts separately arranged on the second surface of the tongue; wherein:
108[i]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
108[j]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
108[k]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
108[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
108[m]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
108[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
108[o]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue,
108[p]	the socket structure is a universal serial bus socket structure and

108[q]	each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover, and
108[r]	each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover,
108[s]	the tongue only contacts an interior portion of the plug when the plug is inserted,
108[t]	each contact of the first and second contacts is connected to a respective portion of a respective terminal,
108[u]	the grooves in the first surface of the tongue each include a at least a portion of respective ones of the first contacts, and
108[v]	the grooves in the second surface of the tongue each include at least a portion of respective ones of the second contacts.

Claim 109:

109	An electrical connection socket and plug comprising the socket structure of claim 108 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 110:

110[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
110[a]	a plastic base;
110[b]	a metal housing at least partially covering the plastic base;
110[c]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
110[d]	a tongue, which has a top side with a first surface with grooves, and a bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
110[e]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
110[f]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein

110[g]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
110[h]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
110[i]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
110[j]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
110[k]	the at least one row of first contacts has a reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
110[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
110[m]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
110[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
110[o]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue,
110[p]	the socket structure is a universal serial bus socket structure and
110[q]	each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover, and
110[r]	each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover,
110[s]	the tongue only contacts an interior portion of the plug when the plug is inserted,
110[t]	each contact of the first and second contacts is a portion of a respective terminal,
110[u]	the grooves in the first surface of the tongue each include a respective portion of respective ones of the first contacts,

110[v]	the grooves in the second surface of the tongue each include a portion of respective ones of the second contacts,
110[w]	a portion of the tongue opposite the plastic base is tapered, and
110[x]	the tongue has chamfered edges on two opposite sides of the tongue.

Claim 111:

111	An electrical connection socket and plug comprising the socket structure of claim 110 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 112:

112[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
112[a]	a plastic base;
112[b]	a metal housing at least partially covering the plastic base;
112[c]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
112[d]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
112[e]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
112[f]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
112[g]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
112[h]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
112[i]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
112[j]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;

112[k]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
112[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
112[m]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
112[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
112[o]	the tongue is disposed at a central location within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue,
112[p]	the socket structure is a universal serial bus socket structure and
112[q]	each of the first contacts is electrically connected to the respective first pin extending out of the plastic base through a rear cover, and
112[r]	each of the second contacts is electrically connected to the respective second pin extending out of the plastic base through the rear cover,
112[s]	the tongue only contacts an interior portion of the plug when the plug is inserted,
112[t]	each contact of the first and second contacts is connected to a portion of a respective terminal,
112[u]	the grooves in the first surface of the tongue each include at least a portion of respective ones of the first contacts,
112[v]	the grooves in the second surface of the tongue each include at least a portion of respective ones of the second contacts,
112[w]	a portion of the tongue opposite the plastic base is tapered,
112[x]	a thickness of the tongue, in at least one portion, is less than third of a height of the connection slot, and
112[y]	the tongue has chamfered edges on two opposite sides of the tongue.

Claim 113:

113	An electrical connection socket and plug comprising the socket structure of claim 112 and the plug, wherein the socket structure is operatively connected to the plug, and wherein the socket structure is operative to simultaneously electrically connect via the first and second contacts.

Claim 114:

114[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
114[a]	a plastic base;
114[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
114[c]	a tongue, which has a first surface and a second surface disposed opposite the first surface and
114[d]	is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
114[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
114[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
114[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
114[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
114[i]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
114[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
114[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of

	connection terminals of the plug are electrically connected to the at least one row of second contacts and
114[l]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with up, down, left and right chambers around the tongue; and
114[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
114[n]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 115:

115[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
115[a]	a plastic base;
115[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
115[c]	a tongue, which has a top side with a first castellated surface and bottom side with a second castellated surface disposed opposite the first castellated surface and
115[d]	is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
115[e]	at least one row of first contacts separately arranged on the first castellated surface of the tongue, wherein
115[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
115[g]	at least one row of second contacts separately arranged on the second castellated surface of the tongue, wherein:
115[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base,

115[i]	the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue; and
115[j]	the socket structure is thereby configured for two separate operational states:
115[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second castellated surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
115[l]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with up, down, left and right chambers around the tongue; and
115[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first castellated surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
115[n]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 116:

116[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
116[a]	a plastic base;
116[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
116[c]	a tongue, which has a first surface and a second surface disposed opposite the first surface and
116[d]	is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
116[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein

116[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base, wherein
116[g]	a first portion of each of the first contacts is proud of a top-most surface of the tongue; and
116[h]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein
116[i]	a second portion of each of the second contacts is proud of a bottom-most surface of the tongue, and
116[j]	the socket structure is operative to simultaneously electrically connect on both sides of the tongue via the first and second contacts, wherein:
116[k]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base; and
116[l]	the socket structure is thereby configured for two separate operational states:
116[m]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
116[n]	the tongue is disposed at a middle within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
116[o]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
116[p]	the tongue is disposed at within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 117:

117[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
117[a]	a plastic base;

117[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
117[c]	a tongue, which has a top side with a first surface and bottom side with a second surface disposed opposite the first surface, and
117[d]	the tongue is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
117[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
117[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
117[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
117[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
117[i]	the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue; and
117[j]	the socket structure is thereby configured for two separate operational states:
117[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
117[l]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
117[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
117[n]	the tongue is centrally located within the connection, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 118:

118[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
118[a]	a plastic base;
118[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
118[c]	a tongue, which has a top side with a first surface and a bottom side with a second surface disposed opposite the first surface, and
118[d]	the tongue is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
118[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
118[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
118[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
118[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
118[i]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts;
118[j]	the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue; and
118[k]	the socket structure is thereby configured for two separate operational states:
118[l]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
118[m]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
118[n]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the

	plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
118[o]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 119:

119[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
119[a]	a plastic base;
119[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
119[c]	a tongue, which has a top side a first surface and a bottom side with a second surface disposed opposite the first surface, and
119[d]	the tongue is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
119[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
119[f]	each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
119[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
119[h]	each of the second contacts is electrically connected to a second pin extending out of the plastic base;
119[i]	the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue; and
119[j]	the socket structure is thereby configured for two separate operational states:
119[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and

119[l]	the tongue is disposed at a middle within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
119[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
119[n]	the tongue is disposed at within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 120:

120[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
120[a]	a plastic base;
120[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
120[c]	a tongue, which has a top side with a first surface and a bottom side with a second surface disposed opposite the first surface, and
120[d]	the tongue is disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot based on an operational state when the socket structure is connected to the plug;
120[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
120[f]	each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
120[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
120[h]	each of the second contacts is electrically connected to a second pin extending out of the plastic base;
120[i]	the socket structure is operative to electrically connect on the top side, the bottom side, and the top side and the bottom side of the tongue; and

120[j]	the socket structure is thereby configured for two separate operational states:
120[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
120[l]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
120[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
120[n]	the tongue is centrally located within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 130:

130[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
130[a]	a plastic base;
130[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
130[c]	a tongue, which has a first surface with recesses, and a second surface with recesses, the second surface disposed opposite the first surface,
130[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
130[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
130[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
130[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:

130[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
130[i]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
130[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for two separate operational states:
130[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
130[l]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
130[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
130[n]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 131:

131[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
131[a]	a plastic base;
131[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
131[c]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
131[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides

	of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
131[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
131[f]	each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
131[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
131[h]	each of the second contacts is electrically connected to a second pin extending out of the plastic base;
131[i]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
131[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured such that:
131[k]	when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts; and
131[l]	when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts.

Claim 132:

132[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
132[a]	a plastic base;
132[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
132[c]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
132[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides

	of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
132[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
132[f]	each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
132[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
132[h]	each of the second contacts is electrically connected to a second pin extending out of the plastic base;
132[i]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
132[j]	the at least one row of first contacts has a functional reverse mirror configuration relative to the at least one row of second contacts, and the socket structure is thereby configured for reversable connection such that:
132[k]	when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts; and
132[l]	when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts.

Claim 133:

133[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
133[a]	a plastic base;
133[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
133[c]	a tongue, which has a first surface with recesses, and a second surface with recesses, the second surface disposed opposite the first surface,
133[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides

	of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
133[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
133[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
133[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
133[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
133[i]	the socket structure is operative to simultaneously electrically connect via the first and second contacts;
133[j]	some of the at least one row of first contacts has a functional reverse mirror configuration relative to some of the at least one row of second contacts, and the socket structure is thereby configured for two operational states:
133[k]	a first operational state when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts and
133[l]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue; and
133[m]	a second operational state when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts, and
133[n]	the tongue is disposed within the connection slot, wherein the connection slot is symmetric with symmetric up and down chambers, and symmetric left and right chambers around the tongue.

Claim 134:

134[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
134[a]	a plastic base;

134[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
134[c]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
134[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
134[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
134[f]	each of the first contacts is electrically connected to a first pin extending out of the plastic base; and
134[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
134[h]	each of the second contacts is electrically connected to a second pin extending out of the plastic base;
134[i]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
134[j]	at least some of the at least one row of first contacts has a functional reverse mirror configuration relative to at least some of the at least one row of second contacts, and the socket structure is thereby configured such that:
134[k]	when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts; and
134[l]	when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts.

Claim 135:

135[pre]	A socket structure with duplex electrical connection, the socket structure comprising:
135[a]	a plastic base;

135[b]	a connection slot, which is disposed in front of the plastic base and configured to be connected to a plug having at least one row of connection terminals;
135[c]	a tongue, which has a top side with a first surface with grooves, and bottom side with a second surface with grooves, the second surface disposed opposite the first surface,
135[d]	the tongue being disposed on one end of the plastic base and within the connection slot, such that chambers of the connection slot on two sides of the tongue allow the plug to be normally and oppositely inserted and positioned into the connection slot;
135[e]	at least one row of first contacts separately arranged on the first surface of the tongue, wherein
135[f]	each of the first contacts is electrically connected to a respective first pin extending out of the plastic base; and
135[g]	at least one row of second contacts separately arranged on the second surface of the tongue, wherein:
135[h]	each of the second contacts is electrically connected to a respective second pin extending out of the plastic base;
135[i]	the socket structure is operative to simultaneously electrically connect on the top and the bottom side of the tongue;
135[j]	a portion of the at least one row of first contacts has a reverse mirror configuration relative to a portion of the at least one row of second contacts, and the socket structure is thereby configured for reversable connection such that:
135[k]	when the plug is normally inserted into the connection slot with the at least one row of connection terminals of the plug facing the second surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of second contacts; and
135[l]	when the plug is oppositely inserted into the connection slot with the at least one row of connection terminals of the plug facing the first surface of the tongue, the at least one row of connection terminals of the plug are electrically connected to the at least one row of first contacts.